Rural Innovation and Smallholders' Livelihoods:

Modes of Intervention in Hillside Communities of Latin America

A thesis submitted by

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List of Acronyms

ACELYS	Hillside Farmer's Organizations, Yoro, Honduras
AIR	Agro-industrial Committee, Consortium for Sustainable Agriculture in the Hillsides, Cauca, Colombia
AMCY	Peasant Women Association of Yoro, Honduras
ANACH	National Association of Honduran Peasants
ANDRI	Association of Users of the Integrated Rural Development Program, Colombia
ANUC	National Association of Peasant Users, Colombia
AHPROCAFE	Honduras Association of Coffee Producers
ASEMCA	Private Service Provider for Peasant Women, Yoro, Honduras
ASHORTOP	Association of Vegetable Crops and Tomato Producers of Pescador, Cauca, Colombia
ASOBESURCA	Association of the Cabuyal Watershed Users, Cauca, Colombia
ASOCIAL	Association of Farmer Research Committees (CIALs), Honduras
ASPROMORA	Association of Mora Producers, Cauca, Colombia
BANADESA	National Bank for Agricultural Development, Honduras
BGYMV	Bean Golden Yellow Mosaic Virus
CAPACA	Training for Smallholders' Participation, Colombia
CARYOSVIL	Cooperative of Land-reform Beneficiary Groups, Yoro, Honduras
COOPROCAIL	Coffee Producers' Cooperative, Yoro, Honduras
CBB	Common Bacterial Blight
CETEC	Foundation of Interdisciplinary Studies and Technical Assistance, Colombia
CEVER	Reformed Evangelist Centre for Vocational Education, Honduras
CGIAR	Consultative Group on International Agricultural Research

CIAL	Farmer Research Committee
CIAT	International Centre for Tropical Agriculture
CIRAD-SAR	Centre de Coopération International de Recherches Agronomiques pour le Développement des Systèmes Agro alimentaires et Ruraux, France
CIDA	Canadian International Development Agency
CIPASLA	Consortium for Sustainable Agriculture in the Hillsides, Cauca, Colombia
CIMMYT	International Wheat and Maize Improvement Centre
CLO	Local Operative Committee
CLODEST	Committee for the Sustainable Development of the Tascalapa Watershed, Honduras
CODEM	Municipal Development Councils, Honduras
CODESA	Private Service Provider for Male Peasants, Yoro, Honduras
COPIs	Independent Producer Organizations, Yoro, Honduras
CORFOCIAL	Corporation of Farmer Research Committees (CIALs), Cauca, Colombia
CORPOICA	Colombian Corporation for Agricultural Research
CORPOTUNIA	Corporation for the Development of Tunia, Cauca, Colombia
COSAPSYL	Cooperative of Independent Male Producers, Yoro, Honduras
COSUDE	Swiss Development Cooperation
CURLA	University Centre of the Atlantic Coast, Honduras
CVC	Autonomous Corporation of the Cauca Valley, Colombia
DICTA	Honduran National Agricultural Research and Extension Organization
DNP	National Direction for Planning, Colombia
DRI	Integrated Rural Development
ENA	National Agricultural School, Honduras
ESNACIFOR	National School of Forestry Sciences, Honduras
FACACH	International Development of Agricultural Cooperatives Project, Honduras
FAMEs	Linking Families for Hillsides Agriculture, Honduras
FEDECAFE	Colombian Federation of Coffee Producers
FES	Foundation for Superior Education, Colombia

FHIA	Honduras Foundation for Agricultural Research
FIDE	Honduras Foundation for Investment and Exports Development
FIDAR	Foundation for Rural Agro Industry Research and Development, Colombia
FSH	Union Federation of Honduras
FUNDAEC	Foundation for Science Education and Training, Colombia
GDP	Gross Domestic Product
GFAR	Global Forum for Agricultural Research
IAASTD	International Assessment of Agricultural Science and Technology for Development
IARCs	International Agricultural Research Centres
ICA	Former Colombian National Agricultural Research Institute
IDB	Inter-American Development Bank
IDRC	International Development Research Centre of Canada
IHCAFE	Honduran Coffee Institute
IICA	Inter-American Institute for Agriculture Cooperation
INCORA	Colombian Agrarian Reform Institute
INA	National Agricultural Institute, Honduras
INRM	Integrated Natural Resource Management
IPCA	Participatory Research for Central America
IPRA	Participatory Investigation with Farmers
IRD	Integrated Rural Development
ISNAR	International Service for National Agricultural Research
IDB	Inter-American Development Bank
IITA	International Institute of Tropical Agriculture
IMF	International Monetary Fund
IRRI	International Rice Research Institute
IPG	International Public Goods
JACs	Local Development Community Boards, Colombia
LDCs	Less-Developed Countries
NARI	National Agricultural Research Institute
NGO	Non-governmental Organizations
NRI	Natural Resources Institute

NRM	Natural Resource Management
PAAR	Project for the Administration of Rural Areas, Honduras
PAN	National Food and Nutrition Plan, Colombia
PASOLAC	Central American Program for Sustainable Hillsides Agriculture
PDA-YORO	Program for Rural Areas Development, Yoro, Honduras
PLANTE	National Plan for Alternative Development, Colombia
PRGA	Participatory Research and Gender Analysis
PRODAIF	Integrated Rural Development Project, Honduras
PROMOSTA	Project for the Modernization of Agricultural Technological Services, Honduras
PRONADERS	National Program for Sustainable Rural Development, Honduras
PRONATTA	National Program for Technology Transfer, Colombia
R&D	Research and Development
REDOLYS	Local Organizations Network of Yorito and Sulaco, Honduras
SAC	Colombian Association of Agricultural Producers
SAG	Agriculture and Livestock Secretariat, Ministry of Agriculture, Honduras
SDC	Swiss Agency for Development and Cooperation
SENA	National Service for Learning, Colombia
SERTEDESO	Private Service Provider for Hillside Agriculture, Yoro, Honduras
SINTAP	Colombian National System of Technology Transfer in Agriculture
SNITTA	Honduran National System for Agricultural Research and Technology Transfer
SOL	Supermarket of Options for Hillsides Agriculture, Yoro, Honduras
TAC	Technical Advisory Committee, Consultative Group on International Agricultural Research
UMATA	Municipal Agricultural Technical Assistance Unit, Colombia
UNDP	United Nations Development Program
URPAs	Agricultural Regional Planning Units, Colombia
USAID	United Stated Agency for International Development

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María Verónica Gottret

Abstract

The debate on whether or not the generation of knowledge and technology reduces hunger and poverty while preserving the environment came to the forefront at the beginning of this century. Thus, assessing the limits and possibilities of this 'technical solution' to reduce hunger and poverty is now highly relevant for those who design policies for poverty alleviation or allocate resources.

This research analyses the potential and limits of knowledge and technology generation in nurturing sustainable smallholder livelihoods, and identifies its preconditions. It takes an actor-oriented process for change position, and uses an "Innovation for Development Analytical Framework" developed specifically for it. This framework has multiple social actors at its centre, and considers access to and control over economic/financial, human, social, natural and physical resources, recognizing explicitly that smallholder communities are not homogenous but socially differentiated. In addition, the frameworks analyses "external intervention" as a historically constructed process.

Empirical research was conducted in the Cabuyal watershed of Colombia and the Tascalapa watershed of Honduras. Fieldwork included four phases: (1) selecting subjects and reconstructing innovation histories, (2) resource entitlement semi-structured interviews, (3) external intervention semi-structured interviews, and (4) innovation adoption and livelihoods surveys. 'Innovation' was regressed against different proxy variables for access to economic/financial, human, social, and natural resources, to analyze the influence of access to livelihood resources on the possibilities to innovate, but not to estimate the probability of innovation. Logit regressions were run for each of the independent variables. Qualitative data validated these results.

Four innovation histories were analyzed, matched to the different modes of intervention and their contribution to the generation of sustainable smallholder livelihoods assessed. Two relate to innovation on traditional commodities (beans), the primary objective being food security. Two relate to the coffee and blackberry markets, and are meant primarily to improve smallholder incomes.

Analysis shows, firstly, that innovation was primarily driven by external intervention and market demand. Secondly, approaches, which foster interaction between farmers and scientists (farmer participatory research) and among different actors along the market chain (market demand-led research), not only are more effective in fostering and spreading innovation, but also are capacity building. Thirdly, interaction between farmers and scientists is insufficient when the objective is broader than achieving food security, requiring interaction with other actors along the market chain. Fourthly, investment in strategic research is crucial to improve the effectiveness of technological innovation. In this case, public investment is more important than private-led investment, which, in contrast, is more important for applied research. Fifthly, providing services that help overcome barriers to innovation is important in the effectiveness and spread of innovation.

The ability of innovation to contribute to sustainable rural livelihoods relates to four factors. First, the effectiveness of the innovation processes itself and the extent to which it can respond to changing contexts and markets. Secondly, the characteristics of the product and its demand for own consumption and in the market. Increasing the supply of commodities with limited demand rapidly results in decreased prices, for which increased production will not compensate. In contrast, diversification into higher value markets and innovation on these crops can offer farmers improved incomes, but entering into these markets and benefiting from them requires meeting their quantity, supply frequency and quality requirements, which is difficult. Thirdly, public and private market regulations and trade policies that provide an enabling [or disabling] environment are decisive for success. Fourthly, access to livelihood resources influences the possibilities to innovate and who benefits from the innovation process. External intervention influences innovation processes and its livelihood outcomes via its influence on affecting access to different livelihood resources.

It is important to recognize that taking the innovation path provides an important but partial option for smallholders in hillside agro-ecosystems. Bottom-up processes to improve access to and control over livelihood resources are extremely slow, require high investment and have limited impact. A complementary 'political solution' needs to be put in place. Non-contradictory top-down and bottom-up political paths have to be taken, together with an innovation path, for reducing hunger and poverty and achieving the millennium development goals.

1 Knowledge and Technology Generation for Poverty Reduction

At the start of the new century, reducing hunger and poverty while preserving the environment continues to be a major unresolved challenge for humanity. In September 2000, the members of the United Nations set an international agenda for the 21st century that includes measurable goals for development and poverty eradication. These goals are not new. Governments, multilateral investment organizations, bilateral cooperation agencies and civil society organizations have been working since the establishment of the United Nations in 1945, to promote economic and social development under the belief that eradicating poverty and improving the well-being of people everywhere are necessary to create the conditions for lasting world peace.

Different views of the food and hunger crisis have led to alternative paths to reducing rural poverty. The literature on agrarian transformation (i.e. Bryceson 2000a and 2000b, de Janvry 1981, de Janvry et al 1989, Jansen 2000, Kay 1999, Kay 2000) proposes four mainstream positions in the debate: the *(semi) proletarianization* position, the *structuralist* position, the *technological determinism* position, and what is in this thesis referred to as an *actor-oriented process for change* position. Those who have taken a *(semi) proletarianization* position have suggested that in the actual neo-liberal and global context the only option for the rural poor with limited access to productive resources is to become proletarians or semi-proletarians if they wish to retain access to land for security and survival. Thus, they have chosen a *basic needs provision path* to reduce suffering and social conflict while re-converting smallholders into proletarians.

Those who have taken a *structuralist* position have argued that limited access to productive resources (mainly land) is the major cause of hunger and rural poverty and that any external intervention will have a limited success unless structures that impede access to these resources change. Therefore, initially they wanted a *top-down political path* to transform these structures, but given the lack of political power and support, intervening agencies have promoted a *bottom-up political path* by facilitating an agrarian reform process conducted by (and not for) the people (de Janvry 1981).

Most governments and multilateral investment organizations, such as the Bretton Woods organizations – the World Bank and the International Monetary Fund (IMF) – have taken a *technological determinism* position, a *technological change path* to poverty reduction. These organizations took this path believing that technological change is crucial for achieving long lasting economic growth in developing countries. This path is clearly seen in Harry S. Truman's 1949 inaugural speech (as president of the United States) often considered the starting point of 'development planning', President Truman argued that technological knowledge should be used by poorer nations to stimulate production led growth and raise living conditions (Willis 2005).

> For the first time in history humanity possesses the knowledge and the skills to relieve the suffering of these people [the world's poor]… I believe that we should make available to peace-loving peoples the benefits of our store of technological knowledge in order to help them realize their aspirations for a better life… What we envisage is a program of development based on the concepts of democratic fair dealing… Greater production is the key to prosperity and peace. And the key to greater production is a wider and more vigorous application of modern scientific and technological knowledge. (Truman, quoted in Escobar 1995:3)

Whilst policy makers and technocrats have acknowledged throughout the twentieth century the importance of the *technology change path* to long-term economic and social development, approaches and methods of employing knowledge and technology to resolve hunger and poverty in developing countries are less clear. Since the most influential governments and organizations have recognised the importance of the *technological change path* for hunger and poverty reduction, it is important to understand whether (and under which conditions) knowledge and technology generation can reduce hunger and poverty, improve nutrition, health and rural livelihoods, and facilitate social and environmental sustainability development, given actual socioeconomic structures. This need has led directly to a three-year (2005 – 2007) initiative entitled 'The International Assessment of Agricultural Science and Technology for Development (IAASTD)' (http://www.agassessment.org) led by the World Bank and most of the United Nations agencies.

Since the late 1980s, those who believe that there is still an option for the under-resourced rural poor in agriculture-based activities took an *actor-oriented process for change* position, and supported a *bottom-up political path* together with an *innovation path.* They suggest that external intervention can be an instrument of social change for creating ideas, facilitating organizational processes and enhancing innovation capabilities for development, instead of merely for diffusing technology. Those who take this position believe it is possible to convert smallholders into viable agricultural entrepreneurs able to innovate and compete in the marketplace.

This leads to the issue of public investment in agricultural research and development, and the question of whether it is worthwhile to invest public resources to generate agricultural knowledge and technology that would facilitate this, instead of investing public resources in social programs to re-convert and incorporate (semi)proletarianized farmers into the broader economy. In Latin America, the question is whether there is a viable *smallholder option,* and if so, what the role of external intervention might be. Which social groups within the smallholder sector are most likely to benefit from external intervention? To what extent can innovation processes contribute to sustainable rural livelihoods for social actors? Can knowledge and technology generation approaches, with a bottom-up perspective, using participatory approaches, and paying particular attention to locality and market opportunities, improve the prospects of smallholders?

1.1 Approaches for the Generation of Agricultural Knowledge and Technology

Since the early 1980s, in an effort to improve food security and alleviate poverty through agricultural research, approaches to knowledge and technology generation have evolved from the traditional 'technology transfer' to approaches that involve farmers as partners and clients of agricultural research. Furthermore, to improve the linkages of farmers with market opportunities and to improve rural incomes, 'market demand-led research' approaches have been introduced to respond to market opportunities and requirements. Thus, the *technological change path* for development and poverty reduction has evolved into an *innovation path* that combines *a technological determinism* position with *an actor-oriented process for change* position. Table 1 summarises and compares these different approaches.

Table 1.1
Evolution of knowledge and technology generation approaches

	Transfer of Technology	**Farming Systems Research**	**Farmer Participatory Research**	**Market Demand-Driven Research**
Driver	Supply push from research	Need to adapt and validate technologies on farmer fields	Demand pull from farmers	Market demand
Innovators	Scientists	Scientist with input from farmers	Farmers and scientists as partners	Chain actors working in collaboration with researchers
Scope	Productivity	Input - output relationships	Farm-based	Market Chain based
Core Element	Technology packages	Adjusted technology packages to overcome constraints	Joint generation of production knowledge	Joint innovation along the market chain
Intended Outcome	Technology transferred and adopted	Adapted technology with better fit to farming systems	Co-evolved technology with better fit to livelihood systems	Co-innovate to respond to market demand
Key Change Sought	Farmer behaviour to improve productivity	Scientists knowledge to improve the input-output ratio with and efficiency focus	Scientist-farmer relationships to improve productivity and make an efficient use of resources	Relationships among market chain actors and researchers to improve competitiveness and incomes

Note: Adapted from a table developed with Robert Chambers, Andy Hall and Maria Fernandez during the International Assessment of Agricultural Science and Technology for Development (IAASTD) Integrated Design Team Meeting, in Montpellier, France, 23-25 May 2005. Shaun Ferris and Mark Lundy from CIAT's Rural Agro-enterprise Development Project also provided valuable input for the market-led research approach column.

1.1.1 Transfer of technology

After World-War II, development organizations saw opportunities to assist developing countries achieve higher growth rates through the 'transfer of technology' approach, In agriculture, this meant formal agricultural research organizations developing technology packages and passing these to farmers through extension agents. It aimed to capitalize on existing knowledge and accelerate technology uptake to raise productivity. This approach sees scientists as the innovators and farmers as adopters [or non-adopters], but not as sources of innovation in their own right.

By the mid 1960s, there was increasing consensus that food security and economic growth could be achieved in developing countries through promotion of the agricultural sector (Schultz 1964). Investments were made in agricultural research capacity and technology generation to increase agricultural supply, without tampering with existing land tenure. The Rockefeller and Ford Foundations took the initiative to establish and institutionalize an international agricultural research system with the aim of producing international public goods that would raise agricultural productivity. In 1960, they founded the International Rice Research Institute (IRRI). Based on IRRI's success, the wheat and maize breeding programme in Mexico was transformed into the International Wheat and Maize Improvement Centre (CIMMYT) in 1966, and two other centres were founded in 1967: the International Centre for Tropical Agriculture (CIAT) in Colombia and the International Institute of Tropical Agriculture (IITA) in Nigeria (Ravnborg 1992).

The establishment of the Consultative Group on International Agricultural Research (CGIAR) consolidated these efforts.[1] Multilateral organizations strengthen National Agricultural Research Institutes with the objective of integrating research, education and extension, following the model used by the Land Grant College System of the United States; the assumption was that the most limiting factor in agricultural productivity was lack of technology and research 'know how'. The first goal of this process was food security (there were chronic famines in many developing countries) and efforts were concentrated on staple commodities such as rice, maize, wheat, potatoes, beans, cassava, and rice. To improve technology transfer across political boundaries, importance was given to the concept of international public goods. Early successes in productivity gains, for example with new wheat varieties in the India sub-continent, were hailed as a new 'green revolution' (see Saith 1990). Other similar events established the CGIAR and its network as leaders in agricultural research and development.

Few issues in development have generated as much debate as the green revolution (see Remenyi 1988). Critics suggested the new technologies disrupted traditional rural communities, favoured wealthy farmers and larger landowners, and caused increased rural unemployment and landlessness (Pearse 1980). The early approaches used in the green revolution were also criticised for not being participatory and for ignoring local knowledge, which would have supported more sustainable implementation of technology packages. The green revolution, focused on raising productivity through capital-intensive inputs rather than through a more systematic effort to harness the potential of under-utilized rural labour, since adopting a high-labour approach would have required radical land reform and significant changes in socio-political policies and organizational structures (Ross 1998a). These capital-intensive technologies worked well where ecological conditions were relatively uniform, i.e. in irrigated areas and where delivery, extension, marketing and transport services existed and were already efficient.

The Green Revolution concentrated technology changes in poorer regions and focused international agricultural research on developing improved varieties of staple food crops, rather than on internationally traded 'cash crops' (Saith 1990). This clearly supported the rural and urban poor who depend on these crops to secure their livelihoods. However, the green revolution also benefited larger farmers in well-endowed regions, who often achieved the best yields. This led to uneven regional development and over-investment in developed regions, even where shifting resources into poorer regions might have had better results in improving rural livelihoods.

Whilst several studies show that international agricultural research conducted over the past thirty years has been successful in developing technical innovations that have increased productivity (Pinstrup-Andersen and Pandya-Lorch 1995), the reality in many marginal agro-ecosystems is that production gains have been due to increased production area. Most farmers in these areas cannot afford the inputs required to realize the productivity gains and instead try to increase their production area if they can (though land can be unavailable or costly). A major downside of rapidly increasing areas of production is the effect on the environment and the costs of maintaining high rates of production growth. For example, many of the Green Revolution technologies, such as hybrid varieties, made producers and developing countries more dependent on foreign technology and imported inputs required to sustain high production levels. This dependence seriously threatens both the environment and the sustainability of economic growth.

1.1.2 Farming systems research

In the early 1980s, environmental issues inherent in high-input agriculture attracted increasing global concern due to the contribution of farming to deforestation, pesticide pollution in water systems, and other forms of environmental degradation. The World Conservation Strategy (IUCN 1980) argued that if economic growth was to be successful, it must be environmentally sustainable. FAO (1984) predicted future difficulties in sustaining food production given anticipated population growth rates, particularly in some less developed countries (LDCs), with many more people living in fragile and difficult environments. Thus, the link between growth and environmental sustainability gained considerable importance in the agricultural agenda.

To address this, the 1960s 'transfer of technology' approach has undergone, since the late 1970s, a series of adaptations, and the farming systems research movement moved from research stations into farmers' fields. This transformation began with the 'farmer systems research' approach (Brouwer and Jansen 1989; Farrington 1990; Flora 1991), which aimed to develop more appropriate and sustainable technology packages to overcome the local constraints faced by smallholders and resource-poor farmers adopting new technologies.

The main changes sought were to improve scientists' relations with the rural community and to gather local knowledge in order to develop more sustainable technologies, better suited to existing farming systems. The approach attempted to improve productivity and optimize input-output relationships, and was driven by scientists' need to understand farmers' conditions and needs. It saw farmers as objects of study and sources of information. Thus, farmers played a greater role in providing information to scientists and the tool for learning was through surveys. Scientists remained the lead innovators who would produce adapted and more sustainable technology packages with a better fit to farming systems. This approach was criticised for treating farmers only as providers of land and labour, while scientists set up the research agenda and supplied ready-made solutions developed at research stations (Ashby et al.

2000). Farmers were finally supplying (a minimal) input to research, though this fell short of what they were able to provide.

1.1.3 Farmer participatory research

Farmers were further empowered in technology design and development by the use of 'farmer participatory research' approaches and methods specifically meant to blend explicit knowledge from formal research processes (and contained in modern technologies) with local knowledge based on farmers' experience. This research approach aimed to respond to the limitations of the Green Revolution by benefiting resource-poor farmers dependent on complex, diverse and risk-prone agriculture.

The, 'farmer participatory research' approach pays less attention to the form and sources of knowledge, places greater emphasis on equity and peoples' control over local and exogenous knowledge, and looks for synergies to recombine multi-layered sources of knowledge. In it, research on local knowledge may legitimize knowledge for the people and thus help to analyze and criticize dominant practices promoted by external agents. Local knowledge then becomes a source of political-economic empowerment (Jansen 1998). This approach, then, is not merely using local knowledge to avoid environmental disaster brought by modern science and technology, or to fight the imposition of cultural homogenization, or develop technology independent of the formal research system (Banuri and Apffel-Marglin 1993; Grillo Fernández 1998). In it, local and exogenous knowledge are not dichotomized (see Jansen 1998) but are multi-layered, interweaving, hybridizing and creolizing continuously (Long and Villareal 1994). This is consistent with the earlier proposition by Chambers et al. (1989) that farmer-first approaches and methods constitute a complementary paradigm to traditional forms of knowledge generation.

The important point was the use of local knowledge to generate new technologies that would alter the ownership and impact of agricultural research. Thus in the second half of the 1980s it was recognized that while formal science generates packages that focus on efficiency gains, resource-poor farmers have other specific needs. These farmers need an approach to agriculture with a high degree of flexibility, to counter the unpredictable effects of weather, market forces, and the interplay between community-based activities and household resources (Richards 1989). Scientists increasingly recognized farmers as innovators and experimenters with highly rational behaviour based on their experience and knowledge. This has led to a more equitable blend of exogenously developed technologies with local knowledge that capitalizes on the skills, initiatives and experience of farmers (Chambers and Ghildyal 1985; Richards 1985).

If external agents are not the owners of knowledge but facilitators of the innovation process (Chambers 1989), farmers have a major role in analysis, choice and experimentation, and outsiders have new roles as conveners, catalysts, advisers, searchers, suppliers, supporters and consultants. This is a significant contribution to the process of change, a vision of agriculture complex in its farming systems, diverse in its environments, and risk-prone, giving priority not just to sustainable agriculture, but to sustainable livelihoods based on agriculture (Scoones and Thompson 1994).

Beginning in the 1990s, this new approach to agricultural knowledge and technology generation (called '*farmer participatory research*') emerged and was adopted widely by research and development practitioners. The driver of this approach is farmers' demand for knowledge and technology with a farm-based scope. The role of farmers in participatory research is to diagnose their situation, experiment with possible solutions, test and adjust them to fit their production systems. This approach considers farmers and scientists as colleagues and innovators collaborating in supply-led research and jointly generating knowledge and technology in response to farmer needs. The key change sought by this approach is in the relationship between farmers and scientists, allowing technology to evolve with a better fit to local livelihood systems.

1.1.4 Market demand-led research

Another emerging concern was equity in the distribution of benefits among the different stakeholders. Although agricultural research increased food production, thus improving food security for the urban and rural poor, the increased supply has also led to a fall in prices of agricultural goods that has not allowed for capital accumulation in rural areas, especially among smallholders. Thus, it is possible to find islands of success, but in most developing countries and particularly in those countries with slow overall growth, problems of food security, poverty, and natural resource degradation have persisted (CGIAR, 2000). In part, this can be attributed to the multiple and to some extent antagonistic goals of agricultural research: food security, low-cost food for the rapidly growing urban poor and income growth for the rural poor.

Typically, smallholders in rural communities produce low value commodities that face declining real prices and increasing competition from medium-to-large-scale producers. The majority of smallholder families find themselves on a production treadmill: millions of farmers produce the same undifferentiated commodities using traditional, low input systems. Inevitably, these farmers are price takers in the market, and the adoption of improved production technologies not only fails to improve incomes, but may lead to losses of income. To overcome this, a 'market-demand driven research' approach to the generation of knowledge and technology has emerged over the last two decades. It aims for the joint generation of knowledge and technology, using a strong private sector influence on decision-making to respond to consumer demands. The role of farmers in this approach is to innovate in order to meet required market standards and to add value to primary production as far as this improves systemic competitiveness, in order to generate higher incomes. This approach considers farmers and scientists as colleagues who collaborate with other actors along the market chain to develop knowledge and technology with a better fit to consumer demands. The key change sought is to alter the relationships among farmers, scientists, other chain actors and investors in order to improve the competitiveness of the system and raise rural incomes.

1.2 Research Questions and Purpose

The knowledge and technology generation approaches discussed in the previous section show that the whole notion of 'technological change' has shifted from a linear process to a continuous 'process of innovation' seeking to involve farmers and other stakeholders as equal partners and to recognize them as clients of agricultural research. However, to date there has been little assessment of whether, how, and under which conditions these new approaches are more effective in promoting innovation and the extent to which they contribute to alleviating hunger and poverty.

The research presented here explores this area and ascertains the effects of these new and more inclusive approaches. It uses an innovation systems approach (Lundvall 1992; Clark, 2002; Douthwaite et al., 2004; and Hall et al., 2004a) to analyse how the interactions among multiple actors and multi-layered sources of knowledge have been facilitated in the past, to what extent the scope has been expanded to include other actors beyond the farm gate and with what outcomes. It also assesses the degree to which these experiences have resulted [or not] in institutional changes to improve and facilitate more effective innovation capabilities.

The cases on which this research is based are in Latin America, where the rural sector has undergone a process of social differentiation since colonial times manifested in access to land (both by area and quality) and other productive resources, markets and financial capital, knowledge and technology, and complementary inputs. This process of social differentiation, exacerbated by the emergence of the neo-liberal model in the late 1980s, has created a highly differentiated peasantry with differential access and control over resources. For example, the emergence of modernizing capitalist farms has been accompanied (see Kay 2000) by a structural shift in the composition of the agricultural labour force. Some peasants have evolved into 'capitalized family farmers' whereas many have become 'proletarians in disguise'. Although formally owning a smallholding, in practice they are completely dependent on agri-business, earning an income similar to that of rural wage labourers. Others have become 'semi-proletarians', whose principal source of income stems from their labour power rather than from the household plot. A significant proportion of peasants have been openly and fully proletarianized.

Thus, to analyze the limits and possibilities of knowledge and technology as drivers in improving rural livelihoods among socially differentiated smallholders in hillside agro ecosystems of Latin America means taking into account the profound economic, political, social and cultural transformations that have taken place since World War II. It also must be particularly concerned with rural innovation processes (as the link between external intervention and sustainable rural livelihoods) and how socially differentiated actors innovate to improve their livelihoods. Hence, it explores the process of rural innovation, its outcomes on socially differentiated actors and the role of multi-layered sources of knowledge in the process. This knowledge should better equip those who design policies for poverty reduction and allocate resources for the generation of agricultural knowledge and technology for development.

1.3 Chapters Overview

Before moving on to present the research findings, Chapter 2 explores three theoretical themes that have evolved over the last four decades: external intervention for the generation of agricultural knowledge and technology, rural innovation, and sustainable rural livelihoods. Key issues, include how these concepts have evolved, the theoretical perspective used in this study to assess them, and the analytical framework used to evaluate linkages among them.

Chapter 3 focuses on the implications of the conceptual framework developed for this study. It also describes the methodology used to conduct the research and introduces the case studies, starting the presentation of the empirical findings of the research. As such, it describes the Cabuyal watershed in the Municipality of Caldono in Colombia and the Tascalapa watershed in the Municipality of Yorito in Honduras. This begins with a description of the biophysical and socio-economic characteristics of both sites, including an analysis of differential access to human, social, economic/financial and natural resources. The introduction to the case studies continues with a description of the livelihood strategies of the population, including agricultural activities, activities to add value to agricultural primary production, off-farm employment, non-agricultural activities and migration. It also considers the relative importance of these strategies with respect to their contribution to livelihood outputs.

Chapter 4 analyses modes of intervention in the Cabuyal watershed of Colombia, focusing on how the complexity of debates about rural development, and specifically the generation of knowledge and technology for development, are linked to actual policies and development practice 'on the ground', affecting the livelihoods of socially differentiated actors within a delimited area, time and context. In addition, it analyzes the multiple actors that these approaches involve, the interaction among them, and their degree of agency. By doing this, this chapter combines and contrasts differing strategies and approaches for the generation of knowledge and technology with the reconstruction of the history of research and development practice in the territory. This aims to analyze the discourse behind the different intervention processes that took place and how these different theories of development and approaches have informed intervention practice or 'praxiology'. In addition, it analyzes how power differences among those actors involved, who advocated or supported different ideas, have influenced how technological, social and institutional innovations were shaped in the watershed. By taking a historical approach to reconstruct external intervention in the watershed, this chapter conducts an analysis on how development debates, ideas and contradictions have influenced different modes of intervention and shaped social and institutional innovations in the watershed.

Chapter 5 assesses the limits and possibilities of producing 'international public goods' to promote rural innovation that can be scaled-out from a given research site to other localities with similar agro-ecological and socio-economic characteristics with the aim of broadening the impact of technological, social and institutional innovations in research pilot sites. From its origin in the late 1980s, the process promoted in the Cabuyal watershed in Colombia was done as an experimental model with the idea of developing technological, social and institutional innovations that could be replicated in other regions of Latin America, and the developing world in general. In doing this, this chapter explores and analyses the process of out-scaling technological, social and institutional innovations developed in Colombia to the Tascalapa watershed in Honduras, and its outcomes.

Chapter 6 analyses how external interventions for the generation of knowledge and technology lead to innovation in traditional commodities, assisting smallholders. It questions which actors are more likely to participate in these innovation processes, and to what extent these innovation processes can contribute to the generation of sustainable rural livelihoods for differentiated social actors in marginal hillside agro ecosystems. This chapter analyzes two innovation processes in bean production in Colombia and Honduras, which promoted improved food security. This chapter also moves the analysis further by assessing how access to livelihood resources influences the innovation possibilities of socially differentiated actors, and the extent to which these processes contributed to the generation of sustainable rural livelihoods for these actors.

Chapter 7 complements the results of the previous chapter by analysing two innovation processes developed with the objective of diversifying hillside agricultural production away from traditional commodities into higher values crops. The first is the case of diversification to coffee in the Tascalapa watershed in Honduras that started in the late 1980s, followed by a set of technological innovations during the 1990s and a more recent initiative that started in the late 1990s to get into higher value coffees. The second innovation process analyzed is the case of diversification to blackberries in the Cabuyal watershed in Colombia.

Chapter 8 analyzes and links the issues discussed in the earlier chapters. It lays out the possibilities and limits of external public intervention to promote agricultural knowledge and technology for development and the conditions required to promote long-lasting processes. Moreover, it discusses alternative entry points and interventions that could promote effective innovation for hunger and poverty reduction.

Notes

1. CGIAR is an alliance of countries, international and regional organizations, and private foundations that support 15 international agricultural centres around the world with the main goal of mobilizing agricultural science to generate global public goods to reduce poverty, foster human wellbeing, promote agricultural growth and protect the environment (http://www.cgiar.org/who/index.html).

2 Innovation Processes and Sustainable Rural Livelihoods

This chapter explores three theoretical themes that have evolved over the last four decades: external intervention for the generation of agricultural knowledge and technology, rural innovation, and sustainable rural livelihoods. Key issues include how these concepts have evolved, the theoretical perspective used here to assess them, and the analytical framework used to evaluate linkages among them.

2.1 Theses of the Food and Hunger Crisis and its Influence in Development Practice

Throughout the second half of the twentieth century, the rural sector of Latin America has been subject to a variety of policies and external interventions that were influenced by different theses on the food and hunger crisis. According to de Janvry (1981) three of these theses, which he calls technological determinism, monetarism and structuralism, consider the supply side of the food crisis, while the other three, which he calls neo-Malthusianism, over-consumption, and poverty, focus on the demand side. The history of external intervention in the rural sector in Latin America clearly shows that the relative weight of each of these theses has changed over time, influencing the paradigms behind external intervention and the importance given to the generation of knowledge and technology. These paradigms on external intervention, along with the methodologies used, have also been evolving in an attempt to improve their effective-ness, efficiency and targeting.

Since the late 1950s, the structuralists saw agricultural stagnation and rural poverty in Latin America as a result of a land tenure (latifundio-minifundio dualism), where the former produce commodities for the national and international markets and the latter supply labour to the former. This tenure system fuelled peasant militancy and threats of agrarian rebellions in many countries: agrarian leagues had large memberships and made strong claims for access to land in reaction to extremely unequal patterns of landownership dominated by semi feudal social relations and massive rural poverty. In 1961, governments launched a land reform strategy meant to redress this inequality on a continental scale. However, most land reform processes in Latin America were limited to land redistribution and success was uneven:

> [t]hese reforms were always too limited, too unequal, and too late relative to urban-industrial development. As a result, they were unable to counteract dependency relations and break class alliance between dependent bourgeoisies and foreign capital. (de Janvry 1981:260)

Thus, agrarian reform programs implemented from the 1960s to the 1980s in Latin America failed to incorporate the peasantry into the development process (Kay 1999).

By mid-1960s, a combination of the technological determinism and neo-malthusianism theses that viewed the food and hunger crisis as a problem that could be solved by increasing food production through the development of superior technologies (to resolve agricultural stagnation) started to dominate external intervention. This line of thought resulted in the support of agricultural research together with extension programmes that would ensure the diffusion of new technologies. This thesis motivated a massive increase in agricultural research investment on food crops, which doubled in real terms between 1962 and 1968, while expenditures in agricultural extension services more than doubled (Boyce and Evenson 1975). International agricultural research centres were created and National Agricultural Research Systems spread all over Latin America.

External intervention in the late 1960s and early 1970s was motivated by the economic goal of promoting agricultural production in the commercial sector by spreading Green Revolution technologies while relying on the peasant sector for cheap labour (de Janvry 1981). Thus, the focus of external intervention in the agricultural sector during this period was on achieving increased productivity (Byerlee 1998). However, the modernization of commercial agriculture led to massive rural impoverishment, because land was increasingly concentrated in the commercial sector at the expense of the peasantry (de Janvry 1981). Mechanization severely limited employment creation in commercial agriculture, and high rates of urban unemployment reduced the possibilities of urban migration. Thus, the peasantry was increasingly marginalized in subsistence agriculture and semi-proletarianized.

As a response, the poverty thesis was proposed by an increasing number of analysts in the liberal-reformist tradition, who saw poverty and the consequent lack of effective demand as the core issue of both the food and hunger crisis. This started to gain importance in the early 1970s. Thus, the policy of poverty eradication through the meeting of basic needs became the major objective of development (Griffin 1978; Streeten et al. 1981). However, technological determinism continued to predominate. Thus, many Latin American countries initiated rural development projects that relied on promoting Green Revolution technologies among that minority of the rural population who controlled sufficient resources to adopt them profitably and had the capacity to produce marketable surplus. The main intervention mechanisms of these rural development projects were improved access to agricultural credit (institutional change), and research and extension (technological change). Later, these projects became 'integrated' rural development projects through the addition of activities in infrastructure construction and the distribution of public goods and services. Mexico and Colombia initiated large-scale programs and essentially every Latin American country launched pilot projects throughout the 1980s and early 1990s.

However, the economic effect of the first rural development projects (those implemented during the 1970s) was minimal due to: (i) the structural characteristics of the peasant economy that condition the diffusion of new technologies; (ii) the levels of profitability and risk associated with the recommendations made; and (iii) the effectiveness of the diffusion methods used (de Janvry 1981). Integrated rural development programs implemented within the existent agrarian structures had an extremely narrow clientele of upper wealth strata peasants, due to the advanced process of social differentiation (de Janvry 1981). The majority of the rural poor were highly proletarianized and more dependent on employment and wages for their subsistence than on agricultural production. Moreover, for the minority of more endowed farmers, for whom rural development was potentially meaningful, successful programmes hinged crucially on the availability of an adequate technology and on remunerative terms of trade.

At the end of the 1980s, the monetarist thesis of stagnation advocated by neoclassical economists and conservatives gained political support.

This thesis argues that public interventions distort the free operation of market forces and thus reduce the profitability of agricultural investments and increase their risk, leading to stagnation of production and poverty. Based on this approach, since the early 1990s, countries across Latin America have implemented neo-liberal policies. This has not been a homogenous process but rather one full of politically driven decisions: economies were opened to external competition and an outward-oriented development strategy was promoted to stimulate agricultural exports while the domestic market was opened to imports. At the same time, neo-liberal land policies abandoned their previous focus on expropriation, emphasizing instead on privatization, de-collectivization, land registration and titling. Moreover, the investment of public resources on research and development (meant to generate and transfer information and technology and to create technical and organizational capabilities) was severely curtailed and in many cases privatized.

In the 1990s, at a time when the rural landscape in Latin America was being transformed at an unprecedented pace because of neo-liberal policies and unfulfilled economic growth, poverty alleviation, natural resource management and environmental conservation issues entered the agenda. The main rationale for agricultural research and development became poverty alleviation and natural resource management, as the UN World Commission said in 1987 in its environment and development report, Our Common Future, better known as the 'Brundtland Report'. From this merger of ideas emerged the concept of 'sustainable development', defined as:

> [d]evelopment that meets the needs of the present without compromising the ability of future generations to meet their own needs. (World Commission on Environment and Development, 1987: http://www.ace.mmu.ac.uk/eae/Sustainability/Older/Brundtland_Report.html).

In the wake of more than a decade of neo-liberal policy implementation, new research and development approaches emerged to propose a smallholders' road, taking an actor-oriented process of change position, drawing in part from previous ones. This aims to support peasant farmers by promoting innovation processes as a means to contribute to poverty alleviation, sustainable livelihoods and environmental conservation. New strategies were proposed and implemented since the late 1980s, with the following characteristics:

1. Agricultural research and development was broadened to go beyond the development and transfer of 'technological packages', including and recognizing the importance of innovations in organizational processes and institutions to provide an enabling environment that facilitates rural innovation (Douthwaite, 2002).
2. Technological and organizational capabilities received special attention, to facilitate rural innovation processes that targeted smallholders by linking them to more competitive market chains based on two major principles: equity and resource sustainability.
3. Rural risk management was stressed, directed at reducing vulnerability by helping rural inhabitants develop resilience to external shocks and increase the overall sustainability of their livelihoods.
4. Participatory and more holistic approaches were adopted that emphasize the social as well as the economic and environmental dimensions of rural life, aiming to promote a bottom-up development process that takes into account the social and political dynamics of the locality.

2.2 Theoretical Perspective

2.2.1 External intervention

Development practice is necessarily an 'intervening practice' and assumes an external and invasive position, as its basic function is that of relating an external actor with a hosting actor (Ramirez, 2002). In addition, any external intervention has a specific type of discourse that is explicit in a programme or project proposal and materializes in a series of activities conducted with a specific approach and a combination of methodologies. Furthermore, external intervention requires a legitimatized institutional setting of norms, rules and values that guide the intervention and within which organizations implement their activities. Thus, external intervention is more than simply the implementations of a series of activities in a delimited geographical area. On the contrary, a specific intervention in a given area is just the epilogue of a discursive construction that fundaments, instruments and legitimates the implemented actions. The discourse that underlies external intervention is an essential part of development practice (Muller 1987; Ferguson 1990; Escobar 1995).

Any analysis of external intervention must recognise that development is a historically produced discourse (Escobar 1995). The ways in which external intervention has subjected societies to systematic, detailed and comprehensive interventions are rooted in how the problem of hunger and poverty was conceptualized and analyzed and how development, as a domain of thought and experience, evolved. Furthermore, development is a normative project (Bebbington 2005) in which representations are produced by actors; these representations are based not only on how actors believe things are, but also on how they believe situations have come to be the way they are, and of how they feel these ought to be. Thus, representations are theoretical and normatively laden, and move in some relation to the balance of power in broader struggles over the meanings and goals of development.

The approaches, methodologies and tools generated and used for development practice are based on institutionalized strategies for action, and therefore are social technologies that may be either already known or innovative, and are legitimized by an associated discourse. This discourse transforms a social problem into a technical one: describing and interpreting a given reality, formulating an action plan for improvement and producing an outcome (Carrión 1990). Over the last decades, donors have sought ways to rationalize the planning process for intervention and to strengthen the tools to evaluate projects and programs they financially support, using:

> [a] structured, logical approach to setting priorities and determining the intended results and activities of a project. (Dearden and Kowalski 2003: 502)

This guides development projects managers through the successive stages of diagnosis, definition of objectives, planning of actions, implementation, and evaluation or assessment of outcomes.

These successive stages are termed the 'project cycle', although it is not the intention of development intervention to be circular, arriving again at the beginning; instead, a programme or project should close at the end and its progress assessed. To justify external intervention, it should lead to a preferred situation and be completed within a given period – project or program cycles of one to three years are common practice. Thus, the discursive formulation of external intervention, besides giving it a specific objective and direction, provide a specific shape and interpretation to each situation, both the one to be modified as well as the one imagined as the goal or ideal (Ramirez 2002). These external interventions are in most cases designed beyond the local context and are the product of a historical, situated discourse based on the global challenge of reducing hunger and poverty (Escobar 1995). For interventions designed within the local context, decentralization processes are often important, but these interventions are still part of a historical, global discourse.

The work of Long and colleagues (Long and van der Ploeg 1989; Arce and Long, 2000) provides a slightly different criticism of development planning tools. Similar to Gasper (1999), these writings convey a concern for what is excluded or simplified in planned intervention. They also display an interest in the role of culture, not as something fixed in social organizations (as in Biggs and Smith 2003) but as an outcome of agency and thus highly diverse and heterogeneous. For them, the 'failure' of planned interventions is not a result of cultural 'weaving' faults in development organizations but the consequence of a lack of ethnographical understanding of how modernization projects initiated by external agents are being reworked in the everyday lives of the intervened. This framework rejects the image of a target group, which has to be modernized through a planned intervention. Instead, the intervened already partake in societies that hold opposing value systems, encompass multiple varieties of socio-cultural forms and repertoires, and are continuously undergoing dynamic change. In this larger world, the intervened re-position exogenous modernization and unpack and repack the intervention so that it differs from its original intentions.

The neglect of how local people manage their everyday affairs and think, argue and act for themselves is also taken up by Long (1992a), who considers it a product of linear development thinking (i.e. interventions promoting systematic policy formulation, implementation and evaluation are essentially linear in nature). This critique of linearity addresses the sequence of the intervention process itself and its neglect of the more intricate dynamics of social life, but does not yet fully address the possibility that these interventions reshape the notion of time itself people live in a contextual, constructive, experiential and relative world of processes (Adam 2003). Past, present, and future do not form a simple linear sequence. People reconstitute the past with reference to the future, and in relation to the present. Both past and future are ideational, based on selection and adjustment.

The linear and temporal thinking criticised by Long and Adam, and catalyzed by increasing donor pressures for accountability, has generated a vast number of studies (see Anderson et al. 1998) aiming to measure the impact of research and development interventions. This literature is dominated by themes related to the adoption of agricultural technologies and the economic returns on related investments. Reviews of this can be found in Darlymple (1986a and 1986b), Seré (1986), Timothy, et al. (1988), Echeverria, et al. (1989), Lee et al. (1991), Pachico (1992), Byerlee and Moya (1992), Evenson (1992), Stifel (1992), Horton et al. (1993), and Collinson and Tollens (1994). New, robust quantitative methodologies using economic surplus methods to estimate the net present value of benefits, internal rates of return, and cost-benefit ratios synthesized and extended previous analyses (Alston et al. 1995). Impact assessment approaches could be quantitative or qualitative, and often use non-economic measures to capture a variety of research and development effects (see Horton et al. 1993). Even though these measures do not use a common metric (such as economic returns), they provide important information for giving priority to certain types of research.

Studies measuring the impact of research and development interventions have also expanded their methodologies to assess the impact of post-harvest, processing and market innovations (i.e. Mullen 1985, Janssen 1986; Lynam 1988, Mullen et al. 1991, Scobie, et al. 1991, Best et al. 1994; Gottret and Henry 1994; Ospina Patiño et al. 1999, Gottret and Raymond 2003). Most of these studies also extended economic surplus models to consider the size and distribution of benefits in the context of multiple factors and multiple-product markets. Impact assessment estimates of agricultural research using annual economic returns are often sophisticated and simplify decision-making by producing relatively simple numbers and, even if these analyses are becoming suspect (see Alston et al. 2000), these estimates remain an easy point of comparison and represent nearly 40 years of cutting-edge research efforts.

However, estimates of annual economic returns to agricultural research concentrate on assessing outcomes but speak little about the social actors involved or about the processes through which planned intervention result in those outcomes. Moreover, they provide insufficient feedback on the processes through which 'planned interventions' result in economic, social and environmental outcomes, or on how these interventions affect socially differentiated actors and beneficiaries.

Development practice can be improved by social science, but new kinds of impact assessment studies are needed that take into account the contrasting (and often conflicting) interests of the different actors involved. Even social actors considered weak or powerless (see Scott 1985) might shape the negotiations that take place in complex and manipulative ways, thus extracting certain significant benefits for themselves. The various actors involved need to accept interventions as legitimate, or at least not worth contesting (Long 1997b:230) in order for any imposition of State policies, development programs, or measures to be effective.

The above conception of external intervention resembles and can be complemented with the concept of 'social learning' introduced by academics studying – and contributing to – interventions aimed at enhancing external intervention for development (Dunn 1971, Friedmann 1984, Milbrath 1989, Woodhill 2002). The notion of social learning was, according to Leeuwis and Pyburn (2002), originally presented primarily as a critique of earlier discourses, which assumed that the future could be planned rationally from above in a top-down approach. It reflects the idea that the shared learning of interdependent stakeholders is a key mechanism for arriving at futures that are more desirable. The concept of social learning has intertwined with related ideas such as soft systems thinking (Checkland 1981, Bawden 1994, Röling and Wagemakers 1998) and adaptative management (Holling 1995), and a consistent characteristic of the various approaches is that they advocate an interactive (or participatory) style of problem solving whereby outside intervention takes the form of facilitation (Leeuwis and Pynburn 2002).

Social learning has been placed in the context of cognitive theory (Röling 1992) and seen as an interactive process, moving from multiple cognition to collective or distributed cognition, with a central role for multi-stakeholder platforms in which the challenge is to facilitate learning processes. This expands the concept of adaptive management by highlighting the role of learning processes and stakeholder interaction. Social learning is then a different manner of getting things done, which emphasizes cognition and communication rather than economics or technology as keys to sustainable development. This approach capitalizes on the diversity of perspectives and experiences and seeks to harness the creative energy of collective engagement in problem solving. The facilitator's role is to help establish platforms and catalyze dynamics that enable such synergy to occur (Röling 1992).

Several conclusions have been put forward about social learning (see Leeuwis, Piburn and Boon 2002). The first is that it is the processes and not the preconceived outcomes that are amenable to design. The second is that even if processes are amenable to design, they can only be designed to some extent since social learning processes are evolving, contextual and affected by uncertainties. Inherent in the idea of social learning is that one cannot predict in advance how processes will evolve, not what intermediary outcomes will be, and neither can one foresee the capricious dynamics of human negotiation. The third is that social learning implies a movement away from methodological blueprints, and therefore it is unhelpful and unproductive to try to 'structure' and 'control' interactive social learning processes by means of detailed ex-ante plans, schedules and procedures for the medium and longer term. Such plans are incompatible with the idea that change processes are inherently context-specific, messy and conflictual. Thus, facilitating an interactive process requires the weaving together of different strategies and activities in a flexible and contextual manner.

To provide a better understanding and analysis of processes of change, the research presented here uses an actor-oriented approach (Long 1992a and Long 1992b) to analyze 'external intervention for the generation of knowledge and technology', 'rural innovation processes' and their outcomes in terms of 'sustainable rural livelihoods'. The selection of an actor-oriented approach, which places actors at the centre, permits the visualization of interventions as an on-going transformational process in which different actor interests and struggles are located, instead of viewing it as the simple implementation of a plan for action. Thus, in this research, social actors are not seen simply as passive recipients of intervention, but as active participants who process information and develop strategies to deal with other local actors as well as with external intervention. Furthermore, it aims to assess the extent to which external intervention to promote rural innovation has promoted 'social learning' among multiple stakeholders.

This study considers the different discourses that have shaped external intervention for the generation of knowledge and technology since the 1950s as a historically constructed experience that created a domain of thought and action. It centres on how development practice followed different and contesting development theories, and how these discourses resulted in concrete practices of thinking and acting. Thus, it will assess external intervention by analyzing the characteristics and interrelations of three axes that define it according to Escobar (1995). First, the forms and sources of knowledge that external intervention refers to and through which it comes into being and is elaborated into objects, concepts, theories, methodologies and activities. Second, the system of power that regulates its practice, not as a unidirectional system (intervener over those intervened) but also considering the variety of forms with which people contest, resist, negotiate and struggle to create alternative ways of being and doing. Third, the forms of subjectivity fostered by those discourses through which people come to recognize themselves as developed or underdeveloped, poor or non-poor, and through which differentiated actors construct representations of the state of development and the means and goals of development interventions.

Based on the above debate (and see de Vries 1997), external intervention in this research is defined as

> '…an unpredictable ongoing social and historical construction and transformational process where multiple external and local social actors are involved. This process is constantly reshaped by its own organizational and political dynamics and the specific conditions it encounters or it creates, and for which processes, to some extent, but not preconceived outcomes are amenable to design.' (Long 1992a:37)

This definition recognizes that processes are inherently context specific, messy and conflictual.

2.2.2 The concept of innovation

Probably the most significant trend affecting food and agricultural markets, and therefore farmers' income, is the process of globalization, fuelled by liberalized trade policy and a broad range of technological, social and institutional innovations. Globalization has increased competition amongst farmers in developing countries, which can no longer compete based on their comparative advantages (i.e. natural resources endowment, climate, cheap labour). The fact that some farmers receive subsidies and have greater levels of tariff protections than others have, and yet all compete in a general marketplace, complicates the situation.

To remain competitive, actors along the market chain are adopting strategies to increase their economies of scale through, technological innovation, collective action, concentration of ownership and vertical integration (Ferris et al. 2006). These developments generally do not favour resource poor farmers unless they can achieve one or more of the following options:

1. Improve the competitiveness of production for local markets;
2. Strengthen organizational processes to achieve economies of scale through collective action, to improve access to inputs, financial and non-financial services and markets, as well as to be able to respond to market demands, e.g. by providing a constant supply and a homogenous quality;
3. Diversify into higher value crops or livestock products linked to identified market demands and growing markets;
4. Add value to primary production by accessing higher-priced markets, enhancing product quality and or incorporating processing activities that meet consumer needs;
5. Enter into new types of contractual agreements, based on forward sales or denomination of origin that help to 'lock in' buyers over longer periods at advantageous rates;
6. Link to financial or trade related services, particularly with new institutions that have instruments, which enable long-term relationships.

The above options require that smallholders engage in the market in a continuous innovation process rather than a one-off exercise, meeting new challenges and opportunities as they arise. To facilitate a successful process of rural innovation, appropriate institutions are required to generate knowledge and build the technical and organizational capabilities to allow rural producers, processors and market agents to use their available resources effectively and efficiently. Such capabilities are a site-specific form of knowledge made-up of the combined skills of a broad range of social actors and accumulated over time.

Knowledge and technology as an international public good

The generation and dissemination of knowledge and technology may result in the creation of international public goods (Kaul et al. 1999, Stiglitz 1999, Kanbur 2001, Morrissey et al. 2002). The main policy issue with knowledge, these authors agree, is not so much under-provision but insufficient or unequal access. Intellectual property rights that are too strong can hurt market efficiency and equity, and among suggestions to improve the accessibility and price of knowledge is the creation of 'knowledge banks' (Stiglitz 1999). The idea of establishing a knowledge bank for agricultural development has been behind the concept of establishing an international agricultural research system (the CGIAR) with provision of international public goods (IPG) as its core mission. As spelled out in TAC/CGIAR (1987), the mandate and research programmes of the CGIAR have a global perspective, focusing on problems that cut across national borders and lend themselves to international solutions. They are based on a principle of universality, which has as its aspiration the accessibility of research results to all interested parties and makes the CGIAR an open system to all partners seeking collaboration. Moreover, this emphasizes the international status of the centres that make up the CGIAR system and highlights CGIAR's technocratic character, which gives it an apolitical status that protects it from political pressures. Since the mid-1990s, the overriding importance of enhanced nutrition and well-being for poverty alleviation, spelled out in the guidance statement of the CGIAR (TAC/CGIAR 1990), has been stressed (TAC 1997).

IPGs are a benefit, the satisfaction of a want, or a provision, that in principle is available to everyone (see Morrissey et al. 2002). 'International' signifies that benefits extend well beyond national boundaries without necessarily applying everywhere on the globe. International public goods have a spatial range across borders and continents. The concept of 'public' is at the hearth of the IPG and signifies that everyone can derive a benefit from the provision of it, without implying that all people derive a measurable benefit. 'Goods' are benefits that provide utility or satisfy wants. Most discussion of public goods is about producing them or making the benefits available, but making them available is independent of the issue of whether every potential beneficiary actually benefits. The utility derived from an IPG depends on its consumption; to maximize utility (total benefit) it is desirable to enable everybody who wants to benefit. In short, an IPG, in Morrissey et al.'s definition is a benefit providing utility that is in principle available globally to everyone. A classic but somewhat technical economic definition of a public good is one:

> [w]hich all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good. (Samuelson 1954: 387)

Society needs to invest in the generation of public goods because although the marketplace may be the most efficient way of producing private goods, society also relies on a set of goods that the marketplace does not provide, and are often provided by non-market or modified market mechanisms (Kaul et al. 1999). People need both public and private goods whether or not they engage in market transactions: public goods have benefits that cannot easily be confined to a single 'buyer' (or set of 'buyers') since once they are provided, many can enjoy them free.

A pure public good is one whose benefits are non-excludable and non-rivalry (Kanbur 2001). Non-excludable implies that once the good is provided nobody can in fact be prevented (or excluded) from enjoying it. Non-rivalry means that consumption by one person (or country) does not diminish the amount available to others. In practice, goods will be impurely public, as neither characteristic may be exhibited completely, but they all have significant elements of both. As such, many goods may be quasi-public or mixed public/private, in the sense that they are non-rivalry or non-excludable, but not both.

Three types of benefits tend to be non-excludable and non-rival, hence give rise to public goods – risk reduction, enhancing capacity, and direct provision of utility; they are inter-related (and a particular public good may provide all three types of benefit) (Morrissey et al. 2002). Enhanced capacity to produce goods (which may be public or private) is an important public good. Knowledge and technology themselves are enhanced capacity international public goods. A more specific example is research, and it is the inherently public nature of research that encourages private companies to seek protection of intellectual property rights over what is otherwise a public good. The property of no-rivalry may be technologically determined and as such knowledge and technology are inherently non-rival and the use by one party does not diminish the knowledge and technology available to another party; however, knowledge and technology may be excludable since they are not just technological constructs; policy deeply influences access (Kanbur 2001).

For example, the findings of basic genetic research satisfy the non-rivalry property but not the property of non-excludability (Kanbur 2001). Public sector researchers make their findings available to all, while private sector researchers have a right to keep them private. In contrast, one of the main contributions of development research to development is the knowledge it generates about the success (or failure) of different research and development projects and strategies. International agencies disseminate this type of research actively in the form of publications, methods and tools to the extent possible, and therefore no party is excluded.

Thus the International Agricultural Research Centres (IARCs) contribute to both global knowledge and research (as their core activity is the generation of knowledge and technology), but complementary activities that contribute to disseminating knowledge and technology, such as maintaining internet sites and facilitating global and regional networks, are also needed. Poverty reduction may be highly desirable from many points of view, but poverty reduction itself is not a public good. Those who remain poor derive no benefit from the reduction of poverty of others (they are excluded). The increase in income that takes some out of poverty does not bear the non-rivalry condition in that it is not available as an equal benefit to others. Because the poor may be the least able to derive benefit from public goods, reducing poverty allows more people to benefit from public goods, and is therefore a complementary activity, increasing social welfare.

Challenging the transfer of technology approach

The 'transfer of technology' approach that predominated during the second half of the twentieth century was a product of linear development thinking, and relied heavily on neo-classical economics rationality. The logic was that some research themes give greater returns to research investment and that by selecting them ex-ante, or reviewing comparable ex-post cases, the performance of research could be improved (Alston 1995). Research projects were designed and implemented by scientists in order to develop technological packages that could then be transferred to farmers who would learn and adopt them, resulting in development outcomes. This is consistent with what Gibbons et al. (1994) have called a 'mode one' of knowledge production, where knowledge is generated, often with government or international aid assistance, by a research community accountable to its disciplinary peers.

However, the transfer of technology approach does not recognize the complex social process that converts knowledge into concrete innovations, instead it treats the process as a 'black box' that cannot be analyzed or explained in detail (Goldsmith 1993). Treating this process as a black box neglects the more intricate dynamics of multiple knowledge sources, partnerships, diversity, social and institutional learning and capacity building that are important aspects of innovation processes (Hall et al. 2004a).

Defining innovation

The current debate on the institutional, political, economic and social dimensions of knowledge production is broader than concerns about research and development (R&D) as a basis for the development of new technologies, although both ultimately remain important (see Hall et al. 2004b). Thus, the term 'innovation' helps to break away from the confines of a debate focused on research and allows a more inclusive discussion of the process of development and change; innovation in the broad sense is

> [t]he activities and processes associated with the generation, distribution, adaptation and use of new technical, institutional, and managerial knowledge. (Hall et al. 2004c:207)

The term 'innovation' has different meanings (see Goldsmith and Foxall 2003):

> (1) The process of invention through which new things, ideas or practices are created; (2) new things, ideas and practices developed; or (3) the process by which existing innovation becomes part of the cognitive state of the innovator and his knowledge repertoire (Zaltman, Duncan & Holvec 1973 pp. 7-8).

A difference between R&D and innovation can be made by differentiating the above meanings, where 'R&D' sees innovation in a narrow sense (the invention of new technologies in research laboratories or experimental fields) while 'innovation' see R&D as part of a larger process that brings about technical, economic and social change (Hall et al. 2004a).

As concern over the role of knowledge and technology in economic development and poverty reduction has increased, the scope of analysis expanded from exploring research and technology transfer to looking at the wider innovation process (Hall et al. 2004a). The concept of innovation in agricultural knowledge and technology has its conceptual roots in debates that took place during the last three decades, such as the work of Biggs on the institutional context of research (Biggs 1978) and on multiple sources of innovation (Biggs 1990). Also, Chambers and Ghildyal

(1985), Röling (1990 and 1992), Lall (1993), and Echeverria (1998) made important contributions to the discussion of innovation.

Innovation policies in developed countries have undergone an important conceptual shift, which is starting to influence innovation policies and practices within the CGIAR, and also in some developing countries. This is an increased emphasis on promoting innovation rather than focusing on research alone (Hall et al. 2004b). Innovation is a complex process, often requiring technical, social, and institutional changes, and also involving the interaction of organizations across the conventional knowledge producer/user divide. Thus, recently, a number of policy analysts have started to use explicitly the innovation concept in relation to agricultural knowledge and technology generation: using an 'innovation systems framework' in relation to research policy in developing countries (Hall 2001 and Hall et al. 2001).

The origin of innovation systems thinking, can be traced to the 'national systems of innovation' proposed by Freeman (1987) and Lundvall (1992) and at its simplest is that innovations emerge from evolving systems of actors involved in knowledge production and use. (Hall et al. 2004c) The critical components of innovation systems are learning and the role of institutions; it is impossible to understand learning without referencing its institutional and cultural context since it is an interactive and socially embedded process (Lundvall 1992). Applications of this concept can be seen in the work of Ekboir and Parellada (2001), Clark (2002), Byerlee and Alex (2003), Temel et al. (2003), Douthwaite et al. (2004), and Biggs and Messerschmidt (2004).

Innovation is an interactive 'learning process' between the R&D team and innovators, leading to the belief that the new technology makes a 'plausible promise' of bringing benefit (Douthwaite 2002). Seeing innovation in this way exposes the workings of 'learning selection' in technologies ranging from rice harvesters to computer software (see Hall et al. 2004a).

Networks of users and technology developers are valuable in both developed and developing countries (Douthwaite 2002) and researchers who adopt participatory innovation processes have at least six advantages over those that think that they can develop finished technologies themselves. They can take advantage of a broad pool of innovative talent; they can benefit from innovations they themselves cannot develop; when key stakeholders begin to feel ownership towards a technology, they work to improve the environment for the technology; the probability that people will adopt and recommend the technology is higher; public opposition against the technology is less probable; and research maintains relevance and practicality. Innovation requires a champion and innovative partners willing to take risks; is catalyzed by a 'real and felt need'; and uses selection mechanisms based on open, agreed and objective criteria (Douthwaite 2002).

Thus, for purpose of this research innovation is defined as the process of technical, social and institutional change that results from the interaction among multi-layered sources of knowledge and its transformation into new things, products or practices, applied in a specific socioeconomic, institutional and cultural context.

For this research, it is also important to classify innovations according to the degree of change they produce, i.e. whether changes are 'continuous', 'dynamically continuous' or 'discontinuous' (Goldsmith and Foxall, 2003). 'Continuous innovations' are small alterations of existing products with minimal effect on production, commercialization or consumption patterns. 'Dynamically continuous innovations' have bigger effects on production, commercialization, or consumption patterns than continuous innovations. Although they generally do not produce completely new patterns, they can include the development of a new product or practice as well as the modification of an existing one. 'Discontinuous innovations' lead to new production, commercialization or consumption patterns, and therefore to the development of new products. Most of the innovations analyzed here are 'continuous' or 'dynamically continuous'.

It is likewise useful to classify innovations according to their capacity to produce changes in livelihoods, as 'basic', 'process', and 'institutional innovations'. Basic innovations directly contribute to the generation or improvement of sustainable livelihoods, and include those technological or market innovations that alter production, post-harvest, processing, distribution or marketing patterns. Process innovations generate changes in organizational and management processes, and include those changes which improve social actors agency and nurture (build, maintain or sustain) the motivation to innovate and are essential for basic innovations to work. Institutional innovations change social actor roles, rules, norms, power and/or control mechanisms and permit individuals to overcome limitations to innovate such as access to land, credit, markets and other livelihood resources, increasing the opportunities social actors have to innovate effectively and to develop their livelihoods.

Innovation and the challenge of up-scaling

The evolution from the 'transfer of technology' approach to the concept of 'innovation' discussed above and the concession to new approaches for the generation of knowledge and technology, such as 'farmer systems research', 'participatory research approaches' and 'market-led approaches', which are site and context specific has put forward new challenges. Farmers reached, poverty reduced, sustainability of the development process or influence in policy, have often been little affected by agricultural R&D projects (Gonsalves 2001). Poverty alleviation, food security and environmental protection all should be contributed to by R&D efforts, but only if these are scaled up (Harrington et al. 2001); thus, the issue of scaling-up has been placed at the centre of much debate within R&D institutions since the late 1990s, as research has moved beyond seed technologies to more knowledge and management intensive innovations (Unwin 1995, IIRR 2000, Unwin et al. 2000, Gündel et al. 2001, Harrington et al. 2001). The issue of scaling up relates to the concept of international public goods, since the latter aim to benefit everyone throughout the globe, at least in principle, and fulfil the conditions of non-exclusiveness and non-rivalry.

Scaling up was addressed by the CGIAR NGO Committee and the Global Forum for Agricultural Research (GFAR) in three sponsored workshops in 1999 and 2000, followed by another held at the Natural Resources Institute (NRI) in the UK in 2001. In these workshops, participants arrived at a multifaceted understanding that 'scaling up leads to more quality benefits to more people over a wider geographic area more quickly, more equitably and more lastingly' (Gonsalves 2001:6). This definition has been criticized by Menter et al. (2004) as problematic because it defines the objective of scaling up using a comparison without stating with what is it comparing; the scale refers not only to the benefits brought about through the intervention in terms of numbers of people and geographical area affected, but also to the quality of impact in terms of sustainability and equity (i.e. time and justice scales). Nonetheless, they argue that scaling up implies increasing the impact of an innovation or intervention to its appropriate level, which in turn implies reaching larger numbers of people.

The term 'scaling up' is used often as a catchall term to refer to a combination of different processes (see Menter et al. 2004) which themselves have a variety of definitions. 'Scale' is generally understood in terms of hierarchy, and different disciplines generally have their own criteria for defining and measuring it. Two important concepts concerning scale are ecological fallacy (what works at one scale will work at another), and composition fallacy (what is good for one person is good for everyone). Thus multi-scale, multi-disciplinary analysis plays a key role in supporting the process of scaling up the use and impact of knowledge and management intensive technologies, approaches and methodologies (Menter et al. 2004).

Scaling up has been disaggregated in various ways. It has been defined as having three categories: project replication, building grassroots movements and influencing policy reform (Clark 1991), or four: quantitative, functional, political and organizational (Unwin 1995). There are also detailed taxonomies (Unwin and Miller 2000, Gündel et al. 2001). This research will concentrate on quantitative scaling up, alternatively called 'scaling out' or 'horizontal scaling up' by Gündel et al. (2001), and political scaling up, alternatively called 'vertical scaling up' or 'institutionalization' by Gündel et al. (2001). The first refers to the increase in the number of people or geographical area involved, through replication or dissemination of activities, interventions and experiences. The second refers to the movement beyond project or program service delivery, towards empowerment and structural or institutional changes to overcome the political causes of underdevelopment.

The 'horizontal scaling up' of knowledge and management-intensive innovations differs from the process of disseminating a new seed variety (see Menter et al. 2004); the former involve the end-users and work with several different components of a complex system and therefore immediate research outcomes will be less applicable for others. 'Horizontal scaling up' implies adapting knowledge and innovations to the conditions of different end-users, which requires understanding the principles underlying an innovation, and this in turn requires capacity development and transferring understanding about the underlying principles. 'Vertical scaling up' also requires recognizing the usefulness of the innovation to solve other problems and bringing additional actors into the process since decisions are being made at a higher level or scale. Thus, beyond capacity development, it requires building networks, creating functional organizational structures, and gaining institutional support. Furthermore, 'institutionalization' requires that the principles underlying an innovation, and the required adaptative capabilities, become an internal part of an institution in a sustainable manner, which usually requires political support.

Scaling out (reaching more people over wider areas) and scaling up (institutionalizing or influencing decision-making at higher levels to enable the innovation process) face barriers that have nothing to do with the innovation itself (Menter et al. 2004). Scaling up requires adaptation of innovations, understanding of their underlying principles, capacity development, gaining political and institutional support, and therefore, substantially greater investment. This supports the position of CGIAR and GFAR (2000) who propose that their aim is not to scale up technologies and innovations, but the processes and principles behind the technologies or innovations. This is consistent with the belief that scaling out is not just replication but flexible and interactive adaptation and learning, and that it is possible to cover a wider area through multiplication with adaptation.

It has been argued (see Pachico and Fujisaka 2004) that interest in scaling out and up derives from the need to show donors research impact beyond the plot or research site. Thus researchers have to tell donors that they want to show wider outcomes of their research, but to do so, they require more money, over a long term that they can spend in a flexible manner (Menter et al. 2004).

This research analyses the limits and possibilities of out-scaling and up-scaling knowledge and management-intensive innovations to augment and accelerate the scale of geographical coverage and impact of innovation processes. It emphasizes efficiency and effectiveness in generalizing and propagating research results through replicating, disseminating, and adaptating technologies, approaches, methodologies or practices, but also in changing institutions and structures to overcome the limitations of promoting technological, social and institutional innovations that may contribute widely to the generation of sustainable rural livelihoods.

2.2.3 Social actors, organizational processes and institutions

The revision of the concepts of 'external intervention' and 'innovation' highlighted the importance of the interaction among multiple social actors and therefore their organizational processes. The concepts of 'social actors', 'organizational processes' and 'institutions' are key to an analysis of external intervention and innovation processes.

Social actors and organizations as processes

Social actors are not passive subjects of external intervention, or of economic, social or institutional structures (Arce and Long 1992). Rather, they are agents, whose strategies and interactions shape the outcome of innovation processes. The notion of human agency attributes to the individual actor the capacity to process social experience and to devise ways of coping with change, uncertainty and external shocks (Giddens 1984). Social actors, within the limits of information and other constraints, are 'knowledgeable' and 'capable' and thus have 'agency'. An individual or group with agency is able to make decisions and do things based on own choices (Willis 2005). Agency must not simply be equated with decision-making capacities, because agency makes a difference to pre-existing state of affairs or course of events, is composed of social relations and can only become effective through them (Long 1992a:23). Effective agency, therefore, requires organizing capacities: it is not simply the result of possessing certain persuasive powers, but agency (and power) depend crucially upon the emergence of a network of actors who become partially, though hardly ever completely, enrolled in the 'project' of some other person or persons.

Yet, while the quintessence of human agency may seem to be embodied in the individual, single individuals are not the only entities that reach decisions and act accordingly. Enterprises, state agencies, political parties and church organizations are examples of social actors: they all have means of reaching and formulating decisions and of acting on at least some of them. (Hindess 1986: 115)

Nevertheless, although people are born into social groups and institutions, the concept of social actor does not cover collectivities, agglomerates or social categories that have no discernible way of formulating or carrying out decisions. The term 'social actor' is restricted to those social entities that can meaningfully be attributed with the power of agency and decision-making (Hindess 1986).

Following this argument, 'organizations' have been defined in this research as 'groups of individuals bound by a common purpose to achieve objectives' (North 1995). These can be political (political parties, the senate, a city council, a regulatory agency); economic (firms, trade unions, family farms, cooperatives); social (churches, clubs, athletic associations); or educational (schools, colleges, vocational training centres). Similarly, but from a more instrumental perspective, organizations have been seen as 'decision-making units – families, firms, bureaus – which exercise control of resources' (Ruttan 1988). In addition, organizations exist only because there is a set of working rules or underlying institutions that define and give these organizations meaning (Leach et al. 1999).

Following a post-structuralist view, an organization can be conceived as 'a set of practices' (Nuijten 1992:204). This implies that organizations can take the many forms in which differentiated social actors are organized in their everyday life to perform different activities. Instead of seeing organizations as bounded social systems, as the objects of analysis, this view proposes the analysis of organization as a process (Nuijten 1992). This means getting away from viewing organizations as a product or outcome, and move to an understanding of organization as a process' Wolf (1990: 590-1). This suggests beginning by looking at 'the flow of action', and by asking what is going on, why it is going on, who engages in it, with whom, when, and how often. Approaching organization as a process shifts the focus from looking at the functioning of an entity (with its own rules, principles or culture), to creating and reshaping different organizational forms. Individuals and groups do not operate in clearly defined institutional frameworks, but rather construct fields of action which often crosscut formal organizational boundaries (Long 1989).

Based on the above review, 'social actors' are defined in this study as individuals or organizations that formulate and carry out decisions, are knowledgeable and capable – within the limits of information, uncertainty and other constraints – and therefore manage available resources to perform a portfolio of livelihood strategies to engage in processes of change and pursue their goals. Within this definition, the concepts of 'knowledgeable' and 'capable' are translated culturally (Long 1992a: 26). In the field of innovation and development, this definition makes it possible to analyze how different conceptions of power, influence, knowledge and efficacy shape the responses and strategies of the different actors. It also addresses the question of how far notions of agency (which differ according to the type of promoted policy) are imposed on local groups (e.g. concepts of 'participation', 'targeting the poor' or 'the role of the progressive farmer' in planned development). Moreover, since this deals with 'multiple realities', potentially conflicting interests, and diverse and discontinuous configurations of knowledge, it means looking closely at the issue of whose interpretations or models prevail over those of other actors and under what conditions. By approaching organization as a process, this study shifts the focus from looking at the functioning of an organization with its own 'rules', 'principles' or 'culture', to the creation and reshaping of different organizational forms.

Institutions

Institutions are defined in new institutional economics (North 1995), as 'the rules of the game of a society'; the humanly devised constraints that structure human interaction are implicit in this definition. In this study, institutions are seen as composed by formal rules (statute law, common law, regulations), informal constraints (conventions, norms of behaviour and self-imposed codes of conduct), and the enforcement characteristics of both. Moreover, these institutions are given purpose since they 'are formed to reduce uncertainty in human exchange' (North 1994), or in other words, to reduce transaction costs, thus, when it is costly to transact, institutions matter.

New institutional economics, new economic history and public choice theory add an extra dimension to the definition of institutions by proposing that they should not be viewed as the rules themselves, but 'as regularized patterns of behaviour that emerge from underlying structures or sets of 'rules in use'' (Leach, et al. 1999). Rules, rather than institutions existing as fixed frameworks are the key, and 'rules' are constantly made and remade through people's practices (Leach, et al. 1999). Institutions are then seen, as in the work of Berry (1989 and 1993), as maintained by, and existing only because of, people's active investment in them. Regularized practices, performed over time, eventually constitute institutions, which may be formal or informal, i.e.:

> [f]ormal institutions maybe thought of as rules that require exogenous enforcement by a third-party organization. Informal institutions, however, may be endogenously enforced; and are upheld by mutual agreement among the social actors involved or by relations of power and authority between them. (Leach et al. 1999:238)

This has important implications since while:

> [f]ormal rules can be changed overnight, informal norms change only gradually. Since it is the norms that provide the essential legitimacy to any set of formal rules, processes of institutional change do not happen immediately. (North 1995)

Thus for this study institutions are defined as humanly regularized patterns of behaviour that emerge from underlying rules in use on society that structure human and social interaction, are constantly made and remade through people's practices, maintained by people's active 'investment' in them, and legitimized by informal norms that change only gradually.

2.2.4 Sustainable rural livelihoods framework

The 'sustainable rural livelihoods framework' has grown out of the work of, amongst others, Sen (1981), Chambers and Conway (1992) and Leach et al. (1999), and has been placed in an analytical framework by Scoones (1998) and Carney (1999). It:

> [d]escribes what constitutes livelihoods, what factors determine and improve the sustainability of livelihoods, and to some extent, how they relate to one another. It is a framework, which puts people and their claims over resources at the centre, combines a holistic view with discourses of ordinary people, and permits and examination of the macro global issues of policy and environmental change without displacing the micro issues of livelihoods and their goals, or the local environmental matters, which affect such livelihoods. The framework has normative aspects, such as endorsing the values of participation and equality. Although the definition of its terms and interpretations of its aspects may be over-tight, it is nevertheless, grounded in theory. For example, Sen's theoretical approach helps explain the occurrence of famine, showing that it occurs more as a result of a failure in people's entitlements than as a result of shortage of food at the national level. (Neefjes 2000:205-206)

This framework attempts to answer the following multi-layered question. Given a particular context of policies, politics, history, agro-ecology and socio-economic conditions, what combination of livelihood resources result in the ability to follow a combination of livelihood strategies (agricultural intensification / extensification, livelihood diversification and migration), and with what outcomes? (Scoones 1998:3). Thus, it has a scope for broad application to evaluating and explaining external intervention, and assessing its influence on poverty and environmental sustainability.

'Sustainable rural livelihoods' can be defined, drawing from Chambers and Conway (1992), Scoones (1998: 5), as:

> the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets, both now and in the future, while not undermining the natural resource base. (Scoones 1998:5)

This definition can be disaggregated into two sub-components mirroring the themes of a sustainable process of rural innovation. The first focuses on well-being, or 'livelihoods', which includes aspects of employment, income, and poverty reduction. The second is the 'sustainability' dimension, comprising the resilience of livelihoods and the natural resource base on which they depend.

Livelihoods

As discussed earlier in this chapter, conventional analysis of the food and hunger crisis takes either the supply side or the demand side position. The 'technological determinism' (supply side) and the 'neo-malthusianism' (demand side) theses are both based on 'production thinking', where problems of food security (under-nutrition, malnutrition and famine) are usually seen as problems of not producing enough food (see Chambers and Conway 1992). There is, though, overwhelming evidence that although food output must be one of the variables that can, inter alia, influence the prevalence of hunger, Malthus was badly mistaken in his diagnosis of overpopulation at the end of the eighteenth century (Sen 1999). Based on FAO data on food production and population, there is no real decline in world food production per head, but quite the contrary, at this time the trend is quite clearly upward (Sen 1999). Thus, the problem is not food supply but of distribution:

> [a] person may be forced into starvation even when there is plenty of food around if he loses his ability to buy food in the market, through a loss of income for example, due to unemployment or the collapse of the market for goods that he produces and sells to earn a living. On the other side, even when food supply falls sharply in a country or a region, everyone can be saved from starvation by a better sharing of the available food. (Sen 1999:161)

This is essentially a structuralist view, based on 'employment thinking', where the problems of the rural poor are seen as lack of employment, leading either to the prescription of generating large numbers of new workplaces (e.g. Schumacher 1973 as cited by Chambers and Conway 1992) or otherwise forcing a land reform for the rural poor so they will generate their own employment in agricultural activities (Ross 1998b). The ideal is full employment so that everybody has a 'job'. This fails to describe much of rural reality, in which people seek to put together a living through multiple activities (Chambers and Conway 1992). It also depends on the type of job, the wage paid and the working conditions. Moreover, this is related with the self-esteem of peasants who prefer to be their own employers as opposed to being identified as 'wage labourers' and the recognition that employment provides of being engaged in something worthwhile.

The 'poverty' thesis, which started to gain importance in the early 1970s and has been placed at the centre of the development debate in the 1990s, is defined in terms of a single continuum, a poverty line that is measured in terms of income (especially wages or salaries) or consumption. However, deprivation and well-being, as poor rural people perceive them, have many dimensions that do not correspond with this measure (Chambers and Conway 1992). There are major limitations to this statistical approach (Pyatt 2001): by focusing on income/consumption-poverty it marginalizes other dimensions of poverty; and, while it is self-evident that income/consumption-poverty will be reduced if the incomes of the poor can be increased, the poverty line approach is unhelpful when it comes to suggesting how best this might be achieved.

Furthermore, these production, employment and poverty-line concepts are generated in urban conditions and for professional convenience, but do not fit or capture the complex and diverse realities of most rural life. They account for the failure of much conventional analysis to show the plural priorities of the rural poor and their many and varied strategies to obtain a living. As an alternative, two concepts have increasingly commanded consensus: capability and equity. Used normatively, each states a desirable goal or criteria for evaluation; and used descriptively, each can be empirically observed, or in principle measured. Moreover, each is both 'end' and 'means' (Chambers and Conway 1992).

It might be more useful to divide livelihoods into three sub-components: numbers of working days created (employment and income), poverty reduction, and well-being and capabilities (Scoones 1998). The first relates to the ability of a particular combination of livelihood strategies to create gainful employment. This may be on or off-farm employment, part of a wage labour system, or subsistence production, and has three aspects: income (through a wage), production (in form of a consumable output) and recognition.

The second sub-component of livelihoods refers to the poverty level, which according to Scoones (1998) can be measured with either an absolute 'poverty-line' measure (based on income or consumption levels) or a 'relative poverty' or inequality measure (using Gini coefficient measures). This is mainly the statistical approach used by the World Bank (e.g. Ravallion 1992). These quantitative assessments of poverty can be combined (see Scoones 1998) with more qualitative indicators of livelihoods (e.g. Johda 1998; Schaffer 1996), but this component of livelihood can also be approached differently (Chambers and Conway 1992):

> In conventional terms, equity can be measured in terms of relative income distribution. But we use the word more broadly, to imply a less unequal distribution of assets, capabilities and opportunities and especially enhancement of those of the most deprived (Chambers and Conway 1992:6)

Thus, poverty can be seen as both a lack of entitlement over livelihood resources (Sen 1999, Pyatt 2001) and at the same time as a structuralist issue

> that emphasises ... the generation and sustainability of livelihoods as a function of the abilities that individual household members might possess; their productive assets, such as land, tools and housing; their access to public goods and services; and to markets; and the terms of trade that maintain at the interface between the household and the monetized economy. (Pyatt 2001:2)

The poverty and structuralist approach proposed by Pyatt (2001) for poverty analysis supports Chamber and Conway's (1992) conceptualization of equity and poverty.

The third sub-component of livelihoods proposed by Scoones (1998) refers to the notions of 'well-being' and 'capabilities', and sees poverty as the deprivation of 'basic capabilities' rather than merely as a matter of income which is the standard criteria identifying poverty Sen (1999). Moreover, the perspective of capability-poverty does not involve any denial of the sensible view that low income is clearly one of the major causes of poverty, since lack of income can be a principal reason for a person's capability deprivation. The view of 'development as freedom' proposed by Sen (1999) provides an important contribution to the concept of 'capabilities', as he proposes a view of freedom that involves both

> the processes that allow freedom of actions and decisions, and the actual opportunities that people have, given their personal and social circumstances. Unfreedom can arise either through inadequate processes (such as the violation of political or civil rights) or through inadequate opportunities that some people have for achieving what they minimally will like to achieve (including the absence of such elementary opportunities as the capability to escape premature mortality or preventable morbidity or involuntary starvation. (Sen 1999:17)

Thus, 'capabilities' are the substantive freedoms that a person enjoys to lead the kind of life he or she has reason to value (Sen 1999).

Sustainability

One of the most influential texts during the late 1980s was the 'Brundtland Report' (World Commission on Environment and Development 1987), which showed how existing, yet apparently conflicting, aspirations of economic growth and environmental conservation, might be harnessed together, and how they might be framed as part of a common goal. Since the Brundtland Report and Agenda 21, almost all levels of national and international policy and almost every economic sector of society now call for new forms of growth: sustainable, environmentally aware, integrating economic and social development and more equitable in its impact (van der Duim 1997).

The concept of sustainable development has influenced and been influenced by a variety of actors – policy-makers, academics, activists – and has been shaped by earlier debates about poverty, development and environmental protection. An important contribution to the sustainable development concept is the acknowledgement that there is a conflict at its core that explains its contested status (McNeill 2000). This can be manifested as a conflict between the interests of the present and the interests of future generations, between human well-being and the protection of nature, between poor and rich, or between a local and a global focus. Moreover, there is an emerging new conflict between 'technicists', including both social and natural scientists looking for technical solutions to environmental problems, and 'humanists', whose approach is altogether more critical, and, if it looks anywhere for 'solutions', will presumably look towards the altogether messier realm of politics. The later view is an important contribution of the work of Ferguson (1990) who concludes that poverty is not a technical but a political problem and therefore requires both technical and political solutions.

During the 1990s, it was recognised that the implementation of what had come to be known as 'sustainable development' should be based on local-level solutions derived from community initiatives (Ghai and Vivian 1992; Ghai 1994). Such approaches, which are evident in the policies and programs of national governments, donor agencies and non-governmental organizations (NGO), argue for 'co-management', or an appropriate sharing of responsibilities for natural resource management between national and local governments, civic organizations, and local communities (Leach et al. 1999).

A practical focus to the discussion on 'sustainable development' is provided by Neefjes (2000), who asks how to bring into alignment (i) participation and its goal of empowerment, (ii) the alleviation of poverty, and (iii) environmental improvement. This questions having the idea of 'participation' as central to putting into practice the concept of 'sustainable development' and highlights the difficulties of involving citizens and lower-level officials in development initiatives. In addition, it questions the compatibility of economic growth with poverty alleviation and environmental improvements, as well as the presumed synergy between environmental sustainability and poverty alleviation. It also raises the question of whether the poor can be blamed for environmental degradation (Neefjes 2000; see also Dobson 2000, Sagoff 2000). Thus,

> sustainable development simply incorporates 'environment' with the otherwise unchanged goal of GNP growth. This leads to 'blaming the victim': 'the poor were quickly identified as agents of destruction' and 'the environment could only be protected through a new era of growth' (Sachs 1992:29)

The debate on 'sustainable development' received another important contribution from Neefjes (2000) in the assertion that poor people's environments are primarily local environments – the forests, seas, watersheds, rivers and land where poor people live and usually work. Thus, in rural areas of developing countries local people emphasise their concern about managing their environments in order to sustain the productivity of their fields to achieve food security and improve their incomes and ensure future production and income. Thus, while poor people often look positively at their environments and environmental productivity, northern-based environmentalism and statutory regulation is predominantly about minimizing negative impacts.

The sustainability debate is linked, not only to the previously discussed debate of agrarian change, but to the concept of 'social differentiation'. 'Social differentiation' is highly relevant to current debates on the environmental effects of socio-economic change, because it is the starting point for understanding why producers use their environment for different purposes and in different ways (Jansen 1998).

This 'sustainable' component of the sustainable rural livelihoods framework has two aspects: (1) livelihood adaptation, vulnerability and resilience, and (2) natural resource base sustainability (Scoones 1998:6). The former is the ability of a livelihood to cope with and recover from stresses and shocks that is crucial to both livelihood adaptation and coping (Scoones 1998). Thus, those who are unable to cope (temporary adjustment in the face of change) or adapt (longer-term shifts in livelihood strategies) are inevitably vulnerable and unlikely to achieve sustainable livelihoods. Assessing this sub-component of a sustainable livelihood requires an analysis of a range of factors, including an evaluation of historical experiences of responses to various shocks and stresses (Payne et al. 1994:15). The latter sub-component refers to the sustainability of the natural resource base:

> The ability of a system to maintain productivity when subject to disturbing forces, whether a 'stress' (a small, regular, predictable disturbance with a cumulative effect) or a 'shock' (a large infrequent, unpredictable disturbance with immediate impact). (Scoones 1998:6-7)

Measuring this aspect is notoriously difficult (as Scoones points out) as it is critical to link indicators of resource depletion or accumulation to both the temporal dynamics of systems resilience and livelihood needs.

Livelihood resources

The ability to pursue different combinations or a portfolio of livelihood strategies depends on access to and control over tangible and intangible assets, also called 'livelihood resources'. Drawing on an 'economic metaphor' such livelihood resources may be seen as the 'capital' base from which different productive streams are derived to construct livelihoods (Scoones 1998). This 'economic metaphor' may be explained by arguing that capital and resources are productive in the sense that they both facilitate ends which would not be attainable in their absence (see Johnson 1997). Like different resources, capital can generate value and productivity for those who have it at their disposal, and can be accumulated and transferred, but once it is used for a specific purpose, it becomes a resource. Livelihood resources include economic/financial, physical, natural, human and social capitals.

Without entering into a debate about the definition of these 'capitals', but based on a literature review (Coleman 1990: 297-300; Gaventa 1996; Johnson 1997; Scoones 1998; and Bebbington 1999), they can be defined as follow:

1. *Economic/financial capital*: the capital assets (cash, credit/debt, savings, working capital and investments) that can easily be converted into economic resources (money) and are essential for the pursuit of any livelihood strategy. Economic/financial capital also includes technologies, livestock, seeds, and information.
2. *Physical capital:* the physical assets and infrastructure including access roads, basic infrastructure, production equipment and plantations.
3. *Natural capital:* the stock and the quality of natural resources (soil, forests, water, air, genetic resources, etc.) and environmental services (hydrological cycle, carbon sequestration, etc.) from which both resource flows and useful services for livelihoods are derived.
4. *Human capital:* the capacities, skills, knowledge, ability to work, good health, and physical capability important for the successful pursuit of different livelihood strategies. It is possible to develop human capital consciously through formal education and training, and unconsciously through experience. This could also include labour, although some authors prefer to identify labour as an asset in and of itself (Moser 1998).
5. *Social capital:* the assets that one has because of relating with others and one's membership in organizations (networks, social relations, affiliations, associations, norms, trust, and disposition to work for the common good) upon which people draw when pursuing different livelihood strategies requiring coordinated and collective action, and that facilitate access to other resources.

In general, economic/financial, physical and natural capitals can be considered as tangible assets, while human and social capitals are intangible assets, although they can be possessed individually. Sequencing, substitution, clustering, access, trade-offs and trends of livelihood resources all need further attention (see Scoones 1998). The issue of sequencing of livelihood resources is important when analysing processes of change, as we can ask if one type of livelihood resource may be an essential precursor for gaining access to others.

Livelihood strategies

'Strategy' refers to the way people resolve their livelihood problems and organize their resources by actively pursuing their own 'projects' and by constructing their own patterns of organization. Thus, livelihood resources cannot be seen as simple assets that people use in building livelihoods, but are instead resources that give them the capability to be and to act, and form the basis of social actors' power to act and to reproduce, and to challenge and change the rules that govern and control them (Bebbington 1999). Thus, a livelihoods framework sees resources as vehicles for instrumental action (making a living), hermeneutic action (making living meaningful) and emancipatory action (challenging the structures under which one makes a living).

According to Long (1997a) 'livelihood' best expresses the idea of individuals and groups striving to make a living, attempting to meet their various consumption and economic necessities, coping with uncertainties, responding to new opportunities, and choosing between different value positions. To achieve a 'livelihood', individuals and groups follow a diversity of strategies. The term 'livelihood' is thus only the outcome of a complex economic and social process performed by differentiated social actors. Thus, studying 'livelihoods' entails identifying the relevant social units and fields of activity, and this has implications for the range of actors that need to be involved in the analysis of 'livelihoods' (Long 1997b). First, a range of labourers and entrepreneurs, small, medium and large, need to be included from agricultural workers, smallholders, private land-owners, traders, transporters, export-company entrepreneurs, and retailers in the domestic market (local, regional and national). Second, a range of governmental and non-governmental bureaucrats need to be included, from present actors such as front-line workers and technicians, service provider officials, community-level leaders, government functionaries and political bosses, to non-present actors such as policy makers, donors, development 'experts', researchers and media creators and communicators who shape the conduct of others through 'action at a distance'. These non-present actors, act through the mediation of nonhuman elements such as policy documents, project designs, technological packages, methodologies and material 'conditionalities' (Long 1997b: 229).

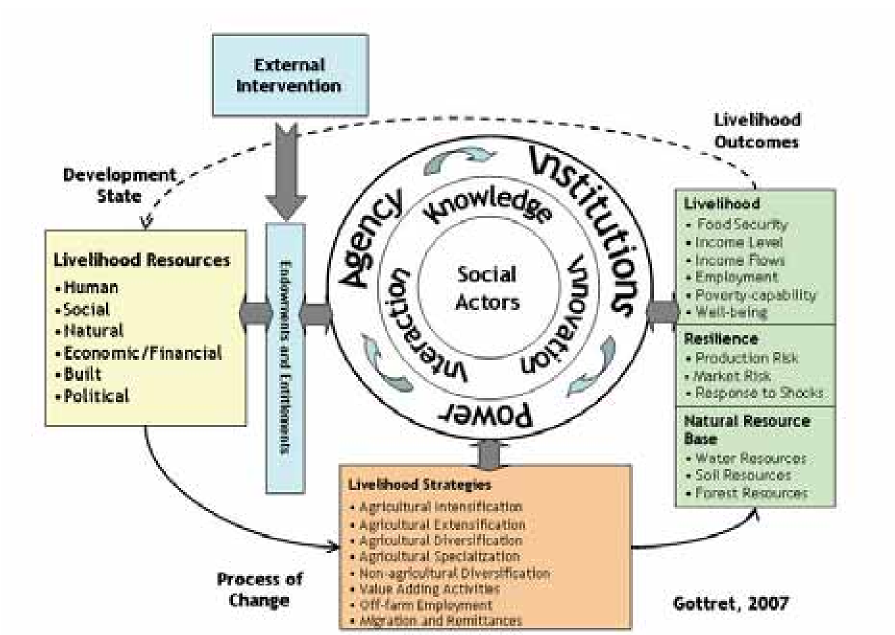
The range of options open to rural people can be grouped into three broad clusters of livelihood strategies: (i) agricultural intensification and agricultural extensification; (ii) livelihood diversification within agriculture or to non-farm activities, and (iii) migration (Scoones 1998). Rural people might gain more income from agriculture (including livestock rearing, aquaculture, forestry etc.) through processes of intensification (more output per unit, through capital investment or increases in labour inputs) or extensification (more land under cultivation). Or they can diversify to other agricultural activities or to a range of off-farm income earning activities, including paid employment; or move away to seek a livelihood elsewhere, either temporarily or permanently. However, more commonly, they pursue a combination of strategies together or in sequence. In addition, diversification strategies can take different forms: diversification within agriculture, diversification to off-farm value-adding activities such as post-harvest management of farm products, processing, or trading; and diversification to non-agricultural activities. Some actors may also pursue specialization strategies, but this strategy may affect livelihood sustainability since they may reduce livelihoods resilience.

2.3 Analytical Framework: Innovation for Sustainable Rural Livelihoods

Assessing the role of external intervention for facilitating innovation processes and its contribution to the generation of sustainable rural livelihoods is complex, and impossible to do in an integrated manner by taking a single conceptual framework, since none of the frameworks discussed in this section respond to all the questions raised in this research. The Interactive Learning and Innovation for Sustainable Rural Livelihoods Framework developed for this study suits the research problem and objectives, links the different concepts, and combines different conceptual frameworks. The framework in its schematic form is presented in Figure 1. It combines an actor-oriented approach (placing social actors at the centre and raising the issues of power and agency) with a sustainable rural livelihoods approach (explicitly focusing on the importance of institutions and the composite nature of rural peoples' livelihoods), and provides a broad model for a holistic and integrated view of the processes by which people achieve (or fail to achieve) sustainable livelihoods, and the institutions that mediate the access to livelihood resources.

‘Entitlement analysis’ is used to take a full account of the conditions that constrain choices and strategies of differentiated social actors who interact and negotiate to access and control livelihood resources. Understanding the role of these structural factors permits an assessment of the possibilities to achieve desired economic, social and environmental outcomes, as well as the role of institutions as mediating the access to livelihood resources. According to Scoones (1998), understanding institutional processes is a prerequisite for identifying restrictions/barriers and opportunities for achieving sustainable rural livelihoods. Because formal and informal institutions mediate access to livelihood resources, an understanding of institutions is critical for designing, implementing and assessing interventions.

Figure 2.1
Innovation for Sustainable Rural Livelihoods Framework



The framework's five key components reflect (1) the state of development, (2) the interactive learning for innovation process implemented by social actors who perform livelihood activities and strategically get involved in organizational processes and practices in their everyday life by a common purpose to achieve objectives (central to the process of change and binding the elements of the framework together), (3) the process of change (and its underlying livelihood strategies), (4) the livelihood outcomes, and (5) external intervention and its underlying institutions, who mediate access to livelihood resources and intervene into peoples' livelihoods.

This framework also acknowledges an ongoing process of change that is circular, since changed rural livelihoods also change the livelihood resources base from which social actors pursue their livelihood strategies. The framework sees innovation as a dynamic social process that results from the explicit interaction of multiple social actors, in line with the actor-oriented approach selected for the study, with multi-layered sources of knowledge. Thus, the framework places social actors at the centre as active participants who interact, process information, learn, produce knowledge and innovate. This analytical framework is important for a better analysis of innovation processes that result from the fact that social actors are capable of questioning the efficiency and legitimacy of traditional production and social forms and practices, and of formulating new ways of classifying, interpreting, strategizing, and combining resources. Thus, social change may result from the fact that social actors respond to endogenous and exogenous changes, or because they encounter development programs or projects, or other communities and cultures with different ideologies and knowledge. This permits the visualization of innovation processes as continuous processes of technological, social and institutional change in which different actor interests and struggles are located instead of the transfer of technology approach that implies a linear model for the generation of knowledge and technology.

An important element of the framework is that it analyzes external intervention and its underlying institutional arrangements through their social and historical role in mediating access to livelihood resources. Thus, it proposes that external interventions influence the possibilities to pursue sustainable rural livelihoods by affecting not only the endowment of livelihood resources, but also who is entitled to use these resources. Different types of external interventions may effect a different combination of livelihood resources endowment and/or can change the entitlement to use these resources by differentiated social actors. In addition, some intervention processes are set up to enhance access to livelihood resources by delivering them directly, while others work in facilitating access to livelihood resources indirectly by aiming to change structures and institutions to affect rural people's access to and control over resources. Moreover, macroeconomic and policy interventions or non-intervention can also enhance or limit the possibilities to access resources as well as the possibilities that they can be transformed into well-being.

Therefore, instead of taking as given that social actors can use livelihood resources to develop their livelihood strategies, this framework recognises the need to understand how formal and informal institutions affect social actors' entitlement to their given endowments. The framework aims to analyse how social actors can organize themselves and develop their capabilities to change institutions in order to improve their access to livelihood resources, and therefore, their well-being. Moreover, it recognises the existence of social differentiation among rural individuals and households. To analyse the livelihood strategies of people in a community, it is important to understand the institutional and organizational dynamics as well as the power relationships within its members. One fundamental assumption in many intervention processes is that a distinct community exists (Leach, et al. 1999). External interventions thus see communities as relatively homogenous, with members' shared characteristics distinguishing them from 'outsiders'. However, social science debates and empirical work have questioned this assumption. A large body of work concerned with social differences has highlighted the ways that gender, caste, class, wealth, age, origins, and other aspects of social identity divide and crosscut so-called 'community' boundaries. In these studies it is emphasised how diverse and often conflicting values and resource priorities – rather that shared beliefs and interests – pervade social life and may be struggled and 'bargained' over (Carney and Watts 1991, Moore 1993, Leach 1994, Mehta 1997, Jansen 1998).

This view corresponds to a political economy approach that bases analysis on the concept of social differentiation as contradictory components of the social system. Specific policies are then the outcome of an attempted resolution, at the level of the state, of crises that arise from class contradictions and condition the development of the economic and social system, in particular its performance in terms of growth and distribution (de Janvry 1981). Therefore, the analysis is linked to the political expression of social differentiation and the influence of these policies on development.

According to Long (1997b), the issue of whether an actor-oriented approach might be reconciled with a political economy approach is unresolved, yet such a combination would produce a more rounded analysis of the complexity and heterogeneity of the structures and their underlying institutions that limit, or broaden the choice of social actors in terms of their alternatives and opportunities. Long argues there are inherent epistemological and theoretical incompatibilities of structural versus actor explanations (i.e. Long and van der Ploeg 1989:238). However, this reconciliation is possible when concepts of structure are re-defined from an actor-oriented perspective (Hebinck and van der Ploeg 1997). This implies focussing on how specific interrelations are established (between farm enterprises and communities on the one hand, and institutions such as the market, the state, and processes of rural innovation on the other), how these relationships affect farming practices and livelihood strategies, and how they might be changed over time. In other words, the a priori assumptions of some forms of structural analysis, as practiced by many in the 1990s, are changed into a set of research questions within structural analysis (Hebinck and van der Ploeg 1997). Hence, structural analysis studies, how and when existing institutions shape processes of change (i.e. agrarian change and farmer practices). It also studies how social actors' knowledge, power and agency affect institutions, which permits the analysis of bottom-up as well as top-down processes of change, giving importance to both processes.

3 Research Approach, Methodology and Case Studies

This chapter focuses on the implications of the conceptual framework developed in Chapter 2, describes the methodology used to conduct the research and introduces the case studies. It also describes the Cabuyal watershed in the Municipality of Caldono in Colombia and the Tascalapa watershed in the Municipality of Yorito in Honduras. These descriptions begin with the biophysical and socio-economic characteristics of both sites, including an analysis of differential access to human, social, economic/financial and natural resources. The introduction to the case studies continues with an analysis of the livelihood strategies of the population, including agricultural activities, activities to add value to agricultural primary production, off-farm employment, non-agricultural activities and migration, and their relative importance.

3.1 Methodological Consequences of the Selected Research Approach

The Interactive Learning and Innovation for Sustainable Rural Livelihoods Framework was developed for this research to assess the role of external interventions in facilitating innovation processes and their contribution to the generation of sustainable rural livelihoods. It takes a holistic and integrated view, focusing on social actors and their organizational processes, entitlements to access and control over livelihood resources, institutions and the role of external intervention in mediating access to and control over these resources, interactive learning for innovation, and the composite nature of people's livelihoods.

This methodological choice has the following implications in the conceptualization of the central analytical issues of the research.

1. The research focuses on 'rural innovation processes' vis-à-vis specific 'technological fixes'. It analyzes rural innovation as a complex social

process that involves human agency, knowledge generation, construction of technological and organizational capacity, power relations, and the conflict and struggle around access to and control over livelihood resources to innovate, instead of analyzing technology generation, diffusion and adoption as a linear process.

2. The study looks at smallholder livelihoods outcomes as the result of the combination of different strategies that aims to secure people's livelihoods and, at the same time, improve its resilience. It interprets rural innovation processes and their economic and environmental outcomes as results of the struggle and negotiation that takes place between individuals, groups, and organizations with differing, and often conflicting, strategies and interests. It sees strategy as important in understanding how socially differentiated producers, processors, market agents, service providers and rural inhabitants resolve their livelihood problems, mitigate their constraints, organize their resources, and deal with intervening agencies.
3. 'Planned intervention' is seen as an 'intervention process' shaped by the interactions that evolve between local and intervening social actors, including the responses and strategies of local and regional groups who may struggle to define and defend their own social spaces, cultural boundaries and positions within the wider power field. It is used to analyze the roles embraced by formally organized governmental and non-governmental agencies and private entrepreneurs that attempt to organize and control production and commercialization. The research also analyses the conflicts faced by formal and informal intervening agencies, both among themselves and with donor agencies, over resources and power.
4. The research recognises the need to understand the wider structural phenomena, as processes outside the immediate arena of interaction shape many of the strategies pursued by individuals or groups. Therefore, it acknowledges the need to examine how structural factors (i.e. changing markets and international conditions, shifts in governmental development policy or in the power exercised by groups at a national or regional level) constrain or enhance the choices and alternatives that affect local actor organizational processes and strategies.

3.2 Methods, Case Studies and Research Sites

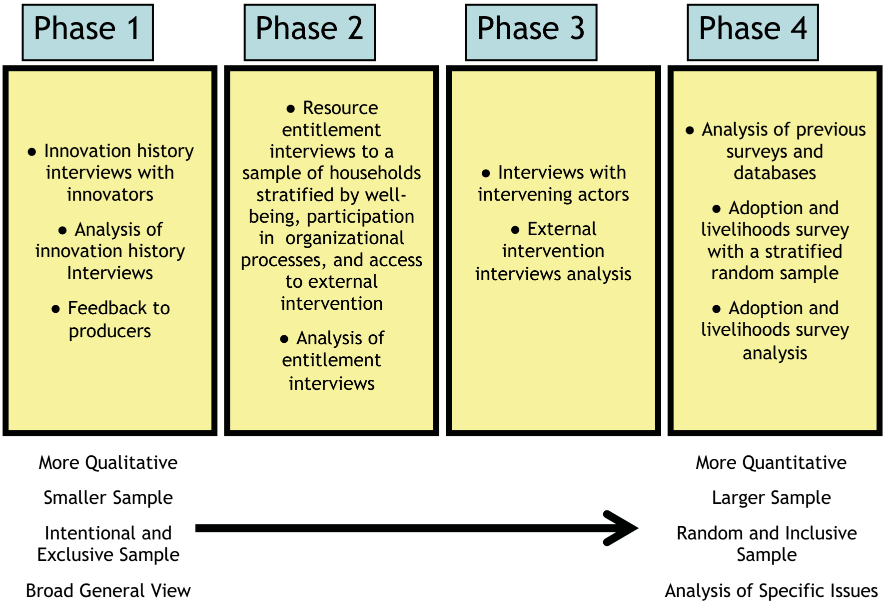
The Cabuyal watershed, located in the Municipality of Caldono in Colombia, and the Tascalapa watershed, located in the Municipality of Yorito in Honduras, were selected because of their long histories of interventions led by a broad range of agencies, including Integrated Rural Development (IRD) programmes. They provided an opportunity to assess intervention processes in support of resource-limited smallholders and the different approaches taken to promote innovation processes. Both have also been involved in the Integrated Natural Resource Management (INRM) approach supported by a multi-institutional alliance, and shaped and implemented by the International Centre for Tropical Agriculture (CIAT). INRM was meant to foster collective action across the watershed, using a common vision; it was developed in Colombia, in collaboration with national and local partners beginning in the late 1980s, was used first in the Cabuyal watershed and was then scaled up to include the Tascalapa watershed from 1996.

The selection of the two sites was made to assess the scaling up potential of external intervention strategies to promote innovation processes for development in similar agro-ecosystems and regions and therefore evaluate the 'international public goods' nature of this process for rural innovation. The selection of two research sites was not with the aim of conducting a formal comparative analysis.

INRM started in the 1980s in the Cabuyal watershed in Colombia as an experimental pilot model with the idea that if it was successful it could be replicated and tested in other regions of Latin America and ultimately in Asia and Africa. As part of this process, participatory action research started in the early 1990s, with the Cabuyal watershed being used as a living laboratory where technological, social and institutional innovations could be developed and later scaled up to justify the investment made.

Data collection for the present research was done through (a) content analysis of the literature, project reports, and development and innovation policies, (b) analysis of databases from previous surveys conducted by the several organizations, and (c) through fieldwork in both sites between April 2002 and January 2004. Fieldwork was conducted in four phases, permitting fieldwork and preliminary analysis to inform each other, as shown schematically in Figure 3.1. Both quantitative and qualitative (including structural/actor-oriented) data were collected. The fieldwork and data collection started with open, semi-structured and qualitative interviews that aimed to give a broad view. This also assisted in the selection of innovation processes to be analyzed and the reconstruction of innovation histories. As data collection and analysis progressed, data became more structured and quantitative, to assess emerging issues such as the diffusion of the innovation process, its outcomes and its influence on livelihoods and their sustainability.

Figure 3.1
Schematic representation of the fieldwork and data collection methodology



Before fieldwork began, personnel in CIAT and the International Service for National Agricultural Research (ISNAR) were interviewed to discuss their perception of how approaches for the generation of knowledge and technology had changed within the CGIAR system and CIAT in the last decades. The social, political, economic and technological drivers of these changes, as well as how these factors influenced research agendas of international and national agricultural research systems were also discussed in these interviews. In addition, personnel from National Agricultural Research Institutes of different countries of Latin America were also interviewed to discuss the same issues along the duration of the fieldwork as opportunities became available.

3.2.1 Phase one

Fieldwork started with an open and semi-structured qualitative approach that included participant observation of the researcher. This helped to gain a better understanding of the context and select innovation processes to be analyzed, meet potential innovating farmers to be interviewed as well as personnel from intervening agencies.

In the case of the Cabuyal watershed in Colombia, nine innovation processes were identified:

1) Intensification in bean production through the introduction of new varieties and improved crop management practices and marketing innovations;
2) Diversification from cropping to livestock for milk production and processing;
3) Diversification to blackberry production;
4) Intensification in plantain production through the introduction of improved varieties and crop management practices;
5) Diversification to cut flowers production;
6) Market differentiation for poultry commercialization;
7) Soil management and conservation practices;
8) Reforestation and improved management of water sources; and
9) Establishment of community-managed credit schemes.

In the Tascalapa watershed in Honduras, six innovation processes were identified:

1) Intensification in traditional food crops such as beans and maize;
2) Diversification to coffee, intensification through the introduction of new varieties and improved management practices and product differentiation;

3) Diversification to cattle production, intensification through the introduction of improved pastures and specialization;
4) Soil management and conservation practices;
5) Reforestation and improved management of water sources; and
6) Establishment of community-based rural banks

Once innovation processes were identified and selected, the reconstruction of the innovation processes followed, through interviews with innovating farmers. Twenty-seven innovators were interviewed in the Tascalapa watershed of Honduras during October and November 2002; and 33 innovators in the Cabuyal watershed of Colombia between December 2002 and February 2003. Farmers were selected from those who participated in the different innovation processes. Interviews were taped with farmers' permission, transcribed and coded with the N-Vivo program. This process was important for a preliminary analysis of the interviews, giving a general and broad view of innovation processes in both sites. This initial assessment looked at how innovation processes were related to access and control of livelihood resources, the role of external intervention in those processes, as well as a first approximation of how these innovations changed livelihood strategies and influenced livelihood outcomes. In addition, a smaller set of innovation processes was selected to deepen analysis during the other three phases of fieldwork.

3.2.2 Phase two

To assess how access and control over livelihood resources influenced innovation processes, how different actors benefited from these processes, and how this influenced livelihood strategies, a second set of farmers was interviewed. In the Cabuyal watershed, to broaden the sample from innovating producers to the whole population, 1993 census data, gathered by an inter-institutional committee and analyzed by Cabra (1998), was used to classify households according to their access to livelihood resources. The first classification variable used was the 'level of well-being' (low; medium; and high) based on a study by Ravnborg and Guerrero (1997), who estimated the well-being index based in local perceptions and indicators. These local indicators included access to economic/financial and physical resources. Three other variables were used to complement this stratification variable:

1) Whether the household head had access to primary education, as a proxy for access to human resources;
2) Whether the household participated in a producer's organization with agricultural research, production, processing, or commercialization objectives, as an indicator of access to social resources; and
3) The location of the household in the watershed (lower watershed, medium watershed; and upper watershed), as an indicator of access to physical resources.

Based on these parameters, households fell into 33 of 36 possible combinations and one household was chosen randomly from each. Since no household fell in three of these combinations, 33 semi-structured interviews were conducted during June and July 2003. Because this sampling strategy was based on information collected 10 years before, the head of households interviewed were older than 30 years old, creating a bias towards the older population.

In the Tascalapa watershed in Honduras, this sampling strategy was impossible, as the names of the households were not included in the database constructed by the DRI-Yoro Program based on a survey of the whole population in 1993. Without names, it was impossible to link each survey with its respective household. Hence, selected innovators interviewed in Phase 1 were asked for the names of producers who had not participated in the innovation processes, but had seen their work and results, and a set of these producers were interviewed in the second phase, together with a number of day labourers. Producers interviewed were representative of the different strata of the population according to their access to livelihood resources. Twenty-six semi-structured interviews were conducted during this phase of fieldwork (in February 2003). All the interviews conducted during this second phase of fieldwork were also taped with farmers' permission, transcribed and coded in the N-Vivo program.

3.2.3 Phase three

The third phase of fieldwork reconstructed innovation histories from the interveners' perspective. Personnel from different governmental and non-governmental, national and international, intervening agencies that worked in both sites and participated in the innovation processes were interviewed. These interviews analyzed the discourse behind the intervention processes and how different approaches and theories for development and for the generation of knowledge and technology have informed intervention practice or what Röling and Jiggins (2001) have called 'praxiology'. Twenty-six semi-structured interviews were conducted in Colombia between April and June 2003 and 15 semi-structured interviews in Honduras, during June and July 2003. In addition, 12 interviews were conducted in Tegucigalpa with personnel from governmental organizations in charge of innovation policy making in Honduras.

3.2.4 Phase four

Based on the results of Phases 1-3 of the fieldwork and the analytical framework developed for this research, an Innovation and Livelihoods Survey was designed and applied to randomly stratified samples in the Cabuyal watershed of Colombia and the Tascalapa watershed of Honduras. The survey was directed toward the household head and ideally to the household head and spouse, or otherwise toward a family member who knew about the household's agricultural and non-agricultural activities. The survey contained eight sections:

1) Survey identification and household characteristics;
2) Access to human resources, including formal and informal education, capabilities, agency, and access to labour;
3) Agricultural and livestock activities that included aspects such as land tenancy, land use, crops, cropping systems and technology used, markets for agricultural products and income obtained, livestock production and technology used, markets for livestock products and income obtained, and access to information and agricultural markets.
4) Access to social resources, including participation in producer and community organizations, and relations with external (formal and informal) agents;
5) Post harvest activities and income;
6) Non-agricultural activities and income;
7) Employment and wages; and
8) Access to and management of natural resources (soil, forest and water resources).

The sampling unit was the household, defined as a family group of people living under the same roof and preparing food together. The sampling frame (or list of sampling units) for the Cabuyal watershed was defined based on the 1993 census (Cabra, 1998), and the sampling frame for the Tascalapa watershed was defined using the list of households per community provided by the Yorito Municipality. The stratification variable was the location of the household in the watershed (lower, middle, or upper watershed) since this affected both agro-ecological conditions and access to basic infrastructure. To determine the sample size, the following formula was used (Cochran 1977, Lohr 1998, Thompson 2002):

$$n = \left(\frac{t * s}{d * \bar{x}}\right)^2$$

where:

n = estimated sample size

t = level of confidence

s = standard deviation of key continuous and/or discontinuous variable

d = maximum permissible error

$\bar{x}$ = mean of key continuous and/or discontinuous variable

Two key variables were used to estimate the sample size. Since the survey was conducted with three main purposes: (1) assessing access to livelihood resources (a combination of continuous and dichotomous or categorical variables); (2) estimating innovations diffusion (a dichotomous variable), and (3) evaluating livelihood strategies and outcomes (a combination of continuous and dichotomous or categorical variables), a continuous and a dichotomous variable were used to estimate the sample size. The first was farm size, a continuous variable, and the mean and standard deviation were estimated with 1993 census data in the case of the Cabuyal watershed, and with data from the 1993 DRI-Yoro survey in the case of the Tascalapa watershed. The second was the diffusion of innovation, a dichotomous variable, and to be in the safe side the maximum possible variance was used (0.25) that is equal to p*q, where: p = proportion of innovating households (0.5) and q = proportion of non-innovating households (0.5). The sample size was then allocated to each strata, proportionally to the number of households in each location, and also the number of households to be surveyed per community were distributed in proportion to the number of households in each community. In the Tascalapa watershed, surveys were also conducted in the main town of Yorito.

Based on this, Table 3.1 shows total sample size, sample size per strata, as well as maximum permissible error and confidence levels for the continuous and discrete variables estimated in each site. The confidence levels range from 91.5 to 96.5, being lower for the estimation of continuous variables than for discrete variables. Maximum permissible errors were between 3% and 4% for the discrete variables, 9% for the continuous variables in the Tascalapa watershed and 20% for the continuous variables in the Cabuyal watershed. In the later case, it was impossible to increase the sample size given the security situation in Colombia at the time that the survey was conducted. The surveys in the Cabuyal watershed were made in November and December 2003, and the surveys in the Tascalapa watershed in January and February 2004.

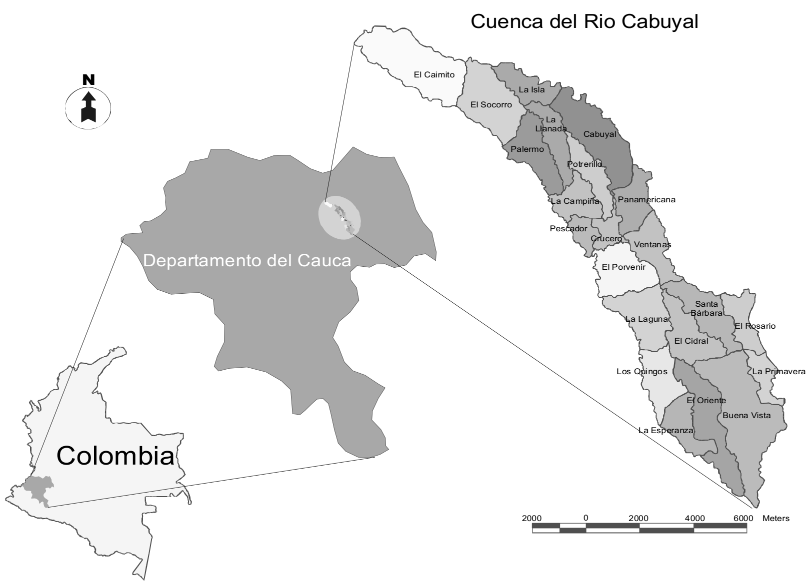
Table 3.1
Sample size, confidence level and maximum permissible error of the survey used in the Cabuyal and Tascalapa watersheds

	Cabuyal Watershed		Tascalapa Watershed	
Total sample size	117		192	
Upper watershed	27		84	
Medium watershed	60		13	
Lower watershed	30		76	
Main town	–		19	
	Continuous variables	**Discrete variables**	**Continuous variables**	**Discrete variables**
Confidence level	91.5	96.5	92.0	95.5
Max. permissible error	0.20	0.04	0.09	0.03

3.3 Introduction to the Case Studies

The data from the Innovation and Livelihoods Survey provides the basis for the information and analysis in this section, together with participant observation of the researcher, unless otherwise indicated.

Figure 3.2
The Cabuyal watershed in the municipality of Caldono, Colombia



Source: CIAT Land Use Project, Cali, Colombia

3.3.1 Watershed characteristics and population dynamics

The Cabuyal Watershed is part of the municipality of Caldono on the occidental side of the central Andes mountain range in the northern part of the Cauca Department (see Figure 3.1). It is located at one hour south from Popayán – the capital of the Cauca Department – and two hours from Cali, one of the three most-important cities of Colombia, with a population of almost 3 million people. The Pan-American Highway that connects Cali and Popayán runs through the municipality and the watershed and divides it in two. Although this highway facilitates access to two main cities (1-2 hours), access from the highway to the different communities is not easy, especially for the lower and upper watershed communities. Average travelling time, under normal conditions, from the highway (Pescador) to the communities is 35 minutes but varies from zero to four hours depending on the community. Most of the population (94%) have access to piped water, 20% cook with electricity, 41% with propane gas, and 88% with firewood, although most communities have electricity.

The Cabuyal watershed is 7,400 ha in size and altitudes range from 1,200-2,200 m above sea level (Ravnborg and Rubiano 1998). The high variation in altitudes along the watershed results in a diverse climate. While the average temperature in the lower watershed is 24 º C with a dry climate (an annual mean precipitation of 1,400 mm), the higher watershed presents mean temperatures of 12 ºC and a humid climate (an annual mean precipitation of 2,500 mm) (Vivas 2000). Average annual rainfall in the watershed is just below 2,000 mm, and a pronounced dry season lasts from June to August (Ravnborg and Rubiano 1998).

The watershed has three micro-regions containing 22 communities. About half of the watershed has slopes of more than 30%, and another third has slopes between 12-30%, making variation a salient feature of the area (Urbano et al. 1995). Therefore, a high proportion of the watershed is hillsides where soils are exposed to erosion and less fertile. This reduces productivity and makes the land less sustainable if inappropriate cropping practices are used. The Cabuyal watershed is an important source of water for the population that live in the valley, for human consumption and irrigation (Ostertag 1994). Fifty-four percent of the households have water springs on their farms.

According to the 1993 Census (Cabra 1998), the Cabuyal watershed has a population of 5,170 inhabitants and is densely populated (100 persons per km2) although there are substantial variations in density between communities; excluding the semi-urban population of Siberia (the watershed's only town) most people live in rural areas. According to the health census of 1999, Caldono has a population of 31,943 inhabitants that has been decreasing at an annual rate of 0.4% over the last ten years, highlighting a strong emigration process. There are four indigenous territories and five indigenous local authorities in the municipality and this population represents approximately 68% of the total population. However, only 47% live in the indigenous reserves and are under indigenous authority. Thus, the indigenous population in Caldono live in three different situations: (a) in the indigenous reserves under indigenous authority, (b) outside the indigenous reserves but under the indigenous authority, and (c) outside both the indigenous reserves and the authority

(Rojas 1993). Households have an average of 4-5 persons and most are male-headed but 15.4% are female-headed. These are mainly widows who have lost spouses to the violence in the region.

Figure 3.3
The Tascalapa watershed in the municipalities of Yorito and Sulaco, Honduras

Source: CIAT Land Use Project, Tegucigalpa, Honduras

The Tascalapa watershed is located in the municipalities of Yorito and Sulaco, in the southern part of the Department of Yoro, situated in the Central Northern part of Honduras (See Figure 3.2), four hours north from Tegucigalpa and three hours south from San Pedro Sula, the two major cities of the country. Access to these municipalities is difficult given that not all roads are paved and transportation services are limited. Access from the towns of Sulaco and Yorito to the communities is even more complicated because public transportation is almost nonexistent.

Farmers take on average 80 minutes (1 1/3 hours) to travel from Yorito to their communities, but this varies from zero to five hours depending on the community. Most of the population have access to piped water (92%), but all of them use firewood for cooking since electricity and propane gas services are limited.

The Tascalapa watershed covers 11,280 ha and includes parts of the municipalities of Yorito and Sulaco that together have an extension of 45,490 ha. Altitudes range from 400-1,800 metres above sea level, resulting in a diverse climate with average temperatures ranging from 13-31ºC according to altitude. Mean temperatures vary from 24-29 ºC and the relative humidity from 60-80%. Annual mean precipitation ranges from 1,100-1,300 mm, distributed in two periods: a rainy season from May to October, and a dry season from November-April (data from CIAT Hillsides Project, Tegucigalpa, Honduras). Given the two-season rainy pattern, it is impossible to crop throughout the year without irrigation. Given these rain patterns and the lack of entitlements to access livelihood resources, an important percentage of the population faces seasonal food scarcity during three months of the year (June-August). Usually the food harvested and stored is insufficient to meet the food demand of the population until the next harvest is ready in the next year.

Most of the land in Yorito and Sulaco is hillside and 70% of the area has slopes of more than 30%, although there are also two small valleys. Soils are not deep and their fertility level ranges from medium to low. The major environmental constraints in the watershed are the excessive slopes (which are susceptible to soil erosion), small farm sizes, slash and burn practices, overgrazing, low soil fertility, and natural forest depletion (Ravnborg 1999). The upper watershed is an important source of water for the lower valleys, both for human consumption and irrigation, and a few projects have activities with the aim of protecting the remaining forests and water springs. Thirty-one percent of households have water springs on their farms.

According to the 1996 Census, the municipalities of Yorito and Sulaco have 26,374 inhabitants, with population increasing by 3.3% annually. The Tascalapa watershed alone has a population density of 173 habitants per km2, an estimated population of 19,500. Thirty percent of them are of the Xicaque ethnic group, which lives in the higher altitudes and has as its major activities the exploitation of forest resources, handicrafts and (to a lesser extent) agriculture. The other 70% of the population are mestizos, commonly called in Honduras 'ladinos' (Ravnborg 1999). Households have an average of 5-6 persons and 87% of them are male-headed. Female-headed households are mainly due to death; migration of household heads is almost nonexistent.

Although both regions are representative of the hillside agroecosystems of Latin America, they also have important population differences. First, the Cabuyal watershed, which was the living laboratory where technological, social and institutional innovations were to be developed, is significantly smaller in terms of area and population size than the Tascalapa watershed, where these innovations were to be out-scaled. Moreover, both household size and population density in the Tascalapa watershed are higher and growing. This situation places a higher pressure on natural resources in the Tascalpa than in the Cabuyal watershed.

Both regions have a combination of indigenous populations located mainly in the upper watersheds and mestizo populations principally living in the medium and lower watersheds. However, the Cabuyal watershed has a higher proportion of (a well-organized) indigenous population, with a higher proportion of these living in indigenous territories under indigenous authority, who have gained important rights with the 1991 Colombian Constitution. The indigenous population in the Tascalapa watershed is less organized and in the process of being recognized by the State but no clear policies are directed at this population.

Second, the Tascalapa watershed is more isolated than the Cabuyal watershed, not only because distances to major cities and markets are larger, but also because access roads and transportation services are more limiting. This difference is critical to market opportunities and the type of crops that can be commercialized. Furthermore, although in both watersheds most households have access to aqueduct and piped water, access to electricity and other sources of energy is more constraining in the Tascalapa watershed. In short, the Cabuyal watershed has better basic services, such as transportation, water, and electricity and other sources of energy, resulting in less pressure on forest resources.

Third, although climatic conditions in both watersheds constrain the possibilities to produce all the year (which would improve food security and provide constant supply of marketable products) the biophysical and climatic characteristics of the Tascalapa watershed are more constraining that those of the Cabuyal watershed. The former has deeper slopes, poorer soils, less precipitation, fewer water sources and a longer dry season

3.3.2 Access to livelihood resources

Access to human resources

Table 3.2 compares access to human resources in the Cabuyal and Tascalapa watersheds. Households in the Tascalapa watershed have in average one more member and while households in the Cabuyal watershed have an average of 2.1 children, households in the Tascalapa watershed have in average 3.7 children. Other household demographic variables are similar.

Average years of formal education are higher in the Cabuyal watershed, while access to informal education and training is almost the same. However, household members in the Cabuyal watershed have had more opportunities to visit other communities or regions through field trips, probably through the area's better accessibility and transportation services. It is important to note that both household head and spouse tend to have the same level of formal education, and in the case of the Tascalapa watershed, wives have a slightly higher level of formal education. Male household heads in the Cabuyal wratershed have an average 3.9 years of formal education; this is slightly lower (3.6 years) in female-headed households. Male household heads in the Tascalapa watershed have an average of 2.7 years of formal education, almost the same as female household heads (2.6 years).

Households in the Cabuyal watershed have had more access to non-financial support services such as technical assistance, training, transportation, storage, processing and commercialization services, as well as more access to information on prices and markets. On the other hand, farmers in the Tascalapa watershed are more interested in experimenting, participating in community and producer groups, working with external organizations, projects or programmes, and are more comfortable in leading groups. In short, households in the Tascalapa watershed are slightly bigger and overall access to human resources slightly higher in the Cabuyal watershed, although people there seem less interested in participating in activities promoted by external organizations

Table 3.2
Comparison on access to human resources in the Cabuyal and Tascalapa watersheds

Human Resources	**Cabuyal Watershed (N = 116)**	**Tascalapa Watershed (N =192)**
Household demography		
Mean household size	4.4	5.6
Male-headed households (%)	84.5	87.0
Mean age of household head (years)	48.4	50.2
Mean age of spouse or partner (years)	41.0	42.3
Mean number of children	2.1	3.7
Access to formal education		
Average years of formal education of:		
Household head	3.9	2.7
Spouse or partner	3.8	3.1
Access to informal education and training		
Average number of:		
Training events attended	2.3	2.2
Fieldtrips that participated	0.5	0.3
Access to non-financial services and information		
Households that received:		
Non-financial support services (%)	82.8	65.6
Commercialization services (%)	35.3	n.a.
Price and market information (%)	12.1	4.9
Interest in innovation processes		
Household heads who:		
Like to experiment (%)	10.3	78.1
Prefer that others experiment and then innovate if results are good (%)	11.3	12.5
Like to participate in organizational processes (%)[1]	22.6	59.4
Like to work with external organizations, projects or programs	n.a.	57.8
Feel good leading a group (%)	29.6	47.9

Source: Innovation Adoption and Livelihoods Surveys, Cabuyal (Nov-Dec. 2003) and Tascalapa (Jan-Feb. 2004).

Access to economic and financial resources

Access to economic and financial resources in the Cabuyal and Tascalapa watershed: access to land and the land tenancy situation, access to other productive resources and access to financial services in cash or in kind are compared in Table 3.2. Average farm size in the Cabuyal watershed is 4.8 ha, although this has a high standard deviation (7.3 ha) and ranges from 0 – 48 ha. Ninety-eight percent of households have access to land and the most common form of land tenancy is private property with legal titles, although 10.6% of the land is considered private property but without legal titles. Moreover, those who do not own land and access land by renting show that in the region an important land market exists.

Average farm size is bigger in the Tascalapa watershed (8.0 ha), however, its distribution is even more skewed with a standard deviation of 26.6 ha. A high percentage of households also have access to land (92%), and although private property is as important as in the Cabuyal watershed, it is important to note that half of the households that own land do not hold legal titles, and land disputes are one of the major causes of conflict and violence in rural Honduras (Roquas 2002). In addition, although a market for land exists in both sites, with differential prices according to the legal status of the land, the land market in the Tascalapa watershed is less developed, the percentage of land rented is smaller, and a significant percentage of land is accessed through non-market mechanisms. These mechanisms include sharecropping, borrowing from friends or relatives, or communitarian use among land reform beneficiaries.

One of every five households in both watersheds own cattle. However, in the Cabuyal watershed those who own cattle have on average nearly twice as many as those who own cattle in the Tascalapa watershed. Access to productive resources such as processing units to add value to primary production is also important. Almost half of the households own processing units to store basic grains (Tascalapa) or to process coffee (Cabuyal), and an important percentage of households in the Tascalapa watershed also own coffee processing units. These coffee processing and basic grain storage facilities were established with support from the Colombian Coffee Federation (in Colombia), the DRI-Yoro and other aid programmes (in Honduras) but access to other processing facilities (usually artisan) is limited to 10% of households. Half of the households have access to financial services as cash or in the form of inputs for agricultural production.

Table 3.3
Comparison on access to economic and financial resources in the Cabuyal and Tascalapa watersheds

Economic/Financial Resources	**Cabuyal Watershed (N = 116)**	**Tascalapa Watershed (N =192)**
Access to land and land tenancy		
Average farm size (ha)	4.8	8.0
% of households who have access to land	98.3	92.2
% of area owned with legal title	76.8	39.5
% of area owned without legal title	10.6	48.7
% of rented land	7.6	1.7
% of borrowed land	2.4	2.1
% of area under share cropping	1.4	2.2
% of area under communitarian use	1.2	5.8
Access to other productive resources		
% of households that own cattle	21.1	19.8
Average number of cattle owned by those who own cattle	4.3	11.5
Average number of milking cows among those who own cattle	2.1	4.4
% who own coffee processing unit	49.3	17.2
% who own a silo to store grains	-	43.8
% who own other processing facilities	7.8	10.9
Access to financial services		
Households that have received credit (%)	45.7	51.4
Households that received agricultural inputs (%)	52.6	60.4

Source: Adoption and Livelihoods Surveys, Cabuyal (Nov-Dec, 2003) and Tascalapa (Jan-Feb, 2004) watersheds.

Access to social resources

External intervention in both watersheds has promoted a series of organizational processes fomenting collective action for different purposes: land reform, accessing basic services and credit, improving smallholders bargaining power through production and commercialization via cooperatives, accessing new technology and inputs, and lately, collectively managing natural resources, conducting participatory research and developing agro enterprises. This has led to an increased interaction with external support organizations and the existence of many organizations with multiple purposes. The extent of this collaboration with external organizations, as well as the participation of households in organizational processes with different objectives, is given in Table 3.3, comparing the two watersheds.

Table 3.4
Comparison on access to social resources in the Cabuyal and Tascalapa watersheds

Social Resources	Cabuyal Watershed (N = 116)	Tascalapa Watershed (N =192)
Bonding social resources		
% of households with membership on:		
Producer organizations	57.8	38.0
Community organizations	51.7	55.2
Bridging social resources		
% of households who have received support from:		
Any local or external organization	89.7	75.0
Community-based organizations	39.7	26.0
External organizations of any orientation	80.2	69.3
Production and income generation oriented external organizations or projects	78.4	49.5
Welfare-oriented external organizations or projects	34.5	25.0
Credit-oriented local or external organizations	15.5	22.9
External organizations or projects that work on natural resource management	27.6	12.5
Private service providers	9.5	9.4

Source: Adoption and Livelihoods Surveys, Cabuyal (Nov-Dec, 2003) and Tascalapa (Jan-Feb, 2004) watersheds.

Slightly more than half of the households belong to producer or community organizations, with Tascalapa biased towards community organizations and Cabuyal towards production-oriented ones. Bonding social capital is similar in both sites: in Colombia organizational process have specific production and income-generation objectives, and fewer community improvement objectives, and in the Tascalapa watershed, the opposite holds.

With respect to the relation of households with support organizations, both local and external, these results show extensive interaction with these organizations in both sites, showing that three out of four households in the Tascalapa watershed, and nine of every ten households in the Cabuyal watershed, have interacted with external organizations and received support from them. In both sites, most of this support was oriented towards production and income generating activities, followed by welfare-oriented interventions. In addition, while formal credit services have a broader coverage in the Tascalapa watershed, external support for improved natural resource management has had a higher coverage in the Cabuyal watershed.

Access to natural resources

Hillside agro-ecosystems cover about one million square kilometres in the Andean region and in Central America and sustain an estimated ten million smallholders (Schiøler 2002). The watersheds in this study do represent a range of these. For example, in the Cabuyal watershed access to natural resources is limited (Table 3.4), but the situation is more constraining in the Tascalapa watershed. One of every seven households in the Cabuyal watershed and one of every five in the Tascalapa watershed has their main cropping field on steep slopes, one of the most important factors that contribute to soil degradation in hillside agro-ecosystems, together with intense rainfall. The depth of arable land is slightly deeper in the Cabuyal watershed (20-25 cm) than in Tascalapa, indicating a loss of fertile topsoil.

Although half of the households in the Cabuyal watershed, and one of every three households in the Tascalapa watershed, have water springs on their farms, 36.8% of households suffer from seasonal water scarcity during the driest months of the year (June-August), an average of 2.3 months per year. In the Tascalapa watershed, the situation is even more critical and 46.3% of households suffer from seasonal water scarcity during the driest months (February-April), an average of 2.2 months per year. Thus, water availability is more constraining for the population in the Tascalapa watershed. With respect to the actual condition of water sources, people in the Cabuyal watershed claim that over half of the water springs feeding the aqueducts have enough trees planted in the area, while one third have coffee plantations, and the rest have cattle and pastures or are already eroded. Most of the households in the Tascalapa watershed (84.5%) claim the water springs that feed the aqueducts have trees, 9% that they have coffee plantations and only 4.5% say they have been converted to pastures for grazing cattle.

Table 3.5
Comparison on access to natural resources in the Cabuyal and Tascalapa watersheds

Natural Resources	Cabuyal Watershed (N = 116)	Tascalapa Watershed (N =192)
Access to Soil Resources		
% of households who have their principal plot in:		
Steep slopes (> 30%)	14.9	20.5
Slopes (10-30%)	65.8	51.8
Almost flat land (5-10%)	19.3	16.9
Flat land (< 5%)	–	10.8
Average arable land depth (cm)	24.6	21.8
Access to Water Resources		
% of households with:		
A water spring on their farm	53.9	30.6
Water availability all the year	63.2	49.0
Access to Forest Resources		
% of households:		
Collecting firewood near the house	78.7	38.5
Who have to travel far from the house to collect firewood	15.7	45.3
Who have to buy firewood	5.6	16.2
With access to forest resources with commercial value, besides firewood[2]	14.7	25.0

Source: Adoption and Livelihoods Surveys, Cabuyal (Nov-Dec, 2003) and Tascalapa (Jan-Feb, 2004) watersheds.

The Tascalapa watershed shows important signs of deforestation. All households use firewood as their source of energy for cooking and only 6.5% uses also electricity or propane gas. Although 38.5% of the households collect the firewood near the house, because of its overuse almost half of the households claim that they have to travel long distances to collect firewood, while only 16% of households are in this situation in the Cabuyal watershed. Moreover, one of every seven households in the Tascalapa watershed needs to buy firewood because it is scarce, and one of every four households extract forest products with commercial value, mainly wood for diverse uses such us home construction, carpentry, poles to build farm fences and for handicrafts. This, together with a low coverage of basic services such as electricity and gas, places even more pressure on the forest for firewood collection.

Both sites thus have serious constraints in their natural resources, especially the Tascalapa watershed. Endowments to human and economic/financial resources are also limiting in both sites, again being even more limiting in the Tascalapa watershed. People have tried to overcome their limited access to resources through social organization to foster collective action. Social resources, especially networking with external support organizations, has partly compensated for such resource limitations, and helped to improve access to other resources. It is through external support that access to human resources have been improved, mainly through training and contact with other experiences and sources of knowledge. The same is true for improving access to economic and financial resources, although the outcomes have not been outstanding.

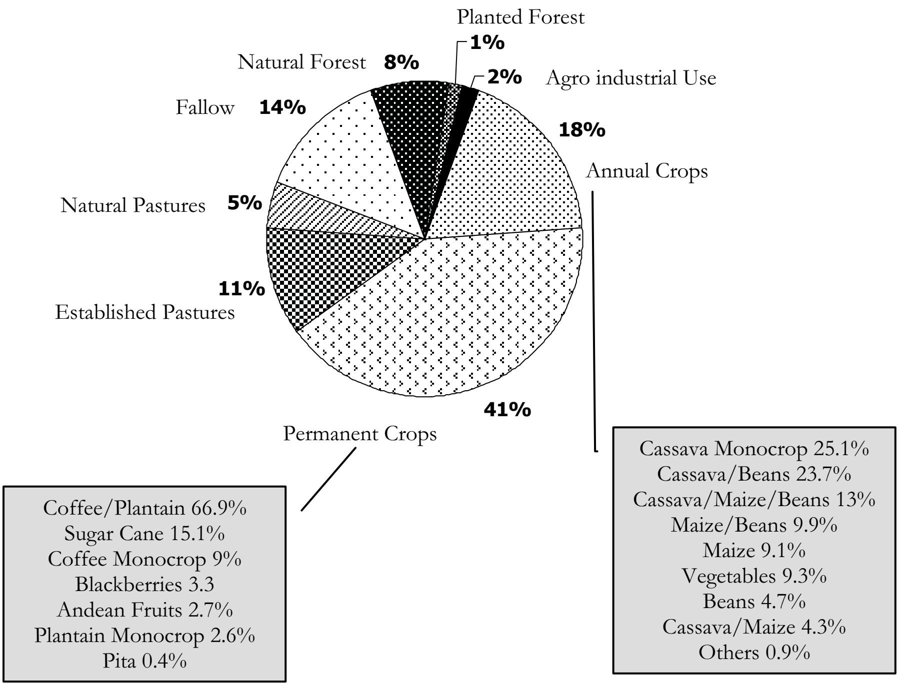
3.3.3 Livelihood strategies

Agricultural activities

Land use (Figure 3.3) also varies between the two communities. In the Cabuyal watershed, annual and permanent crops predominate, occupying almost two thirds of the land. In the Tascalapa watershed cropping is also the most important use given to available land, however, it takes a smaller percentage of it (41%). Easier access to markets in the Cabuyal watershed partly explains this situation. Households in the Tascalapa watershed, meanwhile, allocate more land to pastures, since the number of cattle heads per household is higher there. Again, market access limitations in the Tascalapa watershed partially explain this, since cattle breeding is a less risky activity than cropping and usually preferred in distant regions. About the same percentage of land is fallow is each community, and therefore the more intensive cropping in the Cabuyal watershed is in part at the expense of forest.

Figure 3.4
Comparison of land use in the Cabuyal and Tascalapa watersheds

The Cabuyal Watershed of Colombia

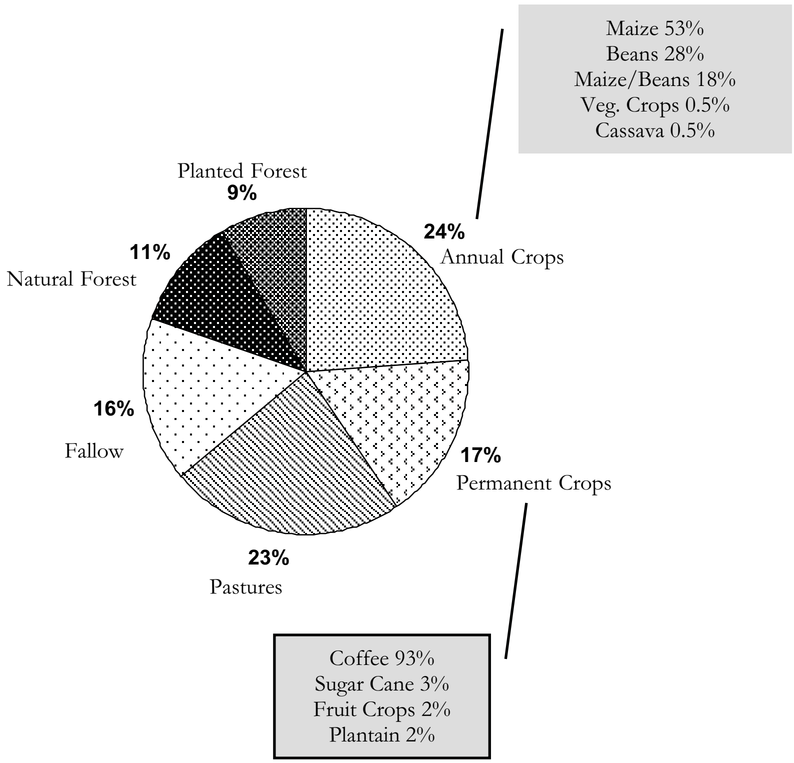


(continued)

Agriculture is the most important livelihood strategy in both sites, over 90% of the households are involved in cropping activities (see Table 3.5) and the average area cultivated per household is three ha. However, the Cabuyal watershed has a more diversified production system that includes a broader variety of food security crops *and* some higher value crops, while in the Tascalapa watershed maize and beans, especially planted in monocrop systems predominate.

Figure 3.4 *(continuation)*

The Tascalapa Watershed of Honduras



Source: Adoption and Livelihoods Surveys, Cabuyal (Nov-Dec, 2003) and Tascalapa (Jan-Feb, 2004) watersheds.

More than eighty percent of the households in the Cabuyal watershed have established permanent crops, mainly coffee intercropped with plantain. The second most important crop in the Cabuyal watershed is sugar cane for panela production. Producers also plant blackberries and other Andean fruit crops that are starting to gain importance in the watershed cropping system. In the Tascalapa watershed, however, only half of the households established permanent crops, coffee still being the most important. Producers process coffee to add value to the product, by eliminating the coffee cherrys' flesh and sun drying the beans. Half of all households have these facilities in the Cabuyal watershed, but only 17% in the Tascalapa watershed.

Table 3.6
Livelihood strategies in the Cabuyal and Tascalapa watersheds

Livelihood strategies	**Cabuyal Watershed (N = 116)**	**Tascalapa Watershed (N =192)**
% of households with agricultural activities	94.0	91.1
Mean cropping area among those who cultivate crops (ha)	3.2	3.1
% who have established permanent crops	81.9	49.0
% who plant temporal crops	86.2	88.0
% of households with post harvest / processing activities	8.6	9.4
% of households with cattle	21.1	19.8
% with income from cattle raising	13.8	13.0
Average number of cattle heads of those who own cattle	4.3	11.5
Average number of milking cows per household	2.1	4.4
% of households that raise minor species	82.8	89.1
Raise pigs	25.0	38.0
Have poultry	77.6	87.0
Raise other minor species	19.8	3.6
% of households with off-farm employment	64.7	59.4
With members as day labourers in agriculture	54.3	46.4
With member in non-agricultural employment	11.2	20.8
With a retired member	1.7	0.0
% of households with non-agricultural activities	23.3	20.3
With members who are traders	3.4	3.1
With members who work on sales	14.7	13.5
With members with other non-agricultural activities	12.1	5.2
% of households that receive remittances	28.4	37.0
% with members who have migrated	48.3	52.1

Source: Adoption and Livelihoods Surveys, Cabuyal (Nov-Dec, 2003) and Tascalapa (Jan-Feb, 2004) watersheds.

Eighty-six percent of the households in the Cabuyal watershed plant temporal crops, cassava being the most important; this is planted monocrop or intercropped with beans and occupies 66% of the area under temporal crops. Maize, intercropped with beans or alone, follows cassava and beans in importance. A high percentage of households in the Tascalapa watershed also plant temporal crops (88%), but there are two important differences. First, these are mainly cassava, beans and maize in Cabuyal; cassava is almost nonexistent in Tascalapa. Second, temporal crops in Cabuyal are planted mainly in intercropped systems, which are more sustainable, less of a production risk, and improve cash flow compared to the monocropping of maize and beans that predominates in Tascalapa. People in both places add value to beans and maize, most by threshing manually with a stick, and some using small threshing machines rented or borrowed from farmer groups or individuals. In the Tascalapa watershed, forty-four of the households have a silo to store grain against seasonal food scarcity.

While agricultural diversification is almost non-existent in the Tascalapa watershed besides coffee (which is now a traditional crop), diversification efforts in the Cabuyal watershed have started to show some results. Their traditional crops (coffee, plantain, cassava, beans and maize) are supplemented by (in order of importance, in terms of area planted) vegetable crops (mainly tomatoes), blackberries, fruit crops (mainly grown in the upper watershed) including Andean fruits such as 'lulo' *(Solanum quitoense)* and 'tomate de árbol' *(Cyphomandra betacea)*, and flowers. 'Fique' *(Furcraea cabuya)* is grown for its fibre, but this traditional Colombian crop (locally called cabuya, after which the watershed and one of the biggest communities of Caldono has been named), once one of the most important crops in the watershed, has almost disappeared because of commercialization problems.

Post harvest and processing activities

Primary agricultural production is the base of the economy for most of the households in both watersheds, however, almost one of every ten households are involved in value adding activities through post harvest management or processing. Traditional small-scale agro industries such as panela and sour cassava starch are important in the Cabuyal watershed. Twenty-eight percent of the households that produce panela own a processing unit, installed with credit obtained with the support of development agencies or with own resources, while the others process their panela in neighbouring units in exchange for a percentage of the production. Less than 1% of households own sour starch processing units (obtained through inheritance). New value adding activities have been promoted by intervening agencies and as a result, 8% of households are processing milk into a variety of products, 6% are producing and packing flowers and a few (less than 1%) produce honey.

In contrast, in the Tascalapan watershed agro-industry is incipient. The most common is milk processing to produce butter and cheese, done in the house as a small-scale, low investment activity by 9% of households. Milk processing is mainly a women's business and 77% of households produce artisanal cheese and butter for the market, although most of the households that process milk, produce cheese (94%) and only a quarter, produce butter. The 5% of households who process sugar cane into panela (locally called rapadura) use rudimentary processing units and, while 60% produce panela using their own processing units, the rest rent or borrow these from relatives and neighbours.

Livestock and other minor species

In both sites, one of every five households own livestock; however while each household in the Cabuyal watershed owns in average 4 heads of cattle, in the Tascalapa watershed they own on average 11.5 cattle. Households in both sites use cattle mainly for milk, although most of them are for meat as well. Those households with cattle have bought them with income obtained from cropping in years of good prices, showing that cattle are considered a saving strategy, although the percentage of households who have access to resources by this means in the Cabuyal watershed is much higher (71.5% compared to 40.5%). In the Tascalapa watershed, income from agricultural wages and inheritance has also been an important means to access cattle (55.5% of the households). Credit, income from non-farm activities, and remittances were also sources of financial capital to buy cattle in both watersheds. Households also raise minor species, mainly poultry, and one third of the households in both watersheds raise pigs. In addition, households also raise other minor species especially in the Cabuyal watershed, where guinea pigs and rabbits are produced for own consumption and the market.

Off-farm employment

Given that, agriculture cannot provide all the cash income required by families, around 60% of households in both watersheds relies on off-farm employment for developing their livelihoods. Most off-farm employment is provided by agriculture, although non-agricultural employment provides extra cash income for one in ten (Cabuyal) or one in five (Tascalapa) households in the watersheds. More than half of the households in the Cabuyal watershed undertake day-wage labour in local and valley farms, while less than half of the households in the Tascalapa watershed do so. Non-agricultural sources of employment in the Cabuyal watershed are limited to workers that are more skilled: teachers (5%) and technicians (3.4% of households have members working as technicians with local organizations). These local young professionals, both men and women, are starting to occupy positions that outsiders took before. Although one of every five households relies on non-agricultural employment in the Tascalapa watershed, most of these jobs are in construction work and only 5.2% of households have a member with access to more skilled employment such as technicians or teachers.

Non-agricultural activities

One of every five households has diversified to non-agricultural income sources, which are better remunerated than agricultural diversification, especially in the Tascalapa watershed. Non-agricultural activities in the Cabuyal watershed are diverse. The most common are sales and other non-farm activities such as transportation, restaurants, food catering, recreation, and handicrafts. In contrast, a household in the Tascalapa watershed, if involved in non-agricultural activities, will work in sales, food preparation or clothing manufacture. Only a small percentage of households in both watersheds have members that trade with agricultural products.

Temporal and permanent migration

Migration, especially of daughters and sons, is a source of income for half of the households in both sites. However, only 28% (Cabuyal) and 37% (Tascalapa) of households receive remittances in cash or in goods (food, medicines and clothes). In the Cabuyal watershed, most members who migrate go to Cali, the capital of Valle del Cauca Department (38%), or within the Department to richer agricultural regions (7%). Within the Cauca Department, people migrate to small towns near the watershed (17%) or to the capital of Popayán (10%). There is also migration to other agricultural regions of the country (11%), other cities of Colombia (10%), and even to Ecuador (2%) and Europe (3%). Most of the people from the Tascalapa watershed migrate to San Pedro Sula (36%), to Tegucigalpa and other intermediate cities of Honduras (21%), or other richer agricultural regions of Honduras (14%). An important percentage of the people that leave the watershed go to the United States (18%) and a small number go to other Central American and Caribbean countries (2.5%). Another 8.5% migrates within the watershed to bigger communities and the town of Yorito.

3.3.4 Livelihood outcomes

The main source of income in the both watersheds (Table 3.6) is agriculture; however, gross income from agricultural activities in the Cabuyal watershed is almost three times than in the Tascalapa watershed. In addition, while temporal crops are a more important source of income in the Tascalapa watershed, permanent crops are more important in the Cabuyal watershed. The higher agricultural diversification in the Cabuyal watershed, as well as the stronger linkages of this watershed to the market, may explain in part this difference. Two well-being indicators that describe households with the highest and medium levels of well-being are diversification of cropping systems and getting sufficient food (Ravnborg and Guerrero 1997). The income difference could also be in part because although agro industry is not an important source of income in either watershed, this sector is more developed in the Cabuyal watershed, providing more than eleven times the gross income from agro industrial activities of the Tascalapa watershed.

The second most important source of income in the Cabuyal watershed is the production of minor species, mainly poultry and pig farming, while in the Tascalapa watershed; this is the least important source of cash income. The second most important source of income in the Tascalapa watershed is off-farm employment. However, although more than twice as many households have members employed as day labourers in agriculture than in other jobs, the latter generate three times more income. Based on local well being indicators, those households that sell their labour during more than three months every year have the lowest level of well-being (Ravnborg 1999).

Table 3.7
Livelihood outcomes in the Cabuyal and Tascalapa watersheds

Livelihood Outcome (Source of Income)	Cabuyal Watershed (N = 116)		Tascalapa Watershed (N=192)	
	(US $/year)[3]	(% of total income)	*(US $/year)*[4]	(% of total income)
Agricultural Activities*	**1,798**	**41.1**	**639**	**36.5**
Temporal crops[5]	707	39.3	225	35.2
Permanent crops	1,091	60.7	414	64.8
Post Harvest Activities	**342**	**7.8**	**30**	**1.7**
Cattle Raising	**416**	**9.5**	**167**	**9.5**
Meat	346	83.2	79	47.3
Milk	70	16.8	88	52.7
Minor Species	**824**	**18.9**	**99**	**5.7**
Pigs	313	38.0	68	68.7
Poultry	498	60.4	21	21.2
Other minor species	13	1.6	10	10.1
Off-Farm Employment	**600**	**13.7**	**324**	**18.5**
Day Labourer in Agriculture	326	54.3	81	25.0
Other Jobs[6]	176	29.3	243	75.0
Retirement	98	16.3	0	0.0
Non-Agricultural Activities	**285**	**6.5**	**172**	**9.8**
Trader	64	22.5	54	31.4
Sales	97	34.0	77	44.8
Other activities	124	43.5	41	23.8
Remittances	**107**	**2.5**	**320**	**18.3**
Total Income per capita	**4,372**	**100.0**	**1,751**	**100.0**

* Incomes reported are gross incomes since production costs were not subtracted

Source: Adoption and Livelihoods Surveys, Cabuyal (Nov-Dec, 2003) and Tascalapa (Jan-Feb, 2004) watersheds

Temporary and permanent migration by daughters and sons accounts for 97% of those who leave the watershed, and provide the third most important source of income in the Tascalapa watershed. One in every five households receive remittances in-cash or in-kind (food, medicines, clothes), amounting to an average of US$ 1,575 per year, for these households. Remittances are the least important source of income in the Cabuyal watershed, where one in every five households receives, on average, US$ 460 per year in remittances. In part because fewer income-generating options exist in the Tascalapa watershed, more households rely on this source of income. In addition, the proximity of Honduras to

United States facilitates international migration to an economy with higher wages, making this a more attractive option, especially for young people.

Cash income from cattle is less important on average in both watersheds; however, it is crucial as a savings strategy for emergencies or when households have a special cash income need. Those households who have cattle enjoy the highest level of well-being (Ravnborg and Guerrero 1997, Ravnborg 1999), generating an average gross cash income per year from this activity of US$ 3,016 (Cabuyal) or US$ 1,283 (Tascalapa) annually. Sales of cattle for meat provide more income in the Cabuyal watershed, while income from milk production is almost the same in both watersheds, but slightly higher in the Tascalapa watershed.

Income from non-farm activities is less important in both watersheds, but while service provision and sales are the most important in the Cabuyal watershed, in the Tascalapa watershed, only sales is an important non-farm activity. Those households who have diversified to non-agricultural sources of employment generate an average gross cash income of US$ 1,225 (Cabuyal) or US$ 825 (Tascalapa). Households with non-agricultural sources of income are thus better off than those who have not diversified to non-farm activities. Households with non-agricultural sources of income enjoy the highest level of well-being (Ravnborg and Guerrero 1997).

Households in the Cabuyal watershed thus have better and more sustainable livelihoods than those in the Tascalapa watershed. Average per capita income in the Cabuyal watershed is 2.5 times higher, households have more diversified livelihood strategies, and as a result, their livelihoods are more resilient.

Notes

[1] In the Cabuyal watershed this includes households that like to work with external organizations, projects or programs.

[2] This includes, in the Cabuyal watershed, bamboo, wood for home construction and for poles, and reed, in declining order of importance. In the Tascalapa watershed, it includes, in declining order of importance, wood for home construction, poles and carpentry, followed by fruits.

[3] Calculated at an exchange rate of 2,500 Colombian pesos per 1 US$.

[4] Calculated at an exchange rate of 18 Lempiras per 1 US$.

[5] Includes crops with a cropping cycle of less than two years

[6] This includes technicians, teachers and other type of employment but does not include day laborer in agricultural activities.

4 Modes of Intervention in the Cabuyal Watershed of Colombia

Modes of intervention in the Cabuyal watershed of Colombia, and specifically the ways in which knowledge and technology for development are generated, have been shaped by the link between the complexity of debates about rural development and actual policies and development practice 'on the ground'. Multiple actors interact in intervention processes and the degree of agency each is perceived to have depend upon particular interpretations of power distribution (Willis 2005).

In analyzing this context and these interactions, a number of questions arise, including: (1) How does smallholder agriculture emerge in marginal hillside ecosystems? (2) How does the emergence of different development theses, representing differing approaches to development, influence and permeate development practice in hillside communities of Latin America? (3) How did these shape institutions and policies as well as research and development organizations? (4) To what extent did they promote a learning process among these organizations or did development practice simply follow the current development theory or fashion of its time?

This chapter reconstructs the history of research and development practice in the Cabuyal watershed of Colombia, and compares the different approaches and strategies used to generate knowledge and technology, analyzing the discourse behind the different intervention processes, as well as how different theories and approaches have informed intervention praxis ('praxiology'). In addition, it analyzes how power differences among the actors involved (who advocated or supported different ideas) influenced how technological, social and institutional innovations were shaped in the watershed, and analyzes how development debates, ideas and contradictions have influenced those interventions and shaped social and institutional innovations.

4.1 Formation of the Territory and its Agrarian Structure

The Caldono municipality was founded in 1856, but the first Paez inhabitants arrived during the Spanish colonization as the result of the persecution of this ethnic group by colonizers. The Spanish crown created the Caldono indigenous territory as part of its strategy to concentrate and control the indigenous labour force, to make them pay tributes, and to preserve these communities from extermination. This indigenous territory was dissolved at the end of the nineteenth century partly because of inconsistencies in its legalization process, but mainly because the Colombian government exchanged it for depressed government bonds to improve the State finances and credit. During the 200 years of Spanish colonial rule, the criollos and Spanish claimed ownership of the more fertile lower lands of the municipality, for agriculture and mining. The Paez population moved to the hillsides to avoid paying tributes or working on criollos[1] or Spanish land. Mestizo smallholders also displaced them from the lower hillsides, and so arrived in the upper watershed (Paz 1980).

In the Cauca Department, as well as in the rest of the Andean region of Colombia, this process continued and accelerated during the first two decades of the twentieth century, in the Republican period. At that time, the Colombian government did not have special programs to intervene in agrarian structures consolidated after independence. However, the State gave legal property rights to criollo and mestizo colonizers who had advanced rapidly, consolidating large estates in line with the Conservative Republic. The promoters of the new Republic considered abolishing titles that gave the indigenous population legal rights to their land and the right to have their own authority, as part of the political cost for indigenous populations of getting independence from the Spanish rulers (Machado 1986).

In addition, the Law 71 of 1917, designed to defend and facilitate the conformation of a smallholder class by providing them with State-own lands, did not achieve its objectives. During the first four decades of the twentieth century, 91% of State-own properties titled were larger than the 20 ha upper limit defined by the law for receiving a title (Bejarano 1984). Thus, the formal intention of the Colombian government to consolidate smallholder agriculture in order to promote agricultural development did not stop the titling of large areas to landowners and colonizers. They were not only able to evade the legislation that limited the areas that could be titled, but also took the better and/or more strategic locations, whilst displacing smallholders further into the more marginal hillsides (Machado 1986).

Because large landowners did not use the land intensively, land was less productive, leading to high internal food prices and inflation. At the same time, the price of land was overvalued and social conflict emerged among landowners, colonizers, smallholders, agricultural workers and the indigenous population. In response, the government established different mechanisms to increase agricultural production without modifying the existing agrarian structure. Titling of unused land to landowners and colonizers continued, and the government solution in areas of high social conflict was to buy unproductive land and sell it to smallholders with fewer than 50 ha. At this time, the Emergency Law of 1926 reduced import taxes to allow food imports into the country to reduce food scarcity and inflation. This law was viable through earnings from coffee and oil exports, but created tension among the members of the Colombian Association of Agricultural Producers (SAC) and those who believed that the Colombian population should have enough food at low prices. The former won the debate, arguing that protectionism was justified to benefit those who plough and harvest the land, and in1931 a new protectionist era started in the country (Machado 1986).

Thus from the beginning of the Republic, Colombia faced power struggles among different interest groups. The indigenous population wanted to retain their territories and sovereignty based on indigenous customary law. Mestizo smallholders wanted to access more land to improve their negotiating position as labour providers. Capitalist farmers wanted to control land, labour and capital, and urban inhabitants wanted a reliable supply of cheap food. These different interests had a strong influence in land policies, depending on the political party in power and their differences in agency and power. The power struggle among them resulted in vacillating and incoherent State policy. Land policies were based on short-term pressures and interests, and in most cases, the Colombian government did not have the capacity to control reform effectively.

4.1.1 First intent and failure of land reform (1930s-1950s)

In Colombia, when the liberal party took power in the early 1930s, agriculture was the base of the economy. Land was the most important productive resource, and therefore access to and control over it was a major political issue. It was inequitably distributed among the social and ethnic groups that made up the rural population at the time. It was also an issue because Colombia was producing insufficient food to meet the demands of a rapidly urbanizing and industrializing nation, and experiencing agrarian conflicts and lack of clarity on land property rights. The social conflict in rural areas became a national concern and encompassed (1) strikes and demonstrations related to working conditions on large farms; (2) disputes around land property rights of large landowners who used the land unproductively and speculated with public land acquired with national debt bonds; and (3) conflicts in regions with high concentrations of indigenous people such as the Cauca Department (Suárez 1986).

Colombia's rural conflict had several causes. First, the failure to consolidate a smallholder class during the colonization period after independence resulted in inequitable land distribution, combined with insecure and ambiguous land tenancy. Second and mainly driven by the interest in accessing and controlling land resources, the struggle between the conservative and liberal parties had a history of periodic violence concentrated in the rural areas[2]. Third, incomes were stagnant or falling, associated with the world depression. Fourth, the first coffee boom (1880-1930) that generated surplus income from coffee exports, together with foreign investment, made it possible for the government to invest in public infrastructure that further increased land prices as well as the demand for labour. Peasant discontent caused by these factors led to the invasion of a large number of estates, creating an acute national political problem and leading to government intervention to clarify the definition of legal property rights (Berry 2002).

The first effort to promote land reform in Colombia was Law 200 of 1936, during the first liberal government under the presidency of López Pumarejo (Berry 2000). This law had multiple intentions. First, it aimed to address the high level of rural discontent in the 1930s, which worried politicians because of its destabilizing impact and because leaders of the liberal party believed smallholders and colonizers to be an important political resource. Second, it responded to interest groups who wanted to support the emergent industrialization process who thought that rural turmoil impeded food production and the release of agricultural labour, both necessary to foster industrialization. Third, the government saw an opportunity to increase State revenues by legalizing smallholders' property.

However, although Law 200 was able to contain peasant discontent, by the end of the 1930s the liberal government retreated because of a combination of chronic tensions among different interest groups. Thus, it was unable to redistribute the existing large estates, and favour the capitalist transformation of landowners, stimulating further colonization of unused land. Thus agrarian policy in Colombia failed to resolve smallholder demands during the 1930s, and whatever possibilities existed for an agrarian and productive reform, following decades of violence (Berry 2002). During the 1950s, the expansion of commercial agriculture placed further pressure on smallholder agriculture displacing it to minifundios located on hillsides with low quality soils, promoting the semi-proletarization of those with less access to productive resources and consolidating medium-scale petty producers and capitalist farmers (Suárez 1986). Thus, the first attempt at land reform failed to solve the problem of a highly inequitable access to land that resulted from the manner in which the colonization process took place after independence. Furthermore, the effort of the government to buy or expropriate the larger estates and redistribute land to smallholders was modest.

Concurrently, in the municipality of Caldono, State bureaucrats promoted the dissolution and division into plots of the indigenous territories, convincing the Paez people that the only way to secure access to land was by getting a title that provided legal property rights, resulting in the dissolution of one of the indigenous reserves of Caldono, the Aguada reserve. These indigenous titles were then superceded by titles held by whites or mestizos, whose titles had been given by persons with more power. In reality, this was a strategy to fragment indigenous collective land ownership to reduce the negotiating power of this ethnic group, at the same time increasing State tax revenues. The other two indigenous reserves in Caldono, Pueblo Nuevo and Pioyá, were not dissolved during this period, however only the Pioyá reserve kept all its territory untouched, in part due to its location (it was bordered only by other reserves) but mainly because it maintained its indigenous authority. The indigenous population of Pioyá resisted all attempts to take the land, was able to overcome the political violence, and maintained its position as the indigenous power pole (Rojas 1993).

4.1.2 A second intent of land reform (1960s-early 1970s)

Immediately after the Cuban revolution and based on the US preoccupation with the effect it could have on other countries in the region, the mission to Colombia by Lauchlin Currie (who at that time was administrative assistant to the United States former President Franklin Roosevelt) conducted a diagnosis of the country development situation in the light of similar revolutionary possibilities. The mission felt that the plight of millions of poor peasants suffering from low incomes, hunger, lack of education, and endemic diseases, represented a major problem. They concluded that these conditions resulted from encroachment on hillsides and marginal lands, and recommended fully proletarianization and urbanization of these communities. The economic assumptions informing this political ideology are summarised by Zamosc (1986):

> In Currie's opinion, the irrational use of labour power and land in agriculture was the main obstacle to economic growth in Colombia… most of the labour was being wasted in the insufficient minifundista agriculture on the worst soils of the mountains and slopes… The development of a more productive modern agriculture in the plains would create conditions for a massive transfer of population to the cities and, therefore, for accelerated industrial expansion (Zamosc 1986:21)

However, the Colombian State decided to confront the agrarian conflict through land redistribution under the framework of the 'Alliance for Progress', based in a proposal made by the United States government under the presidency of Franklin Roosevelt. This proposal was part of a continental strategy of the United States that provided a loan of US$ 20 thousand million for the economic development and social progress of Latin America. In Colombia, Law 135 of 1961, in line with this strategy, put the Land Reform Program in place, and created the Colombian Agrarian Reform Institute (INCORA). The power of large landowners was still great, as was the case in the 1930s, and the law was highly controversial both among them and among the leftist groups that emerged in the country during the political violence of the 1950s (Berry 2002). The latter felt that the land reform was just a palliative, and that instead of promoting a necessary agrarian reform was just providing smallholders with unused and marginal State-owned land. They argued that land invasion was the only means to access good quality land and to agitate for a radical agrarian reform.

Despite the concentration of land by capitalist farmers during the first half of the twentieth century (they received most State support including subsidized credit, free technical assistance and investment in public infrastructure), smallholders survived. By the early 1960s, smallholders were responsible for 51% of the cropping area and 45.8% of national food production (Moncayo and Rojas 1978). Thus, the development of a peasant economy and capitalist agriculture had a contradictory but a complementary character. Smallholders displaced to the Andean hillsides with poor access to infrastructure and soil resources, specialized in crops that required medium and cold temperatures and intensive labour (Zamosc 1984).

Unresolved social conflict and movements in different regions of Colombia in the early 1960s resulted in the emergence of the National Association of Peasant Users (ANUC). The decree 755 of 1967 during the Government of Carlos Lleras Restrepo created the ANUC to link the beneficiaries of state services in an autonomous organization with national coverage and strong participation (Suarez 1986). In addition, Law 1 of 1968 allocated more resources to INCORA and established a ten-year period for transferring the land to share croppers or renters that had made a request, albeit stringent conditions were put in place for this transfer (Fajardo 1986b). This law proved counterproductive because it created an incentive for landowners to accelerate the displacement of sharecroppers and renters to avoid transferring their land to them (Berry 2002).

After the first ten years of the Law of 1968, results were not as expected and only 4.3% of the families subject to the program benefited from it, mainly at the expense of other small or medium-scale landowners. Moreover, Colombian land reform did not redistribute land with good agricultural potential but mainly promoted a colonization process that expanded the agricultural frontier to marginal lands. This process was followed by granting legal property rights to colonizers (Roldán et al. 1988). During 1962-1970, most of the resources allocated for land reform were spent on infrastructure and subsidized credit, while only 8.3% was spent buying land (Berry 2002).

4.1.3 Contra reform and violent recuperation of indigenous territories (1970s-1980s)

In 1970, the conservative party took over under the presidency of Misael Pastrana (who promoted a drastic change in ANUC, an organization of heterogeneous actors that ranged from medium and small-scale capitalist farmers to landless rural workers) making the party susceptible to fragmentation. The opponents of agrarian reform skilfully exploited the situation by lobbying the new government to repress the ANUC, leading to its repression in this period, further marred by the assassination of some leaders. These events convinced many members that the time had come to press for access to land, and that land invasions were the only means to achieve this access (Berry 2002). The contra-reform policies put in place in 1972 by the Pastrana government hastened the confrontation between peasants and the State, leading to a dynamic land invasion process that took place in 21 of the 23 Departments of Colombia. This process involved 16,000 families and invasions on 645 large farms (Suárez 1986). Indigenous communities also participated in these uprisings, especially those located in the northern region of the Cauca Department (Fajardo 1986a).

To ameliorate social conflict in rural areas during the early 1970s, the government designed and implemented social agrarian reform projects. A second phase of land reform (1973-1982) started when land was assigned to collectives of farmers through communitarian enterprises with the aim of fostering agriculture and livestock raising activities. INCORA provided advice and controlled the boards of these enterprises that were elected by community members. However, according to de Janvry and Sadoulet (1993), and to Binswanger, and Deininger (1997), the mandate of INCORA was more a palliative to rural social conflict than a promotion of changes to extant agrarian structures. A serious agrarian reform was never discussed and most of what was done was not well implemented.

Communitarian enterprises were also promoted in the indigenous territories but the intervention of INCORA in these communities had the main objective of demarcating indigenous territories, while others intended to dissolve them, arguing that the communities had disappeared under the pressure of the market for land. This situation promoted the emergence of indigenous movements with the purpose of recuperating and/or defending their land. These groups also agitated for the preservation of their culture and their language, and for the end of the violence against them. The rebirth of the indigenous organizations had its strongest exponents in the Cauca Department, where the violence between landowners and the indigenous communities was especially, taking many victims among this population and causing a rapid deterioration of their living conditions (Fajardo 1986a).

New Paez settlers started to return to Caldono due to migration opportunities promoted by the indigenous leader to recuperate their land. At the same time, the claims of the indigenous population pushed the organization of the smallholder mestizo population to maintain ownership of their land. Violence ensued, and the fight for land initiated by the indigenous communities in the early 1970s, extended until the late 1980s. Illegal armed groups of ethnic origin (such as the Quintín Lame movement) were also involved. This group fought to recuperate lands that historically belonged to the indigenous communities, especially the Paeces. A mestizo who owned a farm in the upper part of the Cabuyal watershed in the municipality of Caldono, remembers that:

> By the end of the 1970s, things became very violent here because the Paeces organized in the Quintín Lame movement used to go to the white and mestizo houses to take them off their land and property… we were all frightened and had to leave everything behind. They occupied my land and one day 40 men surrounded the house and told me that I had to leave and empty the farm… they used to say that Juan Tama owned my farm and that they had title to it. That was their argument. I had to leave because they threatened me and said that if I did not leave they would kill me; they gave me no time[3].

In this manner, many indigenous people were able to acquire a piece of land. This was the case for Mélida Chocué, who despite not participating actively in the indigenous reserve activities was able to gain a plot of land with the help of her husband who is a distinguished member of the indigenous authority,

> The history of our land is a big and messy thing; rich people took this land and the owner sold it to another person who pawned it to the Caja Agraria. During this time, the indigenous invasions started and those from Pueblo Nuevo came here and convinced the indigenous people here to take over the lands. Thus, the Caja Agraria[4] negotiated this land with INCORA who bought it and gave it to the indigenous authority[5].

As an outcome of this process, the Municipality of Caldono is located on an ethnic frontier between two important power bases. The first is the indigenous authority, represented by the 'Cabildo', which occupies approximately 35% of the territory although they only represent 18% of the population in the municipality. The indigenous authorities, with the exception of the authorities of the Pueblo Nuevo reserve that supported the conservative party, developed a strong relation with the liberal party as a way of protesting against the land policies of conservative governments (Rojas 1993). The second power force is the mestizo population, mainly medium and small-scale affiliated to the conservative party. However, the distinction between being indigenous and mestizo is not simple. People belonging to the indigenous community do not necessary share all the principles of indigenous customary law. For example, Jaime Ulchur, a member of the indigenous population of Caldono, works on the collective property of the Cabildo, but considers this piece of land as well as the one he has obtained for his two sons, as personal property. According to him,

> I have no title over my land; it belongs to the indigenous authority, but they let me work here and I know that this is my land. How could they tell me to leave this land? I have worked with the Cabildo (indigenous council) for seven years, and seven years are 1,750 days, so if I charged for this time, how many millions would they have to give me to leave this land so I could buy another?[6]

Among the mestizo population, there are important differences: some have a history in the territory; others have migrated from other regions such as Antioquia, Nariño and Huila because of land pressure. These more recent immigrants brought with them the coffee culture, together with bean cultivation and cattle farming, increasing ethnic differences in the territory. The latest migrants were the 'Guambianos', an indigenous group who had abandoned their dwindling land because of fractionalization and low productivity. This group bought small farms, as told by Benecio Velasco who migrated with his family in the 1950s from Silvia, a 'Guambiano' territory,

> We came here when I was eight years old because life in higher altitudes was hard… we only had one maize crop per year. At the beginning we worked as 'share croppers'[7] but my parents got tired and bought a piece of land (six ha) on the hillside and we came to work here. Silvia was good for the people that had cattle, but for us, having to live on cropping, it was

> difficult. Here you plant maize and in three months, you are harvesting; in 18 months, you have cassava but you can start harvesting earlier, you can also harvest plantain and sugar cane, there is a higher diversity of crops. We started planting coffee, plantain, cassava and then we expanded the coffee crop.[8]

4.1.4 A new millennium starts with limited and conflictive access to land

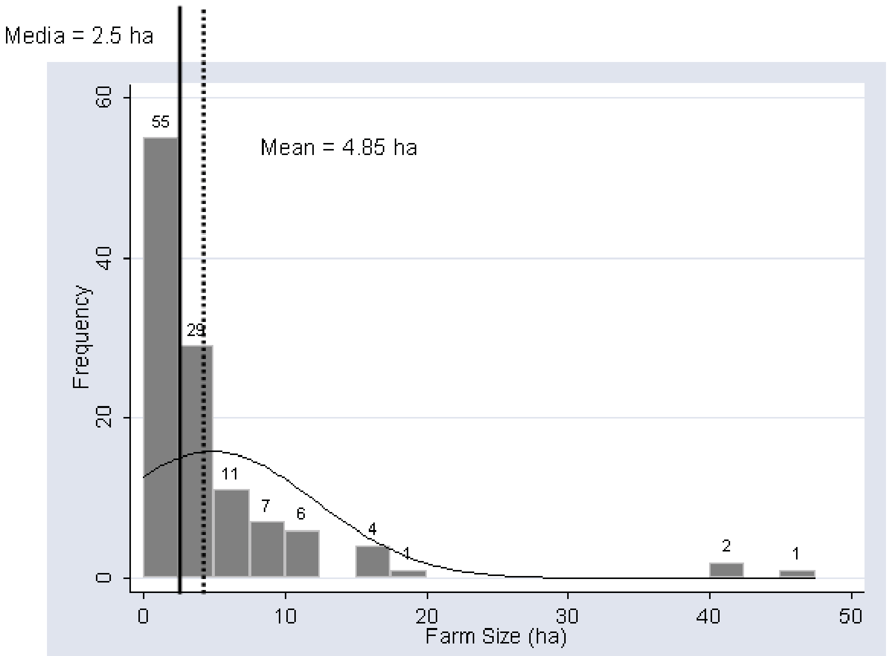
At the beginning of the twenty-first century, conflict over land entitlement persists. The process of dividing indigenous territories into individual plots that started in the 1950s, their exchange in the market during the 1960s and 1970s, and the subsequent fight of the indigenous population to recoup their land, has left a complicated situation. White, mestizo, and indigenous smallholders co-exist and have their own property around the indigenous territories but also inside them with no clear property rights. In the Caldono Municipality, recouping land has been a socially conflictive and politically unpopular task and has accentuated differences between the mestizo and indigenous communities. Some mestizos, having grown up in Caldono, see how this process became a threat to their property rights

> All my family came from this community, now the municipality is in a lot of trouble with these indigenous territories. We were looking at the titles from the year 1846 that we have (this land belonged my great-grandfather) and we asked ourselves how, since we have been on this land since then… now these indigenous people aim to take us out of here[9].

Later on, the 'Caleños'[10] acquired farms along the Pan American Highway mainly for recreational purposes, increasing land prices and placing further pressures on land demand.

In 2004, average farm size in Caldono among the mestizos and indigenous population who work outside the indigenous territories was 4.8 ha, ranging from zero to 48 ha. Approximately 50% of the households have less than 2.5 ha, showing a skewed land distribution towards smaller holdings (see Figure 4.1). Most (87.5%) of these households consider themselves owners of the land they work, but 12% do not have legal titles. Only 7.6% work on rented land, 2.4% on borrowed land and 1.4% as sharecroppers. The latter is explained by the land reform policies of the 1970s, which created an incentive for landowners to displace sharecroppers and renters to avoid land expropriation. Land reform also failed to improve access to land for the landless rural population. Sixty percent of landowners have bought land and the rest inherited it. As a result, in the Caldono Municipality, a smallholder class co-exists with capitalist farmers who produce mainly export crops in the valleys, and the indigenous territories in the upper watershed.

Figure 4.1
Farm size in the Cabuyal watershed, 2004



Source: Adoption and Livelihoods Survey, December 2003.

One of the major concerns that mestizo smallholders have is the low utility that the indigenous population have given to their lands and the contradictions between the low population density in the indigenous territories compared to that of the mestizo population. The former are sub-utilized (through lack of labour) while many mestizos are landless

The indigenous population have already expropriated some lands in the upper part of the municipality, but they do not gain from this. What happens is that the guerrilla movements convince them to take land by telling

> that all this land is theirs, but the guerrilla does it only to be able to move freely in these territories and live comfortably in their houses[11].

However, the use and management that a community gives to the land depends on the significance it has for them. In the case of the Paez indigenous people, land surpasses its productive and commercial value (Gómez and Ruiz 1997). In addition, indigenous communities follow a different cropping logic than mestizos. They usually have three types of crops to improve the resilience of their livelihoods: crops meant to secure food security and ethnic/religious consumption, crops planted for exchange purposes, and crops planted for the market.

The conflict for land among the indigenous and mestizo populations has led to stereotypes about external intervention, causing mestizos to rethink the legality of the indigenous population's regained lands:

> When I was a little girl, the indigenous people were different. Of course we had ancestors that had treated them badly and they base their claims over the land on this, but also the anthropologist and sociologist came here and brainwashed them and they started to do all this [recouping land]… this has been the work of these anthropologists and sociologists. I don't understand why the people that study this don't understand that peasants and mestizos also belong here. For example, we have indigenous last names, my mother's is Guetia and this is an indigenous name[12].

Among smallholders, the tiny amount of land they own reduces their ability to generate their livelihoods through agriculture and limits their capacity to buy more land and develop an agriculture extensification strategy. As a result, they resort to renting land when possible, or work as day labourers on neighbouring farms:

> I got this small plot from my mother-in-law, we bought it from her… it is 20 m long and 40 m wide and I don't have anything here. I have to rent land to work and I also work as a day labourer; I work for some neighbours but it is not a stable job. I get three to four days of work and that is all[13].

Landless households also make special arrangements with neighbours who have land and some capital to plough the land and buy the seed, providing their labour and dividing the produce. Other small producers have received land through inheritance, but this often requires division among siblings and thus plot sizes are fractionalized to a point where they are too small to support a household and commercially unviable:

> This land was distributed and I inherited 2 ha… My father bought 6 ha but because we are three living brothers, each of us got only 2 ha[14].

In general, it is difficult for smallholders to buy or rent land, whether due to lack of capital, land scarcity or, as concluded by a study conducted by FAO and CEGA (1994), because of the lack of an integrated land market. Segmentation and asymmetries of power characterize markets for land in Colombia. There is one market for small-scale properties in which smallholders participate and another for large estates, restricted to people with a high purchasing power. Exchange opportunities between these markets are lacking. Moreover, there are only isolated recent cases of landless producers receiving their land from INCORA. For example, a Farmer Research Committee (CIAL), a group of farmers from a community who get together in order to test new farming options or technologies, was able to obtain a piece of land through INCORA. Ignacio Roa, a researcher from CIAT who works with CIALs explains:

> We work with many farmers who have their house and a small plot but have no farm. When we start with the experimental trials they do them in their small plot near the house, but they start to have problems when they had to validate the trials at a larger scale, and even more at the commercial level. We have seen that people do what they can… they work in arrangements with relatives or rent land. However, one of these groups applied to INCORA to get land and this is how the Diviso farm was born… INCORA technical personnel went to visit them and the institution adjudicated 40 ha to the twelve families that form part of the Diviso CIAL group[15].

Although a few organized groups have been able to get land from INCORA, the majority of smallholders failed, as the requirements are not easy to fulfil even for farmers that have been organized for some time. Still, some mestizo smallholders see INCORA as a threat for them and as an institution that works for the interests of the indigenous population in recouping land.

CETEC, an NGO that has been working in the region for a long time, acknowledges that smallholders have no place in the actual agrarian structure in the region and that this constrains households trying to develop their productive projects and achieve appropriate livelihoods from agriculture. It decided to support activities to acquire collective land in the market. However, this strategy is complex and few groups have opted for it. ASORECRO, in the community of Crucero del Rosario, was one of the few that did:

> Among our plans, one that has been realized quickly was that of buying a farm… we used to say, 'when would it be possible for us to have a farm?' That was one of our dreams, and one year ago, we had a brand new one. We allocated a budget of 15-20 million pesos [US$ 6,500-8,700] and we said that one day we would be able to get a farm. A neighbour from Cali offered a farm to one of the members of our group and we bought 17 ha. The price was also good because the farm cost us 9 million pesos [US$ 3,900]; of course, it had no improvements. The house was built from bareque [cane and mud], but at least it had a house that little by little can be fixed; it was a big bargain. Our priority now is to pay off the debt we got into to buy the farm so we can start improving it[16].

Land is one of the most important resources to an agriculture-based livelihood. However, the history of the existent agrarian structure in the Cabuyal watershed, characterized not only by the predominance of smallholdings (mean farm area 4.8 ha) but also by a highly inequitable land distribution (see Figure 4.1) shows a complicated and conflicting settlement process. After independence, establishing country estates in an economy based mainly on agriculture has been both an economic process and the centre of political power, because in a country dominated by two competing political parties, the political colour of large landowners had great importance.

The agrarian structure and poverty in the Cabuyal watershed is largely the result of an economic and political process. This was highly influenced by the conservative party, led by the Vivas family, which was in power until the 1970s and supported by the mestizo smallholders; its subsequent defeat by the liberal party (led by the Sandoval family) was supported by the indigenous population. The indigenous people were interested in political recognition and power, and expressed this by joining the liberal party. The only indigenous territory in Caldono where its leaders did not opt to join the liberal party was Pueblo Nuevo, which survived the division of the indigenous territories promoted by the conservative government, and became the centre of indigenous resistance, together with the reserve of Pioyá. However, the State, instead of providing a political solution to the poverty problem of the region (see below) diverted the attention of the population with a technological solution:

the Integrated Rural Development Program (DRI Program), implemented between the 1970s and the early 1990s.

4.2 Integrated Rural Development (1970s–1990s)

In 1950, 75% of Colombians lived in rural areas, and agriculture provided close to 40% of the gross domestic product (GDP). By 1972, fewer than 50% lived in rural areas, producing only 26% of GDP. The largest cities grew at an annual rate of 7% or more, and the manufacturing sector grew rapidly as economic diversification continued and the country shifted from a rural to an urban-oriented economy. The decline of agriculture was an uneven process: while traditional crops cultivated by peasants (i.e. beans, cassava, plantains) tended to stagnate, crops cultivated by capitalist farmers under modern conditions (i.e. cotton, sugarcane, rice, soybeans) grew at an annual rate of 8.2% from 1950-1972 (Escobar 1995:126). Thus, the latter grew almost five times faster than traditional crops, and three times faster than other crops under mixed (capitalistic and peasant) cultivation conditions (such as maize, coffee, potatoes, wheat, tobacco, cocoa and bananas). This impoverished the peasantry and brought social and cultural changes. This situation formed the backdrop for the health, nutrition and integrated rural development strategies of the 1970s and 1980s.

The next phase of agrarian policy in Colombia started at the beginning of the 1970s with the DRI Program, shifting emphasis away from land reform (which modifies agrarian structures) to the provision of basic services and technical assistance to support productivity improvement on smallholder farms. Three main components (production, social and infrastructure) were articulated around the DRI Program. Although this policy had merit and constituted an essential continuation of land redistribution (Berry 2002), it was established after the failure of land reform in the 1960s. In addition, it can be argued that it was not meant to alleviate poverty among the 'backward' or traditional sector, but to provide cheap labour and cheap food for the 'modern' sector, using a combination of multinational, state and local capital that coexisted with the modern sector (de Janvry 1981).

The DRI Program in Colombia emerged under the National Food and Nutrition Plan (PAN), which was an important element of Alfonso López Michelsen's government's development program 'to close the gap' ('para cerrar la brecha' in Spanish) (Roldán et al. 1988). This program, created by decree 1269 of 23 June 1976, had four objectives: (1) guarantee enough food to improve the nutrition of the population and the income of the rural poor; (2) improve the income of smallholders by organizing the market, implementing price policies, building communication infrastructure and providing basic services; (3) generate new sources of productive employment for smallholders and reduce migration to urban areas, and (4) integrate the marginalized rural population into the national economy (Moncayo 1986). This decree acknowledged that smallholders were important and that the appropriate level of attention could turn them into productive citizens. In addition, perhaps, they could increase their production capacity to maintain the supplies of cheap food required by urban centres, which would thereby maintain the levels of cheap labour required by the economy. The DRI Program in Colombia was part of a continental strategy financed with loans from the World Bank and the Inter-American Development Bank (IDB). Thus, 'always willing to be the first guinea pig for the socioeconomic experiments of the international development community, Colombia in the mid-1970s started to implement the first nationwide integrated rural development program in the third world' (Escobar 1995:131) with financial and technical support from the Canadian International Development Agency (CIDA).

Smallholders with less than 20 ha of land, 500 thousand pesos (equivalent to US$ 25,000 during the early 1970s) in total assets and with at least 70% of their income from agriculture were the target of the DRI Program (Fajardo et al. 1991, Escobar 1995). These farmers constituted a sort of buffer group or 'minimal agrarian petty bourgeoisie' (de Janvry 1981). The basic premise of the program was that the major cause of rural conflict and poor development was low productivity, and that improving access to credit and modern technologies would contribute directly to improving agricultural productivity, a conception that was highly influenced by the green revolution (DNP/DRI, 1975):

> It was essential to bring multiple services (with no mention to the land problem)… In one hand, technical assistance received a fundamental role to promote rural development, and on the other hand, basic health infrastructure was promoted through constructing health units in rural areas and providing basic services such as energy and water. Improving and building road infrastructure was also a priority, to take smallholders' production to the markets, together with subsidized credit. It was in this sense

> that the strategy was understood as an integral one to overcome rural development problems with smallholders… of course those that had land[17].

Thus, the DRI primary objective was to increase food production among its 'target population' and to integrate poor rural communities into the market economy:

> Capital, technology, training and infrastructure – the 'missing' factors accounting for the backwardness of smallholders' production were to be provided as a package through a strategy unprecedented in both scope and style. The intent was to bring the green revolution to the small farmers and to turn them into entrepreneurs in the fashion of commercial farmers, only on a smaller scale. (Escobar 1995:137).

4.2.1 First phase (1976–1982) and the fique project

The first phase of the DRI Program included the provision of basic services such as roads, electricity and aqueducts through a centralized model that was coordinated from Bogotá, but in which the local level committees[18] were instrumental in extending and deepening the reach of the services. The Program also provided technical assistance with a 'transfer of technology' approach in which ICA, the Colombian National Agricultural Research Institute (NARI) created in 1962 that integrated research, education and extension, following the model of the Land Grant College System of the United States, was fundamental. The World Bank promoted the establishment of NARIs all over the world, together with the Consultative Group for International Agricultural Research (CGIAR) as part of its initiative to support agricultural research and the transfer of technology to increase agricultural productivity in developing countries. In the early 1970s, extension activities were strengthened at the expense of reducing resources for activities oriented to the generation of new knowledge, resulting in substantial changes that shifted the institutional objectives from providing 'extension services' to promoting 'rural development'.

In 1975, the newly established DRI Program supported the creation in ICA of the Sub-Direction for Development, giving a higher priority within the organization to smallholders. The strengthening of communication and extension activities aimed to correct the 'technological gap' between experimental yields and those obtained under commercial conditions. According to Balcázar (1986), this strategy implied an education, enlightenment and information process directed to producers with the aim of 'training' them for 'rational' decision-making under the assumption that they were still unable to operate in an entrepreneurial mode because of their educational level and their cultural traditions. Therefore, it intended to 'educate' them for 'adequate' decision-making, by providing information about technological alternatives. The DRI Program also invested resources in improving smallholders' access to subsidized credit to provide the capital needed to adopt new technologies. In addition, the social program component included a series of education and health programs to raise living standards in the countryside, similar to those introduced by the PAN Program:

> ICA used to have very good programs; they provided the money to cultivate cassava and on top of that they gave us a price bonus in the market, the loans came through the Caja Agraria and the Banco Cafetero[19].

In the Cabuyal watershed, the DRI Program (during its first phase) promoted fique (a vegetable fibre used to manufacture coffee sacks) production as part of its production component. Caldono had the highest fique production in the Cauca Department, and although it was a traditional activity, the government, as part of the DRI Program, promoted it. Implementing partners of the project included the Caja Agraria (the most important agrarian institution in the country in charge of providing credit for agricultural production), INCORA (which was more involved in technical assistance and credit provision than in the agrarian reform process for which it was created in the early 1960s), and the Colombian Federation of Coffee Producers[20]. In addition, two private companies producing packing materials (Empaques del Cauca S.A. and Empaques de Medellín S.A.) also participated.

As a strategy to generate employment after the shutting down of a brewery in the region, leaving many people unemployed in the mid 1960s, Empaques del Cauca S.A. was founded in 1965 to utilize fique produced in the Department of Cauca. More than 16,000 indigenous and smallholder families produced fique as a means to generate their incomes. One of these was the family of Elciaro Velasco, who remembers working in fique production when he was young:

> My father used to shred fique to obtain the cabuya; I had to take out the fibre and sometimes to cut it or ruffle. We use to cut the plant, ruffle it and then place it in the shredding machine. At four in the afternoon we used to turn off the machine and load the fibre into the mules, then we took it to the river to wash it… we used to work until seven in the night, I

remember that it was already dark and we were still loading the mules with the washed cabuya[21].

Although the crop required hard work, in the early 1970s when it had a good market it was a profitable activity and therefore many smallholders specialized in fique production:

I used to have all my land with fique; I had 10,000 plants. I had part of my crop in a plot that belonged to my father-in-law and another here that was only mine. I planted fique because it was profitable and thus was a good business. Of course, it was cheap but it had a market and could be sold easily in Siberia or Santander to Empaques del Cauca; they also used to take it to Medellin because there was a packing plant there too[22].

The DRI Program, fostered fique production among smallholders and the indigenous population of Caldono by providing them with subsidized credit, seed, technical assistance, fertilizers, shredding machines and a secure and ample market for the product, with the participation of the private agro-industry. As a result, during the 1970s the area planted with fique became much larger. Smallholders dedicated their best plots to its production, displacing traditional crops such as maize, beans and cassava. This resulted in an oversupply of the fibre and the consequent drop in prices, fostered by the import of synthetic fibres such as polypropylene, which limited the use of cabuya. Moreover, the five packing producing industries in Colombia took advantage of the lack of a price policy to control cyclical price fluctuations by managing the situation. This led to a crisis in the sector and many smallholders who had invested in fique production went bankrupt. In 1977 a local newspaper reported

The Colombian packing companies have gradually reduced their fique purchases so that now Empaques Medellín S.A. is only buying 10-15% of what it used to buy, and Empaques del Cauca S.A. have suspended temporarily their purchases of the fibre.

The ensuing crisis in the fique sector provoked continuous uprisings among indigenous and smallholder producers, who used to close the Pan American Highway between Cali and Pasto, pressing the packing industries to continue buying the fibre. Producers who had invested in the crop with the hope of improving their incomes, and who had worked with the crop for a long time, remember their experience with the project as a complete failure:

> We got a loan with my daughter to buy a shredding machine but I could not even pay the interest, this money was too expensive and the business became unprofitable. I decided to pay the credit and get out of this business[23].

The demand for fique was related to coffee production since most of the packaging produced with cabuya was used to export coffee. The Colombian Federation of Coffee Producers became the main buyer of packaging produced from fique, giving a relatively stability to the sector until 1996 when their stocks rose to 20 million sacks and they stopped buying it. At the beginning of the 1990s, when the coffee quota agreement was terminated, coffee importers started to request the commercialization of coffee in bulk, reducing significantly the demand for cabuya packaging. This, together with the reduction in coffee production because of 'broca' (a new pest at that time) and the use of synthetic fibres, reduced market demand for the natural fibre significantly. As a result, prices for cabuya declined sharply, leading to the crisis of Empaques del Cauca, and the liquidation of the company. However, the company transferred the business to its former employees in 1997, in response to their petition.

Although fique production became an alternative for income and employment generation in Caldono, the consequences of the sector crisis on the fragile smallholder economy who had invested in the crop and in the machinery to process it (mostly with loans that were difficult to pay off), were significantly negative. Fique production has reduced drastically. In 2004, producers in the Cabuyal watershed only devoted 0.4% of the area under permanent crops to fique production and abandoned the cabuya processing plant. Fique production has become a marginal activity conducted by few households for small handicraft market niches, and nothing is left of the former fique agro industry promoted by the DRI Program except debts and bad memories.

The fique project promoted by the DRI Program in Cabuyal followed in part a market driven approach. Producers and the agro-industry responded to a market opportunity, working as partners within a commercial market chain and were able to meet required market standards, but with a strong public sector influence on decision-making. In the short-run fique production was an economically and socially successful initiative that generated income and employment in the region. However, the DRI Program not only had a strong influence in decision-making but also followed a paternalistic approach, offering subsidized credit and free technical assistance that promoted production intensification and led to oversupply, which in turn disturbed market forces and depressed prices. Moreover, this approach limited capacity development among market chain actors to develop a continuous innovation process to respond and adapt to changing contexts and markets. Nor did the Program develop strong links with sources of external knowledge, such as research organizations or universities, to promote an interactive learning process for innovation that could have solved problems at least in the medium term. Market chain actors were unable to respond to changing market demands and failed to generate a sustainable economic and social development process.

Evaluations of the first phase of the DRI Program showed that both direct beneficiaries (those who received individualized assistance) as well as the indirect ones (those who only benefited from the basic infrastructure component) had higher levels of income and quality of life than those not intervened by the program (Vargas del Valle 2003). However, important regional differences were evident. Those regions with an established smallholder class that owned sufficient land responded well to the DRI Program: food production and incomes increased, and rural employment was generated. However, on regions where most smallholders were established on marginal lands provided by land reform, results were modest.

4.2.2 Second phase (1982–1989) and the CAPACA Program

The DRI Program underwent conceptual and institutional changes during its second phase. First, the administration of PAN and DRI were integrated into PAN-DRI, however the importance of the PAN strategy, which saw rural development as a component of an overall nutrition strategy, was reduced, giving more importance to DRI, which was seen as a more appropriate response to agrarian problems. The names were duly inverted to DRI-PAN, and the program was assigned to the Ministry of Agriculture, instead of the National Direction for Planning (DNP) where it had been during its first phase. Second, the focus of the DRI Program during its second phase shifted to regions with higher levels of smallholders and more potential to develop and implement strategies for improving smallholders' commercialization.

> '[I]mproved commercialization and marketing, identified as critical bottlenecks, became the surrogate for land distribution' (Escobar 1995:140).

In this phase, the program assigned a larger share of the budget to production and commercialization and less to basic infrastructure (Vargas del Valle 2003). Third, Virgilio Barco's government (1986-1990) brought DRI-PAN to the forefront as a key component of its 'Fight against Absolute Poverty' strategy. The program continued to be the fundamental policy element used by the state to support smallholders, contain social conflict in rural areas and continue providing cheap food and labour for the country's modern sector (Fajardo et al. 1991:155).

Despite these changes, the DRI Program continued focusing on production improvements, adding to their strategy the creation of farmer cooperatives to improve the commercialization of agricultural products. The DRI Program also designed the CAPACA Project (Training for Smallholders' Participation) during its second phase with the objective of improving smallholders' awareness of farmer organization as the strategy to improve commercialization. The CAPACA Project implemented by the National Service for Learning (SENA) took a step forward, and according to many people that participated, promoted organization not only to improve commercialization, but also to achieve community development objectives.

The importance of this project is also highlighted in the evaluation of the DRI Program, where it was commended for its contribution to developing smallholders' capacities to visualize and prioritize existing problems in their communities and to search for alternative solutions with the support of the State, using community initiative (Roldán et al. 1988).

> The CAPACA Program used an education methodology that aimed to make producers the leaders of their own development, so that they would first identify the needs of their region and community, and based on a development plan designed by them, they could express their own demands. This was a well-structured methodology, based on philosophical concepts, and the Program provided us with all the required training materials to implement the methodology. The Program also gave us all the necessary support to get to the communities and work with the people. Marco Tulio Zapata (technician working more than 25 years for SENA).[24]

This project helped those smallholders who were beneficiaries of the DRI Program to improve their access to social and human resources, since it provided training to develop their capacity to mobilize projects and other resources for their communities and developed their leadership. At the same time, it gave smallholders the opportunity to share their knowledge and experiences, creating the spaces to foster their organization. This project formed many leaders that later occupied important positions such as municipality councillors and presidents of Local Level Committees. The first Mayor of Caldono elected by popular vote also participated in the CAPACA Program. That SENA was effective is clear from participants:

> I thank the government, or who knows whom, because I was like a newly born dog, with my eyes closed. We used to work with SENA and they taught us that the government did not have to give us orders as they used to do. For example, when Caja Agraria programmed credits to plant cassava, why did they establish a cassava program in these lands that are so arid and sterile? This crop was exhausting the soil… We used to ask ourselves why Caja Agraria did not schedule a meeting with the peasants and ask us what we thought could be produced in the region. We organized ourselves in ANDRI (Association of Users of the DRI Program) and we used to call the Departmental Director of Caja Agraria, and even the National Director; we used to talk with big personalities and propose our projects to them.[25]

The CAPACA project was an important support for ANDRI, where all the beneficiaries of the DRI Program were associated. Although ANDRI did not play a protagonist role in the implementation of the DRI Program, its objective was to become a support team multiplying the effect of the training offered through CAPACA. CAPACA had a short cycle because the DRI Program cut it, arguing that it lacked the resources to maintain it. However, many argue that there were other reasons for eliminating the project:

> This methodology had a big impact on the people… it was opening the eyes of people and getting them out of the hands of politicians… of this political manoeuvring that has always existed in the country. Politicians came to talk with the people, but they were not the ones that were talking, as before, it was the community that put their own conditions… this is the real reason for stopping this project, the peasants were awakening.[26]

The results of the project were also obscured by rumours that some beneficiaries, supporters and leaders had connections with illegal armed groups, a valid reason to consider it a strategy leading to political instability in rural areas. The CAPACA Program was also diverting SENA (financed by private entrepreneurs) from its mandate, which was to train workers. The entrepreneurs argued that the Program was in the wrong organization, providing a rationale to stop it. In addition, in 1985, the government decided to institutionalize the DRI Program, creating an independent entity with its own autonomy and budget (the DRI Fund) attached to the Ministry of Agriculture. The restructuring of the DRI Program facilitated the decision to cut the CAPACA Program.

Another key intervention during the second phase of the DRI Program was the Technological Development Program, which took a Farming Systems Research approach and set up model farms in various regions, varying according to socioeconomic and ecological context. Smallholders' adoption of technological packages was found to be hampered by a number of constraints, such as the high cost of inputs compared with the low price and inadequate marketing for smallholders' products, insufficient farm size, low levels of education and 'cultural backwardness' (Fondo DRI 1989). In addition, by the end of 1980s planners were becoming aware that the technological packages were meant to maximize the biological productivity of crops and paid no attention to potential increases in the productivity of natural resources (Escobar 1995). Thus, during this phase, although the DRI Program started to take a 'farmer systems approach' to the generation and diffusion of agricultural knowledge and technology, the 'transfer of technology' approach continued to predominate.

Although the DRI Program included a participatory component from inception, and the CAPACA project was an instrument to 'educate' people for participation, the decision-making and control of resources remained at the central level, rendering local participation insignificant. The DRI Program understood participation as a bureaucratic problem to be solved by the institution, not as a process circumscribed by complex political, cultural and epistemological questions (Escobar 1995). One of the critiques to the DRI Program, as part of the evaluation conducted for the Departments of Cauca and Nariño at the end of its second phase, was the absence of community participation in the diagnosis of problems and in providing alternative solutions to them. This evaluation argued that 'the implementation of the DRI Program was done from the centralized levels, with project prototypes elaborated by technicians brought to the local communities (passive entities in the process) who could accept or reject them' (Roldán et al. 1988). According to a member of the evaluation team,

> During the 25 years of Program implementation, an intensive intervention process was implemented, and different bets were made with the objective of promoting rural development. Many were able to improve the living conditions of smallholders through credit, technical assistance and training; however, many were non-fructuous projects that led smallholders to lose their capital and/or their land.[27]

4.2.3 The third and fourth phases (1990–2003) and the decentralization process

The 1980s was an important decade of social and technological development in the Cabuyal watershed. Beyond all the land reform intents and failures, it was during this decade that intervention focused in smallholders with complementary approaches through the DRI Program, which provided training, technical assistance and credit to smallholders with access to land. While during its two first phases, the DRI Program had a top-down approach, centralized at the national level, its implementation in the third and four phases changed significantly. The administrative decentralization process that started in the country with Law 11 of 1986 (because of macroeconomic, institutional and popular pressure) was extended by the constitutional reform of 1991, which brought unprecedented local, regional and cultural autonomies. This opened new mechanisms for local participation in decision-making, and greatly influenced the third phase of the DRI Program, where the municipality and the community of beneficiaries constituted the basic unit for the planning of rural development.

The DRI Program continued viewing technological change as the keystone of an invigorated production strategy, and what was at stake, as always, was the modernization of smallholder production practices (Escobar 1995). During its third phase, the DRI strategy was directed to the creation (in 1992) of the Municipal Agricultural Technical Assistance Units (UMATAs), controlled by the Municipalities or by private organizations, and receiving resources from the DRI Fund to implement projects aimed to make them autonomous entities with resource mobilization capacities.

The UMATAs started to take responsibility for providing technical assistance and transferring technology with resources from the DRI

Fund under the coordination of the municipality. The director of a local UMATA was directly dependent on the mayor of the municipality, and occupied an important technical position, but with political power. Many UMATA directors, their good administration recognised by the population, could easily become mayors if they stood for election. The UMATAs unfortunately had no formal links with state research institutions, although they were represented on the board of directors of Corpoica (the Colombian Corporation of Agricultural Research)[28]; and have only weak links with the Secretary of Agriculture. This has led to what many label 'free-wheeling' units within the National System of Technology Transfer in Agriculture (SINTAP), created in 1989 to enhance production of non-traded staples and improve the social and economic performance of the rural sector. Other criticisms of the UMATAs are that the law forces municipalities without (or with little) agriculture to spend funds on technical assistance, personnel turnover is high (for political reasons), personnel costs are high in relation to running costs, and it lacks means, working tools, and extension methodologies (Bojanic 2001).

By 1995, the UMATAs were only reaching 27% of the potential demand, although there were regional differences (Bernal 1998). This was also true in the municipality of Caldono, where resources were initially used to strengthen the logistic capacity of the UMATA, but were insufficient to develop the different productive projects planned or to respond to farmer demands. The UMATA of Caldono had a director and six technicians, in a municipality where 95% (27,182) of the population is rural (Comité Departamental de Estadística 2000). After 1994, the DRI Fund stopped sending resources to the UMATAs, leaving the responsibility of financing them to the good will of the municipalities. As a result, the UMATA of Caldono's staff shrank to a director and only two technicians, forcing them to concentrate their work in the upper watershed communities, including those communities with a higher concentration of smallholders, as well as indigenous territories where there was less NGO intervention.

In its fourth phase (1996-2003) the DRI Fund disappeared, leaving the State intervention process for rural development in the hands of the UMATAs. This radical change meant transition from a classical system based on the national research and extension institute (Corpoica) to a more decentralized scheme, but with limited funding. The central government delegated its responsibility of promoting the technological transformation of smallholder production units to the Municipal governments. Despite several problems, including the Colombian armed conflict, national insecurity, and an economic recession, the new model, which is based on the articulation of different organizations on several levels, was able to reach more farmers and among them, the poor (Bojanic (2001). This has not been a homogenous process however, and the effectiveness of individual UMATAs significantly depends on the ability of its technicians and on the willingness and ability of the local government to invest in their UMATA. Thus, although the new decentralized model had been well conceptualized, it has operative, budget and capability limitations:

> Our responsibility is to provide technical assistance and training to smallholders, however we have limitations. We cannot reach all the communities; neither can we attend all the needs of the agricultural sector of the municipality. [29]

The success of the UMATAs depends on the priority and budget allocation given by the municipal government, but also on the capacity of its director and technicians to mobilize additional resources and expertise, making use of policy mechanisms designed by the central government or of technical cooperation projects financed by international research and development agencies. To some extent, Caldono was a privileged municipality, receiving strong support from CIAT and NGOs with a strong and long-term presence in the area:

> The advantage we had in Caldono was the creation of the Inter-institutional Consortium for Sustainable Agriculture in the Hillsides (CIPASLA). The Consortium had projects that included training and they linked us to this process. We started to collaborate with CIPASLA and to participate in the activities proposed by the different organizations that form it. This fostered our relations with other organizations that became key partners for our work, with whom we share working experiences and approaches. These complement our activities and make it possible to give coverage to all the communities of the municipality, and to mobilize resources. [30]

4.3 A Weaker State and New Forms of Intervention since the 1990s

Under the policies of the late 1980s and early 1990s, non-governmental organizations (NGOs) strengthened by becoming the interlocutors of marginal sectors of the population and as an alternative development approach for intervention in rural areas. NGOs promoted the creation of community-based organizations as a mechanism for community participation in decision-making, and as more endogenous development processes[31]. Many NGOs arrived in Caldono with their projects and interests; two of them played an important role in the processes of intervention in the Cabuyal watershed. The Foundation of Interdisciplinary Studies and Technical Assistance (CETEC) based in Cali, and the Corporation for the Development of Tunia (Corpotunia), based in the town of Tunia (part of the municipality of Piendamo) in the Cauca Department. Other NGOs working in the watershed during the 1990s are the Foundation for Rural Agro Industry Research and Development (FIDAR), and the Foundation for Science Education and Training (FUNDAEC), both based in Cali, and Fundación Sol y Tierra, formed mainly by reinserted members of the Quintín Lame guerrilla movement.

4.3.1 CETEC

CETEC was created to promote development processes in the North region of the Cauca Department; it started its work in another municipality of the Cauca Department: Santander de Quilichao. When CETEC started to work in the region in 1989, it had no clear intervention approach or methodology, although it centred its interest on supporting smallholders via technical assistance in production and the elaboration of projects to access credit. The latter was based on CETEC's premise that financial resources were fundamental for farmers to take advantage of technical assistance[32]. The first phase of its work in the Cauca Department focused in providing technical assistance for producing and processing cassava, a traditional crop that provides 20% of the area's agricultural income (Adoption and Livelihoods Survey, December 2003). CETEC participated in a regional research and development program established to increase cassava production incomes in the region; this was led by CIRAD-SAR (Centre de Coopération International de Recherches Agronomiques pour le Développement des Systèmes Agro alimentaires et Ruraux, France) and CIAT's Cassava Program, involving different national and local partners.

CETEC start working in the Cauca Department promoting the organization of smallholders to access credit from formal providers, mainly to produce and process cassava. Serious difficulties limited its ability to improve the livelihoods of its 'beneficiaries'. First, the credits offered by formal credit providers were insufficient and inopportune since they arrived after the crop was planted and even after it was harvested. Second, formal credit providers had too many requirements, such as the property mortgage, and many smallholders either lacked or had no legal property rights, making the project unviable:

> Why did the banks lend peasants 500,000 pesos (US$ 625) per hectare planted with cassava, if the farmer needed one million pesos (US$ 1,250)? We were doing nothing: if the farmers did not produce enough, they did not had enough to repay the loan, nor to make a profit. They opted to apply the fertilizer but not the lime, or the lime but not the fertilizer. In addition, the credit came later than needed, and therefore was of no use.[33]

This was surely not a technical problem, because CETEC provided all the necessary technical assistance, based on the research and advice of the International Centre for Tropical Agriculture (CIAT), and had made a financial analysis that showed that farmers could pay back the credit. Moreover, banks did not take into account the length of the production cycle of cassava and started to ask for repayment after six months even though cassava in these hillsides only starts to produce 14-18 months after planting.

After this initial experience and during the early 1990s, CETEC decided to change its approach to promoting and strengthening community organizations, and extending its work to three communities of the Cabuyal watershed: La Campiña, Potrerillo and Cabuyal. This was in response to a community participatory diagnosis conducted by its personnel, showing that technical assistance and credit were insufficient to generate development processes, as noted by technicians:

> They [smallholders] used to tell us that they had a problem with their cattle or their crops, but that was not enough because people needed credit to solve these problems. However, there were no credit lines in the bank or the amounts were not sufficient, or people had restricted access to credit because they had unpaid loans with the Caja Agraria or did not have the guarantees that formal credit institutions requested; as a result the smallholders with whom we were working were not able to access financial resources[34]

CETEC reached the conclusion that it was impossible to meet the financial requirements of smallholders through formal credit channels and developed the idea of creating a financial fund in the communities, called 'capital semilla' (seed capital). The idea of the new scheme was to mobilize resources for the community-base organizations to manage a seed capital that could be allocated among community members to finance their productive projects. They would in turn repay with interest, increasing the seed capital. Producers who received the credit were also offered technical assistance and training by CETEC to ensure the project's success. With this decision, CETEC changed its technical assistance approach to a community-based development approach, where the entry point was strengthening community organizations by giving them access to credit and at the same time promoting a social development process.

The NGO starts its work in communities with a participatory diagnosis that leads to the formation of community organizations that become counterparts of CETEC, whose strategy is to strengthen capabilities to promote long-term development processes. It does not work with the Local Community Boards (JACs), arguing that they represent their communities with the state and are subject to political manoeuvrings and short-term decision-making processes. Nor does it work with existing community organizations, because it thinks their objectives are too specific. CETEC opts for an 'integral development process' that includes an organizational process to develop human and social resources, a productive component to intensify agricultural production, an administrative component to improve the administration of livelihood resources, and an agro industrial transformation component to add value to primary production. Its view of its work and peoples' perception of interventions are generally at odds:

> The most common situation we encounter in our work is that when an external organization comes to work in the communities, people expect to receive money or things… 'How much are they going to give us or what are they going to give'; they have expectations that result from their own daily needs. Thus, when we call of the first meeting many people come with those expectations, but many also do not come back because we do not start working with the economic component. At the beginning, our interest is to have the organization analyze its reality, give priority to their actions and define a long-term proposal. We focus on the community organization, and then we see how it can establish relations, or involve other organizations with more specific objectives. The interaction between CETEC and the community is through its organization. We work in this manner because we are interested in positioning the community organization, not CETEC. However, even though we promote long-term devel-

opment objectives in the organizations, an important aspect of the process is the design of concrete short-term working plans that permit the implementation of specific actions in the short-run.[35]

In 2004, there were seven community organizations in the Cabuyal watershed being promoted by CETEC and with formal, legal status but with big differences in their capital, which ranged from US$ 2,000 to US$ 27,000, and 14.4% of the households in the watershed belonged to one of these organizations. Of these members, three-fourths participated to access credit or to receive financial support, 14% to have access to training and technical assistance, 10% for the sake of getting organized for the development of their communities, and only 1% to develop relations with other community members. Thus, in contrast with CETEC objectives to promote community organizations with broad development objectives, most members participate with the single and specific objective of having access to financial resources for their production activities.

4.3.2 Corpotunía

The Carvajal Foundation is a non-profit organization that has been working for the last 45 years in the Cali area with resources it receives from its shares in the companies of the Carvajal S.A. group and by mobilizing development resources from the government or cooperation agencies. In 1985, the Carvajal Foundation responded to the interest of the community of Tunía by supporting the consolidation of a local development organization called Corpotunia to promote rural entrepreneurial projects. Thus, the history of Corpotunia is linked to the foundation, whose interest in consolidating this organization originated in the decision of Carvajal S.A. to move one of its book publishing facilities from Tunia to the city of Popayán. Although many employees were offered jobs in Popayán, they rejected them because they did not want to migrate to the city. Instead, they asked the Carvajal Foundation to propose options for local economic development. In response, the foundation created the Agricultural Development Program and supported the creation of Corpotunia.[36]

Corpotunia started with a credit program that expanded rapidly to eleven municipalities in the Cauca Department (later reduced to six, including the municipality of Caldono). A health program was added to complement the credit program, as was a program to support rural micro entrepreneurs and agricultural production. In the beginnings, training in small farm management and appropriate agricultural production technology were the most important components of Corpotunia's strategy and reached a high number of producers. However, as the organization re-evaluated its approach, the promotion of entrepreneurs' collectives became an essential component.

Corpotunia's interventions have gone through five phases as its approach and intervention methodologies evolved. In the first phase (1985 – 1990), it started to be consolidated as an NGO – with strong support from the Carvajal Foundation – mainly to provide business management training to individual farmers and small entrepreneurs. In its second phase (1990 – 1993), this was expanded to include designing and implementing technology adaptation projects and becoming an important partner of CIAT in the development of the Farmers Research Committees (CIALs) methodology. This collaboration was short-lived because of differences that emerged between CIAT and Corpotunia on the approaches and methodologies used[37]. This period ended with a financial crisis that questioned the sustainability of this local development NGO.

Thus, between 1993 and 1997, Corpotunia focused on finding and applying strategies to achieve sustainability not only in their projects, but also in the organization itself. A new and more flexible administrative structure was developed, called the 'snail strategy', consisting of having minimal core personnel that expanded or contracted as new projects were mobilized or terminated. The organization ended the millennium with a more holistic strategy that included a combination of income generation, organization strengthening, technological development and human development objectives.[38]

In 2000, a new period started for the organization called 'Corpotunia towards the XXI Century' when the organization redefined its vision and mission:

> Corpotunia is an institution with a community-base origin that contributes to the integral and sustained development of participant communities. The organization builds on and strengthens community organization processes with a production chain approach, focusing on the technological aspects of production, post harvest and processing functions, as well as on marketing and the development of entrepreneurial capacities.[39]

4.4 CIAT-Led Intervention in the Cabuyal Watershed

In the Cabuyal watershed, CIAT began with the Phosphorous Project, financed by the Ford Foundation and with a 'farming systems research' approach that tested research results obtained in CIAT's experimental station on farmer fields. Thus, CIAT rented a farm in the watershed to conduct its research on breeding and crop management on beans, cassava and pastures (three of its four mandate crops) with the help of hired farmers. However, CIAT social researchers and technicians started to see that no farmers in the area were using the results of their research, because farmers did not have the resources to buy the needed inputs. CIAT technicians consequently started searching for strategies that could be used. This re-oriented the objectives of the program, which expanded its approach from a purely technical one to a socioeconomic one. Consequently, it became more interested in the community:

> Since 1983, we have asked ourselves why farmers do not do all the nice things that we, as researchers, do. We realized that our beautiful experiments with convincing and impressive results did not cross to the plots of neighbouring farmers who did not have a sense of what we were doing. We started to inquire and realized that they could not adopt our technologies. It was not easy to find the inputs we were using in the nearest towns of Santander or Popayán, where they bought their inputs. Farmers were only day-workers in our research plots and they had no idea of what we were doing; even worse, they were not involved in decision-making, and we did not care that they did not know what we were doing.[40]

Participatory approaches in the CGIAR began when the system broadened its mandate to work in rain-fed agriculture, mainly dry land agriculture that came with the idea of 'farming systems research'. Under this new mandate, it became more difficult to identify 'silver bullet technologies' *à la* Green Revolution and the system moved into the 'unknown'. There was no previous work or knowledge in this area for this new work to inherit, and by the late 1980s, it was clear that neither the 'transfer of technology' nor the 'farming systems research' approaches were working. People started asking where the Green Revolution for rain-fed agriculture was, and what was impeding its success. The first response was that farmers were traditional, ignorant and resistant to change, and that there were market problems. To solve this 'adoption' problem and find ways to make farmers adopt, the system started to hire social scientists. With that purpose in mind, twenty years ago the Rockefeller Foundation designed its Social Science Postdoctoral Program to bring social scientists (who were seen at that time by the Foundation as 'agents of change') into the system to understand the 'social constraints to technological innovation'. This brought social scientists to CIAT, and today many of those social scientists are members of CIAT's management team.[41]

Thus, CIAT started to introduce 'farming systems research' approaches but the CIAT Director General at that time closed this area of research and decided that the Centre should go back to a straight commodity focus aiming to improve yields:

> The work of social scientists was viewed as irrelevant, they were seen as scientists who went to the field to talk with the farmers but whose work was seen neither as important nor as a contribution to Centre goals. Other scientists saw them as too critical and not constructive. CGIAR was convinced that it had the 'right technologies' and that social scientists were only needed to make farmers adopt these technologies, or in other words to solve the 'adoption problem'. For example, I came to work in the IDC Phosphorus Project, which they could not get farmers to adopt. They brought Douglas Pachico to study the intermediary in cassava to find solutions to the adoption problem in cassava. However, social scientists started to tell scientists that the problem was not the farmers, but that they were offering the 'wrong technologies' and that these, rather than the farmers, had to be re-engineered. Hundreds of experiences of failure could be found. It was clear by then that a better understanding of the farmers and the acknowledgement of farmer's needs and constraints was important and had to be taken into account in technology development. Thus, participatory breeding started with the aim to incorporate farmer's criteria into the breeding process. It was clear that there was a need to be more client-oriented to develop the 'right technologies.'[42]

Participatory research approaches emerged as a critique of top-down technocratic approaches to research. The capital intensive and frequently environmentally damaging approaches associated with the Green Revolution were criticized for their negative environmental impacts, high cost, and inability to be context specific. In the 1970s, as alternatives to context-insensitive approaches, participatory approaches emerged in Latin America (as did the liberation theology work of Camilo Torres, Gustavo Gutierrez and Paulo Freire, who introduced the concepts of 'critical reflection' and 'committed co-investigation') (Selener, 1997). The concept of participatory research was put forward in development theory and practice by Chambers and Ghildyal (1985) and Chambers et al. (1989).

At this time, Participatory Action Research emerged in CIAT, aiming to involve farmers in decision-making. During 1986-1988, the Participatory Investigation with Farmers (IPRA) project studied farmer experimentation and found a wealth of informal experimentation conducted by farmers. However, formal research and extension was not linked to farmer experimentation. Thus, CIAT social researchers identified the need to organize experimenting farmers, to encourage their research and diffusion of results.

4.4.1 Community-based farmer research committees (CIALs)

To start working with a 'farmer participatory research' approach to knowledge and technology generation, CIAT established community-based farmer research committees (called Comités de Investigación Agrícola Local, or CIALs). These committees were formed directly in local communities, or with existing informal groups formed by NGOs for credit and extension purposes (related with the work of Corpotunia), or with farmer associations or cooperatives. By early 1995, 55 CIALS were scattered in nine municipalities of the Cauca Department, many of them in Caldono (Ashby 1999).

The CIAT team that developed the CIAL concept and methodology defined it as a farmer-run research service answerable to the local community. The community elects a committee of farmers chosen for their interest in research and willingness to serve. CIAL conducts research on priority topics identified through a diagnostic process in which all community members are invited to participate. After each experiment, CIAL members report to the community. Each community has a small fund to offset the costs and risks of research and a trained facilitator supports the group until it is mature enough to manage the process independently. The steps of the CIAL process are motivation, election of the research committee, diagnosis, planning, experimentation, evaluation, analysis and feedback (Ashby et al. 1998 and 2000).

The results derived from monitoring the first CIALs showed that 48 of them, with decreasing institutional support, carried out a large and increasing number of on-farm trials that could largely be statistically analyzed and that were useful for knowledge generation. In 75% of the participating communities, participants perceived new seed and new cultural practices or recommendations as benefits. In addition, the communities set up more diverse research agendas than that of the institutions that considered only cassava, pastures, sugarcane and coffee. The CIALs' research agenda reflected farmers' interests in identifying alternatives to the traditional cash crops and their aim to increase food sufficiency by growing staples such as potatoes, beans and maize (although farmers in the region were already producing these food security crops, local supply was insufficient and they were being imported from other regions of the country). Since 1991, the CIALs of the Cauca Department have met annually for one to two days to exchange results. This prompted the election of a central coordinating committee in 1993, and in 1994 led to the CIALs' decision to form a corporation of CIALs, called CORFOCIAL, through which paraprofessionals began giving courses to the UMATA technicians that contracted them to support the establishment of CIALs elsewhere and paid 50% of the paraprofessionals' salaries (Ashby 1999).

CIAT personnel initial feeling that commercial production and income generation objectives were unimportant was a disincentive for farmer involvement in CIALs. Specifically, although developing small business enterprises was not part of the original design for CIALs, six of them begun to produce improved seed, getting involved in small seed-production enterprises to meet local demand (Ashby 1999). More than 10,000 farmers have purchased CIALs seed, improving their incomes and providing a powerful incentive to research activities.

4.4.2 CIPASLA

At the end of the 1980s, the different governmental and non-governmental organizations working in Caldono had the following concerns: The first was the confluence of various intervening agencies that provoked the discontent of their beneficiaries because they worked in an uncoordinated manner with different and sometimes contradictory objectives.

> When we asked peasants about the organizations that came to work with them, they told us that people from intervening agencies used to come whenever they wanted. Different organizations came with different messages for the same purpose, and there was a complete lack of coordination among them… one technician would come in the morning and in the afternoon, another from a different organization would come to talk about the same thing.[43]

Duplicate efforts among intervening agencies, but with contradictions in the approaches and methodologies used, left farmers disoriented and more confused than before, unsure what kind of assistance they really wanted.

> As CETEC, we used to have strong discussions, but big ones, and it was because we used to feel ashamed in front of the peasants, for example, we were giving a training course with SENA promoting an alternative approach to agriculture that suggested organic production in the region. However, when farmers met with technicians from other organizations, they used to tell them: 'what are you going to apply to these plants? No… you have to apply chemicals…' Thus, people used to say, 'why do you say one thing and the others tell us something different?' This was embarrassing for us.[44]

As new development paradigms emerged, intervening agencies also started to argue that it was necessary to strengthen community organizations to stop them from being only passive recipients of aid and to make them catalysts of their own development, with the coordinated support of organizations working in the region.

At the same time, CIAT was starting to work explicitly in natural resource management (NRM) research as a response to donor demands that CGIAR, and therefore CIAT, adjust their agendas and allocate resources to NRM.

> The agenda on NRM research certainly came from outside of the Centre. I was the Bean Program Leader by that time and was preparing a talk for the Board… I was planning to say that our goal was to have tangible results and impact in the short run and that I thought that they should judge the program on whether we could make a difference in people's welfare. However, the Director General took me outside and said that I could not say that anymore and that I had to talk about sustainability and the long-run consequences of the technology we introduced. CIAT scientists did not welcome these ideas initially and felt that the Technical Advisory Committee (TAC) of CGIAR was unaware of how much work they were already doing to address sustainability issues. Scientists in CIAT were already working on nitrogen fixation, rotation of pastures with crops, disease resistant varieties, integrated pest management and soil conservation, and they felt that they were not getting credit for this. In addition, they sensed that to some extent the slogan of NRM was used as an unfair criti-

cism of the Centre, and ultimately as a pretext to take resources away from them.[45]

As a result, CIAT was re-structured in 1996, and instead of being organized around four commodity programs (beans, cassava, rice, and pastures) it had 16 projects divided between two Adjunct Directors: the Director for Genetic Resources and the Director for Natural Resource Management. Sociologists working in NRM research supported the hypothesis that the successful management of natural resources depended on the involvement of local organizations and on fostering collective action among them. While NRM was formerly viewed as primarily an ecological and technical issue, its social and economic dimensions needed to be recognised. The sociologists were clear that NRM problems tended to arise when one actor's use or neglect of a particular resource influenced another actor's ability to use that (or another) resource, making the development of institutions a crucial issue (Ravnborg and Ashby 1996). Thus, to begin NRM action research, CIAT took advantage of the felt need in Caldono for inter-institutional coordination, where it was already working with 'farming system research' and 'farmer participatory research' approaches. CIAT proposed the formation of CIPASLA, as well as an association of the Cabuyal watershed users (ASOBESURCA).

As discussed earlier, conflict over resources was always an important issue in the Cabuyal watershed, where the long history of disputes over entitlement to access land resources has been accompanied with ethnic and social class conflicts that resulted in a long and painful process of social differentiation and a skewed land distribution. In 1993, sixteen percent of farmers cultivated less than half a hectare (amounting to 2% of the watershed-cultivated area). In contrast, the 9% of farmers who cultivated 4 hectares or more controlled 30% of the area cultivated (Ravnborg and Ashby 1996). In addition, during the early 1990s conflict for natural resources became an additional source of conflict. CIAT saw these conflicts over water, forest and soil resources as opportunities to pursue their NRM research agenda.

Conformation of CIPASLA

In November 1992, CIAT invited all the organizations that were working in the North region of the Cauca Department and specifically the area influenced by the Ovejas River to the first inter-institutional planning workshop for sustainable hillsides agriculture. This workshop was organized with the aim of finding mechanisms for the coordination of activities to provide a more integral and effective intervention in the region, where organizations could complement their actions instead of duplicating (or even worse contradicting) them. This workshop also aimed to agree on an approach to strengthen the community organization and improve the dialogue between the community and intervening agencies, with the aim of promoting active community participation in the work of supporting organizations. It was in this workshop that the organizations working in the region approved CIAT's proposal to organize an Inter-institutional Consortium, giving birth to CIPASLA.

Two important aspects of this meeting later had implications in this process. The first was that intervening agencies considered communities important. The second was the idea that CIPASLA was an experimental model, and as such, it was important to learn from it in order to replicate the experience in other places. Thus, the Consortium recommended a participatory action-research approach, in which its actions would be decided in consultation with its social bases and a permanent forum would be created linking intervening agencies and the community, and the interest in replicating the model in other areas would be taken into consideration.

The watershed users' association (ASOBESURCA) was also formally constituted and local leaders, active in promoting the association, defined its membership base as all the different local organizations and interest groups (not necessarily all formally organized). Thus, community organizations such as the JACs and the Community Aqueduct Boards promoted by the municipality, community organizations promoted by CETEC, the CIALs promoted by CIAT, and the indigenous authority of La Laguna all participated in ASOBESURCA. Thus, in its beginnings the process was able to bring together smallholder *mestizos* and the indigenous population despite their long time differences and fights over land resources. The membership reflected the perception of the local leadership elite that ASOBESURCA would be a pressure group composed of people like themselves, who could be expected both to mobilize local support and to interact effectively with external organizations.

In early 1993, community leaders began visiting different areas of the watershed to motivate local people to collaborate in improving watershed management. They focused their campaign on decreasing water availability (which they associated with deforestation of the upper reaches of the watercourses) and organized a series of task forces to visit communities in the upper reaches. This was the first time that many had gone to these communities, and they found much greater poverty that in the lower altitudes: impassable car tracks, an absence of schools, low quality housing, poor crops, and an extensive wasteland of bracken-covered fallow land left after shifting cultivation. The farmers in the upper watershed described their problems and concerns and explained how the clearing and cutting of trees around the reservoirs provided not only cropland, but also charcoal, almost their only source of cash (Ravnborg and Ashby 1996).

On March 1993, at a second planning workshop, the participating organizations selected the Cabuyal watershed as the pilot area for CIPASLA: they identified a joint program in which each had a defined role and contribution. They also agreed that natural resource conservation activities required complementary community organization, research, training, production, agro industrial, commercialization and natural resource management activities, mirroring community plans to compensate upland farmers (Ashby 1999). The 12 organizations specified common objectives responding to community demands and identified verifiable indicators to monitor the results at the end of the first phase (three years) of the Consortium. Each organization began to identify its activities as complementary with those of others. By mid-1993, CIPASLA had developed a budget from outside grants (with strong support from CIAT), participating organizations, and the participating communities, the latter mainly providing in-kind contributions. The structure of the Consortium was organised around various committees, where the intervening agencies, their personnel and the community were represented; a paid Director was appointed to manage CIPASLA.

The golden years of CIPASLA (1993-1998)

In its beginnings, CIPASLA generated many expectations among the intervening agencies and the community. The participatory diagnosis, the census conducted in the area and the creation of ASOBESURCA generated enthusiasm, if not among all the population, at least among the community leaders, who went to all the communities in search of active participation and the support of the local people. The initial expectations of the intervening agencies were realized in the implementation of various coordinated projects during the second semester of 1993 (Cock

2002). Eider Tovar, producer and president of a coffee producer group tells how community leaders participated in the process,

> We started by recouping the water springs in our community because water is very important for us; we even have pictures of our first works. Then, we made a census of water springs and water streams, and started planting trees in the springs and had a working day to plant bamboo. CIPASLA brought 3,000 bamboo plants. We planted them one km around the water springs, every 5 meters, and along the water streams. We also started a tree nursery with 9,000 trees and started to plant them little by little and people from the 'third age' group helped us planting trees.[46]

CIPASLA also supported the education sector in the region:

> CIPASLA gave a lot of support to educational institutions because they saw the importance of investing in educating the children to improve the management of natural resources. We had a lot of support in training, in the elaboration of methodological guides to teach the children how to take care of the environment. We initiated the process in our school and then we transferred it to another 13 primary schools in the watershed. We changed our teaching curricula and learned how to identify alternative solutions to our problems and mobilize needed support.[47]

To finance the Consortium, participating organizations mobilized external resources from donors who, at the time, prioritized NRM. CIAT was very active in mobilizing resources and contributed directly from its own core resources. In its first phase, CIPASLA mobilized 238 million pesos (almost US$ 250,000) of which 46% came from CIAT, 37% from the International Development Research Centre of Canada (IDRC) and the other 17% from the DRI Fund. To access these funds, the organizations in the Consortium had to present project proposals in line with the objectives set up during the planning meetings. Implementing organizations co-financed these projects by providing goods and services, personnel and existing infrastructure. Thus, CIPASLA became a source of funding for the intervening agencies as far as they designed their projects in line with Consortium goal and objectives. During this period, most of the projects financed by CIPASLA related to NRM, following a CIAT agenda that was highly informed by the CGIAR and its donor's agendas.

CIPASLA also allocated resources to ASOBERSURCA, which invested them in a permanent fund placed as a perpetual investment in the Foundation for Superior Education (FES), which managed similar funds for social, ecological and research organizations under attractive conditions. The idea was that ASOBERSURCA would use 70% of the interest to finance projects for the communities, and that the other 30% would capitalize the fund (Cock 2002).

For its second phase (1996-1998), CIPASLA mobilized a total of US$ 315,000 from IDRC, the DRI Fund, CIAT and other governmental organizations. Most of this went to the NGOs already working in the watershed (all members of the Consortium) since they had the advantage of having working experience in the region. These NGOs supported 156 projects, reaching almost every community of the watershed (Cock 2002). Corpotunía worked in reforestation projects with bamboo, artisan handcrafts and women's groups that were producing flowers. CETEC implemented projects to improve the use of animal energy, provide advice for the establishment of 'seed capital', and improve the quality of water resources. Fundación Sol y Tierra participated in the construction of a watershed scale model and the design of educational programs, and FIDAR worked on the development of rural agro industries.

These resources also helped to mobilize governmental resources by using them as the co-funding usually required by the Colombian government, as was the case of the National Program for Technology Transfer (PRONATTA[48]). In addition, CIPASLA attracted other governmental organizations that came to work in the watershed with their own resources but coordinated with CIPASLA. Thus, the Consortium became the channel to articulate local demands to potential providers; it allocated 13% of the total cash resources mobilized from international donors and the Colombian Government directly to community organizations. The resources transferred to community organizations were invested in office equipment for the indigenous authority, in exchange for its work on the watershed reforestation, a milk processing plant for ASERCA, a milk producers' association, and the establishment of a community-based seed capital fund for ASOBESURCA (data obtained from the presentation CIPASLA 2000).

The resources that allowed the Consortium to support the work of NGOs and community organizations characterized the first two phases of CIPASLA. These resources also provided CIPASLA and the local government with the necessary flexibility to co-fund projects financed by the Colombian government. Thus, during these years there were a large number of projects.

In the first phase of CIPASLA, the agenda of CIAT on NRM was evident, as most of the projects implemented related to this area of research. This focus was identified by partner governmental, non-governmental, and community organizations as one of the limitations of CIPASLA, because the environmentalist focus left other production, processing and commercialization demands unaddressed (Cock 2002). In its second phase, the Consortium allocated resources for productive projects, without leaving out the theme of NRM, as other intervening agencies (especially CETEC and Corpotunía, with many years of continuous presence in the region) started to gain increasingly protagonist roles in the Consortium.

The crisis of CIPASLA (1999-2000)

Despite all the resources available for the Cabuyal watershed and projects implemented between 1993 and 1998, problems between the CIPASLA coordination and ASOBESURCA started to emerge early. In September 1994, ASOBERSURCA sent letters to CIPASLA expressing their 'preoccupation with CIPASLA's failure to carry out the projects that were presented by the communities' (Coordinating Committee Meeting minutes, 29 September 1994). By mid-1995, ASOBESURCA requested 'more support and follow-up from the technical coordinator of CIPASLA' (Coordinating Committee Meeting minutes, 5 July 1995), and two months later the Coordinating Committee expressed its concern about the growing difficulties in the relation between CIPASLA and the community, especially between the CIPASLA Director and the members of ASOBESURCA. The beneficiaries complained about the lack of trust in them, as well as about difficulties in getting resources paid out and their projects implemented (Coordinating Committee Meeting minutes, 25 October 1995).

During 1996, problems continued and the distrust created a growing distance between CIPASLA and ASOBESURCA. ASOBESURCA felt that there was no link between the activities of the intervening agencies and the communities, that the community organization was not working and required support, and that nobody was providing follow-up to their projects (Coordinating Committee minutes, 21 February 1996). Thus, the community continuously asked for more support and follow-up, but CIPASLA did not respond to this request. In 1997, two presidents of the ASOBESURCA board resigned and the association decided to separate their offices from CIPASLA. The accusations of ASOBESURCA, who felt excluded and cheated, reached intervening agencies and the assistance of ASOBESURCA members at meetings reduced significantly, falling under quorum requirements (Cock 2002).

Another problem add-up to this crisis with the community: the start of a resource scarcity period after six years of successful resource mobilization. IDRC and CIAT had invested in the administration and coordination costs of CIPASLA because they were interested in conducting participatory action research and promoting a new institutional model for NRM. Their contribution was US$ 322,000 (22% of total resources invested). However, once they considered the model consolidated, it became difficult to justify more investment in administrative and coordination costs. Moreover, the Consortium did not develop any strategy during its golden years to secure its financial sustainability. Thus, although CIPASLA and ASOBESURCA were able to mobilize resources from governmental programs and other donors, these all required co-financing and only provided resources for operation costs, not for administration and coordination. Thus, CIPASLA only had US$ 2,500 for operations beyond 1997 (CIPASLA Financial Report, Coordinator Committee). As a result, the intervening agencies that made up CIPASLA continued mobilizing resources and coordinating their activities, but there were no resources for coordinating and administrating the Consortium.

At the beginning of 1998, CIPASLA obtained its legal status and became one more intervening agency with the possibility of mobilizing resources directly and not through its members (Board Minutes 41, 26 January 1998). However, for legal reasons the governmental organizations that participated in the Consortium were not able to participate in CIPASLA. Thus, in practice, CIPASLA was divided in two: the Consortium that continued working under the general agreement, as before, and CIPASLA, a new NGO formed by people and not by organizations, which was able to mobilize resources directly. CIPASLA and ASOBESURCA were then able to obtain resources from PRONATTA, but these were the only projects the Consortium was able to mobilize during this period. In February 1999, CIPASLA's critical financial situation forced its board to transfer resources from specific projects to its administration fund, a situation that repeated in September of the same year (Board Minutes, 21 September 1999).

To alleviate this crisis, the CIPASLA Coordinating Committee proposed putting together all the resources distributed among different objectives to form one administration fund as was done before, based on the argument that, otherwise, the CIPASLA office had to close (Coordinating Committee Meeting Minutes, March 22 2000). CIAT's representative in the Committee refused to sign the agreement approving this transfer of funds, arguing that it was not ethical because it required taking resources away from the communities to fund the administration of CIPASLA. Thus, a confrontation between the two positions started: on one side, those who thought that CIPASLA should be saved, and on the other, those who felt resources could not be used for any purpose other than the ones for which they were donated, even if this implied closing the office and laying out the CIPASLA Director. To make things worse, the permanent fund of ASOBESURCA was frozen, together with the funds of 431 other social organizations in Colombia, a result of mismanagement of the financial branch of FES.

In the beginning of 2000, the situation was critical. The leaders of ASOBESURCA had a bad relationship with the CIPASLA's Director, and neither CIPASLA nor ASOBESURCA had operating funds. This led to the resignation of the CIPASLA Director, who was questioned on the transfer of resources from the implementation of projects to the administration fund and the poor relationship with ASOBESURCA and the community in general. CIPASLA was left with a total fund of US$ 7,000 (Cock 2002).

The apparent failure of CIPASLA and the survival of the process

In the next CIPASLA Board Meeting, a member affirmed that the Consortium itself was not in crisis, only its administration. To a certain extent he was right, since the intervening agencies continued working in the region, and through their commitment to the process and acknowledgment of its benefits they (especially the Technical Committee, which was always more active) continued meeting to coordinate activities. However, ASOBESURCA's resource, participation and credibility crisis continued, together with the threat of closing CIPASLA, which for almost a decade had been (for the communities) the visible part of the intervening agencies. The members of CIPASLA discussed alternative scenarios in which to continue with the process, and never thought about ending it. In July 2000 a new part-time coordinator, native to the watershed, was hired. After the problems that arose with the former Director, the members of CIPASLA thought that it was important that the new CIPASLA Director, besides having the necessary credentials, would be a producer linked to CIPASLA, or a person that had worked in the agriculture sector in the Municipality of Caldono. An important characteristic that the board of CIPASLA sought in the new Director was that the person knew the local people and had strong links with them.

The office continue running with small contributions from most CIPASLA members, and in May 2001 CIAT donated US$ 4,000 as a seed fund to support the mobilization of new projects and the search for new donors. At the same time, the organizations that made up CIPASLA launched a campaign to regain community credibility and participation in ASOBESURCA. Because of the promotion of a 'New CIPASLA', participation in ASOBESURCA assemblies increased noticeably. Thus, during the first semester of 2001 up to 76 delegates of 42 community organizations and the JACs participated in ASOBESURCA meetings, the highest levels of participation in the organization's history (CIPASLA Report, January-July 2001). Having a Director who was native to the region (and with strong links with the community) contributed to this outcome.

Although CIPASLA had a new, consolidated direction that restored the participation and credibility of the community, in 2004 there were still no secure resources for its operation. ASOBESURCA also lacked resources and was thinking of starting to charge an affiliation fee to finance meetings. Its capacity to implement its own projects, such as the community-based credit seed funds, depended on new donations and on its resource mobilization capacities. From the crisis, a strengthened community organization had emerged with an important role in the process of change of the Consortium. However, the sustainability of the process depended on the capacity of CIPASLA and ASOBESURCA to mobilize resources, independently.

Despite overcoming the worst problems and being able to continue with CIPASLA, the inter-institutional coordination process has been interrupted. The Coordinating Committee has not met and the Board meets only sporadically, and only for specific purposes other than strategic ones. In two and half years, the coordination was unable was neither able to finance new projects nor to develop a clear procedure for this purpose. It survived because it received a contribution from CIAT in

2001, a donation from the Kellogg Foundation, a prize won in the World Forum of Johannesburg, and the resources of the Agro-industrial Committee (AIR Committee) promoted by CIAT's Rural Agro-enterprise Project since 1999. Administrative costs took an important percentage of this. Some intervening agencies, in contrast to the previous spirit in CIPASLA where members took the initiative, left the weight of CIPASLA on the shoulders of its new Director, and just watched the Consortium from the sidelines. Others (such as FIDAR and Fundación Sol y Tierra) have stopped their activities in the region, or reduced their actions significantly.

While CIPASLA lacked resources and projects, ASOBESURCA became more vigorous, and resources from donations were channelled in a more effective manner to support productive projects for the communities. The association also built an alliance with an NGO to strengthen its organization and to work in food security projects, showing that it has consolidated, has become more independent from the intervening agencies that have created it, and has developed capabilities it formerly lacked.

By 2004, there were only two spaces for inter-institutional coordination in CIPASLA: the Technical Committee (always the most active of its committees) and the AIR Committee. The intervening agencies that work in the region on a permanent basis participate in the Technical Committee, since the coordination of daily activities and the sharing of experiences has been institutionalized. The AIR Committee includes the Director of CIPASLA, a representative of ASOBESURCA, some of the organizations that participate in CIPASLA (CIAT, Corpotunia, CETEC, CORFOCIAL), and one producer's organization, ASERCA. Although this committee existed previously, it only became operative in 1999 when it started to promote the methodology of Integrated Productive Projects (PPI) around five agro-chains (anthuriums, chickens, blackberries, milk products and plantain) developed by the Rural Agro Enterprise Development Project of CIAT. These agro-chains were prioritized according to whether: (1) market demand for the product existed, (2) the agri-chain was technically, environmentally and economically feasible, (3) a producers' organization existed that could implement the project, and (4) an intervening agency was committed to supporting the project.

The AIR Committee is different from the other coordination experiences of CIPASLA in two respects. The first is that it responds to the long-time wish of ASOBESURCA to receive support for the implementation of productive projects that generate new income opportunities as the entry point for intervention (instead of CIPASLA's original NRM entry point). The second is that although each agro-chain is supported by a different intervening agency participating in CIPASLA, all of them share a common set of working principles, and follow the approach and methodology developed by the Rural Agro Enterprise Development Project, adjusted by the partner organizations. This methodology has an entrepreneurial approach, is oriented to satisfy market demands, is based on an agro-chain analysis, involves all the relevant actors in its design and implementation, and includes research and development activities. The AIR Committee meets monthly to discuss the advances, and share concerns and experiences, promoting a horizontal learning process. Thus, the AIR Committee is an example of effective inter-institutional coordination, although it only works in this theme of agro enterprises and with some of the members of CIPASLA.

4.5 Reflecting on Modes of Intervention in the Cabuyal Watershed of Colombia

The Cabuyal watershed has a long history of external intervention that started in the mid 1930s with the first Land Reform. One of the causes for land reform was a chronic tension between the conservative and liberal parties, and between different factions of the liberal party. Behind these tensions were emergent capitalist farmers who colonized large tracts of state land and received legal title for them, in most cases larger than the maximum allowed by Law 71 of 1917 (which aimed to defend and facilitate the formation of smallholdings). The emergent capitalist farmers received every available State benefit, including subsidized credit, free technical assistance and investment in public infrastructure, becoming a powerful pressure group to promote counter-reforms, especially during conservative party governments.

The 'Alliance for Progress', which started with the establishment of the Land Reform Program and the creation of INCORA[49] in 1961, continued with unsuccessful land reforms in the 1930s. However, land reform failed to redistribute land with good agricultural potential, instead mainly promoting a colonization process that was followed by granting individual legal property rights. This created further tension between *mestizo* smallholders and the indigenous peoples who started to fight to keep their territories and to regain those that had been lost in this colonization. An outcome of this is that communitarian land tenancy among smallholder *mestizos* is non-existent, the percentage of land rented to landless farmers or under sharecropping is relatively low (11.5%), about the same as the land that farmers consider private property but for which they lack legal property rights (12%).

This first period of external intervention, which started in the 1930s, was informed by the structural 'food and hunger thesis' that spawned a rural development strategy focused on improving access to land resources. However, land reform only reached a small percentage of landless households, and these were able to access only a suboptimal amount of marginal land. Behind this inequitable land distribution is a long political conflict between two political parties with relatively equal power, which resulted in a complete lack of continuity in agrarian reform policies and strategies: counter-reform processes alternated with land reform processes.

Intervention in the next period (by the Integrated Rural Development Program or DRI Program) was based on technological determinism and a neo-Malthusian thesis of the food and hunger crisis. This was a pilot project for Latin America, and the first nationwide integrated rural development program in the Third World. Colombia has always been a country where new development theses could permeate easily: it has always been willing to put theories into practice, facilitated by its higher level of human resources compared to other Latin American countries.

The implementation of the DRI Program started in the early 1970s as an expression of the positive spirit of the time: there was an optimistic view of development, faith in what could be planned and implemented, and a trust in the State as regulator. The DRI Program rejected a land reform and favoured productivity gains by smallholders. The DRI Program strategy focused on agricultural intensification with a 'transfer of technology' approach complemented by subsidized credit and infrastructure projects. This supports the argument that the program was not established to alleviate poverty in the 'backward' or traditional sector, but to maintain a non-conflictive semi-proletarian rural class to secure cheap food and labour for the emerging industrial 'modern' sector.

In the Cabuyal watershed, the DRI Program was made operational through parallel, but not integrated, projects. During the 1970s, the DRI Program promoted fique (fibre) production, by developing and promoting superior technologies, providing financial resources, constructing a modern processing infrastructure, and linkage smallholders with agro industrial buyers. Changes in market demand led to failure of the process. This, coupled with limited access to market information, inequity and power asymmetries in the supply chain and the lack of innovation to respond to constantly changing market demands, led to the project's inability to generate sustainable livelihoods in the region. The result of the project was broken and indebted farmers, with less resilient livelihoods, and further (semi) proletarization of smallholders.

During the 1980s, when the poverty thesis gained acceptance in development practice, the DRI Program started to spend resources on improving access to human and social resources by training smallholders for participation. In the Cabuyal watershed, this was the Training for Smallholders' Participation (CAPACA) Program, initiated to 'promote an education, enlightenment and information process directed to producers with the aim of training them for rational decision-making'. In practice, this project was well conceived and implemented, showing rapid results in terms of people's empowerment, having a greater impact in fostering human and social resources than expected, all well recognized by its beneficiaries. The CAPACA Program not only offered a technical solution to poverty but also a bottom-up political solution. However, the latter was seen as a threat by those in power, who feared that the empowerment of people could lead to political instability in rural areas. The program had a short cycle, ostensibly because of a lack of resources, together with the argument that it was causing SENA[50] to deviate from its original mandate. The Director and thinker behind the program had to leave the country because of a threat on his life. It was not the technical solution and its implementation that failed, but the unwillingness to provide a political solution to poverty alleviation that stopped it.

The 1990s saw a new development paradigm informed by the concept of sustainable development. This new approach emphasized natural resource management and rural development. It aimed to develop local capabilities and collective action by, and not for, the people, which was a useful departing point in a struggle for democracy and articulation. Participatory approaches that had emerged earlier started to gain importance both in rural development and agricultural research. External intervention shifted towards a strong focus on facilitating access to human and social resources to foster new ideas and organizations and to foment collective action and a political project instead of merely technology transfer. This came together with decentralization processes and a greater importance given to the territory and local identity.

At the same time, the monetarist thesis of the food and hunger crisis strongly influenced macroeconomic policies. Thus, structural adjustment, trade liberalization and opening of the economy to global competition were introduced. Decentralization as a means to promote economic and social development clashed with globalization and its pressure for competitiveness. It can be argued that the former provided palliative measures to limit the social conflict promoted by the latter. In any case, most state and societal responsibilities were left to market forces, while the social impact of globalization justified the investment of public resources on local development projects and initiatives.

In the early 1990s, CIAT had a severe budget cut, in part as a result of critiques of the Green Revolution and CIAT's failure to reach smallholders in marginal agro ecosystems. CIAT was pressured to introduce a natural resource management agenda in its mandate, and began conducting research for tropical hillside agro ecosystems where smallholders predominate. With the mandate of producing 'international public goods' for these agro ecological and socio economic conditions, CIAT intensified its work in the Cabuyal watershed, the chosen pilot site in Latin America for its new mandate, making use of novel and innovative knowledge and technology generation approaches. CIAT developed and promoted social and institutional innovations such as farmer participatory research approaches and methodologies (CIALs), multiple stakeholder bottom-up approaches to collective action (CIPASLA[51] and ASOBESURCA[52]), and, later on, agro-enterprise development with an innovative territorial, market-oriented approach (CIPASLA's AIR Committee), together with technological innovations for sustainable production in hillside agro ecosystems.

Influenced by all of this, CIPASLA initially emerged with a strong NRM focus (a response to donor demands), but benefited from the participation of a network of constructive and critical organizations that shaped a new institutional model. CIPASLA became a parallel structure to the municipal government, taking over its coordination responsibilities for the promotion of local development. During its golden years, it had more resources than the municipal government, and therefore more decision-making power and implementation capacity. Although, this could have been an opportunity for the municipality of Caldono to improve its effectiveness, a limitation was the biophysical delimitation of the intervention area of CIPASLA (given by its NRM agenda) which conflicted with the political delimitation of the municipality, thus limiting the possibilities of collaboration between the local government and CIPASLA. CIPASLA's area of intervention included only those communities within the Cabuyal watershed, while the municipality had to support all the communities within it. It would not have been politically correct for the local government to join efforts and resources to support only a part of its mandate area of intervention.

Despite the lack of external resources and the withdrawal (or reduced support) of many of the supporting organizations after 2000, the CIPASLA process has been ongoing for more than a decade. This is despite the fact that the NRM entry point has not proved effective (even though water resources are a critical constraint for agricultural activities in the watershed) because access to economic/financial resources is a more constraining resource. As such, CIPASLA, and its members, started to use income generation and agro enterprises development as their entry point in the early 2000s, and as formal financial institutions were unable to meet household's financial needs, NGOs established alternative schemes, such as the community-based seed capital approach introduced and implemented by CETEC[53].

The social and institutional innovations introduced in the region during the 1990s strengthened peoples' capabilities by improving access to human and social resources. This has been an important achievement as a means to promote innovation. Moreover, as the Cabuyal watershed was initially conceptualized as a pilot learning site, it led to the shaping of new organizational processes and institutional models based on multi-stakeholder decision-making strategies to promote sustainable development, and a set of methodological guides that have been used since the late 1990s for training and out-scaling the experience.

The historical reconstruction of external intervention in the Cabuyal watershed shows the high level of discontinuity between the timing of development processes and the policies and strategies of development, and shows how development theory has permeated and greatly influenced development practice in Colombia by shaping external intervention, institutions, organizational processes and strategies. Development practice has moved from a strongly food security-based, structuralist position to a strongly actor-oriented position coupled with a monetarist approach, but a learning process that builds on previous experiences and improves development practices was not promoted, limiting the success of external interventions. However, this history also shows that even with a high level of discontinuity, social actors develop and use new ideas to change, and to adapt to new events and circumstances.

Notes

1. 'Criollos' was the term given to the population born in the colonies from Spanish parents.

2. The antagonism among the liberal and conservative political parties has historically been an important source of hostility and together with the equal strength of both parties explains, in part, the high level of political violence in Colombia for more than hundred years (Maingot 1968).

3. Daniel Vallejo, 2 July 2003, Crucero del Rosario, Caldono.

4. Caja Agraria was a rural bank, set up by the Colombian government to provide farmers with subsidized credit. It was later privatized as Banco Agrario.

5. Melida Chocue, 26 December 2003, Guaico Alisal, Caldono.

6 Jaime Ulchur, 15 January 2003, El Oriente, Caldono.

6. This is a common arrangement in the region where indigenous people are given a piece of land for cropping on a large estate in exchange for working for the landowner.

7. Benecio Velasco, 7 January 2003, El Porvenir, Caldono.

8. Adiela Rosas, 4 February 2003, Ventanas, Caldono.

9. 'Caleños' are the people that live in Cali, a city with approximately 3 million people located one and a half hours' drive from Caldono.

10. Adiela Rosas, 4 February 2003, Ventanas, Caldono.

11. Adiela Rosas, 4 February 2003, Ventanas, Caldono.

12. Fabriciano Chocué, 27 June 2003, Ventanas, Caldono.

13. Benecio Velasco, 7 January 2003, El Porvenir, Caldono.

14. José Ignacio Roa, IPRA Project, CIAT, 9 May 2003.

15. Marta Guetio (ASORECRO member) 20 January 2003, Crucero del Rosario, Caldono.

16. Luis Carlos Castillo, member of the Cauca and Nariño Departments DRI Program Evaluation Team, Universidad del Valle, 21 May 2003.

17. 'Juntas de Acción Comunal' (JAC).

18. 19 Adiela Rosas, 4 February 2003, Ventanas, Caldono.

19. The Colombian Federation of Coffee Producers was founded in 1927 to promote rural development in coffee producing areas by providing basic infrastructure and technical assistance for coffee production and the promoting productive projects that could represent diversification opportunities to reduce risk so that producers not depend exclusively on coffee production.

20. Elciario Velasco, 31 January 2003, Ventanas, Caldono.

21. Benecio Velasco, 31 January 2003, Ventanas, Caldono.

22. Benecio Velasco, 31 January 2003, Ventanas, Caldono.

23. Marco Tulio Zapata, SENA, 30 April 2003.

24. Adiela Rosas, 4 February 2003, Ventanas, Caldono.

25. Marco Tulio Zapata, 30 April 2003.

26. Luis Carlos Castillo, 21 May 2003.

27. Corpoica is a private non-profit corporation responsible for agricultural research and technology transfer. It resulted from the modernization and privatization of ICA in the early 1990s. Corpoica operates at central and regional levels and has ten strategic programs managed at the central level, where it also provides general guidelines for research policy. At the regional level, it has eight programs based on farming systems, and carries out applied research for ten agro-ecological regions.

28. Ruben Guetio, Technician of the Caldono UMATA, 30 April 2003.

29. Ruben Guetio, 30 April 2003.

30. NGOs are not-for-profit private organizations working for public interest by promoting social activism or providing technical and financial services, usually with outside personnel; local people form community-based organizations (Mauricio Pardo 'Movimientos Sociales y Actores no Gubernamentales', in *Antropología en la Modernidad*, ed. Maria Victoria Uribe and Eduardo Restrepo (Bogotá: Instituto Colombiano de Antropología, 1997).

31. Personal communication, Gentil Romero, CETEC Professional Staff, 1 May 2003.

32. Angelica Salazar, former CETEC Technician, 29 April 2003.

33. Angelica Salazar, 29 April 2003.

34. Maria Eugenia Morales, CETEC Professional Staff, 6 May 2003.

35. Libardo Ochoa, Special Projects Coordinator, Carvajal Foundation, 23 May 2003.

36. Operational differences were, first, that CIAT (which developed the methodology to conduct agricultural research) initially did not share Corpotunia's

interest to use it also for animal production or agro-industrial research. Second, CIALs received a non-refundable grant to conduct its research activities, but Corpotunia preferred to give these resources as a credit to be repaid by the group if the research was successful, as a shared-risk capital. Moreover, among CIALs, Corpotunia pushed the idea of financially managing this grant to ensure the economic sustainability of the groups. A conceptual and fundamental difference was that CIAT developed and consolidated the CIAL methodology with a research objective, aiming to generate knowledge, while Corpotunia saw an opportunity in the methodology to conduct research for income generation (Libardo Ochoa, personal communication, 2003).

37. Luis Alfonso Olivia, former Director of Corpotunia and presently Professional Staff at the Carvajal Foundation, 28 April 2003.

38. William Cifuentes, Director of Corpotunía, 13 June 2003

39. Carlos Arturo Quiros, CIAT Researcher, IPRA Project, 22 April 2003, Cali, Colombia.

40. That is, Joachim Voss, CIAT Director General, Douglas Pachico, CIAT Research Director, and Jacqueline Ashby, Director of CIAT's Innovation Institute, all came to CIAT as part of the Rockefeller Foundation Social Science Postdoctoral Program (personal communication, Jacqueline Ashby, Director, Rural Innovation Institute, CIAT, Cali, Colombia, April 2002).

41. Jacqueline Ashby, Cali, Colombia, April 2002.

42. Magnolia Hurtado, former CIPASLA Executive Director, 5 May 2003.

43. Angelica Salazar, 29 April 2003.

44. Douglas Pachico, Research Director, CIAT, Cali, Colombia, April 2002.

45. Eider Tovar, 30 January 2003, La Venta, Caldono.

46. Consuelo Perdomo, primary school teacher in the community of Crucero del Rosario and legal representative of ASORECRO, 23 May 2003.

47. PRONATTA together with Corpoica constituted the extension and research backbone of the Colombian National System of Technology Transfer in Agriculture (SINTAP), created in 1989 to provide a way to increase the production of non-traded staples, through the transfer of appropriate technologies, improving the social and economic performance of the rural sector. This program operated mainly through bidding mechanisms by which research and technology transfer organizations submitted proposals and competed for funding (Bojanic 2001).

48. INCORA is the Colombian Agrarian Reform Institute.

49. SENA is the National Service for Learning, the Colombian agency in charge of implementing the CAPACA Program (Osorio, 1984).

50. CIPASLA is the Inter-institutional Consortium for Sustainable Hillsides Agriculture, established in the Cabuyal watershed in 1992 by a group of intervening agencies working the watershed, together with community organizations.

51. ASOBESURCA is the Association of Users of the Cabuyal Watershed, established by CIPASLA.

52. CETEC is the Foundation of Interdisciplinary Studies and Technical Assistance, an NGO based in Cali, Colombia that started to work in the Cabuyal watershed in 1989.

5 Out-scaling International Public Goods: The Tascalapa Watershed in Honduras

'International public goods', public goods on which anyone in the world could conceivably draw, would include a strategy to promote rural innovation processes that could be out-scaled. This chapter focuses on how complex and knowledge-intensive international public goods, which require a permanent interaction with multiple stakeholders for their generation, are produced. It assesses the effectiveness of producing international public goods in a specific research pilot site (e.g. the Cabuyal watershed) and out-scaling then to other localities with similar agro-ecological and socio-economic characteristics.

From its origin in the late 1980s, the process promoted in the Cabuyal watershed of Colombia and discussed in the previous chapter was meant to be an experimental process, developing technological, social and institutional innovations that could be replicated in other regions of Latin America, and the developing world in general. This chapter explores and analyzes the process of out-scaling social and institutional innovations developed in the Cabuyal watershed of Colombia to the Tascalapa watershed of Honduras. In doing so, it also discusses modes of intervention in the Tascalapa watershed in a historical manner (as done in Chapter 4 for the Cabuyal watershed) and compares development practice in different Latin American countries.

5.1 Formation of the Territory and its Agrarian Structure

The history of the Tascalapa watershed begins with the Tolupán ethnic group living in the valleys; the upper watershed was unpopulated and under forest cover. About 88% of Honduras was originally forested, which is its best potential use; however, at the beginning of the twenty-first century only half of the land is under forest cover (Vallejas 2003).

With the arrival of the Spanish colonizers in 1560, the indigenous population that was settled in the Tascalapa watershed started to migrate to what became the upper watershed communities of Luquigüe, Santa Marta and Mina Honda, where their descendents now live. The 'royal road' that connected the centre of the country with the north coast passed near Luquigüe, the oldest community of the watershed. The *mestizo* population only started to migrate to the upper watershed communities in the early 1930s, with the expansion of the coffee crop. Most of the watershed territory belongs to the Luquigüe, Santa Marta and Mina Honda tribes (49%) and represents 4.6% of the area claimed by these tribes. Yorito, the main town, was founded in 1660 but the Yoro Department was created in 1825 and the municipality of Yorito in 1889 (PAAR 2003).

About 70% of the population of the watershed are *mestizos,* commonly called in Honduras *ladinos* (Ravnborg 1999), and the rest are indigenous people. The indigenous population in the Tascalapa watershed is less organized than in the Cabuyal watershed in Colombia. The Honduran government is just in the process of recognizing the indigenous population and giving them political power, while the Colombian Constitution formally recognized that country's indigenous population, their customary practices and law in 1991. The major activities of the indigenous population are the exploitation of forest resources, handicrafts and (to a lesser extent) agriculture.

Peasant movements initially emerged as a response to the threat of expulsion by the Tela Railroad Company, a subsidiary of the United Fruit Company, which had plantations in the Departments of Atlántida, Cortés and Yoro. The company had accelerated its expansion, increasing its banana plantations and diversifying to other crops, jeopardizing the way of life of smallholders settled on national and collective lands. These first peasant movements were promoted by the Union Federation of Honduras (FSH), established in 1929, but repressed by he Honduran state for almost two decades (during the 1930s and 1940s). The current peasant organizations in the north of Honduras are really a second wave, having their origins in the aftermath of the 1954 strike which mobilized 25,000 agricultural workers and resulted in the firing of around 18,000 workers who went back to peasant communities and started to occupy the land (Cerfontaine et al. 1998).

Two major factors (Cerfontaine et al. 1998) have influenced the emergence of peasant movements in the region. First, the location of the watershed and its marginal conditions made this region a major reception site of the banana companies' ex-workers, who already had a tradition of organizing. Second, the Catholic Church was highly influential and was socially active in this area: supporting peasant organizational processes (male organizations but also female) and becoming a major protagonist in organizing landless peasants with a humanistic and social change vision. The Jesuit priest Guadalupe Carney, considered a pioneer in the promotion of peasant organizations in Honduras, was highly influential in this process. Thus, in the mid-1950s peasants used their social resources to fight for access to land. They were assisted by the immigration of the banana companies' ex-workers and by the intervention of the Catholic Church. This shows that social actors can use one type of livelihood resource – in this case a social resource – to access other resources (such as land, an essential economic/financial resource).

The formation of the territory in both watersheds (Cabuyal and Tascalapa) followed a similar pattern. Both started with indigenous populations – the Paez and Tolupan indigenous groups, respectively – that migrated from the valleys to the hillsides and upper watershed because of Spanish colonization. A mestizo (or ladino) smallholder population emerged in the more fertile valleys and displaced the indigenous population to the hillsides, with their erosion-prone soils and a topography that made them more expensive to develop. The hillside topography makes building basic infrastructure such as access roads and basic services and irrigation systems, as well as machinery and other new technologies, more expensive. Thus, a commercial and entrepreneurial agriculture emerged in the valleys using mainly waged labour, and smallholder agriculture emerged on the hillsides, where family labour predominates.

5.2 The Land Reform Period (1960s to mid 1970s)

The above political and social scenario created the need to establish a Land Reform process that led to the creation of the National Agricultural Institute (INA) during the government of Ramón Villeda Morales (1958-1962). However, land reform actions only started in the mid 1960s and even then within serious limits. In its first phase, the INA aimed to gain control over national and collective lands taken illegally, and to give them to peasant farmers, placing emphasis on the productive function of the land. Two new decrees passed in the early 1970s deepening the reform, defining it as 'a group of measures to modernize agrarian structures as a national project'. During this period, land reform was high on the political agenda and in 1973 and 1974, the Honduran government adjudicated most of the land to landless peasants. However, the most effective mechanism to enforce land titling was its occupation by peasant groups, in most cases not peacefully:

> By the 1960s, the land reform started and during this period there was a lot of support for peasants and women, those were the priorities for state support. The National Association of Honduran Peasants (ANACH) trained us and helped us to regain land in the Boca de la Lima; thus, we shaped the reformed groups[1]

The northern part of Honduras, where the Tascalapa watershed is located, was one of the main areas in which peasant movements fought over land with the banana companies. This dispute started in the 1950s, but it was not until 1964 (when the Tela Railroad Company returned the land to INA as part of a project to abandon relatively marginal lands) that a decree to deepen the land reform process was passed and peasant farmers began to organize over access to land. This resulted in the establishing of 'reformed groups' who took over national land that was later titled to them. This initial land reform process was slowed by the Honduran state in 1975, in response to pressure from capitalist farmers who owned extensive plots of land.

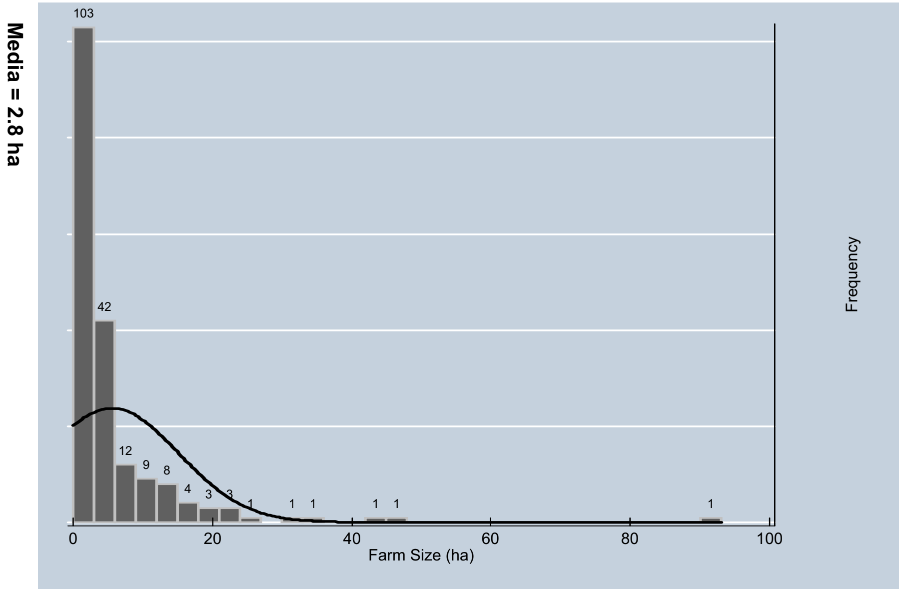
The work of the Catholic Church (see Cerfontaine et al. 1998) created an extensive network of peasant organizations that forced through some land reform. By the early 1980s, two types of peasant farmers occupied the Tascalapa watershed: the 'reformed groups' of peasants and cooperatives with collective access to land, and the 'independent producers', who had individual access to the land.

Ten percent of the producers, affiliated to five different national scale peasant groups, had collective access. However, the organizations were weak. For example, a land reform group called 'Fortaleza' had a very good piece of land (490 ha) shared among 49 producers, owned three tractors, grain storage facilities, and a truck, but failed.[2] The organizations had limited skills to administer their resources (50% were illiterate), lacked leadership, and were susceptible to corruption, as individual interests predominated over the collective (Cerfontaine et al. 1998). Moreover, support from the State to legalize their lands was slow, especially for those who could not pay bribes to government officials for speeding up the process. By 1983 land reform beneficiaries had an average of 2.5 ha that was mainly used to produce maize as a low yield monocrop (averaging 1,600 kg/ha in the valleys) lacking capital and technical assistance (Cerfontaine et al. 1998). Data from the survey conducted in 2004 supports this information as households who still consider their land communitarian averaged 2.6 ha.

Among the other 90% percent of producers with individual access to land, this access was highly inequitable. For example in 1983 5% of producers owned 53%, 33% occupied 38%, and the remaining 62% had access to only 9% of available land (Cerfontaine et al. 1998). This differential access was not only in terms of area but also in quality: medium to large scale producers were mainly in the more fertile valleys, while *mestizo* smallholders and the indigenous population occupied marginal hillsides. These independent producers were unorganized. They had (as was also the case among reformed groups) as their main product mono-cropped maize farmed through slash-and-burn agriculture. They had almost no access to basic infrastructure (physical resources), formal credit (financial resources) or technical assistance (human resources). Their natural resources were obviously deteriorating, through the deforestation of the hillsides that impoverished the soils (through erosion) and reduced the level of the water in rivers and streams. Maize monocropping crop with little or not fertilization also contributed to soil resources deterioration.

Given this pattern of land colonization, including a failed land reform, agrarian structure at the beginning of the twenty-first century in the Tascalapa watershed was even more inequitable than in the case of the Cabuyal watershed, and land tenure more insecure. In 2004, mean farm size in the Tascalapa watershed was 8.0 ha, but ranged from zero to 314 ha; half of households had less than 2.8 ha, showing an even more skewed land distribution than in the Cabuyal watershed (see Figure 5.1). In addition, while 77% of the households in the Cabuyal watershed had legal titles to their land in 2004, in the Tascalapa watershed only 40% did. Over half of the arable land in Honduras is owned either by the Honduran government or by the two largest banana companies: Chiquita and Dole / Standard Fruit Company (Humphrey 1997). The vast majority of agricultural producers in Honduras (72%) own just 11.6% of the cultivated area, while the 1.7% large landowners with more than 100 ha own 30% of it. This excludes the 35.8% of rural families that are landless (World Bank 2001).

Figure 5.1
Access to land in the Tascalapa watershed, 2004



Source: Adoption and Livelihoods Survey, January-February 2004.

5.3 The Integrated Rural Development Program (1984–1996)

From 1984-1996, the Swiss Agency for Development and Cooperation (SDC), financed and implemented the Integrated Rural Development Project of Yoro (DRI-Yoro), which was co-financed by the Honduran government. SDC conceived the program as a long-term development process (10-20 years) to alleviate poverty in six municipalities of the Yoro Department, including Yorito and Sulaco. This project intended to promote an integral process changing the economic, cultural, social and political structures of the area, and to equilibrate and harmonize economic and social development with the environment. The strategy of the program was to promote a sustainable development process working around three axes: sustainable agriculture, social development, and entrepreneurial organization and development. Thus, it aimed to intensify agriculture, involve the population in decision making, and promote sustainable development. Within sustainable agriculture, the program worked on basic grains, diversification, irrigation projects (mainly in the valleys) and sustainable hillside agriculture. Its social development axes initially included infrastructure projects and basic services, and later also included a component that aimed for the social development of peasant women. Support for women was not included under the promotion of productive and income generating activities, but as a paternalistic social support offering training for women to help them better perform their household duties.

The target population of the DRI-Yoro was producers with access to land or organized producers that were beneficiaries of the land reform program, excluding those in the process of invading and taking over land. It did not support cattle breeding, assuming that producers had insufficient land for this to do it profitably. The program was unaware that local producers who were able to capitalize did so by investing in cattle as a savings strategy (since cattle raising was less risky than basic grain production). They did not know (though farmers did) about the importance of milk production as a source of permanent cash flow to meet daily cash needs. The designers of the DRI-Yoro Program were thus unaware of smallholders' rationality: as farmers do well in agriculture and generate a cash surplus, they invest it in land and cattle, promoting further social differentiation in the region. According to data from the survey conducted in Yorito in 2004, households who own cattle had an average farm size of 18.3 ha, while those who did not own cattle had an average farm size of 5.4 ha, a significant difference ($p=0.004$). Moreover, those households that owned cattle had an average annual income of US$ 3,287 while those who did not averaged US$ 1,338, again a significant difference ($p=0.003$).

The DRI-Yoro Program largely replaced existing state development interventions. It was as a quasi-state agency located in the Yoro Department: the municipal government had no important role and the DRI-Yoro Program used to represent the Ministries of Education and Health and other governmental entities. When the program ended, it transferred its health, housing and education provision responsibilities to the state, but instead of start strengthening the state since its inception to take this responsibility in an effective manner, the DRI Program weakened the State.

This is another significant difference between the DRI Program in Colombia and the DRI-Yoro Program. Although international cooperation agencies co-financed both DRI Programs (the Canadian International Development Agency, CIDA, in Colombia and SDC in Honduras), the Colombian Government established the DRI Program under the National Planning Department, later transferring it to the Ministry of Agriculture and Rural Development. Most of the resources to implement the project came from the Colombian government, but most importantly, the state governed the program and had an important role in decision-making. In contrast, the state presence in the Tascalapa watershed was limited while international cooperation had an important role. The DRI-Yoro Program was an autonomous entity, financed by SDC, which governed the program via its advisors and employees, who had an important role in decision making, while the Honduran government only co-funded it, mainly by contributing personnel from its different organizations, none of whom shared the multi-sector vision of the program, instead following their own sector objectives.

It is also important to note that the DRI-Yoro Program actively promoted organizational processes to improve access to social resources. The promotion of these processes relied to a certain degree on 'social political stability, an organized civil society and institutional openness' (Probst 2002:108). Social political stability exists neither in Honduras nor in Colombia. However, civil society has a higher level of organization in Colombia than in Honduras and institutions are more willing to adjust and change. In Honduras, social inequality, repressive military regimes and anti-communist fervour discouraged, and indeed penalized, collective activities at the community level leading to a climate of fear and distrust (Humphries 1996; Probst 2002).

5.3.1 Opening phase of the DRI Program (1984-86)

During the first phase of the DRI Program, support was provided to land-reform beneficiary groups and to independent producer organizations (COPIs). The latter organizations were promoted to support small-scale (0.7-3.5 ha) producers that were not land-reform beneficiaries. The program mainly reached producers in the valley areas, and mostly men (although it provided a marginal support to women).

For many independent producers, the COPIs were their first organizational experience, and through them, they gained physical resources such as roads, schools, wells, water tanks, latrines and other amenities; and productive resources such as grain storage facilities, draught animals to prepare the land and equipment, among other things. Besides these social projects, the major motivation to participate in the groups was the possibility to access credit, which was not always a success:

> The possibility to access credit was seen by many producers as a very important motivation to participate in the COPIs. However, at the end, many people had problems with credit because they managed these resources badly and as the production increased, prices felt. Most farmers paid off their credit, but mainly with money obtained from coffee plantations, and not with the product of their maize and bean fields. Thus, producers faced many difficulties to pay off their credit because the crop was not profitable, and many had to sell their things to pay these debts. For others, the possibility to access credit helped them to increase their production and with the income obtained they were able to buy the inputs for the next crop, so did not need credit for the next crop. For me those credits were not the solution because they gave them without knowing the people, thus a lot of money was wasted.[3]

Other producers preferred not to participate in the COPIs because of the collective nature of the credit, as was the case of Miguel Vaquedano, today a prosperous farmer dedicated mainly to cattle raising,

> When the DRI-Yoro personnel told me that this credit were based on the groups, I asked myself what would happen if one of the members did not repay… probably the other members would have to pay. Thus, I asked them who was participating in the group and when they told me the names, I told them that most of the people that were participating only liked to drink and go around with women. I was sure that as soon as they get the money, they would spend it in other things and since they know the money is from the group, they will not pay. This is exactly what happened… many had to pay for the ones that didn't.[4]

During the first phase of the DRI Program, access to organizational processes that previously had been limited to producers belonging to reformed groups was extended to independent producers through the COPIs. Although reformed groups had used social resources to access land, during this period producers who participated in reformed groups and COPIs used social resources to access financial resources and other support services.

5.3.2 Expansion phase of the DRI Program (1987-91)

During the second phase of the DRI Program, its reach (in terms of the number of producer groups supported) expanded. In addition, second-level organizations were formed to provide financial services to producers: these Cooperatives were the CARYOSVIL for land-reform beneficiaries and COSAPSYL for independent, male producers.

Gender issues started to emerge in the development agenda and formal support for women's groups started with the promotion of a women's organization: AMCY. However, support for women was marginal and biased towards 'female things', perpetuating traditional gender roles. The interveners defined priorities for support, but women were not involved in the process; they were highly paternalistic and did not believe that women could lead their own development processes. For example, the program supported the establishment of vegetable gardens, which was not a support prioritized by the women, and therefore was not appreciated:

> There were many projects directed to us, but all were donations and women did not appreciate them. They did not make any effort to improve. The biggest one was a project on vegetable crops designed in a top-down manner. People used to say 'I do not plant vegetables because it is too complex and we do not have technical assistance'. Then instead of getting proper technical assistance by hiring a serious and good service provider, the assistance provided had no impact. Productive projects failed for different reasons. That is what the DRI- Yoro left us with, a terrible paternalism. If DRI-Yoro did not send us a technician, nothing was done and we lost all the investment.'[5]

Thus, the women grew accustomed to numerous handouts and free training, but did not develop the capacity to be agents in their own development processes, e.g. by establishing and managing their own businesses to having their own source of income.

In addition, the program started to target hillside farmers through the promotion of a hillside farmer's organizations, ACELYS, to work on the production of traditional products (maize and beans) and coffee, soil conservation and watershed management. ACELYS were meant to be informal organizational processes to support the provision of technical assistance and training but not to promote a *bottom-up political path* to development.[6] This was a time of intensive intervention in the watershed, and producers' access to physical, financial/economic, social and human resources were highly fostered. However, human agency was an important factor that influenced how people managed these resources:

> Many people participated in the DRI Program and many retired from it because they received credit and did not pay it off. However, there are always people that participate and know how to take advantage of these things. In my case, I improved my house and I received credit and technical assistance to establish a coffee plantation, which was crucial to improving our livelihoods since every year we get cash income from coffee. With the DRI Program we also started to manage the watershed, leaving some protected areas to ensure water availability.[7]

Thus, the DRI Program fostered social differentiation not by providing differential access to resources (since it aimed to be highly inclusive) but mainly through differences in human agency. Producers with greater agency capacity used the improved access to livelihood resources provided by the DRI Program as a springboard to improve their livelihoods.

> I started to establish my coffee plantation with my own resources, but when I got credit, I was able to expand it. I paid off the credit and continued expanding the plantation, not with credit but with the cash income, I received from coffee. I could buy more land and plant more coffee. The credit I received was only a first boost, and when coffee prices were good I harvested a lot and was able to improve my house. Coffee was my star crop and gave me all I have.[8]

Other producers developed their economic careers and improved their livelihoods without any direct support from the DRI Program; however, indirectly they benefited from employment generation, and later on, they adopted innovations proposed by the Program.

> We came to Yorito in 1983 looking for work and started harvesting coffee as day-wage workers. In 1984, a merchant from Yoro lent me 500 lempiras in clothes to sell and this is how my wife and I started… harvesting coffee and selling clothes. We use to sell the clothes and return the money to the merchant in Yoro, and he gave us another credit. After doing that for three years, we found a good piece of land to plant maize and beans when it was not the coffee-harvesting season. After that I bought 3½ manzanas [2.45 ha] of land in Higuero Quemado and El Plantel to plant coffee and that is how I started planting coffee. We took advantage of good coffee

prices and were able to buy two cows and from there we moved ahead. Now we have 70 cattle (cows and calves) and 14 cows are actually producing milk.[9]

Thus although the DRI Program improved access to livelihood resources among those who participated directly, it also did so indirectly for producers who did not participate, via employment generation. Moreover, other informal agents such as merchants and intermediaries also benefited indirectly from increased cash flows in the communities.

5.3.3 Transfer phase and post DRI-Yoro period (1992 to present)

In 1997, when the DRI Program officially terminated, the importance of the different organizations and their relations gradually changed. In addition, it 'left a legacy of handouts, which created dependent populations in many communities, as well as credit insolvency for many households' (Beaudette 1999:103).

In its last phase, the DRI Program prioritized the consolidation of peasant organizations, and the transfer of service provision to public and private institutions. Thus, there was an effort to create private service providers to continue delivering the services offered previously by the DRI Program through its technical assistants. The SDC supported former DRI Program employees establishing such private organizations, and provided them with operational funds for their first two years. Thus, a group of former DRI-Yoro technicians created Sertedeso S. de R.L. to support hillside farmers using sustainable agriculture through its organization, ACELYS, created during the DRI-Yoro Expansion Period. Other groups of former DRI-Yoro technicians established ASEMCA to support the women organization, AMCY, and CODESA to support male-producer organizations, CARIOSVYL and COSAPSYL. This was in line with the monetarist thesis that gained political support during the late 1980s, aiming for structural adjustment, reducing external intervention and privatizing most support services formerly provided by the State. This importance given in Honduras to establishing private service providers to take over some services delivered by the project was an important difference between modes of intervention in the Cabuyal watershed and the Tascalapa one. In Colombia, extension services were descentralized but not privatized.

The private enterprises formed in Honduras after 1993 (based on the enactment of the Law for the Modernization of the Agricultural Sector) to provide these services initially focused on technology transfer. DICTA was responsible for generating technology, concentrating on products for domestic consumption mainly produced by smallholders. In addition, the Honduras Foundation for Agricultural Research (FHIA) has been generating technology for agro industrial and export products with a larger scale of production (personal communication, Orly García, SAG, 2003).[10] Other research organizations also supported the generation of agricultural knowledge and technology in Honduras (forming part of National System for Agricultural Research and Technology Transfer, SNITTA) including higher-level education institutions such El Zamorano, the University Centre of the Atlantic Coast (Curla), the National Agricultural School (ENA) and the National School of Forestry Sciences (ESNACIFOR).

5.3.4 Private service providers: strategies and outcomes

One of the major differences between modes of intervention in the Tascalapa watershed and those in the Cabuyal watershed was the type of service providers that took responsibility for supporting smallholders once the DRI Programs ended (in the case in Honduras) or were significantly cut (as was the case in Colombia). In Colombia, the state passed responsibility to the municipal government as part of the decentralization process, and therefore the UMATA was handed out this mandate, although its limited human and financial resources affected the coverage and quality of those services. Thus, NGOs such as CETEC and Corpotunia took over a big share of the government's responsibility, providing technical services [actually called business development services] and financial services, mobilizing public resources (national and international) to do so.

In Honduras, the state passed this responsibility to private service providers with the idea that the private sector could provide more effective, efficient and client-oriented services. In addition, beneficiaries [clients] were to pay an increased share of the costs, as their subsistence economic activities [called in the new jargon agro enterprises or micro enterprises] develop into profitable livelihood strategies. As their clients became successful entrepreneurs, private service providers also had to take a big share of the responsibility for providing necessary services, and to do so have to mobilize public resources. The real differences between these modes of intervention were in terms of who provides the services, their effectiveness, and who paid for them. Private service providers struggled to survive once the DRI-Yoro Program officially ended in 1996, because of its implications *vis-à-vis* the availability and quality of local services.

ASEMCA

ASEMCA, the private service provider targeted to support the women association, AMCY, failed and disappeared for a number of reasons. First, the support women received was marginal and had no income generating objectives, being meant only to help them in their traditional household care role. Thus, women had no means to pay for the services that were formerly provided by the DRI- Yoro Program. Second, those services were supply-led and women were not willing to pay for them because they had no real demand. Women wanted to solve basic problems such as housing and essential services to reduce health problems among household members, and they did not feel that the training and organizational support provided by ASEMCA would meet those needs in the short-run. Third, the technicians that formed AMCY were unable to change their mentality from being DRI-Yoro employees to being private service providers with an enterprise focus. Thus, ASEMCA survived only while SDC continued financing its activities by paying for the services provided to women, since it did not develop the capacity to mobilize resources from other international cooperation agencies or the state, nor did it develop a client-oriented approach.

> Once the DRI-Yoro Program concluded, it did not leave us with proper support and that received from ASEMCA was not of good quality. ASEMCA was only interested in the money that COSUDE [SDC] allocated them. They designed projects and implemented them, but never took under consideration our interests or needs. ASEMCA left us when the money was over, and was never able to mobilize other resources, as Sertedeso did.[11]

Mistrust in the capabilities of the women's organization was high. Inter-institutional coordination spaces did not involve AMCY and women preferred to join the Committee for the Sustainable Development of the Tascalapa Watershed (CLODEST) or a CIAL for serious support. However, despite the AMCY situation, its members have started to believe in themselves, increasing their self-esteem. The women's organization gained credibility from the Swedish cooperation that decided to finance them directly. This financing agency had started to believe in the capacity of the organization's members, and started to support their work without the mediation of male organizations, service providers, or NGOs. However, leaving everything in the hands of AMCY was not a good bet: this extreme position makes a more efficient use of available resources, but may be less effective in achieving longer-term development objectives. To bring new information and knowledge, it is important to have access to external collaboration to the extent that it complements, but it does not replace, local knowledge and capabilities. AMCY has yet to mobilize resources other than those provided by the Swedish cooperation,

> We have not been trained to develop project proposals; we just had an option to get funding from the United Nations Development Program (UNDP), and we had to assess the needs and develop the proposal. However, I do not feel capable of doing this. If I call them to follow-up, they will ask for the proposal and we are not able to prepare it, unless we hire Sertedeso or somebody else to help us. I have not received any training on proposal writing, and nobody else in the organization has this capacity. Argentina Salguero, our president, had access to good training and she is very smart to mobilize the interest of cooperation agencies to support us, but we fail when we have to develop the proposals, we need support on this.[12]

Moreover, when AMCY manager Nubia Rodriguez acknowledges the limitations of the organization, she highlights the limitations of the project scheme used by donors to fund projects because of the lead-time needed for project negotiation, proposal preparation, before they can get the resources and implement a project. It can take up to four years to get a project financed. Thus, by the time resources are available, needs have changed.

CODESA S. de R. L.

CODESA was the first private service provision enterprise established in Yoro (and in Honduras) with a mandate to support valley producers in irrigation and diversification, an area not strengthened by the DRI-Yoro Program and requiring further support. The possibility of being financed by PROMOSTA established in October 1996 with a loan from the Inter American Development Bank (IDB) for 15 million US$ and another

US$2 million in co-financing from the government of Honduras, motivated its formation.

The objective of PROMOSTA was to 'develop the competitive potential of the agricultural production of Honduras, increasing productivity and improving the quality of agricultural products'. To achieve this, PROMOSTA proposed to develop the market for agriculture technological services by responding to producer demand and fostering the supply of these services by private providers. The project has two components. The first is consolidating the SNITTA; and the second is establishing a competitive fund for financing agriculture technology generation and transfer, as well as for the training of researchers and extension workers (La Gaceta, República de Honduras, 1997). PROMOSTA support was concentrated in the Honduran valleys and highlands with a larger concentration of 'potentially big' producers with the capacity to use technology, credit, inputs, markets and information, as explained by its Director.

> PROMOSTA focuses on commercial agriculture... not on the 330,000 rustic rural properties dedicated to subsistence agriculture, most of them located on the hillsides. For that type of agriculture there is the PAAR [Project for the Administration of Rural Areas], which focuses on basic grains and soil conservation and was designed by the World Bank; and PRONADERS [National Program for Sustainable Rural Development] which manages social investment resources.[13]

To access these resources it is necessary that the technology generation and transfer service provider present a proposal, together with those producers who need the service. The fund allocates a maximum of US$ 100,000 to those projects approved, but expects that producers co-finance 10% of the cost in the first year, 15% in the second year, increasing it progressively. However, most producers are unwilling to pay for services since other intervening projects did not charge for similar services. In addition, the number of private service providers is small, limiting the competition among them (personal communication, Perla Carias, FIDE)[14].

However, CODESA had to readjust its strategy because PROMOSTA did not even reach the valley producers of the region, since those who administered the fund considered them too small and non-commercial. CODESA had serious problems trying to start its operation as a private service enterprise,

> When the DRI-Yoro was operating, resources were used more effectively. Now there are well-conceived projects in Honduras but they do not reach the communities – they are implemented in luxury hotels, whereas the DRI-Yoro was operative at the community level. If there was a need for education, medicines, roads, credit, housing or whatever, it was provided, returning taxes to the people. It was also more efficient; the personnel and operating costs were less than the resources invested directly in the people. We started as a private service provider as a phase-out strategy of the DRI-Yoro, and we thought we could succeed with PROMOSTA, but it never started operating in this region. It was a well-designed project: they talked about research, agro exports. We thought about linking there, but it was not possible.[15]

PROMOSTA did not fund a single project in the Tascalapa watershed after those who implemented the program gave priority to capitalist medium and large-scale farmers to secure its impact, and DICTA only started to have a few activities in the watershed after 2000, as part of a project to develop improved pastures in the watershed. However, the technician in charge of this project received limited support from his organization, and really supported the project because of its own personal motivation. In contrast, in the Cabayul watershed PRONATTA (the equivalent to PROMOSTA in Colombia and also financed with a credit of IDB and co-financed by the government) made a special commitment for directly funding smallholders, and therefore, supported a portfolio of innovation projects.

CODESA was at first unable to fulfil the objective for which it was created and the members of the two cooperatives (COSAPSYL and CARYOSVIL) that were their clients were either unable or unwilling to pay for the services it offered, and CODESA was unable or unwilling to provide those services free. Thus COSAPSYL and CARYOSVIL continue providing credit with the financial resources left by the DRI-Yoro Program, but stopped receiving technical assistance and continued working on their own (not without problems, as will be discussed later). CODESA continued providing technical assistance; however, with limited financial resources that they had to mobilize from other programs or projects. CODESA did not offer the credit services that would have made it possible for smallholders with limited access to financial resources to innovate.

COSAPSYL abandoned the DRI-Yoro objective of working only with smallholders, and shifted to better-off producers:

> The COPIs are now made up of producers who have their land and cattle. When the DRI-Yoro ended, the cooperatives realized that if they continued working with very poor smallholders, they would be broke because they would be unable to pay off the loans. We are aware now that we have to work with those that have the capacity to repay the loans, so our support for smallholders is minimal. If we evaluate a producer and he has the capacity to pay off the loans, has enough property and fulfils our expectations, we approve the credit fast. Therefore, we provide loans to coffee producers and those who have the means to pay. If we give loans to smallholders for basic grain production and they have a bad harvest, they do not even have the means to cover the costs.[16]

The situation of CARYOSVIL, which groups land reform beneficiaries who have fewer resources than the members of COSAPCYL, was critical in the early 2000s. The cooperative was highly indebted. There was many reasons for this. First, although the DRI-Yoro Program supported the cooperative for three years (1990-1992) until its consolidation in 1993, only the leaders accessed the training programs, and they did not allow other members to develop their leadership abilities to take over management responsibilities by rotating the leadership. The leaders received special privileges because of their position and were unable to give these to other members. Moreover, they embezzled financial resources. Second, the DRI-Yoro approach with this group of producers was highly paternalistic, facilitating everything that was needed but not developing the capacities of its members. Third, all the productive projects promoted by the cooperative failed. They had a hot pepper project, which included a processing plant to obtain the paste and direct commercialization links (a formal contract) with an export company in San Pedro Sula that exported to the United States. However, prices felt, pests and diseases damaged the crops, and the venture became unprofitable. Their project with okra production also failed because producers were unable to meet the high quality requirements. Their experiences with vegetable crops also failed because crop management is more complex than for the basic grains in which producers had more experience. The crops were lost through inappropriate management (farmers were left without proper technical assistance), and through climate problems (personal communication, Rogelio Rodriguez, Manager of CARYOSVIL, 2003).[17]

Given its critical situation, CODESA had to change its strategy to provide services to hillside producers by mobilizing resources from international cooperation agencies. In addition, it had to diversify its services to reduce the risk involved in providing a single service, planning to open an agricultural inputs and machinery supply business, and diversifying its services to provide technical assistance, road improvement and solid waste management. As a private enterprise, its survival was its initial challenge and, as this is being achieved, its next challenge is to become profitable. As a local service provider that sub-contracts with governmental and non-governmental development agencies, it must sell results, such as a number of ha diversified, number of people trained, or families contacted, but the compromise with the long-term development process is unclear:

> As PROMOSTA did not support projects in this region, we [CODESA] started to work on diversification but in the hillsides, with international cooperation resources, we were able to mobilize. We do not have resources to invest, but if we can, we invest a little bit directly on productive activities to be able to achieve the project goals and provide our clients with the expected results. For example, with pineapple we give free seed to producers so they can start, and those producers who receive the seed must multiply it and give it to other three producers. This is like a political strategy to gain an election; each producer has to convince other three producers. If this strategy works, it can reach more people and get many supporters, whether used in elections, religious conversion, or, in our case, to spread our impact and show results to those agencies that pay for our services.[18]

The long-run consequence of the decisions taken by the farmer cooperatives and CODESA is a group of farmers that had the means to access financial resources, but failed in their productive projects because they lacked appropriate technical services. On the other hand, another group of farmers that received appropriate and intensive technical assistance but lack the means to innovate for lack of access to financial resources.

Sertedeso S. de R. L.

Sertedeso supported proactively hillside agriculture, continuing the work that DRI-Yoro started during its expansion phase. Hillside farmers were unable to pay for these services, but Sertedeso was initially established and supported by SDC, which contracted it for the first two years to continue working in hillside agriculture. Sertedeso distinguished itself as an organization that worked hand-in-hand with its target population using an integrated 'family' approach, incorporating gender issues and encouraging leader families to work together on sustainable agricultural activities, and to become models for other families in their communities to improve their agricultural and watershed management practises. It became an important organization for the community, and was active in mobilizing resources from different sources.

An important source of funding for Sertedeso was the Project for the Administration of Rural Areas (PAAR), dependent on the Agriculture and Livestock Secretariat (SAG) and financed by the World Bank to work on watershed management with hillside smallholders. With resources from this project, Sertedeso provided support on maize, beans and coffee production; soil conservation; and watershed management, based on a diagnosis of the needs of its clients who initially paid a small percentage of the cost of those services. The Central American Program for Sustainable Hillsides Agriculture (PASOLAC) –another project financed by SDC- also contracted Sertedeso to validate and transfer appropriate technologies for hillside agriculture. The objective was to train farmers based on their interests and that in exchange, farmers would pay a percentage of the cost of the service, in line with the approach taken by the PAAR project. Sertedeso personnel felt that people had more commitment to the work if they were paying for the services, and that at the same time farmers were in the position to demand a good quality service. However, as other development projects and organizations financed by different cooperating agencies started to work in the watershed without charging for their services, people did not want to pay anymore.

Hurricane Mitch, which hit the Central America Caribbean Coast in 1998, brought intense rains that flooded extensive areas, provoked avalanches and landslides, and brought short and medium-term international assistance to the watershed. Many of these organizations came to work in the watershed without a clear articulation with the longer-term intervention process and had a transient and charity character. This further limited the possibilities to change people's expectations that external intervening agencies would bring 'things' for free to the communities, instead of building people's capabilities to promote more sustainable development. However, the private character of Sertedeso allowed it to take advantage of the high inflow of external aid to strengthen the organization. Thus, it mobilized more resources to the watershed from regional projects financed by the Inter American Development Bank (IDB), the World Bank, SDC and other European NGOs. Moreover, AMCY, the women's association, contracted Sertedeso to provide technical assistance and credit services after ASEMCA failed.

With the resources that Sertedeso effectively mobilized into the region, it could continue providing support to ACELYS. However, once its support from the DRI-Yoro Program was over, and after two years of providing technical assistance with resources from the PAAR Project as well as other assistance funds brought after Hurricane Mitch, ACELYS could not hold the interest of families, since it did not provide enough incentives for people to invest their time. As people learned improved crop management practices in hillsides, achieving a better and more sustainable production of their traditional crops (maize and beans), they started to get more interested in income generation activities, including the establishment of agro enterprises to add value to primary agricultural production. This led to the evolution of ACELYS into community-based rural banks that became a more concrete and immediate solution to access the necessary financial resources to innovate and generate income. Not everybody used the credit to invest in productive activities; in many cases, they use credit to solve immediate cash needs or emergencies. The amounts lend by the rural banks depend on the savings of the people, and therefore, are still too small to finance household investment in cattle or other enterprises requiring higher investment.

According to producers in different communities where community-based rural banks were established, they have many advantages. First, people acquire a savings culture and have a higher motivation to save because the transaction costs of a savings account are significantly lower. Second, when people need a credit they do not have to lose time looking everywhere for it, or travelling and incurring high transaction costs with no guarantee they will get the credit; instead they can find it in their own community when they need it, without complicated paperwork, and with a quick approval process. This more than compensates for the higher interest rates. Third, the rural banks have a reserve fund to help their members in an emergency. Fourth, members do not need guarantees because their own savings serve as a guarantee, and there is social control because people within a community know each other and the rural bank gives credit to those who have a good credit history – and the norms and rules are straightforward and clear. Fifth, they award higher interest for savings than the Cooperatives, COSAPCYL or CARYOSVIL, or formal Banks (2% per month, instead of 7.44% per year). Sixth, when a producer gets a loan from the bank, the interest capitalizes the financial institution, however, the interests paid to the rural bank capitalize its member's accounts and the financial resources stay in the community, giving ownership to the people who have a strong desire to repay their loans.

The advantages that the rural bank offers have started to motivate different community and producer organizations to place their resources in it, instead of depositing them in the Cooperatives. Access to timely credit has also helped producers improve their bargaining power in the commercialization of their crops and products, since they no longer feel an urgency for cash to solve immediate needs (Pablo Olvera[19], Carlos Medina[20], Francisco Ramirez[21], Pablo Colindres[22], Alejandro Estrada[23], personal communication, 2003). The only limitation of the rural banks[24] is the amount they can lend to farmers, which is determined by their savings and the capacity of the fund, limiting their possibilities to adopt innovations with higher investment requirements.

An important difference between the 'community-based seed capital' promoted by CETEC in the Cabuyal watershed and the 'community-based rural banks' promoted by Sertedeso, is that the latter promotes a savings culture among its members, making it not only a more sustainable process, but also improving the repayment rate. Another important characteristic of the community-based rural bank promoted by Sertedeso is that the amount lent to members grows progressively as their saving capacity grows. This is an important difference. The model promoted by CETEC depends more on external support, and therefore, the availability of funds to provide credits to farmers depends initially on CETEC's ability to mobilize funds from donors. In contrast, the model promoted by Sertedeso, although initially dependent on the funds that Sertedeso lends to rural banks for their initial start-up, become more independent as the funds grows (not only as loans are repaid with interest, but more importantly as the savings capacity of members increases.) This promotes the capitalization of smallholders.

5.3.5 CIAT out-scaling strategies to the Tascalapa Watershed

Experience in the Cabuyal watershed, CIAT's laboratory, showed that CIALs and the CIPASLA model for inter-institutional collaboration, social and institutional innovations (developed by CIAT and its local partners in Colombia) had the potential to foster effective innovation processes to reduce hunger and poverty and preserve natural resources in developing countries, in line with CIAT's mandate. To fulfil this mandate, these institutional innovations have to be widely adopted. They have to be robust enough to be replicable in different contexts, without losing the essential characteristics that make them effective. However, researchers questioned whether these innovations would work in other countries and the extent to which organizations other than CIAT could support these innovation processes (Ashby et al. 2000). Thus with resources from different international cooperation agencies (IDRC, SDC and the Kellogg Foundation were among the most important) CIAT took the challenge of disseminating these innovations to other sites in Honduras and Nicaragua. One of these sites was the Tascalapa watershed of Honduras.

Replicating farmer research committees (CIALs)

Activities to replicate the CIAL methodology for generating agricultural knowledge and technology started in Honduras in 1993, as a CIAT-IPRA project called Participatory Research for Central America (IPCA), launched under the direction of former CIAT staff, Sally Humphries (Ashby et al. 2000). Since 1995, the University of Guelph, with funding from IDRC, has coordinated this project. It has made rapid progress, and by 2000, it had established 57 CIALs in Honduras, of which 27 work in the Tascalapa watershed (Classen 2003). This has been an important achievement in out-scaling a social innovation developed in the Cabuyal watershed of Colombia to the Tascalapa watershed, and even broadly to Honduras and to an important number of Latin American countries. However, before out-scaling this methodology, CIAT took the time to document and analyze its experience, extract the lessons learned, and prepare appropriate and friendly training materials and documentation to assist those interested in replicating the methodology.

It is important to highlight that IPCA has not applied the methodology in the Tascalapa watershed as a recipe, but adjusted it as required to meet its new circumstances. IPCA adopted the principles and made the methodology appropriate for the specific site, which is why IPCA claims that it has broadened the CIAL approach to include 'assisted learning for sustainable land use and social development' (Humphries et al. 2000:7).

A key characteristic of CIAL members is that they are 'joiners' (Humphries et al. 2000). 'Joiners' also participates in other local organizations. People who participates in CIALs say that they have worked with over 35 local organizations and intervening agencies (Probst 2002). They thus had access to social resources, fundamental to the rapid outscaling of CIALs to the Tascalapa watershed, as were the skilled and compromised facilitators that promoted their establishment; CIALs had important roles in their communities:

> I can see a positive impact of the actions of the IPCA project in the people. They are reaching those in more need and one reason for this is the quality of the technicians that work in the project: they stay in the communities and work with the people. CIALs are now getting involved on more things that just improving bean and maize varieties. They are actively working to improve the living conditions of households in the communities. Most of them are participating in community organizations and boards, and are influencing local decision-making.[25]

An important constraint on the ability of CIALs in the Tascalapa watershed to improve the economic situation of households was the more limiting access to livelihood resources of its population, compared to the Cabuyal watershed of Colombia. The immediate needs of people in the Tascalapa watershed limit their interest in and ability to conduct research. People instead want to see tangible results in terms of improved income.

> The main achievement for us has been the knowledge we have now. We have had a lot of training and have meetings among CIALs where we share information and knowledge. Some people make fun of us because we plant small plots and they say this is for lazy people, but I think that we have acquired a lot of knowledge. The work we are doing has given us many opportunities to share knowledge. Last week we were in Nicaragua to see what other CIALs are doing; they were also in Honduras visiting us. We feel very proud of meeting other people and being in other countries.[26]

Landless, this member works on her father in-law's farm. Thus, although she has acquired knowledge and has developed capabilities, she has no place to apply them, and has no decision-making power on farming activities that her husband and father-in-law take. She assures them that with the new bean varieties developed by the CIAL, yields can increase significantly, but this has not yet been reflected in a higher income for her family. A similarly landless family head who has participated in a

CIAL and in a facilitators' training program financed by the IICA-Laderas project has also found that a lack of financial/economic resources limits her ability to use the knowledge she has acquired to improve the livelihood of her family:

> I have worked with many institutions, they have taught us how to plant maize and beans, and we have learned to use them to improve the nutrition of our family. We learned about crop management practices, as well as how to use plants to control pest and diseases. This has not improved the situation of my family. What can I do? If you bring me a new seed but we have a disease and we do not have the money to buy inputs to control it, or to buy fertilizers, I will loose my crop anyway. They have taught us how to cultivate many things, but now what we need is to cultivate money.[27]

This lack of resources caused IPCA to support the transition of CIALs from farmer research committees to micro enterprises. Thus, in 1998, IPCA made an agreement among the five organizations working with the CIAL methodology in Honduras to establish a national CIAL organization. In 1999, a regional chapter was set up in the Tascalapa watershed, where a large proportion of the CIALs linked to IPCA are located. This second-level organization of CIALs, called ASOCIAL (Association of CIALs), is equivalent to CORFOCIAL in Colombia, and is gradually taking over IPCA's responsibility to support the CIALs to develop them into micro enterprises that will also continue their research activities:

> The research work of CIALs has been very good, if people do not know how to solve a production problem, or want to start with a new crop, it is important to conduct research; however, it cannot be done without money. Research is important but we cannot make a living on this exclusively. If a CIAL is conducting research on soybeans, it should be thinking on establishing a micro enterprise to produce soybean-based products to make a profit. We can generate knowledge and good results, but if it is not profitable, it does not help to improve people economically.[28]

ASOCIAL set up a fund to stimulate commercial ventures based on research results (Ashby, et al. 2000). Although this has some similarities with the community-based rural banks that Sertedeso promotes, it has important differences. For example, the CIALs are required to save in the ASOCIAL fund if they want to access financial resources to establish and develop their micro enterprises, and ASOCIAL provides financial resources to the CIAL as joint-risk venture capital.

> We lend financial resources to CIALs that save in the ASOCIAL fund. If they make a profit, they have to repay the money plus 50% of the profit; however, if they lose money, we share 50% of the losses. We charge half of the profit because it is possible to make a profit, but also to lose money. If the CIAL makes a profit, we all win, and if it loses money, we all lose. If, in contrast, we lent them money and charged an interest rate, the CIALs would be working only to pay the interest on the loan, as usually happens when farmers borrow money from financial institutions.[29]

Replicating the CIPASLA Institutional Model

As discussed in Chapter 4, by the late 1990s in the Cabuyal Watershed of Colombia, CIAT was consolidating an inter-institutional model for promoting the integrated management of natural resources, connecting institutions from the public sector, NGOs, and farmers' associations. In addition, as discussed in the previous chapter, ASOBERSURCA was constituted as speaker for the community to promote wide community participation in CIPASLA. Given that the process in Colombia was going through its golden years (1993-1998) and the DRI-Yoro Program was in its concluding and transference phase (1992-1996), SDC was interested in attracting more institutional presence and investment in its area of influence. It invited and co-financed CIAT to continue supporting the process in the Tascalapa watershed.

SDC's interest was consistent with CIAT's intent to out-scale the Colombian experience to Central America. With this in mind, CIAT invited the IICA-Holanda hillside project – financed by The Netherlands government and implemented by the Inter-American Institute for Agriculture Cooperation (IICA) – to join the initiative in the Tascalapa watershed. Together with IICA, CIAT then promoted the creation of an inter-institutional coordination body, the Local Operative Committee (CLO). In 1998, after the DRI-Yoro Program ended, the CLO became the Local Committee for the Sustainable Development of the Tascalapa Watershed (CLODEST). The promoters of CLODEST envisioned as its mission the coordination of the different organizations that worked in its area of influence to promote actions in support of sustainable hillsides agriculture and watershed management.

This organizational process promoted by CIAT appropriated most of the principles and methodologies proposed during the 1990s to improve the effectiveness of the generation of knowledge and technology for sustainable development as discussed in Chapter 1. While the organizational process in Colombia went from 1993 to 1998 before showing effective actions, it has been claimed that in Honduras the process that began in 1998 showed positive results after only three years, using the facilitation tools and methods developed in Colombia (Beltrán et al. 2004). However, what these results were is unclear, and although the initiative may have achieved some results after three years, the argument that it is possible to speed up the process needs further analysis (see the last section of this chapter).

Once SDC and the Honduran government officially concluded the DRI-Yoro Program, external intervention in the watershed was fragmented among a broad variety of research and development agencies. In addition (an important difference from the Cabuyal watershed) 'private service providers' and no local NGOs were present, only a few new projects like IPCA and Program for Rural Areas Development (PDA Yoro), financed by World Vision. These agencies and private service providers were competing for resources, affecting the outcomes of coordination objectives, or brought their own resources and thus felt no need to coordinate or articulate their work. In this void, CIAT, SDC, IDRC, and IICA saw CLODEST as a local, community-based way to coordinate the activities of the different organizations with the common objective of promoting a sustainable development process, filling the hole left by the former DRI Program.

To foster active participation and increase the bargaining power of local organizations in CLODEST, CIAT also fostered the formation of the Local Organizations Network of Yorito and Sulaco (REDOLYS) as the equivalent of ASOBESURCA in the Cabuyal watershed. This network, aimed to link ten community-level committees made up of representatives of different community organizations (e.g. local level committees[30], water-user committees, CIALs, parent committees, the tribal council, sports committees, cooperatives, coffee producer associations and cooperatives, and women's groups among others). However, REDOLYS had to deal with the local legacy around credit:

> It was necessary to strengthen community organizations to foster community participation in CLODEST, and with this purpose, REDOLYS

> was established and we allocated financial resources to the network for financing productive projects in their communities. However, producers did not feel any ownership for these resources; they have always had the concept that institutional credit is a gift; this is part of their culture, it is important to change this mentality. Thus, farmers did not pay back the credit. REDOLYS at this moment is non-operational.[31]

While ASOBESURCA was strengthened with the crisis of CIPASLA and this was crucial to keep the process alive, REDOLYS was not the result of a strong organizational process but a paper organization with any sense of belonging among the beneficiary population. This difference in the strength of the local beneficiaries' organizational processes in the two watersheds was critical, and two factors may explain it. The first is the higher level of human resources in Cabuyal, measured by the level of formal education (mean years of formal education of the adult population in Cabuyal, is 3.9 years compared to 2.7 years in the Tascalapa) and the availability of informal training. The second is that in the Cabuyal watershed during the DRI Program period, people's abilities to participate in organizational processes were developed and strengthened, building on a history of locally-induced organizational processes of the indigenous and *mestizo* population (to access land and defend their own culture and customary law).

In the Tascalapa watershed, the DRI-Yoro Program, together with the NGOs and development projects that came to the region afterwards, had a highly paternalistic approach that failed to develop local capacity for active and effective participation in organizational processes. Moreover, since people became accustomed to receiving things for free without a real sense of belonging to the process, most of the credit that CLODEST gave to develop productive projects and to keep beneficiaries interested in the process [or were given as a payment for their 'participation'] was not repaid.

As with CIPASLA, CLODEST began as a parallel entity to the municipality of Yorito, which had minimal access to financial and human resources. The DRI-Yoro not only replaced the State, but also did not contribute to develop the state's ability to take responsibility for promoting the development of the region and the providing basic infrastructure and services. Thus, when CLODEST started in 1998, the administrative decentralization process had not started in Honduras, and, according to Manuel Cantillano, the Yorito municipality mayor (2002-2005),[32] the municipality had no relevant role aside from being the place where people went to do needed paperwork or pay taxes. Thus, CLODEST took over not only the responsibility of promoting sustainable agricultural development, but also parts of the education and health sectors, taking a more integral local development approach. This was important because it created an important link to the municipal government, although the education sector assumed the leadership in the process and teachers not only took Board positions but also benefited most from the capacity building initiatives promoted by CLODEST.

Like CIPASLA, CLODEST initially used natural resource management objectives as its entry point, but it failed to generate enough interest to justify the interaction costs of participating in the Consortium. In addition, other organizations in the watershed did not participate in the process. This situation led to the lost of interest among the different organizations that initially were enthusiastic about the process: as the CLODEST coordinator remembers:

> Initially I CIAT hired me to provide advice to the different committees of CLODEST as well as to the Board, but soon my responsibilities changed from providing advice to inter-institutional coordination. The work started to generate interest and other sectors joined the process. Intervening agencies used to come to CLODEST to consult with local organizations to make sure that their work had real demand and was not repetitive (that they were not doing activities that others were already doing). Most intervening agencies were interested in ensuring their work would not overload people, or knowing whether they would be uninterested in it, leading to the failure of their projects. However, the coordination became very difficult because each organization had its own interests and intentions, in line with their mandates, the projects they were implementing, and their donor agencies. People and organizations started losing interest. Everyone wanted to gain something from participation, especially producers looking for resources, and therefore the solitary idea of coordination and consulting was just not enough to keep their interest.[33]

The CLODEST Board and committee members felt that the process involved too many meetings and insufficient action. CLODEST members did not consider concerted action alone as sufficiently worthwhile to justify such a Consortium and the time it took from other activities, particularly income-producing ones (Humphries et al. 2000). As was the case in the Cabuyal watershed but much more quickly, the common interest that brought the different organizations together moved rapidly toward income generating activities, i.e. promoting productive projects, developing micro enterprises, and establishing community-based credit schemes, using the rural banks methodology introduced by Sertedeso. Despite this change, private service providers whose survival depends on the mobilization of resources and implementation of projects, continued feeling that the interaction costs involved in CLODEST were higher that the benefits obtained:

> Sertedeso is a private enterprise whose income depends on the projects it implements, thus for us participating in CLODEST meetings that do not lead to concrete activities and projects reduces our motivation and limits our interest. For example, we were very motivated to work on agro enterprises, but the process was too slow and involved too much planning. As Sertedeso we are more operative, we do not like planning for months if it does not lead us to concrete activities. In addition, agro enterprises have to deal with highly dynamic markets that do not let you have passive attitudes.[34]

As members of CLODEST had no real demand for the coordination services it provided, and the projects financed to CIAT by SDC and IDRC ended, CLODEST, like CIPASLA, ended up unable to cover their operational costs. They found it necessary to complement their coordination role with the implementation of projects and the establishment of credit services, which had a higher demand:

> We transformed CLODEST into an operative entity. I am the only person that gets a salary and the resources for it come from the projects we are implementing, complemented with interest we obtain from credit that we are channelling. The rest of the people do voluntary work. CLODEST has evolved into a small NGO; we just got a legal status and we want to implement projects directly, and not through CLODEST partners.[35]

Thus, the objective of CLODEST shifted to implementing projects as funds became available, a move from its initial coordination objectives and funding principles. The original idea that CIPASLA and CLODEST would be coordinating entities that could also serve as vehicles to mobilize resources for their member organizations was not operational, since their members did not buy the idea of investing in this coordination and resource mobilization service. Thus, to survive, CLODEST, like CIPASLA, became a competing NGO with the advantage of being a local and more permanent organization, not only run by lower-cost local personnel (with salaries in line with local standards), but run by personnel with whom local people identified better.

This situation also has its downside. As in the case of Colombia, public organizations by law cannot be members of an NGO, thus they are excluded from CLODEST through its new legal status. In the case of CIPASLA, non-governmental organizations became members of the NGO, CIPASLA as a coordination entity continues, and governmental organizations can participate. In CLODEST, individuals that initially represented their organizations in the committee took individual membership because of the benefits they received by being members of CLODEST. Many feel that the consortium represents private interests and no longer public ones.

> Incentives to participate in CLODEST are unclear, as it became a professional and friends club, with members taking advantage of all the training activities, excluding people and benefiting a few. It developed human and social capabilities and I see this as a positive outcome, together with the inter-institutional coordination it brought, leading to concerted action. However, I found that they were doing the paperwork to get a legal status, and they clearly defined who would be the members of CLODEST as individuals but not in representation of their organizations. This is not correct. I am now a member of CLODEST as the mayor of Yorito, but once my mandate is over, I have nothing to do with the consortium; the new elected mayor will have this responsibility. There were a few members of CLODEST that were there representing their organizations, but even after resigning from their positions they continued participating on an individual basis to continue benefiting from it.[36]

The decentralization process that started in Honduras in the early 2000s requires that all the municipalities set up a Municipal Development Council (CODEM) with coordinating, resource mobilization and project implementation functions. This represents both opportunities and challenges for CLODEST:

> The law now requires that each municipality has a Local Development Council (CODEM), and this is how the municipality looks at CLODEST. The current mayor was part of CLODEST when we started, and he knows well the objectives that lead to its establishment. The idea now is that we take this role.[37]

However, the mayor has his own concerns about giving this role to CLODEST:

> My concern is that CLODEST, in becoming an NGO with individual and not institutional membership, will loss its public character and will stop being a democratic organization that is open to everybody. This is a major weakness of having CLODEST to take over the role of CODEM. If CLODEST stops getting external resources to cover its operational costs, I do not know who is going to pay them. I do not think that its members will do so since they did not even repay the credit they received on a personal basis.[38]

Most of the organizations working in the watershed recognize the importance of the coordination mandate of CLODEST, as well as the technical limitations and continuous changes in the municipal government that would make it difficult for the State to assume these responsibilities:

> There is still a need of integration among the intervening organizations and local actors that permits us to discuss our policies, because everybody continues intervening in an isolated manner. The most we achieved is the coordination we have around CLODEST but that is not enough, because CLODEST and the municipality are not coordinating well either, and it is not clear for us where the coordination, discussion and negotiation takes place. In addition, we tend to forget that there are other actors working in the territory who work in an isolated manner. It is becoming increasingly important to define clear norms and rules, to discuss what we are going to do and how are we going to do it so we can organize our interventions and be more effective. The municipal government has many reasons not to assume this needed coordination. I do not refer only to the financial limitations of the local government, but also to its technical limitations. In addition, the local government changes every four years, thus leaving responsibility to them is like giving a process a four-year life. We do not have any idea how the next government will behave.[39]

If CLODEST is able to fulfil the demand of the municipality, coordinating local development activities, becoming its technical branch, and representing organizations but not individuals, it will be possible to institutionalize the process and it will become more sustainable since the state will not end in the way a program or project financed by an international cooperation agency does. With the current mayor actively participating in the process, the potential for this link to the government is high. However, CLODEST committees and its Board are unsure whether to get involved in politics to ensure that the new elected mayor is a person who has already been involved in CLODEST and therefore has knowledge of the process and a commitment to it. Technical personnel and local people that work in the process do not want to get involved in politics, which has a developed a bad reputation over the last two decades of democracy in Latin America. However, to achieve a real process of change they know it is important not only to make decisions, but also to have the power to implement them to achieve sustainable and structural changes.

The private service providers promoted by the DRI-Yoro Program are not only measures of its success, but important in keeping its institutional memory, and fostering informal learning. However, their success in this has been limited since new support organizations (that came after the DRI-Yoro Program ended) have not always taken into consideration their opinions and experiences.

> The experience to work with other organizations in CLODEST is that requires an investment of time from which it is possible to take an advantage. If you become isolated, you can lose many opportunities. However, it requires will and effort to be there and see beyond your nose. The thing we disagree with is when new organizations come to the region to take advantage of what we have done, or try to impose their ideas, but we like the people that come and articulate their work with ours to achieve common objectives.[40]

5.4 Modes of Intervention in Colombia and Honduras: A Reflection and Comparison

The encroachment of a socially differentiated smallholder class between the indigenous populations in the upper watershed (who migrated to avoid extermination by the Spanish colonizers) and the commercial and entrepreneurial farmers in the better-endowed valleys, characterizes the current agrarian structure in both watersheds considered in this study. This structure is, in both sites, the outcome of a social interactive process among different interest groups with power asymmetries. This begs the question of why smallholder agriculture has survived despite its lower competitiveness compared with the more commercial and entrepreneurial agriculture in the valleys. There is no single answer, but in addition to the fact that indigenous groups have no other place to go, some explanations emerge. The first, shown by the historical reconstruction of the social dynamics and modes of intervention in both sites, is the implicit interest of those with more power on maintaining a smallholder class that provides cheap labour and raw materials for the development of commercial agriculture and the industrial sector. This interest in maintaining inequality was more affected by the intervention process in the Cabuyal watershed and the agency of its smallholders; the Tascalapa watershed has altered less.

By considering the history of the process that led to the current agrarian structure, its livelihood strategies and outcomes, it is also clear that diversifying livelihood strategies within and outside agriculture has been an important strategy for the survival of smallholders. They make up their livelihoods by combining a portfolio of strategies that includes producing food security crops, as well as commercial crops to generate cash income, and when they generate an economic surplus, they invest in cattle as a savings and capitalization strategy. Households combine these agricultural strategies with off-farm employment in agriculture. As it becomes feasible, they also develop non-agricultural activities, and when things become difficult, they resort to temporary or permanent migration within the region, within the country or to other countries. As access to resources in the Tascalapa watershed is more limited, and livelihood strategies less diversified, there is more pressure for migration and a larger proportion of the income comes from remittances (18.3% compared to 2.5% in the Cabuyal watershed).

After social conflict and a failed land reform resulted in an inequitable agrarian structure that led to further social unrest, the next attempt to alleviate poverty and hunger were the DRI Programs, which were ready to provide a new technological (but to some extent paternalistic) solution. These programs, as part of a strategy to reduce social unrest in Latin America generally shifted emphasis away from the need to modify agrarian structures, towards the provision of basic infrastructure and technical assistance to improve smallholders' productivity and organizational skills. However, while the DRI Programs implemented in Latin America since the 1970s were consistent with the technological determinism thesis of the food and hunger crisis, those implemented since the early 1980s were couched within the poverty thesis. The DRI Program in Colombia, considered a pilot country for Latin America, corresponds to the former approach, while the DRI-Yoro Program in Honduras – the last program of this sort in Latin America – followed the latter approach, incorporating some of the lessons learned from previous DRI Programs in Latin America. Thus, the first DRI Program in Colombia focused on increasing food production by developing and promoting superior technologies and providing financial resources without solving the land access problem.

The DRI-Yoro Program developed its own vision based on previous experiences. It aimed, at least on paper, to build a society that would provide equitable opportunities for participation and access to political power, means of production and services. The objectives and strategy of the DRI-Yoro Program were greatly influenced, especially during its last phase, by new emerging development paradigms, including the concept of sustainable development and its valorisation of local knowledge, as well as the inclusion of participatory and bottom-up development approaches. Thus, the DRI-Yoro Program spent considerable resources to improve access to human, social, financial, technological and physical resources, but invested less in entrepreneurial organization and development. These strategies proved to be more inclusive and holistic, but failed to solve either the land access problem or the issue of access to markets and information, which arose as major constraints for the generation of sustainable livelihoods.

The DRI Programs in both watersheds included a strong discourse on community and producers' participation. A significant difference between them was that the DRI Program in Colombia included a specific and well-designed training program to develop people's capacity to participate actively and effectively in their own development process. This was the CAPACA Program, which did not restrict the training provided to technical issues, but was also meant to develop management capabilities and applied knowledge in a thorough manner in collaboration with technicians, so that knowledge management for innovation would be a permanent and autonomous process after the end of the intervention.

Another important difference between the DRI Program in Colombia and the DRI-Yoro Program in Honduras was the degree of state accommodation to and involvement in the intervention process. Although international cooperation agencies co-financed both programs, in Colombia most of the resources for implementation came from the Colombian government, which therefore governed the program and had an important role in decision-making. State involvement with and accommodation to the DRI-Yoro in Honduras was minimal, as SDC took a predominant role, becoming a quasi-statal. Thus, SDC governed the program via its advisors and employees, who had an important role in decision-making, and the Honduran government, had a limited role in decision-making.

The difference in state presence between the watersheds continued during the post-DRI Program period. Because of the decentralization process in Colombia, which came with the new Constitution of 1991, state presence increased (through the local government and the Municipal Agricultural Technical Assistance Unit (UMATA))[41]. The national government transferred financial resources and decision-making powers to the local government. Moreover, through different financing mechanisms, such as PRONATTA[42] (created to promote innovation among smallholders) it financed a portfolio of projects in the watershed. However, state presence in the Tascalapa watershed continues to be limited: government financing mechanisms such as PROMOSTA, the competitive innovation fund managed by DICTA, the Honduran National Agricultural Research and Extension Organization, did not fund a single project in the watershed, and international cooperation maintains an important role. According to the mayor of Yorito[43], it was not until 2003 that the central government start transferring financial resources to the municipalities, and even then, they did not transfer 5% of the national budget (as required by law) but only 2%. There are also power asymmetries between the different municipalities:

> It is not the same when the mayor of Yorito arrives as when the mayor of Tegucigalpa or San Pedro arrives: they get many media, while we are not even noticed, because we are small and poorer local governments. This resembles what is going on with the globalization process, the poorer have to mobilize resources from external sources. In Honduras, we have many projects established in Tegucigalpa with funds from the World Bank and IDB that the municipalities can access. However, we have been trying to mobilize these resources for the last year and a half and we got nothing because of bureaucracy and political manoeuvrings.[44]

The monetarist thesis of stagnation that influenced policies in the 1990s, led to weaker states in Latin America, and new intervening actors became the interlocutors of marginal sectors of the population, taking over former state responsibilities to provide services to smallholders. In Colombia, NGOs started to promote local development processes beginning in the mid-1980s and gradually started to replace the state. However, they kept their public nature and local governments established the

UMATAs with the aim of continuing to provide technical assistance in a more sustainable manner than did the NGOs. In Honduras, the change was more drastic, and private service providers, such as Sertedeso and Codesa[45] replaced former state organisations that were responsible for providing services to hillside smallholder communities. The idea behind this was that private service provision would become client oriented, and therefore, more efficient and effective. At the same time, clients would have to pay a share of the cost of the services, which will increase gradually as their agro enterprises develop and generate better profits. Through this, they would gain ownership of their own development process, avoiding past paternalistic approaches.

In terms of the quality of the services provided, things have changed little since the technicians of DICTA (the Honduran National Agricultural Research and Extension Organization), the Secretary of Agriculture and the various DRI programs established these private service enterprises. The human resources of private providers are the same, but with fewer resources, and dedicating an important proportion of their time to mobilizing and competing for resources to continue providing their services, since their clients lack the capacity to pay for them. The Agribusiness Specialist of the Honduras Foundation for Investment and Exports Development (FIDE), and former staff of PROMOSTA, highlights the mismatch between policy objectives and the human and financial resources available to achieve these results.[46]

Thus, eventually most of the technicians that were working in state organizations or programs [or programs financed by international cooperation agencies] during the 1980s continue providing services to smallholders, either by working for an NGO, by establishing their own NGO, or by starting a Service Provision Enterprise. Human resources did not change significantly. Resources to pay for these services continue coming from public sources (from the national or local governments or international cooperation agencies), since clients have been unable, or unwilling, to pay for them. In addition, while the idea of private service providers was attractive to donors, the clients [or beneficiaries] feel that private service providers are more interested in making a profit than in helping them.

The CIPASLA and CLODEST[47] institutional model has been a relatively effective mechanism to foster inter-institutional coordination and concerted action to promote more sustainable development processes.

Both consortiums were financed by international cooperation agencies as pilot activities to develop and validate the model. The question is who would finance a broad out-scaling of this institutional model. Ideally, this responsibility rests with the local governments, responsible for supporting local development processes. This would give them the time they require for evolving, maturing and responding more effectively to the specific needs of a given locality. The tendency has been for the local governments through their municipalities to establish these councils. This is a good start. However, setting up and nurturing this process requires qualified personnel and financial resources to pay for these qualified human resources as well as for operational costs. If the state leaves its coordination responsibilities to private individuals or organizations, even if they are non-profit organizations, the institutional model loses its public character. In addition, based on the experiences analyzed in this study, participating organizations are unwilling to support such a committee even though they agree that the functions it provides are important. If those functions are important, and the institutional model needs to maintain its public character, public investment is crucial.

The paternalistic approach of the DRI-Yoro has left a legacy among the target population: a dependency mentality that is difficult to change by means of new intervention approaches. The DRI Program not only failed in developing capacity among its beneficiaries to participate actively and effectively in the agency of their own development, but also has negatively affected this capacity. As such, people have the believe that only organizations that give them agricultural inputs, grain storage facilities and other donations and amenities have a real and long-term commitment with hillside farmers[48], and feel that CLODEST requires a high investment of time in meetings, but does not help them get resources or a good project.

Moreover, the recurrences of natural disasters and the donations that come with this, as well as paternalistic modes of intervention of some NGOs, have not contributed to the establishment of more sustainable and effective modes of intervention in the watershed. For example, CARYOSVIL[49] received direct support from the Sweden Cooperative fund but even with this direct cash inflow, it ran out of resources in 2003:

> Our leaders have no capacity and our members are not fully conscientious when they select them. This has led to bad management of the coopera-

> tive. There is a big difference between a 'training program' and a 'formation process'. The DRI-Yoro has not formed the people, but has created a great dependency… dependency for economic resources. They used to consult us over what we wanted, and then immediately brought the money we asked for. People are used to defaulting on their credit, or just exchange them for their participation in natural resource management projects. When the DRI-Yoro ended, we were alone. People did not know how to manage their projects and started to sell their land, sell the production infrastructure they got from the DRI-Yoro, or just rent their land to somebody else. They gave us money, but never oriented us to develop a strategy for the sustainability of our cooperative.[50]

This is one of the most significant differences between the Cabuyal and Tascalapa watersheds. While people in Colombia were trained to participate actively and effectively, to promote an organized civil society, and to manage their projects (the CAPACA Program being instrumental in this), the DRI-Yoro Program in Honduras has created dependency among its target population.

5.5 Out-scaling Institutional Innovations: Challenges and Limitations

Two out-scaling cases were analyzed in this chapter: the CIAL social innovation for the participatory generation of knowledge and technology, and the CIPASLA institutional model to promote coordination and concerted action for local sustainable development. An important difference between these two international public goods is that the first was based on a clear and well-developed conceptual framework, was evaluated, documented and translated into a proper methodology that had some basic principles, and delivered in a friendly format. The second was not based on a well-developed conceptual framework, and was out-scaled based on a methodological manual developed without through evaluation, systematization and documentation of the processes. In addition, the level of complexity of the CIPASLA institutional model is greater than that of the CIAL social innovation.

Moreover, the challenge of out-scaling the CIPASLA institutional model turned out to be more complicated that initially expected, since institutional innovations, which are knowledge and capacity intensive, are more difficult to diffuse than technological innovations. Out-scaling the CIPASLA institutional innovation not only faced more competition from developing agencies seeking the same resources (whether with different or similar strategies and principles) but also lower levels of human resources for implementation. In addition, the natural resource management entry point has not proved to be effective and both CIPASLA and CLODEST are now using income generation and agro enterprises development as their entry point.

Both the CIPASLA and CLODEST processes continue. However, financial limitations have shifted their priorities from inter-institutional coordination to promote concerted action for sustainable agricultural development, to the mobilization of resources to support existing consortiums or new NGOs that are implementing projects directly. This new focus is not a response to the initial objectives of the new institutional model designed and tested, but to the lack of financial resources. The important issue is to what extent these processes maintain their public character, serving the broader community, and not only self-serving interests.

With respect to the possibility of speeding up this type of processes, results show that to a certain degree proper approaches and methodologies can lead to processes that are more effective in achieving desired outcomes. However, processes, especially those that involve human beings and social relations, take their time. Therefore, the pressure to speed up processes may have negative effects. For example, in the case of CLODEST the pressure to show rapid results led facilitating organizations to essentially purchase local organizations' participation by attracting them with soft credit that in most cases was not repaid, perpetuating the dependency mentality of the local population. Developing capabilities to promote a more sustainable development process would have been much slower.

What is clear is that agricultural knowledge and technology need to articulate to complex development processes if they are to contribute to the generation of sustainable rural livelihoods. Thus, the whole concept of international public goods needs revisiting. International and regional public goods help democratize access to knowledge and technology, and make this access more efficient in an increasingly connected and globalize world. However, it is important to move forward in the definition of what an international or regional public good is. The history provided here shows that international public goods are not a magic formula, in the same way that improved seeds were not a magic formula for the green revolution. International public goods should be the result of properly conducted technological, socioeconomic and institutional research, among multiple stakeholders. These results could be contained in a seed, a management practice, a social innovation, a new institutional model or a policy mechanism, among other things, but would have been generated by democratic innovation systems with transparent information and knowledge management. These principles necessarily have to be contextualized, adapted and adjusted to effectively articulate to complex development process in order to contribute to the generation of sustainable rural livelihoods and poverty reduction.

Notes

1. Isabel Lanza, El Destino, 26 October 2002, Yorito, Honduras.

2. Rogelio Rodriguez, manager and member of CARYOSVIL, 1 July 2003, Yorito, Yorito.

3. Juan Pedro Herrera, 27 October 2002, Santa Cruz, Yorito.

4. Miguel Vaquedano, 23 October 2002, Jalapa, Yorito.

5. Argentina Salguero, President of AMCY, 3 July 2003, Yorito, Yorito.

6. Saúl San Martin, manager of Sertedeso S. de R.L., 2 July 2003, Yorito, Yorito.

7. Pablo Olvera, 27 October 2002, Santa Cruz, Yorito.

8. Pedro Pérez, 29 October 2002, El Plantel, Yorito.

9. Oscar Nuñez, 26 October 2002, Yorito, Yorito.

10. Orly Garcia, Agriculture and Livestock Secretary (SAG), 3 December 2003, Tegucigalpa.

11. Argentina Salguero, President of AMCY, 3 July 2003, Yorito, Yorito.

12. Nubia Rodriguez, Manager of AMCY, 3 July 2003, Yorito, Yorito.

13. Roberto Arellano, PROMOSTA Director, 5 December 2003, Tegucigalpa.

14. Perla Carias, agribusiness specialist, National Competitiveness Program, Foundation for Investment and Export Promotion (FIDE), and former PROMOSTA professional staff, 4 December 2003, Tegucigalpa.

15. Odilber Bustillo, manager of CODESA and former DRI-Yoro technician, 2 July 2003, Yorito, Yorito.

16. Nery Sosa, leader of COSAPSYL, 3 July 2003, Yorito, Yorito.

17. Rogelio Rodriguez, 1 July 2003, Yorito, Yorito.

18. ilber Bustillo, manager of CODESA and former DRI-Yoro technician, 2 July 2003, Yorito, Yorito.

19. Pablo Olvera, 27 October 2002, Santa Cruz, Yorito.

20. Carlos Medina, 31 October 2002, Las Cañas, Sulaco

21. Francisco Ramirez, 1 November 2002, Calichito, Victoria.

22. Pablo Colindres, 2 November 2002, La Albardilla, Sulaco.

23. Alejandro Estrada, 3 November 2002, San Antonio, Sulaco

24. Isabel Lanza, 26 October 2002, El Destino, Yorito.

25. Manuel Cantillano, mayor of the municipality of Yorito, 30 June 2003.

26. Maria Hernandez, 3 November 2002, Mina Honda, Yorito.

27. Narcisa Cruz, 2 November 2002, La Albardilla, Sulaco.

28. Juan Pedro Herrera, President of ASOCIAL, 4 July 2003, Yorito, Yorito.

29. Juan Pedro Herrera, President of ASOCIAL, 4 July 2003, Yorito, Yorito.

30. Local Level Committees in the Tascalapa watershed are the equivalent to the JACs in Colombia, called in Honduras '*patronatos*'.

31. Jairo Urmeneta, teacher at the Instituto San Pedro, 30 June 2003.

32. Manuel Cantillano, mayor of the municipality of Yorito, 30 June 2003.

33. Benjamin Ferrera, , 30 June 2003, Yorito, Yorito.

34. Saúl San Martin, 2 July 2003, Yorito, Yorito.

35. Benjamin Ferrera, 30 June 2003, Yorito, Yorito.

36. Manuel Cantillano, mayor of the municipality of Yorito, 30 June 2003.

37. Benjamin Ferrera, CLODEST Coordinator, 30 June 2003, Yorito, Yorito.

38. Manuel Cantillano, mayor of the municipality of Yorito, 30 June 2003.

39. Saúl San Martin, manager of Sertedeso S. de R.L., 2 July 2003, Yorito, Yorito.

40. Saúl San Martin, manager of Sertedeso S. de R.L., July 2000, Yorito, Yorito.

41. The UMATAs were established in Colombia in 1992 as part of the decentralization process to take the responsibility of providing technical assistance and transfer technology under the coordination of the Municipalities.

42. PRONATTA was the Colombian National Program for Technology Transfer, financed with a loan from the World Bank.

43. Manuel Cantillano, mayor of the municipality of Yorito, 30 June 2003.\

44. Manuel Cantillano, mayor of the municipality of Yorito, 30 June 2003.

45. Sertedeso and Codesa are private service providers established in the Tascalapa with support from SDC during the Conclusion and Transference Phase

of the DRI-Yoro Program, as part of its strategy to transfer the responsibility of delivering technical assistance services (offered previously by the DRI-Yoro Program with hired technicians) to private organizations.

46. Perla Carias, Agribusiness Specialist, National Competitiveness Project, FIDE, 4 December 2003, Tegucigalpa, Honduras.

47. CLODEST is the Local Committee for the Sustainable Development of the Tascalapa watershed established in 1998 to out-scale the CIPASLA institutional innovation in the Cabuyal watershed.

48. Nery Sosa, leader of COSAPSYL, 3 July 2003, Yorito. COSAPSYL is a co-operative that associates male landowner producer associations of the Yorito and Sulaco Municipalities, promoted by the DRI-Yoro Program during its Conclusion and Transference Phase.

49. CARYOSVIL is a cooperative that associates land reform beneficiary associations of the Yorito and Sulaco Municipalities, also promoted by the DRI-Yoro Program during its Conclusion and Transference Phase.

50. Rogelio Rodriguez, manager and member of CARYOSVIL, 1 July 2003, Yorito.

6 Innovation in Traditional Commodities: Beans in Colombia and Honduras

How did two innovation processes in bean production in Colombia and Honduras promote improved food security? More generally, how do external interventions for the generation of knowledge and technology lead to innovation in traditional commodities, or assist smallholders? Which actors are more likely to participate in these innovation processes? To what extent do these innovation processes contribute to the generation of sustainable rural livelihoods for differentiated social actors in marginal hillside agro ecosystems?

Innovation processes in bean production in the Cabuyal watershed of Colombia generated technological innovations; a social innovation for participatory farmer research called Committees for Local Agricultural Research (CIAL); and new market linkages at both the input and output levels. The input markets were based on the creation of an artisanal seed-production enterprise and the output market on new market channels.

Initially a group of farmers, supported by technicians from CIAT's Participatory Research Project (IPRA), started trials with bean varieties in 1987 and linked their production to markets. This three-year intervention laid the groundwork for the CIAL methodology. By early 1995, 55 CIALs were scattered in nine municipalities of the Cauca department, many of them in the municipality of Caldono. During the 1990s, a number of research projects in other Latin America countries replicated this methodology.

The second innovation process also focuses on beans, but in the Tascalapa watershed of Honduras. This intervention started with on-farm research promoted by the DRI-Yoro Program in the 1980s and early 1990s. In the early 1990s, this program adopted the CIAL methodology.

Beans (*Phaseolus vulgaris* L.) are the most important legume cultivated around the world representing 57% of the total world supply of legume crops. A large part of beans in Latin America is produced by smallholders on farms ranging from 1-10 ha, often on sloping land of limited fertility. Estimates suggest that hillside agro ecosystems hold 80% of the area planted with common beans in Latin America. These smallholdings are dispersed and main production areas are seldom determined (Aguirre and Miranda 1973). In the hillsides, 73% of total Latin America production occurs in areas with moderate to severe water deficits at some time during the cropping season. Except for a few highland areas with particularly abundant and well-distributed precipitation, bean production is rain fed and drought affects yields. The sub-humid Mesoamerican area and the Andean highlands are considered the regions of origin of common beans. This production zone has moderate to low temperatures with a moderate water stress to adequate moisture, and anthracnose and ascochyta are the most common diseases.

In the Andean region of Latin America, the growing period varies with altitude, but in general beans are seldom grown as the main crop but are part of complex production systems, in which 'days from planting to harvest' has a premium value for most farmers. In Colombia, 90% of the production is located on hillsides of difficult topography on farms from 0.5 to 5 ha. In Central America, farmers face numerous constraints to bean production. For example in Honduras, smallholders located on the hillsides produce beans in marginal soils, and their major limitations are the Bean Golden Yellow Mosaic Virus (BGYMV) and Common Bacterial Blight (CBB). Most new varieties released in this region of Honduras had some resistance to these constraints.

If they can, farmers plant bean varieties that have the highest market demand, best prices, a high and stable yield, and resistance to common pests and diseases. Beans have an enormous genetic diversity and this diversity combined with self-pollination restricts private sector investment in this crop. This is understandable since genes are locked into the seed and farmers only need to buy a few seeds once, and will only be interested in buying new seed when their seed fails. It is not possible to make a profit selling seeds for a self-pollinating crop with many different grain types, each one for a small number of clients, unless varieties break down quickly and there is a need for the continuous development of new varieties. To respond to this challenge, CIAT has been conducting public research on beans since the early 1970s. Its mandate is to produce efficient cultivars for farmers who plant beans, from the entrepreneurs in the most favourable areas, to the poorer smallholders in marginal areas.

6.1 Innovations on Beans in the Cabuyal Watershed of Colombia

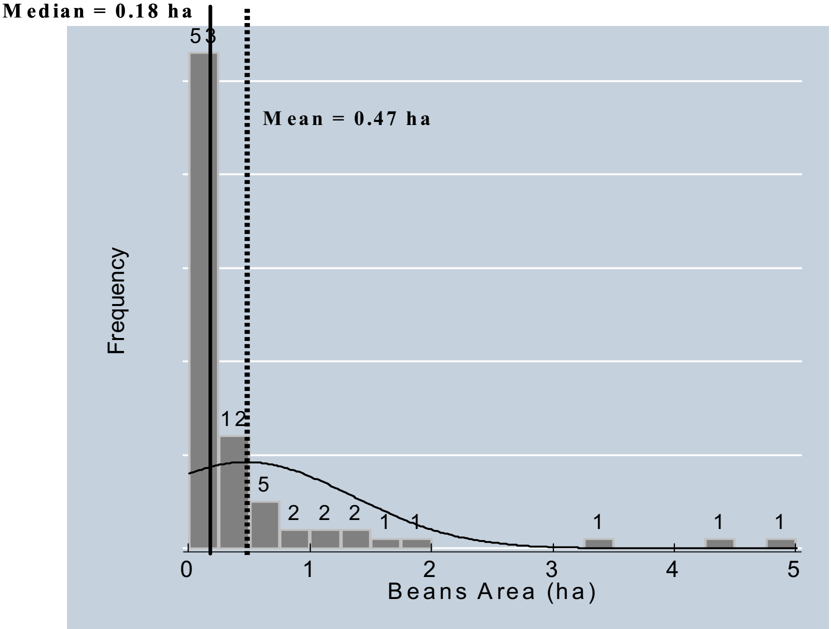
Beans are an important crop in Colombia, especially in temperate regions and on smallholder farms. They are a principal component of the diet of the population and represent 1.3% of the food price index (being the least expensive source of protein for the Colombian population). Local production has been declining in the last decade, with planted area decreasing 4.6% annually since 1993 due to lack of competitiveness with imports from more efficient, but also subsidized, farming systems in Canada and USA, or from countries with lower labour costs such as Ecuador and Peru. This decline has occurred even though yields have been increasing at 2.72% annually since 1993.[1]

Farmers normally plant beans intercropped with maize and/or cassava, while bean monocropping only accounts for 1.5% of the area under crops. However, with respect to the area under temporal crops[2] (annual and bi-annual crops), beans intercropped with maize and/or cassava occupies 43% of the area and bean monocropped 4.4%. In the Cabuyal watershed, 14% of the area under crops is intercropped with maize and/or cassava.

In 2003, beans were the fifth source of cash income from agriculture for households in the Cabuyal watershed after coffee, cassava, blackberries, and tomatoes, providing an average annual income per household of US$ 150, which represents 8% of gross cash income from agricultural production. Fifty-three percent of households in the watershed grow beans and produce an average of 10.3 quintals (4.7 ton) of beans per year. Farmers sell 88% of their production and keep the rest for home consumption, saving approximately 1.4% of their crop for seed. Thus, beans are important for food security, especially as a cheap source of protein, and households that produce beans have an average per capita consumption of 18.7 kg/year, compared with the national average of 3.5 kg/year. Thus, an average family in the Cabuyal watershed of 4-5 members (4.45) consumes an amount of beans per year valued (at the 2004 regional bean price of US$ 0.34/lb) at US$ 60 and earns an additional US$ 150 through bean sales (Adoption and Livelihoods Survey, October-December 2003).

Households producing beans have an average planted area of 0.47 ha, although 50% have less than 0.18 ha planted with beans, mainly for subsistence. Among households who plant beans, there is a skewed distribution towards smaller size plantations, although there are also a few households with large plantations (see Figure 6.1). Given an average per capita consumption of beans of 18.7 kg and an average yield of 1,440 kg/ha, a typical family in the region with 4-5 members, will require an area planted with beans of 0.06 ha to secure their consumption needs. Twenty percent of households who plant beans have less than this and therefore have to buy beans, as do the 47% of households who do not plant beans. More than half of the households (55%) that plant beans have an area planted that ranges from 0.06 and 0.50 ha and plant them mainly for own consumption, but sell their surplus production as it is available. Only one of every four households plants beans as a commercial cash-income generation activity (have half or more ha planted with beans), earning on average US$ 573 per year from bean sales.

Figure 6.1
Area planted with beans per individual farm in the Cabuyal watershed, 2004



Source: Adoption and Livelihoods Survey, October-December 2003

In the Cabuyal watershed, although beans are a traditional commodity the importance of the crop increased as diversification into vegetable crops production, initiated by the Colombian Federation of Coffee Producers (FEDECAFE) to offset the negative effects of rapidly falling coffee prices, failed. Given the good prices for vegetable crops, FEDECAFE supported the creation of the Association of Vegetable Crops and Tomato Producers of Pescador (ASHORTOP). Vegetable crops came hand in hand with a rapid expansion in the use of agrochemicals such as fertilizers, pesticides and disease controllers, which brought their own problems:

> One of the crops that expanded rapidly during 1986-87 was tomatoes, which arrived together with the agrochemicals boom promoted by private companies. Those products were very toxic; they came with a first toxicity category and killed young men. There were people who died from cancer, and that was very hard. I think that was the worst problems we had in our community with crops.[3]

In the Cabuyal watershed at this time, NGOs were promoting the creation of community-based organizations as a mechanism for community participation in decision-making and for developing local agency within more endogenous development processes. As discussed in Chapter 4, CETEC played an important role in this, and offered credit to producers to invest in vegetable crops and tomatoes.

However, prices of vegetable crops felt rapidly as markets became oversupplied and producers were unable to repay loans. ASHORTOP failed because of the oversupply stimulated by external intervention and the lack of demand to absorb this excess supply, and farmers had to start looking for other more profitable alternatives:

> We used to plant tomatoes, green beans and sweet peppers, but because of the low prices, we could not repay the credit we obtained. We lost money. Thus, we decided to search for a more profitable option.[4]

Despite the failure of the diversification initiative, the social organizations promoted in the process, provided a platform for CIALs that conducted participatory research on beans. As discussed in Chapter 4, 'farmer participatory research' approaches to the generation of knowledge and technology had already emerged in CIAT in the early 1980s, and by the mid 1980s CIAT social researchers identified the need to mobilize local leadership to develop local capacity for experimentation.

By the end of the 1980s, CIAT's bean program decided to include farmers in their breeding research so they could select the varieties that farmers preferred. This was a new practice, and this new participatory breeding approach formed the basis of the IPRA project. The Kellogg Foundation became one of the major stakeholders of the project, supporting it for 20 years.

One of CIAT's research goals in low soil fertility, low-income areas was to find bean varieties adapted to low inputs:

> We started working on improving fertilizer efficiency in bean production because that was our research project and then we complemented our work with breeding research. We chose to work with beans because they are a short-cycle crop (three months) so it was easy to repeat trials with different varieties through the year, and farmers love new varieties. This facilitated our research. Based on our previous experiences in 1990s, we started to work with the CIAL methodology. We saw that communities had different committees, the sports committee, the church committee, and the committee-in-favour-of-who-knows-what, but they did not have an agricultural committee. Thus, we thought, why we could not promote agricultural research committees in the communities. We started with five committees.[5]

6.1.1 New varieties, crop management practices and new market linkages

Traditionally, farmers planted bushy red bean varieties such as *Frijol Cacha, Sangre Toro*, *Guarzo,* and some traditional *Calima* and *Radical type* varieties. Beans were produced on a low scale and once a year, mainly for own consumption (Ostertag 1994). In 2003, these varieties occupied only 24 % of the area planted with beans in the Cabuyal watershed:

> Previously, we used to plant native varieties, the production was very low, and this was not profitable for the producer. We used to produce a red bean variety and the yield was only one arroba [25 lb] per pound of beans planted (an approximate yield of 1,250 kg/ha) and people used to plant it only for own consumption. I used to plant *Radical Pescador*. However, that was problematic, because it is susceptible to pest and diseases and there was no knowledge to control them. Therefore, we could not plant larger areas.[6]

To start participatory research on beans in the Cabuyal watershed, CIAT identified farmers 'with experience in planting beans, but also young, motivated farmers' (Roa 1990). Thirty-five producers who were members of ASOHORTOP made up the first group, which started during the first semester of 1987 trialling 170 bean varieties provided by CIAT. The group received 200 hours of training in bean production from CIAT technicians and researchers, and training on entrepreneurship through the Carvajal Foundation to combine the production and business management components of bean production. After six trials, farmers selected the best ten bean varieties based on their productivity and quality characteristics, using their own criteria for selection. Farmers preferred two varieties (PVA-7 and PVA-46) because they had a good acceptance in the market. The first was a *Calima* variety, the preferred type of bean in the Cali market, the principal market for agricultural products in the region. Farmers named it ICA-Caucayá. The second variety, also a *Calima* variety, was a red bean that is in high demand in the coffee region of Colombia, commonly known as ICA-Cafetero or simply Cafetero. With the continuous support of the IPRA project, this group of producers acquired new knowledge about bean cropping and seed management, but by the end of 1989, the group had only seven members because participating producers saw no economic benefit for themselves in the training:

> People could not handle all the training we received; they started to leave the group, until we were left with only seven members, however, we still had a good group. Only a few people stayed because we had continuous meetings, once or twice a week. We also had a very good training course on seed production that lasted six months; we learned about pest and disease management as well as seed management.[7]

The research on traditional and new bean varieties followed methodological steps such as diagnosis, planning, implementation, evaluation of results, and feedback; was based on farmers' criteria; and gave birth to the CIAL social innovation described in chapters 4 and 5. This methodology aims to involve farmers actively in research activities so that they can apply in their own fields the results and knowledge generated (Ashby et al. 1998, Ashby et al. 2000). Thus, CIALs aimed, in using this methodology, to overcome the limitations of traditional 'transfer of technology' approaches for the generation of knowledge and technology, but also had to deal with farmer inertia:

> Maybe there is a lot of criticism of CIPASLA, and in general to external intervention, because people say that here we had a parade of organiza-

tions and money but we cannot see the results. The truth is, and I have always expressed this in the community meetings, that the knowledge we have obtained through workshops and training is for us to apply, at least partially, in our own farms. Unfortunately, people participate in these workshops and training with the hope that they will distribute resources. They always have this mentality, and they are happy when organizations say 'we are going to give you this much'. They can invite us to all the training sessions and we can take our notebooks and make notes, but if we do not apply anything, nothing to our farms, nothing will change. Farmers need the follow-up to apply what they learn through training. If you ask here, most farmers have participated in training workshops, have lost their time to go there, but we do not know if they go for the lunch or to take a ride or why they really go, because if you go to their farms, you will see that they keep on doing the same.[8]

The two varieties selected by farmers during the first CIAL (in the community of Pescador) were released (with ICA support) in 1991. The 'ICA' part of the name was contentious:

I did not agree at that time that our bean variety would be called ICA-Caucayá. We tested and selected this variety, but we had to give it that name because that is a norm in Colombia: if a new variety does not have the ICA[9] patent, it cannot be sold in the market. They came after all the work was done, after we had worked for three to four years with CIAT setting up the trials to search for a new bean variety. They came when we were in the final phase and already starting the commercial plots, so were nearly ready to release the variety and sell the seed. We needed by law the supervision of ICA and we had to go and tell them to come and see what we had. They only came at the end to see our plots, to do the laboratory test and organize the field days to diffuse the variety. Thus, they named the variety ICA-Caucayá and we let them in order to receive their permission to diffuse it.[10]

A CIAT technician (José Ignacio Roa), who supported the CIAL on beans, had previous experience in the Oriental Plains of Colombia in establishing a seed production enterprise, which had produced and commercialized *Brachiaria* seed. This enterprise had generated additional income for its members, but also made the seed available for other farmers to plant, which is usually one of the constraints for new varieties. Thus, he proposed that a similar enterprise with the CIAL farmer researchers would move their research forward and generate income for their families. In addition, it could improve the access of other farmers to low-cost high-quality seed of the new varieties that they were demanding at that time. In December 1989, the farmer research group met with the IPRA project team to evaluate the possibility of establishing a seed enterprise. In 1990, the group started a small-scale seed enterprise, producing and selling bean seed of the *ICA-Caucayá* variety. The variety diffused rapidly, since the farmers were able to assure other farmers that it permitted them to double their bean yields and that the characteristics and quality of the beans facilitated commercialization since the beans were in high demand in the market.

Initially, the newly founded seed enterprise commercialized its bean seed through local intermediaries in the nearly towns of Santander, Piendamo and Caldono. In 2003, 51% of the farmers that planted beans in the Cabuyal watershed said that they had produced bean seed, 48% sold them, and 83% bought the seeds. In 1990, the group produced 3.5 tons of seed with no clear strategy to sell it. The IPRA project contacted the Carvajal Foundation to support the group in their commercialization activities. As part of the entrepreneurial training program, farmers went to the municipality of San Gil in the department of Santander to see a similar farmer cooperative that was commercializing certified bean seed. ICA certified the seed, helping them to access other commercialization channels, increasing the price of their seed. By the end of 1990, the group had sold 2,400 kg of seed to other NGOs, including FEDECAFE, which distributed the seed among coffee producers in other regions of Colombia for promoting diversification among coffee growers (Roa 1990). The Carvajal Foundation also helped the group to commercialize 1,280 kg of seed, and other producers bought 980 kg directly from the group. However, it is not possible to claim that farmers accessed this bean seed market in a sustainable manner, since most of the buyers, with exception of the seed sold directly to farmers with the help of the Carvajal Foundation, were institutional markets that bought the seed to help the group.

Furthermore, CORPOTUNIA, another NGO working in the watershed (and described in Chapter 4) together with the Carvajal Foundation, helped the group to sell its excess seed production as grain. For that purpose, the group packed the beans into one-pound bags under the brand *'Don Chepe'*, which was lent by the Carvajal Foundation. With this packaging and brand, farmers distributed their beans in Cali through a chain of supermarkets *'La 14'* and through a network of food stores supported by the Carvajal Foundation in the poor neighbourhood of *'Agua Blanca'* in Cali. Through this channel, they sold 4,725 tons of beans as grain in 1990 (Roa 1990).

The creation of the bean seed enterprise, together with the credit provided by NGOs such as CETEC and the commercialization support given by the Carvajal Foundation and CORPOTUNIA, stimulated commercial bean production in the region:

> Everybody started to produce beans, the NGOs came to lend money and there were many resources invested here, they use to lend up to 3 and 4 million pesos (US$ 3,000 – 4,000 at the exchange rate in the early 1990s) to a single farmer to plant beans, and that was very useful. We started producing five tonnes of seed and then we increased our production to 50 tonnes and started to sell our product beyond the Cauca and Valle del Cauca departments to other coffee-producing regions. We developed as bean producers and became a regional and national example. We designed a threshing machine, and started to apply all the technology and were able to reduce costs. Beans practically displaced the cassava crop.[11]

The boom in the bean crop not only stimulated producers in the Cabuyal watershed to produce beans, but also attracted immigrants from the neighbouring department of Nariño, who also had traditionally grown beans and where attracted by the high bean price. They rented land in the region and produced beans intensively. According to producers from the Cabuyal watershed, people from Nariño were more successful because they had cheaper labour costs. The income they earned from bean production and commercialization made it possible for them to buy land in the communities of El Pital and El Cidral in the watershed.

> Do you know what advantage they have over us? They used to bring people to work from Nariño just in exchange for the food. They used to come, rent the land and bring workers with them who would work in exchange for food. People were going hungry over there; they had nothing to eat. Thus, they had very cheap labour. In contrast, we had to pay the complete day-wage here.[12]

Furthermore, people from Nariño brought their own threshing machine, and modified it as production volumes increased and quality requirements became stricter. The threshing machine designed by producers who participated in the bean seed enterprise, with the support of CIAT and the Carvajal Foundation, became obsolete, and the group started to contract the people from Nariño to thresh their beans:

> We designed, together with the people in Cali, a threshing machine, and as we trialed and adjusted it, we decided to buy it with a loan from the Carvajal Foundation. At this moment we trialed it and liked it, but that was in the beginning when we did not have big harvests. Then, it was useful. However, when we started to plant more beans it was not appropriate to our needs anymore. The people from Nariño designed a better threshing machine and we decided to rent their service instead of buying a new machine. They used to charge us by arroba and we did not have to deal with the maintenance of the machine, nor with the workers. They knew how to operate the machine and we did not have to bother with it. There is another man here that copied the machine from the people of Nariño, these machines are efficient, you can thresh 50 sacks (100 kg. bags) per day and they come out dry. With the machine we had with the group, we were only able to thresh 15 sacks per day and then we had to finish drying them. This machine also classifies beans into first and second grade quality; it is very good.[13]

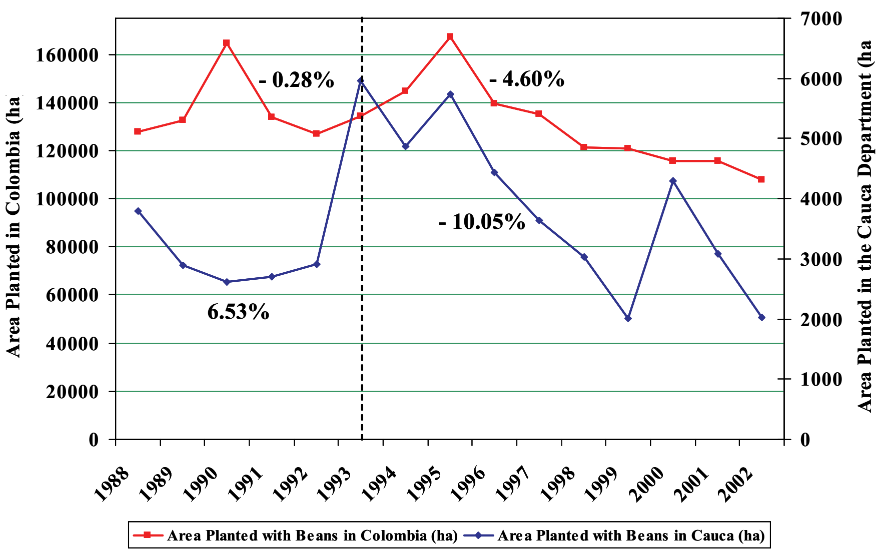
The area planted with beans in the Cauca Department increased at an average annual rate of 7% during 1988-1993, compared an average annual reduction in the country of 0.3% per year (Figure 6.2). At the same time, bean yields increased in Colombia steadily between 1989 and 2002 at an average annual rate of 2.72%, resulting in a net average annual increase in production of 2.44%. In the Cauca Department, yields increased during the 1988-1993 period at an average annual rate of 8.2% and have increased since 1993 at 3.8% annually (Figure 6.3). Thus, bean production in the Cauca Department doubled in importance as the percentage of bean production in Colombia, from 2.0% to 4.2% by 1993. As happened with the tomatoes, the increased production led to an oversupply of beans, not only in the Cauca Department, but also in the main coffee producing regions in Colombia where the crop was promoted by FEDECAFE as an option to diversify from coffee production, and this depressed bean prices.

In addition, the opening of the Colombian economy to foreign competition during the Gaviria government in the early 1990s resulted in massive bean imports from more competitive and larger scale producers in Ecuador and Canada, which further depressed bean prices, and significantly reduced bean seed demand:

> In 1994, there was impact; the Cauca Department became an important coffee producing region. With the new bean varieties brought by CIAT and some improved crop management practices that made it feasible to

produce in those degraded and acid soils (including the use of proper planting densities and organic fertilizers) bean productivity rose and people made good money. However, everything fell apart because of the macroeconomic policy at that time. Agriculture in Colombia had been protected by import tariffs, and during the Gaviria government, these tariffs were lowered, resulting in massive bean imports. People lost money; we were just not prepared for this. This was not the fault of the intervening organizations, but of macroeconomic policies, over which our organizations have no influence.[14]

Figure 6.2
Trends in area planted with beans in Colombia and in the Cauca Department (1989-2002)

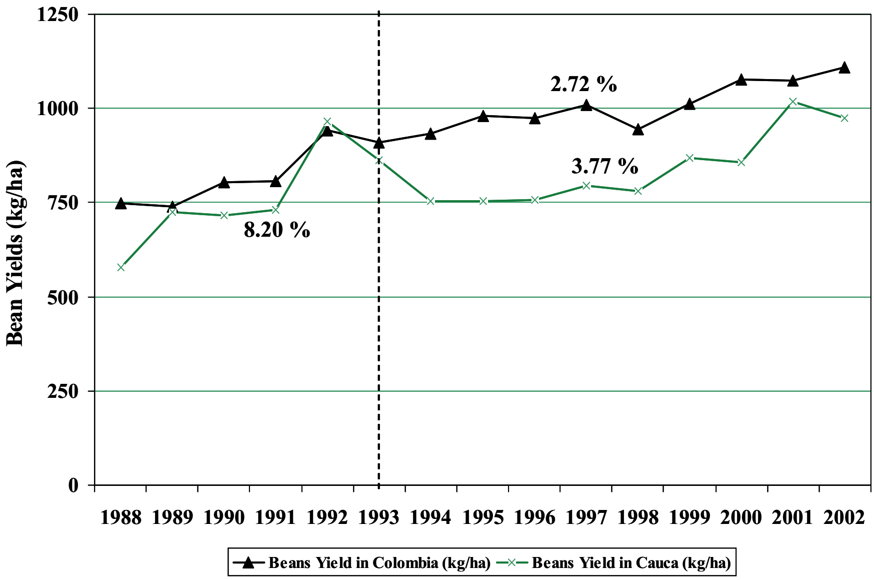


Source: Agricultural Sector Statistics, Colombian Ministry of Agriculture and Rural Development, http://www.minagricultura.gov.co/08cifras/08_cifras02.aspx, accessed in 2006, but periodically updated.

Many producers that had placed their hopes in bean production could not sell their crops and were unable to repay their debts:

The opening of the economy found us unprepared; that was a big mistake at the national level, nobody prepared us for that. The famous Gaviria government took us by surprise when we were in the best moment of bean production, and that was our ruin. We lost money and could not recover from this; it was a terrible downfall. We could not overcome it, and that was the end of the group. Some of us continued working, but many ended up highly indebted; most of the people ended up with debts.[15]

Figure 6.3
Trends in bean yields in Colombia and in the Cauca Department (1989-2002)



Source: Agricultural Sector Statistics, Colombian Ministry of Agriculture and Rural Development, http://www.minagricultura.gov.co/08cifras/08_cifras02.aspx, accessed in 2006, but periodically updated.

The variety *ICA-Caucayá* was also susceptible to new pest and diseases such as *antracnosis,* which appeared in the region with the larger scale production, and farmers started to replace them with new varieties that the farmer research group (now left with four members) continued trialling, multiplying and diffusing. These four bean producers became the bean experts in the region, and when people needed advice, they usually asked them first.

Table 6.1
Adoption of new bean varieties in the Cabuyal watershed, 2003 (N=62)

Bean Variety	No. of years since 1st trial of the variety	% of farmers that tested the new variety	% of farmers that plant the variety	Mean area with the variety among those who plant it	Mean area with the variety	% of the bean area with this variety
Traditional Varieties						
Cacha	31.89	12.34	2.50	0.27	0.003	0.76
Calima type	27.53	18.29	15.00	0.45	0.03	6.43
Sangre Toro	25.88	7.41	1.25	0.14	0.002	0.40
Guarzo	15.38	9.88	6.25	1.14	0.07	16.29
New Varieties						
Radical type	7.43	8.54	4.94	0.06	0.02	4.06
ICA-Caucaya	6.88	50.55	13.75	0.30	0.04	8.52
Cargamanto type	6.59	46.51	33.33	0.12	0.04	8.22
Calima type	6.37	62.22	51.25	0.44	0.24	55.32

Source: Adoption and Livelihoods Survey, October-December 2003

By 2003, only 14 % of bean producers planted *ICA-Caucayá*, which occupied 8.5% of the area planted to beans. However, new varieties of the *Radical, Calima* and *Cargamanto* types have emerged in the region. Eighty four percent of producers who plant beans are using these new varieties, which together occupy 76% of the area planted with beans (see Table 6.1). Thus, the CIAL was crucial in leaving farmers with the capacity to continue with the innovation process:

> We liberated the variety *ICA-Caucayá* and brought it to the market. Initially it was a very effective variety, but as time passed, it became very susceptible to diseases. Thus, we realized that we needed to continue experimenting with new bean varieties of the same bushy type that we prefer because they are better for commercial plantations. You do not have to train the plants and that saves time and inputs (you do not have to go and cut wood for the stakes or invest money in buying the wire for training the plants). Because of the difficulties we were having with the variety *ICA-Caucayá*, we started trialling with two new varieties: *ICA-Catio* and *ICA-Toné* [both *Calima* type varieties]. They gave us very good results because they are best suited for intercropping with maize and cassava. In contrast, when we planted *ICA-Caucayá* intercropped with cassava, it had a negative effect on the quality of the grain. The market is very strict with the colour, and *ICA-*

Toné has a good red colour; it is also more resistant to diseases and well accepted in the market.[16]

To analyze how access to livelihood resources (economic/financial, human, social and natural) affected the adoption of new bean varieties, logit regressions, where the dependent variable is whether of not the farmers adopted a new bean variety (1=have adopted a new bean variety; 0=otherwise), were run, against a set of variables that aim to capture access to resources. Regressions were run for each one of the variables to avoid multi-colinearity problems since many of those variables are significantly correlated. Table 6.2 shows the results, including the estimated regression coefficient, the standard error and the probability that the estimated coefficient is not equal to zero ($P > |z|$).

The adoption of new bean varieties was not only high (76% of the area planted with beans in the watershed was planted with new varieties) but access to resources did not limit the adoption of these varieties. On the contrary, farmers with lower farm size were just as likely to adopt new bean varieties. This shows that new approaches for the generation of knowledge and technology, together with the efforts of external agencies to reach smallholders and increase productivity without changing land structures, was to a certain extent successful in the case of beans. In addition, although with a lower level of significance, non-financial support from external intervening agencies influenced positively the adoption of new bean varieties.

There is no significant difference in bean yields between those farmers planting improved varieties (1,419 kg/ha) and those planting traditional varieties (1,517 kg/ha) with the probability of them not being different of 88%. Average bean yield in the Cabuyal watershed is 1,437 kg/ha, however, the variability in bean yields among those farmers who plant new varieties is significant less than the variability among those planting traditional varieties. Thus, although the new varieties yielded no better than traditional local varieties, they permitted farmers to increase their production because they were more resistant to pest and diseases, improving yield stability at larger production scales and reducing production risks.

Furthermore, there is no significant difference in cash income per ha among farmers who plant new bean varieties (US$ 976/ha/year) and those who plant traditional varieties (US$ 1,059/ha/year) (with a probability of them not being different of 86%) or in the value of bean production, once own consumption is eliminated. Thus, the adoption of new bean varieties did not have a significant effect on income generation, but was important for improving livelihoods by reducing production risks.

CIALs have been instrumental in the diffusion of bean varieties and 18% of the farmers who have trialed these new varieties have seen them for the first time in the CIAL trials. Farmer-to-farmer diffusion of new bean varieties accounted for 66.7% of the diffusion, showing that participatory approaches have fostered seed distribution among farmers not only in the same community but also from different communities and regions. Only 15.3% of farmers have accessed new bean varieties directly from intervening agencies, of there CETEC, CIAT and Corpotunia being the most important. This dynamic diffusion process was important to achieve an adoption rate of 81%.

Besides, the adoption of new bean varieties, farmers also innovated in bean crop-management practices. A clear majority (83.5%) of farmers apply organic fertilizers in bean production, which farmers previously used only for cassava production, while only 9.5% of the farmers are applying chemical fertilizers to beans (Table 6.3). A practice that came mainly from farmers' initiative has been diversifying from the cassava mono-cropping system to an intercropped system with beans (and in many cases even with maize) used by 66% of producers. Of these farmers, four out of five said that they had seen it in other farmers' fields in their own community or in other communities, and some even claimed it was a traditional practice based on local knowledge that farmers have regained through the CIAL trials. This practice has important implications for improving food security, households' income, cash flow, livelihoods resilience and soil conservation, because:

> It is very difficult for a farmer to generate a minimum wage with a bean mono-cropping system; they need to intensify land use. Farmers in Cabuyal say that they plant beans, maize and cassava intercropped, because maize is needed for household own consumption and to feed chickens, with bean sales income, they pay off production costs, and the cash income they obtain from cassava is their net profit. This is their rationale for intercropping.[17]

Table 6.2

Influence of access to livelihood resources on the probability of adopting new bean varieties in the Cabuyal watershed, Colombia (N=62)

Variable	Estimated Coeffi-cient	Standard Error	P > |z|
Economic/financial resources:			
Total Farm Size (ha)	-0.068	0.031	0.030
Total area planted with beans (ha)	-0.441	0.275	0.109
Access to productive resources (no. of cattle heads)	0.350	0.370	0.343
Has received credit and/or inputs	0.944	0.623	0.129
Human resources:			
Number of training events received and applied	-0.041	0.166	0.805
Interest in agency processes of change[(a)]	-0.733	0.661	0.267
Years of formal education of household head	-0.032	0.086	0.713
Access to family labour (# of family members)	0.004	0.142	0.979
Has received non-financial support services[(b)]	-	-	-
Has access to price and market information	-0.010	0.622	0.988
Social resources:			
Is member of a producer's organization	-0.411	0.620	0.507
Is member of a community organization	-0.693	0.648	0.285
Received support from:			
any type of organization[(c)]	-	-	-
an external organization	-1.042	1.086	0.337
production-oriented external organizations	-1.135	1.083	0.295
natural resource management-oriented external organizations	1.034	0.810	0.202
community-based organizations	0.036	0.607	0.952
welfare-oriented organizations	-0.082	0.608	0.892
credit-oriented organizations	-0.336	0.731	0.645
private services[(d)]	-	-	-
Physical resources:			
Travelling time to the town of Pescador (minutes)	-0.005	0.007	0.467
Natural resources:			
Plot slope[(e)]	0.321	0.618	0.604
Arable land depth	0.030	0.027	0.257
Has a water spring in the farm	1.135	1.083	0.295
Water availability[(f)]	-0.022	0.665	0.973

Notes:

(a) Agency=3, if household head has shown interest in experimenting, participating in farmer organizations, working with institutions, and leading processes of change; agency=2 if household head has shown an intermediate interest on the above; and agency=1 if household head has shown no interest.
(b) Correlation between dependent and independent variable is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.
(c) Correlation between dependent and independent variable is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.
(d) Correlation between dependent and independent variable is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.
(e) 1 = steep slopes; 2 = slopes; 3 = almost flat land; 4 = flat land.
(f) 1 = has water all year; 0 = has seasonal water scarcity.

Table 6.3
Adoption of bean crop management practices in the Cabuyal watershed, 2004 (N=62)

	Applies organic fertilizer to beans	Plants beans associated with maize and/or cassava	Applies chemical fertilizers to beans
Number of years since first trial	13.50	12.50	7.00
% of farmers that have trial the practice	98.97	81.82	9.46
Who recommended the practice?			
Neighbours	38.04	40.00	28.57
A farmer from other community or region	30.43	22.86	14.29
Nobody, it is considered a traditional practice	13.04	17.14	14.29
An external support organization	10.87	12.86	0.00
The CIAL	5.43	5.71	28.57
A local organization	2.17	1.43	0.00
A seller of the product			14.29
% of farmers that use the practice	83.51	65.91	9.46
% of farmers that recommended the practice	84.38	84.72	85.70

Source: Adoption and Livelihoods Survey, October-December 2003

Survey data validates this. In 2003, households who produced maize only sold 26% of their maize production in the market as grain, and used 37% for own consumption and the remaining 34% to feed animals (and therefore sold their maize as milk or beef, adding value to it). Thus, average cash income from maize sales among those households who sell it is only US$ 60 per year, but those households that sell milk and/or beef generate an annual cash income of US$ 3,000. Farmers who produce beans sell 75.5% of their production in the market and get an average annual income of US$ 338. Households that produce cassava sell 81% of their production and get cash income from cassava sales of US$ 728.50 per year. Thus, a household that plants these crops, using an intercropped planting system, will have an average annual cash income of US$ 1,127 that is almost equal to a minimum wage in Colombia, plus enough staples for household consumption. Households, besides consuming 37.3% of the maize they produce, also consume 21.8% of the beans and 14.8% of the cassava they produce. The estimated average per capita consumption of maize is 27.3 kg, beans 18.7kg, and cassava 37.2 kg.

Table 6.4

Influence of access to livelihood resources in the probability of adopting improved crop management practices in the Cabuyal watershed (N=62)

Variable	Organic fertilizers	Inter-cropping	Chemical fertilizers
	(Estimated coefficients (P > |z|)		
Economic/Financial Resources:			
Total Farm Size (ha)	0.004 (p=0.937)	0.041 (p=0.311)	-0.030 (p=0.666)
Total Area Planted with Beans (ha)	0.023 (p=0.964)	0.137 (p=0.661)	-0.403 (p=0.615)
Access to Productive Resources (number of cattle heads)	0.084 (p=0.775)	-0.024 (p=0.818)	0.099 (p=0.575)
Has received credit and/or inputs	1.774** (p=0.050)	0.452 (p=0.360)	-0.714 (p=0.379)
Human Resources:			
Number of Training Courses / Work-shops/Field Trips received and applied	0.036 (p=0.882)	0.065 (p=0.607)	-0.338 (p=0.211)
Interest in Agency Processes of Change	0.907* (p=0.076)	-0.070 (p=0.846)	-0.747 (p=0.136)
Years of Formal Education of the Household Head	-0.055 (p=0.622)	-0.091 (p=0.178)	0.095 (p=0.316)
Access to Family Labour (no. of family members)	-0.141 (p=0.408)	0.052 (p=0.635)	-0.551** (p=0.045)
Has received non-financial support services	1.299 (p=0.165)	0.975 (p=0.136)	-0.071 (p=0.950)
Has received support on price information and commercialization	0.232 (p=0.796)	-0.087 (p=0.850)	-0.397 (p=0.649)
Social Resources:			
Is member of a producer's organization	0.133 (p=0.875)	0.420 (p=0.354)	0.198 (p=0.805)
Is member of a community organization	0.989 (p=0.270)	0.546 (p=0.229)	-0.619 (p=0.441)
Received support from			
any type of organization	2.183 (p=0.030)	0.711 (p=0.402)	-0.965 (p=0.420)
an external organization	0.955 (p=0.295)	0.796 (p=0.178)	0.269 (p=0.811)
production-oriented external organizations	0.869 (p=0.344)	0.643 (p=0.264)	0.368 (p=0.743)
natural resource management-oriented external organizations	-0.123 (p=0.892)	0.292 (p=0.558)	-1.076 (p=0.333)
community-based organizations	(a)	0.693 (p=0.139)	-1.822* (p=0.100)
welfare-oriented organizations	(b)	0.778 (p=0.103)	-1.762 (p=0.112)
credit-oriented organizations	(c)	1.397 (p=0.079)	1.235 (p=0.136)
private services	-0.516 (p=0.656)	-0.489 (p=0.492)	(d)

(continued)

Table 6.4 *(continuation)*

Variable	Organic fertilizers	Inter-cropping	Chemical fertilizers
	(Estimated coefficients (P > |z|)		
Physical Resources:			
Travelling time to the highway (minutes)	0.002 (p=0.882)	-0.001 (p=0.894)	-0.001 (p=0.945)
Natural Resources:			
Plot slope	-0.730 (p=0.375)	-0.586 (p=0.193)	1.158 (p= 0.127)
Arable land depth	-0.002 (0.933)	-0.005 (p=0.700)	0.010 (p= 0.663)
Has a water spring in the farm	0.138 (p=0.903)	-0.066 (p=0.907)	0.711 (p= 0.429)
Water availability	0.957 (p=0.394)	-0.425 (p=0.369)	0.382 (p= 0.636)

Note: Cannot estimate coefficients because:
(a) Correlation between use of organic fertilizers and independent variable is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.
(b) Correlation between use of organic fertilizers and independent variable is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.
(c) Correlation between use of organic fertilizers and independent variable is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.
(d) Correlation between use of organic fertilizers and independent variable is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.

Access to resources (see Table 6.4) had no influence on the decision to intercrop beans with maize and/or cassava, but did affect fertilizer use. Farmers who had more interest in participating in intervention process and leading groups, and therefore who received support from external organizations (especially those who provide financial services) are applying organic fertilizers to their bean crop. Farmers with less access to family labour opted to use chemical fertilizers since they involve less work and effort. Farmers who received private support services, such as those provided by chemical input sellers, are also more likely to apply chemical fertilizers to their bean crop. Thus, technical assistance provided by private sector companies who sell agricultural inputs has been effective in promoting the use of chemical fertilisers.

Farmers who applied organic fertilizers had an average bean yield of 1,610 kg/ha compared to a yield of 976 kg/ha, among those who do not apply them (with a probability of 70% that these yields are different). Farmers who applied chemical fertilizers produced an average yield of 2,600 kg/ha, compared to a yield of 1,340 kg/ha, among those who do not apply chemical fertilizers (with a probability of 90% that the yields of those who use chemical fertilizers will be significantly higher than of those who do not apply them). Given these differences, applying organic fertilizers generates an extra gross income of US$ 365/ha, at average 2003 prices received by farmers, while the application of chemical fertilizers results in an extra gross income of US$ 940/ha.

6.1.2 Characteristics and outcomes of innovation on beans in the Cabuyal watershed of Colombia

Innovations in beans in the Cabuyal watershed of Colombia led to three concrete outcomes. First, although new bean varieties did not improve yields, their resistance to pest and diseases made yields less variable, reducing production risk, so farmers with less land could use these new varieties to increase their livelihood resilience. Second, applying (organic or chemical) fertilizers had a significant positive effect on yields, the effect of chemical fertilizers being higher. Decisions on whether to use organic and chemical fertilizers depended on access to human, social and financial resources. Farmers with better access to human and social resources used them to access the necessary financial resources for applying organic fertilizers, whereas the more entrepreneurial producers, who depended partially on contracted labour, preferred to apply chemical fertilizers (which require less work). The technical assistance received from the private companies that sell these products also influenced their decision. Third, intercropping beans with maize and/or cassava is an important practice, and is based on local knowledge with less external support. However, the interaction among producers fostered by participatory approaches for the generation of knowledge and technology facilitated the revival of this practice, which has important implications for income per area of available land and for cash flow. Access to resources did not influence the possibility to revive this practice.

In addition, one of the most important outcomes of the social innovation that led to the conformation of the farmer research group which later became a CIAL, was the fostering of human resources and the development of innovation capabilities among producers. These capabilities became crucial to continuing the innovation process by searching new bean varieties once the new variety *ICA-Caucayá* showed a lack of resistance to new diseases brought by the increases in the scale of production, but also, as will be discussed in the next Chapter, for the diversification to higher value crops.

One of the most important characteristics of the innovation process in beans in the Cabuyal watershed has been the learning process that resulted from the interaction among multiple actors with different knowledge and capabilities. The farmer participatory approach built on an ongoing organizational process, and enabled farmers to access new knowledge by interacting with external sources, but also through farmer-to-farmer interaction and field trips to see peer experiences. Relations with external organizations were crucial not only to get new knowledge but also to gain access to the necessary financial resources for innovation. Moreover, the relationship with CIAT was important because it provided new technical knowledge and a broader genetic diversity to the innovation process. External knowledge and support was also important for the design of the bean threshing machine that was initially essential for seed production.

Another key element was the development of an alternative market for bean production as seed, adding value to the product, improving incomes, and making higher-quality seed widely available for farmers, improving the adoption process. These things remain true even though this proved to be a short-term exercise because there were no repeat buyers once an important percentage of the potential clients have bought the seed. Also, with the support of the Carvajal Foundation and Corpotunia, farmers were able to penetrate into new markets for their products such as a supermarket chain and food outlets. This wider market was able to absorb the region's increased bean production. Moreover, the bean production boom brought immigrants from the Department of Nariño, a poorer region. This migrant population brought with them not only qualified and cheaper labour, but also additional knowledge to the innovation process in the form of new bean varieties, different cropping systems and a more appropriate bean threshing machine.

The innovation process led to agricultural intensification and value adding activities that made better use of existing livelihood resources (land) and facilitated access to more resources through external intervention (credit, knowledge, genetic diversity, and new markets as the most important), improving household livelihoods, but more importantly their resilience. However, the lack of available land, financial and water resources prevented further increase in scale and limited livelihood outcomes, as did unexpected macroeconomic policy changes that did not acknowledge the importance of this type of micro level process. These macro policies (specifically the removal of tariffs on beans) created an external shock to which the innovation process, although to some extent successful and embedded in the community, could not adapt.

It is clear from the description of this innovation process that the multiple actors who participated had different levels of negotiating power and influence, based on their knowledge and access to resources. Farmers' agency was fostered through the process, improving their bargaining power. However, most farmers focused more on immediate and survival needs than on the longer-term development and capacity-building processes. Many farmers withdrew from the process because their immediate expectations [financial resources, free inputs and other tangible benefits] were not met, which seems to have been a rational decision when bean production stopped being a remunerative option. These kinds of situations exert pressure on intervening agencies, who might then give 'things' to producers to keep them in the process, responding to short-term expectations, even where these are contrary to long term goals. Finally, the national government exerted its higher level of power by changing macroeconomic conditions, affecting the whole process.

6.2 Bean Innovation in the Tascalapa Watershed of Honduras

For many years, beans and maize have been the most important crops in the production system of households in the Tascalapa watershed in Honduras. They are mainly for consumption, and surpluses are sold for cash income. The survey conducted for this study in 2004 showed that farmers in Yorito allocated 24% of their land to annual crops, mainly to maize (53%), beans (28%) or maize intercropped with beans (18%); they only diversified 1% of the area under annual cultivation, growing vegetables crops and cassava. Farmers plant maize and beans in two cropping seasons. The first season starts in May when farmers plant their *'primera'* (first) crop. In August, rains decrease; they start increasing again in September, when farmers plant their *'postrera'* (second crop of the year). The dry season starts in November and lasts until March and April. Given that most of the agriculture in the watershed is rain fed, people do not plant during the dry season, but they always face the risk of not having enough rain during the rainy season (May-October) as well.

Average bean yield in Honduras (according to Cotty et al. 2001) is 702 kg/ha. In line with this, average yield in the Tascalapa watershed is 690 kg/ha, about half average yield in the Cabuyal watershed of Colombia. Per capita bean consumption in the Tascalapa of 48 kg per year, valued at US$ 140 per year, considerably more than the 19kg/year in the Cabuyal watershed (survey data).

Maize mono-cropping via slash-and-burn practices was the predominant production system in the early 1980s (Cerfontaine et al. 1998), contributing to hillsides deforestation. This impoverished the soils and reduced the level of the water in rivers and streams (Palacios et al. 1998).

> We used to live on migratory agriculture. The land was not suitable for agriculture; we had to cut the trees and clear the land. It was a lot of work and we did not have oxen. People did not like to go to the towns because they were scared and ashamed, and we used to walk barefoot. There were no roads and we had to travel on mules or walking.[18]

The history of innovation in basic grains in Tascalapa started with the migration of ex-banana plantation workers and the fight of landless peasants to access land (1930s and 1940s). The migrant population exerted a great deal of pressure on soil and forest resources, to produce traditional products for their consumption. In the many years of smallholder production in the watershed that followed, the natural resources deteriorated, eventually creating a crisis in food production. The process of innovation in basic grain production and post harvest management that followed the crisis can be divided in two periods. The first was based on the DRI Program intervention period, where the program's main objective was the integral development of rural communities by gaining food security and, thereafter, commercializing production whilst preserving the ecological equilibrium of the region (Palacios et al. 1998). During this period, links with agricultural research organizations were weak (aside from some collaboration with the National Agricultural Research Organization, DICTA that established on-farm trials). The second, or post-DRI, period provided an opportunity for research organizations such as CIAT (invited by SDC to work in the watershed), which were explicitly introducing the theme of Natural Resource Management.

6.2.1 New varieties and crop management practices during the DRI-Yoro program: sustainable hillside agriculture

When COSUDE and the Honduran government launched the DRI-Yoro Program in 1984, the situation was critical. According to the program designers, from being a zone with high agro-forestry potential, the Tascalapa watershed and the Department of Yoro was rapidly advancing towards desertification (Palacios et al. 1998). A first diagnosis made in 1983, before the official start of the program showed that the main problems in agricultural production in the region were (i) slash-and-burn agriculture, (ii) cropping on highly erosion-prone slopes, and (iii) excessive attention to food production without paying attention to soil conservation practices and the protection of water sources. In addition, farmers were using poor quality and low-yielding seeds, had little investment capacity, and lacked access to enough land to satisfy the needs of their households (Foletti et al. 1998).

The majority of producers lacked any support for agriculture (such as credit and technical assistance). The Honduran Ministry of Natural Resources only gave assistance to producers that had access to credit through the National Bank for Agricultural Development (BANADESA), which represented only 6.2% of the producers in the area. Other private organizations such as the Reformed Evangelist Centre for Vocational Education (CEVER), a project on the International Development of Agricultural Cooperatives, and a project on Integrated Rural Development (FACACH/PRODAIF) financed by German Technical Cooperation, also had a limited coverage (4.3% of producers) and excluded smallholders. The Honduran Coffee Institute, IHCAFE, had a greater coverage (43% of coffee producers) but was limited to coffee producers. The limited human and financial resources, and logistical problems given the high geographic dispersion of producers explained the lack of coverage (Palacios et al. 1998).

The DRI Program concentrated, during its opening phase (1984-86), on providing essential basic infrastructure that was either precarious or absent:

> The big changes started in the early 1980s with the administration of Roberto Soto Córdoba, when they started to build the roads, and with them health promoters and the church started to come here with latrines and other things. We also built the health centre.[19]

> The DRI Program used to help us with everything; they helped us to build basic infrastructure such as roads and schools.[20]

> The DRI-Yoro helped us to repair the road to the community, to install latrines, build the aqueduct; this program served the community.[21]

During the opening and expansion phases of the program, most technical assistance was concentrated on those farmers located in the valleys who had benefited from land reform. However, during the expansion phase it was recognized that the concentration of the better valley lands in the hands of a few was forcing other farming families into the hillsides in search of wood and firewood, forage for animals and land for cropping basic grains. The inappropriate cropping on the hillsides affected water sources in the valleys, where the risk of flooding and droughts increased. Thus the DRI-Yoro Program, in the last years of the expansion phase and during its conclusion phase, decided to focus on achieving higher levels of agricultural production and productivity in the hillsides. The program prioritized food production for local consumption by using appropriate technologies to improve household incomes to satisfy basic needs. DRI-Yoro aimed to develop an 'integral, biological or organic, and sustainable agriculture' (Foletti et al. 1998).

However, when the DRI-Yoro Program decided to work with hillside producers to improve food production and at the same time to reverse the deterioration of natural resources that slash-and-burn practices had caused, it found that most of the technological options available were not designed for hillside agro-ecological conditions. They also learned that most hillside farmers in the region were illiterate, and their only livelihood resources were their small plot and family labour. Thus, the development of technological options appropriate for the conditions, knowledge and resources of this type of farmer was needed. The DRI Program was able to use available technologies as basic knowledge to start the innovation process, but could not transfer this knowledge directly without the necessary adaptation and adjustments (Palacios et al. 1998).

The approach taken by the DRI-Yoro Program was influenced by new ideas on sustainable rural development (i.e. Box 1986, Conway 1990, Amanor 1993, Perrings 1994, Ghai 1994) that linked with the farming systems research approach for the generation of knowledge and technology (i.e. Brouwer and Jansen 1989, Flora 1991). Thus, technicians of the DRI-Yoro Program started by looking at the ways that hillside farmers' in other places maintained their cropping systems by using a combination of practices including crop rotation and farming associations. New innovations in basic grain production in the watershed were built on the production systems developed by farmers, but complemented with the introduction of improved seeds and soil management practices (such as barriers to prevent soil erosion, the incorporation of organic matter, the elimination of slash-and-burn practices and the use of green manures). In addition, the DRI-Yoro Program promoted crop management practices that included the use of animal traction to prepare land, contour cropping, increasing planting densities, rational use of chemical fertilizers, opportune weeding, and integrated pest management. The program also supported local production of good quality seed, and provided infrastructure for post-harvest grain conservation (Palacios et al. 1998).

The program defined agriculture extension as a 'continuous system of training, technical assistance and infrastructure support directed to producers with the objective of improving agricultural production practices' (Foletti et al. 1998). Thus, it complemented training activities with support for irrigation, storage infrastructure and access to credit, as well as on-farm research. In addition, it aimed to change the approach to extension; however, this has been more rhetoric than practice. Participatory diagnosis became the main instrument to extract information about the problems faced by farmers and their causes, as well as to learn about the most positive elements of traditional practices. Program technicians reflected on this diagnosis and planned their activities, which included traditional technical assistance methodologies, and on-farm trials to test new varieties, different planting densities and fertilizer regimes.

The DRI Program used different strategies to promote the diffusion and adoption of new varieties and crop management practices. In 1986, the Program established a 'Best Field Contest' as an incentive to farmers for adopting more sustainable crop management practices. These practices included no-burning, incorporation of crop residues, use of green manures and intercropped production systems.

> I started with DRI-Yoro, which opened the doors for us. I had limited knowledge but they gave us technical assistance and credit and we owe a lot to this program. I hope there will be an organization like the DRI Program that supports the producers as they used to do, not only technically but also with resources to apply the ideas. The support was integral; the

> technicians used to be on top of us, looking at our crops. They also established the best field contest; I once got second place and won a ploughing machine. They also wanted to help us with the market but that did not work. At the end they helped people only with silos so could store the grain; they use to sell these silos at a price that hardly covered the costs, and gave us credit to buy them.[22]

Another, strategy meant to make agriculture more sustainable was farmer-to-farmer diffusion, promoted by giving direct support to selected Linking Families for Hillsides Agriculture (FAMEs) who acted as links between the communities and the DRI-Yoro technicians. This process included innovative farmers with an interest in learning and applying new technologies and sharing their knowledge with other farmers. In addition, the DRI Program helped FAMEs within the municipalities of Yorito and Sulaco to conform ACELYS. It also established on-farm research and demonstration plots in the fields of these farmers who became para-technicians and helped in the promotion of sustainable hillsides agriculture.

Within the program, this created conflict. The program technicians (as well as those in other national organizations) believed that para-technicians represented a potential threat to their employment. Another source of conflict was the fact that many of the extension workers in the DRI-Yoro Program were lent by other national institutions and responded to the priorities of their organizations rather than to the DRI-Yoro Program policies and strategies (Palacios et al. 1998).

6.2.2 Breeding and crop management during the post DRI-Yoro period: participatory approaches

When the DRI Program ended, private service providers (Sertedeso and CODESA) continued promoting soil conservation practices through ACELYS, organized as a central directorate and four regional groups. Although Sertedeso personnel argue that ACELYS supports communities by designing projects to mobilize resources and providing financial services (savings and loans) to its members, the reality is that farmers seldom mention ACELYS and most of them have evolved into CIALs and/or rural banks after the DRI-Yoro Program ended. Thus, the new projects that came to the region took advantage of the existing organizational processes, but fostered organizations with clearer and specific objectives, such as conducting research or providing community-based financial services.

As discussed in Chapter 5, one of the first activities of CIAT in the Tascalapa watershed was to establish the IPCA project, with the aim of out-scaling the participatory approach developed in the Cabuyal watershed (Ashby et al. 2000). Since 1995, this project has been supported by the University of Guelph, with Canadian funding (Humphries et al. 2000, Classen 2003). CIAT also established in the watershed the Supermarket of Options for Hillsides Agriculture (SOL), which became a source of 'plausible promises' or 'best-bet technological options' for hillside producers. Luis Brizuela, former CIAT Coordinator in Yorito, argued that the SOL did not aim to provide technological options that could be adopted, but was set up to help farmers to better understand cause-effect relations in crop management as well as water-soil-plant relations. The SOL provided options for farmers, supporting decision-making in new areas of intervention. For CIAL members, the SOL is a source of ideas and seeds that they can bring with them to test in their plots.

> I am very much interested in the SOL and I do not get bored going there many times because, as farmers, we can conduct research there and continue learning. If you want cassava, sweet potatoes, rice, soybeans, beans or maize, you can go there and see what variety can be adapted to your conditions, they give us the seed and we bring it to our own plots to test them. They have different types of beans and maize. I see it as a place where you can go, see and take away what you need. The other day we were saying (with CIAL members) that the SOL is like a market: if you need something, you can go there and find what you need.[23]

CIALs became instrumental for evaluating new varieties and crop management practices set up in the SOL. The initial idea of CIAT was that other organizations or farmer groups would set up other SOLs, creating a network of SOLs. Although CIALs set up trials, local organizations and farmer groups did not established SOLs since it is an expensive and knowledge intensive process, difficult without certain human and financial resources. As a response, since 2002 CIAT has been pro-active in bringing groups of farmers from all over the watershed to visit the SOL. Farmers have different opinions about it. Most see no difference between the SOL and traditional on-farm research approaches, viewing it as a demonstration plot where they could get ideas and new seeds:

> Many people have been trained in the SOL on how to plant and how to manage crops. I was in one field day where we learned how to prepare organic fertilizers; we saw the difference in results between organic and inorganic fertilizers, and the former was giving better results because they stayed longer in the soil and plants were greener and stronger. They invite everyone, but there are always those that are not interested and do not want to lose their time, not everybody likes these things. The meetings there are between 8:00 am and 3:00 pm (of course they give us lunch) and any interested person can participate. Many people come, sometimes 40 or even 50 farmers.[24]

> I went once to the SOL; we went to see how CIAT is working and saw many important things and we ask for many things we saw there. They gave us sweet potatoes and rice seeds, which I am going to plant when the rain comes. I am also planning to prepare organic fertilizers[25]

> The SOL is beautiful: the crops they have, the maize and beans varieties. We do not plant rice here because the region is too dry but I saw rice varieties that are suitable for our conditions. It also caught my attention to see beans and maize planted among trees; they prune the trees to manage the shadow, and that helps produce food while preserving the environment.[26]

Despite CIAT's efforts to bring people to see the SOL, and the good impression it makes on farmers, some farmers feel that they could not adopt the things they see in the SOL because they lack the resources and knowledge that CIAT has. They admire it but feel incapable of applying all the things they see on their own farms. On the other hand, technical services providers have a different opinion:

> The SOL provides farmers with an extensive range of options. It is a place where they can see and select the things they want. It provides access to new experiences, knowledge and planting material. However, it lacks the follow-up necessary to disseminate and adjust the experience to other places. I think we should move on from visits and training and take the experience of the SOL to the communities in a more systematic manner, because there is a large demand for these things. We could start working with interested farmer groups to establish their own SOLs. A potential partner for this could be the FAMEs, which could help to cover a larger area, and we could move away from a having a single, concentrated site, as it is now.[27]

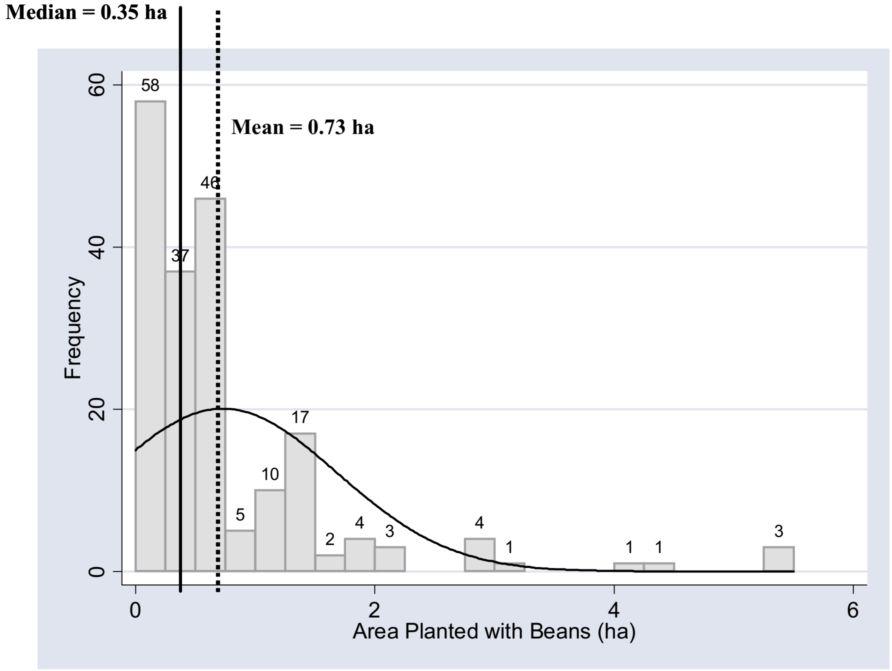
IPCA (together with plant breeders from El Zamorano)[28] developed and adjusted the CIAL methodology further and promoted participatory plant breeding as a means to improve smallholders' access to materials based on a broader genetic pool. They also wanted to improve selection and validation: to develop more productive and stable cultivars that would be adapted to the specific agro-ecological conditions of smallholders, be more acceptable for own consumption, and meet market quality requirements. Such participatory breeding thus has advantages for farmers as well as for breeding programs (Rosas et al. 2003). Farmers acquire new knowledge and skills and increase their individual and collective decision making capacity. They also allow breeding programs to evaluate their germplasm in specific localities, in collaboration with local partners, re-combining researchers' knowledge and experience in setting up experiments, with farmers' knowledge. This is not possible using conventional breeding programs, and results in a faster and more effective way to disseminate improved germplasm.

6.2.3 Innovation in beans during the DRI-Yoro Program

The 78% of households in the watershed that plant beans have an average of 0.7 ha each; however, half of them have less than 0.35 ha. As shown in Figure 6.4, area planted with beans tend to be small, usually too small to meet household demand (0.4 ha assuming a family (typical for the region) of 5-6 members, an average per capita consumption of beans of 48.5 kg per year and an average yield of 689 kg/ha.) Thus, half of the households hardly produce enough for their own consumption needs, and the rest sell excess to earn some US$ 261 per year from bean sales.

Most farmers in the Tascalapa watershed (65.5%) plant beans in monocrop production systems, and 22.5% of them intercrop with maize. The latter innovation makes a better use of the available land, and at the same time improves the food and cash flow of the households. Three out of every four farmers plant beans during the *'postrera'* cropping season to harvest between December and February, when prices are higher because of the Christmas festivities. More than half also plant beans during the *'primera'* if they have enough labour and land to harvest between June and September, in order to have food during the months of food scarcity (June and part of July).

Figure 6.4
Area planted with beans per individual farm in the Tascalapa watershed, 2004



Source: Adoption and Livelihoods Survey, January-February 2004

Traditional bean varieties vary among communities, but mainly between the valleys and hillsides of the watershed. The most important traditional bean varieties in the hillsides are *Concha Rosada* and *Chingo*. According to producers, *Concha Rosada* is more suitable than other new varieties for planting in 'postrera' because of their shorter cycle and resistance to the diseases that are common during the second cropping period. Farmers like *Chingo* because of its good taste and dark red colour, which has market demand. In 2004, 28% of producers were planting the *Concha Rosada* and 31% Chingo, occupying 32% and 13% of the area planted with beans. Other traditional varieties, such as *Pedreñito, Estica* and *Negro* are not broadly used. The DRI-Yoro Program introduced other varieties in the late 1980s, for instance, *Catrachita* in 1987, but in 2004, only 7.3% of producers planted it, occupying only 0.7% of the total area planted with beans in the Tascalapa watershed. Other varieties released at the same time by DRI-Yoro such as *Santa Catarina* have almost disappeared.

However, seeds were a sideline, and the DRI-Yoro mainly promoted improved crop management practices in beans, such as the use of fertilizers, integrated pest management, incorporation of crop residues, contour planting and the use of live barriers to prevent soil erosion (Sertedeso, Codesa, IPCA and CIAT continue recommending these practices). These crop management practices were also promoted by other farmer support organizations, which conducted research on organic fertilizers and green manures during the post-DRI period, and in general disseminated widely (Table 6.5).

Table 6.5
Adoption of crop management practices on beans in the Tascalapa watershed, 2004 (N=150)

Variable	Incorporate crop residues	Plants in contour rows	Identifies pest or diseases & samples before spraying	Use of chemical fertilizers	Use of organic fertilizers
Number of years since first trial of the practice	8.3	12.3	7.8	7.4	3.6
% of farmers that have trialed the practice	72.2	47.2	43.7	35.4	5.6
Who recommended the practice?					
Other farmer	45.4	62.0	47.9	56.5	30.0
CIAL	10.1	11.4	13.7	11.3	20.0
IPCA/FHIPA/CIAT/ Clodest	1.7	3.8	2.7	-	10.0
Sertedeso/CODESA/ DRI-Yoro	37.8	19.0	27.4	25.8	10.0
Other Intervening Agencies	2.5	3.8	4.5	8.0	20.0
% of farmers that use the practice	71.5	35.4	37.5	29.2	4.9
% of farmers that recommended the practice	68.1	33.3	35.4	31.2	5.6

Source: Adoption and Livelihoods Survey, January-February 2004.

By the time the DRI-Yoro program ended in 1996, bean yields had doubled from their 1983 levels, from an average 10 qq/mz (649 kg/ha) to 22 qq/mz (1,429 kg/ha) in the valleys, and from 8 qq/mz (520 kg/ha) to 15 qq/mz (974 kg/ha) in the hillsides (Foletti et al. 1998). Smallholders also report this increase in yields, clear from information provided by the DRI-Yoro Program:

> I am now harvesting 10 qq in half a mz (20 qq/mz or 1,299 kg/ha), while before we produced only 2 qq in half a mz (4 qq/mz or 260 kg/ha).[29]
>
> Bean yields were low before because we did not apply any technology and now we have improved our production system. Maybe our yields are not as high because our land is not of good quality, but I am harvesting 12-14 qq/mz (779-909 kg/ha) and before I only harvested 5-6 qq/mz (325-390 kg/ha).[30]
>
> Now we are harvesting 14 qq/mz (909 kg/ha), but earlier, when we had no technical assistance, we were only harvesting 8 qq/mz (520 kg/ha).[31]

Table 6.6
Yield differences attributable to improved crop management practices in bean production (N=150)

	Incorporates crop residues	Plants in contour rows	Identifies pest or diseases and samples before spraying	Uses chemical fertilizers	Uses organic fertilizers
Mean bean yield without the innovation (kg/ha)	583.2	680.4	681.8	611.3	637.2
Mean bean yield with the innovation (kg/ha)	738.9	705.9	701.0	895.5	1,866.9
Mean difference (kg/ha)	155.7	25.5	19.2	284.2	1,229.7
T-statistic	-1.301	-0.213	-0.164	-2.293	-4.719
Probability that mean yields will be different	0.902	0.584	0.565	0.988	1.000

Source: Adoption and Livelihoods Survey, January-February 2004.

In 2004, farmers who used at least one of these crop management practices had average yields of 706.5 kg/ha (compared to 624.5 kg/ha among those who use none of these new practices). The yield differences for each of the crop management practice given in Table 6.6 show that the use of organic fertilizers (and to a lesser extent chemical fertilizers and incorporating last-crop residues) has had an important effect on bean yields, as concluded using a t-test to assess the significance level of mean yield differences.

Table 6.7
Influence of access to livelihood resources on the adoption of improved management practices in bean production in the Tascalapa watershed (N=150)

Variable	Use of organic fertilizers	Use of chemical fertilizers	Uses soil conservation practices[(a)]	Uses pest management practices
	Estimated coefficients (P > |z|)			
Economic/Financial Resources:				
Total Farm Size (mz)	-0.079 (p=0.352)	0.001 (p=0.897)	0.109 (p=0.064)	-0.005 (p=0.691)
Total Area Planted with Beans (ha)	0.007 (p=0.919)	0.068 (p=0.287)	-0.060 (p=0.212)	0.133 (p=0.302)
Access to Productive Resources (owns cattle)	0.504 (p=0.556)	1.430*** (p=0.000)	0.326 (p=0.585)	0.137 (p=0.738)
Has received credit and/or inputs	1.453 (p=0.183)	0.822** (p=0.034)	0.763* (p=0.111)	-0.086 (p=0.817)
Human Resources:				
Number of Training Events received and applied	0.036 (p=0.838)	0.191*** (p=0.014)	0.332** (p=0.030)	0.137* (p=0.094)
Interest in Agency Processes of Change	-0.073 (p=0.925)	0.163 (p=0.650)	0.461 (p=0.334)	0.405 (p=0.272)
Years of Formal Education of the Household Head	-0.141 (p=0.435)	0.001 (p=0.991)	0.085 (p=0.449)	0.030 (p=0.704)
Access to Family Labour (# of family members)	0.249* (p=0.115)	0.090 (p=0.226)	0.175* (p=0.118)	0.158** (p=0.049)
Has received non-financial support services	1.178 (p=0.280)	0.490 (p=0.209)	0.617 (p=0.204)	-0.099 (p=0.794)
Has received support on price information & commercialization	-	0.192 (p=0.823)	-1.099 (p=0.382)	1.065 (p=0.391)

(continued)

Table 6.7 *(continuation)*

Variable	Use of organic fertilizers	Use of chemical fertilizers	Uses soil conservation practices[(a)]	Uses pest management practices
	Estimated coefficients (P > |z|)			
Social Resources:				
Is member of a producer's organization	0.209 (p=0.789)	-0.538 (p=0.156)	0.281 (p=0.574)	0.393 (p=0.279)
Is member of a community organization	0.081 (p=0.917)	-0.023 (p=0.948)	0.808* (p=0.093)	0.752** (p=0.043)
Received support from				
any type of organization	0.715 (p=0.513)	0.847** (p=0.076)	0.100 (p=0.857)	0.066 (p=0.877)
an external organization	0.107 (p=0.900)	0.606 (p=0.143)	0.160 (p=0.762)	-0.092 (p=0.818)
production-oriented external organizations	0.320 (p=0.681)	0.646** (p=0.071)	1.001** (p=0.045)	0.122 (p=0.731)
natural resource management-oriented external organizations	-0.122 (p=0.892)	0.448 (p=0.359)	1.281 (p=0.225)	0.673 (p=0.189)
welfare-oriented organizations	-0.715 (p=0.513)	-0.082 (p=0.840)	-1.078 (p=0.030)	0.137 (p=0.738)
credit-oriented organizations	-0.597 (p=0.585)	0.230 (p=0.568)	-0.052 (p=0.926)	0.369 (p=0.383)
private services	0499 (p=0.653)	0.022 (p=0.970)	-0.370 (p=0.655)	-0.055 (p=0.935)
Physical Resources:				
Travelling time to the town of Yorito (minutes)	-0.006 (p=0.330)	-0.012*** (p=0.000)	-0.007** (p=0.030)	-0.004* (p=0.108)
Natural Resources:				
Plot slope[(b)]	0.308 (p=0.506)	0.419** (p=0.050)	0.673** (p=0.042)	-0.080 (p=0.696)
Arable land depth	0.027 (p=0.231)	0.030** (p=0.044)	0.010 (p= 0.663)	-0.023 (p= 0.184)
Has a water spring in the farm	—(c)	0.372 (p=0.664)	—(d)	0.366 (p=0.719)
Water availability	1.827* (p=0.088)	0.220 (p=0.472)	0.342 (p= 0.398)	-1.323*** (p=0.000)

Notes:

(a) Soil conservation practices include the incorporation of crop residues, the planting in contour curves and/or the use of barriers to prevent soil erosion.

(b) 1 = steep slopes; 2 = slopes; 3 = almost flat land; 4 = flat land.

(c) Correlation between the use of organic fertilizers and the independent variable is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.

(d) Correlation between the use of soil conservation practices and the independent variable is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.

Access to certain livelihood resources has influenced the adoption of improved crop management practices in bean production in the Tascalapa watershed (Table 6.7). For example, access to productive resources (economic resources) and credit (financial resources) in cash or in-kind has had a significant effect on the adoption of chemical fertilizers, and to a lesser extent, access to credit and/or inputs have had a significant effect on the adoption of soil conservation practices. In addition, farmers with more access to land were more able to plant barriers to prevent soil erosion, incorporate crop residues and/or plant in contour rows than those who do not have enough land. However, access to economic/financial resources has not influenced decisions to use organic fertilizers or to improve pest management practices.

The most important human resources have been informal education through training courses, workshops and field visits: all foster the adoption of improved crop management practices in beans, especially more knowledge intensive practices such as the use of soil conservation and pest management techniques. Access to family labour has also been important for bean management practices that are labour intensive, such as organic fertilizers, soil conservation and pest management. External intervention, especially during the DRI-Yoro period, significantly influenced the use of chemical fertilizers in bean production (through training). In contrast, formal education (measured by the number of years of formal education received by the household head) did not influence the adoption of improved crop management practices in bean production. This shows that for the adoption of improved crop management practices, informal technical and production-oriented training is more important than formal school education.

Production-oriented support projects have influenced the use of chemical fertilizers, and membership in community organizations has had an effect on the use of soil conservation and pest management practices. In addition, production-oriented intervening agencies influenced innovation on soil conservation practices and welfare-oriented intervening agencies influenced the use of chemical fertilizers by giving away those inputs to smallholders. So did distance from town: farmers more distant from the town of Yorito received less support to innovate on crop and pest management practices or for the use of chemical fertilizers. This is most significant for chemical fertilizers, as distance from Yorito increases transportation costs, making fertilizer more expensive and therefore less profitable.

Those farmers with better quality soils (soils with greater arable depth or lower slopes) are more likely to apply chemical fertilizers to beans and use soil conservation practices. Those with more easily available water were more likely to use organic fertilizers, as well as soil conservation and pest management practices.

6.2.4 Farmer participatory research and innovation in bean production during the post DRI-Yoro period

In 1998, during the Post-DRI program, the IPCA Project and CIAT supported participatory research on bean production, and especially on bean varieties. The CIALs that had worked on bean research were those of La Sabana de San Pedro, Mina Honda, Pueblo Viejo, Patastera and Cafetales, and a third of the farmers in the region say they know the results these CIALs have generated. The best-known new variety selected, validated and diffused by a CIAL is *'Tío Canela',* considered a good variety especially when planted in the first season of the year. Some farmers argue that when they plant *'Tío Canela'* during the *'postrera'* season they have too many problems with diseases; while others say it is more resistant to diseases and drought. Producers also say that *'Tío Canela'* is well accepted in the market and that bean can also be sold as seed for a better price, while others say its pale colour reduces its price.

Despite some controversies and differences among micro regions, by 2004 two thirds of the farmers that plant beans had trialed the variety in their commercial plots, and 36.2% of them continue planting it, so it occupies one quarter of the area planted with beans in the region. Most farmers (63%) that have tested the variety say that they learned of it from other farmers and 20% say that they saw it in the CIAL trials, showing that farmer-to-farmer diffusion of this variety has been effective. These results show unprecedented levels of adoption of a new variety in hillside environments and merits further analysis of the process that made this happen:

> We started the CIAL with beans because at that time, we only had one bean variety in the community, *Chingo*, and we needed better varieties. Most of the people in the group had previous experience working with institutions and we knew what we wanted, so the technicians did not influence our decision as they sometimes do. They only gave us the seed and

> we did the rest. The arrangement was different from the way that IPCA is working now (they pay farmers for the labour and give them all the inputs), we only got the seed and had to do the rest. When the Hurricane Mitch hit our region, we were already conducting trials with bean varieties and found that *Tio Canela* was a promising one. However, the hurricane significantly reduced seed availability and a project brought by CIAT called 'Semillas de Esperanza' *(Seeds of Hope)* funded us; they supported us in the formation of a seed enterprise. With funds from this project, they bought all the necessary equipment and gave it to us. The arrangement with CIAT and IPCA was that we could keep the equipment for as long as we were active producing seeds of basic grains. Thus, we started producing seed and everybody wanted the *Tio Canela;* that was our glorious moment. However, once people had the seed they stopped buying it and we started to have difficulties that forced us to stop producing the seed because there was no demand. We wanted to continue producing seed and to become entrepreneurs, but IPCA wanted us to continue conducting research on beans and we were not interested on that. We told them that we were going to continue producing seed even if they did not like it, that we wanted to be as they taught us to be, we wanted to stand up alone, to walk, to run and to fly. They did not like our ideas, but now if you see them, they are supporting other CIALs to become rural enterprises. We continue working independently of IPCA; they have excluded us, but we continue doing research. However, we are working now with vegetable crops because we want to work with high value crops and improve our marketing activities.[32]

Tío Canela has had an important effect on yields. Farmers who plant it have an average yield of 748 kg/ha, compared with a yield of 657 kg/ha, with a probability of these yields being different of 0.78. The results with *Tío Canela* show the importance of participatory approaches in improving the effectiveness of research activities. Furthermore, giving farmers the responsibility of producing seed was an effective and efficient mean to diffuse the new variety widely at the same time that it (temporarily) generated income for the farmers that established the seed enterprise. The process has developed capabilities among farmers who, despite all the difficulties, continue to innovate in other areas, such as vegetable crops.

Farmers, who did not participate in CIALs, but adopted improved cropping practices and *Tio Canela,* recognize that this has improved yields:

> With the practices, technicians taught us, we put more dedication to the crop and bean yields have increased. Before I did not obtain more than 12 qq/mz (779 kg/ha), while now with improved practices and *Tío Canela* I am getting around 24 qq/mz (1,558 kg/ha), depending on the management we give to the crop… yields have almost doubled.[33]

The variety adapts better to the valley agro-ecological conditions than those of the upper watershed. Therefore, farmers in the Sabana of San Pedro, which is located in the lower watershed, selected it. This confirms the site specificity of agricultural technology and explains the differences in opinion among producers about its resistance to diseases, grain characteristics and acceptance in the market. Because *Tio Canela* has performance limitations in the upper watershed, other CIALs located in this zone started to search for varieties that would perform better on the hillsides and be more resistant to diseases:

> We started working with the CIAL [of Pueblo Viejo] three years ago (1999) with 103 bean varieties besides *Concha Rosada* and *Chingo*, which are the varieties we used to plant traditionally in the community. From these varieties, we selected 24 that entered the second trial, and from this, we selected 12 varieties for a third trial. From these we selected two varieties: *Tío Canela* and PRF953311 (which we named *Cayetana 85* after my mother, who is 85 years old and works with us in the CIAL). There are 17 women in the group, there used to be two men but they have left because they only wanted to work from 6:00 a.m. – 1:00 p.m., and we work with no schedule. With *Tío Canela* we produced 18 qq/mz (1,169 kg/ha) and with *Cayetana 85,* we are getting 27 qq/mz (1,753 kg/ha), while in the past with the traditional varieties we did not get more than 6 qq/mz (390 kg/ha).[34]

Since 1998, the CGIAR Program on Participatory Research and Gender Analysis (PRGA), the United Stated Agency for International Development (USAID), and the Norwegian Fund for Development, have supported a participatory plant-breeding project to El Zamorano (Rosas et al. 2003), with IPCA in charge of the field implementation of the project in Yorito. The CIAL has been working on improving traditional bean varieties,

> Since we could not find a variety that was better than the local ones for the upper watershed, we started with the traditional *Concha Rosada.* They took this variety to El Zamorano, an agricultural university near Tegucigalpa, where it was crossed with beans of the 'bushy' type that are more resistant to diseases, and they sent us back 120 F3 families crossed with the *Concha*

> *Rosada*. We planted them and they taught us how to recognize different bean diseases so we could evaluate the varieties and select those that were more resistant. Based on this, we obtained 65 new F5 lines of bean families. From these families, we selected 16 F6 family lines. Now (2002), after 5 years of working on this, we are starting to plant these varieties in our own plots; we are giving each CIAL member 10 lb of seed and they have to return 20 lb once they harvest their crop. We also evaluate the grains for its commercial value and taste. Now we have *Tio Canela*, *Concha Rosada Mejorado*, *San Martin*, *Dorado*, *Silvio* and we are reviving an old cultivar called *Pedreñito*.[35]

As a combination of all the initiatives supported by IPCA, CIAT and local organizations, farmers introduced new bean varieties to the region, but also they revived some traditional varieties. The adoption patterns of bean varieties, in which three generations of bean varieties can be seen, are shown in Table 6.8. The first generation of bean varieties corresponds to those varieties that farmers consider traditional, probably brought to the region by migrant farmers. These traditional varieties include, in order of importance, *Concha Rosada*, *Chingo*, *Negro*, *Estica* and *Pedreñito*. Forty seven percent of farmers, on 54% of the area planted to beans, continue planting these traditional varieties, showing that they are still important in farmer's fields. CIALs, as the one of Pueblo Viejo, are also reviving bean varieties with good characteristics that were being lost (such as *Pedreñito* that actually represents only 2.1% of the area planted to beans). Overall, though, traditional varieties have lower yields (552 kg/ha), compared to varieties introduced after the DRI-Yoro Program started to work in the region (802 kg/ha), with a probability of them being different of 99%.

The DRI-Yoro Program brought the second generation of bean varieties, which includes those released during the second half of the 1980s such as (in order of importance): *Concha Blanca*, *Retinto*, *San Martin* and *Catrachita*. However, the DRI-Yoro Program introduced these varieties using traditional technology transfer methods, resulting in lower adoption rates. Only 14% of bean producers in the Cabuyal watershed planted these varieties in 2004, and they account for only 11.4% of the area planted to beans. Farmers who plant these second-generation varieties have lower yields (526 kg/ha) than those who plant traditional varieties or those introduced in the post-DRI period using farmer participatory approaches (715 kg/ha), with a probability of them being different of 0.88.

Table 6.8
Adoption of new bean varieties in the Tascalapa Watershed, 2004 (N=150)

Variety	Number of years since first trial of the variety	% of farmers that have tested the new variety	% of farmers that plant the variety	Mean area with the variety among those who plant it (ha)	Mean area with the variety (ha)	% of the bean area with this variety
Traditional Varieties:						
Concha Rosada	20.47	28.2	28.2	1.5	0.3	31.7
Chingo	20.0	31.2	12.7	1.4	0.1	13.3
Negro	18.3	10.5	4.7	0.7	0.03	2.6
Estica	17.6	11.9	6.0	1.0	0.05	4.6
Pedreñito	17.2	26.8	7.4	0.4	0.02	2.1
Varieties introduced by DRI-Yoro:						
Catrachita (1987)	12.0	7.3	0.7	1.3	0.01	0.7
Retinto	11.7	9.3	3.4	0.5	0.01	1.2
Concha Blanca	8.5	18.9	7.4	1.0	0.1	5.6
San Martin	8.4	6.0	4.7	1.1	0.04	3.9
Varieties introduced in the Post-DRI Period:						
Dorado (1991)	5.8	13.4	1.3	1.1	0.01	1.2
Tio Canela (1996)	3.6	61.7	36.2	0.9	0.3	25.9
Concha Rosada Mejorado (2000)	2.5	13.7	9.4	0.7	0.1	6.3
Don Silvio (1992)	2.3	4.7	2.7	0.4	0.01	0.9

Source: Adoption and Livelihoods Survey, January-February 2004.

The last generation of bean varieties, introduced into the region through participatory research methods, include *Tío Canela*, *Concha Rosada Mejorado*, *Don Silvio* and *Dorado*. Almost half of all bean producers plant these varieties, which represent 34.3% of the area planted to beans, with *Tío Canela* playing an important role (26% of the area planted with beans). In addition, the variety developed through participatory plan breeding (*Concha Rosa Mejorado)* is also increasing its importance, and 9.4% of producers on 6.3% of the area planted to beans in the watershed planted it in 2004. Farmers who plant these varieties have a higher average yield (813 kg/ha), compared to those who did not (613 kg/ha) with a probability of them being significantly different of 96%.

Four factors can explain the success of *Tío Canela*. First, the variety was selected in farmer-run trials. Second, this type of beans has commercial value because the grains have characteristics the market desires. Third, a smallholder seed enterprise was established, crucial for seed multiplication and distribution to other farmers. Fourth, the Hurricane Mitch affected bean seed availability in the region, creating a felt need among smallholders who then satisfied this need with *Tío Canela* seed. In contrast, according to farmers a new variety introduced during the same period (*Dorado*) has a high yield compared to other varieties. In 2004 produced 1,115 kg/ha, but it has no commercial value because the colour of the grain is not appreciated in the market.

Despite the good characteristics of *Tío Canela* and its success, the site specificity of breeding limited its adoption to the lower watershed; its performance in the upper watershed was less good. However, two new varieties are emerging with good potential for the upper watershed: *Don Silvio* and *Concha Rosada Mejorado*. Of the 6% of farmers that have tested *Don Silvio*, only 2.7% adopted the variety, not because productivity concerns (in 2004 it had an average yield of 1,394 kg/ha) but because it has a lower price in the market. Those who plant the variety argue that it is good for household consumption because is soft and has a very good taste. Meanwhile, *Concha Rosada Mejorado* is starting to emerge as a good option for the upper watershed agro-ecosystem. Farmers not only tested the variety, but also improved it with support from El Zamorano (which has crossed it to have the traits desired by farmers). The main limitation in 2004 for further diffusion of this variety was the availability of seed and at that time, only 50% of farmers claim to have given seed of this variety to other producers.

Thus, because of experimentation and validation of technological options with co-innovating producers, farmers are increasing their bean yields on the hillsides. For example, Maria Hernández and her son, both members of the CIAL of Mina Honda, estimate that production costs using improved technologies is 2,500 Lempiras/mz (US$ 214/ha). When they plant traditional varieties, they can get an average yield of 613 kg/ha, resulting in a production cost of US$ 0.35/kg. If they sell their bean production at 2004 average prices of US$ 0.32/kg, they will lose money. However, if they plant improved varieties and get a yield of 813 kg/ha, their production cost per kg produced will be only US$ 0.26, resulting in a net profit of US$ 0.06/kg. Thus, they can get a net income per ha of US$ 48.8/ha per crop. If they are able to plant in the 'primera' and 'postrera' cropping seasons, net income per year would be almost

US$ 100/ha. However, even with this yield a producer will need to plant at least 12 ha of beans in 'primera' and 'postrera' to make the equivalent of a minimum salary (US$ 105/month), assuming there are no climate problems affecting the crop, something which normally occurs every 2-3 years. Moreover, this estimate does not take into consideration the effect an oversupply would have on prices. However, farmers plant in average only 0.73 ha of beans per cropping season, obtaining an average gross cash-income from bean production of US$ 36 per cropping season or US$ 72 per year if they plant in both 'primera' and 'postrera'.

Access to livelihood resources influenced the adoption of new bean varieties released during the DRI-Yoro Program with its technology transfer approach, as it did the adoption of the new varieties from the post-DRI Program period with its participatory approach (Table 6.9). Access to economic/financial resources influenced adoption of new bean varieties promoted by the DRI-Yoro Program. Having access to credit, in cash or in-kind, had a significant effect. Thus, farmers who received support from the program, in the form of credit or inputs, had a higher probability of adopting these varieties. On the other hand, access to financial/economic resources had no effect on the adoption of new varieties developed in the Post-DRI Program period. On the contrary, those farmers with smaller areas planted with beans (which are those who have their farms in the upper watershed) adopted more of the varieties that were suitable for their agro-ecosystem.

With respect to access to human resources, technical assistance was an important factor influencing the adoption of improved varieties introduced during the DRI-Yoro Program. In the post-DRI period, the access of household heads to formal education (measured by the number of years that the household head attended school) related more closely to the adoption of varieties introduced during the Post-DRI period. Education also is an important factor explaining participating in CIALs and taking advantage of the knowledge and new varieties evaluated and developed through farmer participatory research.

External support, especially from production and welfare-oriented agencies, had a significant influence on the decision to adopt new bean varieties introduced during the DRI-Yoro program. Membership in community-based organizations had a significant effect on the adoption of new bean varieties introduced during the Post DRI-Yoro period. These results are in line with the change in approach used to generate knowledge and technology. Transfer of technology and on-farm research approaches gave way to participatory research approaches promoting a more endogenous process, but still with support from external organizations working as facilitators.

Table 6.9
Influence of access to livelihood resources in the probability of planting new bean varieties in the Tascalapa watershed (N=150)

Variable	Varieties introduced by the DRI-Yoro Program	Varieties introduced after the DRI-Yoro Program
	Estimated coefficients (P > |z|)	
Economic/Financial Resources:		
Total Farm Size (mz)	-0.012 (p = 0.599)	-0.010 (p = 0.422)
Total Area Planted with Beans (ha)	0.181 (p = 0.377)	-0.574*** (p = 0.018)
Access to Productive Resources (owns cattle)	-0.263 (p = 0.658)	-0.114 (p = 0.771)
Has received credit and/or inputs	1.445** (p = 0.026)	-0.238 (p = 0.483)
Human Resources:		
Number of Training Courses/Workshops/Field Trips received and applied	0.075 (p = 0.461)	-0.010 (p = 0.898)
Interest in Agency Processes of Change	0.003 (p = 0.971)	0.031 (p = 0.614)
Years of Formal Education of the Household Head	0.087 (p = 0.381)	0.152** (p = 0.046)
Access to Family Labour (# of family members)	0.051 (p = 0.619)	0.085 (p = 0.243)
Has received non-financial support services	1.075* (p = 0.099)	0.367 (p = 0.311)
Has received support on price information and commercialization	2.819** (p = 0.017)	-0.991 (p = 0.397)

(continued)

The use of the higher-yielding bean varieties introduced during the post-DRI period has been relatively better among farmers with higher quality soils (flatter land and soils that are more fertile). In contrast, varieties introduced during the DRI-Yoro period have been more attractive to producers with farms in the lower watershed, where farms lack water springs (which farms in the upper watershed have), validating the finding that those varieties were more suitable for the lower watershed.

Table 6.9 *(continuation)*

Variable	**Varieties introduced by the DRI-Yoro Program**	**Varieties introduced after the DRI-Yoro Program**
	Estimated coefficients (P > |z|)	
Social Resources:		
Is member of a producer's organization	0.423 (p = 0.381)	-0.720** (p = 0.031)
Is member of a community organization	0.601 (p = 0.243)	0.659** (p = 0.054)
Received support from:		
any type of organization	1.897* (p = 0.069)	0.044 (p = 0.911)
an external organization	1.351* (p = 0.079)	0.434 (p = 0.254)
production-oriented external organizations	1.194** (p = 0.028)	0.372 (p = 0.261)
natural resource management-oriented external organizations	-1.309 (p = 0.214)	0.507 (p = 0.286)
community-based organizations	-0.301 (p = 0.583)	-0.662* (p = 0.077)
welfare-oriented organizations	0.940** (p = 0.054)	-0.228 (p = 0.548)
credit-oriented organizations	-0.219 (p = 0.712)	-0.867** (p = 0.040)
private services	0.217 (p = 0.790)	0.161 (p = 0.789)
Physical Resources:		
Travelling time to the town of Yorito (minutes)	0.0001 (p = 0.979)	-0.002 (p = 0.364)
Natural Resources:		
Plot slope	-0.243 (p = 0.408)	0.480** (p = 0.020)
Arable land depth	0.011 (p = 0.513)	0.047*** (p = 0.010)
Has a water spring in the farm	-[a]	-1.275 (p = 0.259)
Water availability	-0.359 (p = 0.375)	0.241 (p = 0.405)

Note:
(a) Correlation between the use new bean varieties introduced by the DRI-Yoro Program and the independent variable is -1 and therefore cannot estimate coefficient, but influence in the dependent variable is significant.

6.2.5 Characteristics and outcomes of innovation in beans in the Tascalapa watershed of Honduras

External intervention (such as the DRI-Yoro Program, Sertedeso, CIAT and IPCA) greatly influenced bean innovation processes in the Tascalapa watershed of Honduras, leading to the adoption of improved crop management practices for sustainable agriculture in hillsides. These practices (initially brought by the DRI-Yoro program after the end of its expansion phase using on-farm research approaches, and later developed further by private services providers and CIAT with a similar approach) were effective in their impact on yields. Between one third and two thirds of producers adopted these practices. Two thirds of producers started incorporating crop residues to increase soil fertility and raise bean yields. Depending on their access to livelihood resources such as land, financial resources, labour, and knowledge, they adopted soil conservation practices, initially because external support organizations facilitated access to these resources (with the exception to land), but tied their support to the adoption of these practices. One third of farmers use chemical fertilizers, which has had important yield and soil improvement impacts. However, its use depends on access to economic/financial resources owned or accessed with the support of external organizations, and on access to the main towns (to reduce transaction costs). A few farmers now use organic fertilizers, which although is one of the most effective way to increase yields, has been the least adopted. Sources of organic fertilizers are not broadly available in the watershed, because bean farmers usually have no cattle or commercial poultry, as they do in the Cabuyal watershed in Colombia. In addition, preparing and applying organic fertilizers is a labour-intensive activity, and therefore, households with more family labour available tend to adopt the practice, as do those with water available to prepare them. Farmers have made fewer inroads in pest management practices, which are knowledge intensive and therefore rely heavily on access to human resources; however, the innovation process has approached pest and diseases control more through germplasm resistance than through management practices per se.

Second, the new varieties introduced with a transfer of technology approach by the DRI-Yoro program did not surpass the yields or quality characteristics of traditional varieties. However, those tested and improved with participatory research approaches during the Post-DRI period no only surpassed the yields of traditional varieties, but also provided differentiated varieties adapted to the lower and upper watershed, with the characteristics demanded by the market. These new varieties are also more resistant to the most important pests and diseases, improving livelihoods resilience. The difference in approaches for the generation of knowledge and technology between the DRI-Yoro program and the Post-DRI interventions by IPCA with support from El Zamorano and CIAT, not only had an important influence on the effectiveness of the innovation process but also on determining who benefited from it. The adoption of bean varieties during the DRI period was highly dependent on access to external support. Since the yield effect of the new varieties introduced by the program was null, farmers only planted them to have access to the financial resources that DRI-Yoro provided to those who follow its technical recommendations. Once the program ended, farmers stopped using these varieties. However, bean varieties tested and improved by farmers (with external support) were adopted by those farmers who participated in community-based organizations and with higher levels of human and social resources, showing a more endogenous innovation process, that linked crucial external knowledge and support.

As in the Cabuyal watershed of Colombia, the social innovation contained in the CIAL methodology was important in fostering human resources and improving access to social resources and in developing innovation capabilities to develop new varieties, as happened when *Tío Canela* was found to be less suitable to upper watershed agro-ecological conditions, and other varieties were developed. Thus, seeing innovation as a social learning process, and developing human resources and fostering interaction among multiple stakeholders accessing and using different sources of knowledge has been an important contribution of the CIAL methodology.

External interventions aimed to foster innovation processes on beans in the Tascalapa watershed were mainly concerned with food security, while those in the Cabuyal watershed focused on both food security and income generation. They achieved, in the Tascalapa watershed, the objective of improving the supply of beans, an important source of protein for the population, reaching a significant proportion of at least the households that had better access to human and social resources, which to a certain extent made up for limited access to economic, financial and even natural resources. They were able to help early adopters increase their production without oversupplying the market, increase their income, and re-invest in land or in productive assets such as cattle, moving to a higher level of well-being. They did not factor in that production surpluses would contribute to a long-term decrease in bean market prices, making bean production unprofitable, despite the adoption of new bean varieties and improved crop management practices.

The longer-term prospects are that beans will not provide an attractive opportunity to generate cash income for smallholders in the watershed. Furthermore, the Free Trade Agreement is likely to mean that these smallholders will be uncompetitive. The market risks are increasing, especially for non-diversified producers. Although production risks have reduced among those who adopted soil conservation and pest management practices, the production risk inherent in pursuing rain-fed agriculture where droughts occur every two to three years, persists.

6.3 A Final Reflection on Bean Innovation Processes in Colombia and Honduras

The innovation processes on beans were effective, resulting in higher and more stable yields and therefore improving food security and livelihood resilience. The new approaches used to promote these innovations have also proven to be more inclusive, reaching both male and female-headed households with limited access to livelihood resources. It is important to recognize that these processes take time, requiring five to seven years from the start of the trials to the multiplication and distribution of improved varieties. Therefore, innovation processes do not offer immediate responses to food and/or cash income needs that smallholders have. This makes it difficult to keep farmers motivated without giving them some short-term rewards. In addition, such processes require a substantial investment of farmers' and technicians' time, as well as financial resources to facilitate the process and set up trials.

Moreover, the possibility of these innovations to improve cash income for farmers with limited access to land, financial resources and water to increase their scale of production and move beyond food security is limited, given the small profit margins that traditional commodities, such as beans, offer in an increasingly competitive and globalized market. Thus, even if smallholders' access to land, financial capital, and water could increase, the resultant oversupply would only depress prices further, given the limited and inelastic market together with the subsidies developed countries give to their farmers. On top of this major market constraint, and regardless of the fact that improved bean varieties and crop management practices have reduced production risks, farmers still face risk through their dependence on rain-fed agriculture and the constraining climatic conditions in hillside agro-ecosystems. Thus, cash crops sold as commodities cannot offer income security.

Thus, making an important investment in human and financial resources to facilitate an innovation process in traditional commodities may not be an appropriate decision, if intervening agencies and beneficiaries' expectations are greater than securing food availability for the population at low prices. Thus, it may not be fair to ask farmers to make an important investment of time and other resources in return for a possible increase in cash income of US$ 100-350 per year after five to seven years of hard work. This is especially so given that sudden changes in macroeconomic policies can alter the terms of trade and affect the competitiveness of the sector, possibly even eliminating this gain in cash income.

Notes

1. Calculated based on data from the Colombian Ministry of Agriculture Website: http://www.minagricultura.gov.co/17_sistemas.html. July, 2005.

2. The term 'temporal' crop refers to crops with a growing cycle of not more than two years. Thus, it includes annual and bi-annual crops.

3. Carlos Trujillo, 20 May 2003, Pescador, Caldono.

4. Marcos Garcia, 7 July 2003, La Campiña, Caldono.

5. Carlos Arturo Quiros, CIAT Researcher, IPRA Project, 22 April 2003, Cali, Colombia.

6. Marcos Garcia, 7 July 2003, La Campiña, Caldono.

7. Elias Claros, 10 September 2003, Pescador, Caldono.

8. Elmer Vitelio Menza, former mayor of Caldono, and producer. 23 May 2003, Caldono.

9. As explained in Chapter 4, ICA was the former National Agriculture Research Institute in Colombia, until it was semi-privatized, becoming Corpoica.

10. Carlos Trujillo, 20 May 2003, Pescador, Caldono.

11. Carlos Trujillo, 20 May 2003, Pescador, Caldono.

12. Elias Claros, 10 September 2003, Pescador, Caldono.

13. Elias Claros, 10 September 2003, Pescador, Caldono.

14. Libardo Ochoa, professional staff, Carvajal Foundation, 23 May 2003, Cali, Colombia.

15. Carlos Trujillo, 20 May 2003, Pescador, Caldono.

16. Marcos Garcia, 7 July 2003, La Campiña, Caldono.

17. Jose Ignacio Roa, technician IPRA project, 9 May 2003, Cali, Colombia.

18. Carlos Medina, 31 October 2002, Las Cañas, Sulaco.

19. Carlos Medina, 31 October 2002, Las Cañas, Sulaco.

20. Valentin Palma, 23 October 2002, Jalapa, Yorito.

21. Santiago Banegas, 25 October 2002, Luquigüe, Yorito.

22. Santiago Banegas, 25 October 2002, Luquigüe, Yorito.

23. Gavina Herrera, 6 November 2002, Pueblo Viejo, Yorito.

24. Carlos Sosa, 25 October 2002, Luquigüe, Yorito.

25. Leonidas Hernandez Mejia, 23 February 2003, Santa Cruz, Yorito.

26. José De La Paz Matute, 1 November 2002, Cafetales, Victoria.

27. Saul San Martin, manager of Sertedeso S. de R. L., 2 July 2003, Yorito, Yorito.

28. El Zamorano is an international agricultural university in charge of developing the capabilities of Latin American students in sustainable management and conservation of natural resources, rural transformation for poverty reduction and the improvement of global rural competitiveness (http://www.zamorano.edu).

29. José De La Paz Matute, 1 November 2002, Cafetales, Victoria.

30. Pablo Colindres, 2 November 2002, La Albardilla, Sulaco.

31. Isabel Lanza, 26 October 2002, El Destino, Yorito.

32. Cesar Romero, 26 February 2003, Sabana de San Pedro, Yorito.

33. Pablo Olvera, 27 October 2002, Santa Cruz, Yorito.

34. Gavina Herrera, 6 November 2002, Pueblo Viejo, Yorito.

35. Maria Hernandez, 3 November 2002, Mina Honda. Yorito.

7 Diversification to Higher Value Crops: Coffee and Blackberries

Because (given steadily falling prices) traditional commodities cannot generate sustainable rural livelihoods for smallholders on the tropical hillsides, the next option for profitable agricultural production has been high-value market crops, which (according to intervening agencies) offer a potential treasure chest for hillside smallholders. Over the last two decades, some external interventions have pursued this option by promoting higher value coffees or other crops. These interventions emphasized products (such as blackberries) agencies felt were particularly suited to the intensive management small production units could provide. They also saw the perennial nature of these crops as attractive, because continual groundcover is a prerequisite for sustainable agriculture in hillside agro-ecosystems. Several research and development agencies argue that the local and international markets for these products (which are expanding and more elastic than markets for traditional commodities) are capable of supporting sustainable development if producers can overcome production and marketing obstacles.

Two of the innovation processes studied here aimed to diversify hillside agricultural production to include high value crops. The first introduced coffee production in the Tascalapa watershed of Honduras as part of the DRI Yoro programme in the late 1980s, which fed into an initiative beginning in the late 1990s, aiming to help coffee farmers enter higher value coffee market niches. This intervention began as a 'transfer of technology' approach and evolved to some extent into a 'farmer systems research' approach, and later into a 'market-led research' approach. The second innovation process analysed is the diversification into blackberries in the Cabuyal watershed in Colombia. This followed initially a 'farmer systems research' approach, but rapidly changed to a 'farmer participatory research' approach, complemented later on with a 'market-led research' approach.

7.1 Diversification to Coffee and Innovation to Access Higher Value Markets in the Tascalapa Watershed

When the DRI Yoro programme started in the mid 1980s, bean and maize production was the base of the economy in Yorito. Twenty years later, 53% of households in the region have coffee plantations, mainly the Arabiga type, and rely on this crop as their major source of cash income. Coffee is the principal diversification crop in the region, occupying 93% of the area given to permanent crops (16% of total land) and providing 76% of the cash agricultural income for households with coffee plantations. Coffee is planted mainly as a monocrop (66% of coffee area), but also intercropped with plantain (34%), which provides shade and additional income.

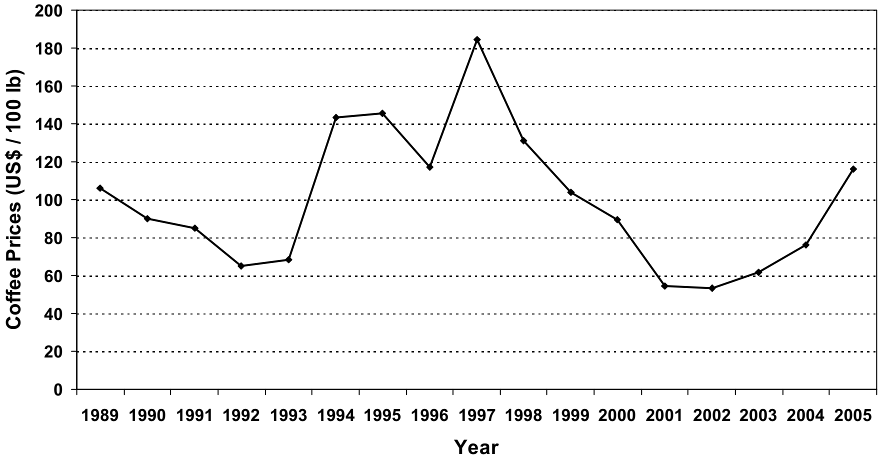
7.1.1 Diversification to coffee

In the opening phase of the DRI Yoro programme (1984-86), a major thrust was to improve access to basic infrastructure and roads that (although still rudimentary) provided a catalyst for expanding coffee production in the region. During the DRI Yoro programme expansion phase (1987-1991), most producers established their coffee plantations. The programme promoted coffee plantations by providing credit, first via the COPIs and land-reform beneficiary groups, and later through their second level cooperatives, COSAPSYL and CARYOSVYL. The expansion of coffee production in Yorito lagged behind the most dynamic coffee expansion in Honduras, which started in the 1970s and continued over the 1980s and 1990s as the number of producers and area planted increased (Jansen 1993). When Yorito coffee producers began production (after 2-3 years of establishing their plantations) they were able to take advantage of the high coffee prices of the 1990s, especially during 1993-1999 (see figure 7.1).

Coffee has been instrumental, in improving the livelihoods of producers able to take advantage of the support given initially by the DRI Yoro programme and IHCAFE[1]:

> I have established my first manzana [0.70 ha] of coffee with credit; I had a good crop and the prices were good, so I increased the area planted with coffee and I was able to improve my house. Coffee was my star crop; it has given me all I have. Other crops are more risky and although you can gain one year, in another you can lose everything.[2]

Figure 7.1
Trend in international coffee prices (1989-2005)



Source: New York Board of Trade (https://www.theice.com/productguide/)

This assessment of coffee was evident in other interviews, for example:

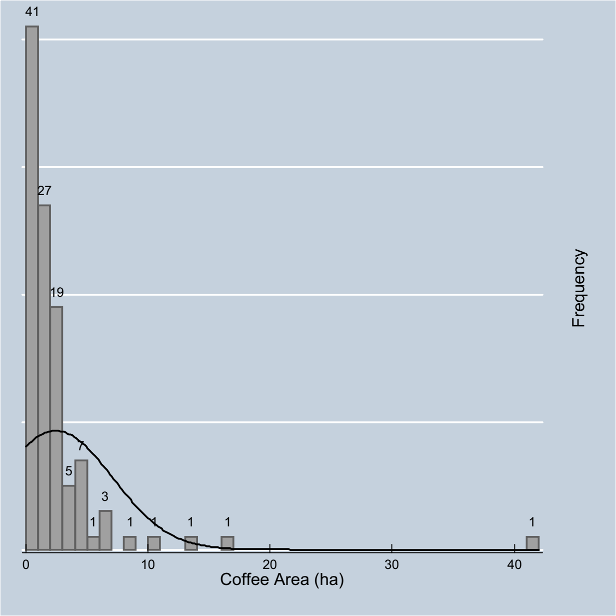
> I would not be scared of getting a loan to plant more coffee because coffee gives the most income. My experience with my father was that he obtained loans for agriculture (maize or beans) and then he had to repay them with the income he obtained from coffee. Every time he has a bad year with grain, he pays off the loan with coffee income. Coffee prices have been low, but never lower than 250 Lempiras per quintal.[3]

Back in the late 1980s, farmers were pushed (by DRI Yoro and IHCAFE personnel) to establish coffee plantations, but they were attracted to the crop largely by early innovators (5% of producers) who used credit from DRI Yoro to diversify. These early innovators were able to lead others because coffee had a good market and therefore a good potential to generate income. Other farmers followed, investing in their own coffee plantations. Only a few households established small plantations for their own consumption (8%), or went into coffee production because they inherited a plantation (5.5%).

Half of all coffee producers continued expanding their coffee plantations after establishing them, and 50% did so by re-investing profits obtained from coffee sales. The rest invested wages earned as fieldworkers

(29%) or income earned by buying crops in advance at lower prices (12.5%). Only 9% expanded their coffee plantations with credit provided by the government through IHCAFE, which came tied to a technological package that included applying chemical fertilizers and (for a few years) the elimination of shade on coffee plantations.

Figure 7.2
Coffee area on individual farms in the Tascalapa Watershed, 2004



Source: Adoption and Livelihoods Survey, January 2004

In 2004, the average coffee area per household was 2.5 ha; however, half had less than 1.4 ha of coffee, resulting in a larger number of producers with smaller plantations (see figure 7.2). Logit regressions, used to analyze how access to livelihood resources influenced diversification into coffee in the Tascalapa watershed, showed that access to land significantly limited the possibility to diversify into coffee production. Moreover, the area planted with coffee was positively correlated with total farm size owned by the household (correlation coefficient = 0.87; Spearman's rho = 0.6018, with a probability of them being independent of 0.0000) (see Table 7.1). Having access to other productive resources, measured as a proxy by the number of cattle owned, also had a significant influence on the decision to diversify.

Table 7.1
Influence of access to livelihood resources on the probability of diversifying to coffee in Yorito, Honduras (N=192)

Variable	Estimated Coefficient	P > |z| [(a)]
Economic/Financial Resources:		
Total Farm Size(mz)	*0.133*	*0.000*** (b)*
Access to Productive Resources (Cattle)	*1.108*	*0.006****
Has received credit and/or inputs	0.298	0.312
Human Resources:		
Number of Training Courses Received and Applied	*0.184*	*0.012***
Interest in Agency Processes of Change[(c)]	0.517	0.080*
Years of Formal Education of the Household Head	0.010	0.859
Access to Family Labour (# of family members)	0.017	0.788
Has received non-financial support services	*0.753*	*0.015***
Social Resources:		
Is member of a producer's organization	*0.933*	*0.003****
Is member of a community organization	0.483	0.099*
Received support from:		
any type of organization	*0.966*	*0.005****
external organization	*0.828*	*0.010****
production-oriented external organizations	*1.257*	*0.000****
integrated rural development programs	0.361	0.273
community-based organizations	0.603	0.075*
welfare-oriented organizations	0.056	0.867
credit-oriented organizations	0.560	0.114
private services	0.360	0.477
Physical Resources:		
Travelling time to the town of Yorito (minutes)	*0.009*	*0.000****
Natural Resources:		
Plot slope[(d)]	*-0.582*	*0.003****
Arable land depth	-0.010	0.477
Water availability[(e)]	*1.855*	*0.000****

Notes:
(a) Probability that the estimated coefficient is not equal to zero
(b) *** Significance level between 0.00 – 0.01; ** significance level between 0.01 – 0.05; and * significance level between 0.05 – 0.10.
(c) Households have been grouped using cluster analysis with the average link method in two groups: agency = 1 if household head has shown interest in experimenting and in participating in farmer organizations and work with institutions; agency = 0, otherwise.
(d) 1 = steep slopes; 2 = slopes; 3 = almost flat land; 4 = flat land
(e) 1 = has water all year; 0 = has seasonal water scarcity

The quality of human resources in the household, estimated by the number of training workshops in which household members participated and which provided ideas applied by the households in their own activities, had a strong influence in the decision to diversify to coffee. This shows that informal training, as opposed to formal education, was more important in developing the capacity to diversify to coffee production. The significant effect that accessing non-financial support services had on the decision to diversify reinforces this conclusion. So does the fact that the interest of farmers in experimenting, participating in producer organizations and working with external support organizations, are also determinants of the decision to diversify into coffee.

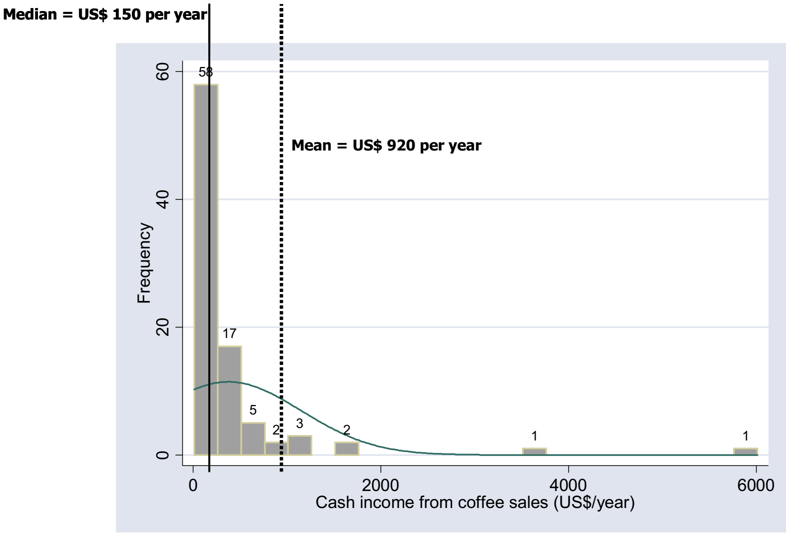
Access to social resources, estimated according to whether household members participated in producer and community organizations and whether they receive support from service provider organizations also is a factor in the decision to diversify to coffee. The relation with external support organizations (especially those that support production and income generating activities) had a stronger influence.

Access to physical resources, measured as travelling time from the farm to the main town of Yorito, has not discouraged farmers from diversifying into coffee, although the roads built with DRI-Yoro help were crucial catalysers of this diversification. The reason there is a positive relation between farmers' decision to diversify to coffee and travelling time to the town of Yorito relates to the fact that coffee is grown mainly in the upper watershed, which is more distant but has the most suitable agro-ecological characteristics for growing good quality coffee. In addition, travelling time to the farms, as far as roads are available, has not limited the possibility to diversify to coffee since the product is not highly perishable and can stand sub-optimal storage and transport.

Moreover, households who have farms with steeper slopes, being prone to soil erosion, have established coffee plantations because coffee is more suitable for this type of soil than basic grain production. Thus, diversification to coffee has made an important contribution to reducing land degradation in the upper (and hillier) watershed. Having access to water in the farm also encourages diversification into coffee, because water is an important resource for coffee production, especially for plant nurseries to establish or renew plantations.

In 2004 coffee producers gained 76% of their cash income from coffee sales, an average gross income from coffee sales of US$ 920 per year and a total gross cash income from agricultural activities of US$ 1,150 per year. In contrast, non-coffee farmers earned US$ 570 per year. However, average figures can be misleading, as the data in Figure 7.3 shows mean and median incomes from coffee are quite different. As in the case of coffee area distribution (see Figure 7.2), a few households with large incomes skew the distribution, and half of the households that produce coffee have an annual cash income from coffee sales of less than US$ 150.

Figure 7.3
Distribution of annual cash income from coffee sales in the Tascalapa watershed, 2004



Source: Adoption and Livelihoods Survey, January 2004

7.1.2 Supply-led innovations: new varieties and improved practices

As have been shown in the previous section, the most significant achievement of the DRI-Programme with regard to coffee was the expansion of the area established with coffee plantations in the watershed. It has been argued (see Foletti et al. 1998) that by replacing traditional coffee varieties such as *Café Indio, Típica* and *Borbón,* usually planted at low densities (1,150-1,450 plants/ha to a maximum of 1,700 plants/ha) and by using improved practices, coffee farmers were able to increase their yields from 500 to 1,400 kg/ha. However, in 2004 average coffee yields in Yorito were only 710 kg/ha, more in line with those reported by Baumeister (1990).

Table 7.2
Adoption of coffee varieties in the Tascalapa watershed, 2004 (N=102)

Variety	Average number of years since first trial of the variety	% of farmers that have established coffee plantations with the variety	Mean area with the variety among those who plant it	Mean area with the variety	% of the coffee area with this variety
Típica	18.3	40.5	2.4	1.0	30.1
Indio	12.3	27.6	1.9	0.5	15.6
Borbón	10.6	18.1	0.9	0.2	5.2
Caturra	10.1	39.5	1.4	0.6	17.8
Catuai	8.2	16.4	1.0	0.2	4.9
Café 90	4.2	46.6	1.5	0.7	22.1
Lempira	3.8	11.2	0.9	0.1	3.1
Catimor	2.7	5.2	0.8	0.04	1.2

Source: Adoption and Livelihoods Survey, January 2004.

The pattern of adoption of these new coffee varieties is shown in Table 7.2. In 2004, a minority of producers planted traditional varieties. As farmers established new coffee plantations or renewed old ones during the DRI Yoro, and with the support of IHCAFE, they planted varieties *Caturra* and *Catuai*. These varieties were, according to the producers, brought to the region for the first time in 1979-80. By 2004, 23.2% of producers had plantations with *Caturra,* and 8.4% with *Catuai*. In 2004, IHCAFE introduced new varieties such as *Café 90, Lempira* and *Catimor*.

The major advantage of traditional varieties are that although they take longer to start producing (5-7 years) they do not need to be renewed in the farmer's lifetime. They also maintain a stable yield without fertilization and do not deplete the soils. The plants also have a better taste and aroma, and although they are high, they are easy to harvest since the branches bend without damaging the plant.

Table 7.3

Influence of access to livelihood resources in the probability of adopting new coffee varieties in Yorito, Honduras (N=102)

Variable	Estimated Coefficient	P > |z| (a)
Economic/Financial Resources:		
Total Farm Size (mz)	*0.069*	*0.101*(b)*
Area Planted with Coffee (mz)	*0.301*	*0.068**
Access to Productive Resources (Cattle)	*2.123*	*0.043***
Has received credit and/or inputs	*1.024*	*0.039***
Human Resources:		
Number of Training Courses Received and Applied	*0.273*	*0.055**
Interest in Agency Processes of Change(c)	0.390	0.428
Years of Formal Education of the Household Head	0.030	0.774
Access to Family Labour (# of family members)	*0.189*	*0.087**
Has received non-financial support services	*1.429*	*0.004****
Social Resources:		
Is member of a producer's organization	*2.272*	*0.003****
Is member of a community organization	0.773	0.113
Received support from:		
any type of organization	*1.386*	*0.008****
an external organization	*1.741*	*0.001****
production-oriented external organizations	*1.547*	*0.003****
integrated rural development programs	0.291	0.603
community-based organizations	*1.526*	*0.049***
welfare-oriented organizations	-0.283	0.601
credit-oriented organizations	0.816	0.220
Physical Resources:		
Travelling time to the town of Yorito (minutes)	0.005	0.129
Natural Resources:		
Plot slope(d)	*-0.694*	*0.012***
Arable land depth	0.003	0.904
Water availability(e)	*1.455*	*0.000****

Notes:
(a) Probability that the estimated coefficient is not equal to zero
(b) *** Significance level between 0.00 – 0.01; ** significance level between 0.01 – 0.05; and * significance level between 0.05 – 0.10.
(c) Households have been grouped using cluster analysis with the average link method in two groups: agency = 1 if household head has shown interest in experimenting and in participating in farmer organizations and work with institutions; agency = 0, otherwise.
(d) 1 = steep slopes; 2 = slopes; 3 = almost flat land; 4 = flat land
(e) 1 = has water all year; 0 = has seasonal water scarcity

> My plot with *Café Indio* has existed for 47 years; this is the coffee of the poor because it is very resistant, the new coffee varieties have a period when they produce well, but then you have to replace the plantation… they don't last more than 15 years.[4]

Farmers were aware of the trade-offs:

> IHCAFE and AHPROCAFE [the Honduras Association of Coffee Producers] were the guilty ones that came and told farmers to change the traditional varieties. We were also guilty because we already knew that the *Café Indio* and *Borbón* are the best ones and with the best aroma and taste. With *Caturra* we get good yields because we plant 3,500–4,000 plants/mz [5,000–5,700 plants/ha] and this is the reason it produces more, but it also depletes the soil, because there are more plants competing to absorb the soil nutrients.[5]

Traditional varieties, planted at a lower density, have a low production per area and therefore occupy more land, which is one of the most constraining resources in the watershed. One mz of well-maintained *Indio* coffee can produce 22.5 qq/mz (1,461 kg/ha), while one mz of *Caturra* can produce 64 qq/mz (4,156 kg/ha), and coffee beans of both varieties are sold for the same price.[6] Traditional varieties also take longer to start producing: a plantation established with *Indio* will take five years to start producing, while a plantation with improved varieties will start producing in the second year. Thus, the good coffee prices during the 1990s and the possibility to obtain a better yield per ha motivated people to change to new varieties such as *Caturra* and *Catuai*.

At the end of the 1990s and in the first years of the 2000s, IHCAFE introduced new varieties such as *Café 90, Lempira* and *Catimor*. Producers tested these varieties and *Café 90* now occupies one fifth of the coffee area in Yorito, becoming the second most important variety in terms of area planted, after *Tipica,* showing a good acceptance for the variety.

Access to livelihood resources influenced the adoption of new coffee varieties (Table 7.3). Once farmers decided to diversify into coffee, the decision to establish coffee plantations with new varieties was less dependent on farm size than on area planted with coffee, and more dependent on having access to productive resources, especially credit and inputs. Moreover, adopting new coffee varieties strongly relates to having access to non-financial support services and training, and to networking with other people within and outside the community. Thus, participation in producer organizations and getting support from local and external organizations increases the probability of adopting new coffee varieties. Access to family labour and water on the farm has also encouraged the adoption of new varieties since both are important for planting nurseries.

The new management practices adopted in coffee production (Table 7.4) can be categorized into three groups of practices. The first group includes the use of chemical fertilizers, adopted towards the end of the DRI-Yoro Programme expansion period. IHCAFE promoted this practice, and to a lesser degree the DRI-Yoro technicians, but farmer-to-farmer diffusion was the most important.

Table 7.4
Adoption of coffee management practices in the Tascalapa watershed, 2004 (N=102)

New Practices	Use of chemical fertilizers	Shade Management	Planting density according to variety	Pruning after harvest	Planting in contour curves	Use of organic fertilizers
% of farmers that have tested the practice	19.0	64.3	29.6	19.4	16.3	13.3
Number of years since first trial	10.2	8.9	8.8	8.8	7.1	5.9
% of farmers that use the practice	12.1	64.3	29.6	19.4	15.3	12.2
% of farmers that recommended the practice to others	90.0	95.2	82.8	89.5	93.8	76.9

Source: Adoption and Livelihoods Survey, January 2004

Although IHCAFE did promote this, its main strategy was to modernize the crop by introducing new varieties, and reducing the shade on coffee plantations and using chemical fertilizers were secondary. The reduction of shade in coffee plantations had detrimental results in coffee production:

> Before, IHCAFE told us to plant coffee without shade but we had a bad experience because during the dry season the plants suffer from stress and loose their leaves.[7]

In 2004, only a small percentage of producers used these practices (7 and 12%, respectively), in part due to low coffee prices that failed to pay off the investment and because of a tendency to move away from chemical inputs towards more sustainable coffee production practices, promoted later by most external interventions and not only IHCAFE.

The second group of practices (introduced during the conclusion and transference period of the DRI-Yoro Programme) include the use and management of shade in coffee plantations, changing planting densities according to the coffee variety established, and the practice of pruning coffee plants after harvesting. IHCAFE and DRI-Yoro technicians, together with the newly-created technical assistance enterprises (Sertedeso and Codesa), promoted these practices (among others) for more sustainable coffee production; farmer-to-farmer diffusion was important but less than for the previous group of practices. Diffusion mechanisms for these practices (during the concluding period of the DRI-Programme and mainly during the Post-DRI period) included farmer visits to other places and, to a lesser extent, the use of communication technologies such as the radio.

The third group of practices includes planting coffee in contour curves to follow the slope of the land (important to reduce soil erosion), and the use of organic fertilizers. The DRI-Yoro Programme started to promote these practices during its concluding phase, but their adoption started during the Post-DRI Programme period. IHCAFE, the DRI-Yoro Programme and the newly formed Sertedeso and Codesa all promoted planting in contour curves, which had lower levels of farmer-to-farmer diffusion. By 2004, 15.3% of coffee farmers had plated their coffee using contour curves.

Access to livelihood resources influenced the adoption of input-intensive management practices in coffee production that require externally bought resources such as chemical fertilizers (Table 7.5). Access to human and social resources was less important for adoption of this type of practice, as were economic/financial resources, physical resources and a well-endowed (with water resources and flatter land) farm. In addition, access to private services that promoted the use of input-using technologies influenced their adoption.

Table 7.5

Influence of access to livelihood resources in the probability of adopting coffee management practices in Yorito, Honduras (N=102)

Variable	Input-intensive management practices	Knowledge-intensive management practices
	Estimated coefficients ($P>\lvert z\rvert$) [a]	
Economic/Financial Resources:		
Total Farm Size (mz)	*0.018*** [b] *(p=0.050)*	0.030 (p=0.128)
Area Planted with Coffee (mz)	*0.139*** *(p=0.022)*	*0.138*** *(p=0.090)*
Access to Productive Resources (Cattle)	*1.291*** *(p=0.028)*	*0.937*** *(p=0.053)*
Has received credit and/or inputs	0.271 (p=0.647)	0.588 (p=0.128)
Human Resources:		
Number of Training Courses Received and Applied	0.019 (p=0.882)	*0.419**** *(p=0.000)*
Interest in Agency Processes of Change[c]	-0.018 (p=0.975)	0.585 (p=0.139)
Years of Formal Education of the Household Head	0.132 (p=0.222)	*0.231**** *(p=0.014)*
Access to Family Labour (# of family members)	0.144 (p=0.229)	0.128 (p=0.126)
Has received non-financial support services	0.088 (p=0.889)	*1.391**** *(p=0.001)*
Social Resources:		
Is member of a producer's organization	0.644 (p=0.264)	*1.046**** *(p=0.010)*
Is member of a community organization	-0.606 (p=0.290)	0.146 (p=0.709)
Received support from		
any type of organization	1.331 (p=0.211)	*1.188**** *(p=0.013)*
an external organization	1.642 (p=0.122)	*1.739**** *(p=0.000)*
production-oriented external organizations	0.640 (p=0.305)	*1.042**** *(p=0.008)*
integrated rural development programs	0.384 (p=0.522)	0.194 (p=0.648)
community-based organizations	0.007 (p=0.991)	0.377 (p=0.381)
welfare-oriented organizations	-0.719 (p=0.367)	*1.117*** *(p=0.028)*
credit-oriented organizations	0.591 (p=0.328)	0.293 (p=0.512)
private services	1.165 (p=0.100)	0.615 (p=0.383)

(continued)

Table 7.5 *(continuation)*

Variable	Input-intensive management practices	Knowledge-intensive management practices
	Estimated coefficients (P>|z|)[a]	
Physical Resources		
Travelling time to the town of Yorito (minutes)	*-0.009** *(p=0.053)*	0.003 (p=0.328)
Natural Resources:		
Plot slope[d]	*0.740* *(p=0.093)*	-0.178 (p=0.547)
Arable land depth	0.042 (p=0.175)	*0.060* *(p=0.034)*
Water availability[e]	*1.316* *(p=0.039)*	0.200 (p=0.627)

Notes:
(a) Probability that the estimated coefficient is not equal to zero
(b) *** Significance level between 0.00 – 0.01; ** significance level between 0.01 – 0.05; and * significance level between 0.05 – 0.10.
(c) Households have been grouped using cluster analysis with the average link method in two groups: agency = 1 if household head has shown interest in experimenting and in participating in farmer organizations and work with institutions; agency = 0, otherwise.
(d) 1 = steep slopes; 2 = slopes; 3 = almost flat land; 4 = flat land
(e) 1 = has water all year; 0 = has seasonal water scarcity

Instead, knowledge-intensive innovations, such as shade management, adjusting planting densities to the variety planted, pruning after harvesting or planting in contour curves were more dependent on access to human and social resources. Contact with external organizations (through direct technical assistance or training) brought new knowledge to the local system, as did being part of a producer organization, where farmers had the opportunity to share knowledge. The latter was key to innovation on knowledge-intensive practices. Farmers with more area planted with coffee also had a higher probability of adopting these practices.

The effect of technological innovation on income and livelihoods (Table 7.6) shows that, on average, coffee yield is significantly higher among coffee producers that have established plantations with new varieties than among growers relying on traditional varieties. At average producer prices in 2004, growers of new varieties earned an extra annual gross income of US$ 92/ha (a 35% increase in gross income). Yield differentials are even larger for input-intensive management practices, which added US$ 441/ha (a 70% increase in gross income).These innovations also require a higher investment, and therefore their use depends not only on having access to resources, but also on their profitability, which depends on input costs and output price. The yield differential from knowledge-intensive practices is lower, representing only an extra annual gross income of US$ 82/ha (a 30% increase in gross income), but usually does not represent a significant extra cost.

Table 7.6
Analysis on yield differentials because of technological innovations in coffee (N=102)

Coffee Yields	New coffee varieties	Adoption of input-intensive management practices	Adoption of knowledge-intensive management practices
Mean Coffee Yield without the innovation (kg/ha)	445	495	505
Mean Coffee Yield with the innovation (kg/ha)	688	1,655	721
Mean Coffee Yield differential (kg/ha)	243	1,160	216
Probability that means yields are different	74.3%	99.7	76.7
Mean price paid to the producer (US$/kg)	0.38	0.38	0.38
Extra gross income (US$/ha)	92	441	82

7.1.3 Market-led innovations: bargaining power and accessing higher value markets

The DRI-Yoro Program succeeded in diversifying agricultural production in the Tascalapa watershed from beans and maize towards coffee, which had a market with high demand and good prices and offered potential to generate decent incomes for small-scale producers. New institutional arrangements also emerged to establish a distribution channel through local intermediaries, which in turn created a demand for coffee production in the region and established a market in Yorito.

Coffee production increased in many countries over the last decades of the twentieth century with the use of high yielding varieties, fertilizers, high-density planting and pesticides. Still, given the importance of coffee as a valuable product in the tropics, where it is a principal product of national economies, and its role in generating rural incomes and employment in many developing countries, development projects around the world have promoted coffee as a means to diversify hillside agriculture, and promote rural development. This increase in coffee production, together with the failure of participating countries to sign a new International Coffee Agreement in 1989, resulted in a crash in international coffee prices (see Figure 7.1), reducing farm-gate prices significantly. This induced farmers to limit the use of fertilizers, and in general, to stop maintaining their plantations properly, resulting in non-maintained coffee plantations, reduced yields, and reduced household incomes.

> During the last two years, I have not applied any organic or chemical fertilizers because with the actual coffee prices it is not profitable. The low prices have forced us to stop fertilizing the plantations and productivity has decreased. Without any fertilization, I have harvested last year 57 qq from the six mz [617 kg/ha] I have in production; this is a low production. With chemical fertilizers, I used to harvest 100 qq in the same area [1,104 kg/ha]. The technicians have recommended we prepare 'bokashi'[8], but some of the materials are not available here and bringing them from other areas is too expensive.[9]

Farmers lost interest in maintaining their plantations when prices fell, but some are starting to think about using organic fertilizers to maintain the crop during low price periods.

> Coffee brings us good memories, I owe this house to coffee and now that prices are low, we still do not want to give it up, because coffee always gives something. Four fifths of coffee producers lost interest when prices fall, and when prices increase their plantations are neglected. Then they try to take care of it again, but the production does not stay the same and even decreases. To avoid this problem, we are starting to think about organic coffee. We can use the pulp as fertilizer (normally it is wasted), it gives very good results and we do not have to spend on fertilizers. We have tried it and the yields increase, the plant grows strong and does not get any disease. Sertedeso has been helping with this.[10]

Since farmers were unable to apply the 'bokashi' recommended by technicians, given that not all the required materials were available at their farms, innovative farmers have been finding ways to overcome their production and market constraints. The deterioration in coffee market conditions has served as an incentive to search for new lower cost options to fertilize the crop. Thus, farmers started to experiment with different sources organic fertilizers and methods to produce them in their farms. The farmer quoted below (Oscar Nuñez) has been an innovator in using organic fertilizers in his coffee plantations, experimenting with them since the early 1990s.

> We started with organic fertilizers, because we used to work only with chemical fertilizers and, six or seven years ago, the plantation gave us a very high production (around, 30 qq/mz [1,950 kg/ha]). However, the next year the production dropped and the plantation became completely deteriorated, and we only harvested 4.3 qq/mz [280 kg/ha]. Somebody told me that this was a consequence of using too much chemical fertilizer and that we should trial with organic fertilizers. We started applying poultry manure but we had to buy it in the poultry farms and it was expensive to transport it to the coffee plantation. Then somebody told me that we could prepare our own organic fertilizer. Thus, we started to prepare it with cow manure, sugar cane processing residues, coffee pulp, and lime. I did not know how to prepare organic fertilizers, but I got a booklet from IHCAFE where they explained how to do it. Some of the indications in the booklet where OK, but then I started talking with other people that gave me other ideas, I kept on experimenting and improved it. IHCAFE also invited me to Santa Barbara where they have a Research Centre; I saw how they prepare the organic fertilizer; they talked us about the Californian worm, and I took some worms to my farm but I lost them. Thus, I started producing it without the worms but continuously mixing it to do the worms' job. I have been producing my own organic fertilizer for the last six years. It has stabilized the yields and reduced costs. This is how I kept my coffee plantations in good shape during these years of low prices when we do not make enough to buy chemical fertilizers. With organic fertilizer, I am producing the same 30 qq/mz [1,950 kg/ha] I used to produce, and even if some years the production drops, it does not produce less than 21 qq/mz [1.365 kg/ha]'[11]

Although, adoption of organic fertilization has been more the result of local knowledge and experimentation, external knowledge via different networks also fostered and enriched the innovation process. Sertedeso and Codesa supported coffee producers in their efforts by bringing new ideas that enriched local knowledge.

Given the effect of the coffee price crisis on reducing coffee plantations maintenance, but also on catalyzing farmer experimentation with organic sources of fertilization, a group of coffee producers, with the support of CIAT and CLODEST, started identifying new market opportunities for their crop. As a first concerted action, coffee producers negotiated their crop with an exporter in San Pedro Sula, leading to a 15% increase in price in return for strict grading and quality control. This improved the negotiation power of producers with intermediaries that are the traditional coffee buyers in the region.

> The negotiation process we have started with the exporter in San Pedro Sula to sell our conventional coffee for a better price has created competition for the Yoro wholesale intermediary. Because of this negotiation, the intermediary has agreed to pay 50-100 Lempiras (US$ 3-6) more per qq of dried coffee equivalent, thus we sold it for 600-620 Lempiras per qq of dried coffee equivalent.[12]

The second concerted action was the initiation of a certification process with the participation of 47 producers who wanted to sell their coffee in organic export markets. The price differential for organic coffee in the international market fostered the initiation of this innovation process. In 2002, the international price of coffee was US$ 50/qq, the lowest price since the late 1980s (see Figure 9), while the organic market offered a price differential of US$ 15-30/qq. In addition, the fair trade market offered a base price of US$ 121/qq, but with the organic certification, a premium of US$ 15/qq was possible, plus US$ 10/qq to invest in the development of the producers' communities. Thus, prices in the fair trade market at that time could reach up to US$ 146/qq; almost three times that of conventional coffee.

A casual meeting between coffee producers and Biolatina technicians, a certification company, in San Pedro Sula started the process. Biolatina agreed to provide training to coffee producers interested in organic certification and to do the inspection of their coffee plantations. Interested producers agreed to pay for training and the certification process. This was the first time that farmer groups paid for a support service in the Tascalapa watershed, showing a real demand for it.

As part of the training process, coffee producers visited similar experiences in Honduras and realized that they lacked the organization required to improve their bargaining power and export organic coffee themselves. This new market opportunity motivated the organization of producers to have the required volumes to attract Biolatina, the certification organization to the region, to negotiate their coffee production in the export market, and to fulfil the requirements for entering the fair trade market in the future.

In February 2002, 33 producers in the watershed had their coffee plantations certified as 'organic' and in November 2002, organic coffee producers formalized their cooperative. However, farmers that were able to certify their coffee as organic were those for whom it was worthwhile to make the investment of participating in the process, paying for the visits to other regions, the training courses and the certification visits to their farms.

In 2004, 12.2% of coffee producers were using organic fertilizers in their plantations. Using these fertilizers has not been influenced significantly by access to livelihood resources (Table 7.7) as to adopting other innovations. However, the transition to organic farming is linked to having access to credit and technical assistance, facilitated by participation in producer organizations. Having a water spring in the farm (access to water resources) also influenced the decision to make the transition from conventional to organic production, showing that having a better-endowed farm facilitated the process.

Although applying organic fertilizers seems a good alternative for coffee producers, the requirements for organic certification and its effects on return to the investment made for crop re-conversion are not clear. A 'capitalized family farmer', who made the profit-based decision not to continue with the transition to organic coffee, explains his decision.

> I have started with organic coffee this year. The technicians of Sertedeso have given us orientation in organic production, especially on the preparation of the organic fertilizer; I participated in the workshops organized by CLODEST and CIAT, as well as in the training sessions with Biolatina and the tour to Marcala to visit an organic producer's cooperative. Nevertheless, I am retiring from the project because this is delicate. This year I have applied 40 qq of chemical fertilizer in my son's plots, he is in the USA and I take care of his crop. My plots are all organic, I have applied onion and lime to control pest but it is no very effective. I have made 25 trips with bean crop residues, bringing my car full of them. I have paid for the inspection of Biolatina, but they said we have to decide whether we are organic or not, that we have to choose, and we cannot have a single bag of chemical fertilizers in our farm. I think that I am not going to continue with the process of becoming an organic producer because although the difference in prices is big, 1 mz with chemical fertilizer produces more than 1 mz of organic coffee. A technician from IHCAFE has told me that

1 mz with chemical fertilizer can produce 40 qq if you take good care of it, but 1 mz with organic will only give you 20 qq.[13]

Table 7.7
Influence of access to livelihood resources in the probability of doing the transition into organic coffee production in Yorito, Honduras (N=102)

Variable	Estimated Coefficient	P > |z| [(a)]
Economic/Financial Resources:		
Total Farm Size (mz)	0.006	0.142
Area Planted with Coffee (mz)	0.049	0.141
Access to Productive Resources (Cattle)	0.867	0.169
Has received credit and/or inputs	*1.378*	*0.085*[*(b)]
Human Resources:		
Number of Training Courses Received and Applied	0.124	0.324
Interest in Agency Processes of Change[(c)]	0.546	0.433
Years of Formal Education of the Household Head	0.176	0.117
Access to Family Labour (# of family members)	0.020	0.879
Has received non-financial support services	1.676	0.116
Social Resources:		
Is member of a producer's organization	*1.083*	*0.093*[*]
Is member of a community organization	-0.216	0.728
Received support from any type of organization	-[(e)]	-
Received support from an external organization	-[(f)]	-
Received support from production-oriented external organizations	1.378	0.085[*]
Received support from integrated rural development programs	-0.196	0.780
Received support from a community-based organizations	1.048	0.091[*]
Received support from welfare-oriented organizations	0.052	0.941
Received support from a credit-oriented organizations	1.259	0.044[**]
Received support from private services	0.747	0.379
Physical Resources:		
Travelling time to the town of Yorito (minutes)	0.002	0.631
Natural Resources:		
Plot slope[(d)]	-0.290	0.533
Arable land depth	0.047	0.144
Has a water spring in the farm	*3.012*	*0.005*[***]

Notes:
(a) Probability that the estimated coefficient is not equal to zero
(b) *** Significance level between 0.00 – 0.01; ** significance level between 0.01 – 0.05; and * significance level between 0.05 – 0.10.
(c) Households have been grouped using cluster analysis with the average link method in two groups: agency = 1 if household head has shown interest in experimenting and in participating in farmer organizations and work with institutions; agency = 0, otherwise.
(d) 1 = steep slopes; 2 = slopes; 3 = almost flat land; 4 = flat land
(e) Correlation between transition to organic coffee and support received by any type of organization is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.
(e) Correlation between transition to organic coffee and support received by any type of organization is one and therefore cannot estimate coefficient, but influence in the dependent variable is significant.

Producers with smaller coffee plantations and with fewer resources who have obtained organic coffee certification have had more difficulties participating in the producer group and sticking to their decision.

> It has been a year since we started with this process and I think it has been a good initiative, but I have found it too difficult to collect the materials to prepare the organic fertilizer because it is not possible to find everything in this community. For example, we do not have cattle here and we have to bring the manure from other places. Transporting 30 qq of manure to my coffee plantation costs 400-450 Lempiras (US$ 23) per trip, if I have 3,000 plants per mz and applying 4 lb per plant, then I need four trips that have a cost of 1,800 Lempiras (US$ 108), and I found this too expensive. We are also in the process of constituting a cooperative and this requires a contribution of 320 Lempiras (US$ 18) per member for the legal costs. The certification costs were 400 Lempiras for the first inspection and 500 Lempiras for the second one, totaling 900 Lempiras (US$ 54), we also had to make a contribution of 50 Lempiras (US$ 3) for the visit to Marcala. CLODEST has been helping a lot but this has a cost and may not be worthwhile for small-scale producers: I only have 1¼ mz of coffee. I have been losing interest in this. I need to decide whether I pay for this or buy food for my family."[14]

The 2002/2003 coffee harvest was not negotiated as organic because negotiations in this market are done during the month of September, prior to the harvesting season (November-February) and at that time producers did not yet have the certification. For the 2003/2004 coffee harvest, CIAT's Rural Agro enterprise Development Project support staff in Honduras negotiated an export contract for one container of organic coffee. However, the negotiated price was only US$ 5-10 above the

New York board of trade price, in contrast with the expected US$ 15-30 price-differential. This price differential did not even justify the extra cost of US$ 10/qq to further process the coffee to comply with the requirements for export. Marco Vasquez, CIAT's research assistant, explains how difficult it was to obtain a better price differential for organic coffee,

> Organic coffee prices are currently low, only US$ 5/qq above the New York board of trade price. Maybe the best price differential you can get is US$ 20/qq, some talk about US$ 30/qq but who knows where they get this price. This organic coffee business is not as good as expected. They also talk about the famous Fair Trade certification that pay US$ 140/qq, however the procedure to sell in this market is as complicated as asking for an interview with Bush, and they say that now they are going to charge for the certification. There are other better alternatives as selling to Starbucks, who pays between US$ 100-130/qq, but quality standards are strict. 15

The reality is that 'fair trade coffee' is facing the same oversupply problem as the larger market. The half a million farmers (according to Jeffrey 2002) certified by Transfair produced 170 million pounds of coffee in 2001, yet only 40 million pounds were sold under fair trade terms and the rest at normal market prices. This shows that diversifying into 'niche' markets and then adopting a mass production approach will naturally oversupply small markets more quickly than the larger traditional commodity markets. On the other hand, the rise on international coffee prices since 2003 (see Figure 7.1) has reduced the price premium for 'organic coffee', reducing the return on investment of entering into this market.

The second problem faced by coffee farmers was the lack of collective action. Of the 33 producers that had their coffee certified as organic, only eleven delivered their corresponding coffee export quota. Thus, it was impossible to fill the required container and the exporter cancelled the contract. The cooperative was fortunate that the exporter had not signed a formal contract with the buyers; otherwise, the buyers could have faced a legal suit brought by the exporter that would have been transferred to the producers' cooperative. Sound organization needs to support this type of innovation, especially when dealing with smallholders. Coffee producers belong to the Honduras Coffee Producers' Association, AHPROCAFE. By law, producers pay dues through a de-duction per bag sold, and thus all automatically belong to AHPROCAFE. Fifteen district boards are represented in AHPROCAFE. These represent the local boards (municipal level) and the Rural Boards that exist in all coffee producing communities. However, when coffee producers were asked to which community organizations they belong, only 9.8% said they belonged to AHPROCAFE, and only 6% participate in the coffee producers' cooperative, COOPROCAIL, organized to improve coffee commercialization. Although, there have been many external intervention initiatives to organize coffee producers for different purposes (to receive an ecological coffee-processing unit, to collectively produce coffee, or to commercialize conventional and/or organic coffee), the results have not been outstanding.

The third problem for organic coffee producers has been the low availability of financial resources, which limited their ability to wait one or two months to receive the payment for their coffee. Thus, the exporter proposed to pay for the coffee at the market price one week after receiving the coffee in its warehouse, and then pay the price differential once the importer paid for the coffee. However, producers (lacking credit) did not accept this proposal. Only 27% of coffee producers receive support from institutions that provide credit and 44% have had access to credit at all.

> Organic coffee certification is only useful if producers are prepared to export. This requires that they comply with the negotiated volume and quality, have the financial capacity to sell the coffee and wait at least a month to receive, and have negotiated at a feasible price given the investment that the certification requires.[16]

7.1.4 Characteristics of diversification to coffee and innovation processes

Two diversification processes have taken place in Yorito since the mid 1980s. The first was diversification from basic grains (beans and maize) to coffee production, and the second was the intent to move from conventional to organic coffee markets. These diversification processes were driven by a combination of factors. First, there was sufficient pressure and urgency in the system for finding improved sources of cash income to secure the livelihoods of smallholder households. Second, the DRI Yoro programme played a key role in improving access to those livelihood resources providing an enabling institutional environment. The programme improved access to basic infrastructure, essential for improving coffee commercialization, facilitated access to financial resources, upgraded human resources through training and technical assistance, and promoted farmer organizations and networking to create new opportunities and legitimate leadership in the process. Third, a combination of market conditions triggered the innovation process. During 1990-1998, coffee prices increased at an annual rate of 9.6% creating an important incentive to diversify to coffee or expand coffee plantations. Furthermore, coffee was not a completely new crop; a supply chain already existed, together with the necessary institutional arrangements required to move the product from the farm to the consumer, reducing substantially crop diversification and expansion risk. As prices of coffee in the conventional market started to decrease since 1999 until 2004 at an annual rate of 11.4%, coffee producers in their search for alternative market opportunities for their coffee crop started to re-convert their plantations to enter the organic market that offered a price premium. However, as prices in the conventional market started to increase again in 2005, the incentives to sell in fair trade and organic markets decreased.

As most innovation processes not all the target population was included, although 53% of households have established coffee plantations. The major constraint for the poorest has been access to land; none of the external interventions has promoted the necessary institutional changes to improve access to this basic resource. The second constraint has been people's interest in participating in and managing processes of change. Although, external intervention provided training and technical assistance and promoted organisational processes, it cannot force everyone to participate. The individual choice to participate was essential for anyone wishing to take advantage of the opportunities provided for diversification to coffee. Thus, producers interested in diversifying to coffee, with available land to do so, have been able to establish coffee plantations, and have consequently benefited from subsidized credit, re-investment of profits from coffee, maize or bean during good cropping seasons, or by buying future production at very low prices from farmers who need to finance their crops. Some households also established coffee plantations with remittances from household members who have migrated to the USA or to urban areas within Honduras; such remittances also came from the temporary migration of the household head.

The livelihood outcomes for those households able to diversify are important. During the 1990s, when coffee prices were higher, households were able to improve their houses and in general achieve better living conditions. Even in 2004, despite record low international prices, coffee provided 76% of cash income from agricultural activities among households with coffee plantations, generating an average gross income from coffee sales of US$ 920 per year. In addition, households with coffee plantations generated an average gross income of US$ 1,150 per year from agricultural activities, compared with US$ 570 among those without coffee plantations (though there are significant household-to-household differences, related to the area planted and therefore with the volumes produced). In any case, coffee provides important cash income. However, given 2004 average coffee prices, this does not even provide a minimum monthly legal wage (US$ 105 per year). There has been a continual fall in farm gate coffee prices in the early 2000s, despite the fact that the retail price of coffee in western nations continues to rise (Robbins and Ferris 2002).

Once smallholders have diversified to coffee, IHCAFE has been introducing new coffee varieties and has promoted a green revolution technological package, following a 'transfer of technology' approach. IHCAFE just told farmers what to do, but did not promoted a dynamic and effective innovation process. The latter would have been needed to perform well in a highly competitive market such as coffee. Thus, coffee innovation in Yorito and in Honduras in general, lagged behind that of other competing countries, resulting in lower productivity and overall competitiveness.

Coffee producers have responded to the pressure of maintaining coffee plantations despite low prices that do not provide enough income to buy chemical fertilizers, by applying organic fertilizers. The decline in coffee prices has induced a significant reduction in chemical fertilizer use, serving as an incentive to search for new ways to fertilize the crop. External intervention with respect to this initiative has failed to support farmers' experimentation and has given contradictory messages.

The adoption of new coffee varieties and crop management innovations has not led to outstanding incomes. Limited access to productive and financial resources affected the adoption of new coffee varieties but more importantly so did access to non-financial support services and networking. An inability to promote a multi-level, coordinated network of interdependent stakeholders is vital to promote effective innovation, but this has not been one of the strengths of 'transfer of technology' approaches. Restricted access to financial, productive and physical resources limited the adoption of input-intensive management practices, while limited access to human and social resources restricted the adoption of knowledge-intensive management practices.

In the late 1990s, IHCAFE, along with other intervening agencies, realized that most of the support given to coffee producers centred on production technology and that there was a need to support them to sell their coffee for better prices. Thus, intervening agencies started to support coffee producers to improve their negotiating power in the conventional market and to enter into higher-value coffee markets. Coffee producers opted for the organic coffee market and 33 of them were able to get this certification. However, the process failed because the market was not as promising as expected, the organization process failed, and producers lacked the financial float needed to wait two months to get paid for their coffee.

The technological innovation [the hardware] worked, action research [the software] and the organization to get the organic certification [orgware] also worked, but although the later seemed to be functional, it failed when price premiums for organic coffee became non-profitable. The process lacked an enabling institutional and policy environment [the institutional and policy-ware] to address higher-level issues in the policy arena, and nobody's hardware or software or orgware has been able to do so. The only farmers in the world who have ever dealt with such issues are farmers in the developed countries, and they have done so via market regulation and good old supply management.

7.2 Diversification to Blackberries in the Cabuyal Watershed

Mean cash income from blackberry production (US$ 198.27 per household per year) is third in importance, after coffee (US$ 607.24 per household per year) and cassava (US$ 377.46 per household per year). Mean cash income from blackberry production in the upper watershed is much higher (US$ 573.94 per household per year) and is the first in importance followed by cassava (US$ 521.71 per household per year), coffee (US$ 514.46) and tomatoes (US$ 412.97). Thus, blackberry production is an important source of cash income for upper watershed farmers.

Based on blackberries, cassava, coffee, and tomatoes, the upper watershed has a higher average gross cash income from agriculture (US$ 2391.55 per household per year) than the middle (US$ 1,457.26) and lower watershed (US$ 1,783.57).

7.2.1 Blackberries cropping as a commercial activity

Diversification to blackberries in the Cabuyal Watershed in Colombia is synonymous with the name of Pedro Herrera, who provided leadership in this process. Blackberry producers in the region recognize that Pedro Herrera has been a role model and has motivated them to test this new crop with a commercial purpose. Pedro Herrera's father was a *mestizo* with a half of a hectare farm where he planted coffee, plantain and sugar cane. As his family expanded, the produce of the farm was not enough to provide a livelihood for the household. He heard that in a the upper reaches of hills (some 1,500 meters above sea level in the nearby municipality of Caldono) it was possible to acquire land because people were not cultivating the hilly land and preferred to rent land near the rivers or in flatter land. Thus, his father sold the farm in Piendamo and moved with his family to the community of La Primavera (The Springtime) in the upper hillsides of Caldono. This community did not have electricity and the aqueduct had major deficiencies since it was built provisionally while the community gathered the necessary resources to build a permanent one. At this time, Pedro was 14 years old and had left the school in the third grade because his father lacked the resources to send him to school:

> I was a smart kid in school but my family could not buy me a single notebook. My father gave me a blackboard and told me to use it since I could write, erase and re-use it. I used to look for second-hand notebooks; I took the used pages and fixed them so I could do my schoolwork. However, I could not continue studying and had to start working in the field with my father.[17]

Lack of formal education was not an impediment for Pedro to work as a day-wage worker: he only needed to know how to use a hoe and shovel. In addition, they were busy conditioning the newly bought farm to start producing maize and beans. After having met the family's food security needs, they started to plant coffee. It was a good way to generate cash income because there was an established commercialization channel in the region through the Coffee Producers Committee. Later on, people in the community started to use oak trees to produce charcoal, and it became an important economic activity in the upper watershed, but placed a strong pressure in the forest. Although farmers had wild blackberries in their backyard, the product did not have a commercial market.

Back in 1991, a CIAL in the community of Sotará, promoted by CIAT's IPRA Project, started to conduct research on blackberry production. Producers were interested in the crop because it was well adapted to the upper reaches of the hillsides, did not required large areas of land, and had a good market demand. This group experimented with the local variety and a commercial one called *'Mora de Castilla'* and started multiplying the plants and distributing them among interested farmers:

> I started planting blackberries because I went to a farm in Sotará and the crop looked so beautiful, the plants were full of big blackberries, and I though it had to be a good alternative. Thus, I brought a few plants to my farm, prepared some land and started to plant. At that time the market for blackberries was complicated, I used to sell a pound for 30 or 40 pesos (4-5 US cents) and that was cheap; there were almost no buyers in the region, but I continued working, increasing my area and experimenting… I like to experiment very much.[18]

Because there was no technical assistance in the region at that time for producing blackberries, Pedro got a booklet from the Federation of Coffee Producers of Colombia (which was promoting the crop in other regions of the country). The booklet described the crop and gave some instructions on how to plant and grow it, and with this, he started his first commercial plot. Over time, he realized that blackberries were more profitable than coffee and started gradually replacing his coffee plantation with blackberries. In addition, blackberry fields could be managed with family labour:

> I used to have a very good production of coffee. I used to harvest 50 qq from the 5,000 plants I had, but the profit was little; most of what I gain from coffee sales was spent paying for the workers.[19]

Before 1992, State presence in the Cabuyal upper watershed was limited to the building of roads and the State enterprise in charge of energy production, water supply and natural resources management, the Autonomous Corporation of the Cauca Valley (CVC), which was engaged in preservation of water sources and the forest. Pedro Herrera's fields lie at the head of a 7,000-hectare area drained by the Cabuyal

River, which in turn feeds into the larger watershed of the Ovejas River. Water from Herrera's land eventually makes its way to the city of Cali with approximately 3 million habitants, 100 kilometres to the north, and the CVC was mainly interested in managing this water source for water supply and energy production.

The first external intervention related to agricultural production in Pedro Herrera's community started in 1992 when the UMATA started working in the upper watershed with funds provided by the DRI Fund. The UMATA started a blackberry demonstration plot, recognising both the market opportunities of the crop and the interest of farmers. At that time, the UMATA of Caldono had a Director and six technicians in a municipality where 95% (27,182) of the population was rural (Comité Departamental de Estadística, 2000), resulting in approximately one technician for each 1,000 farmers. In Caldono, DRI Fund resources were initially used to strengthen the logistic capacity of the UMATA, but they were insufficient to develop the different productive projects planned and to respond to all the demands of farmers. After 1994, the DRI Fund stopped sending resources to the UMATAs, leaving the responsibility of financing them to the municipal governments. In 1995, the UMATAs in Colombia were only reaching 27% of the potential demand, although there were regional differences (Bernal, 1998). The UMATA of Caldono ended up with a Director and only two technicians, forcing them to concentrate their work where there was less NGO intervention:

> As the UMATA, we are in charge of providing technical assistance. When we began, we prioritized a few crops and started to establish demonstration plots for these: blackberries in the upper watershed, beans in the middle watershed and cassava in the lower watershed. We had resources from the DRI Fund to do this work. We wanted to compare farmer practices with a plot managed with the technological package. The DRI Fund paid our salaries, but also the cost of establishing these plots and all the operational costs. But after the responsibility of financing the UMATA was handed over to the municipality, it no longer had the resources to continue with the work. Now the municipality of Caldono pays our salaries and gives us a small operating fund to invest with farmers, but it is never the same as before.[20]

Because the UMATA lacked resources, the demonstration plot was short lived. CIAT, which had started a CIAL in the community of Buenavista, a neighbouring community, gradually took over the work done by the UMATA, using a farmer participatory research approach. Pedro Herrera says that he has learned a lot in the CIAL, especially in the visits they made to other blackberry producing communities.

> With the CIAL, we started to experiment with blackberries but also with lulo [*Solanum quitoense*][21], beans and maize. We planted a blackberry plot on land lent by a neighbour. We used to call the technician to explain us how to prune the plants and manage pest and diseases, and we started experimenting to improve crop management. We did it well. We are not specialists but we have learned a lot because now people come from other places of Colombia (Nariño, Medellin, and the Savannas of Bogotá) to see our crops and they tell us our crop looks very well, because they have had many problems with pests and diseases. We manage pest and diseases mainly by pruning the plants and burning the cropping residues. Moreover, besides having all these experiments, the CIAL used to take us to farms with more technology, were we were able to see many things such as organic fertilization and live barriers to prevent soil erosion; then we used to come back to our fields and apply what we thought was good. Sometimes, I also use some chemical fertilizers with potassium and phosphorus to have a better harvest. Many people that have come here have told us about organic agriculture, but this is very difficult because of nutrient deficiencies in our soil. In addition, when many people start planting the same crop, pest and diseases start to spread.[22]

A market opportunity identification and evaluation study, conducted by CIAT's Rural Agro-enterprise Development Project with support from CIPASLA, also informed this diversification process:

> When our project started to work with CIPASLA in the mid 1990s we started to talk about the need of the people to improve their incomes, but the agronomists working in the region, both from the NGOs and CIAT, did not see this as important. They had the idea that if farmers were producing beans, they had to continue with that, and what was important was to increase bean yields. We started to talk about markets and demand as the entry point. They invited us to the technical committee meetings of CIPASLA, and yes, they listened to us, but immediately forgot everything. Technicians were paid to do other things. Afterwards, the same people from the community started to claim that taking care of resources was fine, but they also needed cash income. They used to argue that it was fine to do research, but it should respond to market demand. I started to work developing a study to identify and evaluate market opportunities. We started with a biophysical and socioeconomic profile of the watershed,

then we did a market study in its area of influence, including Popayán and Cali, and finally we characterized the market options that we identified. This included blackberries, lulo [*Solanum quitense*], uchuva [*Physalis peruviana*}, strawberries, guava, flowers, figs, and snap beans, among others. We presented these options to farmers and they selected the ones they liked. Maybe this first experience was not participatory, but at least it was a consultative process and we were trying to understand better their problems, needs and interests. At the same time we started promoting an agro-industrial committee in CIPASLA'[23]

In 2004, blackberries occupied 5.3% of the area under temporal crops and provided 4.3% of cash income from agricultural activities in the Cabuyal watershed (blackberries are only grown in the upper watershed, 2000-3000 m above sea level, where they occupy 14.4% of the area under temporal crops and provide 12.5% of cash income from agricultural activities). On average, farmers started planting blackberries nine years ago, in the late 1990s (1996-1997). Half of those who grow blackberries got the idea from seeing other farmers in the watershed and the other half took the idea from technicians from the UMATA, SENA or from contacts with people from outside the watershed. Ninety-one percent of farmers think that they will expand their areas planted with blackberries if they will have the resources.

Nobody planted blackberries in these communities, only Pedro Herrera was doing it. One day, fourteen producers from the community got together and Don Pedro told us about his blackberry crop. Afterwards we had a meeting with doctor Nacho Roa and Carlos Quiroz from CIAT and other technicians, and told them that we wanted to learn more about blackberries and we presented a project to ASOBESURCA. While we were waiting for the resources from ASOBESURCA, CIAT put some money in, and gave us chicken manure and lime to plant the blackberries. I got into the project because Pedro told us his story with the blackberries; he said it was a good crop and that he was making his livelihood mainly with blackberries, that it was a product easy to sell. He taught us how to plant and manage the crop, and we got into it.[24]

In 2004, 8.8% households had diversified to blackberry production and in the upper watershed, 25.6% of the households had done so. These households have an average area planted with blackberries of 0.9 ha (ranging from 0.12 and 2.25 ha) and have a mean annual production of 115 qq valued at US$ 2,730, giving an equivalent monthly income of US$ 227 (nearly twice the minimum wage in Colombia).

> My father did not know this crop, but for me, blackberries have been a very good thing. They do not require hard work; you can do all the work with family labour. It is better than coffee because you harvest it every eight days and receives your cash income once a week. With coffee you have to wait for harvest time, harvest it, then process the beans and dry them, it is much more work, while with blackberries, you only have to pick them every week, and if you are going to sell to an intermediary, you go out and you sell them immediately.[25]

Table 7.8 shows the results of the analysis on how access to livelihood resources has influenced the decision to diversify to blackberry production. Farm size has had no influence in the decision to diversify to blackberry production since one of the most attractive characteristics of this crop is that it does not require much land to provide an acceptable level of income. A hectare of land with blackberries can provide a household with an income equivalent to two monthly legal wages along the whole year. In addition, it is important to note that access to land is not one of the most constraining resources in the upper watershed (where most blackberries are planted) since the indigenous authority owns most of the land and the households that belong to this have fewer problems accessing the land (see quote from Jaime Ulchur, Caldono, page 94)

Small-scale blackberry producers in Buena Vista have not found access to land to be a constraint neither:

> Here it is not difficult to rent land for agriculture because there is a lot of uncultivated land in this community. There is no land owned by the indigenous people, they wanted to put this land under the indigenous authority but we did not want this, because here everybody has a plot and it is easy to rent land if you need it. People cannot cultivate all their land because they lack the financial resources. A blackberry crop requires resources; I have already invested four million pesos (US$ 1,600) in my blackberry crop. Of course, you can regain this investment if you do not lose the crop; this crop gives the highest profit.[26]

Having access to other productive resources and financial resources also did not influence moves into blackberry production. However, informal training (as measured by the number of courses, workshops or field trips taken by any member of the household that were useful and knowledge acquired was applied to productive activities) did.

Table 7.8

Influence of access to livelihood resources in the probability of diversifying into blackberry production in Caldono, Colombia (N=117)

Variable	**Estimated Coefficient**	**P > |z[(a)]**
Economic/Financial Resources:		
Total Farm Size (ha)	-0.001	0.991
Access to Productive Resources (number of cattle heads)	-0.084	0.662
Has received credit and/or inputs	-0.223	0.763
Human Resources:		
Number of Training Courses/Workshops/Field Trips Received and Applied	*0.295*	*0.066[*]*
Interest in Agency Processes of Change	-0.017	0.976
Years of Formal Education of the Household Head	-0.058	0.623
Access to Family Labour (# of family members)	-0.142	0.464
Has received non-financial support services	0.504	0.644
Has received support on price information and commercialization	-0.073	0.379
Social Resources:		
Is member of a producer's organization	-0.103	0.882
Is member of a community organization	-0.470	0.503
Received support from:		
any type of organization	-0.172	0.877
an external organization	0.693	0.524
production-oriented external organizations	0.808	0.457
natural resource management-oriented external organizations	*1.804*	*0.015[**]*
a community-based organization	0.182	0.794
welfare-oriented organizations	-0.686	0.407
credit-oriented organizations	-0.435	0.690
Physical Resources:		
Travelling time to the town of Pescador (minutes)	*0.015*	*0.045[**]*
Natural Resources:		
Plot slope	0.246	0.683
Arable land depth	***0.036***	***0.038[**]***
Has a water spring in the farm	-0.455	0.515
Water availability	0.844	0.229

Note: (a) Probability that the estimated coefficient is not equal to zero.

> We had many meetings with Carlos Quiroz in Pescador... I think he is from CIAT. We had workshops for a whole year. They taught us about blackberries from the root to the top of the plant, and I still have all that information. We started with five plots in the community, each with 200 plants. They told us that they were going to give us 700 pesos (US$ 0.28) per plant, the poultry manure to fertilize and everything for us to plant, but they did not give us anything. We waited for a long time, but at the end we only got the seed. They came on a Sunday and the group was big, but you know that not everybody works the same. Some took the plants from the top branch and that was not the right way to do it, some plants dried up. I knew that was not right, so I told my son how to do it and to help me separating our plants from the others. Although they never brought the organic fertilizer, I decided not to lose my work and to plant blackberries. Today I have my blackberry crop, from the five plots we planted, mine is the best. I am taking good care of the crop.[27]

> The grandfather of my wife encouraged me to participate; they took us to the farm of a man called Tiberio in Versalles and I liked the way he works. Then we started to meet with Pedro Herrera, he told us how he started planting blackberries. I continued participating and we went to other field-trips. We went to the farm of 'el Turco' and I liked how they planted there, he had a variety of crops, and the way they were recuperating the eroded soils. Then we went to a farm in Yotoco where we saw how they prepared organic fertilizers with earthworm compost. I have my blackberry crop now and I am applying many things that I have seen on those trips.28

Access to natural resource management-oriented interventions also had a significant influence in the decision to diversify to blackberries. These were from organizations that supported diversification to blackberries, but as discussed early, their interest in the upper watershed was mainly in the management of natural resources, and specifically water. Water has always been a contentious issue: communities in the lower and middle watershed get their drinking water from an aqueduct that has its water intake in La Esperanza, an upper watershed community. When water becomes scarce, people in the lower watershed used to blame people in the mid-altitude communities for transgressing existing regulations by using drinking water to irrigate their tomatoes. Mid-altitude communities in turn claimed that there was seasonal water scarcity because people in the upper watershed were cutting down forests in the area from which the aqueduct takes its water. People in the upper watershed defended themselves by saying that they had no alternative source of income other than clearing the woodland. They also argued that they were significantly disadvantaged in roads, schools, piped water and electricity. Thus, they could not see why they should give up their incomes to benefit better-off, low-lying communities (Ravnborg and Ashby 1996).

The need to produce food crops and generate income in the upper watershed seems to have been at the root of the area's water problems:

> My family has always lived here. My father used to sell charcoal, he used to burn a lot of oak in a partnership with a man that lived higher than we did, and they use to live on that. When they were not burning oak trees, they used to clear the forest for planting maize and beans; they usually cleared the land between July and August and planted in September and October. After I left school, when I finished the second year of primary school, I used to work as a day-wage worker or harvesting coffee, and I had to help my father to cut the trees and burn the wood to make the charcoal. He used to sell it in Piendamo. Sometimes, the CVC confiscated the charcoal and used to fine those who were selling it. My father got his charcoal confiscated many times and had to pay many fines. Now this business is over, there is almost no wood and the trees we have are in the riverbanks and water springs.[29]

Thus, multiple stakeholders were interested in finding a more environmentally friendly income generation alternative than charcoal production for the upper watershed communities, to protect their water resources. Blackberries were seen as a good option, both to generate income in the upper watershed and to reduce deforestation there, and were therefore promoted by external agencies interested in natural resource management.

Access to the Pan-American Highway, which crosses the town of Pescador, has not affected the decision to diversify to blackberry production, since this is balanced out by the fact that the climate in the upper watershed (more distant from Pescador) is optimal for blackberries. This explains why travel distance from Pescador has a significant positive effect in the decision to plant blackberries. However, communities relatively near the Pan American Highway, letting producers bring their product to the near towns as well as the cities of Popayán and Cali.

Soil quality, measured by the depth of the arable land, has had a positive effect on the likelihood of diversifying to blackberry production, but the availability of water does not, even though water is a scarce resource and represents a risk factor in blackberry production.

> I worked during eight years with the JAC [Local Development Community Board]. During those years, we were able to build an aqueduct in the community and get electricity services; before we did not have water or energy in this community. However, we still have problems to get water to irrigate our crops. If the dry season becomes too long, we face the risk of losing our blackberry crop. A small stream passes through my farm but is not enough and I have to share it with my brother.[30]

Some blackberry producers have solved their water supply problem with resources from the indigenous authority:

> I have my own water source. To build the aqueduct, the Federation of Coffee Producers told us that they could give us the tank but that we needed to supply the sand, the cement and our labour. I went to the indigenous authority and asked for the sand and cement and I got it. When the Federation came, we had the required infrastructure and they gave us the tank. Then, because we needed to bring the water to the tank, my sharecropper partner gave me a hose, and the Local Water Board gave me another one that was buried. Thus, I have my own water for home consumption and for irrigation. Of course, when the dry season is too long, I have to negotiate with the Water Board to get the water during the night… before 5:30 a.m. They let me do it because they understand that I am working hard with my crops.[31]

7.2.2 Supply-led innovations in blackberry production

As discussed above, outside interest in the upper Cabuyal watershed started only in the late 1980s, because it is an important source of water, both for the medium and lower watershed communities and for cities such as Cali. Organizations such as the UMATA and CIAT started working in the upper watershed only in the early 1990s. CIAT's interest was also in watershed management. Therefore, the UMATA, and latter on SENA, were the only external organizations that provided technical assistance to blackberry producers. CIAT supported blackberry research conducted by the CIAL, but did not conducted strategic research on tropical fruit production at that time. Thus, most of the technological innovations aimed to increase blackberry productivity came from other regions, or more importantly, were based on basic principles learned with participatory research on other crops such as beans. Fertilization (organic or chemical) and weeding were already used with other crops. Training was a practice introduced to prevent diseases and improve product quality in climbing bean production. Pruning and burning of the residues to prevent diseases was a practice that farmers had seen during site visits to other regions. Thus, the role of institutionalized external intervention in supply-led innovations on blackberries was limited.

With limited knowledge and the support of non-specialist organizations, starting with a new crop was not easy. Farmers learnt by trial and error and through contacts with people from other regions with more experience:

> When I became interested in planting blackberries, the CVC used to work here. One day I told the technicians that I was interested in learning how to produce blackberries. Thus, they came here and gave me some instructions but with no practice. I went and cleared a plot and planted it with blackberries as I had been told to do, but I had no experience with the crop. I planted a wild blackberry that we have here and all of it took root, I applied organic fertilizers and it grew a lot but there was no fruit. A man from Popayán came, saw my plantation and told me that I was wasting my time, that what I had was wild blackberries and they were not going to give me any fruit because that was a different plant. This was true; I got no crop and cleared all the land. A boy brought me a blackberry plant from Buga in the Valle del Cauca Department and told me that this was the plant to produce blackberries. I planted it and the crop started to expand, I did not know very much on how to manage the crop but I placed some stakes to lift the plants, and I had a crop. They told me that I had to prune after harvesting and with the plants I cut, I planted more and from that plant, I obtained more seed, and that was good seed. Now I have a very good quality blackberry, the fruits are big, round and black, this blackberry is beautiful.[32]

In 2004, all blackberry producers knew the new variety 'Mora de Castilla', have experimented with it and have it planted in their commercial plots. Mean yields were 4.6 ton/ha per year, lower than the average yield in Colombia (between seven and 8 ton/ha per year) and lower than the average yield in neighbouring Valle del Cauca Department (5.5 ton/ha per year). The UMATA and CIAT provide technical assistance in blackberry production as well as other external organizations such as SENA and CORFOCIAL. CIAT promoted the latter, establishing it in 1994. With this assistance, farmers have learned more on pest and disease management, use of fertilizers, and management practices such as pruning and training.

Table 7.9
Adoption of improved practices in blackberry production (N=10)

Management Practice	Producers who use the practice (%)	Mean yield of those who use the practice (ton/ha)	Yield differential with respect to those who do not use the practice (ton/ha)	P > t Ha: mean diff > 0 or (diff < 0)	Income differential at average 2004 prices (US$/ha)
Prunes after harvesting	60.0	4.1	-1.1	0.68	-
Applies organic fertilizer	*60.0*	*5.3*	*1.5*	*0.74*	*809*
Applies chemical fertilizers	30.0	4.3	-0.5	0.58	-
Applies lime	30.0	4.1	-0.7	0.59	-
Trains the plants	*60.0*	*5.3*	*1.5*	*0.74*	*825*
Weeds the crop	*70.0*	*5.2*	*1.7*	*0.75*	*916*
Controls diseases by cutting and burning affected branches	70.0	4.9	0.7	0.61	-
Prevents diseases by burning prune residues	70.0	4.9	0.7	0.61	-

Table 7.9 shows the use of crop management practices and the yield differentials among those who use these practices and those who do not use them. Given the limited number of observations, a probability of more than 70% suggests that a practice significantly affects yield. Thus, producers who use organic fertilizers, train the plants and weed their crop have higher yields than those who do not. Farmers who use these three crop management practices have average yields one and a half ton per ha higher than those who do not. At the average price received by farmers in 2004 of US$ 536/ton, this means an additional income per year of US$ 800-900 per ha.

It was impossible to use logit progressions to analyze the effect of access to livelihood resources on the adoption of supply-led innovations in blackberry production, because of the low number of observations. However, when farmers adopting these practices are compared with those who do not (Table 7.10) according to their access to economic/financial, human, social, and natural resources using a group mean comparison test. Those farmers who have innovated have a larger area planted to blackberries, less family labour (as a consequence of agricultural intensification livelihood strategies), better access to water (most have springs on their farms), have received support with credit and/or inputs, non-financial support services and support from external organizations. They also participate in community organizations who have given them support. On the other hand, farmers who are using these practices have lower soil quality and therefore, feel more need to take care of their soil.

Table 7.10
Adoption of improved practices in blackberry production and its relation with access to livelihood resources (N=10)

Livelihood Resource	**Mean of those who use improved practices**	**Mean of those who do not use improved practices**	**P > t Ha: mean diff > 0 or (diff < 0)**
Economic/Financial Resources:			
Total Farm Size (ha)	6.03	3.69	0.241
Area Planted with Blackberries (ha)	*1.12*	*0.28*	*0.040*** (a)*
Access to Productive Resources (number of cattle heads owned)	0.67	0.25	0.269
% who received credit and/or inputs	*83.3*	*50.0*	*0.1561**
Human Resources:			
Number of Training Courses/Workshops/Field Trips Received and Applied	3.50	2.75	0.331
Interest in Agency Processes of Change	2.83	2.50	0.238
Years of Formal Education of the Household Head	2.33	4.25	0.201
Access to Family Labour (# of family members)	*3.83*	*5.00*	*0.148**
% who received non-financial support services	*100.0*	*75.0*	*0.121**
% who received market information	*16.67*	*50.0*	*0.156**
Social Resources:			
% that are members of a producer's organization	66.7	50.0	0.323
% that are members of a community organization	*83.3*	*25.0*	*0.038****
Received support from:			
any type of organization	*100.0*	*75.0*	*0.121**
an external organization	*100.0*	*75.0*	*0.121**
production-oriented external organizations	*100.0*	*75.0*	*0.121**
natural resource management-oriented external organizations	66.7	75.0	0.403
community-based organizations	*66.7*	*25.0*	*0.121**
welfare-oriented organizations	33.3	25.0	0.403
credit-oriented organizations	16.7	0.0	0.223

(continued)

Table 7.10 *(continuation)*

Livelihood Resource	Mean of those who use improved practices	Mean of those who do not use improved practices	P > t Ha: mean diff > 0 or (diff < 0)
Physical Resources:			
Travelling time to the town of Pescador (minutes)	63.3	60.0	0.423
Natural Resources:			
Plot slope	2.17	1.75	0.181
Arable land depth (cm)	*29.2*	*45.0*	*0.051****[***]*
Has a water spring in the farm	*66.7*	*25.0*	*0.121*[*]
% who have water available all year	50.0	50.0	-

Note:
(a) *** Significance level between 0.00 – 0.01; ** significance level between 0.01 – 0.05; and * significance level between 0.05 – 0.10.

7.2.3 Market-led innovation processes in the blackberry chain

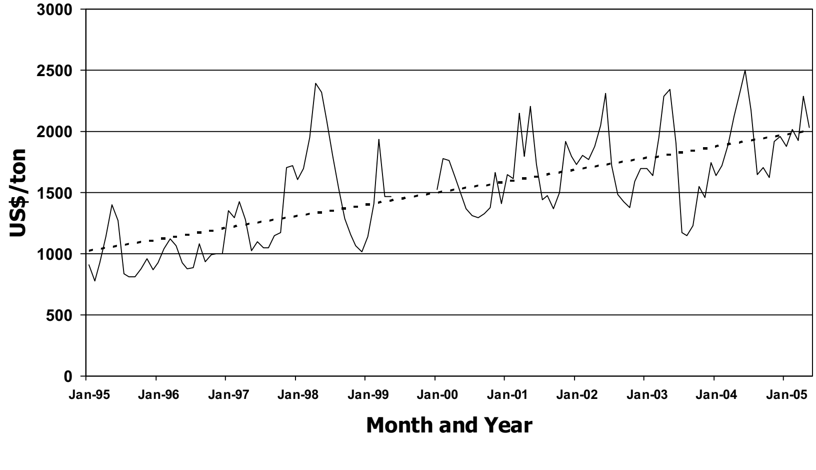
Through the work of the CIPASLA Agro industrial Committee, intervening agencies such as the UMATA and SENA facilitated market visits for farmers, with the support of CIAT:

> The UMATA does not work directly on commercialization, but in the case of blackberries, we had the opportunity to participate in a training process with SENA on post harvest management, and we also took farmers to supermarkets and open markets in Cali for people to learn about the market; we did market research with them. Blackberry producers identified different markets for their product as well as the markets' requirements. Blackberry producers have their production well positioned; they are still commercializing their product and have survived.[33]

During the 1990s, demand (both in Colombia and internationally) increased for both fresh and processed blackberries. International markets consume the processed product because of its convenience, but fresh consumption has been increasing because of consumer preferences for fresh fruits and vegetables. Exports to the European Union have increased during the 1990s at an annual average rate of 14%, while exports to the USA (the major world blackberry importer) grew an annual average rate of 3.5% (CCI, 1999).

In Colombia, apparent consumption of fresh blackberries increased during the 1990s at an annual average rate of 6%, while industrial use increased at an average annual rate of 10%. As a response to the growing blackberry demand, production in Colombia increased during the 1992-2000 period at an annual average rate of 8.9% as producers responded to market incentives (data from the Ministry of Agriculture and Rural Development). Blackberry production also increased as the Federation of Coffee Producers and other governmental development programs promoted it, as they saw it as a good opportunity for diversification. For example, during the 1990s the National Plan for Alternative Development (PLANTE) promoted blackberry production among smallholders with fewer than three ha of land as an alternative to illicit crops such as coca and poppy. Private companies did the same. For example, Postobon, one of the biggest soft drink companies in Colombia, with the support of Corpoica and the Coffee Producers' Committees of the Departments of Risaralda, Caldas and Santander, promoted the establishment of 300 ha of blackberry among smallholders. Another private company, 'Moras de Oriente', gave technical assistance to small and medium-scale producers in the Department of Antioquia to establish 200 ha of blackberries in order to have enough fruit to process into pulp for export to Central America (CCI, 1999).

Figure 7.4
Trend in blackberry wholesale prices in Colombia (1995-2005)



Source: http://www.cci.org.co/informacion/sipsa/index.html

Although yields decreased by 2.2% annually, blackberry production in Colombia increased from 1992-2000 because area planted grew at an average annual rate of 11%. Despite this increase in production, wholesale prices in the main cities of Colombia almost doubled during the 1995-2005 period (see Figure 7.4). This shows that the market demand for blackberries has been growing over the last decade.

A high level of intermediation characterizes fresh blackberry commercialization because it is a highly perishable product. The most common commercialization channel for blackberry producers in Cabuyal is through a local intermediary, who can also be a local producer, collecting the fruit from producers at their farms or close by and taking it to the wholesaler in a nearby town (Siberia, Piendamo, Santander) or even to the city of Cali. Wholesalers sell blackberries to consumers in open markets, or some have specialized as suppliers for supermarkets or for the agro industry. Supermarkets pay better but wholesale traders have to comply with their quality and packing requirements and in some cases, they even have to include the coding bar. Here is a typical pattern:

> We sell our blackberries to intermediaries and they get most of the benefits, because they pay cheaply in here, at 10,000 or 11,000 pesos per arroba (US$ 0.32-0.35 per kg.), and in Cali they sell it at 20,000 or 25,000 per arroba (US$ 0.64-0.80 per kg.) Thus, it is 15,000 or 10,000 pesos (US$ 0.48-0.32) less than we could make if we could sell our product directly in Cali. However, they get this income because they buy in the entire region, and pay a trip to take 80 or 100 arrobas and with this, they can pay the transportation and have profit. However, I only have 10 arrobas and taking my production to Cali is not worthwhile because all the profit goes to pay for the transportation. If producers get together it will be easier, but this is the difficulty. Most producers think that if they go to sell their product to Cali, they lose more time and money going there, and thus end up with the same as if they sold it here.[34]

This farmer (Pedro Herrera) has been concurrently increasing his blackberry crop, learning about its commercialization and making contacts with wholesalers. As a result, besides being a producer he also works as a local intermediary and buys blackberries from neighbours to increase his volume and improve his bargaining power. Although to ensure these higher volumes he has been promoting a blackberry producers association in his community (ASPROMORA) he does not have a secure market:

> We take the blackberries to Cali but we do not have a secure market; sometimes we sell to wholesalers and sometimes directly to the consumer in the open markets. This [lack of a secure market] has motivated us to organize and bring all the production from the community so we can negotiate it better.[35]

Through CIPASLA and its agro-industrial committee (promoted by CIAT's Rural Agro Enterprise Development Project) this farmer has visited blackberry producer organizations in other departments of Colombia, including those having good results working with supermarkets (which offer better prices) and has also met with fruit processing companies that offer a more secure and stable market through future contracts. He has also participated with other producers in market research with the support of CIPASLA and CIAT. He has learned about alternative ways to sell blackberries, and the quantity, quality and constant supply requirements set up by supermarkets and the agro industry. He has gradually become convinced of the importance of a producer organization, not only to ensure volumes that increase bargaining power, but also to access higher value markets by understanding and meeting their requirements. He is also aware that most governmental support to producers is now conditional on their being organized into organizations with legal status:

> We are now 30 blackberry producers in my community and we have been improving our technology. I am planting a lot and helping my neighbours. My idea is to add value to the crop to secure the market; we are preparing many projects, and we want to have a micro enterprise in our community. Farmers come to me; I do them the favour to bring their fruit to Cali, and I charge them 2,000 pesos (US$ 0.80) per arroba (25 lb), I take their fruit and bring them back their money, but I cannot give them any security because it is not easy to sell it. We got organized in ASPROMORA, but we want to include the producers of Buena Vista, El Oriente and La Esperanza to have only one group and commercialize all our production together and maybe in the future we could become exporters. We want to sell our product in the supermarkets, because we can get a better price, but they take fifteen days to one month to pay. We do not have the capital to wait for the money; farmers prefer to sell to the intermediary at a lower price because they pay the cash needed to pay field workers and to eat. Anyhow, we need to legalize our organization and get the coding bars to sell in the supermarkets; maybe we can still commercialize our product without formalizing the organization, but the new government will only

> support farmers who belong to organizations with legal status. Thus, this is what we want: to get organized so we can get some support. We want to have refrigeration facilities here, grade the product and bring the best to the supermarkets. I think that most people will like to get organized, but they are tired of meetings and they want to see some action. For example, if we can get a contract with *La 14* [a supermarket chain] and some organization tells us that they are going to lend us resources to buy the packing materials and baskets that the supermarkets require, then I am sure that many producers will join the group and become motivated. We do not need any more training in production techniques because by now we know how to produce. We have a market but it is not a secure one.[36]

In 2002, the agro-industrial committee of CIPASLA facilitated workshops with blackberry producers in the four most important blackberry communities of the Cabuyal watershed, following the same methodology used for market chain analysis in the Tascalapa watershed of Honduras for the coffee market chain. Based on this participatory market analysis, blackberry producers and intervening agencies developed an action plan to improve the products' competitiveness. In these workshops, they reached the conclusion that their major problems were (a) access to financial resources, (b) lack of irrigation that made the crop risk prone, and (c) that although farmers could always sell their product, they were losing the opportunity to access higher value markets for their blackberries such as agro industry and supermarkets. When they analyzed the causes of these problems, all three were rooted in their lack of proper producers' organizations.

Thus, the action plan developed included, as its short-term objective, fostering and strengthening farmers' organizations while providing farmers with technical, management and marketing follow-up. Participating farmers and intervening agencies expected that the improved organization would permit blackberry producers to take advantage of alternative market channels, securing a larger share of the market for blackberries, and consequently obtaining better prices. Intervening agencies thought this improved market situation would motivate more farmers to diversify into blackberries and encourage those already planting the crop to increase its area and further innovate in production and post-harvest technology. The expected results are higher production and productivity, better incomes, employment generation and the subsequent improvement in rural households' quality of life:

> We are a group of indigenous peasants from the communities of La Esperanza, Buena Vista y La Primavera who produce and commercialize good quality blackberries to improve our incomes and quality of life and to strengthen ourselves as producers. Our vision is that in 2006 we should be a hard-working, serious and trustworthy organization at the regional, national and international level with a processing plant that allows us to export fresh and processed fruits, becoming a role model for other organizations.[37]

Intervening agencies tried to support the implementation of the action plan on two parallel fronts. The CIPASLA AIR committee transferred some resources to CORFOCIAL to start research plots and provide technical backup with the support of the UMATA, and Corpotunía took the responsibility of fostering the organizational process and strengthening it. Both strategies failed. Most research plots were lost and few people participated in the workshops led by Corpoica. CORFOCIAL blamed the producers for a lack of commitment, but later found that their technician, a former farmer leader, was keeping most of the inputs for his own benefit and not delivering them to the farmers for research purposes. Corpotunía attempted in different occasions to support the organizational process and help farmers to form their organization, without getting a response. However, in their absence, farmers took the decision themselves to form the organization. This could be seen as positive, since the initiative came from farmers (showing a more endogenous process) but it was led by farmers from only one community (who had their own objectives), was highly criticized by farmers of the other communities, and failed:

> First, people in the upper watershed became highly dependent on CIPASLA. Since most water springs are in this area, intervening agencies gave people in these communities many things free, or in exchange for the protection of the water sources, and this was not the approach of the renewed AIR Committee. Second, mistrust among community leaders and farmers made the identification and negotiation of common interests difficult. This was crucial to get people together. Third, most of these communities belong to the indigenous authority – at that time accusing CIAT and CIPASLA of taking their genetic resources. Fourth, Pedro Herrera has his business strategy well developed and implemented. He is now a strong intermediary, provides transportation and commercialization services to blackberry producers and usually does them favours, I do not think he

gives cash advances, but he secures them a market and picks up the product in the farms…. Why do more?[38]

Producers with small-scale blackberry production have solved their commercialization problems by selling their produce to local intermediaries. They may have only a quarter of a hectare planted with blackberries, and a local intermediary buys the entire crop at the farm. Commercializing a crop directly takes time and the extra price one might get is insufficient compensation for the transportation costs. Moreover, blackberries are probably not the farmer's principal product and so accessing financial resources to expand its area has more priority than investing time in improving its commercialization. Thus, such a farmer will not be interested in participating in an organizational process to commercialize blackberries:

> We were in the process of organizing a blackberry producer organization but that did not work. We went to many meetings but there was too much talking and no help. They gave us chicken manure to fertilize but we had to pay for it and this is no help; what we need is money to work. I do not know who benefits from the help that the organizations bring. No technicians come here to see the crops. This is why people like Pedro have been crucial for us, I have learned a lot from them. They are already technicians and experts in blackberry production. Don Pedro also lost interest in the organization. It was a waste of time and at the end, there was no help. In one meeting, they told us that they were going to help us with 800,000 pesos (US$ 320) in organic fertilizers. At the end they only gave us 30,000 pesos (US$ 12) in fertilizer, we had to reimburse 13,000 pesos (US$ 5), and we had to spend a lot to attend the meetings, like 500 or 1,000 per meeting (US$ 0.20 – 0.40). Then I said, this is not for me, the only one that gave us something free (but little) was the mayor of Caldono, who sent us 80 or 100 bags of chicken manure; this was really a gift. What blackberry producers really need is the organic fertilizers because selling the product is not a problem.[39]

Other producers, such as Enrique Patiño (who sells his crop in the nearby town of Puerto Tejada where his wife has a selling place in the market and obtains a good price for his product and that of his neighbouring producers) has also solved his commercialization problem given the quantity of blackberries he produces. He participates in ASOPROMORA and recognizes that as blackberry production increases, they will have to find different commercialization channels and this is when the association could be a good solution.

This suggests that one of the major causes for the failure of the organizational process to enter into higher value markets and improve the incomes of blackberry producers was the predominance of individual interests over collective ones, but more importantly the lack of a longer-term vision.

7.2.4 Characteristics of diversification to blackberries and innovation in production and commercialization

Blackberry production has been a promising option to diversify agricultural production in the upper Cabuyal watershed and has had a significant impact in providing needed cash income for those farmers who have diversified. Mean cash income from blackberry production (US$ 198.27 per household per year) is third in importance, after coffee (US$ 607.24 per household per year) and cassava (US$ 377.46 per household per year) the most important traditional crops in the region. In the upper watershed, mean cash income from blackberry production is even higher (US$ 573.94 per household per year) and is the first in importance followed by cassava (US$ 521.71 per household per year), coffee (US$ 514.46 per household per year) and tomatoes (US$ 412.97 per household per year). Based on blackberries, cassava, coffee, and tomatoes mainly, the upper watershed has a higher average gross cash income from agriculture (US$ 2,391.55 per household per year) than the medium and lower watershed (US$ 1,457.26 and US$ 1,783.57 per household per year, respectively).

Diversification to blackberries was the result of a dynamic innovation process. It started with farmer participatory research conducted outside the Cabuyal watershed. Then the CIAL methodology fostered the diffusion of results from farmer-to-farmer. The idea reached Pedro Herrera who became the champion in the innovation process. It was his motivation and leadership, together with the pressure and urgency in the system for finding not only new sources of needed income but also more environmentally sustainable alternatives to charcoal production that drove this innovation process.

The crop offers some important advantages to the poorest farmers, and works for hillside smallholders more than the other products analyzed in this research. It does not require hard work and with family labour, it is possible to do most of the cropping activities, being also gender friendly. It is better than coffee in terms of cash flow because blackberry farmers harvest and sell their product every week. Market demand triggered this innovation process because farmers can sell their blackberries easily and in the same community, if they are willing to accept a lower price. In addition, a market opportunity identification and evaluation informed farmers about the market for the product and the possibilities it offers to generate cash income. Furthermore, the CIAL offered farmers the possibility to trial and learn about the crop without taking the initial risk to invest in a crop that they did not know how to produce in larger scales, or how to commercialize. Fieldtrips to other producing regions and informal training were also crucial to promote farmer-to-farmer diffusion, and participatory market research was essential for farmers to learn about commercializing the crop and the requirements of the different markets (intermediaries, supermarkets and the agro industry). In addition, getting into blackberries needs no large initial investment, as in the case of coffee; the product has a local market where farmers can learn more about the crop and its market chain, and as they develop their product, they can trial with multiple and growing markets.

As blackberries in the Cabuyal watershed are a newer crop than coffee in the Tascalapa watershed, only 8.8% of its producers have diversified, but 25.6% have done so in the upper watershed where the agro-ecological conditions are particularly suitable for blackberry production. Besides, neither access to the required natural resources (proper agro-ecological conditions and soil quality, measured by the depth of the arable land), nor access to resources constrained diversification into blackberry production. However, participation in training courses and workshops, initially through demonstration plots, but afterwards in participatory farmer research, as well as in field trips to visit blackberry producers in other regions and market visits, significantly influenced the decision to diversify to blackberries. Furthermore, the support of natural resource management-oriented external organizations also influenced the diversification process, since they had a special interest in promoting alternatives to charcoal exploitation, to reduce and stop the deforestation of water springs and riverbanks.

The subsequent process to innovate in blackberry production resulted in an average yield differential of 1.54 ton/ha but this change only represents an extra annual gross income of US$ 45 per ha. Moreover, not all practices tested in demonstration plots and CIALs had a positive effect on yields. In the case of chemical fertilizers and lime applications, management practices included in the technological package promoted by the UMATAs using demonstration plots, the results show that they had no significant effect on improving yields and even tended to have a negative effect on them. Practices tested in CIALs, such as organic fertilization, training, and weed control, did have a more significant and positive effect on yields. However, the innovation process lacked technological options developed through formal research that could have enriched it with more sources of knowledge and improved its effectiveness.

Despite all the restructuring of CIAT during the 1990s, the Centre continued prioritizing research on cassava, beans, rice and pastures, giving a low priority to work on innovation and rural entrepreneurial development, shown in the modest percentage of core resources allocated to these research areas. The Centre has started research on higher value crops and has established a fruit project that is working with tropical and Andean fruits, probably ten years too late, showing the difficulties of changing large public sector institutions. Corpoica, the semi-privatized national agricultural research organization, formerly ICA, although participating in CIPASLA was unable to work in the region because since its privatization, it works through projects, and no financing was available for work in the watershed. Thus, it was unable to respond to the technological demands of blackberry producers. As a result, technological innovation in blackberries lacked the external knowledge that could have been generated through formal research. Furthermore, because this was a new crop for most producers in the watershed, they also lacked local indigenous knowledge about commercial blackberry production.

Adoption of improved management practices in blackberry production was constrained mainly by access to financial resources, but also by the area planted to blackberries and the availability of family labour. Farmers who had a higher area planted with blackberries and have been planting them for a longer time are more interested in improving their productivity than those who have a small plot and are just starting with the crop. In addition, farmers who have less access to family labour are more motivated to innovate. The networking capabilities of blackberry producers who developed bonding social resources by participating in community-based organizations, and used these social resources to interact with external organizations (e.g. providers of production-oriented support) was an important driver of innovation in blackberry production. However, it is important to highlight that blackberry producers have an informal organizational process that has been proved far more effective than a formal structure promoted by external intervention.

Market innovation was highly constrained by the small-scale production system. Given the level of production of most farmers, it is not worthwhile for them to incur in the transactional costs required to enter higher value markets such as supermarkets, or more stable and secure markets such as the agro-industrial market. Thus, commercialization through intermediaries is still the best option they have. A producer such as Pedro Herrera, who has a higher production and commercializes his neighbour's crop, provides more incentives to innovate in blackberry marketing. However, the external intervention preconception that intermediaries 'are the bad ones' and cause many of the problems that farmers face in commercializing their crops, and the unchallenged framework that farmers have to be organized before being supported, constrain the possibilities to find different ways to support and innovate in blackberry marketing.

7.3 A Final Reflection on Diversification to Higher Value Crops

The analysis of innovation processes on higher value crops validates the effectiveness of 'farmer participatory research' and 'market-led research'. However, it is important to acknowledge that they do not replace but complement the formal generation of knowledge and technology. Farmers had an important pool of external knowledge from which to develop innovation processes in beans, given that a significant amount of public resources was invested in the generation of knowledge and technology. In the case of blackberries, this pool of external (and even local) knowledge was limited. Minimal external knowledge constrained smallholder innovation. Nevertheless, moving to a higher value crop has proven to have more potential to generate cash income for hillside smallholders, showing that they are a better investment option than traditional commodities.

The above findings need to read with caution as they may lead to the conclusion that higher value crops are the new magic formula to reduce poverty. Diversifying into smaller markets and then adopting a mass production approach will naturally oversupply small markets more quickly than the larger markets, as is now the case with fair trade and organic coffee. This would continually reduce the early adopter profit window in size and time as more farmers chased small, higher-value niche markets. The race to bottom that started in the major commodities could be easily repeated, even more quickly with smaller niche markets. Hence, the idea of focusing funds and growth in niche markets may be an oxymoron. Niche markets are only valuable when a few people are supplying them. Mainstreaming approaches to niche markets cannot work unless market regulation and supply management methods are in place and working properly.

The analysis also leads to the conclusion that innovation takes time, although market demand can catalyse the process, making it more dynamic and shorter. Even so, the process is too long to respond effectively to continuously changing market demands, institutional arrangements and policies. If medium and large-scale farmers with better access to resources are struggling to respond to rapidly changing environments and maintain their competitiveness in a globalize world, the challenge is much more difficult for small-scale farmers with limited access to resources. In addition, facilitating innovation processes on high-value crops does not respond to the short-term basic needs that smallholders face in their daily struggle for survival, and although it may provide a more sustainable and longer-term response to meet these basic needs, short-term policies are still needed.

Notes

1. IHCAFE is the Honduras Coffee Institute in charge of conducting research on coffee and transferring it to coffee producers.

2. Pedro Perez, 29 October 2002, El Plantel, Yorito.

3. Roque Olvera, 4 November 2002, Santa Cruz, Yorito.

4. José Amado Hernández, 4 November 2002, Santa Cruz, Yorito.

5. José De La Paz Matute, 1 November 2002, Cafetales, Victoria.

6. Oscar Nuñez, 26 October 2002, Yorito, Yorito.

7. Noel Murillo, 28 October 2002, Pueblo Viejo, Yorito

8. This organic fertilizer has the advantage that can be applied after 15 days of preparing it, instead of 4-6 months that takes the one produced with worms, but has the disadvantage that requires the use of lime, has to be turned every three days and watered constantly to keep it fresh.

9. Pedro Perez, 29 October 2002, El Plantel, Yorito.

10. Alejandro Estrada, 3 November 2002, San Antonio, Sulaco

11. Oscar Nuñez, 26 October 2002, Yorito, Yorito.

12. Pedro Perez, 29 October 2002, El Plantel, Yorito.

13. Ruben Sarmiento, 28 October 2002, Pueblo Viejo, Yorito

14. Osman Abdulio Amador, 5 November 2002, Santa Marta, Yorito.

15. Marco Vasquez, CIAT Research Assistant, Rural Agro enterprise Development Project, 6 June 2005, Tegucigalpa, Honduras.

16. Marco Vasquez, CIAT Research Assistant, Rural Agro enterprise Development Project, 6 June 2005, Tegucigalpa, Honduras.

17. Pedro Herrera, 26 December 2002, La Primavera, Caldono.

18. Pedro Herrera, 26 December 2002, La Primavera, Caldono.

19. Pedro Herrera, 26 December 2002, La Primavera, Caldono.

20. Olmes Torrez, Technician of the UMATA of Caldono, 23 April 2003, Caldono, Caldono

21. Lulo, Solanum quitoense is an Andean fruit used to prepare juices and has a high demand in the local, regional and national market.

22. Pedro Herrera, 26 December 2002, La Primavera, Caldono.

23. Carlos Felipe Ostertag, Market Specialist, CIAT Rural Agro enterprise Development Project, 22 May 2003, Cali, Colombia.

24. Delio Pechene, 13 January 2003, La Esperanza, Caldono.

25. Enrique Patiño, 20 January 2003, La Primavera, Caldono.

26. Carlos Cuetia, 15 July 2003, Buena Vista, Caldono.

27. Jaime Ulchur, 15 January 2003, El Oriente, Caldono.

28. Delio Pechene, 13 January 2003, La Esperanza, Caldono.

29. Delio Pechene, 13 January 2003, La Esperanza, Caldono.

30. Simeon Patiño, 20 January 2003, Buenavista, Caldono

31. Jaime Ulchur, 15 January 2003, El Oriente, Caldono.

32. Simeon Patiño, 20 January 2003, Buenavista, Caldono.

33. RUBEN GUETIO, Technician of the UMATA of Caldono, 30 April 2003, Caldono, Caldono

34. CARLOS CUETIA, 15 July 2003, Buena Vista, Caldono.

35. PEDRO HERRERA, 26 December 2002, La Primavera, Caldono.

36. PEDRO HERRERA, 26 December 2002, La Primavera, Caldono.

37. PEDRO HERRERA, 26 December 2002, La Primavera, Caldono.

38. WILLIAM CIFUENTES, Former Corpotunía Director, 1 September 2005, Quito, Ecuador.

39. MANUEL MORIONES, 15 Julio 2003, La Primavera, Caldono

8 Possibilities and Limits of Rural Innovation for Poverty Reduction

The debate on whether or not the generation of knowledge and technology is an appropriate instrument to reduce hunger and poverty came to the forefront at the beginning of the new century, when most world states and leading development organizations agreed on sustained action and unprecedented efforts: the millennium development goals. Assessing the contribution of rural innovation to development, and understanding the limits and possibilities it offers to reducing hunger and poverty has become highly relevant for those who design poverty alleviation policies and allocate resources.

This research questioned whether participatory approaches to agricultural innovation applied since the 1980s (with a bottom-up perspective that paid attention to the locality, to market opportunities and to sustainable rural livelihoods) are more effective in promoting innovation processes. In addition, it aimed to assess whether, how, under which conditions, and to what extent promoted innovation process with these new approaches have contributed to sustainable rural livelihoods.

With this objective, and recognizing the complexity of assessing how external intervention promotes the generation of knowledge and technology for innovation and contributes to sustainable rural livelihoods, the 'Innovation for Sustainable Rural Livelihoods Framework' was developed in Chapter 2, since no existing approach addresses all the linkages between external intervention, rural innovation and sustainable rural livelihoods.

Based on this framework, this research used an innovation system approach to analyze how the interaction among multiple actors with multi-layered sources of knowledge has been facilitated, whether the scope has been expanded to include other actors beyond the farm gate, and the degree to which these experiences have [or have not] resulted in change. In addition, it assessed the development outcomes of these innovation processes on socially differentiated actors as well as the degree to which they have developed innovation capabilities themselves. A contribution of this research has been the development, application and validation of this analytical framework.

8.1 The Innovation Path: An Improved Technical Response

Knowledge and technology generation approaches have evolved from the traditional 'transfer of technology' approach to approaches that involve farmers as partners and clients of agricultural research. 'Market demand-led research' approaches also improve the linkages of farmers with market opportunities and improve rural incomes. Thus, the *technological change path* for development and poverty reduction has evolved into an *innovation path* that follows *an actor-oriented process for change.* The first issue at stake in this thesis is whether knowledge and technology generation approaches have improved the effectiveness of innovation processes.

This research analyzed four innovation processes that approached the generation of knowledge and technology differently. Their direct outcomes (their spread among producers and their effect on yields) are summarised in Table 8.1. In the Cabuyal watershed, technological innovations were most likely to be adopted where participatory research approaches are combined with market-led demand approaches. In the Tascalapa watershed, they were adopted more frequently in bean cropping (where 'farmer participatory research' approaches were introduced) than in coffee production (where a 'transfer of technology' approach predominated until the end of the 1990s). This shows that participatory and market-demand led approaches to generating knowledge and technology are more effective at spreading innovation. These approaches also proved to be effective in fostering and spreading new bean varieties and knowledge-intensive innovations (as opposed to input-intensive innovations) as 60% of farmers or more have adopted improved crop management practices.

Technological innovation has also been generally effective in improving bean yields, the exception being the new varieties in Colombia, which did not increase yields but reduced yield fluctuations due to pests and diseases resistance. The innovation process was different in the two watersheds: in Colombia, farmers did not participate in the breeding of new varieties but only conducted evaluation and validation trials, while in Honduras; farmers participated actively in the breeding process. This involved a higher level of interaction between producers, technicians and researchers, and therefore combined local knowledge with the external information brought by technicians and researchers.

Table 8.1
Comparison of the direct outcomes of the analyzed innovation processes

Comparison Criteria	Innovation Process			
	Beans in Cabuyal, Colombia	Beans in Tascalapa, Honduras	Coffee in Tascalapa, Honduras	Blackberries in Cabuyal, Colombia
Area planted with new varieties (%)	76	46	49	100
Adoption of innovations:	***% of producers***			
Plant new varieties	83.9	43.8	81.8	100.0
Apply organic fertilizers	83.5	4.9	12.2	60.0
Apply chemical fertilizers	9.5	29.2	12.1	30.0
Plant intercropped	66.0	22.5	34.0	-
Use improved crop management practices	48.7	71.5	60.3	60.0
Yield differentials:	***% increase (probability that there is no significant yield differential)***			
With new varieties	-6.4 (p=0.4392)	19.0 (p=0.2160)	54.3 (p=0.2573)	-
With use of input-intensive management practices	50.0 (p=0.3259)	76.2 (p=0.0061)	234.8 (p=0.0026)	-10.6 (p=0.4221)
With use of knowledge-intensive management practices	81.2 (p=0.1343)	67.4 (p=0.0672)	42.8 (p=0.2329)	40.8 (p=0.2615)

Source: Adoption and Livelihood Surveys, Cabuyal and Tascalapa Watersheds, October 2003-February 2004

Technological innovation processes in coffee that initially took a "transfer of technology" approach, promoted the establishment of coffee plantations with new varieties and the use of input-intensive crop management practices that were successful in generating significant yield improvements. On the other hand, knowledge-intensive crop management practices that farmers can apply regardless of having access to financial resources, are more effective if developed in an interactive innovation process that resulted from combining a 'farming systems research' with a 'market demand-led research' approach. For that reason, knowledge-intensive innovations in coffee (not developed in an interactive manner) had a lower up-take and less impact on yield than those achieved in beans using 'farmer participatory research'.

The limited interaction between coffee producers and other key market chain actors also reduced the effectiveness of coffee innovation processes. Moreover, farmers did not interact with researchers, and their interaction with other sources of knowledge on organic coffee production was limited. As a result, farmers got their coffee certified as organic because their low-input production system (given their lack of financial resources to buy chemical inputs as coffee prices decreased) allowed it, not as the result of applying more appropriate and low-cost organic production technologies.

In addition, farmers did not interact sufficiently with organic market buyers and exporters, and only started to look for buyers when their coffee harvest was certified and they were almost ready to sell their product in the market. Given the lack of a longer-term relationship among coffee producers, buyers and exporters; the continuous decrease in conventional coffee market prices; and the oversupply of organic and fair-trade coffee by producers in other places who used the same strategy, coffee producers in the Tascalapa watershed were unable to negotiate an attractive price premium. In addition, collective action among coffee producers was limited, due to a lack of trust among producers with a long local history of social conflict and violence over access to livelihood resources (erased by external intervening agencies), affecting their ability to access a higher value market.

Innovation in blackberries focused mainly on market opportunity. Farmers and technicians worked as colleagues to meet market standards and improve productivity, and collaborated with local intermediaries to improve their bargaining power in the market chain and obtain better prices. Thus, the innovation process involved both farmers and other actors along the market chain. However, the lack of public investment in blackberry research meant the process lacked interaction with external sources of knowledge and outcomes in terms of yield increases were not outstanding, reaching an average of 28% among farmers with the capacity to apply organic fertilizers and labour to weed and train the crop.

Thus, the lack of participation of researchers in the process resulted in less effective technological innovations in terms of yield improvements.

Based on the above evidence, this study showed that new approaches for the generation of knowledge and technology that foster interaction among farmers and scientists [farmer participatory research] and among different actors along the market chain [market demand-led research] are more effective in facilitating innovation processes. This is even more evident in the case of innovation processes that lead to knowledge-intensive technologies that do not require substantial financial resources and are therefore more appropriate for smallholder producers. In addition, such approaches develop the innovation capabilities of farmers, permitting them to learn the principles behind these processes, which they can use later in other higher value crops, as was the case with innovations in beans and blackberries in the Cabuyal watershed.

Together with the approach taken to generate knowledge and technology, investment in strategic research also influences the effectiveness of innovation processes in terms of yield improvements. Public investment in strategic research in beans has been relatively high, given the limited interest of the private sector to invest in the crop, because beans are important for both rural and urban food security, as a low-cost protein source. Public investment in coffee and blackberry research has been lower, but the private sector has invested in coffee research and has mobilized public resources in this area, especially in leading coffee-production countries such as Colombia and Brazil. On blackberries, the private sector has invested only limited resources in primary production research, limiting its investment to research on post-harvest and processing. These differences in investment have influenced the direct outcomes of technological innovation: while innovation in beans and coffee has led to an increase in yields between 30% (low-input agriculture) to 70% (higher input agriculture), the yield increase in blackberries has been only between 20-30%.

Despite the achievements of 'farmer participatory research' and 'market-demand led research' approaches to improving the effectiveness of innovation processes, they have limitations. When using participatory approaches, existing constraints and the technologies developed to overcome them may be locality specific, making it difficult to draw lessons that can have a wider application. Innovations without a proper out-scaling strategy may have a low spread beyond the site, resulting in low returns on investment. Scientists can also place too much responsibility on farmers. In addition, when applied mainly as a supply-led research approach, participatory approaches may result in oversupply, leading to low prices making it impossible for farmers to generate a proper income and to capitalize.

Thus, 'market demand-led research' approaches are a way to overcome the limitations of supply-led innovation processes and improve cash incomes, but risk placing too much emphasis on market research and less on meeting the supply requirements: a prerequisite to taking advantage of these market opportunities. Technological innovation is usually required to meet the constant supply of a particular volume at a set quality for responding to identified market demand. Thus, although 'market demand-led research' is crucial for innovation processes that contribute to income generation (as shown in the analysis of innovation in coffee and blackberries) this needs to be teamed with technological innovation, and (when smallholders are involved) with collective action to provide a constant and homogenous supply at competitive prices to stay in the market.

In blackberry cultivation in Colombia, the combination of 'market demand-led research' initially with the 'farmer systems research' approach used by the UMATA, but replaced rapidly with a 'farmer participatory research' approach through a CIAL, was an important success factor. The CIAL gave farmers the opportunity to experiment with commercial blackberry production and marketing before taking the decision to diversify, reducing the risks. Moreover, farmers' strong links with local intermediaries who had good market information and contacts were important.

An interaction solely between farmers and scientists is insufficient when the objective is broader than achieving food security. Improving innovation processes requires interactions with actors able to complement the knowledge of farmers and scientists. This is crucial to identifying and taking advantage of new market opportunities, and competing in a sustainable manner in rapidly changing markets.

This research shows the importance of this, adding another column to Table 1.1 (see Table 8.2): 'interactive learning for change.' This includes elements of the 'farmer participatory research' and 'market-led research' and takes an innovation system position that moves along the market chain, but also brings in multiple sources of knowledge and providers of technology.

Table 8.2
An emerging approach for the generation of knowledge and technology: 'Interactive Learning for Change'

Characteristic	Farmer Participatory Research	Market Demand-Driven Research	Interactive Learning for Change
Driver	Demand pull from farmers	Market Demand	Respond to changing contexts and demands
Innovators	Farmers and scientists as partners	Chain actors working in collaboration with researchers	Multiple actors with multi-layered sources of knowledge in an innovation system
Scope	Farm based	Market chain based	Market chain based, including different knowledge and technological service providers
Core Element	Joint generation of production knowledge	Joint innovation along the market chain	Facilitated interactive innovation and learning for change
Intended Outcome	Co-evolved technology with better fit to livelihood systems	Co-innovate to respond to market demand and opportunities	Enhanced capacities to innovate for development
Key Change Sought	Scientist-farmer relationships to improve productivity and make an efficient use of resources	Relationships among market chain actors and researchers to improve competitiveness and incomes	Institutional, professional and personal change to improve the interaction among multiple actors

The main driver is the need to respond to rapid change and new demands, a need met by facilitating interaction among multiple actors and sources of knowledge not only beyond the farm gate, but also beyond the market chain. This approach does not aim to replace scientists as formal knowledge providers with farmers or the private sector along the market chain, but aims for a better interaction among scientists, farmers, and all the other actors along the market chain. Thus, the key changes sought are institutional, professional and personal, all meant to improve the interaction among multiple actors in order to enhance capacity for innovation for development. The role of farmers is to co-generate knowledge and technology, together with all the actors in an innovation system.

8.2 Contribution of Innovation Processes to the Generation of Sustainable Rural Livelihoods

The new approaches for the generation of knowledge and technology have been effective in fostering innovation processes and have enhanced producers' capabilities to compete effectively. Despite their limitations, they have increased productivity, improved access to higher value markets for existing products, and aided farmers in diversifying to higher value crops. However, the second issue at stake in this thesis concerns the extent to which these innovation processes have improved rural livelihoods and made them more sustainable.

The contribution of these productivity increases to improved household incomes is shown in Table 8.3. Innovation in beans achieved outstanding results in terms of adoption levels and yield increases, and made an important contribution to food security, but was unable to meet income generation objectives. These were supply-led innovations that involved farmers, scientists and providers of technical assistance services, but not other actors along the market chain. Farmers prioritized research on beans because this was important for food security, but they had limited market information, and, to a certain degree, scientists and technicians (who had more knowledge on beans because research centres invested important resources on this crop) influenced the priority setting process.

In the Tascalapa watershed, bean innovations improved food security and raised average per capita consumption (to 45 kg per capita per year), representing an average in-kind income per household of US$ 140 per year in 2004. However, bean sales only represented an average gross cash income per household of US$ 261 per year, equivalent to approximately 20% of a minimum wage in Honduras. Thus, although those farmers who adopted technological innovations in bean production have increased their gross cash income from beans by 56% without using input-intensive management practices and by 130% when using them, this did not result into a significant increase in income.

Table 8.3
Effect of increased productivity on income

Comparison Criteria	Innovation Process			
	Beans in Cabuyal, Colombia	Beans in Tascalapa, Honduras	Coffee in Tascalapa, Honduras	Blackberries in Cabuyal, Colombia
Cash income differential:	**% change over those who did not innovate**			
Diversification	-	-	102	119
Use improved varieties	-7.8	48.5	13.9	-
Use input-intensive management practices	104.4	130.7	24.3	17.7
Use knowledge-intensive management practices	78.3	56.4	25.4	14.3

Source: Adoption and Livelihood Surveys, Cabuyal and Tascalapa Watersheds, October 2003-February 2004

In the Cabuyal watershed, bean innovations involved intervening agencies that not only facilitated 'farmer participatory research' and supported the establishment of a seed enterprise (as in the Tascalapa watershed) but also supported farmers in differentiating their product by packing and branding the beans, and including a code bar. This meant that farmers were able to fulfil the requirements of supermarkets, which paid a better price and absorbed part of the oversupply generated by technological innovation. In addition, farmers were able to expand the demand for their product further, by placing it in food outlets supported by the same intervening agencies in poor urban neighbourhoods in the city of Cali. Thus, innovation in beans not only improved food security for both the rural and urban population, but also (from 1990-93) temporarily benefited many households in the watershed (both in food security and in cash income). However, the opening of the Colombian economy to international competition destroyed the economic opportunity generated by this intervention.

In 2004, the average Cabuyal household's gross income from bean sales was US$ 338 per year, equivalent to approximately 20% of a minimum legal wage in Colombia. The fact that the amounts involved are small means that even though farmers who use improved varieties combined with knowledge-intensive crop management practices have bean-related incomes that have increased by almost 80%, this is not much in real terms. The same is true when improved varieties used in combination with input-intensive crop management practices increase incomes by 100% (as production costs increase). As in Honduras, the increase in income is insignificant, given the low contribution of bean production to average total household income.

In the case of coffee and its 'transfer of technology' approach, income increases resulting from technological innovation ranged from 14-25%, so have been smaller percentage-wise than those obtained with a 'farmer participatory research' approach to beans (48-131%). This suggests that 'farmer participatory research' approaches are not only more effective than the 'transfer of technology approach' in fostering innovation, but the resultant innovations are also more effective in improving income.

Diversification to higher value markets or crops has improved household income (see Table 8.4), but not all farmers diversified, and their choice of crop partly depends on external support. For example, while half of the producers in the Tascalapa watershed have diversified to coffee, and 25.5% had already diversified twelve years after the process started in the early 1980s, only 9% of the Cabuyal watershed farmers were growing blackberries after the same period (the process started in the early 1990s). This difference appears to be partly due to the financial support provided to farmers for diversification to coffee during the DRI-Yoro intervention compared with the lack of support in Cabuyal, where farmers diversified with their own resources. However, in the upper watershed, where agro-ecological conditions are optimal for blackberry production, the diversification rate reached the same level (25.6%) as coffee diversification over the same time-period.

Diversification to higher value crops (coffee and blackberries) have certainly offered farmers opportunities to improve their incomes, as those households who have diversified to organic coffee have doubled their incomes from agricultural activities, and those growing blackberries have seen an even larger (120%) income increase. By 2004, coffee was the most important income-generating crop in the Tascalapa watershed. Households who were able to establish and maintain coffee plantations, received an average yearly income of US$ 920, in addition to their own consumption, valued at US$ 43 per year, providing a total average income of US$ 963 per year, the equivalent of 80% of the minimum legal wage in Honduras.

Table 8.4
Diversification and its Income effect

Comparison Criteria	Innovation Process			
	Beans in Cabuyal, Colombia	Beans in Tascalapa, Honduras	Coffee in Tascalapa, Honduras	Blackberries in Cabuyal, Colombia
Producers who grow the crop (%)	53	78	53	9
Producers who sell in the market (%)	80	50	100	100
Average per capita consumption (kg/year)	19	45	20	9
Value of household consumption (US$/year)	60	140	43	5
Average gross income from sales (US$/year)	338	261	920	2,730
Total average gross income (US$/year)	398	401	963	2,735
Percentage of gross cash income from agriculture	10.4	23.2	51.3	4.3
Gross cash income differential from diversification	-	-	102	119

Source: Adoption and Livelihood Surveys, Cabuyal and Tascalapa Watersheds, October 2003-February 2004

Accordingly, diversification to blackberry production increased average household incomes in the Cabuyal watershed, specifically in the upper watershed where farmers previously had few income-generating opportunities other than charcoal production (which damages forest resources and watershed health). In 2004, blackberry production provided an average household income of US$ 2,730 per year to blackberry-farming households, on average 1.6 times the minimum legal salary in Colombia. In addition, reducing charcoal production and introducing a permanent crop were crucial to improving watershed management, protecting soil, forest and water resources.

This suggested that innovation processes can improve rural livelihoods and make them more sustainable. However, it also shows that these possibilities depend on the effectiveness of the innovation process itself and the extent to which it develops local capabilities to innovate, because farmers need to be able to respond to changing contexts and markets. This means farmers need a good understanding of: (1) the characteristics of the product and its demand, not only for own consumption, but more importantly for local, national and international markets; (2) external factors such as public and private market regulations and trade policies that provide an enabling [or disabling] environment for the innovation process, and (3) access to livelihood resources.

8.2.1 Influence of product and market characteristics

Market demand is a major catalyzer of innovation processes. In the case of beans in Honduras, farmers were interested in increasing production because the demand for own consumption was not fulfilled and because beans, a low-cost protein source, are important for food security. In Colombia, farmers were also initially interested in increasing bean production for this reason, but new market developments not only catalyzed further innovation, but attracted farmers from other places that interacted with local people, making the innovation process more effective.

Nevertheless, the income elasticity of beans after a certain level of income becomes negative, and their price elasticity is low. This implies that as the income of the poorer population increases, or as the price of beans decreases, households will increase consumption, but there is a limit to this. As income increases further, people will start (partially) replacing beans with higher-cost sources of protein. Bean consumption will increase at a lower rate than bean prices fall, and higher strata population will not increase their consumption of beans if the price decreases. Thus, an increase in supply will rapidly result in a fall in prices. Increased productivity does not compensate for this reduction in prices, so producers will not benefit from technological innovation beyond improving their food security, and can even lose income.

The market for coffee was not the initial local driver for coffee production in Tascalpa, Honduras. Access to credit and the technical assistance provided by the DRI-Yoro Program initially motivated farmers. However, it was the growing market demand for coffee, reflected in increased prices from 1993 to 1999 that catalyzed the adoption of supply-led technologies in coffee production. By 2004, half of the producers in the watershed had replaced their original plantations with improved coffee varieties, and 60% used improved management practices (increasing yields by 40%), while another 12% applied chemical fertilizers, (increasing yields by 70%). Similarly, the growing demand for blackberries greatly influenced diversification to blackberries in the Cabuyal watershed of Colombia. There was good demand in local and regional markets, making it easy to sell the product in the same community, at good prices, and with low transaction costs.

Changes in market conditions, reflected in price fluctuations, also influence [positively or negatively] innovation processes. In the case of coffee in the Tascalapa watershed, after coffee prices peaked in 1997, they decreased over the next 5 years. In 1999, coffee producers, faced with falling prices, started looking for alternative markets. Declining coffee income and the support from CIAT's Rural Agro Enterprise Development Project and CLODEST with a 'market demand-led research' approach catalyzed technological and social innovations. Thus, farmers started innovating to meet organic coffee market requirements that by 1999 offered an attractive price premium (60% for organic coffee, 100% for good quality organic coffee, and 280% for organic coffee with a fair trade certification). Farmers wanted and were willing to pay for technical and organic certification services because these services were crucial for responding to this market opportunity.

Thus, diversification into higher-value markets and innovation in crops with elastic and growing market demand certainly offered farmers the opportunity to improve incomes. Entering these markets and benefiting from them was more difficult than initially expected, requiring technological, market and social innovations. Effective technological and market innovation processes were generated through farmer participatory and market demand-driven approaches. However, the Achilles heel has been the difficulty in generating needed collective action among smallholders as lack of trust predominates in their relations.

8.2.2 Enabling [disabling] environment

This research showed that public and private policies are decisive in whether rural innovations can help to generate sustainable rural livelihoods, because public and private policies provide an enabling or disabling environment for market demand. Clear evidence of this can be seen in bean innovation in Colombia and coffee innovation in Honduras.

For almost three years (1991-1993), farming income in Colombia's Cabuyal watershed increased significantly because innovations in bean farming led to demand and supply increases and improved the price received by farmers. The area planted with beans also more than doubled during this period. However, the lack of supply management, coupled with the opening of the Colombian economy in the early 1990s to imports (including beans) from more competitive (or subsidized) countries, depressed bean prices and made bean production unprofitable.

Since then, the devaluation of the Colombian currency (in the late 1990s) and continuous increases in bean yields (at an annual average growth rate of 3.8%) have again increased the relative competitiveness of the region, where 53% of households continue producing beans. Those farmers who have stayed in the market have started to benefit from bean production again.

Coffee production and marketing also provide evidence that private and public policies have an important influence on rural livelihoods. Coffee prices peaked in 1997, when coffee was generating a significant income increase for those households able to establish coffee plantations. However, between 1998 and 2002 income from coffee production declined because of the oversupply generated by the dissolution of the International Coffee Agreement and the proliferation of development projects around the world that promoted the establishment of coffee plantations. This global change significantly lowered household coffee incomes in the watershed.

As a result, coffee producers stopped giving maintenance to their plantations, or reduced it to a minimum, leading to reduced yields and further decline in household incomes. At the same time, falling coffee prices that made chemical inputs non-profitable, despite their significant effect on yields, have catalyzed farmer experimentation with alternative less-expensive organic sources to fertilize their coffee plantations. This innovation process was mainly the result of local knowledge and experimentation, but was also fostered and enriched with external knowledge via different networks, such as private technical assistance and certification service providers. New practices also spread rapidly from farmer to farmer.

This conversion to organic coffee production, catalyzed by changing public and private policies (the international coffee agreement and the price differential for organic coffee in the international market) led a group of farmers to begin the certification process that would allow them to sell their coffee in organic export markets. In addition, coffee producers organized in order to have the required volumes to attract the certification company to the region, to negotiate their coffee production in the export market, and to fulfil the requirements of the fair trade market. This did not have the desired impact because coffee was oversupplied in the fair trade market, and the weak farmer organization constrained collective action to supply the volumes required by the export market. In addition, smallholder limited financial resources affected their ability to manage the cash flow flexibility imposed by this new market for coffee.

By altering public trade and fiscal policies, State intervention affects corporate policies and private behaviour, and thus whether any given innovation process is able to contribute to the generation of sustainable rural livelihoods. For example, although both countries in this study received international support to implement their DRI Programs, the Colombian government provided significant co-funding, controlling Program implementation and decision-making. As such, Colombian governance and negotiating power were stronger than in the case of Honduras, where the DRI-Yoro Program was an autonomous entity replacing the State, giving it limited negotiating power and a lesser role in decision-making. These differences in State presence continued once the DRI Programs ended. The Colombian government transferred resources, responsibilities and decision-making in this area to local governments. Despite its budget limitations, the Caldono municipality (like most municipalities in Colombia) took this on, establishing the UMATA, continuing with the provision of technical assistance to smallholders. In addition, the central government established competitive funding mechanisms that were essential to a portfolio of projects in the watershed. The decentralization process in Honduras came later, the central government transferred less funding to local governments, and the competitive funding mechanisms established by the central government to promote rural innovation did not reach smallholders.

8.2.3 Access to livelihood resources

Access to economic, physical, and human resources influences the ability to innovate. Producers with fewer resources tend to be left out of the innovation process, unable to appropriate the benefits of the *innovation path*. Logit regressions on whether the household innovated or not, as a function of access to different livelihood resources, show that access to human and social resources influenced the adoption of new varieties and knowledge-intensive crop management practices. Access to economic/

financial, physical and natural resources had a greater influence on the possibilities to adopt input-intensive innovations.

The analysis of innovation processes in beans in both countries provide evidence that new approaches are more inclusive as they depend less on access to economic/financial, physical or natural resources. This is true for innovation in new varieties or knowledge-intensive crop management practices, both influenced mainly by access to human and social resources. The lack of access to economic/financial, physical and natural resources limits the use of input-intensive crop management practices (such as using organic or chemical fertilizers) required to take full advantage of new varieties. The use of organic fertilizers is dependent on access to natural resources and on having the physical resources needed to transport them. The use of chemical fertilizers is more dependent on access to economic/financial resources.

With respect to the possibilities to diversify to higher value markets or crops (with their greater impact on income) access to resources was crucial. Since the intervention process that facilitated innovation in blackberries supported farmer access to human and social resources, but not to economic and financial resources, merely 9% of watershed households and 26% of the households in the upper watershed grow them. This percentage is lower than the percentage of the households that have diversified to coffee in the Tascalapa watershed (53%), where external intervention also facilitated access to financial resources.

In addition, although farmers identified possibilities to get into higher value markets, such as the organic market (for coffee) and supermarkets (for blackberries), limited access to social resources constrains their ability to take advantage of these opportunities. Lack of collective action (social resources) limits their ability to comply with the demands (volume, constant supply and a homogenous quality) of these higher-value markets. This shows that market-demand led innovations require a strong organization supporting them in order to succeed, especially when dealing with smallholders, who will lack the scale and ability to provide a constant supply needed to negotiate in the market individually. The lack of trust (a social resource) among producers in this study derived from a long history of social conflict and violence, not easily overcome.

Providing services that help to overcome limited access to resources would improve the ability of farmers to generate sustainable incomes. In the case of innovation on beans, the development of a new input market to provide seed of improved varieties was crucial for the spread of new varieties that in 2004 occupied 76% (Cabuyal) and 46% (Tascalapa) of the area planted with beans in the watersheds. Seed production enterprises not only made higher-quality seed widely available for farmers, but also temporarily improved average household incomes for those producing seed. This increase is temporary, since there would be no repeat buyers once most potential clients have bought the seed. Therefore, although this is a feasible service and farmers are willing to pay for it, it is unsustainable unless a dynamic breeding process results in the periodic liberation of improved new varieties.

In the case of coffee in Honduras, the availability of organic certification service providers was important. However, the lack of a local market in organic inputs such as organic fertilizers limited the feasibility of entering this market. Coffee producers had a real demand and were willing to pay for both services, in contrast to the technical assistance services (subsidized by IHCAFE and cooperation agencies) that showed no concrete results and had no real demand.

For innovation in blackberries, three services proved to be essential: commercialization, market research (with a participatory approach) and technical assistance (with an interactive learning innovation approach). Producers have always paid for commercialization services and have a real demand for them. Local intermediaries provided this effectively in a way not undermined by the initiative to establish a farmer organization to offer this service. Market and production research services were partially subsidized, but producers invested their time in these, shaping the result. The low public and private investment in blackberry production research fostered broader participation in this research, bringing in multiple actors with different sources of knowledge.

8.3 Influence of Different Modes of Intervention

Chapters 4 and 5 described the way intervention in the Cabuyal, Colombia and Tascalapa, Honduras watersheds followed different and contesting development theories, and how these discourses resulted in concrete practices. The third issue at stake in this thesis is how different modes of intervention facilitated access to livelihood resources, the extent to which they contributed to more effective innovation processes, and how this translated into sustainable rural livelihoods.

The research showed that external intervention influences innovation and its outcome by affecting access to resources. Researchers collaborating with development agencies catalyzed innovation in beans by pushing for the establishment of CIALs and providing 'explicit knowledge' generated through previous (extensive) publicly-funded bean production research. Thus, CIAT (with IPCA and El Zamorano in the case of Honduras) and its local partners facilitated access to information and knowledge (human resources), and social resources by promoting the establishment of CIALs.

Coffee production in the Tascalapa watershed started during the expansion of the DRI-Yoro Program (1987-91), after the program had significantly improved roads and basic infrastructure in its opening phase (1984-86). The DRI-Yoro Program promoted coffee production by providing farmers with credit to establish coffee plantations, but also by supporting them to improve bean production that, among early adopters, resulted in increased income that they could then invest to establish coffee plantations. Thus, the DRI-Yoro Program catalyzed diversification to coffee by improving access to physical, financial and human resources.

The innovation process in blackberries started (with less external intervention) when a group of producers realized that the crop had a high value in the market, given its growing demand for fresh consumption and with agro industrial purposes, but external agents also catalyzed this process. The 'market demand-led research' approach taken by CIAT and CIPASLA's Agro-industrial Committee helped farmers identify this new market opportunity and conduct participatory market research, which was crucial for accessing market information and improving knowledge about the market chain. This new knowledge was important in attracting buyers to the upper watershed communities, who started to buy as soon as they realized that there was sufficient supply. It also allowed growers to make the necessary contacts to sell their product in other municipalities and the city of Cali. Thus, in this case, CIPASLA, with the support of CIAT, has improved access both to knowledge about the market chain (a human resource), and to a network of buyers that helped them link to the market chain (social resources).

Moreover, the analysis on modes of intervention showed how different theses on the causes of food and hunger, have shifted from a structuralist position (seeing agrarian structures as a major impediment for development) that advocated for a *political path* to solve the food and hunger crisis, to technological determinism, monetarist and poverty theses that advocate for a *technical change path*. he *political path* was inconsistent with multiple stakeholders' interests, leading to technological determinism that placed a great faith on technology without tampering with existing agrarian structures: the *technological change path*. The technological path was constantly criticized for its limitations, leading to the poverty and monetarist theses that have come forward in a parallel and to some extent contradictory manner. The poverty thesis recognized that technological change could solve the food crisis, but could not alone solve the hunger and poverty problem and that access to and control over livelihood resources limits the abilities of new technologies to contribute effectively to the generation of sustainable livelihoods. Development initiatives such as the DRI Programs, although to some extent aimed to solve this access problem, concentrated on providing basic infrastructure and services, but continued providing a technological solution, combining a *basic needs provision path* with the *technological change path*. Neither paths led to major political opposition from those with more power and control of resources, nor did they represent a high political cost for those in government, and therefore they were not highly questioned.

The monetarist thesis emerged together with serious financial crises in most Latin America countries. The crises led to structural adjustment programs after the mid 1980s, which left most states weaker and with smaller roles, as it advocated that state intervention has a negative effect in economic growth, pleading for its retreat from a regulating role, taking instead a facilitating one. This left more responsibility for reducing hunger and poverty to market forces, something that the market by itself was unable to do and that to some extent exacerbated the problems. Thus, local development initiatives have come forward as the state decentralized, aiming for a bottom-up development process that upgrades the *technological change path* to a more participatory and effective *innovation path*. At the same time, the political response was left to a weaker and decentralized state with limited capacity to take a bottom-up *'political path'* to reduce hunger and poverty. Civil society organizations such as NGOs and private service providers, took this role during the 1990s, mainly with international cooperation resources. However, the bottom-up *political path* for change and development is still far from reaching millions of needy people and there is little evidence of a convergence of bottom-up and top-down approaches. Since political power is essential to make real changes, this lack of convergence limits the possibilities of the *innovation path* to contribute to solve hunger and poverty.

External intervention is becoming increasingly complex, with continuous changes in development thinking, development policies and development practice. It is responding to development fads, and the resultant lack of continuity affects institutions, intervention, and organizational processes among both the interveners and the intervened. This continuous process of erasing history, as if nothing that happened in the past mattered and the new development paradigm will provide the 'magic formula' to reduce hunger and poverty, limits intervening agencies' ability to understand the process that put a given community in its actual situation. Instead, intervening agencies seem to construct a romantic and static image of rural life and of a homogenous community, failing to recognize numerous realities that have resulted from power asymmetries and differential access to livelihood resources, all of which can affect participation, negotiation capacity, and decision-making processes.

In addition, intervening organizations come with their own specific projects, financed by external agencies, and aiming to implement previously planned activities to achieve the results and outcomes that they promised to their donors. This situation creates strong competition among intervening agencies for donor resources, clients and recognition. The target population of these interventions takes advantage of the situation to get immediate rewards, and are unmotivated to work towards longer-term but more sustainable development. Thus, the need to show results in a compressed time leads to transient interventions that limit the possibility of longer-term social learning. Aware of the transience of these interventions, intended beneficiaries used them wisely as tools to achieve their own individual interests to the detriment of collective development goals.

8.4 The Role of CIAT on the Intervention Process and the Concept of International Public Goods

The fourth issue at stake in this thesis relates to the role of an international agricultural research centre, CIAT, in promoting rural innovation. This issue also relates to the demand of CIAT stakeholders that as an international agricultural centre it has to produce 'international public goods for development', which cannot be produced by national organizations. Revisiting the concept of 'international public goods' discussed in Chapter 2, this means that knowledge generated by CIAT, besides leading to innovation and a positive impact on sustainable development in specific sites, has to be up and out-scaled to broaden its impact, providing an international solution that is available for all interested parties.

In both the Cabuyal and Tascalapa watersheds, CIAT strengthened the *innovation path* and the *bottom-up political path.* Their promotion of CIALs, a 'farmer participatory research' approach that led to social innovation, improved the effectiveness of the *innovation path* and made the process more inclusive. It also promoted CIPASLA and CLODEST, institutional innovations that facilitated multi-institutional coordination, initially to improve the effectiveness of natural resource management, but later on these contributed to the *bottom-up political path*. CIAT also fostered 'market demand-led research' approaches, helping to improve further the effectiveness of the *innovation path* and replacing 'natural resource management' with 'income generation' as a more effective common interest area to promote collective action along a *bottom-up political path.* CIAT intervention in both watersheds highlights the importance of social and institutional innovations to provide an enabling environment for a proper articulation of agricultural research to broader development objectives.

Despite the advances that CIAT made, improving the effectiveness of the *innovation path* by developing social and institutional innovations, its work in both watersheds was highly criticized for deviating from its mandate of producing 'international public goods' and conducting strategic research. CIAT stakeholders expected 'magic bullets', applicable worldwide to solve hunger and poverty. The findings of this research suggest that no such bullet exists, because innovation is a complex social process, with multiple actors and multi-layered sources of knowledge interacting and transforming knowledge into new things (or artifacts), products or practices, and applying these in specific socioeconomic, institutional and cultural contexts. Socio-economic researchers cannot pack and patent their products easily in the way that breeders and biotechnologists can. Although this research shows that technological, social and institutional innovations are complementary, because social and institutional innovations are required to make technological innovations relevant and responsive and to create an enabling environment to nurture them, the latter results in tangible products that are easily packed as 'international public goods', while the former does not.

The other issue about social and institutional innovations is who finances their development and more importantly, their up and out-scaling, to achieve a broader impact. In the case of the social and institutional innovations led by CIAT in the Cabuyal watershed and out-scaled to the Tascalapa watershed, different international cooperation agencies provided financing to develop and validate these innovations, because CIAT social scientists were able to sell the idea. Nevertheless, it is unclear who would finance a broader up and out-scaling process. The only sustainable manner to do that, and maintain their public character, would be through central and local government budgets. However, this requires taking not only a *bottom-up political path*, but also a *top-down political path* in the direction of an institutional change that would broadly develop people's capabilities and provide political education.

The analysis conducted in this research challenges the concept of 'international public goods' while reiterating the need to generate knowledge and technology and to democratize access to it in order to reduce hunger and poverty, and make rational and optimal use of natural resources. This may mean redefining 'international public goods' so that the expectations in international research centres are realistic, viable and fair. International public goods are not a magic formula to solve hunger and poverty problems, or to make up for a lack of sustainability in the use of natural resources. Although stakeholders of international research centres expect that the knowledge they produce have a global perspective, focus on problems that cut across national borders, and be accessible to all interested parties in different parts of the world, knowledge by itself cannot provide an international solution to the hunger, poverty and environmental problems.

Innovation depends on interactions among multiple actors in an enabling environment and is context specific. Thus, innovations *per se* cannot be out-scaled or up-scaled. An international public good is the knowledge that results from properly conducted technological, socio-economic and institutional research among multiple stakeholders that could be contained in a seed, or generalized principles, or a new institutional model, or a policy mechanism generated in a democratic innovation system with transparent information and knowledge management, and available to all interested parties.

Producing this knowledge requires that research organizations either set up their own living laboratories to learn, which is costly and as shown in this research is not the most effective manner to achieve this objective, or develop learning alliances with development organizations and the state. It is impossible for international research organizations to support thousands of experiences such as the one supported in the Tascalapa watershed of Honduras directly. However, they can collaborate with development organizations and the state to complement their capacity and foster learning processes for change.

8.5 Alternative Paths to Generate Sustainable Rural Livelihoods

New approaches for the generation of knowledge and technology, including the 'interactive learning for change' approach proposed in this research, have the potential to improve the effectiveness of innovation processes and contribute to generate sustainable rural livelihoods for smallholders. They can certainly improve the effectiveness of innovation processes among medium and large-scale capitalist farmers. They can increase the likelihood that pro-poor knowledge and technology generation contribute to sustainable rural livelihoods in hillside agro ecosystems. However, it is important to recognize that technological solutions cannot be the only option for smallholders. A complementary 'political solution' able to solve structural agrarian problems and put in place enabling local, national and international policies is also required. Bottom-up processes to improve access to (and control over) livelihood resources need to be paired with non-contradictory *top-down* and *bottom-up political paths* to reduce hunger and poverty and achieve the millennium development goals.

This leads to the conclusion that the *basic-needs provision path* (in the short run), and the *innovation* and *political paths* would all have to be taken, based on a throughout understanding of the specific characteristics and context of each locality. In the short-run, the *basic-needs provision path* may be essential to provide basic infrastructure and services as a pre-requisite to longer-term development goals. However, all implementing parties and the target population would need to reach a consensus on their expectations and acknowledge that short-term aid is just a means to move into a longer-term development process that requires walking along the *innovation path* and the *political path* in a coordinated manner. The *basic-needs provision path* and the *political path* [top-down and bottom-up] are important to redistribute livelihood resources and give people the opportunity to take the *innovation path*. They can then make individual decisions on whether or not to walk along it. To be effective, this 'participation' cannot be forced or bought with 'gifts and amenities'; the ability to participate actively and effectively needs to be developed.

Thus, the CAPACA Program in Colombia, which twenty years ago aimed to develop that capacity and provided political education to smallholders, is now more relevant than ever. Under CAPACA, training was not limited to technical issues (the development of hardware) but included the development of entrepreneurial and organizational skills (software development). This holistic approach contributed to the ability of households in the Cabuyal watershed to manage processes of change and to make better use of external intervention. Thus, resources to build this capacity are needed, to harness political power to reduce hunger and poverty.

References

Adam, B. (2003) 'Reflexive Modernization Temporalized', *Theory, Culture and Society* 20(2): 59-78.

Aguirre, J. A. and H. Miranda (1973) 'Bean Production Systems', in D. Wall (ed.), *Potentials of Field Beans and other Food Legumes in Latin America*, pp. 161-87. Cali, Colombia: CIAT.

Alston, J.M., C. Chan-Kang, M. C. Marra, P.G. Pardey, and T. J. Wyatt (2000) 'A Meta-analysis of Rates of Return to Agricultural R&D: Ex Pede Herculem?', *International Food Policy Research Institute Research Report Number 113*. Washington, D.C.: IFPRI.

Alston, J.M., G.W. Norton and P.G. Pardey (1995) *Science under Scarcity: Principles and Practice for Agricultural Research Evaluation and Priority Setting*. Ithaca: Cornell University Press.

Amanor, K.S. (1994) 'Farmer Experimentation and Changing Fallow Ecology in the Krobo District of Ghana', in W. de Boef, K.S. Amanor, K.D. Wellard and A. Bebbington (eds), *Cultivating Knowledge: Genetic Diversity, Farmer Experimentation and Crop Research*, pp. 35-43. London: Intermediate Technology Publications.

Anderson, J.R. (1998) 'Selected Policy Issues in International Agricultural Research: On Striving for International Public Goods in an Era of Donor Fatigue', *World Development* 26(6):1149-62.

Arce, A. and N. Long (1992) 'The Dynamics of Knowledge: Interfaces between Bureaucrats and Peasants', in N. Long and A. Long (eds), *Battlefields of Knowledge: The Interlocking of Theory and Practice in Social Research and Development*, pp. 208-46. London: Routledge.

Arce, A. and N. Long (2000) 'Reconfiguring Modernity and Development from an Anthropological Perspective', in A. Arce and N. Long (eds) *Anthropology, Development and Modernities: Exploring Discourses, Counter-tendencies and Violence*, pp. 1-31. London: Routledge.

Ashby, J. (1999) 'Institutional Innovation as an Entry Point for System-Level Technological Change', in S. Fujisaka and A. Jones (eds), *Systems and Farmer Participatory Research: Developments in Research on Natural Resource Management*, pp. 141-54. Cali, Colombia: CIAT.

Ashby, J., A.R. Braun, T. Gracia, M.P. Guerrero, L.A. Hernández, C.A. Quiros, and J.I. Roa (2000) *Investing in Farmers as Researchers: Experience with Local Agricultural Research Committees in Latin America.* Cali, Colombia: CIAT.

Ashby, J., T. Gracia, M.P. Guerrero, C.A. Quiros and J.I. (1998), 'Supporting Farmer Experimentation with Local Agricultural Committees', in L. van Veldhuizen, D.A. Johnson and J. Thompson (eds), *Farmers' Research in Practice: Lessons from the Field*, pp. 245-61. London: Intermediate Technology Publications.

Balcázar, A. (1986) 'Cambio Técnico en la Agricultura', in A. Machado (ed.), *Problemas Agrarios Colombianos*, pp. 205-23. Bogotá: Siglo XXI Editores de Colombia LTDA.

Banuri, T. and F. Apfell-Marglin (eds) (1993) *Who will Save the Forests? Knowledge, Power and Environmental Destruction*. London: Zed Books.

Baumeister, E. (1990) 'El Café en Honduras', *Revista Centroamericana de Economía* 11(33): 33-78.

Bawden, R (1994) 'Creating Learning Systems: A Metaphor for Institutional Reform for Development', in I. Scoones and J. Thompson (eds), *Beyond Farmer First: Rural People's Knowledge, Agricultural Research and Extension Practice*, pp. 258-63. London, U.K.: Intermediate Technology Publications.

Beaudette, A.L. (1999) 'Understanding Complexity in Household Well-being and Agro-ecosystem Management in Three Communities of Yorito, Honduras', M.S. Thesis. University of Guelph, Canada.

Bebbington, A. (1999) 'Capitals and Capabilities: A Framework for Analyzing Peasant Viability, Rural Livelihoods and Poverty', *World Development* 27(12): 2021-44.

Bebbington, A. (2005) 'Donor-NGO Relations and Representations of Livelihood in Nongovernmental Aid Chains' *World Development* 33(6): 937-50.

Bejarano, J. (1984) *Economía y Poder: La SAC y el Desarrollo Agropecuario Colombiano 1871-1984*. Bogotá, Colombia: SAC-CEREC.

Beltrán, J.A., P.P. Orozco, V. Zapata, J.I. Sanz, M.C. Roa and A. Schmidt (2004) 'Scaling Out and Scaling Up: The Importance of Watershed Management Organizations', in D. Pachico and S. Fujisaka (eds.), *Scaling Up and Out: Achieving Widespread Impact through Agricultural Research*, pp. 153-71. Cali, Colombia: CIAT.

Bernal, F. (1997) 'Evaluación Institucional de las UMATA', Final Report. Bogotá: Ministerio de Agricultura y Desarrollo Rural, y Fondo de Cofinanciación DRI.

Berry, R.A. (2000) 'Agrarian Reform, Land Distribution, and Small Farm Policy', in E.W. Nafziger and R. Vayrynen (eds), *The Prevention of Humanitarian Emergencies*, pp. 96-114. New York: Palgrave.

Berry, R.A. (2002) '¿Colombia Encontró por fin una Reforma Agraria que Funcione?', *Economía Institucional* 4(6): 24-65.

Berry, S. (1993) *No Condition is Permanent: The Social Dynamics of Agrarian Change in Sub-Saharan Africa*. Madison: University of Wisconsin Press.

Berry, S. (1989) 'Social Institutions and Access to Resources' *Africa* 59(1): pp 41-55.

Best, R., G. Henry and M.V. Gottret (2004) 'El Impacto de la Industria de la Yuca en la Costa Atlántica de Colombia', Paper presented at the Seminar, El Desarrollo Rural en América Latina hacia el Siglo XXI, Pontificia Universidad Javeriana, Bogotá D.C., Colombia (8-10 June).

Biggs, S.D. (1990) 'A Multiple Sources of Innovation Model of Agricultural Research and Technology Promotion', *World Development* 18(1): 1481-99.

Biggs, S.D. (1978) 'Planning Rural Technologies in the Context of Social Structures and Reward Systems', *Journal of Agricultural Economics* 24(3): 257-274.

Biggs, S. and D. Messerschmidt (2005) 'Social Responsibility in the Growing Handmade Paper Industry of Nepal', *World Development* 33(11), p.1821-1843.

Biggs, S. and S. Smith (2003) 'A Paradox of Learning in Project Cycle Management and the Role of Organizational Culture', *World Development* 31(10): 1743-57.

Binswanger, H.C. and K. Deininger (1997) 'Explaining Agricultural and Agrarian Policies in Developing Countries', *Journal of Economic Literature* 35(December): pp 1958-2005.

Bojanic, A.J. (2001) 'Extension, Poverty and Vulnerability in Bolivia and Colombia: Country Studies for the Neuchâtel Initiative', Working Paper 153. London: Overseas Development Institute.

Box, L. (1986) 'The Experimenting Farmer: A Missing Link for Agricultural Change?', in J. Henderinck and E. Szule (eds), *Successful Development in Third World Countries*, pp. 87-95. Utrecht: Geographical Studies No. 67.

Boyce, J., and R. E. Evenson (1975) *Agricultural Research and Extension Programs*. New York: Agricultural Development Council.

Brouwer, R. and K. Jansen (1989) 'Critical Introductory Notes on Farming Systems Research in Developing Third World Agriculture', *Systems Practice* 2(4):379-95.

Bryceson, D.F. (2000a) 'Peasant Theories and Smallholder Policies: Past and Present', in D.F. Bryceson, C. Kay and J. Mooij (eds), *Disappearing Peasantries? Rural Labour in Africa, Asia and Latin America*, pp. 1-36. London: Intermediate Technology Publications.

Bryceson, D.F. (2000b) 'Disappearing Peasantries? Rural Labour Redundancy in the Neoliberal Era and beyond', in D.F. Bryceson, C. Kay and J. Mooij (eds), *Disappearing Peasantries? Rural Labour in Africa, Asia and Latin America*, pp. 299-326. London: Intermediate Technology Publications.

Byerlee, D., and P. Moya (1992) 'Ex-post Assessment of Research Impact: CIMMYT's Experience', in D.R. Lee, S. Kearl and N. Uphoffs (eds), *Assessing the Impact of International Agricultural Research, Proceedings from the 1991 CIIFAD Symposium*, pp. 81-88. Cornell University, Ithaca, New York.

Byerlee, D. (1998) 'The Search for a New Paradigm for the Development of National Agricultural Research Systems', *World Development* 26(6): 1049-55.

Byerlee, D. and G.E. Alex (2003) 'National Agricultural Systems: Recent Developments and Key Challenges', Rome: Interim Science Council of the CGIAR.

Cabra, M.C. (1998) 'Análisis Estadístico para Caracterizar Social, Económica y Biofísicamente la Sub-cuenca del Río Cabuyal', Cali, Colombia: Universidad del Valle.

Carney, D. (1999) 'Approaches to Sustainable Livelihoods for the Rural Poor', *ODI Poverty Briefing*. London: Overseas Development Institute.

Carney, J. and M. Watts (1991) 'Manufacturing Dissent: Works, Gender and the Politics of Meaning in a Peasant Society', *Africa* 60(2): 207-41.

Carrión, F. (1990) 'Instituciones Sociales y Tecnologías Políticas: Una Reflexión en torno a la Participación Campesina en el Desarrollo Rural'. Santiago, Chile: FAO.

Cerfontaine, B., T. Causillas, J.A. Meléndez, D. Villatoro, O. García, J. Adalid Hernández and O. Palacios (1998), in A. Herranz (ed.), *Organización Campesina y Desarrollo Empresarial: Síntesis de la Experiencia DRI-Yoro*. Tegucigalpa, Honduras: Gobierno de Honduras y Agencia Suiza para el Desarrollo y la Cooperación (COSUDE).

CGIAR (2000) 'Integrated Natural Resource Management Research in the CGIAR', a brief report on the INRM Workshop, Penang, Malaysia (21-25 August).

CGIAR, and Global Forum for Agricultural Research (GFAR) (2000) 'Highlights', paper presented at the IIRR Workshop on Going to Scale: Can we bring more Benefits to more People more Quickly?, Silang, Cavite, Philippines (10-14 April).

Chambers, R. and G. Conway (1992) 'Sustainable Rural Livelihoods: Practical Concepts for the 21st Century', IDS Discussion Paper 296. Brighton: Institute of Development Studies.

Chambers, R. and B. P. Ghildyal (1985) 'Agricultural Research for Resource-Poor Farmers: The Farmer-First-and-Last Model', *Agricultural Administration* 20 (1985): 1-30.

Chambers, R., A. Pacey and L.A. Thrupp (eds) (1989) *Farmer First: Farmer Innovation and Agricultural Research*. London: Intermediate Technology Publications.

Checkland, P.B. (1981) *Systems Thinking, Systems Practice*. Chichester, U.K.: J. Wiley and Sons.

Clark, J. (1991) *Democratizing Development: The Role of Voluntary Organizations*. Connecticut: Kumarian Press.

Clark, N. G. (2002) 'Innovation Systems, Institutional Change and the New Knowledge Market: Implications for Third World Agricultural Development', *Journal of the Economics of Innovation and New Technologies* 11(4-5): 353-68.

Classen, L. (2003) 'Assessing Sustainable Rural Development: A Participatory Impact Assessment of the IPCA Project in Honduras', MA Thesis. University of Guelph, Canada.

Cochran, W.G. (1977) *Sampling Techniques*. New York: John Wiley & Sons, Inc.

Cock, J.C. (2002) 'Estudio de Caso de CIPASLA', Cali, Colombia: CIAT.

Coleman, J. (1990) *Foundations of Social Theory*. London: Belknap Press of Harvard University Press.

Collinson, M.P. and E. Tollens (1994) 'The Impact of the International Agricultural Centers: Measurement, Quantification and Interpretation, Issues in Agriculture 41. Washington D.C.: CGIAR.

Comité Departamental de Estadística (2000) 'Anuario Estadístico del Departamento del Cauca'. Popayán: Gobernación del Departamento del Cauca, República de Colombia.

Conway, G. and E.B. Barbier (1990) *After the Green Revolution: Sustainable Agriculture for Development*. London: Earthscan Publications Ltd.

Corporación Colombia Internacional (CCI) (1999) 'Perfil de la Mora', *Boletín CCI:SIM*, 4 (April-June): 1-19.

Cotty, D., M. García, I. Estrada and E. Anchundia (2001) 'Indicadores Básicos sobre el Desempeño Agropecuario 1971-2000'. Zamorano, Honduras: Proyecto de Información Agrícola y Análisis de Políticas, El Zamorano/USAID.

Darlymple, D.G. (1986a) 'Development and Spread of High Yielding Rice Varieties in Developing Countries', Washington D.C.: USAID.

Darlymple, D.G. (1986b) 'Development and Spread of High Yielding Wheat Varieties in Developing Countries', Washington D.C.: USAID.

de Janvry, A. (1981) *The Agrarian Question and Reformism in Latin America*. 1st edition. Baltimore: The Johns Hopkins University Press.

de Janvry, A., E. Sadoulet, and L. Wilcox Young (1989) 'Land and Labour in Latin American Agriculture from the 1950s to the 1980s', *Journal of Peasant Studies* 16(3): 396-424.

de Janvry, A. and E. Sadoulet (1993) 'Path-Dependent Policy Reforms: From Land Reform to Rural Development in Colombia', in C. Hoff, A. Braverman and J.E. Stiglitz (eds), *The Economics of Rural Organizations: Theory, Practice and Policy*, pp 305-320. New York: Oxford University Press.

de Vries, P. (1997) 'Towards Responsibility: On Development Administrators' Fantasies and Field-Level Workers' Anxieties', in H. de Haan and N. Long (eds), *Images and Realities of Rural Life: Wageningen Perspectives on Rural Transformations*, pp. 89-106. Assen, The Netherlands: Van Gorcum & Comp. B.V.

Dearden, P. N., and B. Kowalski (2003) 'Project and Programme Cycle Management (PPCM): Lessons form South and North' *Development in Practice* 13(5): 501-14.

DNP/DRI (1975) 'Síntesis del Programa de Desarrollo Rural Integrado'. Bogotá, Colombia: DNP/DRI.

Dobson, A. (2000) 'Sustainable Development and the Defence of the Natural World', in K. Lee, A. Holland and D. McNeill (eds), *Global Sustainable Development in the Twenty-First Century*, pp. 49-61. Edinburgh: Edinburgh University Press.

Douthwaite, B. (2002) *Enabling Innovation: A Practical Guide to Understanding and Fostering Technological Change*. London: Zed Books.

Douthwaite, B., J. Ekboir, S. J. Tomlow and J.D.H. Keatinge (2004) 'The Concept of Integrated Natural Resource Management (INRM) and Implications for Impact Assessment', in B. Shiferaw, H. A. Freeman and S. Swinton (eds) *Methods for Assessing Economic and Environmental Impacts*, pp. 321-340. CABI International.

Dunn, E.S. (1971) *Economic and Social Development: A Process of Social Learning*, Baltimore: John Hopkins University Press.

Echeverria, R.G. (1998) 'Agricultural Research Policy Issues in Latin America: An Overview', *World Development* 26(6): 1103-11.

Echeverria, R.G., G. Ferreira, and M. Dabezies (1989) 'Returns to the Investment in the Generation and Transfer of Rice Technology in Uruguay', *ISNAR Working Paper* 17. The Hague: ISNAR.

Ekboir, J. and G. Parellada (2001) 'Continuous Innovation Processes: Public-Private Interactions and Technology Policy', in D. Byerlee and R. G. Echeverria (eds), *Agricultural Research Policy in an Era of Privatization: Experiences from the Developing World*, pp. 120-54. Wallingford, U.K.: CAB International.

Escobar, A. (1995) *Encountering Development: The Making and Unmaking of the Third World*. New Jersey: Princeton University Press.

Evenson, R.E. (1992) 'Notes on the Measurement of the Economic Consequences of Agricultural Research Investments', in D.R. Lee, S. Kearl and N. Uphoffs (eds), *Assessing the Impact of International Agricultural Research, Proceedings from the 1991 CIIFAD Symposium*, pp. 51-78. Cornell University, Ithaca, New York.

Fajardo, D. (1986a) 'El Cauca Indígena y el Desarrollo Rural', in A. Machado (ed.) *Problemas Agrarios Colombianos*, pp. 431-59. Bogotá, Colombia: Siglo XXI Editores de Colombia LTDA.

Fajardo, D. (1986b) 'Haciendas, Campesinos y Políticas Agrarias en Colombia, 1920-1980', Bogotá, Colombia: Centro de Investigaciones para el Desarrollo, Universidad Nacional de Colombia.

Fajardo, D., M. Errázuriz and F. Balcázar (1991) 'La Experiencia del DRI en Colombia', in D. Fajardo (ed.), *Campesinos y Desarrollo en América Latina*, pp. 123-259. Bogotá, Colombia: Tercer Mundo Editores y Fondo DRI.

FAO (1984) *Land, Food and People*. Rome: Food and Agricultural Organization.

FAO, and CEGA (1994) 'El Mercado de Tierras y la Formación de Propietarios en Colombia: Estudios de Caso', Bogotá: CEGA.

Farrington, J. (1990) 'New Approaches to Agricultural Research', *Development Policy Review* 8(1): 97-104

Ferguson, J. (1990) *The Anti-Politics Machine: Development, Depolitization, and Bureaucratic Power in Lesotho*. Cambridge: Cambridge University Press.

Ferris, S.; R. Best, M. Lundy, C.F. Ostertag, M.V. Gottret, T. Wandschneider (2006) 'Strategy Paper: A Participatory and Area-based Approach to Rural Agro-Enterprise Development', *CIAT Rural Agroenterprise Development Good Practice Guide 1*. Cali, Colombia: CIAT.

Flora, C.B. (1991) 'Building Sustainable Agriculture: A New Application of Farmer Systems Research and Extension', *Journal of Sustainable Agriculture* 2(3): 37-49.

Foletti, C., O. Palacios, T. Causillas, D. Villatoro, O. García, J.A. Meléndez and J.A. Hernández (1998) 'La Agricultura Sostenible en el Desarrollo Rural del Programa DRI-Yoro (1984-1996)'. Tegucigalpa, Honduras: Gobierno de Honduras y Agencia Suiza para el Desarrollo y la Cooperación (COSUDE).

Fondo DRI (1989) 'Programa de Desarrollo Integral Campesino'. Bogotá: Ministerio de Agricultura/Fondo DRI.

Freeman, C. (1987) *Technology and Economic Performance: Lessons from Japan*. London, U.K.: Pinter.

Friedmann, J. (1984) 'Planning as Social Learning', in D.C. Korten and R. Klauss (eds), *People Centered Development: Contributions towards Theory and Planning Frameworks*, pp. 189-194. Connecticut: Kumarian Press.

Gasper, D. (1999) 'Problems in the Logical Framework Approach and Challenges for 'Project Cycle Management'', *The Courier* 173(January-February): 75-77.

Gaventa, J. (1996) 'The Political Economy of Land Tenure: Appalachia and the Southeast'. Brighton: Institute of Development Studies.

Ghai, D. (1994) 'Development and Environment: Sustaining People and Nature', *Special Issue of Development and Change* 25(1).

Ghai, D. and J. Vivian (eds) (1992) *Grassroots Environmental Action: People's Participation in Sustainable Development*. London: Routledge for UNRISD.

Gibbons, M., C. Limoges, H. Nowotny, S. Schwartzman, P. Scott and M. Troww (1994) *The New Production of Knowledge*. London, U.K.: Sage.

Giddens, A. (1984) *The Constitution of Society: An Outline of the Theory of Structuration*. Cambridge: Polity Press.

Goldsmith, A. A. (1993) 'Institutional Development in National Agricultural Research: Issues for Impact Assessment', *Public Administration and Development*, 13 (3): 195-204.

Goldsmith, R.E. and G. R. Foxall (2003) 'The Measurement of Innovativeness', in L.V. Shainina (ed.), *The International Handbook on Innovation*, pp. 321-29. Oxford: Elsevier Science.

Gómez, H. and C.A. Ruiz (1997) 'Los Paeces: Gente Territorio'. Popayán: Universidad del Cauca.

Gonsalves, J. (2001) 'Going to Scale: What we have gathered from Recent Workshops', *LEISA* 17(3): 6-10.

Gottret, M.V. and G. Henry (1994) 'La Importancia de los Estudios de Adopción e Impacto: El Caso del Proyecto Integrado de Yuca en la Costa Norte de Colombia' in C. Iglesias (ed.), *Memorias de la Tercera Reunión de Fitomejoradores de Yuca*, pp. 193-223. Cali, Colombia: CIAT.

Gottret, M.V. and M. Raymond (2003) 'Analysis of a Cassava Integrated Research and Development Approach: Has it Really Contributed to Poverty Alleviation?', in S. Mathur and D. Pachico (eds), *Agricultural Research and Poverty Reduction: Some Issues and Evidence*, pp. 205-26. Cali, Colombia: CIAT.

Griffin, K. (1978) *International Inequality and National Poverty*. London: Macmillan

Grillo Fernández, E. (1998) 'Development or Decolonization in the Andes?', in F. Apffel-Marglin (ed.),*The Spirit of Regeneration: Andean Culture Confronting Western Notions of Development*, pp. 193-243. London: Zed Books Ltd.

Gündel, S., J. Hancock and S. Anderson (2001) 'Scaling-up Strategies for Research in Natural Resources Management: A Comparative Review''. Chatham, UK: Natural Resources Institute.

Hall, A.J., B. Yoganand, R.V. Sulaiman, S. Rajeswari Raina, C.S. Prasad, G.C. Naik and N.G. Clark (2004a) 'Introduction' in A.J. Hall, B. Yoganand, R.V. Sulaiman, S. Rajeswari Raina, C.S. Prasad, G.C. Naik and N.G. Clark (eds), *Innovations in Innovation: Reflections on Partnership, Institutions and Learning*, pp. 1-26. Andhra Pradesh, India: CPHP, ICRISAT and NCAP.

Hall, A.J., R.V. Sulaiman, B. Yoganand, S. Rajeswari Raina, N.G. Clark and G.C. Naik (2004b) 'Institutional Learning and Change: Towards a Capacity-building Agenda for Research. A Review of Recent Research on Post-harvest Innovation Systems in South Asia', in A.J. Hall, B. Yoganand, R.V. Sulaiman, S. Rajeswari Raina, C.S. Prasad, G.C. Naik and N.G. Clark (eds), *Innovations in Innovation: Reflections on Partnership, Institutions and Learning*, pp. 207-30. Andhra Pradesh, India: CPHP, ICRISAT and NCAP.

Hall, A.J., B. Yoganand, J.H. Crouch and N.G. Clark (2004c) 'The Evolving Culture of Science in the Consultative Group on International Agricultural Research: Concepts for Building a New Architecture of Innovation in Agribiotechnology', in A.J. Hall, B. Yoganand, R.V. Sulaiman, S. Rajeswari Raina, C.S. Prasad, G.C. Naik and N.G. Clark (eds), *Innovations in Innovation:*

Reflections on Partnership, Institutions and Learning, pp. 135-62. Andhra Pradesh, India: CPHP, ICRISAT and NCAP.

Hall, A. (2001) 'The Development and Use of the Innovation Systems Framework in India: Northern Perspective', paper presented at the North South Research Co-operation, Royal Netherlands Academy of Arts and Science, The Netherlands (3 December).

Hall, A., G. Bockett, S. Taylor and M.V.K. Sivamohan (2001) 'Why Research Partnerships Really Matter: Innovation Theory, Institutional Arrangements and Implications for Developing New Technology for the Poor', *World Development* 29(5): 783-97.

Harrington, L., J. White, P. Grace, D. Hodson, A.D. Hartkamp, C. Vaughan and C. Meisber (2001) 'Delivering the Goods: Scaling out Results of Natural Resource Management', *Conservation Ecology* 5(2):19 [online] Available in http://www.conselco.org/vol15/iss2/art19.

Hebinck, P. and J.D. van der Ploeg (1997) 'Dynamics of Agricultural Production. An Analysis of Micro-Macro Linkages', in H. de Haan and N. Long (eds) *Images and Realities of Rural Life: Wageningen Perspectives on Rural Transformations*, pp. 202-25. Assen, The Netherlands: Van Gorcum & Comp. B.V.

Hindess, B. (1986) 'Actors and Social Relations', in M.I. Wadell and S.P. Turner (eds), *Sociological Theory in Transition*, pp 113-126 Boston: Allen and Unwin.

Holling, C. S. (1995) 'What Barriers? What Bridges?', in L.H. Gunderson, C.S. Holling and S.S. (eds), Light in *Barriers and Bridges to the Renewal of Ecosystems and Institutions*, pp. 3-37. New York: Columbia University Press.

Horton, D., W. Ballantyne, B. Uribe, D. Gapasin and K. Sheridan *Monitoring and Evaluating Agricultural Research,* CAB International.

Humphrey, C. (1997) *Honduras Handbook, including the Bay Islands and Copan*: Emeryville, California: Moon Publications Inc.

Humphries, S. (1996) 'Migrants, Dairy Farmers, and Agricultural Land-Use in the Humid Tropical Hillsides of Northern Honduras', Internal Report. Tegucigalpa, Honduras: CIAT-Hillsides Project.

Humphries, S., J. González and J. Jimenez (2000) 'Searching for Sustainable Land Use Practices in Honduras: Lessons from a Programme of Participatory Research with Hillside Farmers', *AgRen Network Paper No. 104*.

International Institute for Rural Reconstruction (IIRR) (2000) 'Going to Scale: Can we bring more benefits to more people more quickly?', paper presented at the IIRR Workshop on Going to Scale: Can we bring more Benefits to more People more Quickly?, Silang, Phillippines (10-14 April).

IUCN (1980) *World Conservation Strategy: Living Resources Conservation for Sustainable Development,* Glands: International Union for the Conservation of Nature and Natural Resources

Jansen, K. (1993) 'Café y Formas de Producción en Honduras', *Revista Centroamericana de Economía* 14(41): 58-96.

Jansen, K. (1998) *Political Ecology, Mountain Agriculture, and Knowledge in Honduras*, Amsterdam: Thela Publishers

Jansen, K. (2000) 'Structural Adjustment, Peasant Differentiation and the Environment in Central America', in D.F. Bryceson, C. Kay and J. Mooij (eds), *Disappearing Peasantries? Rural Labour in Africa, Asia and Latin America*, pp. 192-212. London: Intermediate Technology Publications

Janssen, W.G. (1986) 'Market Impact on Cassava's Development Potential in the Atlantic Coast region of Colombia', PhD dissertation. Agricultural University of Wageningen.

Jeffrey, Paul. (2003) 'Depressed Coffee Prices yield Suffering in Poor Countries', *National Catholic Reporter* (February 7).

Johda, N. (1988) 'The Poverty Debate in India: A Minority Viewpoint', *Economic and Political Weekly* 21: 1169-81.

Johnson, C.A. (1997) 'Rules, Norms and the Pursuit of Sustainable Livelihoods', *IDS Working Paper* 52. Brighton: Institute of Development Studies.

Kay, C. (1999) 'Rural Development: From Agrarian Reform to Neoliberalism and Beyond', in R.N. Gwynne and C. Kay (eds), *Latin America Transformed: Globalization and Modernity*, pp. 272-304. London: Arnold.

Kay, C. (2000) 'Latin America's Agrarian Transformation: Peasantization and Proletarianization', in D.F. Bryceson, C. Kay and J. Mooij (eds), *Disappearing Peasantries? Rural Labour in Africa, Asia and Latin America*, pp. 123-38. London: Intermediate Technology Publications.

Kanbur, R. (2001) 'Cross-Border Externalities, International Public Goods And Their Implication for Aid Agencies', paper presented at the Conference on Global Tension in honor of Ester Boserup, Cornell University, Ithaca, New York (9-10 March).

Kaul, I., I. Grunberg and M.A. Stern (eds) (1999) *Global Public Goods: International Cooperation in the 21st Century*. New York: Oxford University Press.

La Gaceta (1997) 'Decreto del Congreso Nacional No. 187-96 del 21 de enero de 1997: Convenio de Préstamo BID # 981-SF/HO, Proyecto de Modernización de los Servicios de Tecnología Agropecuaria'. Tegucigalpa, Honduras: La Gaceta, Diario Oficial de la República de Honduras, Decano de la Prensa Hondureña.

Lall, S. (1993) 'Understanding Technology Development', *Development and Change* 24(4):719-53.

Leach, M. (1994) *Rainforest Relations: Gender and Resource Use among the Mende of Gola, Sierra Leone.* Edinburgh: Edinburgh University Press.

Leach, M., R. Mearns and I. Scoones (1999) 'Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management', *World Development* 27(2): 225-47.

Lee, D.R., K. Steven, and N. Uphoffs (eds) (1991) *Assessing the Impact of International Agricultural Research for Sustainable Development, Proceedings from the*

CIIFAD Symposium at Cornell University. Ithaca, New York: Cornell University Press.

Leeuwis, C. and R. Pyburn (2002) 'Social Learning for Rural Resource Management', in C. Leeuwis and R. Pyburn (eds), *Wheelbarrows Full of Frogs: Social Learning in Rural Resource Management*, pp. 11-21. Assen, The Netherlands: Koninklijke Van Gorcum B.V.

Leeuwis, C., R. Pyburn and A. Boon (2002) 'Concluding Reflections on Social Learning: Tadpoles, Lilipads and Lotus Flowers', in C. Leeuwis and R. Pyburn (eds), *Wheelbarrows Full of Frogs: Social Learning in Rural Resource Management*, pp. 449-70. Assen, The Netherlands: Koninklijke Van Gorcum B.V.

Lohr, S.L. (1998) *Sampling: Design and Analysis*. London: Dexbury Press.

Long, N. (1997a) 'Agency and Constraint, Perceptions and Practice: A Theoretical Position', in H. de Haan and N. Long (eds), *Images and Realities of Rural Life: Wageningen Perspectives on Rural Transformations*, pp. 1-20. Assen, The Netherlands: Van Gorcum & Comp. B.V.

Long, N. (1997b) 'Agrarian Change, Neoliberalism and Commoditization: A Perspective on Social Value', in H. de Haan and N. Long (eds), *Images and Realities of Rural Life: Wageningen Perspectives on Rural Transformations*, pp. 226-44. Assen, The Netherlands: Van Gorcum & Comp. B.V.

Long, N. (1992a) 'From Paradigm Lost to Paradigm Regained? The Case for an Actor-oriented Sociology of Development', in N. Long and A. Long (eds), *Battlefields of Knowledge: The Interlocking of Theory and Practice in Social Research and Development*, pp. 16-43. London: Routledge.

Long, N. (1992b) 'Introduction', in *Battlefields of Knowledge: The Interlocking of Theory and Practice in Social Research and Development*, edited by Norman Long and Ann Long, 3-15. London: Routledge.

Long, N. (ed.) (1989) 'Encounters at the Interface: A Perspective on Social Discontinuities in Rural Development', Wageningen Studies in Sociology Vol. 27. Wageningen: The Wageningen Agricultural University.

Long, N. and J.D. van der Ploeg (1989) 'Demythologizing Planned Intervention: An Actor Perspective' *Sociologia Ruralis* 29(3/4):226-249.

Long, N. and M. Villarreal (1994) 'The Interweaving of Knowledge and Power in Development Interfaces', in I. Scoones and J. Thompson (eds), *Beyond Farmer First: Rural People's Knowledge, Agricultural Research and Extension Practice*, pp. 41-52. London: Intermediate Technology Publications.

Lundvall, B. (1992) *National Systems of Innovation and Interactive Learning*. London, U.K.: Pinter.

Lynam, J.K. and W.G. Janssen (1988) 'Methodology Development for the Planning and Evaluation of Integrated Cassava Development Projects', CIAT Working Paper 32. Cali, Colombia: CIAT.

Machado, A. (1986) *Políticas Agrarias en Colombia 1900-1960*. Bogotá, Colombia: Empresa Editorial, Universidad Nacional de Colombia.

Maingot, A. (1968) 'Colombia: Civil-Military Relations in a Political Culture of Conflict'. Gainesville, Florida: University of Florida.

McNeill, D. (2000) 'The Concept of Sustainable Development', in K. Lee, A. Holland and D. McNeill (eds.), *Global Sustainable Development in the Twenty-First Century*, pp. 10-30. Edinburgh: Edinburgh University Press.

Mehta, L. (1997) 'Social Difference and Water Resource Management: Insights from Kutch, India', *IDS Bulletin* 28(4):79-89.

Menter, H., S. Kaaria, N. Johnson and J. Ashby (2004) 'Scaling Up', in D. Pachico and S. Fujisaka (eds), *Scaling Up and Out: Achieving Widespread Impact through Agricultural Research*, pp. 9-24. Cali, Colombia: CIAT.

Milbrath, L. W (1989) *Envisioning a Sustainable Society: Learning our Way Out*. New York: State University of New York Press.

Moncayo, V. (1986) 'Política Agraria y Desarrollo Capitalista', in A. Machado (ed.), *Problemas Agrarios Colombianos*, pp. 85-120. Bogotá: Siglo XXI Editores de Colombia LTDA.

Moncayo, V. and F. Rojas (1978) *Producción Campesina y Capitalismo*. Bogotá: Editorial CINEP.

Moore, D.S. (1993) 'Contested Terrain in Zimbabwe's Eastern Highlands: Political Ecology, Ethnography and Peasant Resource Struggles', E*conomic Geography* 69(4): 380-401.

Morrissey, O., D.W. te Velde and A. Hewitt (2002) 'Defining International Public Goods: Conceptual Issues', in M. Ferroni and A. Mody (eds), *Incentives, Measurement, and Financing,* pp 31-46. London: Kluwer Press.

Moser, C. (1998) 'The Asset Vulnerability Framework: Reassessing Urban Poverty Reduction Strategies', *World Development* 26(1): 1-19.

Mullen, J.D. (1985) 'The Impact of Consumers and Cattle Producers of Changes in Beef Processing Costs', Ph.D. Dissertation. Texas A&M University.

Mullen, J.D., G.R. Wohlgenant, G.R. Griffith and K.G. Morris (1991) 'The Returns from Research and Promotion Activities in the Australian Pig Industry', ACIAR Interim Paper. Canberra, Australia: ACIAR.

Muller, A. (1987) 'Peasants and Professionals: The Social Organization of Women in Development Knowledge', PhD Dissertation. University of Toronto.

Neefjes, K. (2000) 'People Defining their Environments: A Future of Change', in K. Lee, A. Holland and D. McNeill (eds), *Global Sustainable Development in the Twenty-First Century*, pp. 200-20. Edinburgh: Edinburgh University Press.

North, D.C. (1994) 'Constraints on Institutional Innovation: Transaction Costs, Incentive Compatibility, and Historical Considerations', in V. Ruttan (ed.), *Agriculture Environment & Health: Sustainable Development in the 21st Century*, pp. 48-70. Minneapolis, Minnesota: University of Minnesota Press.

North, D.C. (1995) 'The New Institutional Economics and Third World Development', in J. Harriss, J. Hunter and C.M. Lewis (eds), *The New Institutional Economics and Third World Development*, pp. 17-26. London: Routledge.

Nuijten, M. (1992) 'Local Organization as Organizing Practices: Rethinking Rural Institutions', in N. Long and A. Long (eds), *Battlefields of Knowledge: The Interlocking of Theory and Practice in Social Research and Development*, pp. 189-207. London: Routledge.

Osorio, M.A. (1984) 'Capacitación para la Participación Campesina: CAPACA', Primera Parte: Metodología. Bogotá: SENA, CINTEFOR - OIT, Programa de Promoción Popular Rural.

Ospina, B., M.V. Gottret, D. Pachico, and C.E. Leite Cardoso (1999) 'Integrated Cassava Research and Development Strategy: A Case Study on Adoption and Impact in Northeast Brazil', in L. Sechrest, M. Stewart and T. Stickle (eds), *A Synthesis of Findings Concerning CGIAR Case Studies on the Adoption of Technological Innovations*, pp. 37-47. CGIAR Impact Assessment and Evaluation Group, Rome, Italy: FAO.

Ostertag, C.F. (1994) 'Estudio Rápido de los Sistemas de Producción y Comercialización de la Microcuenca del Río Cabuyal en el Norte del Cauca', Cali, Colombia: Programa de Laderas, CIAT.

PAAR (2003) 'Land Use Planning', Municipality of Yorito, Honduras.

Pachico, D. (1992) 'Experiences and Challenges in Research on the Assessment of Impact of International Agricultural Research', in D.R. Lee, S. Kearl and N. Uphoffs (eds), *Assessing the Impact of International Agricultural Research, Proceedings from the 1991 CIIFAD Symposium*, pp.89-94. Cornell University: Ithaca, New York.

Pachico, D. and S. Fujisaka (eds) (2004) *Scaling Up and Out: Achieving Widespread Impact through Agricultural Research*. Cali, Colombia: CIAT.

Palacios, O., C. Foletti, T. Causillas, D. Villatoro, O. García, J.A. Meléndez and J.A. Hernández (1998) 'Desarrollo Rural Sostenible: Síntesis de una Experiencia'. Tegucigalpa, Honduras: Gobierno de Honduras y Agencia Suiza para el Desarrollo y la Cooperación (COSUDE).

Payne, P., M. Lipton, R. Longhurst, J. North and S. Treagust (1994) 'How Third World Households Adapt to Dietary Energy Stress: The Evidence and the Issues', Food Policy Review 2. Washington:IFPRI.

Paz, Elciario (1980), 'Monografía de Caldono'. Caldono, Cauca: Municipality of Caldono.

Pearse, A. (1980) *Seeds of Plenty, Seeds of Want*. Oxford: Clarendon Press.

Perrings, C. (1994) 'Sustainable Livelihoods and Environmentally Sound Technology', *International Labour Review* 133(3): 305-26.

Pinstrup-Andersen, P. and R. Pandya-Lorch (1995) 'Prospects for World Food Security and Distribution', paper presented at the Eco-regional Approaches for Sustainable Land Use and Food Production: Proceedings of a Symposium on Eco-regional Approaches in Agricultural Research, ISNAR, The Hague (12-16 December).

Probst, K. (2002) 'Participatory Monitoring and Evaluation?', PhD dissertation. Hohenheim University.

Pyatt, Graham. (2001) 'An Alternative Approach to Poverty Analysis', paper presented at the Valedictory Address as Professor of Economics of Development, Institute of Social Studies, The Hague, The Netherlands (29 November).

Ramírez, F. (2002) 'Para Re-pensar el 'Proyectismo': Poder, Conocimiento y Sujetización en las Intervenciones del Desarrollo', in F. Ramírez (ed.) *Versiones y Aversiones del Desarrollo*, pp. 103-39. Quito, Ecuador: Centro de Investigaciones CIUDAD.

Ravallion, M. (1992) 'Poverty Comparisons: A Guide to Concepts and Measures', *Living Standards Measurement Paper 88*. Washington: World Bank.

Ravnborg, H.M. (1999) Developing Regional Poverty Profiles based on Local Perceptions', CIAT Working Paper 291. Cali, Colombia: CIAT.

Ravnborg, H.M. (1992) 'The CGIAR in Transition: Implications for the Poor, Sustainability and the National Research Systems', Agricultural Administration (Research and Extension) Network Paper 31, Copenhagen, Denmark.

Ravnborg, H.M. and J. Ashby (1996) 'Organising for Local-level Watershed Management: Lessons from Río Cabuyal Watershed, Colombia', *ODI Agricultural Research & Extension Network Paper* 65(July).

Ravnborg, H.M. and J.E. Rubiano (1998) 'Farmers Decision Making on Land Use: The importance of Soil Conditions in the Case of Río Cabuyal Watershed, Colombia', *Geografisk Tidsskrift, Danish Journal of Geography* 101(July): 115-30.

Ravnborg, H.M. and M.P. Guerrero (1997) 'Evaluación de la Pobreza Rural: Un Método Práctico para Extrapolar y Cuantificar Percepciones Locales', CIAT Working Document No. 29. Cali: CIAT.

Remenyi, J.v. (1988) 'Partnerships in Research: A New Model for Development Assistance', in C.A. Tisdell and P. Maitra (eds), *Technological Change, Development and the Environment: Socio-Economic Perspectives*, pp. 92-115. London: Routledge.

Richards, P. (1989) 'Agriculture as a Performance', in R. Chambers, A. Pacey and L. Ann Thrupp (eds) *Farmer First: Farmer Innovation and Agricultural Research*, pp. 39-50. London: Intermediate Technology Publications.

Richards, P. (1985) *Indigenous Agricultural Revolution*. London: Unwin Hyman.

Roa, J.I. (1990), 'Producción Artesanal Participativa de Semilla de Frijol: Pescador-Cauca', paper presented at the La Comercialización: Una Realidad Vital de los Programas de Producción Agrícola Campesina, Perico Negro, Cauca, Colombia (5-6 July).

Robbins, P. and S. Ferris (2002) 'Impact of Globalisation on the Agricultural Sectors of Countries in Eastern and Central Africa'. Kampala, Uganda: IITA.

Rojas, J.M. (1993) 'La Bipolaridad del Poder Local: Caldono en el Cauca Indígena'. Cali, Colombia: Universidad del Valle.

Roldán, D., J.M. Rojas and L.C. Castillo (1988) 'Proceso de Evaluación Participativa del Programa de Desarrollo Rural Integrado: Distritos de Nariño y Cauca'. Cali, Colombia: Universidad del Valle.

Röling, N.G. (1990) 'The Agricultural Research-Technology Transfer Interface: A Knowledge Systems Perspective', in D. Kaimowitz (ed.), *Making the Link: Agricultural Research and Technology Transfer in Developing Countries*, pp. 1-42. Boulder, Colorado, USA: Westview Press.

Röling, N.G. (1992) 'The Emergence of Knowledge Systems Thinking: A Changing Perception of Relationships among Innovation, Knowledge and Configuration', *Knowledge and Policy: The International Journal of Knowledge Transfer and Utilization* 5(1): 42-64.

Röling, N.G. and J. Jiggins (2001) 'Extension Studies: An Ugly Duckling? Explorations in Reflexive Praxiology', paper presented at the 15th European Seminar of Extension and Education, Wageningen (26-31 August).

Röling, N.G. and M.A.E. Wagemakers (eds) (1998) *Facilitating Sustainable Agriculture: Participatory Learning and Adaptative Management in time of Environmental Uncertainty*. Cambridge: Cambridge University Press.

Roquas, E. (2002) *Stacked Law: Land, Property and Conflict in Honduras*, Thela Latin American Series. Amsterdam: Rozenberg Publishers.

Rosas, J.C., O. Gallardo and J. Jiménez (2003) 'Mejoramiento Genético del Frijol Común mediante Enfoques Participativos en Honduras'. Zamorano, Honduras: El Zamorano.

Ross, E.B. (1998a) 'Malthusianism, Counterrevolution, and the Green Revolution', *Organization and Environment* 11(4): 446-50.

Ross, E.B. (1998b) *The Malthus Factor: Poverty, Politics and Population in Capitalist Development*. London: Zed Books Ltd

Ruttan, V. (1988) 'Generation and Diffusion of Agricultural Technology: Issues, Concepts and Analysis', in I. Ahmed and V. Ruttan (eds), *Generation and Diffusion of Agricultural Innovations: The Role of Institutional Factors*, pp. 69-127. Aldershot: Gower Publishing Company Limited.

Sachs, W. (ed.) (1992) *The Development Dictionary: A Guide to Knowledge as Power*. London: Zed Books.

Sagoff, M. (2000) 'Can Technology Make the World Safe for Development? The Environment in the Age of Information', in K. Lee, A. Holland and D. McNeill (eds), *Global Sustainable Development in the Twenty-First Century*, pp. 115-44. Edinburgh: Edinburgh University Press.

Saith, A. (1990) 'Development Strategies and the Rural Poor', *The Journal of Peasant Studies* 17(2): 171-243.

Samuelson, P (1954) 'The Pure Theory of Public Expenditure', *Review of Economics and Statistics* 36(4): 387-89.

Schaffer, P. (1996) 'Beneath the Poverty Debate: Some Issues', *IDS Bulletin* 27(1): 23-35.

Schiøler, E. (2002) 'From the Rural Heart of Latin America: Farmers, Agricultural Research, and Livelihoods', Future Harvest. Washington, D.C.: Danish Royal Ministry of Foreign Affairs.

Schultz, T.W. (1964) *Transforming Traditional Agriculture*. New Haven: Yale University Press.

Scobie, G.M., J.D. Mullen and J.M. Alston (1991) 'The Returns to Investment in Research on Australian Wool Production', *Australian Journal of Agricultural Economics* 35(2): 179-95.

Scoones, I. (1998) 'Sustainable Rural Livelihoods: a Framework for Analysis', IDS Working Paper No. 72. Brighton: Institute of Development Studies.

Scoones, I. and J. Thompson (1994) 'Introduction', in I. Scoones and J. Thompson (eds), *Beyond Farmer First: Rural People's Knowledge Agricultural Research and Extension Practice*, pp. 1-12. London: Intermediate Technology Publications Ltd.,

Scott, J.C. (1985) *Weapons of the Weak: Everyday Peasant Forms of Resistance*, New Haven and London: Yale University Press.

Selener, D. (1997) 'Participatory Action Research and Social Change'. Ithaca, New York: Cornell Participatory Action Research Network.

Sen, A. (1999) *Development as Freedom*. New York: Anchor Books.

Sen, A. (1981) *Poverty and Famines: an Essay on Entitlement and Deprivation*. Oxford: Oxford University Press.

Seré, C. (1986) 'Adoption and Impact Studies: Status and Current Thinking within the Tropical Pastures Program', *Trends in CIAT Commodities*. Cali, Colombia: CIAT.

Stifel, L.D. (1992) 'Impact Assessment in Africa: Experiences of IITA and other IARCs', in D.R. Lee, S. Kearl and N. Uphoffs (eds), *Assessing the Impact of International Agricultural Research, Proceedings from the 1991 CIIFAD Symposium*, pp. 109-121. Ithaca, New York: Cornell University.

Stiglitz, J.E. (1999) 'Knowledge as a Global Public Good', in I. Kaul, I. Grunberg and M.A. Stern (eds), *Global Public Goods: International Cooperation in the 21st Century*, pp. 308-325 . New York: Oxford University Press.

Streeten, P., S. J. Burke, M. L. Haq, N. Hicks and F. Stewart (1981) *First Things First: Meeting Basic Needs in Developing Countries*. New York: Oxford University Press.

Suárez, I. (1986) 'Las Luchas Campesinas en la Etapa de la Agricultura Comercial', in A. Machado (ed.) *Problemas Agrarios Colombianos*, pp. 403-29. Bogotá: Siglo XXI Editores de Colombia LTDA.

Schultz, T.W. (1964) *Transforming Traditional Agriculture*. New Haven: Yale University Press.

TAC (1997) 'CGIAR Priorities and Strategies for Resource Allocation during 1998-2000', Washington D.C.: CGIAR Secretariat.

TAC/CGIAR (1987) 'CGIAR Priorities and Future Strategies', Rome: TAC Secretariat, FAO.

TAC/CGIAR (1990) 'A Possible Expansion of the CGIAR', Rome: TAC Secretariat, FAO.

Temel, T., W.G. Janssen and F. Karimov (2003) 'Systems Analysis by Graph-Teoretic Techniques: Assessment of Agricultural Innovation Systems of Azerbaijan', *Agricultural Systems* 77(2): 91-116.

Thompson, S.K. (2002) *Sampling*. New York: John Wiley & Sons, Inc.

Timothy, D.H., P.H. Harvey and C.R. Dowswell (1988) 'Development and Spread of Improved Maize Varieties and Hybrids in Developing Countries', Washington D.C.: USAID.

Unwin, P. (1995) 'Fighting Hunger at the Grass Roots: Paths to Scaling Up', *World Development* 23(6): 927-39.

Unwin, P., P. Jain and L. Brown (2000) 'Think Large and Act Small: Toward a New Paradigm for NGO Scaling Up', *World Development* 28(8): 1409-19.

Unwin, P. and D. Miller (2000) 'Scaling Up: Thinking through the Issues', paper presented at the Workshop on Going to Scale: Can we bring more Benefits to more People more Quickly?, IIRR, Silang, Philippines (10-14 April).

Urbano, P., J.E. Rubiano, W.B. Bell and E.B. Knapp (1995) 'Cambios en el Uso de la Tierra como Posible Indicador de un Desarrollo Sostenible en una Zona de Laderas: Subcuenca del Río Cabuyal, Cauca, Colombia', paper presented at the IV Congreso AESIG, Barcelona, Spain (7-9 September).

Vallejas Larios, M. (2003) 'Municipal Forest Management: A New Alternative for Honduras', in L. Ferroukhi (ed.), *Municipal Forest Management in Latin America*, pp. 57-88. Bogor, Indonesia: CIFOR/IDRC.

van der Duim, R. (1997), 'Sustainable Development of Tourism. A Framework for Discussion and Research', in H. de Haan and N. Long (eds), *Images and Realities of Rural Life: Wageningen Perspectives on Rural Transformations*, pp. 306-23. Assen, The Netherlands: Van Gorcum & Comp. B.V.

Vargas del Valle, R. (2003) 'La Experiencia Reciente del Fondo DRI de Colombia', paper presented at the Seminario Latinoamericano sobre Heterogeneidad Agraria y Políticas Diferenciadas, Cocoyoc, Morelos, Mexico (27-29 November).

Vivas, R.H. (2000) 'Desarrollo Armónico de la Comunicad de la Cuenca del Río Ovejas en el Departamento del Cauca a Partir de la Acción Concertada entre la Comunidad y las Instituciones', Cauca, Colombia: CIPASLA.
Willis, K. (2005) *Theories and Practices of Development*. First edition. Abingdon, Oxon: Routledge.
Wolf, E. (1990) 'Facing Power: Old Insights, New Questions, Distinguished Lecture', *American Anthropologist* 92(3): 586-96.
Woodhill, J. (2002) 'Sustainability, Social Learning and Democratic Imperative', in C. Leeuwis and R. Pyburn (eds), *Wheelbarrows Full of Frogs: Social Learning in Rural Resource Management*, pp. 317-32. Assen, The Netherlands: Koninklijke Van Gorcum BV.
World Bank (2001) *Poverty Reduction Strategy Paper, Honduras* [cited. Available from http://wbln0018.worldbank.org/lac/lacinfocleint.nsf.
World Commission on Environment and Development (1987) *The Brundtland Report: Our Common Future*. Oxford: Oxford University Press.
Zaltman, G., R. Duncan and J. Holbek (1973) *Innovation and Organizations*. New York: John Wiley.
Zamosc, L. (1986) *The Agrarian Question and the Peasant Movement in Colombia: Struggles of the National Peasant Association 1967-1981*. Cambridge: Cambridge University Press.
Zamosc, L. (1984) 'Los Usuarios Campesinos y las Luchas por la Tierra en los Años Sesenta'. Bogotá: CINEP.

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