The Impact of Agroforestry-Based Soil Fertility Replenishment Practices on the Poor in Western Kenya

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Foreword

For decades, there has been significant investment in the development of agricultural technologies that aim to increase productivity of smallholder farms in Africa. At a macro-level, however, farm output and productivity have stagnated and poverty rates have remained stubbornly high, even increasing in some areas.

It is widely acknowledged that policy and infrastructural constraints play a large role in reducing incentives for farmers to invest in agriculture. Yet the fact that farmers have made some investments and that some progress has occurred suggests that characteristics of the technologies themselves, or the way in which they are promoted, also facilitate or inhibit wider adoption and impact.

This research report, part of a set of studies on the impact of agricultural research on poverty led by IFPRI, analyzes the adoption and impact of agroforestry techniques for soil fertility enhancement in one of the poorest regions of the world—the western Kenyan highlands. It further examines the role that government and nongovernmental organizations and their different dissemination methods play in reaching potential users and helping them understand and use this knowledge-intensive technology. In this study, the researchers have used quantitative and qualitative research methods to make discoveries and develop insights that neither method alone could accomplish.

The authors find that improved fallows and biomass transfer systems are attractive to the poor because they are low in cost and provide noticeable increases in crop yields. Lower and higher income groups in the study villages use these systems in similar ways—this is not the case for fertilizer use—but the small farm sizes of the region limit the impact of this technology. The size of area under these systems remains small after six years of dissemination, indicating that yield improvements do not translate into significant household-level welfare impacts for the most part.

Maintaining information flows is a challenging task with such high rates of poverty and the continuous search for livelihoods on and off farm. Persons in close contact with development organizations increase their knowledge of soil fertility management, but villagers noted problems with the quantity and quality of information. Different methods for disseminating knowledge have strengths and weaknesses with respect to reaching poor farmers and women, and this has implications for social capital.

It is challenging to reduce short-term poverty rates in highly populated areas where farm sizes have decreased to less than one hectare. Adverse shocks are ubiquitous and they almost always deplete household asset bases. The authors do not find any single occupation or investment that always improves welfare. Thus, the study confirms in a clear way that poverty reduction will require sets of interventions and greater understanding of their sequencing and integration. Low-cost methods for raising soil fertility can be coupled with other feasible enterprises for poor farmers, such as the use of improved maize varieties that are resistant to streak virus and the increased planting of higher value crops like kales and climbing beans. Greater investment in poultry or ruminants and in fruits or woodlots are also within the capacity

of poor households. The spread and speed of such investments would need to be underpinned by increased access to capital or credit, which is very scarce in the study site.

Joachim von Braun
Director General, IFPRI

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Summary

Western Kenya is one of the most densely populated areas in Africa. Farming there is characterized by low inputs and low crop productivity. Poverty is rampant in the region. Yet the potential for agriculture is considered good. In the study described here, researchers looked specifically at soil fertility replenishment (SFR) systems as part of a larger IFPRI effort to examine the impact of agricultural research on reducing poverty. Focused on two specific systems—the tree-based "improved fallow" system and the biomass transfer system—the study compared rates of adoption in poor and nonpoor communities and evaluated the extent to which their adoption reduced poverty.

Improved fallow refers to the intentional planting of a fallow species. Improved fallows are more efficient than natural fallows, typically achieving the same effect on crop productivity in a much shorter time. Biomass transfer systems are those in which organic nutrient sources are grown in one place and then transferred to crops in another place. Such a system allows farmers to grow crops continuously, an advantage over the improved fallow system. The space available for producing organic nutrient sources on-farm is limited, however.

Combining Qualitative and Quantitative Analysis to Assess Poverty

The range of issues covered in the study required the use of a variety of research methods and interdisciplinary perspectives. For example, distinguishing the poor from the nonpoor for the purposes of the study was not straightforward. The researchers used a variety of methods to assess poverty levels, including quantitative measures from surveys, enumerator ratings, and farmer self-assessments. Local perceptions of poverty and the role of gender, power, and other social constructs in understanding why and how farmers adopted the new systems, and the impact of the systems, could only be explored using qualitative research methods and sociological perspectives. These were combined with quantitative measures of adoption and impact, along with economic analysis. The researchers also drew on long-term knowledge of the region based on work by members of the study team and others.

Study Findings

- Over the course of the study, welfare or livelihood outcomes worsened for many households. There was a general deterioration in welfare indicators, including assets, expenditures, and food consumption. Particularly striking was that households with relatively high welfare indicators in the initial period suffered the greatest losses. This was due partly to the large number of adverse shocks affecting households and the cultural obligations felt by all community members.
- Households did see the importance of SFR, and there were many human capital impacts. Both the qualitative and quantitative research found significant knowledge acquisition taking place, not only for agroforestry methods but also for general soil management and farming practices. People valued this information and often put it into practice.

- The poor adopted SFR strategies at the same rate as the nonpoor. Adoption rates were not outstanding but were encouraging, with about 20 percent of all farmers using the technologies on a regular basis.
- Adoption at the early stage was at low levels of intensity. Although an encouraging number of households used or tested SFR practices, the size of plots on which they were applied was small. It is not yet known whether this is a ceiling or a consequence of the early stage of dissemination.
- The dissemination analysis found that farmers appreciated some aspects of different disseminating organizations and the many different methods tried. Although characteristics of SFR affected whether people adopted a system, aspects of the dissemination process also affected adoption. The dissemination analysis found that the main feature of most dissemination approaches—group-based methods—can strengthen human and social capital, and that farmers of different social status benefited from such methods. However, this analysis also found that group-based approaches may disadvantage farmers of lower social status and women, who are less likely to participate in or dominate groups. These findings reinforce the idea that it is best to use a variety of methods to disseminate new technologies or knowledge.
- Sustainability of dissemination structures and processes proved possible, but challenging, due to problems encountered by farmer groups, limited capacity of local administration, social dynamics within villages, and limited cost-sharing ability. Monitoring would help to pick up these problems so that resolutions could be sought where possible.
- SFR did significantly raise crop yields. Respondents in the case studies and formal surveys consistently reported significant increases in yields from the use of SFR practices. This is consistent with farmer-managed trial data.
- Despite being used by a number of poor households and having an impact on yields, SFR's impact at the household level is modest. This is due to the small land sizes under SFR and because the weak rural economy is not conducive to investment and development. As a result, technological innovations alone are likely to have limited short-term impact. Poverty alleviation should encompass other sectors as well.

Strategies for Addressing Poverty and Soil Fertility

SFR technology interventions imply assumptions about the role of agriculture in people's livelihoods that may not be true. The assumption that poverty can be reduced through farming is not necessarily reflected in the investments in livelihood activities made by people in the region. In fact, their decisions are embedded in their economic circumstances, cultural and normative frameworks, and social identities.

Identifying agricultural strategies to reduce poverty is difficult due to low prices, variable climate, and the high cost of profitable investment. Small land holdings, in turn, limit the amount of diversification that households are willing to undertake. This study shows that even when progress is made, households can easily slip back into poverty. Therefore, in addition to the generation of production and income, the need exists for insurance through investment in risk-buffering assets.

The soil fertility systems being disseminated are useful options for farmers, and many farmers who have never before invested in soil are giving them a try. There are clear limitations to the use of improved fallows and biomass transfer, however. Small farm sizes, for example, limit the extent to which niches can be found to produce the green manures. The technologies are therefore best perceived as components of a larger farm-level integrated soil fertility management strategy. Consequently, dissemination strategies should encompass a range of management practices for addressing the problem of poor soil fertility.

CHAPTER 1

Introduction

Background to the Study

This study of soil fertility replenishment (SFR) technologies in western Kenya is one of seven case studies that comprise a research project examining the impact of agricultural research on poverty. The impetus behind these studies is the belief that "the contribution of CGIAR and national agricultural research centers to food production is well established. However, the extent to which the poor have benefited from agricultural research is less certain" (IFPRI 2000). To address this concern, CGIAR's Special Program for Impact Assessment (SPIA), formerly the Impact Assessment and Evaluation Group (IAEG), requested that IFPRI develop and coordinate a project to strengthen capacity for poverty assessments, not only to identify the conditions under which agricultural research is a sound investment for reducing poverty, but also to improve the targeting of research priorities to the changing needs of the poor. Each study aimed to develop methods for evaluating the impact of agricultural research on poverty in the context of different agricultural technologies and within different country, social, and institutional settings. It is hoped that collectively the studies will point toward a conceptual framework that agricultural research centers can draw upon for impact assessment work, and that will also help them to identify research priorities and guide technology design to increase the impacts on poverty in the future (IFPRI 2000).

The project started with a review and synthesis of the literature on the relationship between agricultural research and poverty, and this stage was completed in 1999. The second phase, begun in September 2000, involved the seven empirical case studies. The seven studies are identified in Table 1.1. Each case study focuses on a set of research questions driven by the nature of the technology under study and its context. Five of the case studies (the exceptions are the China and India studies, which used econometric analysis of secondary data and did not involve new fieldwork or mixed research methods) address a set of common themes, and used "livelihoods conceptual framework" (see Chapter 2) as a starting point for the research design. Each of the five studies involves a combination of previous and new quantitative data sets and qualitative methods. All seven studies have been synthesized into a set of findings and recommendations on future impact assessment work (Meinzen-Dick et al. 2004).

Introduction to the Western Kenya Case Study

Western Kenya is an area of high poverty and low agricultural productivity, especially when contrasted with its potential. The International Center for Research in Agroforestry (ICRAF) was invited by the government of Kenya to base a research program at the Maseno Research Centre on the Kisumu-Busia road. The first activity was a diagnostic study of farmer conditions, problems, and opportunities in the area. One of the problems highlighted by farmers was

Table 1.1 Phase 1, Wave 1 case studies of impact of agricultural research under the IFPRI/SPIA project

Country	Technology	Lead CGIAR center
Bangladesh	Modern rice varieties Polyculture fishponds Improved vegetables	International Rice Research Institute (IRRI)
Bangladesh	Modern rice varieties	International Food Policy Research Institute (IFPRI)
Kenya	Soil fertility management	International Center for Research in Agroforestry (ICRAF)
Zimbabwe	Modern maize varieties	IFPRI
Mexico	Creolized maize varieties	Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT)
China	Agricultural research investments	IFPRI
India	Agricultural research investments	IFPRI

poor soil fertility. During the same period, other pioneering work from Wageningen (Stoorvogel and Smaling 1990) established that nutrient outputs from western Kenyan farmers' fields exceeded inputs by a wide margin. Drawing from this evidence, ICRAF established a research program to address soil fertility problems in western Kenya. The rationale for why such a program was expected to alleviate poverty is discussed in Chapter 4.

ICRAF tried out the improved fallow technology in western Kenya in 1991, both under experimental circumstances and on farms. At that time the only species used was *Sesbania sesban,* an indigenous species that had proven its potential in southern Africa (Kwesiga and Coe 1994) and was a prolific biomass producer under western Kenyan conditions (Onim, Otieno, and Dzowela 1990). The agronomic performance and economic profitability of *Sesbania* fallows were studied in detail (Hartemink et al. 1996; Swinkels et al. 1997; Jama, Buresh, and Place 1998a). At that time, alley farming was also being tested and a major review of that research raised questions as to its performance and viability in western Kenya. Thus, there was a period of stagnation (1994–95) during which there was little dissemination of soil fertility technologies to farmers.

In 1996, new fallow species had been introduced with promising results, and the directors of ICRAF, the Kenya Agricultural Research Institute (KARI), and the Kenya Forestry Research Institute (KEFRI) decided to intensify efforts in research and dissemination of improved fallows. This was catalyzed by recent success in Zambia, where yields and profits were found to increase substantially from improved fallows, compared to low-input farmer practices.[1] Moreover, a study of existing soil fertility management practices in western Kenya revealed that about 50 percent of farmers did leave some of their fields uncultivated for at least a season on a regular basis (De Wolf, Rommelse, and Pisanelli 2000). Screening trials resulted in the selection of new species that

[1]Many farmers had been using fertilizer in Zambia, but the government subsidization of fertilizer price and credit halted after structural adjustment policies were adopted.

in most cases were shrubs and had a shorter life cycle than *Sesbania sesban.* The most promising and widely used species are *Crotalaria grahamiana* and *Tephrosia vogelii* (Niang et al. 1999). Other aspects and management options that were tested under research conditions are planting densities (Niang et al. 1999), the addition of inorganic phosphorus fertilizer (Jama, Swinkels, and Buresh 1997; Jama, Buresh, and Place 1998a), the effect on weeds (Niang et al. 1996), effect on nematodes (Desaeger and Rao 1999), and minimum-tillage planting.

Also from the mid-1990s, testing began of local shrubs in collaboration with the Tropical Soils Biology and Fertility Programme (TSBF) to look at the potential to supply nutrients to maize crops. One species, *tithonia,* was found to be the most promising among several because of its ease of establishment, easy handling (some other species have thorns or sharp leaves), high concentration of nitrogen, and good yield impacts on crops. In the beginning, *tithonia* leaves were gathered from roadsides or farm boundaries and applied to plots at planting time. Later, farmers explored a whole range of management options, but in all cases, a system of biomass transfer was practiced (growing the shrubs in one place and applying the biomass in another).

From 1996 to 2001, extensive on-farm experiments were conducted to assess the potential of fallows and biomass transfer using these species, often in combination with phosphorus fertilization. Agronomic and economic performance was studied within these trials. Initial efforts at the beginning of 1997 were focused in a pilot project area involving 17 villages distributed mainly in the neighboring districts of Vihiga and Siaya. Village committees were established to help facilitate information flows between the community and research staff. In addition, field technicians were made available to many of the villages for a period of about two years. Wide-scale dissemination of improved fallows and biomass transfer across western Kenya started at the end of 1998.

To disseminate the technology more widely, the research partners developed partnerships with the Ministry of Agriculture and with nongovernmental organizations (NGOs) such as CARE-Kenya, KWAP-Busia, Hortiquip-Vihiga, SCODP-Siaya, NCCK-Kisumu, VI-Agroforestry project–Kitale, IRAM-Vihiga, and many community-based organizations. Some interaction with these partners took place in earlier phases of the technology development process, but these intensified in 1998. The NGO partners integrated agroforestry options into their existing portfolios of options for communities and disseminated them using existing approaches, including training of primary contact farmers, field days, and exchange tours. To make this happen, the research partners trained extension and development organization staff on the establishment and management of the agroforestry technologies and provided them germplasm of species new to the area. Many field days were conducted, first at researcher-managed sites and later at farmers' fields. Finally, extension materials were developed for use by development agents.

In several instances, organizations, communities, or individual farmers took the initiative to seek information. Almost every day, the research center at Maseno received visitors requesting germplasm or information about the agroforestry systems. One particularly interesting case was West Kanyaluo, located in Rachuonyo District (one of our case study sites for the quantitative work). A subchief (leader of a sub-location) heard about the fallows and led a small group of farmers to Maseno. Having received some seed and information, a few farmers planted the fallows. The following year, the subchief returned to acquire additional seed for the community. More than 100 farmers are now practicing improved fallows in the community without ever having received technical assistance from research or extension.

This study of SFR technology was one of a set of CGIAR case studies examining the impact of agricultural research on poverty.

This particular ICRAF technology was selected for this study because it was an example of natural resource management research as opposed to the more common crop variety research. Because the agroforestry technologies offered an affordable option for soil fertility improvement, it was expected that rates of use and adoption would be relatively high among the poor. Further, there was some question whether the nonpoor would perceive any benefits of agroforestry compared to fertilizer. However, whether the poor can substantially benefit from agroforestry is still an empirical issue. It may depend on their understanding of how to effectively manage the systems as well as their capacity and willingness to increase their land and labor investment in these systems.

The study was also unique in its focus on comparing approaches to dissemination of the technology. Exploring dissemination processes speaks to debates around social capital, empowerment, and participatory development. Technology is mediated by social processes and social relationships. In addition to examining how these processes unfold, the study explores several hypotheses related to the use of local organizations and other forms of participation for dissemination: that social capital will be enhanced; that social divisions will emerge; that farmers will be newly empowered in certain dimensions; and that existing power relationships will be reinforced. Although these may appear contradictory, we found that they occur simultaneously, with a range of effects on different individuals. Also, in disaggregating the focus groups into women and men, and poor and less poor farmers, a hypothesis suggesting socially differentiated impacts is implicit. The findings have implications for policy and program choices related to forms of farmer participation in technology development and dissemination, and suggest the importance of understanding local social dynamics in designing program interventions.

It should be mentioned that the range of issues covered in the study required the use of mixed research methods and interdisciplinary perspectives. Issues pertaining to local perceptions of poverty, the mediation of technology by social processes, and the role of gender, power, and other social constructs in understanding adoption and impact could be explored only by using qualitative research methods and sociological perspectives. These were combined with quantitative measures of adoption and impact, and economic analysis. The quantitative analyses proved valuable in identifying the prevalence of patterns of adoption and impact relationships among the general population and the poor. We also draw on long-term knowledge of the region, based on work by members of our study team and others. The study was designed using a livelihood conceptual framework as a starting point, drawing on concepts of vulnerability, access to and limitations on combinations of assets (e.g., natural, human, and social capital), and the importance of institutions and processes. However, other constructs from economics and sociology were introduced as required. This was done not so much to promote a particular, alternative paradigm, but rather in the spirit of handling the important research questions raised by the entire team, comprising individuals of diverse backgrounds and experiences.

Outline of the Report

Chapter 2 presents the methods, with an analysis of how they were used to address the many detailed questions that guided the research. It also reports on the sampling procedures and outcomes. Chapter 3 provides a contextual background to the study at the national Kenya level, the western Kenya region, and also by ethnicity, as we conducted studies in both the Luo and Luhya communities. Included, too, are the assumptions of the soil fertility replenishment research program. Chapter 4 probes the con-

cept of poverty from official, researcher, and local perceptions and definitions and includes some analysis of our data. Chapter 5 presents data on livelihood strategies. While largely descriptive, it also offers insights as to the compatibility between investments in soil fertility and the pursuit of better livelihoods. Chapter 6 focuses on adoption of soil fertility practices, describing the process in the pilot and non-pilot villages. It proceeds to explore in some depth the patterns of adoption across different types of households, including the poor versus the non-poor. Chapter 7 then explores in great detail the extent to which various productivity and welfare impacts may have taken place as a result of adoption of soil fertility replenishment practices. Chapters 8 and 9 address the effect that various dissemination organizations and their methods have on knowledge acquisition, adoption of the technologies, and the communities in which they are introduced. Chapter 8 focuses on farmers' evaluations of different dissemination methods introduced by external organizations, while Chapter 9 focuses more on local dissemination processes, impacts on social and human capital, and other aspects of social relationships. Last, Chapter 10 includes a summary of methodological and empirical findings, along with considerations for future poverty alleviation programs in western Kenya.

CHAPTER 2

Research Methods

The Livelihoods Framework

A livelihoods framework was used in the research for this report to understand and link issues of agrotechnology development with social processes and poverty. It was used first as a guide to collect data and to phrase questions for the case studies. At a later stage, it guided the interpretation of data and structured the report. Toward the end of the report, we will assess the framework.

The livelihoods framework is a tool to improve our understanding of livelihoods, particularly those of the poor. "Livelihood" has been coined as an umbrella concept for research as well as for development planning. It involves a framework of analysis that has two main objectives. First, it links holistically the variety of ways by which rural people manage to make a living for themselves within the contexts in which they operate. Second, it attends to the processes that shape these endeavors, and to the activities of institutions and individuals that are external to the communities under consideration, but intervene in the way people try to make a living.

The idea behind this framework can be summarized in the definition formulated by Robert Chambers and Gordon Conway in the mid-1980s, which stated that livelihood comprises 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 shock and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Carney 1998, 4).

Such a definition links livelihoods with people's resources, capabilities, and activities, that is, what people do with such resources or assets. We shall return to a discussion of resources later.

The livelihood framework serves a variety of purposes and interests. Approaches by policymakers that provide a blueprint or preconceived plan for improving the conditions of living for poor countries and poor people have been widely criticized. For policymakers, and particularly for the international donor community, "livelihood" provides a framework that focuses on poverty within the contexts of the people who are poor, and on the processes that underlie poverty. For consultants who operate in the field of development, "livelihood" represents a framework for the formulation of development projects that focus on the people being affected by the project and the variety of ways in which they might be affected. For social scientists, such as anthropologists, sociologists, and economists, "livelihood" provides a framework for a holistic interpretation of the dynamics of development and the different rhythms of change. For plant breeders, soil scientists, and other technologists, the livelihood framework links their

specific work and capacities with what people are capable of doing, what they are looking for, and how they perceive their needs.

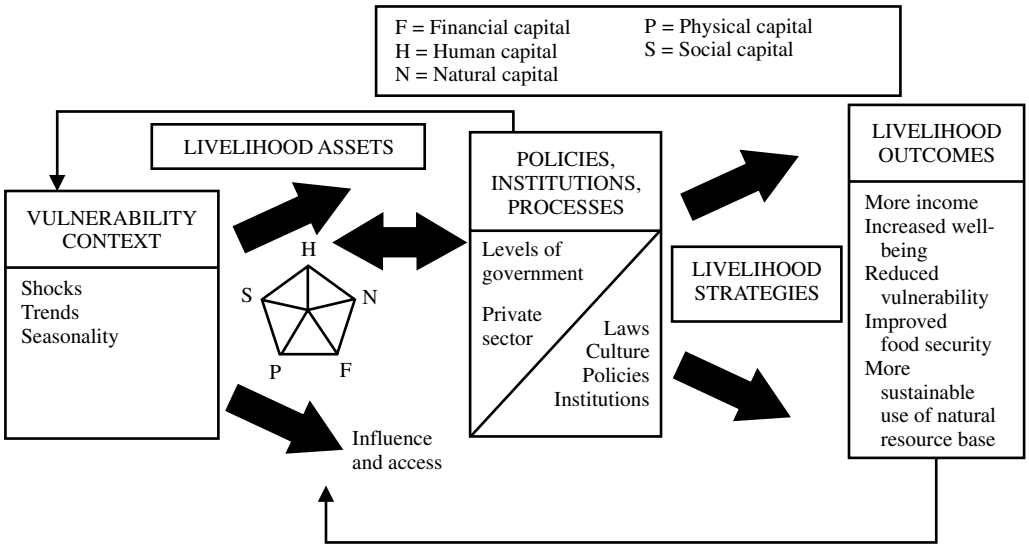
The livelihood framework thus provides a guide for research and intervention. "Livelihood" focuses on the fact that the people directly affected by poverty, through attempts to alleviate it, are striving to make a living, preferably above the level of mere survival. In doing so, they try to create and embrace new opportunities, such as trade and crafts, food processing, new technological innovations for agricultural production, and labor migration. At the same time they may have to cope with risks and uncertainties, such as erratic rainfall, diminishing resources, pressure on the land, changing life cycles and kinship networks, epidemics such as human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) and other diseases, chaotic markets, increasing food prices, inflation, and national and international competition. These uncertainties, together with new emerging opportunities, impinge on how material and social resources are managed and used, and on the choices people make between different sets of values and identities associated with such usage.

Livelihoods include activities both within the locality and stretching beyond it. These activities concern, for example, agricultural practices, production of knowledge and gathering information, trading, migratory labor, transport, the search for money via credit schemes, or the negotiation of sex. Wide-ranging interpersonal networks link rural and urban areas, on-farm work and off-farm work, and dryland farming and irrigated farming. Livelihood by definition transcends the boundaries between economic sectors (agriculture vs. industry, formal employment vs. informal activities). Livelihoods often transcend geographical boundaries, particularly those between urban and rural environments. In other words, people do not live and work only in domains where the boundaries are defined by bureaucracies, like rural and urban or districts and land resettlement schemes, or by natural conditions, such as watersheds or agroclimatic zones (Rhoades 1998). People's livelihoods are analytically situated and practiced by people in social spaces with boundaries defined by social networks, relationships, and identities. These spaces are fluid, constantly changing, and are shaped and constantly renegotiated by people themselves. They are often understood as "arenas" since they are subject to struggles and negotiations. More often than not, such arenas also involve the contestation of knowledge—clashes between different bodies of knowledge.

Livelihoods, then, can be understood only by mapping out the various actors (farmers, their families, administrators, traders, extension workers, state institutions, and so on), and the networks and social relationships between them. These actors pursue a variety of identities, interests, and needs—shaping, in turn, the particular strategies they devise to improve their conditions of living and their well-being. These strategies are invariably multiple, implying both that there are a variety of ways to sustain a livelihood and that people undertake manifold activities to obtain food, shelter, money, and identity. Some individual and corporate interests collide, as do their strategies and discourses of development. For instance, development interventions by external agencies, such as state institutions, are often shaped by ideologies of modernization, resulting in a lack of attention to local knowledge, cultural repertoires, and practices.

The U.K. Department for International Development (DFID) developed the sustainable livelihoods (SL) framework, together with social scientists, to both capture livelihoods and to analyze how livelihoods change over time (see Figure 2.1). The arrows within the framework are used as shorthand to denote a variety of relationships, all of which are highly dynamic. None of the arrows implies direct causality, although all imply a certain level of influence. Although the previous discussion has referred to these

Figure 2.1 Sustainable livelihoods framework



components, we now focus on a few core concepts: the importance of context, transforming processes, and livelihood assets or resources.

Context

Context is fundamental to understanding livelihoods and is pervasive in this report. Context refers not only to broad political and economic structures, but also to the immediate physical, social, and cultural environments. Contexts vary enormously, as do development processes. These processes are locally specific, shaped by history, cultural repertoires, economic and political relationships, and the natural environment. Livelihood is essentially contextual: livelihoods can be captured and understood only in particular contexts.

For those with few resources, these contexts are often risky, making people vulnerable to shocks, stresses, and changes. Changes in growing populations, family composition, governance, technology, health and diseases, as well as changes due to conflict, seasonal variation, drought, and pests, affect what people do and may enlarge or limit their room for maneuver. Specific program interventions attempt to reduce some aspects of vulnerability.

The context of this particular research in western Kenya is one of endemic poverty; declining soil fertility due to land degradation; failing markets, particularly for agricultural inputs (that is, seeds and fertilizer); low farmgate prices for cash crops such as maize and coffee; lack of alternative employment opportunities; low incomes; increasing food prices; and reduced landholding as a result of population pressure and continuous subdivision of land. Cash crops introduced earlier in the region, such as coffee, sugarcane, and cotton, have so far not proved sustainable. Their acreage has gradually declined, leaving only signs of their previous existence. Some farmers, however, still maintain a few coffee bushes in the hope that there will one day be a market for coffee. Those who grow sugarcane do not earn much because of monopsonistic market conditions whereby the processors capitalize on the imperfect market conditions.

Many "households" are currently net food buyers rather than sellers. In the past they relied on the flow of cash from migrants for the purchase of food, although today this

rural–urban connection is jeopardized because decent off-farm employment opportunities in urban centers are not easy to find (see also Omosa 1998). For those unable to afford inputs, soils may decline to the extent that the farmers then grow what are mainly known as "poor man's crops," such as sorghum, cassava, sweet potatoes, and millet. They may also move away from hybrid maize, turning back to local maize varieties. However, those who cannot afford inputs may also experiment with alternative ways of reproducing soil fertility, including agroforestry.

One "structural" feature of agriculture in the region is the predominance of noncommodity relationships and the role of a seemingly localized market. Farmers' strategies are clearly geared toward reducing cash outlays for agriculture, searching for low-cost resources and distancing them from markets. In such a context, from a theoretical point of view, agroforestry-based technologies would fit perfectly.

This context also has clear political, institutional, and economic dimensions. Extension services are declining as a result of natural attrition as well as retrenchments following the implementation of the Structural Adjustment Programme by the World Bank in the early 1990s. The situation is now even worse, since the World Bank stopped funding the agricultural development sector in early 1997. Extension departments have few funds and their officers are virtually grounded.[2] Furthermore, input prices have increased while farmgate prices for outputs can hardly keep up with inflation. Under such conditions it is difficult to sell an extension message based on commoditized inputs. Such messages become increasingly irrelevant, even to extension workers.

An important part of the economic dimension is the poor state of the country's economy. In the formal sector, more jobs disappear than are created because of lack of investment (e.g., there has recently been a net outflow of foreign direct investment), and the government is trimming staff to meet the conditions for a restoration of World Bank and International Monetary Fund (IMF) borrowing. In these declining economic conditions and lack of alternative employment, people return home and start farming again.

Transforming Processes

The livelihood framework specifies in more detail the transforming processes and structures that change and shape the contexts in which people try to make a living. The transforming processes and structures thus, directly or indirectly, impinge on people's livelihoods (Carney 1998; Scoones 1998; Ellis 2000). They operate at various levels. The social level includes changing relationships and the structures of kinship, gender, and age. There is a cultural level incorporating customs, religion, and other beliefs, including notions of development. The economic level involves investments, global and local markets, prices, international competition, and technologies. The political level covers governance and policies, tribal authority, the state, and wars and conflicts. It is linked to the judicial level, which covers laws of the state, customary laws, and such things as land tenure and rights. The natural environment is also relevant, particularly when natural calamities occur or when the land erodes away. The framework thus aims to link the micro and macro levels of development. It attends to how these interact with each other, and how changes at any level transform what is happening and what is

[2]In 2001, a new extension program funded by the Swedish International Development Cooperation Agency (Sida) was launched. This will provide resources to a team of extension agents who will then concentrate in one cluster of villages per division in all of the medium-to-high potential areas in Kenya.

possible at the micro level. This also brings in the necessary dynamic element of change: processes of transformation that shape livelihood contexts.

Luhya and Luo agriculture generally is subject to transformations at many levels. The social level constitutes the transformations at the level of labor relations where the ability or inability to mobilize labor is an important issue for agricultural production (despite the perception of the outside observer that labor is widely available). Moreover, labor is drawn away from agricultural production to other economic activities on and off the farm. The impact of HIV/AIDS on labor relations is also notable.

Land tenure relationships, particularly the inheritance of land, are subject to conflicts owing to a confusing mix of customary and state law; the latter fosters private land ownership.[3] Furthermore, land and labor relationships are obscured by jealousy. Jealousy is embedded partly in interpersonal relationships, for example, between brothers, and partly in the kinship and lineage complex. The latter seems to be more important for the Luo than for the Luhya.

The natural environment of Luo and Luhya agriculture is one characterized by bimodal rainfall patterns providing the opportunity for planting twice a year. The highland ecology offers considerable scope for tree growing and is characterized by genetic variation. For instance, various so-called local maize varieties are available, providing farmers with opportunities to breed and select seeds themselves, rather than relying on hybrid maize seed. Occasionally, however, the rains fail, causing people to plant late.

Soil fertility is among the major obstacles to increased agricultural production. Nitrogen amendments can be increased either through purchased fertilizers or through on-farm organic techniques such as animal manure or agroforestry. The shortage of phosphorus, however, can be adequately addressed only through buying the nutrient.

As referred to earlier, markets generally are imperfect, in terms of access, availability, and price setting (market structure and conduct) as well as an underdeveloped infrastructure (marketing context). The recent liberalization of markets for inputs (seeds, fertilizers, output) made these markets rather chaotic and unreliable. Cash returns to farm labor through involvement in such markets is not as high as farmers would hope. Such uncertainties and limitations affect peoples' social identities as well as incomes. Potential farmers are left asking themselves whether they can make a living based on agriculture.

Resources, Capitals, Assets

Livelihood resources are often categorized as the vital "capitals" that one needs to achieve a sustainable livelihood. These resources, as the framework specifies, include:

- *Human capital* such as labor, skills, knowledge, creativity, experience, drive toward experimentation
- *Natural capital* in the form of natural resources such as land, water, minerals, crops, forest, and pastures
- *Physical capital* that can be food stocks, livestock, tools, and machinery
- *Financial capital* in the form of money, loans, or credit; state transfers; remittances; savings
- *Social capital,* which concerns the quality of relationships among people and the extent to which one can count on support by the family or mutual assistance

The coining of "social capital" highlights the idea that livelihoods are seldom con-

[3] See Hebinck and Mango (2001) for an analysis of land conflicts in the Luo region.

structed on an individual basis only, but rather are embedded in interpersonal networks. Three core elements constitute social capital:

- *Relationships of trust, reciprocity, and exchange between individuals,* often embedded in specific local forms of organization and shaped by cultural repertoires
- *Connectedness, networks, and groups,* including access to wider institutions and so-called "distant" actors
- *Rules, norms, and sanctions* that are often, but not always, mutually agreed upon

These resources or assets will be described in detail in Chapter 5 with a focus on understanding rural livelihoods in the region.

Prioritizing Research Questions

The development of the research questions was a three-stage, iterative process. The first step, outlined in the introduction, involved the development of a research proposal that outlined six "researchable" questions that spoke to specific objectives of the wider SPIA/IAEG work within an SL framework.

The second stage was a workshop, held in Maseno and Nairobi in December 2000, to obtain stakeholder input into research issues and methods, important elements of vulnerability contexts, assets and transforming structures and processes, and relevant findings from previous and ongoing work. Stakeholders included academics from the fields of development studies and agricultural economics, ICRAF staff, farmers, chiefs, NGO staff working in the region, and teachers. Based on their input and subsequent discussion, the original proposal was revisited to determine whether the original questions remained appropriate; identify relevant subthemes and research questions; clarify sources of existing information; and identify where additional knowledge should be gained.

After discussion at the stakeholder workshop and among the research team, it was decided to retain the existing research questions, with some modifications to language. However, in response to presentations on the overall study objectives, the SL framework and the outline of the Kenya case study (as presented in the IAEG/SPIA research proposal), a number of useful suggestions were provided on the development of appropriate subthemes and more detailed research questions to address the larger research issues. These included (parentheses refer to the place within the SL framework that these suggestions fell):

1. The importance of understanding the social context of farming/agriculture in the region (transforming structures and processes)
2. How poverty is understood locally
3. The tensions between agriculture and off-farm work (livelihood strategies)
4. Farmer adaptation of the "standard" AF practices (vulnerability contexts; transforming structures and processes; livelihood strategies; and livelihood outcomes)
5. Distinguishing between adoption/nonadoption and the intensity of adoption as defined by the area planted and kind of AF technology, for example, improved fallow; biomass transfer (transforming structures and processes; livelihood strategies)
6. The importance of disaggregating by gender (vulnerability contexts, assets, transforming structures and processes; livelihood strategies, livelihood outcomes)
7. The mechanisms by which crop surpluses are translated into increased stocks of assets; what constrains choices (vulnerability contexts, assets, transforming structures and processes; livelihood strategies, livelihood outcomes)

8. The different dissemination approaches in the wider region (transforming structures and processes)
9. Changes in socioeconomic differentiation in these localities and the extent to which they are an outcome of differences in the intensity of adoption or use of agroforestry

The third stage was a three-day meeting of the principal researchers in Nairobi, in April 2001, that focused on reviewing the research questions and subthemes in light of preliminary findings. These are outlined in Tables 2.3 and 2.4.

Quantitative Methods

Quantitative methods are used for the following analyses: (1) characterizing and identifying the poor, (2) assessing the ability of alternative dissemination approaches to reach the poor, (3) assessing the extent to which the poor are using the agroforestry technologies, and (4) assessing the degree to which the poor are benefiting from the use of agroforestry technologies. In terms of identifying the poor, ICRAF had already used a survey instrument containing many wealth-related variables (identified through wealth-ranking exercises) to make a preliminary classification of households according to wealth. This classification served as a stratification for the 1999–2000 baseline survey of food and nutrition and as well for the case study selection in the qualitative analyses (see section "Case Studies on Livelihoods, Adoption, and Impacts"). However, this is used as a preliminary sampling tool only. In the evaluation of the impact of agroforestry on the poor, more rigorous definitions of poverty are used, including quantitative measures of assets and baseline consumption or expenditures.

For the remainder of the quantitative analysis, it is first useful to distinguish the analysis for households within the pilot project area and those outside. Within the pilot project area, an earlier baseline assessment of assets, expenditures, and food consumption had been made. The baseline was given to 120 households, stratified in the following ways:

- 60 Luo, 60 Luhya
- 60 not yet using agroforestry, 60 starting to use agroforestry
- 40 from the poorest tercile, 40 from the middle tercile, and 40 from the wealthiest tercile
- Balanced design so that approximately 10 in each of 12 cells were enumerated

The baseline was administered at four different times of the year, and for food consumption, was measured by 24-hour recall for three- and two-day periods. In the follow-up for 2002, only one time period was enumerated, that being the April–May period just before the harvest from the long rains. It is during this period that differences in crop yields and incomes have the most impact on food consumption.

The analysis focuses on the changes in assets, expenditures, and consumption over the 1999–2002 period, and how these are related to the use of the agroforestry systems, conditional on initial wealth status. Two-stage methods are used in which the choice of use of the agroforestry technologies will be modeled in the first stage and the impact from the use modeled in the second stage.

In addition to this detailed quantitative study of approximately 120 households, ICRAF had been monitoring the use of the agroforestry systems between 1997 and 2001 for about 1,600 pilot project area households. Together with a 1997 census instrument, it was possible to assess dynamic patterns of use of the technology by the poor and less poor. Multinomial logit regressions are made to identify factors associated with non-adoption, dis-adoption, and adoption. We also assess the role of household factors in the intensity of adoption both spatially and temporally. Within the pilot project area,

ICRAF and its partners were the main engines of dissemination, so that there is really no variation in dissemination techniques within the pilot project area.

Outside the pilot project area, six villages were selected as research sites: Luo: Muhande-Arude (Siaya), Ugunja (Siaya), and West Kanyaluo (Rachuonyo); and Luhya: Mwitubi (Vihiga), Shinyalu (Kakamega), and Bukhalalire (Busia). The sites were selected because they were among the earlier places where dissemination occurred and they were reached using different dissemination methods. CARE had operated in Muhande and was the principal agent there, until they left in 1999. An umbrella NGO operated in Bukhalalire, a local catchment committee (formed by extension to be their liaison in the community), and a local CBO in Ugunja. In Shinyalu, KARI had established a participatory learning and action approach with the community. Finally, in West Kanyaluo, a local assistant chief learned of the technologies and spearheaded collaboration with ICRAF by funding a trip to Maseno. He and other farmers visited about three times in all to obtain information and seed.

In each village, 60 households were selected, approximately half of which were found to be using agroforestry.[4] The survey instrument was broad, covering basic household characteristics, acquisition of information on agroforestry, use of agroforestry, and impacts from agroforestry. In addition to agroforestry, identical questions on information and use were asked about other soil fertility management strategies. No baseline survey was conducted for these households, so in only a few cases could data on changes be measured, for example, for physical assets. In other cases, impacts are assessed only based on current (2002) values.

Similar to the analysis of the pilot project households, regression techniques will be used to assess the extent to which the poor are receiving information about agroforestry (conditional on dissemination method, too), the extent to which the poor are using agroforestry (and comparing these rates to other soil fertility practices), and finally assessing the impacts of agroforestry on a variety of variables including crop yields, soil fertility, assets, and other wealth indicators.

Qualitative Methods

To obtain participant-defined characterizations of livelihood strategies and outcomes, it was decided to aim for a series of case studies. It was also decided that the fieldworkers would try as much as possible not to identify themselves with ICRAF (and thus avoided being dropped off by ICRAF vehicles). This was to prevent participants from giving answers they felt ICRAF would want to hear.

The intrinsic value of this work is that it can be used to direct or extend some of the quantitative investigations. For example, it can help specify appropriate livelihood outcomes for further study, patterns, and reasons for adoption/adaptation/dis- and non-adoption; pick up stories about conflicts with implementing agencies and their implications for the future; and so on. In addition to providing directions for the quantitative research, the qualitative research can also provide insights and explanations that the survey data cannot. The qualitative research was composed of two major data collection exercises, mirroring the two sets of central research questions. The first concerns livelihoods, adoption, and impacts; the second relates to technology dissemination.

[4]Initially, we had intended to stratify on the basis of wealth rather than use of agroforestry. However, the rates of use were highly variable and in our second intended village (Central Gem), we found only five farmers using agroforestry. Thus, we abandoned the more ideal but risky strategy of stratifying by wealth alone, and opted to ensure sufficient numbers of adopters and non-adopters.

Case Studies on Livelihoods, Adoption, and Impacts

The study draws on a mix of approaches. The core method would be a series of household-level case studies, which involve extensive informal interviews held within and outside the household over a period of six months, supplemented by participant observation. Focus groups would be used to confirm findings of individual case studies, reconcile divergent findings, and allow a wider range of voices to be heard. Such an approach, it was thought, would result in the wider IAEG/SPIA study containing a range of experiences—including both those that employ extensive use of group methods (and little or no case-study work), and those in which case studies took the lead supported by group-based activities.

Acknowledged concerns of undertaking lengthy case studies were (1) the replicability, particularly for future impact assessment work of studies involving six months of fieldwork, and (2) that fewer households would ultimately be represented in the study. (The follow-up group work, however, helps counter the latter disadvantage). In the end, it was decided that the depth of understanding gained compared to a more rapid assessment approach was substantial and thus should be considered as a potential method for future impact assessment work. One persuasive argument is the fact that if research centers are able to spend an extended period of time conducting survey work, then an extended period can and should be given to qualitative work as well, if that work is to provide insights that could raise the likelihood of increasing impact. In addition to these methods, key informant interviews would be used to discuss issues with individuals with specialized knowledge.

In sum, the decision to base much of this work on case-study narratives was motivated by the recognition of the importance of going beyond quantitative information, to understand perceptions regarding soil fertility and its management and reasons underlying those perceptions. There is also a clear need to go "inside the household" or even "beyond the household," partly because gender and age may differentiate such perceptions and partly because access and control of resources may vary within household units.

Table 2.1 Case study villages

Case studies	Pilot area	Non-pilot area
Luo land	Sarika	Muhanda-Arude
Luhya land	Eshikhuyu	Mwitubi

As in the original research proposal, the study focused on households in pilot and non-pilot areas (Table 2.1). This is based on the idea that being exposed to agroforestry programs (e.g., technical support) has an impact on the adoption process of such technologies. Villages in the non-pilot areas also experience different dissemination approaches that, in turn, may affect processes of adoption.

Within the villages, criteria such as wealth and adopters or non-adopters were applied to select households for further qualitative research. Within the wealth criteria or perceived relative status of poverty (taken from earlier wealth-ranking exercises done by ICRAF) and adoption/non-adoption, the selection procedure also captured as much as possible variations across:

- Female-headed, male-headed, child-headed households
- Relative importance of agriculture in family income (kind, cash)
- Age groups: "young" and "older" households
- Monogamous and polygamous households

The selection procedure made use of the quantitative database that is available from ICRAF. Twenty households were identified, but only ten ultimately selected per village. Among these households, half were users of either biomass or improved fallows. Based on ethnographic understanding, it was agreed that individuals rather than the compound or

household should be the unit of analysis for the qualitative research. The 1997 ICRAF survey attempted to sample nuclear households rather than a compound. The compound may comprise more than one household: husband, wive(s), dependent children, and married children still at home. However, it may also be that changes have taken place in family composition, off-farm work, adoption of technologies, and so forth. This case selection then broadens the scope. The individuals are then to be treated as entry points to the compound only.

The notion of household may fit more closely in the Luhya community than with the Luo, since the Luhya do not have compounds like the Luo. Among the Luhya, when a father dies, land is subdivided between the mother and the sons who have their own plot; each will have a gate. But there is much cooperation between these units, for instance, sharing labor, oxen, and plows.

The objective of the qualitative analysis was to contextualize and understand what a technology does to a society such as the Luo and Luhya. Qualitative research by means of case studies allows for an analysis of social processes. Case studies are instrumental in exploring how technologies create new and/or transform existing social relationships among villagers (particularly intergenerational relationships) as well as between villagers and interveners. Gender is only one component of such a social transformation process. Similarly, qualitative studies are probably better equipped than quantitative studies to disentangle what poverty actually is and how to operationalize a notion of poverty for policy-oriented studies. Poverty, being subjective, needs to be understood as local people view it as well as how policymakers try to measure it with such means as the poverty line.

Focus Groups on Dissemination Approaches

Because the overall study has emphasized evaluating technology dissemination processes, with four of the original eight research questions focused on these issues, an additional data collection exercise was designed to focus on dissemination. Although the household case studies addressed some aspects of dissemination, focus groups were chosen as the main method for this part of the study. This is because of the need to speak to a large number of people in a short time and because dissemination activities take place largely in groups. A group-based research method would thus allow people to debate their experience of these collective activities. The focus groups combined discussions with the use of certain Participatory Rural Appraisal (PRA) methods.

Research questions to be answered through the study were determined through two stakeholder meetings, where representatives from government, NGOs, KARI, KEFRI, ICRAF, and some local organizations discussed their concerns with the dissemination approaches and the kinds of questions they wanted to explore. In addition, key informant interviews were conducted with representatives of the main organizations that disseminated technologies in the villages selected for the focus groups, in order to gain their insights and operational interests with regard to the research. The questions centered around evaluations of the disseminating organizations and their teaching and outreach methods, their interactions with the community, access to information and barriers, group methods of outreach, school programs, quality of training and what farmers have learned, and community social relationships, including solidarity and conflict.

Most of the questions were addressed through group discussions, in which facilitators posed open-ended questions and participants discussed their answers in conversation that was recorded. However, three different participatory exercises were also used, involving (1) mapping of formal and informal institutions inside and outside the village, and information flows between them; (2) scoring of external and local institutions;

Table 2.2 Villages and dissemination approaches in the dissemination study

Type of village	Type of dissemination approach	Disseminating organizations[a]
Luo villages		
Muhanda – Arude[b,c]	TRACE approach	**CARE-Kenya,** ICRAF, MoARD
Sauri	Village approach	**ICRAF, KEFRI, KARI,** MoARD
Gongo	Catchment area approach	**MoARD,** ICRAF
Luhya villages		
Mwitubi[b,c]	Catchment area approach	**MoARD,** ICRAF
Mutsulio	PLAR	**KARI, MoARD,** ICRAF, KIT
Bukhalalire[b]	Umbrella group approach	**KWAP**, MoARD, ICRAF

[a]The main disseminating organization is in bold. The rest joined in after the approach was in place and used it to reach farmers. Acronyms not defined earlier: KIT, Royal Dutch Institute for Tropical Agriculture; KWAP, Kenya Woodfuel Agroforestry Programme; MoARD, Ministry of Agriculture and Rural Development; TRACE, Training of Resource Persons in Agriculture for Community Extension.
[b]Also survey village.
[c]Also case study village.

and (3) using "ladders" to represent progress in knowledge acquisition in each SFR technology. These methods are described further in Chapter 8, with visual examples provided there.

The focus groups were conducted in six villages. The villages were selected to represent a range of different dissemination methods by different organizations, although there is overlap in the forms of teaching and outreach used. Among these six villages, three were from the Luo ethnic group (Sauri, Muhanda-Arude, and Gongo) and three from the Luhya group (Ishikhuyu, Mwitubi, and Mutsulio). Twenty-four groups were held in total, with four groups per village disaggregated by sex and by poverty level, using a previous categorization of households based on survey data and wealth-ranking data. The basis for these disaggregations was to explore whether perceptions and experiences with the dissemination methods were different depending on whether one was male or female, very poor or less poor, and Luo or Luhya. The villages selected and dissemination approaches studied are presented in Table 2.2.

Text data from the focus groups were coded using HyperResearch data analysis software. The results of the PRA exercises were put into an Excel spreadsheet and the descriptive statistics reported. Data analysis involved triangulation of the focus group results with the quantitative data and case study findings.

Prioritizing Research Questions

The various workshops described earlier formulated the priority research questions in detail as well as the sub-research questions and themes. The latter also served as a guide for the fieldworkers in their case study work and the focus group discussions on poverty (Table 2.3) and dissemination strategies (Table 2.4).

Table 2.3 Research design matrix: Assets, vulnerability, and livelihoods

Location in SL framework or other key concepts	Main questions in proposal	Subthemes/research questions to explore
Livelihood outcomes; targeting; social differentiation	1. What is the ability of SFR to reduce poverty?	How successful have the technologies been in improving outcome indicators (assets, [see below] food security)? How do people define poverty and well-being? How successful are they at targeting the poor? What are the key groups among the poor? What are the key factors that contribute to making people poor and to vulnerability? What is needed to reduce poverty and what protects against vulnerability? Why have some households or individuals benefited and others not (gender, other social categories)? How was poverty conceptualized at the early stage of ICRAF's work? How have interventions contributed to women's decisionmaking ability, control over resources, and negotiating ability (creating space/empowerment) with regard to household and community? How has it improved or worsened intra-household relationships? What are the indirect affects in terms of asset accumulation, access to markets, human capital formation, social capital formation/community social relationships, empowerment? Has SFR influenced people's interest in farming? (generational differences); and how do they perceive these in relation to other options?
Livelihood outcomes		How has SFR technologies affected social differentiation? Has it contributed to increased or decreased inequality? How do local priorities compare/conflict with government priorities? Or are compatible with government priorities in terms of outcomes?
Assets; livelihood outcomes	2. What are the livelihood strategies that people pursue and what are the dynamic relationships between livelihood strategies and how do SFR technologies relate to these?	What are the main categories of livelihood strategies pursued by different groups? Who in the household is contributing to what types of work, and why? (attention to generational differences) How do different technologies fit within these livelihood strategies (or not)? What are the complementarities with other activities, including seasonal activities? What are the conflicts with other activities, including seasonal activities? How are the technologies adapted by farmers and why are these adaptations made? What are the different types of farmers and farming systems? How have these farming systems changed over time? Why do people choose to pursue certain livelihood strategies (resources/assets; trends; identity/how people see who they are)? What are the sources of perceived vulnerability (natural, financial, social, and so on)? What are the gender and class and other significant power structures in the villages and households (that will influence answers to questions below)
TSP vulnerability assets	3. What factors have influenced adoption? What factors and processes mediate the ability of different social groups to take up new technologies? Look at all of these questions in terms of gender, class, and other forms of difference.	What assets are necessary for adoption (physical, natural, social, human, financial, political, cultural)? What makes a good farmer? How does SFR technologies relate to this? What assets did/do people have? Why are these assets available or lacking? What are the key relationships between different types of assets needed and sequencing? Is there scope for substitution among assets? Which are more important than others? What is the role of social relationships/social capital in facilitating or constraining adoption? Why do some people not take up the technologies, stop using them or reduce their use (broad, including attitudes)? Who makes the decision to adopt? Who has had input into this decision? What was the basis of the decision? What cultural and social aspects mediate adoption?

(continued)

Table 2.3—Continued

Location in SL framework or other key concepts	Main questions in proposal	Subthemes/research questions to explore
		What is the significance of landholding or use arrangements (size, quality, ownership, other)? What vulnerability issues may keep people from adopting or stop them from using technology (natural; health crises [AIDS, malaria, and other]; retrenchments; changing family relationships/ composition; market changes/prices)? How is soil fertility perceived? How identified and assessed? How is fertilizer perceived? Is it money or affect on soil, and so on? How does it affect qualities of crops (role of myth; magic; science, and so on)? How does SFR mitigate vulnerability? Are poor people more or less vulnerable to vulnerability factors (pests, late planting, striga, food shortages)? Compare SFR to other kinds of choices that farmers could make. What assets do people have access to that are not being used and how could they be used?
Structures and processes		What is the role of policy? Are farmers even aware of the policies (local)? Are the disseminators aware? How do these policies facilitate or constrain them? What is the enabling environment —what do farmers want them to do? Are there competing policies (land use; soil fertility; conservation; cost-sharing: health, schools)? Who is enforcing them and whom is it being enforced upon?
Assets and vulnerability	4. What are the effects of the SFR interventions on people's productive and risk-mitigating assets?	How do these technologies facilitate people's investment in assets (physical, natural, social capital, human, financial, cultural)? Does it increase labor availability? What is the relationship between adoption of SFR and crop productivity (differentially defined)? In relation to different crops and relative importance of those crops? What maize varieties do better with SFR technologies? What other qualities does SFR help: taste, color, drought resistance, milling, food security? Are the practices sustainable (physical and financial)? How do people perceive the sustainability? Does it strengthen or undermine community and household cooperation (for example, between poor and rich)? Does use or success of technology increase or decrease sharing or individuality (sharing of knowledge, wood, seeds; fighting *striga;* protection from mud damage; scaring of birds; scrambling for *tithonia;* refusing to share seeds, etc; husbands and wives working together)? Does the technology help people to diversify activities and cope with weather, threats to economic shocks, or trends? Or does it increase vulnerability?

Table 2.4 Research design matrix: Dissemination strategies

Location in SL framework or other key concepts	Main questions in proposal	Subthemes/research questions to explore
Transforming structures and processes	5. What are the main dissemination approaches being used by different government and non-government institutions and what levels and types of participation by farmers do they involve?	What are the main categories of dissemination approaches? What are the relative financial costs of these to the institutions? How do people value the time spent at meetings, farmer field visits, and so on. What are the economic and social costs and benefits? Do they make contributions? Why do they go? What do you get out of it? Opportunity costs of not going? What are the informal mechanisms through which people learn about these technologies? Observation, social relationships/social capital; learning by doing What were they doing before? What kind of experimenting? What kinds of soil fertility management? Are they still using them? Stopped using them? Combining them?
Targeting	6. How effective are these approaches at reaching the poor?	Under these approaches, to what extent are different categories of farmers (for example, very poor, poor) being reached with information? What kinds of information do they expect to get? Why do different types of farmers come? What groups exist previously related to agriculture (map picture to compare)?
TSP livelihood outcomes	7. How do these approaches, including their principles, organizational forms, methodological tools and processes, impact human and social capital formation?	What have been the effects on social capital formation or strengthening and why? How do these differ among different social groups (among the poor, ethnic groups) Under these different approaches, what kinds of innovations are emerging? What have been the effects on human capital formation and why? (Measure training given and knowledge acquired.) Have people taken on new activities through their organizations/groups? What institutions and services do people know about? Have they increased their demands on outside institutions (nongovernment organization, Ministry of Agriculture at local level, ICRAF/KEFRI/KARI, banks, AFC) or ability to negotiate with them? Which institutions do they use? Also ask about approaching political representatives. To what extent to they make demands or seek information/assistance from village committees, the sub-location committees; local authorities (councilors) or other government officials; the chiefs Which institutions do they find most helpful and why? What do people want to get from them? Do they alter or reinforce power relationships in communities? How effective are these methods at creating a sense of ownership and commitment to the group? Have the groups done any further dissemination in other villages? What were the experiences of this group in doing this dissemination? How have practices of extension agents (including ICRAF/KEFRI, government, and other) affected local social relationships (are farmers who are visited frequently seen as "model farmers," respected or resented? Does the attention make people want to work harder and better?)
TSP	8. What key factors explain why these different approaches are more or less effective in making an impact on the poor?	What is the relative importance of social relationships (including gender, age)? Why are certain approaches more or less effective for women and men? Levels of poverty/wealth: Why are certain approaches more or less effective for poor and non-poor farmers; other groups (method for choosing participants; expectations of reciprocity)? What is the role of cultural and ethnic variations (including trust, cooperation, preferences for individual or collective activities)? Human capital (education) Factors in the institutional environment (including relationships and coordination between different institutions)

(continued)

Table 2.4—Continued

Location in SL framework or other key concepts	Main questions in proposal	Subthemes/research questions to explore
		What are people's perceptions of the different institutions and their approaches, and the individuals involved? Farmers' perceptions of the individuals responsible for dissemination? Quality of training (too little or too much information; appropriateness; equal partners or students/do ideas flow both ways; follow-up) To what extent have policies, practices, and training been changed in response to information from farmers? Methods and tools used: language, teaching materials What is the significance of the early stage of the approach? (Was method developed with people or presented to them? How much work was done in advance to understand local systems?)

CHAPTER 3

The Context of the Research

The aim of this chapter is to contextualize the relationship between technology and development processes with respect to this research, dealing with social and cultural relationships, customs, and institutional dimensions of social and economic life in the region. Processes such as socioeconomic differentiation and gender are crucial to understanding the importance of power, how power works, and how it shapes decision-making. The chapter also draws attention to the agroecological conditions (climate, soils, rainfall patterns) for farming; the skills of local people to generate a description of human capital; issues of poverty; and the agricultural policies implemented by the Kenyan government.

It is crucial to note that the research area is inhabited by two different ethnic groups: the Luo and the Luhya. Where relevant for the research, the differences between them are elaborated.

People, Institutions, and Structures

This description is based on a literature review and some qualitative fieldwork. While distinct differences remain between the Luo and Luhya, over the years the cultural repertoires have changed due to interactions with other cultures, modern and colonial laws, and customs of social order.

Between the Luo and Luhya, social life hinges around kinship relationships that define rules and obligations vis-à-vis each of the individuals belonging to a certain social unit. This social unit is at best represented at different levels: the "household," the family, the clan, and the lineage. These are reflected in settlement patterns as well, such as the compound and the village. The compound is something typical for the Luo and is less important and visible in the Luhya context. Furthermore, it appears that in the Luhya context of decision-making, the "household" plays a larger role than among the Luo. Here the extended family plays a more important role, particularly in situations where the son(s) are still residing in their father's compound. As will be explained later, genealogical seniority is very important among the Luo.

A typical Luo homestead (*dala*) consists of a site with the houses of monogamous or polygamous domestic groups, surrounded by their fields. The smallest social unit in the homestead is the "household," which is made up of at least two generations: the father and mother(s), and their offspring. (The "household" as considered in the qualitative research may also include others with significant livelihood linkages, for example, nonresident sons, and sometimes non-blood relations.) Occasionally, households of brothers of the homestead's owner are also found there, as well as servants and "strangers." Several homesteads make up a village. Residence is based on kinship, but also on alliances developed out of strategic considerations. The elementary social relationships among the Luo and Luhya are organized around the normative principle of patrifocality that cements the relationships between father, mother, and their children. This unit thus deals with people of the same father and operates as

one corporate group and shares and distributes most of the domestic activities. Daughters are included only before marriage, since they are not considered when it comes to the inheritance of wealth. The normative respect for age (that is, seniority) is such that the eldest son must marry first, then the second eldest, and so on in order of seniority; the same is true of daughters.

When the senior son of a Luo father marries and has children, he is the first to build a new and independent homestead.[5] When the father dies, the eldest son takes over the responsibilities of leadership of the family. In situations of polygamy, relationships then start from the matrifocal unit that combines a mother, her sons, and unmarried daughters as an independent set of people. This implies affiliation to the mother rather than to the father per se. In a monogamous situation, the position of the father is very strong, as there is no rivalry. In a polygamous situation, the position of the father is weakened substantially in favor of the mothers and grandmothers. The relationship between the matrifocal units within the compound is referred to in terms of "jealousy" when it refers to the relationship between co-wives themselves and "rivalry" when it involves all in a matrifocal unit as a group against another, opposing group.[6] The matrifocal unit that combines a mother and her sons in the second generation is referred to as "the people of the same grandmother." At this level, the rivalry and competitive relationships between co-wives and their sons start fading. The position of the grandfather regains importance. Beyond the grandmother and grandfather line, at the third and up to the fifth generation, the extended family appears as the next organizational form. People descending from the same great-grandfather make up extended and often polygamous families. The elders act as representatives in disputes between opposing families. They are also intermediaries between younger members and the ancestors and therefore act as foster-father guardians. They form the first organized council to arbitrate land and boundary disputes between members of their extended family. At this stage, social control of the community is exercised partly through the authority of these elders and partly through the control over the means of accumulation, which the leader of the group protects. Control and accumulation of resources is a basic requirement for subsistence and competition in Luo and Luhya society.

A next level is the lineage, which involves descendants of a common ancestor, usually from four to seven generations back. It is a maximal lineage of landholding, cooperating agnates and generally considered to be the backbone for settlement, household and family formation, and social reproduction.

When it comes to marriage, both kinship relations and the seniority principle are of primary importance. Marriage is arranged between families of different clans. The Luo custom is that the senior son of the senior wife should marry first. When he is of age, he is first given a cow and a young bull, which lineage members take to the bride's homestead. Bride wealth is only drawn from the male lineage, particularly from the grandfather's or great-grandfather's line. Daughters of the same mother also marry in order of seniority. The seniority principle is less prominent among the Luhya.

Land is not private property per se. Despite title deeds issued over the years to the customary male landholder, it is hard to

[5]The Luo call this "liberation." They distinguish, however, between two different forms. The first liberation is when a woman starts cooking in her own house in the compound of her father-in-law. The second liberation is when a man establishes his own homestead.

[6]This relationship often generates the various kinds of conflicts, competitions, envy, confrontations, and divisions that are so characteristic at various levels of Luo social organization.

speak about private land and/or a land market. Land distribution is still very much shaped by the image that it is the family and the lineage or clan that controls the land. Land inheritance is still basically organized around father–son(s) relationships. The *mondo,* the father's field, is inherited by the last-born son. Women are not considered in land inheritance or allowed to own land. Women cultivate the land, however. Monogamy and polygamy make a difference here, although there is variation from the general rule. Among the Luhya, when a father dies, land is subdivided between the mother and the sons; each has his and her own plot and own gate. This differs quite substantially from the Luo. When the husband dies, the wife cultivates smaller parts of the son's land. Another major difference between the Luo and Luhya is that, among the latter, there is much more evidence of land transactions, including purchasing and renting. A further difference is that the Luhya practice circumcision, unlike the Luo.

The lineage and clan also play an important role in the political life of the Luo and Luhya. The clan-head is someone who, together with the elders, rules with reference to his understanding of customs and customary law. The clan-head, however, does not denote a clearly defined office entailing specific rights and duties. The status of a clan-head is based more on personality, influence, and personal status; he is someone who stood out among his age mates. Currently, the status of clan-head has diminished in favor of village elders (who are not necessarily the oldest in the village), chiefs, assistant chiefs, and elected councilors. Belonging to the country's political parties, councilors have roles, duties, and responsibilities fixed by public law. Chiefs and assistant chiefs are appointed by government and derive a salary from that office, unlike village elders, whose influence depends on status within the village. The chief organizes his public meetings (*barazas*) to discuss particular issues with the people and often provides an entry point for NGOs and government institutions into the communities. Clearly the de facto authority of the chief varies from community to community, as some *barazas* are poorly attended.

Social Categories: Gender, Age, and Class

Based on the preceding description, the most important and relevant social categories to consider are gender and age. Roles, tasks, and responsibilities of men and women are fairly clear and respected. Women do not own or control land but provide most of the agricultural labor—planting, weeding, harvesting—and perform most domestic tasks—cooking, fetching water and firewood, washing, raising children, and so on. Men do the heavy work (plowing) and decide how to use the plot and spend the money earned. But we have to be careful with such a conclusion. First, this does not hold in many cases where men are absent, as when they work outside the village. Second, if we listen carefully to women themselves, they indicate their ability to decide for themselves and to negotiate with their husbands to secure most of their needs for food, money, and protection. Not in all cases, however, do women successfully negotiate with their husbands.

The case studies point up that women make many decisions, as they do most of the farmwork; however, few appear to notice or acknowledge this role. Typically, they consult with their husbands after actually making the decisions. For example, in the case of soil fertility replenishment technologies, it was evident that women frequently make the decision to implement or not. This is possible because they are the laborers on their own farms. For instance, Mary, one of the farmers, was the first in the household to receive knowledge about use of *tithonia* and the fallow trees. She discussed this with her husband when she had planted and tried them out on her plot. Agnes works alone because her husband has no interest in working the farm. Therefore

she decides on what technology she wants to employ. Clearer still is the case of two co-wives from the same homestead and husband. Florence decided to adopt the SFR technologies, while Patricia did not, each for her own reasons.

An emerging social category is that referred to as the female- (or even child-) headed household. Either because of a husband's long absences, divorce, or death, households are increasingly managed by women.

Age also plays a major role. Generally, the elders control village life politically and take responsibility for maintaining tribal norms and values (such as respect for elders) and customary laws. An implication of the responsibility and prestige of genealogical seniority among the Luo is that it puts elders in the position of first harvesting (*dwoko cham*), and first sowing (*golo kodhi*), as well as of eating specified parts of animals, usually the best meats. In these situations, it is the elder who determines what and when to plant. Similarly, in a polygamous setting, it is the first wife who must start plowing and planting first before the second wife. If these rules are not obeyed, *chira* will be her fate, as one informant expressed. *Chira* is a curse that befalls a person who has violated some taboo.

A third level relevant for discussing development and change is one that deals with processes of social differentiation. Land, being an important asset, is not equally distributed. Only some of the individuals in our study "own" more than 10 acres of land; the majority own zero to five acres. This quantitative aspect of landownership, size, is important in the analysis of technology and social change.

A second element that plays a role in social differentiation is related to income generation, even in a largely subsistence economy. The amount of land and the ability to control *and* mobilize family and/or hired labor plays a role in the amount of money people earn in agriculture. Income in the form of remittances from labor migration also plays a major role. Access to land, labor, and urban jobs is clearly associated with income differentiation.

Agroecological Conditions

The research in western Kenya is focused largely on medium-to-high potential highland areas. Rainfall is good, ranging from 1,200 to 1,800 millimeters per year with two cropping seasons annually: the long rains from March to July, and the short rains from August to November. The short rainy season is traditionally less reliable in terms of total rainfall and length of growing season, but the rains have been good since 1998. Rains are slightly less in Busia, one of our sites nearer the Ugandan border, and notably less in another site, Rachuonyo District to the south. The altitude ranges between 1,200 and 1,700 meters above sea level and the topography is undulating with moderate slopes. Soils are of generally good physical structure but are low in nutrient stocks. In many parts of the region, phosphorus is the major limiting nutrient, but nitrogen and potassium limitations are also prevalent (Shepherd et al. 1996; Jama et al. 1998b). Soils are much less fertile in the lower elevations (such as Rachuonyo). Moreover, heavy infestation with *Striga hermontica,* a parasitic weed that devastates the maize crops, is common (Oswald et al. 1996).

Socioeconomic Context: Vulnerability, Education, and Poverty

High population densities prevail, ranging from 500 to 1,200 per square kilometer in all of the western Kenya sites, and are particularly acute in Vihiga District. The Luhya inhabit Kakamega, Vihiga, and Busia districts, while the Luo reside in Siaya and Rachuonyo districts. The farming system incorporates crops, livestock, and trees. Maize (local varieties) and beans are the most common agricultural products. The food situation was reported as deficient by 89.5 percent of the households in Siaya and Vihiga;

they had to buy food to supplement their own harvest (Wangila, Rommelse, and De Wolf 1999). Only 8.9 percent of the households were food secure from their own production. Average household income for western highland households was only US$1,014 and crop income was a paltry US$321, according to a recent study (Argwings-Kodhek et al. 1999). Average labor productivity from agriculture was about US$76 per year in western Kenya, only one fourth the level achieved by farmers in central Kenya.

In fact, many of the communities under study are among the poorest in all of Kenya and clearly the poorest among the medium to high potential areas. For example, a recent national study of poverty found Western Province (including Kakamega and Vihiga among its four districts) to be one of the poorest in the country (Kenya—Ministry of Planning 2000). It was estimated that 31.5 percent of households in western Kenya are among the hardcore poor, as opposed to 19.6 percent for all rural areas. Western Province and Nyanza Province (including Siaya District) also had high incidences of sickness that were twice as high as those reported in central Kenya, an area with similar farm sizes (median of about one hectare).

Agricultural Policies, the State, and NGOs

Agricultural polices of the state for the country and region under study rests on providing services and incentives to agricultural producers in order to increase production to satisfy a variety of needs: that of the economy as a whole (export and national consumption) and for individual households. Policy objectives were aimed at stimulating exports from industrial crops in certain regions and to promote food production (mainly maize) in the much larger remaining areas. The government hoped to achieve this through a mixture of market- and non-market–oriented instruments. From the colonial period onwards, state efforts were geared toward setting up relevant institutions (extension, technology research and development, markets for agricultural commodities, physical inputs, capital, and land). These state structures are many—there were 57 parastatals on the books of the Ministry of Agriculture and Rural Development in 2000. But over the years, their presence and influence have diminished.

Before Structural Adjustment, the state was almost omnipresent as an extension agency supplying and disseminating knowledge and new technologies, as a credit agency supplying credit and loans to farmers, and as a market agency determining input and output prices (of seed, maize, fertilizer, milk, and so forth). It also controlled marketing as the sole buyer of agricultural commodities. This particular role of the state was not without problems. It is widely known and referred to in both the literature and the field that these state services were very inefficient. State interventions that attempted to improve peoples' livelihoods were plagued by corruption and failing markets. This is especially true of the output side, where the prices paid to farmers were notably low and delayed.

Structural Adjustment, implemented as of the early 1990s, was launched to streamline the functioning of the agricultural sector. Structural Adjustment spurred political and economic reforms such as privatization and liberalization. Many government institutions vanished; others now face competition from private companies. In the process, extension services to farmers have substantially dwindled, and agricultural credit supply lies exclusively in the hands of private institutions, although some NGOs operate microcredit schemes in the region. The previously existing tractor-hire scheme and fertilizer subsidies were already abolished long before structural adjustment programs were imposed on the country.

Now that many markets are liberalized and decontrolled, agricultural markets have not become less efficient but have created unequal access to inputs and revenue. The

private sector has responded well to provide trade opportunities in the more productive regions of Central Kenya and the Rift Valley (e.g., in the dairy sector), but have proved inadequate in the western highlands. Many high civil servants were appointed as managers of newly privatized businesses; because of corruption, various commodity markets and cooperatives have started to collapse, with private monopolies emerging in these less favored areas. For the western Kenya region, the operation of input and output markets was seriously affected. The once booming sugar industry, coffee sector, and textile industry have collapsed almost completely as a result of these processes. Regulation of the private sector is poor as well, and farmers register frequent complaints of fraudulent activities, such as adulteration, by retailers of seed and fertilizer.

The advent of structural adjustment made NGOs more prominent in the field of agriculture, however. Numerous NGOs now render services to farmers. CARE-Kenya (working with smallholder farmers on adaptive research for maize and soil fertility, health, and education), Lagrotech (providing open pollinated maize varieties), and OFPEP (an environmental NGO concerned with issues of soil fertility and erosion) are all examples of NGOs becoming more prominent now that the state is less and less functional.

CHAPTER 4

Poverty in Context

The aim of this chapter is to discuss poverty in western Kenya in detail. The first section deals with official government definitions of poverty. The second elaborates how ICRAF conceptualized and understood poverty in its technology-development work, monitoring and evaluation exercises, and quantitative analysis. The third section draws on the qualitative research and attempts to depict how the various people in the communities define poverty. The last section, based on qualitative and quantitative data, explores who the key or most vulnerable groups are among the poor.

Official Definitions of Poverty

The Government of Kenya undertook a nationwide study of poverty (Wealth and Monitoring Survey) in 1994 and 1997. It is generally agreed that the 1997 data collection exercise was more accurate than the one in 1994, so it is these data that are used to estimate poverty levels across the country. To calculate poverty rates, the government uses a headcount of persons below a specified poverty level and then divides this by the total population. The poor are defined as those members of society who are unable to afford minimum basic human needs, comprised of food and non-food items. Food requirements are based on World Health Organization/Food and Agriculture Organization of the United Nations (WHO/FAO) minimum standards for food energy intake (FEI) of 2,250 calories per adult per day. This is then translated into an expenditure value of 927 Kenya shillings (KSh) per adult per month for the rural areas.[7] Non-food requirements are estimated at 312 KSh per adult per month. The absolute poor include anyone under the level of 1,239 KSh per month and the hardcore poor include anyone under 927 KSh per month.

In 1997, it was estimated that the percentages of the population in hardcore poverty were the following for western Kenya districts:

District	Percentage in hardcore poverty
Kakamega	50.09
Vihiga	56.26
Siaya	43.64
Busia	56.26
Kisumu	54.99
Rachuonyo	62.78

[7]There are slight adjustments by province to account for purchasing power disparities across rural locations.

While some reliable quantitative panel data are available from other African countries, this is not yet possible in Kenya using official statistics. Some other studies are useful in assessing changes in poverty indicators (e.g., Jayne et al. 2001).

ICRAF and Conceptions of Poverty

ICRAF conducted a number of diagnostic studies around field sites in east and southern Africa during the late 1980s. These aimed to identify farmers' main problems and then design agroforestry systems that could address them. Not surprisingly, low resources and incomes emerged as key socioeconomic problems in all the sites. At the same time, different biophysical problems were found across the locations: poor soil fertility, excessive soil erosion, lack of wood, low quality fodder, and unmet demand for fruits. Initial technology design processes were focused more on the technical aspects of meeting these biophysical needs rather than in addressing the socioeconomic needs and constraints. Thus a phase of researcher-managed trials ensued with relatively low input from social scientists.

This all changed in the mid-1990s, when farmer-designed and managed research became the most important mode of experimentation. In addition to making strides in advancing technological designs, this brought the socioeconomic constraints and needs of farmers to the forefront. Thus, the major conceptual lens for western Kenya evolved from a total focus on low soil fertility to one that put more and more emphasis on poverty alleviation. Despite this evolution, the focus on soil fertility did not change, as it was felt that poverty could not be reduced without increases in soil fertility and thus agricultural productivity. But further probing into farmers' resources reveals that poverty implied certain constraints. For example, farmers would not be able to purchase seedlings, so soil fertility technologies that relied on seedlings would not be appropriate. Small farm sizes also meant that reliance on a single technology, such as improved fallow, would have serious limitations.

In terms of ICRAF's research process, it embraced the goal of poverty reduction and adjusted its research strategy accordingly. The first step was to understand who the "poor" were. Wealth-ranking exercises were held in many pilot project villages to identify the criteria used by villagers to classify themselves as better off or worse off. The villagers also placed themselves in their own categories (between three and five, depending on the village). ICRAF then used some of these criteria to make its own quick assessments of where households stood along the wealth–poverty continuum. These criteria included farm size, number of livestock held, whether fertilizer is purchased, and whether labor is hired. ICRAF scientists used this information to identify targets for impact assessment and to stratify households for testing and monitoring work so that the poor would be involved in technology development. ICRAF also studied the links between perceptions of wealth and social networks to understand better how the poor could be reached.

Local Definitions and Understandings of Poverty

This section draws on the qualitative data gathered through the case studies and the group discussions. For these discussions, men and women sat separately with the fieldworker. Poverty appears to be a slippery concept. Most commonly heard was the perception that "nobody is poor." The notion of "poor" or poverty, rather, represents a rejected type of person. It was thus reported that "Poor people are those that are handicapped. The poor stay and beg in towns, as they do not have land and shelter. At least I have a shelter."

There is no "rich" person either. The "rich" were described as those who have something extra. Since nobody in our sample

was seen to actually have anything extra, people reason that there are no rich people. The notion of "rich" is not favored or used at all in everyday discussions. According to general standards, the rich would not admit they are rich. Nevertheless, it is widely acknowledged that the "rich" have more land than the "poor." They therefore have more to leave fallow and thus could profit more from improved fallow technologies.

Reluctant to classify themselves or others as poor, people prefer to say that they are "lacking something." Poverty is thus associated with lacking income both from employment and from business.

While classification along poverty lines is contested, differentiation among members of the community is acknowledged. People will still describe characteristics of being poor. Poor people are those who have small pieces of land, grass thatched houses, and large families with children walking in tattered clothes who have fallen out of schools. Poor people engage in casual jobs and can never buy enough food. Physical disability is seen as a cause of poverty; many of the physically challenged beg at the market. Mental disorders are very common among the poor because they are unable to seek assistance for the condition. Poverty was said to refer to:

- Lack of land
- No daughter or son on the farm
- Inability to feed one's family
- Inability to pay for education, health care, and so forth
- Wearing tattered clothes
- Having unemployed children
- Physical disability
- Housing with a leaky roof

Laziness and drunkenness are often cited as causes of poverty within the community. Nevertheless, there is more evidence that unemployment and increase in population are the real major causes of poverty, since there is no industry in the area, and little diversity in business to generate income.

Rather than speaking of the "rich," people spoke of an ideal type, a "good farmer." A good farmer, respondents said, seems to be able to combine the good things of life. A good farmer has high crop yields, his stores are always full of maize, and he has zero grazing animals. The farmers claim that a good farmer never buys food. Instead, people flock to his farm. A good farmer uses hybrid maize varieties such as 511, farmyard manure, diammonium phosphate (DAP) fertilizer and top dressing using calcium ammonium nitrate (CAN), and urea. Therefore, a good farmer is one with the money to buy these inputs.

We have to take into account that in communities such as these, most women and young adults are the active farmers. From observation, women weed, prepare farmyard manure, and milk cows. Women are also more likely than men to take casual jobs. According to the women, most men are far from home and send too little money to sustain the family for a month. Those men who are present are either "too old" or have business in Luanda, a market town in Siaya District, and are hardly seen on the farm. Women claim that their husbands argue that their work is to pay school fees and undertake major projects such as constructing houses and purchasing land.

Milking cows and growing vegetables, such as kale, cowpeas, and groundnuts are considered to be petty activities that belong to women. Many newly married women have no options, as many of their husbands engage in formal employment or small-scale business outside the home. It is still customary that women should stay at home and maintain the home. Even if a woman is working or has a business, she should return home early.

A second area for analysis is what makes people vulnerable. The following are named by local people as contributing to vulnerability among the poor:

- Limited principal resources/assets such as land
- Unemployed children

- Theft
- Lack of alternative to farming as a source of income
- Lack of markets
- Low prices
- Being childless
- Old age
- Illiteracy
- Poor health, especially HIV/AIDS

The vulnerabilities listed are intrinsically the outcome of social processes. Through an analysis of such processes we can better understand the effects of agroforestry technology on social development, linking the social, political, economic, and agroecological context in which all this occurs. These social processes can be broken down as follows:

- Some of the vulnerabilities refer to a lack of an enabling institutional environment. The way the market operates, and specifically prices for commodities in relation to the cost of inputs, makes commercial agriculture uneconomical. The relevance for soil fertility is that the fertilizer is beyond almost anyone's financial reach. Such a situation strengthens the need for alternative soil fertility enhancing technologies.
- Other vulnerabilities, on the other hand, refer to other externalities, such as AIDS, that both reduce labor and drain financial, physical, human, and social assets. In conditions where labor and financial resources are drained, introducing labor-intensive technologies may be counterproductive.
- The vulnerabilities listed also point to the overall importance of accessing and mobilizing resources (social, financial, natural, human, and physical) and the character of such resources.
- More specifically, some of the vulnerabilities hint at issues of aging. Introducing labor-demanding agroforestry technologies to an aging community puts pressure on the availability of labor at community and family levels. The implications of aging need to be understood at the level of livelihoods: many people would rather migrate to urban centers in search of jobs rather than retain a land-based livelihood with low returns to labor given low market prices.
- The vulnerabilities listed also draw attention to issues of security (e.g., theft) and incidences of diseases that affect both plants (*Striga*) and humans (malaria).

Findings, however, also show that incidences and severities of poverty are cyclic, especially between generations, and this pattern, too, tended to follow in the area of adoption and dis-adoption of the technologies under consideration. Whereas there is sufficient evidence that SFR technologies adopted have impacted positively on the lives of the poor, it is also clear that some of the basic requirements of these technologies have continued to exclude some of the most vulnerable members of the community. From the case studies, the biggest risk is hailstones and heavy winds that crush down maize. Many case study farmers cite the lack of money as another vulnerability. Because of lack of money, they cannot hire labor for *tithonia* use or to dig terraces, cannot buy pesticides and insecticides for tomato growing (this is one of the reasons why tomato growing is not very popular—they claim tomato blight can clear the whole crop, which leads to losses). They also lack agricultural assets, for example, ox plow and tractors for faster tilling. This puts additional burdens on labor and requires cash payments (about 50 KSh per person per day) and to supply meals to the laborers when they work a full day (about four to six hours).

Striga is also very common and causes stunting in crops. Streak virus is a disease they are not familiar with and turns leaves yellow, then they rot and dry. Cassava mosaic has cleared cassava in the village; one cannot find a single cassava stem in the

village. Moles have worsened the cassava menace.

Lack of food is the main worry for most of the community members, as without food —defined as maize—they cannot have the energy to work. Lack of food is equally a problem for the casual laborers, as work is intermittent and pays only about 50 KSh a day. During the months of April, May, and June, maize prices shoot up to between 15 and 20 KSh per kilogram. By observation, many people seem to work or farm just to get something to eat.

Vulnerability is compounded by disease. During the heavy rains, malarial mosquitoes increase, and hungry people have lower resistance to malaria. The incidence of death is high during this period, drawing more time away from farming. From the case studies, HIV/AIDS is also a major threat to the society. It robs families of strong young men and women, leaving behind elders who cannot handle heavy work and orphans who need to be fed and educated. On other aspects of livelihoods, the fluctuation in prices of farm produce is a further concern. During the harvest, maize prices drop as low as 10 KSh per a two-kilogram tin, while during planting time, prices shoot up to 30 KSh for the same amount. In addition, Kenyans from Kitale, Molo, and Naivasha flood the market with cheap maize, tomatoes, cabbage, and kales (*sukuma wiki*), making the crops that local farmers have toiled for lack market value.

Key Groups among the Poor

In identifying the poor, we have not used a simple definition, but rather have attempted to employ alternative approaches in attempting to distinguish the poor from the less poor. As noted earlier in the methodology section, the first method used by ICRAF was that of wealth ranking. During this exercise, villagers identified criteria that they found important in differentiating between socioeconomic classes. A few of these variables—those that were more robust across sites and easily measured (farm size, cattle holdings, use of fertilizer, hiring of labor)—were used to create a wealth index for each household in the pilot villages. This wealth variable was then used as the poverty marker for households in the adoption study within the pilot areas (n = 1,633). The drawback of this variable is that there is no standard of comparison with which to judge whether or not a particular household is poor—it only provides an ordinal ranking of households. Therefore, it is not possible to propose that a certain percentage of households are "poor." For a subsample of pilot village households (n = 120), more detailed information is available. We can further classify households on the basis of asset poverty, expenditure poverty, or food consumption poverty (measured at the beginning of the study period). Each of these methods is used. For assets, we then calculated the number of months a household could cover its basic subsistence needs if all non-land, non-building assets were liquidated. We assumed that coverage for less than three months constituted extreme poverty. The middle group could sustain itself for between 3 and 12 months, while the well-to-do group could meet its needs for at least one year. For expenditures, data were collected on spending over a three-month period. Because that period is not necessarily representative of spending at other times of the year, we do not attempt to generate an annual expenditure amount.

Thus, we have calculated per capita expenditures and distinguished three groups of households based on inductive discovery of gaps in the distribution (this was at 800 and 2,500 shillings). For food consumption, we are able to make some normative-based calculations of the number of people in poverty, based on minimum requirements for food and basic needs (e.g., see the Government of Kenya definition in this chapter). Households not meeting minimum daily requirements are treated as poor, while those who meet minimum needs but do not exceed

Table 4.1 Distribution of poverty in pilot villages (n = 104) using alternative classifications

	Months sustained by assets	Expenditures per capita	Protein sufficiency
Percentage in wealthiest group	2.9	11.5	26.9
Percentage in middle group	30.5	38.5	22.1
Percentage in poorest group	66.7	50.0	51.0

150 percent of the minimum are considered to be in the middle group.

In all three cases, there is a sizeable percentage of households in the poorest class—as many as two thirds using the asset measure (Table 4.1). While this is reasonably consistent across measures, the subjectivity of the measures reveals itself more clearly when attempting to identify a wealthier group. Estimates range from as few as 2.9 percent to as many as 26.9 percent of households. Of course, such variation in estimates may be valid, since we cannot expect all poverty indicators to be highly correlated. Analysis using all three measures shows that 19.1 percent of households are consistently classified as poor. A further 38.4 percent fall into the poorer group in two of the three measures so a total sum of 57.5 percent are estimated to be poor by at least two of the measures. At the other end, no household is classified as wealthy under all three measures and only 5.7 percent are estimated to be wealthy in at least two measures.

In the non-pilot villages, our cross-sectional survey attempted several ways of distinguishing the poor from the non-poor. In terms of quantitative measurement, a detailed asset inventory was obtained and related to household size and basic needs, similar to that for the pilot villages. We also tried to measure poverty from two additional perspectives. The first was based on household self-perception in which respondents were asked to compare themselves to their neighbors on a number of wealth-related criteria (e.g., yields, off-farm income, ability to cope with risks, natural capital). From this, an index was created. Based on the distribution of the index, we were able to isolate a group of households that were better-off than the rest. The cutoff between the lowest and middle groups was more arbitrary, but was selected so that those in the lowest group in fact ranked themselves as worse off than their neighbors in most categories. The second identifier of the poor was an assessment by enumerator after having inspected the entire farm. The outcome was the classification of the household as either very poor, poor, or non-poor. The results of these classifications are presented in Table 4.2. Between 9.4 and 17.5 percent of households are identified as being wealthy relative to their counterparts. The lowest estimation of the number of non-poor came

Table 4.2 Distribution of poverty in non-pilot villages (n = 360) using alternative classifications

	Months sustained by assets	Farmer relative ranking	Enumerator evaluation
Percentage in wealthiest group	15.0	10.0	9.4
Percentage in middle group	43.8	40.1	48.8
Percentage in poorest group	41.3	49.9	41.8

from the enumerators. The poorest group constituted between 41.3 and 49.9 percent of the households. The lowest estimation was based on the asset coverage measure. This may be optimistic, however, because we did not control for differences in quality of assets or difficulties in disposing of assets in calculating asset values. The highest estimation is from farmers' own evaluation. While the analysts selected the cutoff, it is not surprising that a large number of people rank themselves below their neighbors in many categories.

Finally, we compared the results across classification measure to see whether the households are similarly classified across measure. In fact, few households fall into the same category for all three different classifications. However, the vast majority received the same score in at least two of the three classifications. We found, for instance, that 13.2 percent of the households were placed in the poorer group under all three classification measures. A further 28 percent were rated as poor in two of the three classification measures. This creates a "poorer group" of 41.2 percent of households. At the other end of the spectrum, a small group of 6.6 percent of households was rated as wealthy in at least two of three measures.

CHAPTER 5

Household-Level Livelihood Strategies and Their Context

In this chapter, we look at the main types of livelihood strategies that households pursue, linkages within and between strategies, and the strategies' implications for poverty reduction. To try to understand these strategies fully, we also consider why people choose particular livelihoods. In particular, we focus on the impact of these choices on people's life chances, household-level division of labor, notions of good farming, and outcomes. "Livelihoods" here refers to people's way of life. It covers what people do for their survival: striving to make a living, attempting to meet various consumption and economic necessities, coping with uncertainties, responding to new opportunities, and making a choice between different value positions (Long 2002). Therefore, in addition to finding shelter, transacting money, and preparing food to put on the family table, livelihoods are also about the management of relationships, the affirmation of personal significance and group identity, and the interrelation of each of those tasks (Wallman 1984, 22). As such, livelihoods are also about the image people desire to project of themselves, and the value system informing this perceived identity (Omosa 1998, 137; Omiti and Omosa 2002, 9). A person's livelihood is therefore an ongoing and dynamic process.[8]

Types of Livelihood Strategies Pursued, How and Why

Generally, rural households pursue several livelihood strategies, both on- and off-farm (Table 5.1). In Siaya and Vihiga districts of western Kenya, most households interviewed pursued at least one of the following sources of livelihood: arable farming, livestock rearing, business, employment, and remittances.

In the pilot areas, a majority of household members interviewed were students and therefore dependent on other household members for their subsistence. The rest of the respondents were engaged in some productive work, with the majority being farmers or farmworkers. Only a negligible proportion of the respondents were reportedly engaged in off-farm employment, signaling the fact that agriculture is central to the livelihoods of most households in rural Kenya. Farming as a livelihood strategy entails the cultivation of crops or livestock rearing.

[8]The sections that follow focus mainly on occupations and income strategies, in part because of their importance to the study, and in part because of the experience of the fieldworkers who tended to be more oriented toward picking up these dimensions of livelihoods. However, there is also discussion that touches on identity, aspirations, recognition, social status, and so forth.

Table 5.1 Livelihood strategies pursued by individuals in pilot villages (130 households)

Livelihood strategy	Frequency	Percentage
Student	310	36
Farming	217	25
Farm help	114	13
Home worker	91	11
Casual non-farm labor	51	6
Business/trade	47	5
Civil servant	15	2
Preacher	12	1
Skilled labor	8	1
Totals	865	100

Source: Quantitative Survey 2002.

Crops cultivated include cereals, legumes, root crops, and horticultural crops. The livestock include cattle, goats, and sheep.

One of the main features of the livelihood strategies pursued in rural Kenya is the fact that several strategies are applied, sometimes in combination, sometimes in succession, with the possibility of making reversals. The question therefore becomes: How are these strategies applied and under what circumstances? The various case study accounts suggest that generally, choices depend on the resources at hand, perceptions of incentives (rewards and costs), the desire to belong and fear of isolation, and how events unfold both for individuals and for their networks, wherever they are located.

These criteria for choices are illustrated by an analysis of the livelihood strategies of Sufu, a 35-year-old farmer. As detailed in Box 5.1, Sufu started off as a small-scale farmer growing vegetables for sale. Within farming as a strategy, he preferred tomatoes to maize farming and worked out ways to improve his earnings. However, about two years later, he moved out of farming to take up casual employment secured through a brother. However, he also left that situation after a year because of the uncertain nature of casual employment.

Nevertheless, he had saved funds, and in 1991 opened a grocery shop using his savings. This particular source of income transformed Sufu's life for the better, but the good fortune did not last. He was frequently attacked by armed robbers, and these setbacks reduced his capital base drastically. In 1994, ICRAF came to his village, prompting Sufu's return to farming. The same year, he married. Three years later, he moved into politics, leaving many of the farm activities to his wife.

Sufu's account shows that the circumstances that determine choices vary from time to time. For instance, after Sufu sat for his secondary school certificate examinations, he went into small-scale agriculture because it was not possible to continue with education. Thereafter, the choices he could make within agriculture now depended on his knowledge base and ability to seek information. We therefore see him linking up with a farmer friend who was earning a fairly good living from tomato farming. But his friend earned far more from his tomatoes than Sufu did, because his farm was near a main highway and he employed superior crop husbandry practices. But we also see Sufu preferring cabbage to tomato farming because the former require fewer and less expensive inputs. In other words, in addition to having a good market and access to required knowledge and skills, these livelihood choices also depend on one's capital base.

On the other hand, people shift their livelihood strategies because others have suggested so or just for a change. Hence, in spite of having invested quite a bit in terms of knowledge and skills, Sufu easily moved out of farming to take up casual employment. The availability of this employment was a result of the fact that he had a brother in town who found him this job. However, only a year later, Sufu returned to the village but with sufficient capital to invest in some off-farm employment in spite of having had some experience in agriculture. Yet, vulnerability to armed attacks pushed Sufu out of this otherwise lucrative strategy and back to farming. In many ways, therefore, it is

Box 5.1 Relay Type of Strategies

"My name is Sufu and I am 35 years old. I completed secondary school education in 1987, after which I spent two years at home engaged in small-scale agriculture. I planted onions, cabbages, *sukuma,* tomatoes, and beans.

"I preferred planting the 'money maker' tomato variety because it used to fetch a relatively good price as compared to maize. I used only compost manure. Later on, my skills were much improved after taking lessons from a farmer friend from a neighboring village who was able to fetch 200 KSh per crate of tomatoes. This was mainly because my friend lives near the main road to Eldoret; he applied insecticides and was able to time well so that harvest time coincided with the dry season. This friend also taught me cabbage planting. At that time I preferred cabbage farming because it is less costly and it requires less labor. I was also able to sell all my cabbage to Emusire High School.

"I spent my earnings on fashion trousers since at that time I was still a young man. I also paid school fees for my younger brother and bought some maize for my parents.

"In 1990, I left for Nakuru at the invitation of my brother, who had found me a casual job at the post office. I, however, quit this job later in the year, because I had been a casual for a long time.

"In January 1991, I opened up a grocery shop in the village selling cabbage, *sukuma,* and retail goods. This time I had a lot of confidence because I was already experienced in business and I had some knowledge of accounts. I started with a stock of 10,000 KSh and at the end of that month the stock was 15,000 KSh. The capital for my business was from the savings of my former job.

"This business was very successful and profitable. After six months I had already acquired four cows and six sewing machines. At the end of that year I built a semi-permanent house at a cost of 18,000 KSh.

"In 1992, disaster struck: thugs attacked me and took away all the stock, valued at more than 25,000 KSh. I was forced to sell two cows to restock. In September of the same year, armed thugs robbed me of goods worth 67,000 KSh and this demoralized me. I closed the shop for one month, following which an Asian friend in Luanda gave me goods on credit. This time around I employed four men to transport and sell goods outside the shop and to avoid too much stock. I also made burglarproof doors and we requested the local District Officer to put up a police camp at the Chief's office. However, the posting of police was delayed by lack of houses and an office because some members of the community were reluctant to contribute toward the construction of houses for fear of police harassment, especially because of local brew.

"By 1993, my stock had fallen from 150,000 KSh to a mere 40,000 KSh, because multiparty politics introduced market-regulated policies while sources of income for our customers remained the same. Goods such as fruit juice, bread, and margarine became luxuries and were therefore never purchased. Furthermore, the Asians who used to give us credit stopped because they feared the outcome of the multiparty election and change of government. As my business fortunes dwindled and I was contemplating what next, ICRAF came to our village in 1994. This was an opportunity for me to rest from shaky business and venture into agriculture. The same year I decided to marry. I now have five children, two of whom I had sired before marrying.

"In 1997, I joined active politics and left farm activities wholly to my wife. However, our maize harvest dropped due to poor maintenance. I was so discouraged that the

next season I decided to plant napier grass with the hope of getting a zero-grazing cow. This was because the few farmers that I knew who kept zero-grazing cows are able to pay fees and buy food and they could even afford a beer. I was so thirsty for these cows that at some point I wanted to sell all the indigenous cows I had, but my wife resisted. Once I get money, I am planning to concentrate on tomato farming, because I already have knowledge on how to use *tithonia* and manure as fertilizer."

Source: Isikhuyu Village, Vihiga District.

difficult for a single household to improve its level of development without comparable improvement by others.

It is also apparent that ability to combine livelihood strategies is sometimes dependent on availability of labor. Sufu's account is a good example of a relay type of approach. While he was still a single man, Sufu tended to use only one strategy at a time, some of which had no direct linkage with succeeding ones. Although there is no mention of the reasons why he preferred such an approach, there is a possibility that he faced labor constraints or could easily meet his needs. Hence, as soon as he married, Sufu started combining active politics with farming, which, however, he "delegated" to his wife. Probably because he was now not as committed and the person in charge had not had as much exposure as Sufu regarding improved farming methods, their yields dropped. We therefore see Sufu making adjustments, some of which, however, are contested by his wife.

Indeed, some of the other case studies also show that in an attempt to straddle, some livelihood strategies actually contradict and therefore interfere with the success of individual strategies. In several instances, however, these livelihood strategies complement one another to the extent that many of them cannot be pursued in isolation. Among the issues that are therefore central to this impact assessment is the need to understand the driving force behind the choices that people make and why they sometimes remain in strategies that seem unprofitable. Some of the issues that could explain choice among rural households is people's notion of good farming and how this influences the type of strategies that they pursue to earn a livelihood, and the nature of investments that they put in place, including the soil fertility replenishing (SFR) technologies adopted. Therefore, whereas the rural poor may be in a position to appreciate the dynamic changes around them, they are often unable to take full advantage of opportunities that are perceived as capable of occasioning a turnaround. As such, whereas the rural poor may be aware of some of the opportunities that are available in the vicinity, such as good farming practices, they are often constrained from taking advantage of such opportunities. In other words, making opportunities for poverty reduction available does not necessarily mean that they will be accessible to the poor. In addition, failure of the poor or target group to take up these technologies does not imply their lack of knowledge of what is required to make their situation better. Poverty can therefore coexist with opportunities meant to enable the poor to make their situation better for as long as these opportunities remain inaccessible.

Local Notions of Farming as a Livelihood Strategy

The question is, therefore, who is a good farmer? It is noted that there are different types of farmers and farming systems and these have changed over time. Local notions about good farming are based on people's

Box 5.2 Types of Farmers and Farming Systems

Maria is 46 years old and the mother of ten children, four of whom are deceased. Maria and her husband lived in Mombasa for over 20 years and returned to the village only in 1993. At the beginning of 2001, her husband migrated to Busia to operate his newly opened retail shop. Prior to this, Maria's husband was quite idle, because he was never acquainted with farmwork. Other than having lived in town for many years, Maria's husband grew up among many girls and therefore never did much work during his youth.

Maria works on the farm with her daughter, Grace, who although out of school, indicated that she goes to the farm only because she has no alternative. The other younger siblings help with farmwork only during the holidays and over the weekends, especially in peak working periods. They own about one acre of land and almost one half of this is occupied by the homestead.

Since returning from Mombasa where she worked as house-help in a white man's house, Maria has been engaged in farmwork to raise food for her children. In 1997 she registered as a farmer with ICRAF and was taught how to use *tithonia* to improve land productivity. She decided to plant *tithonia* on alleys in her farm to cut down on the labor and time that is required to look for it from far away. However, she has used rock phosphate only once, when ICRAF supplied them with some.

Maria has never planted other fallow crops such as *C. grahamiana* and *T. voghelli* because she claims she does not have enough land to leave fallow for a whole year because "I have to plant in the two seasons to get something to feed my children." She first learned about the use of *tithonia* from a neighbor and later attended village workshops organized by ICRAF. They were taught how to make compost manure using *tithonia.* For one year, Maria has not attended ICRAF meetings and workshops to gain knowledge about the new technologies. When I asked her why she does not attend these meetings, she said, "*Jotelo mag* ICRAF *man e gweng' ka obuono jomoko*" (The ICRAF agent/contact in the village is biased; he gives information to some people and not others). Because of this, many people are not as enthusiastic as before and they therefore lack current information. She added that "*ma omiyo tinde ok ati maber*" (because of this I do not work as well as I did then or as I could had I got the new technologies as taught by ICRAF staff).

When she can afford it, Maria uses inorganic fertilizers. Her husband or her son helps her to buy the fertilizer (DAP). She states, however, that continuous use of inorganic fertilizers destroys the soils and that the fertilizers should be used together with compost manure. She says that the inorganic fertilizer is good only with plenty of rainfall; otherwise all the crops dry up. So, even when she has fertilizer, she uses it only during the long rains.

When I asked her how she detects soil fertility levels, she said that she knows this by looking at the health of the plants growing on the farm, crop yields, and the kinds of weeds. "When I see *Striga* weed, then I know that the soil is poor."

Maria plants only indigenous crop varieties because the hybrids are too expensive for her and many times in short supply. She also says that hybrid maize is not sweet for eating when green.

Maria feels that her own piece of land is not enough and would like to hire more land for farming. She has once hired land for a year. This was situated far from her home and although the crop did well she did not harvest much because people stole most of it. This

time she tried to get land closer to her home but it was not possible. She says she does not use *tithonia* on hired land because the owner may decide at any time to terminate her contract after she has improved the soils through the use of *tithonia.* "Some people have chased their tenants when they realize that the tenants are getting good yields. Therefore many people only use inorganic fertilizers on hired land."

Source: Sarika Village, Siaya District.

aspirations and these largely hinge on output and recognition from neighbors and friends, an aspect of people's livelihoods. In this section, we explore some of these issues with the aim of understanding further the various livelihood strategies that households pursue. In particular, we look at the different types of farming, what people perceive as good farming, and how these relate to soil fertility.

Maria's account (Box 5.2) suggests that whereas most people are aware of what it takes to be regarded as a good farmer, many of them become constrained by circumstances in their attempts to become good farmers. Further, in attempts to adapt to a diversity of situations, different types of farmers and farming systems emerge.

Hence, although Maria's husband is present on the farm, he has decided not to get involved in farming and this therefore takes away from him the decision-making power and related choices. But, because of this, too, Maria cannot go for expensive farm inputs and she therefore suffers the same fate as many female-headed households. For instance, much as *tithonia* is more effective when used in combination with rock phosphate, Maria used the latter only once when it was supplied to her free of charge from ICRAF. Subsequently, she has been using only inorganic fertilizers whenever these are purchased for her.

Other evidence, however, suggests that reluctance to use inorganic fertilizer goes beyond finances to include how people perceive the dangers associated with these technologies. On her part, Maria uses inorganic fertilizers only during the wet season when, in her view, they cannot destroy the soil. This therefore means that the choices that people make regarding farming activities and that ultimately characterize their farming styles depend on how they perceive any of the practices that they engage in, irrespective of whether they are recommended or not.

Furthermore, farming styles are also dependent on access to land. Hence, Maria is unable to adopt fallow crops because of the limitations arising from the size of her land. And, whereas she can afford to hire in additional land, the expectations of those leasing out land make it difficult to implement soil fertility replenishing technologies and therefore determine whether one actually takes up these technologies fully or not. In other words, no matter the level of exposure to soil fertility replenishing technologies, adoption as a strategy to enhance one's livelihood is also dependent on availability of basic inputs, land being one of them. Therefore, much as soil fertility may have been successfully identified as a prerequisite to good farming practices, actual implementation is subject to vulnerabilities, such as people's failure to honor the contractual obligations governing leasing out land.

Linkages between and within Strategies

In light of the foregoing, are there different types of farmers? According to Maria's account above, there are different types of farmers, but their categorization depends less

on their knowledge and skills than on available resources—and how individuals perceive the opportunities and risks facing them. Are there any linkages therefore between and within the strategies that households pursue?

Generally, the livelihood strategies that households pursue vary with gender to the extent that women diversify much more than men do. For instance, while Sufu seems to pursue only one strategy at a time, Maria alternates between several farm activities. However, these choices are also a function of resources. Generally, resource-poor households tend to diversify their strategies for fear of taking a risk or because none of the strategies can provide adequately on its own. Therefore, even though her land is small, Maria continues to combine several crops just to eke out a living. On the other hand, Sufu's strong asset base allows him the freedom to concentrate on one approach at a time. These combinations also depend on the nature of risks facing any one particular individual and how he or she perceives available opportunities, if any.

Last, all these strategies and livelihood approaches are linked since they largely constitute a people's identity and therefore provide a sense of belonging. Nearly all residents tend to follow the norms of behavior in their home area. For instance, in spite of its lack of rewards, subsistence farming has persisted—sometimes just because people wonder "what the neighbors will say" should they change. Hence, the struggle to belong and the continued search for identity forces some to continue actions that they might otherwise gladly put aside.

CHAPTER 6

Processes and Patterns of Adoption

This chapter elaborates in detail what specific factors have influenced the adoption of soil fertility replenishment (SFR) technologies.

First we detail which assets ICRAF thought would be vital for adoption, particularly with reference to the sustainable livelihoods (SL) framework. In the second section, we describe the actual patterns of adoption in the region, in both pilot and non-pilot areas, based on the quantitative data. At this level of analysis we will present a first typology of adopters, one that is developed and used by the disseminators themselves. The third section deals with decision-making by households regarding the adoption of agroforestry technologies.

Explaining the exhibited patterns of adoption is an important task of this chapter. The most important issue is the extent to which the poor households, as defined in the previous chapter, are able to use improved fallow and biomass transfer technologies. In the analysis, two important social dimensions deserve specific attention. We look at which assets play a key role and whether they have shaped the adoption of SFR-based practices. We also provide an account of issues of control and mobilization of resources. Particular attention is given to the significance of land tenure arrangements. The analysis is disaggregated in terms of gender and age and other relevant forms of social differentiation. Furthermore, it elaborates the links between the adoption and perception of the technologies, and the way these were introduced into the communities. Last, a *social* typology of adopters is presented and elaborated. This typology differs from the first one in that it aims to capture local images and labeling.

The fifth section draws our attention to how other technologies available to replenish soil fertility, such as fertilizer and cattle manure, are perceived and how they compare with agroforestry-based technologies. The last section deals more specifically with how farmers adapted the original package to their benefit and the implications of the interventions for reducing poverty.

Researcher Assumptions about Adoption of Agroforestry

The premises underlying ICRAF's decision to invest in the development of agroforestry-based soil fertility replenishment systems can be summarized as follows:

1. Agriculture is important in rural households' livelihoods, poor and wealthy alike.
2. Reducing poverty in the short term requires improved incomes from agriculture.
3. Increasing agricultural income will necessitate increased crop productivity.
4. Soil fertility is critical for increased crop productivity.
5. Fertilizer and animal manure is out of the reach of the poor.
6. Households lack cash, but can spare some land and sufficient labor (especially at non-peak periods) for improved soil fertility management.

7. Women will be empowered to plant trees for soil fertility inputs, even if they are not allowed to plant other types of trees.

Given these assumptions, ICRAF, KARI, and KEFRI embarked on a collaborative research and development project in western Kenya. This impact-assessment research will allow for a quantitative validation of hypotheses 5, 6, and 7—and some insight into hypothesis 4. For hypotheses 1, 2, and 3, we rely on the qualitative analysis.

Actual Patterns of Adoption

In this section we present evidence of adoption of the improved fallows and biomass transfer agroforestry systems, in both pilot and non-pilot villages. For the former, all households were monitored, so the figures show the rates of adoption. For the non-pilot villages, our ultimate sample was stratified on the basis of use of the technologies, so they are not representative. For this sample, we show only how use has evolved over time. For estimating the rates of adoption in the non-pilot villages, we present the results of preliminary censuses from these sites conducted in order to develop sampling frames.

Tables 6.1 and 6.2 and Figure 6.1 show the use of the agroforestry technologies over time in pilot and non-pilot villages. Distinctive patterns emerge inside and outside the pilot area. Inside the pilot villages, there was a rapid surge of use between 1997 and 1999, when usage reached about one quarter of households for each technology. The year 2000 saw a significant decline in use, followed by a recovery in 2001. In 2001, 15.2 percent of households were using improved fallows and 16.7 percent were using biomass transfer. A likely interpretation is that considerable technical support, along with the bandwagon effect, may have led to early high rates of testing. This rise was followed by dis-adoption by those who did not receive sufficient benefits or were unable to manage the technology after ICRAF and partners reduced backstopping efforts (see later). Then in 2001, some early testers retried the systems and new testers surfaced. Outside the pilot villages, the dynamics differed considerably, with steady increases found over time for both technologies (and other SFR technologies as well).[9] Starting with just about 5 percent of households using agroforestry in 1997, the ending figures showed that 12.4 percent were using improved fallows and 21.6 percent were using biomass transfer in 2001. Biomass transfer therefore appears more desirable outside the pilot villages than inside. In both areas, however, there are new testers.

Table 6.1 Use of agroforestry in the pilot villages over time (as percentage of 1,538 households)

Year/season	Biomass transfer	Improved fallow
1997 Long rains	10.8	n.a.
1997 Short rains	10.4	n.a.
1998 Long rains	20.9	20.5
1998 Short rains	20.0	20.8
1999 Long rains	25.9	23.1
1999 Short rains	6.8	21.9
2000 Long rains	12.3	13.5
2000 Short rains	7.4	14.0
2001 Long rains	16.7	15.2
2001 Short rains	11.2	13.1

n.a., data not available.

There are further differences in the use of SFR within and outside the pilot villages. Within the pilot area, 54 percent of those who employ agroforestry are using both the improved fallows and biomass transfer, compared with only 38 percent outside the pilot area. Thus, when households have less contact with project staff, they more often than

[9]Note that while use of agroforestry was monitored annually within the pilot villages, the data for the non-pilot villages were based on recall from 2001.

Table 6.2 Use of agroforestry in non-pilot villages over time (as percentage of 360 households)

Year	Biomass transfer	Improved fallow
1997	6.1	4.1
1998	8.0	7.2
1999	14.7	13.7
2000	19.9	13.0
2001	21.6	12.4

Table 6.3 Patterns of use of improved fallows and biomass transfer in the pilot villages (as percentage of 1,598 households)

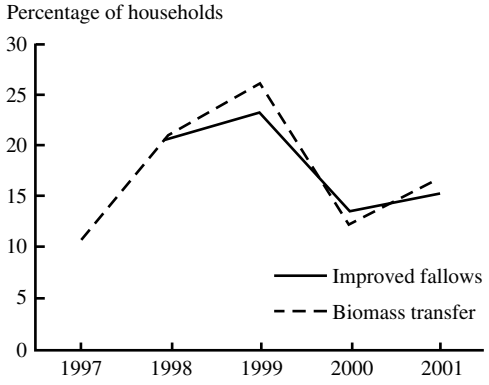
	Improved fallows	Biomass transfer
Non-adopters	61.4	59.9
Dis-adopters	9.1	10.4
Recent testers	7.6	14.6
Adopters	22.0	15.0

not prefer only one of the agroforestry systems. This is further supported by the fact that of the new testers in the pilot villages, those who started after project staff had left, 88 percent are trying just one of the systems.

For the pilot villages, the data presented in Table 6.1 were analyzed to classify households into different categories of adoption. The adoption dynamics were summarized into four mutually exclusive outcomes for each technology:

1. Households that never used the technology (non-adopters)
2. Households that used the technology early on but never again (dis-adopters)
3. Households that did not use the technology early on but used it recently (recent testers)
4. Households that used the technology throughout the period (adopters)

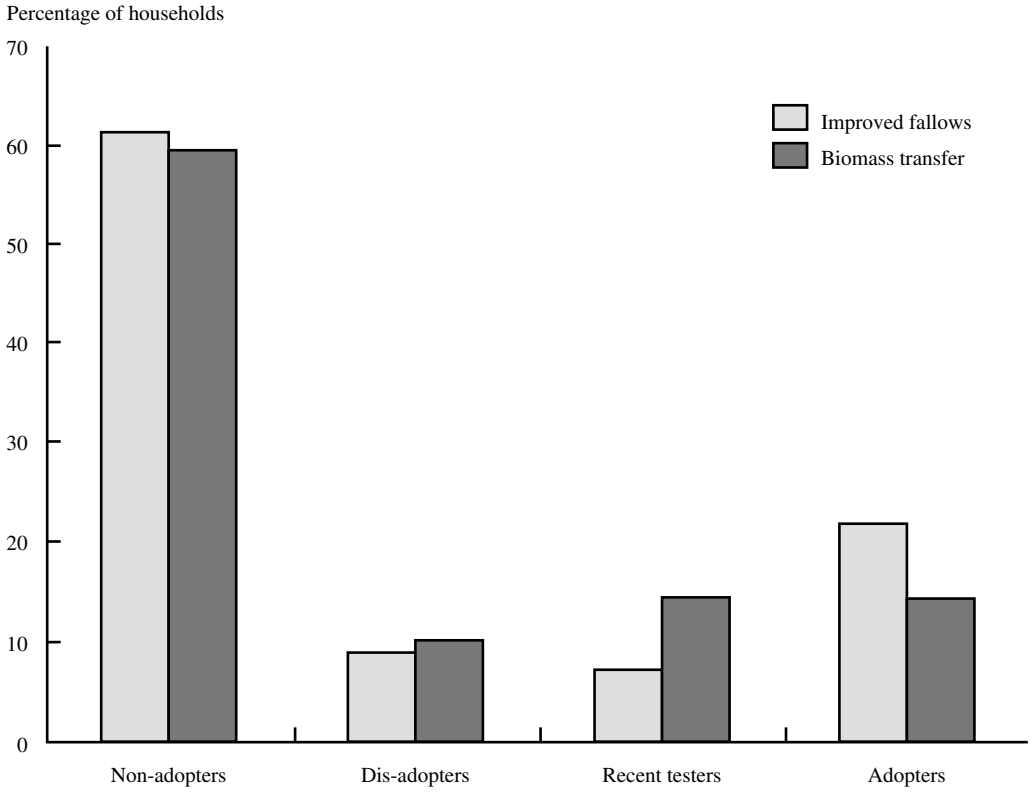
Figure 6.1 Adoption patterns of improved fallows and biomass transfer in the pilot villages over time, 1997–2001 (as percentage of 1,630 households)



Because the actual patterns of use varied a great deal, the rules for placing households in any of the above categories are quite lengthy. For the most part, adopters will have used fallows more often than dis-adopters and testers, but some dis-adopters may have used fallows two times (that is, in 1997 and 1998). Table 6.3 and Figure 6.2 show that the majority of households—about 60 percent—had not tried either of the technologies by 2001. A greater percentage of households have adopted improved fallows (22.0 percent) than biomass transfer (15.0 percent). However, about twice as many households have recently tested biomass transfer than have tried improved fallows (14.6 percent to 7.6 percent). For both technologies, about 10 percent of households tried and then dropped the practice.

Censuses were performed at six different sites outside the pilot villages but nearby (about 1,000 households in all). Because the rates of use are expected to be relatively high compared to other non-pilot villages (indeed, this is one of the variables for stratification), these should not be taken to be representative. Table 6.4 shows that rates of use are very high in five of the six sites, ranging from about 24 to 59 percent. This is encouraging, given that technical support from the project in these sites has been relatively low. In fact, the site with the highest adoption rate (West Kanyaluo) is the one that received the least amount of attention

Figure 6.2 Adoption patterns of improved fallows and biomass transfer in the pilot villages by 2001 (as percentage of 1,630 households)



from ICRAF or any other intermediary. An umbrella NGO works in the Bukhalahire site and has assisted farmers there. Muhande is a former CARE village and along with Mwitubi hosts ICRAF technicians from time to time because of its proximity to the research center in Maseno. Shinyalu hosts researchers from KARI-Kakamega. Finally, Central Gem is a site where the main contacts for improved fallow dissemination were the members of a soil- and water-catchment committee, formed by extension workers.

The use of improved fallows and biomass transfer has increased over time in the non-pilot villages. Overall use is increasing for both technologies, in contrast to the pilot villages, where use patterns seemed to mirror the intensity of ICRAF technical support.

Table 6.4 Rates of use of improved fallows in early non-pilot area villages

Site	Number of households	Percentage of households with improved fallows
Bukhalahire (Busia)	110	33.6
West Kanyaluo (Rachuonyo)	233	58.8
Shinyalu (Kakamega)	90	44.4
Mwitubi (Vihiga)	118	30.5
Muhande-Arude (Siaya)	150	23.3
Central Gem (Siaya)	105	3.8

Note: Ugunja was enumerated, but a proper census with a full listing of households was not performed there.

Table 6.5 Size of fallows over time in pilot villages (square meters)

	Mean	Median
Size in 1998	480	244
Size in 1999	364	225
Size in 2000	457	270
Size in 2001	440	234
Change over time[a]	–137	–81

[a]Calculated only for those farmers with at least two fallows occurring at least two years apart (2001 minus 1998 size, or 2001 minus 1999 size, or 2000 minus 1998 size).

Table 6.5 shows that average fallow area was highest in 1998, dropping to a low in 1999 and recovering somewhat in 2000 and 2001. Fallow size was reduced in 1999, partly because of both rainfall and seed supply constraints in addition to farmer preferences. In 2001, the mean fallow size was 440 meters squared or 0.04 hectares. While this does not sound like much, it should be recognized that the average farm size for many is about 0.6 hectares, of which perhaps 0.3 to 0.4 is under maize. Further, the fallow system calls for a rotation of a fallow followed by three seasons of maize. If this pattern is followed, one would expect only one fourth of the maize area to be under fallow at one time—this would be between 0.075 and 0.100 hectare. Viewed in this way, adoption intensity among those using fallows appears to be more significant.

Table 6.6 shows the percentage of households who planted *tithonia* on their farm. This is perceived as increased investment in the biomass transfer system by increasing the amounts of organic material available or reducing the labor required for collection of the material off-farm (or both). It can be seen that considerable planting occurred in 1998, 1999, and 2001, over 11 percent of households in each case. It is not known why investment declined so significantly in 2000. Continued monitoring will help to reveal whether this was just an anomaly or an early sign of saturation of interest.

Table 6.6 Planting of *tithonia* biomass transfer systems on farm over time in pilot villages (as percentage of households planting)

Year	Percentage of households
1997	7.9
1998	11.7
1999	11.9
2000	4.2
2001	11.0

Decisionmaking

The issue of who decides to adopt (or not to adopt) SFR technologies is a tricky one. Customarily, among both the Luo and Luhya, it is the husband who makes such decisions. A researcher asking questions about intrahousehold decision-making tends to get the same answer ("The men decide"), even from women ("My husband decides"). In cases where the man in the household or compound is present, he is the recognized "owner" of the land and the head of the household, and men often decide to try improved fallows or green manure. This does not necessarily mean, however, that women have no say in such matters. As described in Chapter 3, one of the female farmers was the first in the household to receive knowledge about use of *tithonia* and the fallow trees; she shared this information with her husband after she had planted them on her plot. Another female farmer works alone because the husband has no interest in working on the farm, so she decides what kind of technology to employ on the farm. In the case of two wives of a Luo husband from the same homestead, one decided to adopt the SFR technologies while the other has not. Each has their own reasons.

The situation as explained in Chapters 3 and 5 is such that men often seek off-farm employment, leaving their wife or wives behind to cultivate the fields. In such cases, it is not unusual to hear women say that they have made the decision to experiment and plant fallow and green manure species. Yet

women rarely mention that they decide what to do but rather give their husbands the credit.

Some of the case studies show that the decision to adopt or not has caused disagreements. In one particular case, both husband and wife pursue different farming practices, as a preference. In this case, the man first learned of the new SFR technologies. But because he is an alcoholic with low social status in the community, his wife was not convinced that his new farm practices were anything to emulate. Instead, she viewed them as a likely continuation of his wayward tendencies.

One difference occurs at the level of pilot versus non-pilot villages. In the pilot villages, women are active adopters. However, in the non-pilot villages, the few adopters are mostly men.[10] The reason could be that new knowledge has to be searched for from a distance as compared to the pilot villages, where the knowledge is brought close to home and women are able to attend the learning sessions.

For several major reasons, men have an advantage over women in accessing information. Relatively free of household chores, men have a great deal of time to be away from home. Because of their larger social space, they can also interact with other people more freely, and go for exchange visits and other meetings without being questioned as to their whereabouts. Men's absence from home also does not interfere with domestic work such as childcare, cleaning, cooking, or fetching water and firewood to keep the household going. One female farmer in a pilot village, an elite woman, educated to form four, said that a hindrance to women's participation in exchange visits is the allegation that some of them befriend the ICRAF staff. Therefore any trip is suspect as a potentially illicit opportunity.

Higher adoption of the SFR technologies by women in the pilot village was inspired mainly by the fact that they needed higher yields to be able to provide food for their households. One woman said, "We work hard and do what we can to increase our yields, because we are the ones who stay with the children at home. If we cannot give them food, they will cry 'on our heads.'"

Education was not found to play a major role in the decision of farmers to take up technologies. Less educated women excel in adopting new technologies as long as explanations are provided in simple terms. Interestingly, the data clearly show that women understand the management and impacts of SFR technologies better then men. This may help explain why women are enthusiastic about SFR and decide to adopt such techniques.

Because many of the technologies were taught in a practical manner, it was easy for the farmers to try them. Education was found to be important, however, when it came to understanding technical issues such as the science of how the fallows and *tithonia* work in the soil, including the release of nitrogen gas and uptake by crops.

Gender must also be considered as women must ask their husbands' permission to attend seminars and meetings. When the bus broke down during a study tour, the reactions showed how seriously the gender roles and constraints must be taken. When the bus broke down, ICRAF was forced to provide hotel accommodations for the participants, including the women. The husbands, it turned out, were not happy with the fact that their wives had spent the night away from home. While such sentiments may be part of gender relationships in general, it remains unclear whether the angry reactions might also have something to do with

[10]As will be shown in a later section, the rate of adoption among female heads is similar to that of males in both the pilot and non-pilot villages. These perceptions by community members on gender participation are more likely related to a comparison of absolute numbers of male and female users.

ICRAF and/or the way SFR technologies had been introduced.

Explaining Adoption and Dis-/Non-Adoption

This section reviews the analysis of the quantitative and qualitative data.

Quantitative Findings

Pilot Villages. A multinomial logit regression was run to examine the effect of several explanatory variables on the likelihood of being a dis-adopter, a tester, or an adopter, relative to having never tried the technology (an improved fallow or biomass transfer, examined in separate models). The distribution of these outcomes for each technology has already been presented in Table 6.3. While some categories have a relatively low percentage of households, the large number of observations permits us to include them in the analysis.

The explanatory variables are from a survey conducted in 1997 in 17 villages. Thus, all the variables included in the model are predetermined in relation to the adoption variable. Moreover, most of the variables could be treated more rigidly as exogenous. Such exogenous variables include village location in pilot area or not (selected by external organizations), ethnicity, education level of household head, age of household head, and owned land area. There may be some selectivity of households over the number of adults in the household as well as the decision-making structure. Mainly, it may be that other exogenous variables (e.g., owned land area) may affect migration decisions of households and therefore the probability of having a female head with the husband living away. Also, the wealth index, based on farm management practices (e.g., ability to hire labor) and assets, is likely to be related to similar exogenous variables.[11] Different models were thus run with and without these choice variables, as well as with other non-exogenous variables. The model reported in the table is a compromise that attempts to include as much as possible only exogenous variables, but that also includes other variables highly relevant to poverty, the main focus of the research.

Table 6.7 shows the results of a multinomial logit analysis of dynamic use patterns of improved fallows in the pilot project areas between 1997 and 2001. In general, the included variables appear to be very important in distinguishing between dis-adopters and non-adopters, to some extent between adopters and non-adopters, but not very relevant to distinguishing between recent testers and non-adopters. Rather than describing results outcome by outcome, we shall instead analyze by variable across the different outcomes.

First, we shall discuss the variables most closely linked to poverty, the wealth index, the type of household, and farm size. The wealth index was not statistically significant in any of the pairwise comparisons, suggesting that the different use patterns are neutral with respect to wealth—the poor are as likely to be adopting as the wealthy. Household type was also not related to adopting improved fallows—the technology is being adopted to the same extent by female-headed and other nontraditional household structures as by the more common male-headed, monogamous household. A final variable linked to poverty, farm size, shows

[11]Note that farm size is just one component of the wealth index, as many other variables were cited as essential indicators or contributors to wealth. We use the terms "wealth category," "wealthy," or "poor" to relate to the classifications based on the broader wealth index measures. It should be recognized, however, that all the "near-landless" households are not included in our group of "poor" households. Thus, in the conclusions chapter, we reinforce this difference by using the phrase "non-land wealth" to reflect the findings related to the wealth index. We note separately the results of analyses of the effects of farm size on adoption and impact.

Table 6.7 Household factors related to adoption of improved fallows in pilot villages, 1997–2001 (*n* = 1,583)

	Outcome		
Variable	**Used early and dropped**	**Used recently only**	**Used throughout period**
Constant	–3.0833**	–2.7064**	–2.5034**
	(.0000)	(.0000)	(.0000)
Pilot village	0.6555**	–0.1494	0.8041**
	(.0006)	(.4238)	(.0000)
Luo household	1.3505**	0.2413	0.9998**
	(.0000)	(.2714)	(.0000)
Number of adults	0.2685**	0.1331**	0.0944**
	(.0000)	(.0189)	(.0214)
Female head—husband away	0.6750**	0.4922	0.0461
	(.0318)	(.1336)	(.8414)
Female head—no husband	0.1070	0.3812	0.0262
	(.6892)	(.1480)	(.9150)
Male head—polygamous or single	0.6628**	–0.3149	0.1717
	(.0136)	(.4238)	(.4238)
Secondary education	–0.8548**	–0.2650	0.2335
	(.0246)	(.4840)	(.3682)
Upper primary education	–0.2314	–0.1058	0.1763
	(.4008)	(.7589)	(.4231)
Lower primary education	–0.2194	0.2804	–0.0686
	(.4377)	(0.94)	(.7642)
Age	–0.0168**	–0.0055	–0.0059
	(.0358)	(.5389)	(.3174)
Owned land area	0.1417**	0.0846	0.2306**
	(.0246)	(.2302)	(.0000)
Wealth index	0.0418	0.1270	0.0395
	(.5828)	(.1216)	(.4840)
Percentage of cases observed	9.1	7.6	22.0

Notes: Omitted outcome is the group of farmers never trying improved fallow. *p*-values in parentheses; **significant at at least 5 percent level; *significant at 10 percent level.

a different pattern. Non-adopters of fallows have smaller farm sizes than dis-adopters and adopters. Somewhat encouraging is that households that are newly trying improved fallows tend to have farm sizes indistinguishable in size from those of non-adopters. Using the land/adult labor ratio in an alternative regression, it is found that greater ratios are positively related to the adoption of fallows (though not significant for dis-adoption or recent testing). Thus, for adoption, land is a more important household constraint than is labor.

Among other variables, being in one of the focal pilot villages (10 of 17 villages in the pilot area) was instrumental in testing fallows at an early date, whether the practice was continued or not. However, location is not important for recent testers—this is suggestive that recent testing is related less to technical backstopping, other external motivations, and to the spillover effect of larger numbers of nearby users. One interpretation is that because fallows and their effects are highly visible, many farmers were able to make early decisions about whether to test them (hence the relatively few recent testers) and thus there are few relationships between explanatory variables and recent testing. Early use was similarly higher among Luos as compared to Luhyas. However, just like the case with the pilot location

Table 6.8 Household factors related to adoption of biomass transfer in pilot villages, 1997–2001 (*n* = 1,583)

	Outcome		
Variable	**Used early and dropped**	**Used recently only**	**Used throughout period**
Constant	–1.765**	–1.9317**	–3.6500**
	(.0002)	(.0000)	(.0000)
Pilot village	–0.1868	0.4200**	0.7082**
	(.2714)	(.0070)	(.0000)
Luo household	0.1926	1.0225**	1.9524**
	(.3174)	(.0000)	(.0000)
Number of adults	0.1019**	0.1660**	0.2045**
	(.0456)	(.0004)	(.0000)
Female head—husband away	–0.0801	–0.3833	–0.1384
	(.7642)	(.1936)	(.6892)
Female head—no husband	–0.0854	–0.1599	0.0303
	(.7644)	(.4840)	(.9204)
Male head—polygamous or single	0.3162	0.0911	–0.0365
	(.2302)	(.6892)	(.9220)
Secondary education	–0.3323	0.0778	0.7820**
	(.3174)	(.7890)	(.0094)
Upper primary education	–0.5478**	0.0254	0.5783**
	(.0456)	(.9204)	(.0214)
Lower primary education	–0.2762	0.0638	–0.1561
	(.2714)	(.7895)	(.5486)
Age	–0.0130*	–0.0218**	–0.0041
	(.0892)	(.0010)	(.5486)
Owned land area	0.0770	0.0693	0.1352**
	(.1336)	(.1616)	(.0026)
Wealth index	0.2596**	0.1679**	–0.0172
	(.0004)	(.0070)	(.7889)
Percentage of cases observed	10.4	14.6	15.0

Notes: Omitted outcome is the group of farmers never trying biomass transfer. *p*-values in parentheses; **significant at at 5 percent level or less; *significant at between 5 and 10 percent levels.

variable, new testers are equally likely to be Luhyas as Luos.

Education level and age of the household head were not related to adoption of improved fallows (or to early testers). Thus, those households using fallows in 2000–01 are similar in terms of household-head characteristics as households who never tried fallows. Older household heads and those with a secondary education were less likely to have dis-adopted fallows rather than having never used one. In other words, younger household heads were more likely to be adventurous and try a fallow but then abandon it than an older household head who had never tried a fallow.

For biomass transfer, the included explanatory variables distinguished the three different outcomes from the base case of non-adoption about equally well (see Table 6.8). Several variables were important for each pairwise comparison. The wealth index variable was not related to adoption of biomass transfer compared to non-adopters (thus wealth is not linked to the adoption of either agroforestry practice). However, the more wealthy households are more likely to have dis-adopted or recently tried biomass transfer. This means that should the recent testers become adopters, the profile of adopters will become wealthier. The structure of household is not related at all to the

pattern of use of biomass transfer, so that the technology is completely neutral with respect to household decision-making structures. The size of the farm is positively related to the adoption of biomass transfer, though not to decisions to dis-adopt or test in recent times. However, the supply of labor is also very important in the use of biomass transfer (all three outcomes where use has taken place). When the land/labor ratio is used as a regressor (rather than the two variables independently), it is not significantly related to any of the outcomes, implying that neither land nor labor dominates the other as a constraint.

A Luo household in a focal pilot village is much more likely to have adopted biomass transfer than a Luhya household in a nonfocal village. Moreover, new testers are similarly likely to be drawn from this population. Because external assistance has largely been withdrawn from these sites, this result likely indicates that there has been significant farmer-to-farmer learning in which large concentrations of early users lead to large concentrations of new testers. The reason for higher use of biomass among the Luo is not clearly known. One hypothesis is that their strong subclan affiliation may lead to increased use among clusters of households. But we find only partial support for this, with very high or low rates of adoption in about half the Luo villages, but moderate levels in the other half.

Education and age play a stronger role in use of biomass transfer than they do for improved fallows. More educated household heads are more likely to have adopted biomass transfer than noneducated household heads. Similarly, there is some evidence that more education leads to less dis-adoption than non-adoption. Age of household head is not statistically related to adoption, but younger heads are more likely to be recent testers as well as being dis-adopters than those who had never tried biomass transfer. So younger household heads seem to show great interest in biomass transfer, but have not always had sustained interest or ability to maintain the use of the practice.

Non-Pilot Villages. A multinomial logit model is used to analyze adoption behavior of households in non-pilot villages, as was the case for the pilot villages. In this analysis, we again classified households into different categories of technology use. One key difference, however, is that we did not know at what point a given household was exposed to information about the agroforestry practices (whereas almost all households were informed about the practices at the same time in the pilot villages). Therefore, it becomes harder to differentiate between testers and adopters. Further, the more restricted number of households (361) reduces the flexibility in number of distinct categories. We therefore created three categories of households: (1) nonusers/dis-adopters, (2) infrequent users, and (3) frequent users. In the case of improved fallows, 15.8 percent were frequent users and 13.6 percent were infrequent users. The comparable figures for biomass transfer were 18.0 percent and 19.1 percent.

We used the same household explanatory variables as in the case of the pilot villages with the following exceptions. For household type, all female-headed households were combined into a single dummy variable owing to insufficient numbers in several more disaggregated categories. Second, we reduced the number of variables depicting the education level of the household head to include primary and secondary/above (as opposed to further splitting the primary education variable as was done in the pilot villages). Third, for wealth we actually have more varied and rigorous measures and include three alternative specifications in our model. Last, because the non-pilot villages cover a wide geographical area, we include location dummies for each site.

The results for the improved fallow and biomass transfer regressions are given in

Table 6.9 Multinomial logit results for adoption of improved fallows in non-pilot villages (n = 361)

	Technology use	
Variable[a]	**Infrequent**	**Frequent**
Constant	–4.34396**	–2.81731*
	(.024)	(.094)
Luhya	2.24805*	0.07469
	(.077)	(.940)
Female-headed household	–0.77250	0.60553
	(.148)	(.142)
Polygamous male-headed household	0.37230	0.68091
	(.389)	(.123)
Primary education of head	–0.49873	0.34139
	(.338)	(.531)
Secondary or greater education of head	–0.67662	0.70998
	(.280)	(.239)
Age of household head	–0.01375	0.00307
	(.331)	(.813)
Number of household members	0.04306	0.06291
	(.578)	(.401)
Farm size	0.00359	0.03117
	(.947)	(.494)
Wealth—Log of assets	0.09571	0.11995
	(.549)	(.424)
Wealth—Farmer-generated index of wealth indicators	0.10673*	0.14969**
	(.057)	(.004)
Wealth—Enumerator-generated middle wealth level	0.92191**	0.20254
	(.018)	(.564)
Wealth—Enumerator-generated high wealth level	1.3722**	0.26358
	(.024)	(.666)

Notes: The three alternative wealth specifications are tested in separate models. Explanatory variables reported are for the Wealth—Log of assets specification. Where the results of the non-wealth variables change across specification, it is noted in the text. The two reported columns are to be compared to the omitted outcome of never having used the technology. p-values in parentheses; **significant at 5 percent level or less; *significant at between 5 and 10 percent levels.

[a]Eight location variables not reported.

Tables 6.9 and 6.10. One key result is that there are hardly any statistically significant results among the household variables, contrasting the results from the pilot villages.[12] One statistical reason why this may be expected is that the number of observations is about 20 percent of those in the pilot villages and standard errors of estimates will be higher, all else equal. There is also greater geographical dispersion among the six non-pilot villages (in five districts) than in the 17 pilot villages (in two adjacent districts) and therefore unobserved factors may have played a stronger role.

The only household variable that was linked to the frequent use of improved fallows was one of the wealth variables (farmer perception of relative wealth), in

[12]There were many significant results among the location dummies.

Table 6.10 Multinomial logit results for adoption of biomass transfer in non-pilot villages (*n* = 361)

	Technology use	
Variable[a]	**Infrequent**	**Frequent**
Constant	–4.53487**	–4.5567**
	(.006)	(.006)
Luhya	0.59624	0.16505
	(.564)	(.861)
Female-headed household	–0.23176	–0.07907
	(.555)	(.845)
Polygamous male-headed household	0.01958	–0.40696
	(.961)	(.413)
Primary education of head	0.50588	0.34027
	(.290)	(.492)
Secondary or greater education of head	0.24172	0.28078
	(.669)	(.625)
Age of household head	–0.00776	0.00975
	(.527)	(.447)
Number of household members	0.04704	0.10073
	(.491)	(.179)
Farm size	–0.00333	0.01840
	(.949)	(.696)
Wealth—Log of assets	0.18310	0.26398*
	(.190)	(.071)
Wealth—Farmer-generated index of wealth indicators	0.15621**	0.15984**
	(.001)	(.002)
Wealth—Enumerator-generated middle wealth level	0.55798*	0.34610
	(.085)	(.307)
Wealth—Enumerator generated high wealth level	0.74071	0.10013
	(.183)	(.877)

Note: The three alternative wealth specifications are tested in separate models. Explanatory variables reported are for the Wealth—Log of assets specification. Where the results of the non-wealth variables change across specification, it is noted in the text. The two reported columns are to be compared to the omitted outcome of never having used the technology. *p*-values in parentheses; **significant at 5 percent level or less; *significant at between 5 and 10 percent levels.

[a]Eight location variables not reported.

which case the more wealthy households were more likely to be frequent users as opposed to non-using households. The same variable was positively related to infrequent use and the enumerator evaluation of household wealth was also positively related to infrequent use. So although not all the wealth variables are producing similar results, there are indications that wealth is important in the use of improved fallows. The only other significant result in the fallow regression is that Luhya households were much more likely to be infrequent users as opposed to the Luo. This is difficult to interpret because the same variable has almost no influence whatsoever in regards to frequent use of improved fallows.

A similar pattern emerges for biomass transfer. Only the wealth variable(s) is related to the use of biomass transfer. In particular, the asset and farmer measures are positively related to frequent use of biomass transfer. The farmer measure is also related to infrequent use and the enumerator evalu-

ation of wealth is weakly positively related to infrequent use. So, a similar conclusion is that there is a positive link between wealth and the use of biomass transfer. No other household variables were statistically significant in the regressions. When the wealth variables are omitted altogether, the only change in statistical significance is with the labor variable in the biomass transfer regression, which now becomes significantly positively related to frequent use.

There is a positive link between wealth and the uptake of the technologies in contrast to the findings in the pilot villages. This may reflect the extra attention given to reaching the disadvantaged groups within the pilot villages, or could also be partly attributable to different measurements of wealth in the two sets of regressions. It is equally interesting to note that while farm size and labor constraints were apparent in reducing the uptake of improved fallows and biomass transfer in the pilot villages, such constraints did not emerge in the non-pilot areas. There is a marginally positive effect of labor on biomass transfer in the non-pilot areas, but the impact of farm size is almost nil. This issue requires further investigation.

Analysis of Qualitative Data

Qualitative data analysis confirms the results of the previous section, and also reveals further important issues and insights. *Land,* and particularly the *size of a field,* is an important factor explaining adoption and non- and dis-adoption. In Sarika, for instance, more than half of the farmers have an average field size of one acre, including the homestead. Many of the homesteads occupied 0.5 acre or slightly more. Those who could afford to rent land from others—mainly from older women—could escape the limits imposed by their own field size. The so-called "rich" in the community rent fields from those who are not able to work on their land. Yet for many, the cost of hiring land has become too high. It is in this context that one needs to understand that *tithonia* for biomass transfer purposes is favored compared to planting trees for improved fallows. An advantage of planting *tithonia* is that it can be planted or harvested anywhere—in hedges, on roadsides, and so on—and does not necessarily require extra space. In constrained acreage, improved fallows occupy space that normally would be planted with crops planted in the short rains (maize, cassava, and sweet potatoes) that play a major role in food security during difficult times.

Labor, in terms of both *quality and quantity,* is key as well. Labor shortages can occur when able-bodied men migrate to off-farm jobs. *Age* also plays a role. Many dis-adopters argued that they were simply too old to apply the required management practices. Many of the people older than 60 years of age, in fact, were not enthusiastic about the technologies. Even those who felt that they were good technologies that result in crop-yield improvement said that they would have done better with them as young, energetic people. Elders said that they no longer have enough strength for heavy farmwork. Some have already apportioned their parcels to their adult children.

Many farmers said that harvesting, transporting, chopping, and eventually applying biomass is too labor intensive. While some refer to age, others, especially women, said their domestic chores and other livelihood activities such as small-scale businesses do not allow them time to use the agroforestry technologies. Some of the farmers have tried to modify the technologies—especially in the case of *tithonia*—to minimize labor. They skip certain steps; for instance, instead of mixing *tithonia* with soil, they may simply broadcast the *tithonia* leaves (see, also, "Adaptations" later).

A crucial issue that the quantitative research did not disclose is that labor is complicated not only because of availability, but also by issues such as control over labor. Labor may be available—but beyond the control of farmers. Control over labor is partly regulated by the complexities of

kinship relationships (see Hebinck and Mango 2001; Mango 2002) and has partly to do with the history of Luhya working as "slaves" for the Luo.

Adoption and Method of Technology Introduction

Whereas the previous section attempted to explain processes of adoption with reference to material assets (land, labor, financial capital, and so on), this section explores adoption from the point of view of social relationships between villagers and interveners.[13] The analysis of the data hints that the perception of the AF-based technologies—and the actual use, adaptation, or dis-adoption—is associated with both the social fabric of the communities and the social processes involved when these technologies were introduced. Looking at the available qualitative data, we must account for:

The interfaces emerging out of relationships between villagers and encounters with representatives of intervening agencies such as ICRAF, KEFRI, and KARI
The initial role of the seed market
The roles of knowledge and its exchange

Interfaces and Encounters: The ICRAF Agents and Favoritism. Generally, participants expressed a great deal of appreciation for the work of the Maseno station staff. But mixed feelings also persist. Interviewees said they "love the Maseno people" for their inputs, but do not like the "agents." By "agents," or more specifically "ICRAF agents," is meant certain individuals who gained a great deal of attention from ICRAF/KEFRI/KARI in their endeavors to introduce and disseminate agroforestry technologies in the region. Getting a great deal of attention means receiving a lot of visitors (VIPs such as the minister of agriculture, district commissioner, director general of ICRAF, foreigners, extension workers) or sometimes even favors such as gifts.[14] A specific concern raised in the case studies is that these individuals were not democratically elected by the villagers, but hand-picked by ICRAF staff.

A number of farmers in the pilot and non-pilot villages felt that the agents were biased in many of their interactions with farmers. They were said to give information to a few individuals and not others. This caused some of the farmers to cease attending the meetings and workshops organized by ICRAF staff in the village. It was said, "they (the agents) only give information to whomever they please. Therefore it is not possible to attend a meeting for which you have not been invited." Another farmer said, "When it comes to exchange visits, he does not use the list he is given from the office in Maseno. He only takes his friends. And that he (the agent) does not want farmers to talk to ICRAF staff from Maseno without passing through him."

People frequently mentioned that particular farmers were taken for field visits and others left out despite the fact that all of them were adopters. Those left out feel the technology is only for particular people. They blame the ICRAF staff for heavily relying on the agents to choose people who attend seminars and workshops. The agents tend to choose their relatives and friends. This issue of "agents" can partly be explained with reference to jealousy. But it is widespread: an overview of the cases shows this concern mentioned in at least 40 percent out of a total of 40. Contentious focus group discussions also support this observation (see Chapter 9). The "agent" issue also raises the question of how individuals manage to maneuver themselves into strategic positions. In both the Luo and Luhya

[13] For an elaboration of this notion, see Long (2002).

[14] This is also supported by Mango (2002). See, particularly, Chapter 8.

villages, "clanism" and political party affiliations appear to play an important role. Furthermore, the social science literature provides evidence that this is not limited to Kenya and gives some clues on how dissemination of technologies through targeting indeed helps empower certain individuals rather than communities.[15] Visits of ICRAF and other agencies clearly lend prestige and thus a fair amount of social capital.

Another expressed concern is that "Wazungu [white people] have taken our land." In fact, scientists rent local plots for experiments and trials. That the local people themselves might not be part of the experiment or trial (thus feel no ownership) may be responsible for this concern. Not only might this lack of ownership encourage disadoption; it also reinforces the importance of social relationships with and between villagers, and between villagers and implementing agencies. In addition, interviewees mentioned a number of cases of theft of seeds or use of "magic."

Ownership of trees is another frequently cited issue. Often farmers view trees as "CARE trees" or "ICRAF trees" rather than their own. This image is probably associated with the way agroforestry technologies were originally introduced. Villagers explained in one of the group discussions that ICRAF paid people to prepare the land and to plant trees for them in a trial held in the village. Agroforestry was clearly labeled a "Mzungu [white] thing."

These comments suggest that we need to interpret such views, as well as favoritism, as part of the nature of social relationships that emerge over time between institutions such as ICRAF and individual farmers and communities. It is important to stress that such images (irrespective of being "right" or "wrong") and favoritism have negatively shaped people's perceptions of agroforestry-based technologies. This does not, however, say anything about the technology per se.

The Seed Market. The SFR project generated income opportunities for farmers, particularly in the beginning when seeds could be sold at high prices. Quite a few people in the pilot villages took advantage of this situation and made a good deal of money from the early seed market. Some of them even managed to buy a dairy cow, a perfect source of milk and manure (see Mango 2002 for similar cases). Some farmers decided to adopt after ICRAF promised to purchase the seeds; others adopted with the hope that whites who came to the demonstration site would give them money and farm tools. When this did not take place, dis-adoption began, owing to non-fulfillment of some farmers' expectations.

The early situation of good markets and high prices for seed certainly colored people's understanding and perception of SFR and agroforestry-based technologies. This situation has, however, changed over the last few years. When seeds were no longer in demand by ICRAF and other agencies, agroforestry and the selling of seeds in particular lost their status for some people. Some of the seed sellers dis-adopted after prices dropped substantially. This process accelerated after 1999, when ICRAF was accused of abandoning the people in the pilot villages. From ICRAF's point of view, such accusations are unavoidable and "part of the scaling up of our operations, which implies that resources had to be withdrawn from the pilot areas."

Knowledge as a Resource. In the pilot villages included in the case study research, the main source of knowledge regarding the new technologies is ICRAF. Although ICRAF, KEFRI, and KARI staff from Maseno work together, KEFRI and KARI have a low profile, as all visible vehicles bear the ICRAF logo. Therefore, for the farmers, a mention of Maseno means ICRAF. Only one farmer in Sarika knew the difference.

[15] See, with reference to cases in Mexico, Arce (1993) and Villarreal (1994).

Although ICRAF may dominate the dissemination of knowledge and skills, farmer-to-farmer sharing appears to be a close second. Particularly, seeing one's neighbors "doing it" emerges as crucial. Curiosity and being connected to their neighbors are important elements in the dissemination process. Yet despite this and the fact that in most of the villages, people are kin in one way or another, there is some evidence that farmer-to-farmer extension has generated intense jealousy. Questions that remain unanswered include: Has this always or often been the case? Or is it specific to these interventions? Or might it be part and parcel of the dissemination approach? Is the information passed on as it was in the original form?

ICRAF stimulated the exchange and adoption of agroforestry technologies through village committees and meetings (*barazas*). The available data indicate that some of the villagers do not attend ICRAF meetings. They may not have time to do so. Women are absent more frequently than men. Women are taking care of children, milking cows, and doing other household chores, and such activities consume so much time that women cannot participate in the meetings (see Chapter 3). Furthermore, church meetings also constrain women; they must attend church on certain days. Funerals are similar: If you fail to attend, people say you do not think highly of the deceased.

When lack of time is probed through observations, however, it appears that often people just sit at home instead of attending. This non-participation may indicate a lack of interest, and/or could be associated with the "agents" issue addressed earlier. A huge stimulant to attend ICRAF meetings, though, is the provision of "good food and drinks."[16] The data also hint at issues such as "people that attend such meetings withhold the information for themselves." Another is that announcements of meetings reach only a few and that only some people are invited.

A group discussion in Isikhuyu showed that people perceive the whole concept of innovation as an external and superior practice. Thus, this knowledge necessarily has to be brought in by knowledgeable and unique persons. Some of the people used as agents and entry points into the community were previously working at the ICRAF demonstration plot in the village. That some of these agents had been watchmen at the demonstration site, however, contradicted the view that good knowledge comes from outsiders.

The fact that adoption is pervaded with ongoing social processes suggests that the success of these SFR technologies is dependent on the entire social framework within which it takes place. For instance, it was reported that attendance at training sessions is dependent on who makes the invitations and who else is likely to attend. Some of the characteristics found to be important include political alignment and perceived social status.

A Typology of Users

At this point we can elaborate in more detail what kind of typology of agroforestry users is relevant. The available data suggest four types, explained in this section. One surprise may be that these social typologies or portraits are distributed across the villages and are not distinguishable by access to resources such as land, labor, and capital. The quantitative analysis discussed earlier underlines that it is not easy to find consistent results linking adoption to particular assets or resources. Access to land is found to be important within the pilot villages, but wealth has no effect. In the non-pilot village analysis, however, almost the exact opposite

[16] The common meeting time became the late morning, as attendance would be highest (villagers no doubt manipulated this by not showing up at other times). ICRAF provided bread and sodas to participants.

results are obtained. The typologies hinge much more on identities of people; that is, people's perspectives of how they see the future and how they identify and use new opportunities.

The "Seed Adopter." This social category refers to those who saw the opportunities offered by the seed market in the early phase of the project. The agroforestry-based SFR technologies require significant amounts of seed (*crotalaria,* for instance, is free seeded at a rate of 26,000 seeds per hectare). Thus, one of the driving forces to adopt SFR technologies was clearly the view that seeds are a source of cash. The relatively high prices of seeds at the time stimulated these types of "adopters" to grow seeds needed by ICRAF. Some of them managed to invest this money in other activities such buying dairy cattle. Most of these "seed adopters" lost interest in agroforestry and dropped out of seed provision, however, as soon as seed prices dropped and the seeds were no longer collected by formal organizations. The issue of money in these cases overrode the soil fertility replenishment agenda of the SFR project. One old farmer said, "I have kept these seeds waiting for the time they will ask for seeds so that I can sell to them."

In sum, it was not so much the soil improvement effect that attracted farmers to plant such trees—despite the fact that the yields obtained from the same plot within the same period were better. As a result, when prices went down, a large number of people cut down their fallows.

The "NGO-Networker." This type of agroforestry user stands for the individuals that through their early involvement with agroforestry and ICRAF managed to maneuver themselves into strategic positions to gain access to resources distributed by NGOs and other projects or programs. Their involvement with agroforestry in their capacity of village elder or secretary of a community committee made them known to other agencies. The case material and other qualitative research in the region (e.g., Mango 2002) show that because of this, some of the "agents" got a dairy cow from a dairy development project, or a bicycle or other reward. In one of the cases in this project, after a man got a dairy cow, he clearly lost interest in agroforestry. As a village elder, he still keeps his agroforestry plots for demonstration purposes, but his fields show that the technology is not used. Mango (2002) refers to a man who, because of his role as an adaptive research farmer for one of the NGOs, was nominated and later appointed assistant chief—a relatively well-paid job. After he took office, he completely neglected both agroforestry and adaptive research and, instead, married a second wife.

The "Keeners." This category includes those who perceive agroforestry as a useful way to replenish soil fertility. Many of the respondents who had used SFR technologies said that they obtained progressively increased yields and appreciated the technology. However, they typically failed to remember their prior yields. Many could remember only the previous season's yields and, more specifically, the portion of production that they managed to keep in the sack at the end of the season. Produce consumed while green in the field was difficult for them to estimate.

These adopters are enthusiastic about agroforestry because it increases yields and reduces monetary costs for maintaining soil fertility. A reduction in the "hunger period," the medicinal value derived from some of the shrubs, and improved life styles resulting from raised incomes are clearly positively associated with the technology. A second important element in their explanation is that agroforestry-based technologies can be easily combined with other technologies, such as the use of farmyard manure, cow dung, and compost.

Dis- and Non-Adopters. Grouped together, dis- and non-adopters are the farmers who

never tried or have stopped using agroforestry because of labor requirements, age, shortage of land, and/or the small size of fields. A variety of people fit this typology, which analytically and practically makes this the most difficult group to identify. Generally, though, the group can be subdivided into:

1. Those who do not adopt because of age. In the qualitative sample, it was mostly widows who fit this profile.
2. Those who have difficulty rallying and controlling family labor, and thus cannot meet the extra labor input required. The case studies show that this profile fits:
   - Families in which spouses are labor migrants
   - Families affected by HIV/AIDS across the social unit
   - Families that have difficulty in controlling family labor because of intergenerational differences

The latter two deserve more detailed comments.

HIV/AIDS-Affected Families. These families lose labor because of AIDS, which, in the majority of cases, affects the most able people, fathers and mothers. Financial resources dwindle to pay medical bills and are not allocated to hiring labor for agricultural purposes. HIV/AIDS-affected families are among the most fragile in the communities, for whom labor-intensive agricultural work is most difficult.

Generational Issues. Many of the male youths, out of school but not yet married—with no direct responsibility to feed someone else—have no motivation to work in the fields. They are focused on finding white-collar jobs in town—they "tarmac" as it is called locally. If the job has to be in the agricultural sector, then for them it must pay: their labor culture is not tuned to working collectively on their parents' land for a pooled yield at the end of the season. Their parents, however, will not pay for their labor. Therefore it is common to find young men performing casual labor on someone else's farm, rather than his parents'. Young women mostly work together with their parents.

There is another generational difference to explore. Youth generally perceive farming differently from their parents. The youth who pursue farming plant high-value crops such as vegetables or chewing-type sugarcane to sell. This group prefers using commercial fertilizer in farming rather than improved fallows and *tithonia.* In contrast, their parents produce crops for subsistence first and what is left (if any) goes to market.

Another issue is that, despite the small land size, social expectations for young people affect their attitude toward farmwork and SFR technologies. The society *expects* them to migrate to the urban areas, work, and send money home. Therefore any youth who cannot do this may feel like a failure and therefore find it difficult to remain in the rural area. To accomplish this social expectation, most of the youth have become migrants and thus are not present in the villages where farming takes place.

Fertilizer and Cattle Manure

Table 6.11 shows the relative importance of the SFR technologies introduced by ICRAF and others in the region. Animal manure and fertilizers are used more frequently than fallows and biomass transfer technologies. The use of manure and fertilizer has increased steadily over the last few years, partly due to some users' strong belief in fertilizers. Wilbert from Sarika village, for example, commented that once "you have started using fertilizers, it becomes very difficult to do without it, because it is not possible to realize good yields without applying it." When he plants with DAP, the growth rate of plants is high and, according to him, better than results using *tithonia.*

Others, like Joseph from Ishikhuyu, said that he has never used any inorganic fertilizer because he believes his land is still fertile and maize yields are fairly good. But, on the other hand, he says, "I don't have enough money to purchase any inorganic fertilizers."

Table 6.11 Use rates of soil fertility management options over time in non-pilot project areas

SFR options	1997	1998	1999	2000	2001
Animal manure	30.5	36.0	43.5	49	50.1
Fertilizer	10.8	14.4	19.1	24.1	28.0
Improved fallows	4.1	7.2	13.7	13.0	12.4
Biomass transfer	6.1	8.0	14.7	19.9	21.6

The case material suggests that fertilizers are mostly used for commercial crops like *sukumawiki* (kale) and tomatoes, rather than food crops (maize, beans, millet/sorghum).

Analysis of the available quantitative and qualitative data shows that fertilizer and animal manure use are positively linked to wealth, both within and outside the pilot villages. Fertilizer is also strongly linked to education levels, perhaps directly and indirectly through the implication of having had off-farm employment. All practices are positively linked to farm size to some degree in at least one regression. Fertilizer use is less common among female-headed households than male-headed households. Synthesizing these results suggests that improved fallows and biomass transfer may be reaching a wider clientele, including less advantaged groups, than fertilizer or animal manure options. This cannot be said of compost, however, which appears to be quite common among women farmers and less educated farmers. An analysis of the pilot villages found that the agroforestry technologies were being adopted or tested by 44 percent of those households that were not using other soil fertility methods. In other words, they seem to be extending the range of options rather well. The comparable figure in the non-pilot villages is lower, but still encouraging, at 30 percent.

The relevance of alternatives such as biomass transfer and improved fallows as soil fertility management options is that both fertilizer and animal manure application is constrained by a number of factors. One factor as already indicated by Joseph is the price of fertilizer, which has increased progressively over the last 20 years or so. The majority of people interviewed commented that cost prevents them from using fertilizers. In addition, fertilizer prices increase faster than produce prices farmers can charge. This squeeze on agriculture (also labeled as "the treadmill") is not likely to decrease in the near future. It is therefore unlikely that, in poor areas such as western Kenya, fertilizer will remain an attractive option. Furthermore, in approximately half the cases, farmers insisted that "fertilizer spoils the soil." They sincerely question the effectiveness of fertilizer as a way to reproduce soil fertility. However, such an opinion is contested by other farmers, who claim that fertilizer is a perfect technology, though unfortunately not affordable for them. Issues such as these suggest that fertilizer use cannot be explained without reference to poverty, rumors, and misunderstandings about nutrients, flows, and soil–plant interactions.

Similar factors can be mentioned when discussing the application of animal or *boma* manure. Animal manure is a traditional favorite as far as soil fertility replenishment is concerned. The Luo, in particular, were pastoralists and traditionally valued cattle. Cattle rearing and arable farming were linked by cattle providing nutrients for arable agriculture. Over the years, however, the number of cattle has dropped substantially owing to lack of grazing area. Technologies developed over the last three decades and improvements in the field of zero grazing, though, now provide workable alternatives for scarce land. Feed and fodder systems—such as cut-and-carry of napier grass and the growing of fodder trees—reduce the demand for grazing land. This may in the end help fulfill the dream of Luo

and Luhya men and women to own dairy cattle to restore the connection between livestock and arable farming. Manure nowadays is much favored, as it does not require cash outlay as long as one owns cattle. Only occasionally do villagers purchase manure. Salome's story shows that there is more to add to the analysis of manure and inorganic fertilizer use and that one has to include property rights as well. Salome, who lives in Arude in Luoland, mentioned that she used to add *boma* manure to her land where she cultivates continuously. She did this until 2000, when she fell sick. Thus she says she is likely to realize reduced yields this year. She has never used any commercial fertilizers because (1) they are expensive and she lacks funds to purchase them and (2) she now has the alternative of using land owned by the extended family. When a field is no longer productive, she can open a new field (which is not easy for her at this time as she only occasionally gets help to clear the bush and remove the stumps of trees). She also commented that when she was young, *boma* manure was never applied on the fields, as these were then very fertile. Instead, cow dung, she said, was used in the past as fuel in the cowshed, to cook long-cooking meals such as blood or *nyoyo* (maize and beans), and to provide warmth to people and animals out in the open.

The comparison of fertilizers and manure with improved fallows and biomass transfer is made not only with reference to prices. Issues of labor (particularly in the case of biomass transfer) and land size (very relevant for improved fallow) play a role as well. Fertilizer certainly has the advantage of being less labor-intensive than biomass transfer. These issues have been dealt with in previous sections of this chapter but should be taken into account when all the soil fertility replenishment practices are examined and considered.

Adaptations

It is significant that, once adopted, SFR technologies are adapted or redesigned to fit a farmer's particular situation. Concerning improved fallows, farmers claim that *C. grahamiana* trees are more difficult to handle compared to *Tephrosia vogelii* or any other *Tephrosia* species, because *C. grahamiana* can attract large caterpillars. However, farmers have discovered that interplanting the two tree species reduces or eliminates caterpillar infestations. Therefore many farmers interplant them on the same field.

Farmers also noted that *Tephrosia* roots tend to keep away moles; this is another reason for interest in planting more than one species. Farmers also played a role in the eventual definition of the "best-bet" fallowing systems. Initially researchers had experimented with *Sesbania sesban,* which required a nursery stage before planting seedlings on a fallow field during the onset of the rains. Farmers preferred species that could be sown directly, saving considerable labor time. They further helped develop a system whereby the tree seed is sown into an existing maize crop. This reduces the amount of time land is taken out of production and also cuts the labor needed to weed a separate tree plot.

With respect to biomass transfer, there has been little innovation in the species used, and *tithonia* still dominates. What has changed as a result of farmer innovation is the range of crops on which biomass transfer is used. While researchers had conducted all their research on maize and beans, farmers tried *tithonia* on kales, tomatoes, and French beans. In the villages, a significant and growing number of farmers have switched to using *tithonia* on higher value crops. This trend has also influenced dissemination messages, which now emphasize the greater returns to biomass transfer on high-value crops. Farmers have also been experimenting with *tithonia* leaves. They sometimes add them to compost heaps to produce higher quality material. They have also made liquid nutrient concoctions, which they find easier to apply to the soil. Last, some have been testing the usefulness of *tithonia* as a pesticide.

CHAPTER 7

Soil Fertility Replenishment and Rural Peoples' Livelihood in Western Kenya

This chapter provides insight into the complex relationship between two soil fertility management practices (improved fallows and biomass transfer) and livelihood transformations and improvements. While the previous chapters and notably Chapter 6 have accounted for the processes that explain adoption or dis-adoption, here we aim to address whether such soil fertility management interventions have had a positive impact on rural peoples' lives. In the discourse of the sustainable livelihood (SL) framework, this chapter deals with the outcome indicators of livelihood improvement-related interventions and activities.

One of the advantages of the more ethnographic approach of this research is that it allows us to introduce the voices of participants in the interventions. The first section brings this to the fore, with the rest of the chapter referring to both qualitative and quantitative data analysis. The second section considers the anticipated relationship between soil fertility and crop productivity, especially for maize. The third section examines the quantitative relationships between the SFR technologies and changes in a number of household-level welfare indicators. The indicators explored are related to household assets, nonfood expenditures, and food consumption and nutrition. The patterns of changes in these variables are described first, and these descriptions are followed by econometric analyses to explain these changes. The following section analyzes how SFR impacts are conditioned by many individual and household factors using the case study evidence; in other words, who has benefited from the SFR technology interventions and what are the constraints preventing impact on a wider population? The penultimate section attempts to position the impacts from SFR technologies within the broader context of poverty alleviation in western Kenya. The final section summarizes the key findings of the chapter.

Voices and Realities

The major incentives to use these technologies appear to be income from the sale of seed, increase in yields, reduction in the "hunger period," the medicinal value derived from some of the shrubs, and improved lifestyles due to raised incomes.

Farmers state that the various SFR technologies have increased their yields, raised household incomes, and improved food security or their ability to mitigate crises. But, as we will see from the two case study accounts later, actual impact also depends on the circumstances in which these SFR technologies are applied. Both Gilbert and Asselo are retired, older men faced with challenging situations, including eking out a living from fairly unproductive farm activities. Their case history accounts show that biomass transfer and fallow crops have improved their farm yields, especially for food crops. Gilbert reports an output of four bags of

Box 7.1 Increased Farm Yields

Gilbert retired and returned to his home village in 1993 after about 50 years in Nairobi. Since then he has been working on the farm together with his wife, Hellena. They have four grown children, all married. The couple registered themselves as ICRAF farmers about three years ago.

Gilbert owns 1.3 hectares of land and one cow. Most of the land is on a slope leading down to a stream. He says this land has not been productive and requires soil fertility improvement. Although he had heard of ICRAF's ideas earlier, he did not adopt until the year 2000, when he decided to plant *C. grahamiana* and *T. vogelli.* He obtained seeds from ICRAF. The major incentive for him to plant more *C. grahamiana* is that ICRAF buys seeds at a good price. However, so far, he has not been able to sell seeds to ICRAF because his plants are not mature yet. Some people have already stopped planting *C. grahamiana* because it has been some time since ICRAF purchased seed from farmers. In addition, *C. grahamiana* can attract large caterpillars and is therefore not popular with many people.

Gilbert is convinced that these fallow crops add "manure" to the soil because although he has not planted food crops on this piece of land, he is able to tell from the type of weeds that grow now. They look healthy. He intends to clear and dig it when he gets capital to hire labor.

He has also planted *tithonia* on *fanya juu* terraces. He decided to use tithonia because he saw a neighbor get good yields from a small piece of land. And when he used *tithonia* as green manure, he harvested four sacks of maize from two plots where he used to get about two. He now intends to plant more *tithonia* because he has realized that it gives good yields. However, because of their advanced age, Gilbert and Hellena may not practice these technologies for long. Already, Hellena is not keen on the SFR technologies taught by ICRAF because she feels that the work is too hard.

Gilbert plants indigenous varieties of maize and beans because he finds hybrids to be unaffordable. He used DAP once in 1994, but says that fertilizers make soils unproductive and salty in the long run. He has also used farmyard manure, but most of his cows were stolen; the remaining one cannot provide enough manure for his farm.

On the other hand, Hellena, Gilbert's wife, sells fermented finger millet (*thowi*) at Yala market twice a week. She spends her profits on foodstuffs and occasionally hires labor to work on the farm. Because Hellena cannot carry the load to and from the market, Gilbert assists by transporting the *thowi* on his bicycle. When he gets committed elsewhere, they organize with a nephew or any other bicycle transport to take it to the market. Hellena explained that unlike farmwork, she could still carry on with the *thowi* business because "I can send someone like my husband or my daughter-in-law or any other relative to buy for me the dried finger millet from the market. I would be able to do other things and some of my customers would come to buy from me at home. This business helped me a lot during that period. Even now that I can go to the farm a bit, it is still good because the farm yields get finished before the next harvest and we can use this to buy food. Actually, when I was sick, we used the little savings I had from this business to seek treatment. This has reduced my capital investment in the business, and currently I cannot buy ten *gorogoros* of finger millet as before. But I hope God will help me get more money to reach where I was before."

Sometimes Hellena and Gilbert receive financial assistance from their younger son, who is employed at a fairly stable job in town. Their eldest son lives with them at home and, they say, is not responsible. He spends much of his time in politics, and his wife is now also dependent on Hellena and Gilbert. In fact, Hellena complained that this son does not even send his children to school, claiming that he has no money. Hellena intended to pay their school fees so that they could go back to school. Because they sometimes have nothing to eat in their house, Hellena shares what they have with them.

According to Hellena, a poor person is one who cannot carry out his or her farmwork effectively because of a lack of income and new ideas. Such a person has no food to eat and cannot send his children to school: "Look at my grandchildren here. They cannot go to school because their parents cannot afford it. Now I am trying to work hard to get for them some money to send them back to school." According to Gilbert, people in his village have different economic abilities. And, in his assessment, he is neither rich nor poor because he can afford to work on his own farm and harvest something for his food. Nevertheless, he feels that it is important to have another source of income besides farming, especially when seasonal rains change, as has been the case in the recent past.

Gilbert and Hellena concur that a rich person is one who has money, plants his own food and has surplus, owns livestock, and has new ideas that can be implemented successfully. They say that this is only possible with adequate money. Hellena, however, stressed that money alone does not equal riches, especially when it is not used well.

Source: Sarika Village, Siaya District.

maize after using SFR, up from just two bags produced previously (Box 7.1). Asselo (Box 7.2) claims similar output. However, even when yields double, the net effect may not be substantial. This is because for most of these households, needs are many and acreage is limited. In other words, although the SFR technologies do improve productivity, they cannot on their own dramatically reduce poverty.

For instance, Asselo sold more than half of his maize harvest, but the earnings translate into just 2,400 KShs. This cash went immediately into basic needs such as buying sugar for tea and paying school fees. Furthermore, we are not convinced that the two bags set aside for home consumption were sufficient for his food needs. Low productivity and low market value of cereal output bring about food scarcity; this is exacerbated by the need to sell a sizable portion of the maize harvest. So even in situations in which improved yields may have contributed to stabilized supply, improved food security may not be observed.

Nevertheless, adoption of SFR technologies is also contributing to training and the general development of the human capital base. Both Asselo and Gilbert have been able, through these technologies, to start new lives after retirement from formal, off-farm employment. It is possible that each of these men would have been quite disoriented if they were to return to the village to depend entirely on less productive farm activities. Both men have financial responsibilities that they seem to meet from their farm incomes, however slight.

The case studies also suggest that the SFR technologies adopted have given some members of the community an amount of social capital, especially in terms of their being seen as successful farmers and people who attract visitors from "far away." Indeed,

Box 7.2 Mitigating Vulnerability

"My name is Asselo and I am 52 years old. I schooled up to Form Two before I was forced to drop out of school in 1972 for lack of fees. Between 1972 and1974, I assisted my mother on the farm, planting maize, bananas, and coffee. In 1975, a friend invited me for a job in Eldoret as an apprentice up to 1982, when I quit the job because I was sickly. I stayed at home for a year seeking medical treatment. By the end of 1983, I had become so broke and idle that I had to get something to do. A great friend of mine whom I once assisted to find a job gave me a soft loan of KShs 20,000 with which I opened a shop at Soy in Lugari. The business was good and I earned about KShs 3,200 profit per month. I used this money to educate my three stepbrothers and my children in primary school. I also used to hire land and plant maize, which I then sold at a higher price. I used these earnings to buy land at the settlement scheme.

"In 1996, the land on which my shop stood was demarcated and allocated to squatters, and I was forced out. In November of the same year, my mother passed away and this compelled me to return to the village to take care of the home. I had no option because I am the last-born, and I had stayed away from home for 22 years, and age was catching up with me.

"In 1997, I started farming maize, beans, cassava, and sweet potatoes. These were the easiest crops and everyone else was growing them. I harvested five bags of maize and two bags of beans. I never used any fertilizer because I had no money, and the majority of the people were not using any fertilizer to plant maize. I saved two bags for home consumption and sold three bags at KShs 800 each. This money went into buying sugar, books, and paying school fees for my last-born child in secondary school. In 1998, I planted maize, beans, onions, and *sukuma wiki.*

"In 1999, I got *grahamiana* from ICRAF when they came to see my friend, Fannuel. I planted the trees on a small piece in my *shamba* and immediately they reduced the *Striga* weed. After removing these trees, I planted maize, and there was a difference as compared to the other years. I harvested five bags of maize from half an acre of land when previously I used to harvest only half a bag of maize. I have also learnt from my neighbors how to make compost manure. I find it easy and cheap to prepare because I don't need to hire any labor or buy inputs.

"This is different from before, when at the settlement scheme I used DAP for planting and urea for top dressing and harvested 35 bags of maize per acre. That time I had money from business. I have never tried this at home because I have no money. I am now a very poor man."

Source: Isikhuyu Village, Vihiga District.

some of these visits have been so eventful that several families have named their children after these personalities. On the other hand, the decision to adopt or not to adopt SFR technologies as a livelihood strategy has brought about jealousies and disagreements, some of them at the level of the family unit. In the case described earlier of the husband and wife who now pursue different farming practices, the use of these SFR technologies has changed the husband's status. This particular farmer is now described by others as someone who has adopted the SFR technologies successfully.

On the other hand, the potential of some of the SFR technologies is realized on only a few farms, largely because most of the target farmers are resource poor. For instance, although Gilbert is already aware of some of the potential benefits of fallow crops, he was yet to cultivate a piece of land that had been under fallow crops owing to lack of labor to clear the field. He himself is an old man, and his equally old wife is unable to assist because of an old injury. For the same reasons, Gilbert is not so interested in biomass transfer.

It is also evident from Asselo's account that people tend to take up these SFR technologies—in fact, farming in general—after all else has failed. By this time, they may be too old or too poor to invest what it takes to realize good yields. So the agroforestry technologies appear to be providing some scope for development among disadvantaged households. However, the success of these SFR technologies depends on having in place some minimum provisions. Indeed, findings show that higher yields and raised incomes have not always translated into improved economic well-being, at least as is commonly understood (e.g., increased food consumption). In some instances, additional production could not be properly stored or was sold at very low prices under distress. In a few instances, increased incomes have resulted in a man taking a second wife. This might lead to enhanced welfare of the man, but not necessarily that of the first wife or other household members.[17] Hence, benefits vary across gender and accrue to different members of the household. Some households have succeeded nevertheless.

SFR, Production, and Productivity

In this section, we present the results of many analyses linking the use of SFR and crop yields. This section is distinct from the econometric analyses in the following sections because unlike other indicators, no baseline yield estimates were collected from farmers' fields.[18] We include data from our surveys of farmers, the case study reports, and researcher-designed/farmer-managed trials. Table 7.1 presents a summary of the performance of several soil fertility replenishment practices on maize yields, based on farmer recall in the non-pilot villages. The number of farmers using the practices is higher than the number used to calculate yield effects because of certain missing or unclear data. The SFR yields are compared to a control case of maize production with no soil nutrient inputs.

It can be seen that fertilizer, improved fallows, and biomass transfer all led to positive yield changes in most cases, with fertilizer being the most likely (93 percent) to lead to a positive change, but improved fallows and biomass transfer close behind. All three SFR practices were reported to have significant effects on yields, as reported by the percentage increase in median and mean yield.[19] For example, median yield increases from biomass transfer and improved fallows were equal to 167 percent over a

[17] These findings support other studies that have found social networks to be very important to the diffusion of other types of innovations in the region. For example, informal women's groups were found to have facilitated adoption of birth control where cultural values and beliefs discouraged adoption, and where other programs had failed (Rodgers et al. 2001; Behrman, Kohler, and Cotts Watkins 2002).

[18] In practice, establishing a baseline would have been tricky, because farmers would select a portion of a large maize plot on which to try a fallow. Because there is within-plot heterogeneity, it would have required yield measurements at very small scales.

[19] We report the percentage increase and not the absolute increase because plot areas appeared to be rounded upward in many cases, implying that absolute yields would be biased downward.

Table 7.1 Soil fertility practices and maize yield impacts

	Improved fallow	Biomass transfer	Fertilizer
Number of cases	48	56	59
Compared to no inputs:			
Percentage with non-positive effect	12.5	12.5	6.8
Mean increase in yield (percent)	128	114	89
Median increase in yield (percent)	167	167	122
Median size of area (acres)	0.25	0.25	1.00

no-input maize cropping system. The agroforestry practices compare favorably with fertilizer because fertilizer amounts are quite low in practice, whereas farmers are able to generate significant amounts of nitrogen from the agroforestry systems on the relatively small plots on which they were applied. The last row of Table 7.1 shows the median size of field on which the practices are applied. While the typical farmer who uses fertilizer applies it to one acre, the area under the agroforestry systems remains considerably lower, at 0.25 acres (recall that the more accurately measured fallow fields in the pilot villages indicate an average of about 0.11 acres).

We tried to calculate a financial analysis of the data reported in Table 7.1, but this proved unsuccessful. First, the data on plot area are imprecise and absolute differences in yields therefore not reliable. Further, because labor data were not collected from this single-visit survey, precise plot areas are required to apply average labor figures from secondary sources. Finally, for biomass transfer systems, farmers were unable to provide accurate information on the amount of biomass collected and applied.[20] Instead, farmers in the non-pilot villages were asked to describe how their maize yields have changed between 1997 and 2001. These changes were compared against the use of SFR practices and wealth level of households. These measures of yield change are not as precisely attributable to SFR because we asked for general impressions, but given the generally pessimistic attitude of many farmers in western Kenya, the association between SFR practices and improved yields is potentially important to spurring development processes. In terms of perceived changes in maize yield, 36.8 percent were thought to have remained unchanged, 28.5 percent were lower, and 34.7 percent improved.

Cross tabulations were run contrasting the use of different SFR practices and perceived maize change over the 1997–2001 period. Fertilizer is most strongly associated with perceived positive maize productivity change. Households who are frequent users of fertilizer rarely report declining maize yields (8.5 percent), whereas 35.2 percent of households who do not use fertilizer report decreasing yields. There are similar, positive patterns with biomass transfer, improved fallows, and animal manure, but they are not statistically significant.

Perceived maize yield change is not highly linked to wealth group. The enumerator evaluation measure of wealth/poverty was, however, very significant: 47 percent of the wealthy stated that their yields increased as opposed to only 23 percent of the poor.

On a related issue, farmers were asked to provide data on the area under maize in 2001 and 1997. One hypothesis is that if SFR can improve yields, it may catalyze

[20] Thus, we are collecting more detailed information from pilot village farmers for the 2003 long-rain season for subsequent analysis.

shifts into other higher value crops. The data show that 67 percent of farms did not change area under maize, 9 percent had decreased, and 24 percent had increased area. Analysis of variance (ANOVA) and correlation tests did not find any relationship between change in maize area and the use of biomass transfer, improved fallows, or combined use of SFR practices.

Within the pilot villages, two more controlled analyses were made. First, we present findings from farmer-managed trials of improved fallows and biomass transfer within the pilot villages. The improved fallow trial involved about 70 farmers, and yields from control and treatment plots were carefully measured by technicians for four consecutive seasons. The control was the planting of maize with no nutrient inputs in every season. The improved fallow trials involved one or two seasons under trees with two or three seasons of maize (so that the opportunity cost of land is included in the calculation). The seasonal per acre net gain to *tephrosia* fallows was $22.33 and for *crotalaria* it was $19.96 (again, compared to the no-input case). The same set of trials also assessed the returns to labor from fallowing systems that were found to be around $2.17 per day, 33 percent higher than from no-input, continuous maize production. Returns to biomass transfer on maize in trials fared poorly owing to high labor costs against relatively low-value return from maize, but amounts of biomass in the treatments were substantially above those commonly applied by farmers.

These returns are not large, but they are important to very poor households. To find more profitable opportunities, farmers have directed soil nutrient inputs to higher value crops, rather than maize. Farmer-managed biomass transfer trials with kale and tomatoes have shown that similar increases in yields are obtained on these crops. Because they fetch much higher prices, returns to land are much higher than on maize. For example, returns to biomass transfer on vegetable production were high, with returns to land reaching as high as eight times those with no nutrient inputs.[21]

A second analysis is a production function estimation involving many of the same households as covered in the household welfare impact analysis presented later, but for the 2003 long rains production season, the year after the main study was completed. The data on yields and inputs are from farmer estimates; although many of the data are reasonably collected, there are problems with the biomass transfer and improved fallow variables. There were only 10 positive biomass transfer values among 150 plots. For the improved fallow variable, about 30 positive cases were reported. Yet, from our annual monitoring survey (see Chapter 6), far more households had invested in fallows, so it is unclear whether all are captured in this new data set. Moreover, the average size of plot in this estimation is 0.14 hectare, which is the same as the average size of plot that was recently under an improved fallow. However, our other data set is quite clear that the average size fallow was only 0.04 hectare (see Chapter 6). Thus, it is uncertain as to whether the measured yields actually correspond uniquely to the effect of the fallow. For all these reasons, the reliability of these results is questionable. For biomass transfer, we found a positive and significant result ($p = .04$). The coefficient value was extraordinarily high, beyond reasonable effects based on nutrient content of the biomass, and thus is difficult to explain. For improved fallows, the coefficient was not statistically significant. As noted earlier, it is unclear whether the fallow plot and maize yields were properly

[21] There are many varied treatments using combinations of organic and inorganic nutrients with few observations, so it is dangerous to report means. However, returns to kales with *tithonia* range between $600 and $1,000 per hectare per season.

matched up through the survey. It is obvious that trying to assess yield effects of SFR is fraught with many challenges.[22]

Econometric Models to Evaluate Household Impacts of SFR

In the following three sections, econometric models are used to assess the effect of biomass transfer and improved fallow systems on changes in asset values, changes in nonfood expenditure, and changes in food and nutrition indicators. All of these variables were tested on our pilot village sample. In the non-pilot villages we were able to investigate only changes in assets because of lack of a baseline for other variables. However, this analysis is not reported, owing to lack of sufficient instrumental variables taken prior to the period of adoption of agroforestry. The rest of this section therefore relates solely to the pilot villages and that sample of households ($n = 103$).

The testing of the effect of the use of improved fallows and biomass transfer is not straightforward because they are also endogenous variables. Hence, two-stage methods must be employed in which adoption of agroforestry is explained in the first stage and the predicted values used in the second-stage impact regression. One requirement for this analysis is the identification of variables that may affect adoption intensity but not impact. This is not easy to do from a theoretical aspect, because adoption and impact on assets are very closely related. The variables we selected as instruments to explain adoption but not impact relate to household perceptions of the importance of agroclimatic shocks for the village (the risks of drought, hail, and pests/diseases perceived prior to the period of study), the father's farm size, and the jobs and social positions held by their fathers. We also included whether either of the adult members of the household had previously held a job in the formal sector. Some of these might also affect impact, but we feel that those would be much more muted than the effects on adoption because they relate mainly to incentives to adopt or exposure to new ideas, but have little to do with direct agricultural management, which is important for adoption to translate into impact.

It is expected that where drought is perceived as a common occurrence, there is less interest in fertilizer (which is known to perform poorly during droughts) and thus more interest in fallows or biomass transfer. Occurrence of hail, pests, and diseases may have the opposite effect on interest in agroforestry. A father's farm size is expected to influence the farming practices learned as a child. Where farm size is smaller, it is expected that intensification practices, including fertilizer use, were advanced and picked up by the current household. On the other hand, larger farms would have been more likely to practice fallowing and less likely to use fertilizer, leading to reduced understanding of fertilizer for the current household. It is expected that where the father had a good non-farm job or acquired a position of influence, he may have been more likely connected with extension agents and the private sector and therefore been farming with fertilizers. Much like the father's experience, asking about previous formal-sector employment of the head or spouse attempts to capture his or her access to knowledge of modern farming techniques such as fertilizers. Although these variables are hypothesized to influence choice of soil fertility management practice, we do not expect any of them to be associated with actual impacts.

A second issue to resolve is the measurement of adoption of the agroforestry systems. Recall that in the previous chapter, adoption was described by noting different

[22] Fertilizer quantity had a positive and significant effect on yield, but the effect of manure quantity was found to be insignificant.

dynamic patterns, for instance, dis-adoption and continuous use. This was very relevant in trying to capture quite distinct dynamic behavior. Here we are less concerned about teasing out the different motivations behind the use of agroforestry but rather interested in how different degrees of use may affect asset holdings and other welfare indicators. This is better measured by a continuous variable that can capture intensity of adoption over space and time. For improved fallows, the sizes were verified by enumerators in the pilot villages. The sizes of plots on which biomass transfer was used were not measured.[23] Hence, for the pilot villages, our "intensity" variables are the sum of total area under improved fallow and the sum of the number of seasons for which biomass transfer was used. Both of these include only those seasons relevant to the study period (six seasons).

All these intensity variables are continuous variables, but they exhibit a non-normal distribution in that there are large concentrations at the value of zero—which reflects all the households who never used the technology. We therefore have two approaches we can use in the two-stage procedure. The first is to proceed and run both first- and second-stage regressions using ordinary least squares (OLS). This leads to biased coefficient estimates in the first stage, owing to the nature of the dependent variable, but the standard errors for the predicted values in the second-stage regression are unbiased. This is computationally easiest, as it is simply a two-stage least-squares procedure. The second is to run tobit models in the first stage, which gives unbiased estimates in the first-stage regression. The predicted values from the tobit model can then be used in the second stage. However, in this case, the standard errors are biased and a technique such as bootstrapping needs to be employed to be able to give reasonable estimates of unbiased standard errors for the coefficients. Both methods are used and second-stage results from both are discussed. For improved fallow area, the correlation between the actual value and the predicted value is 0.49 from the tobit model and 0.51 from the OLS model. The fit is not as close for biomass transfer, but is reasonable at 0.36 from the tobit model and 0.38 from the OLS model.

In the two-stage least-squares approach, three included variables (perception of hail problem, father's job, and father's social position in the community) were significant to the total area under improved fallows (see Appendix A for a full presentation of first-stage results, including statistical tests). However, none of the first-stage regression variables were significant in the number of seasons using biomass transfer. For improved fallows, the first-stage OLS regressions for fallow area were significant in terms of an F-test ($p = .02$) and the tobit regression chi-square value was fairly strong ($p = .12$). However, the regressions for biomass transfer were not highly significant. We ran a series of tests to check for the effectiveness of the instrumental variables. For these, mixed results were obtained. Durbin–Hausman–Wu tests on the residuals revealed some remaining concerns on the correlation between improved fallow area and the residuals for the expenditure and iron nutrient regressions. There were no problems for the other impact indicators. Hausman tests showed that the instruments were acceptable in all cases except for the improved fallow variable in the expenditure model. Last, chi-square tests for overidentification using a regression of residuals on all explanatory variables and instruments could not be rejected in four of the six impact regressions (overidentification could be

[23] The reason that they were not measured by enumerators is because they could not be observed in the field (the biomass is incorporated into the soil and not visible), unlike most fallows that were in the field during the time of annual monitoring.

rejected only in the expenditure regressions). So, to conclude, the instruments selected for the most part seem to do reasonably well in terms of correlating with the actual value and cutting the correlation to the error terms. There are remaining concerns with the set of instruments, which is not surprising, given the difficulty in distinguishing between the close concepts of adoption and impact and perhaps also because of the small number of observations. There are particular concerns as to the usefulness of the predicted improved fallow variable in the expenditure equations.

Three models are run for each indicator. A two-stage least squares model is run with household variables such as age, gender, education, and ethnicity of household head used as explanatory variables.[24] The household variables reflect pre-adoption values (in reality, few variables changed over time anyway). A second model is a difference equation and tests for the link between agroforestry use and the welfare indicators, factoring out household structural factors. The third model is a two-stage approach in which tobit models are used in the first stage to generate predicted values of the intensity of agroforestry use. In the second stage, bootstrapping techniques are used to improve the estimates of the standard errors of the coefficients. In the text, we present tables showing only the second stage of the 2SLS results. The other models gave identical results except where noted.

SFR and Investment in Asset Accumulation

If the yield impacts from SFR investments are to lead to sustainable increases in livelihoods, then one would expect to observe some degree of asset accumulation. The qualitative research found that this was indeed occurring for some households, but whether these are outlying cases (e.g., only those who have applied SFR on large areas) or whether this may describe the average household needs to be examined. In this section, we first describe the major asset holdings of households in the study and then analyze the effect of the SFR investments on changes in asset holdings.

Table 7.2 shows some descriptive data on assets for households in the pilot villages and those outside. The included assets here are those deemed to be mobile and salable —all types of livestock but only some forms of physical capital.[25] For instance, farm implements were valued, but not wells. It can be readily observed that asset values are higher for households outside the pilot villages. Part of this undoubtedly reflects the actual situation because farm sizes in most of the non-pilot villages are larger than those in the pilot area and livestock densities per household are correspondingly higher. It should also be noted, however, that the survey instruments were slightly different in that the pilot village survey was made to conform to an earlier (2000) survey. It can also be noticed that the magnitude of changes between the baseline and follow-up years is much larger for the non-pilot villages. Recall that the time between the base period measure and current measure is longer in the non-pilot data set, and because the general economy in Kenya has been poor throughout the study period, this may have led to steeper losses of assets.

Looking at the actual values, livestock comprises about 70–80 percent of the value of all liquid assets. The mean total wealth held by households was $408 in the current

[24] We did attempt to include the base period welfare indicator as a regressor, but because of our inability to overcome possible measurement error and regression to the mean, these results from these models cannot be properly interpreted.

[25] It is too difficult to value items like houses and wells that are not often marketed and whose quality is difficult to assess.

Table 7.2 Description of household liquid assets in pilot and non-pilot villages

Variable	Pilot villages	Non-pilot villages
Livestock wealth ($)		
Baseline mean	189	424
Baseline median	119	200
Current mean	178	302
Current median	138	210
Percentage with negative change	46.9	50.3
Total liquid wealth ($)		
Baseline mean	260	515
Baseline median	196	337
Current mean	236	408
Current median	188	315
Percentage with negative change	54.1	51.1

Notes: Baseline date is 2000 for the pilot villages and 1997 for the non-pilot villages and the current date is 2002 for the pilot villages and 2001 for the non-pilot villages. Values are in constant 2002 dollars.

year in the non-pilot villages and $236 in the pilot villages, whereas that of livestock was $302 and $178, respectively. A large number of households suffered through disinvestment in both livestock assets and total assets over the period. This is remarkably consistent in both sites, with percentages ranging tightly between 47 percent and 54 percent. Notice that the absolute and relative differences in magnitudes between means and medians (for both asset measures and both sites) are much larger in the baseline year than in the current year. This indicates that in general, households with higher initial wealth fared poorly compared to the less wealthy.

Because livestock is vitally important in the calculation of assets, we explore this trend in more detail. The inverse relationship between initial livestock wealth and the change over time is, in fact, supported and elaborated by cross tabulations and *t*-tests. The poor are in many cases able to increase their holdings of poultry, but not other animals. But the main reason for the decreasing inequality is that some of the more wealthy households have seen their livestock holdings collapse. One of the reasons for the collapse is disease, and 50 percent of farmers in the non-pilot villages whose poultry holdings changed over time claim that disease was the key factor. Another important factor is the forced selling for obligations. Funerals are very common because of AIDS and other diseases, and the slaughter of goats and cows is still followed by custom. With such high poverty rates, the wealthy are being increasingly called on to provide animals for these occasions.[26] Thus, between 26 and 33 percent of changes in goat or cattle holdings are attributed to forced sales/slaughters. Given these sobering trends, the importance of protecting or building assets from SFR investments or any other intervention cannot be overstated.

We now turn to the econometric analysis undertaken to test whether the agroforestry-based SFR technologies have had an impact on asset portfolios. Livestock and total wealth followed similar patterns because it was mainly livestock wealth that changed

[26]It is not known whether livestock owners were compensated for providing their animals.

Table 7.3 Econometric results from second-stage regression of agroforestry on changes in assets in pilot villages (n = 97)

	Two-stage least squares	
Variable	**Coefficient estimate**	**Significance level**
Predicted area under fallow	4.773	.346
Predicted area under biomass transfer	1,076.104	.708
Luo ethnic group	572.121	.852
Female-headed household	4,277.755	.269
Household head obtained primary education	2,461.805	.470
Household head obtained secondary education	–3,058.495	.464
Household head age	–48.551	.626
Household size	925.546	.125
Farm size	–1,681.671**	.035
Constant	–6,047.048	.442
R^2	.062	
Probability of F	.283	

p-values: **significant at 5 percent level or less; *significant at between 5 and 10 percent levels.

over time, so we examine only one dependent variable, the change in total asset wealth.

Table 7.3 shows the results from a second-stage regression of agroforestry adoption on liquid asset change. Neither of the agroforestry variables is significant. In fact, the only significant variable is farm size; it is found that asset holding positions changed in more positive directions where farm sizes were smaller. This suggests that non-land assets are not highly correlated with land assets, a reflection of market imperfections in land relative to other assets. The general lack of significance among other variables indicates the existence of complex relationships that are not easily captured by more structural household variables.

SFR and Expenditures

In this section, we examine the effect of the use of the SFR technologies on household expenditures. We begin with a brief description of expenditures and then follow up with econometric analysis. The econometric analysis uses the same approach as done in the analysis of assets and thus we do not repeat the exposition of the methodological approach. Expenditures were collected for the pilot village subsample of 103 households both in 1999–2000 and in 2002. The April 2000 survey matches exactly the time period of the 2002 resurvey and thus we report on and examine only the expenditures reported at these two visits. Expenditures were collected on all types of budget items, including clothing, utensils, other household goods, fuelwood/energy, transportation, medicines and medical treatment, and school fees. Expenditure information was estimated for the preceding three-month period to match the baseline methodology that was planned as a quarterly instrument. In the baseline, we attempted to obtain information about expenditures on food items as well. In the follow-up, this information was inadvertently left off and when discovered, it was then decided to omit the data for several reasons.[27]

[27] First, the three-month recall caused households to struggle with many items in terms of amounts consumed, the proportion of consumption that was purchased, and the amount spent. Thus, the reliability of such data is low. Second, interpretation of such expenditures is complicated because food expenditure is not clearly linked to welfare, since on-farm production may substitute for it.

Table 7.4 Total non-food expenditures, per capita non-food expenditures, and changes during the three-month-long rainy season in 2000 and 2002 (in U.S. dollars)

Variable	Mean	Median	Percent negative
Total non-food expenditures in 2000	97	60	
Total non-food expenditures in 2002	104	68	
Per capita non-food expenditures in 2000	16	10	
Per capita non-food expenditures in 2002	16	10	
Change in total non-food expenditures	7	8	43.7
Change in per capita non-food expenditures	–0.5	1	47.6

In this section, we therefore focus on the non-food expenditures (food consumption analysis follows in the next section). We analyzed changes in non-food expenditures per household and also per capita. For the latter we divided by the number of household members rather than converting all members to consumer equivalents, as consumption coefficients are not necessarily constant across type of expense. For both the descriptive and econometric analysis, we examine both total and per capita expenditures. As before, two different methods of econometric analysis were used (pure 2SLS and a tobit/linear combination) but only the results from the 2SLS are reported, since the results are not qualitatively different between the two. Table 7.4 describes non-food expenditures, non-food per capita expenditures, and changes in these variables between 2000 and 2002 for 103 households in the pilot villages. Mean non-food expenditures in 2000 were $97, while the median was $60, indicating that there are relatively wealthy households bringing up the mean. The mean level of non-food expenditures rose slightly to $104 over the period, and the median behaved similarly over time. Per capita non-food expenditures, on the other hand, were flat over time, with a mean and median of $16 and $10, respectively. Taken together, the two variables indicate weak improvement or stagnation, which compares favorably with all other welfare indicators examined in this chapter (note that if inflation were considered, trends in real expenditures would also be negative). The final column of the table, however, shows that there is also a large number of households (44–48 percent) experiencing a setback in welfare as measured by non-food expenditures.

Given the wide variation in the distribution of non-food expenditures and per capita non-food expenditures, these welfare indicators lend themselves rather well to the testing of the effect of SFR technologies. Table 7.5 presents the second-stage results from a 2SLS procedure. The two agroforestry variables have the opposite sign. The coefficient estimates for the fallow variables are negative and significant at around the 5 percent level (although in the tobit model, the significance level is somewhat reduced after bootstrapping). Why this is the case is not apparent, because many households with improved fallows report real yield gains. Users of fallows may be driven by a few other alternatives and thus the use of fallow may be capturing effects of omitted variables on changes in other livelihood strategies. Yet, why it occurs for expenditures and not for any other indicator is not clear (although the 2SLS tests suggest that possible biases might arise in these expenditure models). None of the other included variables in Table 7.4 were significant.

SFR and Food Consumption

Food consumption and nutritional measures were based upon 24-hour recall surveys of households. During the baseline, households were visited on three consecutive days, but it was found that reducing interview schedules

Table 7.5 Econometric results from second-stage regressions of agroforestry on changes in non-food expenditures and per capita non-food expenditures in pilot villages (*n* = 102)

Variable	Changes in nonfood expenditures per household	Changes in nonfood expenditures per capita
Predicted improved fallow area	–9.973*	–1.691**
	(.066)	(.046)
Predicted number of seasons with biomass transfer	5,101.192	736.170
	(.156)	(.189)
Luo ethnic group	–4,875.978	–735.134
	(.115)	(.128)
Female-headed household	3,701.186	501.621
	(.353)	(.420)
Household head obtained primary education	–192.820	–110.445
	(.955)	(.837)
Household head obtained secondary education	2,216.158	446.506
	(.604)	(.504)
Household head age	96.070	13.369
	(.362)	(.417)
Household size	–208.409	–14.103
	(.732)	(.882)
Farm size	–16.756	32.896
	(.983)	(.795)
Constant	–3,431.242	–617.102
	(.689)	(.645)
R^2	.00	.00
Probability of F	.665	.636

Notes: *p*-values in parentheses; **significant at 5 percent level or less; *significant at between 5 and 10 percent levels.

to two consecutive days led to nearly the same information. So in the 2002 survey, households were visited only twice.[28] Enumerators recorded all food consumed at each meal, including units, weights, and whether the food was consumed raw or cooked. They also recorded the number, gender, and age of all people who shared the meal. Recordings of consumption were not made at an individual level, although there is little doubt that consumption will differ across individual members.[29] Instead, household-level indicators of intake and nutrition were calculated based on age requirements of consuming members. Nutritional indicators were taken from Food and Agriculture Organization of the United Nations (FAO) and U.S. Department of Agriculture (USDA) sources, depending on which was able to more accurately reflect the specific type of food consumed (e.g., cooked kales). Total amounts of intake and nutrients were recorded and an index of sufficiency was calculated for each day. Then the scores from the two days were averaged. The index assumes a value of 100 when household

[28] This was also desirable because we wished to retain two of the same enumerators who conducted the baseline and heavy rains during the period meant that the two were very stretched to complete the surveys in a reasonably short span of time.

[29] This was not done because it was agreed by all members of the team that such information could not be collected with any degree of accuracy.

Table 7.6 Percentage of daily requirements of nutritional measures at the household level prior to a long-rain harvest

Variable	Mean percent sufficiency	Median percent sufficiency	Percent households less than 100 percent sufficiency
Energy intake in 2000	125	119	25.2
Energy intake in 2002	108	105	41.7
Carbohydrates in 2000	185	175	3.9
Carbohydrates in 2002	164	161	9.7
Protein in 2000	116	99	50.5
Protein in 2002	87	81	72.8
Iron in 2000	292	254	1.0
Iron in 2002	209	192	5.8
Folic acid in 2000	213	148	35.9
Folic acid in 2002	109	92	53.4
Niacin in 2000	170	159	4.9
Niacin in 2002	151	146	16.5
Riboflavin in 2000	161	154	6.8
Riboflavin in 2002	150	146	14.6

intake or nutrition levels equaled the daily requirement as expressed by FAO/USDA.

Table 7.6 shows the level of various consumption and nutrition characteristics in 2000 and 2002. The variables are presented in the form of sufficiency of meeting the requirements according to the consumers for each meal. A value of 100 means that requirements have been met at the household level. The table shows that the average household in the sample scores well in terms of energy, carbohydrates, iron, riboflavin, and niacin in both years. An analysis of baseline data revealed that maize accounts for 75 percent of total energy. The data for 2002 show some diminished sufficiency in folic acid and low levels of protein sufficiency. These averages disguise an often large number of households with scores of below 100. For instance, 42 percent of households had less than 100 percent sufficiency in 2002 in terms of energy intake, 53 percent for folic acid, and 73 percent for protein. The bottom line is that there is considerable variation in sufficiency levels for many nutritional characteristics. It is also interesting to note that there is a general decline in nutritional status over the two-year period—in fact, none of the variables exhibits improvement over time.

Econometric analyses were made to estimate the relationship between the use of agroforestry SFR and several of the nutritional indicators. We focused on those that exhibited significant change over time and are deemed to be vital to human development in the literature: energy, protein, and iron.

As can be seen in Table 7.7, neither of the agroforestry adoption variables was found to be significantly related to changes in food intake and nutritional status. In fact, the only significant variable in each regression was gender of the household head, where female heads are associated with positive change (or less negative change) in each of the three indicators.[30] Note that decreases

[30] The only different result from the tobit–OLS 2SLS procedure was that Luo ethnicity was associated with poorer expenditure change as opposed to Luhya ethnicity. For all indicators except assets, the sign on the Luo variable is negative. The samples are from the same general area so that market and agroclimatic differences are minimal. The Luo community is known to have been affected more by HIV/AIDS than many other ethnic groups, but whether this also relates to the Luos of the Siaya highlands is not known.

Table 7.7 Econometric results from second-stage regression of agroforestry use on nutritional measurements (n = 102)

Variable	Energy	Protein	Iron
Predicted improved fallow area	0.0054	–0.0208	–0.0711
	(.831)	(.547)	(.394)
Predicted number of seasons with biomass transfer	23.3291	23.8093	79.8342
	(.169)	(.302)	(.152)
Luo ethnic group	–13.3120	–10.4403	–13.3354
	(.360)	(.598)	(.779)
Female-headed household	43.1884**	47.5732*	130.6258**
	(.023)	(.066)	(.036)
Household head obtained primary education	18.2851	27.0920	45.5115
	(.260)	(.222)	(.393)
Household head obtained secondary education	5.3631	21.0868	34.7518
	(.790)	(.443)	(.600)
Household head age	0.3742	0.6219	0.4415
	(.452)	(.359)	(.787)
Household size	0.9970	2.3064	12.0369
	(.728)	(.556)	(.204)
Farm size	–3.6886	–1.3343	–3.0956
	(.336)	(.798)	(.805)
Constant	–74.4262*	–114.5048**	–287.2588**
	(.068)	(.040)	(.033)
R^2	.00	.03	.00
Probability of F	.601	.793	.583

Notes: p-values in parentheses; **significant at 5 percent level or less; *significant at between 5 and 10 percent levels.

in sufficiency levels do not mean that the household is now facing nutritional insecurity (see Table 7.6). Therefore, the dynamics of food intake and nutritional status are very complex processes. They are not easily pinned down to initial characteristics of households. They are likely to be related to a myriad of decisions and livelihood changes that take place during the period.

SFR and the Beneficiaries

Generally, adoption is pervaded with ongoing social processes and the success of SFR technologies is then dependent on the entire social framework within which it takes place. As such, who gets to benefit and why can be understood only within the context in which these technologies are disseminated and implemented. Some of the key points of differentiation therefore include people's resource base, access to markets and public services, the type of livelihood strategies that they choose to pursue, the nature of vulnerabilities facing them, the likelihood that these risks can be easily mitigated, and the gender power relations governing their social system.

The four case studies narrated in Chapter 5 and this one suggest that social networks are extremely crucial to one's ability to derive benefits from SFR technologies. For instance, three of these cases only got to know about SFR from friends and neighbors who were already enjoying the benefits. Besides being able to transfer the knowledge and skill required, such association was testimony to the potential benefits and a driving force behind the decision to take up SFR technologies. This therefore means that in cases where people may be sidelined as reported by Maria, there is still the possibility of benefiting through a third party.

In all the cases cited, access to the three main factors of production, namely land, labor, and capital, comes through as an important precondition to drawing benefits from SFR technologies. Hence, although Maria is relatively young and energetic, the amount of land at her disposal does not allow her to practice all the technologies available. This is also the case for Gilbert, who is even double-burdened because of his advanced age. In addition, both of these farmers indicate that because of family labor shortages and inability to hire any, they are unable to carry out some of the recommended activities. In such cases, biomass transfer becomes one of the least attractive of the SFR technologies. On the other hand, fallow crops require that some land be set aside and no matter the benefits accruing, this is a great sacrifice for most farmers.

Similarly, households that have diversified their sources of income cope better with some of the demands of implementing SFR technologies. For instance, Sufu is able to select and even experiment with very specific crops and technologies because he has a relatively better capital base (see Chapter 5) as compared to Gilbert who, in spite of wanting to use farmyard manure, cannot do so because he has only one animal.

The general indication therefore is that not everybody who has been reached in terms of disseminating the SFR technologies has adopted or benefited. Some of the people left out are women who have found it difficult to participate because they lack sufficient land or they cannot attend the demonstrations/field days owing to restrictions from their spouses or their heavy domestic workloads. Nevertheless, there are examples of households in which husbands and wives cooperate in the conduct of their farm activities with great success. In other words, although there is evidence to show that adoption and continued implementation of the various SFR technologies may have enhanced gender disparities, it is also the case that these technologies have managed to improve availability of cash incomes. However, as would be expected, the direction that is taken when it comes to sharing these resources depends on what else is going on in each particular household.

Improved fallows and biomass transfer, used by many poor households (see Chapter 6), are found to have perceptible effects on crop yields and production levels, but no significant impact on household expenditures, consumption, or asset building. This is not to say that the technologies have had no impact whatsoever—the qualitative and quantitative data indicate that a few households have indeed benefited greatly from the technologies and have increased their welfare. However, this is confined to relatively few households. For the average household, the quantitative analysis finds that current use patterns are too modest to lead to appreciable impacts at the household level.

The amount of land or number of household members is not an important determinant of changes to welfare indicators during the time period studied (an exception is with respect to assets in the non-pilot villages). The reasons for this are potentially numerous, with both agricultural and non-agricultural explanations. What is important to emphasize from the lack of relationship is that households with many different resource portfolios are equally likely to be improving or worsening in terms of a host of welfare indicators. It is not the case that certain levels of owned land or household labor are requirements for improved livelihood outcomes. Rather, households have apparently been able to cope when they are lacking in these resources and equally others have been unable to take advantage of relatively abundant resources. Along these lines, it should also be noted that gender of household head was often not linked to changes in welfare indicators, although nutritional status was found to be higher in female-headed households. The results also have implications for poverty dynamics. While some households are mired in low-level productivity–investment cycles, we found considerable

evidence that the many households can move across poverty/welfare categories. Simple analyses of welfare change found that better-off households in the baseline period incurred significant losses in assets, and sometimes in expenditures or consumption. Combining this evidence with the historical case studies leads to the conclusion that the majority of households are vulnerable to poverty and targeting to a narrow population may be unnecessary.

So what is driving the changes in welfare indicators? As a step toward resolving these complexities, we tested for associations between different types of livelihoods and welfare indicators. Participation in casual or salaried labor was not related to changes in any of the indicators, nor was the presence of remittances. The only relationship found was that households who were engaged in business had more positive changes in non-food expenditures and non-food per capita expenditures. Thus, like agroforestry interventions, none of these non-farming livelihood strategies seems to contribute significantly to improved livelihood outcomes by themselves. The real factors behind changes in livelihood outcomes are multifaceted and varied across different contexts. Certainly, this suggests that finding causal relationships between contemporaneous endogenous processes will be almost impossible to achieve, given the reality of a large number of changing factors beyond the control, measurement, and analytical tools of researchers.

SFR and the Poor

The SFR technologies aim at improving soil fertility with the ultimate goal of making farm practices more sustainable and profitable. However, whether these technologies have been successful in targeting the poor is dependent on who is classified as poor in the context of the study area vis-à-vis who is actually capable of implementing these practices and in a profitable way.

Generally, both biomass transfer and cultivation of fallow crops are best among smallholder farmers, most of whom engage in subsistence production and could therefore be classified as poor. But this particular category of rural dwellers is subject to various vulnerabilities, many of which are beyond their control. Even if they do have a surplus for sale, they face several odds, including lack of markets and market information, poor and noncompetitive prices, and a relatively small amount of negotiating power, both at the economic and political level.

Furthermore, the possibility that the SFR technologies being promoted will succeed in involving the most destitute households becomes remote with a reduction in the farmers' resource base through subdivision of land, through HIV/AIDS and other illnesses, and through increasing demands on scarce capital. Therefore, whereas the physical location of the project could be appropriate, the requirements of the technologies may not always accommodate farmers who are absolutely poor. Moreover, even in situations where the poor manage to meet the basic requirements, this is neither sustainable nor adequate to make the expected difference.

Generally, most households interviewed pursued more than one livelihood strategy, mostly in mitigation against several vulnerabilities. In some instances, these strategies are employed simultaneously, while for some people, they are taken up sequentially. No matter the approach, all households interviewed were found to be pursuing strategies other than SFR technologies with the aim of enhancing their incomes. Some of these strategies are complementary to agriculture, while others run parallel or even work in competition.

All farmers were found to grow more than one crop so as to meet their diverse needs and as a way of spreading risk. Indeed, in spite of perceived dangers associated with inorganic fertilizers and coupled with the fact that most of these fertilizers are unaffordable, a few farmers still went in for these inputs. Hence, whenever they

received assistance such as remittances, some of the farmers were found to purchase inorganic fertilizers such as DAP with the aim of boasting their production, especially in cases where they are interested in immediate results. Off-farm employment and trading were found to be the most common livelihood strategies after farming. Some farmers, such as Sufu, opted out of farming to take up off-farm employment, while others combined these two activities simultaneously. In either case the aim was to enhance household incomes and hopefully stave off poverty. And in the case of Hellena, she opted to sell *thowi* after realizing that her injuries could not allow her to engage in farmwork.

Social networks and enlisting the support of others are also other strategies that households employ from time to time. In the case of Hellena, her eldest son's children are dependent on her for support and it is apparent that in the absence of the kind of provisions that she makes, they would become destitute. But, Hellena, too, is dependent on her daughter-in-law for labor and a younger son for cash income. In other words, therefore, when resources are scarce or shrouded in uncertainty, one can still keep out of poverty, at least in the short run, by depending on the good will of others.

Conclusions

Several conclusions can be emphasized from the analysis of this chapter:

- There is stagnation or decline in welfare indicators.
- There are many adverse shocks that affect strategies of poverty alleviation.
- The social/economic environment is unfavorable for rural development.
- SFR is reaching the poor and they receive some benefit.
- The benefit is not large enough to be visible for the majority of practicing households.
- There does not appear to be any single rural-based livelihood strategy that effectively reduces poverty for many households.

We found that few households exhibited positive changes in welfare indicators. Many households saw their liquid asset portfolios decline and their expenditure or consumption levels to stagnate or fall. It appears that no household is immune to welfare or livelihood losses as, in many cases, it was the more well-to-do households that suffered the greatest absolute losses. To be sure, some gains were made, and it should be stressed that almost all households are actively pursuing some strategies for advancement.

Significantly affecting the changes in welfare indicators are adverse shocks coupled with households' inability to cope with them. It was rare indeed for any of the case study households to be free from major calamity or catastrophe during the past few years. This includes death or severe illness of family members, loss of employment or income source, loss of livestock from disease, unplanned contributions to funerals, and theft of crops. These occurrences lead to significant shifts in asset portfolios or planned investment levels.

What these conclusions further point to is that the overall rural economy has been very weak. Investments of any kind cannot be effective in an environment where agriculture is not rewarded (economically, culturally, socially), institutions are collapsing because of bad governance, and few nonagricultural employment opportunities are created for rural dwellers. Such an environment acts to increase risks of adverse shocks (e.g., thefts, loss of employment) as well as to reduce households' ability to cope with shocks (e.g., risks of building livestock assets).

The agroforestry technologies, which were found to be used by a good number of poor households, had mixed effects on livelihoods and welfare. On the one hand, the preponderance of evidence from the surveys, the case studies, and the trials, showed that agroforestry did generate increased

yields for most households. Some households, including poor households, were able to benefit from the use of the technologies and reported building up of assets and increased food consumption. This came about from the intended effect of the technology on yields, but also from sales of tree seeds and to improved connections with other development organizations.

However, the welfare increases were mainly modest, owing to the small land sizes on which they are applied. Moreover, because of acute need for cash, such increases were not usually converted into sustained increases in livelihood assets. The state of the local economy and starting asset bases of households play a large role in this. Poor asset portfolios mean that households cannot fully take advantage of the new technologies in the sense of taking more risk with larger areas or complementing them with improved varieties or new crops. The weak economy means that there are few off-farm livelihood sources that could diversify risks and provide working capital for farm investment.

Given that welfare of most households declined, there do not appear to be any single promising livelihood strategies to escape poverty. Households with relatively large livestock numbers suffered larger decreases in welfare than others. Larger farms were not able to do better than smaller farms. Other forms of soil fertility investment (e.g., fertilizer) were not highly accessible to the poor. Moreover, none of the non-agricultural livelihoods were strongly linked to improved welfare, although in some cases, it was clear that non-agricultural foundations were very important. There is clearly no sure way to climb and remain out of poverty—it seems to require extreme flexibility and adaptation by households. Diversification from subsistence crop cultivation is imperative for all of the poor, but the direction that they take will not be uniform.

CHAPTER 8

Dissemination of Soil Fertility Replenishment Technologies: Comparing Approaches, Methods, and Experiences

While much of the study focuses on impacts of the technology itself, it also looked at dissemination processes. A study of dissemination is important to this study because (1) dissemination approaches used by organizations in western Kenya are intended not only to disseminate technology, but to strengthen human and social capital such that farmers and farmer groups are able to disseminate technologies to other farmers in the village and ultimately to other villages; (2) approaches to dissemination, methods, and experiences affect these organizations' ability to reach the poor and women—in other words, the process of dissemination can have as much impact on adoption as the nature of the technology itself. It is thus important to understand the different approaches used by different organizations in western Kenya, the experience of implementation in practice, and the effectiveness in achieving the objectives identified in (1) and (2) above.

More specifically, the next two chapters address the following issues: the extent to which dissemination approaches have reached different groups of farmers; people's perceptions of the disseminating organizations and methods of teaching; the relationships between the disseminating organizations and communities; flows of information between different types of disseminating and recipient institutions and individuals; the effectiveness of the training; perceptions of local sources of information; the performance of farmers and local groups in carrying out dissemination; the effectiveness of the approaches in reaching the poor and women; impacts on human capital, social capital, and local social relationships; and sustainability issues. More detailed accounts of experiences in each of the six focus group villages are found in Appendix B.

Study Design and Methods

The methods used to design the research questions and criteria used for site selection are discussed in Chapter 2. To reiterate briefly, here, the research took place in a selection of villages that overlap with villages selected for the survey and household case studies. The main methods used for studying dissemination were focus groups and a household survey, supplemented by some case study material. Twenty-four focus groups were conducted across six villages (three Luo and three Luhya), with four groups per village representing poor and non-poor

Table 8.1 Village selection for dissemination study

	Type of dissemination approach	Disseminating organizations[a]	Survey	Focus group discussions	Case studies
Luo villages					
Sarika	Village approach	**ICRAF,** KEFRI	X	X	
Muhanda-Arude	TRACE approach	**CARE-Kenya,** ICRAF, MoARD	X	X	X
Sauri	Village approach	**ICRAF,** KEFRI, KARI, MoARD	X		
Gongo	Catchment area approach	**MoARD,** ICRAF	X		
West Kanyaluo	Sub-chief visited Maseno	Local leaders	X		
Ugunja	Local CBO through ICRAF	ICRAF	X		
Luhya villages					
Eshikhuyu	Village approach	**ICRAF,** KEFRI	X	X	
Mwitubi	Catchment area approach	**MoARD,** ICRAF	X	X	X
Mutsulio	PLAR	**KARI,** MoARD, ICRAF, KIT	X	X	
Bukhalalire	Umbrella group approach	**KWAP,** MoARD, ICRAF	X	X	

[a]The main disseminating organization is in bold. The rest joined in after the approach was in place and used it to reach farmers. Note that other organizations were also active with projects that may have included soil fertility in some of these villages, but were not the main SFR interventions of interest to this study. Acronyms not defined earlier: KWAP, Kenya Woodfuel Agroforestry Programme; TRACE, Training of Resource Persons in Agriculture for Community Extension.

men, and poor and non-poor women.[31] The survey covered 360 households across six villages (three Luo and three Luhya), but only four overlap with the qualitative study on dissemination.[32] Table 8.1 shows this breakdown.

Each focus group used two types of information collection methods. One was open-ended discussions, using a structured guide but allowing responses to take their own directions and participants to discuss or debate with each other. The second involved the use of several PRA methods to allow people to visually express their evaluations of dissemination organizations and processes and then debate the responses. These included the methods described below.

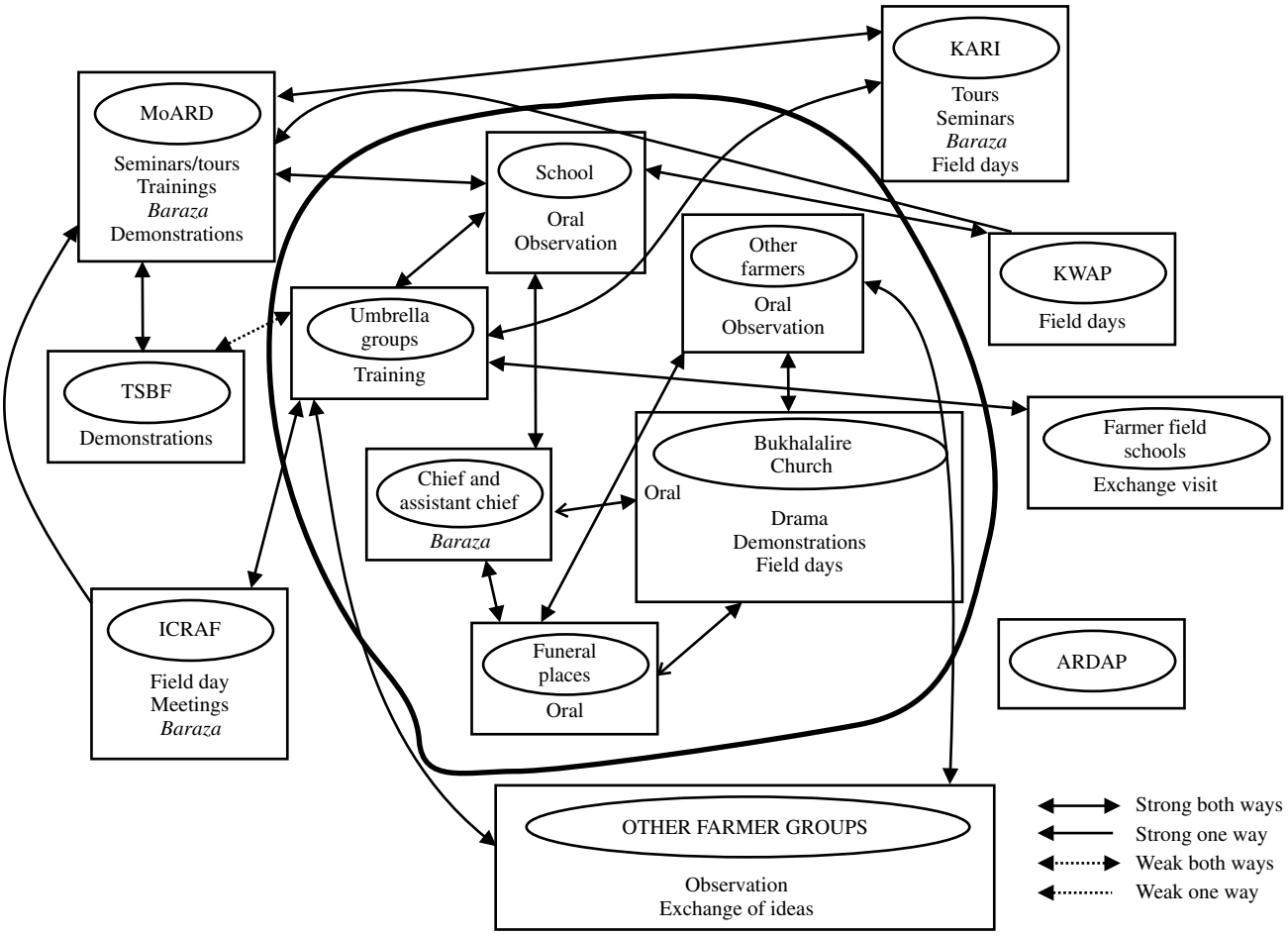
Mapping of Organizations and Information Flows

The purpose of the exercise was to learn which local and external organizations and individuals were operating in the village and involved with providing, passing on, or receiving information and training about soil fertility replenishment and agroforestry methods, and the means and media through which information was passed on. It aimed to understand how people accessed informa-

[31]In the following two chapters, "poor men" refers to participants in the poor men's focus group, "non-poor women" refers to the focus group participants in the non-poor women's focus group, and so on. It does not, of course, mean that they speak for everyone inside or outside the group, although information included in these chapters tends to reflect a response that was prevalent within the respective focus group. Furthermore, "poor" and "non-poor" are relative categories: even the non-poor are often households struggling to make ends meet, and many might be considered poor in relation to an urban working class household, or compared to some categories of rural dwellers. Selections were made based on survey data described in this report, so definitions of poor and non-poor can be found there.

[32]The quantitative study of dissemination, adoption, and impact was administered in non-pilot villages only, so Sauri pilot village was not in the sampling frame. Second, Gongo was not part of the quantitative study because too few households were found to be practicing agroforestry, and Ugunja was selected in its place.

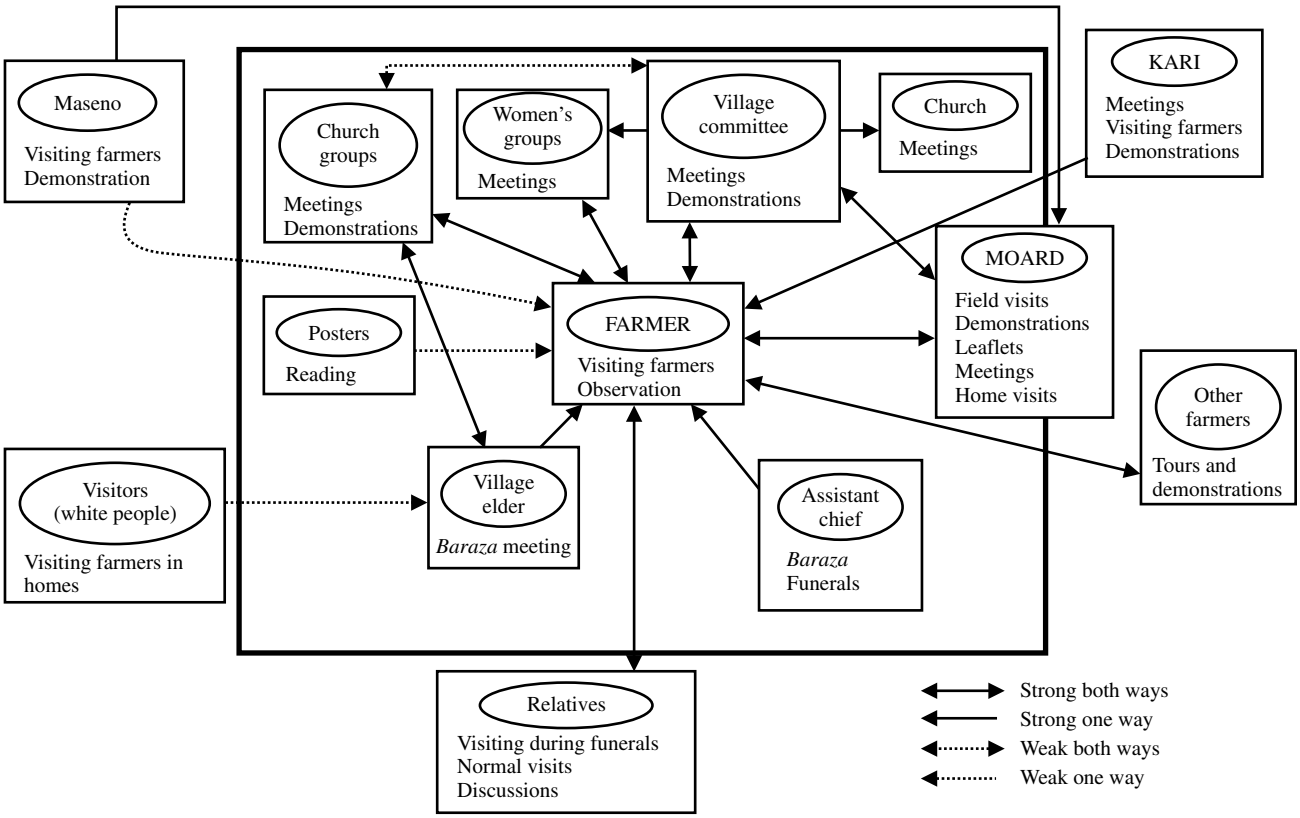
Figure 8.1 Village map of institutions involved with SFR information exchange—Bukhalalire village, poor men



tion, how information moved through the community, and where barriers or weak linkages existed that prevented access or made access unreliable.

A map was drawn on a large sheet of paper on the ground, representing the boundary of the village. Farmers were asked about all providers of information on soil fertility management, agroforestry, and conservation from outside the village, and to place these outside the village map. These included, for example, ICRAF, Ministry of Agriculture and Rural Development (MoARD), and CARE. They were then asked about providers of information within the village, and these were placed inside the map. Some of these included local women's groups, village committees, schools, other farmers, and contacts farmers. Some organizations were placed at the boundary. Farmers were then asked to list the medium of information exchange between the providers of information and themselves. Each of these was drawn in below the provider that uses them. Some of these included *barazas,* field days, farmer exchanges, demonstrations, and tours. Finally, the facilitator asked farmers about the linkages between the organizations, groups, and individuals within the village, between external organizations, and last between those on the inside and the outside. Participants drew these linkages, representing strong or weak communication, and whether the communication was in one direction or two-way. Examples of the drawings can be seen in Figures 8.1–8.3.

Figure 8.2 Village map of institutions involved with SFR information exchange—Mutsulio village, poor women



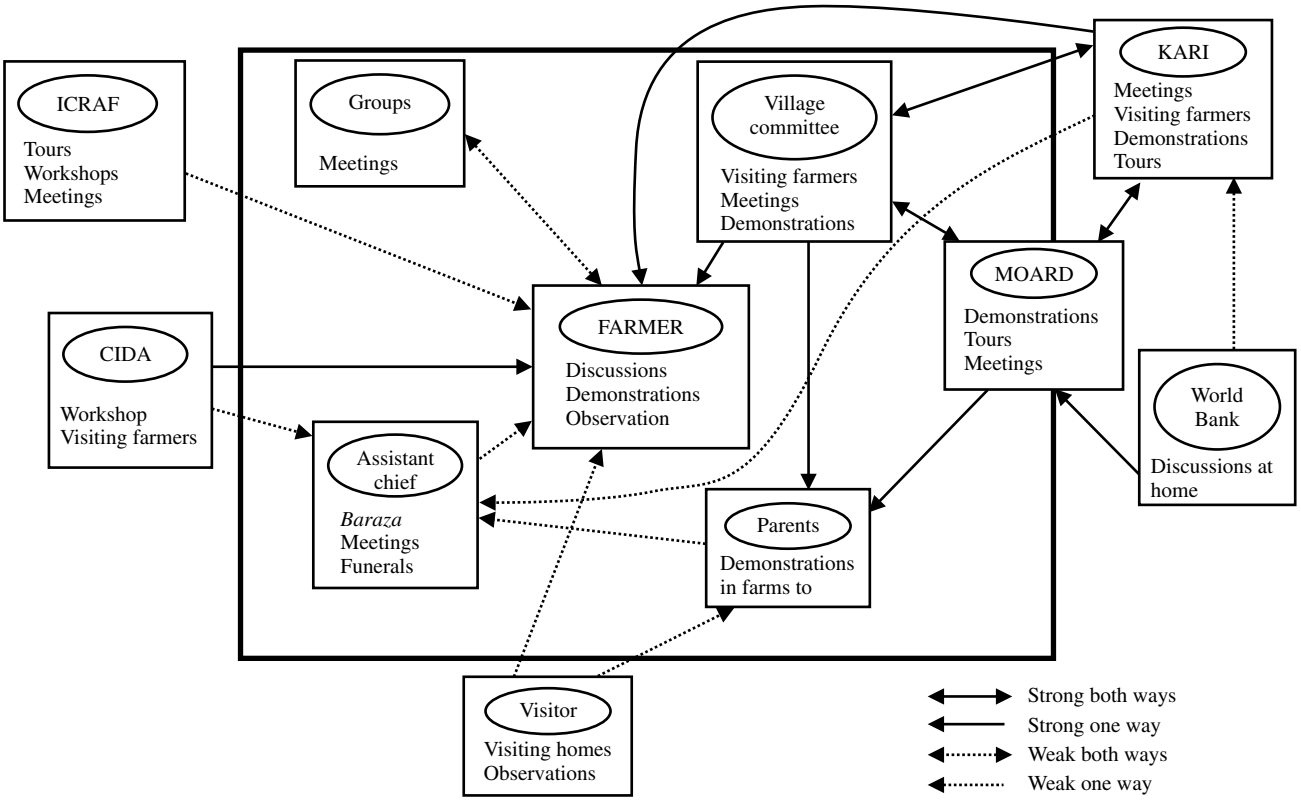
Scoring of External Information Providers and Methods

Having established what information providers operated in the village and the media of information, farmers were then asked to score the usefulness/importance of each provider and media. This exercise was done several times: for external providers, internal providers, and methods of dissemination. Criteria for evaluating the usefulness and importance of particular providers of information were solicited from the group. For each of the three categories, participants were given 100 grains of maize (or beans) and asked to give each provider a score of between 1 and 100, with decisions about relative importance represented by the number of grains. The total number distributed was limited to 100, so that results could be expressed quantitatively in percentages. In all cases, people were asked to express their reasons behind the scoring and their answers were probed.

Knowledge Acquisition: Ladders

This exercise focused on the effectiveness of training and farmer self-evaluations of their knowledge gained on soil fertility replenishment before, during, and since the intervention. The facilitator started by asking the farmers to list all the soil fertility management and conservation technologies that the main provider of information was disseminating in the village. In some cases, if the discussions were being held in someone's compound, the farmers were asked to bring a sample of the materials that they were using, for example, handfuls of compost and animal manure, leaves of *tithonia* shrubs, legumes fallow species, and spoonfuls of DAP. Participants were asked to grade their knowledge at three periods in time:

Figure 8.3 Village map of institutions involved with SFR information exchange—Mutsulio village, poor men



(1) before the intervention/provider arrived; (2) the period they spent with the provider; and (3) since the provider left. The facilitator brought out two (real) ladders with 10 rungs each and explained that each rung represents an increase or decrease of 10 percent, starting with 0 percent (no knowledge concerning a technology) and ending with 100 percent (total knowledge in terms of implementation and ability to pass on to others).

For each technology, farmers indicated where on the ladder they were before, during, and since the intervention. If they had samples of the materials, these were placed on the rungs physically using tape. Discussions, arguments, and reasons for grading each level were captured.

Quantitative Survey

A sample of 360 households, 60 from each of six villages, was selected. Of these, approximately half were using agroforestry-based SFR technologies. The survey instrument was broad, covering basic household characteristics, acquisition of information on agroforestry, use of agroforestry, and impacts from agroforestry. Among those related to acquisition of information were questions about the household's awareness of different disseminators of information about SFR, their direct interaction with the disseminators of information, and their assessment of the frequency and reliability of the information received. We also asked questions to better understand how households were connected in the community—their positions of leadership and their membership in groups.

Approaches to Dissemination in Western Kenya

As Table 8.1 shows, a range of different organizations are disseminating SFR technology approaches used in this region,

and the organizations use different systems for dissemination, which we refer to as "dissemination approaches." These share certain methods of organizing and teaching, but differ in a number of ways. Below are descriptions of the approaches used in the six villages in which this research took place. The actual experience may vary in practice, or people's perceptions may be different from what the organizations intend, as evident in differences between the descriptions below and the study findings that follow. Nevertheless, we describe the approach as designed by the disseminating organization, and refer to the intended or actual experience across the wider group of villages in which the approach was used.

Village Approach—ICRAF Dissemination Approach

ICRAF and its partners (KARI and KEFRI) initiated a "village approach" to dissemination. Initial contact was made through the assistant chief and village headman where they discussed soil fertility problems and possible solutions. The village headman in turn organized a field meeting for all farmers in the village to meet with researchers. Everyone was exposed to the technologies and each farmer tested at least one strategy. With connectivity between villages, researchers decided to work with the cluster of villages within the sub-location, providing the opportunity to include a wide range of farmers from different socioeconomic and cultural groups. It was necessary to develop a community-based extension system that would facilitate the dissemination of some of the new locally developed technologies in a sustainable manner. The approach involved institutionalization of existing community social structures. Using participatory methods, social and clan groups in each village were identified and linkages among the groups in terms of membership were established. Each group and/or clan group selected a representative to be part of the village committee, responsible for providing information to group members. After all the villages had formed their committees, each village committee (VC) elected two representatives to form the sub-locational committee (SLC). It was at the sub-location level that information from external agents could enter the community and spread down to each farmer through the VC and groups.

The various committees were trained in technical agroforestry aspects of seed production, handling and storage, nursery establishment and management, soil fertility replenishment strategies, group dynamics and team building, record keeping, leadership skills, monitoring and evaluation, and proposal writing. Farmers were reached through the following channels, field days, tours and exchange visits, seminars at the village and at research centers, chief's *baraza,* church services, funerals, and village meetings. After training of the committees on different issues mentioned earlier, it was the responsibility of committee members to train other farmers. The SLC organized field days for farmers from other villages to visit and learn what they are doing. Also during the chief's *baraza,* the chairperson of the SLC could talk to farmers about agroforestry technologies. The committees were also involved in sourcing for new technologies and bringing them to all farmers in the village. The chairperson of the SLC and VC informed farmers of upcoming events such as field days, seminars, and meetings. Occasionally, scientists participate in village and SLC meetings and share ideas with farmers. The SLC and VC have taken up new initiatives that complement the soil fertility technologies, for example, managing an input credit scheme, rotational dairy cows program, apiculture, and growing of high-value fruits.

Catchment Area Extension Approach—MoARD

The Ministry of Agriculture and Rural Development is mandated to provide extension services to farmers in Kenya. There are trained Frontline Extension Workers (FEWS) and Divisional Extension Coordi-

nators (DECs) whose responsibility is to implement the approach and provide extension services. Having begun as a soil conservation program, the catchment approach evolved (from the 1970s to the 1990s) to embrace all farming issues from farm production, soil and water conservation, and marketing to farm management, home economics, and other activities.[33] It relies on creating forums where farmers play the leading role in identifying their problems, opportunities, and solutions. In one year, all physical and human efforts of extension are concentrated in one site within a division. Such areas/sites normally are about 400 hectares in area comprising 400–500 farm families.

The first step is focal area identification and selection conducted by land users/farmers, FEWs, and DECs, followed by publicity through field *baraza,* churches, and schools. PRA is carried out, an action plan is drawn up in a public meeting stating activities and responsibilities of each participant, and a catchment area committee is formed, who are trained for three days. Catchment area scheme planning entails developing a focal area map and list of farmers and/or households, development of community- and farm-specific action plans by farmers and extension staff, and implementation of action plans. Demonstrations and field days are then conducted according to the action plan, farmer tours and excursions are organized and held as necessary, and continuous participatory monitoring and evaluation is carried out. The FEWs and DECs conduct field visits and prepare reports. At the end of the year, a five-day workshop is held to review work and need for maintenance and continued implementation of specific action plans. Apart from using the catchment committee to reach all the farm families within the catchment, the FEWs and DEC use field days, social groups (e.g., women, youth, church, and self-help groups), chief's *baraza,* funerals, radio, and village meetings. Establishment of demonstrations on farmers' fields allows farmers to learn from each other and exchange ideas through conducting field days on those farms.

Training of Resource Persons in Agriculture for Community Extension (TRACE)

This is a participatory extension methodology that is used by CARE-Kenya in its agroforestry program. It is based on the hypothesis that communities are organized into groups and it is easier in terms of time and resources to work with these already established groups. TRACE used groups and schools in a simultaneous and supplementary manner. The TRACE process is implemented through extension and training, institutional capacity building, and adaptive research. TRACE starts with site selection where all the stakeholders discuss and agree on a specific area. Later the site (referred to as synergy area) is characterized and leaders of this area are trained. Leaders from surrounding sites are also trained. During this training, the Locational Development Committee (LDC) is formed. Farmers are selected from the village level to be Village Agricultural Promoters (VAPs). At the same time, the groups in the village select representatives who are called Group Resource Persons (GRPs). The VAPs and GRPs act as Adaptive Research Farmers (ARF) who conduct trials on their farms and these farms are used as learning grounds. Any new technology is first tried by the two groups of farmers. The VAPs and GRPs sit at the Village Management Committee (VMC). Schools in the area are part of the VMC. If there are many, then they form a school committee that regularly attends meetings

[33]As of 2001, this is now the official extension approach in cultivated areas of Kenya, known as the National Agriculture and Livestock Extension Programme.

with the VMC. Several representatives from each VMC join to form a Sub-location Management Committee (SMC).

The overall body is the Locational Development Committee (LDC), which is used as entry point into the community. The LDC members are chiefs of locations and they are trained in participatory approaches. This serves to eliminate bias that could be introduced by staff and promotes sustainability, providing an exit strategy for the project. The CARE groups were connected to the agroforestry structures formed by ICRAF. At the SMC, some farmers were selected to the Locational Agroforestry Committees (LACs) and the chief is the patron. The LACs serve in raising awareness and community mobilization, coordination/facilitation of groups, schools, and ARFs.

The LDC and LAC members are trained in trial management, monitoring and data recording, and analysis. Groups, on the other hand, are trained in group dynamics, farm layout, and record keeping. The training is held in a GRPs farm and field days are held at opportune times in the season. GRPs were occasionally taken for exchange visits to other sites. Methods used to reach farmers and pupils include field days, *baraza,* group meetings, environmental clubs, special class lessons, churches, exchange visits, evaluation meetings, and parents' days. Farmers were involved in committee formation and more women were involved than men because the groups that were interested were mainly women's groups. Most of the GRPs are women and the VAPs are men. The farmers were involved in managing experiments, record keeping, extension message development, and dissemination. Farmers also took over organizing field days and village meetings.

Participatory Learning and Action Research (PLAR) Approach

Participatory Learning and Action Research (PLAR) is a research and extension approach that stimulates individual and communicative learning for Integrated Soil Fertility Management (ISFM) and was implemented by MoARD, KARI, ICRAF, KEFRI, and KIT (Royal Dutch Institute for Tropical Agriculture). The PLAR approach was aimed at helping farmers improve their soil fertility management through on-farm learning, self-discovery, and experimentation. Initially, the PLAR team contacted the assistant chief and informed him of the activities to be conducted in the village within his sub-location. The assistant chief invited all farmers to an introductory meeting and the PLAR team attends. Several analyses are then done: at the individual farm level an analysis is made of the specific circumstances of each farm and farm family, their problems, financial sources, access to inputs, their hopes, and opportunities. Resource flow maps are used to visualize and analyze farmer practices, rotation schemes, input supply, and other soil fertility strategies. Planning maps are used to plan for alternative practices. Through experimentation, individual farmers adapt technologies to their own situation and integrate them into their farming system. At the village level, an analysis is done on farmers' information and communication networks, since information sharing is the key to PLAR, and of SFR strategies prevalent in that particular community setting.

Through this analysis, farmers are grouped into good, average, and poor soil fertility managers. Farmers are selected from these three categories during a community meeting, called test farmers, and form the interface between farmers and external change agents. They form the village committee for ISFM, and are involved in developing options for ISFM. They are encouraged to exchange experiences and views with their peers and the PLAR team, and are introduced to new information. The results of test farmers are regularly aired in farmers' groups and community meetings, in the hope that they will stimulate other farmers to take action. Each SFM committee draws a village action plan containing activities in the field of training, experimenting, moni-

toring, and evaluation. The SFM committee organizes field days and seeks information for other farmers.

With this approach, each member of the community has access to information and ownership is established through training of the village committee members on planning, monitoring, and evaluation. Interactions between farmers and extensionists (which in this case are represented significantly by KARI researchers) are on three levels: community meetings, group meetings with selected farmers, and household meetings with members of selected farms. Farmers are encouraged to communicate horizontally by exchanging information and insights. Regular meetings are central elements in the process and they rely heavily on open-ended conversations and regular exchange of findings from the test farmers. Since they are selected from groups with similar SFM strategies, the village committee (composed of test farmers) is responsible for sharing information among farmers with similar characteristics. At the same time, they seek information from external agents. The roles of extension staff in PLAR are to assist farmers in learning and self-discovering, experimentation and in their search for new information, facilitate farmer-to-farmer learning, stimulate interaction between committees, assist the functioning of farmers' platforms, stimulate contacts of committees with other development organizations, and share knowledge with research/extension staff of all levels.

Umbrella Development Group Approach—KWAP

Kenya Woodfuel Agroforestry Programme (KWAP) was based in Busia District in western Kenya. After conducting problem identification and analysis, farmers and the KWAP team chose the Mirror technique (see later) and the school program to be undertaken through the Umbrella Development Group approach (UDG). The UDG is an amalgamation of several social groups in an area, including women, youth, churches, self-help and welfare groups, and development societies.

The extension approach used a framework involving "A, B, and C" areas: "A" was a pilot area that was a catchment composed of about 400 households; "B" was an administrative location in which the pilot area falls; and "C" was an intervention agroecological zone in which a pilot area falls. In A areas, UDGs were formed and KWAP worked intensively with partners who included extensionists from government agencies and NGOs operating in that area. In B and C areas, KWAP left the work to line agencies that had mandated to offer extension services and KWAP's role was to facilitate these line agencies in execution of their duties. In A areas, segregated farmer groups had existed, that is, catchment committees, women groups, youth groups, adult educational groups. KWAP assisted these groups to consolidate into site umbrella development groups (UDGs), in order to have better bargaining power in terms of resource acquisition. These UDGs, which are comprised of 30 members, had responsibility for coordinating and steering the developmental activities of individual groups. The UDGs had various subcommittees, which were charged with different responsibilities. One such subcommittee was the Adaptive Research Farmers Committee (ARFC), whose role was to develop and test any promising technology on behalf of the community. All the UDG members had the responsibility of being Resource Persons (RPs) for their respective groups in the technology transfer process. The whole program had six catchments in total with six to eight Adaptive Research farmers in each catchment. All resource persons had three to four follower farmers for closer guidance in their respective groups.

KWAP's role was to strengthen the UDGs in terms of technical and managerial capacities through training and farmer educational tours. KWAP also carried the cost of production of the teaching materials. KWAP organized two main methods of teaching.

The *mirror technique* employs use of a "mirror" in front of the community so that it is able to detect and understand its own problems. This was done through local drama, songs, role-plays, films and poems in *baraza* and field days, and TV productions to communicate agroforestry messages. This methodology was geared at triggering discussions, creating awareness, and changing the attitude of household members toward tree planting (particularly woodfuel, which is regarded as a secondary need and as woman's responsibility). The mirror technique was aimed at encouraging farmer-to-farmer extension (since it is farmers acting and/or singing). The plays and songs were also heard on the local radio station.

The KWAP team also used schools for dissemination, where committees composed of students and teachers were formed. The committee organized field days, sensitized and prepared the community for the event, and prepared their tools for passing information (that is, drama, songs, poems, and role-plays). During these events, as many as 1,000 people could attend.

Outside Institutions, SFR Technology, and the Study Villages

As indicated in Table 8.1, the six villages in the qualitative study received interventions from several disseminating organizations, with one organization usually primary with respect to dissemination of SFR technologies. However, because in practice organizations overlapped in their coverage, local residents sometimes had trouble identifying which outside organization was most active in the community, and it was rare to find anybody who could readily identify the name of the dissemination approach, for example, "PLAR" or the "catchment" approach. Nonetheless, this lack of recognition does not stop people from developing strong, divergent opinions on organizations. These differences in opinion reflect people's experience with the organizations' dissemination strategies.

Disseminating Organizations

According to our study design, each of the six villages in the qualitative studies was to focus primarily on the dissemination approach and associated external institution that were the most prominent with regard to SFR. However, in all villages more than one institution was working with different forms of SFR, and some organizations had worked in each village in some capacity at some point in time. For example, the government's extension service (through MoARD) in theory would work in every village regardless of a major intervention by another institution, and CARE might invite ICRAF into villages where it is working to introduce new information. Hence, in each village, we may touch on multiple interventions where villagers raise them, but an effort is made to focus on the approach and institution that was particularly influential. As in much of western Kenya, the villages were also hosts to a large number of other organizations addressing different problems, from malaria control to credit schemes to wells. Although an attempt was made not to cover these organizations, their presence in the villages means that they were sometimes compared in the focus groups to the main organizations of interest.

Of the qualitative study villages, Sauri and Mutsulio had four organizations active in SFR at some point in time, Muhanda and Bukhalalire had three, and Mwitubi and Gongo had two organizations active. Focus groups participants did not refer to or describe the approaches specifically, but they were aware of which organizations worked there and the methods they used.

Assessments of External Disseminators in Communities

Respondents in the focus groups have strong opinions about the usefulness and importance of the different organizations that

worked in their villages. Five organizations were primary disseminators in the six study villages: KARI, MoARD, ICRAF, CARE, and KWAP. Of these, residents were usually aware of four of them: KARI, MoARD, ICRAF, and CARE. KWAP was relatively unknown because it was only active in one village (Bukhalalire). Where organizations were not present or their work was much earlier or not as central as an SFR intervention, we do not assess residents' views of these organizations. Table 8.1 indicates which organizations were mentioned as being familiar in each village, with the main organizations of interest to the study in bold. Figure 8.1 presents an example (in the eyes of the poor men's focus group in Bukhalalire) of the number of organizations involved in one village, both external and internal to that community, and in what ways and how well information flows between them.

Comparing the four organizations most active in the communities (KARI, MoARD, ICRAF, and CARE) seems to reveal uniformity of opinion. In fact, all organizations score approximately equal on the PRA exercises among those groups that rank them according to their usefulness and importance. Where identified, residents score MoARD and KARI at approximately 25 percent. Similarly, residents rank CARE at 21 percent for usefulness and importance, although it was not ranked in three communities. Among the four most common SFR distributors, ICRAF scores highest at 32 percent (although it was not ranked in Gongo and scored low in Mutsulio, where it was barely active). Comparing these numbers across communities is an imperfect measure because not all organizations were operating or equally active in each village. However, the rough uniformity and the fact that the most active organizations usually score higher suggest a basic degree of satisfaction (e.g., Sauri, Arude, and Mutsulio scored ICRAF, CARE, and KARI, respectively, at more than 60 percent). Where it operates, ICRAF seems to rank consistently highest in usefulness and importance compared to other organizations. In fact, considering its low score in Mutsulio, ICRAF's scores in communities where it was most active (average 52 percent) are especially high.

Although they were only the primary SFR disseminators in two communities, ICRAF is unusual in that it was active in all study communities. But MoARD was also active in every community and scores lower. Part of the reason for this relatively high assessment of ICRAF may lie in the way in which it works with groups. From the focus groups discussions, it appears that where ICRAF is active, it tended to use existing social structures, such as church and women's groups and funeral societies as forums to disseminate their technologies. At least in the study villages, MoARD seemed to have formed new local groups to disseminate SFR technology, and these are less favored in these communities. In the two communities where MoARD was most active, Gongo and Mwitubi, residents saw these groups as leading to more stratification, and disenfranchisement.

But the most compelling reason for this ranking emerges from respondents' assessments of the outside disseminators' links with farmers. In the PRA exercise mapping lines of communication, 11 of the 24 focus groups showed ICRAF as actively involved with individual farmers. No other organization performed this well in this exercise. One complaint from participants was that external organizations did not spend enough time with farmers, so these lines of communication may help to explain ICRAF's high scores. Also, the case studies reveal that people like ICRAF because of the high profile visitors and access to other organizations that ICRAF provides. An additional trend that is to be expected is that people rank organizations that are most active in their community as more useful and important. Residents claimed that the prime disseminator is more useful in five of the six communities. In three of these cases, the

most active organization dwarfs all others. Residents in Sauri, Arude, and Mutsulio scored ICRAF, CARE, and KARI, respectively, at higher than 60 percent. No other organization comes within more than 19 points of them. In two other cases, Gongo and Bukhalalire, residents rank MoARD and KWAP, respectively, about 10 percent higher than other organizations. In the final case, however, residents rank the group most active there 30 percent *lower* than another. Residents of Mwitubi rank MoARD at 33 percent, but ICRAF at 67 percent.

It is also worth noting that one organization received only praise from participants. The Centers for Disease Control of the United States ran a mosquito eradication program in Gongo to limit malaria. While eliminating a terrible, endemic, and infectious disease would make any organization popular, and was outside the scope of other organizations, their popularity also stems from another reason more relevant to this study. They spent their time extensively training local collaborators and expressly showing the good that could come from adopting their technologies. This hands-on approach endeared them to the community, and made them popular in all groups.

Evidence on Effectiveness of Dissemination Sources from the Quantitative Survey

Table 8.2 displays a variety of information regarding recognition and contact with different sources of information about SFR. Across the columns are the main sources of information on SFR (a few less important sources, such as the media, are omitted). The variables along the rows are then contrasted for each source. The first row simply states the number of villages where the particular source is active, because not all villages would be expected to be reached by each source. We expect that all villages would have known about ICRAF (meaning ICRAF and/or its research partners, KARI and KEFRI) as well as potentially receiving information about SFR from extension and other farmers. In terms of NGOs or CBOs, while all villages may be in contact with at least one from each group, the number known to be providing some information on SFR is less. Thus, NGOs and CBOs actively provide information on SFR in only four and three villages, respectively.

The second row indicates the percentage of households (using the total number of households in the villages relevant to the particular source) that are aware that information about SFR is provided by the different sources of information. ICRAF ranks highest for awareness, as 44 percent of farmers were able to name ICRAF. The next most recognized source was CBOs at 32 percent. NGOs and extension were nearly identical at 22 percent and 21 percent, respectively. Finally, other farmers were mentioned as sources for SFR by 18 percent of the households. NGOs may have received relatively low recognition because some of them maintain strong linkages with only a few farmers in a village. In other cases, households may be aware of the NGO, but perhaps for non-SFR–related activities.

The third row shows the percentage of households that claim to have had direct contact with the source. By definition, this figure will be less than that of the previous variable. By dividing the direct contact variable by the awareness variable (that is, dividing row 3 by row 2), one can generate a measure of direct support provided by each source (in parentheses in row 3). In these terms, CBOs score highly in that they have direct contact with over 90 percent of those households who are aware that they provide information on SFR. Farmer-to-farmer methods of dissemination also tend to involve personal contact in most cases. Extension agents also seem to be effective in reaching clients, at least those who are aware of extension as a source for SFR information. NGOs and ICRAF, the two external organizations, are found to have the least pervasive direct support to households. This is not surprising, given that they work extensively in many different villages.

Table 8.2 Summary of reach and effectiveness of different sources of information on SFR (as percentage of all households located in relevant villages)

Indicator	CBOs	NGOs	Extension	Farmers	ICRAF/ research
Number of relevant villages	3	4	9	9	9
Percentage of farmers in these villages who mention them as source of information on SFR	31.7	21.8	21.3	17.7	44.3
Percentage of farmers in these villages with direct contact on SFR	28.3 *(89.3)*	15.6 *(71.6)*	17.5 *(82.2)*	14.7 *(83.1)*	28.3 *(63.9)*
Percentage of farmers in these villages satisfied with the information on SFR	17.0 *(60.0)*	10.8 *(69.2)*	4.3 *(24.6)*	6.4 *(43.5)*	12.2 *(43.1)*

Notes: In row 3, italicized numbers represent percentage of households having direct contact among those aware that the source provides information on SFR (row 3 divided by row 2). In row 4, italicized numbers represent percentage of households satisfied with information among those with direct contact (row 4 divided by row 3).

The final row shows the percentage of households reporting to be satisfied with the SFR information received from the source. Dividing this percentage by the percentage of households with direct contact (in the parentheses in row 4) provides a measure of the effectiveness of the information provided by each source.[34] On this account, CBOs and NGOs rate highly, with approximately two thirds of contacted households being satisfied with the information provided. Other farmers provide satisfactory information in about half the cases and ICRAF in just about 40 percent. The lowest rated source of information is extension, which does not provide adequate information in about 75 percent of cases. It is possible that poor extension services in other aspects of farm production may have led to poor ratings for SFR.

It is not possible to directly infer from this information the effectiveness of specific approaches. For example, the fact that a source of information scores relatively low on direct contact may simply result from the fact that they intended to have a low direct contact and planned that contact farmers would in turn pass on the information. Eventually, one would wish to know how many households in total have heard about SFR. One vehicle that is encouraged by all approaches is farmer-to-farmer contact. Table 8.3 shows the percentage of households who received information about SFR from fellow farmers in the different sites. As can be seen, farmer-to-farmer exchange is highest in Mwitubi (26 percent of households where MoARD and ICRAF were quite active) and then in Muhande (39 percent of households where CARE was active for many years). Buhkalarire was lowest with only 5 percent, having received information from other farmers, but as noted earlier, this may be partly the result of very active dissemination by local groups. In terms of access to SFR from any source, 73 percent of households across the six sites replied that they did receive some information. This implies that information dissemination is very good overall in these early dissemination sites. The two sites that are relatively low are Buhkalarire (63

[34] One could also divide by the awareness percentage, but it is not clear that households that are aware of a source of information actually received information with which to make an assessment of quality.

Table 8.3 Percentage of households receiving information on agroforestry from other farmers or any source

Site	Percentage of households receiving information from other farmers	Percentage of households receiving information from any source
Mwitubi	26	71
Muhande	39	78
Shinyalu	13	82
Bukhalalire	5	85
Ugunja	12	63
West Kanyaluo	12	57

percent) and West Kanyaluo (57 percent). These happened to be the furthest sites from ICRAF's base in western Kenya and in the case of West Kanyaluo, recall that these farmers visited Maseno for information and no organization was present in the village to disseminate information on SFR.

Differentiation within Communities in the Focus Group Results

Returning to the focus group results, some differences were found between men and women, and between non-poor and poor focus group participants, in their attitudes toward disseminating organizations. In the aggregate, the average scores for men and women were roughly similar. Three of the four outside groups get almost exactly equal scores from both men and women at 30 percent. The only significant difference is for ICRAF. Here, men rank ICRAF at 50 percent, while women rank it at slightly less than 40 percent. This is a small difference and difficult to explain. ICRAF's use of extension approaches that visit farmers in the field could have gained them popularity with men who have greater visibility as head of household and greater access to land. However, ICRAF does attempt to reach women farmers, and is successful as evidenced by the high score they do receive from women. In fact, direct visits with farmers in their fields can also favor women who might be less inclined to attend public dissemination activities.

Viewing results by wealth, there are some significant differences. Three of the five organizations (CARE, KWAP, and KARI) are more popular among non-poor residents. For example, non-poor groups rank CARE as about 30 percent *more* important than do the poor groups. In contrast, MoARD and ICRAF are more popular among poor residents. These distinctions suggest that these two organizations are reaching poor farmers. Since focus group discussions indicate that, generally, poor farmers have less positive experiences in groups, they might appreciate ICRAF and MoARD's practice of visits to individual farmers. Although this was popular everywhere, poor groups, and especially poor men, unanimously liked this method.

But other patterns emerge in combining gender and wealth. For example, KARI and KWAP are both more popular among poor women than non-poor women, but more popular among non-poor than poor men. One possible explanation for this pattern could lie in the heavy use of local groups in their approaches. In both communities where these groups were most active, all men, but especially poor men, noted that the groups founded by disseminators created stratification, since they relied on local elites as their contacts. In contrast, both groups of women, but especially poor women, said that these dissemination groups "eliminated social differences." The elite men in these groups may have dominated less well-off men, while not affecting women's groups, where they were not present.

In contrast, poor men and non-poor women assess MoARD most positively. This is of particular interest as MoARD's chief dissemination technology, the catchment area approach, was the only one used in both Luo and Luhya areas, and suggests that the differences we find here may not be affected by cultural variables. In Gongo, poor men ranked MoARD as high as 75 percent. However, their qualitative assessments of MoARD in the discussions were not especially positive, indicating that although MoARD was their preferred organization in relative terms, there is still considerable room for improvement. In contrast, non-poor women like it. They said, unlike other groups, that farmers were chosen equitably for assistance.

Differentiation of Dissemination Effectiveness According to Social Groups: Evidence from Quantitative Surveys

Cross-tabs were run to analyze whether the poor were as likely to receive information as the less poor from the different sources of information. Recall that three wealth categories were formed: (1) the ability of assets to meet basic needs (asset coverage), (2) index of household relative wealth levels, and (3) enumerator evaluation. The first two measures were converted into categorical variables with three wealth levels. For all three measures, the number of households in the highest wealth category is less than in the other categories (about 10–15 percent of all households). We show the results for all three wealth variables because they do differ somewhat in the way that they differentiate households (see Table 8.4).

In general, there are few statistically significant results. Farmer-to-farmer contact does not appear to discriminate at all across different wealth groups. Extension was similarly found not to favor the wealthy farmers, contrary to widely perceived beliefs. In fact, according to one wealth measure (household perception), extension actually favored the poorer groups in terms of direct contact. This lack of bias in government extension toward the wealthy sharply differs from the region's past. Between 1960 and the late 1970s, Kenyan development programs during the colonial and post-independence period favored wealthier farmers (Leonard 1991). This change is likely due to the current greater concern with poverty that induced both the government and donors to emphasize more farmer participation in extension. While our qualitative research also showed a lack of bias in extension toward wealthier farmers, it also found that poor and less poor farmers had different perceptions as to how they were affected by dissemination methods. For example, poor farmers felt they were disadvantaged in some aspects of group-based methods (see later).

For CBOs, NGOs, and ICRAF, there is some evidence that the more wealthy households benefited from direct contact for SFR information. For CBOs and NGOs, a positive and significant relationship existed for one of the three wealth indicators only (asset coverage for CBOs and enumerator evaluation for NGOs). At the same time, other wealth indicators showed evidence of the contrary. Thus, the data are not clear for these two types of organizations. The evidence seems strongest in the case of ICRAF, where a positive relationship between contact and wealth level is found for two of the three wealth indicators. For example, ICRAF reached between 42 and 47 percent of the wealthiest group of farmers but only about 23–25 percent of the poorest. It is not surprising that ICRAF tended to favor the wealthy more than others in these non-pilot villages in that their familiarity with the local population is the weakest of the different sources and the time that ICRAF could put into developing a village profile is highly limited.

Cross-tabs were also run to identify any patterns between awareness, information contact, and gender. No significant relationships were found between gender and information flow for the entire sample or by

Table 8.4 Percentage of households with direct contact for SFR information, by source and wealth group

	Wealth level		
Source and wealth indicator	**Highest**	**Middle**	**Lowest**
ICRAF			
Asset coverage	31.7	30.0	24.2
Household measure[a]	41.7	31.0	23.3
Enumerator evaluation[a]	47.1	28.4	25.4
NGOs			
Asset coverage	11.4	29.8	16.3
Household measure	20.0	17.1	13.6
Enumerator evaluation[a]	40.9	11.0	13.3
CBOs			
Asset coverage[a]	50.0	29.8	16.3
Household measure	20.0	36.0	23.3
Enumerator evaluation	18.8	38.3	19.0
Extension			
Asset coverage	22.2	14.1	19.5
Household measure[a]	0.0	22.1	17.2
Enumerator evaluation	14.7	17.0	20.1
Other farmers			
Asset coverage	12.7	17.6	11.7
Household measure	19.4	13.1	15.0
Enumerator evaluation	20.6	15.9	11.5

[a]Significant at .05 level or lower.

individual source. Thus, women do not appear to be discriminated against in receiving information. The reason may well be that women are, by and large, the major farmers in the study sites and men may often be absent from the farms.

Perceived Problems with the Approaches

Perhaps the main criticism of outside disseminators raised by participants in the focus groups is that they leave too soon: "What limits full implementation is that they are usually left before standing on their feet" (NPW, Gongo). Among all the organizations, only ICRAF is not mentioned as leaving too early, though in the case studies, ICRAF received the same criticism. In the focus groups as well, some residents reported that ICRAF, like the others, did not follow up with communities as they should have. MoARD, KARI, CARE, and KWAP were mentioned as leaving too early by at least one of the four focus group divisions (poor and non-poor, men and women) in each village. One of the consequences is that groups founded by these disseminators collapsed once the project ends, and residents feel resentful.

This is compounded because people feel disseminators do not allocate enough staff to their projects: "Since the extension staffs were few, the only staff allocated to the division could not reach out to every farmer" (PM, Sauri). Residents criticized all outside disseminators at some point for this. All of these methods emphasized smaller extension staffs and more use of local groups. In the

case of Gongo, for example, MoARD founded a number of groups, but lacked the trained staff to answer questions. In contrast, the one organization in Gongo that provided the most extension staff, the CDC (see case study in Appendix B) was by far the most popular.

Teaching and Dissemination Methods Employed by External Organizations

The last section introduced some aspects of dissemination methods because residents often do not separate their assessments of outside disseminators from the methods they employ. In the last section, however, we attempted to evaluate the popularity of disseminating organizations on the basis of their overall methodological package. It is also important to assess the specific methods outside organizations use and their popularity in these communities. These reveal another complex pattern of relationships that is again associated with gender and class, and to a lesser extent ethnicity. Specifically, people, and especially poor people, prefer a mixed approach of formal and informal methods. The following material draws on the focus group results.

Methodologies of the Disseminating Organisms

At first glance, the five approaches employed by disseminating organizations appear complex. Each of them has an extensive and well thought out plan for the communities. But these methods share a number of features and can be broken down into a number of small components that are responsible for their relative successes. As a result, they also share a number of problems that can be corrected.

Each of the dissemination approaches seeks to spread technologies by a combination of methods. Broadly speaking these all seek to correct widespread criticisms of earlier dissemination approaches that were found to be overly technical, to not listen to local people, to be insufficiently aware of local ecological and land tenure conditions, and to favor better-off farmers. Newer approaches sought to correct this by seeking to talk to farmers about their realities, determining whether the technologies were useful, and learning about farmers' conditions and needs. This was done through working with individual farmers and local groups that were to take on the work of adaptation and dissemination.

The methods used in western Kenya are described below. The common element is that all involve interactions between farmers and resource persons, the latter of whom are often researchers, staff of NGOs, or extensionists.

Demonstrations. These are training sessions designed to convey information about a specific topic and it is usually done by displaying how a technique works or through encouraging the farmers (trainees) to try out the skills themselves. The aim of this is to impart the skills to them. The skills taught in the demonstration could be very narrow, such as pruning of branches, or more general, such as management of pests. They could be conducted at a research station, but in western Kenya it is more likely that they are conducted in the villages, either at a researcher-managed plot or on a farmer's field.

Field Days. These are organized sessions where farmers meet resource persons, be they extensionists or researchers, to discuss important topics. Field days often involve both discussions and demonstrations on a set of technologies. They may be conducted at the farmers' fields, or at research or extension demonstration plots.

Farmer Tours. These are planned visits to one or more farms, usually by a group of other farmers. The idea here is for a farmer to demonstrate a farming technique and to train other farmers. The fact that such a practice is being undertaken successfully

by another farmer usually instills confidence in the trainees that they can also do the same on their farms. The visits are usually to farms where the farming practice/technique being promoted is working well. Several farmers, stations, or organizations may be visited at a time and the tour itself may last for longer than a day.

Farms/Farmer Visits. These are organized routine visits to see the farmers/farms where researchers or extensionists or development workers are undertaking some activities with the farmers for the purpose of monitoring and evaluating the performance of the farming practices/techniques that is being promoted.

Barazas. These are "official" meetings for the community called by a chief (government appointed administrator of a location) or a subchief (government appointed administrator of a sub-location) or any other provincial administrator. Some leaders call regular *barazas* that may cover a range of topics. Others may call special *barazas* to handle specific issues. New information about agriculture could be the subject of a *baraza.* In most cases the administrator calls the officials from different government departments and occasionally other development workers are also called to discuss important topics that are seen to be relevant and crucial to the community at that particular time. In most *barazas,* "the community is addressed by the experts."

Meetings. These can be formal or informal forums for interactions between different parties. They can be held in a meeting room or just under a tree and can also target specific individuals or be more open. For most of the meetings, one person is appointed to coordinate and moderate the discussions. Meetings are held to discuss upcoming plans, to resolve issues, or to monitor progress and identify needs.

Observations. While oral and written communication methods are important, first-hand observation is also key for learning to take place. Dissemination methods, such as farmer visits, tours, and demonstrations, are all designed so that farmers can observe how certain practices are done so that they may be more easily replicated on their own farms. Observation also takes place informally, where farmers observe the farms of their friends, family, and neighbors, or where farmers observe the fields of the "contact farmer," an individual experimenting under the supervision of an external disseminator or of members of committees of SFR-related local groups.

Oral Conversation. Oral conversation is the most common vehicle through which information is shared because it is the most flexible and responsive vehicle in which to handle a variety of information needs. Field technicians employed this daily to field questions from farmers and try to provide answers related to the management of agroforestry systems. Oral conversation is also the main communication method used in all other dissemination approaches, such as meetings, field visits, and so forth. Oral conversation also takes place informally among family members, neighbors, and friends.

Training. This is a general term that covers all aspects of training from group training to individual training. It occurs at all levels, since researchers, NGO staff, extension, and farmers have all received some form of training on agroforestry. Also covered under training is the production of training materials, such as extension guides. Training can involve other discussed dissemination methods, such as demonstrations tours and field days.

Exchange Visits. This is similar to a farmer tour, but one in which reciprocal visits are arranged. The most common one is where a group of farmers from Village A visits farmers in Village B and later on the farmers from Village B will visit those in Village A. These can take place across international borders and staff from research

centers or NGOs often accompanies the farmers.

Evaluation of Teaching Methods in the Focus Groups

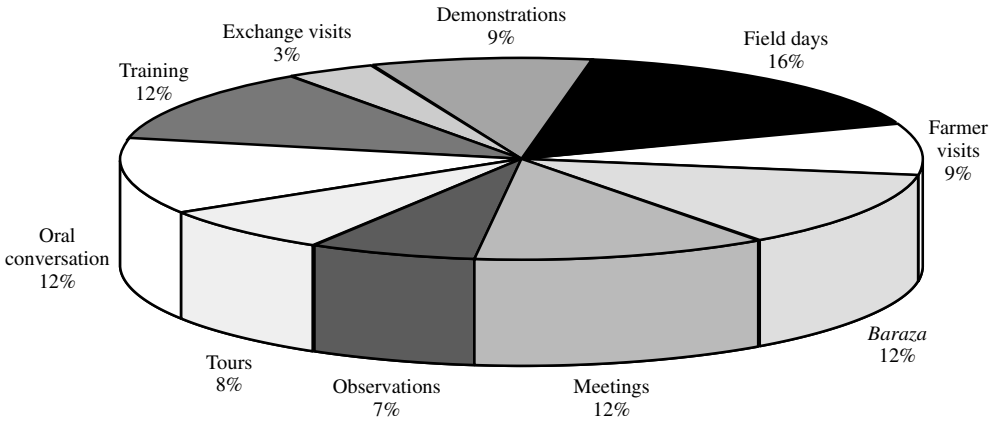
In the analysis of the PRA exercises that follow, the methods used can be categorized in a three-part typology of meetings, informal methods, and interactive extension methods. A special category of meetings is *barazas.* In all communities, external organizations entered through contacts with chiefs who called people to *barazas,* which are open to everyone in the community. Informal methods represent the oldest of the three categories. Farmers frequently spoke of learning about new technologies in one of two ways. They would observe their neighbors and copy them if they liked what they saw. They would also talk to their neighbors, and adopt technologies if the reports were positive. The third category, interactive extension, involves some traditional ways that outside organizations disseminate technology, although the way they are used in western Kenya often involves a more innovative dimension than the older conventional approaches. In these communities, farmers spoke of the field days, demonstrations, tours of model farms, and exchange visits with other communities as means to learn about new technologies. Residents also listed two formal extension methods: farmer visits by extension staff, and hands-on training of farmers by extension staff. These, too, are very popular in the studied communities, where some participants asked that more training be done through these individual farmer visits.

For the most part, the picture painted is one of information flowing mainly from disseminator to farmer, and less in the other direction. Most of the organizational maps showed one-way rather than two-way arrows. Even in Bukhalalire, where dissemination methods were most popular, most focus groups said that information mainly flowed from disseminator to farmer. However, some degree of farmer input was solicited in all approaches, and groups from at least three of the six villages mentioned this specifically: in Sauri, some participants reported that ICRAF allowed them to help develop the approach, and both poor men and women noted that ICRAF asked for their input in developing training manuals. In Mutsulio, disseminators (MoARD and KARI) were said to have asked for farmers' ideas and suggestions: "in the initial stages, when contact is strong, our ideas are usually taken into consideration" (PW, Mutsulio). In Mwitubi, contact farmers helped in developing training materials. It is likely that where contact farmers are used, they had input into the technology, although most participants in the focus group were not familiar with this process.

Taking the average across the 24 focus groups, the overall breakdown of preferences for dissemination methods is shown in Figure 8.4. People's perceptions of each of these methods are described below.

Meetings. Disseminating organizations normally enter the villages via the assistant chief, who holds a *baraza,* or mass meeting, open to all. *Barazas* are thus seen by residents as a very important method of dissemination, as it is the one from which they are most likely to be included. Slightly less popular in these communities are "general meetings," which are similar to *barazas,* except that they are called specifically by the outside organizations rather than the assistant chief. Disseminating organizations also encounter a range of local organizations, from church associations to women's groups to funeral associations, which they use as a means of disseminating technologies. Other organizations initiate groups for this purpose. Taken as a whole, meetings (be they *barazas,* general, or group) are a very common place for residents to receive information. Among the groups that list each method, meetings are ranked at 20 percent in terms of their usefulness and effectiveness; *barazas,* at 22 percent; and general meetings, at 19 percent. This is considered

Figure 8.4 Average preferences for dissemination methods used by external organizations in six villages



high, given that each of the formal methods receives a score between 15 and 5 percent. However, these scores are strongly influenced by two communities. Mutsulio ranked group meetings at 55 percent, or higher than all the other communities combined, and the median score for group meetings was about 15 percent. Rankings did not vary systematically by ethnicity for any of these three methods.

Rankings vary considerably owing to gender and income. Perhaps the most noticeable difference to emerge is that women score group meetings somewhat higher than men. However, case studies and focus group discussions indicate that women also feel marginalized in group meetings where men are present. It may be that in the scoring, women were considering women's group meetings. This difference, however, is most greatly influenced by poor men, who rank group meetings at 6 percent. This may represent the same point made earlier, that poor men may feel more excluded from group meetings due to the role of elite men. A similar difference, however, has a less clear explanation. Women rank *barazas* higher than men, at approximately 27 percent compared to 16 percent for men. No clear differences existed when these rankings were further broken down by non-poor and poor.

Informal Methods. Also highly important for dissemination of information from external organizations are methods that they do not have to plan. Non-poor women in Gongo said that "few people learn from formal ways . . . but many do so informally through observation on other farmers' farms or orally from other farmers." Among groups that included these methods in their scoring, each method received approximately 20 percent. As with other methods, these assessments vary by village, but less by ethnicity, gender, or wealth. These findings on the importance of informal methods support other studies that have found social networks to be very important to the diffusion of other types of innovations in the region. For example, informal women's groups were found to have facilitated adoption of birth control where cultural values and beliefs discouraged adoption, and where other programs had failed (Rodgers et al. 2001; Behrman, Kohler, and Cotts Watkins 2002).[35]

[35] Networks succeeded despite cultural values favoring large families, beliefs that oral contraceptives decrease women's physical beauty, and rules that prevent women from visiting outside their households. They even succeeded in spite of the fact that most women's networks that discussed birth control were very small, composed of three or four friends (Rodgers et al. 2001; Behrman, Kohler, and Cotts Watkins 2002).

The main way that farmers' assessments of these informal methods vary is by location, where informal methods are more important in Luhya communities. Mutsulio residents rank conversation at 41 percent. This is particularly important for men, who rank conversation at over 50 percent. Similarly, conversation is very popular in Mwitubi, although not mentioned at all in Bukhalalire. In contrast, no Luo community scores this higher than 15 percent. For the informal method observation, two Luo villages, Arude and Gongo, rank this at 21 and 22 percent, respectively. This might indicate a Luo preference for observation, except that Sauri ranks observation at 4 percent. No Luhya community ranks observation higher than 10 percent. As noted elsewhere in this study, it is difficult to conclude that there are ethnicity-based differences, though this would be worthy of further exploration.

No clear, significant pattern emerges from looking at different focus groups' assessments when gender and wealth are considered together across the communities. The possible exceptions to this are that non-poor men prefer conversations to observation by a score of 19 to 9 percent and poor women prefer observations to conversations by a score of 21 to 13 percent. This may suggest that non-poor men are most able to rely on their social ties for information of this nature. It also may suggest that poor women are more comfortable hanging back and viewing others before trying something themselves. Possibly this is because they have fewer social ties that they can use, and possibly it is because they are more reluctant to take risks, as has been established to be the case for poor farmers with greater degrees of vulnerability in many contexts. There may also be a factor of education and experience at play, where wealthier farmers may be more easily able to digest verbal descriptions and convert them to feasible plans. These figures are also consistent with the general assessments of observations by gender. Women rank them at 19 percent. Men rank them at 10 percent. However, it is not entirely clear that these methods occur separately, that is, people probably observe and converse at the same time. Nevertheless, people listed these as two different ways of receiving information, and gave them different scores in many cases.

Interactive Extension Methods. Among those focus groups that mentioned them, farmers claimed that, taken together, demonstrations, visits by extension staff, tours, field days, and exchange visits account for about two thirds of the useful information they obtain from outside sources. This is of interest because some of these are formal agricultural extension methods that are criticized in much development literature, although in western Kenya many of these methods have evolved to include innovative dimensions. Some of the weight given to these methods is attributable to the fact that there are more of them and they are mentioned in more villages. Nonetheless, these scores are important because they indicate that people like these methods, which is supported by the positive comments made in the focus groups. People found them especially likable as they allowed farmers to have direct contact with disseminators, and avoided the problems associated with groups and meetings. This reinforces the key challenge for dissemination—how to balance the need for engagement with individual farmers with the need to reach a large number of them.

No clear patterns exist in farmer preferences for these extension methods. They are somewhat more popular in the Luhya villages where, on average, they collectively score 10 points higher at 60 percent. The only notable difference was field days, which the Luhya villages collectively scored at 22 percent versus the Luo villages at 9 percent. But none of the other possible patterns of subgroups vary by more than 5 percent. Generally all farmers rate these methods at 15 percent. The exception is exchange visits, which residents hold responsible for 6 percent of their information, probably

suggesting that these do not occur often, rather than that they are not useful.

Ultimately, the most important finding to emerge from focus groups' discussions of these formal methods is that they are important and that local people value them a great deal. In some focus groups, people specifically said that they would prefer more visits in their homes, rather than group meetings, for example, non-poor women in Muhanda who said that "Meetings are too far away and people conduct business there instead of train. ICRAF staffs should walk from home to home, talk to people and hear their suggestions." Mutsulio also offers an interesting case: there, the PLAR approach was used that uses the least amount of traditional dissemination methods and places its reliance on local groups. Even there, formal extension methods were scored at 45 percent in terms of importance as a source of information.

Methods and Outside Organizations. The six communities in this study present a wide range of dissemination approaches, some of which are quite different. Nonetheless, all of them use a combination of group presentations, informal methods, and formal extension approaches to disseminate information. Furthermore, residents seem to like the combination. Rather than try to emphasize some at the expense of the others, for example, working through small groups rather than farmer visits or mass meetings, disseminating organizations will probably be most successful when they use this diversity of methods.

Some logistical problems were raised that can be easily solved. These included meeting times interfering with funeral and market days, dissemination staff arriving late, overly long meetings, and use of Swahili. In Sauri and Mutsulio, all four focus groups complained that participating in groups interfered with attendance at funerals or church services, since their meeting times frequently overlapped. Non-poor men in Sauri stated that, "lateness in attendance to *barazas* reduced the hours that farmers would have otherwise learnt while at the *barazas,*" as well as a number of other scheduling problems that may affect this method elsewhere. In Mutsulio, poor women noted that they interfered with domestic chores as the meetings could stretch for four hours. In Sauri, both non-poor groups commented that the use of Swahili, rather than local languages, limits understanding.

CHAPTER 9

Human and Social Capital Formation: Dissemination within the Villages

In each of the dissemination approaches, the external organization introduces technologies and conducts training. However, these organizations cannot reach all farmers effectively, and a range of local institutions can be used to further the process. Furthermore, one objective of these approaches is to build capacity within the villages, including human and social capital, so that residents can continue carrying out dissemination activities with other farmers, and eventually in other villages. This chapter looks at farmers' perceptions of the various internal methods of dissemination. It then examines the experience of the local groups intended to disseminate SFR, where these have been successful, and the types of problems they face. Two other internal methods of dissemination are then looked at more closely: the "contact farmer" method, and teaching through the schools. Finally, the chapter examines knowledge gained about SFR technologies—ultimately one of the most important measures of success in dissemination.

Forms of Dissemination in the Village: Local Groups, Contact Farmers, Schools, and Other Methods

There are several means by which dissemination takes place using local institutions. These were referred to in the focus groups as "internal providers." The sources mentioned in all six villages were *barazas,* other farmers, and schools, with some form of SFR group created or utilized by outside organizations mentioned in five. Local leaders were mentioned in four villages, and women's groups in three. The contact farmer was mentioned as a source of information in PRA exercises in only two villages, seen as useful in relative terms in Mwitubi, and not so in Muhanda-Arude. Funerals were said to be a source of information in Gongo, Mwitubi, and Bukhalalire.

Barazas are meetings called by the chief and open to all villagers. These are used by the external organizations for meetings and training activities. They are also used within the village for ongoing activities, and focus group participants always listed them as "internal providers." Other farmers are an informal source of learning, meaning that farmers teach each other either actively or passively as farmers observe each other's fields. Schools refer to programs that external organizations have normally initiated, where teachers or outsiders conduct training within the schools. Most commonly, the training is given to schoolchildren, who, in turn, are expected to do planting at home and to teach their parents. "Local leaders" refers to administrators, chiefs, and other leaders recognized within a given village. The contact farmer, also referred to in some interventions as an adaptive research farmer, is an individual chosen either by the external organization or by community members to use the technology

on his or her farm, with considerable assistance given directly to that farmer. This serves two main purposes: (1) the contact farmer experiments with using the technology under local biophysical conditions, discovering what works and what does not and adapting the technology along the way; and (2) other farmers learn from and are assisted by the contact farmer.

"SFR group" is not a term used by the disseminators; rather, we use it to refer to local groups that take on disseminating activities: actual names include village committees, catchment committees, umbrella groups, and others, and sometimes villagers just refer to them as groups or committees. They take different forms and sometimes overlap with other internal provider categories, for example, women's groups—either preexisting or newly formed through the intervention—may become the SFR group for women. Because of the importance of the groups within the different dissemination approaches, and the implications they have for human and social capital, considerable attention to the experience and evaluations of these groups is given.

Quantitative Assessments from the PRA Exercises

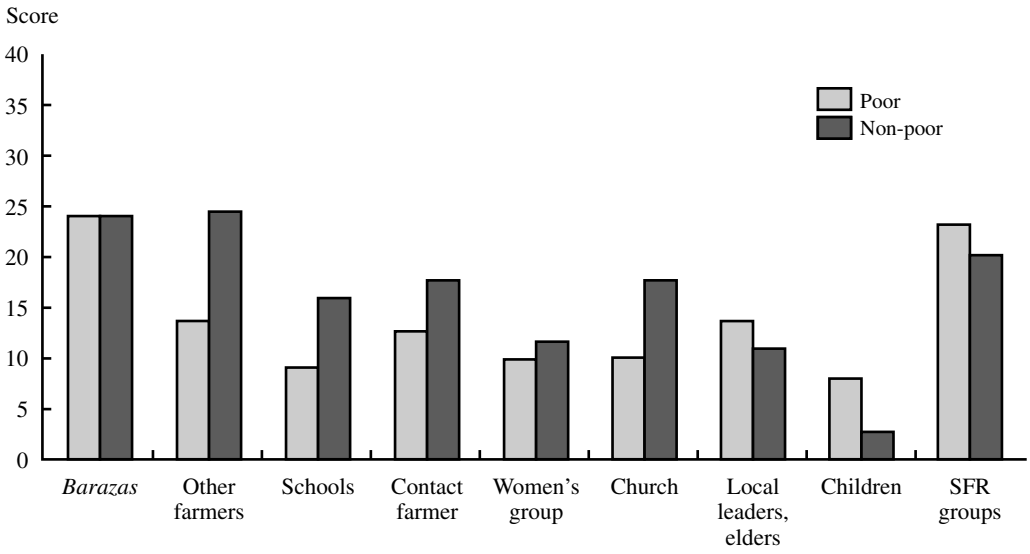
Aggregating all villages, there is not a great deal of variation in ratings of the importance/usefulness of these internal providers, ranging from 9 percent to 17 percent of total preferences. Contact farmers, *barazas,* SFR groups, local leaders, and other farmers were given higher ratings than church and women's groups and schools. *Barazas* rank the most consistently high across the villages. Only the two Luhya villages of Mwitubi and Mutsulio saw *barazas* as less important than at least one other internal dissemination method. On average across the six villages, there was no difference between non-poor and poor farmers, and *barazas* were only slightly more favored by men (highest rating) than women (second highest). The popularity of *barazas* can be understood in terms of their being community-wide meetings from which no one is excluded, and a forum that people are accustomed to attending. However, although residents score this method high and it is very good for imparting information, it is not good for exchange of information among participants nor is it particularly regular enough to really demonstrate and follow up with support for a new innovation.

The SFR groups were generally viewed as important sources of information across the villages, especially in Mutsulio, which reported groups as particularly important sources of information across all four focus groups. This is in spite of many problems reported with the groups (see later). The exceptions were Arude, which ranked SFR groups low, and Mwitubi, which did not mention them in the ranking exercise, although they did mention them in the discussion. Arude was the one village that ranked women's groups as important, however, indicating that the women's groups worked better than those for men. A more detailed discussion of findings on the SFR groups is found later in this chapter.

The only other source that Arude ranked highly was "other farmers." "Other farmers" implies an informal approach to learning where people learn from others in informal settings through observation or conversation. Non-poor men in Sauri also gave a very high mark to "other farmers" and to the schools. Non-poor men in Mwitubi had a particularly good impression of the church group. These last two findings probably reflect particularities of the villages rather than an explainable pattern (although they are consistent with the earlier findings on external methods).

Contact farmers were mentioned in the scoring exercise in three of the six communities, and only by poor men in Arude, by the women's focus groups in Mwitubi and Mutsulio, with low scores in the latter. Contact farmers are mainly mentioned as the entry point of contact for outside organiza-

Figure 9.1 Average assessments of relative importance of internal disseminators in poor versus non-poor focus groups

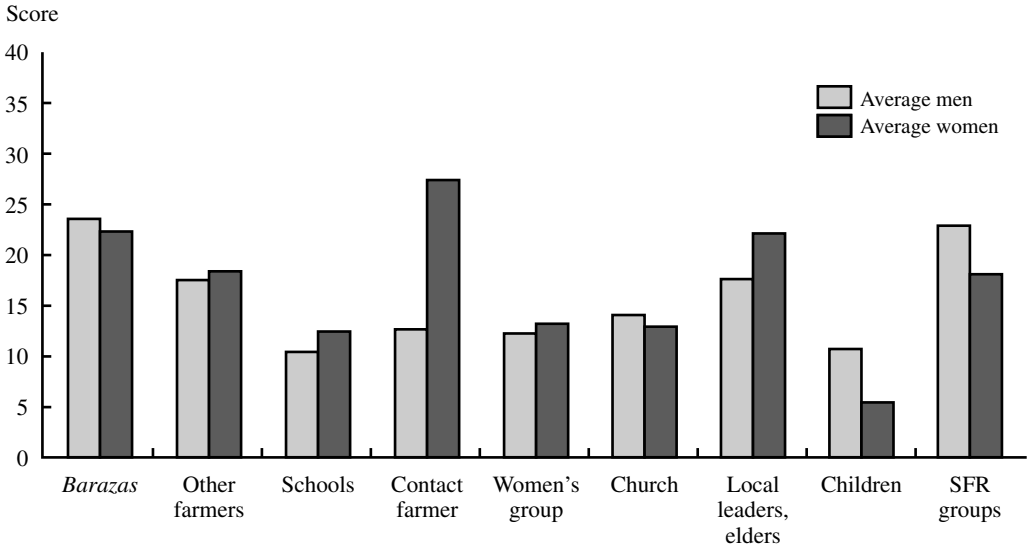


tions into the village. They are not credited with disseminating much information to other farmers. Three villages revealed specific cases of dissatisfaction with the contact farmer (in one of these, only the poor men's group), while the other three were positive or neutral. They appear in the organizational maps in Arude, Mutsulio, and Mwitubi, having links with either other farmers or groups in the latter two villages. Insight provided by the focus group discussions into people's perceptions of contact farmers, including their usefulness and tensions they introduce, are discussed later in this chapter.

Ethnic Group Differences. It is difficult to see significant differences emerging between the Luo and Luhya villages. Aggregating the villages by ethnic groups, there was no difference in overall evaluations of *barazas,* other farmers, schools, contact farmers, and women's groups. The only apparent differences were among women, where Luo women had stronger favorable views of *barazas* than Luhya women, though the difference was not great, and where some Luhya women had a good impression of the contact farmer, whereas women in the Luo groups did not even recognize them. Similarly, Luo women did not recognize local leaders/elders and children, whereas the former were given a high rating by Luhya women. However, not too much should be read into this, given that only three villages per ethnic group are represented. The villages were stratified by ethnic group to see if any striking differences emerged, but we cannot draw conclusions based on the evidence found.

Wealth Group Differences. Turning to aggregations by non-poor and poor farmers, there was little difference between these groups in evaluating *barazas,* SFR groups, contact farmers, women's groups, and local leaders/elders (Figure 9.1). However, non-poor farmers evaluated "other farmers," schools, and church groups more favorably than did poor farmers' groups, on average, and poor farmers had a more favorable evaluation of the role of children. Non-poor women generally have more favorable reviews of the internal disseminators than do poor women. That was the case for all

Figure 9.2 Average assessments of relative importance of internal disseminators in men's versus women's focus groups



categories except women's groups, church groups, and SFR groups (where there were equal rankings across wealth status), and poor women rated local leaders/elders more favorably. This suggests that the group-based approaches are working well for poor women, where they feel less excluded than they do from more conventional approaches involving *barazas,* other farmers, and contact farmers. Non-poor men tend to favor other farmers, schools, women's and church groups, and local leaders more than do poor men, whereas poor men favored *barazas,* schools, and SFR groups (not greatly) compared to non-poor men.

Gender Differences. In the aggregate, there were strikingly few differences in the evaluations of men and women, suggesting that these methods were not discriminating based on gender. This is also consistent with the survey findings (Figure 9.2). The main exception is the contact farmer, where women gave a score of 27 compared to men's scores of 12. If the contact farmers were men in these villages, which is implied in the focus group discussions, it may be that women did not feel as competitive toward them, and were less affected by the amount of attention they received from outsiders, which was one of the two main complaints against them. It could also mean that women did not expect as much from them or knew less about their function, so that they were less disappointed in the contact farmer not sharing information, which was the second main complaint against them. SFR groups were slightly more favored by men than women, which may reflect men's greater participation in these groups. The picture changes, however, when men and women's groups are disaggregated by wealth groups. Poor men significantly favor *barazas,* schools, and SFR groups more than poor women, whereas poor women prefer the contact farmer, women's and church groups, and local leaders more than poor men. This suggests that gender differences are greater among poor farmers than among women and men as an undifferentiated group. However, there is less difference between non-poor men and non-poor women, with the only significant difference being the contact farmer, which receives a rating of 35 from non-poor women but a 0 from non-poor men. Church and SFR groups also

get a somewhat higher rating from non-poor men than non-poor women.

Other Findings Related to Particular Groups and Villages. Among the villages, other ratings that stand out (40 or over) are in Gongo and Bukhalalire, where poor men gave notably high ratings to SFR groups as compared to the other groups in the village; in Mwitubi, where a church group was particularly popular among the non-poor men; and in Sauri and Arude, where the women's groups were successful in the eyes of poor women. Non-poor men in Sauri had a very favorable impression of the schools program, of other farmers, and of the contact farmer. Finally, non-poor women in Arude rated other farmers with a 70.

It is also worth pointing out the case of SFR groups in Mutsulio, where they were ranked high by all four groups and given a score of 80 by poor women, and in Gongo, where they were given ratings of over 40 by poor men (compared to the average of around 10 for the other three groups), and Bukhalalire (where the average for the others was closer to 20). Notably absent is any mention of SFR groups in Mwitubi.

The Importance and Performance of the Local SFR Groups

As discussed earlier, each of the dissemination approaches used across these six villages relies upon local groups for disseminating the technology across a wide group of farmers, and for ensuring sustainability. For this reason, community perceptions of the local SFR groups (hereinafter "groups") warrant more detailed discussion. Focus group discussions focused heavily on issues surrounding groups, in part because of the questions asked and in part because participants had strong views on these groups. These groups were ranked as a relatively important source of information, but they have also experienced many problems.

Access to the Benefits of SRF Groups: Group Participation and Training by Group Members

In most cases, the groups were said to have provided benefits to their members. However, in most villages they appear to be providing little information to other farmers. One problem is the lack of participation in the groups, either because of self-exclusion or exclusion by group members. Low levels of participation directly in the groups would not be as large a problem if the groups were conducting dissemination activities with other farmers as envisioned. The second problem, however, is the lack of training and dissemination carried out by the groups to other farmers. Five of the six villages reported one or both of these problems.

In Muhanda, both men's focus groups said that the local groups introduced social tensions, attributed to the fact that some village members benefited from the groups while others did not. Low levels of participation were reported in the groups, and the groups were said not to have disseminated to other farmers. This is confirmed by the absence of any linkages drawn between the groups and other farmers in the organizational mapping exercise. Non-poor women showed a strong two-way information flow between a women's group and their relatives, although neither focus group showed a link between the groups and other farmers. In the discussions, however, women were more positive about the experience with groups and their potential for the future. Women report having benefited financially from the women's groups formed through the CARE intervention, although these groups did not last after CARE left. Non-poor women, however, did say they would like to have women's groups dealing with agriculture, and that women's church and welfare groups also serve as agriculture groups in some cases, for example, contributing maize and beans for funerals. It is possible that, especially under conditions of an AIDS crisis, groups are strained for

resources and members strained for time, and those with simultaneous welfare functions, as well as those more established and thus more cohesive, may be more enduring.

In Gongo, a more complicated picture emerges from the experience of groups. Here, poor farmers said they were less active in the groups than non-poor ones, and in the focus groups only non-poor men and women showed links between groups and farmers. At the same time, in the scoring, the groups were said to be the most important internal source of information for poor men. This might imply that poor residents have less access to initial introductions of information by disseminating organizations that deal with groups, and that information filters through groups to the poor. In the organizational map, poor men showed MoARD as responsible for many types of training, but not with direct links to groups or farmers; poor women did show a weak two-way link between MoARD and groups. Non-poor men and women drew strong two-way interactions between MoARD and both internal groups and community members. In Sauri, residents scored group meetings as comparatively less important as sources of information. In the discussions, rather than saying that the groups did dissemination, the men's focus groups mentioned that members "lead by example." This implies that group members adopt technologies and that others are intended to observe them. This is one of the intended means of dissemination, but group dissemination activities are intended to go beyond this. It is important, however, to note that three of the four groups' organizational maps (the exception was poor men) showed strong two-way links between groups and other farmers, implying that dissemination was taking place. Additional positive outcomes of group activities did emerge, however, which are reported later in the section on social relationships. An additional issue emerged in Sauri concerning men's dominance and its effect on women's participation in groups. In the focus groups, poor and non-poor women said they felt intimidated by men at groups, and that this limited their ability to learn from them. This reiterates the importance of having separate groups for men and women.

The issues emerging from comparing Luo and Luhya villages were similar in both positive and negative findings. This indicates that groups were not necessarily a more effective means of disseminating locally within one ethnic group more than another, as was initially thought might be the case. For instance, in Mutsulio, a Luhya village, the groups formed through the PLAR methodology are visible and ranked as an important source of information compared to other villages, especially by poor women who gave them a score of 70, and who commented that "committee members participated very much in organizing and mobilizing farmers." In the organizational maps, it is also the women that showed links between groups and farmers. Three of the four focus groups said the groups were effective, with one saying that the groups were continuing with their work after the external organization left, and motivated to work harder as yields increased. Nevertheless, in the discussions, group members were said to have disproportionately benefited from the process. Most other farmers in the communities were said not to participate in the groups, and those that do are the better off. Poor men note that they do not have enough land to become group members. As in Sauri, observation of group members' fields was the main way in which the groups approached dissemination: members were said to "envision commitment and hard work as ways to spread technology, so that other farmers can observe the technologies as practiced by the committee members." Three of the four Mutsulio focus groups reported that the committees did not talk to farmers as much as they said they would, and often ignored their requests. Interestingly, while women rank groups highly as a source of information, they also say that the groups are forums for men or are dominated by men. Non-poor women expressed reluc-

tance to participate for this reason, again affirming the value of separate groups for men and women.[36]

In Mwitubi, women had more positive evaluations of the groups, whereas men tended to have a more negative view. In the organizational maps, three of the four groups showed links between the groups and farmers, although oddly only the men's group mentioned women's groups (poor women emphasized church groups) and only poor women mentioned the catchment committee. In the discussions, however, all four focus groups were familiar with the village committees, and there were no indications of greater or lesser access to the committees, with the exception that non-poor women thought that farmers with more money were the ones who participated in committees and groups. However, both men's focus groups said that the committee did not teach or advise other farmers, although poor men said that village committee members had trained their children, neighbors, and friends. Women's views were different. Non-poor women indicated that the committee catered to farmers' needs, and that members reached out to nonmembers with information and the latter were eager and willing to learn. Poor women indicated that non-committee members gain skills by observing trials on members' farms. Women saw new SFR groups, in particular women's groups, as critical to extension and argued that some have taken up that role and were disseminating with the support of the chief and his assistant. Women come across as pragmatic in their views of and contributions to extension work in the community. It is women's groups that turn out to be continuing with dissemination work and not the village committee, although the latter had been formed for the sole purpose of dissemination. This suggests a finding similar to that in Muhanda, that existing groups seem to work better than new ones formed for this intervention. With regard to groups, there were no major differences of opinion between poor and non-poor participants of either gender. Bukhalalire presents a very different picture from the other villages. All maps show the umbrella groups, and though more links are shown with schools than directly with farmers, the discussions reveal considerable success with the use of groups. Moreover, it is the only one of the six villages that reported that groups were involved with dissemination outside the village as well as inside, which is the long-term goal of ICRAF and its partners in the SFR interventions. It is not possible to know the extent to which this success is a result of the umbrella group approach, or a more socially cohesive community, although probably both factors play a role. According to participants, preexisting groups were involved and new women's groups were formed through the intervention, and across villages the groups elected representatives to the umbrella group committee that coordinates activities throughout the catchment. There does not appear to be visible gender- and wealth-related differences. Benefits from the group were said not to depend on one's social or economic status and benefits were said to have been equally accessible. All four focus groups described training and dissemination that the groups were carrying out, inside and outside the catchment, to other groups and schools. Women were particularly descriptive and vocal about the group's activities. Non-poor women said that the umbrella group is useful in dissemination through demonstrations and field days, and that neighboring villages learn from them informally and through attendance in dissemination sessions. Poor and non-poor women said that nonmembers of the umbrella groups

[36] This finding on the effectiveness of women's groups for reaching women is supported in the studies referred to in Chapter 8 (Rodgers et al. 2001; Behrman, Kohler, and Cotts Watkins 2002) on the importance of women's informal networks.

attend and learn in the field days, which they organize without staff of external organizations. Participants were also of the view that farmers had been involved in developing training materials and that the groups had continued with dissemination work.

Social Capital, Social Relationships, and Power

One of the study hypotheses[37] was that dissemination through local groups will enhance a community's social capital—the social networks, relationships, and organizations that facilitate access to resources, provide support, and otherwise enhance the well-being of the village and individuals who participate in them. Conversely, it is possible that the groups introduced new social divisions. A second, though weaker hypothesis, was that the SFR interventions, including the training and group-based, might increase the confidence of farmers, leading farmers to make more demands of the groups and groups to make demands on external institutions. At the same time, it was hypothesized that the interventions and group-based activity could possibly reinforce or alter existing power relationships within the village. The exclusion of some people from the groups as discussed in the previous section is one way in which power relationships were expressed, though these might be reassertions of preexisting power relationships or indications of new ones. Because the issues of social relationships, empowerment, and power are also closely related, they are addressed together in this section.

Many of the villages reported that group activities related to the SFR interventions had increased community solidarity in certain respects. In Sauri, all focus groups mentioned that the new groups had brought the community closer together in some way. However, all focus groups except non-poor women implied that local elites were stronger as a result of these groups. It may be inevitable that to some extent, local elites will dominate groups, especially new ones formed for managing new resources. At the same time, the interventions in Sauri also had the effect of increasing farmers' confidence —a comment made by all groups except non-poor men. According to focus group discussions, local people were instrumental at changing a number of dissemination practices, including "demanding" that local committees bring in other technologies such as dairy cows, that the area committee send members to other villages to learn about technology, that ICRAF exert influence over local committees when their rules were not acceptable, and that meetings be held when no funerals or markets were underway.

In Muhanda, poor men said the extension activities had brought the community together. They also, however, emphasized the importance of making a greater effort to bring the entire community together for initial introductions to the intervention, so that some people do not get excluded (this is directed more to the external organizations than the groups). However, both men's focus groups said that the local groups introduced social tensions and politics, attributed to the fact that some benefited and others did not, the extra attention that some farmers had from the external organization (in particular, the contact farmer), uneven distribution of resources, the ability of some to amass wealth through the process, and conflicts over resources. Women's groups formed by the CARE intervention created new forms of social capital, but collapsed after CARE left, in part because of financial mismanagement, which created new social tensions among the women affected.

[37] The study did not work with explicit hypotheses; rather it asked a set of research questions. Nevertheless, questions about whether social capital is enhanced through the use of groups imply a hypothesis that it might.

In Gongo, poor and non-poor residents had different views of the impact of the groups on social relationships. Non-poor men and women reported that the presence of the groups in the communities strengthened local solidarity. These views must be seen within the context of existing power structures within the village. Twelve members of the groups formed by MoARD were chosen from each of the clans living in Gongo. In practice this meant that clan elders were selected. Thus, those serving in the groups were likely the oldest, wealthiest, and most powerful residents. This may explain why poor men and women reported that local groups were chosen unfairly, and asked that this be remedied in the future. Non-poor men and women acknowledged that group members get benefits first, and that they give these benefits to their close kin before others.

In Mutsulio, the dominant picture that arose was of better-off farmers as the most common group members. Poor men noted that they feel a great constraint to participating in groups, since they do not have enough land to become group members. In Mwitubi a mixed picture arises with marked gender differences. Non-poor women expressed that dissemination had brought farmers closer together as a result of "sharing in on-farm technology trials" and that the technologies "united the farmers." Men participants were generally of the view that interventions through the groups/committees led to alteration in community power relationships. Poor men, in particular, pointed to the misunderstandings caused by the fact that outside institutions visited some farmers often and not other farmers. Women participants saw the situation less as one where people acquired status through the groups, but rather that those who joined already had status. This makes sense as the propensity to seek community leadership positions often hinges on the socioeconomic status of an individual. However, poor men appear to have acquired some power through the process, reporting that farmers made demands on the committee when it was active and the committee, in turn, made demands for extension services on MoARD.

All four focus groups in Mwitubi mentioned conflict within the groups, particularly related to rivalry among the leadership. Non-poor men added that failure of committee members and extension staff to visit farmers was another source of conflict. However, all the groups appear to agree on the fact that the extension interventions led to competition and conflict in some ways and to cooperation and cohesion in others. Overall, the participants seem to have viewed the emerging conflicts and competition more as learning points than as negative sides of extension. One group looked beyond the life of the dissemination intervention to argue that farmers interact closely even after the external disseminating organization had left.

In considering the effect of the umbrella group approach to dissemination on community social relations in Bukhalalire, participants across the spectrum agreed that the approach had brought community members closer together. Poor men said this occurred through "discussing and exchanging information about the various technologies" and that they "now work mostly as a team." The participants also indicated that the groups did not favor those of any particular social status; rather that benefits of the technologies depend ultimately on how hard one works. The umbrella group approach appears to have supported the evolution of a cohesive community that strove to be self-reliant through intracommunity exchange of information.

The Contact Farmer

As noted earlier in this chapter, contact farmers are mainly seen as the point of contact for outside organizations, and not much more was said about them in most of the villages. Focus groups in three of the six villages indicated problems with the contact

farmer method (although in one, only poor men were critical). Although most groups were positive about the method, they provide important insight into unintended social consequences that dissemination methods can have. First, the contact farmer was seen as unfairly receiving too much attention from external organizations and thereby gaining too much power: "model farmers gained more prestige and control over other farmers as they trained them." Second, contact farmers in two villages were not seen to have shared information with other farmers. In one village, non-poor men said that no efforts were made to extend the technology to the rest of the catchment members, no field day was done, and the rest of the catchment members felt excluded. Although they could observe what the contact farmer was doing, they did not copy and adopt what they observed because they were not sensitized to believe that what was being done was for their own benefit.

In another village the experience with the contact farmer left an unfavorable impression with three of the four groups (the exception was non-poor women). They were seen as (1) unfairly favored and (2) keeping knowledge to themselves rather than spreading it among others. Poor and non-poor men stressed that the contact or adaptive research farmers do not share information, and according to the better-off men, they are seen as "the wealthy and educated who are frequently visited and make others feel left out and different from the preferred farmers." The constant attention from government and other institutions is said to be a problem. There was also the perception that the contact farmers were selected by the external institutions, although according to the organizations, they are to be selected by the villagers. Poor women criticized the contact farmer for not sharing seeds, saying that people waste their time trying to get things from them. However, both groups of women saw one CARE contact farmer in a positive light, recalling that he helped with training and, more significantly, brought women together to form women's groups to promote the technology.

Notwithstanding local perceptions in some villages, it is important to recognize the role of the contact or adaptive research farmer from the perspective of the disseminating organization. As CARE points out in its TRACE approach, technologies that work in one region may not be adapted to a new region. Adaptive research farmers are crucial for testing technologies and practices and adapting them to local conditions, before they are disseminated to other farmers. There may thus be a period in which there is considerable contact between the ARF and the external organization, before many other farmers are brought into the process. It is equally important, however, to recognize that the social context will affect outcomes, and that this method as currently practiced is clearly problematic, given local social relationships, and has significantly affected the way in which people respond to the external organizations as they introduce technologies. It may be necessary then to bring the community more widely into the learning process at an earlier stage, to make sure people understand the role of the ARF and approve of the choice.

Dissemination through the Schools

The schools' approach to dissemination is hinged on the premise that students would go back home to practice what they learned in schools and may influence or train their parents and communities to adopt learned technologies. Therefore, some of the disseminating organizations working in western Kenya made specific efforts to reach schoolchildren with messages on agricultural technologies. In each of the villages under study, there was evidence that schoolchildren had been reached with dissemination messages by one organization or another. The organizations mentioned as having reached the schools with dissemination include MoARD, KWAP, CARE,

KARI, Action Aid, and Africa NOW. MoARD and CARE reached the schools mostly through 4K clubs; KWAP and Action Aid Kenya, through the umbrella groups; and Africa NOW, directly. Although several technologies were disseminated to schools in respective villages in a variety of combinations, tree nursery establishment/management and tree planting were the main focus of the schools approach across the villages. Only in Gongo and Sauri villages were soil and water conservation, and potable water harvesting, respectively, disseminated in addition to messages on tree growing.

After learning the various technologies in schools, students made efforts to train their parents on the same, albeit weakly in some instances. For example, the poor men's focus group in Gongo village said,

> The extension approaches reach schoolchildren from primary to secondary schools and had been done normally through 4K clubs or by the organizations themselves by introducing tree nurseries in schools. Students also train their parents on what they have learned from the schools such as the planting of trees, which was introduced by CARE to the schools. Parents learn what is happening in the schools through their children and have not trained anybody because schoolchildren do not deeply and adequately explain acquired technologies to their parents and some parents do not have children in schools.

In Muhanda, where CARE also promoted school programs, the women's focus groups said that children came home, made vegetable gardens, planted trees at home, and trained their parents in kale and tomato planting. Children are said to still be practicing what they learned.

Where students have not made specific efforts to train their parents, the latter "learn through observation in the school compounds" as the poor men's focus group in Bukhalalire village put it. Parents' learning by observing the school farms appears to be weakening over time because, as the non-poor focus discussion group in Gongo village said,

> In the past when there was any occasion in school, parents were taken round the school so that they could see what their children planted. These days, parents are not learning anything from school because even when they attend any function in school, they are not taken around to see the ongoing projects.

The poor women's focus group in the same village argued that children reach their parents with the technologies learned by practicing the technologies at home, "although they hardly convince their parents to adopt the technologies." Students had tried at home such technologies as kales and tomatoes growing in Muhanda and Bukhalalire villages, and had earned income from selling their produce to the community. Where the school approach was not in place, such as in Mutsulio village, no agricultural knowledge flowed from the schools to the community and students did not practice any agricultural activities of their own at home. The woodlots established in the schools still existed as at the time of this study and schools had reaped benefits by selling trees in some of the schools. In Sauri village, the non-poor men's focused discussion group argued, "parents only know the outcome of sale of trees when called upon during parents' meetings and the school committee informs them as parents." The income earned was used to pay the school watchman and buy pieces of chalk. In Muhanda, Mwitubi, and Bukhalalire, focus groups were agreed that the trees were a source of income and building materials for the schools.

The major challenge identified with the schools approach was that in some villages, students hardly convinced their parents to adopt technologies. This is because parents looked at the students as children from whom

no serious idea could originate. In addition, it was argued that formal agriculture lessons in the schools were theoretical and lacked practical exposure, so that students had nothing tangible to disseminate. Another challenge was that livestock from the neighborhoods of some schools destroyed trees in the schools.

Overall the schools' approach to dissemination appeared effective in the medium to long term as it put agricultural knowledge at the fingertips of tomorrow's farmers. This way the next generation of farmers would be better trained. In the short run, the approach has shortcomings in that not all parents in the farming community have children in school so as to be reached with the approach. Moreover, in an African rural setting where children are considered ignorant and have no established forums for discussion with their parents and other adults in the community, the flow of information from students to their parents and communities is largely hampered.

Knowledge Acquisition

Although focus group participants have varying opinions of disseminating organizations and their methods, the best measure for assessing the performance of these organizations is the amount of knowledge people gained through the dissemination efforts. Participants report that they learned a great deal about technologies, and are generally consistent in this assessment. Like all other factors, however, knowledge gain varies along with community of residence, gender, and wealth. Equally important is that people improved themselves personally in a variety of ways, owing to their knowledge gain.

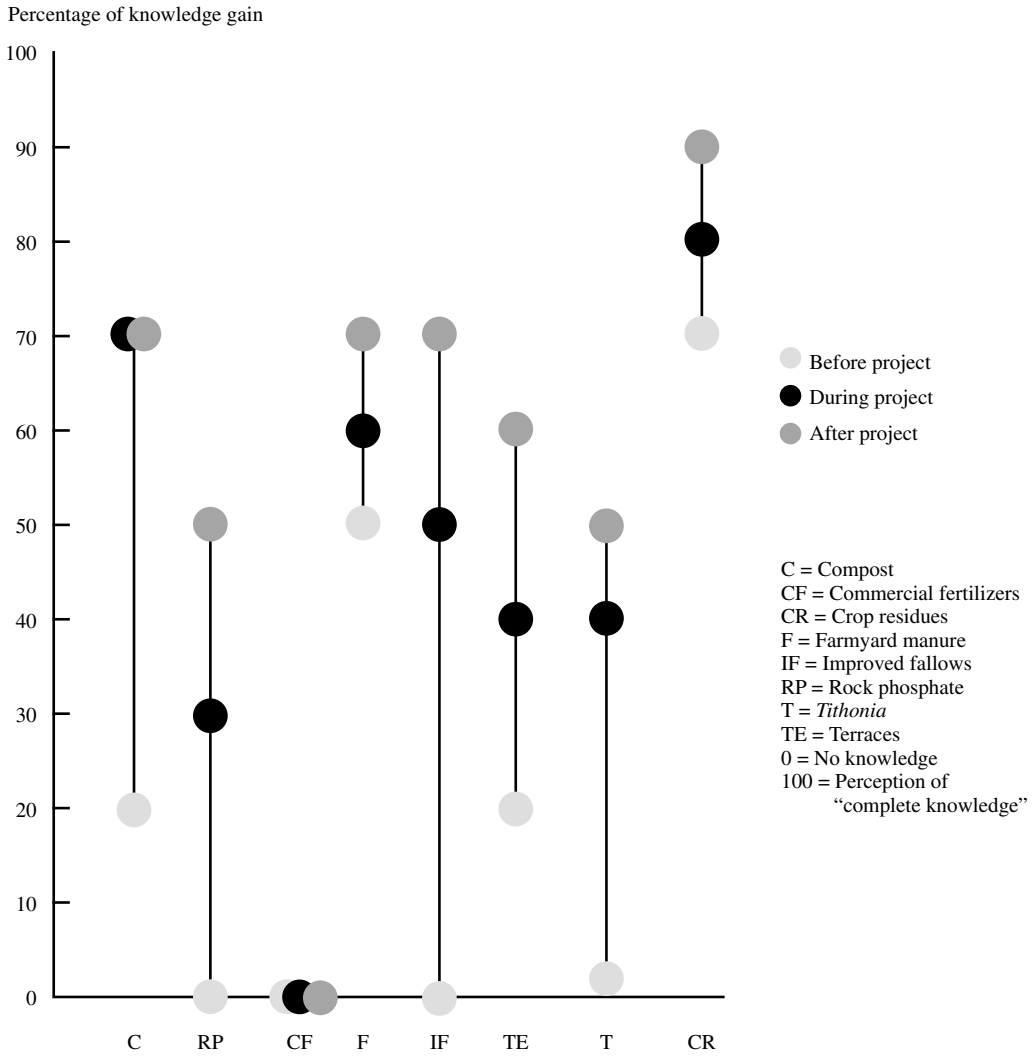
Technologies Introduced

Villagers learned about many different agricultural techniques and technological innovations. In Sauri, for example, residents learned about schemes to grow and market sunflower seeds, maintain rabbit warrens, use household rubbish as mulch, and keep *koi* ponds. A more typical example is Gongo, where residents learned about building latrines, malaria prevention, and sanitizing drinking water. All the villages in the qualitative dissemination study were exposed to a wide range of SFR technologies, with a total of nine mentioned across them. Of these nine, seven were mentioned in all six villages studied, a finding made more interesting by the fact that the focus group participants themselves generated the categories. Everywhere, people mentioned *tithonia,* farmyard manure, compost, commercial fertilizer, rock phosphate, improved fallow, and terraces as SFR technologies. One of the remaining two, crop residue, was mentioned in all communities except Arude. The final technology, alley cropping, is mentioned only in Bukhalalire, because it was introduced only there. The consistency with which the same technologies were mentioned across the villages and the high scores for knowledge gained indicate strongly that people know about and learn about the technologies that organizations introduce.

Knowledge Gained

As described in the previous chapter, focus group participants used "ladders" to indicate the amount of knowledge on the technology they had before the intervention, the percent increase after the intervention, and the percent increase (or decrease) between the end of the intervention and the present. A score of 0 means no knowledge and 100 percent means full knowledge. Figures 9.3, 9.4, 9.5, and 9.6 show graphic representations of the ladders exercise for four focus groups. Figures 9.3 and 9.4 compare results within Sauri village across poor and nonpoor women. Figures 9.5 and 9.6 compare results within Mutsulio village across poor women and poor men. Focus group participants already divided by poverty level and by men and women were further divided

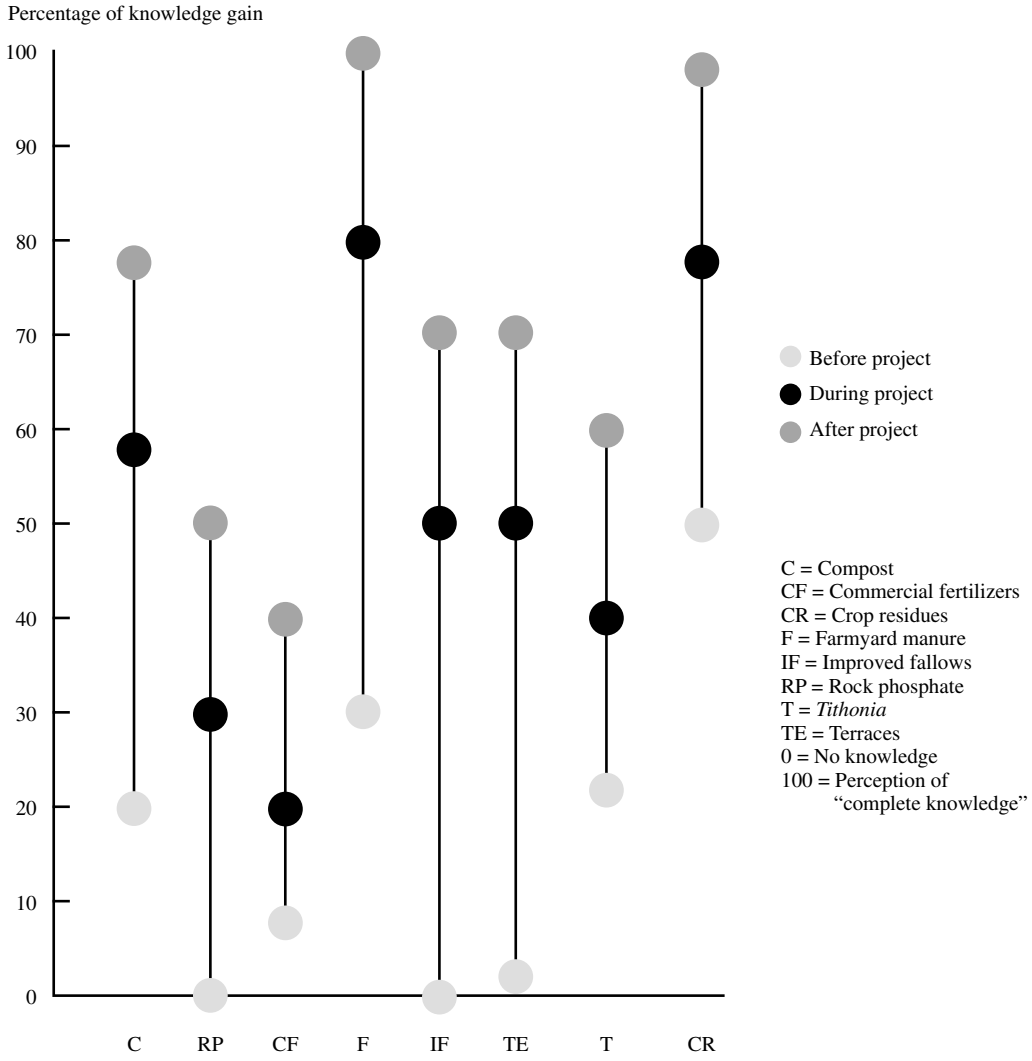
Figure 9.3 Sauri poor women's group: At least four years of primary education



according to education levels.[38] Most results reported here aggregate these groups' answers, except where significant differences emerged, which are reported in the section on "education levels" below. Figure 9.7 shows average knowledge gain (across the four focus groups) in each village for each technology. The most surprising finding about the amount of knowledge gained is its uniformly high level and its consistency. Although the range is from 33 percent to a massive 76 percent, the last number is for alley cropping, a technology that was only introduced into one community (Bukhalalire) but appears to have been extremely successful in terms of what people learned. More typical figures come from other technologies. Total knowledge gain on these

[38] In the analysis, no education was combined with up to three years of primary education, considered to be "less educated." Those with four years of primary education were combined with those with secondary education, considered "more educated."

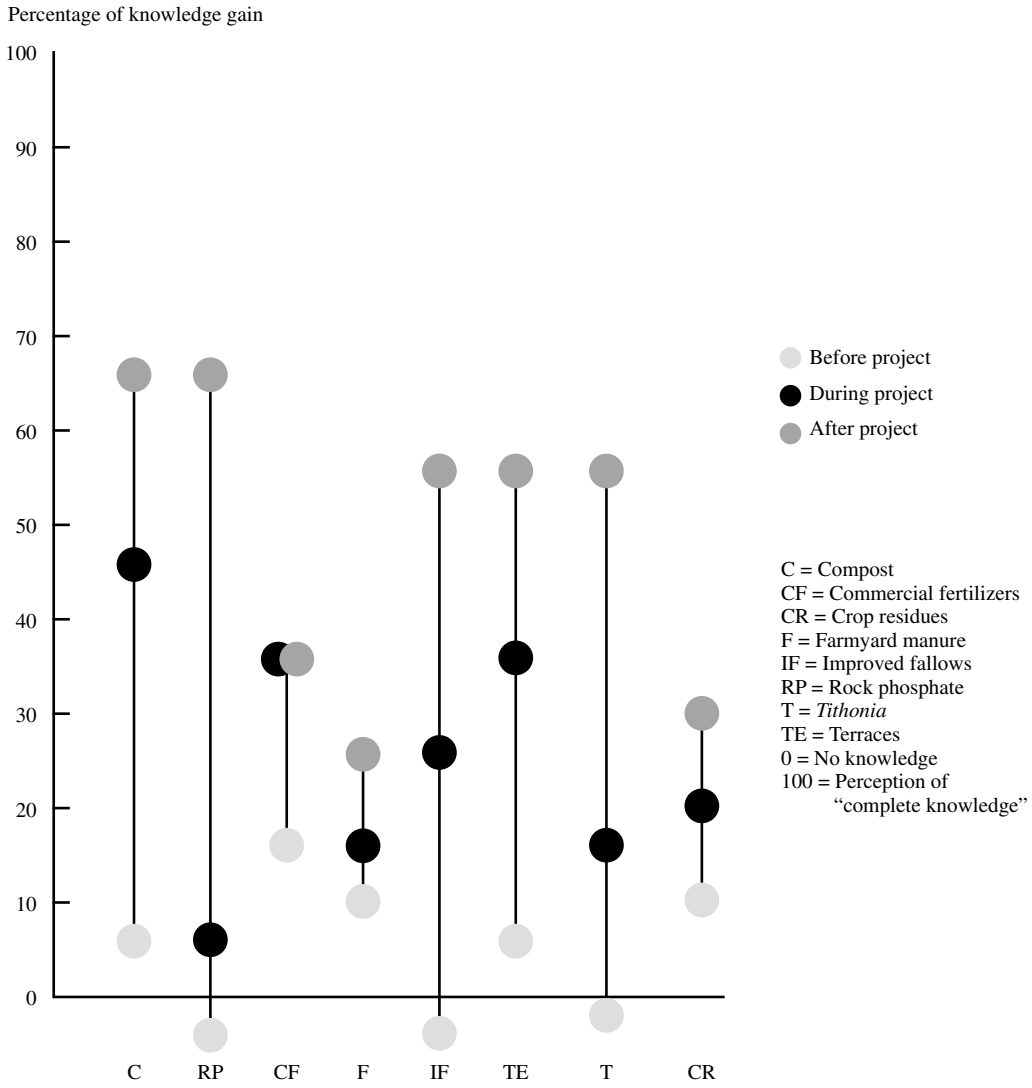
Figure 9.4 Sauri non-poor women's group education level: At least four years of primary education



varies between 33 percent for rock phosphate and 54 percent for crop residue and terraces. Most are clustered around the mean of 49 percent knowledge gain. The two lowest scoring technologies are rock phosphate and commercial fertilizers, but even here participants claimed to have increased their knowledge by 33 percent and 39 percent, respectively. These lower levels of knowledge acquisition are likely to reflect the fact that these technologies are more difficult or expensive to obtain, and fewer people have much experience using them.

High levels of knowledge growth were achieved in terracing, which in Kenya usually involves leaving a vegetative strip in place (i.e., not plowing all the land) that forms a terrace. Average knowledge gain was 53 percent with no village gaining less than 43 percent, indicating that those organizations that promote it, particularly CARE, are doing so to great effect. For the two technologies of primary interest to this study, *tithonia* and improved fallow, knowledge gain was around the average for the other technologies, at 51 and 45 percent,

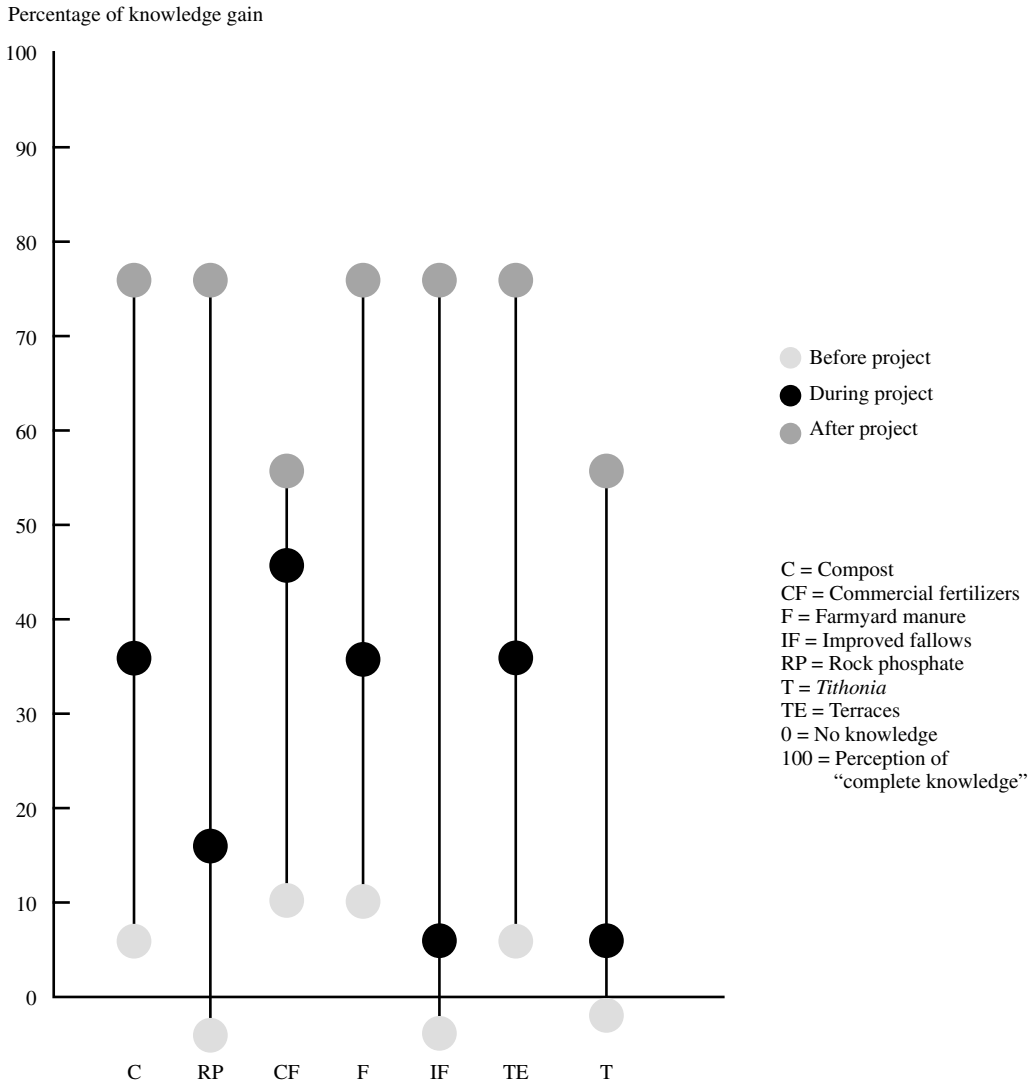
Figure 9.5 Mutsulio village—poor women: At least four years of primary education



respectively. Knowledge gains on these technologies for all villages are summarized in Table 9.1. The highest increase was for Bukhalalire, at 61 percent and 69 percent, respectively. The average was brought down by one village, Gongo, at 14 percent and 7 percent, respectively. In Gongo, poor and non-poor men's focus groups reported problems with the technologies: that *tithonia* was too labor intensive and improved fallows required too much land. Both also expressed that the disseminating organization did not adequately respond to these concerns, and this caused negative evaluations of the experience and the conclusion that little was learned about these technologies. In fact, as noted in Chapter 6, very few farmers were using the agroforestry systems. This points to a relationship between good two-way dialogue between disseminating organization and farmers, on the one hand, and ability to learn about the technology, on the other.

All but 4 of the 24 focus groups reported that before the intervention they had no knowledge at all of either *tithonia* or improved fallows. Although scores of pre-intervention 0's are common for other

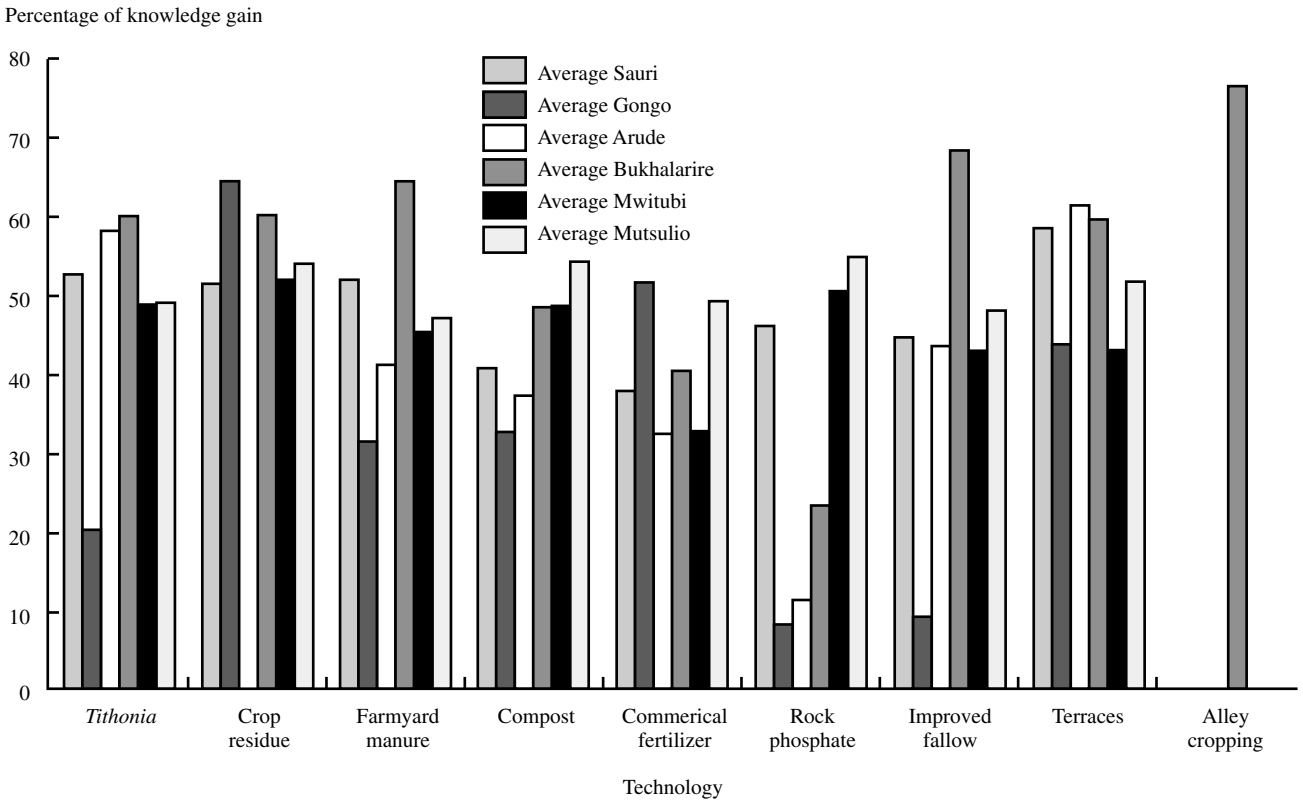
Figure 9.6 Mutsulio village—poor men: At least four years of primary education



technologies as well, these two stand out as being particularly unfamiliar. The fact that Bukhalalire claims the highest gains suggests that there may be a correlation between levels of satisfaction with the dissemination process, including success with group-based methods, and success in knowledge acquisition.

In cases other than Gongo, low rankings cannot be readily explained. Crop residue was not mentioned in Arude focus groups. In addition, rock phosphate scored low in Arude (9 percent) and Bukhalalire (22 percent), but participants did not offer explanations for this. On the other hand, one community stands out as achieving high gains in two technologies. Bukhalalire participants claimed to gain a 63 percent increase in knowledge on farmyard manure and improved fallow resulting from the intervention. Similar figures for the average across the villages were 46 percent and 45 percent, respectively. It was also highest on *tithonia* and improved fallows in Bukhalalire than in the other villages. Bukhalalire participants generally claim to have learned more than the average on most technologies, the exception being rock phosphate and commer-

Figure 9.7 Average knowledge gain for each technology, by village



cial fertilizer. Given the success with the use of groups, there may be a relationship between how well the local groups function and the success achieved in terms of knowledge acquisition in the technologies.

Variations by Education Level of Villagers and Age of the Intervention. Two other ways in which knowledge gain varies are by education level, and by age of the intervention. Participants with more education generally learn more about SFR technologies than those with less. Nonetheless, the difference is less dramatic than one may expect, which indicates that these technologies can be used by people regardless of education, and that SFR disseminators have achieved their goals of reaching some of the more vulnerable individuals.

The PRA exercise reveals that people learn between the beginning and end of the intervention (knowledge before intervention

Table 9.1 Knowledge gain for *tithonia* and improved fallows in the six study villages from focus group discussions

Study village	Average knowledge gain for *tithonia*	Average knowledge gain for improved fallows
Sauri	52	50
Gongo	14	7
Arude	61	44
Bukhalalire	62	69
Mwitubi	54	43
Mutsulio	51	55

compared to knowledge after) than they do between the end of the intervention and the present. In no cases do people report that they learned a greater amount after the intervention (i.e., through practice) than they learned through the intervention (that is, through teaching and practice), and in only one case, a group reported that they knew less now than before the intervention. In almost all cases, people indicate that they continued to learn an impressive amount after the intervention was over, that is, through practice or ongoing dissemination activities. This suggests that in spite of the many critiques that people have of the dissemination processes, organizations, or local groups, they are using or at least have learned a considerable amount about the technologies, and this learning continues after the organization departed. In very few cases do people report knowing less now than they did after the end of the intervention.

Those with more education claim to learn more than those without across all technologies, although, on average, the difference is small. Those with secondary education, on average, claim to increase their knowledge by 50 percent across all technologies, while those with no or primary education learn 46 percent. For *tithonia,* the differences are somewhat greater. Those with secondary education claim to have increased their knowledge to 64 percent (42 percent during the intervention and another 22 percent since). People with little or no education said they learned less, at 51 percent (only 28 percent during the intervention, but a similar level of 23 percent since). But these differences are not especially high, indicating that education level is not that important to knowledge acquisition with these technologies, and that disseminating organizations have been successful in reaching the less educated and thus more vulnerable residents. It also suggests that they have been effective in their training, with assistance from local disseminators. The average difference of about 10 percent in knowledge gained between more and less educated people is understandable in that the former have reaped the benefits of the cognitive changes associated with more education.

Table 9.2 Knowledge acquisition in agricultural topics from household survey in non-pilot villages (n = 361)

Agricultural topic	Percentage of households with knowledge gain
Soil fertility assessment	69.6
Use of fertilizer	34.6
Use of manure	70.4
Use of agroforestry	50.0
Crop husbandry	65.4
Livestock management	43.7

Evidence of Knowledge Acquisition from Quantitative Surveys

Regression analysis was done to examine the associations between dissemination method and major improvements in knowledge of several agricultural topics on the other. The dependent variables included improvements in agroforestry, fertilizer, soil fertility assessment, manure, livestock, and crop husbandry knowledge and were measured as a dichotomous variable (and consequently a logit model was used). As indicated in Table 9.2, knowledge acquisition was common, ranging from 35 percent of households in the case of fertilizer to 70 percent of households for soil fertility assessment and use of manure. The fact that agroforestry information does not rank in the top three in terms of prevalence attests to the fact that considerable dissemination activity occurs beyond SFR in the sites.

We attempted two separate tests. The first was to evaluate the changes in knowledge according to site, but controlling for other household characteristics. This is only an indirect measure because the site dummy could be capturing other variables aside from dissemination differences, although it is not apparent that any of those would have changed over the period and have been

related to increased knowledge. The results showed that fewer positive changes in agroforestry knowledge were taking place in Mwitubi than in Bukhalalire, Shinyalu, Ugunja, and Rachuonyo. Fertilizer knowledge was improved less in Mwitubi and Rachuonyo than in Bukhalalire, Shinyalu, and Ugunjua. As for other types of knowledge (soil fertility assessment, crops, livestock), there were hardly any further differences between the sites, the exception being less perceived improvement in understanding soil fertility problems in Bukhalalire than in Mwitubi.

The second analysis was to determine the impact of specific sources of information on SFR on changes in knowledge. We used direct contacts with different sources (yes or no) to proxy for whether the source was used by the household. A single household may have received information from more than one source. Logit models with and without site variables were run. In terms of improved information in agroforestry, positive impacts were associated with direct contact with ICRAF, a nongovernmental organization (NGO), or a community-based organization (CBO). Contacts with extension or other farmers did not have an effect on acquisition of agroforestry knowledge. Perhaps because the technologies are very new to the region, farmers were more wary of the knowledge and experience of extension and other farmers. We also ran regressions for spillover effects in other types of agricultural knowledge, because all information providers attempt to address issues pertaining to other farming aspects. For all other types of knowledge, however, the only strong evidence we were able to find was that CBOs were able to impact positively on knowledge gain in soil fertility assessment, use of manure, and use of livestock. Other sources of information did not have an impact on knowledge acquisition in these other areas. This result is concerning in two ways. First, it suggests that extension has not made a significant impression. Thus, in spite of a liking for extension methods (see the qualitative analysis) extension does not seem to reach many farmers with the methods. Second, the commonly formulated strategy of promoting farmer-to-farmer dissemination may prove to have a weakness in transmitting important contextual and conceptual information about technology use.

Differences in Gender and Wealth among the Focus Groups

In the focus groups, there are not particularly large differences in knowledge gain by gender and wealth. Nonetheless, the few that exist are worth exploring. The clearest differences are between knowledge gain by wealth on commercial fertilizer and improved fallow. For fertilizer, non-poor participants report a 49 percent gain. Poor participants report a 39 percent gain. This is likely explained by the fact that commercial fertilizer is one of the only SFR technologies introduced that costs money. The converse is true for improved fallows. This receives the same scores but with "non-poor" and "poor" interchanged. Improved fallow serves more or less the same function as fertilizer, improving fertility, but does not cost anything, except forgone harvest. With regard to *tithonia,* the poor group was slightly more positive about their knowledge gain, at 57 percent compared to non-poor at 51 percent. Women claimed they gained somewhat more knowledge on *tithonia* than men, at 57 percent versus 48 percent. In Sauri, although participants said that it is difficult for women to work with *tithonia,* women also said their knowledge gain was twice that of men for *tithonia* and improved fallows.

In addition to these impressive gains in knowledge on the technologies, people report additional types of personal gains. Some mentioned that they gained yields as a result, but also confidence. What is most impressive is that groups of women and poor people mention the issue of confidence with greater frequency. Of the nine focus groups where this came up, six were women's and five were in poor groups.

Sustainability

Project approaches and activities are considered sustainable when local people perpetuate or support them, with minimal or no external assistance. This may be deduced on the basis of how local people support ongoing activities while external agencies participate in implementation or how they handle project activities and approaches, once the external organizations leave their communities. The current study uses both of those approaches for understanding and discussing sustainability.

Project activity costs are an important challenge to the continuance of activities after external initiating organizations phase out of communities. The manner in which those costs are handled, therefore, constitute a significant way of weighing the sustainability of project activities and approaches. In some of the projects in western Kenya under study, farmers had demonstrated their willingness and ability to share in the project activity costs, provided that benefits are clear, and the disseminator is willing to do its part. Thus, according to our poor men's focus group in Mutsulio, "Farmers are ready to work with any organization on a cost sharing basis if only the organization is ready to stay in the village and tell farmers what will be benefited and steps to follow whenever problems arise." Farmers proved willing to provide locally available materials in support of respective projects. For instance, in Gongo and Sauri villages, farmers provided bricks, sand, and rocks while Africa NOW, the external organization initiating a water project in the villages, provided cement and paid constructors. Thus the external Africa NOW provided only items that the community could not raise in the circumstances of the time. In Gongo village, farmers provided a total of 33 acres to a KARI-sponsored project for demonstration activities. In addition, in Mutsulio, Bukhalalire, and Mwitubi villages, farmers mobilized their colleagues for training sessions and *barazas,* and arranged venues as their in-kind contribution to projects. Overall, farmers in all villages were aware that project activities cost time and funds, and had taken initiative in those costs in some way that they considered appropriate.

In some instances, however, respondents in a few focus group discussions were not clear on how they shared in project costs, mainly because they looked at cost sharing as constituting monetary contributions. This is why a focus group discussion of poor men in Bukhalalire village reported that they gave monetary contributions to support dissemination activities and were disappointed when they gave a bigger portion than ICRAF. In the same vein, poor women of Mutsulio village said that farmers were "not ready" to cost share because they had no money. Some people saw cost sharing in a negative light. For example, poor women in Mwitubi stated that "farmers explained that a mere mention of the word money, that is, paying for something, is enough to send some members of social/farmer groups packing." But showing the strong will among farmers to sustain project activities, the poor women focus group of Bukhalalire village insisted: "as poor as we are, we may not make payment for most services but we are ready to do so whenever we can." Hence, it is the non-poor women focus group from Bukhalalire village who captured the in-kind aspects of cost sharing, arguing, "farmers also provide plots, labor and take the risk associated with experimentation on the farm." Cost sharing viewed from the in-kind perspective, therefore, leads to the conclusion that farmers met a significant part of the project costs in time and material, pointing to the communities' potentials in sustaining project activities and approaches in that sense.

In terms of institutional sustainability, the study turned to the committees/groups that supported dissemination approaches and activities. The main issues for examination were whether or not the said groups/committees continued to exist after con-

cerned external organizations had phased out of respective communities and if they existed, how they performed in terms of dissemination. The main finding was that most committees/groups set up or adopted for dissemination work by external organizations continued to exist after the latter had ceased to operate in the communities, although in some villages, groups had collapsed. In Bukhalalire village, the umbrella group was still active in dissemination in spite of the fact that KWAP, which initiated it, had left the community many years earlier. Poor men in the village said, "The umbrella group continues to disseminate to other villages beyond the catchment and giving briefings on its activities to schools." Thus the umbrella group disseminated much more widely than the MoARD had done through the catchment approach in earlier years. The umbrella group continued to use field days to disseminate to farmers, even after KWAP had left the village. In Mutsulio village, the committees were active and effective in dissemination and community members had not thought of making any changes in the ways they functioned, even after the external organization, KARI, had reduced contacts and ICRAF came and left the village. Focus group members said the committees in the village were motivated to work harder as the crop yields for the farmers they worked with kept increasing.

However, a few committees, such as those for water set up by Africa NOW in Gongo village, had collapsed mainly because of mismanagement. Poor management, especially of finances, had also kept some groups/committees weak and ineffective in dissemination. In Mwitubi village, for example, the village committee had become inactive as a result of MoARD's withdrawal from the village, but also because of opaque management practices in the committee, especially with regard to finances. In Gongo, Sauri, and Muhanda villages, most groups were active, except for some groups that had collapsed in Gongo and Muhanda, due to financial mismanagement or thievery. It is worth noting, however, that mismanagement is not a pervasive problem; these are the exceptions. For example, in Bukhalalire, non-poor women said that "mismanagement is not a constraint to participation in these groups because there is no money to mismanage, but it is a minor problem."

In all focus groups, the local administration came across as important to sustainability. The chiefs, their assistants, and village elders mobilized farmers for *barazas* and other dissemination sessions, and sometimes disseminated directly to them. This is important for sustainability because after the external organizations left the villages, the chiefs remain in their influential positions, and have the potential to continue to convene *barazas* that support dissemination. Although this is potentially an important source of sustainability, however, it is not sufficient, as chiefs sometimes complain that people do not attend *barazas* anymore. The major challenges to sustainability may be adduced at two levels: at the level of cost sharing and at the level of institutions. At the level of cost sharing, the major problem relates to the high levels of poverty in the project areas, which makes it difficult for farmers to continue to fund activities and groups sufficiently after external organizations phase out. In some cases, farmers said they were willing to share costs, but they would first need to see the financial benefits of adopting the technologies. At the institutional level, the local administration was involved in dissemination ad hoc and without undergoing any structured training on dissemination. Therefore, although the administration was said to be involved in dissemination, the content may not have been in line with the desires of farmers; however, given the powerful position of that administration in the lives of the people, they could not question it. Also at the institutional level, poor leadership and mismanagement of funds hampered the continued vibrancy

of groups/committees after external organizations left the communities. The major reason that respondents cited for the collapse or inactivity and ineffectiveness of groups was mismanagement of funds or poor leadership. For institutional sustainability to be achieved, future projects should focus some more on leadership and management training, to provide safe grounding for project activities and approaches after external organizations phase out.

CHAPTER 10

Conclusions and Recommendations

This chapter serves three main objectives. The first is to discuss the advantages of the research methodological approach and remaining challenges. The second is to highlight the key empirical results of the impact assessment study. The last is to explore more broadly alternative options for poverty alleviation in western Kenya and the role of soil fertility investment.

Research Methods

The study used a number of methods/approaches that shaped the research process and the findings. The important aspects are the following:

- Use of a sustainable livelihoods (SL) framework
- Integration of qualitative and quantitative methods
- Dialoguing across different institutions and stakeholders
- Arm's length data collection
- Viewing poverty from multiple perspectives

Use of a Sustainable Livelihoods Framework

The SL framework was used in the formulation of the final proposal and in identifying the key research questions. It provided a cross-disciplinary language that allowed for the articulation of an integrated research design. This was attractive. As it turned out, the research team was conversant in a number of paradigms and methods that included similar concepts, and it is not clear that the SL framework was necessary to achieve similar results. Still, the framework ensured that many key issues and relationships were not overlooked. The team introduced other concepts not included or explicit in the framework as needed. In terms of research questions, it was noted that the SL framework, although quite comprehensive, did not provide guidance as to the major direct relationships among variables. As a consequence, all variables are related to one another and this then tends to result in the formulation of similar, overlapping, or duplicated research questions.

In the implementation of the research, the SL framework was rarely explicitly discussed, except in the formulation of the research questions and during certain forums where these questions and preliminary findings were reviewed. This is less a criticism or compliment to the framework than a reflection of the fact that the research team had agreed on the importance of a comprehensive and diversified research approach.

Integration of Qualitative and Quantitative Methods

As the research questions were being developed, the research team noted the particular contribution that could be made from qualitative and quantitative methods. For most of the

questions, it was clear that qualitative and quantitative methods could complement one another. As much as possible, checklists and questionnaires were formulated to provide insights into common issues/questions. Certainly, the integration was useful for understanding different types of information—quantitative results led to identification of general patterns and qualitative results to help understand processes of adoption choices, information flows, and impacts. Quantitative results give a much stronger sense of representativeness, given the large numbers, but qualitative data were essential for uncovering issues related to culture, normative frameworks, and social dynamics.

The integration succeeded in issues such as meanings of poverty, adoption, and dissemination issues. It worked less well with impact analysis, mainly because the quantitative research had a baseline as a guide, but was limited to a small set of indicators, while the qualitative research did not benefit from a baseline, but was broader in its scope. Although a great deal of complementary and supporting information is available, true integration requires the researchers to sit together and compare/contrast results. Limitations on time and funding, and the timing of the last survey, resulted in the team not being able to spend sufficient time to jointly analyze the research results. The report is therefore too compartmentalized into results from different methods.

Another issue was the use of numbers generated from PRA exercises. These were quite useful in understanding relative assessments of different institutions, methods, and knowledge acquisition within villages. They were less useful than they could have been, however, and difficult to compare and analyze across villages, because of the different meanings attached to numbers, and the fact that different categories were identified across villages. This could have been controlled by standardizing categories, but would have undermined the participatory nature of the exercise, stifling generation of local categories. Still, there was enough comparability across categories to allow for some meaningful comparison, albeit in broad strokes in some places.

Dialoguing across Different Institutions and Stakeholders

A key aspect of the research process was the stakeholder meetings that helped to plan and review the research. The launching stakeholder workshop in western Kenya was particularly valuable to some members of the research team who were unfamiliar with the research setting. Having issues raised by residents of the region added a degree of objectivity to the research design that may not have been as defensible had the design been driven by ICRAF and its partners alone. It also increased the practical relevance of the results, and ensured an audience for the results. In addition to the initial workshop, there were several meetings among the research team members, which also involved other stakeholders, such as development agents. These meetings helped to plan specific components of the research, such as the focus groups on dissemination strategies that included representatives of organizations whose methods we were evaluating. Some of these same stakeholders acted as sources of data for the project as well, providing some data triangulation.

Arm's-Length Data Collection

The qualitative and quantitative fieldwork was undertaken almost exclusively by persons not attached to the project. The qualitative fieldwork was supervised by Ph.D.- and M.A.-level faculty sociologists, and carried out by M.A.- and B.A.-level sociologists, all of whom had current or former connections to the University of Nairobi and Wageningen University. They were supported by the "Social Analysis Team," composed of sociologists from IFPRI and Wageningen University. The exception to this was assistance with organizing (but not facilitating) some focus group discussions from an ICRAF social scientist. There were two reasons for using independent (non-

ICRAF) researchers. First, we wanted the fieldworkers to be viewed by villagers as completely detached from ICRAF. ICRAF has had mixed experiences in the past with obtaining open responses from farmers in the pilot villages. They have often hidden problems with the technologies from ICRAF scientists unless specifically probed. Thus, we felt that it was essential to de-link the collection and analysis of qualitative data from ICRAF. It is not clear that this worked that well in practice, as ICRAF is well known in the area and much of the inquiries were related to agroforestry. Nevertheless, the long period of fieldwork built up relationships between fieldworkers and respondents that produced candid replies.

The second reason for employing independent researchers was to maximize the objectivity of the impact assessment process, for example, reducing conflicts of interest with respect to reporting negative results where they may occur. With respect to qualitative data analysis, ICRAF was not involved in the initial analysis but did review it and provide feedback to the analysts. While the use of independently contracted social analysis researchers did help with perceived and real objectivity, this also meant that internal capacity for undertaking social analysis was not built within ICRAF. Nevertheless, ICRAF has built relationships for new potential collaborators in the future.

The issue of the independence of evaluators was less of a concern with respect to survey enumerators, but we nevertheless felt it advisable to use students and other collaborators to collect these data as well. Because of the complicated nature of the survey questions, the same enumerators who collected the baseline information on consumption and expenditures were used again to ensure quality and consistency, and to make households more comfortable in discussing the topics. In the non-pilot villages, ICRAF was involved only in setting up the logistics. Students from Belgium supervised the collection of data in three villages while a student from the University of Nairobi supervised data collection in the other three villages. Both students and ICRAF scientists participated in the data analysis, but because of strict deadlines and complexity (with respect to the SFR systems and the econometrics), the ICRAF project leader contributed the vast majority of the quantitative analysis in this report. However, this was guided by mutually generated questions and oversight from IFPRI reviewers and the independent advisory committee.

Viewing Poverty from Multiple Perspectives

As noted earlier in this report (Chapter 4), poverty is a slippery concept. Yet the task was to see how, if at all, the agroforestry technologies impacted on the poor. So the team was forced to come to grips with how to assess who is poorer compared to others. Rather than devising a single qualitative or quantitative classification, the team was open to alternative views and ways of comparing poverty levels across households. This approach seems to best fit with reality in that poverty is dynamic—many households are vulnerable to poverty and are engaged in a range of survival strategies. In an effort to maintain consumption levels, many households will resort to working off-farm (and potentially jeopardizing yields) or selling assets. By looking at only one of these dimensions of poverty, important changes or effects could be missed. It is important to look at the many manifestations of poverty for seeking solutions as well. Certain types of poverty indicators may move together, while others may not. For example, we found that expenditure and consumption changes over time were quite similar, but asset portfolio changes behaved somewhat differently.

Highlights from Empirical Findings

1. While there is no doubt that poverty is pervasive in western Kenya, distinguishing the poor from the non-poor is not straightforward. Poverty is a slippery concept and

people often do not accept being labeled as poor. When pressed, people will admit that poverty implies the lack of certain basic needs. The study used a variety of methods to assess poverty levels, including quantitative measures from surveys, enumerator ratings, and farmer self-assessments. These produce different outcomes so that which households are classified as very poor depends on the criteria used.

2. Welfare or livelihood outcomes are worsening for many households. There was a general deterioration in welfare indicators during the period of study. This holds true for assets, expenditures, and food consumption. Particularly striking was that households with relatively high welfare indicators in the initial period suffered the greatest losses. This is attributable partly to the large number of adverse shocks affecting households and the cultural obligations felt by all community members (e.g., the wealthier households contribute animals for slaughter at funerals).

3. SFR technology interventions imply assumptions about the role of agriculture in people's livelihoods that have varying validity. The role of agriculture in people's livelihoods is determined by economic circumstances, cultural, normative frameworks, and social identities. The assumption that poverty can be reduced through farming is not necessarily reflected in the investments in livelihood activities made by people in the region. Their decisions are embedded in their economic circumstances (including assets and institutional environment), cultural, normative frameworks, and social identities. Decisions about agricultural investments are also shaped by "structural" phenomena such as the output to input price squeeze on agriculture that does not guarantee adequate return to human and physical capital investments. In western Kenya, farmers are very aware of this squeeze in making livelihood decisions. While researchers may evaluate agroforestry in terms of its role in generating agricultural production, rural people will be assessing its ability to contribute to the variety of objectives they pursue.

4. Households do realize the importance of SFR—and there have been many human capital impacts. Both the qualitative and quantitative research found significant knowledge acquisition taking place, not only for agroforestry methods, but also for general soil management and farming practices. People valued this information and have often put it into practice.

5. Farmers like to be exposed to multiple dissemination opportunities and methods. The dissemination analysis found that farmers appreciated some efforts of almost all disseminating organizations and certain aspects of the many different methods tried. They particularly appreciated direct contact and field observation methods. Information flows were not guaranteed, however, because individuals may not be able to make scheduled meeting times and different methods benefit some social groups more than others. Thus, the poor favor being able to access information through a variety of channels.

6. Social status and social relationships within villages affect outcomes of different dissemination methods. Although characteristics of SFR affect whether people adopt or not, aspects of the dissemination process also affect adoption. The dissemination analysis found that the main feature of most dissemination approaches—group-based methods—can strengthen human and social capital, and farmers of different social status have benefited from them. This analysis also found, however, that group-based approaches can also disadvantage farmers of lower social status and women who are less likely to participate in or have key positions in groups. However, women's groups have worked well for women. Furthermore, the dissemination analysis and case studies found that the use of adaptive research farmers is necessary, but it also generated social tensions because of the amount of attention selected individuals received from outsiders. These findings reinforce the con-

clusion that use of a variety of methods are best, and point to the importance of understanding local social dynamics in designing dissemination interventions.

7. Sustainability of dissemination structures and processes is possible but tenuous. Sustainability of dissemination structures and processes has proved to be possible, but challenging, because of problems encountered by groups, limited capacity of local administration, social dynamics within villages, and limited cost-sharing ability. Monitoring would help to pick up these problems so that resolutions can be sought where possible.

8. The poor are adopting SFR strategies at rates similar to those of the non-poor. In villages where information on SFR was disseminated several years ago, adoption rates are not outstanding but they are encouraging. About 20 percent of all farmers are using the technologies on a regular basis (a similar percentage among the poor) and a sizable percentage of farmers are newly testing them. Using different datasets and non-land wealth measures, it is found that rates of use are similar across most wealth/poverty indicators. Other types of soil fertility measures such as manure and fertilizer are more clearly linked to non-land wealth indicators. This does not mean that SFR strategies are equally likely to be adopted across all levels of asset or resource holdings. Biomass transfer was particularly related to the pool of household labor and improved fallows to sufficient land holding size.

9. Adoption at an early stage is at low levels of intensity. While an encouraging number of households are using or testing the SFR practices, the sizes of plots on which they are applied remain small. It is not yet known whether this is indeed an optimum ceiling, or a consequence of the early stage of dissemination, in which villages are learning to adjust to a significant withdrawal of support from project personnel.

10. New technologies transform or create/introduce new existing social relationships in (rural) societies. New technologies and the methods of dissemination have created social tensions and contribute to (more) conflicts. The nature of such tensions complicates an assessment of technology interventions and has much more to do with the way technologies are/were introduced and thus has been of more concern in the pilot villages established by ICRAF.

11. SFR does significantly raise crop yields in most cases. The best test of this was from longitudinal farmer managed trials that showed significant yield and returns to labor gains. Respondents in the case studies and formal surveys also consistently report very significant increases in yields (>100 percent) from the use of SFR practices. Not all farmers benefit from SFR, however; there is variation in performance and these are difficult to isolate and quantify from farmer recall surveys.

12. SFR on its own cannot bring about a turn in poverty reduction. This conclusion is drawn from the body of impact assessment work. Despite the fact that SFR is being used by a number of poor households and has an impact on yields, its impact at the household level is modest because of the small land sizes under SFR and because the weak rural economy is not conducive for investment and development. This means that technological innovations alone are likely to have a limited short-term impact. Poverty alleviation interventions must encompass other sectors as well.

Implications for Poverty Reduction in Western Kenya: The Way Forward for Soil Fertility Replenishment

Pathways out of poverty are varied and highly uncertain. It seems that in order for widespread poverty alleviation to take place, many components of the rural socioeconomy need to be functioning well. This means that many agricultural enterprises and their markets need to be promising, the nonfarm economy needs to be growing, human and animal health diseases need to be kept at

bay, information flows need to function well, and general pessimism needs to be replaced by optimism. Macro economically, the performance of the non-agricultural sector has been poor, offering few opportunities for those who aim to diversify from agriculture into other sectors of the economy as labor migrants or entrepreneurs. In the short term, improvement in the lives of rural households will have to evolve around unlocking land-based agricultural activities and opportunities. Smallholders in central Kenya, with nearly the same sized farms, generate more than three times as much agricultural revenue as do farmers in western Kenya. This comes about partly because of extraordinary yields, but more as a result of agricultural enterprise choice, in which high-value enterprises such as tea, dairy, coffee, macadamia, and other horticulture products are common. Given that some of these enterprises enjoy growing export markets (e.g., tea and macadamia), agriculture also seems to offer some promise throughout medium to high potential areas of Kenya. This is particularly so in western Kenya, because soils are deep and well drained and rainfall patterns are arguably the best in all of Kenya.

But realizing this vision for agriculture has many obstacles. Prices for agricultural commodities are low and agriculture continues to be subjected to climate risks. Most of the profitable agricultural enterprises require capital investment and poor households simply do not have sufficient financial resources. They may try to start more modestly, but even that process is problematic. Household responses to the HIV/AIDS pandemic are creating a drain on financial and human capital resources, the latter through illness, care taking, and attendance at lengthy funeral rituals. Small land sizes in turn limit the amount of diversification that households are willing to undertake. A major challenge is that irrespective of the direction taken, agriculture needs to proceed in such a way that monetary costs are kept at low levels. The scenario of labor intensification is the most likely outcome, as it can generate opportunities for the existing pools of rural labor and reduce the monetary costs of production.

Within agriculture, poor households can take initial steps by building on crops/enterprises that they already have. The strategy under consideration in this study was a relatively safe one of increasing yields of the basic staples of maize and bean. These are safe because increases in production can be consumed on-farm and markets always exist for these commodities. However, their value is low, so that safety is traded for only modest income boosts.

More substantial income increases may come from increasing investment in poultry, woodlots, or vegetables, which are also found among the poor. In order for these enterprises to generate sustainable incomes, the greater socioeconomy must be functioning well. Poultry is highly vulnerable to disease, vegetables require outlays of scarce capital, and woodlots require a waiting period in which income must be derived from other sources. These risks and investment costs are more easily borne through surpluses generated from other enterprises or livelihoods. Promoting diversity of options will continue to be important. Pathways out of poverty based on specialization (in tea, and so forth) is interfacing with the cultural frameworks of local, rural people, who have been trying to improve their lives through diversification. Further, households are likely to continue to allocate significant amounts of land and labor resources to food-producing crops. Of course this may change in the near future. But some will adapt to the new circumstances; others will not.

Even if progress is made, the study has clearly shown that households can easily slip back into poverty conditions. In addition to generating production and income, there is need for insurance through investment in risk-buffering assets. Without these assets, the numerous adverse shocks can easily impact on household expenditures and consumption levels. Markets that enable households to build and divest assets when

necessary do exist. What is more problematic are the sociocultural pressures that force the more well-off households to sacrifice assets for funerals and other hardships. The well-off also tend to be targets of theft, in both on-farm and off-farm activities. Such social phenomena can discourage the buildup of the very assets that are needed to reduce vulnerability to poverty.

What is the future for agroforestry in all of this? The soil fertility systems being disseminated are a useful option for farmers. There are cases in which this one type of technology seemed to trigger more sustained development. There are clear limitations to the use of improved fallows and biomass transfer, however. Improved fallows are less likely where farms are very small and where other perennial crops are found. There are similarly some limitations of space for growing organic biomass, but it seems to be a useful option, especially as part of a strategy to intensify production of high-value crops.

Agroforestry does combine aspects of indigenous practice and knowledge with advanced science. The SFR systems enable farmers to be able to improve soil fertility without reliance on markets and with little expenditure of the most precious production factor, money. This can become real only by theoretically rethinking the notion of resources in two ways. One is to move beyond the view that resources are a given, to be used as designed by the developing scientists. It is more appropriate to imagine resources as unfolding. Resources unfold in and through practice and this involves learning by doing. That resources unfold is reflected in the processes of adaptation one witnesses in the field. Farmers often change the original design when it does not fit with their ideas. Sometimes farmers rework a technical design in a way that the original version cannot be detected. The notion of unfolding is also important in that sometimes resources seen as relevant by scientists are initially seen as irrelevant by farmers, who only later may discover their relevance.

The case material and our analysis have indicated a second direction in which resources can be rethought: resources need to be understood not only as material objects and artifacts, but also as a social relationship; social relationships are embedded in technology. This means paying attention to the relationships that emerge between technology designers and agents of extension, on the one hand, and the "beneficiaries," on the other. It also means paying careful attention to the types of individuals and households who are likely to be able to understand and adopt agroforestry for improving soils. Theoretically and empirically so far, the technologies do not seem to strongly discriminate between the rich and the poor as do other technologies, because of their low cash requirements, although some minimum amount of land is necessary for improved fallows and similarly some ability to command labor for biomass transfer. Also, both men and women are using them. Where it has led to social tensions seems to relate more to the manner in which information about the technology is disseminated. Many potential users of the technology may not receive information or become alienated from trying if dissemination methods are not considered to be equitable. These technologies carry certain requirements, not the least of which are those related to knowledge. Systems for diffusing information over wide areas are critical and the fact that agroforestry for SFR has not yet been well established in extension systems means that considerable work is required in building capacity in national programs. For ICRAF, it should see its role in identifying the key research gaps that constrain the possible basket of options that extension and other development organizations can bring to farmers.

APPENDIX A

Results and Tests from First-Stage Regressions

Results from First-Stage Regressions to Predict Improved Fallow Area and Number of Seasons Practicing Biomass Transfer

Table A.1 OLS regression results for improved fallow area

Source	SS	Df	MS
Model	10206539.6	14	729038.54
Residual	29109225.7	84	346538.401
Total	39315765.3	98	401181.278

Ifoarea	Coefficient	Standard error	t	$P > \|t\|$	[95% Conf. interval]	
Female	–87.82046	171.1557	–0.51	0.609	–428.1823	252.5414
fedp_me	–10.61622	180.5004	–0.06	0.953	–369.561	348.3286
feds_me	165.9946	213.0973	0.78	0.438	–257.7728	589.7619
Hhsize00	–4.450973	30.17775	–0.15	0.883	–64.46274	55.5608
Hhage00	–3.700338	4.939231	–0.75	0.456	–13.52254	6.121865
land_me	45.36534	39.15098	1.16	0.250	–32.49068	123.2214
Luo	63.83339	278.1738	0.23	0.819	–489.3457	617.0125
Formal	140.123	150.1618	0.93	0.353	–158.4902	438.7362
sh_drou	186.7531	218.1992	0.86	0.394	–247.1599	620.6661
sh_hail	–320.537	197.6369	–1.62	0.109	–713.5596	72.48571
sh_pdis	61.92062	195.2881	0.32	0.752	–326.4312	450.2725
Fathland	4.363276	7.520947	0.58	0.563	–10.59295	19.3195
Fathpost	116.0823	34.99074	3.32	0.001	46.49941	185.6653
Fathstat	–328.7021	153.5171	–2.14	0.035	–633.9877	–23.41643
_cons	265.0111	482.1148	0.55	0.584	–693.727	1223.749
n	99					
F (14, 84)	2.10					
Prob > *F*	0.0194					
R^2	0.2596					
Adj. R^2	0.1362					
Root MSE	588.68					

Table A.2 Tobit regression results for improved fallow area

Ifoarea	Coefficient	Standard error	t	$P > \|t\|$	[95% Conf. interval]	
Female	–258.125	287.2942	–0.90	0.371	–829.3429	313.0929
fedp_me	–215.3961	301.6733	–0.71	0.477	–815.2034	384.4111
feds_me	76.08159	351.4711	0.22	0.829	–622.7371	774.9003
Hhsize00	–10.83875	51.88529	–0.21	0.835	–114.0006	92.32311
Hhage00	–5.903317	8.252373	–0.72	0.476	–22.31124	10.50461
land_me	64.44983	65.16894	0.99	0.325	–65.12347	194.0231
Luo	–179.3787	467.1353	–0.38	0.702	–1108.169	749.4113
Formal	139.9458	254.9542	0.55	0.585	–366.9714	646.863
sh_drou	199.2094	353.6231	0.56	0.575	–503.8881	902.3069
sh_hail	–400.9649	399.738	–1.18	0.241	–1076.455	274.5253
sh_pdis	–165.5929	333.8149	–0.50	0.621	–829.3064	498.1206
fathland	10.05552	12.54332	0.80	0.425	–14.88396	34.995
fathpost	144.5664	55.63691	2.60	0.011	33.94536	255.1875
Fathstat	–496.5452	262.8425	–1.89	0.062	–1019.146	26.05605
_cons	439.4475	798.1036	0.55	0.583	–1147.396	2026.291
_se	891.3746	97.53837			(Ancillary parameter)	
n	99					
LR χ^2 (14)	20.18					
Prob > χ^2	0.1245					
Pseudo-R^2	0.0223					
Log likelihood	–441.5466					

Table A.3 OLS regression results for number of seasons practicing biomass transfer

Source	SS	Df	MS
Model	29.9475104	14	2.13910788
Residual	172.55754	84	2.05425643
Total	202.505051	98	2.06637807

bttotnum	Coefficient	Standard error	t	$P > \|t\|$	[95% Conf. interval]	
Female	–.6158123	.4167187	–1.48	0.143	–1.444503	.2128786
fedp_me	.151868	.4394706	0.35	0.731	–.7220673	1.025803
feds_me	.4234396	.5188354	0.82	0.417	–.6083215	1.455201
Hhsize00	–.0120002	.0734748	–0.16	0.871	–.158113	.1341125
Hhage00	–.012782	.0120257	–1.06	0.291	–.0366964	.0111325
land_me	.0514792	.0953222	0.54	0.591	–.1380795	.241038
Luo	.3643132	.6772794	0.54	0.592	–.9825311	1.711158
Formal	–.3548971	.3656041	–0.97	0.334	–1.081941	.3721467
sh_drou	–.3228499	.5312571	–0.61	0.545	–1.379313	.7336132
sh_hail	–.5353592	.4811934	–1.11	0.269	–1.492265	.4215467
sh_pdis	.6468972	.4754748	1.36	0.177	–.2986365	1.592431
fathland	–.0112162	.0183115	–0.61	0.542	–.0476307	.0251982
fathpost	.0668684	.0851932	0.78	0.435	–.1025476	.2362844
fathstat	–.2888269	.3737735	–0.77	0.442	–1.032116	.4544626
_cons	2.14867	1.173822	1.83	0.071	–.1856025	4.482943
n	99					
F (14, 84)	1.04					
Prob > *F*	0.4221					
R^2	0.1479					
Adj. R^2	0.0059					
Root MSE	1.4333					

Table A.4 Tobit regression results for number of seasons practicing biomass transfer

bttotnum	Coefficient	Standard error	t	$P > \|t\|$	[95% Conf. interval]	
Female	–1.833084	.8078389	–2.27	0.026	–3.439284	–.2268841
fedp_me	–.0585737	.7861003	–0.07	0.941	–1.621552	1.504404
feds_me	.6121713	.9080543	0.67	0.502	–1.193284	2.417626
Hhsize00	–.0521806	.1316892	–0.40	0.693	–.3140141	.2096528
Hhage00	–.016619	.0209079	–0.79	0.429	–.0581894	.0249515
land_me	.0340565	.1704845	0.20	0.842	–.3049124	.3730253
Luo	.6604521	1.195421	0.55	0.582	–1.716366	3.03727
Formal	–.6905759	.6846575	–1.01	0.316	–2.051858	.6707065
sh_drou	–.237789	.9133946	–0.26	0.795	–2.053862	1.578284
sh_hail	–.854459	.8571341	–1.00	0.322	–2.558671	.8497532
sh_pdis	.5572763	.8367896	0.67	0.507	–1.106486	2.221038
fathland	–.0184144	.0330755	–0.56	0.579	–.0841773	.0473485
fathpost	.118098	.1451177	0.81	0.418	–.1704348	.4066308
fathstat	–.5886464	.668509	–0.88	0.381	–1.917821	.7405286
_cons	2.566359	2.096128	1.22	0.224	–1.601304	6.734023
_se	2.280505	.2582738		(Ancillary parameter)		
n	99					
LR $\chi^2(14)$	15.01					
Prob > χ^2	0.3778					
Pseudo-R^2	0.0501					
Log likelihood	142.32167					

Tests on the Selection of Instruments for First-Stage Regressions

1. Correlation tests between predicted and actual values
   - 1A. Improved fallows
     - Correlation from OLS first-stage regression: $r = .51$
     - Correlation from Tobit first-stage regression: $r = .49$
   - 1B. Biomass transfer
     - Correlation from OLS first-stage regression: $r = .38$
     - Correlation from Tobit first-stage regression: $r = .36$
     - All correlations are significant at the .01 level.

2. *F*-tests and χ^2 tests for first-stage regressions
   - 2A. Improved fallows
     - Significance of *F*-stat from OLS first-stage regression: .02
     - Significance of χ^2 stat from Tobit first-stage regression: .12
   - 2B. Biomass transfer
     - Significance of *F*-stat from OLS first-stage regression: .42
     - Significance of χ^2 stat from Tobit first-stage regression: .38

3. Tests for overidentification
   Significance of n^*R^2 from regression of impact residuals (actual values of impact indicators less their predicted values) on all RHS variables, including the instruments (with degrees of freedom of number of instruments (7) less the number of endogenous RHS variables (2) = 5).

3A. Change in expenditure per capita regression:
$\chi^2 = .9306$, overidentification hypothesis is rejected.
3B. Change in protein regression:
$\chi^2 = 2.6532$, overidentification hypothesis cannot be rejected.
3C. Change in iron regression:
$\chi^2 = 2.8512$, overidentification hypothesis cannot be rejected.
3D. Change in energy regression:
$\chi^2 = 5.6034$, overidentification hypothesis cannot be rejected.
3E. Change in assets regression:
$\chi^2 = 2.2466$, overidentification hypothesis cannot be rejected.

4. Durbin–Hausman–Wu tests on significance of agroforestry residuals (actual values of agroforestry variables less their predicted values) in regression with impact indicators as dependent variables.

Tests for significance of residuals of first-stage regression on dependent variables.

Regression	Improved fallows residuals	Biomass transfer residuals
Change in expenditures per capita	+ (p = .04)	+ (p = .09)
Change in protein	n.s.	n.s.
Change in iron	+ (p = .06)	– (p = .10)
Change in energy	n.s.	n.s.
Change in assets	n.s.	n.s.

n.s. = not significant.

5. Hausman specification tests comparing estimates on agroforestry variables from OLS and 2SLS procedures.

Significance levels for differences between estimators in the two procedures.

Regression	Improved fallow predicted value	Biomass transfer predicted value
Change in expenditures per capita	.082	.185
Change in protein	.272	.439
Change in iron	.130	.159
Change in energy	.918	.256
Change in assets	.914	.403

APPENDIX B

Six Village-Level Case Studies of Dissemination Processes

Michelle Adato, Mary Nyasimi, Christopher O'Leary, and Eduard Ontita

Below are detailed village-level case studies for the six villages where dissemination processes were studied, using focus group and PRA methods. These findings are summarized in Chapters 8 and 9.

The Village Approach in Sauri

As the only Luo village where International Center for Research in Agroforestry (ICRAF) was the primary disseminator among the six villages studied, Sauri is of special interest for this study. This dissemination approach attempted to be simultaneously broad and sensitive to local culture. ICRAF believed that this was a means by which they could avoid the pitfalls of providing irrelevant or unusable information. It was largely successful. People in Sauri generally think more highly of the organization than they do of others that do similar work in the village. The organization, however, has not lived up to all of its goals for accessibility. Nonetheless, the infrastructure they set up remains strong. Sauri's participants are unanimous in their positive assessment of the SFR technology, and the dissemination methods.

ICRAF, along with its partners, designed their work to be adopted in this area of great need. Sauri experiences significant ecological problems. Although the area has sufficient rainfall, this alone is inadequate. Local soils are notably deficient in key nutrients, especially nitrogen and phosphorous. In addition, local population density rests at one of the highest levels in the world for agricultural populations at about 1,000 people per square kilometer. To top it off, the population growth is 3.4 percent per annum, putting even more of a crunch on local farmers. These factors make Sauri an important test case for any method that would increase soil fertility. It is an even more important process here as government funds for more capital-intensive development are not forthcoming.

Assessment of Disseminating Organizations

By and large, local assessments of ICRAF show that people hold the organization in high regard. All of the four focus groups rank it at 70 percent in terms of usefulness and importance. While this number itself is only a little higher than the other community where ICRAF is most active (Mwitubi), what is perhaps more important is that there is almost no disagreement regarding ICRAF. Variations across the four focus groups are less than 10 percent, making this

case one of the most unanimous of any assessment. Furthermore, no criticisms were made about ICRAF in the focus groups. One description of ICRAF was "motivating." In other communities, many complain about insufficient time outside organizations spend in communities, even when they spend far longer in a place. In Sauri, people noted that one year was short but sufficient. Poor men were dissatisfied with groups that left after five years of activity in the past. But, when asked about ICRAF, they quickly retracted this statement, saying that one year was plenty of time.

The assessment of organizations active in the area was varied, indicating that people assess other things than technology when evaluating organizations. Kenya Forestry Research Institute (KEFRI) was ICRAF's direct research partner here. In addition, the Ministry of Agriculture and Rural Development (MoARD) entered the community a little later, and sought to disseminate similar technologies. Finally, CARE was active in the community, and used schools as a means to spread knowledge. These other organizations scored less than half as well as ICRAF. People disagreed more on MoARD's effectiveness, with poor men and non-poor women scoring MoARD about twice as high as the other groups. KARI did not seem to make an impression in this village. Participants are generally positive about the technology disseminated by CARE. In fact, all groups were grateful for the trees they planted. These are used to pay school guards, buy chalk and blackboards, and improve buildings. Yet, in the scoring, CARE was credited with about one-seventh the importance of ICRAF. Resident's feelings toward ICRAF stem from their dissemination methods and the resultant knowledge gains.

Teaching Methods

ICRAF's stated goal was to disseminate via local groups that would then conduct field days, trials, training at meetings, and to show an example that other farmers could emulate. Local people would spread these technologies via informal means such as conversation as well. But farmers ranked conversation as a means of learning far lower than in other villages. This is most important in looking at poor men's assessments of informal conversation as a way to gain information. In the communities as a whole, poor men ranked conversations at 50 percent in terms of their usefulness and importance. In Sauri, the number is 7 percent. Similarly, focus groups in other villages ranked conversations at 15 percent. Here, the average came to about 10 percent. Similarly, small group meetings were ranked at 10 percent (in non-poor men) and 35 percent (in poor women) in other communities. Here, only poor men and women mention that they learn anything about SFR technology from social groups. Poor women put their importance at 15 percent, less than half of the average. People in Sauri do not believe that they are getting much information from groups, and groups are less important for dissemination than ICRAF intended. Furthermore, people in all groups complained that the groups distributed information about technology unfairly.

Given that some of ICRAF's intended methods did not have the effect intended in Sauri, the reason for ICRAF's high status in participants' minds emerges as an important question. The answer lies in formal extension methods. Most notable in Sauri assessments of dissemination methods is that *barazas* and tours emerge about twice as high as in the study communities generally. *Barazas* here were ranked at about 40 percent, and tours at about 20 percent in all Sauri focus groups. Perhaps most surprising is that poor men scored tours at 25 percent in Sauri but 10 percent, on average, across all villages. These numbers combined suggest that formal methods are more accessible to the poor in Sauri than they are in the communities as a whole. People also hold even more formal methods in high regard. A specific part of ICRAF's dissemination method was posters that describe technologies, extension agents, and even field technicians in some villages that visit farmers.

Although these did not show up in the PRA exercise, all focus groups positively commented on both of these.

Indeed, it is difficult to argue with ICRAF's effectiveness at disseminating technology. Average farmer assessments of their knowledge gain in Sauri were about equal for all disseminated technologies when compared to other communities. The biggest difference appears in rock phosphate, which was higher in Sauri (44 percent versus 30 percent, on average). Poor men ranked lowest of the four groups with regard to knowledge gain on all technologies except rock phosphate and improved fallows. Especially notable in this regard is *tithonia,* where poor men reported a 25 percent knowledge gain, while both women's groups said they gained over 65 percent. But, this does not stop with poor men. In contrast to many other locations, both men's groups reported less knowledge gain on *tithonia* than women of similar social status. Nonetheless, this relatively low assessment does not take away from the fact that people in Sauri believe they are gaining more than their counterparts elsewhere.

Local Dissemination

The most interesting and diverse aspect of ICRAF's methods involved use of local institutions in dissemination. Here, ICRAF tried to use local groups for a variety of reasons. One way to increase adoption of potentially helpful technologies is to use local groups. This is the keystone of ICRAF's approach, which is covered in the main body of this report. ICRAF conducted a study of village networks and groups in selected villages and concluded that virtually all Luo, including those in Sauri, belong to one social group aside from their immediate family. Examples of others common in the area include church organizations, women's groups, and funeral associations. ICRAF assumed that these groups are especially effective ways to reach other farmers and effect change since they are important forums where people talk about politics and innovation, among other things. Thus, work with such a group can be a way to facilitate dissemination. Specifically, these groups were used to then filter the information down through smaller groups until it would reach farmers. This had a number of advantages, such as spreading already stretched resources over a greater area, and eliminating linguistic problems associated with multilingual societies such as this one.

This approach also attempted to strengthen these groups. Through this, they hoped to lay the groundwork for later technology dissemination. It would also allow greater farmer input, as stronger groups would presumably be better at arguing for their own ideas. Groups were used by different organizations for different purposes. In Sauri, they were taught technologies such as improved fallows, composting, and planting trees for fruit, wood, and medicine. They were also trained in bookkeeping, leadership, and proposal writing. Furthermore, they hoped to expand to other areas of training such as beekeeping, microcredit schemes, and more complex fruit growing.

Local assessments of these locally based approaches supports their effectiveness. Participants ranked *barazas* as the most important and useful form of dissemination. In fact, *barazas* scored higher among all groups, with the exception of non-poor men. Poor men and non-poor and poor women ranked *barazas* at 28 percent, 40 percent, and 40 percent, respectively. All of these are higher than their scores in other communities. In contrast, non-poor men ranked other farmers at 45 percent and schools at about 33 percent. Considering that the analysis above shows that *barazas* in Sauri may be particularly appealing to the poor, and that non-poor men probably have more active social networks where they can learn about new technologies, we could expect them to assess other farmers as more important than *barazas.* Similarly, they were the only group that mentioned parent meetings as a way they learn information. This probably indicates that non-poor men are most active

in these groups, and therefore the most likely to know about, discuss, and use school programs. Finally, no group mentioned funerals as a means to disseminate information, and only a few mentioned churches. Finally, only poor men mentioned children as a local disseminator. The last is not especially surprising, as schools were not such important sources of information in Sauri. The relative unimportance of funerals and churches as sources of information can be explained in the context of focus group discussions about groups. Although participants ranked group meetings as relatively unimportant, they were a large part of ICRAF's method. ICRAF worked with women's, church, and youth groups, and founded geographical committees (called Sub-Location Area Committees [SLAC]). Each of these would periodically meet with ICRAF agents, and discuss grievances and techniques. Yet nobody mentioned that these groups disseminated any information outside of the PRA exercises. Much to the contrary, both men's groups mentioned that group members "lead by example"—meaning, we believe, that they did not do very much direct dissemination, but would adopt technologies and expect others to copy them. This helps explain why participants rank local groups at 22 percent. Similarly, every focus group complained that participating in groups had one negative side effect. Participation meant that you could not attend local funerals, or church services, since their meeting times frequently overlapped. Thus, funerals and church were not good sources of information.

Nonetheless, it is a mistake to believe that local groups were entirely ineffective in accomplishing ICRAF's goals. Groups were responsible for both bringing issues to the disseminators' attention and for strengthening social ties. According to the farmers' focus group discussions, locals were instrumental at changing a number of dissemination practices. According to both men's focus groups, residents "demanded" that local committees bring in other technologies, such as dairy cows. These two focus groups also reported that residents demanded that the SLAC send members to other villages to learn about other technologies. Finally, all focus groups reported on demands to ICRAF that membership fees be waived or lowered (ICRAF had suggested that SLACs collect fees to provide for their operational expenses), and that meetings be held when no funerals or markets were underway. While the AIDS epidemic and importance of local marketing practices make it unlikely that the meetings could have accommodated everybody, people were grateful that local committees made efforts to correct this. In addition, all groups except non-poor men said that a great benefit of these ICRAF-inspired groups is that individuals have become more confident as a result of membership. All focus groups mentioned that the new groups had brought the community "closer together," which is perhaps their greatest accomplishment. It seems, then, that ICRAF has made progress toward realizing its goal of improving social capital by improving local groups. While this assessment is positive, areas for improvement emerged from the focus groups and PRA exercises. One way that disseminators appeal chiefly to the wealthy is that they disseminate much of their information in Swahili, rather than local languages. Interestingly, it was non-poor men's and women's focus groups who complained about this (although they should be in a better position to understand than poor farmers), and noted that it limited understanding. In addition, both women's focus groups reported that they felt intimidated by men at groups, and that this limited their ability to learn. This was expressed with exceptional strength when women reported that some men had stolen group funds. Further, all groups except non-poor women reported that local elites were stronger as a result of these groups. This is one possible reason why poor men reported that they gain less than men of similar status elsewhere. They are cut out of elite circles. Similarly, even less poor men are largely not drawn from local

social elites, and therefore do not gain as much information as they could. In contrast, women started with lower levels of knowledge in the first place. Thus, they gain more knowledge about technologies. By making these groups more inclusive of non-elite people, disseminating organizations could also make local groups more responsive to other local needs. For instance, all groups reported that the way they were taught to use *tithonia* was too hard for old people to use, since it is too labor intensive. Groups did not address these concerns.

Conclusions

Making these groups accessible to non-elites would also make them more effective at disseminating information. Although ICRAF hoped to use local groups, these groups have drawbacks. Instead, farmers reported that most of their social learning occurred via formal means as explained earlier. It should come as no great surprise that groups dominated by elites were not especially effective at disseminating information to the majority.

Disseminators should be cognizant of this potential for domination and revise approaches in a way that could reduce this influence, so that they do not become agents of social stratification as well as technology. Perhaps much of this fault rests with ICRAF's assumption that residents are part of groups outside kinship. Some people obviously are, but others are not. ICRAF should redouble their efforts to reach those people outside groups, as people reported that they learned more about SFR outside groups. In spite of this, people in Sauri are gaining much from ICRAF's interventions.

The Catchment Approach in Gongo

Gongo represents an interesting case for a variety of reasons. For one, it was chosen as a research site that represented the catchment approach as used by MoARD. Also, organizations used a variety of methods. Participants are most positive about this approach, as it allows them to shape local programs through their participation. Nonetheless, participants have some complaints about their participation level. Notably, they complain that the approach does not include everybody. These complaints are illustrated when participants compare MoARD to an organization of superior resources, the United States' Centers for Disease Control and Prevention (CDC). These offer some ways for MoARD to improve dissemination of SFR technology.

Assessment of Disseminating Organizations

Gongo had contact with more external organizations than most other villages. Participants readily identified CARE, KARI, and MoARD as locally active. Wealthier men and women also reported that ICRAF worked in the community, although they provided little other information on this. In addition, Gongo saw many other groups working there. A group called Africa NOW attempted to set up irrigation and water systems. One called ICA attempted to teach another technique for biomass transfer. Kenya Seed set up subsidized seed buying programs. Several hospitals ran public health education programs. Residents could conceivably have learned about everything from sunflower raising, to compost, to credit from groups that ranged from the local religious organizations, to a World Bank team, to the CDC.

Although focus group participants sometimes had difficulty associating organizations with specific technologies or methods, they generally had a positive association with the organization they closely associated with the community. Their assessments of MoARD do particularly well. Gongo participants ranked MoARD as more useful than participants in other communities, giving it an average score of 50 percent. Poor men and women ranked MoARD particularly high. Poor men scored it at 75 percent, while poor women gave it 62 percent. While the

assessment goes down among non-poor men and women (to 27 and 33 percent, respectively), every number is higher than the average ranking of MoARD at 23 percent, and 21 percent in Luo communities.

Other agencies did not do as well. Although it still scores higher than the average, KARI scores lower at 35 percent. Of course, this is still much higher than its Luo average of 15 percent, and this gain is significant since KARI's involvement in the community was limited. KARI did better among non-poor men and women, both of whom ranked it at 45 percent. Local assessments of CARE indicate this difference between non-poor and poor more dramatically. In this case, poor men and women each ranked CARE at about 5 percent. In contrast, non-poor villagers gave it 25 percent. Only non-poor men and women identify ICRAF as working in the community, and nobody attributed any dissemination to it.

Some of these differences can be explained by histories of organizations in the community. Few participants identified ICRAF as working in the community at all. This is probably because the organization was new to the area, and had contacted local leaders and organizations only to this date. It is less obvious why CARE and KARI would rank lower, but reasons are suggested by the role of local groups. Both organizations work mostly with local groups. Especially in the case of KARI, focus group participants drew strong links between the organization and local committees, most of which existed before the programs began. These committees were predominantly composed of wealthier residents. An example of this comes from a story told by both poor men and women in the community. KARI wanted to create a model farm in Gongo, of a farm size larger than that desired by or to be found among poorer farmers. Both poor groups commented on the exclusion they felt. This ended up further weakening participants' associations with KARI, and KARI opened up the project to all who wanted to participate. Although no similar story exists for CARE, participants reported that they also work with committees and that even their work with schools limited the poor's participation, since school attendance is not universal, and the school clubs they used to disseminate SFR were better attended by wealthier children.

Teaching Methods and Knowledge Gains

MoARD's positive assessment stems from its good work that participants saw as positive and participatory. In Gongo, MoARD entered the community via assistant chiefs' *barazas,* and moved on to encourage participation among all residents. They particularly focused on active participation via local committees chosen by elections in different clans. These committees would then receive training on how best to disseminate agricultural technology, including those related to SFR. From there, committees performed a variety of dissemination methods. These ranged from tours of model farms, to general meetings, to *barazas.* They also were expected to visit individual farms to encourage use of SFR. Residents were supposed to learn a variety of techniques of soil fertility improvement, soil and water conservation, farming practices, and accounting practices such as double entry bookkeeping. Finally, MoARD attempted to follow up on these techniques with monitoring and evaluation that would allow them to identify their shortcomings and to generate new areas for improvement. The result of this was that participants reported back good assessments of the technologies, methods, and staff of MoARD.

Participants were generally positive about the effects of the technologies MoARD sought to introduce. Poor farmers were particularly positive about the results. Participants saw their improved yields as the direct result of the technologies. Although knowledge gain on most technologies was substantial, among the eight technologies participants learned about (*tithonia,* crop residue, farmyard manure, compost,

commercial fertilizer, rock phosphate, improved fallows, and terraces), they reported learning more than the average across the six villages only on crop residue and commercial fertilizer. These scores are somewhat biased by non-poor participants, as poor men did not mention that they gained any knowledge about crop residue and poor women reported only a 40 percent knowledge gain, compared to 63 percent for all of Gongo. Similarly, poor participants learned slightly less than others about commercial fertilizer. Poor participants reported a 47 percent knowledge gain. Non-poor participants reported a 60 percent knowledge gain. Participants reported that they learned less about five technologies (*tithonia,* farmyard manure, compost, rock phosphate, and improved fallows) than participants in other villages. On *tithonia,* rock phosphate, and improved fallows, with average knowledge gains of 14 percent, 4 percent, and 7 percent, respectively, knowledge gains are quite low. Nonetheless, all groups commented on the value of these technologies. The fact that the poor were especially positive on the utility of the technologies they learned from MoARD indicates that, although they do not believe they learned as much as farmers in other communities, the knowledge they gained was especially applicable and beneficial.

This assessment suggests that SFR disseminators in Gongo are using effective teaching methods. As in most communities, people prefer one or two methods. The chief difference in Gongo is that participants prefer methods less popular elsewhere. But, as in most places, assessment of methods varies by wealth status. Here, the most popular method among the non-poor was group meetings. Among the poor, the most popular method was observation. What these two methods share is that they both fundamentally involve inclusion. Rather than present model versions of technology removed from much of the social and ecological context where farmers are likely to use them, these methods allow residents to see technology in action, participate in its development, and to ask questions freely as they see fit. This is what all focus groups said they liked about the methods. Local participation led MoARD to emphasize dairy farming, nutrition, and canning among the technologies they disseminate. Formal presentations, such as demonstrations, tours, training, and committee meetings, score far lower in Gongo than in the rest of the communities.

The greatest challenge to these methods arises from the preference of different social groups for different dissemination techniques. Although gender preferences do not differ from the overall pattern, with women preferring *barazas,* meetings, and tours, wealth status preferences differ greatly. As noted earlier, the non-poor group prefers meetings and the poor prefer observations. Group meetings are specific social contexts, whereas observations can occur any time and any place. This indicates that, although it generally succeeds, MoARD has not directly reached poor residents as much as it would like.

Local Disseminators

It is difficult to distill a pattern on attitudes toward local groups. Only poor men and non-poor women mention the catchment committees, giving them scores of about 11 percent. "Other local groups" are given a score of 39 percent by poor men, but less than 10 percent by all other groups. Poor men also favor learning from "other farmers," giving them a score of 20 percent, over twice as high as that from any of the other three groups. In contrast, churches are seen as useful forums by all groups except poor men. *Barazas* receive the most consistently high scores of between 20 and 30 percent, but poor men do not mention them at all. Trying to understand the wide variations in this scoring would take additional research. Additional information about people's experience with groups is, however, provided by the mapping of village information flows, where poor men and women showed either no link or a weak link between MoARD and

local groups or farmers. In contrast, non-poor men and women both said that MoARD has strong two-way interactions with groups and farmers. This appears somewhat contradictory, given the high scores that poor groups gave MoARD. This may indicate, however, that people recognize the importance of MoARD in providing information by different means, but that poor farmers had less experience in groups on which to comment.

Participants' reports on local social capital further verify this. In their discussions, non-poor men and women both reported that the presence of the groups in the communities strengthened local solidarity. And, from their perspective, they may have. The fieldworker researching Gongo reported that in practice, the means of choosing groups meant that clan elders were selected. In societies with clans, an elder is necessarily both older and from the dominant lineage. In other words, those serving in the groups were the oldest, wealthiest, and most powerful residents. It is understandable then that both poor men and women reported that local groups were chosen unfairly, and wanted this rectified in the future. To their credit, non-poor men and women both admitted that group members get benefits first, and that they give these benefits to their close kin before others.

Conclusions

It should be noted, however, that although lack of participation is a problem that should be corrected, participants are generally positive about MoARD and the information they bring. But it should also be noted that MoARD is not the most highly regarded group disseminating technology in the area. That honor is held by the CDC. Considering what the CDC does can also offer valuable lessons for those seeking to distribute SFR.

Participants presented almost a constant stream of praise about the organization, because the CDC provided a technology that people saw as extremely useful and well distributed. They provided antimalaria technology, specifically nets that keep mosquitoes from breeding, and treatment information for malaria sufferers. The community clearly desired these benefits. All focus groups reported that malaria was a problem in the community. Furthermore, all focus groups reported that the technologies worked and were easy to use. To top it off, the technologies were given to all residents for free. The CDC also held well-attended seminars and had their staff regularly visit residents to ensure that they were following guidelines.

It is perhaps unfair to compare other organizations to the CDC. No other group could possibly have provided such direct and clear benefits as malaria prevention. Nor could any other group marshal the trained staff used by the CDC. But, although the comparison may be unfair, it also provides a valuable lesson to other groups. While SFR is not as beneficial as prevention of an endemic, chronic, and debilitating disease that can strike anybody, it is important to note that the CDC did other things well. Although agricultural disseminators cannot purchase inputs for farmers, which participants are in favor of, they could do a better job of trying to reach all community members with their interventions, as did the CDC. Similarly, by all accounts, the CDC patiently explained the benefits of their intervention. They also listened to local concerns and answered questions. This provides ideas for how MoARD and other SFR disseminators can be more effective in further efforts.

The Trace Approach in Muhanda-Arude

Muhanda-Arude is a Luo village located in the Siaya District. CARE began working with tree management and tree nurseries, more than SFR technologies, promoting, for example, *Leucaena* and *calliandra.* This work began in the mid-1980s and CARE stayed until 1999, although farmers said that the real intervention ended earlier. ICRAF picked up SFR activities in the village later.

Some villagers recall work on soil fertility done by MoARD as far back as the 1970s, though there is little recollection of this and it is not evaluated here. Muhanda was chosen as a site for the dissemination focus groups because (1) it was one of the earlier villages to receive the technology, and thus there is a greater time horizon for evaluating the technology; (2) it was one of the villages where the survey and case study work was done for this project, allowing some overlap in site selection; and (3) CARE used its TRACE approach there (Training Resource Person in Agriculture or Agroforestry for Community Extension), an important form of intervention that was used throughout Siaya. As one of our stakeholders, CARE has an interest in the results of the study.

As described in the main report, TRACE was an effort to promote sustainability through a network of farmers, local groups, and regional groups that would conduct needs assessment and promote training. Officially, the structure involved regional groups called Locational Agroforestry Committees (LAC, later changed to LASCO), which were to select groups, which, in turn, chose Group Resource Persons and several adaptive research farmers. In Muhanda-Arude, however, these structures were not operating as envisioned, at least in the perception of farmers. Still, some effective training took place and people are using the technologies.

Teaching Methods

As in the other villages, different types of training forums were used by these organizations. Among the focus group participants as a whole, *barazas* and "general meetings" were by far the most popular, especially among poor women. This suggests that people in Muhanda-Arude are most comfortable with forums that involve the whole community, rather than sessions that involved a more select group of farmers, such as tours and exchange visits, which were the least popular. Both poor and better-off women explained the importance of the village elder in bringing farmers together to inform everyone of the presence of one of these external organizations in the village. Although some say this system works, some poor women said they never receive this information, and suggest that the village elder invite every household in the village directly. One of the stronger messages from the research was that all four groups—men, women, poor, and better-off farmers—expressed that the community at large needs to be more involved in processes of technology dissemination than it has been in these past interventions, rather than the communication being primarily with a few.

Observations of other farmers' fields were also a popular method of learning compared to most other methods, somewhat more so in Arude than in four of the five other villages, though this was only among rich men and women. Of these, the women preferred this method far more than men, which is consistent with the hypothesis that women benefit more from methods that are inclusive and open to everyone, rather than a smaller invited group. Demonstrations, field days, meetings (of smaller groups, as opposed to "general meetings"), oral conversations, "training," and exchange visits had a low popularity among both men and women. Neither women's focus groups mentioned field days, exchange visits, or small meetings, suggesting that women participated less in these. The most popular methods for poor farmers were the "general meeting" and *baraza,* whereas rich farmers do not mention general meetings at all. In contrast, only rich farmers mentioned observations, oral conversation, and exchange visits. Most interesting is that none of the four groups mentioned funerals; Muhanda is the only village among the six where funerals are not mentioned at all in the focus groups.

On average across the four groups, CARE was given a rating of 60 percent compared to ICRAF's 40 percent, indicat-

ing that both organizations were popular but CARE more so. Possibly because of CARE's longer-term involvement versus ICRAF's more recent intervention, CARE is remembered for having done more in the community. However, CARE is viewed much more favorably by the better-off groups than by the poor groups, which favor ICRAF substantially. In spite of this scoring, poor men remarked that CARE worked for a long time in the village and benefited the farmers who worked closely with the organization, and poor women appreciated the gardening tools that CARE left for use in the nursery. Men and women view the two organizations essentially equally, consistent with both focus group comments and survey results, indicating that disseminating institutions were not discriminating by gender. However, when asked about the strength of communication between the organizations and farmers, only poor women said communication was strong with both CARE and ICRAF, with the other groups saying communication was weak or nonexistent with both organizations. Only the poor men remember MoARD, saying that there was strong two-way communication with MoARD at the time, although the overall assessment of MoARD was lower than for CARE and ICRAF. No women mention MoARD, possibly because in the early 1970s, the government was not paying much attention to women as farmers.

Poor and better-off women mentioned that the venue for meetings needed to be more suitable for participation, probably reflecting their greater restrictions on traveling. The better-off women pointed out that these far away venues are used simultaneously for trading, leaving insufficient time for the training, and that they would prefer organizations to go from home to home visiting farmers.

One dissemination method of particular concern to farmers is the "contact farmer" or "adaptive research farmer" approach, whereby the external organization works primarily on the farm of individual farmers, who, in turn, are expected to serve as demonstrators to other farmers in the village. Villagers reported that at first CARE worked with individual farmers, and then changed to a group-based approach. However, the TRACE approach still uses Adaptive Research Farmers (ARFs). ICRAF used these adaptive research farmers as well. This approach has caused problems, and is disliked by both men and women and by rich and poor groups alike. According to participants, these contact farmers are resented because they are seen as (1) unfairly favored and (2) do not spread their knowledge to others. Both groups of men in particular stressed that the contact or adaptive research farmers do not share information, and according to the better-off men, they are seen as "the wealthy and educated who are frequently visited and make others feel left out and different from the preferred farmers." The constant attention from government and other institutions is said to be a problem for the rest of the village, as well as the contact farmers themselves in terms of time it takes up. Non-poor men also said that contact farmers were picked by the institutions, and better-off men commented that most people did not even know of the designations. This is contrary to the intended position of CARE and ICRAF that farmers themselves should choose the contact farmer. Poor women criticized the contact farmer for not sharing seeds, saying that people waste their time trying to get things from them. However, they saw one CARE contact farmer in a positive light, recalling that he helped with training and, more significantly, brought women together to form women's groups to promote the technology.

Notwithstanding local perceptions, it is important to recognize the role of the contact or adaptive research farmer from the perspective of the disseminating organization. As CARE points out in its TRACE approach, technologies that work in one region may not be adapted to a new region.

Adaptive research farmers are crucial for testing technologies and practices and adapting them to local conditions, before they are disseminated to other farmers. There may thus be a period in which there is considerable contact between the ARF and the external organization, before many other farmers are brought into the process. It is equally important, however, to recognize that the social context will affect outcomes, and that this method as currently practiced is problematic in the context of local social relationships, and has significantly affected the way in which people respond to the external organizations as they introduce technologies. It is necessary then to bring the community more widely into the learning process at an earlier stage, to make sure people understand the role of the ARF and approve of the choice.

Evaluation of Training

TRACE involves a training needs assessment, in which the groups chosen by LAC are consulted regarding what kind of training is needed in the village. Focus group participants were not aware of this process (it is possible that few if any were part of this consulted group). People found the training and the technologies useful and effective, however. SFR technologies that people learned about include *tithonia,* crop residue, farmyard manure, compost, commercial fertilizer, rock phosphate, improved fallow, and terraces. Additional training took place in tree planting, nursery management, improved cookers, and kitchen gardens. The "ladders" exercise where participants rated the percent increase in their knowledge of the SFR technologies suggested considerable learning took place during the intervention and that knowledge has continued to increase through practice for some of the technologies. In the discussions, however, men were critical of the depth of the training and the number of people who benefited. Some men said that farmers were using these technologies but with a "shallow idea" and that inadequate training and demonstration was a constraint on uptake and the benefits that flow from adoption. Rich men said that CARE did serious training, but that only a few benefited from the training, particularly the group members (see later), a comment they made about ICRAF as well.

Women spoke more favorably about the training in several technologies than did men, with rich and poor women emphasizing the training that CARE gave in tree planting and that women were planting trees and benefiting from them. ICRAF was also said to have provided useful training. In the ladders exercise, poor farmers report they have learned more than rich farmers on the more easily available technologies such as terraces, *tithonia,* composting, and improved fallows, with the greatest knowledge growth in the first two technologies. Richer farmers learned more about commercial fertilizer and rock phosphate (knowledge gain was the lowest on rock phosphate for all four groups). Of all groups, poor men stand out as having learned the most about *tithonia* (80 percent knowledge gain), terraces (80 percent), and improved fallows (70 percent). Women tend to feel that they learned more than men on all technologies (those mentioned thus far as well as farmyard manure and compost), except improved fallows, possibly because their starting point of knowledge and training is generally lower than men's. The rich women's group in particular talked at length about all they had learned through CARE, ICRAF, and MoARD. This is significant because it suggests that women are benefiting from the interventions, at least in terms of human capital development.

CARE's program of training through the schools is viewed as successful in Arude. All four groups said that children are learning about tree planting and agriculture. Children plant vegetables and trees at home, and parents are said to learn by observing this planting. Women say that sale of vegetables at home produces income for the family, and men point out that the trees

have produced income and timber for the schools, and that the trees are still there, although rich men said that there are fewer than before. No problems were raised with the schools program.

Group-Based Extension

CARE started out using contact farmers, but changed to a group-based approach when the former method was found not to be working well. Both women and men seemed to remember the women's groups formed by CARE more than men's groups, and the former were remembered as having been successful for a time. One of these groups had as many as 40 members. The men's groups seem more informal, without identified names (as the women's groups). This seems to be consistent with greater group-based activity in general among women than men.

Men said that few farmers were involved in these groups, and that while they benefited their members, this was only a small group and most villagers have not benefited. This is confirmed by the Venn diagram by rich men that shows a link between CARE and the contact farmers, but not the groups, and no link between the group and other farmers, or between the contact farmer and the groups or other farmers. There is a strong link between ICRAF and the groups, however. Rich men said that the committee organized field days and gave demonstrations to farmers, and one group member offered his land for nursery management and training. They said that CARE did more of the organizing of farmers than farmers themselves, however. In the ranking exercise for internal organizations, only the group of rich men mentioned a committee and ranked it lower than the other organizations. Significantly, the groups seem to be working better for rich men than for poor men, evidenced by the fact that poor men did not mention groups in the ranking or in the Venn diagram. One issue related to sustainability of the methods is whether groups or farmers are willing to pay for extension services. Although there is no evidence of this having occurred with SFR, rich men said they would be willing to share costs for a technology if it would be beneficial to them.

Other internal sources of information were *barazas,* other farmers, schools, women's and church groups, and local leaders/elders. Rich men ranked local leaders/elders and other farmers highest, while poor men only mentioned the first three and preferred the *barazas.* Women viewed *barazas* less favorably than men, and poor women ranked other farmers, women's groups, and churches highest. Curiously, rich women did not mention women's and church groups in the ranking.

The CARE contact farmer assisted women in Arude in setting up some new women's groups for the purpose of promoting the trees, and poor and rich women said they benefited from these groups. In the Venn exercise, poor women showed that both CARE and ICRAF had strong links (although unidirectional) with the women's groups; however, rich women showed no links between the women's group and either organization. Furthermore, the women's groups collapsed after CARE left, suggesting the value of using existing group structures, rather than establishing new ones for the purpose of a new intervention. It is likely that, especially under conditions of an AIDS crisis, groups are strained for resources and members strained for time, and that those with social insurance functions will be the strongest. Rich women, however, did say they would like to have women's groups dealing with agriculture, and women's church and welfare groups also serve as agriculture groups in some cases, for example, producing maize and beans for funerals. This could suggest the value of more agriculture activities being channeled through existing groups. One small women's group involved with growing beans, maize, and potatoes continued its activities and hoped that ICRAF would train them in new farming

techniques and SFR to increase their yields. The groups are seen as potentially providing benefits in addition to training, such as seeds and credit.

In general, there do not seem to be many two-way information flows between external and internal organizations or individuals. This implies that although farmers may be receiving good information, the system by which external organizations learn from the input of farmers does not seem to be working well. Poor and rich women showed a two-way link only between the chief[39] and women's groups (rich women included friends and relatives). However, rich men do show a strong two-way link between ICRAF and the local groups, and poor men showed a strong two-way link between CARE and the contact farmer.

The LAC and LASCO structures did not appear to be functioning in Arude, or were perhaps not visible widely enough to be known by the farmers in the focus groups. This was confirmed by rich men who said that LASCO is known only to a few farmers, that they have not been effective, and no longer exist. Poor men said that neither LAC nor LASCO existed in the village, and women did not mention them at all. Below are notes from the focus group with rich men:

> CARE, which did some serious training though only a few especially group members benefited. A majority in the village did not benefit. There are only two adaptive research farmers in the village but not known by this designation. Most participants did not know of these designations or existence of any committee. Only one out of ten [focus group] participants knew of LASCO and was a member of the committee. The committee was active only during the time of CARE and could organize for field days on occasions to demonstrate to farmers what they need to do. Since the approach targeted group members only, they are the majority of beneficiaries. The committee (LASCO) as well as the groups collapsed after CARE; hence no activity is now done by committees.

Poor men said that some of the extension activities brought the community together. The groups introduced or were affected by certain social tensions, however, some of which contributed to their collapse. The root of this, as described by the men's groups, is that some village members benefited from the groups while others did not: the greater attention that these farmers had from CARE, uneven distribution of resources, the ability of some to amass wealth through the process, and conflicts over resources—all fostered resentment and politics. There was also mismanagement of resources among both the men's and women's groups after CARE left the village, which, in turn, increased social tensions within the village. Villagers felt that CARE left the village too soon, before the groups where able to stand on their own feet, and that there was a need for greater monitoring and follow-up. Part of the problem may lie in the fact that CARE envisioned LACs to carry out monitoring and evaluation, and if the LACs were not functioning well for this community, this function could have slipped through the cracks.

[39] These village-level studies refer often to "chiefs" as involved with dissemination through their serving as liaison between external organizations and farmers, holding *barazas,* and involvement with other aspects of dissemination. Technically a chief is the head of a location and the subchief is the head of a sub-location. Most of those involved in dissemination would be subchiefs because a chief has thousands of households under his jurisdiction. Given the many other obligations of a chief, his/her role as a disseminator would be limited, while assistant chiefs would be more directly involved. In the focus groups, however, participants usually referred to "chiefs" even if they usually meant assistant chiefs. We have thus chosen to use their language and keep the word chiefs.

Conclusions

As indicated in the survey, the case studies, and the focus groups, the SFR technologies are seen as valuable and people welcome the training, and have learned a considerable amount about the technologies. However, the group-based dissemination methods themselves do not appear to have functioned as envisioned, with lack of participation and sustainability over the long term. The experience in Muhanda suggests that more time and effort would have been necessary for building capacity in groups, and that additional monitoring after the dissemination intervention ended could have helped to identify problems and resolve them where possible. To a certain extent, the tensions that arose around the groups, as well as those around the contact farmers, are, however, social dynamics that can never be entirely avoided.

The PLAR Approach in Mutsulio

All of the disseminators covered in this study attempted to include the opinions of community members in their methods. In some cases this attempt aims to improve dissemination methods or to point out deficiencies in the approach. The Participatory Learning and Action Research (PLAR) approach in Mutsulio represents an attempt to go further. Here, local people ideally not only served as checks on the disseminating organisms, but also participated in developing the programs. The program met with success on many levels. It achieved impressive results in knowledge gain. It also achieved impressive dialogue with local groups and local farmers. The approach also led to a heavy dependence on local groups and meetings to the exclusion of other methods and internal organizations. The most notable problem with this dependence was that more than other methods, this benefited some to the exclusion of others, and has caused enthusiasm for it to wane over time. The initial focus of PLAR was on soil fertility. Households were ranked according to better or worse soil managers and then groups were formed around similar managerial types. The focus of the PLAR approach was thus greater than agroforestry, but less than the range of technologies disseminated by the MoARD extension program.

Assessment of Disseminating Organizations

As noted in greater detail in the methods section, the approach used to disseminate SFR technology in Mutsulio was specifically designed to increase local participation at all levels. In this it is commendable, as a frequent complaint residents voiced in other communities was that they were not sufficiently involved in planning and improving SFR projects. Although eliciting local opinions may sound simple, this approach shows it is not so. This appears to be one of the most elaborate of the approaches in these communities, as well as one of the best planned dissemination approaches covered here. Fundamentally, the approach sought to aid dissemination through participation, but also by appealing to a number of motivations. It sought to help farmers learn new soil fertility methods through "on-farm learning, self-discovery, and experimentation." Disseminators hoped to satisfy people's curiosity about technologies they saw their neighbors using, and to thereby empower farmers. They hoped that it would increase farmers' capacity to join groups, speak for themselves, and positively affect their own lives. The approach set up a means to include farmer input at most levels. Although the specifics of the program are complex, the four "steps" of its approach all involved input and interaction of farmers and extension staff. For instance, farmers' groups were supposed to draw up action plans for dissemination into the community. Similarly, farmers would suggest the topics to be covered in a general *baraza* that would expose the whole community to the technology. Key to the approach is that "open-minded" farmers are active in groups, which meet

often so that agents can discuss technologies. They are then urged to try out the technology, see if they like it, and disseminate it to others. Ultimately, their goal was to get farmers to suggest technologies themselves, and to figure out ways to improve them.

The implementation of this program looks different from this ideal. In practice, it is most notable for differences in degree of group activity. The disseminating organizations that were active here, KARI, MoARD, and ICRAF (although ICRAF's was an intermittent and supportive role to KARI), all entered the community in more or less the same way, and went on to found numerous village committees. It is not surprising that the organizations proceeded in more or less the same way, as MoARD introduced the other two into the community. In addition, all used MoARD's means of entering the community. All organizations entered and were introduced via the same local man, who introduced extension staff at a *baraza.* Once this meeting was staged, local groups were formed by electing members from other local groups, mostly clan, church, women's, and funeral savings groups. For this reason, local groups resembled those in other communities to a great extent. Like in other communities, participation in these varied by social status. Poor focus groups list an average of one group as existing prior to dissemination of SFR technology. Non-poor groups list an average of five. Most likely this indicates that wealthier residents were more active in local groups, and that, therefore, groups formed by SFR disseminators were groups of the better-off residents.

Importantly, outside organizations were supposed to be especially active in local dissemination, especially in seeking feedback from villagers. There can be no doubt that they did this. Most notably, men's focus groups both said that KARI had either strong two-way or one-way interactions with farmers. The two women's focus groups, on the other hand, indicated that KARI had one-way interaction with farmers or groups. MoARD and ICRAF were both held to be active in the community by two focus groups. The most interesting figure from this is that ICRAF was held to be active only by the two men's groups. ICRAF thus appears to have not made as many efforts to reach women in this village.

This information is reflected in focus groups' assessments of outside organizations' usefulness and importance. As we may expect, KARI scores the highest on this assessment. The three focus groups that mention it rank it at slightly higher than 60 percent. In contrast, the three groups that say they get information from ICRAF rank it at slightly less than 20 percent. But the most surprising aspect of ranking concerns two facts. The first is that only one group, non-poor women, rank the three sources, even though all three were active. In contrast, poor men say that they obtain all of their information from MoARD. Because nothing in either of the focus group discussions suggests animosity toward any disseminating organization in particular, this diversity suggests something else; that is, that the focus group participants of Mutsulio generally are unclear on which outside group is active in the community.

Teaching Methods

Focus group analyses of the methods used by SFR technology disseminators eliminate what little controversy exists about the enormous influence groups hold in this method. The most common method used in disseminating knowledge was group meetings. Three of the four groups rated this much higher in Mutsulio than in other communities. Most notably, poor women ranked groups at 70 percent, compared to about 35 percent in other groups. Similarly, both non-poor groups ranked group meetings at 50 percent, five times the number reported elsewhere. Although poor men do not report on this method per se, they, too, use groups. Here, the most common method for receiving information was "PLAR," which one participant reported meant going to groups and then trying out technology. The only

other method remotely as popular was oral conversations. These, however, were reported only by the two non-poor groups. They ranked conversations at about 40 percent. But this, too, supports the preceding analysis in which relatively non-poor individuals would be more likely to gain from conversations with group members.

Such use of groups to the exclusion of all other methods has a number of problems that are not unique to Mutsulio. Like everywhere, solely using groups for dissemination leads to members gaining disproportionate amounts of information. Perhaps the best illustration of this comes from a statement made by the fieldworker who did the research here. He reports that poor men "envision commitment and hard work as ways to spread technology, so that other farmers can observe the technologies as practiced by the committee members." According to notes, these farmers see no other way that committees disseminate technology. But diffusion takes time. The only people who could be assured of benefiting from these technologies were those to whom it was introduced in the first place.

These groups also suffered from a number of other problems. Most notable is that farmers do not participate in them. As argued earlier, non-poor people are the most typical group members, meaning that the majority of people in these communities are not participants. Poor men note that they feel a great constraint to participating in groups because they do not have enough land to become group members. Although this may not matter as several also noted that they did not have enough land to adopt some of the technologies anyway, it was a barrier to participation. Similarly, women see groups as being forums for men. Others see them as dominated by men, if only passively. Non-poor women even expressed their reluctance to participate because of men's dominance. In particular, they noted that men sit through meetings and then reject the technologies when they get home without having said a word at the meetings. Others would go solely to reap the monetary remittances that some groups paid, which they would pocket without adopting the technology. But the groups and disseminating organizations were dissatisfying for another reason. Three of the four focus groups reported that they did not talk to farmers as much as they said they would, and would simply ignore their requests when they did.

These groups also suffered from a number of logistical and technical problems. All four focus groups reported that they are less likely to attend meetings or to be active in groups owing to their overlap with funerals. Similarly, poor women noted that they interfered with domestic chores, as the meetings could stretch for four hours. Both poor and non-poor men noted that organizations had failed to deliver on their promises several times. These same two focus groups also suggested that some of the committee members were chosen poorly. In particular, they were not especially hard working, which caused dissemination to take place at a very slow pace. These problems are aggravated, as few other dissemination methods were in use.

The ultimate test of this method's effectiveness, however, lies not only in comments on process and disseminating structures. It also lies significantly in the amount of information people learned from it. In only one case did farmers say they gained little information: neither poor men nor non-poor women report that they learned anything about crop residue management. This is somewhat counteracted by the massive gain that occurred in non-poor men (70 percent knowledge gain in Mutsulio versus 40 percent in other villages). In addition, it should be noted that poor men and non-poor women reported relatively small gains in crop residue management of 10 and 20 percent in all the study communities. Farmers report about the same level of knowledge gain on average in three of the four technologies (*tithonia,* 60 percent; farmyard manure, 46 percent; and compost, 55 percent). But the gains in commercial fertilizer, rock

phosphate, improved fallows, and terraces are impressive. For example, poor women report a 63 percent knowledge gain in rock phosphate. In other communities, they report a 29 percent gain. Similarly, poor men report a 68 percent knowledge gain in commercial fertilizer, which compares favorably to the 33 percent reported elsewhere. All groups report at least one substantial gain over the average. It is impressive that these gains could have occurred over such a range of technologies, particularly as none was specifically targeted.

Local Dissemination

Focus groups have surprisingly little disagreement on their sources of information inside the community. Far and away the most commonly listed source of information here was groups inside the community. In fact, residents ranked this as highly as all the other sources of information combined, at just over 50 percent. Perhaps the most impressive number to emerge from the PRA exercise on internal forms of dissemination was the assessment of local groups by poor women at 80 percent. The comparable figure for the study villages as a whole was 22 percent.

The second highest figure to emerge from this PRA exercise was farmers' assessments of the usefulness and importance of other farmers as a source of information. Here, both poor groups ranked this about the same as the average. In contrast, the two non-poor groups ranked it about twice as important. Non-poor men rank it at 30 percent and non-poor women at 25 percent. These figures suggest that less poor people are the prime beneficiaries of this approach. Not only are groups most likely composed of the non-poor, but also the non-poor are more likely to know others of their kind. Therefore, they are more likely to know group members who can teach them more. As such, the two non-poor groups get more information from other farmers.

A number of other differences appear on this list related to low rankings. Although *barazas* score slightly higher than average among poor men in Mutsulio (33 percent versus 31 percent), every other score is lower for all technologies. Notably absent from this list are funerals, schools, women's groups, church groups, and local leaders. In fact, based on our focus groups, one would conclude that these are not among SFR disseminators. At the very least, they are not used with great frequency.

Conclusions

Clearly PLAR can lead to impressive gains in knowledge. It may be less able to sustain this growth, however, owing to resentment created in the community and inability to truly engage different social groups, which undermines the goals of PLAR. It may have been more effective had they also tried other methods, or taken steps to try to ensure that the groups were not the domain of relatively few community members. Finally, this almost complete reliance on groups in practice leads to the inability to hear community concerns. Improving this method can allow disseminators to accomplish their other goals of improving local groups and leading to direct community involvement with technology and empowerment.

The Catchment Approach in Mwitubi

Mwitubi village is in Mwitubi sub-location in a Luhya area of western Kenya. The catchment area forms the main focal point in the dissemination approach utilized in the village and it was introduced by MoARD. However, various NGOs have since entered and worked in the village, using a variety of other approaches to reach farmers with a variety of messages. The catchment approach focused on a group of villages with the same water catchment and drainage system to tackle the issue of water and soil loss. MoARD organized farmers in this group of villages, covering the catchment into what has come to be known as a Catchment Committee. The committee mobilized farmers

to be trained and to provide labor in the soil and water conservation works within the catchment. Later MoARD also formed village committees in the catchment and it is the village committee that participants zeroed in on during their discussions, as it was fresh in their minds.

MoARD worked with a group of villages with common geographical orientation in order to deal with not just a common problem, but also through measures that complemented each other to deal with the problem in totality. The topography of the catchment was taken as presenting the total problem and conservation work in any one farm and village added up to solve the problem. As work proceeded, the entire catchment was covered with conservation work and the whole problem of water and soil loss in the catchment lessened significantly. This approach was a deviation from earlier approaches that focused on single farm units and failed because the problem was not tackled in the farms upstream and in those downstream. In this new approach, the problem of soil and water loss was taken as a community-wide (catchment) problem and community physical and human resources were mobilized to deal with it. The approach focused on providing skills to the people in the catchment to use local institutions and resources to tackle the problem at hand.

Farmers in the village made terraces on individual farms before MoARD introduced concerted soil and water conservation measures through the catchment approach. A catchment committee elected by the local farmers coordinated the activities in the catchment. Although training by MoARD focused on soil and water conservation, other agricultural matters were covered as well to help improve agricultural standards in the catchment.

Farmers' Comparative Evaluation of the External Organizations

When focus group discussions considered the organizations that worked with farmers in Mwitubi village, poor and non-poor male participants named MoARD, ICRAF, and FSDA, while poor and non-poor female participants named MoARD and ICRAF. The fact that female participants, both poor and non-poor, were unaware that FSDA had worked in the village may imply that women have limited access to information about the goings-on in the village unless they are targeted directly, as has been done by MoARD, for instance. FSDA did not undertake widespread dissemination activities in the village.

In ranking the various organizations that had undertaken dissemination in the village, the poor and non-poor men's groups both gave ICRAF an 82 percent rating and MoARD an 18 percent rating. Poor women gave ICRAF 47 percent and MoARD 53 percent, while non-poor women ranked them conversely, at 55 percent and 45 percent, respectively. Overall, participants rated ICRAF significantly higher than MoARD, in spite of the fact that the latter had worked in the village for a longer time. Part of the reason for this scenario was that farmers' interaction with ICRAF was recent and it provided transport for MoARD staff and, hence, was assumed to have replaced the latter. However, non-poor women participants noted that the interaction between MoARD and ICRAF was smooth, with the latter using staff from the former to reach farmers in the village. The ratings did not vary significantly on the bases of the socioeconomic status of the participants, although women tend to view MoARD more favorably than do men, and poor women had a slight preference for MoARD, while non-poor women slightly preferred ICRAF. It may therefore be concluded that ICRAF made better arrangements to work with farmers and reached them in more sustainable ways via MoARD staff, as the government was unable to do this.

In ranking methods of dissemination employed by external organizations, participants in Mwitubi village identified demonstrations and *barazas* as the most important. The poor and non-poor men ranked demonstrations at 40 percent, while poor and non-

poor women ranked *barazas* at 40 percent. On average, however, men appeared to prefer demonstrations, whereas women preferred the *baraza.* This is in line with focus group discussions on the methods where poor men argued that they forgot what they learned in *barazas* and meetings soon after learning. This is because lectures do not facilitate effective adult learning; hence, the participants preferred demonstrations as the main means. They also indicated that radio was a problematic source of agricultural information owing to lack of radios or the batteries to power them among many farmers. Women may have preferred *barazas* not so much of their own free will but because traditionally *barazas* have been compulsory for all adults in the villages, and hence saw them as an opportunity to fulfill a chief's regulation as well as listen to the disseminators. On the model/contact farmers and other farmers frequently involved by the external organizations in training other farmers, the poor men participants were of the view that model farmers gained more prestige and control over other farmers as they trained them. Non-poor men participants argued that farmers who trained others gained knowledge of agricultural technologies earlier and interacted better and more easily. They further argued that committees led by women were more effective. While poor women argued that richer and more educated farmers adopted inorganic fertilizers and poorer and less educated ones adopted organic practices, non-poor women participants were of the view that relationships between committee members and non-members were amicable. This was because members reached out to non-members with information and the latter were eager and willing to learn. Overall, therefore, farmer trainers or committee members who were trained to train other farmers did not appear to present problems to dissemination processes in the village, although there were some tensions over the contact farmer.

Looking at the dissemination methods at a higher level of generality, participants appeared to link the methods to the technologies that accompanied them and the tangible benefits accruing thereto. Poor male participants indicated that they liked the approaches used to reach farmers in the village, as they were able to train others in their groups on SFR shrubs and zero-grazing techniques. They were also happy with and willing to continue sharing costs for veterinary services. Non-poor male participants liked the technologies in which they were trained, as they were beneficial to them. Poor women participants liked the dissemination approaches because of the training activities and the farm inputs that came with them. Non-poor women participants, on the other hand, liked the dissemination approach because of MoARD's training in soil conservation, which had contributed to and improved crop production and also because the technologies disseminated took a short time to implement and realize results. From the foregoing, it appears that dissemination approaches are better if they deliver technologies that relate to the realities of farmers in ways that are easy and convenient to implement.

Discussing the type of interaction between farmers and the various institutions, poor male participants were of the view that extension staff were too few and they took too long to revisit them after initial training. Other groups had a difference experience: non-poor men and poor women participants indicated that the training offered by the various agencies was beneficial to them and had been owned by the community. Non-poor women participants also thought that interaction with MoARD and ICRAF was smooth, with the latter using staff from the former to reach farmers in the village. Participants also indicated that the local chief usually linked farmers to dissemination organizations, in particular, MoARD, and took initiative to disseminate any knowledge acquired. However, there was unanimity that the extension agencies' policies, practices, and training have not responded to farmers' feedback and that visits by extension staff

were scanty, shallow, and too little time was often allocated to them. In spite of such shortcomings, participants agreed across the board that the institutions had developed meaningful rapport with local social structures such as chiefs, *barazas,* and farmers' groups in general that enabled them to work smoothly. Particular farmer participation in dissemination processes was wanting. As participants in the focus groups indicated, farmers participated mainly through responding to questions during training sessions and mobilizing their colleagues for the sessions as appropriate.

As a result of the training provided by the disseminating organizations, farmers' skills in a variety of technical areas in agriculture had improved. For instance, poor women participants said that before ICRAF trained them on the use of the shrub *tithonia* for soil fertility improvement, they had considered the shrub a weed. Their knowledge in using that technology increased from zero at the point of intervention to 60 percent at the time of this study. Participants said that farmer skills in the use of compost, farmyard manure, improved fallows, terraces, inorganic fertilizers, and rock phosphates had significantly increased following the interventions by the dissemination organizations.

Besides the knowledge farmers gained in the technical agricultural areas, participants indicated that farmers had developed a much closer relationship with each other as a result of dissemination work in the village. Groups that had thus been set up mainly for dissemination resulted in group leadership being institutionalized in the village. Overall, study results indicate that individuals had gained both technical skills in agriculture and social interaction/communication skills as they trained their colleagues or shared information with them in systematic ways.

There was consensus among all the four groups of participants in the focus group discussions that schoolchildren were being reached with agricultural dissemination in one way or another. Participants said that the students learned agriculture in class and practiced what they learned both on school plots and at their homes. MoARD also trained schoolchildren in tree planting mostly through the 4K clubs in primary and secondary schools. Men participants saw the flow of agricultural information from school kids to parents and the village in general as emanating from the school plots and the plots given to the children to practice agriculture at home. The men participants were of the view that parents and other villagers observed those plots and drew positive lessons from them. Women participants on their part said that students trained their parents on the technologies they learned in school and also came home with agricultural inputs such as tree seedlings for planting. All four groups of participants were also agreed that technologies disseminated to the local school were still there and were re-disseminated to the village through field days, tree planting days, and songs organized in the school. The school can therefore be said to represent a focal point for dissemination work in the village.

Local Organizations and Community Relationships

Prior to intervention, the main groups that existed in Mwitubi village included church groups, and women's and youth groups as well as merry-go-round groups. None of the groups mentioned was involved in agricultural dissemination prior to intervention by the external organizations. On the commencement of intervention in the village, some groups were formed to further the objectives of dissemination. Through MoARD, village committees were formed in 1996. The main objective of the committee was dissemination of agricultural technologies. The participants said that elections to the village committee offices were conducted when it was formed, members make monetary subscriptions to it monthly, and meetings are held ad hoc whenever the leaders deem it fit. No initiatives have been taken by the committee, as it is weak and had

almost collapsed when MoARD staff completed their intensive backstopping in the village and moved to another one the following year. According to poor female participants, when the committee was active, its members (who represented various areas of the village) disseminated information to villagers through farm trials on committee members' farms. Non-poor men for their part argued that the committee relied mainly on the local chief and their assistant to disseminate to the villagers.

All four groups of participants were in agreement that village-level committees were formed by MoARD for purposes of agricultural technologies dissemination. The structure of the committees was not presented as uniform and while all participants focused on one village, that is, Mwitubi, some thought the committee met ad hoc; others said it met once, twice, or thrice per month. There was also no clear understanding by the participants as to how the committees disseminated information. These contradictions indicate that the village committees have weakened and ceased to be major avenues for dissemination in the village so that villagers do not remember much about them. Village committees in the study areas may not have been sustainable institutions for agricultural dissemination.

Participants said that some farmers approached the village committee for agricultural training, but the same was not forthcoming. Therefore the objectives of the committee were not met. The committee was reported as riddled in leadership wrangles to the extent that it scared away the members' subscriptions, and MoARD's limited visits to the village, given low staffing, dealt a final blow to the committee. While it lasted therefore, the committee's performance was lackluster at best. In general, the main constraints to the work of the village committee had to do with leadership problems and limited contact with ICRAF and MoARD. The village committee did not therefore present a dependable avenue for dissemination or local organizational change and development as would be expected. Hence, the committee became more of a constraint to social capital formation and human capital development/empowerment in the village.

The work of the committee appears to have gone smoothly but, without design, moved into the hands of the administration, that is, the chiefs and their assistant. While participants reported that the administration acted in consultation with the committee in mobilizing farmers for dissemination sessions and doing actual dissemination in *barazas,* by the time ICRAF arrived, they worked more closely and directly with the chiefs and their assistants in mobilizing farmers and disseminating to them. It is for that reason that poor women participants reported that chiefs and councilors were active in committee activities and in dissemination to non-committee members, adding "farmers attended dissemination meetings organized by chiefs and their assistants." Underscoring the point further, non-poor women noted, "The chief is the unifying factor in the village, linking the community with (dissemination) service providers." There is need to point out that beyond the village where the committee had not performed well, the catchment committee, which was wider, was reported to have achieved highly in soil conservation efforts in the same community but at a higher level.

In general, and beyond village committee activities, participants were of the view that dissemination efforts facilitated cooperation among farmers in Mwitubi village. There were no differences in the views of the various groups of participants on how community cooperation/conflict relates to the dissemination approaches. All the groups, of men and of women, of the poor and of the rich, appear to agree on the fact that the extension interventions led to cooperation and cohesion in some ways and to competition and conflict in other ways. Overall, the participants seem to have viewed the emerging

conflicts/competition more as learning points than as negative sides of extension. This is perhaps why one group of participants looked beyond the life of a dissemination project to argue that farmers interact closely even after the external disseminating organization had left. These, therefore, are the effects of the practices of external institutions on local social relationships.

Participants reported that their main contribution to dissemination efforts constituted their mobilizing other farmers to attend dissemination sessions and to the in-kind contributions, for example, in terms of plots for experimentation. In terms of sharing the costs of extension work, non-poor men said they were unwilling, while poor women said they were willing, so long as they were empowered financially through some credit scheme. However, the main bases of sustainability of the dissemination approach and practices lay in the involvement of the chiefs, their assistants, and village elders in mobilizing farmers and often disseminating directly to them. All the groups of participants recognized the chiefs and their capacity to mobilize farmers as critical to the sustainability of the dissemination approaches.

Poor women participants added another dimension to the sustainability, arguing that the fact that individual farmers appreciated the critical place of dissemination in their work was important. This is because such a scenario creates a demand-led dissemination process that is less likely to collapse than a situation where farmers had not fully recognized the need for extension. From the foregoing, however, the dissemination approach and process in Mwitubi village can be said to be sustainable only if the chiefs, their assistants, and the village elders had been trained as trainers of trainers. In the event that none of the disseminating organizations trained them, as is the case, they have no knowledge to disseminate and therefore there is need for them to have been linked with trained farmers in order to close the knowledge gap and sustain the process and approach.

Conclusions

The dissemination organizations generally satisfied farmers' expectations of learning new or improved agricultural technologies. The organizations provided training on relevant and innovative technologies that interested the farmers. The organizations did not study the communities they worked with at the commencement of their projects, however, to understand them and their problems fully. MoARD, for instance, moved into the village and formed the catchment/village committees, ignoring local institutions and groups by which people organized their agricultural activities. The farmers argued that through that approach, MoARD contributed significantly to soil conservation in the village. The success of the approach is best explained, however, by the importance of the problem it tackled rather than the efficacy of the approach itself. Indeed, when ICRAF arrived in the village, farmers led its workers more to the *baraza* and the chiefs than to the catchment committee as the focal point for dissemination in the village.

ICRAF and MoARD did not as a matter of policy proceed to involve farmers in their dissemination processes. Study results show no evidence of farmer participation in the development of dissemination approaches, let alone their fine-tuning over time. Farmer involvement was limited even in the development of training materials. Farmers said that their feedback did not influence agency policies and practices. While the organizations appear to have developed high levels of rapport with farmers and their groups to the extent that their dissemination meetings were well attended and supported by local leaders such as chiefs and village heads, critical participation that could empower farmers to be self-reliant afterwards was lacking. Farmers or committees do not appear to have followed the dissemination processes and internalized them to a level that they may broker such services on their own in the future. Discussions by the various groups of

participants brought out very clearly the critical role of schools in the dissemination process. Schoolchildren were said to come home not just with skills but also with inputs such as seedlings, which they planted at home. In general, the children attempted to train their parents and other farmers on what they learned. Fine-tuned properly, the school approach to agricultural dissemination could become a very important avenue, because the school kids were very motivated to learn and implement. The children need, however, to be facilitated to get plots and inputs on which to practice and from there influence their parents and communities. The trees already planted in the village school with the help of MoARD are important and may be replicated for demonstration, school income, and observation by farmers adjacent to the schools.

With regard to local leadership and institutions, chiefs, their assistants, and village-level leaders were critical in the dissemination processes. They mobilized farmers at no cost and to the convenience of the disseminators. While the organizations fell into the trap of village life as organized around the chief's *baraza,* however, farmers forgot most of the dissemination messages given in the *barazas* almost instantly in their own admission. Farmers preferred demonstrations and farm trials that provided them with opportunities for practical learning.

The Umbrella Group Approach in Bukhalalire

Bukhalalire village is in Bukhalalire sublocation, Malachi East Location, Butula Division of Busia District, Western Province. The Luhya occupy the village. These are mainly small-scale resource-limited farmers with low literacy levels. Like in other parts of the country, agricultural dissemination in the village was pioneered by MoARD during the colonial period. However, during the era covered by this study, dissemination was through the catchment area approach, which was started in 1993 by MoARD. When Kenya Woodfuel Agroforestry Programme (KWAP) entered the village in 1994, the umbrella group approach was adopted. While the former approach focused on soil and water conservation as they affected people living within a common drainage system, the latter focused more on agroforestry and other related agricultural technologies. The umbrella group brought together about 11 groups in the villages that were interested in agricultural dissemination. They elected two representatives each to the executive committee. These were trained and they in turn trained members of the sponsoring groups. The chiefs were critical in the dissemination process as they convened *barazas* and mobilized farmers, most of whom were not members of the groups to attend the dissemination meetings.

Farmers' Comparative Evaluation of the External Organizations

Focus-group discussion participants reported that several organizations had worked in the village, covering a number of issues. These organizations included MoARD, KWAP, KARI, Tropical Soils Biology and Fertility Programme (TSBF), and ICRAF, but the presence of the first two was much stronger than the other organizations. Agriculture was reported to be the central theme of all the organizations' work (there was an additional organization, KENFINCO, that focused on the provision of water to the villagers).

When participants were asked to rank the various external organizations that had disseminated in the village, ICRAF was rated at 50 percent, 20 percent, 22 percent, and 13 percent by poor men, poor women, non-poor men, and non-poor women, respectively. On similar lines, poor men, poor women, non-poor men, and non-poor women rated KARI at 25 percent, 40 percent, 33 percent, and 20 percent and MoARD at 25 percent, 40 percent, 44 percent, and 66 percent, respectively. Both men and women participants ranked MoARD higher, on average, than all the other organizations. This perhaps results from the long history of associating

agricultural dissemination in Kenya with MoARD as it was for a long time the sole service provider. Comparing the poor and non-poor participants closely indicates that the poor ranked ICRAF and CARE higher, while the non-poor ranked MoARD higher. This may be a result of ICRAF's and CARE's focus on bio-intensive, low-capital requiring and labor-intensive agriculture that resonates with the circumstances of the poor, compared to MoARD's focus on high-capital requiring and external-input–based agriculture that the non-poor readily identify with.

The foregoing point also relates to the differences between men and women in perceived benefits from the organizations. While men participants argued that adoption was slow and dis-adoption was setting into the village, because KARI did not fulfill its promises to the farmers and TSBF had focused on only two farmers, women maintained that disseminated technologies were beneficial and were taken very seriously by farmers. They associated most good developments in the community with KWAP, saying, "Schools and homes alike have income from the trees planted earlier and the tree nurseries established on a continuous basis."

Overall, all the groups of participants tended to agree on the fact that for technologies to be useful to the community, they had to be relevant to local needs. They identified KWAP-disseminated technologies as most relevant and therefore most helpful. Participants also concurred that the umbrella group approach was most appropriate because it worked through groups and reached more farmers for training. Participants' views did not contradict each other on the basis of gender or class.

When participants ranked the various methods employed by the external institutions in dissemination, demonstrations and meetings/*barazas* were identified as the most important methods. On average, both men and women preferred demonstrations to the same level of 20 percent and, hence, preference of the method did not vary with gender. On balance, however, women ranked meetings/*barazas* higher than their men counterparts did. In the focus group discussions, poor men and poor women participants were agreed that training did not reach all the farmers that it should have reached. All the groups were also agreed that the departure of the disseminating organization before the agreed time could be one factor to blame. Although poor men thought that the use of *barazas* as venues for training could increase coverage, rich men and women were of the view that training provided was sufficient but that it could be improved through increased training as well as monitoring and evaluation by the organizations. Overall, the *barazas*/meetings appear to have been preferred by women and the poor, possibly resulting from the weak social position of women and the poor in the Luhya society and, hence, their propensity to obey regulations such as attending *barazas* on chiefs' orders.

Besides the *barazas*/meetings, umbrella group committee members had the responsibility of reaching out to farmers within and outside the catchment. Discussing possible increase of skills and confidence of individual farmers, poor men participants said that umbrella group members are occasionally invited by outside groups and schools to give seminars and briefings on agriculture. This implies that some farmers had improved their communication skills as well as acquired knowledge in forms that they could individually and independently disseminate. Non-poor men participants also argued that umbrella group members were usually consulted by other farmers on various technical areas and they trained other farmers even beyond the catchment; hence, their confidence had improved. Poor and non-poor women participants expressed similar views on the capacity of umbrella group members to disseminate within and without the catchment. This implies that farmer trainers were effective and had become a significant component of the dissemination

approach in Bukhalalire village. In ranking the internal organizations involved in dissemination in Bukhalalire village, participants identified *barazas* and other farmers as major sources of information. Non-poor participants ranked both *barazas* and other farmers higher. On average, while women preferred *barazas,* men identified more with other farmers. This scenario is borne out by the fact that men among the Luhya have more time on their hands to visit each other than women, who do most farmwork and almost all domestic chores. Women then attend *barazas* both as a requirement of the chief and also to get agricultural information. Therefore, the main currents of dissemination in the village coalesce around farmer-to-farmer communication and *barazas.*

It is for the foregoing reasons that the chief who convenes *barazas* was a central subject of discussion when participants looked at communication linkages that supported dissemination. Therefore, when the participants looked at committee interactions with and demands on local authorities or chiefs, poor men said the umbrella group had links with the local administration, mainly the chiefs, who provide them with security and help with dissemination through *barazas.* They said that farmers send their chiefs to negotiate demands with MoARD. Dissemination organizations, including MoARD, KWAP, KARI, and ICRAF, all came in through the chief's *baraza.* Non-poor men participants argued that there existed a strong link between the umbrella group, the chiefs, and their assistant at the time of entry of a dissemination organization into the village, for mobilization, and actual dissemination, on occasion. Poor women and non-poor women participants concurred with the foregoing that chiefs and their *barazas* had been critical to dissemination work in the village.

On farmers' knowledge of their rights, from the poor men participants' perspective, it would appear that they knew their rights to extension. Non-poor men and poor women were of the view that farmers knew what they needed from each of the disseminating organizations and made efforts to make demands on them. To this extent, they therefore pursued their rights to extension services. Non-poor women saw no evidence of farmers' knowledge of their rights. The participants were agreed that farmers had increased their skills and knowledge as a result of the dissemination efforts undertaken. Poor men participants said farmers had increased skills in tree nursery establishment and tree planting, which they learned from KWAP, as well as SFR technologies, which they learned mainly from ICRAF. Non-poor men for their part mentioned increased skills in soil conservation and fertility improvement. Poor and non-poor women mentioned fodder crops, and soil and water conservation. Besides the technical skills that translated into better-conserved, fertile soils and higher farm yields, farmers had also acquired interpersonal communication skills, which enabled them to exchange knowledge in agriculture more effectively. They had come to a level in which they recognized each other as sources of useful agricultural information.

The school program was strong in Bukhalalire village. The participants identified a variety of programs that were targeting schools with dissemination activities. Poor men identified school demonstration farms. Non-poor men and non-poor women for their part identified the CARE program working in conjunction with Action Aid at Bukhalalire primary and secondary schools. They added that KWAP also worked with the schools, although not directly but through the umbrella group. Poor women said that the KWAP program assisted Bukhalalire primary school to establish a woodlot.

Asked whether the technologies were reaching the schools, poor men participants argued that schoolchildren both at primary and secondary levels learn about various technologies and have practiced them at home in the past. Non-poor men said that the technologies reached the schools and

children of about three generations ago could disseminate what they had learned from school by having their own farms at home, but such is not going on now. They added that KWAP had a woodlot at the village school. Poor women concurred with the foregoing, naming the trees in the woodlot as including grevillea, *casuarina,* and *jacaranda.* Non-poor women said the woodlot was still in the village school and that the trees had not benefited the school as they have not matured for harvest. They added that at present, the children learn a great deal of agricultural theory in school with little practical application.

When participants discussed how and if students trained their parents and other villagers on what they had learned in school, non-poor participants were of the view that children did not undertake any training. Poor participants for their part argued that students tried to train parents as well as demonstrate at home what they had learned in school. The implication of the foregoing is that the poor have limited sources of technical information and hence are keen to receive information from any source, including their children, while the non-poor have options and may not emphasize their children as a source.

Some participants said that the technologies disseminated to schools were still being utilized, adding that the woodlot established at Bukhalalire primary school was benefiting the school with income through the sale of trees. When the participants turned to problems associated with the schools programs, poor men indicated that for whatever reason, pupils no longer practice what they learn in school at their homes, while non-poor men identified no problems with the programs. Poor women participants for their part said that the major problem was that pupils try to reach out to their parents with the technologies that they learn in school but they hardly convince them to adopt. The non-poor women said that there was no practical learning for kids in schools and, hence, the children have little to disseminate. They added that cattle from the school's neighborhood were destroying woodlots in the school.

Local Organizations and Community Relationships

On organizations and informal networks that existed prior to intervention, poor men participants said that there were women's, youth, clan, and merry-go-round groups and of those, youth groups were said to provide farm labor at a fee to raise revenue. Non-poor men added church groups to the poor men's list, adding that Kuku women's group was engaged in agricultural activities. Other focus groups identified others, like a clay work group and church groups, but they were involved in what was considered non-agricultural activities.

When discussing the new groups or committees formed through the interventions, poor men mentioned Kuku women's group and Bukhalalire handcraft women's group. They said that the two groups were part of the umbrella group and their foremost objective was agricultural dissemination together with poultry keeping and handcraft business, respectively. In terms of organization, the groups are affiliated to the umbrella group committee, which coordinates activities in the entire catchment. The groups elect their own representatives to the umbrella group committee. The women's groups are mostly informal. The umbrella group undertakes local training and dissemination outside the catchment in other groups and in schools. Non-poor men indicated that the new groups include women's groups, which became part of the umbrella group. These women's groups included Amuka, Namudu Wekhonye, and Banguria, and all are involved in dissemination as part of the umbrella group committee. Organizationally, they said that the groups are from various villages and are represented in the umbrella group committee by two representatives each. Elections to the umbrella group committee were supposed to be held annually, but an arrangement was struck to hold them

after every three years. The committee was involved in dissemination within and outside the catchment and in schools through field days, informal oral discussions, and observation. Poor women concurred with the non-poor men on the new groups set up following intervention, how they operate, and were organized.

Non-poor women on their part said that following intervention, the umbrella group was set up and 11 groups sent two representatives each to form the executive committee of the group. After the umbrella group was formed, the main objective of all groups represented in the executive committee became to disseminate agricultural technologies. The umbrella group usually met once each month and, in case of urgent matters to deal with, they met more often. Participants said that the attendance in the meetings was good. The participants also pointed out that elections to the umbrella group executive committee were supposed to be held after three years and those elected at the start of the group were reelected for a second term. They further said that the umbrella group is useful in dissemination through groups' demonstrations and field days; neighboring villages learn from them informally and through attendance in dissemination sessions.

Participants were agreed that the umbrella group approach was effective in reaching farmers with dissemination messages. It is for that reason that participants were of the view that farmers had been involved in developing training materials and that the groups had continued with dissemination work. When participants discussed the involvement of committees in further dissemination outside the village, poor men said that umbrella groups have been involved in developing training materials and are occasionally invited outside the catchment to give seminars and briefings on agriculture to schools. They also reach out to other villages to undertake dissemination through informal contacts or by invitation. Non-poor men said that the umbrella group undertakes dissemination to other villages through informal oral discussions and field days. Some of their members attend field days in neighboring catchments as well as villages and schools and their neighbors in turn attend theirs. Poor women said that non-members of the umbrella groups attend and learn in the field days, which they organize without outside staff. Non-poor women concurred with the foregoing.

The participants further indicated that the groups were involved in new dissemination activities after the external organizations had left. These activities were undertaken because the methods of dissemination in use had been internalized by the groups and were being replicated independently by the community and its structures. Therefore, on new activities undertaken by the dissemination groups, poor men participants said that the umbrella group has given briefings to schools about their activities and reached out to disseminate to other villages outside the catchment. Non-poor men participants mentioned exchange visits to neighboring villages and catchments as well as field days on farms where technologies had been implemented. The instructors in the field days were drawn from the umbrella groups. Poor women and non-poor women said they had seen no new activities undertaken by the groups. Although effective, however, the methods in use and the activities engendered, especially after the external organizations had left, appear to have excluded women or proceeded in ways that did not capture women's imaginations, so that they did not notice them.

In considering the effect of the umbrella group approach to dissemination on community power structure, participants across the spectrum agreed that the approach had brought community members closer together in "discussing and exchanging information about the various technologies." The participants also indicated that benefits from the group did not depend on the status

of a member and that people benefited from the group equally, although implementation of technologies depended ultimately on how hard one works. Therefore, the umbrella group approach to dissemination had contributed significantly to the evolution of a cohesive community that strove to be self-reliant through intra-community exchange of information.

Sustainability

When participants discussed the status of the groups, poor men said that the umbrella group was still in existence for the purpose of continuing to benefit from the technologies disseminated. They argued, "the umbrella group continues to disseminate to other villages beyond the catchment and giving briefings on their activities to schools." Non-poor men participants said that the umbrella group is still in existence and members meet once per month, but if there is an urgent matter, meetings can be called at any time. They noted, "in the meetings they discuss ongoing activities and how to enhance adoption of the technology that they disseminate." They further said that currently, umbrella group members are involved in dissemination through field days, oral discussion, and observation on farms where implementation has taken place.

Poor women participants said that the umbrella group was still in existence and that members make contributions and have participated in mobilizing farmers for field days. The participants said that the umbrella group was continuing with dissemination, arguing, "up to now they organize field days with very little support from external dissemination agencies." Non-poor women participants concurred with the foregoing, reporting that the umbrella group was organizing field days and getting in touch with disseminating organizations that came after KWAP to increase their pool of knowledge. They also said that the catchment committee was active in water and soil conservation, although not as active as during the time before the formation of the umbrella group. They concluded that the umbrella group was continuing with dissemination both within and outside the catchment.

Poor men participants also indicated that dissemination activities were continuing in the catchment and umbrella group members have been involved in doing it in villages and schools outside the catchment. Farmers from outside also attend trials and other activities in the catchment. Non-poor men said that the umbrella group has had contact with other outside agencies after KWAP left and this has kept the group working on beneficial technologies even after the former left. This is because making contact with other dissemination agencies helps replenish their know-how and encourages them to keep working on dissemination. Poor women participants concurred with the foregoing. Non-poor women for their part argued that non-group members are reached through the field days, which they are free to attend, and informally as they observe and discuss with group members. They also indicated that umbrella group members have also gained knowledge and planting materials (mainly cassava) from outside the catchment, especially from friends and relatives.

Conclusions

All groups of participants recognized that selection of technologies for dissemination should be linked very closely with the needs of the villagers. For this reason, the technologies disseminated by KWAP resonated well with them. Participants said that farmers' needs for cash, building materials, and fuelwood were readily met as a result of the technologies disseminated by KWAP. Community members were therefore eager to implement those technologies. Farmers also learned from each other easily because the technologies met their felt needs.

Participants also thought that the *barazas* and, hence, the chiefs and their assistant were critical to dissemination processes in the village. They identified with the *baraza*

as their meeting point for dissemination and sent the chief to MoARD with demands for extension services. They therefore recognized the chief as a knowledge focal point and implied that further training of the chief in the area of dissemination of agricultural technologies would be beneficial. Farmer-to-farmer communication of agricultural technologies was also strong, especially among men in the village.

All participants also recognized the umbrella approach as effective in the village. They argued that it involved farmers from a variety of groups and was therefore able to reach more farmers than was possible with other approaches. They viewed the approach of using existing groups for extension as more inclusive and for that reason criticized other approaches, such as those by TSBF that focused on a few individuals.

The groups and the dissemination activities they promoted were also judged as sustainable. Farmers' groups have increased and have come to focus on dissemination as their main purpose. These groups have also continued with dissemination work long after the external institutions that worked with them have left the community. In addition, the groups have reached out with agricultural information to farmers within and outside the village where work in collaboration with external organization had originally started.

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