

How can Systems Thinking, Social Capital and Social Network Analysis help Programmes Achieve Impact at Scale?

Results of a Demonstration Project in the Kenyan Dairy Sector

Karabi Acharya, Bette Booth, Charles Wambugu, Esther Karanja,
Hellen Arimi and Shera Bender



World Agroforestry Centre
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ABSTRACT

Development practitioners are often faced with a common challenge: how to scale-up activities to reach thousands of farmers rather than hundreds, or millions of babies instead of thousands? This paper presents the results of an evaluation of a project funded by the United States Agency for International Development (USAID) and the World Agroforestry Centre that worked to build social capital among organizations working in the Kenyan dairy sector using the SCALE® approach developed by USAID and the Academy for Educational Development. SCALE is a communications-driven management approach that strengthens social capital, governance, and can result in increased sustainable economic growth. The evaluation used social network analysis to understand the roles organizations play within the larger system and how they are connected to other organizations at two points in time. The paper discusses the results of implementing the SCALE approach within feeding systems of small-holder dairy farmers in Kenya.

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INTRODUCTION

Development practitioners are faced with two common challenges. The first is how to scale-up activities to reach thousands of farmers rather than hundreds, or millions of babies instead of thousands. Many development projects have greatly improved people's health, livelihoods and well-being. However, this has often been restricted to small geographical areas where the impacts are limited to a small number of people – a few hundred farmers adopt high yield cultivation techniques, or a few thousand infants are exclusively breastfed. The challenge for development practitioners is how to achieve these impacts at a large scale that can be sustained over time.

The second challenge is how to implement programmes that support innovation and diffusion of innovation when the development solutions or technologies are constantly changing. There is an increasing recognition that our understanding of the appropriate technologies or solutions or actions that lead to sustainable development is changing rapidly as the pace of scientific discovery and technology changes our world.

Four major trends, namely climate change, economic globalization, HIV/AIDS, and population growth, are exposing rural communities to greater pressures and risks.

The pace of change is so rapid that traditional innovation systems are generally unable to cope. (Clark, 2006)

For example, the appropriate infant feeding practices in the context of HIV has evolved over time and no doubt will continue to evolve as HIV treatment and vaccines becomes a reality. Our understanding of the inter-connections between livelihoods and natural resource management mean that what is considered appropriate farming practices have changed. So increasingly for development practitioners, the challenge is not so much in “getting the messages out” but in strengthening systems and communication structures that can react quickly to changes in the “messages” and more importantly can support innovative solutions to local problems.

This paper describes an implementation strategy, SCALE® (System-wide Collaborative Action for Livelihoods and the Environment) that attempts to address both these challenges. SCALE is a communications-driven management approach developed by USAID and the Academy for Educational Development that strengthens social capital, governance, and that can facilitate increased and sustainable economic growth. This paper presents results from an evaluation of a demonstration of SCALE within the Kenyan dairy system that worked to build social capital among organizations working in the Kenyan dairy sector using the SCALE approach.

CONCEPTUAL FRAMEWORK

The SCALE framework and evaluation drew on three rich theoretical fields to help us understand how organizations are connected and recognize the potential leverage of change of each within the larger system. These are systems thinking, social capital and social network analysis. While there is clear complementarity and synergy among the three fields, there is surprisingly little written about the benefits of bringing them all together in the context of development programmes.

Systems Thinking

Systems thinking shifts attention away from individual component parts to the relationships and connections among those parts (Bawden, 2006; Richmond, 2000). Systems thinking eludes simple definitions but Wikipedia (2008) describes it:

Systems thinking attempts to illustrate that events are separated by distance and time and that small catalytic events can cause large changes in complex systems. Acknowledging that an improvement in one area of a system can adversely affect another area of the system, it promotes organizational communication at all levels in order to avoid the silo effect. Systems thinking techniques may be used to study any kind of system — natural, scientific, engineered, human, or conceptual.

Systems thinking has been popularized by Peter Senge for use in organizational development and business settings (Senge, 1990). Within health and development, a systems-driven approach recognizes the complex interconnections among development issues such as health, environment and economic development and identifies critical “leverage points” (Meadows, 1997) to support change and innovation. Systems thinking helps to conceptualize the complex interactions of ecological and social systems that result in environmental damage. The public health field is using systems dynamics to model and understand chronic disease epidemics such as diabetes. The growing recognition of the contribution of systems thinking to understand health issues is illustrated by a special issue of the American Journal of Public Health on systems thinking and the development of MPH competencies on systems thinking by the Association of Schools of Public Health. The SCALE approach applies systems thinking not so much to understand the biological or ecological systems of a development issue but as a way to map and catalyze the complex social and organizational system that can solve development problems.

Social Capital

The concept of social capital has received considerable attention in development settings. Social capital, defined as the relationships and bonds among different people or “the value of connectedness and trust between people” (Pretty 2003)¹, can also be understood at an organizational level in addition to individual and household levels. In their review paper, Pretty and Ward (2001) identify four aspects of social capital: relations of trust; reciprocity and exchanges; common rules, norms, and sanctions; connectedness, networks and groups. They highlight the importance of valuing and creating the different types of connections. Woolcock (2001) defines three types of connectedness that have been identified as important for the networks within, between and beyond communities [...] bonding, bridging and linking types of social capital

¹ World Bank (2004) <http://www1.worldbank.org/prem/poverty/scapital/whatsc.htm>

- **Bonding social capital (horizontal ties or linkages)** describes the links and relationships between people with **similar outlooks and objectives**. This can include a range of types of groups such as guilds, credit groups and cooperatives to name a few. Bonding social capital is needed to give groups a sense of identity and common purpose.
- **Bridging social capital** describes the capacity of groups to have relationships **with others that may have different views**. Bridging ties transcend social divides such as religion, ethnicity, socio-economic status.
- **Linking social capital** refers to vertical connections to formal institutions or to people in power

Smaller, tighter networks can be less useful to their members than networks with lots of loose connections (weak ties) to individuals outside the main network. More "open" networks, with many weak ties and social connections, are more likely to introduce new ideas and opportunities to their members than closed networks with many redundant ties. It is better to have connections to a variety of networks rather than many connections within a single network.

Social capital is one of the keys to success for sustainable livelihoods along with natural, human, physical, and financial capitals (Pretty and Ward, 2001; Krishna, 2002). Increasingly evidence suggests that if these conditions are met (bonding, bridging and linking types of social capital)...then local people's economic and social well-being improves. Households with greater connectedness have been shown to have higher incomes (Narayan and Pritchett, 1996; Krishna, 2002; Wu and Pretty, 2004), better health, educational achievements and longevity (Fukuyama, 2000), improved social cohesion (Schuller, 2001). Greater connectedness can also lead to more honest government (Putnam, 2000).

Social Networks

Social network analysis (SNA) refers to understanding the networks that link individuals or organizations. Analysis of individual networks has been used to understand adoption of family planning methods (Kincaid, 2000) and perception of HIV risk (Bühler, & Kohler, 2003). At an organizational level, studies have shown that strengthening organizational networks can strengthen the private sector (Lyon, 2000). This literature reinforces the need for strengthening both bonding and bridging connections to achieve change (Abers, 2007; McEvily & Zaheer, 1999). The literature on value chains for specific commodities also emphasizes bonding connections among producers, for example but more critically on building linkages vertically along the value chain, from producer to processor to distributor to exporter (da Silva and de Souza Filho, 2007).

Within social change and development, there have been very few studies that use social network analysis as a tool to evaluate the changes in connections over time, particularly at an organizational level. A cross-sectional study of non-governmental organizations (NGO) in Mozambique found that the more connections an NGO had, the more beneficiaries they served (Moore et al, 2003).

Understanding organizational networks allow us to map the "highway" through which new information, products, or behaviors can travel as well as to influence the "highway" structure itself. It is increasingly recognized that the power that an organization has to effect change and support innovation depends a great deal on how and to what extent that organization is connected to other

organizations (McEvily and Zaheer, 1999). These frameworks emphasize the importance of understanding where people *and organizations* sit within the whole system, what role they play, how they are connected to other organizations, and the potential leverage of change of each within the system.

SCALE has used SNA as a tool for stakeholders to analyze their own networks and as the primary methodology to measure change in social capital within the Kenyan dairy feeding system. Evaluation of social change programmes that use systems approaches is a new field with very limited examples to draw from. Recently there has been an attempt to summarize the current thinking in this nascent field (Williams, Imam, 2006). A special issue of *New Directions for Evaluation* focused on the use of SNA in evaluation, a relatively new field. The editors state

“As organizations develop and implement more complex programmes in response to their own increased understandings about complexity and systemic change and as evaluators develop evaluation designs from programme goals and objectives that reflect that complexity, we also need to adopt methodologies to measure and understand that complexity.” (Durland and Fredericks, 2005a)

SCALE in the Kenyan Dairy Sector

“In a subject as complex as smallholder dairy, **partnership** is the way forward. This is because you cannot isolate the dairy component from the food crops [...] Some of the partners represented here may feel they belong more to the crop rather than the animal world but let us remember that the smallholder farm is a system in itself. It is therefore my hope that we shall explore the ways and means of **meaningful and lasting partnerships where there is mutual trust, responsibility and benefit sharing.**” [emphasis added] –
George Karanja, Kenya Agricultural Research Institute

The dairy sub-sector has great potential for improving food security, incomes and welfare of Kenyans. About 2 million households have dairy cows and about 55% of total annual milk production is marketed. One of the major challenges facing the dairy industry is poor feeds and feeding practices that need to be addressed at both the farm and the market level.

Even with the best of genetic potential and animal health, the production potential can only be fully exploited through adequate nutrition. Through the use of enriched feeds such as fodder shrubs – calliandra (*Calliandra calothyrsus*), trichandra (*Leucaena trichandra*), tree lucerne (*Chamaecytisus palmensis*) and mulberry (*Morus alba*) – farmers improve their feeding systems at a minimal cost and increase dairy livestock productivity – milk quantity and quality. The economic benefits of enriched feeds include a reduced cost of production and increased milk yields leading to higher returns and improved livelihoods.

In a country where the average income is around \$300.00 (USAID, 2007), fodder crops can generate about \$US 100 per cow per year from increased milk production — dramatically increasing revenues for farmers, milk collectors and processors, and other dairy value chain stakeholders. Fodder trees also provide other benefits to farm families including firewood, natural fencing, and erosion control (Place et al., 2009). Despite the great potential that fodder shrubs offer, knowledge of and access to quality planting materials is a major constraint and institutional mechanisms for widespread adoption

are limited (Franzel et al, 2005). Over eight years, ICRAF and its partners had been able to reach about 48,000 farmers in central Kenya. They wanted to increase those numbers dramatically.

The Agricultural Partnerships for Productivity and Prosperity (AP³) project was funded by the United States Agency for International Development with the overall goal of demonstrating the SCALE approach. The focus was on improving the livestock feeding systems for small-holder dairy farmers in Kenya, in order to improve the quantity and quality of milk produced and lead to improved livelihoods. AP³ applied the SCALE process to the entire feeding system - from farmers and extension agents to the media and distributors - in order to increase the efficiency and impact of their working relationships. Communication and collaborative action were needed between and among the stakeholder groups who will ultimately create a viable and vibrant dairy sector that can respond to the challenges and new opportunities of free trade. AP³ was a 15-month demonstration project with limited resources. In Kenya, AP³ was led by ICRAF with support from the Academy for Educational Development. There was approximately \$150,000 for in-country costs such as local staff, and meetings; 3 local full time staff; and technical assistance from the AP³ team based in Washington, DC and Cairo, Egypt through e-mail, phone calls, and intermittent field visits

SCALE was developed from the thirteen year, 30 country experience of the United States Agency for International Development (USAID) Environmental Communication Project – GreenCOM. The lessons learned evolved into SCALE – a systems-wide social change framework, participatory management process, and set of tools that seek to interweave governance, economic, environmental and social interests in a way that manages and conserves resources while also creating new economic opportunities.

SCALE is a set of principles, a framework, a management process and a set of tools that build social capital and guide stakeholders in scaling up the use of sustainable best practices. Much emphasis is placed on defining the system to which the practice relates and ensuring that key stakeholders in the system participate in the process. Effective communication is both the catalyst and the glue in a participatory, multi-directional process that enables stakeholders to agree to a common vision for the future, and to create and implement collaborative and sustainable solutions towards this shared vision.

The SCALE approach seeks to generate system-wide change by generating social capital, strengthening effective communication and relationships among the stakeholders related to a common issue – individuals, groups, organizations, businesses, and institutions – and supporting them to negotiate and implement concurrent, sustainable collaborative action toward a common vision. The SCALE process (Figure 1) provides a road map to initiate, implement, and evaluate this system-wide development approach. It includes five components - Map the Context, Catalyze Coalitions and Partnerships, Create Collaborative Sustainable Solutions, Act, and Value.

The SCALE Process

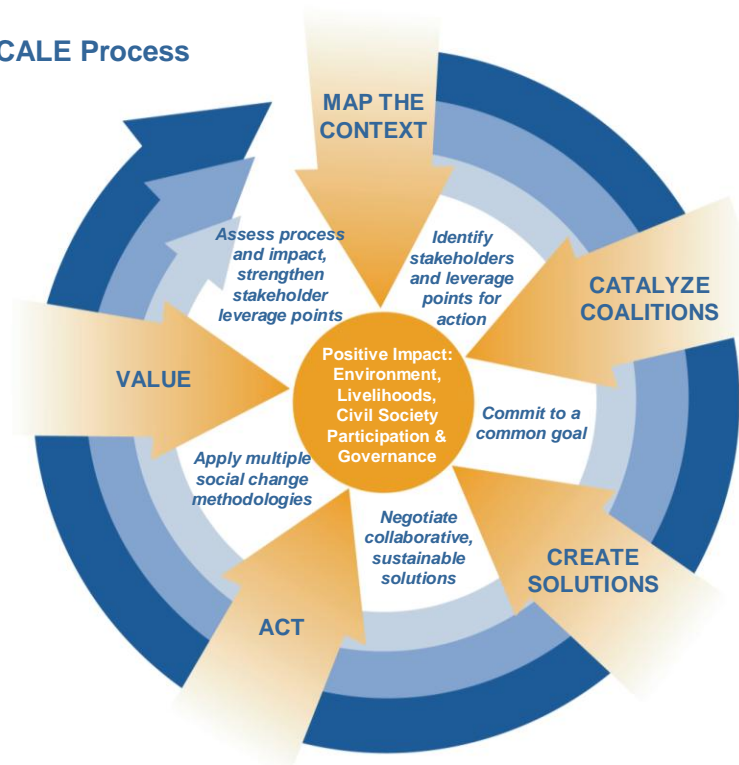


Figure 1: The SCALE Participatory Management Process.

Map the Context: The SCALE process begins by pulling together the collective knowledge about the issue and its context. A steering committee was formed that included representatives from research, extension, development agencies and the farmers. The team was drawn from private, media, research, governmental and non-governmental sectors and the farming communities. The committee discussed at great length the “frame” or focus of the Whole System in the Room workshop (described below) and in the end, the steering committee decided to have the focus on enriched feeds for improving the productivity and incomes of smallholder dairy farmers.

With the focus established, the steering committee brainstormed the relevant stakeholders for feeding systems. The committee focused on the dairy value-chain; from production to processing and marketing of milk and dairy products.

Catalyze Coalitions and Partnerships: SCALE facilitates a system-wide exchange of ideas at the onset by bringing stakeholder representatives together to define their common ground and to develop shared goals and strategies. The whole-system-in-the-room (WSR) planning workshop² is critical to jumpstart the process of engaging a broad base of people who will take action. A WSR workshop was held in March, 2006 in Nairobi with the theme of “Enriched feeds for improving productivity and livelihoods of smallholder dairy farmers”. A total of 125 people attended who represented the following stakeholder groups: farmers, media, NGO extension, micro finance,

² GreenCOM has adapted the WSR technique Future Search (Copyright 2004 by Future Search Network, A Program of Resources for Human Development, Inc. and used with permission).

processors and distributors, researchers, trainers, and government extension. The three-day workshop was conducted using the Future Search methodology where the participants examined the past, reflected on the present and finally focused on the future and developed common goals. On the third day, stakeholders analyzed sociograms of the entire network to identify where connections were needed. This sparked lively discussions and fed into the action plans. The workshop ended by developing action plans as individuals and in stakeholder groups to address the common goals.

On the last day of the WSR, stakeholders agreed to seven common goals listed in Table 1.

Table 1: Common Goals Resulting from the WSR

- 1) Improved credit accessibility
 - Having affordable and accessible farmer friendly credit facilities
 - 2) Enhanced information dissemination
 - More involvement of the media in disseminating agricultural information
 - Easy access to adequate and timely information related to markets, inputs, technological information, etc.
 - 3) Improved marketing
 - Stable and efficient marketing systems
 - 4) Scaled up use of fodder shrubs and other enriched feeds
 - Organized distribution, propagation, promotion and adoption of enriched feeds e.g. fodder shrubs and herbaceous legumes.
 - 5) Improved research and extension services
 - Capacity building on improved feeds production, management and utilization to both extension providers and farmer groups.
 - Increased and simplified information packaging and dissemination
 - 6) Improved policy development
 - Participatory policy formulation and implementation
 - 7) Improved stakeholder linkages and collaboration
 - Increased collaboration among stakeholders
 - Establishment of common interest groups
-

Create Collaborative, Sustainable Solutions: SCALE builds stakeholders' capacity in coalition/partnership formation and group process facilitation – two essential communication skills for successful collaborative action. Stakeholders work together to generate options that address policy, structural, technological, economic and social aspects of the issue. They negotiate and prioritize collaborative solutions and identify specific opportunities to work together as partners. At the end of the WSR, stakeholder groups developed short and long-term action plans that supported the common goals. Over 50 participants stood up to make public, personal commitments related to the common goals. The details of the action plans are described in Participatory Training Promotions Institute (2006). The action plans included items such as establishing nurseries, creating farmer friendly credit and a great deal of training.

Act: SCALE helps stakeholders to select and use the most effective combination of communication methodologies in an integrated and coordinated strategy. Following the WSR workshop, stakeholders began implementing the action plans they had developed. AP³ divided its attention between facilitating the communication among stakeholders that started during the WSR and specific activities for the promotion of fodder shrubs. The main activities included stakeholder

engagement meetings, capacity building and facilitating flow of information and discussion through various communication channels. AP³ used standard communication channels to facilitate the flow of information including simple low-cost print materials, a monthly newsletter, and a web presence.

Stakeholder meetings were organized into five geographical regions to address specific needs of the area as expressed by representatives of various institutions active in that region. The meetings provided a forum for training, sharing experience, enterprise development, receiving and providing feedback, and marketing of seeds and seedlings. The project had realized that the media had unique needs and therefore required separate meetings from other stakeholders. Field trips were organized for media representatives to expose them to the performance of the technologies. This enabled them to appreciate the actual realities on the ground leading to development of several articles disseminated through the print, radio and television media.

AP³ built capacity through training and guided practice to a number of institutions, organizations, and individuals. The trainings focused on technical aspects of production, management and utilization of fodder shrubs and other quality feeds. In addition the project placed emphasis on entrepreneurial and dissemination skills. The project emphasized the use of SCALE principles and approaches in achieving the desired adoption rates that most of the training participants found to be effective and efficient.

Value (Monitoring and Evaluation): This component's name was intentionally chosen for its multiple meanings. The SCALE process helps stakeholders to value the resources on which they all depend, and also to value other stakeholders' perspectives, roles, and contributions towards reaching their collective goals. Rural growth, environmental enhancement, and poverty reduction require a system-wide approach that takes into consideration governance, economic, social, and environmental interests. SCALE's monitoring and evaluation approach seeks to understand the structure of these cross-sectoral relationships and how they change as a result of their collaborative efforts (Booth et al., 2006).

METHODOLOGY

Unlike traditional communication programmes that have one-two target audiences and a small set of discrete behaviors being promoted at an individual level, SCALE catalyzes many different kinds of stakeholders to take on various actions relevant to the role they play in the system. For example, extension workers committed to training farmers in the use of fodder shrubs while financial institutions committed to a totally different set of actions such as creating financial products that would help farmers take on the investment of fodder shrubs.

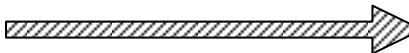
Evaluation Questions

Key questions in the evaluation included:

- What is the size and overall structure of the dairy feeding system network?
- How are organizations connected with regards to specific purposes and strength of relationships including exchange of information, coordination of programmes, and contractual relationships?
- Which organizations are particularly important for promoting the dairy feeding system (as assessed through their positions within the network structure)?
- What important organizations have little connection to the rest of the system?

- How closely connected are organizations *within* a stakeholder group (bonding ties)?
- How closely connected are organizations *across* stakeholder groups (bridging or linking ties)?
- What opportunities are there for facilitating connections among organizations (both within and across stakeholder groups)?
- What collaborative actions result from the network?
- How did inter-organizational relationships change over time, including development of new relationships and coalitions, new organizations becoming engaged and the overall structure of the network?
- How did the SCALE approach work to engage stakeholders to enhance their efforts to develop and implement specific programmes and interventions?

Table 2 provides a summary of the data that has been collected at two different time periods. The evaluation was conducted using four data collection methods. The collaboration rating survey was implemented just before the WSR and one year later. Semi-structured Interviews with a range of stakeholders were conducted one year after the WSR (Time 2). Media monitoring and Collaborative Actions Logs were on-going.

Table 2: Summary of Data Collected		
	Time 1: Before the Whole System in the Room (3/06)	Time 2: 1 year later (3/07)
	(number of respondents)	
Collaboration rating survey	87	77
Semi-structured Interviews		20
Collaborative Action Log		
Media Monitoring		

A collaboration rating form was developed which included a list of organizations that were anticipated to attend the WSR. Respondents were asked questions about their organizations' relationship with the organizations listed. The first question assessed the type of relationship and the latter three questions assessed the degree to which information is exchanged. Most forms were completed prior to the WSR. Some respondents completed the forms with assistance as they registered for the WSR.

The collaboration form for Time 2 differed slightly from the form in Time 1. Specifically, the choices for the type of relationship were changed to reflect relationships more meaningful to much of the programme's focus: exchange of training, planting material, or publications. Three organizations were broken down into their regional offices (Ministry of Agriculture, Ministry of Livestock and Fisheries Development and Kenya Agricultural Research Institute). Every attempt was made to interview the same people in the same organizations in order to accurately compare the data from Time 1 to Time 2. The data were analyzed with Ucinet6 (Borgatti et al. 2002). Overall, 77 people were interviewed at both times. In order to directly compare changes in the network

structure between Time 1 and Time 2, unless otherwise specified, the data presented in this paper only includes organizations where data is available at both points in time.

Semi-structured interviews were conducted one year after the WSR. Two members of each stakeholder group were purposively selected based on their involvement in the sector. The questions focused on what had been accomplished over the past year, what relationships have been strengthened and what challenges remain. Detailed notes were taken for each of these interviews and entered into Word.

AP³ staff maintained a running log of collaborative actions as they became aware of them. The log was used to capture new collaborations as they developed, record brief descriptions of each new collaborative action and which organizations were involved.

The AP³ team monitored and recorded articles on enriched feeds that were carried in the print media and broadcasted through radio and TV. The media representatives involved in AP³ project were requested to alert AP³ team about the media reports that they were intending to publish or broadcast. The team bought copies or listened to the broadcasts. Since some of these were broadcasted in vernacular languages, the team identified individuals conversant with the languages to monitor the content and feedback from the targeted audience.

EVALUATION FINDINGS

The following findings and results from the evaluation are presented in two sections. The data from all sources is integrated into these two sections. The first section examines the feeding systems network and sub-networks to understand the structures and kinds of ties within the network. The second section describes the collaborative actions around the broader common action agenda from the WSR that were recorded over the year following the WSR within dairy feeding systems. This last section also reviews some information about changes in livelihoods, although this was not a focus of the evaluation.

Outcomes in the development of Social Capital and Relationship Networks

The following section analyzes the outcomes in the development of social capital and relationship networks resulting from the AP³ SCALE implementation

It is clear that the size and structure of the dairy feeding system network changed considerably over the year following the WSR. When asked how many new relationships they had formed during the year, 79% of respondents reported 1-10 new relationships. One person reported over 100 new relationships and a farmer reported 1000 new relationships!

During interviews, respondents described new relationships both within and across stakeholder groups. They developed new “bonding” ties with organizations that have similar functions within the systems and new “bridging” ties with organizations that perform very different functions within the system.

With the WSR, new stakeholders were brought into the system and developed an understanding of the contributions they could make. As one respondent noted “My network has increased with different partners. I can easily refer or get information from the appropriate sources. It has made it

easy to promote new technologies including fodder shrubs.” Farm-Chem reported that it had over 100 new relationships with farmers and as a result its earnings had increased. Fresha Milk (one of the largest milk product companies in Kenya) reported 12 new relationships, especially with farmers’ groups and reported that milk production increased in some areas. Respondents saw a direct connection between improved flow of information and better livelihoods.

Figure 2 shows two sociograms, produced by Ucinet, which represents the dairy feeding system network as measured at Time 1. The circles, or nodes, represent each organization that was rated. The lines between nodes represent the ties or relationships among them. In this diagram, a line between two nodes means that they either work on projects together or have a contract together.

The left side of the diagram shows the connections among organizations at the time of the WSR. The right side of the diagram shows the connections after a year. On the far left side of the diagram there are a few nodes which are not connected to the network at all (called isolates). They include two farmers, three training organizations, two media groups, and two input service providers. The diagram is arranged so that nodes with fewer ties are on the perimeter while nodes with many ties are in the center of the diagram. One can see that the input service providers, with the notable exception of American Breeding Society (ABS) and training organizations are on the periphery. At the center of the sociogram are the ministries of agriculture and livestock development. This means that the highest numbers of projects and contracts are with these ministries. The private sector, composed of processors and input service providers, do not have many contracts or projects with the rest of the system.

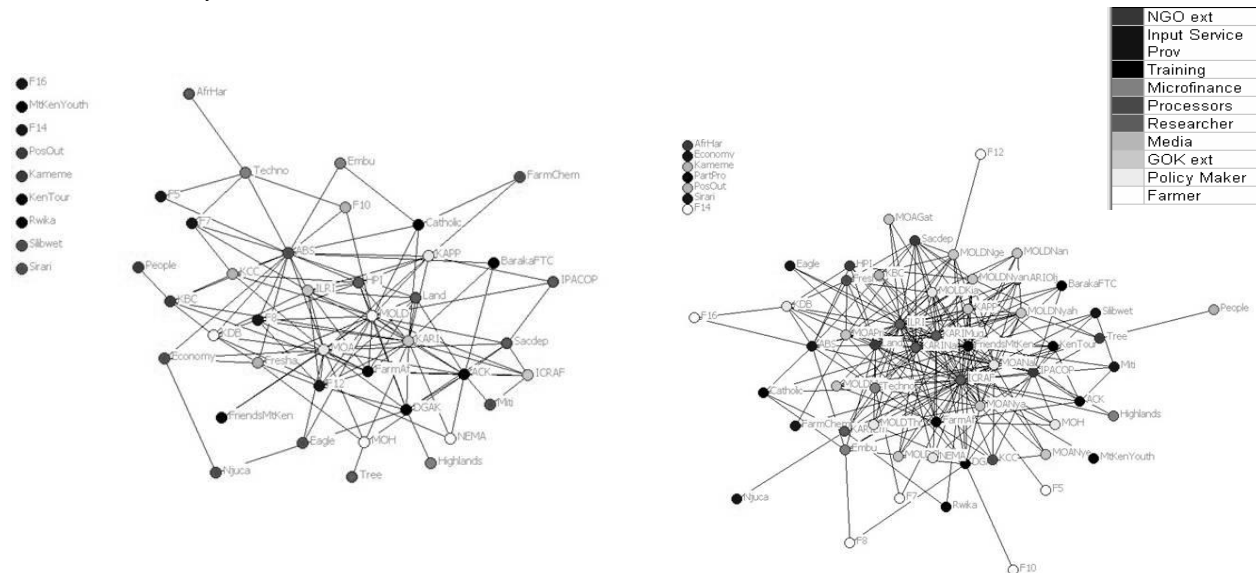


Figure 2: Time 1 and Time 2 Dairy Feeding System Projects or Contracts (matched organizations).

The right side of Figure 2 shows the dairy feeding system network as measured at Time 2. Note that there are more nodes on this Time 2 figure than Time 1. This is because several national organizations were divided into regional organizations in Time 2 to more clearly articulate their role in the system (Ministry of Agriculture, Ministry of Livestock and Development, Kenya Agricultural Research Institute). The isolates (organizations with no contracts or projects with the rest of the

system) include one NGO, two input service providers, two media groups (the same ones as at time 1), one training organization and one farmer. The Time 2 diagram has many more ties among the organizations. GoK extension (light blue nodes) is more prominent in the system and research organizations are playing a more central role as shown in the center of the diagram.

The density of the network is the ratio of the average strength of all ties over all possible ties. “Density ... [can] give us insights into ... the speed at which information diffuses among the nodes, and the extent to which actors have high levels of social capital and/or constraint.” (Hanneman, 2005). The overall density of the network at Time 1 is 58%. That is of all the possible ties among all the organizations, 58% of the ties exist. At Time 2, the density of the network has increased to 77.5% which reflect both an increase in ties where there were none as well as an increase in the strength of the ties. Since we assigned values to the strength of the relationship based on the frequency of information exchange and whether there was a contract (as opposed to a binary tie or no tie measure), the density measures the average strength of the tie.

Figure 3 shows which organizations provide planting materials. In this diagram, the larger the circle of the node, the more organizations that that circle supplies with planting material. By far the biggest sources of planting material are ICRAF and KARI-Nairobi.

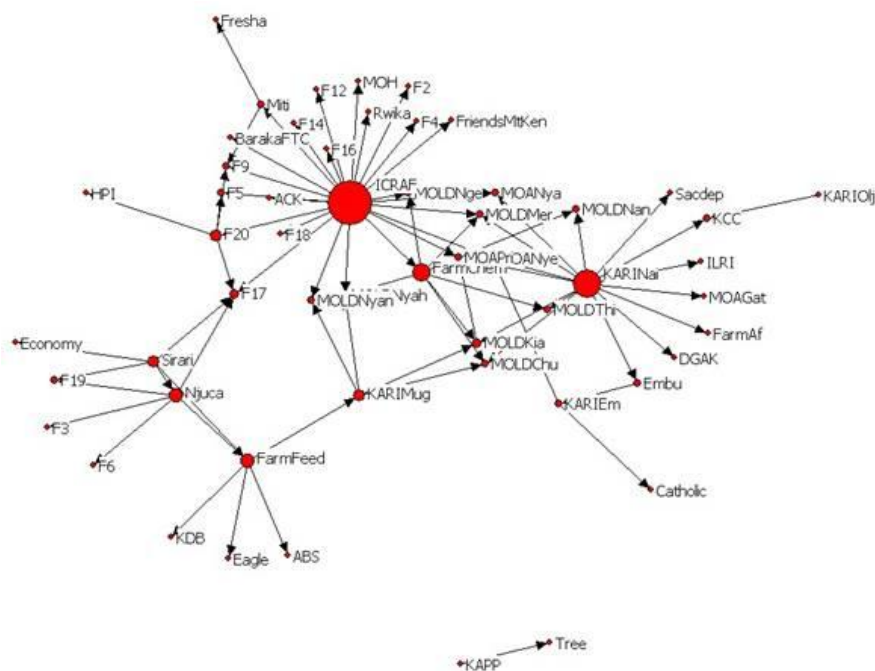


Figure 3: Organizations Providing planting materials (Time 2).

We are able to describe which organizations are in powerful or central positions based on where they sit within the network. Table 3 presents the organizations with the highest betweenness centrality at Times 1 and 2. “Betweenness centrality looks at where organizations sit on the paths to other organizations (for example if many organizations must go through organization X to get to organization Y, then organizations X has a high degree of betweenness centrality)” (Wasserman and Faust, 1994). The top 4 to 5 organizations hold considerable power in the network in that other organizations must go through them to access the rest of the network. By comparing the two tables, one can see that there has been a considerable shift in the power structure of the network. American

Breeding Society is the only organization that remained in the top five at Time 2. ICRAF's betweenness centrality is very high at Time 2. The research organizations are playing a more prominent role at Time 2 than at Time 1. It is important to note that there are no NGO extension organizations among the top ten in Time 2.

Table 3: Comparison of Organizations with the highest betweenness centrality at Time 1 and Time 2

Time 1		Time 2	
Organization	Stakeholder Group	Organization	Stakeholder Group
Ministry of Livestock Development	Policy Maker	ICRAF	Research
Ministry of Agriculture	GOK Extension	International Livestock Research Institute	Research
American Breeding Society	Providers	Dairy Goat Association of Kenya	Training
Kenya Agricultural Research Institute	Research	New Kenya Coop Creameries	Processor
Kenya Agricultural Productivity Project	GOK Extension	American Breeding Society	Input Service
New Kenya Coop Creameries	Processor	Ministry of Agriculture – NALEP	Providers
Anglican Church of Kenya	Training	Kenya Agricultural Research Institute - Nairobi	Policy Maker
Land-o-Lakes	NGO Extension	Kenya Agricultural Productivity Project	Research
International Livestock Research Institute	Research	Friends of Mt Kenya Forest	GOK Extension
Kenya Dairy Board	Policy Maker	Ministry of Livestock Development - Kiambu	Training
			Policy Maker

Once we know which organizations hold powerful positions within the network, we can examine their ties more in-depth through an egonet. An egonet is a network of one organization's direct ties and the ties among those organizations. Egonets illustrate a node's "neighborhood". The heavier the line, the stronger the connection; the narrowest line would indicate frequent exchange of information, an intermediate line that the organizations work on project together and the heaviest line indicates the organizations have a contract with each other. Figure 4 shows two egonets for ICRAF at Time 1 and Time 2. The egonet shows the dairy feeding system ties. At time 1, ICRAF has fairly limited ties to the rest of the system, considering the size of the network. There are no connections to processors or microfinance organizations and a direct connection to only one input service provider. No ties to GoK extension were reported.

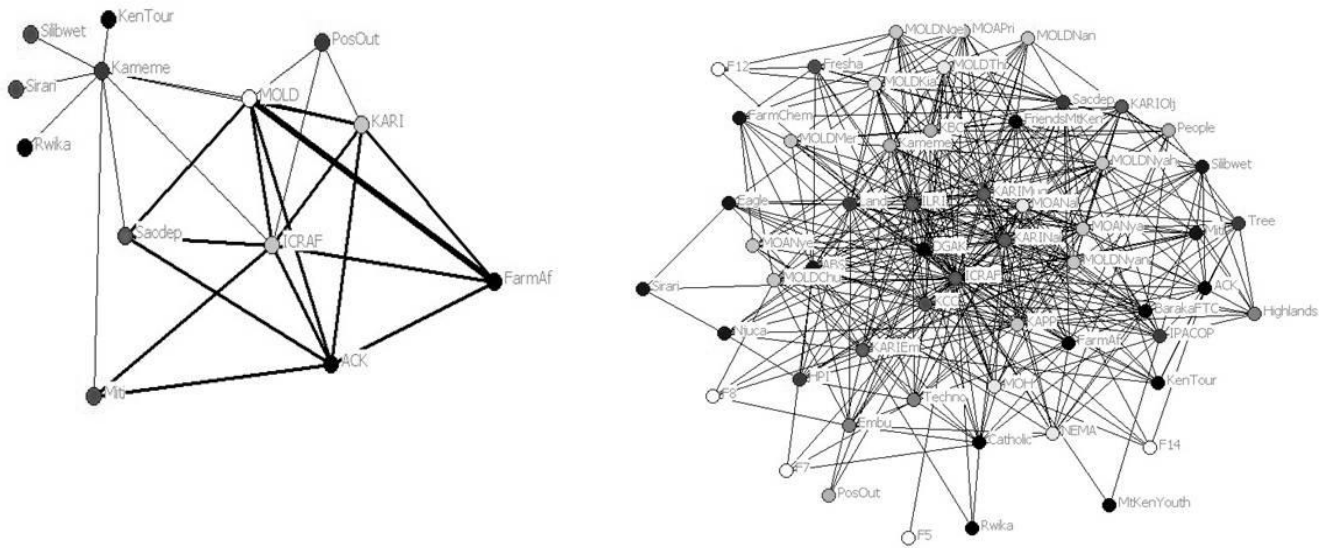


Figure 4: Time 1 and 2 ICRAF Dairy Feeding System Ties (Frequently exchange information, projects, contracts).

The right side of Figure 4 shows the ICRAF egonet at Time 2. For the sake of simplicity, all lines are the same weight regardless of the strength of the tie. It is clear that there has been remarkable growth in the ties between ICRAF and other organizations in the dairy feeding system. There is a dense network of relationships among research institutions. The Dairy Goat Association of Kenya (a training organization) is also right in the center of the egonet. ICRAF now has ties to GoK extension and private sector organizations. Kameme FM (radio) and Kenya Broadcasting Company (KBC) are also much closer to the center of the diagram. The tremendous increase in ICRAF's network is not a surprise since they were leading the project but is evidence of the commitment that ICRAF made to building a strong and diverse network of partners.

Figures 5-6 show the Time 1 and Time 2 egonets for a training organization (Catholic Diocese), and an input service provider (Silibwet). In each case, the diagram shows a significant expansion of the network of each organization.

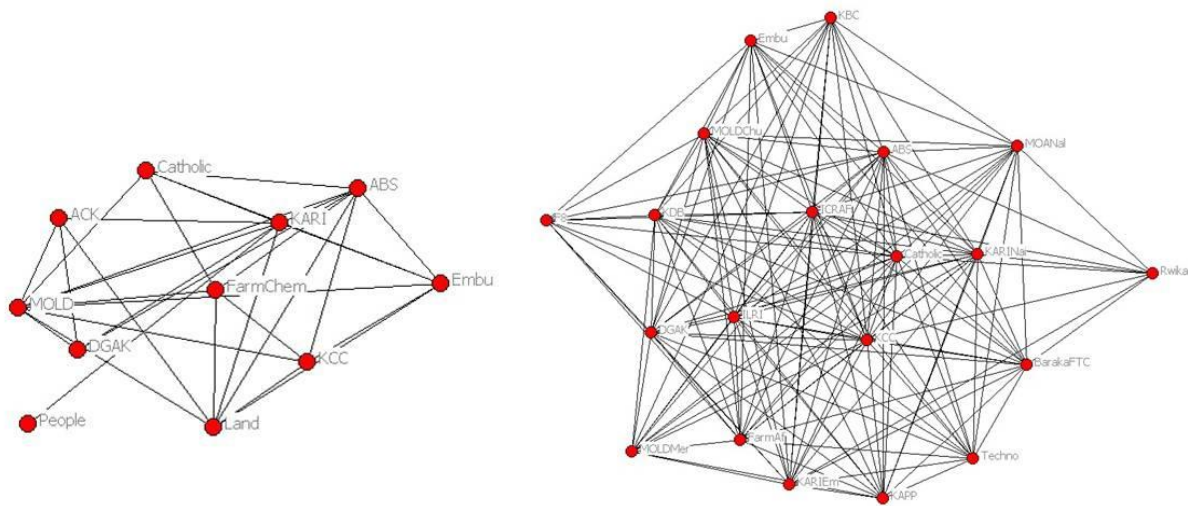


Figure 5: Time 1 and 2 Catholic Dairy Feeding System Ties (Frequently exchange information, projects, contracts).

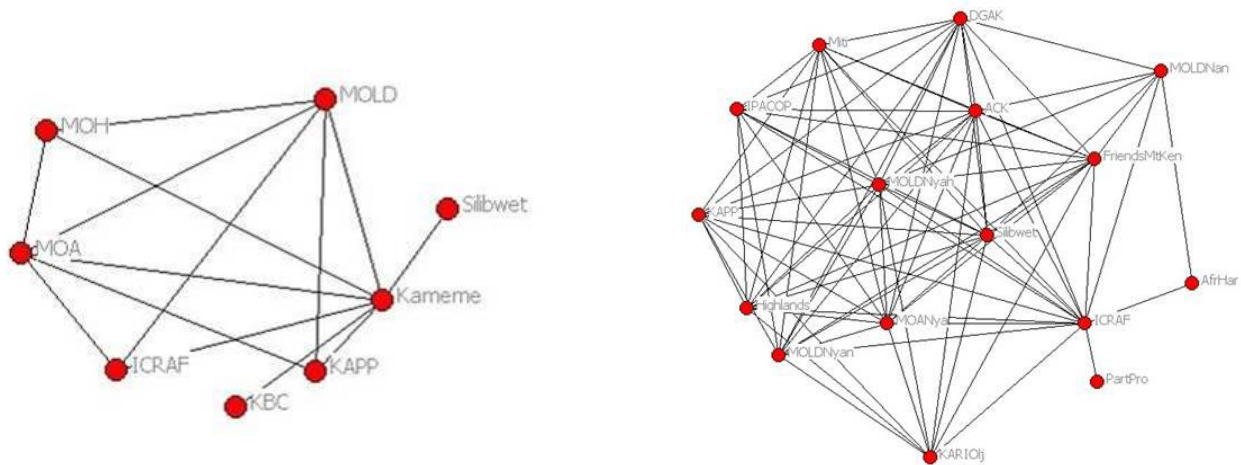


Figure 6: Time 1 and 2 Silibwet Dairy Feeding System Ties.

Collaborative Actions toward the Common Action Agenda

Respondents to the semi-structured interviews reported on the main changes they had seen in the dairy sector during the previous year. One person summed it up by saying that “Farmers have been empowered with information and seed sources.” The changes reported included the following:

- Bigger network of businesses and organizations.
- Improved milk marketing, prices
- Recognition of role of fodder shrubs
- Improved business skills

Table 4 provides a summary of the main collaborative actions that have occurred during the one-year project. In general, these actions were not initiated or financed by AP³ but the project played a critical role by 1) facilitating the flow of information, 2) serving as a neutral stakeholder, and 3) organizing meetings among stakeholders. When the project did play a financial role, the amount of funding was often nominal such as paying for refreshments or the meeting space.

Table 4: Summary of Collaborative Actions Resulting from SCALE

Associations and Agreements

Creation of Kenya Association of Tree Seeds and Nursery Operators (KATRESNO)
 Linkages among different actors in the dairy value chain established and strengthened

Capacity Building

Reported training of over 100,000 farmers (based on reports of semi-structured interview respondents)
 AP3 team trains 53 Tanzanians on SCALE methodology
 Participation and training in the international trade fare in Nairobi by seed dealers for 6 days

Media Coverage

Television and radio shows and newspaper articles on dairy feeding issues, especially fodder shrubs.
 Documentaries on fodder shrubs produced by KBC and Citizen TV
 Thirty-one Print articles, and Radio and TV shows on dairy feeding issues, especially fodder shrubs.
 Live broadcasts at national and vernacular radio stations

Seed Sales and Nurseries

Mt Kenya Youth Progress Group establishes nurseries in 5 secondary schools
 Seed dealers have increased from 35 to 50
 2,356 kg of calliandra seeds and about 368,000 calliandra seedlings were sold based on reports from 53% of seed distributors
 Mass awareness programmes that triggered search for information and linkages with service providers.

Livelihoods Creation (These are not all solely attributable to SCALE)

The seeds and seedlings sold would support plantings by approximately 112, 856 farmers
 Farm-Chem reports increased earnings
 New KCC reports increased milk production
 Employment creation for over 55 seed and seedling dealers
 Reports of increased milk production realized leading to increased milk sales and availability of more milk at household level for home consumption leading to increased household incomes and improved household nutrition.

Organization of the Sector: Associations and Agreements

On May 7, 2006, the seed dealers association, KATRESNO, was registered with the office of the registrar. Many people saw the newly formed KATRESNO as one of the most important connections and relationships they could have. KATRESNO members became the most important links to other farmers and institutions since they became reliable sources for quality fodder shrub germplasm and information. Thus, they were invited to conduct trainings for dairy farmer groups. The Vice-Chairman of KATRESNO assumed a higher role by being allocated a government vehicle by the Kirinyaga District Livestock Production Officer to disseminate fodder shrub technologies in the district. KATRESNO is important for both bonding ties (seed dealers can exchange information

and trade seed more easily among each other) and for bridging ties (creating links with organizations that want to buy seed). The formation of KATRESNO has been viewed by many stakeholders as an important and significant achievement that will ultimately lead to increased profits among both seed dealers and farmers.

Capacity Building

Training and capacity building were a major area of activity. During the expression of personal commitments at the WSR, over 50 people stood up to describe the actions they planned to take to promote enriched feeds. Many mentioned how many people they planned to train in some way. Some farmers described going back to the cooperatives they belonged to while NGO representatives described more formal capacity-building efforts with a much wider reach. The farmer trainers were backed-up by extension staff and this helped in reaching thousands of new farmers during field days, farmer meetings, agricultural shows and other events that involved large number of farmers.

Media coverage

From the beginning of the project, the media were considered an important stakeholder in the dairy feeding system. By beginning with inviting the media to the WSR as a *stakeholder* and active participant, the media took their role seriously. There was extensive media coverage through radio, print and TV coverage through 10 different media outlets in Kenya. Thirty-one different media events (e.g., articles and shows) on enriched feeds, particularly fodder shrubs) were recorded. Two television stations each produced a 30 minute documentary on fodder shrubs which were broadcast a number of times.

Livelihoods Creation

Seed sales by private vendors are booming in Kenya. AP3 has monitored seed sales made by 47 private seed vendors. Four types of fodder shrubs were monitored: calliandra, trichandra, tree lucerne, and sesbania. Between June 2006 to April 2007, over 3800 kg of seeds for fodder shrubs and over 540,000 seedlings were distributed based on monthly reports from 53% of seed distributors. That amount of seeds and seedlings would support approximately 112,000 farmers (with cows, does not include goats) based on current use rates (Table 5). Note that these data are estimates using assumptions based on reported sales of seeds and seedlings. A great deal can happen between selling the seed and increased milk production or even income from milk sales. There may be some wastage since dealers may sell seed that is never planted. Most significantly, these figures account for seed and seedlings sold by only about half of the seed dealers and do not take into account farmer to farmer transfer of seed and seedlings. . The data thus provide a rough estimate of the number of farmers benefitting and hopefully will be validated through a household survey if funding becomes available.

Table 5. Estimates of Seedlings, Shrubs and Farmers Supported by Seed Sales, June 2006-April 2007 (based on monthly reports of an average of 25 seed dealers out of 47)

	Calliandra	Trichandra	Tree		Total
			Lucerne	Sesbania	
Reported seeds sold (kg)	2,356	862	58	528	3,804
Reported seedlings sold (number)	368,360	125,690	16,700	38,380	549,130
Estimate of total number of shrubs (assume 60% survival of seedlings and 1kg seed=10,000 shrubs)	23,779,016	8,698,414	587,520	5,306,028	38,370,978
Number of farmers supported (assume 340 shrubs for 2 cows)	69,938	25,584	1,728	15,606	112,856

CONCLUSIONS AND FURTHER RESEARCH

Within 15 months, SCALE in Kenya has achieved significant results. Social capital among the dairy stakeholders has increased. Significant changes in the network structure occurred within a year. The number of ties among stakeholders increased and the strength of those ties increased. There is more interaction among organizations that perform similar (bonding) and different (bridging) functions in the system. ICRAF and other research institutions have increased the role they are playing in the dairy sector. This is important and significant since research organizations create new practices that are useless if never communicated to the rest of the system.

The numbers of farmers reached with training and with seeds has increased dramatically within the year. While ICRAF and its partners were able to reach 48,000 farmers over eight years, through SCALE very conservative estimates indicate over 112,000 farmers have been reached within one year.

There is a need for future research on the effects and outcomes of strengthening cross-sectoral networks. The sustainability of the strengthened network in Kenya is unclear and would require further research. There is a need for new ways to articulate and visualize the results and impact of a systems approach such as SCALE. Linear cause and effect models do not adequately describe the complex inter-relationships within a system. SCALE has shifted from a linear causal pathways model to systems thinking and social network analysis. It is difficult to articulate the results and impact of this systems approach in a traditional cause-and-effect linear logic model. We are exploring ways to articulate and visualize the results and impact of a systems approach such as SCALE in terms of social networks and social capital as well as the traditional indicators of success, such as improved environment, governance, health, and livelihoods. Clearly much more work is needed in this area.

Systems thinkers have long understood the complexity of determining the boundaries of a system. SCALE emphasizes the need to start working at the scale at which impact is desired. SCALE also focuses on a development goal rather than one specific solution. Both of these principles make it difficult to draw the boundaries within which a project should work. Development work, by its nature, is highly interconnected with the larger social, political and economic environment. The question of boundaries comes up as decisions need to be made on how to frame the WSR, who to invite to the WSR, and which opportunities to pursue. For the evaluation and social network analysis, this has implications for different sampling approaches and questions of which network one is describing.

There are two other limitations to the evaluation presented here. First, a lack of funds prevented a comprehensive examination of outcomes including changes in farmers' use of fodder shrubs, milk production or increased income from milk sales. Second, the SNA drew a boundary around a group of organizations in the dairy feeding system in order to understand changes in the network structure within those boundaries. The SNA, therefore does not examine how new stakeholders may have helped to grow the network.

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112. Estudio de las cadenas de abastecimiento de germoplasma forestal en la amazonía Boliviana.
113. Biodiesel in the Amazon.
114. Estudio de mercado de semillas forestales en la amazonía Colombiana.
115. Estudio de las cadenas de abastecimiento de germoplasma forestal en Ecuador.

The World Agroforestry Centre is an autonomous, non-profit research organization whose vision is a rural transformation in the developing world where smallholder households strategically increase their use of trees in agricultural landscapes to improve their food security, nutrition, income, health, shelter, energy resources and environmental sustainability. The Centre generates science-base knowledge about the diverse role that trees play in agricultural landscapes, and uses its research to advance policies and practices that benefit the poor and the environment.



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