Keywords:
Extension, farmer-centred research, fodder shrubs, landcare, natural vegetative strips, tree fallows

Chapter 7

Scaling up the impact of agroforestry: Lessons from three sites in Africa and Asia[1]

S. Franzel, G.L. Denning, J-P. Lillesø-Barnekow, *World Agroforestry Centre, Kenya* and A.R. Mercado Jr, *World Agroforestry Centre, the Philippines*

Abstract

This chapter assesses recent lessons learned from attempts to scale up agroforestry improvements, drawing on three case studies: fodder shrubs in Kenya, improved tree fallows in Zambia and natural vegetative strips coupled with the Landcare movement in the Philippines. Currently, more than 15 000 farmers use each of these innovations. Based on an examination of the main factors facilitating their spread, 10 key elements of scaling up are presented. These include: taking a farmer-centred research and extension approach; providing a range of technical options; building local institutional capacity; sharing knowledge and information; learning from successes and failures; and strategic partnerships and facilitation. Three other elements are important for scaling up: marketing, germplasm production and distribution systems, and policy options, although the three case study projects had only a marginal reliance on these. As different as the strategies for scaling up are, they face similar challenges. Facilitators need to develop exit strategies, find ways to maintain bottom-up approaches as innovations spread, assess whether and how successful strategies can be adapted to different sites and countries, examine under which circumstances they should scale up innovations and under which circumstances they should scale up processes, and determine how the costs of scaling up may be reduced.

Introduction

During the past two decades, researchers have worked with farmers throughout the tropics to identify and develop improved agroforestry practices that build on local indigenous knowledge and offer substantial benefits to households and the environment (Cooper et al. 1996; Franzel and Scherr 2002; Place et al. 2002; Sanchez 1995). Research and development projects have demonstrated in many instances that agroforestry increases household incomes, generates environmental benefits, and is particularly well suited to poor and female farmers. But in most cases these success stories have been confined to localized sites, often with unusually concentrated institutional support from research and development organizations.

As a consequence, considerable attention has been devoted in recent years to 'scaling up' the benefits of research, that is, 'bringing more quality benefits to more people over a wider geographical area, more quickly, more equitably, and more lastingly' (IIRR 2000). The issue of scaling up is particularly important

[1] This chapter is a shortened version of a longer published paper: Franzel, S., G.L. Denning, J.P.B. Lillesø and A.R. Mercado 2004. Scaling up the impact of agroforestry: Lessons from three sites in Africa and Asia. *Agroforestry Systems* 61–62(1–3): 329–344.

to agroforestry and natural resources management innovations, because they are relatively 'knowledge intensive' and, unlike Green Revolution technologies, may not spread easily on their own. Drawing on a range of expertise, Cooper and Denning (2000) identified 10 essential elements for scaling up agroforestry innovations: farmer-centred research and extension approaches, technology options, building local capacity, germplasm, market options, policy options, knowledge and information sharing, learning from successes and failures, strategic partnerships, and facilitation (Figure 1).

The objective of this chapter is to assess recent lessons learned in scaling up agroforestry benefits, drawing on three case studies in Kenya, Zambia, and the Philippines. Two of these, from Kenya and the Philippines, were reported in Franzel et al. (2001a), but this chapter will show important developments since then. Firstly, concepts and definitions of scaling up are reviewed. Secondly, the case studies are presented, followed by a discussion of their use of the 10 fundamental elements. Finally, conclusions are drawn and research challenges are discussed.

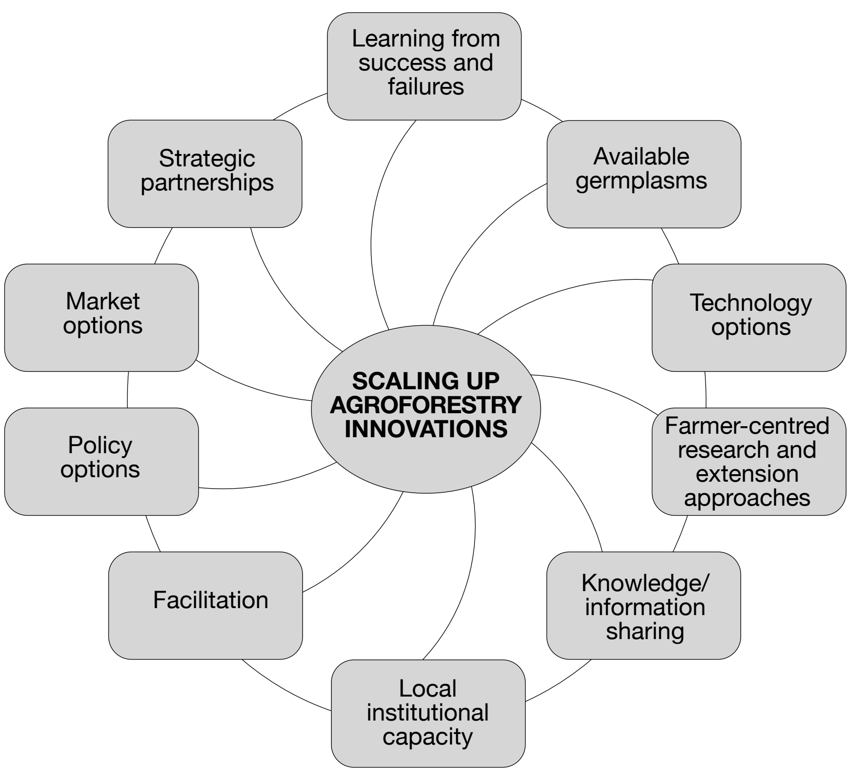

Figure 1. *Essential elements for scaling up agroforestry innovations.*
Source: Cooper and Denning (2000).

Scaling up: Definitions and concepts

There is a proliferation of terms to describe scaling up (Gündel et al. 2001; Uvin and Miller 1996). For instance, Uvin and Miller's typology involves 17 different kinds of scaling up, focusing variously on structure, when a programme expands its size; strategy or degree of political involvement; and resource base, referring to organizational strength.

In this chapter we follow Gündel et al. (2001), who adopt the IIRR (2000) definition of scaling up, which notes that the 'scaled-up state' can either occur spontaneously or because of the deliberate, planned efforts of governments, non-governmental organizations (NGOs) or other change agents. Much can be learned from studying how spontaneous dissemination of innovations takes place, and in particular the role of farmer-to-farmer dissemination. Scaling up is a communication process, and change agents have to understand how farmers receive, analyse, and disseminate information in order to facilitate it. There is emerging literature on agricultural knowledge and information systems, exploring how those involved in the creation of agricultural knowledge acquire, transmit and exchange information (Garforth 2001).

Case studies from Kenya, Zambia, and the Philippines

1. Fodder shrubs, Kenya

The low quality and quantity of feed resources is a major constraint to dairy farming in central Kenya. Most farmers also grow Napier grass as fodder, but it is insufficient in protein and the daily yield of cows fed on it is only around 8 litres. Commercial dairy meal is available but farmers consider it expensive and most do not use it (Franzel et al. 2003).

Development of the innovation

In the early 1990s, researchers (from the Kenya Agricultural Research Institute – KARI, the Kenya Forestry Research Institute

– KEFRI, and the World Agroforestry Centre – ICRAF) and farmers around Embu, Kenya, tested several fodder shrubs. Most of the trials were farmer-designed and managed. *Calliandra calothyrsus* emerged as the best performing and most preferred by farmers. It was found to grow in a range of 'neglected niches' on their farms, including in hedges along internal and external boundaries, around the homestead, along the contour for controlling soil erosion, or intercropped with Napier grass. When pruned to a height of 1 m, the shrubs did not compete with adjacent crops. Growing 500 shrubs increased farmers' incomes by around US$98–124 per year. By the late 1990s, two other shrub species, *Morus alba* (mulberry) and *Leucaena trichandra,* were introduced to farmers following successful on-farm testing (Franzel et al. 2003).

Scaling up

By 1999, 8 years after the introduction of fodder shrubs, about 1000 farmers around the research sites had planted them. However, there was limited scope for reaching all the 625 000 dairy farmers in Kenya; seed was scarce, and the farmers, extension staff and NGOs away from the on-farm trials were not aware of the work. During 1999–2001, KARI, ICRAF and the International Livestock Research Institute (ILRI) collaborated in a project to scale up the use of fodder shrubs in central Kenya. An extension facilitator, working with a range of government and NGO partners, assisted 180 farmer-development groups (comprising 3 200 farmers across seven districts) to establish nurseries and plant fodder shrubs. This approach proved to be very effective: by 2002, each farmer had an average of 340 shrubs and had given information and planting material to an average of six other farmers. Sixty percent of participating farmers were women.

Beginning in 2002, a project financed by the Forestry Research Programme of DFID (the UK's Department for International Development) and implemented by the Oxford Forestry Institute and ICRAF helped a range of partner organizations to increase the adoption of fodder shrubs. By early 2003, there were about 22 000 farmers planting fodder shrubs in Kenya and several thousand in four other countries. Facilitators are helping to train the extension staff of a range of different organizations, including government, NGOs, churches, community-based organizations, farmer groups and private-sector firms. The project is also helping to facilitate the emergence of private seed producers and dealers, and to help link them to buyers in areas where seed demand is high (Franzel et al. 2003; Wambugu et al. 2001).

2. Improved tree fallows, Zambia

The plateau area of eastern Zambia is characterized by a flat to gently rolling landscape, with annual rainfall around 1000 mm. Approximately half the farmers practice ox cultivation, the others cultivate by hand hoe. Maize is the most important crop, and sunflower, groundnuts, cotton and tobacco are also grown.

Surveys identified soil fertility as the farmers' main problem; fertilizer use had been common during the 1980s but was in decline as farmers now lacked the cash to purchase it (Franzel et al. 2002; Howard et al. 1997; Kwesiga et al. 1999).

Development of the innovation

In 1987, a Zambia–ICRAF agroforestry research project began research on improved fallows, using *Sesbania sesban.* By 1995, several hundred farmers were involved. In researcher-led trials, farmers chose among three different species and two different management options – intercropping with maize versus growing the trees in pure stands. In farmer-led trials, farmers planted and managed the improved fallows as they wished. Most farmers opted for a 2-year fallow and planted their main food crop, maize, for two seasons following the fallow. *Tephrosia vogelii, Cajanus cajan* and *Gliricidia sepium* were the main fallow species used. Maize yields following improved fallows averaged 3.6 t ha^{-1}, almost as high as for continuously cropped maize with fertilizer (4.4 t ha^{-1}) and much higher than maize planted without fertilizer (1.0 t ha^{-1}).

Scaling up

Extension activities began in earnest in 1996 when an extension specialist in the Zambia–ICRAF project set up demonstrations, facilitated farmer-to-farmer visits, and trained staff from the Ministry of Agriculture, several NGOs and development projects in Eastern Province. The project helped launch an adaptive research and dissemination network, consisting of representatives from several organizations, farmers' associations and projects (Katanga et al. 2002). The extension effort received a big boost with the start of a United States Agency for International Development (USAID)-financed agroforestry project in 1999, covering five districts. The Centre also facilitated the visits of farmers from Malawi, thus helping to launch the practice there (Böhringer et al. 1998). Scaling up objectives included sensitization, building grassroots capacities, developing effective partnerships, promoting policies more conducive to adoption, monitoring and evaluation, and conducting research on the scaling up process (Böhringer et al. 2003). By 2001, more than 20 000 farmers in eastern Zambia had planted improved fallows (Kwesiga et al. 2003).

3. Natural vegetative strips (NVSs) and Landcare, the Philippines

The upland municipality of Claveria is located in northern Mindañao, the Philippines. Annual rainfall of 2 200 mm allows a farming system of two maize crops per year. However, with this high rainfall, coupled with cultivation of sloping fields and use of animal tillage, soil loss through erosion had degraded lands and led to declining maize yields.

Applied research began in 1985 on contour hedgerow systems using nitrogen-fixing trees to minimize erosion, restore soil fertility and improve crop productivity. But adoption of this system was slow, and many hedgerows were abandoned owing to the high labour requirement to maintain them, poor adaptation of leguminous trees to acid soils, and competition between the trees and the maize crop.

Development of the innovation

Through participatory on-farm experiments, ICRAF researchers concluded that the *concept* of contour hedgerows remained popular and that farmers were concerned about soil erosion and loss of productivity. Researchers observed that farmers often ploughed along contour lines, leaving crop residues and/or natural vegetation in strips between ploughed fields. The latter innovation evolved into natural vegetative strips (NVSs) and emerged as a crucial entry point for reversing land degradation on sloping fields.

Over several years, the NVS technology, coupled with contour ploughing, spread spontaneously among farmers. This innovative farmer-based system and its components were the subjects of intensive on-farm research. Farmer innovations such as the 'cow's back method' (using the view of the ox's backbone when ploughing to maintain a reasonable trajectory for laying out contour lines) were identified as acceptable alternatives to the more technical 'A-frame' technique (ICRAF 1997). For the strips, some farmers demonstrated interest in such cash crops as fruit, timber and coffee; others preferred improved fodder grasses and legumes. In all cases, these innovations built on and enriched the foundation of the NVSs.

Scaling up

With the spontaneous visible spread of NVSs in and around ICRAF's applied research sites, considerable interest emerged from communities, local and provincial government agencies, and NGOs to learn more about this innovation. In 1996, the Centre responded to communities' requests for technical support and training by introducing and testing the appropriateness of Landcare, a participatory, community-based approach from Australia involving the development of groups in partnership with local government to promote conservation-farming practices (Campbell and Siepen 1994; Catacutan et al. 2001; Mercado et al. 2001). Farmers' interest led to the formation of the Claveria Landcare Association, which has emerged as the platform for widespread dissemination of conservation farming based on NVSs. In 1999, Landcare was extended to another ICRAF research site in nearby Lantapan municipality, and by 2002 there were an estimated 500 Landcare groups, involving more than 15 000 farmers in the Philippines.

Comparing the key elements of scaling up

Farmer-centred research and extension

Participatory research, in which farmers play a critical role in the design, implementation, and evaluation of research, has been shown to improve the effectiveness of research and to reduce the time between initial testing and uptake (CGIAR/PRGA 1999).

Farmers were involved in the early stages of the development of technologies at all three sites. In both Kenya and Zambia, researcher-led and farmer-led trials were conducted simultaneously: the former primarily to assess biophysical response, the latter for socioeconomic assessment (Franzel et al. 2001b). Encouraging farmers to experiment with the new practices as they wished led to new innovations and greatly improved the practices at both sites – reducing costs, promoting adoption and making scaling up more rapid.

In the Philippines, it was a farmer innovation – leaving crop residues along the contour, where they revegetate forming NVSs – that proved very popular. Researchers later proved that these strips were effective in controlling soil erosion and required little maintenance. The use of NVSs spread rapidly and farmers continued to innovate (Mercado et al. 2001). Also, establishing a long-term field presence in Claveria enabled researchers to identify and validate farmers' innovations, such as the cow's back method, and to help farmers adjust the NVS system to better reflect their interests, in particular by introducing such cash-generating enterprises as timber and fruit.

There was some variation in extension strategies among the three case studies. In Kenya, extension facilitators provided training to government extension and NGO staff and representatives of village-based farmer development groups, resulting in a significant amount of farmer-to-farmer extension. A similar strategy was implemented in eastern Zambia, except that facilitators established a network of farmer-trainers. In the Philippines, partnership with farmers in on-farm research paved the way for active farmer participation in the scaling up of both the technical innovations and the Landcare approach.

Technical options

Offering a range of options to farmers rather than a specific recommendation is important for several reasons (Franzel et al. 2001c):

- Diversification minimizes production and market risks, and allows for different preferences.
- Farmers' resources vary and different options often have different resource requirements.
- Different options allow for a variable environment.

In all three sites, researchers and farmers quickly developed a range of options for the technologies in question. In Kenya, farmers have the choice of three fodder shrubs and a herbaceous legume, which can be planted in a range of different niches and arrangements on their farms. Moreover, they can feed the leaves to their animals fresh or dry, or store them.

In Zambia, farmers choose from four different species and a range of management options for their improved fallows, depending on their preferences and available labour. They can plant the crops in pure stands or intercropped.

In the Philippines in the early 1990s, farmers and researchers began with a single innovation – the NVS. But by the end of the decade, farmers had introduced 31 different perennials, on their own initiative or with advice from facilitators. These different options included fruits, timber trees, fodder grasses and legumes. Many planted with the intention of earning cash (Mercado et al. 2001).

Local institutional capacity

Empowering local communities to plan their own development and mobilize resources is fundamental to any successful development strategy (Binswanger 2000). The three case studies used different approaches to building local institutional capacity. In central Kenya and eastern Zambia, extension facilitators provided training to village-based groups on the technologies they were promoting, but there were few direct efforts to otherwise build the capacities of these groups.

In Eastern Province, Zambia, in the mid-1990s, ICRAF assisted partner organizations to form an adaptive research and dissemination network to plan, implement and evaluate on-farm research, training and dissemination activities. The network facilitates the involvement of local groups in the plans and activities of research and development organizations, which enhances their capacity and feelings of ownership of the network and practices (Katanga et al. 2002).

In the Philippines, Landcare has gone further in building local institutional capacity. It has enabled communities to share knowledge and experience, influence the agenda of researchers and local policy makers, and mobilize financial resources. Mercado et al. (2001) noted that the "greatest success of Landcare" was the change in the attitudes of farmers, policy makers, local government and landowners with respect to land use and environmental management.

Germplasm

The lack of planting material is repeatedly identified as one of the most important constraints to the wider adoption of agroforestry innovations (Simons 1997). National Tree Seed Centres have been unable to deliver seed to large numbers of smallholders and, as with crop seed, "the seed demand–supply relationship in a large proportion of Africa's smallholder farming systems appears to represent a situation of market failure" (DeVries and Toenniessen 2001).

Successful production and distribution of quality tree seed to resource-poor farmers depends on a number of factors, some of which are biophysical, for example, identifying adapted provenances and seed sources or ensuring sufficient genetic variation, while other factors are economic, organizational and institutional, such as the protection of and ownership of seed sources, and cost-efficient production and distribution networks.

The Kenyan calliandra case study shows a typical dilemma: farmers unfamiliar with the new practice cannot be expected to buy seed, yet provision of free seed discourages them from harvesting it and undermines the emergence of private-sector marketing systems. ICRAF and KARI are trying to improve the situation in four ways:

- Helping link dealers in western Kenya to buyers in other parts of Kenya.
- Assisting fodder shrub growers and private nurseries in central Kenya to produce high-quality seed and seedlings and become seed dealers.
- Working with an NGO, Farm Input Provision Services, to help private dealers to package and sell seed through stockists.
- Encouraging private firms to produce fodder shrub seed or to buy seed from seed dealers.

The situation of improved fallows in Zambia has many similarities. One solution tried here through a USAID-financed project is to loan seed to farmers in return for a promise to give back double the amount they took. The sustainability of this system is uncertain; no private seed dealers have yet emerged, despite the wide-scale adoption of improved fallows.

In the expansion of Landcare, hundreds of communal and private individual tree nurseries have been established to provide seedlings for fruit and timber species. In Lantapan, farmers organized themselves to create the Agroforestry Tree Seed Association of Lantapan (ATSAL), a farmer-operated seed collection, production, processing and marketing association. The organization has trained more than a thousand farmers in both exotic and indigenous tree species and has extended its operations to other areas of the country.

Marketing

Linking farmers to markets and adding value to raw products have great potential for improving the incomes of smallholders and facilitating the scaling up process (Dewees and Scherr 1996). All three of the main practices promoted in the case studies produce inputs: fodder for increased milk production, and soil erosion control and soil fertility for crop production. However, only one of them, fodder, can be sold, explaining the relatively low emphasis given to marketing and product transformation in the case studies. Nevertheless, the uptake of the new practices depends on the availability of markets for the final products.

As mentioned above, efforts are needed in all three cases to promote the marketing of seed and seedlings. Moreover, there are also options for increasing the marketing of fodder from shrubs, which could be promoted as a cash crop for farmers who do not own livestock. In Kenya, there is also great potential for selling leaf meal as a protein source to millers producing dairy concentrates, who currently import protein in the form of fish meal, soybeans and cottonseed cake.

For thousands of low-income farmers in the Philippines, the NVS system has evolved as a means to graduate from subsistence maize farming to cash cropping. Claveria is well connected by road to the large port city of Cagayan de Oro, opening up potential markets for a range of agroforestry products. NVS adopters in Claveria are now observed to be growing a wide range of timber and fruit trees and are increasingly expressing interest in backyard livestock enterprises to diversify and stabilize their incomes. Market access has been critical for the intensification and diversification of the NVS system.

Policy options

Policy affects scaling up operations in several different ways: policy constraints may limit adoption of new practices, policy incentives help promote adoption, and policy makers themselves may be engaged to promote or even finance scaling up activities – a relatively untapped resource (Raussen et al. 2001).

In Zambia, local leaders played important roles in promoting improved fallows in two ways. Firstly they helped sensitize and mobilize their constituents to plant improved fallows. Secondly, they passed, and in some cases, promoted the enforcement of bylaws to remove two of the main constraints to agroforestry adoption: the setting of uncontrolled fires and free grazing of livestock (Ajayi et al. 2002).

The Landcare movement has benefited from and, in turn, reinforced the Philippine government policy of decentralization and devolution of responsibilities to local government. The local government units (LGUs) are now seen as important partners in local natural resource management initiatives, providing policy support for institutionalizing Landcare and conservation farming practices, training staff, and financing Landcare activities (Catacutan and Duque 2002; Catacutan et al. 2001).

Knowledge, information sharing and learning from successes and failures

The dissemination of knowledge and information about scaling up among stakeholders is necessary for making effective decisions. Monitoring and evaluation systems, both formal and informal, ensure the generation of such information at a range of different scales and from the perspectives of different stakeholders (Cooper and Denning 2000).

In Kenya and Zambia, monitoring and evaluation have been conducted in several different ways. Village workshops enabled researchers to gain an up-front understanding of farmers' assessments and expectations of the technologies they are using. In both Zambia and Kenya, Centre staff and partners engage in collaborative monitoring and evaluation. These studies include economic analyses, impact assessments and assessing factors affecting adoption. The system in both countries is not without problems, not all organizations involved in scaling up participate and some are unable to collect even the minimum data required. But the collaborative mechanism gives partners a greater sense of ownership and buy-in as well as access to more information and feedback (Nanok 2003).

Knowledge sharing and learning are priorities at all three sites. As highlighted earlier, Landcare groups have proved to be an effective vehicle for knowledge sharing in areas of conservation farming and livelihood improvement. This institutional platform for knowledge sharing is especially valuable in heterogeneous biophysical environments and dynamic local economies where farming systems are constantly evolving.

Strategic partnerships and facilitation

When scaling up, partnerships offer high potential benefits. Organizations with complementary strengths, resources and 'reach' can improve the efficiency and effectiveness of scaling up efforts (Cooper and Denning 2000). However, these need to be weighted against such potential risks as high costs in terms of time and resources, compromised impact, and loss of identity (Jacquet de Haveskercke et al. 2003).

Landcare in the Philippines is based on a strategic partnership of farmers, LGUs and technical facilitators (such as ICRAF and government line agencies). These alliances are an important aspect of the Landcare movement as they strengthen the influence of farming communities on policy formulation and resource allocation decisions. One concern is that ICRAF continues to play a seemingly indispensable role in facilitation; more effort is needed to develop local skills, preferably in the community or with NGOs that have a long-term commitment to the local communities.

Conclusions: Research challenges

The review of the three case studies highlights the fact that there is no single recipe for scaling up (Table 1). Different approaches can all be successful, depending on the innovation, the environment and the resources at hand. The key elements contributing to improved impact in the case studies were: taking a farmer-centred research and extension approach; providing a range of technical options; building local institutional capacity; sharing knowledge and information; learning from successes and failures; and creating strategic partnerships and facilitation. Three other elements are important for scaling up: marketing, systems of germplasm production and distribution, and policy options, but the performance of the cases on these was, at best, mixed.

Although the facilitators in the three case studies used many of the same elements, their scaling up strategies were very different. The case of fodder shrubs in Kenya offers the simplest approach, in which a focus on on-farm research and facilitating extension services, NGOs and farmer groups reaped surprisingly high benefits. Certainly the limited scope of the innovation – it being one among several important management practices in the dairy enterprise – prevents certain scaling up approaches from being used.

Table 1. *Agroforestry practices, extension strategy, policy options and institutional innovations promoted in the three scaling up case studies.*

Technology		**Extension strategy**	**Policy options**				**Institutional innovations**		
Type	Origin	Facilitating extension services, NGOs, farmer groups	Engaging local government in facilitative role	Obtaining local government financing	Lobbying for local policy changes	Lobbying for national policy changes	Capacity building of farmer groups	Facilitating the creation of federations of farmer groups	Promoting consortia of partners
Fodder shrubs, **Kenya**	Researcher- and farmer-led trials	X					X		
Improved fallows, **Zambia**	Researcher- and farmer-led trials	X	X		X		X		X
Natural Vegetative Strips/ Landcare, **the Philippines**	Farmer innovation with research inputs	X	X	X	X	X	X	X	X

Improved fallows in Zambia is an intermediate case, in which a more complex management practice relevant to several enterprises is being scaled up. Facilitators are using several strategies in addition to those used by fodder shrub facilitators, including engaging local government in a facilitative role, lobbying for policy changes, and promoting a network of partners. These have greatly added to the success of the innovation and to its spread across eastern Zambia.

The case of NVS/Landcare in the Philippines presents the most extensive set of innovations, a technical one accompanied by an institutional one. The technical innovation is simple, yet serves as a platform for a multiplicity of other technical innovations and, indeed, a transformation of the farming system. The institutional innovation, Landcare, has had far-reaching ramifications, as federations of farmer groups can wield not only increased economic power but political power as well. In addition to the strategies used by those promoting fodder shrubs and improved fallows, facilitators in the Philippines have obtained local government financing and have facilitated the establishment of federations of groups. Moreover, they have persuaded policy makers to incorporate the Landcare approach into local and national policy.

But as different as the case studies are, they face five similar challenges:

- Articulation of a clear exit strategy, to leave farmers on their own to continue to implement and disseminate the innovations, with limited local backstopping.
- Maintaining the bottom-up, participatory nature of the scaling up process, which contrasts with the top-down approaches of many government services and NGOs.
- Adapting the scaling up innovations and processes from one site or country for use at another site or country.
- Deciding under what circumstances facilitators should seek to scale up technologies, and under what circumstances to scale up the process by which adoption and adaptation have taken place. In other words, is a scaling up strategy applicable only for a particular technology, or can it be used for several innovations, for any type of agricultural innovation or for agriculture in general?
- Making sure that the benefits of scaling up out-weigh the costs. This includes promoting or formalizing farmer-to-farmer information systems, and encouraging farmer organizations such as Landcare to take on some of the functions of these systems

All of the above issues are at least to some extent researchable. For example, careful assessments of the costs and benefits, and advantages and disadvantages of different strategies can be made. Simple planned comparisons of different scaling up mechanisms can be undertaken. Just as learning and knowledge sharing are critical functions in the scaling up of innovations, they are critical for identifying effective and efficient scaling up strategies. Investment in understanding scaling up processes will reap important rewards leading to improved livelihoods of beneficiaries.

Acknowledgements

The comments and suggestions of Chris Garforth and Robert Tripp on earlier drafts are gratefully acknowledged.

References

Ajayi, O.C., R. Katanga, E. Kuntashula and E.T. Ayuk 2002. Effectiveness of local policies in enhancing adoption of agroforestry technologies: The case of by-laws on grazing and fire in eastern Zambia. Pp. 93–99 in: Kwesiga, F., E. Ayuk, and A. Agumya (eds) Proceedings of the 14th Southern Africa Regional Review and Planning Workshop, 3–7 September 2001, Harare. Southern Africa Development Community–World Agroforestry Centre (SADC–ICRAF) Regional Programme, Harare, Zimbabwe.

Binswanger, H.P. 2000. Scaling up HIV/AIDS programs to national coverage. *Science* 288: 2173–2176.

Böhringer, A., E.T. Ayuk, R. Katanga and S. Ruvuga 2003. Farmers' nurseries as a catalyst for developing sustainable land use systems in southern Africa. Part A: Nursery productivity and organization. *Agricultural Systems* 77: 187–201.

Böhringer, A., N. Moyo and R. Katanga 1998. Farmers as impact accelerators: Sharing agroforestry knowledge across borders. *Agroforestry Today* April–June 1998, World Agroforestry Centre (ICRAF), Nairobi, Kenya.

Campbell, A. and G. Siepen 1994. Landcare: Communities Shaping the Land and the Future. Allen and Unwin, Sydney, Australia.

Catacutan, D.C. and C.E. Duque 2002. Locally-led Natural Resource Management. Proceedings of a regional workshop, 8–9 November 2001, Valencia City, Bukidnon, the Philippines.

Catacutan, D.C., A.R. Mercado and M. Patindol 2001. Scaling up the Landcare and NRM planning process in Mindanão, the Philippines. *LEISA (Low External Input and Sustainable Agriculture) Magazine* 17(3): 31–34.

CGIAR/PRGA (Consultative Group on International Agricultural Research/Participatory Research and Gender Analysis) 1999. Crossing perspectives: Farmers and scientists in participatory plant breeding. Cali, Colombia.

Cooper, P.J.M. and G.L. Denning 2000. Scaling Up the Impact of Agroforestry Research, World Agroforestry Centre (ICRAF), Nairobi, Kenya.

Cooper, P.J., R.R.B. Leakey, M.R. Rao and L. Reynolds 1996. Agroforestry and the mitigation of land degradation in the humid and sub-humid tropics of Africa. *Experimental Agriculture* 32: 235–290.

DeVries, J. and G. Toenniessen 2001. Securing the harvest: Biotechnology, breeding, and seed systems for Africa's crops. CAB International, Wallingford, UK.

Dewees, P.A. and S.J. Scherr 1996. Policies and markets for non-timber tree products. Environment and Production Technology Division Discussion Paper No. 16. International Food Policy Research Institute, Washington, DC, USA.

Franzel S. and S.J. Scherr (eds) 2002. Trees on the Farm: Assessing the Adoption Potential of Agroforestry Practices in Africa. CAB International, Wallingford, UK.

Franzel, S., P. Cooper and G.L. Denning (eds) 2001c. Scaling up the benefits of agroforestry research: Lessons learned and research challenges. *Development in Practice* (Special volume) 11(4): 524–534.

Franzel S., C. Wambugu and P. Tuwei 2003. The adoption and dissemination of fodder shrubs in central Kenya. Agricultural Research and Network (AGREN) Series Paper No. 131. Overseas Development Institute, London, UK.

Franzel S., D. Phiri and F.R. Kwesiga 2002. Assessing the adoption potential of improved tree fallows in eastern Zambia. Pp. 37–64 in: Franzel, S. and S.J. Scherr (eds) Trees on the Farm: Assessing the Adoption Potential of Agroforestry Practices in Africa. CAB International, Wallingford, UK.

Franzel, S., P. Cooper, G.L. Denning and D. Eade (eds) 2001a. Development and Agroforestry: Scaling up the Impacts of Research. *Development in Practice* (Special volume) 11(4): 405–534.

Franzel, S., R. Coe, P. Cooper, F. Place and S.J. Scherr 2001b. Assessing the adoption potential of agroforestry practices in sub-Saharan Africa. *Agricultural Systems* 69: 37–62.

Garforth, C. 2001. Agricultural knowledge and information systems in Eritrea: A study in sub zoba Hagaz. The University of Reading, UK.

Garrity, D. 2000. The farmer-driven Landcare movement: An institutional innovation with implications for extension and research. Pp. 7–9 in: Cooper, P.J.M. and G.L. Denning (eds) Scaling Up the Impact of Agroforestry Research. World Agroforestry Centre (ICRAF), Nairobi, Kenya.

Gündel S., J. Hancock and S. Anderson 2001. Scaling up strategies for research in natural resources management: A comparative review. Natural Resources Institute, Chatham, UK.

Howard, J.A., L. Rubey and E.W. Crawford 1997. Getting technology and the technology environment right: Lessons from maize development in southern Africa. Paper presented at the Meeting of the International Association of Agricultural Economics. 10–16 August 1997, Sacramento, USA.

ICRAF (World Agroforestry Centre) 1997. Annual Report 1996. ICRAF, Nairobi, Kenya.

IIRR (International Institute of Rural Reconstruction) 2000. Going to Scale: Can We Bring More Benefits to More People More Quickly? IIRR, Silang, Cavite, the Philippines.

Jacquet de Haveskercke, C., A. Böhringer, R. Katanga, L. Matarirano, S. Ruvuga and D. Russell 2003. Scaling out agroforestry through partnerships and networking: The experience of the World Agroforestry Centre in southern Africa. Southern Africa Agroforestry Development Series No. 2. World Agroforestry Centre, Zomba, Malawi.

Katanga, R., D. Phiri, A. Böhringer and P. Mafongoya 2002. The adaptive research and dissemination network for agroforestry: A synthesis of the adaptive workshops. Pp 93–99 in: Kwesiga, F., E. Ayuk and A. Agumya (eds) Proceedings of the 14th Southern Africa Regional Review and Planning Workshop, 3–7 September 2001, Harare. Southern Africa Development Community–International Centre for Research in Agroforestry (SADC–ICRAF) Regional Programme, Harare, Zimbabwe.

Kwesiga, F.R., S. Franzel, F. Place, D. Phiri and C.P. Simwanza 1999. *Sesbania sesban* improved fallows in eastern Zambia: Their inception, development, and farmer enthusiasm. *Agroforestry Systems* 47: 49–66.

Kwesiga, F., S. Franzel, P. Mafongoya, O. Ajayi, D. Phiri, R. Katanga, E. Kuntashula, F. Place and T. Chirwa 2003 Improved fallows in eastern Zambia: History, farmer practice and impacts. Conference Paper No. 12. Internationale Weiterbildung und Entwicklung/International Food Policy Research Institute/New Partnership for Africa's Development/Technical Centre for Agricultural and Rural Cooperation (InWEnt/IFPRI/NePAD/CTA) Conference 'Successes in African Agriculture', 1–3 December 2003, Pretoria, South Africa.

Mercado, A.R., P. Marcelino and D.P. Garrity 2001. The Landcare experience in the Philippines: Technical and institutional innovations for conservation farming. *Development in Practice* 11 (4): 495–508.

Nanok, T. 2003 Assessment of the adoption and dissemination of improved fallows and biomass transfer technologies in western Kenya. MSc. thesis. Department of Agricultural Economics. Egerton University, Njoro, Kenya.

Place, F., S. Franzel, J. DeWolf, R. Rommelse, F. Kwesiga, A. Niang and B. Jama 2002a. Agroforestry for soil fertility replenishment: Evidence on adoption processes in Kenya and Zambia. Pp. 155–168 in: Barrett, C.B., F. Place and A.A. Aboud (eds) Natural Resources Management in African Agriculture: Understanding and Improving Current Practices. CAB International, Wallingford, UK.

Raussen, T., G. Ebong and J. Musiime 2001. More effective natural resources management through democratically elected, decentralised government structures in Uganda. *Development in Practice* 11(4): 460–470.

Sanchez, P.A. 1995. Science in agroforestry. *Agroforestry Systems* 9: 259–274.

Simons, A.J. 1997. Delivery of improvement for agroforestry trees. In: Dieters, M.J. and C.A. Matheson (eds) Tree Improvement for Sustainable Tropical Forestry. Queensland Forestry Research Institute, Gympie, Australia.

Uvin, P. and D. Miller. 1996. Paths to scaling-up: Alternative strategies for local nongovernmental organizations. *Human Organization* 55(3): 344–354.

Wambugu, C., S. Franzel, P. Tuwei and G. Karanja 2001. Scaling up the use of fodder shrubs in central Kenya. *Development in Practice* 11(4): 487–494.