Scaling up the benefits of agroforestry research:

lessons learned and research challenges

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Research and development institutions are becoming increasingly committed to scaling up the adoption and impact of technical, institutional, and policy innovations that improve household livelihoods. Scaling up is a complex subject; Uvin and Miller (1999) developed a taxonomy and arrived at 17 different kinds of scaling up, focusing on structure (when a programme expands its size), strategy (degree of political involvement), and resource base (organisational strength). The International Institute of Rural Reconstruction (IIRR) (2000) gives a useful and succinct functional definition of scaling up: efforts to 'bring more quality benefits to more people over a wider geographical area more quickly, more equitably, and more lastingly'. Different users of the term consider different issues as important. Proponents of the technology-transfer paradigm often imply that the main issue in scaling up is to replicate the use of improved practices – for example, more farmers using mineral fertiliser – and they focus on such issues as delivery of inputs and demonstration of benefits (Quiñones and Gebre 1996). Others, such as Krishna *et al.* (1998), consider scaling up in much broader terms, that is, as a process of adaptation, innovation, feedback, and expanded human capability. In line with the latter approach, Cooper and Denning (2000) identified ten essential and generic elements of a successful scaling-up strategy, as noted in Denning (2001). Our paper summarises the main lessons learned from the case studies that appear in this volume and presents them by element.

Technical options

Most of the case studies involved scaling up the use of technical options that had first been developed by researchers and farmers conducting participatory research. All involved offering farmers a range of options.

In Southern Africa, for example, several species and practices were available for producing fodder trees, fuelwood, and fruit, and for enhancing soil fertility. Offering farmers alternative practices and tree species to solve a particular problem was important for several reasons:

- Farmers want to diversify income and thus reduce the multiple risks they face. For example, a single option may, over time or through expanded use, succumb to pests or diseases. Farmers also face the risk of market failure and the risks associated with season-to-season variation; thus they value multiple options.
- Different farmers are likely to have different preferences. Anyonge *et al.* (2001) found that farmers in densely populated areas preferred *Grevillea robusta* for timber, because it competed little with their crops. Farmers in sparsely populated areas, however, where farm size was larger, preferred the more competitive and faster-growing *Eucalyptus* spp..
- Different options are likely to perform differently in different environments. Weber *et al.* (2001) noted variation in ranking in wood density among provenances of a timber tree, *Calycophyllum spruceanum*, in different areas of a watershed in Peru. The variation in ranking was associated with differences in soil type and rainfall.
- Promoting different species and different provenances or varieties of the same species enhances biodiversity.
- Diversity of tree species can diversify income and thus reduce the risk of market failure.

Practices that could be adapted to a range of different biophysical and socio-economic circumstances were also useful in the scaling-up process. For example, improved fallow options in Southern Africa included a range of species that could be planted by direct seeding or by growing seedlings in nurseries, and they could be planted in pure stands or intercropped with maize. In addition, the different species offered different by-products, including pesticide, food, and wood for fuel and construction.

Another critical function in the case studies was defining the recommendation domains of options, that is, the biophysical and socio-economic circumstances under which farmers would adopt them. Wambugu *et al.* (2001) found that *Calliandra calothyrsus*, a fodder tree, performed poorly on acidic soils in central Kenya. Furthermore, it was not attractive in irrigated areas, where farmers preferred to use their labour to produce vegetables.

Farmer-centred research and extension

Farmer-centred research was key for generating appropriate practices for farmers and for responding to farmers' problems during the scaling-up process. Diagnostic surveys helped identify farmer problems and opportunities; farmer preference surveys and market assessments helped researchers in Peru to set priorities on species for research (Weber *et al.* 2001). In Mexico, farmers held workshops at which they selected the practices they wanted to test. Haggar *et al.* (2001) helped them form research groups and conduct their own experiments, which facilitated the exchange of information and experiences among group members.

But it is not possible for researchers to work directly with many farmers or even in many villages in a given area; scaling up is thus often viewed as involving some tension or conflict with participation (IIRR 2000). Field practitioners in the case studies minimised this problem in several ways:

- Wambugu *et al.* (2001) worked with a range of local development partners who themselves used participatory techniques and promoted farmer experimentation and innovation. These partners included NGOs, government extension services, community-based organisations, private companies, and church organisations.
- Faminow *et al.* (2001) scaled up participatory research, helping farmers to establish 1850 test plots in 850 villages. Unique among the case studies, this project paid farmers a cash subsidy. However, the authors concluded that the high rate of uptake by farmers not receiving subsidies indicated that this incentive may not have been necessary.
- In Southern Africa, researchers helped farmers establish hundreds of farmer-designed trials, in which farmers tested new practices and species on their own and as they wished. Researchers facilitated farmer-to-farmer learning tours and monitored small samples of farmers (Böhringer 2001).

In conducting participatory extension, the case studies highlight the need for pluralistic, integrated, and bottom-up approaches (Anyonge *et al.* 2001). Wambugu *et al.* (2001) started by ensuring farmers' interest in available practices and the appropriateness of the practices to their circumstances, both biophysical and socio-economic. Böhringer (2001) noted the need to support a minimum number of farmers in an area,

about 10 per cent, to catalyse uptake. Nearly all of the case studies focused on working with farmer groups rather than individuals, to economise on scarce facilitation resources and ensure greater farmer-to-farmer dissemination and exchange of information. An eclectic approach concerning extension methods was also advocated; Anyonge *et al.* (2001) found that working through schools was the most effective approach in some areas while in others, working through farmer groups was more effective.

There was also considerable variation in the degree to which practitioners in the case studies were able to involve women and also focus on the poor. In Southern Africa, Böhringer (2001) noted that facilitators with the International Centre for Research in Agroforestry (ICRAF) encouraged partners to ensure that 50 per cent of beneficiaries were women. In establishing fodder trees in central Kenya, 60 per cent of participating farmers were women (Wambugu *et al.* 2001). At the other extreme, in India, Faminow *et al.* (2001) experienced difficulty in involving women because they were excluded from owning land, and thus they were allocated only 5 per cent of the test plots. Nevertheless, the project was able to reach women by offering smaller-scale tree nurseries more suited to their needs and resources. Concerning wealth, only Noordin *et al.* (2001) in western Kenya compared the uptake of technology options among different wealth groups. While wealth was positively related to the use of fertiliser, it was not related to the use of improved fallows and biomass transfer. Because agroforestry practices require little, if any, cash outlay, they are especially suitable for resource-poor farmers.

Building local capacity

One of the most exciting achievements in the case studies has been the building of local institutional capacity, not just for implementing agroforestry but also for planning, implementing and evaluating a broad range of development activities. In local-level planning in Nyandarua and Nakuru Districts in Kenya, communities developed action plans based on their needs and designed and implemented activities together with extension staff. Many critical lessons were learned; for example, community planning was more effective through village elders and leaders of organised groups than through open public meetings. Planning exercises must take place before government staff submit their work plans so that the staff are able to commit their time to new activities (Anyonge *et al.* 2001).

In western Kenya, agroforestry researchers and development staff helped representatives of farmer groups to form village committees in order to promote the testing of practices to improve soil fertility. They also planned soil conservation activities, exchange tours with other villages, and the collective purchase of inputs. Building on existing farmer groups rather than creating new, competing structures was found to enhance impact and give the groups a sense of ownership of the process. Village committees federated into sub-location and location-level committees, and some were assisted in developing proposals, which were successful in obtaining funds for scaling-up activities. But there were also important problems. Higher-level committees were generally weaker than the village committees. Moreover, the performance of the committees was dependent on follow-up from project staff, even three years after they were formed (Noordin *et al.* 2001).

In Uganda, participatory research tools were useful in building local capacity. Agroforestry researchers and development practitioners helped communities to conduct participatory mapping exercises to plan the planting of contour hedges on hillsides to curb soil erosion and provide fodder, stakes, and fuelwood. Farmers used the maps to calculate the numbers of seedlings they needed and the numbers of seasons it would take to plant the required seedlings. They then used the information to decide how many group nurseries they needed to supply the seedlings. Such participatory methods greatly increase farmers' motivation, willingness to participate in collective action, and sense of ownership over the development process (Raussen *et al.* 2001).

In Mindanao, Philippines, farmers joined together to form Landcare groups, to share knowledge and learn more about sustainable and profitable agricultural practices that conserve natural resources. Conservation teams, made up of a farmer, an extension technician, and an outside facilitator, trained farmers and facilitated exchanges of knowledge and experiences in conservation farming practices and organisational methods. Landcare members increased rapidly in number and chapters formed associations, which sought and received funding from local governments. Their activities included establishing nurseries, training, and making farmer-to-farmer visits. Mercado *et al.* (2001) note that the greatest success of Landcare was the change in attitude of farmers and policy makers about land use and environmental protection. A second key achievement was the increased capacity of farmers to plan and implement development projects and

to lobby local governments for funding and for promoting effective natural resource management. A key question for the future is, as research and extension services in many countries decline, can such farmer federations conduct their own research and development projects and manage to deliver essential services?

Germplasm

Quality planting material is needed to start scaling up, and local systems of producing and distributing planting material are needed to sustain agroforestry development. Weber *et al*. (2001) focus on the need for high-quality, genetically diverse, and appropriate planting material and describe participatory methods for developing such material. They also explain how conservation of genetic resources can take place through the use of productive, adapted, and genetically diverse planting material.

Several innovative systems of community-based seed supply and distribution are described in the case studies. In Peru, farmers are forming networks to produce and sell high-quality seed and seedlings to tree-planting projects and to timber companies (Weber *et al*. 2001). In central Kenya, facilitators are promoting community-based seed production and marketing through a range of partners: individual farmers, private nurseries, farmer groups, and seed vendors (Wambugu *et al*. 2001). Böhringer (2001) reports that ICRAF and its partners in four countries of Southern Africa are helping farmers establish 800 seed multiplication plots and 6000 nurseries in 2001.

A key and often controversial issue in scaling up is whether facilitating organisations should distribute free seed and seedlings. In most situations, small-scale subsistence farmers do not have the cash resources to pay the full cost of seed and other planting material. Yet the supply of free seed is not sustainable on a large scale, and it stifles the private nurseries that sell planting material. In Eastern Province, Zambia, organisations promoting improved fallows arrived at a viable compromise: they supply farmers with seed on condition that the farmers return twice as much seed to the organisation when it becomes available from the trees they plant, which is usually during the second year after tree establishment.

Market options

Among the ten elements of scaling up, the case studies are probably weakest in developing market options. Most do not even mention the

role of markets. Many of the agroforestry practices assessed in the case studies do not yield products for sale; rather, they provide substitutes for purchased inputs, such as fodder shrubs for dairy feeds or improved fallows for mineral fertiliser. Thus, issues concerning product markets are not directly related to their promotion and development. But other agroforestry products such as fruit and timber may be sold, and the potential benefits from transforming and marketing them are often huge. Böhringer (2001) noted that researchers in Southern Africa are beginning to assess market demand and consumer preferences for indigenous fruits, so that mechanisms can be put in place for establishing links between producers and markets. Assessments are being made of selling fresh fruit as well as producing jams, juices, and alcoholic beverages.

Most agroforestry research and development teams, in fact, lack skills in marketing and product development. Gaining access to such expertise needs to be a high priority in scaling up. Lecup and Nicholson (2000) provide useful guidelines for identifying market opportunities for agroforestry products. Franzel and Denning (in press) identify key elements of successful marketing and present a conceptual framework of marketing research and development for scaling up agroforestry innovations.

Policy options

An enabling policy environment is critical for scaling up. Whereas policy research often focuses on the national level, the case studies highlighted the importance of a range of local policy makers, both traditional and governmental, in villages, districts, and provinces. These local policy makers proved to be at least as important for promoting the scaling up of agroforestry as national policy makers based in the capital city.

Agroforestry researchers and development staff in the case studies helped inform policy makers about policy constraints, which has led to the constraints being removed. For example, in parts of Kenya, ordinances require farmers to obtain a permit before cutting down trees, on the seemingly logical assumption that such measures protect trees. But they are actually a strong disincentive against planting trees, since farmers do not want to plant trees that they may not be able to harvest. Moreover, the ordinances are often abused, as farmers are required to negotiate their way through bureaucracies or even pay bribes to obtain the cutting permits. Anyonge *et al.* (2001) described

how agroforestry development staff were able to persuade the provincial administration to make redundant the permits needed to cut trees and thus remove this strong disincentive for planting them.

Also of importance, the case studies demonstrate how local policy makers in particular can act to promote agroforestry. In Nagaland, India, village leaders passed resolutions supporting tree planting, which greatly influenced farmers' decisions (Faminow 2001). In Mindanao, Philippines, local governments provided funds, technical assistance, and policy support for conservation practices. Municipalities developed natural resource plans and they funded conservation teams and Landcare association activities such as nurseries, training, and cross-site visits (Mercado *et al.* 2001).

In Kabale, Uganda, local policy makers played a lead role in scaling up agroforestry. Local leaders are elected, and their re-election depends in great part on their ability to promote development activities for their constituency. The government's ambitious decentralisation programme provided considerable authority and funds to local government councils, which often had a strong interest in agroforestry as a means for improving household incomes and conserving natural resources. Project staff linked with local policy makers in numerous activities to scale up agroforestry, including planning, mobilising the community, and producing community newsletters (Raussen *et al.* 2001). Even in countries with weak local governments, great potential exists to mobilise local authorities to promote agroforestry development.

Successful local pilot projects may also be scaled up to the national level through policy contacts. For example, experience in local-level planning in a development project in Kenya played a key role in developing a national extension programme, which involved greater participation by local stakeholders in planning and budgeting local-level extension programmes throughout the country (Anyonge *et al.* 2001).

Learning from successes and failures

Monitoring and evaluation served to enhance learning among stakeholders in all of the case studies. Many examples were provided about the ways in which feedback from farmers resulted in important modifications in recommendations, strategies, and policies. Faminow *et al.* (2001) report that the low adoption rate of labour-intensive contour bunds resulted in a shift in project direction towards farmers' own measures for soil erosion, which was to use small trenches. Low

adoption rates by women led to special emphasis to find out their needs and to tailor tree-planting strategies to meet those needs. The high rate of tree planting among farmers who were not involved in trials indicated the project's success. Moreover, surveys monitoring farmer plantings helped indicate farmers' preferences for trees that were the most marketable. These findings helped the project to better meet farmers' needs.

Böhringer (2001) presented the idea of pilot development projects as laboratories to understand impact under real-world conditions. In Malawi, he is assessing whether farmers can adopt agroforestry to control soil erosion and is investigating hypotheses concerning gender, wealth, researcher-to-farmer and farmer-to-farmer communication, and the role that community organisations play in promoting adoption.

The case studies also assessed the impact of scaling up. Anyonge *et al.* (2001) explained how aerial surveys in Kenya were used to show that the useable volume of wood in project areas doubled in five years. Wambugu *et al.* (2001) reported the economic benefits accruing to farmers adopting fodder trees and the huge potential benefits nationally if just half of Kenya's dairy farmers were to adopt them. Such analyses provide important arguments to planners and donors for investing further in scaling up tree planting for improving farmer incomes and livelihoods. But there was no clear evidence as to how increased income was actually spent or how it benefited the households. None of the case studies presented values for environmental impact, although several had environmentally linked objectives.

Furthermore, while the case studies emphasise project monitoring and evaluation, little attention was given to farmers' own monitoring and evaluation. Böhringer (2001) describes monitoring and evaluation by three types of actors: individual farmers, development agents, and villagers in workshops. Triangulation among these three approaches would give a more accurate picture of successes and failures than any single one of them alone. Kristjanson *et al.* (in press) describe the importance of farmer workshops for identifying farmers' expectations about the impact arising from adoption of improved practices and farmers' proposed impact indicators.

Knowledge and information sharing

Sharing knowledge and information is critical to ensure effective decision making by a wide range of stakeholders in the scaling-up process (Cooper and Denning 2000). Farmers' indigenous knowledge

played an important role in shaping tree domestication in Peru. For example, farmers were adept at distinguishing among *Bactris gasipaes* (peach palm) varieties. They could associate physical attributes such as waxy coats with desired fruit characteristics, such as oil content. Such information was useful for helping researchers to select which varieties to multiply.

Even more important is for farmers to share knowledge among themselves. Böhringer (2001) reported facilitating farmer-to-farmer group training exercises, in which participants spend several days visiting farmers in another village, sharing knowledge along with board and lodging. Such training exercises cost about one-tenth as much per person trained as do formal training courses. Training and supporting farmer trainers is another key means for promoting farmer-to-farmer knowledge sharing.

The case studies also documented considerable farmer modification of introduced practices. In India, for example, farmers chose to plant timber trees more densely than recommended for several reasons: to reduce weeding, to get straighter trunks, and to reduce soil erosion (Faminow *et al.* 2001). Farmers in central Kenya found that extending the time that *Calliandra calothyrsus* seeds were soaked increased germination. This information was fed back to researchers, who confirmed the validity of the finding. Extensionists now recommend the longer soaking time (Wambugu *et al.* 2001). Continuous farmer experimentation, adaptation, and knowledge sharing are critical to ensure that practices are appropriate over large areas (Böhringer 2001).

Strategic partnerships and facilitation

Most of the case studies put great emphasis on partnerships as a means for scaling up. Most also are written from the point of view of a facilitator assisting a range of partners. Böhringer (2001) noted that ICRAF collaborates with 572 partner organisations in four Southern Africa countries in scaling up agroforestry practices. But he also pointed out that numbers are not what is important; rather, detailed analyses are needed to assess the quality of partnerships, that is, what have been the successes and the failures, and how can high transaction costs be reduced. Noordin et al. (2001) cites several challenges in building partnerships: drawing up clear memoranda of understanding on roles and responsibilities, reducing duplication of effort, reducing partners' expectations about the material benefits they will receive through collaboration, and improving the documentation of activities.

Table 1 is an example of a matrix, adapted from Tanzania, for helping facilitators assess the potential contribution of different partners in agroforestry dissemination. The matrix helps to characterise partners, to compare their strengths and weaknesses, and to decide systematically how much effort to give to each.

Böhringer (2001) highlights the special case of government partners, such as extension services, which are often weak and have top-down approaches in working with farmers. Collaborating with extension staff often requires paying substantial staff allowances to compensate for their low salaries. Yet it is often politically necessary to work closely with them. He suggests that extension roles be redefined to facilitate and coordinate services rather than to deliver them.

Other case studies report on more effective partnerships with governments, especially local government. As mentioned in the section on policy options, agroforestry researchers and development staff have built effective partnerships with local authorities in Uganda and the Philippines. In Mexico, Haggar *et al.* (2001) reported working effectively with government development projects that were training extensionists in participatory methods and agroforestry practices.

Table 1: Matrix for assessing the potential contribution of different partner organisations in agroforestry dissemination (partners can be scored high, medium, or low on each criterion)

	Partner organisation		
	1	**2**	**3**
Reach (areas and no. of farmers)	H	L	H
Participatory approaches	L	H	H
Availability of staff, resources, good management	H	M	M
Commitment to agroforestry	H	H	L
Openness to appropriate practices	L	H	M
Commitment to monitoring and evaluation	M	M	L
Accessibility (distance)	H	M	L
Shared objectives	H	H	M
Time and resources that ICRAF spends on them	L	H	L
Value per unit effort	High, if participatory approach can be introduced	Low, partner is very small	Partner has many activities and is not very interested in agroforestry

A main instrument for facilitating partnerships in Southern Africa has been 'networkshops' – informal, biannual meetings at which representatives from partner organisations and farmers plan and review their agroforestry activities (Böhringer 2001). A most important impact of the workshops is that all partners develop a sense of involvement, enthusiasm, and ownership of promising innovations. A critical task of the networkshops is to define clearly the roles and responsibilities of the different actors in on-farm research and dissemination. In Eastern Province, Zambia, about 75 representatives of research, extension, NGOs, and farmer groups have met once or twice a year since 1996 in networkshops to plan and review the testing and dissemination of improved fallows and other agroforestry practices. Five different organisations provide funding, and networkshops are hosted on a rotational basis and chaired by the provincial coordinator of agriculture.

Whereas in 1996 the ICRAF-Zambia project was seen as the main facilitator of agroforestry in Eastern Province, it has helped build capacity in several other organisations, which now provide seed, training, and technical assistance. The project has evolved from being the hub of agroforestry activity to becoming one of several nodes of the network. This evolution attests to its successful role as a facilitator. Noordin *et al.* (2001) report a similar effort launched in 2001, called the Consortium for Increasing Farm Productivity in Western Kenya. Planned activities include scaling up improved practices, sharing methods and approaches, developing training materials, and issuing a newsletter.

Research challenges on scaling up

The case studies presented in this issue demonstrate the multifaceted nature of scaling up: temporal, spatial, institutional, and functional facets, to name just a few. A key lesson is that scaling up agroforestry is not just transferring inputs and knowledge about improved practices; it involves building partnerships, assisting communities to mobilise resources, and promoting effective participation of stakeholders to test, disseminate, adapt, and evaluate new innovations in a sustainable manner (Wambugu *et al.* 2001). Böhringer (2001) draws a similar conclusion: in addition to offering improved livelihoods, agroforestry is a learning tool for building local capacity to innovate.

Review of the case studies reveals several challenges ahead for enhancing the scaling up of agroforestry. An overarching problem is

that there is a paucity of research on the scaling-up process. Whereas many useful lessons can be derived from the cases presented here, they are almost always based on informal analysis – the reflections of practitioners – rather than on rigorously planned research. Yet careful assessments of the relative costs and benefits and the advantages and disadvantages of different strategies are often possible. Resources dedicated to project or programme monitoring and evaluation could be used or supplemented to investigate the effectiveness of scaling-up processes, and not just the inputs and outputs. In addition, wherever possible, opportunities should be taken to undertake simple planned comparisons of different approaches. Based on the conclusions of these case studies and evidence from the broader literature, the following issues need to be addressed as a matter of priority:

- Scaling up requires a continuous stream of technical options based on both science and farmer innovation. How do we capture farmer innovation and ensure that scientific knowledge and indigenous knowledge are well integrated?
- In the process of scaling up, farmers adapt and improve innovations as they are extended to different circumstances and face different resource constraints and stresses. How can monitoring and evaluation systems be designed to capture the knowledge generated in this way?
- Which information dissemination methods are most effective and why? For example, how do the costs and benefits of farmer-to-farmer visits compare with those of farmer training courses?
- Many different models for empowering local communities as change agents were presented in the case studies. What are the guiding principles for successful and sustainable farmer organisations? How can we help such organisations to federate across villages to improve their efficiency and effectiveness?
- What are the advantages and disadvantages of different means of producing and distributing or marketing seed at different stages of the scaling-up process? How can community-based production and marketing of seed be made institutionally and financially sustainable?
- Marketing agroforestry products is an untapped strategy. How can we link farmer production to local, regional, and international markets?

- How can policy makers – at various levels – become effective promoters of local farmer organisations and agroforestry development? The strategy for involvement will depend on the level at which the policy maker is operating.
- What is the impact of agroforestry practices on the livelihoods of women and poor households and on the environment? How can we facilitate farmer and community-based monitoring and evaluation?
- How can we devise more strategic partnerships and reduce their transaction costs? How can issues of institutional ownership and attribution be overcome for the benefit of small-scale farmers?
- How can research institutions adapt functionally and structurally to be more effective partners in scaling up and, more broadly, in rural development?

Uvin and Miller (1999) claim that 'scaling up' is akin to the Loch Ness monster – many have sighted it, but its description is as varied as the people who have written about it. Unfortunately, but not surprisingly, there is no definitive formula for scaling up. Yet this analysis of case studies, when considered in conjunction with the earlier syntheses by Cooper and Denning (2000) and IIRR (2000), demonstrates a convergence on the elements that, to various degrees, are important in the process. Regional, national, and local specificities clearly suggest that greater investment is warranted in the learning and innovation associated with scaling up.

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