Chapter 8

Building Innovation Systems for Managing Complex Landscapes

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This chapter guides development practitioners in fostering communication and learning to shape innovation systems for managing agriculture and natural resources across landscape systems and to jointly achieve sustainable production, ecosystem/biodiversity, and rural livelihood goals. This ecoagriculture landscape perspective accounts for the physical and biological features of an area together with the institutions and people who influence it. These features are dynamic and encompass diverse sustainable natural resource management practices. The landscape perspective merges ecosystem thinking with multi-stakeholder processes, sustainable production, and good governance of natural resources (International Agricultural Center 2006; Scherr and McNeely 2007). The landscape scale links grassroots, community-based initiatives in sustainable agriculture and integrated natural resource management with wider national or regional goals (Fry 2001).

In landscapes managed for sustainable production as well as conservation goals, producers and entrepreneurs are expected to deliver ecological and amenity benefits to society (ecosystem services) while also extracting value from the resources to secure their livelihoods. Interactions among market, public, and civic institutions generate incentives and capacities for producers and entrepreneurs to participate in the equitable allocation of capital resources: natural, human, social, financial, technical. The relationships and coordinating mechanisms of landscape-level governance systems are inherently diverse and subject to persistent change from internal and external sources (Flora 2001; Sayer and Campbell 2004). A robust and adaptive system of innovation is needed, therefore, to enable managers of landscape systems to coordinate and guide the diverse actors and complicated interactions required to realize the desired outcomes.

An innovation system comprises the actors—the organizations and people—who develop ideas and turn them into knowledge, information, products, or services. This actor-based concept of an innovation system emphasizes the interaction among people with a stake in the outcome of a management system and the learning required to bring about innovations that they consider important. Social learning is the name commonly given to this interactive process and practice (Engel 1997).

The innovation needed to support the management of biological and institutional complexity in multifunctional landscapes is rooted in social learning. The practice of social learning for natural resource management involves generating new insight and knowledge with diverse social actors. It also involves negotiating the development of knowledge processes and products that

foster common understandings and lead to concerted action (Röling and Wagemakers 1998; Buck et al. 2001). The interactions comprise a system of innovation that may generate such knowledge products as studies and manuals, technologies and management practices, items for market, institutional coordination mechanisms, and policy change (Röling and Jiggins 1998).

The innovation systems perspective contrasts with the technology transfer approach. In the more conventional technology transfer framework, new ways of doing things are presumed to travel in a predictable, linear path from a research innovator to an extension educator or transfer agent and to a land user who adopts the new technology (Gillis and Southey 2005). The benefits to society are expected to derive from the cumulative effect of decisions by numerous individuals to adopt the new scientifically based practice. The principal task of the change agent in the technology transfer model is to deliver information and teach new skills to as many individuals as possible, the aim being to influence the cost-benefit metric that each person applies in deciding whether or not to adopt. As the name implies, the focus is on technical knowhow, which commonly is concerned with production and sometimes with marketing practices. Institutional and policy matters are considered to be outside the purview of the main actors (Röling 1992).

By contrast, the innovation systems concept emphasizes the coordination of people and institutions. It is concerned with "learning together for change" (Hagmann 1999; Sayer and Campbell 2004). The principal task of the innovation manager is to facilitate the coming together of stakeholders and specialists to analyze, to learn, to solve problems, and to create and capture new opportunities. The facilitator's role involves connecting people and requires that the facilitator be competent in working with groups (see chapter 5).

A landscape-based innovation system plays an important role when

- problem-solving and meaningful behavior change depend on group action because changes in individual behavior is relatively inconsequential, as in watershed management;
- concerted action is needed by farmers organizations, clubs, user groups, management associations, and the like;
- local ownership of solutions across different groups of actors is essential to ensure ongoing participation and cooperation;
- adaptation is important because management options are knowledge-intensive and solutions are unclear or unacceptable to some who are affected; and
- understanding of complex systems is needed to decide on strategic objectives, management strategies, and action.

This chapter aims to help rural development professionals become more fully aware of competencies they will need and tools they might use to facilitate the social learning that is anticipated to lead to innovation in landscape management. It discusses forms of social organization and strategies for stimulating the communication that can help to get ideas, knowledge, and information flowing across landscapes. The innovation system that these facilitators help to bring about will enable stakeholders to deal with the complex issues, inevitable conflicts, and changing opportunities they face in their efforts to manage natural resources in agricultural landscape mosaics for multiple outcomes.

The rest of this chapter introduces a framework for conceptualizing an innovation system for landscape management and highlights key roles of the facilitator. Competencies that facilitators will need to fulfill their roles in the innovation system then are identified. The chapter goes on to discuss approaches and tools that have proved effective or appear promising for facilitating the social learning needed to support adaptive collaborative management in complex landscapes. It

concludes with a summary of the qualities that are desirable in a landscape innovation system and identifies issues to consider in realizing the potential of the system.

Conceptualizing Innovation in Adaptive Collaborative Management of Landscapes

Productive landscapes that are intended to deliver public benefits such as biodiversity and amenity values in addition to food, clean water, and other forms of livelihood support for the people who live there are inherently complex systems. What makes them adaptive systems is the capacity of the people and organizations within them to self-organize, to learn, and to change in response their social and biophysical environment (see chapter 1).

The innovation needed to help bring about adaptive, collaborative behavior in the management of agriculture and natural resources at landscape scale may be conceived as an actor-based system (Checkland and Scholes 2001). In this conception a landscape innovation system includes the stakeholders involved, the desirable practice to be implemented, the learning to support the practice, the facilitation to support the learning, the institutional support framework, and the conducive policy context (Buck 2003). Figure 1 illustrates these elements and relationships. The actors involved in the system are primary producers and users of agriculture and natural resource products and services. They also include regulators charged with ensuring that resources are not unduly damaged or overexploited. A variety of civic, public, and for-profit groups may have stakes in the resources.

The emergent property of a landscape innovation system is the capacity of actors in the landscape to learn to adapt to changing risks and opportunities. This innovative capacity is focused on the practice of managing complex adaptive agroecological systems at multiple scales in ways that improve the livelihoods of local stakeholders and sustain ecological performance. The central actor in the system is the facilitator, who fosters the communication and learning needed to coordinate interaction among the actors.

The desirable practice of adaptively managing landscapes through collaboration among stakeholders is meant to realize a balanced set of production, conservation, and livelihood outcomes. The social learning to support the practice engages groups in inductive learning by doing. These approaches draw on a suite of methods that motivate stakeholders to learn together and that contribute to practical problem solving. The learning is rooted in systems thinking to enable participants to engage creatively with the complex nature of the problems that are encountered.

The innovation system framework highlights the central role of facilitation in bringing about the communication and learning that drive the system. Among the most enduring effects of good facilitation are the development and strengthening of the institutional support that will sustain social learning over the long term. The strength and durability of the institutional support framework depend on the extent to which supportive policies are in place. Strong institutions, in turn, will help to bring about a more conducive policy context.

The facilitator, as manager of the communication and learning needed to create a supportive institutional environment for managing natural resources at landscape scale, also plays a key role in bringing the elements of the system into alignment. It is this alignment that enables the system to deliver the desired outcome: the adaptive collaborative management of the complex landscape. These critical roles of the facilitator warrant an exploration of the competencies that are needed to fulfill them.

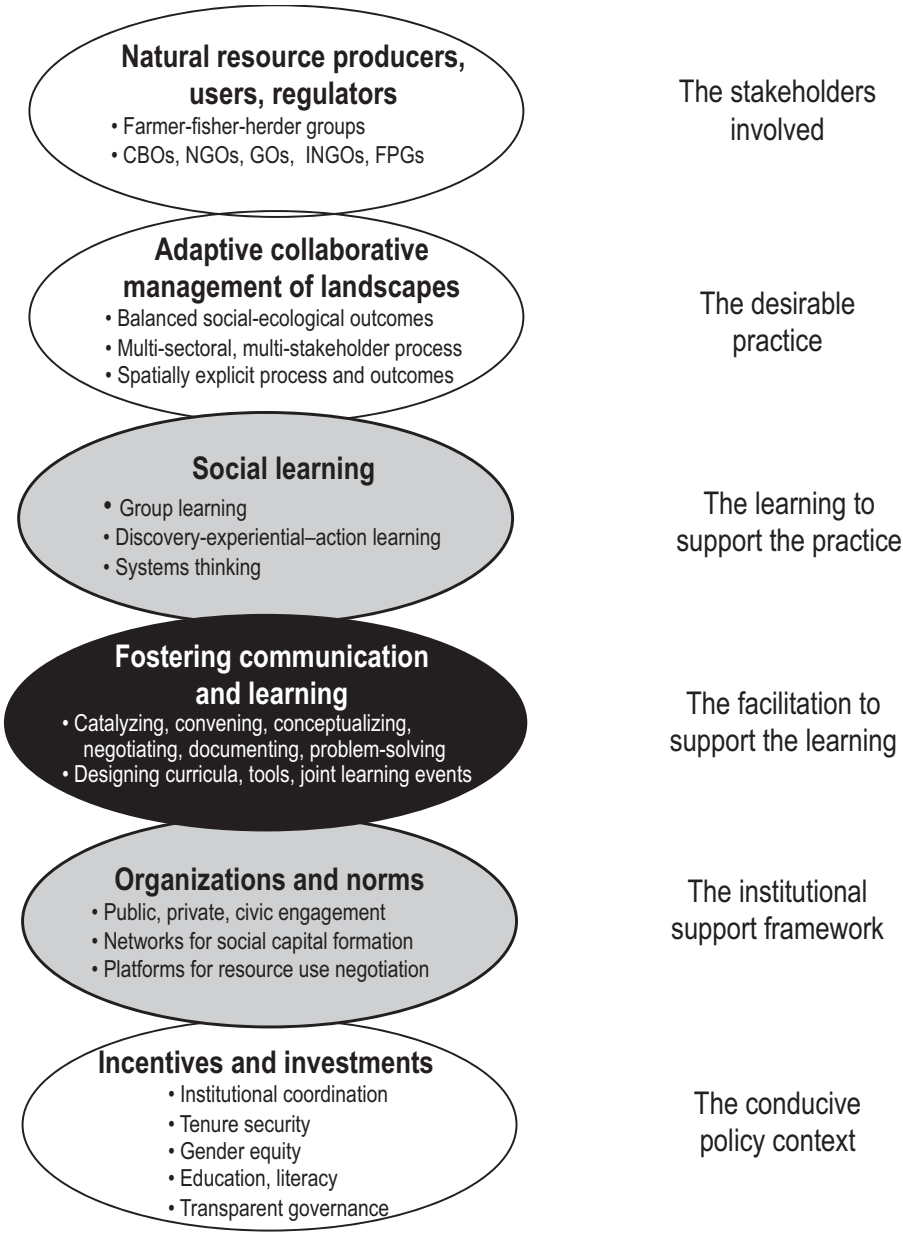

Figure 1. Elements of an innovation system for adaptive collaborative management of landscapes.

Competencies for Facilitating Landscape Innovation Systems

An effective facilitator believes in the creed, "You teach some by what you say, teach more by what you do, but most of all you teach most by who you are." While it is the learner's experience that is most important in the adult learning process, it is also important to be aware of the wealth of experience a good facilitator brings to the situation (Brookfield 1986; Kaner et al. 2007).

Good experiential facilitators are passionate about their work and are able to immerse participants totally in learning situations. They enable learners to gain new knowledge from their peers and their environment. These facilitators stimulate the imagination, keeping participants engaged in the learning experience.

A broad spectrum of competencies helps to prepare the facilitator for this role. Some are similar to those required of technology transfer specialists in the conventional innovation paradigm. These include the translation of research ideas and products into familiar terms and practical ideas, and sharing them with producers, entrepreneurs, consumers, and other stakeholders. The landscape innovation facilitator, however, also needs to be competent in creating strategic learning alliances (Lundy and Gottret 2005) and in managing participatory decision-making processes (Kaner et al. 2007).

Building Learning Alliances and Participatory Decision Processes

Behaving strategically is essential to success in landscape-wide innovation systems. Not all communication and learning activities are equally productive, and there are considerable transaction costs to consider in deciding how to invest in social interaction and learning. Who is it important to get together, why, when, where, and how? Strategic thinking in the first instance involves determining where in the landscape relevant knowledge lies and facilitating its application and adaptation across scales of land use (Lovell et al. 2002). It involves accessing external expertise and documenting local expertise for outsiders. It also involves building learning alliances with powerful external actors who will need to be part of the solution (see chapter 5).

Learning alliances are relationships among actors who have roles in various knowledge processes. In the technology transfer approach, boundaries between the actors and activities concerned with research, extension, and adoption were clear. The communication role lay principally with the extension worker and was comparatively straightforward. In the more dispersed configurations that are characteristic of complex adaptive systems, there are multiple loci of decision making at local, regional, or state levels and beyond, all of which can play out in the landscape. Boundaries between generators and users of knowledge are blurred. It is common for a variety of organizations to interact in particular theaters of innovation (Engle 1997) such as landscape management. Alliances between nongovernmental organizations (NGOs) and their networks are likely to be particularly effective in negotiating through the complexity (Wollenberg et al. 2005).

Capturing the potential for building learning alliances involves bridging gaps and differences. It may be useful for the facilitator to conjure the image of a bridge in fulfilling this core function in an innovation system. Members of communities that are bisected by a waterway know the bridge as a vital resource to be protected. The capacity to make connections is an essential competency for a landscape innovation leader. The section that follows on tools for landscape innovation facilitators suggests some concrete ways to build learning alliances.

The facilitator also helps to build teams of learners who engage in similar knowledge processes, such as management or research, and to help them be inclusive in establishing processes

and rules for decision making. Good facilitation can transform interactions that occur in the participatory decision-making process into creative problem solving, leading to innovative outcomes and lasting commitments. A skillful facilitator employs a variety of tools in helping a team reach convergence of ideas and inclusive solutions that work for everyone who holds a stake in the outcome.

A key to becoming a good facilitator is to appreciate that facilitation is more than a set of techniques for conducting good meetings. It is also a style of leadership that helps to elicit and focus the intellectual capital and goodwill resident in members of a group. Facilitative leadership aids in building collaboration and helps a group to do its best thinking (Wondolleck and Yaffee 2000). The practice of facilitation can help a core landscape management team, for example, to delegate responsibilities to all team members, prevent any one person from controlling learning and decision-making processes, encourage all team members to participate during meetings, promote mutual understanding, and foster inclusive solutions.

In turn, the practice of facilitation will enable the core landscape management team to engage broader groups of stakeholders to do their best thinking and decision making. Most important, it will ensure that all perspectives are heard and incorporated into the alliance-building or team-building process.

Connecting People in Networks and Platforms

Networks and platforms are two useful metaphors for conceptualizing ways that people can organize to innovate in complex adaptive systems. These constructs for facilitating connections among people are explored below.

Networks

Networks are configurations of actors that make good use of people's social relationships. Good relationships among people can be used to address a wide variety of issues over extended periods. Networks tend to foster horizontal, peer-to-peer communication patterns and learning. It is useful to think about networks and networking as investments in social capital formation (Bourdieu 1991, as cited in Engle 1997). Building networks is a deliberate process of fostering relationships among people who are likely to have reason to form more or less durable patterns of interaction based on common interests such as professional pursuits, or security of place, family or community.

Social networks contribute to sustainable agriculture and natural resource management by facilitating information exchange, building awareness, and providing access to resources and services (Colchester et al. 2003). Networks of agricultural professionals and practitioners of various backgrounds and experience provide those involved with additional knowledge, perspectives, ideas, and techniques (Warner 2007). By bringing together strategies and experiences from different actors, networks raise awareness of possibilities and facilitate social learning that can be global in scope (Colchester et al. 2003, as cited in Wollenberg 2005). The Community Knowledge Service (CKS) for Biodiversity and Livelihoods is an example of an international NGO network organized to facilitate cross-regional knowledge sharing.

Community knowledge sharing about ecoagriculture

Community leadership is recognized as critical to the development and management of ecoagriculture landscapes that achieve sustainable agricultural production, ecosystem/biodiversity conservation, and improved livelihoods. A key challenge is incompatibility among holistic management approaches employed by different communities. Most initiatives to provide knowledge and resources to local communities are driven by supply, not demand. The diverse information, materials, resources, and capacity development tools that exist rarely are designed by local community representatives or tailored to build on their existing expertise and capacity. Yet many local communities have developed relevant knowledge through the long-term, sustainable management of their natural resources that may be of value to another group in its own agroecosystem and around the world.

In a series of international community dialogue spaces since 2002, community-based experts and collaborators developed a set of recommendations to address these challenges. These highlight

- investment in processes that support community-led knowledge exchange and capacity development processes;
- access to more appropriate, timely information to support community practitioners;
- strengthened linkages and learning among networks of local communities worldwide experiencing similar challenges and opportunities; and
- strengthened representation of community expertise in policy decision-making processes locally, nationally, and internationally.

In 2006, a group of leaders from community-based organizations, their networks, and support organizations from research, public agencies, and the private sector took on these recommendations and established the Community Knowledge Service (CKS) for Biodiversity and Livelihoods. The goal of the CKS is to enable local communities to share their expertise more broadly and apply new knowledge to strengthen and scale up their work to enhance livelihoods and production while sustaining and conserving biodiversity. The Secretariat for the CKS is shared by the United Nations Environment Program's Equator Initiative and Ecoagriculture Partners.

Information about the CKS is at http://www.equatorinitiative.org/index.php.

Platforms

Platforms are forums for discussion, debate, learning, negotiation, and decision making about a particular issue, problem, or development strategy. Platforms emphasize vertical communication and learning patterns, bringing together diverse actors associated with a particular issue including policymakers, scientists, development educators/advisors, and local community leaders. Woodhill and Röling (1998) describe platforms as "customized mechanisms and processes for decision making on a scale appropriate to particular environmental issues, bioregions or communities." Platform formation takes into account that "what is good for one local community is not necessarily good for another or society at large" (Woodhill and Röling). The goal in creating platforms is to constructively engage stakeholder thought, skills, and organization toward innovation (Buck 1999). It requires building bridges between often divergent views and interests among stakeholders. Behavioral requirements for a platform include openness, accessibility, representation, transparency, and fairness.

Platforms can be constructed within networks. They can be organized around one or more of the following functions: expanding awareness, clarifying goals, negotiating resource use, and fostering joint decision making.

An effective platform commonly develops progressively from the first through the fourth level of activity. Platforms can be challenging to construct, requiring significant time, multiple cycles of interaction, and patience and determination on the part of the facilitator. Without them, however, meaningful progress in sustainable landscape management is unlikely to be achieved.

Cross visits

Farmer-to-farmer education or farm comparison groups are forms of peer learning that are appropriate to the horizontal learning model and have been found to be exceptionally effective in warming farmers up to sharing ideas. Practitioners may be interested already, for example, in how production is achieved at a higher volume or in using an alternative method, but they may be unable to imagine how to bring about the changes in their own operations. Encouraging comparison study groups among producers of similar products or among members of a cooperative can stimulate discussion and lead to farm visits.

Facilitators should carefully compose the groups of farmers. Members of cooperatives and producers who are less competitive or more sympathetic with each other are more likely to share information than producers who compete with one other. The landscape facilitator should help the groups create rules concerning who is welcome and what information can be exposed in visits, meetings, and in print (Leeuwis 2004, p. 219). Within farming communities, it can be instructive to link elders and children in dialogue about historical events and implications for future activity.

Facilitators need to ensure that no farm visited is meant to be the shining example or a poor example. This avoids competition for anyone's favor or insulting members, which could threaten trust and participation. Farmers probably will recognize challenges and innovations and engage each other. Neighboring farmers tend to learn readily from each other (Foster and Rosenzweig 1995). However, the learning does not necessarily spill over to the rest of the village. Facilitators can aim to bridge smaller learning networks, building outward in geographical and professional proximity.

The facilitator may encourage exchange of specific information leading up to or during farm visits. Crop yields or occurrence of disease can be highlighted, for example, to increase the community's collective memory and generate feedback on differences among farms and production methods. Before a group of peers, people may not report accurately about their success. Thus, it may be helpful to ask questions of individuals before a farm is visited by the group or to do a systematic collection of information on the farm or a standard survey (Leeuwis 2004). With permission of the farmer, it is useful to provide the group with the data collected about the farm in written format or to ask individuals similar questions during farm visits and comparison meetings, whichever seems more feasible.

Shaping Landscapes

Landscapes are shaped by the decisions of multiple stakeholders. Improving landscapes requires influencing the behavior of these stakeholders. This can rarely be achieved without

social agreement on rules and regulations, and how they are enforced. To realize the goals of multifunctional landscapes we need to build social movements that have shared landscape values. Tapping into social networks that have the potential for landscape-wide influence is a good place to begin. Networks of growers, fishers, forest users, and others who depend on natural resources in the landscape can be influenced and strengthened through peer-based learning exchanges across landscapes.

Shaping landscapes is primarily a process of negotiation. It is increasingly common for managers and facilitators to think about "negotiating landscapes" as they find that their efforts to plan for landscape-level outcomes are not as fruitful as expected (Sayer and Buck 2008). Fostering perceptions of common interest among diverse stakeholders becomes a key task of the landscape innovation facilitator to ripen conditions for resource-use negotiation among them.

What kind of learning is needed to strengthen networks among locally based resource users and in fostering shared values about the landscape? How can communication and learning be organized to foster ongoing innovation at landscape scale? What are some social learning tools that may be useful in strengthening networks among locally based resource users and in fostering shared values about the landscape? What communication and learning activities can help to build constituencies and negotiate deals that will influence people's behavior to achieve a balance between development and conservation outcomes through their agricultural practices and other land-use choices? We explore these questions in the sections that follow.

Tools for Facilitating Innovation in Landscape Management

Landscapes are constantly evolving under a variety of internal and outside pressures, and the aspirations of people who influence landscapes also change. So there can be no fixed target or endpoint to guide landscape managers who seek to find a balance between agriculture development, natural resource conservation, and livelihood security outcomes. Facilitators need to encourage ongoing experimenting, listening, learning, and adapting—and these need to be shared processes in which everyone involved is learning and adapting (Sayer and Buck 2008).

How can the facilitator foster social learning at the scale of landscapes in ways that will encourage people in the landscape to continue learning together over time? We address this question first by identifying modes of learning that facilitators can draw on to create a perpetual learning environment. We follow with a proposition that developing shared frameworks for assessing change in landscapes can open up a plethora of tools and techniques that engage diverse stakeholders in innovation processes at multiple scales. We then present information about tools that we have found to be useful in evaluating change and fostering innovation in landscapes.

The methods and techniques that are described have been found to stimulate genuine participation throughout the process of assessing change in landscapes—from setting goals to identifying performance criteria and deciding what indicators to measure through the collection of data and interpretation of results. Their use has led to ownership and responsibility of the process by stakeholders involved. The use of the tools by capable facilitators has been demonstrated to enhance engagement, awareness, and understanding, and to foster the transparency and legitimacy that lead to trust (Sayer and Buck 2008). Use the tools to generate ideas about what might be done and knowledge about what can be done while establishing the trust that is the basis for negotiating agreements that form the foundation for behavioral change.

Inquiry-Based Learning

Discovery learning, experiential learning, and action learning belong to a family of methods that are rooted in a learning by doing approach that supports adaptive management. This suite of adult learning methods puts the learner or group of learners at the center of the experience and enables them to construct meaning from the reality that they experience. The methods tend to be motivational—they evoke in the learner an urge to learn more and to act on that learning to solve problems that are posed by the learning situation. They stand in contrast to conventional teaching methods that focus on the presentation of knowledge and skills, commonly known as instructional methods. Familiarity with tools and activities rooted in inquiry-based learning should be in the repertoire of every facilitator of landscape innovation systems.

In discovery learning, the learner draws on his or her own past experience and existing knowledge to discover facts, relationships, and new truths to be learned (Bruner 1961). The method is rooted in the belief that it is best for learners to discover facts and relationships for themselves. Students interact with the world by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments. As a result, learners may be more likely to remember concepts and knowledge discovered on their own, in contrast to a transmission-oriented model. Models based on discovery learning include guided discovery, problem-based learning, simulation-based learning, case-based learning, and incidental learning among others. Farmer field schools are rooted in a discovery learning approach.

Farmer field schools

Established in 1989 in Central Java to develop integrated pest management (IPM) field training methods, farmer field schools (FFSs) have continued to be most popular in IPM because of the significant extent to which farmers' knowledge about pests can inform the discipline (Gallagher 1999). FFSs take place in the field over the course of a whole growing season. Groups of 25 farmers meet weekly for four-hour sessions during which small groups monitor observation plots and report findings to the others. With facilitation, farmers teach each other and solve problems collaboratively. Sessions focus on currently occurring problems, and follow-up activities typically occur after the initial season (Van de Fliert 2003). Having been adapted to work with various crops and diseases, FFSs have spread rapidly across Asia, Africa, and Latin America (Nelson et al. 2001).

FFSs were named from an Indonesian expression that means field school. The name was created to reflect the educational goals; the courses took place in the field, and the field conditions defined most of the curriculum. Real field problems were observed and analyzed, from the planting of the crop (rice) to the harvest. Group decisions on crop management could be evaluated at the end of the season by measuring the yield. A field was established by the participants with a research study to compare IPM methods and farmers' conventional methods. Pre- and post-tests were given, the same farmers and facilitators attended throughout the season, and graduation was based on attendance and learning performance. Certificates were awarded to farmers. Thus, the field school was an institution without walls that taught basic agroecology and management skills (Gallagher 1999).

Proponents point out that the discovery learning approach encourages active engagement; promotes motivation; promotes autonomy, responsibility, and independence; develops creativity and problem-solving skills; and enables a tailored learning experience.

Experiential learning is a method based on reflection on doing. It engages the learner at a personal level by addressing the needs and wants of the individual. Experiential learning requires qualities such as self-initiative and self-evaluation. For experiential learning to be fully effective, it should be employed through the entire learning cycle from goal setting to experimenting and observing, reviewing, and finally to action planning. This complete process allows one to learn new skills, new attitudes, or even entirely new ways of thinking.

Action learning is an educational process in which participants study their own actions and experience to improve performance (Revans 1982). This is done in conjunction with others in small groups called action-learning sets. It enables adult learners to reflect on and review the actions they have taken and the learning points arising. This then guides future action and improves performance. Action learning inquires into action taken and, as a result, knowledge emerges that should lead to the improvement of skills and performance. For example, CIALS are rooted in an action-learning approach.

CIALS

CIAL is an acronym in Spanish for Farmer Research Committees, which emerged in Latin America in the 1980s and later diffused to eastern and southern Africa. CIALs provide groups of farmers with a way to share the risks of trying an agricultural innovation where there is no reliable information or recommendation about its likely performance in their local circumstances. CIAL has become a farmer-run adaptive research service answerable to a client group such as a farmer association or community and electing a committee of farmers chosen for their interest in experimentation and willingness to serve (Ashby et al. 2000). The primary focus now for the majority of CIALs is on the use and conservation of genetic resources. Many have prioritized the rescue of local germplasm that has been disappearing from their local production systems, doing so through linkages with market-based enterprises (Ashby et al. 1995).

Using these inquiry-based experiential learning methods, facilitators can engage groups in self-directed learning and problem solving. Combining internal (local) and external (science-based) sources of knowledge and new experience can expose farmers to new realities and opportunities through farmer-led experimentation and farmer-to-farmer exchanges. Through an interactive process of experiential learning and concerted action, a thematic agenda can be designed to progress from field level to increasingly complex watershed- or landscape-level concerns.

Shared Frameworks for Assessing Change

Establishing a shared framework for measuring change can be a powerful tool in facilitating social learning and adaptation in landscapes. Experience suggests that fundamental to success is investing in the development of shared scenarios for the future of landscapes and in putting into place broad-based participatory approaches to measuring outcomes at the landscape scale. Measuring success first requires some shared understanding among stakeholders of what success looks like and how it differs from current conditions and trends (Sayer et al. 2008).

We acknowledge that creating a common vision for a landscape is a difficult challenge and that in reality all stakeholders never will share the same vision of a desirable future. It is nonetheless worthwhile for facilitators to catalyze and nurture the innovation processes that will enable the informed pursuit of the best set of production, conservation, and livelihood outcomes possible over time.

Before describing methods and tools to aid in this process, we offer some guidelines for facilitating the development of shared frameworks for assessing change in landscapes:

- Use an inclusive, transparent, and equitable facilitation process to negotiate desirable scenarios and effective measures of progress toward their achievement. This is likely to require efforts to level the playing field so that comparatively marginal stakeholders are empowered to interact effectively with more powerful actors (Edmunds and Wollenberg 2001).
- Begin the process of negotiating and assessing landscape performance on a small scale, and expand progressively as experience is gained and networks of collaborators grow.
- Focus on landscape functions. It is easier to reach agreement with multi-stakeholder groups if learning and negotiating focus on flows of goods and services.
- Strive to reach agreement among stakeholders on what an improved state of the landscape would look like, even though it may not be ideal from any one group's perspective.
- Strengthen networks gradually. Bringing together all possible contributors to a network may be ideal but generally is not practical. It is more pragmatic to strategically select representatives of different sources of innovation that are likely to lead to unique combinations of ideas and new applications of technologies.
- Combine indigenous and external sources of knowledge about landscape performance, drawing on not only locally based tools but also emerging technologies such geographic information systems and other models (e.g., watershed or crop growth) and software that allow for detection of patterns in landscape change.

Documenting Current Conditions

The initial set of activities in establishing a framework that multiple stakeholders can use to assess change in the landscape involves examining and documenting current conditions. Deciding what to document at the initial stage can be left to the people involved in the process based on what they consider to be important features and resource flows from the landscape. Useful approaches and tools for initiating the process of inventorying current conditions and reflecting on their status may be drawn from participatory rural appraisal and participatory land-use planning methods (see textbox below).

Participatory assessment and planning

Participatory rural appraisal (PRA) is an approach to tapping into local knowledge and enabling local people to make their own appraisals, analyses, and plans. It developed in the 1970s and 1980s to address problems of miscommunication between rural people and development workers. Animation exercises facilitate information sharing, analysis, and action among stakeholders. Originally developed for use in rural areas, PRA has been employed in diverse situations. For key tenets, tools, organization, and techniques, see the

World Bank Participation Sourcebook (1996). Among the most useful PRA tools for landscape scale innovation systems are three-dimensional maps and transects.

3D mapping involves creating physical three-dimensional relief maps that participants discuss and mark with points, lines, and polygons to delineate resources, boundaries, changes in landscape, and places of cultural or economic importance. The physical maps help local people communicate information about landscapes more conveniently than could be done in the field, for it is easier to bring many stakeholders together around a map than to tour the landscape together. Models also facilitate communication across language and cultural barriers, and maps provide records that can be transferred into a geographic information system for future reference and comparison. For further information, see the Integrated Approaches to Participatory Development Web site (http://www.iapad.org).

Transect maps or diagrams are cross sections of communities or landscapes generated by taking walks with people knowledgeable about the community or landscape. They show key features of different land-use zones in a region. Information about various types of physical and other aspects are recorded in rows of a table in columns headed by sketches of sections of the community or landscape. They are particularly useful when there is a range of land-use systems in an area, which often is the case when communities are on the coast, in hilly areas, on rivers or lakes, or in areas where soils vary over short distances (National Environment Secretariat et al. 1990). Joint transects involve team-based analysis and interpretation, which commonly needs to be negotiated. Transect maps allow participants to identify constraints and opportunities with reference to specific locations or particular ecosystems along a transect. Further information on transects and ways to prepare for transect walks is available from the Food and Agricultural Organization (http://www.fao.org/docrep/W8016E/w8016e01.htm).

Participatory land use planning engages local people in planning the use of their land and natural resources to reduce degradation and improve productivity. Various forms of participatory land use planning have been developed by communities around the world. A Web search will reveal a variety of them, including step-by-step guidelines for implementation.

Visioning Alternative Futures

Thinking about the future can help people imagine a time of better conditions and better cooperation. Visioning allows diverse actors to articulate an ideal future for a problem, identify common perceptions, and reconcile current differences. Actors may speak, write, draw, or act out visions, possibly in small groups of people of similar circumstances and status, to reduce intimidation by other stakeholders. Discussion and voting are useful for negotiating agreements among stakeholder groups (Evans et al. 2006b). Visioning builds networks through both the cooperation needed to come to agreements about plans and feelings of goodwill about future cooperation for mutual benefit. Visualization and scenario-building are two related sets of tools for visioning. The interpretation and sharing of maps can be a powerful communication tool in and across landscapes. The three methods are discussed below. Participatory map drawing can aid all three (see textbox below).

Participatory Map Drawing

Conservation and development organizations make presumptions about the sorts of landscape scale outcomes that stakeholders want. Biologists see protected forests, corridors, and riparian strips of vegetation. Villagers see arable land, land tenure rights, fuel and fruit trees, and water supplies. The International Union for Conservation of Nature's Livelihoods and Landscapes program has found that one of the most effective ways of engaging in a discussion about desired outcomes with local stakeholders is to allow them to draw maps expressing their understanding of the landscape and their wishes for the future (Boedhihartono and Barrow 2008).

Lessons learned from this process include the following:

- ***Listen, learn, and observe.*** Get to know the people first—spend time in the village, take part in ceremonies or sporting events, visit farmer fields, take an interest in the activities of the women and children.
- ***Let people express themselves.*** In general, give as few prompts as possible when asking people to draw landscapes. The process is often slow to start, but then debates flare up among participants to reveal obstacles and opportunities.
- ***Provide advice about scale.*** If people choose their own scale they will generally restrict themselves to their immediate surroundings—their own land, water, and fuel wood sources, for example. To get an idea of how they see and use the broader landscape, it is helpful to provide reference points.
- ***Encourage discussion.*** It may be more valuable than the drawings themselves. The process usually leads to debates; the extent to which innovation leaders take part in these debates and provide prompts depends on the specific objectives.
- ***Have different groups develop different maps.*** Sometimes a cross section of a community can draw a single map, but in many situations it is advisable to get men and women to work separately and to ask different ethnic or interest groups to draw separate maps.
- ***Compare landscape visions.*** Field workers can be used to collect maps from samples of stakeholders using standardized approaches so that the mapped elements can be scored and the scores of different stakeholders statistically analyzed. This technique has been used, for example, to demonstrate different appreciations of "forest" between local people and government officials.
- ***Archive and digitize the maps.*** When the drawings are complete, photograph them for the project archives. Photographs can also be manipulated using various software programs. This requires skill in the use of the software and some artistic talent.
- ***Display the product.*** The final agreed vision for the landscape can be laminated and given to the people to be displayed prominently and used to monitor progress.

More information is available at the following location:
http://cmsdata.iucn.org/downloads/a_avspecial_learning_from_landscapes.pdf.

Visualization

Visualization or visioning is a creative group activity. In it, stakeholders think about desired goals and then brainstorm strategies for reaching them. The approach encourages discussion about past and current changes in the landscape and how these may affect the future. The visioning and pathways approach developed by the Center for International Forestry Research (CIFOR)

and partners applies. It is available in the *Guide for Participatory Tools for Forest Communities* (Evans et al. 2006a).

Visualization may be assisted by simulations, demonstrations, field trips, videos, and animations that help stakeholders and planners imagine alternative outcomes. An example applied at the scale of the farming system is an insect zoo where netted sections of crops can be observed over time to learn about the effects of particular insect species (Leeuwis 2004, p. 222). Creating diagrams of an integrated cropping and livestock system also aids joint visualization. Extrapolation, role playing, and mapping can be useful in predicting the feasibility of realizing alternative visions and can inspire stakeholders to act.

Scenarios

Similar to visualization, scenarios are "stories of what might be" (Wollenberg 2000). Unlike visualizations, scenarios do not need to represent what anyone thinks the future will be in reality. Scenarios provide individuals and groups the liberty to imagine what their ideal futures might be, and they help stakeholders identify factors that may affect the future of their landscape. They can be quantitative models or narratives conducted between participants that stimulate creative thinking and help stakeholders examine situations and plan from a new perspective. Scenarios can help change the way people think about relationships between current actions and long-term consequences. There are infinite ways of facilitating scenarios. Four fundamental styles of scenarios listed below are elaborated by Wollenberg et al. (2000):

- Vision scenarios use snapshot views to illustrate hopes for the future.
- Projection scenarios make predictions about a stakeholder-determined time.
- Pathway scenarios combine the above to plan strategies for a better course.
- Alternative scenarios broaden thinking by exploring a range of possible futures.

CIFOR's *Field Guide to the Future* (Evans et al. 2006b) is a useful resource for implementing scenarios. It identifies projections as the most appropriate for short-term thinking and visioning as the most useful for planning collaboration and reaching consensus on ways to move forward.

Maps

Maps can be used to portray important physical features of the landscape as well as relationships of communities to these features. They can be as simple as pen and paper diagrams that local people create or complex computer-based geographic information systems. The visualization power of maps and mapping help to focus attention, generate information and insight, frame debate, and plan future activity in open and transparent ways. Maps and mapping activity can enhance local community capacity to

- visualize the spatial interrelationships among conservation, livelihood, and food security strategies, thereby facilitating integrated landscape management planning;
- negotiate and defend land rights, resource entitlements, and land tenure;
- share innovations from one community to another; and
- illustrate the location of goals reached, challenges faced, and solutions offered through local and indigenous resource management.

These applications of mapping and uses of maps can be powerful aids in communicating with partners, advocating with policymakers, and showcasing to potential markets such as ecotourism and organic products. Resources on maps and mapping can be found at www.landscapemeasures.org.

Tracking Change

Tracking change in the landscape is important for tailoring the course of innovations, keeping stakeholders engaged, and justifying investments of financial and other resources. Monitoring performance against desirable outcomes for the landscape helps those involved appreciate in objective terms what has been achieved and enhances their understanding of it.

Engaging stakeholders in landscape monitoring plans involves creating a metric that can become a unifying language for the landscape to help foster joint learning and concerted action. Sayer et al. (2008) identify creative ways of engaging stakeholders in the development of performance criteria and deciding on appropriate indicators of the criteria and means of measuring them. In a multi-stakeholder workshop format they use scenario methods to help gain agreement on suitable performance criteria for the landscape. Indicators are selected through a participatory decision process (see textbox below). The multiday workshop continues by running a simple model that projects the values of the outcome indicators under different development scenarios that the model enables the facilitators to manipulate in a transparent fashion. The modeling activity is described further below.

Participatory monitoring

Since 2003, the World Wildlife Fund, IUCN, and CIFOR have collaborated to develop a shared monitoring system to track progress in landscapes where forest conservation and livelihood security are program goals. Multi-stakeholder groups are assembled and, using participatory drawing and flash cards, identify indicators that would tell the group if progress was being made towards a better landscape. About 30 indicators are selected to represent attributes that the participants agree would be easy to measure and represent a good approximation of progress or lack thereof. The group agrees on how each indicator could be scored on a 1-5 (Likert) scale.

A multi-stakeholder group is convened each year to reevaluate the indicators. The group always contains a majority of members from previous years, but as people move on, some renewal has occurred. Each year the discussions reveal a need to add or delete indicators and revise the scoring system. Although the changes from year to year are quite small, it is still possible to detect them. The debates during which the scores are awarded are an important event at which people take stock of progress. External organizations have adapted their programs to take account of the lessons learned from progress each year.

The organizations involved have drawn the following conclusions from the experience:

- Representative participation of all stakeholder groups has not been possible to achieve. The effort relies on NGOs and local government administrators to reflect the points of view of each stakeholder group.
- External convening and facilitation of the process is necessary.
- The scores obtained on the indicators are less important than the opinions that they represent.
- The people and organizations involved find that the annual dialogue on progress has opened up new thinking on what is needed to reconcile environmental and livelihood objectives for the area.

The full methodology is available in Sayer et al. (2007).

Additional ways of engaging stakeholders in identifying indicators of landscape performance and change are presented in an online clearinghouse, the Landscape Measures Resource Center (LMRC). See textbox below.

Landscape Measures Resource Center

The LMRC is an online clearinghouse of information and tools for stakeholders working in landscapes where farming, nature conservation, and livelihood security are being pursued. The LMRC helps people concerned with shaping landscapes to evaluate the flows of services and products coming from a landscape in terms that people who live and work there understand. The tools in the LMRC aid in choosing production, marketing, and land-use strategies that capture synergies and reduce tradeoffs among diverse goals for the landscape. The LMRC has been developed through a Landscape Measures Initiative coordinated by Ecoagriculture Partners and Cornell University.

The LMRC is organized around 20 criteria for ecoagriculture landscape performance that were identified through expert consultation. Indicators for each criterion are landscape specific and need to be determined by local stakeholders. The LMRC takes users through a process of deriving meaningful indicators for their landscapes. A landscape performance scorecard has proved to be an especially useful tool for deriving indicators and fostering discussion and debate about the status of the 20 criteria for landscape performance. Instructions for facilitating the use of the scorecard and examples of how it has been applied in particular landscapes are provided in LMRC (www.landscapemeasures.org).

Repeat landscape photography

Repeat photography is the process of selecting landscape features and key vantage points that will be monitored over time with the use of a digital camera and database to record how important characteristics change over time. Facilitators engage stakeholders in a deliberate process to decide which features are important to monitor. Photographs are meant to show both physical features and ways of life of the people. Ground-based photo-monitoring of ecological change can be conducted using rigorous sampling, data protocols, and archiving methodologies (Lassoie et al. 2006). Or the method can be adapted for use by local communities in participatory monitoring. Both approaches use global positioning system devices to record the longitude and latitude (spatial coordinates) of each photo point. The photographer captures images facing north, south, east, and west of each point to ensure that the same places are recorded each time the process is repeated. The photographer also records the direction of each photo as well as the date and time. The frequency of repeating the photograph depends on how rapidly change in the landscape seems to be occurring and resources available for the activity. It is important to archive the images in more than one location using a system that will endure staff changes, project completions, floods, and other disturbances. Details about the repeat photography method are available at www.landscapemeasures.org.

Assessing Landscape Performance

Assessing the performance of multifunctional landscapes involves analyzing indicators that stakeholders find meaningful to identify patterns of change. A variety of tools can aid the process. Some tools have multiple uses and have been identified above. Repeat landscape photography, for

example, uses the collections of images gathered at different points in time to generate discussion among stakeholders about the nature, location, and pace of changes—both desirable and undesirable. Facilitators lead the discussion to consider how best to take advantage of positive changes and reduce the impacts of those considered undesirable.

Two robust tools for assessing change across multiple variables and scales in landscapes are simulation modeling and land-pattern analysis. Both tools require a blend of local knowledge and external science-based knowledge for effective implementation.

Simulation modeling

Modeling enables the linking of diverse issues and indicators so that synergies and tradeoffs can be better understood and discussed. CIFOR has developed a robust participatory modeling activity using the software package Stella for application in landscapes where conservation and livelihood goals need to be reconciled. Vensim and other user-friendly software packages can be purchased online. The models require quantitative data on land cover, benefit flows to households, and the nature and amount of environmental benefits. For the models to run effectively and to provide plausible simulations, the data need to be reasonably accurate. A task of the landscape facilitator therefore is to negotiate the engagement of researchers and modeling experts in the innovation process to help generate good data and build the models.

Examples of the Stella model in use can be accessed through CIFOR's Tools for Integrating Conservation and Development (http://www.cifor.cgiar.org/conservation/_ref/research/index.htm). Experience has taught that it is vital to fully document the sources and precision of data put into the model and to archive all versions of the models in locations and ways that make them accessible and understandable to future users. The research organizations involved should maintain backup copies of models, for civic employees change jobs and institutional memories can be short.

Further information about the method is in Sandker et al. (2007).

Land pattern analysis

Spatial analysis tools help to measure and assess how different phenomena vary across a landscape and thus to examine changing patterns. The use of spatial methods enables identification of the location and the distribution of environmental features, agricultural activity, and socioeconomic conditions. This information aids in understanding relationships and interactions among these variables. Such a relationship is commonly referred to as a landscape pattern.

The basic unit in landscape pattern analysis is land cover and land use. In the landscape measures approach, land cover-land use is an important integrative indicator because it provides information about many different aspects of the landscape. As the proportions of land uses change over time—natural habitat, cropland, rangeland, human settlement in rural and urban areas—so, too, will the potential to conserve wildlife, maintain ecosystem services, and produce agricultural goods. Facilitators of landscape innovation processes therefore can suggest and help arrange for land cover–land use to be applied to provide stakeholders with quantitative information about many of the 20 criteria for assessing ecoagriculture landscape performance (see last textbox above).

The LMRC provides guidance in how to analyze patterns of change in a landscape using spatial information about land cover–land use.

Summary and Ways Forward

Landscape approaches integrate the multiple scales of complex adaptive systems of agriculture, natural resources, and ecosystem services. Landscape-level outcomes are determined by the actions and interactions of many stakeholders. New ideas and competencies give people more choices for bringing about desired changes and adapting to changing circumstances.

The adaptive capacity of multifunctional landscapes depends on the effective facilitation of innovation processes that lead to new insights, technologies, livelihoods, market linkages, learning approaches, institutional coordinating mechanisms, and policies. The innovation systems needed to support integrative landscape management are rooted in social learning, which engages diverse actors in sharing perspectives, experience, and ways of learning and knowing. The organization of interaction around problems of common concern enables stakeholders to develop new understandings of complex situations and to respond. Communication is a key to the coordination of the landscape innovation system.

Leadership for landscape innovation systems may emerge from local communities, regional authorities, external research organizations, local or external NGOs, and/or other entities. From wherever it arises, effective leadership will depend on team-based approaches. Core competencies needed by facilitators of landscape innovation systems are convening power, capacity to guide without leading, familiarity with learning processes and tools that motivate ongoing action and interaction, group management and participatory decision-making skills, and a sense of humility and public service.

Shared frameworks for evaluating landscape change are promising forums for facilitating social learning and building innovation systems for landscape management. Stakeholders are encouraged to cooperate in identifying, measuring, and evaluating criteria and indicators of landscape performance based on scenarios for the future that they envision. Facilitators employ discovery, experiential and action learning to engage groups of stakeholders in tracking changes across the landscape over time. The density of learning networks and the quality of information that this landscape assessment activity generate gradually and iteratively improve the coherence of the landscape innovation system. New knowledge and understanding that emerge from the activity enhance transparency and objectivity in decision-making platforms and improve negotiation around resource use and management.

In working at a landscape scale we tacitly accept that there needs to be compromise between conservation and material development; that we cannot maximize biodiversity, for example, at the expense of local people. We also understand that compromise must be sought among different groups pursuing livelihoods in the landscape, for example between herders and farmers, commercial and subsistence farmers or fishers, community forest managers and herders, miners and producers of food and fiber, and so on. Similarly, agreement is needed between powerful and weak local actors and between the state and local communities to ensure adequate flows of products and services to maintain the health and resilience of the landscape system.

The landscape innovation system can reveal synergies between different land-use and livelihood options and lead to win-win outcomes. Engaging groups of stakeholders in assessing how their landscape is performing across a range of desired outcomes is a powerful tool rooted in inquiry-based learning. For example, landscape facilitators can help stakeholders discover how much development occurs and how much biodiversity is conserved under different scenarios of land use. Similarly, facilitators can guide them in measuring equity in the distribution of benefits across the landscape, encouraging negotiations that are widely perceived to be fair.

If measurement is a process that involves all stakeholders, then it also provides the framework through which compromise is achieved—it tells us how much development is traded off for how much conservation and where synergies between them can be found. If biodiversity values are very high, for example, and their conservation requires that local people forgo significant production and livelihood options, then progress is unlikely without rigorous regulations, environmental payments, or both. To develop regulations that people will live by or to develop sustainable payment schemes, it is important to measure progress in ways that are understandable and acceptable to all stakeholders concerned.

An innovation system is an intentional one constructed by the concerted action of the actors within it. This understanding provides the basis for addressing key issues that arise in contemplating the development and sustainability of a viable system. Perhaps foremost among such issues is the question of how the landscape facilitator is chosen, prepared for his or her roles, accepted by the people and organizations concerned, and supported over time. Ideally, significant responsibility would be vested in this near-mythical figure. The key to addressing the challenge of securing a viable facilitator is to begin where you are. Find a promising candidate; develop a shared vision for how the roles and responsibilities might evolve; and build activities and competencies to realize the vision as needs dictate and opportunities allow. Depending on the nature and scope of the landscape management objectives being pursued, farmer leaders, entrepreneurs, conservation authorities, district officers, NGO leaders, wildlife agency coordinators, watershed champions, and municipal planners may be viable candidates for facilitation roles.

For organizations to participate in an innovation system, the facilitator must be perceived as a reasonably neutral and unbiased actor. This could be achieved by seeking joint financial support for the position from several groups. Give thought, also, to building landscape facilitation teams comprising people with temperaments for collaboration who complement one another as to gender, experience, and expertise. Put into place incentives for them to work together. Much has been written about the qualities and skills of a good facilitator; become familiar with this work. Encourage candidate landscape facilitators to collaborate with other facilitators to accelerate their learning. At the national or regional level, consider incubating a landscape facilitators' guild to help raise the professional status of these important actors.

A less strategic question but an important one is how to make optimum use of spatial information in landscape innovation systems. A consequence of choosing to work at landscape scale is the importance of location in decision making about agriculture and natural resource management practices. Good spatial information is essential for dealing with the "where" questions in multistakeholder forums. Spatial literacy is notoriously uneven in landscapes, often making it difficult to share and compare experience. To improve spatial literacy in your landscape, find out where current competencies lie and build on them. Consider opportunities to coordinate the acquisition and use of spatial images and technologies, and to train a wide spectrum of people and organizations in the landscape to read maps and to make them.

A third issue is how to document information that your social learning activity generates and where to store it so that local communities and other stakeholders can access it. To help communities access and use information, consider storing it on small billboards and in school archives, journals, and posters that people will see. Support projects and organizations to understand the merits of using open-source platforms for storing and retrieving information about the landscape. Perceptions that important information is proprietary and inaccessible will erode the integrity of an innovation system.

How to sustain a landscape innovation process after projects end is a fourth compelling question. The answer is to consider this question when projects begin and to build this function into plans for sustaining project impacts. Keep in mind the value of learning alliances that cross project and institutional boundaries. Work to marshal support for facilitation from all quarters whenever opportunities for stretching out timelines are presented.

Other challenges will surface when people and organizations with interests in building a landscape innovation system come together around compelling issues in real settings. Address them by articulating and discussing them with all concerned. Build on previous knowledge and experience. Do not shy away from questioning old ideas and habitual ways of doing things and perhaps discarding them. Stay attuned to the reality that the rate at which a viable landscape innovation system emerges will depend in large part on the social capital (see chapter 5) of the landscape and how efforts are organized to nurture, expand, and sustain it.

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