Participatory Monitoring

in tropical forest management

a review of tools, concepts and lessons learned

Kristen Evans and Manuel R. Guariguata

Participatory Monitoring

in tropical forest management

a review of tools, concepts and lessons learned

Kristen Evans and Manuel R. Guariguata

Evans, Kristen
Participatory monitoring in tropical forest management: a review of tools, concepts and lessons learned/by Kristen Evans and Manuel R. Guariguata. Bogor, Indonesia: Center for International Forestry Research (CIFOR), 2008.

50p.
ISBN: 978-979-1412-63-6

CABI thesaurus: 1. forest management 2. tropical forests 3. participation 4. community involvement 5. participative management 6. rural communities 7. monitoring 8. literature reviews 9. guidelines

Printed by SUBUR Printing, Jakarta

Published by Center for International Forestry Research
Jl. CIFOR, Situ Gede, Bogor Barat 16115, Indonesia
Tel.: +62 (251) 622622; Fax: +62 (251) 622100
E-mail: cifor@cgiar.org
Web site: http://www.cifor.cgiar.org

Partner institution: The Swiss Agency for Development Cooperation, Switzerland

All photographs by Kristen Evans unless otherwise noted.

Contents

Acknowledgements

We are grateful to the following people who gave their time and ideas and contributed invaluable feedback as we prepared this publication:

Manuel Bossiere (CIFOR, Indonesia), Marcus Colchester (Forest Peoples Program, United Kingdom), Carol Colfer (CIFOR, Indonesia), Peter Cronkleton (CIFOR, Bolivia), Wil de Jong (CIAS, Japan), Robert Höft (Secretariat of the Convention on Biological Diversity, Canada), Anna Lawrence (Environmental Change Institute, University of Oxford, United Kingdom), Neha Pandey (Livelihoods India Group, India), Patrick Rossier (Helvetas, Vietnam), Gustavo Pinelo (Rainforest Alliance, Guatemala), Nick Salafsky, (Focus on Success, United States of America), Douglas Sheil (CIFOR, Indonesia), Mary Stockdale (Canada), Ben Vickers (SNV, Vietnam), and Eva Wollenberg (University of Vermont, United States of America). We wish to thank Neha Pandey, Elena M. Florian (Costa Rica), Bayuni Shantiko (Indonesia), and James Hayek (Brazil) for searching and compiling information. We also thank Claire Miller for copyediting the final draft.

This publication was externally reviewed by Jane Carter (Intercooperation, Switzerland) and Bianca Ambrose-Oji (University of Wales, Bangor, United Kingdom); we are grateful for their useful comments and suggestions for improvement.

Introduction

Until recently, monitoring in tropical forest management has generally focused on evaluating a project's progress or answering a research question, and it was usually performed by professional managers or scientists. However, in the past decade, our understanding of the importance and role of monitoring has changed significantly. Now local people are working with professionals to develop and implement monitoring programs together. This collaboration changes the dynamic of forest management, with monitoring assuming a central role by encouraging local people to ask questions about their forest and their forest-based livelihoods, think about change in a systematic way and respond with reasoned decision-making. Participatory monitoring becomes a mechanism that drives learning, adaptation and improvement—essential elements of sustainable tropical forest management.

If properly conducted, participatory monitoring has distinct benefits: integrating local knowledge into scientific monitoring; building social capital; empowering local people; strengthening local institutions; and facilitating decision-making. Participatory monitoring can also lower data collection costs for scientists and institutions. However, participatory monitoring programs are not always easy to implement, and they have limitations. For instance, they can be more expensive than expected (especially when considering that local people often bear many costs), the data might not be useful for scientific research, and sustainability can be a challenge when external support stops.

There are now well-documented cases of successful and effective—as well as unsuccessful and flawed—participatory monitoring programs in tropical forests throughout the world. Here we review their impacts, challenges, and shortcomings. We highlight lessons learned and present recommendations for future directions.

This review is not an exhaustive collection of all participatory monitoring research, nor is it a comprehensive discussion of every aspect of participatory monitoring. It is a guide to what we believe are relevant case studies and analyses that will be helpful to scientists, field practitioners and those looking to explore, understand and implement participatory monitoring.

How to use this review

The review has three main sections. The first section introduces concepts and terms. The second section is a synthesis of the lessons learned, organized along two broad themes: planning and implementing participatory monitoring and the main impacts of participatory monitoring. A brief summary is presented with the corresponding reference. The third section is a matrix table of publications organized by theme: forest management for various objectives, biodiversity conservation and wildlife management, human wellbeing, political processes and institutions, non-timber forest products and ecosystem services. It provides a quick reference guide to specific aspects of participatory monitoring, such as tools, methods and monitoring topics.

Methods

The first step in the development of this review was a search of peer-reviewed publications through the *Science Direct*, *Springer*, and *Blackwell Publishing* web-based engines and the *ISI Web of Knowledge* (see Appendix A: Keywords searched). The second step was another web-based search of "grey" literature (project reports, teaching modules, guidebooks, and conference proceedings). Regional searches for other less visible publications were also carried out from India, Central America and Brazil. Information was gathered from current initiatives and ongoing field experiences, as well as step-by-step guidelines for practical implementation of participatory monitoring initiatives (see Appendix B: web sites searched). The literature lists were then compiled using EndNote® software; articles were filtered and selected according to their relevancy to broad issue categories. While filtering, similar keywords were also used to select relevant literature from the list. In total, 387 publications were compiled.

We then polled selected experts by asking (i) What information about participatory monitoring would be most useful to researchers and field practitioners?, and (ii) How should the information be organized? The general consensus was a focused selection of case studies, including tools and methods, organized by monitoring subject or by thematic topics. From the pool of publications, we then selected the ones with either results and lessons learned from field experiences or a relevant conceptual discussion. The literature is relatively recent: most publications included in this review were printed within the last 10 years, and over 80 per cent were released within the last five years. Although our focus is on tropical forests, a few examples from the temperate zone are included where these experiences might translate into the tropical context.

Concepts

What is participatory monitoring?

Monitoring is the systematic gathering and analysis of information in order to gauge if something is changing **(CIFOR 2007)**. Monitoring is more than a one-off assessment; the information must be collected at regular intervals that are appropriate for the subject matter, cost-efficient and not overly burdensome. The information is analyzed, and the results are evaluated and used for decision-making.

The term "participatory monitoring" applies to monitoring activities that involve local people who may have not received specialist, professional training and who have varying skills, expertise, societal roles and interests. Participatory monitoring is an ongoing process where local forest users systematically record information about their forest, reflect on it and take management action in response to what they learn.

Monitoring subjects range from timber harvesting and honey production to institutional transparency and community forest enterprise accounting. Methods might include vegetation samples, transects, fire calendars, field diaries, community workshops, rainfall measurements and many more.

"Participatory monitoring shifts the emphasis away from externally defined and driven programs and stresses the importance of a locally relevant process for gathering, analyzing, and using the information. It means involving (groups of) people in aspects of monitoring in which they have not previously been involved and creating conditions so that they can dictate the focus, means and rhythm of the learning process." *–from* **Guijt (2007)**

Why monitor?

There are three general reasons to monitor. First, monitoring can help tropical forest managers and users answer questions or concerns **(Cunha dos Santos 2002)** about issues such

as sustainable management and livelihoods, biodiversity conservation, human wellbeing, political processes and institutions, and ecosystem services. Establishing clear monitoring questions is the first step in developing a program, according to **Case (1990)** in a manual of participatory monitoring in community forestry which presents step-by-step guidelines with explanations and illustrations. Local people participate by defining and asking core questions, or—in a less participatory way—professionals and authorities can define the questions while local people supply the data. The questions asked will depend on the management goals.

Second, monitoring not only provides answers to questions about forest management, but also creates a culture of questioning. Recent thinking has concluded that monitoring is more than a way of generating information; it is a catalyst for learning processes at the core of adaptive forest management. **Colfer (2005)** discusses how monitoring plays an integral role in the iterative cycle of planning, action, assessment and learning—a cycle that generates systematic progress and adaptation to change **(Colfer 2005, Guijt 2007)**. See Figure 1.

Third, monitoring can be a crucial mechanism for enforcing compliance with important forest management rules, such as resource access, use, conservation and benefit distribution.

Terms used in participatory monitoring

Participatory monitoring can take many forms. Terminology reflecting the diverse cases, tools and approaches encountered during the review are described below.

- *Locally-based monitoring* – **Danielsen et al. (2005b)** describe locally-based monitoring, where local people, including communities and/or local government staff, collect and analyze data. This contrasts with "professional monitoring" by formally trained experts. Approaches range "from self-monitoring of harvests by local resource users themselves, to censuses by local rangers, and inventories by amateur naturalists."

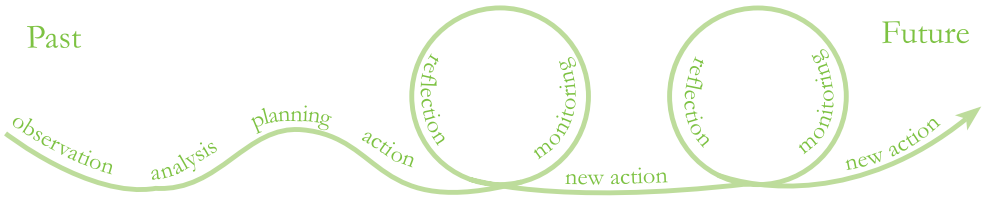

Figure 1: The Worm, adapted from Colfer (2005).

- *Collaborative monitoring* – Collaborative monitoring is "a process of conscious information seeking followed by shared critical analysis to inform collective decisions that affect resource management" **(Guijt 2007)**. Collaborative monitoring stresses the importance of developing a locally relevant process for gathering, analyzing and using information for natural resource management; the emphasis is shifted away from external institutions or professional project managers to focus on the most important issues to local people. When these monitoring activities are linked in an iterative learning cycle, they become the building blocks to collaborative monitoring. **Guijt (2007)** provides a thorough discussion of collaborative monitoring concepts and presents a selection of 14 articles documenting experiences throughout the world in various tropical forest settings.

- *Participatory Assessment, Monitoring and Evaluation of Biodiversity* (PAMEB) – Participatory monitoring, assessment and evaluation of biodiversity involves data collection and analysis performed with and by non-scientists for the purpose of understanding species or ecosystem diversity **(Lawrence and Ambrose-Oji 2001)**. **Lawrence (in press)** presents a comprehensive collection of experiences in PAMEB.

- *Community-based ecosystem monitoring* (CBEM) – This is a term for monitoring programs in developed countries that involve local, non-professional volunteers in environmental or natural resource monitoring, organized by government entities or conservation organizations to improve information collection and community input **(Whitelaw et al. 2003)**.

- *Joint monitoring* – Local people and local authorities engage in monitoring for enforcement together **(Andrianadrasana et al. 2005)**. This is also known as multi-party monitoring **(Bagby et al. 2003)** and is a way of building bridges between local people and authorities by sharing responsibilities **(Steinmetz et al. 2006)**.

- *Self-monitoring* – Local people monitor their own activities related to natural resources (in contrast to monitoring the resource itself). Examples including hunting or timber harvesting **(Noss et al. 2005)**. Self-monitoring is particularly useful for monitoring NTFP extraction and management **(Stockdale 2005)**.

- *Event monitoring* – Local people record incidents whenever they occur instead of during planned monitoring activities (such as a census or patrol). This type of monitoring is appropriate for more stochastic topics such as fire, poaching, problem animals and wildlife mortalities **(Stuart-Hill et al. 2005)**.

Lessons Learned

The following lessons learned, broad themes and conclusion emerged from the review.

Planning and implementing participatory monitoring

This section considers issues around planning and implementing participatory monitoring: Who participates and how? What will be monitored and how? How can a participatory monitoring program be developed and scaled up? What are the pitfalls, and how can they possibly be avoided when implementing future programs?

Who participates and how

Participatory monitoring is defined by the way people work together and the roles they play in planning and implementing the monitoring program. Local people bring their time, access to the natural resources and their knowledge. Their roles can range from solely gathering information to initiating, developing and driving the monitoring program. Outsiders—researchers, development

Battarai (2002) describes how the relationships between researchers and professionals, "outsiders", to local people, "insiders", can range from exploitative to collaborative in participatory monitoring partnerships:

"They know nothing; we just use them as servants or helpers."

"Of course we know better, but they know the way and location better."

"We know better but by asking them it will speed up our work; they also serve us."

"We undoubtedly know better, but they also know a few things that may help our work."

"They know as [much] as we do, but their perception is different; let us consult each another."

"They know a few things much better; let us work together because what we study concerns us all; [the information] belongs to everyone."

practitioners, non-governmental organizations, government authorities—naturally have their own objectives, which may or may not be in line with the objectives of local people. Meeting the objectives of both insiders and outsiders is among the most difficult challenges **(Lawrence and Elphick 2002)**. The assistance of outsiders is often necessary to launch a participatory monitoring program, as they have financial resources and technical expertise. However, programs driven primarily by outsiders are widely recognized as almost never being sustainable and sometimes ethically problematic **(Danielson et al. 2005b; Ghate and Nagendra 2005; Garcia and Lescuyer 2008)**. **Guijt (1999)** points out that in many participatory monitoring systems, local people's roles are often limited solely to data collection: "What distinguishes the more innovative participatory processes is their inclusion of end-users in [participatory monitoring and evaluation] design."

Considerations when developing a participatory monitoring program

Some monitoring experts advise first defining trackable indicators before monitoring gets underway **(Case 1990; Prabhu et al. 1999)**. Criteria and indicator (C&I) frameworks for forest management were developed in the 1990s, primarily for monitoring the sustainability of industrial, large-scale timber harvesting at the national level. **Prabhu et al. (1999)** state that criteria "are the intermediate points to which the information provided by indicators can be integrated and where an interpretable assessment crystallizes", and indicators "are any variables or components of a forest ecosystem or management system that are used to infer the status of a particular criterion". However, opinions differ about the role of C&I frameworks in participatory monitoring. The next publications discuss issues involving the selection of C&I sets, followed by alternative approaches.

There are several approaches to selecting indicators. One is to apply a framework of generic C&I sets that have been developed by professional experts. **Colfer et al. (2005)** discuss the lessons learned in implementing this approach and conclude that the complexity of these C&I sets make it very difficult to implement participatory monitoring with forest-dependent communities, as the sets are hard to measure and require too much professional expertise.

Pokorny et al. in **Guijt (2007)** discuss their experiences in introducing C&I in three forest communities in eastern Amazonia. They report that the communities failed to find relevance in the process or understand the objectives of developing C&I. The authors conclude that C&I sets are neither appropriate nor very useful for communities. If C&I are to be used, the authors recommend selecting a few, very relevant indicators using simple assessment tools.

Purnomo et al. (2005) provide a case study of defining C&I sets among various stakeholders. They found that the indicators selected by various groups—timber concessionaires, government organizations, non-government organi-

zations and communities—were quite different. This led the authors to question the utility of generic C&I when local stakeholders cannot reach consensus. The divergence in perspectives on forest sustainability between communities and NGOs was marked: "…the seemingly disparate views between local communities and NGOs raises an important issue with respect to the ability of NGOs to represent, or speak on behalf of, local communities. Careful analysis and good communication between these two groups must be exercised to insure that NGOs are adequately representing the views and perspectives of the local community."

A second approach involves defining C&I frameworks at the local level. **Ritchie et al. (2000)** offer a methodology with tools to develop context-appropriate C&I that can be operationalized into a monitoring program with an adaptive learning cycle (Figure 1). The publication includes a guidebook for developing C&I frameworks and monitoring plans with local communities. The approach is straightforward, user-friendly and participatory.

Cunha dos Santos (2002) also provides an extensive case study and guidelines for using both locally and scientifically developed C&I frameworks, based on a local monitoring program of community timber harvesting in the western Brazilian Amazon. The author begins with a diagnostic study, followed by a definition of criteria and indicators, through participatory mapping, future scenarios, key questions and semi-structured interviews. The author accompanied the communities and local partners for two

Stuart-Hill et al. (2005) provide recommendations for designing a participatory monitoring system that meets the objectives of managers—not scientists:

- Separate research from monitoring.
- Pay attention to building sustainable monitoring systems rather than obtaining data at all costs.
- Make a conscious effort to understand the working environment of a resource manager so as to realistically assess his capacity to commit to monitoring.
- Focus on topics dear to forest managers. As trust develops the scope can gradually be expanded to include other issues, such as those that help managers to identify effective and ineffective actions.
- Develop a service ethic where managers are the primary 'clients'–i.e. do what they want, not what scientists want.
- Build on small successes rather than being too ambitious.

timber harvest periods, during which participants developed a monitoring program to motivate conflict resolution, improve the project implementation and facilitate forest certification.

Many practitioners have found that starting with C&I frameworks is not the best approach when working with communities. Over-emphasizing C&I when setting up a participatory monitoring program can result in an externally-driven expert system that is not focused on local management priorities, becomes overly complex and cannot feasibly be implemented by a community without external support. Furthermore, the system is less likely to reflect local needs **(Garcia and Lescuyer 2008)**.

Paudel and Ojha in **Guijt (2007)** describe a research project in Nepal that initially set out to develop C&I with local community forest user groups. Several problems soon became apparent: it was difficult to convey the meaning of monitoring and indicators and difficult to develop consensus about the meaning of specific indicators. The entire process became bogged down in the process of identifying indicators. They changed their approach to focus on the bigger picture: how to develop monitoring systems that helped local people develop sustainable livelihoods and manage their forests sustainably. A process was then developed to identify priority issues and develop a plan to resolve and monitor those issues. By changing the focus away from indicators, monitoring ceased to be a separate activity and became part of a larger process that concentrated on the discussion of issues, reflection and action.

Instead of starting with a generic C&I framework, another approach is to develop a basic monitoring system, according to

Whitelaw et al. (2003) learned that when developing a volunteer-based monitoring system of forest ecosystems in Canada it was important to:

- Secure adequate funding and commitment prior to initiation of monitoring activities.
- Provide feedback to volunteers on how their work was contributing to planning and management.
- Understand participant motivations and skill level, and match these to the monitoring protocols selected.
- Collaborate with organizations already monitoring through partnership development.
- Utilize simple and scientifically tested methodologies.
- Incorporate training on monitoring protocols, field supervision and data verification into the design of community-based monitoring.
- Establish a "volunteer recognition" program.
- Focus on outcomes that serve society by delivering information relevant to policy.

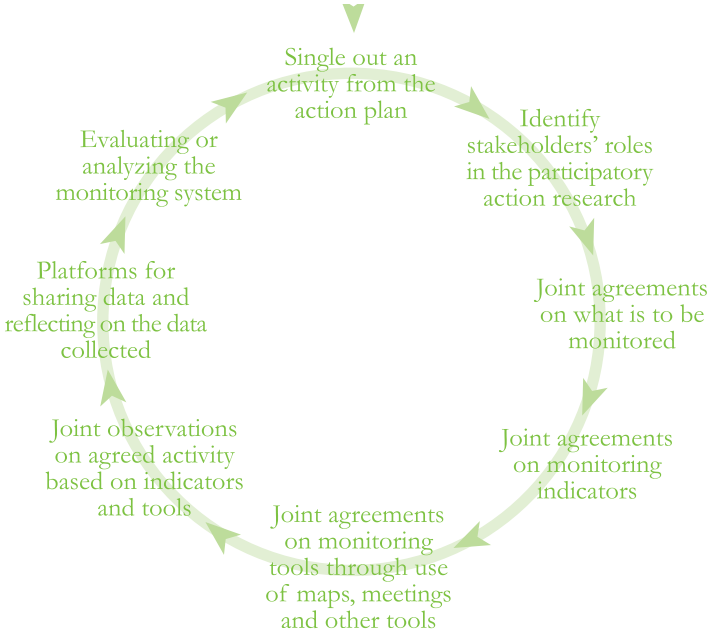

Figure 2: The Collaborative Monitoring Process (adapted from Prabhu [2003]).

Ghate and Nagendra (2005). In a cross-community comparison of monitoring and enforcement programs in India, the most successful and sustainable system started with a single rule; the community then decided how to monitor it. At each meeting the community added more rules to handle new situations. The authors recommend starting monitoring programs with a simple activity and then slowly adding more activities as management situations get more complex and issues evolve. This also gives local people the opportunity to collaborate on the monitoring issues and develop the program based on their needs.

Prabhu (2003) discusses how to operationalize participatory monitoring. Groups develop a common framework for observing the results and impacts of their plans and unexpected outcomes. They discuss and negotiate their objectives and visions, agree on how they are going to collect information and then they discuss, reflect on and analyze the data. Finally they apply what they learned to their planning, and the process begins again. See Figure 2 for a graphical representation of how this works.

CIFOR (2007) discusses two aspects of management that should be examined when developing a monitoring program: processes and impacts. Process monitoring examines the implementation of management actions in order to understand how—and if—they are being carried out. Impact monitoring examines the changes resulting from management action. By monitoring both, the linkage between action and impact can be established.

Garcia and Lescuyer (2008) review participatory monitoring trends and identify problems with programs that are both developed and driven by outside interests. The authors find that externally developed programs fail to link monitoring to the concerns of local communities. As a result, the programs cease to sustain themselves after the funding agency leaves. They point to several reasons: low or no built-in profit incentive, inadequate focus on what is really important to local people (many programs focus on ecosystem issues at the expense of socio-economic concerns), and changing institutional agreements that might eliminate a program's champion and lead to the monitoring arrangements being abandoned. These failures are symptoms of a deeper issue: in many cases, decision-making has not truly been devolved to communities while other more powerful stakeholders continue to exercise control. Therefore, if the community has not received full rights and authority over its forest, participatory monitoring remains divorced from decision-making with little possibility of influencing management. The authors thus introduce the concept of "intentional management" (Figure 3), which occurs when a community formally convenes and makes decisions about management objectives and community needs. The community must be involved in all aspects of the five main elements of intentional management: resource assessment, control, needs analysis, monitoring dynamics and negotiation of access and uses.

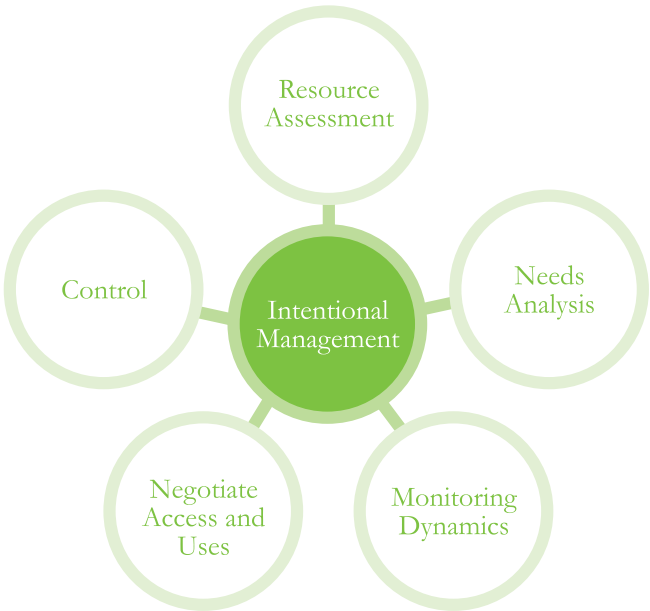

Figure 3: Components of intentional management of local resources. Unless the communities are directly involved in all five components, chances are that participatory monitoring will fail in the short term. Adapted from Garcia and Lescuyer (2008).

Scaling up and networking participatory monitoring programs

Scaling up monitoring programs is possible as long as the methods are simple, adaptable and locally relevant. If information between different forests or at different scales needs to be comparable, then a small set of easy-to-measure indicators should be selected. Furthermore, information needs to be returned to local communities so that they may understand the monitoring program's relevance and can use the information in their own decision-making **(Stuart-Hill et al. 2005)**. Governments and non-governmental organizations often look at participatory monitoring as a cost-effective way to implement large-scale monitoring systems by enlisting local volunteers to do the work **(Whitelaw et al. 2003)**. Governments may benefit from lower costs and front-line feedback **(Whitelaw et al. 2003**, **van Rijsoort and Jinfeng 2005)**. Nonetheless, significant investment is usually needed for local institutional development and capacity-building. Furthermore, in developing countries, local people do not often have the luxury of extra time to volunteer for monitoring activities unless the livelihood benefits are obvious. The following cases discuss some practical considerations, challenges and successes in creating programs that use local-level monitoring for national-level needs.

Stuart-Hill et al. (2005) present the Event Book system from Namibia as a success story in scaling up. The monitoring program integrates local data collection, using a binder and worksheets, into a national monitoring and evaluation database. Its success lies in it being both modular and adaptable; local groups can choose what to monitor—wildlife, hunting, problem incidents—but they always use the same methods as other communities. This allows for the information to be compiled and compared nationally. However, the original records never leave the community, so the community always has the information accessible for its own purposes. This article details the entire Event Book methodology with photographs and examples.

Whitelaw et al. (2003) describe efforts to bring together volunteer monitoring groups throughout Canada to create

Bennun et al. (2005) reflect on issues related to scaling up and networking a monitoring program:

- Strong and ongoing coordination support is needed. In particular, quick and regular feedback, appropriately pitched, is vital for maintaining morale and enthusiasm. It also helps to show how value is added when data are incorporated into a larger dataset.
- Institutionalization of the process is vital. However, it takes time and active effort. There is a gap between monitoring starting and meaningful results being generated, where it can be hard work to maintain momentum.

the Canadian Community Monitoring Network. Volunteers monitor ecosystem issues such as biodiversity, watersheds and land use change. They can extend the monitoring programs to social, cultural and economic issues. The authors argue that the benefits of community-based monitoring can be spread throughout the country to greater effect if local programs are networked. They identify two phases to building a network. The first involves developing the infrastructure necessary to launch community-based monitoring (CBEM) in a particular location. Six related tasks are required: governance analysis, consultation and outreach, identification of champions, partnership development, fund-raising and selection of an appropriate organizational structure for the group or network. Phase two launches CBEM and links monitoring activities and data to decision making.

Bennun et al. (2005) document the development of a national network of community-based monitoring of Important Bird Areas (IBAs) in Africa. There are two types of monitoring in the IBA network—simple and complex—depending on the level of program development in the community. Monitoring topics are organized by the pressure/state/response framework. Indicators include: habitat area, habitat quality, populations of bird species for which IBA is listed, agricultural intensification/expansion, burning of vegetation, deforestation, recreation/tourism, action plan development, number of conservation staff and volunteers and conservation projects/actions implemented. They began with a pilot project in Kenya and have scaled up to include 10 other countries. The challenges have been significant; institutional development, for example, is an ongoing process and the network requires constant assistance. Furthermore, there have been issues with the reliability and usefulness of the data collected by volunteers for conservation management. Nonetheless, the case proves that creating a network of volunteers interested in environmental issues and ecosystem health is possible in developing countries, provided there is significant institutional support.

There are challenges not simply in scaling up monitoring programs, but in bringing the information back to the local level. In Nepal, **Ojha et al. (2003)** analyze what is termed "micro-macro monitoring", or monitoring at the local level for the purpose of national decision-making. They found that a great deal of data is being collected and sent "upward", but little in the way of results is returned to the communities.

Hamilton et al. (2001) worked with 1600 forest user groups (FUGs) in Nepal to create a user-developed, self-monitoring and evaluation program for local-level forest management that could also generate information for monitoring at district and regional levels. The monitoring programs were called the "FUG Health Check" and "FUG Planning and Self-evaluation". The program monitored: (i) institutional criteria—how often the FUG meets, the percentage of men, women and different castes attending and represented on the committee, and whether there are specific plans for the poorest members, among others; (ii) ecological aspects, such as

"Community forestry monitoring would benefit from moving away from the collection of considerable amounts of broad areas of 'data', and instead focus on levels of strategic analysis related to key uncertainties and identified learning questions and indicators at all levels. Since no detailed 'prescription' can be made for an effective micro-macro monitoring system, monitoring should be approached as a process of learning through joint innovation and reflection, by a cross-section of institutions at all levels of forest governance."

- *from* **Ojha et al. (2003)**

simple inventories of specific NTFPs to determine sustainable harvesting volumes; and, (iii) economic aspects—income gained by the FUG (from sales of forest products) and expenditures. The program included creating natural resource maps and social maps, identifying activities to reach the FUG's ideal vision and prioritizing these through pair-wise ranking, and institutional analysis through Venn diagrams to identify current and ideal links and support from other organizations. A pictorial seasonal calendar was also developed to visualize the forest operational plan, showing the management practices needed to reach the ideal and the periods when harvesting could be allowed. The program successfully created "an adaptive and dynamic learning cycle internalized by its users." The process of developing their own monitoring program gave users confidence to suggest indicators that represented their own perspectives and interests. However, the program would need to be standardized to allow FUGS to be compared with each other at the district and regional level. Furthermore, to gain official recognition of the monitoring results for scientific rigor, a minimum set of quantitatively measurable indicators would need to be established.

Ensuring long-term sustainability

Maintaining a participatory monitoring program long enough to fulfill its goals—indefinitely if necessary—is a challenge. In the vast majority of

Danielsen et al. (2005b) identify six principles that contribute to the sustainability of a locally-based monitoring program without external support:

1. Locally-based monitoring has to identify and respond to the benefits that the community derives from the habitat or population being monitored.
2. The benefits to local people participating in monitoring should exceed the costs.
3. Monitoring schemes must ensure that conflicts and politics between government managers and communities do not constrain the involvement of local stakeholders in the monitoring process.
4. Monitoring should build on existing traditional institutions and other management structures as much as possible.
5. It is crucial to institutionalize the work at multiple levels, from country-wide policies down to the job descriptions of local government officers.
6. Data should be stored and analyzed locally, even if this means some loss of quality. It should also remain accessible to local people.

cases reviewed, an external organization initiated and maintained the program. It was not uncommon for the activities to cease once the outside organization departed, even if the monitoring work was not complete. The key is to keep the activities as simple and locally appropriate as possible. Although the start-up costs can be significant and must usually be borne by an outside agency, once begun, some monitoring programs can become self-sustaining.

Topp-Jorgensen et al. (2005) describe a forest monitoring program in Tanzania that tracked resource extraction and

disturbance. Local communities were managing forests through joint initiatives (in the montane forests) or community-based forest management (in the dry miombo woodlands). A monitoring system was needed for allocating permits and collecting fees for resource use. Groups monitored the management process, natural resource revenue, ecological sustainability, wood extraction and fire risks. Tools included village patrols, perceptions interviews, monthly data reports, regular monitoring meetings and informal reports. Although external support was necessary to set up the initial system, the resulting permit system was expected to collect enough fees to ensure sustainability. The monitoring program was simple, cost-effective, and transparent, requiring minimal training and education. The monitoring activities also stimulated discussion on natural resource trends and threats at the village level. This case study describes in detail how and when the community monitored its management practices, with particular emphasis on transparency, social control and the monitoring system's economic sustainability.

Sekher (2001) analyzes three distinct participatory processes and organizational structures in community forest management. The successes and limitations of each structure are discussed in relation to equitable and fair representation of all community members in decision-making, accountability, participation, organizational sustainability and benefit-sharing. The NGO-initiated organization was effective at mobilizing conservation efforts, but its strategies lacked sustainability because of poor representation and participation. The government-organized group had the benefit of government support for participatory resource management, but it lacked autonomy and initiative. The traditional management regime enjoyed better community support. The very fact that the traditional regime had existed many years before the community forestry program is a testament to its success, legitimacy and acceptance. Therefore, traditional governance structures should be viewed as "building blocks in any modern, development-oriented institutional structure aimed at participatory management of community resources."

Integrating scientific research with local knowledge and expertise

Monitoring systems that involve local people in scientifically-designed projects have many advantages, such as enriched data, lower total costs and a better chance of being sustained. Some types of information can only be provided by local people, such as changes or events that have occurred over long timeframes, information about traditional use and community perceptions about the forest. Local people benefit, too, from scientific methods, both from the data generated and the skills transferred by working with scientists. They may participate less in analysis than in data collection, but as long as the results are clear and openly

"Because so little ecological knowledge has been generated by the scientific community regarding the basic ecology of even widely used NTFP species, local knowledge regarding management and harvesting is often at the core of creating reliable indicators of sustainability."

- *from* **Shanley and Stockdale (2008)**

discussed, they can make decisions based upon the results **(Carter 1996)**.

Steinmetz et al. (2006) used "wildlife workshops" with hill tribes in Thailand to create timelines of wildlife degradation. These timelines identified the reasons for the degradation—such as poaching and subsistence farming—and led to monitoring and enforcement plans being created. Local knowledge contributed to discerning temporal scales. These in turn generated distinct insights about certain ecological processes that occur slowly or rarely, such as forest succession and fires. This information was accessible to scientists only by collaborating with communities.

However, monitoring programs that rely on local participation do not always provide sufficiently robust data to be

useful for scientific research; there may be problems of accuracy, precision and perception when non-professionals engage in scientific activities **(Danielsen et al. 2005b)**. Case studies confirm that locally based, participatory monitoring must be simple to be successful: but how simple can the monitoring systems be and still maintain scientific validity? **Danielsen et al. (2005b)** conclude that there is a major gap in understanding the comparability of data between scientifically and locally-collected data. Based on the few comparisons of scientific and local monitoring that have been conducted, the minimum amount of data to be collected by local monitoring programs to generate the same results as scientific methods appears to be high. The authors are doubtful whether local monitoring on its own has the ability to detect changes in populations, habitats, or patterns of resource use of sufficient accuracy and precision to serve for scientific decision-making. They conclude that careful planning is necessary if a monitoring program is to be scientifically valid. The authors provide a six-step framework for planning a participatory monitoring system.

Sheil and Lawrence (2004) discuss the issues of training local para-taxonomists to assist scientists in collecting information for biodiversity research and conservation. Local para-taxonomists can be more effective communicators of conservation and biodiversity values to local leaders than foreign experts. Furthermore, their roles in the community can give researchers access to information that would otherwise be unobtainable.

Shanley and Stockdale (2008) describe experiences of documenting traditional ecological knowledge in Namibia, Brazil and the Philippines, in order to collect sufficient information for the certification of non-timber forest products. They found that the lack of scientific knowledge about NTFPs can be addressed by involving local people in experimental design and data collection. They present various examples where the knowledge provided by local people was useful to scientists, and their input in adjusting methods for data collection proved invaluable. Local people in the Philippines were involved in developing C&I frameworks for collecting NTFPs in a pilot project to develop national monitoring standards. The C&I selected by the participants reflected an interesting holistic perspective on the requirements for sustainable management. For example, their indicators of sustainable honey production included monitoring water sources, important flowering trees and trees that provided ideal conditions for placing hives.

Impacts of participatory monitoring

Decision-making

Participatory monitoring can create spaces and opportunities for more inclusive, better-informed decision-making. The following articles provide examples where monitoring led to concrete decision-making and management actions.

Becker et al. (2005) present a case in montane Ecuador where community-based monitoring fog capture by cloud forest vegetation alerted local people to the importance of forest ecosystem services such as moisture retention and watershed integrity. By being involved in monitoring bird populations, local people learned about local bird species and their conservation status, became familiar with the potential of ecotourism and began to integrate biodiversity conservation into sustainable development planning in their community. There were three significant management impacts: local people voted to create a reserve to protect their watershed; the site was nominated an Important Bird Area (IBA) by Birdlife International; and monitoring created local awareness of ecosystem services. The linkage between monitoring and livelihoods determined how quickly management action was taken. For instance, monitoring fog capture quickly stimulated forest management decisions because the impact on livelihoods from losing water was immediate; within two months, the community established a watershed protection area. Monitoring birds had more gradual impacts—leading to local protection measures and an increase in local development of eco-tourism over a period of nine years—because the benefits were not immediately perceived.

Steinmetz et al. (2006) discuss how a joint monitoring program in the Thung Yai Naresuan Wildlife Sanctuary in western Thailand, adjacent to Myanmar, helped to build bridges between local Karen hill tribes and nature preserve authorities who historically mistrusted each other. Conservation specialists initiated a series of wildlife workshops, including wildlife status assessment, impact assessment, and conservation planning, which all resulted in a joint monitoring program of large mammals. The workshops prompted villagers to recognize population declines of local species due to over-hunting and poaching. They also agreed to monitor the menus of local restaurants responsible for creating the demand for poached meat and create joint patrols of poaching hotspots within the park. Villagers designated "wildlife recovery zones" to provide a refuge for ungulates and primates. Since being established, the zones have received increased publicity, management attention and patrols, and there are fewer reports of either subsistence or commercial hunting in the area. Communication

between villages and local officials has also improved; officials now frequently attend quarterly village meetings about managing protected areas. Joint monitoring worked where past attempts to control local over-hunting had failed.

Anil (2004) presents an innovative tool (participatory 3-dimensional modeling or P3DM) for transforming landscape information into a format that communities can monitor to make management decisions. P3DM is an interactive tool that facilitates the gathering of information and turning it into a 3-dimensional map of natural resource management areas. The map serves as a powerful monitoring tool that is always present for community members to observe and contribute more information as their landscape transforms. Armed with the visual and geographic information provided by P3DM, a community at Sasatgre, Meghalaya, India improved local participation and bonding between its members and facilitated critical reflection that in turn generated important management decisions.

Shanley and Gaia (2002) describe an NTFP monitoring project in the Brazilian Amazon that provided important information to local people about the economic value of their forest. Local rural unions were concerned that farmers were selling timber for low prices with little information about the trees' NTFP value. They asked researchers to work with community members to monitor consumption of NTFPs in order to better understand their economic value and their importance to local livelihoods. Community research assistants completed ecological data sheets with headings showing pictures of animals or fruits that families hunted, harvested and consumed. Families simply had to check beneath the picture to show what they had consumed that day.

Then they calculated the value of their consumption. The value of bushmeat consumed by a single household topped US $1000, underscoring the economic importance of maintaining the forest's ecological health, in dramatic comparison to the small sums received for selling timber. The census of fruit trees revealed that there were far fewer *piquiá* trees (*Caryocar* spp.), an important fruit for consumption, than the local people believed. Communities responded by implementing stricter bans on logging, bans on felling fruit trees and setting up forest reserves.

Learning and adaptation

Each monitoring cycle provides an opportunity for learning and reflection. The following publications explain the linkage between monitoring and learning, and present case studies where monitoring facilitated learning and led to management action.

Kusumanto in **Guijt (2007)** discusses a case where a participatory monitoring program in Indonesia was developed as a way of linking monitoring to learning and advancing forest governance in Jambi, Sumatra. The participatory monitoring program focused on three local governance mechanisms: the election committee, community meetings, and information dissemination throughout the community. Monitoring began with simple technical questions, such as "How do we ensure that people vote in the correct districts?" As the process evolved, the questions became more politically value-laden and complex. The authors learned that as stakeholders' capacities evolve, the monitoring program needs to adapt to answer their new questions. The process helped to institutionalize a culture of accountability and transparency that did not exist before; for instance, when an oil palm plantation wanted to use community land, the refusal was based on majority sentiment, not a decision by local elites.

Lawrence et al. (2006) discuss a biodiversity monitoring program in Nepal that integrated a participatory action research approach with monitoring. By starting the project with a participatory monitoring process, questions were asked and information needs identified that led to new research processes being integrated into forest management. The communities monitored many forest aspects, including forest quality, useful plant species, birds, wild animals, management activities and compliance with rules and procedures. Methods included group discussion, forest walks and resource maps. The identification of biodiversity indicators launched learning cycles and stimulated research questions and experimentation by users, for instance about silvicultural techniques or the value of local plants.

Hartanto et al. (2002) present a participatory monitoring plan for community forestry programs and community development in the Philippines that was structured to facilitate learning and adaptation. They use the C&I framework to identify indicators, followed by scenario exercises.

"By generating data, people become conscious of underlying problems, for example perceived or actual over-hunting of a certain species…Reflection processes can lead to preliminary management action that can be consolidated in an adaptive management process…Communal decision-making is the key, participatory methods provide the inputs and framework for discussion, and detailed scientific information with sophisticated analyses may not be essential, as long as we utilize information with which resource managers and assistants are familiar and confident."

- *from* **Noss et al. (2005)**

The indicators fell into four categories: forest management, organization, incomes and education. They conclude that monitoring was a key element of the learning process since local communities and stakeholders were able to observe the impacts of their own practices.

Noss et al. (2005) discuss a hunting self-monitoring program by indigenous groups in Bolivia. Hunters voluntarily collected data on their own activities and the impacts by recording their practices on data sheets and collecting specimen samples from hunted animals (skulls, jawbones, stomach contents, fetuses). Community monitors assisted the hunters in recording data through line transect surveys and drive counts. Self-monitoring stimulated awareness of changes, group discussion and trust in the data collection process. The authors conclude, however, that monitoring game populations, even with volunteer participation, can be time-consuming and expensive. Furthermore, accuracy in terms of short-term population fluctuations is a problem. The authors also touch on how local people can use scientific monitoring to test traditional beliefs about sustainable wildlife management.

Roy (2004) discusses how participatory vegetation monitoring (PVM) has proven to be an effective tool in India for blending traditional knowledge with modern know-how to identify problems, encourage discussion and make decisions. The PVM process includes assessing the vegetation status of existing and regenerated natural forests and plantations, assessing how knowledge of vegetation status influences local

institutions and economic activities, and monitoring how people are implementing findings to improve the function of institutions, forest condition and income level. First villagers meet and share experiences about forest management, including the changes in vegetation, reasons for monitoring and the need for participation. Next they learn methods for measuring changes in trees, shrubs and herb species. Finally the participants, including the community members and foresters, develop a proposal and plan of action based on their findings. In one village, through monitoring, villagers discovered that 70 per cent of their acacia and eucalyptus trees had their bark peeled to create straps for carrying firewood. This resulted in stunted or dead trees. The community therefore sought out other materials to replace the tree bark.

Bagby et al. (2003) describe a mushroom multi-party monitoring program in the Pacific Northwest of the United States. High international prices of *matsutake* mushrooms were increasing harvesting pressure by commercial collectors, who were primarily recent immigrants from Cambodia, Laos and Latin America. The multi-party monitoring sought to integrate harvesters' knowledge, experience and concerns into grassroots and institutional decision-making processes to resolve the growing problems. The activities by harvesters and public officials included public campground meetings and ongoing, focused reflection among project partners. Early in the project, the necessary trust and rapport for collaboration did not exist among the harvesters, community-based partners and biological scientists. Over time, interest in shared learning and trust has grown as well as interest among the monitors in more systematized resource monitoring, demonstrating that NTFP monitoring can create opportunities for community-based collaboration with scientists.

Building social capital and strengthening local institutions

Participatory monitoring programs have been found to strengthen local institutions and communities. The following articles describe these results in greater detail.

Andrianadrasana et al. (2005) discuss a wetlands joint monitoring plan in Madagascar and the impact on transparency and good governance. Community members and local government authorities monitored lemurs, water birds, fish catches, marshes, hunting and burned areas. They used field methods, such as observations along transects by canoe in zones villagers indicated as important, observations along fixed transects by canoe, identifying species, weighing and measuring fish caught from the first three groups arriving at the shore for each different fishing method and some methods involving GPS-based mapping. The plan improved cooperation and communication between community members and local government authorities. It provided an opportunity

for government agents to clarify the laws and regulations to local people, and increase mutual trust. It improved transparency and accountability by government agents in fisheries control because communities were more aware of the activities of local officials. The program ensured that all parties, including government and community members, knew if fishing regulations or marsh burning restrictions had been breached. The monitoring activities were a non-confrontational way of indirectly enforcing rules; marsh burning decreased when the monitoring program was initiated because villagers were afraid of getting caught. There were also enforcement actions that resulted: agents confiscated more illegal boats and nets. Leaders and politicians made speeches during the public monitoring meetings in support of sustainable management; as a result, they received more public pressure to comply with their public stance. The wetlands monitoring program was combined with a public education campaign through environmental quizzes, competitions and press events. The program found a high correlation between the level of knowledge and positive environmental management. These activities created general interest and momentum in the monitoring program that has helped its sustainability.

Cronkleton et al. in **Guijt (2007)** discuss how a wage-labor monitoring program in community-managed forests in Bolivia served as a mechanism for introducing the concept of monitoring into communities where this was previously little understood. Two communities had been harvesting timber through government-approved forest management plans; community members received wages based on their days of work. The communities were greatly interested in monitoring wages and ensuring that wages were paid correctly and fairly because there were complaints that the accountant and community leaders were mismanaging funds. In a series of public meetings, community leaders met with community members

to review all the wage data together. Facilitators taught community members how to read the accounting books and double-check their own wages against the ledger. The monitoring program not only created more transparency in managing community resources, but also provided a mechanism for understanding how to set up and manage a formal monitoring system. The community members continued to use the wage monitoring system on their own after the facilitators departed.

McDougall et al. in **Guijt (2007)** discuss a self-monitoring program initiated by forest user groups in Nepal. The program facilitated the analysis of how resources and opportunities were distributed among forest users by creating a monitoring system that allowed local people to understand how everyone was benefiting. The study compares the community organizational structures before and after implementing the monitoring program to analyze its impact on decision-making processes and institutions. The community first established certain criteria to evaluate its forest-related activities. These criteria included, among others, income generation, particularly for the most marginalized users. The monitoring activities included a heterogeneity analysis. When the analysis was completed, it became clear that the forest user group was not meeting its objectives in terms of equitable access to resources and improved income generation. In response, users decided to create a bamboo craft enterprise and hired the poorest members as staff to improve their livelihoods. Monitoring created a situation where marginalized users did not have to argue for access to resources. By collecting and analyzing data for the monitoring program, it became clear to all members that there were inequalities that needed to be addressed.

Rule enforcement and compliance

Rule enforcement is a critical component of any natural resource management system, whether the rules are locally developed by communities or adopted at the national level (**Ostrom 1990**). There is conclusive evidence that monitoring for rule enforcement is a necessary condition of sustainable forest management. The following articles discuss the role and importance of enforcement in natural resource management and how participatory monitoring can be an effective and non-confrontational approach to ensuring local compliance.

Gibson et al. (2004) compare rule enforcement and forest condition in 130 forest user groups in 12 countries (temperate and tropical, developed and developing), in order to understand how forest quality reflects four factors: rule enforcement process, social capital, dependence on the forest resource, and whether the group is a formal organization. The results were clear that rule enforcement and forest condition are correlated, regardless of social capital, formal organization or forest dependence. Rule enforcement, executed via systematic monitoring and sanctions, is a necessary condition for successfully managing communal forests.

Ghate and Nagendra (2005) compare three community forest management structures in India: community-initiated management, NGO-promoted management, and state-sponsored Joint Forest Management (JFM). They used field-based techniques to analyze forest condition in three villages under the three different regimes, and used the results of the forest quality tests as measures to analyze the effectiveness of the three institutional structures. The authors find that the community with self-initiated community forest management and the harshest penalties for infractions had the highest quality forest. Locally-based monitoring played a crucial role in rule compliance with regard to common-pool resources and their sustainable management.

> "When sanctions are strictly enforced, they prevent the spread of free-riding behavior, thereby instilling a sense of trust in the community. It is essential to provide conditions that facilitate a sense of justice and fair play in the participants, by ensuring that all individuals who break the rules will be sanctioned irrespective of their position in the community."
>
> - *from* **Ghate and Nagendra (2005)**

Danielsen et al. (2005a) describe a participatory monitoring system implemented in a protected area of the Philippines. The monitoring scheme had four activities: (1) focus group discussions with volunteer "community monitoring groups" of knowledgeable forest product gatherers, hunters and fishers; (2) systematic observations of wildlife and resource use during regular patrols; (3) fixed point photography of selected hillsides; and, (4) simplified line transect surveys. The authors examined the interventions that resulted and their impact on conservation and found that 98 per cent had a positive effect. The monitoring system also led to greater collaboration between park authorities and communities in developing and enforcing resource use rules. The result was a more socially acceptable and effective enforcement regime. Furthermore, indigenous resource use schemes were recognized by government authorities.

Hoare (2004) presents a case of institutionalizing a community-based monitoring network for fire-prevention and conflict resolution in Thailand. Local villages had regulations and fines against uncontrolled fires, but no method of monitoring and controlling fires. Village rules could not be enforced because fires spread from other villages. In response, village leaders integrated a fire prevention and control scheme. They used village-based monitoring teams, visual fire-mapping, fire calendars and sketch maps to monitor forest fires, smoke and rule violations. The monitoring provided a systematic, fair mechanism to understand who was responsible for the infractions and fine them according to agreed rules. The monitoring system brought about the formation of Village Watershed Networks, established boundaries for village fire control responsibility, and strengthened village rules on fire management. Infractions decreased dramatically: uncontrolled

fires reduced from 20 per cent of the area (before the project started in 1998) to less than 2 per cent (in 1999 and 2000). Furthermore, the monitoring programs facilitated conflict resolution.

Van Rijsoort and Jinfeng (2005) present the case study of a participatory monitoring program focused on enforcement in the buffer zones of nature reserves in communities in Yunnan, China. Monitoring subjects included wildlife, wildlife damage and land use practices. Tools used were observations during forest walks, village interviews and market surveys. The program was primarily initiated to control unsustainable natural resource extraction by local people. The nascent monitoring program resulted in an over-emphasis on enforcement and focused exclusively on restrictions instead of concurrently developing sustainable management practices. However, the joint monitoring programs improved relations between villagers and the management staff and improved awareness about sustainable use. Communities were also able to use information from the monitoring programs to justify their claims for expanded use rights.

Kamoto in **Guijt (2007)** describes a monitoring program by local communities in the Chimaliro Forest Reserve in Malawi to control illegal resource extraction in the forest reserve and monitor honey production. In exchange for rights to hang beehives and collect non-timber forest products, communities were expected to execute regular patrols against timber felling and encroachment. Monitoring also tracked honey production and control of the beehives. The initial monitoring approach was not successful: illegal activities continued because of lack of suitable indicators, lack of community participation and lack of social control over the village leaders. Honey thefts continued, sometimes committed by the community leaders themselves and blamed on others. Community members felt no ownership of the management plan and saw no incentive to comply with it. The author introduced a new approach and participatory methods by organizing community workshops and facilitating scenarios—a method for future planning (see **Wollenberg et al. 2000**)—and identifying honey production indicators. Based on the indicators, the participants developed a monitoring plan that generated useful information about honey production and guided community members in selecting locations for the beehives. The community also realized that joint patrols, comprised of community members and forest reserve law enforcement, were necessary if suspects were to be identified and apprehended. The patrols had to be frequent and random in order to catch transgressors. The community monitoring program led to increased honey production and fewer forest reserve violations.

Conclusions: Looking back, looking ahead

Participatory monitoring is a way for the people who depend on the forest to work together towards better management. The diverse experiences reviewed here suggest a new understanding of the importance of monitoring in forest management and the roles of local people. The main lessons derived from this review are summarized below.

There are many ways to develop and implement participatory monitoring programs, and indicators are not always necessary. Indicators can be useful, but they should be locally developed and not overly technical. Some practitioners have successfully avoided indicators altogether and focused instead on monitoring specific activities, issues or rules.

For participatory forest monitoring programs to be sustainable, they must be simple to conduct, inexpensive and locally relevant. Furthermore, participatory monitoring activities should build on existing management institutions (village leaders, forest user group councils), and in turn be institutionalized at the local level. A platform for discussion and reflection is likewise necessary. Training local participants is also an important consideration for success. And the benefits of the monitoring must be clear; in fact the benefits must outweigh the costs. Scaling up programs is feasible with careful planning and significant funding for training. Modular programs allowing for local adaptation can ensure information is comparable and useful between communities, and from local to national scales. Plans should include mechanisms for returning results to the community.

Participatory monitoring catalyzes social learning and builds social capital. When locally developed and properly planned, monitoring creates space for reflection and analysis. Participatory monitoring can help to facilitate community-based decision-making and management action. Participatory monitoring can also serve as a starting point for engaging local people to think about sustainable forest management for diverse products and services. It generates cycles of learning, adaptation and informed decision-making. It can build social capital and reduce conflict. Finally, participatory monitoring may also serve as a necessary component of rule enforcement and sustainable management of forests at the local level.

There are, however, gaps in our knowledge and experience about participatory monitoring. In light of

this review, the areas where future action is needed include:

Designing participatory monitoring systems where the benefits are clear and outweigh the costs – While there are many documented instances of the positive impacts on forest management and forest-livelihoods, it is nonetheless true that many participatory monitoring programs cease because the benefits (tangible and non-tangible) to those involved are poorly understood, as are the costs (time and/or expenses) involved, and the incentives motivating participation. How can participatory monitoring programs be designed to ensure there is enough incentive to participate and maintain the system, particularly when there is no financial reward? What style of participation is likely to be the most successful in those cases where the benefits are not tangible and are long-term (such as in biodiversity monitoring)? Although there is anecdotal evidence of successful cases, an examination of these issues, an analysis of incentives, and the development of a cost-benefit analysis tool would contribute greatly to creating more sustainable monitoring programs.

Developing simpler, cheaper, more scientifically robust tools – We have scores of tools that have been tested in the field: forest walks, participatory mapping, transects, event books, scenarios, among others. However, many of these methods are time-consuming and overly dependent on outside facilitators and experts. Although they might be useful as initial activities to launch a monitoring program, local people are often unlikely to continue them without external accompaniment and funding. There is a need for simple tools that can be used with minimal external input. There is a need to understand how robust these tools are by comparing the results with more sophisticated scientific approaches. And we need new tools that take advantage of remote-sensing technologies; many references in this review identified a need for low-cost access to remote sensing images with enough data resolution to be useful to local communities.

Making monitoring work at bigger scales for multiple goals – Participatory monitoring is clearly effective for local analysis and decision-making. The challenge lies in developing locally-based programs that are also relevant on a larger scale: "scaling up." Many scientists remain skeptical about the validity of local schemes for detecting trends in populations, habitats and the provision of goods and services. Few studies compare the scientific usefulness of local methods. Quantitative comparisons of the results of locally-based and professional monitoring are priority areas for future research.

Compensation and reward mechanisms – Compensation and reward mechanisms for ecosystem services—ranging from habitat and biodiversity conservation to watershed protection and carbon fixation—require reliable, cost-efficient participatory assessment and monitoring programs to monitor compliance and benefit distribution at the local level. **Asquith et al. (2008)** provide an example of such monitoring programs in a Bolivian watershed; this remains an important area for future research.

Biodiversity– Biodiversity conservation has garnered global public support, generated

policy action and mobilized financial resources for habitat conservation efforts at the global level **(Green et al. 2005)**. However, monitoring biodiversity for conservation purposes at the local level and with local people is problematic: it is often expensive, overly technical and too abstract. The local benefits are not clear and the incentives are indirect or vague. During the course of this review very few case studies were found where participatory biodiversity monitoring alone was a mechanism for conservation action. For participatory monitoring of biodiversity to catalyze forest conservation, local perceptions of the term biodiversity need to be explicitly included. Biodiversity indicators must be meaningful to local people and to the scientific and global community if participatory biodiversity monitoring programs are to be both relevant and sustainable.

Matrix Table of Case Studies, Methods and Tools

The following table provides a quick reference to locate articles by monitoring topic (what is being monitored) or the methods and tools used in the participatory monitoring activities. The matrix is a subset of the publications discussed in this review, as only those publications that discuss a specific method, tool or application are included. The references are organized under five broad areas: forest management for multiple objectives, biodiversity conservation and wildlife management, human wellbeing, non-timber forest products (NTFPs), and ecosystem services.

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
Forest Management for Multiple Objectives			
A process for community and government cooperation to reduce the forest fire and smoke problem in Thailand	Forest fires, smoke, rule violation.	Village-based monitoring teams, visual fire-mapping, fire calendars, sketch maps.	Hoare (2004)
Adaptive collaborative management in Acre: A case study of the agroextractive project, Porto Dias, Acre, Brazil	Sustainable timber harvesting, internal evaluation.	Reflective diagnostic, participatory mapping, future scenarios, key question, semi-structured interviews.	Cunha dos Santos (2002)
Analysis of local perspectives on sustainable forest management: an Indonesian case study	Sustainable management of timber.	"Who Counts" Matrix for defining stakeholders, cluster analysis of perceptions for defining indicators, hypothesis measuring.	Purnomo et al. (2005)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
Anticipating change: Scenarios as a tool for adaptive forest management	Change, surprises, planning,	Scenarios, visioning, pathways, projections.	Wollenberg et al. (2000)
Assessing the sustainability of community-managed forests	Ecology, socio-economics, community participation.	The team used a participatory action research approach to develop a program for using Criteria and Indicators (C&I) as a monitoring tool in an adaptive collaborative approach to forest management. Suggests activities such as two-way discussions (key informant, focus group, others), review of records, visioning, analysis of stakeholder rights using pebble distribution games indicating the intensity and quality of collaboration among groups, and pebble distribution games about rights and means to impose sanctions, to regulate conflict and to define boundary limits.	McDougall (2001)
Combining participatory modeling and multi-criteria analysis for community-based forest management.	Sustainable management of timber or other resources.	Participatory modeling using the Co-view modeling program, multi-criteria analysis, scenario development, SWOT analysis.	Mendoza and Prabhu (2005)
Community-based monitoring of natural resource use and forest quality in montane forests and miombo woodlands of Tanzania	Management process, natural resource revenue, ecological sustainability, wood extraction, fire threat.	Village patrols, perceptions interviews, monthly data reports, regular monitoring meetings, informal reports.	Topp-Jorgensen et al. (2005)
Collective action and learning in developing a local monitoring system	Livelihoods, organization, forest management, community development, education.	Criteria and Indicators (C&I) framework for sustainable forest management, Visioning from the future scenarios methods. All methods are workshop based, involving three workshops and several discussion sessions.	Hartanto et al. (2005)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
Ecological criteria and indicators for tropical forest landscapes: Challenges in the search for progress	Sustainable forest management, management implementation, management effectiveness.	Criteria and Indicators.	Sheil et al. (2004)
Establishing the Canadian Community Monitoring Network	Ecosystem issues initially such as biodiversity, watersheds, land use change and then extend to social, cultural and economic issues.	Phase one involves developing the infrastructure necessary to launch community-based monitoring in a particular community. Phase two launches community-based monitoring, and links monitoring activities and data to decision making.	Whitelaw et al. (2003)
Exploring visions: Self-monitoring and evaluation processes within the Nepal-UK Community Forestry Project	Forest condition, forest products, group management, communication, community development activities, income-generating activities.	User-developed self-monitoring and evaluation tools, social and resource maps, pair-wise ranking, seasonal calendars, visioning, institutional analysis through Venn Diagrams.	Hamilton et al. (2001)
Helping village stakeholders monitor forest benefits in Bolivia	Wage-labor, transparency, accounting.	Village meetings, wage-labor charts, accounting records.	Cronkleton et al. in Guijt (2007)
Local enforcement and better forests	Rule enforcement, illegal activity.	Specific monitoring approaches of the individual sites not discussed. Links enforcement to forest quality.	Gibson et al. (2004)
Participatory 3-dimensional modeling for ecological monitoring in mountainous areas	Resource use, land tenure.	Participatory 3-Dimensional Modeling (P3DM) adds a third dimension to a topographical map which captures and integrates people's knowledge and spatial information (contour lines). A given community actively participates to construct the map, facilitated by mapping experts. and hence derives its name. A P3DM is constructed with locally available material such as rubber sheets, ply board, paints, etc.	Anil (2004)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
Participatory resource monitoring as a means for promoting social change in Yunnan, China	Natural resources, wildlife, wildlife damage, land use.	Observation through forest walk, village interview, market survey.	Van Rijsoort and Jinfeng (2005)
Role of monitoring in institutional performance: Forest management in Maharashtra, India	Community compliance with rules, protection of the resource from outsiders; forest degradation: grazing, tree felling (by the community or outsiders), charcoal burning, fire damage.	Daily patrols.	Ghate and Nagendra (2005)
The community's toolbox: The idea, methods and tools for participatory assessment, monitoring and evaluation in community forestry	Sustainable forest management.	This practical, clear and useful guide is one of the first participatory monitoring guides for forest management and still one of the best. It offers clear definitions, steps and suggestions for developing a monitoring program.	Case (1990)
Biodiversity Conservation and Wildlife Management			
A framework for improved monitoring of biodiversity: Response to the World Summit on Sustainable Development	Biodiversity on a local, national, regional and global scale for compliance with the Convention on Biological Diversity.	Presents an approach for developing a biodiversity monitoring program. For scoping, uses the driver-pressure-state-impact-response (DPSIR) framework. Can include any tool in the approach. Discusses in general how to select the most appropriate technical tool: mapping, satellite, etc.	Green et al. (2005)
A participatory counting method to monitor populations of large mammals in non-protected areas: A case study of bicycle counts in the Zambezi Valley, Zimbabwe	Mid-sized to large animal populations, species biodiversity, ungulates.	Line-transect method on bicycle, stratification method of analysis, using DISTANCE software.	Gaidet et al. (2003)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
A simple system for monitoring biodiversity in protected areas of a developing country	Biodiversity, habitat degradation, ecosystem degradation, populations of threatened plants and animals, management impacts, benefits to local people.	Standardized recording of routine observations, fixed point photographing, line transect survey, focus group discussion.	Danielsen et al. (2000)
Adaptive value of participatory biodiversity monitoring in community forestry	Biodiversity, biodiversity values, forest quality.	Group discussion, forest walks, resource maps.	Lawrence et al. (2006)
Biodiversity Assessment for Whom? Issues, Perspectives and Lessons from Community Forestry in Nepal	Biodiversity management.	Participatory action research and learning. Monitoring of on going activity through focus group discussion (sharing/ reflection), observation.	Ojha et al. (2003)
Collaborating to Conserve Large Mammals in Southeast Asia	Populations of large mammals: elephant, tiger, Asian bear, rhinoceros.	Wildlife workshops integrating ranking exercises to develop a spatially explicit picture of long-term trends in the abundance of mammal species and compare species-specific causes for declines.	Steinmetz et al. (2005)
Community-based monitoring of fog capture and biodiversity at Loma Alta, Ecuador enhance social capital and institutional cooperation	Fog capture, ecosystem services, watershed services, biodiversity.	Fog capture, mist nets and strip counts to monitor birds, Statview statistics and spreadsheet program.	Becker et al. (2005)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
Cost and efficiency of large mammal census techniques: comparison of methods for a participatory approach in a communal area, Zimbabwe	Mammals over 200g, biodiversity.	Aerial counts plus five ground-based census methods were compared: daylight and night car counts, bicycle counts, foot counts and water point counts.	Gaidet-Draper et al. (2005)
Does monitoring matter? A quantitative assessment of management decisions from locally-based monitoring of protected areas	Biodiversity, ecosystem products and services.	Focus group discussions with volunteer 'community monitoring groups' of particularly knowledgeable forest product gatherers, hunters and fishers; systematic observations of wildlife and resource use during regular patrols (field diary method); fixed-point photography of selected hillsides; simplified line transect surveys.	Danielsen et al. (2005a)
Hunter self-monitoring by the Isoseno-Guaraní in the Bolivian Chaco	Mammals, hunting, biodiversity.	On-going hunter self-monitoring program with voluntary participation: data sheets, specimens (skulls/jawbones, stomach contents, fetuses) of hunted animals. Community monitors assist the hunters in recording data: line transect surveys, drive counts, track counts, surveys with trained dogs, hunter catch-per-unit-effort analysis, community discussions.	Noss et al. (2005)
Monitoring Important Bird Areas in Africa, towards a sustainable and scaleable system	Habitat area, habitat quality, populations of bird species, agricultural intensification/expansion, forest degradation, development of action plans, resource use controls/quotas.	Pressure-State-Response monitoring framework. Basic monitoring forms completed annually by teams of local volunteers. Detailed monitoring is a more complex, scientifically rigorous process generally handled by experts.	Bennun et al. (2005)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
Participatory ecological monitoring of the Alaotra wetlands in Madagascar	Lemurs, water birds, fish catches, marshes, hunting, burned areas.	Community methods: environmental quiz, participatory ecological monitoring as a competition. Field methods: observations along transects by canoe in zones indicated as important by villagers, observations along fixed transects by canoe, Identifying species, weighing and measuring fish caught from the first three fishing groups arriving at the shore for each different fishing method.	Andrianadrasana et al. (2005)
Participatory vegetation monitoring: Examples from West Bengal	NTFPs, vegetation, forest cover, forest grazing, downed trees for wood.	Village discussions, vegetation plots, household surveys.	Roy (2004)
Projects come, projects go: Lessons from participatory monitoring in southern Laos	Biodiversity, human activities, habitat destruction, key species.	Patrolling, village discussions, joint monitoring logbooks, monitoring ecologically sensitive sites, fishery monitoring, photo points, wildlife trade monitoring and camera traps.	Poulsen and Luanglath (2005)
Taking stock of nature: Participatory biodiversity assessment for policy planning and practice.	Ecosystem biodiversity, species biodiversity.	A compilation of case studies and discussions involving various approaches for participatory biodiversity assessment and monitoring.	Lawrence (in press)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
The Event Book System: A community-based natural resource monitoring system from Namibia	Poaching; predator encounters; rare and endangered animals; fence monitoring; water point monitoring; flooding and river levels; rainfall; wildlife sighting; trophy hunting; wildlife harvesting; livestock theft; livestock condition; fishing effort; long-term vegetation change; seasonal grass grazing assessment; wildlife re-introductions.	The Event Book is a standardized three-ring binder with data collection cards. The process has three steps: 1) data collection; 2) reporting map and monthly reporting chart; 3) long-term reporting chart.	Stuart-Hill et al. (2005)
Human Wellbeing			
Collective action and learning in developing a local monitoring system	Livelihoods, organization, forest management, community development, education.	Criteria and Indicators (C&I) framework for sustainable forest management, visioning from the future scenarios methods. All methods are workshop based, involving three workshops and several discussion sessions.	Hartanto et al. (2002)
Towards wellbeing in forest communities: A source book for local government	Poverty, wellbeing, spheres of wellbeing (natural, economic, social, political), project planning, project implementation, local government programs.	Step-by-step guide to several monitoring tools: monitoring local poverty contexts through interactive mapping; monitoring household wellbeing through local indicators.	CIFOR (2007)
Political Processes and Institutions			
Learning to monitor political processes for fairness in Jambi, Indonesia	Political processes, elections, communication, transparency, social inclusion.	Village meetings, developing communication channels, joint analysis.	Kusumanto in Guijt (2007)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
Towards wellbeing in forest communities: A source book for local government (mentioned above)	Project planning, project implementation, local government programs, decision-making.	Step-by-step guide to monitoring tools: community evaluation of local government programs; communicating communities' needs through scenario-based planning.	CIFOR (2007)
Non-timber Forest Products (NTFPs)			
Equitable ecology: collaborative learning for local benefit in Amazonia	Fruit trees, fruit consumption, bushmeat consumption, timber harvesting, hunting.	Tree census, worksheets, workshops, participatory research, farmer exchanges, experimental fruit sales.	Shanley and Gaia (2002)
Improving forest beekeeping through monitoring in Chimaliro, Malawi	Number of hives, quantity of honey, income generated, handling of income and honey, theft of honey, illegal tree felling.	Force-field analysis, scenarios, patrols, village meetings, resource assessment, transect walks.	Kamoto in Guijt (2007)
Learning to manage a complex resource: A case of NTFP assessment in Nepal	NTFPs, ecosystem services.	Preliminary mapping, habitat mapping and area calculation, transect walk, determining diameter and clump size distribution, sampling and measurement of clumps, estimation of total clumps (by size class) and stems (by diameter class), projection of population, estimation of sustainable yield, prescribed harvesting techniques, discussion with FUG leaders, participatory mapping, stratification, sampling and plot lay out, measurement, analysis and feedback.	Ojha and Bhattarai (2003)
Steps to Sustainable and Community-based NTFP Management: A manual written with special reference to South & SE Asia	NTFP extraction and management.	Type of monitoring depends how much the product is at risk from over-harvesting. Methods include: harvest records, line transects, regeneration plots, access to existing records, household surveys, direct observation in the field, quantitative methods.	Stockdale (2005)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
Sharing Stewardship of the Harvest: Building capacity among low-income Non-Timber Forest Product harvesters	Social, cultural, and environmental dimensions of NTFPs harvesting in the US Pacific Northwest and related land management issues. Objectives are to integrate harvesters' knowledge, experience, and concerns into grassroots and institutional decision-making processes to improve sustainable management and living conditions for harvesters.	Multi-party field monitoring by harvesters and public officials including public campground meetings, and ongoing, focused reflection among project partners.	Bagby et al. (2003)
Traditional knowledge, forest management and certification: A reality check	NTFP sustainable management	Transects, forest walks, C&I, community-driven inventories.	Shanley and Stockdale (2008)
Ecosystem Services			
Community-based monitoring of fog capture and biodiversity at Loma Alta, Ecuador enhance social capital and institutional cooperation	Fog capture, ecosystem services, watershed services, biodiversity, changes in bird species and their distribution over time verifying improvement or deterioration of biodiversity.	Fog capture, mist nets and strip counts to monitor birds, Statview statistics and spreadsheet program.	Becker et al. (2005)

Publication Title	*Monitoring Topic*	*Methods and Tools*	*Citation*
Does monitoring matter? A quantitative assessment of management decisions from locally-based monitoring of protected areas	Biodiversity, ecosystem products and services.	Focus group discussions with volunteer 'community monitoring groups' of particularly knowledgeable forest product gatherers, hunters and fishers; systematic observations of wildlife and resource use during regular patrols (field diary method); fixed-point photography of selected hillsides; simplified line transect surveys.	Danielsen et al. (2005a)
Selling two environmental services: In-kind payments for bird habitat and watershed protection in Los Negros, Bolivia.	Dry season water flows in a forested watershed.	Stream flow velocity, water depth measurements, rainfall measurements.	Asquith et al. (2008)

References

Andrianadrasana, H..T., Randriamahefasoa, J., Durbin, J., Lewis, R..E., Ratsimbazafy, J.H. 2005. Participatory ecological monitoring of the Alaotra wetlands in Madagascar. Biodiversity and Conservation 4: 2757–2774.

Anil, C.N. 2004. Participatory 3 Dimensional Modeling for ecological monitoring in mountainous areas. ICIMOD/IFAD Partnership Programme.

Asquith, N.M., Vargas, M.T., Wunder, S. 2008. Selling two environmental services: In-kind payments for bird habitat and watershed protection in Los Negros, Bolivia. Ecological Economics. DOI:10.1016/j.ecolecon.2007.12.014

Bagby, K., Brown, B., Chapp, S., Hunter, J. 2003. Sharing stewardship of the harvest: Building capacity among low-income non-timber forest product harvesters. Pacific West Community Forestry Center, Taylorsville, California, USA.

Battarai, T. 2002. Process and methods for participatory M&E of biodiversity: A southern reconnaissance. Introduction to theme 3 of the PAMEB workshop: Processes, methods and tools. ETFRN Workshop on Participatory Monitoring and Evaluation of Biodiversity. Environmental Change Institute, University of Oxford, UK.

Becker, C.D., Agreda, A., Astudillo, E., Costantino, M., Torres, P. 2005. Community-based monitoring of fog capture and biodiversity at Loma Alta, Ecuador enhance social capital and institutional cooperation. Biodiversity and Conservation 14: 2695-2707.

Bennun, L., Matiku, P., Mulwa, R.., Mwangi, S., Buckley, P. 2005. Monitoring Important Bird Areas in Africa, towards a sustainable and scaleable system. Biodiversity and Conservation 14: 2575–2590.

Carter, J. 1996. Recent approaches to participatory forest resource assessment. Overseas Development Institute, London, UK.

Case, D.D. 1990. The community's toolbox: The idea, methods and tools for participatory assessment, monitoring and evaluation in community forestry. Food and Agriculture Organization of the United Nations, Rome, Italy.

Center for International Forestry Research (CIFOR). 2007. Towards wellbeing in forest communities: A source book for local governments. CIFOR, Bogor, Indonesia. 90 pp.

Colfer, C. 2005. The complex forest: Communities, uncertainty, and adaptive collaborative management. Resources for the Future, Washington D.C., USA.

Colfer, C.J.P., Prabhu, R., et al. 2005. From Scientific to Local C&I: An Account of CIFOR's Experience. UNESCO, Paris, France.

Cronkleton, P., Keating, R.E., Evans, K. 2007. Helping village stakeholders monitor forest benefits in Bolivia. *In* Negotiated learning: Collaborative monitoring in forest resource management. Guijt, I. (ed.). Resources for the Future, Washington DC, USA.

Cunha dos Santos, M. 2002. Adaptive collaborative management in Acre: A case study of the agroextractive project Porto Dias, Acre, Brazil. Gainesville, Florida, PESACRE/University of Florida/CIFOR. 65 pp.

Danielsen, F., Balete, D.S., Poussen, M.K., Enghoff, M., Nozawsa, C.M., Jensen, A.E. 2000. A simple system for monitoring biodiversity in protected areas of a developing country. Biodiversity and Conservation 9: 1671–1705.

Danielsen, F., Jensen, A.E., Alviola, P.A., Balete, D.S., Mendoza, M., Tagtag, A., Custodio, C., Enghoff, M. 2005a. Does monitoring matter? A quantitative assessment of management decisions from locally-based monitoring of protected areas. Biodiversity and Conservation 14: 2633–2652.

Danielsen, F., Burgess, N.D., Balmford, D. 2005b. Monitoring matters: Examining the potential of locally-based approaches. Biodiversity and Conservation 14: 2507-2542.

Estrella, M., Blauert, W.J., Campilan, D., Gaventa, J., Gonsalves, J., Guijt, I., Johnson D., Ricafort, R. (eds.) 2001. Learning from Change: Issues and Experiences in Participatory Monitoring and Evaluation. International Development Research Center, Canada.

Gaidet, N., Fritz, H.., Nyahma, C. 2003. A participatory counting method to monitor populations of large mammals in non-protected areas: a case study of bicycle counts in the Zambezi Valley, Zimbabwe. Biodiversity and Conservation 12: 1571–1585.

Gaidet-Drapier, N., Fritz, H., Bourgarel, M., Renaud, P., Poilecot, P., Chardonnet, P., Coid, C., Poulet, D., Le Bel, S. 2005. Cost and efficiency of large mammal census techniques: comparison of methods for a participatory approach in a communal area, Zimbabwe. Biodiversity and Conservation 5: 735–754.

Garcia, C.A., and Lescuyer, G. 2008. Monitoring, indicators and community based forest management in the tropics: pretexts or red herrings? Biodiversity and Conservation. Published online 9 February 2008.

Ghate, R., and Nagendra, H. 2005. Role of monitoring in institutional performance: Forest management in Maharashtra, India. Conservation and Society 3: 509-532.

Gibson, C., Williams, J.T., Ostrom, E. 2004. Local enforcement and better forests. World Development 33: 273-284.

Green, R.E., Balmford, A., Crane, P.R., Mace, G.M., Reynolds, J.D., Turner, R.K. 2005. A framework for improved monitoring of biodiversity: Response to the World Summit on Sustainable Development. Conservation Biology 19: 56-65.

Guijt, I. 1999. Participatory monitoring and evaluation for natural resource management and research. Socio-economic Methodologies for Natural Resources Research. Natural Resources Institute, Chatham, UK.

Guijt, I. (ed.) 2007. Negotiated learning: Collaborative monitoring in forest resources management. Resources For the Future, Washington, D.C., USA.

Hamilton, C., Rai, R.K., Shrestha, R.B., Maharian, M., Rasaily, L. and Hood, S. Exploring visions: Self-monitoring and evaluation processes within the Nepal-UK Community Forestry Project. 2001. *In* Learning from Change: Issues and Experiences in Participatory Monitoring and Evaluation. Estrella, M. (ed.). International Development Research Center, Canada.

Hartanto, H., Lorenzo, M.C.B., Frio, A.L. 2002. Collective action and learning in developing a local monitoring system.

International Forestry Review 4: 184-195.

Hoare, P. 2004. A process for community and government cooperation to reduce the forest fire and smoke problem in Thailand. Agriculture, Ecosystems and Environment 104: 35–46.

Kamoto, J. 2007. Improving forest beekeeping through monitoring in Chimaliro, Malawi. *In* Negotiated learning: Collaborative monitoring in forest resource management. Guijt, I. (ed.). Resources for the Future, Washington DC, USA.

Kusumanto, T. 2007. Learning to monitor political processes for fairness in Jambi, Indonesia. *In* Negotiated learning: Collaborative monitoring in forest resource management. Guijt, I. (ed.). Resources for the Future, Washington DC, USA.

Lawrence, A. (ed.) In press. Taking stock of nature: Participatory biodiversity assessment for policy planning and practice. University of Cambridge Press, Cambridge, UK.

Lawrence, A., Ambrose-Oji, B. 2001. Participatory assessment, monitoring and evaluation of biodiversity: The art and science. A background paper for the ETFRN Workshop on Participatory Monitoring and Evaluation of Biodiversity, 29 December 2001. Environmental Change Institute, University of Oxford, Oxford, UK.

Lawrence, A., and Elphick, M. (eds.) 2002. Policy implications of participatory biodiversity assessment – summary report. ETFRN. Policy seminar convened by the Environmental Change Institute. Environmental Change Institute, Oxford, UK.

Lawrence, A., Paudel, K., Barnes, R., Malla, Y. 2006. Adaptive value of participatory biodiversity monitoring in community forestry. Environmental Conservation 33: 325–334.

McDougall, C. 2001. Assessing the Sustainability of Community Managed Forests. IDRC Final Technical Report. CIFOR, Bogor, Indonesia.

McDougall, C., Khadka, C., Dangol, S. 2007. Using monitoring as leverage for equal opportunity in Nepal. *In* Negotiated learning: Collaborative monitoring in forest resource management. Guijt, I. (ed.). Resources for the Future, Washington DC, USA.

Mendoza, G.A., and Prabhu, R. 2005. Combining participatory modeling and multi-criteria analysis for community-based forest management. Forest Ecology and Management 207: 145–156.

Noss, A.J., Oetting, I., Leny Cuellar, R. 2005. Hunter self-monitoring by the Isoseno-Guaranı´ in the Bolivian Chaco. Biodiversity and Conservation 14: 2679–2693.

Ojha, H. and Bhattarai, B. 2003. Learning to manage a complex resource: a case of NTFP assessment in Nepal. International Forestry Review 5: 118-127.

Ojha, H., Paudel, K., Neupane, H. 2003. Biodiversity Assessment for Whom? Issues, Perspectives and Lessons from Community Forestry in Nepal. A Discussion Note. Forest Action, Kathmandu, Nepal.

Ojha, H., Pokharel, B., McDougall, C., Paudel, K. 2003. Learning to Govern: How to improve monitoring system in community forestry in Nepal? Journal of Forest and Livelihood 2: 23-34.

Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions

for Collective Action. Cambridge University Press, Cambridge, UK.

Paudel, K.P., and Ojha, H. 2007. Imposing indicators or co-creating meanings in Nepal. *In* Negotiated learning: Collaborative monitoring in forest resource management. Guijt, I. (ed.). Resources for the Future, Washington DC, USA.

Poulsen, M.K., and Luanglath, K. 2005. Projects come, projects go: lessons from participatory monitoring in southern Laos. Biodiversity and Conservation 14: 2591–2610.

Prabhu, R., Colfer, P.J.P., Dudley, R.G. 1999. Guidelines for developing, testing, and selecting criteria and indicators for sustainable forest management. The Criteria and Indicators Toolbox Series No. 1. CIFOR, Bogor, Indonesia.

Prabhu, R. 2003. Developing collaborative monitoring for adaptive co-management of tropical African forests (Contract Number: B7-6201/99-05/FOR). Final Report for the Period. January 1, 2000-December 31, 2002. CIFOR, Harare, Zimbabwe.

Purnomo, H., Mendoza, G.A., Prabhu, R. 2005. Analysis of local perspectives on sustainable forest management: an Indonesian case study. Journal of Environmental Management 74: 111–126.

Ritchie, B., McDougall, C., Haggith, M., Burford de Oliveira, N. 2000. Criteria and indicators of sustainability in community managed forest landscapes — An introductory guide. CIFOR, Bogor, Indonesia.

Roy, S.B. 2004. Participatory vegetation monitoring: Examples from West Bengal. *In* V. K. Bahuguna, K. Mitra, D. Capistrano and S. Saigal (Eds.), Root to Canopy: Regenerating Forests through Community-State Partnerships. Winrock International India/Commonwealth Forestry Association-India Chapter, New Delhi. Pp. 267-273.

Sekher, M. 2001. Organized participatory resource management: insights from community forestry practices in India. Forest Policy and Economics 3: 137-154.

Shanley, P. and Gaia, G.R. 2002. Equitable ecology: collaborative learning for local benefit in Amazonia. Agricultural Systems 73: 83–97.

Shanley, P. and Stockdale, M. 2008. Traditional knowledge, forest management, and certification: A reality check. Forests, Trees and Livelihoods 18: 55-68.

Sheil, D., and Lawrence, A. 2004. Tropical biologists, local people and conservation: new opportunities for collaboration. Trends in Ecology and Evolution 19: 634-638.

Sheil, D., Nasi, R., Johnson, B. 2004. Ecological criteria and indicators for tropical forest landscapes: challenges in the search for progress. Ecology and Society 9(1): 7 [online] URL: http://www.ecologyandsociety.org/vol9/iss1/art7/.

Steinmetz, R., Chutipong, W., Seuaturien, N. 2006. Collaborating to conserve large mammals in Southeast Asia. Conservation Biology 20: 1391–1401.

Stockdale, M. 2005. Steps to Sustainable and Community-based NTFP Management: a manual written with special reference to South & SE Asia. Quezon City, Philippines, NTFP Exchange Programme for South and Southeast Asia.

Stuart-Hill, G., Diggle, R., Munali, B., Tagg, J., Ward, D. 2005. The Event Book

System: a community-based natural resource monitoring system from Namibia. Biodiversity and Conservation 14: 2611–2631.

Tiani, A.M., Nguiébouri, J., Diaw, C. 2002. Criteria and indicators as tool for adaptive and collaborative forest management: A guide. Center for International Forestry Research, Yaoundé, Cameroon.

Topp-Jorgensen, E., Poulsen, M.K., Lund, J.F., Massao, J.F. 2005. Community-based monitoring of natural resource use and forest quality in montane forests and miombo woodlands of Tanzania. Biodiversity and Conservation 14: 2653–2677.

Van Rijsoort, J., and Jinfeng, Z. 2005. Participatory resource monitoring as a means for promoting social change in Yunnan, China. Biodiversity and Conservation 14: 2543–2573.

Whitelaw, G., Vaughan, H., Craig, V., Atkinson, D. 2003. Establishing the Canadian Community Monitoring Network. Environmental Monitoring and Assessment 88: 409–418.

Wollenberg, E., Edmunds, D., Buck, L. 2000. Anticipating change: Scenarios as a tool for adaptive forest management. CIFOR, Bogor, Indonesia.

Appendix A: Keywords searched

Adaptive management
Biodiversity
Conservation
Community-based monitoring
Community forest management
Community forestry
Conservation biodiversity local community
Conservation biodiversity management stakeholder
Conservation biodiversity people
Conservation local
Ecosystem
Ecotourism
Forest
Forest management
Forest monitoring
Forest monitoring biodiversity
Forest monitoring conservation
Forest monitoring local management
Forest monitoring stakeholder
Indicators
Local community
Local forest management
Local monitoring forest
Management
Monitoring
Non-timber forest products
Participatory
Participatory monitoring
Tools

Appendix B: Web sites searched

www.ifcae.org
www.atree.org
www.modelforest.net
www.eman-rese.ca
www.cbcrc.org
www.forestaction.org
www.fao.org
www.gccbfm.org
www.iisd.org
www.iucn.org
www.iufro.org
www.fecofun.org
www.sierrainstitute.us
www.mekonginfo.org
www.etfrn.org/etfrn/workshop/biodiversity/documents.html
www.idrc.ca
www.ntfp.org
www.recoftc.org
www.dfid.gov.uk
srdis.ciesin.org
cifor.cgiar.org
www.fosonline.org
www.catie.ac.cr
www.forest-trends.org
www.rff.org
www.rightsandresources.org

The Center for International Forestry Research (CIFOR)
CIFOR is a leading international forestry research organization established in 1993 in response to global concerns about the social, environmental, and economic consequences of forest loss and degradation. CIFOR advances human well-being, environmental conservation, and equity by conducting research to inform policies and practices that affect forests in developing countries. CIFOR is one of 15 centres within the Consultative Group on International Agricultural Research (CGIAR). CIFOR's headquarters are in Bogor, Indonesia. It also has offices in Brazil, Bolivia, Burkina Faso, Cameroon, Ethiopia, Vietnam, Zambia and Zimbabwe, and works in over 30 other countries around the world.

Donors
CIFOR receives its major funding from governments, international organizations, private foundations and regional organizations. In 2007, CIFOR received financial support from African Forestry Research Network (AFORNET), Aristotle University of Thessaloniki, Association Intercooperation Madagascar (AIM), Australia, Australian Agency for International Development (AusAID), Binnacle Family Foundation, Brazil, Canada, Charles Stewart Mott Foundation, China, Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), Cordaid, Conservation International Foundation (CIF), Denmark, European Commission, Finland, Food and Agriculture Organization of the United Nations (FAO), Federal Office for the Environment (FOEN), Ford Foundation, France, German Agency for Technical Cooperation (GTZ), German Federal Ministry for Economic Cooperation and Development (BMZ), Indonesia, Innovative Resource Management (IRM), International Institute for Environment and Development (IIED), International Development Research Centre (IDRC), International Fund for Agricultural Development (IFAD), International Tropical Timber Organization (ITTO), Italy, the World Conservation Union (IUCN), Japan, Japan International Research Center for Agricultural Sciences (JIRCAS), Korea, MacArthur Foundation, Netherlands, Norway, Overseas Development Institute (ODI), David and Lucile Packard Foundation, Peruvian Secretariat for International Cooperation (RSCI), Philippines, Spain, Sweden, Swedish University of Agricultural Sciences (SLU), Swedish International Biodiversity Programme (SwedBio), Switzerland, Swiss Agency for Environment, Forests and Landscape, The Tinker Foundation Incorporated, Tropenbos International, Tropical Forest Foundation (TFF), United States, United States Forest Service (USFS), United Kingdom, United Nations Environment Programme (UNEP), United Nations Forum on Forests (UNFF), United Nations Institute for Training and Research (UNITAR), Virginia Polytechnic Institute, Wageningen International, Wildlife Conservation Society (WCS), World Bank, World Resources Institute (WRI) and World Wide Fund for Nature (WWF).

In the past decade, understanding of the importance and role of monitoring in tropical forest management has changed significantly. Monitoring is no longer the exclusive purview of forest managers and scientists. Now local people are working with professionals to develop and implement programs together. This collaboration changes the dynamic of forest management, with monitoring assuming a central role by encouraging local people to ask questions about their forest and their forest-based livelihoods, think about change in a systematic way and respond with reasoned decision-making. Participatory monitoring becomes a mechanism that drives learning, adaptation and improvement—essential elements for sustainably managing tropical forests.

There are now documented cases of participatory monitoring programs in tropical forests throughout the world. This book reviews recent experiences in participatory monitoring in tropical forest management and summarizes the concepts and lessons learned. It discusses impacts, challenges, and shortcomings of participatory monitoring and presents a matrix of case studies, methods and tools as a quick reference guide. Finally it provides recommendations for future directions in participatory monitoring.

CIFOR
CENTER FOR INTERNATIONAL FORESTRY RESEARCH

DEZA
DDC
DSC
SDC
COSUDE