FORESTRY, FOREST USERS AND RESEARCH:
NEW WAYS OF LEARNING

Forestry, forest users and research: new ways of learning. Anna Lawrence (ed.). – Wageningen: ETFRN – European Tropical Forest Research Network. ETFRN Series No. 1. The publication is based on the workshop entitled ”Learning from Resource Users - a Paradigm Shift in Tropical Forestry ”, which was held 28 - 29 April 2000 in Vienna, Austria.
ISBN 3-9501392-0-6
ISSN 1567-4762
Subject headings: Tropical Forestry, Participatory Forest Management, Indigenous Knowledge.

Cover design	:	Loeve & Witmajer bNO, Arnhem, The Netherlands
Printed by	:	Riegelnik, 1080 Wien
Distribution	:	ANN ETFRN, Institute of Forest Ecology, University of Agricultural Sciences, Peter Jordanstraße 82, A-1190 Vienna ETFRN - Coordination Unit, c/o The Tropenbos Foundation, P.O. Box 232, 6700 AE Wageningen, The Netherlands

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ETFRN
European Tropical Forest Research Network
Wageningen, The Netherlands
2000

bm:bwk

The workshop in Vienna (28-29 April 2000) and the workshop proceedings were sponsored by the European Tropical Forest Research Network; the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management; the Austrian Federal Ministry of Education, Science and Culture; the Autrian Network for Environmental Research; and the University of Agricultural Sciences (BOKU).

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FORESTRY, FOREST USERS AND RESEARCH: NEW WAYS OF LEARNING

Anna Lawrence

Forests and their management are the subject of intense public and political attention, requiring foresters to adapt to changing social and environmental expectations. This book examines ways in which local knowledge, and new ways of creating and sharing knowledge, contribute to this adaptation.

The European Tropical Forestry Research Network links researchers and practitioners to facilitate research related to forests, trees and people. In April 2000 it brought together members from 15 countries, to participate in a workshop entitled 'Learning from resource users: a paradigm shift in tropical forestry?' and examine the implications of recent experience involving local knowledge in forestry. The debate looked at both studies of local knowledge, and ways of creating new knowledge. This book is the result of that debate; most of the chapters began life as papers at the workshop while others have been added to create a book which illustrates the diversity and innovativeness of research with forest users, and which we hope will stimulate reflection on the future of forestry research. It is principally a book for researchers, but we believe it will also be valuable to forestry and development practitioners, to research funders, development donors and policy makers.

This introductory chapter guides the reader through a summary of the chapters, and a discussion of key themes emerging from these contributions. The introduction concludes with recommendations which we hope will inform policy and funding decisions, research directions and the role of participatory learning processes in forestry practice.

INTRODUCING THE CONTENT OF THIS BOOK

The book is divided into four sections: overviews; learning from experience; academic research; and discussion. This arrangement helps to group the perspectives of the authors. In section 1, authors analyse the role of local knowledge in forestry, while the next two sections present case studies. Practitioners reflect on innovative learning processes in section 2, and more formal, theory-informed research is presented in section 3. Finally, section 4 summarises the workshop discussions and recommendations.

In the overview section, Wiersum begins with a chapter which considers whether the changes in forestry, to incorporate indigenous knowledge, consist of profound philosophical shifts which might be construed as a paradigm change, or whether the changes are more gradual and adaptive. He sets out three different perspectives which foresters may have, in deciding to incorporate indigenous knowledge, and relates these different objectives to their implications for change. Hence indigenous knowledge contributes to the *adaptation* or *diversification* of forestry through the incorporation of new empirical information, for those who simply want to manage forests to maintain the resources for human benefit; or *institutional change* when forestry accepts the organisational differences in indigenous management.

Only when indigenous perspectives are incorporated in order to transfer decision-making power, can the changes be considered more than adaptive, and represent a real *paradigm change*.

Recognition that approaches to local knowledge and practice depend on individual perspectives is a good starting point for reading the next two chapters. Michon, and Sinclair and Joshi, draw on their own experience and the literature to discuss ways of consolidating the work that has been done in researching local knowledge, and seeking general patterns or theories. Michon is concerned with the way in which such studies have led to the accumulation of lists of practices or useful plants, but have not yet enhance our understanding of the context for such uses. She argues that researchers must go beyond the utilitarian, and seek to understand and synthesise the social and symbolic aspects of knowledge (including access to, and control of, resources; and the role of ritual), as well as the political constraints within which knowledge is applied. This calls for a broader range of tools to be used by researchers, and a recognition by foresters of the value of anthropology. Sinclair and Joshi's chapter takes a different, pragmatic view, explicitly supporting the value of focusing on utilitarian knowledge, and recognising the difficulties of holistic understanding of the whole world view of local forest users; instead, they argue, we should focus more realistically on partial sets of knowledge, relevant to a defined problem. Their exposition of logic-based methods to collect, analyse and compare knowledge enables them to begin to make generalisations about the kinds of knowledge tree users have in different cultures, and how this complements scientific knowledge. Their approach is a practical one, aiming to make local knowledge research as useful as possible in refining research and extension processes.

The last chapter in the overview section, by Lawrence and Green, reports on a survey of research priorities for participatory forest management. Comparing forest users, managers, researchers and policy-makers in six countries, the study highlights a different way in which researchers can learn from the resource user – by understanding their perspectives on how outsiders can contribute to improved management. The chapter shows just how much demand for improved communication there is. Forest users and managers want research to be more relevant and applied, and want to be able to learn more about others' experiences and decision-making processes. All of these if incorporated into research strategies could contribute to the real integration of different types of knowledge and efficiency of its application, advocated by the previous authors. But what the study also indicates, is the widely perceived need for more participatory approaches to research; in forestry these are still relatively scarce, but several are illustrated in the following section, 'Learning from Experience'.

The section begins with a particularly clear and frank chapter by Muraille, which documents a case study in Laos where foresters dramatically changed their approach to joint forest management, by recognising mistakes and learning from local people's response. She shows how difficult it is to plan the involvement of local people in forest management using models which have been successful elsewhere, and how important it is to create opportunities to change direction based on analysis of early experience. It is highly unusual for a donor-funded development project to document a learning process in this way and the chapter provides important lessons.

Muraille concludes that 'learning-by-doing' is essential; without trying new ideas in practice, it would be difficult to understand their impact – but beyond that we need to learn from and adapt the practice to improve it.

The second chapter in this section, by Basha, Omar, Ely, Fakih and Wild, provides another case study where outsiders have attempted to introduce more participatory methods in forest resource management. The chapter is a valuable documentation of the foresters' experiences, and their reflections on the challenges and rewards of engaging the community. Like Muraille, they found that there are political and institutional implications of such work, and it is not only the community which will change by such learning processes. Both Basha *et al*., and Muraille, comment on the enhanced trust which can result between government institutions and forest-dependent communities, as a result of such research.

Learning-by-doing is a phrase used throughout the next two chapters, focusing on experiences of *research* with forest users in Nepal. The chapter by Branney, Malla and Neupane is another highly unusual case– probably the first documented experiments in forest management and silviculture to be conducted in collaboration with forest users. Branney and his colleagues are really at the frontiers of research methodology here, and provide us with a valuable description of participatory research (so often confused with participatory rural appraisal, or PRA). The methodological challenges are greatest for the researcher, who will have to adopt new approaches if he or she is to help develop site-specific technological or social solutions to forest management. If forest users can participate in such research, where problems are identified and solutions tested together, there may be real scope for the type of *empowering* integration of local and scientific knowledge indicated by Wiersum. The next chapter, by Dahal, Gibbon, Kafle and Subedi, describes similar kinds of research, but takes a step back and looks at the political context, recognising the power differences between outsiders (researchers) and insiders (local forest users), and between them and policy-makers. They consider important questions about the role of the researcher, concluding that 'The challenge for researchers to convince donor agencies and research fund managers of the importance of developing local ownership of a research process will, we suspect in future, be as important as the manner in which research is carried out.'

The last two chapters in this section, return to the question of differences between local and scientific knowledge. Both authors reflect on personal experiences to highlight aspects of local knowledge which outsiders tend to overlook, and ways to approach these differences. Lettmayer deliberately uses the word 'foreign' to describe non-scientific knowledge, to emphasise the attitudes of those who use it in what can be seen as unethical ways. For learning to be sustainable, she advocates greater respect for the holistic context of indigenous knowledge and revised roles for researchers in moving away from treating indigenous people as the 'objects' of research. Singhal deals with a different aspect of the power gap, by making explicit some of the reasons for poor adaptive learning between scientists and local resource users in the Indian context; her plea is for improved documentation, communication and adaptation between the two types of knowledge system.

The last group of chapters consists of studies by outsiders, where academic methods and processes have been applied from a range of disciplines, to improve our under-

standing of forestry issues through information obtained from local resource users. These three studies are much more than explorations of 'indigenous knowledge'; they highlight local knowledge, practice, perceptions, beliefs, regulations and responses to policy, all different types of information which outsiders can learn and apply. What is particularly interesting about this section is the range of methodological traditions drawn on, and the types of findings which raise questions about generalisability and the relevance of research in the development process.

The first chapter in this section, by Wall and Wells, is a study of timber supply and regulation in Tanzania. The authors are economists specialising in the construction industry, and they present a detailed description of their approach to the challenges of conducting research into such a complex system where no single actor has an overview of what is happening, where there is great heterogeneity and differences of power among the actors and where some of the activity is illegal (a common problem in social forestry research). The benefits of grounded theory, where theories are allowed to develop while data is being collected, are particularly suitable for outsiders in such a system; but at the same time the authors discuss and defend the role of outsiders in conducting such research, convincingly arguing that there is a need for researchers trained in analytical skills. The focus on developing theories allows them to attempt broad conclusions with national implications.

The other two chapters in this section also have implications for national and donor policy. Gram's chapter, based on sociological methods used to document case studies of project experience in Latin America, seeks to question generalisations based on experience imported from other cultures. His work with indigenous people in Bolivia, Peru and Mexico strongly suggests that organisational issues around sustainable timber management projects need to be revisited, that models developed in South Asia and elsewhere relate to community structures which indigenous people in Latin America find inappropriate and threatening to their culture. Instead he advocates more participatory approaches which involve the forest users in planning a project structure more suitable to their own culture. The last chapter in the academic section, by Schmidt-Vogt, presents a detailed ecological study from northern Thailand showing the value of indigenous knowledge and practice which is being lost under the pressure of economic change. His findings suggest that indigenous forest management systems might contribute more to biodiversity and sustainability than the newer cash-cropping systems, and support the need for new community forestry legislation.

The final section of the book summarises the discussions at the workshop. The workshop brought together researchers and practitioners from a wide range of backgrounds, each with strong learning experiences to share with others. The range of methods and conclusions provided an opportunity for all of us to look for the common themes, challenge our own preconceptions and highlight priorities for future directions in forestry research. The workshop was a catalyst; it did not provide all the answers, but helped us to think in new ways about studying indigenous knowledge, making the learning process more empowering, and revising the role of the forestry researcher. Above all we felt that the challenge for foresters is to learn *with* the resource user, whether or not we manage to integrate the different kinds of knowledge.

DISCUSSION: FORESTRY AND LOCAL KNOWLEDGE

In participatory development change is brought about through new knowledge, which is treated not merely as a product to help decision-makers, but as a process of empowerment where local communities take over their own development. This has two important implications for researchers: development can involve the creation of knowledge; but conversely research where the learning processes are only one-way can reinforce power structures which block participatory development. This discussion looks at how the research and learning approaches presented in this book can affect that process. But first, we need to take into account the changes in forestry and the people involved in forestry, reflected in the contributions to this book.

Forestry and the resource users

Historically, the discipline of forestry lies somewhat uncertainly between an applied science, and an administrative system, in which foresters have from time to time been characterised as policemen whose main role is to keep out illegitimate forest users. Increasingly the technical content has shifted however, from science to social science, and foresters need to involve local users in the management of those resources. Many of the chapters reflect on this shift in focus, and the diversification of forestry. Wiersum, and Michon discuss the historical development of forestry, highlighting the traditional 'separateness' of forests from other natural resources, in the eyes of foresters.

Muraille's experience in Laos echoes this as she reports how villagers' views contrasted explicitly with those of foresters, by seeing forests as just one component of their natural resource system. Other authors reflect diversification of the forestry resource: Sinclair and Joshi, and Lawrence and Green, emphasise wider perceptions that forestry must relate to trees on farms, and farmers as the resource managers, as well as the more traditional forests and plantations, while Schmidt-Vogt notes the shift of attention to secondary forests, and fallow systems.

It is not only the objectives and resources of forestry that are seen in their variety here. This book is about learning processes which involve the resource users. While there is understandably a focus on the rural poor, and often specifically on indigenous peoples living in or near the forest, the chapters reveal the involvement of a complex range of actors. As well as gender-related aspects of resource use, foresters have to take account of ethnic and other social diversity. The majority of forest users now are likely to have moved from elsewhere. The resource users are likely to include women, men, indigenous people, colonisers, the landless, farmers, and shifting cultivators. They may be using resources for subsistence, or to sell; indirect users continue up the market chain (see Wall and Wells), and include not only locals, but 'outsiders': loggers, beneficiaries of the watershed, and the 'public'. Consequently roles can be reversed: resource users may be outsiders, and researchers may be insiders (see Dahal *et al*).

Researching local knowledge in forestry

Research into indigenous and local knowledge has already provided a rich harvest of documentation, and our concern here is more particularly with the debates arising as forestry becomes more diverse and more inclusive.

The idea of 'local knowledge' embraces many definitions, and the contributors include between them local technical knowledge; cultural beliefs and values; local customs and laws; decision-making systems; perceptions of the law, of institutions and of project objectives; and resource management practices. All of these can lead to improved understanding of practices as a result of beliefs, knowledge systems, and perceptions, as well as reasons for success or failure of project interventions. Such understanding can enhance opportunities to work together.

Forests and trees have cultural significance for many, and in this context it is difficult to limit the discussion to technical knowledge. It is here that some of the strongest philosophical differences are expressed by contributors. Sinclair and Joshi advocate a focus on utilitarian knowledge while others are concerned that this cannot be separated from a more holistic context and world view of indigenous people (see Lettmayer, and Michon). The differences are not irreconcilable however; all three chapters debate ways of studying and analysing local knowledge at a remove from the creators of that knowledge. All three contrast with those who regard it as impossible to make knowledge explicit, and instead work with the *results* of knowledge – the more observable practices of local people (contributors who implicitly research at this level include Basha *et al.*, and Schmidt-Vogt). We come back to the question of *why* we are conducting the research and what is the best way to do it. A pragmatic conclusion is that if we study local knowledge, we should do so not because it is a true representation of the world (any more than scientific knowledge is so) but rather as a means to understanding the perceptions and actions of the people who have that knowledge.

New methods for tropical forestry research

A study by the International Centre for Forestry Research (Nair *et al.*, 1995) concluded that much forestry research was wasted because it was irrelevant, excluded people and their knowledge, and treated trees as an isolated system, with poor communication of research results. As forestry moves to become more local, and more empowering, it is the methods rather than the data which will be most sought after. As Lawrence and Green conclude, the need for technical, social and institutional solutions to be developed locally, implies a need both for action research and for sharing of experience across current disciplinary and cultural borders, to broaden options for researchers and facilitators.

The range of methods is enormous. Between them, the contributors include anthropological approaches (open interviews, participant observation); grounded theory; experiments; inventory and ethnobotanical surveys; comparative case studies; sample surveys and semi-structured interviews; learning-by-doing, participatory action research, participatory monitoring and evaluation, and participatory rural appraisal (PRA); formal representation and computer-assisted analysis of partial knowledge-based systems; *post hoc* reflection and documentation of experience, and literature reviews.

Amongst this diversity, one group of chapters refers again and again to the same kind of methods: authors in section 2 focus on participatory action research, participatory monitoring and evaluation, and 'learning by doing', as well as reflection and documentation of experience by participants.

The contributions highlight the new currency of the term 'learning-by-doing', but also warn us against casual over-use of the phrase; Branney *et al.*, and Dahal *et al.*, explain in detail the careful steps of the cycle which are needed to ensure that participants can learn most effectively from their experience.

It is salutary to see the range of learning-by-doing approaches. Participatory research (whether 'action research', participatory technology development or participatory monitoring and evaluation) has moved faster in agriculture than in forestry for several reasons: forests are a 'public' or multipurpose resource; trees are slower growing and take longer to research; the culture of forestry has tended to separate forests and people; and complex systems are in general more difficult to research than single components such as crop varieties, or trials of multi-purpose tree species. The challenges for participatory research in forestry are particularly demanding and exciting because we are dealing with a contested, multi-owner, multi-purpose resource.

Complementing the participatory approaches, specialist training and roles for analysts allow them to reach a depth of understanding which may not be possible using more rapid or participatory approaches. The three chapters included in the 'academic' section of this book all have important implications for policy, and all required methods and understanding specific to certain academic research field (sociology, economics, ecology). Wall and Wells explicitly address the limitations to analysis with local people, who have much more restricted access to information than outside researchers, and consequently may be inhibited in attributing causality.

Consolidating the changes

To build on the changes in forestry and research, the contributors show that it is now a priority to generalise, integrate and institutionalise the approaches they describe. We can think of knowledge and learning in participatory forestry as having three roles: knowledge for local use (e.g. through action research); knowledge for cross-learning (where one group learns from the experience of another); and knowledge for meta-analysis (where reflection and analysis of a range of experience lead to better understanding of the principles of using local knowledge in forest management, and hence to improved predictions about what will work). All of these levels of learning can focus on the methods, or on the content. While methods are more generalisable than content, there are general patterns which can be detected in the kind of knowledge people have.

There is another side to the call for generalisation however. As noted by Lawrence and Green, much of the development in participatory forest management has taken place in Nepal and India. The different cultural, ecological and political contexts found elsewhere may require different ways of working, and contributors to this volume highlight some of the dangers of assuming that processes and techniques which work there, will work elsewhere (see especially Muraille, and Gram).

The discussion chapter highlights a general call from contributors for integration of local and scientific knowledge, but there is also a recognition that before we can formally do this, much more research is needed. The question of integration brings us back to the debate about the need to explicitly represent local knowledge (see Sinclair and Joshi,

and Michon; as well as the constraints identified by Singhal). Documentation of local knowledge brings its own questions of representation, ownership and access, and there is as yet no consensus on the need for, or means to, 'integrate' indigenous knowledge and scientific knowledge, partly because it is not clear that this dichotomy exists; and partly because both kinds of knowledge are evolving and adapting – and to some extent implicitly integrating elements from each other.

Change in research practice begins with individuals, and *ad hoc* exchange between different disciplines, but for sustainable change to take place, the new approaches to learning need to be formally incorporated into institutions. There are three promising routes based on the methodologies reviewed above: participatory monitoring and evaluation as a tool for institutional change (Branney *et al.*; Dahal *et al.*); the involvement of senior staff, government foresters and others who are usually 'outsiders' in research (Muraille; Basha *et al.*); and effective dissemination.

But changing roles for forestry researchers also need to be recognised within those institutions. The contributors to this book share a strong sense of our responsibility as researchers, and recognition that this responsibility is particularly complex in research involving local resource users. As Wiersum points out, the objectives of the forester will depend on his or her values, which affect the choice between 'maintaining forests' and 'working towards equality'. Clearly the role of the researcher is changing, from one who experiments and analyses results on behalf of others, to one who facilitates learning with others, and can be seen as an intermediary, in a position to communicate research needs and results to those who can use them or respond to them by facilitating or enabling change.

All of this will require changes in funding for research. Some contributors highlight the constraints of the academic research culture (see especially Wall and Wells; and Dahal *et al.*). Funders want short time-frames, and widely applicable results. In the context of research with resource users, this can most effectively be achieved through a focus on learning *methods* (see Branney *et al*.) or on analysis of general principles and patterns in local knowledge (e.g. Sinclair and Joshi, and Wiersum). Other more location-specific learning processes may be better carried out in the context of development funding (e.g. Basha *et al*.).

CONCLUSIONS AND RECOMMENDATIONS

The boundaries of forestry are changing, perhaps even disappearing. This book shows in particular three ways in which this is happening. First, forestry is coming out of isolation; it is not only becoming a multidisciplinary sector, it is also accepting the legitimate participation of a much wider range of actors than before, both directly as resource users, and indirectly as having an interest in the fate or impact of forest management. Secondly, forestry is moving beyond the physical boundaries of forest and plantation, into more 'messy' systems which include on-farm trees and secondary regrowth. Finally, and most significantly for this book with its focus on research, as forests and trees are recognised to be key resources at the heart of (participatory) rural development, the boundaries between research and practice, between user, manager and professional researcher are dissolving.

What are the implications for researchers, practitioners and policy makers? The evidence of this book supports a broader conceptualisation of research, and a re-examination of the role of professional researchers in learning processes which lead to development. This is especially the case where research is taking place in situations of greatly unequal access to power, as is often the case with tropical forest resources. The work presented here is only a sampler, but the debate generated among participants at the workshop gives strength to the group's conclusions, and also highlights areas where more work, or analysis, is needed. Because of the wide reach of the ETFRN, and the diversity of participants in the workshop, it is more valid to make recommendations about research *approaches* than to specify location-specific *topics*, although the latter will follow as a response on the ETFRN website (htttp://www.etfrn.org/etfrn/).

The following recommendations are based on a synthesis of the discussions and conclusions of all contributors.

For **researchers:**

1. Research in areas with unequal power relations (either locally or internationally) places an ethical obligation on the researcher to ensure that the process is beneficial to the marginalised, who are often the forest users; this means that such research must respond to needs identified locally, and contribute to knowledge which is useful to those resource users, otherwise the research itself will be reinforcing such marginalisation.
2. Participatory research methods are under-utilised in forestry, and research involving local knowledge can still be extractive without clear feedback to, and analysis by, the communities involved. Consequently researchers should be aware of the methods, impact and relevance of participatory research, or (less formally) learning-by-doing. This is much more than a participatory *diagnosis* or *appraisal* (such as is often achieved through PRA), and involves joint and structured planning, implementation of change and reflection on that change.
3. In so doing, researchers can strengthen local research capacity so that resource users can initiate and use future research results.
4. Clearly many practitioners (and researchers) are still struggling to develop methods, and researchers should focus especially on developing, documenting and disseminating methodology for research and (especially) analysis which can be carried out with resource users. There is an urgent need to consolidate methodological lessons and make available methodological guidelines for joint learning in community forestry. These need to be adapted and tested in different cultures. Such guidelines must pay attention to the *analysis* of information collected from or with resource users, as this is the area which still appears to cause most uncertainty. They will also help to make 'learning-by-doing' respected, in terms of methodological rigour and transparency of process.
5. There is a need to consolidate the evidence presented here, especially in terms of local criteria, and research should be initiated to conduct participatory impact assessment of research involving local people.
6. To complement such location-specific research, there is clearly a role for academic or conceptual research, and especially a need for research which helps to integrate the lessons from existing studies of local knowledge and

research, and indicates what can be generalised and which factors affect variation between different cultures and contexts.

7. The overview of actors in tropical forestry suggests a need for more research into the knowledge, perceptions and decisions of *non-indigenous* people, who have generally been regarded as less attractive research topics than their *indigenous* counterparts.
8. The potential for *technical* research with resource users has been neglected, and the evidence here shows a lack of locally adapted silviculture and resource management practices; development of such methods with local resource users is a priority for ecologically and socially sustainable forest management.
9. All researchers should define clearly how the results will be made available to, and taken up by, both resource users and those in a position to use the results to improve the enabling environment for local resource users.
10. The value of the researcher's role as 'outsider' can be enhanced by turning it into that of 'intermediary'; this requires them to take the opportunity to disseminate research results to policy makers and implementers, or better still, create a constituency for such results by working closely with policy makers to keep them informed of such research from the beginning.

For **forest managers and development practitioners,** the contributions to this book suggest:

1. Incorporation of participatory action research into forest management activities. This does not imply that management is confused with conventional research activities, but rather that opportunities for learning can be consolidated through cycles of planning, implementing and evaluating change, together with key actors in the forest management process.
2. Focus on developing, documenting and disseminating methods, as these are most transferable and empowering, in particular through networking with researchers about methods.
3. With all research or data collection, provide opportunities for feedback, analysis and action by forest users and relevant local organisations.
4. Link with policy makers and government institutions, not only in forest departments but across a range of relevant sectors including agriculture, as well as with the public, to promote the understanding of forestry as a multidisciplinary and participatory field.

For **forestry educators**, the discussion in particular highlights the need to incorporate social and policy issues into training curricula for foresters, and to both use and teach participatory learning methods in such training.

Finally, the book has implications for **policy makers and donors**. Amongst these the following are highlighted repeatedly:

1. The experience of many contributors is that donors are directive, and have little appreciation of the benefits of allowing forest users and local institutions to influence the research process. However, collaborative or participatory research can enhance trust between government agencies and communities; it also helps to ensure the topics addressed are relevant to the communities involved, and results are likely to be used.

2. Participatory learning leads to ownership of new relevant knowledge, and is part of an empowering development process. Consequently, research and development are closely linked; in forest related issues particularly, participatory learning approaches can help with conflict management, institutional development, silvicultural management and monitoring sustainability. Donors and government institutions may therefore need to be less rigid in separating research, extension and management functions.
3. Donors need to be aware of the time needed to establish participatory research processes, and the reasons for their effectiveness, which are closely linked to the direct involvement of so-called beneficiaries; consequently that results cannot simply be transferred between communities, but groups of resource users must be supported to develop solutions based on their own knowledge and experience.
4. Donors should also be aware of the difficulties of transferring 'successful' research or development projects from one area to another, and the importance of local knowledge, values and organisational practice, in shaping successful forest management; conversely, the evidence here highlights the greater transferability of appropriate methods.
5. Priority areas for research are highlighted under the recommendations for researchers; these require support for research on methodologies, analysis of local forest management knowledge and practice, and participatory technical research.
6. Furthermore, research priorities need to be established locally, in the countries in question and where possible with the participation of representatives of forest users.
7. Donors should support, and demand, greatly improved dissemination and uptake of results, and in particular support learning opportunities between researchers and practitioners, and between forest users, e.g. through workshops and networks. These need to bring together actors both locally, and between regions, to optimise communication and learning.

ACKNOWLEDGEMENTS

I would like to acknowledge Julia Rötzer's initiative in organising the workshop, and thank her, Willemine Brinkman and Birgit Habermann for their enthusiastic support for this book. Many thanks also to ETFRN, the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, the Austrian Federal Ministry of Education, Science and Culture, and the University of Agricultural Sciences Vienna for sponsoring the workshop in Vienna and the publication, and to Prof. Gerhard Glatzel and the members of the Institute of Forest Ecology, where ANN-ETFRN is based, for the organisation of the workshop and making it possible for the publication to be formatted at the Institute. I also thank the following colleagues, who have all contributed to the creation of this book, through reviews, comments and suggestions: Mike Arnold, Sasha Barrow, Jonathan Davis, Keith Fisher, Jane Gronow, Isla Grundy, Duncan Macqueen, Yam Malla, Anna Malos, Berenice Muraille, Pat Norrish, Alan Pottinger, Michael Richards, Fergus Sinclair, Michael Victor, and Freerk Wiersum. None of them is however responsible for the views and results presented here, which are those of the authors and editor.

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