Managing Natural Resources for Sustainable Livelihoods

Uniting Science and Participation

Edited by
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List of Contributors

Jacqueline Ashby is a development sociologist by training and her work is focused on action research to promote organizational change and innovation in natural resource management and food systems, both global and local. She recently took on new responsibilities as Director of the Rural Innovation Institute at the International Center for Tropical Agriculture (CIAT) having been, since 1996, Director of Research, Natural Resource Management, and Coordinator for the CGIAR System-wide Program on Participatory Research and Gender Analysis.

Ann Braun is an ecologist by training and has worked in basic and applied agricultural and environmental research and also as a developer of participatory research methods. After two decades with the CGIAR in Asia and Latin America, she now lives in New Zealand's South Island and works as an independent consultant. Her current focus is on creation and support of learning communities to promote social, environmental and economic sustainability. Her interests include mentoring in participatory and user-sensitive approaches to research, education and development, systematization of learning processes, distillation of lessons learned, and promotion of ecological literacy.

K L Heong is a senior scientist at the International Rice Research Institute (IRRI) based in the Philippines. He is an insect ecologist by training, having graduated from the Imperial College at Silwood Park, from which he recently received his DSc. Before joining IRRI, KL worked in the Malaysian Agricultural Research and Development Institute as the rice entomologist. At IRRI his work has focused on community ecology and he has established that insecticides in rice ecosystems do more harm than good, because they disrupt food web linkages and natural biological control mechanisms, favouring the development of secondary pests, such as the brown plant hopper. In his effort to reduce farmers' unnecessary use of insecticides, he applied social psychology frameworks and developed 'heuristics' to motivate farmers to experiment with them. Working with communication scientists and extension workers in Vietnam, he initiated the use of media to scale up farmer motivation, reaching about a million farmers in the Mekong Delta. Farmers' insecticide use was reduced by 50 per cent with no yield loss and he was awarded the Medal for Agricultural Development by the Vietnamese government and won the St Andrews Prize for Environment for this achievement. His interests include using decision sciences for research on resource management decision-making, developing multi-stakeholder participatory processes and the use of Entertainment Education to motivate change.

Cynthia McDougall pursues positive change in the areas of social justice and environmental sustainability through a combination of social science and popular education approaches. Originally trained in political science, comparative development and geography, she has been a part of the Criteria and Indicators for Sustainable Forest Management and the Adaptive and Collaborative Management Research Project teams at the Center for International Forestry Research (CIFOR) in Indonesia for the last five years. Her work there has been primarily focused on strategies for enhancing social learning and equity in community forest user groups in Nepal, as well as contributing to comparative work in other communities in Asia, Africa and Latin America. She has also been involved in participatory research and participatory action research methodology development, with an emphasis on gender and diversity.

Adrienne Martin is a specialist in social and institutional development with over 25 years of experience of development work with a focus on the interaction between people and natural resources. She has worked with a range of organizations, including national, international, governmental and non-governmental organizations. Since 1990 she has been based at the Natural Resources Institute (NRI), University of Greenwich, Chatham, UK, and currently leads the Livelihoods and Institutions Group. She has long-term overseas experience in Sudan where she worked on rural development issues in western Sudan, and in Syria with the farming systems programme at the International Center for Agricultural Research in the Dry Areas (ICARDA). She has extensive professional experience in Africa having undertaken research, consultancy, training and publication on the themes of participatory research, local knowledge (in Uganda and Tanzania) and livelihoods analysis (in Ghana, Uganda and India). Her current interests are in agricultural policy and the institutionalization of client-oriented approaches within national agricultural research and extension systems, rural and urban livelihoods and the role of social capital.

Barry Pound started his career as an agronomist, but has steadily broadened his scope to include farming systems and sustainable livelihoods. He has worked long term on agricultural research and development projects in Tanzania, Nigeria, Dominican Republic, Yemen and Nepal. For the last ten years he has been with the Natural Resources Institute (NRI), University of Greenwich, Chatham, UK, from where he has led, or contributed to, a wide range of research, development and training initiatives in Africa, Asia, Latin America and Europe for multilateral, bilateral and non-governmental organizations. Particular interests of his are the application of participatory approaches, and most recently research into the implementation of farmer-led extension approaches.

Dianne Rocheleau has conducted field research on the social and ecological dimensions of land use change, watersheds, agroforestry and biodiversity for over 25 years, in Kenya, Dominican Republic and the US, as well as short-term studies elsewhere. She worked as a Rockefeller Foundation Social Science Fellow and Senior Scientist with the International Centre for Research in Agroforestry

(ICRAF) from 1983 to 1986 and as a Program Officer with the Ford Foundation from 1986 to 1989. She is currently an Associate Professor of Geography at Clark University. She has co-authored and co-edited five books including *Agroforestry in Dryland Africa*; *Gender, Environment and Development in Kenya*; *Power, Process and Participation – Tools for Change*; and *Feminist Political Ecology*. She has worked extensively on methodologies for community-based and participatory research as well as on the integration of social and ecological research methods and designs. She has also served on the Boards of CIFOR, the Land Tenure Center and committees of the National Science Foundation and National Research Council in the US. In all of her work she seeks to document, promote and protect socially just and viable human ecologies.

Sieglinde Snapp is an Assistant Professor of vegetable integrated crop management at Michigan State University, with a focus on applied, systems research and outreach to develop farmer knowledge and problem-solving capacity. In the long term she works to promote adoption of more biologically smart and sustainable systems in high-risk, high-input vegetable systems. The underlying premise is that nutrient efficiency is enhanced by greater use of carbon sources to build soils and greater reliance on deep-rooting legumes. She collaborates with farmers and extension staff to investigate mechanisms and develop technologies that integrate nutrient sources and use manure and cover crops to diversify systems and promote vigorous roots and healthy crops. She has over seven years of experience working in southern Africa in collaboration with national scientists to research maize and bean systems and the use of integrated soil management practices, and continues to research and teach on African cropping systems. She is deeply committed to developing new outreach methods and improving communication among researchers, farmers, crop advisors and extension workers. She developed a novel farmer participatory research method, the 'mother–baby trial'. This on-farm trial design facilitates the relatively rapid but rigorous integration of farmer and researcher assessment of technologies and varieties. It is now used widely by scientists from eight different countries.

Ann Stroud is completing her 20th year in Africa, having resided in Kenya, Ethiopia, and Tanzania, and is now in Uganda. She has worked in extension, research and development modes. Currently, she is the Regional Coordinator for the African Highlands Initiative (AHI). AHI is a unique programme that aims to improve the integration and coordination of contributions from a number of national, international and non-governmental research organizations to arrest land degradation and improve livelihoods in the highlands of eastern Africa. Her professional career has evolved from her graduation as a weed scientist from Cornell University, US, through work as a farming systems agronomist, to her current broader interests in sociology and institutional dimensions. These interests have been generated by her fieldwork with African farmers and her advisory work with many stakeholders involved in cracking the challenges of rural development in Africa.

Alistair Sutherland has worked in participatory agricultural research projects and programmes in various parts of southern and eastern Africa since 1983. He is currently based at the Natural Resources Institute, University of Greenwich, Chatham, UK, and works within the Livelihoods and Institutions Group on a range of research, training and consultancy activities overseas and in the UK. His current interests include capacity building and training in managing organizational change and performance assessment, the monitoring and evaluation of client perspectives in agricultural research and the development of cost-effective methodologies for participatory research and social analysis.

Ronnie Vernooy is a senior programme specialist at the International Development Research Centre (IDRC), Ottawa, Canada. He received his PhD in the sociology of rural development from the Agricultural University of Wageningen in the Netherlands in 1992 and joined IDRC in the same year. His research interests include rural development, natural resource management, agricultural biodiversity and participatory (action) research methods including monitoring and evaluation. His current work focuses on southeast Asia (China and Vietnam), Central America and Cuba; he has a special interest in Nicaragua where he carried out field research in both hillside and coastal environments during 1985–1986, 1988–1991 and 1997–1998. Recent publications include, as editor and co-author, *Taking Care of What We Have: Participatory Natural Resource Management on the Caribbean Coast of Nicaragua* (2000), *Para una mina de oro se necesita una mina de plata: historiando sobre la Costa Caribe de Nicaragua 1910–1979* (2000) and, as co-editor and co-author, *Voices for Change: Participatory Monitoring and Evaluation in China* (2002).

Linden Vincent is Professor of irrigation and water engineering at Wageningen University in the Netherlands. Previously she worked with the Irrigation Management Network at the Overseas Development Institute, London, and the University of East Anglia in the UK. She has particular interests in the relationships between agroecology, technology and water management, and collective action for water management in mountain areas, semi-arid environments and water-scarce locations. She has also written on the links between irrigation and water management, livelihood security and poverty alleviation. The Irrigation and Water Engineering Group at Wageningen, which she heads, is committed to interdisciplinary research. Staff and students have worked to develop 'socio-technical' theoretical frameworks and research approaches that integrate the environment, technology and society, to understand the relationships between irrigation and rural transformation. Linden Vincent has worked as an academic researcher, field engineer and consultant in development projects in India, Yemen and several countries in sub-Saharan Africa, and continues to facilitate postgraduate research in south Asia, southern Africa and South America. She has worked with various methodological approaches to knowledge generation, including survey and statistical methods of analysis, actor-oriented approaches, rapid rural appraisal and participatory technology development. She believes that it is possible for these different methodological approaches to inform each other.

List of Acronyms and Abbreviations

ACIAR	Australian Centre for International Agricultural Research
ACM	adaptive collaborative management
ADB	Asian Development Bank
AGRITEX	Agricultural Technical and Extension Services
AHI	African Highlands Initiative
ARD	agricultural research and development
BAIF	Bharatiya Agro Industries Foundation
BFRI	Bangladesh Fisheries Research Institute
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung
BRRI	Bangladesh Rice Research Institute
C&I	criteria and indicators
CADC	Catchment Area Development Committee
CARE	Cooperative for Assistance and Relief Everywhere
CBNRM	community-based natural resource management
CBO	community-based organization
CGIAR	Consultative Group on International Agricultural Research
CIAL	Comité de Investigación Agrícola Local (Local Agricultural Research Committee)
CIAT	International Center for Tropical Agriculture
CIFOR	Center for International Forestry Research
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CRP	collaborative research project
DFID	Department for International Development
DICTA	Dirección de Ciencia y Tecnología Agropecuaria
EARO	Ethiopian Agricultural Research Organization
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organization
FFS	farmer field schools
FLAC	FLORES Adaptation and Calibration
FLORES	Forest Land Oriented Resource Envisioning System
FOFIFA	Foibem-pirenena momba ny Fikarohana Ampiharina amin'ny Fampandrosoana ny eny Ambanivohitra, Madagascar
FPR	farmer participatory research
FUG	forest user group

GEF	Global Environment Facility
GFAR	Global Forum on Agricultural Research
GIS	geographic information systems
GO	governmental organization
GTZ	Gesellschaft für Techniche Zusammenarbeit
ICARDA	International Center for Agricultural Research in the Dry Areas
ICIMOD	International Centre for Integrated Mountain Development
ICLARM	International Center for Living Aquatic Resources Management
ICRAF	International Centre for Research in Agroforestry, or the World Agroforestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IICA	Instituto Interamericano de Cooperación Agropecuaria
IIED	International Institute for Environment and Development
INRM	integrated natural resource management
INTA	Instituto Nicaraguense de Tecnología Agropecuaria
IPCA	Investigación Participativa en Centro America
IPGRI	International Plant Genetic Resources Institute
IPM	integrated pest management
IPRA	Investigación Participativa con Agricultores
IRE	Institute for Resources and Environment
IRRI	International Rice Research Institute
IT	information technology (or information tools)
IUCN	World Conservation Union
IWMI	International Water Management Institute
JICA	Japan International Cooperation Agency
KARI	Kenya Agricultural Research Institute
LB	late blight
LTM	long-term monitoring
M&E	monitoring and evaluation
MAG	Ministerio de Agricultura y Ganadería
NACA	Network of Aquaculture Centres in Asia-Pacific
NEDA	former name of the Directorate General for International Cooperation (Netherlands)
NGO	non-governmental organization
NRG	Natural Resources Group
NRI	Natural Resources Institute
NRM	natural resource management
OPEC	Organization of Petroleum Exporting Countries
PACODET	Pallisa Community Development Trust
PAM	Participatory Agroecosystem Management
PAR	participatory action research
PARDYP	People and Resource Dynamics Project

PCI	participatory crop improvement
PGR	plant genetic resources
PIM	participatory irrigation management
PNRM	participatory natural resource management
PNRMR	participatory natural resource management research
PR NRM	participatory research on natural resource management
PR	participatory research
PRA	participatory rural appraisal
PRGA	Participatory Research and Gender Analysis
PROLINNOVA	promoting local innovation
PROSCARP	Promotion of Soil Conservation and Rural Production
QCC	quality control circle
R&D	research and development
RAM	resource allocation map
RDC	rural district council
RIA	Research Institute for Aquaculture
RMD	resource management domain
RMP	Risk Management Project
RRA	rapid rural appraisal
SANREM	Sustainable Agriculture and Natural Resource Management
SARI	Selian Agricultural Research Institute
SDC	Swiss Agency for Development and Cooperation
SERTEDESO	Servicios Técnicos para el Desarrollo Sostenido
VASI	Vietnam Agriculture Science Institute
ViSCA	Visayas State College of Agriculture
WRI	World Resources Institute

Foreword

It is a rare opportunity to be involved in both the creation of a resource on participatory research in natural resource management and in the history that led up to it. My involvement, first as a researcher in Africa and, subsequently, as a Director at two international research centres in different regions of the world, has allowed me the good fortune to witness and participate in the positive evolution of research in natural resource management (NRM).

Motivated by the limited record of conventional NRM research in generating improvements in rural people's well-being (especially that of marginalized peoples) in the 1980s, a number of key international institutions and a wide range of developing-country farmers and other partners began to seriously investigate participatory technology development. As the experience gained from this initiative showed some promise, financial and intellectual investments grew in this new field of research on the ancient human practice of participation for the common good. These developments were stimulated by, and have become part of, a much broader societal movement among non-governmental organizations (NGOs) and academia towards democratizing research and development activities. An ever-expanding community of practice has since developed among social and biophysical scientists and other practitioners working at the community level.

The participatory research and gender analysis approaches undertaken by these scientists, local peoples (ie, the natural resource managers) and partners, when done well, have provided tremendous benefits in mutual learning and problem-solving for local and research institutions alike. Experience has also confirmed, however, that these returns – as in conventional research – are dependent on the quality of the research design, implementation, analysis and dissemination. Unlike conventional research, however, quality approaches to these elements of research have been relatively uncharted territory. Furthermore, the integrative and people-oriented nature of participatory research on NRM has demanded that it address head-on critical challenges that conventional research had previously 'dodged', such as cultural diversity and integrated natural resource management. Finally, experience has also shown us that meeting these challenges is going to require the thoughtful and dynamic integration of both participatory and conventional approaches to science for each context and each issue – in other words, adaptive science for the adaptive management of natural resources.

And this is where this book comes in. *Managing Natural Resources for Sustainable Livelihoods* draws on international authors who are at the forefront of innovation and field experience in applying participatory methods to NRM

research, especially in smallholder agricultural systems in the developing world. It analyses the issues and the lessons that have been raised by the practical application of participatory principles to complex landscapes and social situations. It also looks ahead and considers how to meet the institutional, methodological and technical challenges, which are illuminated by such critical reflection, in order to improve the livelihoods of local natural resource managers, as well as to conserve natural resources for future generations. One of the strengths of this book is that it recognizes and reflects the need for research that parallels NRM in the transition towards adaptive management approaches. This includes the 'democratization' of NRM and research as well as integrated efforts to cope with the unpredictability, variability and diversity that characterize natural systems and help confer resilience. In this context, the book offers a critical review of the potential tensions and synergies of traditional and participatory approaches to research, and the role of gender and stakeholder diversity analysis within that. It offers signposts for researchers and research managers in undertaking effective participatory research and gender analysis (PRGA), including meeting the challenges of 'scaling up' from field, to farm, to landscape levels. It also offers them a practical framework for 'good practice' in PRGA design and implementation. Furthermore, it stretches beyond the research project level, to address two of the key organizational level challenges of our time in NRM: the institutionalization of PRGA in research organizations; and the broader transition towards becoming learning organizations. In this way, the book elucidates the need and potential paths for the conscious evolution of research in NRM towards flexible and multi-faceted approaches that effectively respond to human and ecosystem challenges. We sincerely hope that you find the results as inspiring and useful as was our intent.

Joachim Voss
Director General, International Center for Tropical Agriculture
July 2002

Preface

This book is an important, tangible outcome of the workshop, entitled 'Participatory Research for Natural Resource Management: Continuing to Learn Together', held at the Natural Resources Institute (NRI), University of Greenwich, Chatham, UK, in September 1999, and co-sponsored by the Consultative Group on International Agricultural Research (CGIAR) System-wide Program on Participatory Research and Gender Analysis (PRGA) and the NRI.

The PRGA and NRI convened a group of scientists, nominated by their peers for their involvement in innovative participatory natural resource management (NRM) research, to strengthen interchange in the Program's international working group on participatory research approaches for natural resource management formed in 1998, and to exchange experiences related to:

- management of common property and protected areas;
- natural resource management at the landscape and watershed scales;
- soil and water management, land care and rehabilitation.

These themes were explored through the following key questions:

- What innovative approaches are being developed for collective participation and decision-making in research on NRM problems and processes?
- What new linkages have been established between farmer-led research initiatives and formal-led ones?
- What methods are proving most useful for participatory research with gender and stakeholder analysis and for improving the involvement of specific groups of actors in planning, monitoring and evaluating NRM research?

Each participant at the workshop offered a case study from their own experience that integrated biophysical NRM themes with methods for building and maintaining partnerships with stakeholders.

The workshop enabled the working group, which had hitherto interacted mainly by email, to fuse as a learning community based on a strong nucleus of field experience. The Program prepared a short handbook on the case studies presented at the workshop, and added more from other centres in the CGIAR (PRGA, 2000, *Equity, Well-being and Ecosystem Health: Participatory Research for Natural Resource Management*, Cali, Colombia). This collection is a companion volume to the analysis and synthesis of this work. The participants resolved to

develop a book based on lessons drawn from practical experience and analysis of the case studies as a contribution to the debate surrounding several major questions facing participatory research at the present time. These include:

- challenges to organizing participatory research;
- the quality of participation and quality of science in participatory research;
- scaling up of participatory research approaches and successful participatory natural resource management (PNRM) initiatives.

The purpose of the book is to present a variety of innovative approaches for collective participation and decision-making at various stages of NRM research, to identify principles of good practice for research on NRM, to identify common problems and weaknesses in PNRM research, and to identify priority issues and challenges for future research and institutional change.

Researchers from the CGIAR, universities, government research and development organizations, and NGOs in developed and developing countries, as well as donors, research programme managers and policy-makers are our main audience. We hope that the book will prove useful for graduate courses on both the biophysical and social science aspects of NRM, and to those involved in the field implementation of PNRM.

Chapters 2–7 were commissioned by the editors from case study authors who are active field practitioners of PNRM research. The introductory and final chapters were commissioned from senior research managers. Each chapter was both reviewed by the editors and peer reviewed.

Throughout the book, reference is made to the 23 case studies, summarized in Annexe 1, which illustrate a wide range of NRM research and development situations at the farm, community, watershed and landscape levels, and bring practical reality to bear on generalized concepts.

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Chapter 1

Introduction: Uniting Science and Participation in the Process of Innovation – Research *for* Development

Jacqui Ashby

Introduction

Researchers are approaching the process of innovation, as well as their own role in improving natural resource management (NRM) in a new way. 'Research *and* development' – also known as R&D – derives from the concept of researchers who are in control of a pipeline for producing technological innovations: an idea goes in at one end of the pipeline, research develops a prototype, and then a fully developed product comes out, ready to be released to eager users, at the other end of the pipeline. In contrast, 'research *for* development' emphasizes the iterative, adaptive nature of innovation in complex ecosystems, which is achieved through systematic enquiry combined with learning based in action. The purpose of this chapter is to set the scene for understanding the evolution of new approaches to innovation in agriculture and NRM and the kind of research and development process needed to realize their potential for NRM.

Research for development in NRM is just one part of an innovation process, which is shaped by multiple social and political actors as well as by environmental conditions. Adaptive management is an approach to coping with the complexity of resource management, based on establishing indicators, trying interventions, monitoring their effects and learning from feedback. It depends on the ability of resource managers to receive, understand and respond to positive or negative signals in the physical and social environment and to change management responses accordingly (Berkes and Folke, 1998). Several of the case studies in this book make use of the livelihoods approach (Scoones, 1998), which integrates NRM into a framework for analysing how people use natural resources to make a living. The livelihoods approach treats access to natural resources as one asset among several other kinds of capital – human, social,

financial and physical. A rural livelihood is considered sustainable when it is resilient enough to bounce back from stresses and shocks, maintaining its assets without degrading the natural resource base. From this perspective, natural resource use by individuals or groups is only one part of the livelihood strategy of those people. A reversal of environmental degradation requires new livelihood options that change people's incentives, in particular the benefits and costs of resource use. When innovation in resource management is driven by perceived tradeoffs, participatory assessments of livelihood strategies are important for developing a common understanding of how these depend on natural resource assets (Carney, 1998). Both adaptive management and livelihood analysis approach NRM as a process of social change.

In an adaptive process, enquiry (or research) to generate new knowledge and learning to share existing knowledge are both important, although the emphasis on one or the other will vary from time to time. Researchers are only one among many stakeholder groups, each with different kinds of knowledge and often with competing ideas about the purpose of research, as well as of the use of the natural resources in question. As several cases in this book illustrate, in order to do research for development, researchers are beginning to relinquish classical, reductionist notions of control and objectivity. One of the major challenges is for researchers to recognize that their results and their impact on NRM depend on relationships with other stakeholders, who may have more power to visualize and to realize the desired outcomes of interventions than the researchers do. As a result, the participation of key stakeholders alongside scientists in a jointly managed process of investigation and learning based in action is a central feature of research for development. In such science, quality depends on the quality of the participation of all the relevant stakeholders in research and development, and in the overall innovation process.

The change in concepts and approaches that is represented by 'research *for* development' is a crucial part of a larger societal process of rethinking several important relationships: between post-industrial, globalizing economies and stocks of natural capital; between human health and the environment; between our food systems and the flora and fauna, soil, water and air on which we depend; and, ultimately, the relationship between human society and nature. This shift in thinking is occurring because the capacity of global ecosystems to support current levels of human consumption of food and environmental goods and services is threatened at local, regional and global scales and has finally become a major political issue and a topic for headline news. Research *for* development is also part of a movement to promote broad and inclusive participation in determining the goals and direction of societal development.

Global concern for the depletion of natural capital stocks is not only an expression of the conservation ethic, but is linked to concern with international poverty, famine and disaster. Ecological threats of global significance are paralleled by the vulnerability of over 800 million poor people to malnutrition, disease and high rates of infant mortality, together with rising inequality in the distribution of wealth. The capacity of poor households, communities and countries to recover from external shocks such as war, famine, epidemic disease,

hurricanes, global climate change and indebtedness partly depends on the status of their stocks of natural capital. The diversity of this natural capital gives it an important advantage over man-made capital in providing the poor with the resilience to survive periods of stress in their livelihood systems, given that diverse ecosystems are more able to recover from shocks and stress (Conway, 1985, 1987; Pearce et al, 1990). Poverty, growing inequity and the importance of natural capital to the poor mean that global and local competition between rich and poor over natural resources, such as water, is expected to be one of the most significant causes of conflict in the 21st century.

Several decades of NRM research have proved disappointing to efforts to halt the degradation of stressed environments and fragile ecosystems where poverty is increasing. Critics find that rural development policies, agencies and practitioners have repeatedly been proved wrong and have lost credibility; that the research establishment has shown itself incapable of addressing the decline of rural society, the needs of poor rural populations in fragile environments and deepening crises in the depletion and degradation of natural resources; and that resource management science is fundamentally on the wrong track (Ashby, 2001; Campbell, 1998; Chambers, 1997). Public sector research on NRM could build a stock of socially useful knowledge that would enable human societies to sustain both natural resources and human well-being over the long term. However, the prevalent approach to NRM which treats ecosystem components separately (for example, independent disciplines, programmes and policies for soil, biodiversity, forestry, etc) is unsuited to addressing problems in complex ecosystems. One of the main reasons for this is the high degree of variability and unpredictability of processes in complex ecosystems which tend to reach a critical threshold and then produce unanticipated effects, often the opposite of those the resource managers intended (Holling, 1986; Tenner 1996; McDougall and Braun, this volume).

The conventional approach to NRM is based on reducing and controlling variability in order to contain and avoid negative impacts. But experience shows that if variability is reduced and natural patterns of disturbances are disrupted, they accumulate and return at a later stage on a much broader scale. Diminishing variability tends to increase the potential for larger-scale, less predictable and less manageable disturbances, which can have devastating effects on ecosystems (Ludwig et al, 1997) and reduce their capacity to provide the environmental services on which material and energy stocks and flows depend. A well-known example given by Holling (1986) is forest fire suppression that leads to an accumulation of litter on the forest floor, which eventually provides fuel for a fierce, uncontrollable conflagration once a fire does take hold. In contrast, allowing variability to occur in the form of periodic, small-scale fires helps to maintain a viable forest ecosystem. For NRM to work *with* variability in whole ecosystems, a radical change is called for in the way research is carried out (McDougall and Braun, this volume). The emergent properties of new approaches can already be detected in new ways of doing science as well as in new kinds of research organizations (Ashby, 2001).

New approaches to adaptive NRM involve social and organizational, as well as technical, change. Recent research has highlighted the value of traditional as

well as new, modern local institutions to sustainable resource management – and this evidence has contributed to a forceful critique of the neglect and destruction of local resource management institutions by central government interventions, often leading to worsening resource degradation (Ostrom, 1990; Folke et al, 1998). As a result, decentralization and participation in resource management are widely seen as increasing effectiveness, although for these to be realized, locally accountable representation and power of decision – ie, a domain of independent local decision-making – must be present (Ribot, 1999). Devolution of resource management to local stakeholders is part of the wider movement to empower citizens to determine the directions and goals of development, of which research *for* development is one facet.

Most of the literature on common property regimes for resource management has not yet included a hard look at how institutional and technical innovations are catalysed, or the role of stakeholder-based, participatory approaches to research in the innovation process. However, recent work using field experiments with alternative common property management decision-making regimes conducted in rural communities suggests some insights that are valuable for participation in research for resource management. The findings illustrate the importance of collective participation by researchers and the 'researched'. The construction of communication channels between scientists and the people whose behaviour they were investigating led to preconceived hypotheses being discarded while the participants' explanations opened up new avenues for investigation (Cardenas, 2002). These findings from economics are analogous to those showing that an important result of farmer participation in a plant breeding process is to provide feedback that re-orients breeding objectives and the way plant breeding research is organized (Lilja and Erenstein, 2002).

Although decentralization, devolution and participation are widely promoted as desirable features of the organization of NRM, the need for comparable changes in the organization of research including stakeholder participation has received little attention. Research programmes that do not include organizational learning about relationships between researchers and the people whose NRM practices are being investigated run into serious difficulties. As Stroud's case study in this volume illustrates, stakeholder participation in NRM research requires changes in research practice, attitudes, roles and responsibilities.

The research analysed in this book provides a foundation for addressing the issues of complexity, stakeholder diversity and institutional transformations needed to enable research for development and the cornerstones of 'good practice' for participatory research in NRM.

The challenge for research

When researchers analyse and make recommendations on the management of natural resources – soil, water or biodiversity, for example – they confront the different values that stakeholders assign to these services. Ecological services include: maintenance of the composition of the atmosphere; regulating climate

variability; water quantity and quality; flood control; waste assimilation; nutrient recycling; soil generation; crop pollination; pest regulation; biodiversity maintenance; and landscape maintenance – to name but a few (Daily, 1997; Conway, 1997). Alternative resource management regimes distribute ecological services, and their costs and benefits, differently among different groups in society, who have competing interests in how the resources in question are managed – for example, in managing forests for commercial logging, for tourism or for wildlife preservation. In order to move from theory to practice, and to put research findings to practical use, tradeoffs between different uses have to be taken into account. The tradeoffs between one resource management regime and another have to be negotiated among different interest groups, or open conflict may emerge. Even if conflict over competing objectives for a given resource is not explicit, the result of a lack of consensus about how to manage that resource can be mismanagement – to its long-run detriment. The need for negotiation or conflict resolution to facilitate agreement about the use of natural resources means that research to improve NRM must 'democratize' by involving a broad set of stakeholders. As noted before, this requires researchers to recognize that they are only one group of stakeholders among many with different values and objectives for the resources in question.

The principle of involving stakeholders in NRM research is at the heart of research for development for two important reasons. The first reason is that stakeholder involvement and 'buy-in', or ownership, is crucial for identifying acceptable tradeoffs, for negotiating distributions of costs and benefits and for reaching consensus about the research findings and recommendations. Successful common property regimes can restrict access to a resource and establish procedures for decision-making about joint use; and they typically include social mechanisms for regulating the levels of resource use allowed, by whom, when and where, as well as procedures for resolving conflict, enforcing compliance and sanctioning non-compliance (Ostrom, 1990). Stakeholder 'buy-in' to these self-imposed rules and regulations depends on the existence of a shared understanding about cause and effect in key resource management processes and operations: for example, how much logging can be done without permanently damaging a forest ecosystem. In traditional common property regimes the understanding of cause–effect needed to maintain 'buy-in' can be established by long-term empirical observation and testing of cause–effect relations and may be embodied in long-accepted ritual, religion and custom. In conditions of rapid change, the understanding needed for consensus and compliance requires new knowledge to be generatedby research in order to achieve stakeholder 'buy-in' and often needs to include expertise drawn from other stakeholder groups (Funtowicz and Ravtz, 1993; Irwin, 1995). This form of ownership often needs to be established across a range of institutions and levels of decision-making (Martin and Sutherland, this volume).

A second reason for involving stakeholders in research is that their involvement is key to coping with the unpredictability of change and to sustaining variability, diversity and resilience in ecosystems, which was discussed earlier as an important principle for managing complex ecosystems. To adapt resource management iteratively so that it works with natural variability and

BOX 1.1 ADAPTIVE, PARTICIPATORY NATURAL RESOURCE MANAGEMENT INVOLVES ECOLOGICAL LITERACY

An analysis of several traditional and new local resource management systems, which have proved sustainable over a long period of time, concludes that if stakeholders do not learn how to respond to environmental feedback, they end up in a state of 'ecological illiteracy' (Folke et al, 1998:416–434). Several key features of this trial-and-error approach to learning involve processes integral to participatory natural resource management (PNRM) research, and include:

- Rules and norms that support experimentation.
- Working with local variation in resources, landscapes and local management practices.
- The integration of local and formal scientific knowledge.
- A capacity to self-organize and reorganize to support changing needs for the generation and sharing of knowledge.
- Broad-based stakeholder involvement in assessments for diagnosis, monitoring and the evaluation of the state of resources.

disturbance patterns in ecosystems, stakeholders, including researchers, need to interact with each other in a process of discovery and learning about how each other's behaviour affects an ecosystem, how this alters the status of the natural resources in which they have an interest, and how each stakeholder's actions (or passivity) influences the distribution of costs and benefits. Social norms or behavioural rules, values and institutions that encourage shareholders to engage in shared experimentation, trial-and-error learning and 'ecological literacy' (see Box 1.1) help groups of people to respond to variability and to calculate the cross-scale effects (see Box 1.2) of their behaviour (Vernooy case study, this volume), which may otherwise remain hidden, but powerful, drivers of environmental change. Behavioural rules and institutions for experimenting with resource management can be seen as one aspect of resilience and adaptiveness in co-dependent social systems and ecosystems (Berkes and Folke, 1998). Participatory research for adaptive NRM can be understood as an important cluster of behavioural rules, values and ways of organizing that promote receptivity in a social system to feedback from the environment, and thus ecosystem resilience.

In summary, there are three main facets of the challenge facing participatory research for NRM. The first is to engage stakeholders in processes of systematic enquiry to uncover and understand the 'knock-on' effects of different management regimes and their cross-scale effects. The second is to link this enquiry to knowledge sharing, so that the information produced by research is relevant to common goals, is socialized and provides a basis for action. Given that the problems needing research involve cross-scale effects, the third facet is to find the appropriate scales at which stakeholders' enquiry, learning and action need to mesh with each other in order to change (or maintain) resource management regimes.

BOX 1.2 CROSS-SCALE EFFECTS IN ADAPTIVE MANAGEMENT

Adaptive NRM usually depends on generating new information, socializing it among stakeholder groups and using it to innovate, because complex ecosystems are holarchies, made up of many different holons or components that work together. A holon is a whole system made up of smaller parts, while also being part of a larger system. Holarchies are hierarchically organized and nested one into another on several scales: for example, soil micro-organisms are nested in a patch that is nested in a field that is nested in a landscape (Allan and Starr, 1982; Giampetro and Pastore, 1999). The ecological services that are the focus of NRM are usually generated at more than one level of a holarchy (Holling et al, 1995). As a result, a stakeholder group that understands what is going on at one level of a holarchy does not necessarily have sound information about what is going on at another level. For example, farmers managing field-scale irrigation channels may not have information about how this damages the hydrology of the whole watershed. Similarly, irrigation engineers responsible for managing the watershed do not always have information about how regulating water flow in the river leads to diminished biodiversity in the ecosystem or how this affects the local pest and disease complex and productivity on farmers' individual fields. As a result, farmers and irrigation engineers have potentially conflicting objectives. An iterative participatory research and learning process is essential for the adaptive management of holarchic ecosystems because of the existence of cross-scale effects like these which are hidden or unperceived; of tradeoffs which are unknown or unsuspected; and of stakeholders' goals, needs and values which are not commonly understood, but are powerful drivers of competing resource management priorities.

In order to make the connection among enquiry, learning and action at appropriate scales, it can be useful to situate thinking about participatory research in the broader context of promoting innovation for NRM. Research to promote innovation through learning based in action is a key to successful, sustainable resource management in a rapidly changing environment. An analysis of 208 cases of sustainable agriculture from 52 countries, involving almost 9 million farmers on close to 30 million hectares, concludes that successes have been founded on a participatory approach involving farmer experimentation, and building a capacity to learn about biological and ecological complexity (Pretty and Hine, 2001). Many of the cases in this book are about the transition from doing research *and* development to doing research *for* development that builds on this principle. A sustained, collective capacity for innovation is critical for improving the management of natural resources. The capacity to innovate must be sustained because an iterative learning process is required to maintain or improve the complex natural systems that provide human society with food and environmental services. And the capacity to innovate must often be collective because, most of the time, managing natural resources involves multiple stakeholders with different and often competing uses for the same resources who must negotiate and act together to avoid destructive management practices. As many of the case studies illustrate, research in this setting has to become a collective enterprise in which different stakeholders' values, knowledge and expertise are negotiated to produce results.

Definitions of participatory research

This book is a reflection on the conduct of research for participatory adaptive NRM when this research is part of a learning process shared by multiple stakeholders, including the state, non-governmental agencies, community-based groups and private individuals, as well as research organizations. The terms 'participatory management', 'participatory research' and 'participatory learning' are frequently used interchangeably and with little concern for overlap among them. In order to discuss different kinds of participatory research, it is useful first to clarify what we are talking about, and then to review some of the principles that are common to all.

Participatory natural resource management

Participatory natural resource management (PNRM) involves the management of resources by the relevant stakeholders (as opposed to their being excluded by other agencies). It requires the negotiation of goals and acceptable tradeoffs among multiple stakeholders, who may include researchers and other learning communities. It also involves participatory problem definition, visioning and building a shared agenda for action. Agreeing upon rules of resource management and how to enforce compliance is a typical element of participatory resource management. Examples of participatory management are given in the case studies included in this volume by Brinn, Borrini-Feyerabend and Garrity.

Sharing knowledge among stakeholders to build a common analysis of a problem and its solutions is a characteristic of participatory resource management. Some of this knowledge may need to be generated by research, but this is often not the case. In many cases the knowledge exists in one stakeholder group but it needs to be shared. An example of the role of knowledge sharing in PNRM is the community approach to the control of bacterial wilt (Pound case study, this volume).

Adaptive, participatory natural resource management

The inclusion of the term 'adaptive' means that integrating participatory knowledge sharing with knowledge generation is achieved in an NRM process. Iterative learning and research loops are a major feature of the adaptive approach to management and they involve changes in social institutions as well as in environmental conditions (Folke et al, 1998). This is not just a question of degree, as participatory management often stops short of operationalizing these feedback loops, and as a result is unable to self-correct or to scale up. As Vincent (this volume) and Stroud (this volume) emphasize, the importance of learning lessons in participatory research is to limit mistakes and create new ways of looking at resource management problems. Participatory management without the feedback loop afforded by integrating research and learning often stagnates after the first flush of participation. Successful adaptive PNRM usually involves a process in which one or more stakeholder groups combine their efforts to

understand environmental feedback, do participatory research and use the results to inform the learning process, intervene jointly in resource management, monitor the status of the ecosystem including its people, and learn from this experience in order to adapt the next management intervention. Adaptive PNRM includes re-vitalizing and institutionalizing many practices common in successful local resource management systems (see Box 1.1), for example building monitoring indicators (McDougall case study, this volume).

Participatory learning

Participatory learning is an approach aimed at sharing knowledge based on the principles of discovery learning. Adult education, in particular, uses discovery-based learning because adults often learn and retain information better when they uncover principles and facts themselves rather than when they are told about them. Farmer field schools are a good example of the use of participatory learning to share knowledge for NRM (Nelson case study, this volume). Participatory learning often evolves into participatory research because there are questions that none of the stakeholders can answer satisfactorily and that can best be addressed through participatory research methods (Braun et al, 2000). Vernooy and McDougall (this volume) argue that participatory learning that changes people's fundamental understanding of resource management processes, including their own behaviour, is a means of empowering stakeholders, particularly the underprivileged, to take more control over resources important to their survival.

Research for participatory resource management

Research for participatory resource management requires, but is not limited to, the use of participatory methods. In other words, PNRM does not mean that only participatory research approaches and methods can be used. A wide range of research methods, both participatory and non-participatory are combined and need to be understood as a spectrum of methods and approaches (see McDougall and Braun, this volume, for a comparison of approaches) from which stakeholders – not just researchers – can choose. The cases analysed in this book illustrate how research for participatory management involves stakeholders in generating new information relevant to making decisions about the parameters and procedures for adaptive management. These parameters or procedures may include the boundaries of the ecosystem, the relevant actors, the physical and social spaces for intervention, the priority problems and opportunities, the alternative development paths, optional interventions (both technical and institutional) and the tradeoffs these entail for different stakeholders. The Schreier case study in this volume illustrates the combination of geographic information systems (GIS) research with participatory management; Vaughan's case study in this volume shows how modelling is being integrated with participatory research methods; Martin and Sutherland in Chapter 2 explain how researchers' own institutional studies were used to inform participants in community meetings convened to vision new forms of devolving resource

management. Snapp and Heong, in this volume point out that a major research challenge is to combine the various 'information bits' derived from different stakeholders, and distil these into decision rules that they can use.

A useful rule of thumb is: the more stakeholder 'buy-in' that is required – and the more diverse expertise needed to generate the information required to reach agreement – the more important it is to use participatory research approaches and methods for NRM.

However, whether participatory or non-participatory methods of enquiry are used, research carried out for PNRM has to incorporate stakeholders' different research objectives and criteria for validity and credibility even if, for example, stakeholders are not involved in data collection and analysis. Then methods – both participatory and non-participatory – need to be agreed upon that meet these objectives.

Participatory research

It can be seen from the above discussion that participatory research is a collection of approaches that enable participants to develop their own understanding of and control over the processes and events being investigated. This is derived from the principle that greater understanding and power to use information results from being involved in its generation. Participatory methods for monitoring and evaluation help to make NRM more accountable to stakeholders, and to give participants greater confidence in the results. In the McDougall case study in this volume, easily understood criteria and indicators are developed by local communities, researchers and other stakeholders. These provide a framework for later monitoring, and for assessing key factors and their direction of change. This monitoring process creates the opportunity to feedback information and learning into the community forest management system. It thus serves to guide future action, helping to increase the sustainability of community forest resources. In a different approach, Vernooy and McDougall (Chapter 6) show how creating a set of environmental monitoring indicators with stakeholder participation, and presenting these to local government decision-makers, raised awareness and provided a basis for action. Participatory *action* research has the added objective of enabling participants to act more effectively based on their own improved understanding. Action research combines intervening in the process being studied with investigating the changes this action produces, and this approach is highly compatible with the concept of adaptive PNRM.

Different kinds of participation in research are possible and there are several typologies that distinguish along one or more dimensions (Arnstein, 1969; Biggs, 1989; Pretty, 1995). Empirical study of how different kinds of participation are being used in participatory research shows a huge diversity of practice in combining different types (Lilja et al, 2001). Analysis of 150 NRM projects using participatory research shows that there is a definite pattern of using more empowering types of participation in the dissemination of results – ie, at a stage when conventional researchers are most comfortable in 'letting go' and relaxing conventional controls (Lilja and Ashby, 1999).

One of the fundamental differences among approaches to stakeholder participation in research for NRM is the way in which power relations among different stakeholder groups are structured. Natural resource management and research about it are embedded in power relations (Vincent, this volume). These may encompass powerful international, national or regional interest groups and relatively powerless local people. And they may also include the relatively wealthy, high caste or male members of a community in contrast to the poor and those of low social status, such as women and minority ethnic groups. Information is one source of power in a changing NRM situation, and participatory research can purposively generate new information that changes the balance of power, and can strengthen the bargaining situation of less powerful stakeholders.

Processes to promote participation in the management of resources and in research that fail to examine how power relations affect, and are affected by, the participatory process are often superficial and transitory. For example, participatory rural appraisal (PRA) has been heavily criticized for failing to recognize the incentives for different interest groups to manipulate the appraisal process (Cooke and Kothari, 2001).

The way in which power relations among stakeholders are handled in a participatory research process is intimately related to the issue of research quality. For example, gender relations affect the distribution of power in a participatory research process and bias results. This issue is examined in depth in the chapter in this volume by McDougall and Braun.

One way to assess quality in participatory research is to ask: 'How valid and reliable do the different stakeholders who are party to the research process judge the results to be?' In a PNRM process researchers are stakeholders who set research standards, but they are not the only ones. Thus standards for reliability and validity have to be negotiated with stakeholders. Often researchers have to accept compromises. A variety of different standards will often have to be met for quality assurance. The way in which power relations shape results can make or break the credibility of both the research process and its conclusions. For example, Mosse (2001) describes a PRA sponsored by a State Forest Department in India in which an overwhelming preference for planting eucalyptus trees was identified among the villagers participating. It turned out that villagers had little knowledge or experience of eucalyptus, but prioritized what they perceived the agency was able to deliver. The results of the PRA reflected the balance of power between the villagers and the State Forest Department, but did not provide a valid assessment of villagers' needs nor a conclusion that stands up to further analysis. Sutherland's case study in this volume reports that villagers did not distribute vetevier grass planting material from experiments to other communities because they did not have permission from the project that had paid them for growing these, illustrating how power relations also affect ownership and how research results are used.

One of the major threats to the validity of research occurs when stakeholders have not explicitly negotiated how control or ownership of a participatory research process is going to be managed. Ravnborg et al (1996) show how the exclusion of a key stakeholder group from a problem diagnosis

led to a result that was fundamentally biased against them and towards an interpretation that ultimately damaged the agreed-upon collective reforestation programme. Only once a forum was created, in which the absent stakeholders were included, were new information and competing interpretations of the advantages and disadvantages of slash and burn practices aired. Only then was it possible to negotiate a viable plan for collective action, which was subsequently successfully implemented. The cases in this book illustrate the broad spectrum of approaches to managing power relations, control and ownership of participatory resource management and the research it involves. For example, the African Highlands Initiative (AHI) case did not negotiate power relations explicitly and this affected research quality as researchers began to drop out because of their loss of control (see the Stroud case study in this volume). The 'Landcare' process is quintessentially owned and driven by local groups, but managing the dynamics of power relations among different stakeholders within the Landcare groups or among groups, and how these affect research is not evident in the project strategy (see the Garrity case study in this volume). In the Center for International Forestry Research (CIFOR) case study reported by McDougall (this volume) researchers were flexible from the start in providing a framework for monitoring that enabled multiple stakeholders to develop their own indicators, and eventually to take over and adapt the framework. This approach focused on generating feedback and adaptive learning, making it easier for researchers to see the advantages of 'letting go', but the negotiation of power relationships among other stakeholders in the research process was less explicit. In all these cases, the motivation for the participatory research is researcher-driven, at least at inception.

A different approach is illustrated by the explicit negotiation of control in a PNRM process, which is secondary to and embedded in solving a compelling wetland management problem (see the Borinni-Feyerabend case study in this volume). This case initiated its process with a meeting in which a vision for the future of the wetland involved various 'stakeholders' presenting their individual views and negotiating a basic agreement on rules to be respected and activities to be carried out. Within this framework of agreed rules, stakeholders decided what research they needed and how to collect it in order to throw light on different resource management options.

In summary, research for NRM cannot be carried out as if it were independent of power relations among researchers, or between researchers and other stakeholders. For this reason, a capacity for organizational learning in research organizations is an important determinant of the outcomes and impacts of research, because organizational learning is essential for transforming power relations that otherwise become an obstacle to innovation in NRM, as the case study by Stroud in this volume illustrates. The models or theories of participation and resource management that drive innovation in a research organization engaged in NRM are critical determinants of research practice. Many of the problems encountered in conducting participatory research are rooted in organizational behaviour rather than in the choice of methods or types of participation (see Box 1.3).

BOX 1.3 COMMON ORGANIZATIONAL PROBLEMS IN PARTICIPATORY RESEARCH

- Lack of representation of key stakeholders in the research process.
- Participation is not developed around clearly specified rights, roles and responsibilities.
- Mechanisms of accountability among participants are lacking, especially the accountability of researchers.
- The process is corrupted by hidden agendas.
- Conflicts of interest are not made explicit nor negotiated.
- Transaction costs of participation exceed the benefits to the participants.
- Feedback mechanisms, such as monitoring and evaluation of the research process are not in place so that learning about how to improve the process is minimal or slow.

Models of participation in a research organization provide a means to structure and organize the research process, methods for decision-making, and the rules and behaviours of researchers. Models that are incompatible with adaptive PNRM make it difficult for the necessary learning to occur. When models of participation incompatible with adaptive PNRM prevail in a research organization, for example when research and development is the dominant model in contrast to research *for* development, most of the innovative research is done by an informal, or 'shadow', organization that develops as a way of circumventing the outmoded rules of the formal organization (Sherman and Schultz, 1998). Rocheleau, in this volume, analyses the world of isolated and undocumented participatory research outside formal research organizations and the institutional divides within formal research that are an obstacle to organizational learning. In contrast, in a learning organization new models of how to conduct research *for* development are rapidly incorporated and innovations are readily undertaken. The idea of a learning organization arose in the private sector out of the need to be adaptive in the face of rapid change driven by intense competition, and the learning organization concept has several features in common with participatory methodology, as the chapter by Stroud in this volume explores in detail. The models of participation that drive organizational behaviour and research practice are based on underlying principles (defined as the ideas that are used to formulate models). Principles are more important than rules or methodology: 'rule-generated behaviour doesn't work' (Sherman and Schultz, 1998). For this reason, an important focus of this book is the illustration of the underlying principles of participation that are more important than the specificities of one or another participatory methodology. One way of illustrating how principles are more important than methods is to examine how participation in research adds value to adaptive NRM.

Adding value to resource management with participatory research

Participatory research adds value to NRM in several ways:

- By introducing new information and feedback into participatory learning and adaptive management.
- By increasing the capacity to cope with complexity and diversity.
- By the inclusion of lay knowledge in the identification of problems and monitoring of change.
- By enabling diverse stakeholders to challenge accepted wisdom, whether lay or expert.
- By potentially levelling the playing field and breaking down the monopoly of 'one version of the truth', which is often that of the dominant elites, and which can short-circuit collective action.
- By helping to establish agreement about what information stakeholders need and can use to make collective decisions.
- By building social capital which 'spills over' into collective action.
- By increasing the capacity for innovation.

Participatory learning is an essential part of research for development and adaptive management of complex ecosystems. Participatory research has a vital role to play in making sure that the learning process which drives adaptive management can draw on different kinds of knowledge and is not biased by just one explanation of key cause–effect relationships. When power relationships in the participatory research process are negotiated in an open forum, where different perceptions of cause–effect (and of credit and blame) can be aired, then research adds value to participatory management by bringing to the table new information that all stakeholders can use to forge an agreement. Pretty and Hine (2001) observe that innovation in sustainable resource management for agriculture is fostered by 'farmer participation, rapid exchange and transfer of information when trust is good, better understanding of key agro-ecological relationships in fields, and farmers experimenting in groups'. Several case studies from this volume provide examples of participatory research adding value to resource management by fuelling the process of learning, successful innovation and adaptive management. Adding a farmer research component to evaluate and select promising potato clones with increased late blight resistance complemented learning about potato late blight through farmer field schools in Peru (see Nelson's case study in this volume). Seed management innovations developed in Nepal through a process of interactive learning between indigenous and formal knowledge systems, and the success of community action, depended fundamentally on their ability to control processes of knowledge production through different kinds of research (see Pound's case study in this volume). Their improved understanding of gene flow stimulated the interest of community members in learning plant breeding skills to proactively manage genetic resources.

Participatory research adds value to NRM by building on natural diversity because it is highly decentralized, adapted to location-specific conditions and stakeholder-driven. Classical research is identified with resource management practices based on reducing variability, and this slowly changes the functioning and resilience of an ecosystem, undermining ecosystem capacity to withstand or recover from shocks and stress. If natural variability is reduced or disturbances prevented, they accumulate and return at a later stage on a much broader scale. Diminishing variability tends to increase the potential for larger-scale, less predictable and less manageable disturbances that can have devastating effects on ecosystems (Ludwig et al, 1997), and to reduce the capacity of ecosystems to provide environmental services in the future.

Participatory research adds value to NRM in a different way when it promotes the involvement of extended peer communities in science. Adaptive management of complex ecosystems needs to include the stakeholders in an environmental problem when there is a high level of uncertainty about cause and effect, disagreement about research measurement and debate on ethical aspects (Funtowicz and Ravtz, 1993; Irwin, 1995). Participatory research approaches are especially needed in situations where there is disagreement and conflict over appropriate management: debate heightens the need to include lay expertise in the research process and to bring an end to the practice of research being conducted exclusively by technical specialists. Inclusion of lay expertise promotes an exchange of different forms of knowledge and cross-fertilization across diverse knowledge forms. Research for development requires: a willingness to engage in non-scientifically generated knowledge; an acceptance of a plurality of knowledge forms, not a unitary consensus; and a preparedness to engage with stakeholders' concerns.

Common principles of participatory research

Participatory research can add value to NRM oriented at the development of sustainable livelihoods when some basic principles apply (see Box 1.4) that are common to all the diverse approaches illustrated in this book. First, the research agenda and problem definition is formulated by and with stakeholders and is driven by an organized expression of different stakeholder demands. This usually requires the use of diversity analysis to understand different roles, rights and responsibilities. Examples are given by the case studies of Conroy and Snapp, in this volume, of changes in research priorities after participatory problem analysis and experimentation.

A second principle is that data collection, processing, analysis and interpretation has to involve relevant stakeholders, improve their analytic capacity, advance their understanding of the resource management situation and provide them with a basis for action. Participation in research builds the capacity for ongoing innovation which is essential for sustainable livelihoods and resource management. It is not enough for researchers to collect and interpret data on their own.

Third, different types of knowledge and evidence are usually required and combined – both expert scientific knowledge and lay empirical knowledge – and this involves participatory learning and an exchange of knowledge among different stakeholders to 'level the playing field', and permit shared understanding to evolve. Blending knowledge also involves hybridization of methods, as when free experimentation combines with controlled experimentation, survey research with local observations, or GIS analysis, remote sensing and history with participatory scenario building.

Fourth, establishing the usefulness and relevance of results as a basis for action involves negotiation among all the stakeholders affected by the problem or the proposed action(s). The need for conflict resolution and facilitation skills is widely appreciated in PNRM. It is less well understood that these skills are equally important in the research process when needs for information are diverse, variant standards for what constitutes scientific proof are held, and definitions of participation diverge. Researchers approach participation in different ways, and their notions of participation may not be congruent with those held by local stakeholders, leading to implicit or explicit struggles for control over the research process.

A fifth principle is that mechanisms and procedures for monitoring, feedback and learning are integrated into the research process (as well as into the resource management process). This includes scrutiny of and learning about the quality of the participation and of the research, where questions of professional standards for participation may arise. Organizational learning and change in research entities to stimulate changes in research practice and evolution towards a model of participation in research for development may be crucial.

Finally, locally accountable representation and power of decision over research priorities and practice must be present. Adaptive PNRM is unavoidably embedded in action, real-life decisions and tradeoffs because the natural and social processes being investigated are almost impossible to subject to controlled experimentation. All the stakeholders in a participatory research process intended to promote innovation in resource management that improves livelihoods must have a decision-making domain and power to make choices that *either* approximate their actual situation *or* resemble the changes that are being anticipated in their power to choose among alternative resource management regimes. Otherwise unreal decisions and false choices will corrupt the process and confound the results, leading to conclusions that cannot be replicated or scaled up, issues that are explored by Rocheleau in this volume. Often this implies that researchers and development professionals give up some of their customary control and other stakeholders gain more power over the research process.

From the perspective of research *and* development, the idea of uniting science and participation seems at worst a messy, and even risky, interference by lay people in the domain of experts, complicating controlled experimentation and throwing scientific standards into question; and at best a poor substitute for market research. From the perspective of research *for* development – itself one facet of a broader goal of establishing the rights of citizens to participate in

BOX 1.4 PRINCIPLES OF PARTICIPATORY RESEARCH

- Identify and represent different stakeholder interests.
- Build a capacity for innovation by including stakeholders in joint enquiry and co-development of new resource management regimes.
- Combine different kinds of knowledge and expertise through participatory learning and joint enquiry.
- Employ facilitation, negotiation and conflict resolution to define research priorities and practice as well as resource management.
- Monitor and evaluate participation and the research process according to agreed codes of conduct and standards of research practice.
- Make power sharing a conscious research strategy.

defining the directions of an inclusive and empowering development process – participation is an important procedure for relevant science. This book provides an insight into many innovative efforts to unite participation with scientific rigour that show the promise of this endeavour.

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Chapter 2

Navigating Complexity, Diversity and Dynamism: Reflections on Research for Natural Resource Management

Cynthia McDougall and Ann Braun

Introduction

Despite notable productivity-related successes, traditional, scientist-led, technical research in natural resource management (NRM) has come under criticism from farmers, donors, and even scientists themselves (GFAR, 1999, 2000) for concerns about weak relevance and adoption. In response to this critique, participatory research approaches – with more user-oriented, flexible methods and a different set of assumptions about research – have emerged. Yet as these participatory approaches have gained momentum, criticisms of their application have also emerged, especially around 'scientific rigour', generalizability and naiveté about power relations (Cooke and Kothari, 2001). Furthermore, the relationship between traditional and participatory research is often confusing, the lines between them blurred. Despite increasing interdisciplinarity in enquiry and innovation processes, a multitude of tensions and even scepticism surrounds the two approaches. These tensions have created the risk of NRM researchers aligning themselves either with participatory or with traditional research, and missing opportunities to gain from the strengths of the other. In this chapter, we seek to address this risk by exploring some key dimensions (see below, 'Traditional and participatory research: key dimensions of difference') and the strengths and weaknesses ('Putting it together: reflections on navigating the research spectrum') of both approaches, as well as the related concept of diversity analysis ('Diversity analysis in NRM research'). Through this exploration, we underscore the complexity and dynamism ('The challenge: complexity, diversity and dynamism in human and natural landscapes') inherent in the human and natural systems that

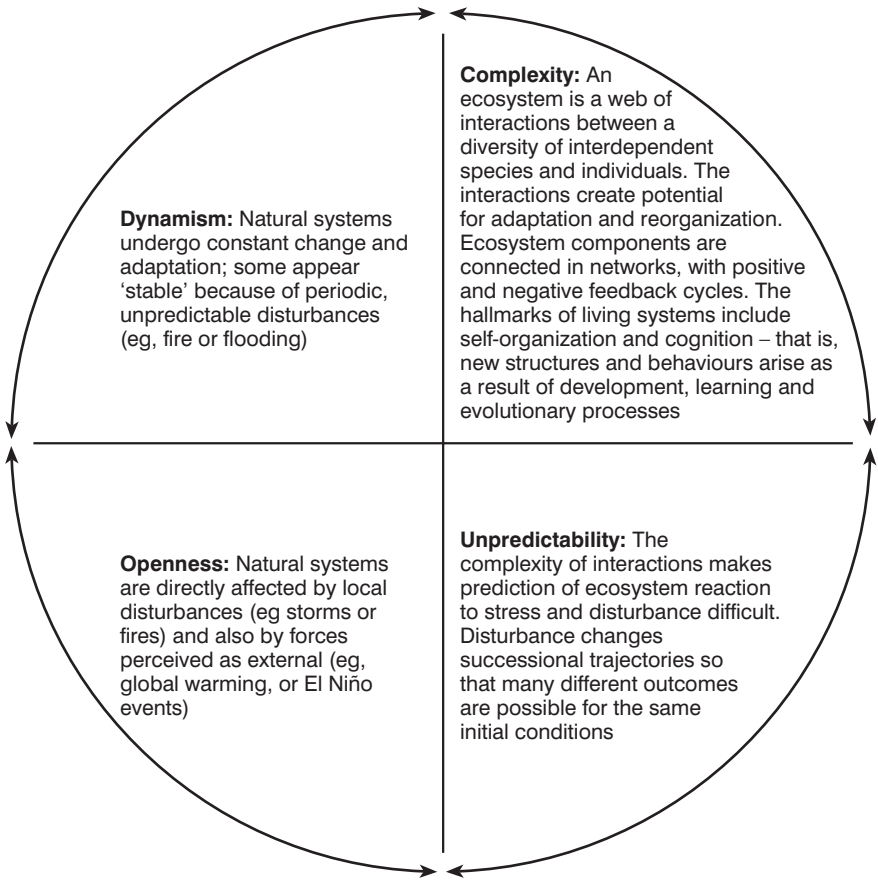
NRM research addresses. We argue that the desired improvements in NRM demand that research institutions assess, more explicitly and thoughtfully than ever before, the multiple facets of traditional and participatory research approaches, and consciously craft appropriate and innovative combinations of approaches for each research initiative.

The challenge: complexity, diversity and dynamism in human and natural landscapes

NRM research faces multiple challenges if it is to contribute to environmental sustainability, improved livelihoods and equitable social development. Many of these can be traced to three factors that underpin the resilience of human and natural systems: *complexity*, *diversity* and *dynamism*. We will briefly explore here how these affect both human and biophysical aspects of NRM systems.

NRM takes place in *complex human landscapes*. Multiple stakeholders such as local people, various levels of government, non-governmental organizations (NGOs), and private sector actors have different perspectives, interests, entitlements, knowledge, capabilities, values and power (see Chapter 3 in this volume). This is true at all scales of NRM, and in all 'sectors', including forestry, fisheries and agriculture. Within stakeholder groups, tremendous diversity also exists – a reality that dispels commonly held assumptions of homogeneous, consensual 'communities' and the existence of stable, universally valued 'environments' (Leach et al, 1997, in Anderson, 2001). Within a single community forest user group, for example, there are overlapping categories of human diversity, such as gender, age, ethnicity and caste, religion, wealth and proximity to resources. These 'internal differences' underpin critical issues of equity, power and access to resources and decision-making. This human landscape is also dynamic in nature. This is especially true in today's global economy: there are no closed social systems (Anderson, 2001); governments are decentralizing; roles and rights are changing rapidly; rural people are often relocating in search of viable livelihoods or to escape environmental or political hardship; and households rely on a constantly changing mix of livelihood activities and strategies.

One of the implications of this human system of complexity, diversity and dynamism is that individuals and institutions face constant changes in terms of risks, opportunities and decisions. The majority of decisions in NRM affect a number of different stakeholder groups, and may affect them differently. Especially where resources are scarce, or have a high value, or where differences in power exist between and within stakeholder groups, NRM becomes an on-going process of negotiation and conflict management. This varies in nature and by degree; from the forging of agreements, through 'hidden' undercurrents, to explicit violence – (such as in illegal logging conflicts in Indonesia). Anderson (2001) insightfully notes that the role of human diversity, or pluralism, is 'somewhat paradoxical since it provides some of the force that can break down or inhibit cooperation and collaboration, while it also provides basic forces for essential elements of robustness and adaptability'.



Source: Adapted from Anderson (2001), and drawing on concepts from Denslow (1980), Grubb (1977), Picket and White (1985), Maturana and Varela (1980), Capra (1997) and Holling (1995)

Figure 2.1 *Key characteristics of natural systems*

One human complexity issue of particular interest in the context of this chapter is the relationship between local people and NRM researchers. Traditional resource managers, such as farmers, may have an extensive understanding of local systems and an interest in applied learning that might lead to increased livelihood security and benefits. In contrast, the aims of most scientists are to understand systems or their individual components, monitor changes, determine responses to management and predict trends and impacts over various time periods. These different knowledge bases and interests reflect Anderson's (2001) reference to the potential for 'clash' or, we hope, complementarity.

As with human systems, natural systems also need to be understood in terms of complexity and dynamism. The Cartesian view of the world provided a relatively simple way of understanding 'nature': that is by dissecting it into smaller and smaller pieces (Capra, 1997). This 'building block' worldview

evolved to recognize how 'blocks' are organized into systems. More recent, and still emerging, perspectives recognize that natural systems can more accurately be understood as self-organizing processes driven by the 'messy' principles of dynamism and complexity, as well as unpredictability and openness. Figure 2.1 highlights these principles.

To make matters more challenging still, human and natural systems are obviously interlinked. If the management of these systems is to be effective, it must parallel their interactive, dynamic and adaptive nature (Anderson, 2001; Costanza et al, 1997, 2000). If research is to successfully contribute to NRM, then the research itself must also embody these qualities. The question then becomes how to translate this into practice. The history of formal NRM research reflects a culture of research endeavours set up along political, sectoral and disciplinary lines, with specialists operating independently on a narrow set of issues, and agendas dominated by short-term, problem-solving concerns (Shreier, pers comm). If complex and diverse human and natural systems, and the research systems that are applied to them, can be brought into harmony, the current trend of diminishing returns and decreasing relevance from research might be reversed. It is for this reason that we now turn to an exploration of participatory and traditional research, and their joint potential to contribute to positive social and environmental change.

Traditional and participatory research: key dimensions of difference

Traditional (or conventional) research and participatory research do not exist as neatly definable and independent concepts. These terms refer to collections of approaches and experiences, which theorists bundle together out of convenience and necessity, as a way of making sense of experience. We draw from several sources in this chapter to outline those dimensions that we find useful (Biggs, 1989; Probst et al, 2000; Pretty, 1994; Milne et al, 2001; Lilja and Ashby, 2000; Johnson et al, 2000).

Who owns and controls the research?

NRM research generally refers to enquiry in which there are both local and external actors involved in some way in an innovation process (Probst et al, 2000). One (some would argue *the*) fundamental dimension of difference between traditional and participatory research is the issue of 'who controls and makes decisions' about this process (Lilja and Ashby, 2000). Biggs (1989) (see Box 2.1) offers a well-known four-tier framework for understanding this range of control. Other typologies of participation that researchers are likely to find useful include those of Arnstein (1969), Pretty (1994) and Ingles et al (1999).

The related question of ownership also needs to be considered when defining participation. *Who is participating in whose process*? Scientists might invite farmers to participate in formal research processes using different types of

BOX 2.1 THE BIGGS TYPOLOGY OF PARTICIPATION

Contractual participation: One social actor has sole decision-making power over most of the decisions taken in an innovation process, and can be considered the 'owner' of this process. Others participate in activities defined by that stakeholder group – ie, they are (formally or informally) 'contracted' to provide services and support.

Consultative participation: Most of the key decisions are kept with one stakeholder group, but emphasis is put on consultation and gathering information from others, especially for the identification of constraints and opportunities, priority-setting and/or evaluation.

Collaborative participation: Different actors collaborate and are put on a more equal footing, emphasizing linkage through an exchange of knowledge, different contributions and a sharing of decision-making power during the innovation process.

Collegiate participation: Different actors work together as colleagues or partners. 'Ownership' and responsibility are equally distributed among the partners, and decisions are made by agreement or consensus among all actors.

Source: Biggs (1989), adapted by Probst et al (2000)

participation or, on the other hand, the scientists themselves might participate to varying degrees in a locally owned innovation process (Probst et al, 2000).

What do these types of participation look like in practice? *Contractual* participation is well illustrated by on-farm research where a farmer provides the land, or socioeconomic surveys in which local people respond to researchers' questions. In this chapter, the term 'traditional research' predominantly involves this type of participation, although it can also include *consultative* participation, or may involve no participation (that is, pure on-station testing of crops, or pure biophysical assessment of water or forest properties).

The other types of participation are effectively illustrated by the case studies found in the annex to this volume. For example, the McDougall et al case study illustrates research that combines *consultative* participation (in the background studies, which gave direction to the subsequent action research phase) with *collaborative* and *collegiate* participation (in the participatory action research (PAR) phase, in which local people, researchers and other partners confronted local issues of forest management decision-making, equity and income generation). While the background studies in this case were basically 'researcher owned', the PAR phase was 'jointly owned' by the forest user group (FUG) members and researchers, with the FUG members ultimately taking over and continuing to integrate the institutional innovations into their on-going management processes.

Where does research end and implementation begin?

The second fundamental difference that we highlight here is the significant difference in the links between the research and implementation (that is, application or adoption) phases of development. Traditional research collects results – typically for several seasons – before data are analysed, put into reports

and then 'released'. These are (ideally) taken up by (separate) extension services and translated into extension messages, which are then disseminated. In participatory research, particularly participatory action research, the implementation of research findings – and the related technical and social changes in the rural areas – is integral to, rather than separate from, the research process (Pound, pers comm).

Other dimensions of difference

In the above sections we located 'traditional' research (if it involves local people) towards the '*contractual* participation' end of the spectrum, and associated 'participatory' research with *consultative*, *collaborative* and *collegiate* participation. We also noted that traditional research operates with research and implementation as discrete phases, while participatory research tends to integrate or iterate between the two. But the terms 'traditional' and 'participatory' research also embody other dimensions. In Table 2.1 we illustrate these differences with a *simplified* view of the 'extremes' of a multi-dimensional spectrum.

Table 2.1 shows how the ends of the spectrum reflect different assumptions and foci (as discussed in the section entitled 'The challenge: complexity, diversity and dynamism in human and natural landscapes'). We can see a difference in the complexity and 'activeness' of the research and in researcher and farmer roles: from single to multiple perspectives and types of knowledge; from neutral or passive roles to active and engaged; and from single level/linear to multiple levels/directions of dissemination. Another point of interest in this matrix, and in the Biggs typology, is the greater degree of overlap in methods compared to other dimensions of difference. Many people assume that any research that uses some participatory methods cannot be 'traditional'; and that 'participatory' research cannot apply 'traditional' scientific tools. Methods, however, are less important in distinguishing these research approaches than the other dimensions or the degree of control over decision-making. One of the reasons for this is the increasing frequency with which traditional types of research (for example the 'transfer of technology' type, see'NRM research in practice: four examples of research "types"' below) use participatory methods of accessing information as a means of increasing the accuracy of information or its legitimacy in the community.

NRM research in practice: four examples of research 'types'

If we pull together the types of participation, the question of 'whose research', and some of the other key dimensions of difference outlined above, we see emerging patterns of NRM research. In Figure 2.2 we illustrate four 'prototypical' approaches to innovation development (adapted from Probst et al, 2000) in relation to control over research and form of participation. These are not the only possible 'types' nor are they mutually exclusive or fixed (as represented by the arrows); we present this typology because it is relatively simple, yet informative.

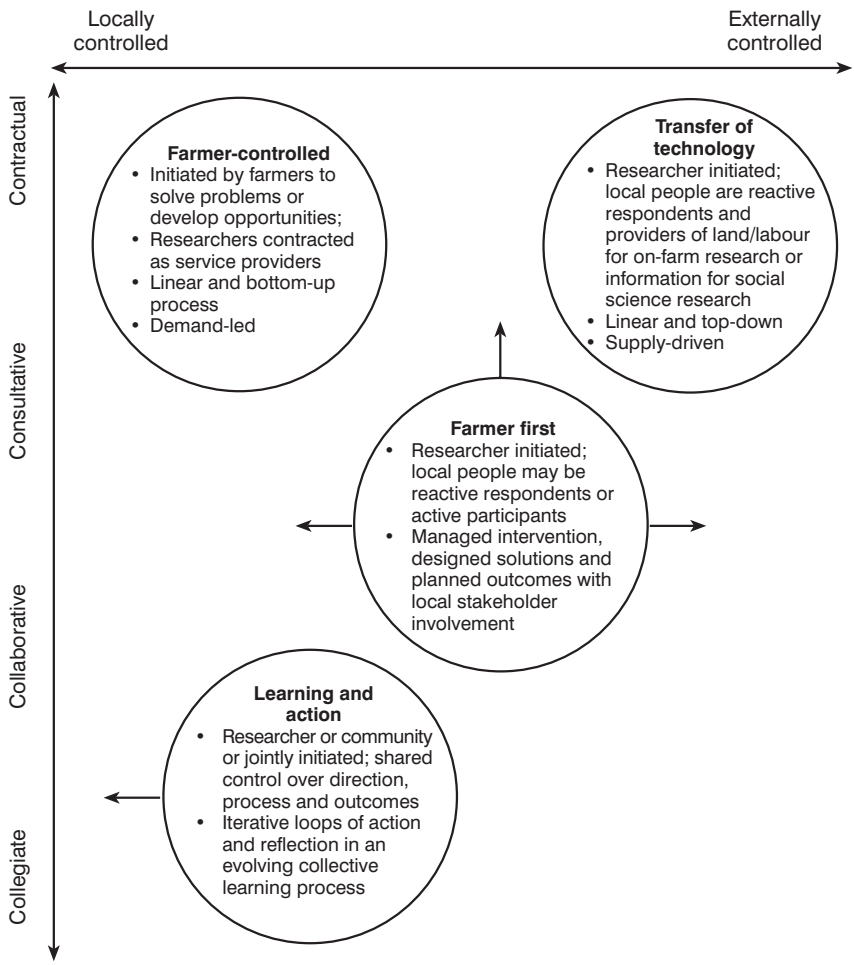
As Mcallister and Vernooy (1999) state so simply, 'there is no right or wrong amount of participation', nor is there any single 'best type', nor 'best place' on

Table 2.1 *Comparison of traditional and participatory research on several key dimensions*

Dimension	*Description of the* 'ends' *of the research spectrum*	
	'Traditional'	*'Participatory'*
Primary objective	Enhanced understanding, prediction and control by discerning general laws or principles Widespread adoption of scientific outputs Increases in productivity, profitability and environmental sustainability	Expanded flexibility and choice of options for sustainable livelihoods and natural resource management Improvements in local sites and broader impacts/influence Increases in production, food security, income, equity and environmental, institutional and financial sustainability Empowerment of communities to identify and address their own priorities
Research approach	Rigorous, controlled experimentation and statistical analysis Focus on problem-solving Places a premium on standardization, replicability, quantitative analysis, disengaged objectivity, representativeness, reduced bias; statistical significance Historically associated with biophysical research; and more recently with social science as well	Intertwining of research with action through a conscious and deliberate iterative, adaptive cyclic or spiral process which alternates between action and critical reflection Balances problem-solving with identification and development of opportunities Analysis is predominantly qualitative (sorting, scoring, ranking, weighting, drawing); analysis is iterative and optimizes tradeoffs between needed information and representativeness; accepts that many problems are site-specific and that statistically significant, generalizable conclusions may not be possible Mix of social and biophysical research; sometimes pure social research
Assumptions	Reality is 'out there' in nature to be discovered through detached, value-free observation	Reality is socially constructed and interpretations are filtered through prevailing cultural values and social, political, financial and resource-access contexts; the research process itself influences outcomes
Roles of scientists	Objective and impartial observer who gathers information for diagnosis, planning and evaluation; shares outside information and mediates between parties	Facilitator and co-learner, active participant in supporting local processes of change and empowerment

Dimension	*Description of the* 'ends' *of the research spectrum*	
	'Traditional'	*'Participatory'*
Roles of local stakeholders	Clients/users are passive recipients of the research results	Local people become researchers, co-learners and experts and are involved in decision-making at each step from identifying problems, defining the research objectives, planning approaches, evaluating results to the dissemination of the findings
Research methods	• Controlled experimentation • Modelling • Formal surveys • Key informant interviews • Semi-structured interviews • Participant/site observation • Analysis of secondary information • Ecological statistics, population dynamics, meta-population theory and landscape ecology, analysis of water and soils, and crop agronomics • Can use participatory rural appraisal tools as a means of generating data for scientists	• Formal and informal experimentation • Semi-structured interviews, personal histories • Focus group discussions • Facilitated discussions (reflection on situations, issues and possible actions) • Learning workshops and facilitated stakeholder meetings • Participatory mapping and modelling • Participant/site observation • Records/document checking • Mother–baby trials • Social diversity (eg, gender, wealth) analysis • Sustainable livelihoods analysis • Support to local initiatives • Analysis of secondary information
Dissemination, adoption and impact pathways	Application generally occurs after several seasons of testing, analysis and interpretation of results by outsiders, followed by a process of relaying these translated messages through a separate extension service Publication in scientific journals, websites and books Reporting in popular media Policy briefs Emphasis is on 'getting technology out' to target groups over a wide geographical area Research and its application are two separate processes with weak interdependencies	Application can be immediate at research site since the user experimenter owns the research; generates insights relevant to similar situations; if successful, other user groups take up new ideas once clear benefits are noted (which can be in the first season) Farmer-to-farmer dissemination (externally facilitated and/or through traditional communication mechanisms) Emphasis is on institutional processes and learning among networks of stakeholders Research and its application at community level are one continuous (often cyclical) process

Sources: Costanza et al, 2000; Biggs, 1989; Pretty, 1994; Lilja and Ashby, 2001; DFID, 1998; Chambers, 1994; Milne et al, 2001; Cooperrider and Srivastva, 1987; von Glasersfeld, 2001; Guendel et al, 2001; Allen, 2001



Source: Adapted from Probst et al, 2000

Figure 2.2 *Examples of four 'prototypical' approaches to innovation development*

the research spectrum. The challenge is for researchers to *consciously navigate* the research spectrum in order to maximize the effectiveness and positive contribution of their research to NRM and development. Before we go on to discuss this in greater depth, including implications for future research, we turn to another fundamental aspect of NRM research: gender and diversity.

Diversity analysis in NRM research

While it is an integral element of traditional and participatory research, diversity analysis is so significant and complex that it merits separate consideration in this chapter. It is obvious how diversity (see Box 2.2) affects some research

BOX 2.2 HUMAN DIVERSITY AND SUSTAINABLE LIVELIHOODS

Human diversity not only refers to ethnicity but also to many other dimensions of social and biological difference, including gender, wealth, age, class, religion and caste. As with gender, this term refers not only to roles, but also to the dynamic aspect of power relations. The various dimensions of diversity (or identity) overlap with one another in each individual, and can act to reinforce positions of relative power or disempowerment. In other words, societies ascribe roles, relations and power structures on the basis of gender in combination with other forms of diversity (McDougall, 2001).

The 'Sustainable Livelihoods' approach[1] explores human diversity by analysing five sets of capital assets: human capital (knowledge or health), social capital (family, group and institutional links), financial capital (cash in hand or indirectly accessible), physical capital (infrastructure) and natural capital (land, water, plants and animals). Families might be poor in some assets, but relatively rich in others. An increase in one set of assets might be accompanied by a decrease in another. Taken together with an analysis of the external (institutional, political, legal and cultural) contexts and of family vulnerability to disaster, the analysis of capital assets can help in understanding, or developing, livelihood strategies that are relevant to individual families, taking into account their particular circumstances and aspirations.

dimensions, such as methods. Yet diversity also interacts in subtle ways with other research dimensions; it influences, for example, the issues of rigour, validity and objectivity. These, in turn, affect the confidence and credibility that can be accorded to research results, and the domains into which they can be disseminated.

What is diversity analysis?

Diversity analysis is more than analysing data by gender or ethnic group. It is an approach in which key elements of human difference, such as gender, wealth, caste, age and ethnicity, become analytical variables throughout the research or programme, from design to implementation, analysis and evaluation. It involves exploring a range of questions and issues spanning both the structure (roles) and dynamics (relations) of human systems. Some of the points for exploration include:

- What are the roles and responsibilities of the different groups relating to natural resource management?
- How and why are these roles, relationships, patterns and differences changing over time?
- What are the differences in how resources are valued?
- What are the differences in the criteria for decision-making about resources and why do they exist?
- Who controls access to resources? Who makes decisions about them and why?
- Who benefits from each activity or enterprise? Who bears any associated costs?

BOX 2.3 A TYPOLOGY OF DIVERSITY ANALYSIS

Descriptive Diversity Analysis: Gender and other social differences among stakeholders in the research site are described – for example, the different roles of men and women, or the power relations among people in different wealth or well-being groups – but this information is not used to design the research questions or process.

Design-oriented Diversity Analysis: As with Descriptive Diversity Analysis, but this information is used in designing the research questions and activities (and in planning the intended outputs and outcomes of the research).

Transformation-oriented Diversity Analysis: As with design-oriented diversity analysis, gender, ethnicity, wealth, and and other stakeholder differences in the research site are described, and this information is used in designing the research questions, activities and intended outputs and outcomes of the research. Also, the research process and outcomes are designed to help marginalized stakeholders overcome barriers to their full access to decision-making processes and resources, both within the research process and beyond it.

Source: Based on Milne et al, 2001 and modified from Lilja and Ashby, 2001

- What are the relationships among the groups? What are the power dynamics?
- How do relationships, power and roles influence the decision-making of the group regarding resources and ultimate outcomes?
- What options exist for increasing equitable access to decision-making and natural resource benefits, especially for marginalized stakeholders?

Many practitioners and theorists increasingly emphasize that the focus of the analysis should be on *relations* rather than *roles* (McDougall, 2001), except at a very descriptive level. This is because a focus on roles offers a 'static' perspective on issues that are based on power relations, and thus inherently dynamic (Young, 1988). In Box 2.3 we offer a modified version of a typology of gender analysis developed by the System-wide Program on Participatory Research and Gender Analysis (PRGA) of the Consultative Group on International Agricultural Research (CGIAR). The typology ranges from an analysis aimed at a description of roles to a more dynamic approach that seeks to address inequities.

As with the participation typologies (see the section entitled 'Who owns and controls the research?'), there is no single 'correct' type of diversity analysis; instead the researcher must identify the key dimensions of diversity or difference that merit inclusion, and navigate the spectrum of participation to find the appropriate level for the given objectives and context.[2] The different outcomes of navigating this spectrum are well illustrated by the range of diversity approaches used in the case studies (see Table 2.2), summarized in this volume.

In its shift from descriptive to more action-oriented enquiry, this diversity analysis typology (see Box 2.3) can be seen to roughly parallel the spectrum of traditional to participatory research. The very 'ends' of the traditional and participatory research spectrum are fairly clearly linked (for example,

Table 2.2 *Types and significance of diversity approaches from case studies*

Case	*Type of diversity approach*	*Function/significance of diversity approach*
Stroud	Descriptive	Enables understanding of ecological, social and economic variability in a region as part of a technology assessment and selection process to improve soil fertility and arrest erosion
McDougall et al	Design-oriented and transformative	Helped shape the local-level research questions and action research process design; promotes equity within local forest user groups and permits navigation of power relations and negotiations between local people and other stakeholders
Braun	Transformative	Marginalized social groups, including women, gain social status and respect through participation in a local agricultural research committee
Jarvis and Klemick	Design-oriented and transformative	Gender-disaggregated data collection and gender equity in employment of local team members enables projects on in situ conservation of plant genetic resources to address livelihood issues
Gurung	Transformative	Builds capacity of indigenous groups to better represent themselves in development dialogue
Schreier et al	Descriptive and design-oriented	Research that focuses on reducing workload of women has had immediate effects on improving the livelihood of rural families
Vernooy and Espinoza	Design-oriented and transformative	Watershed management via collective action, involving local organizations has allowed women, ethnic minorities and the landless to gain more control over resources and to influence policy-making
Peters	Design-oriented	Enables the search for technology options to improve well-being of women and poor smallholder farmers
Nelson	Research design-oriented	Incorporates opinions of men and women in participatory evaluations of varieties and breeding lines and in the design of a training curriculum relevant for women
Pound	Research design-oriented	Community management of a devastating soil-borne disease affecting a crucial income-generating crop required consideration of the needs of women and men of different social groups
Conroy and Rangnekar	Research design-oriented	Collection of gender-disaggregated data assisted the formulation of a plan for collective management of a water trough and storage tank for livestock
van Koppen	Transformative	Creation of inclusive water use associations in South Africa required organizing producers, irrespective of land rights, in a bottom-up way, to ensure transparent election of committees accountable to constituencies

participatory action research and transformation-oriented diversity analysis); the vast middle areas, however, call for considerable attention and flexibility on the appropriate type of diversity approach (eg, consultative research might take descriptive or design-oriented approaches). The potential 'clash' that can be identified between diversity approaches and some traditional research occurs where the research assumes that local stakeholder views and needs are homogeneous. It may be that these views and needs are, indeed, homogeneous in a certain case. In cases where there is significant heterogeneity, however, the 'costs' of overlooking the diversity may be very high, including limitations to the relevance, effectiveness or adoption of the research, or even the marginalization of certain groups. This potential clash can be avoided by research teams seeking out and examining the validity of underlying assumptions in this area, on a case-by-case basis.

Besides the analytical aspects, there is one further point related to diversity that we suggest as necessary for all parts of the research approach spectrum whenever any local people are involved: design and implementation of research that is sensitive to local stakeholders including, and especially, women and marginalized groups. This refers to the simple, yet still sometimes overlooked aspects of accommodating workloads, cultural and other factors that may create difficulties or discomfort for local people in research settings.

Diversity analysis, research and NRM

> Experience has disproved the projections of development pundits who believed in the 'trickle down theory'. The assumption that targeting development interventions at male heads of households would equally benefit other household members, particularly women, has not been validated in practice. (Sarin, 1997)

Natural resource managers' perceived opportunities and constraints in decision-making, and their resulting actions and behaviours, are not only determined by the natural system in which they exist; they are significantly determined by their different (diversity) identities, including their interests, roles, knowledge and vulnerability and power (Schmink, 1999). In this way, diversity analysis in NRM contributes to 'a more accurate and complete picture of a complex social landscape' (McDougall, 2001). Research that better reflects the experiences of diverse (especially non-dominant) groups is more likely to lead to NRM policies or programmes that take into account those different experiences and aim for more sustainable and equitable impacts. Furthermore, a diversity approach tends to bring to light the 'invisible' poor stakeholders, and elucidate the fact that relative well-being is neither neutral nor random. In this way, more accurate and complete assessments also lead to more effective and efficient impacts of research, policy and development programmes (McDougall, 2001; Wilde and Vainio-Mattila, 1995).

While diversity analysis (and sensitivity) is necessary across the research spectrum, diversity analysis and participatory research are mutually reinforcing. In *collaborative* or *collegiate* research there is shared responsibility for, and

ownership of, the outcomes resulting from choices and decisions made jointly. Ideally, by taking part in research, learning, and negotiation, all those who participate become collectively responsible for decisions and for the resulting outcomes. They become the owners of their choices, and the research and consequent NRM process may be 'democratized'. As diversity analysis addresses the key issue of who should participate in decision-making about NRM, it can enable multiple stakeholders to critically assess how different users affect, and are affected by, the status quo and innovations in technology, institutional arrangements, management practices and information flows. Used effectively, participatory research grounded in diversity analysis can draw out and build on the range of perceptions, interests, relations and power, to form the basis for a consensus-building process for increasingly equitable and sustainable NRM. At the same time, these changes are not without risks. These processes can shed light on and activate dormant or latent conflicts. Pound (pers comm) suggests, as well, that enhanced equity in NRM institutions can also reduce motivation and contribute to the loss of local natural resource enterprise viability.

> A final and important question is raised here about the nature of diversity analysis: because it is rooted in a movement for social transformation, and is essentially 'political' in nature, is diversity therefore also transformative about other relations? Specifically, does it redefine concepts of 'subject–researcher' relations? Does it challenge traditional notions of 'objectivity'? Certainly diversity analysis at least demands a certain degree of critical self-reflection by researchers in terms of their roles and relationships with the 'participants' or 'subjects' of the research. This, and the potential reflection on researchers' own identities, influences and biases, pose a (welcome or sometimes unwelcome) challenge for research teams. (McDougall, 2001)

Putting it together: reflections on navigating the research spectrum

The foregoing sections explored the challenging context of NRM research, some dimensions of traditional and participatory research, and the indispensable concept of diversity analysis. The goal of this section is to contribute to critical reflection on research design by highlighting several key factors that relate the research approaches to the desired NRM impacts. The 'litmus test' of an NRM research approach is, of course, the extent to which it contributes to creating greater choice of livelihood and environmental options, benefits and security, while maintaining the quality of the natural resource base. If either traditional or participatory research alone had excelled at this challenge, then the choice of research approach would be relatively simple. In fact, both traditional and participatory research approaches have produced mixed and uneven contributions towards these goals. While there have been

advances in NRM and human well-being that relate to traditional research, for example, its record has been inconsistent and limited, and where it has contributed, it has tended to do so only for the middle-income to wealthy farmers (Conway, 1997). Traditional research also faces some valid questions in terms of its impact on long-term food security, because of its potential narrowing of the agricultural genetic base in farming systems. The field of biotechnology is also faced with questions about its potential environmental and human health threats. While participatory research, especially participatory action research, has made some significant progress in increasing well-being in some communities and management systems at a neighbourhood level, these impacts have been predominantly localized (Guendel et al, 2001). Furthermore, participatory research experiences have also abounded in which the quality of participation was questionable and/or the attention to gender and diversity was not sufficient to counter a bias towards the local elite (Cooke and Kothari, 2001). This being the case, in this section we consider several other factors that can help in the navigation of the research spectrum, including the linking of research approaches to objectives, research questions, knowledge and communication.

Research objectives and approaches

In this section we highlight three ways in which the level and kind of participation needs to be adjusted to the research objectives, defined collectively by researchers and other stakeholders. The first, and perhaps most ubiquitous, issue is the matching of type and degree of participation to the nature and quality of information required for each research case. Questions such as the following may help guide research teams through these decisions:

- What kind of *qualitative* versus *quantitative information* is needed for the desired analysis?
- Do some stakeholders (for example, credit organizations or variety release boards) require quantitative information from the experimentation process?
- To what extent does our research question require participation, and diversity analysis, to achieve the appropriate *level of accuracy* (and specificity) of information?
- What are the tradeoffs between local accuracy and the *generalizability* of findings, and how can they be addressed?
- To what extent can the '*hypotheses*' be tested 'in action', in complex social or natural environments, and to what extent do they require a more controlled environment?

Research with a local-scale agenda, may do well to have a highly participatory and qualitative research process (possibly with a transformation-oriented diversity approach). The degree to which the research questions and objectives demand the ability to extrapolate the findings beyond the site will influence the design in terms of mechanisms for 'scaling up', such as comparative cases with common variables, or tools such as geographical information systems (GIS, see

Chapter 4; van de Fliert and Braun, 2002; Guendel et al, 2001 and the McDougall et al case study in this volume). On the other hand, research into a limited number of components of a specific biophysical process may be well suited to more 'station-based', scientist-led, disciplinary research, which provides an opportunity for 'controlled' experiments where the effect of individual variables can be isolated and compared. This ties into an important role of traditional biophysical research, the development of general theories for the structure and dynamics of natural and managed ecosystems, such as agro-forestry and fishery systems (Schreier, pers comm; Settle, 1997).

The farmer field school experience (see Nelson case study, this volume; Braun et al, 2000) illustrates how traditional research can contribute to locally specific research needs, and how traditional and participatory approaches feed into one another. Farmer field schools emphasize experimentation aimed at discovering how the local agroecosystem operates as the foundation for decision-making. For example, in some contexts, experiments have helped farmer field school participants to realize that a reduced use of pesticides permits the development of larger populations of beneficial species capable of controlling pests. Farmers can translate this knowledge into relatively simple decision rules governing their pesticide use. In other contexts, for example where there are recently introduced species, local understanding of ecosystem components and inter-relationships is not sufficiently developed to permit the development of good field school learning exercises. In these cases, farmers cannot easily formulate simple decision rules (Settle, 1997), and thus there is a need for a more explicit link with formal research (as well as development of farmer capacity for controlled experimentation and relatively rigorous data collection (Loevinsohn et al, 1998; Whitten, 1996; Braun et al, 2000).

The second issue relating objectives to participation is that any research initiative involving local people must define its social goals and its level of obligation to improve the situation of local people. De facto responses to this question range from no responsibility, through return of research findings in an appropriate manner, to engaging in transformative activities at the sites. In fact, in many cases, this decision is made implicitly (by the research team), rather than explicitly, both at the research project and institutional level. This is indicative of the dimension of difference between traditional and participatory research regarding the degree to which the research merges into dissemination and application of the results (see the section entitled 'Where does research end and implementation begin?' above). Our own case experiences suggest that negotiating this decision in a more explicit way can help to strengthen the clarity of the design and objectives (and expectations) for researchers and local people.

The third, and related, issue in the consideration of objectives and corresponding research approaches is that participatory processes can catalyse *institutional learning* in the research team (as opposed to the *acquisition of knowledge* by scientists on NRM issues). They not only potentially change the kind and source of the information gathered but, more fundamentally, require that the research teams loosen their control over the 'lens' through which different NRM options or scenarios are viewed. Research teams that put a premium on their own learning as the basis for adaptive approaches to research may therefore

seek participatory approaches to their initiatives (and likely to their own internal processes as well – see Chapter 6).

Strengths and weaknesses of research approaches

Besides the implications of research objectives, several other factors may play a definitive role in developing an appropriate research approach for a given initiative. Table 2.3 and the following four sub-sections explore some differences, strengths and risks of traditional and participatory research relative to four underlying conditions for successful NRM research:

1 asking the 'right' research questions – those that are critical and relevant to stakeholders;
2 integration of local and scientific knowledge;
3 effective communication of research findings to those who need them;
4 assuring that 'costs' of inputs to research are acceptable to local stakeholders and researchers. (Pretty and Hine, 2001; Chapter 6, this volume).

Asking the 'right' research questions

No matter how good the research, if the question it is seeking to address is not the right one, then its impact is limited. Gladwin et al (2002), for example, suggest that the seemingly crucial question of 'how much nutrient a farmer should put on her soil given the desired output' is not the 'right' question for most poor African farmers. Although these farmers desire higher outputs, and being able to predict the impact of nutrient levels would be potentially useful, their resource constraints do not permit them the luxury of responding effectively to that information. The type of questions they need answers to are more like: 'How much nutrient can we afford to put on, and how much yield will that give and how will we make up for the gaps? (Gladwin et al, 2002)

From Table 2.3, we can see that participatory research (especially the critical objective setting and design phase) offers the advantage of acting as a check on the relevance of research questions to local people (the ultimate beneficiaries). Yet, great local relevance may pose certain risks as well. It may make the research questions (and outcomes) so specific that it limits their generalizability to other areas, and it may shorten the 'lifetime' of the relevance of research questions and their outcomes. Traditional research, on the other hand, typically addresses 'slower moving' issues, and thus research questions with longer time scales. Furthermore, while in theory the outputs of traditional research may be more readily transferred to greater geographical scales than locally oriented participatory research, in practice its results may be of limited 'real world' relevance (especially in the context of relatively more marginalized lands and farmers). Clearly some articulation between the two, as well as appropriate application of diversity approaches, would lend strength to NRM research in terms of an ability to balance issues of scale. The McDougall et al case study in this volume offers one example of an effort towards such articulation. This research project has a set of overarching strategic research questions (that is, conditions and strategies for, and outcomes of, *adaptive and collaborative management* of forests) and a set of basic variables, shared by sites in

ten countries. Researchers at each site use these questions and variables for guidance in their own research design, and respond to them as a part of both their initial context studies and their final analysis. This shared framework enables cross-site and cross-country comparative analysis. Meanwhile, at the site level, researchers and local stakeholders engage in action research that falls within this research framework 'umbrella', yet addresses a locally specific set of priority NRM issues. For example, they explore the possibilities for improving equity and accountability within a forest user group, and enhancing forest-related livelihood benefits, through joint self-monitoring and adjustments in decision-making processes.

Integrating local and scientific knowledge

> The dangers of theorizing while safely ensconced in the ivory tower are not exaggerated. Yet … throwing out the methods of modern science along with quantification and statistics … is putting the researcher in more danger – the danger of being wrong with no way to show it. By contrast, the scientific method requires the researcher to model their interpretation of reality by generating a hypothesis about people's behavior, then collect observational data to test the model, then revise the model based on the test results. This hypothesis-testing sequence is the basis of science. Without it, researchers have no way of giving themselves a reality check. (Gladwin et al, 2002)

The value of the knowledge generated is perhaps one of the most hotly contested of the debates in development science, because it includes questions of rigour and generalizability, as well as different knowledge worlds. As illustrated by many of the case studies in this book (Dey, Stroud, Vaughan, Snapp and Rohrbach, Heong, Nelson and Braun), research that intends to produce agricultural or NRM technologies or processes for 'adoption' and 'adaptation' by farmers needs to integrate the best of local and scientific knowledge worlds, or else risk failure.

We start by addressing the issues of knowledge worlds: what is the relevance of the differences in knowledge worlds in NRM research? Traditional researcher-led experiments draw on the scientific method to provide information on theoretical maximum effects under controlled conditions, where constraints are minimal. They also provide understanding of key processes. Local research by farmers and other resource users provides responses under realistic management conditions where a wide range of constraints may affect the outcome. In traditional researcher-led experiments a limited number of factors are tested and hence the extrapolation of the results to more complex settings is problematic. In farmer-led research, on the other hand, it is more difficult to assess the direct causes of diminished performance, because of the fact that it is addressing issues in a complex and dynamic system.

In terms of the 'validity' of that knowledge, Chambers (1994) points out that there is significant evidence of 'local knowledge' being more 'accurate' than

Table 2.3 *Strengths, weaknesses and risks of participatory natural resource management research approaches (relative to traditional approaches)*

Parameter	*Strengths*	*Risks and weaknesses*
Research relevance	• Diverse local people provide direct feedback on relevance of the research questions • Diverse local people provide a 'reality check' on labour and economic constraints of technology development, and accuracy of information • Needs of poorer and marginalized people can be addressed	• If focus is only on community units and immediate concerns, then the management of larger natural units (eg, watersheds, coastal or ecological zones), or larger scale issues (eg, climate change, epidemics transnational pollution), or long-term concerns (eg, soil fertility decline, resource degradation) may be neglected
Integration of knowledge from many sources	• Formal research is linked to farmer experimentation • Research is more interdisciplinary and holistic • The joint learning process benefits both farmers and researchers	• Increased complexity and challenges of integration • Important external forces may be ignored • Early recognition of future problems may be limited • Interdisciplinary team members must be flexible and capable of negotiation and compromise • Dependence on the willingness of political systems to give communities more power to manage local resources
Communication of results	• Forum for communication for researchers, farmers and the general public • Obliges researchers to learn to communicate better with farmers and the general public	• Scaling up is challenging, especially if not incorporated into project activities from the beginning
Researcher and farmer input	• The focus on developing human capacities can bring sustainable long-term benefits • Diverse local people have a stronger voice in development; they can play a stronger role in development and resource management vis-à-vis more powerful actors • Innovations can be developed and disseminated more rapidly for specific sites	• Participatory approaches are time consuming for farmers and researchers; much time is spent in negotiation and on building capacity • Higher time costs are especially significant for women and marginalized peoples • The traditional 3–5 year research project funding is generally insufficient

Parameter	*Strengths*	*Risks and weaknesses*
		• There are several challenges in balancing: efforts on diagnostic work and participatory technology development; social and biophysical research; qualitative and quantitative data use • Methodologies are complex and require new skills that may not be available in many research institutions – especially interdisciplinary and social science, communication and leadership skills • Interdisciplinary work is challenging; it requires knowledge, people and technical skills that may not be available • Low human capacity, institutional hierarchies and bureaucracy, paternalism and poor community cohesiveness can make participatory processes difficult to initiate

scientific knowledge in some issues; thus the need for 'science' to be humble in its claim for validity. At the same time, the reverse may also be true. Local resource managers may notice the symptoms, but incorrectly assign the cause. For instance, herders in east Africa avoided grazing their cattle on some areas because of their fears of 'poisonous grasses' that made their cattle sick, when it was actually tsetse flies causing trypanosomiasis. In Asia, K L Heong points out that the very visible damage done to the early stages of rice by leaf folders resulted in many farmers spraying their crops in the belief that this would lead to higher yields. In fact, carefully controlled studies showed that the leaf folders did not lead to economic damage, and that spraying was unnecessary (Heong, pers comm).

The issue of the 'quality of science' or 'rigour' has also been at the heart of much debate on the knowledge derived from traditional and participatory science. The wealth of experience of 'rigorous' research that did not take into account local needs, interests, knowledge and preferences, and resulted in 'scientifically' valid, but unused, outputs helps to contextualize this issue. Clearly, classical 'rigour' is not in itself sufficient if the science cannot transfer into real world, complex systems, and ultimately to benefits. In these cases, traditional research can profit from combining with holistic complex local knowledge through the incorporation of participatory approaches. Equally, there are some valid critiques of potential shortcomings of participatory research in gathering and analysing data. Gladwin et al (2002) point out three of these, in relation to 'rapid rural appraisal' types of research (which are participatory – but tend to be on a very short timeline):

1 each member of the research team tends to work with, and then draw generalizations from, too small a sample size (and these generalizations are pooled with other generalizations);
2 time pressures contribute to ignoring variations in farmers' decisions and practices, and focusing instead on similarities;
3 the hypotheses and generalizations generated may remain untested, mainly because much of the data may remain uncoded and unanalysed.

In these cases, the research risks its quality, and/or its generalizability.

Research teams can avoid these pitfalls of participatory research, by directly and creatively addressing them through careful design (while maintaining flexibility), detailed observation and record keeping, and explicit analysis with clear documentation. The design can enhance the quality of its local findings by drawing on the essence of the scientific method (ie, reality checking through testing 'assumptions'), not in a rigid way, but innovatively and as appropriate (eg, the Braun case study in this volume; Gladwin et al, 2002). Several sources highlight ways to safeguard the 'quality of science' in participatory and 'soft systems' research (see Chapter 5, this volume; Pretty, 1994; Chambers, 1994; Dick, 1997; Checkland, 1981; Checkland and Scholes, 1990). We highlight some of these in Box 2.4.

Integrating local knowledge and 'scientific' knowledge is not a simple task. As traditional research seeks to increase its ultimate effectiveness through the

BOX 2.4 SCIENCE QUALITY IN PARTICIPATORY RESEARCH

A scientific claim is an assertion, not a fact. What makes it scientific is that it is 'warrantable'. In the course of a typical participatory action research initiative, many assertions are made. The challenge is to make them adequately warrantable. An assertion is an interpretation of evidence. The evidence is drawn from the data in the study, and from the literature. To be warrantable, the interpretation must have been reached only after attempts to exclude other interpretations. Furthermore, it must account for the evidence as well as, or do so better than, the alternative interpretations. The interpretation can only be as good as the evidence on which it is based. 'Good' evidence must be based on an adequate sample of all the evidence that might have been collected. Participatory action research must address this, while observing the 'givens' of the situation. For example:

- In each cycle the researcher may try to disconfirm the emerging interpretation. Many short cycles permit multiple chances to disconfirm.
- At each cycle the methods used can be critiqued and refined.
- Data collection and interpretation can be included in each cycle. Thus both data and interpretation can be tested in later cycles.
- Divergent data can be specifically sought out to increase the chance that any piece of data or interpretation will be challenged by other data.
- The literature can be used as a further source of possible disconfirmation. The researcher who has deliberately sought disconfirming literature, and failed to find it, has a more warrantable assertion than could otherwise be claimed.
- The planned changes emerging from participatory action research are derived from the data and the interpretation. Analysis of these offers further opportunities for disconfirmation.

Source: Dick, 1997

incorporation of local knowledge and preferences, it comes face to face with diversity of all kinds, and needs also to seek the appropriate place on the diversity spectrum. Approaches for ensuring 'rigour' employed in the research cases in this volume include: the use of common strategic questions and analytical variables across PAR case studies; participatory modelling; the use of forums for the exchange of experimental results; analysis at different temporal and spatial scales; and the use of GIS for extrapolation and the integration of qualitative and quantitative information (see the Vaughan, Heong, Nelson, Braun, Vernooy and Schreier case studies in this volume).

Effective communication and application of research findings

A participatory research approach can contribute to NRM research its experience in the establishment of local communication and research findings 'uptake' mechanisms. The on-going horizontal, multi-directional information sharing between external and local stakeholders, and within local groups, which is typical of participatory research, may help to correct distortions in information. This distortion correction function should not be underestimated; most NRM research is not only operating in a complex system, but at the *intersection* of multiple

complex systems, and the likelihood of misinterpretations by research is very high. Furthermore, this kind of communication is a critical part of generating the immediate application of research findings and thus research impact.

Traditional research offers powerful methods of communicating to audiences well beyond the research site, including international donor agencies, national policy-makers, and extension services. In this case, participatory research experiences can benefit from borrowing strategies and tools for scaling-up results, such as GIS and modelling. The attention to explicit documentation and analysis contributes, also, to the ability of participatory research to effectively use the dissemination channels of traditional research, including scientific journals and policy fora. In other words, it seems very likely that combining the communication (and related impact) strategies of participatory and traditional research, on a base of high quality research, will generate movement towards research that is both relevant locally, and effectively and broadly disseminated and applied.

Costs of inputs to research are acceptable to local stakeholders and researchers

Participatory research is generally viewed as having higher time and 'effort' costs than traditional research, in the sense that a research team can do surveys in dozens of villages in the time that it takes to do participatory action research in one village. Although this is true in relation to the intensity of effort involved, this perception is also somewhat flawed because it is comparing initiatives with different objectives and processes. As noted in the section 'Where does research end and implementation begin?', above, traditional research views the research findings and/or output as the product, whereas participatory research typically views greater livelihood security and positive environmental change as the product. In other words, the participatory research 'timeline' necessarily involves an 'impact' phase that merges with the research phase itself (Pound, pers comm).

A related point, distinguishing the 'efforts' involved in research, is the nature of local stakeholders' decision-making regarding their involvement (and expectations) in research. Traditional research is extractive, and there is no obvious research findings-related benefit to communities; their time is generally either paid for (in cash or in kind), or donated (out of interest, hoped-for benefits, curiosity, a sense of obligation or a variety of other motivations). In well-conducted participatory research, local stakeholders should be clear from the start, and throughout, about the costs and benefits that might accrue to different groups; in other words, they make a conscious decision (and an on-going series of decisions) whether or not to invest their time and effort in a long-term process. An additional consideration here is that the impact in the early years often gives an advantage to the stronger members of a community. This may be due to it taking longer for the socially weaker, less secure members to join the processes of joint experimentation – for reasons that may include time and costs. This can also be because research benefits relating to long-term improvements in financial and natural capital can depend on certain levels of human and social capital, and these must be built up during the research process as well.

Participatory research can speed up the innovation process. For example, participatory plant breeding consistently leads to faster release and dissemination of locally accepted varieties (PRGA Program, 1999). The key is sharing the responsibility for selection with farmers early in the breeding process when the amount of genetic variability is at its maximum (Ceccarelli et al, 2000). In one successful example, Syrian farmers working with barley breeders began producing seed from a few of their own best selections after only two growing seasons (PRGA Program, 1999). On the other hand, as research becomes more participatory, issues of democracy, equity and voice become increasingly significant – all of these require careful process and cannot be rushed. In these cases, and especially where participatory research involves significant or difficult negotiations of interests (either between external and local stakeholders, or among local stakeholders), it will add time to the research process. This cost must be weighed against the potential gains of this type of research; the outcome of this weighing-up will be different for different issues and contexts. As a whole, it seems likely that the future of research may indeed require a shift in the time and effort allotted to NRM research activities. If our hypothesis is correct – that NRM research requires both traditional and participatory research – then these costs may increase slightly; if donors and institutions are committed to impact, then they may have to adjust the traditionally short (three-year) research activity time frames accordingly.

Another critical input to the research process, which differs by approach, are the skills of researchers (including local researchers). Participatory research approaches require new skills, such as facilitation, which have not been part of the training of traditional researchers. The most challenging component of any participatory research approach is the organization and maintenance of the stakeholder processes (Cooperrider and Dutton, 2001). Success, therefore, hinges on positive interactions and creating a spirit of collaboration between researchers, local peoples and other partners. Participatory approaches require that team members have exceptional 'people skills'. This implies that they should be culturally sensitive, tolerant, diplomatic, motivated to collaborate and possess appropriate enquiry skills (eg, avoiding the use of leading questions in favour of open and probing questions). They must be able to engage in multi- or interdisciplinary analysis, and be flexible while seeking ways of maintaining scientific rigour. These skills are necessary so that stakeholders can reach agreement on common objectives, keep the interactions transparent, and maintain open and active trust and communication. While access to these skills may pose a challenge to research institutions in the short term, it seems likely that these costs will be reduced somewhat with the current trend of increasing numbers of interdisciplinarians in research, and a greater emphasis on building teamwork skills, and collaboration in and between research teams.

> Participatory action research is like 19th century physics: the best researchers are the ones with the handicraft skills for building the (social) apparatus necessary to test their hypotheses. (Dean Holland, pers comm)

Conclusions

There will always be some cases where pure 'traditional research' or pure locally oriented 'participatory research' are the appropriate approaches. However, if the assessment above is valid – that appropriate combinations of traditional and participatory research make for more relevant research questions, better knowledge bases and communication – then we can extrapolate a lesson from it for current and future NRM research: NRM research is more likely to achieve livelihood and environmental benefits through thoughtful and appropriate combinations of traditional and participatory research approaches than it is through adopting either approach on its own. This assumes that such combined methodologies can maintain the strengths of both traditional and participatory research vis-à-vis impact, including:

1 maintaining the generation of local benefits in the research sites as participatory research often has;
2 exploring both locally and generally relevant research questions, including the desirability or adoptability of the technologies or processes generated;
3 applying diversity analysis (including gender) to increase inclusivity and relevance;
4 applying appropriate aspects of the scientific method and good documentation and analysis for the validation of results;
5 creating impact by influencing stakeholders (including policy-makers at various levels) through research.

We are at a global crossroads in terms of human and environmental development. Research in NRM needs to respond more effectively than it ever has before, if we are to successfully meet the local, regional and global challenges facing humanity. And yet, NRM research itself also appears to be at a crossroads, with some latent tensions surrounding traditional research on one side and participatory research on the other. This is further complicated by the increasing recognition of diversity as a critical, but as yet weakly implemented, factor in development and NRM. Are traditional research, participatory research and diversity analysis compatible? Our response is that although traditional and participatory approaches may have different philosophical roots and other differences, they are not only compatible but, in many cases, they need one another. Together they generate richer and deeper knowledge, and more effective and appropriate technology than either one alone. How should they be combined to achieve this? There is no prescription for developing research approaches, nor will there ever be. The challenge is for research teams to implement careful, early and on-going assessments of their NRM issues and multiple objectives – through the lenses of complexity, dynamism, gender and diversity – as the basis for the thoughtful and creative building of research approaches for each research initiative. Research teams can use these assessments to sieve through the plethora of research options and decide, with their partners, which aspects of each approach are of value in that context.

Combining aspects of the different approaches thoughtfully and appropriately may enable NRM researchers, development practitioners and policy-makers to access greater understanding of both the fundamental biophysical processes that underlie NRM systems, and the human needs and interests involved. This thoughtful approach to research methodologies may enable societies, both large and small, to begin to deal more effectively and equitably with the challenges and opportunities posed by the complexity and dynamism inherent in human and natural resource systems.

Notes

1 See the Sustainable Livelihoods website of the Department for International Development (DFID): www.livelihoods.org.
2 'Given objectives' refers to those agreed upon by key stakeholders in the research. Depending on the circumstances, this may include diverse local people, researchers, extension agents, non-governmental organizations and others.

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Chapter 3

Whose Research, Whose Agenda?

Adrienne Martin and Alistair Sutherland

Introduction

This chapter starts with the premise that fostering ownership during the natural resource research process is good practice. Fostering ownership requires time and resources. Moreover, it becomes increasingly complex and challenging as the scale of research moves from farm to landscape levels, and research moves beyond the analysis of situations and into the implementation, evaluation and uptake stages. Conflicts of interest may arise at various levels, as each of the stakeholders has a particular perspective, time horizon and expectation about outcomes. The focus of this chapter is on the factors that influence the ownership of research processes; from the identification of the problems and setting of the research agenda through to the ownership and direction of research implementation, evaluation and dissemination. We use the term 'research' liberally, to include situational analysis, participatory learning and planning and the investigation of the constraints to and opportunities for uptake of natural resource management (NRM) strategies and technologies. Three levels of ownership are addressed:

1 Ownership at the macro (national and global) level, by policy- and decision-makers in national governments, donor organizations and international research organizations.
2 Ownership at the meso/district level, by administrators, technical experts, politicians and private sector players.
3 Local ownership, involving communities, households and individual farmers.

We begin with a short discussion of ownership at the macro level and then move on to examine a case of a project fostering ownership at a district level. The cases illustrate some of the different institutional contexts and participatory

approaches used and bring out important general principles relating to ownership of the process. We then focus in more detail on the local level, through a series of case studies which document interventions in communities covering different aspects of ownership of natural resource research and management processes. These cases describe the involvement of communities and other stakeholders during agenda setting and problem identification, research implementation, review and evaluation. The final section discusses some of the critical issues and factors in encouraging broader ownership of research, the benefits of this sharing and the implications for researcher roles and institutional relationships.

Ownership at the macro level

The cases presented at the Chatham workshop focused mainly on implementation issues and good practice at field level. Ownership at the meso and macro levels did not feature strongly in the cases, but was raised during discussions. Aspects of ownership at the macro level relate to the community of researchers, national governments, donors and multinational companies.

The benefits of research practitioners engaging more robustly with the wider community, including the research community, is increasingly recognized as an aspect of more macro-level ownership. This applies to links between researchers within research institutions and across institutions: national, international and advanced. Often, research institutions have fragmented programmes organized along disciplinary or commodity lines, with focused technical research efforts under the control of individuals who may have very limited knowledge of and interest in the activities of their colleagues. Such conditions offer limited incentives for forging links that address key NRM issues from a more holistic perspective. Such fragmentation brings with it the risk of different researchers separately undertaking participatory needs assessment with similar communities as part of a project requirement, but not sharing the results, nor working towards the development of collaborative programmes.

Sustaining the interest of national governments in natural resource research, both in developing and developed countries, may require constant lobbying from the research and development (R&D) community. The privatization trend in research and extension services, and the contracting out of these services, poses a major threat to sustained interest in and commitment to NRM research, particularly the R&D activities that are of marginal interest to the private sector. This threat was not addressed in the cases, although initiatives such as the formation of the Participatory NRM group within Participatory Research and Gender Analysis (PRGA) and policy-oriented publications provide a means for lobbying governments and the donor community (PRGA, 2000).

The way that research is funded and managed is also linked to the above aspects of macro-level ownership. Public research funds are frequently managed by disciplinary-based groups of scientists, who are likely to be more inclined towards promoting disciplinary excellence than with cross-cutting environmental issues and with short-term developmental impact. Private sector

funding for research, while targeted to address commercial concerns/opportunities, and perhaps sensitive to environmental legislation, is often driven largely by a commodity or a product focus that mitigates against a more holistic view of NRM and a concern to provide services to poorer farmers.

International donors contributing technical assistance and guidance to research are key players at the macro level. They have a focus on the impacts of poverty and environmental sustainability and employ technical advisers who have a policy orientation and mandate, along with a perspective on development, which is broader than that of most research scientists. While donor organizations are very image conscious, are sensitive to the sometimes rapidly changing formulations of development approaches and want quick and visible results, they also attach importance to natural resource sustainability, equity and participation. One of the main concerns of the donor community is how to bring the results of previously funded research in NRM to bear on the massive task of addressing a widening poverty gap.

Building ownership at the meso level: ownership and governance of communal resources

Scaling-up successful research initiatives requires that ownership be built among key stakeholders, operating in between the local community and the national government – at the 'meso' level. Challenges of developing participation among different stakeholders for NRM at the meso level include the need to develop a shared vision and to build confidence and capacity among less powerful stakeholders. This can perhaps be done by overcoming communication barriers, engaging in dialogue and discussion over different perspectives and authority structures, negotiating proposals for implementation and monitoring the results.

A participatory research project on NRM systems in Chivi District, Zimbabwe is presented in Box 3.1. It describes a process undertaken to facilitate direct communication from villagers to district officials, avoiding hierarchical transmission through layers of committees. Visions of the future governance of natural resource use were developed and presented by stakeholder groups, including a group of district officials, leading to proposals for a pilot study.

The Zimbabwe case presents a vivid example of how community participation in a process of vision building can lead to re-negotiation of governance roles in NRM. The visions of the future helped to construct alternatives to the current unsatisfactory situation, specifically, the need for greater devolution of decision-making powers to community level. The vision proposed greater community participation in developing regulations and sanctions, monitoring and enforcement, distribution of revenue, identifying development projects, maintaining boreholes and tanks and land use planning.

It is unsurprising that the initial visions developed by the communities were very pessimistic, since it is difficult to develop scenarios when there is no basis in experience for envisioning their acceptance or implementation. This envisioning was developed through the learning process and interaction in the workshops

BOX 3.1 FORGING NEW INSTITUTIONAL ARRANGEMENTS FOR COMMON PROPERTY RESOURCE MANAGEMENT – A CASE STUDY FROM SOUTHERN ZIMBABWE

A three-year participatory research project was initiated in two micro catchments in Chivi District in southern Zimbabwe, to work with communities to develop management systems for natural resources. An institutional challenge for this project was that traditional systems and user groups were the most effective local systems for NRM, while the district council, with an array of bylaws, schedules of fines and enforcement mechanisms, while relatively ineffective, held the legal mandate (Campbell et al, 2001). The researchers convened a workshop involving the district council and community representatives to examine the potential for re-orientating resource management organizations, after the Chief Executive Officer of the Chivi Rural District Council (RDC) expressed enthusiasm for the idea. The workshop format short-circuited the normal administrative route that required community ideas to be transmitted up through a hierarchy of development committees from village, to ward, to council level.

Preparation: A series of all-day meetings were held at the community level to build the confidence of the communities in representing themselves in front of the RDC officials and elected councillors. Preliminary community visions saw traditional leaders as the cornerstone of a local governance system and consider that the RDC should relinquish some of its powers to communities and facilitate community governance by providing legal support for the traditional leaders. Three smaller meetings followed in each catchment area, to select community representatives for the district-level meeting and to further develop the community visions for presentation purposes.

The vision and the future: Participants built visions of the future as a first step towards redefining current development pathways. Sub-groups were formed, largely comprising villagers, who came back with visions that stressed further the need to devolve power from the RDC to local communities. Researchers presented two case studies from Tanzania that illustrated successful devolution. Thus, by the time, the RDC sub-group presented its vision to all the participants at the meeting a good deal had been said about new forms of governance. A new vision evolved that shifted from a command and control mode of operation to greater transparency and local responsibility, where the role of the RDC was primarily as facilitators, supportive of community initiatives.

The RDC sub-group suggested that a pilot project be initiated on the raising and use of fish in dams. In follow-up discussions, RDC officials remained enthusiastic and wanted to expand the pilot project to other resources and more case study communities.

Key features of the process leading to the development of a progressive vision were:

- A long-term process of engagement and positive interaction between the researchers and key stakeholders. Two researchers had been living continuously in each of the micro catchments for periods up to one year prior to the meeting.
- A large number of institutional studies had been conducted which gave the researchers insights into possible intervention points for institutional change.
- Careful orchestration of the meeting and management of the agenda ensured that community visions were presented and forms of governance discussed before the RDC sub-group presented its vision.

- The early decision to hold the proceedings of the district-level meeting in the local language 'Shona' was important.

Problems encountered included:

- The transaction costs of some of the visioning methods need to be examined relative to the benefits.
- There were attempts by certain stakeholders to dominate the village proceedings.
- Younger men were under-represented in the community selection of the people who would go to the district-level meeting.
- There was a pessimistic outlook among villagers about the future, which made it challenging to move towards a positive vision.

Source: B Campbell,[1,2] A Mandondo,[1,2] C Lovell,[3] W Kozanayi,[2] O Mabhachi,[2] T Makamure,[2] F Mugabe,[2] M Mutamba[2]. 1 Center for International Forestry Research; 2 Institute of Environmental Studies, University of Zimbabwe; 3 Centre for Ecology and Hydrology (UK)

and district meeting. The threats to the visioning process – local politics, dominant personalities, assertive 'experts' – that can derail such processes were effectively managed. The methods used in the visioning process allowed the voices of different stakeholders – young men and women – to be heard.

The case study identifies some of the key features that led to this progressive vision and that are relevant to other projects trying to negotiate for greater community participation in meso-level NRM. A concern of the project was to develop a more democratic process. Close examination is required to see the extent to which participation was encouraged among different sections of the community, including youth, women and the poor, or consolidated the traditional male gerontocracy (Hagmann et al, 1999).

Ownership over the research process at the community level

Building ownership in agenda setting and problem identification – examples from villages in India and Uganda

There are many influences determining who defines the research agenda and the specific research focus. Underlying these decisions are the institutional structures, donor and programme priorities and assumptions about who should be involved in the research and whom it is intended to benefit.

The Conroy and Rangnekar case study describes how the community influenced the agenda of a research project focused on finding ways to overcome seasonal fodder scarcity for small ruminants in Gujarat, India. Participatory methods were used to explore problems and priorities of different stakeholder groups and to create ownership of the research from the early stages of the project. Stakeholder participation in identifying priorities led to a specific recommendation that was not part of the original project plan or focus.

BOX 3.2 KUMBHAN WATER TROUGH CASE STUDY, GUJARAT, INDIA

Stakeholder involvement in problem identification

A participatory research project was initiated with the preliminary goal of addressing seasonal fodder scarcity for small ruminants in semi-arid India. A water scarcity issue was raised during semi-structured group interviews. *Rabari* men were asked to identify and rank their main livestock production constraints, which were: (1) water scarcity (dry season); (2) feed scarcity (dry season); and (3) disease. Livestock production constraints – and the relationships between causes, core problem and effects – were further elucidated through a participatory problem tree analysis undertaken by *Rabari* men. The *Rabaris* had to walk long distances during the hot dry season, because a lack of water near their main (communal) grazing area obliged them to go elsewhere for drinking water, thereby limiting the amount of time they could spend in the grazing area. They identified reduced milk production and disease as two specific effects of water scarcity in the dry season.

Livestock-herding is the full-time occupation of some male *Rabaris*, and this group has been keenly interested in the work from the outset, since it addresses the priority livestock production problem that they identified, and since they proposed the construction of the trough. Initially, the *Rabaris* identified the impact of the water problem on themselves as being as important as the effect on their animals. The livestock-keepers proposed the construction of a water trough and storage tank in the vicinity of the grazing area, near to a privately owned well whose owner was agreeable to supplying water to the trough. He was already supplying some water to a channel in his field, but its capacity was small. They expected a general improvement in the performance of their animals due to the saving of energy by a reduction in herding distances.

Although the research project was commissioned to focus on feed scarcity, the researchers decided to give financial support to the construction of the trough, since water scarcity and feed scarcity appeared to be closely inter-related.

Ownership and monitoring of the trough The researchers wanted to see evidence of the livestock-keepers' commitment from the outset and wanted them to be responsible for the trough in the future and remain involved in monitoring its effectiveness. Thus, an agreement was negotiated: the project would cover the material and skilled labour costs of constructing the trough; the livestock-keepers would provide the construction labour voluntarily and would also form a group to maintain the trough.

The monitoring system involved intensive data collection every two weeks regarding the routes and distances covered by herders and their animals, the daily activities of the animals and milk offtake. This was a classic case where the design of the monitoring system was researcher-dominated and the researchers' data requirements were different from those of the farmers. The *Rabaris* themselves did not consider it necessary to collect such detailed quantitative data, as they were able to see the benefits of the trough through normal everyday observations. Finding literate monitors was difficult; schoolboys from other castes were hired and trained to undertake the task. Payment of the monitors caused some resentment among the *Rabaris*.

The monthly group meetings were intended to provide a forum within which the researchers and *Rabaris* could share their observations of the effects of the trough and discuss any management issues. They played this role to some extent, but more time appears to have been spent discussing other livestock production issues. This was partly because of the *Rabaris*' lack of interest in the monitoring data and partly because the research team were not able to analyse and interpret the monitoring data properly until the monitoring period was over.

Source: Czech Conroy and D V Rangnekar

BOX 3.3 PARTICIPATORY MANAGEMENT OF KAPUWAI'S WETLANDS IN UGANDA

Stakeholders were invited to develop together a long-term vision for their wetland. This was to be done with the help of a facilitator, who would ask everyone to describe their vision of the wetland they would like to leave behind for their children and grandchildren. Many believed that the village should develop a long-term vision of the wetland as an element of wealth for the whole community, not a system of resources to be exploited by some individuals, and that only that sort of vision would allow them to manage the wetland with prudence and fairness. Once a common vision was reached, a ritual would be performed by the clan elders and traditional authorities to make it sacrosanct. Every 'stakeholder' would be asked to re-affirm their desire to work together to reach the common vision. Then it would be time to negotiate a management plan, some basic rules for the extraction of resources and other necessary accompanying measures. They would invite all stakeholders to a series of meetings in which ideas and options would be discussed and alternatives compared. They would strive to work transparently, and by consensus rather than by majority vote. On the basis of the common vision and agreed plans and initiatives, a pluralistic management committee or advisory council could be put in place. People felt they could take advantage of the traditional management skills in the community and the local association. Many thought that the Council of Elders should be involved from the very beginning of their wetland initiative.

The Kapuwai people stressed that implementation should be a way of 'learning by doing', and that they would have to plan in advance for regular reviews and discussions of management results involving participation of the entire community. No doubt, there would be problems. Some people would be in need of more land to cultivate; some landowners would want profits from their property – could they be convinced to work with others and forgo immediate benefits for a prosperous wetland in the long run? Also, there would be technical questions to be solved and adjustments to be made in distributing the benefits and costs of management. The participants in our meeting felt that if these were faced in the negotiation phase, and if people would learn from experience, solutions would be found for their all problems.

Source: Grazia Borrini-Feyerabend

The Borrini-Feyerabend case study is highlighted in Box 3.3. It describes a participatory approach to a community articulation of priorities and plans for improved wetland management in Uganda. A process is described of building stakeholder ownership in collaborative NRM through an on-site, joint discussion of relevant problems and opportunities, followed by a 'vision building' session facilitated by external professionals. An increase in rice cultivation had caused a reduction in the area of wetlands, with associated localized flooding, water scarcity in the dry season and the disappearance of wetland resources and biodiversity. Three key elements or phases in the participatory management process were defined:

1 preparing the partnership;
2 developing the agreements; and
3 implementing and reviewing the agreements or 'learning by doing'.

These two case studies illustrate how stakeholder participation at the community level can inform and influence the focus of natural resources research and management. Participation at the early stages of exploring NRM can help to ensure the relevance of the research agenda, and hence engender a sense of ownership.

The preliminary stages are conerned with identifying the main stakeholders within communities and developing communication and a working partnership between them (Grimble, 1998). NRM problems were discussed by different stakeholders together with researchers, to identify their principal concerns and to reach a deeper understanding of the problem. In the first case, the livestock owners perceived a need for a water trough to overcome seasonal water scarcity. Dialogue helped to expose the different interests of the researchers, compared to the livestock owners (eg, an emphasis on the water/feed scarcity relationship and the requirements for monitoring data). In both cases, community-level discussion drew out detail on the benefits perceived by different stakeholders, both immediate impacts and indirect effects on various social groups (eg, the effects of the water trough on people in the next village and on the well owner in India and the different consequences of continuing privatization or community management of wetland in Uganda).

In both cases, the problems and issues in NRM were explored through group activities. In the Indian example, semi-structured interviews with the main stakeholder groups were conducted and then refined through problem tree analysis. This helped to identify different perspectives and the probable technology impacts on other social groups. In both cases, researchers played an important role as facilitators of the discussion and of the process of determining the direction of action. The process of adding a water component into the livestock feed project reflects the value of effective interdisciplinary facilitation and support during the participatory management process.

Sustaining ownership throughout the research process

We now discuss and illustrate factors influencing ownership at more advanced stages of the research process. Three other cases further illustrate the establishment of local research management structures, the interaction between local knowledge and the technologies proposed, efforts to include women stakeholders and the review of technology testing and dissemination efforts. Some of the important issues in generating ownership of the research process highlighted in these cases from Nepal (see Box 3.4), Peru (Nelson case study, in this volume) and Malawi (see Box 3.5) concern the ownership of knowledge, providing adequate support and facilitation, building on existing cohesive social relationships and encouraging motivation by ensuring that research is relevant to stakeholders' priorities and roles.

Ownership and sharing knowledge

Ownership of the research process closely relates to the nature of the problem, the extent of farmers' knowledge, and the process of knowledge sharing. In the next two cases, participation in the research process is based on farmers' interest in learning as a solution to a serious problem. The Pound case study from Nepal illustrates the importance of sharing knowledge and establishing cooperation for community-based disease management. It draws on the experience of researchers, extensionists and farmers in developing an innovative community approach to the control of bacterial wilt (*Pseudomonas solanacearum*) of potatoes. The approach was developed in 1990 by a multidisciplinary team from Lumle Agricultural Research Centre (Pradhanang and Elphinstone, 1997).

The status of knowledge about the problem and provisions made for sharing knowledge are significant. In the Nepal case, developing control strategies for potato bacterial wilt, sharing knowledge of disease symptoms, the factors influencing the spread of the disease and the recommended control measures, was vital in combating the disease. Meetings were held with villagers and training was given through workshops and exchange visits.

The challenges of developing ownership of the research process are much greater the more remote the problem and its causes are from farmers' existing knowledge (Warburton and Martin, 1999). In these circumstances, knowledge-intensive approaches are required, with an emphasis on training and information sharing. The varied response of villages in the Nepal case suggests that the proposed solution is only likely to be acceptable to farmers where the problem is perceived as acute. In the Nelson case study (this volume) farmer field schools in Latin America provided a learning process which included participatory evaluation of resistant lines, but the interest in learning differed between men and women in the participating communities.

Gender and stakeholder involvement

It is apparent that active stakeholder participation in research is more likely to occur when the focus of the research is relevant to their priorities and roles. Consider the Nelson case study from Peru (this volume) that discusses farmers' involvement in participatory research addressing potato late blight through training and local research committees facilitated by farmer field schools (FFS). The approach addressed improved management of this particularly devastating plant disease that often causes complete loss of the potato crop. Resource-poor farmers have little knowledge of the disease. Nelson discusses the role of farmer field schools (held in Peru and other Latin American countries) in increasing farmers' knowledge and raises questions concerning appropriate strategies for increasing women's involvement.

The Peru case study by Nelson highlights the important role of gender analysis in planning and reviewing ownership of knowledge by types of stakeholder. It is unclear whether it was the time-demanding features of FFS

BOX 3.4 COMMUNITY APPROACHES TO CONTROL OF BACTERIAL WILT, NEPAL

The high hills of Nepal have traditionally been a source of supply for clean (disease free) seed potatoes to the mid-hill and lowland potato producers of Nepal. Bacterial wilt is a serious disease, which can survive in the soil for several years and can be spread through infected seed potatoes. From the late 1980s, it affected food production and threatened the trade in seed potatoes as it became established in the villages where seed was produced. The villagers themselves did not know what the life cycle of the disease was, or what control measures to take.

The research team selected four seed-producing villages with contrasting social characteristics and size. A *Samuhik Bhraman* (a type of rapid rural appraisal (RRA)) confirmed bacterial wilt as a major problem and identified the major reasons for the fast spread of the disease – a lack of awareness of the disease; frequent movement of potatoes between and within villages; short crop rotations; poor plant hygiene and the use of volunteer potatoes for tuber yield. It was realized that efforts made by individuals or small groups would not succeed in controlling the disease due to the fragmentation of land holdings, the frequency of potatoes in the cropping cycle, the long survival of the disease in the soil and its spread between plots by runoff, shared tools and the movement of livestock and field workers. To succeed, 100 per cent participation by the community in the implementation of a moratorium on potato production in infested lands for three years was required. Key components of the approach to integrated management of the disease were:

- Each pilot village created a volunteer 'Cropping System Improvement Committee', which was responsible for the practical programme within its village.
- Elimination of infected planting materials from the village through rouging of volunteer potatoes, provision of a pathogen-free seed multiplication programme in the community for a regular supply of healthy planting materials and a prohibition on the cultivation of potatoes or other solanaceous crops for at least three years in infected fields.
- Facilitator/extensionist in each of the project villages to act as liaison between research and the Committees.
- Education of farmers on the symptoms of the disease, its transmission, control measures in fields and stores, and sanitary aspects of disease management.
- Identification of, and support to, alternative NRM options. Alternatives to potato production encouraged, non-host crops introduced and non-agricultural forms of support offered.

Until 1996 there had been a varying degree of success between villages in containing or eliminating the disease. One village, where community cohesion was strong, continued disease-free seed potato production for the three years of the project. In another, community cooperation was difficult to manage and infected material was planted – the disease appeared in the second year and was severe in the third. In a third village, which was less dependent on agriculture and had a lucrative tourist trade, the programme was terminated after the second year. In a fourth village, the disease reappeared when farmers resumed their normal cropping patterns and grew potatoes in traditional fields.

Source: Barry Pound

that discouraged women (context, formality, the demands on time, literacy, etc) or whether their lack of ownership was simply because women do not play a major role in many of the stages of potato production. Either possibility requires that the content or context of any proposed training be based on adequate gender analysis. In this case, the analysis might look at women's concerns and responsibilities, including relevant roles not immediately connected with the field production of potatoes (eg, the purchase and storage of fungicide, varietal selection, potato seed management and participation in informal seed systems).

Motivation and ownership of technical innovation

In addition to training, other motivations may be provided to foster the ownership of new knowledge. In the next case study from Malawi (see Box 3.5), project management had concerns about the effectiveness of local soil conservation management committees, particularly in terms of promoting knowledge and technology dissemination beyond the participating communities. Participatory methods were used to encourage the exchange of knowledge and views about technology adoption and dissemination, which could form the basis for improving ownership and participation in planning in the future. Timelines were used in helping to gain a historical perspective. This case explores the important relationship between approaches to technology testing and demonstration and the extent to which the approach used creates a sense of ownership and motivation for sharing results.

Managing a complex process

The above cases suggest that the process of moving from problem exploration and setting the research agenda to fostering ownership throughout the research process is complex to manage. Factors critical to fostering ownership of the research process relate to relevance, perceptions of benefits, support and training provided and participation in the technology development process.

The case studies suggest that motivation and participation is strongly influenced by the relevance of the research focus and intervention strategy to stakeholders' priorities, roles and their expectations of benefit. The Malawi experience is interesting in that the approach reflected the project's concern with two objectives, reflecting different time scales and levels of interest from farmers – poverty alleviation (in the short term) and participatory and sustainable soil and water conservation (a longer-term objective). Project experience suggests an incompatibility between donors' concern to tackle poverty by directing project resources to the community through incentives, and the wish to stimulate soil and water conservation in a participatory and sustainable manner. There were indications that soil conservation was seen as a response to external pressures and incentives, as opposed to a local effort to improve productivity and conserve soil for the future. The provision of

BOX 3.5 SOIL AND WATER RESEARCH IN MALAWI

The objective of this project was to offer Malawi smallholders a range of soil- and water-related technology options, such as realignment of ridges on the contour, vetiver grass, green manure crops, legume rotation crops, agroforestry and minimum tillage. To encourage uptake, the project provided incentives such as free seeds and seeds on loan, payment for labour on vetiver grass nurseries and in some cases the provision of village wells and pit latrines. Operating through over 300 locally elected Catchment Area Development Committees (CADCs) scattered throughout the country, the project had a stated aim to work in a participatory mode with these committees and also with other agencies.

During the review of its activities, the project management expressed concerns over the slow spread of technologies to neighbouring communities and questioned the functioning of the CADCs, the sharing of benefits between the committee and other community members and the extent to which implementation was participatory. Studies to explore these issues were conducted using participatory research analysis tools at village level, with the CADC members, local extension staff and other members of the community. Communities were encouraged to reflect on their experiences with the project and to look ahead to the time when the project would be finished.

The findings indicated the following points:

- Wide exposure to a range of technologies and soil management skills training was being provided for front line extension staff and farmers.
- It was difficult to distinguish the levels of farmers' interest and motivation because the project provided incentives.
- The incentives encouraged people to view the new technologies as project property – farmers did not feel they had permission to give out vetiver grass cuttings to communities outside their area.
- The CADCs functioned differently in each area depending on their relationship with local political systems.
- There was a lack of correspondence between the committees' accountability to particular social and political groupings on the one hand and the ideal geographical areas for integrated soil and water management on the other.
- Early screening of technologies had not been carried out and some of the technologies had not shown clear benefits (eg, agroforestry species).
- Local field staff and farmers were not empowered to evaluate new technology or initiate the wider spread of appropriate technologies.
- There was a project focus on the introduction of physical structures initiated by external agencies rather than cultural practices, local innovations or assessment of the technical efficacy of technologies that were being promoted.

Source: Alistair Sutherland

incentives to target groups may discourage technology uptake by a wider group of farmers over a larger geographical area.

The extent of professional support and facilitation given to farmers' research is important, particularly in cases of complex and little-known biophysical processes such as new diseases. Multidisciplinary support from technical and social scientists and extensionists and good quality facilitation are often success factors. In the Nepal example, support went beyond information

and training and included the identification of, and support to, alternative NRM options. However, it was noted that scaling up from the pilot project to a wider application would make heavy demands on resources for information gathering, awareness creation, training and support (Gündel et al, 2001; and see Chapter 4, this volume). Similarly, in the Malawi case study, extension officers were concerned that their area of operation was too large to manage intensive extension approaches.

Ownership through participation in a process of technology development and adaptation was lacking in the Malawi case. Although the project later involved farmers in reviewing progress, at the start no structure was put in place for incorporating farmer feedback or generating a participatory research approach. Local perceptions of soil and water technologies focused on externally introduced features, in the absence of an attempt to foster local research capacity or innovation.

The value of building on local social relationships and institutions is evident in several of the case studies. The *Samuhik Bhraman* described in the Nepal case, used interactive and participatory methods not only to identify the reasons for the fast spread of the disease, but also to show that disease control at individual or small crop level would not be effective. Through an understanding of social and ethnic structures and cultural practices, it led to the development of appropriate institutions for control of the disease in the shape of village-level committees. These were crucial to the implementation, monitoring and enforcement of the programme. The project results demonstrated the importance of community relationships in effective disease management. Communities varied greatly in their levels of cohesion or 'social capital'; where this was strong, the programme achieved greater success in eliminating the disease. The project also recognized the importance of targeting and understanding the grievances of non-cooperating members. The Malawi case further illustrates how institutional structures set up to mediate project activities are inextricably bound up with local social and political relationships and processes. Committees functioned most positively when they had effectively incorporated local village leadership and where the village headship was not being contested.

Conclusions

The benefits of fostering shared ownership through dialogue between stakeholders during the research process have been clearly demonstrated in the cases above. Participation during the earliest stages of exploring NRM problems helps to ensure the relevance of the research agenda, engendering a sense of ownership. The sharing of ownership needs careful management if it is to be sustained through the process of implementation and evaluation. Effective management of the process of sharing ownership contributes to local institutional development, encourages more equitable participation by different stakeholders and increases the effectiveness of research at different scales. It also supports capacity building and the development of skills and knowledge,

democratic governance and the spread and uptake of innovations. We conclude by highlighting aspects that are important to fostering ownership in natural resources research and management.

Appropriate institutional structures

In practice, natural resources research is undertaken within the context of NRM. Thus, a commitment to applying new knowledge and technology to community-based NRM brings with it the need for appropriate structures to manage resources. This need emerges from the case studies. The structures appear to be more successful when they build on local social relationships and institutions, for example a particular kin or interest group, community committees, local associations or traditional leadership. Communities vary in their levels of cohesion or 'social capital'. Where this is strong, successful cooperation and joint decision-making are more likely.

The impact of strong local, social capital can also be seen in an improved exchange of information, higher participation in the design, implementation and monitoring of service delivery systems and more effective collective action (Grootaert and van Bastelaer, 2001). The importance of social capital in the livelihood strategies of the poor is becoming well known (Narayan, 1997), however, it appears that the poorest communities are those most lacking in a capacity for joint action. Projects and programmes looking for relative ease of entrance and measurable achievement of results in a limited time frame, may well choose to avoid communities that are lacking cohesion or disrupted by conflict. This may be justified in a participatory research phase where technologies and approaches are being developed, but in NRM beyond the village these issues will have to be addressed. It is important to anticipate the greater requirements for social analysis and facilitation in such communities and the need for a longer time frame.

Where the selected structures are representative and legitimate they can enhance the sense of ownership. In the Indian case, livestock-keepers agreed to form a management committee for the future maintenance of the water trough. In the Ugandan case, a positive factor was the existence of an effective local association. The management of wetlands would draw on management skills and structures already present in the community, but would broaden these to be more representative of the range of stakeholders. Research activities and steps towards developing a management plan and basic rules for resource use were proposed, debated and agreed by the stakeholders themselves.

Acknowledging local belief systems and values

Natural resource management has significance for communities beyond the merely technical. There is an important relationship between NRM systems and institutions and the value and belief systems of communities. In the Zimbabwe case, the legitimacy of traditional authorities' control over natural resources is underpinned by belief systems. In the Ugandan case, there was to be a ritual legitimization of the community vision by clan elders. Furthermore, the

negotiation of the benefits and responsibilities in NRM was integrated with community values of equity and benefit sharing, in particular the question of whether the wetland could be managed to enhance the wealth of the whole community or for individual exploitation.

Political processes

Natural resource management is tied into political processes. The ability of project teams to understand micro-political processes, and counter attempts by powerful interest groups to undermine consensus is important. R&D initiatives working towards shared ownership can be thrown off course by local politics, dominant personalities, traditional leadership or experts. Early awareness, discussion and negotiation of management responsibilities and rules for the use of natural resources can help to prevent social conflicts and problems becoming acute. It also helps to ensure sustainability if participants agree on commitments (eg, the water trough maintenance agreement in Case Study 3.2). In-depth institutional analysis provides insights as to possible intervention points and alternative routes to promote change, as shown in Zimbabwe in Case Study 3.1. This case also points to the importance of maintaining a critical perspective in assessing the implications of decentralizing decision-making to community level. In some cases, agreements to devolve responsibility and decision-making power might be viewed as establishing mechanisms through which district authorities *increase* their control of outcomes, through their retained functions of coordination, arbitration, approval, monitoring and evaluation. In practice, decentralization could function as a means for extending state influence rather than supporting local autonomy and ownership.

Learning, knowledge exchange and methods used

Learning processes are vital in engendering a sense of ownership, as the cases illustrate, particularly in terms of collective learning and interaction between stakeholder groups and researchers. The process outlined for wetlands management in Kapuwai, Uganda, was designed to increase local awareness of problems and opportunities and to enhance the local capacity for sustainable use of the wetland and protection of its biodiversity. It was planned to hold regular reviews and discussions of management results among the entire community.

Researchers and community members may have different perspectives on learning. In the Indian case, while researchers and livestock owners met monthly to share their observations and to discuss management issues, they had different levels of interest in the monitoring data, and the monitoring data itself were not available for feedback and discussion until later. The effectiveness of such meetings depends on sharing knowledge around agreed common interests. Where there are differences in the agenda of communities and researchers that are not made explicit, there is a risk of an inefficient use of research time, of misunderstanding or even conflict. A sense of ownership of the research agenda is one of the early building blocks on which communities can increase their sense of empowerment in managing their resources and their livelihoods.

A joint learning process empowers and challenges both researchers and farmers to extend their knowledge and action into new areas (Hagmann et al, 1999). This is particularly important for the understanding of complex social processes, for highly specialized technical knowledge not available within the farming community and for technology which requires changes in behaviour and management practices, rather than the adoption of discrete technologies. The case studies from Nepal (see Box 3.4) and Peru (Nelson, in this volume) provided examples of learning processes established with farmers, which helped to create a sense of ownership and provide the basis for cooperation.

Knowledge exchanged with farmers is not merely technical knowledge. Technology is socially embedded; its meaning and significance is interpreted and integrated within existing belief and knowledge systems. The technical boundaries of a problem as perceived by researchers do not necessarily have significance for local people. As outlined in the example from Uganda, the exploration of existing knowledge within the local cultural, linguistic and social context is vital, followed by a joint learning process and discussion of management strategies compatible with local norms and institutions. The content and context of the learning process needs to be based on stakeholders' concerns and responsibilities, although it can be helpful to draw on experiences from elsewhere to identify strategies.

There were many methods and tools used in the cases for joint learning about research problems, such as problem trees, *Samuhik Bhraman*, timelines and 'visioning'. These cannot be covered in detail here; we note, however, that each tool has its limitations and is only effective as part of a wider process of learning and consultation.

Motives and perceptions of benefits

The case studies indicate the importance of exploring motives and the benefits perceived by different stakeholders, both in terms of immediate impacts and the indirect effects on various social groups. It also allows interventions to be targeted to specific groups for whom the problem is most acute (livestock owners and herders in Gujarat in Case 3.2, and potato producers in Nepal in Case 3.4). Motivation for participation is strongly influenced by the relevance of the research focus and intervention strategy to stakeholders' priorities, roles and expectations of benefit. A more explicit understanding of this relationship has the potential to encourage the greater involvement of specific groups in monitoring and evaluation. Stakeholders' own criteria of achievement could be the basis for participatory monitoring and evaluation.

Interdisciplinary facilitation and support

Another important lesson emerging from the case studies is the importance of effective interdisciplinary facilitation and support. The extent of professional support and facilitation given to farmers' research is particularly important in cases where farmers have limited knowledge. Knowledge-intensive approaches are very demanding in time and resources and consequently pose a management

dilemma when planning for the scaling up of programmes, as discussed in the Sutherland case study from Malawi.

Operating at different scales

The case studies cover different dimensions of scale, ranging from specific crop or livestock-related interventions to the research and development of holistic management strategies. Organizational scales range from individual learning and adoption, to community-level ownership, to ownership at the district or meso level. The scale of the technology and the different levels of stakeholders involved have implications for ownership and control of the research process. The larger the technology scale, the more difficult it may be to develop a community consensus in determining the research agenda or ownership of the research process since there are more complex patterns of institutional interaction. Generating ownership of individually applied relevant technologies is usually more straightforward than those which require community coordination and joint action. Different institutional stakeholders (researchers, non-governmental organizations (NGOs), local government, private sector) have diverse mandates, financial structures and staffing profiles, which pose challenges for agreeing common ground and establishing communication mechanisms (Sutherland et al, 2001). Decentralized approaches require more inter-sectoral awareness and linkage between institutions. Negotiation processes to establish mechanisms for linkages between community and district level, as described in the Zimbabwe case study, are vital.

Time scale, urgency and the impact of problems on livelihoods, all influence the level of interest and ownership of different stakeholders. Farmers and NRM users may place a lower priority for R&D on problems that threaten longer-term sustainability, as compared with those that threaten their current livelihoods. This may be in contrast to the perspectives of researchers and NRM policy-makers. For interventions that do address problems of immediate concern, their longer-term ownership and maintenance are important if there are to be sustainable benefits. A lesson from the Malawi case study is that incentives may encourage initial interest by the contact group, but they are likely to discourage a wider uptake of the technology and also to be unsustainable. There is a need for realistic time frames for interventions, such as soil and water conservation measures, which are necessarily longer term in their impact.

Implications for changing roles

Clearly, shared ownership has implications for the roles of researchers, extensionists and farmers. In the case studies included here, the power of researchers to direct and decide, based on their control of research funds and their technical skills, is modified to operate in collaborative mode or, in one case, to act in an advisory capacity, supporting community initiatives. Current trends towards the devolution of financial resources and responsibility to district and community level for the commissioning of research and extension are likely to bring fresh challenges and a more radical shift in how research is initiated and owned.

One of the changes in orientation required by this approach is the ability to work more with group-based activities rather than with single individuals. Group activities may involve different combinations of stakeholders than are usually encountered by research and extension personnel. New skills are required, such as the management of meetings in a participatory and democratic way, the ability to explain technical issues in the local language, open-mindedness about different worldviews and explanations. Shared ownership is built through processes of participatory technology development and adaptation.

In addition to new roles and skills, there is also a power-sharing dimension. Participatory approaches to NRM require a shift in power and decision-making from district-level bodies, to community institutions. Complex relationships around governance and the negotiation of equitable outcomes require a high degree of flexibility in approach and methods, and a willingness to accept the need for accountability and transparency. It is recognized that such a shift in power has to be supported with capacity building, for example through a process of confidence building in the community and familiarization and discussion at district management level.

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Chapter 4

Scaling Up and Out

Sieglinde Snapp and K L Heong

Introduction

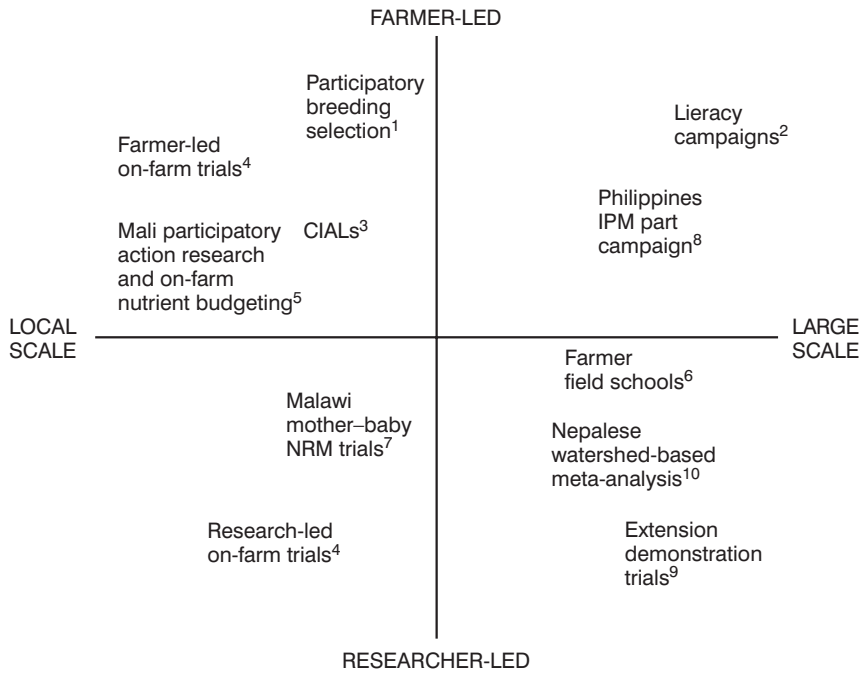
Natural resource management (NRM) is necessarily situated within a landscape and human context. Engaging in participatory research and management with rural families requires an understanding of 'at what scale?', as well as 'who' and 'what'. In this chapter we discuss working across scales, and scaling up and out to reach a larger audience. The primary focus is researchers, farmers and change agents, working together in the southern hemisphere for more sustainable, productive agriculture. The chapter is grounded in case studies, where different approaches to scaling up and out are presented. This includes examples of learning together at a community level and synthesizing the knowledge gained to reach thousands of rural families with improved, integrated crop and soil management practices. Different means of sparking farmer innovation on a large scale are also explored.

'Scaling up' can be defined in diverse ways that are not necessarily mutually exclusive. One definition involves enhanced geographic cover – the scaling up of an intervention or technology to serve a wide area. Another spatially based view involves extrapolating from a small, field or plot-sized, experiment to estimate the impact on a larger area, such as a region. Nutrient budget estimates, for example, can be conducted at local or larger scales (Brown et al, 1999; Smaling et al, 1993). Statistical or simulation modelling approaches are frequently used to evaluate uncertainty associated with scaling up spatially, or temporally. A third definition focuses on the growth of a small-sized organization to a large-sized organization. Projects or initiatives can be 'grown' to a large scale – such as a small-scale and short-lived project that becomes a large-scale endeavour with some permanence (Braun et al, 2000), or a large number of new initiatives that may be scaled up through a multiplier effect (Gündel, 1998). A fourth definition involves expanding impact from a small number of beneficiaries to a large number.

The scaling-up process required to reach large numbers of clients is one of the main challenges that face researchers and farm advisors who are publicly supported (eg, government ministries, universities, non-governmental organizations (NGOs), regional networks and international research institutions such as the Consultative Group on International Agricultural Research (CGIAR)). Government extension systems were set up to reach rural populations; that is their mandate. They are charged with extending technologies and working with less-advantaged members of rural communities. Yet, in general, resource-poor farmers reap few benefits from public services (Chambers et al, 1989). One growing problem is that extension systems suffer from declining numbers of extension personnel, and farmers' access to new information is often very limited. Furthermore, the relevance of extension messages to the most resource-poor households and female-headed households may not be clear (Fujisaka, 1993; Snapp and Silim, 2001).

The primary focus of this chapter is on scaling up participatory research, in terms of it being a process of reaching out and engaging with many stakeholders. A conundrum in participatory research is that improving local resource management requires tremendous investment in human resource development, in local education and in building quality partnerships for learning and action research. This requirement for quality interaction and considerable investment at a local level poses barriers to scaling up and out. Financial and human resource support requirements would have to be massive to engage many people in participatory action research (PAR). One approach to overcoming this investment barrier is to engage farmers through mass media 'research challenges'. Another is to improve farmer-led experimentation through facilitating community research groups or working with extension farm advisors in government and non-government organizations. Other approaches discussed here include PAR that uses information tools such as meta-analysis of watershed, geographic information systems (GISs) and regional researcher–farmer partnerships. These are just a few of the many approaches possible for scaling up and out.

To understand how scale interacts with participatory approaches we combine the classic continuum of participatory research typology and a spatial scale. That is, the continuum from researcher-led (farmers as contractors) initiatives to collaborative arrangements that are client-driven (farmer-led) (Chambers et al, 1989). We explore this relationship as a matrix, with 'scale of operation' on one axis and 'farmer/researcher partnership typology' on the other axis (Figure 4.1). We present case studies documenting examples of researchers and change agents working with people to improve experimentation, technology adaptation and collective management of resources, at different spatial scales.



Source: 1 Sperling et al, 1993; 2 Freire, 1972; 3 Braun et al, 2000; 4 Ashby, 1987; 5 Defoer et al, 1998; 6 Ooi, 1996; 7 Kanyama-Phiri et al, 2000; 8 Heong and Escalada, 1999; 9 Hildebrand and Russell, 1996; 10 Schreier, 1999 and case study in this volume

Figure 4.1 *A comparison of participatory learning and research approaches in terms of scale of operation, and degree of farmer versus researcher involvement*

Situating natural resource management

Attention to spatial scale is implicit in research on NRM. The endowment of resources is tremendously variable from place to place, and the goals of local managers are diverse as well. It is necessary to be situated in a locale to understand the soil, water, flora and fauna present and human interactions with the ecology. The scales at which resources are managed vary from a field, to a whole farm, to a community level, to a regional watershed or agroecosystems and even to the continent level. It is not enough to engage individuals in NRM. Collective action and community participation may be required to protect a watershed, to rehabilitate soil or manage a pest. Natural resource management issues frequently involve many communities and policy-level engagement.

Heterogeneity is a reoccurring motif in NRM. It has both a physical and cultural basis. It occurs across the biophysical landscape, and among stakeholders with their diverse agendas. Biophysical heterogeneity includes the environmental extremes of human habitat, from dry desert to humid tropics, from low altitude shores to mountain tops. Temporal heterogeneity must be considered as well. Risk management in the face of extreme climate variability is

a crucial concern of smallholders, one that can mean the difference between food deficit and security (Rohrbach and Okwach, 1999).

Smallholder farmers are often located in the most marginal environments. Not only are these environments highly variable, they are also rarely enhanced by inputs such as irrigation or fertilizer. A limited resource base impedes the ability to reduce heterogeneity. Extremes in topography and a wide range of locally specific conditions are difficult to characterize and to synthesize (Defoer et al, 2000; Lightfoot and Noble, 1999). Efforts to use information technologies to characterize biophysical heterogeneity include remote sensing and GIS-informed mapping. We will discuss some examples using these approaches later in the chapter (see the case studies in this volume by Williams from India, Peters from Central America and Schreier and Brown from Nepal). As discussed in these case studies, access to knowledge generated using information technologies requires commitment on the part of all stakeholders. Attention must be paid to the generation of figures with indicators that have local relevance as well as indicators that are of interest for research, meta-analysis and an international audience.

Socioeconomic diversity cannot be underestimated either. Different objectives and agendas will occur, particularly when working at watershed or regional scales. Stakeholders of the rural landscape may include nomadic peoples engaged with livestock and farmers active in cropping or integrated cropping–livestock systems. This is explored in a case study from India, where investment in water storage and forage management was evaluated from different perspectives (Conroy and Rangnekar case study from India, this volume). Water requirements for livestock often compete with that needed to irrigate vegetables and demands for household needs, which is frequently a gender equity issue as well (Snapp, 1989). The entrepreneurial elite who have access to capital and local officials or finance institutions are frequently in a position to monopolize irrigation or other water management technologies, as discussed in a case study from South Africa (van Koppen case study, this volume). Soil fertility enhancement through improved residue and manure management to reduce nutrient losses has been explored through field-, farm- and village-level participatory nutrient budgeting in West Africa. In this study, different perspectives and objectives were articulated by nomadic and settled peoples, at the regional, community and household levels (Defoer et al, 1998).

Cultural heterogeneity is a major factor at relatively local scales of operation, where farmers, researchers and external facilitators and advisors interact with a range of organizations. These include governmental ministries, universities, non-governmental development agencies and private industry. Interested participants may include traders, shop owners, fabricators and artisans, financiers, buyers and sellers of produce, all from different resource bases, and linked to local or multinational bodies. Local institutions and the community fabric frequently involve religious groups, social and kin networks, health and educational or community development groups, worker or farmer organizations. Ethnic and cultural differences may be reinforced and overstated by political and hegemonic interests, but they also may inspire fundamentally different viewpoints. Action-oriented approaches that prioritize collaboration across

diverse stakeholders and empowerment that addresses local objectives as well as a wider impact may be a way forward out of the challenging complexity of different agendas (Cramb, 2000).

Dynamics within and across families must be considered. Gender and cross-generational issues can provide quite different points of views, and priorities (Hirschmann, 1995). Female-headed families frequently have unique concerns in farm system management, as suggested by experiences in south eastern Africa (Snapp and Silim, 2001). Empowerment issues are complex and the agendas of stakeholders may differ enormously. Chapter 3 provides an in-depth exploration of these issues, including the challenging questions of 'whose agenda?' and 'whose research?' is being pursued.

Heterogeneity is a major barrier that constrains efforts to reach a wide audience. Over the last few decades the farming systems approach addressed heterogeneity by a reductionist process of documenting different agroecological zones and socioeconomic groups, and then developing recommendation domains (Fernandez, 1988). These domains were to encompass relatively homogenous groups within a complex environment. Participatory action research has evolved towards a more inclusive partnership process among researchers, change agents and farmers (Defoer et al, 2000; Fernandez, 1994). We explore, in this chapter, how some participatory research approaches are enriched by diversity, and attempt to reach many different audiences, engaging with communities rather than defining recommendation domains.

To address heterogeneity, we contend that participatory research and technology development needs to address two issues simultaneously:

1 empowerment and investment in human resource capacity to enhance local experimentation and adaptation efforts;
2 knowledge construction based on indigenous and scientific sources, to understand locally specific agroecosystems, and conduct 'meta-analysis' of universal aspects.

Meta-analysis to extrapolate and predict how technologies will perform within biophysical contexts can help to extend results from localized areas (Conway, 1985; Lightfoot and Noble, 1999 and Schreier and Brown's case study in this volume).

The challenge of synthesizing NRM knowledge

Local resource knowledge and innovative capacity is intrinsic to soil fertility and resource management. It is difficult to embody knowledge or develop synthesized forms of information about how to improve resource management. Integrated decision-making that takes into account the entire system and sustainability of resources is difficult to codify or to distil into small bits of information, in contrast to genetic information (Figure 4.2). Synthesis is challenging due to the locally specific nature of NRM decision-making, and the complex, dynamic relationships involved. Technologies to protect, conserve

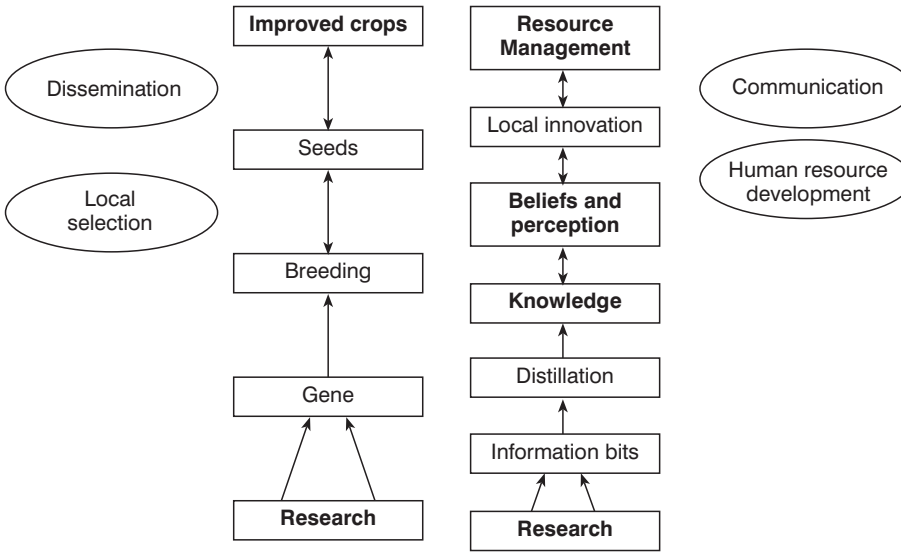


Figure 4.2 *Alternative pathways for enhancing knowledge distillation, testing and dissemination in genetic improvement and natural resource management research*

and regenerate resources require an understanding of agroecosystem relationships, and application to local environments (Lightfoot and Noble, 1999). This is a keystone of the non-formal education approach known as farmer field schools: training farmers and farm advisors in general ecological principles. The idea is to replace recommendations with education, to promote local understanding and adaptation of ecological principles and the development of specific management practices that improve a local system (Braun et al, 2000).

Research information on resource management, though abundant, seems to lack a process that can effectively integrate the various 'information bits' into usable entities (Figure 4.2). This contrasts with genetic technologies, where information is physically embodied in seeds and planting material. The 'information' is encoded within the seed, which can be tried out in many different environments by numerous participants. Locally specific information, generated from participatory breeding research is integrated into new seeds by the breeding and selection process (Figure 4.2). New seeds can be disseminated throughout rural areas through traditional and non-traditional seed distribution channels (Sperling et al, 1993). We suggest a need for processes that distil bits of information and develop them into usable entities or knowledge that can be communicated and used by farmers to make resource management decisions. The research distillation process is rarely used to integrate and simplify volumes of information into decision rules or heuristics (Heong and Escalada, 1999). If more attention was paid to this process, the information could be presented to farmers in an appropriate frame to motivate adoption. One such approach is described in Heong and Escalada's case study in this volume.

Steps to scaling up: enhancing relevance and accountability

Researchers and extension workers have the explicit goal of reaching many clients. Yet farmers are rarely involved in a meaningful way in the assessment of technology development services (Ashby and Sperling, 1995). Thus, accountability is limited. Institutions must address how to involve clients in research priority setting, decision-making about funding and performance assessment (see Chapter 6). In this context, scientists and farm advisors do not necessarily ask relevant questions, or work in partnership with farmers. Researchers may fail to understand farmer priorities (Chambers et al, 1989; Defoer et al, 1998; Sperling et al, 1993). Given the lack of accountability mechanisms, it is not surprising that researchers at times neglect to document the extent of local knowledge and client priorities, and relegate such studies to ex ante analysis and isolated research on indigenous knowledge.

The case studies documented in this book present many examples of researchers making a commitment to understanding local priorities and taking them into account in the research and development process. For example, a participatory research project working with two villages in India shifted from a focus on forage to broadening access to water (Conroy and Rangnekar's case study in this volume). To revisit this conundrum of scaling up participatory research, we note that most examples of accountability in the research and development process occur at a local scale; they are not multinational or regional in scope (Snapp's Malawi case study in this volume).

The result of limited accountability in research and development services has been the development of single, generalized recommendations, which assume that the main underlying priority is maximization of yields. For example, in Malawi, decades of soil fertility research resulted in a single, blanket recommendation for fertilizer rates applied to maize (Kumwenda et al, 1997). Farmers have a wide range of goals, and many are interested in risk aversion or maximizing return to minimal inputs (Rohrbach and Okwach, 1999). Market linkages and specific local quality traits also need to be addressed – yet technology development rarely includes surveying client or market preferences (Kitch et al, 1998; Snapp and Silim, 2001). A step forward in building more appropriate recommendations would be to consider market conditions and agroecozone influences on crop responses to inputs (Benson, 1997). Yet, participatory approaches require further steps: farmers are best served by providing a wide range of flexible, promising technology options, and farmers need to be involved early and often (Okali et al, 1994). It has been almost impossible to address these complex goals while remaining within narrow, commodity-structured organizations.

A closely related problem is that recommendations are not disseminated in ways that facilitate farmer's own experimentation. Demonstrations are frequently not understood by local clients, and they are carried out by extension staff, or by farmers who have been hired specially (Kanyama-Phiri et al, 2000). The purpose of participatory, client-driven research and technology

development, by contrast, is to support local experimentation and decision-making in resource management (Ashby et al, 2000; Braun et al, 2000).

Is participation possible on a large scale?

There is widespread interest in PAR approaches as a way to improve research relevance. Yet, as discussed in the Malawi case study (Snapp's case study in this volume), there are also valid concerns about the costs involved and the feasibility of working intensely over a large area. On the one hand, participatory approaches were seen by participants in this case study as the only way to change farmer decision-making. On the other hand, it was not perceived as a cost-effective method for reaching clients, beyond the few in the project villages. This was a reoccurring theme in the Malawi-based case study, which involves a comparison of on-going technology development approaches in parallel villages. One survey documented that the NGO staff, farm advisors and researchers involved felt that partnering with farmers was only possible on a micro-scale (Johnson et al, 2001). Human resources and capital constraints present significant barriers to farmer empowerment or to partnering with farmers on a significant scale, beyond small, localized case study areas. Surprisingly, extension staff from the government and from NGOs considered conventional trial and demonstration approaches to be the only cost-effective way forward (Johnson et al, 2001 and see Snapp's case study on Malawi in this volume). The same NGO workers who conducted empowerment exercises and helped local farmers conduct their own research were worried about the expense of participatory approaches and felt that they were not a practical way to reach large numbers of clients. In this chapter we explore a range of scaling up and partnership approaches, and discuss ways forward out of this conundrum.

Participatory action approaches explicitly attempt to improve the relevance of NRM research. See, for example, the PAR approaches illustrated by McDougall and colleagues' multinational community forestry case study, and the Dey and Prein case study, in this volume, involving aquaculture systems in Bangladesh and Vietnam. Frequently these efforts involve strong partnerships with NGO staff and community organizers. Academics are often collaborators in transforming research for development, struggling with issues of making feminist and activist agendas work within this development paradigm (Cottrell, 1999). Different types of partnership among academics, scientists and NGO development workers can all be effective. This is illustrated by experiences with soil-conserving contour hedgerow systems in the Philippines (Cramb, 2000). At each location the action research partnerships varied, depending on local organizations, history, land tenure and farmer priorities. Adoption of soil-conserving technologies occurred widely, although it varied in degree and form at different sites (Cramb, 2000; Fujisaka, 1993).

Participatory approaches that involve farmers, change agents and researchers working closely and intensely together allows the articulation of different agendas. Groups that have been neglected by conventional research and extension may gain a voice within organizations. Ideally, scientists and

farmers learn from each other, strengthening traditional knowledge through participatory research. However, the ability of a project to reach beyond the scope of the original locale where scientists and farmers worked together is frequently not addressed. It is becoming widely acknowledged that attention to the scope of a project, and how it might expand out, must be integral, from inception (Braun and Hocdé, 2000).

Some of the case studies presented in this book paid attention to scaling up from project inception, indeed they were central to the conception of the project – for example, the watershed mapping and participatory nutrient budgeting endeavours in Nepal (Schreier and Brown in this volume). New information technologies were used to involve more participants in documentation, monitoring and evaluation, over a larger area. This is also illustrated by the India case study by Williams, in this volume, where GIS is used to guide communities in developing indicators and monitoring progress. However, to ensure the relevance of outputs, the use of information technologies must be negotiated by all partners, as discussed in Chapter 5.

To revisit the conundrum of scaling up participatory research: many of the case studies in this book focus on a few key locales, with limited scope beyond the project scale. On the plus side, human capital is generally built through the empowerment and training that are an integral part of action research projects – as capacity building is an explicit goal. Yet, it is challenging to develop a sustainable approach that lives beyond the project, once funding and technological or human resource support are withdrawn from an area. In three Philippine examples described by Cramb (2000), the adoption of soil-conserving technologies did not spread effectively beyond a few, local success stories. In some cases, technologies such as contour plantings were not maintained after initial investments. Malawi soil conservation efforts also suffered from limited uptake, over both time and area (Sutherland's case study in this volume). Empowering farmers and stakeholders to conduct more effective research in partnership with researchers and change agents may be a necessary but not sufficient step towards improving NRM over the long term (Braun et al, 2000).

Steps to scaling up: building quality partnerships

Cooperation is key to building participatory team approaches. It arises from a recognition of the need to view resource management issues as a complex human activity system (Wilson, 1992). Research, development and extension are interactive as well as iterative. The main emphasis of this approach is to involve key stakeholders in a cooperative and flexible process that facilitates discussion and implementation of activities to achieve improvements. Building social capital, including empowerment of partners to participate provides a foundation for PAR. A cycle of monitoring, reflection and evaluation that involves all partners is key to furthering this process (Braun and Hocdé, 2000). Many participatory techniques are available, including rapid rural appraisal (RRA) techniques, participatory rural appraisal (PRA), focus group discussions and structured workshops (Carmen and Keith, 1994). The common themes across

these techniques are qualitative appraisals and joint participation by stakeholders, fostering common understanding of the problems. However, often it is not how thoroughly analyses have been done but the partnership that will determine success or failure of a project (Norton et al, 1999). As discussed in the van Koppen and Sutherland case studies in this volume from southern Africa, partnerships tend to last when benefits accrue widely, not just to local elites or project administrative elites.

In order to enhance partnership quality, facilitating communication between stakeholders and joint planning, the participatory workshop approach is one way forward. This approach is iterative and inter-related. It frequently involves the following stages, many of which overlap.

Stage 1: Empower stakeholders

Use 'training for transformation' and related approaches to empower partners (Freire, 1970). This is particularly important for farmers and community members who may feel they are uneducated and powerless compared to participants who are perceived as outside experts, thus critical consciousness is a first step in building social capital. Braun and Hocdé (2000) provide concrete examples of local empowerment efforts. It is critical that local knowledge and priorities are articulated and put at the centre stage from the beginning of the participatory workshop (Norton et al, 1999).

Stage 2: Specify problems and opportunities

Use a range of techniques that will facilitate communication between stakeholders. Identify root causes and cause–effect relationships. Use baseline data whenever available. Some of these techniques are described in Norton and Mumford (1993), and texts on quality control circles (QCC) used in management (see for example Karatsu and Ikeda, 1987; Crocker et al, 1984). This can be seen, alternatively, as an opportunity to discuss with partners where opportunities lie and what inquiry or area of research is of interest to the group (See McDougall et al's case study in this volume).

Stage 3: Identify constraints

Brainstorm for opportunities to make improvements and to find ways to remove constraints. The key issues to be addressed include research, extension, training and policy aspects.

Stage 4: Analyse needs and design action plans

Engage participants in determining what actions need to be taken and in outlining action plans to achieve expected outcomes. Egan's (1988) model for change can be usefully employed at this stage.

Stage 5: Evaluate progress and review from different partners' perspectives to redesign action plans

One way to conduct this iterative approach is through a series of workshops, where the review stage is initiated approximately a year or two into the process as an all-stakeholders' review workshop, to ensure the quality of the activities as well as the partnerships (Escalada and Heong, 2003). Action and reflection cycles are integral to this process.

It can be challenging to build quality partnerships on a large scale. A participatory project-based approach, as described above, is generally carried out at the community or watershed scale. However, the information generated can be codified and disseminated through different means, such as farmer field school educational materials (Thalbitzer, 1996; van de Fliert and Braun, 2000), through the mass media (Huan et al, 1999) or via local agricultural research committees (Ashby et al, 2000; Braun et al, 2000, and see Braun's case study in this volume).

Scaling up participatory NRM to the watershed level

An example from India of emerging capacity at the watershed level involves the balancing of different group priorities through participatory watershed development (Turton and Farrington, 1998). Local control of resources by community organizations has been partnered with technical assistance from government organizations to serve local watershed development and conservation-oriented groups. A key component of this approach has been developing human resource capacity and community experience in dispute mediation.

Watershed management has been approached through a wide range of projects that partner technical and academic advisors with community-based organizations that initiate their collaboration through community visioning exercises. In Malawi, this has involved resource and priority setting workshops, integrated with jointly planned research along transects (Kanyama-Phiri et al, 2000). In Nicaragua, community watershed visioning was catalysed through participatory mapping and local training in monitoring tools. Combined with community-led research groups and landscape-level experiments, this has led to local empowerment to address larger-scale questions (see Vernooy's case study on Nicaragua in this volume). Schreier and Brown's case study in this volume presents a watershed-based approach that uses spatial tools, such as GIS, to document landscape ecological parameters in the service of local research endeavours. Long-term sustainability, and replication of these efforts – scaling out – may require a close connection of technical support and watershed tools to priorities and indicators that have meaning for local communities.

An exciting example of the collaborative management of community forests is presented in McDougall et al's case study in this volume. As shown by

the experience of McDougall and colleages, developing sustainability indicators owned by the communities involved is key to adaptive management. Indeed, monitoring and evaluation that involves all stakeholders is the foundation of community-based participatory research. Indicators of sustainability may emerge that focus on economic returns to communities, at least initially (Turton and Farrington, 1998). Long-term, ecologically based indicators frequently emerge over time as technical advisors and communities expand partnerships and extend the scope of their collective visioning (see, for example, the Nicaragua case study by Vernooy).

Beyond the watershed: the continuum of scaling up and out

At the Chatham meeting, we found it useful to discuss the case studies in terms of a continuum, from researcher-led, to farmer-led. Another step further is to consider where participatory natural resource management (PNRM) approaches are situated in a matrix, with 'scale' on one axis and 'type of participatory involvement' on the other axis (Figure 4.1).

Intensive PAR approaches are frequently situated at locally specific sites, involving individual farm families and village community levels of the matrix. For example, PAR on nutrient budgeting to improve community resources in Mali (Defoer et al, 1998; Figure 4.1) requires intensive interaction with a community. Thus it is carried out locally. A major investment of researcher time and funds is necessary for this approach, focused primarily at one location. Advocates say this improves our understanding of nutrient cycling complexity and empowers local change agents to improve nutrient efficiency (Defoer et al, 2000). However, the sustainability of this effort over time, and the ability to reach many beneficiaries needs to be addressed. Farmer-to-farmer training can be a key component of scaling up from local, intensive efforts in PNRM. This could extend the ability to conduct nutrient budgeting to a large number of farmers. Possibly, a farmer field school approach to training would be effective, to educate on integrated crop management, basic nutrient cycling principles, and farm budgeting methodology to improve nutrient cycling efficiency (Braun and van de Fliert, 1997; Braun et al, 2000).

A community-based approach to micro-watershed rehabilitation is situated in the matrix in an intermediate position (Figure 4.1). For example, in India, a participatory watershed development approach has used guidelines that prioritize local autonomy, a decentralization of decision-making and funding, and partnership among NGO and government institutions (Turton and Farrington, 1998). Another type of watershed PAR, involving community visioning, mapping and monitoring is illustrated in Vernooy's case study in this volume. A critical early step in this approach is the group identification of problems early in the analysis. After initial training in interdependence of resources, local decision-makers led efforts to map the consequences of alternative resource utilization strategies.

A regional scale is illustrated by GIS-based landscape analysis and country-wide extension demonstration trials (Figure 4.1). The challenge in these cases is to enhance the quality of participation. Participation is frequently limited to initial consultations or surveys of communities. Documentation of local priorities are – in some cases – integrated to improve the relevance of NRM research (see Schreier and Brown's case study in Nepal; Vernooy's case study in Nicaragua, both in this volume). Researchers are generally the lead designers in this approach, and work is implemented by extension and field staff. There may be little or no systematically designed role for farmers and communities as the project is implemented (Benson, 1997). These efforts, frequently involving hundreds of trials carried out throughout a region or agroecozone, and thousands of measurements and site monitoring, are conducted over several years (Hildebrand and Russell, 1996 in Figure 4.1). Final results are often communicated to communities or a region in the form of recommendations. For example, two major soil fertility endeavours in Malawi were conducted at separate times: each involved hundreds of maize fertilizer demonstration trials (Benson, 1997; Hildebrand and Russell, 1996).

One challenge is that farmers frequently perceive demonstration trials conducted across a region, or landscape monitoring with GIS-based tools, as having limited relevance. Indicators of agronomic performance or watershed sustainability may be quite different from sustainability indicators chosen by farm communities, such as increased market access, employment options or control of water management. It is a challenge to fully understand farmer resource levels and priorities. This is discussed in more detail in Snapp's Malawi case study in this volume, which compares different approaches and how these constrain or enhance partnerships among farmers, researchers and extension (Johnson et al, 2001). A range of indicators and technology trial designs that rigorously link farmer assessment with researcher assessment may need to be carried out, to ensure relevance to diverse stakeholders.

Approaches to scaling up and out include using mass media campaigns to spread information in a way that challenges the listening audience, and builds local capacity. Mass media vehicles have been used too often for uni-directional dissemination of recommendations. Yet media can be used to catalyse experimentation on-farm. An example from Vietnam shows that research and extension staff can use leaflets, posters and radio to engage tens of thousands of farmers in experimenting on their own. Farmers were motivated to test the need for pesticides early in the rice growing season. Pesticides were being overused; after testing this idea for themselves, the majority of farmers involved reduced use of insecticide sprays (Escalada et al, 1999, and see Box 4.1). Local governments extended the approach further and, in 1999, 15 other provincial governments multiplied the media materials and launched their own campaigns, reaching about 90 per cent of the 2.3 million households in the Mekong Delta (Huan et al, 1999).

The potential use of the media to complement face-to-face participatory approaches has not been well exploited. It is evident from this case study that when systematically planned and implemented, a media campaign can initiate and help sustain changes in farmers' beliefs and practices. A number of

BOX 4.1 FARMERS TESTING RULES OF THUMB IN INTEGRATED PEST MANAGEMENT

Farm surveys show that a large proportion of Asian rice farmers' insecticide sprays, especially in the early crop stages, were targeted at leaf-feeding insects, commonly known as 'worms' (Heong and Escalada, 1997a). During the early crop stages, highly visible leaf damage by rice leaf folders, whorl maggots, grasshoppers and beetles, are common. Entomologists, on the other hand, found that initial leaf damage is not usually related to yield loss, and insecticide sprays applied early in the season can harm the ecosystem, causing secondary pest problems (Heong and Schoenly, 1998). In making the decision to spray early, farmers rely on heuristics, such as the rule of thumb that equates visible insect damage with a serious problem. To facilitate farmer testing of this erroneous heuristic, a farmer participatory experiment was conducted utilizing the concept of cognitive dissonance (Festinger, 1957). The heuristic tested was 'Spraying for leaf feeder control in the first 30 days after transplanting (or 40 days after sowing) is not necessary'. Farmers were encouraged to try this on about 500 sq m of their rice fields that would not receive any insecticide treatment in the first 30 days after transplanting. The rest of the field would receive normal treatments. The results were discussed in workshops where farmers shared their experiences with the entire community. Most farmers (88 per cent) who participated found that yields of the two plots, whether sprayed in the first 30 days or not, showed no yield difference. The experiment helped farmers to resolve the conflicting information and, consequently, beliefs changed. Before participating in the experiment, 68 per cent of the farmers applied insecticides in the first 30 days. This was reduced to 20 per cent after a year and to 11 per cent after 2 years.

To motivate change and reach more farmers, a media campaign was launched with 21,000 farmer households in Long An province. Farmers were challenged to experiment with the idea that early pesticide use in rice was not necessary (Heong and Escalada, 1997b). The campaign reached 97 per cent of the households, and 31 months after the introduction of media, farmers' insecticide use dropped by 53 per cent, from 3.4 sprays per season to 1.6 (Escalada et al, 1999).

components could have accounted for the large-scale adoption of the heuristic communicated in the campaign – detailed understanding of farmer decisions, simplicity of the message, educated farmers, benefits of the innovation, the media mix, the materials development process and delivery. In addition, an emphasis was placed on motivating farmers to test the heuristic. Researchers started with an understanding of current farmer knowledge and belief (see Box 4.1), to show how farmers could test for themselves a new, more efficient pesticide use strategy. Economic, ecosystem and health benefits obtained from more targeted pesticide use were also emphasized (Escalada et al, 1999).

In the case of complex agricultural management issues, enhanced human resource development at the local level may be critical to helping communities ask the right questions, and design appropriate research. Soil and disease management issues may not be simple to understand, or straightforward for farmers to test on their own. An example of a methdology for facilitating local experimentation is the CIAL (Comité de Investigación Agrícola Local) or local agricultural research committee, first developed in South America (Figure 4.1, Ashby et al, 2000; Braun et al, 2000, and see the Braun et al case study in this

volume). These act as a platform for improving local research capacity. They are locally situated, but CIALs interact at the regional level through second order organizations and national meetings.

Ways forward

Communication is the medium of participatory research. Technology development collaborative efforts need to be focused on strategic and priority questions. Thus the key role is listening to each other and paying attention to ensure communication among partners. The case study described in Malawi (Snapp in this volume) includes different types of participatory research trial designs. The goal is to assess the costs and benefits of a range of collaborative and communicative modes, from the perspectives of all involved. One promising trial design involves the linkage of simple 'one-farmer, one replica' trials – managed by farmers – so that they feed into central trials managed by academic researchers, extension and NGO farm advisors (Box 4.2). These trials were named 'mother–baby trials' by a participating farmer (Snapp, 1999). The goal is to facilitate communication and researcher attention to farmer input (quantitative and qualitative) in a relatively cost-effective, rigorous and practical manner (Kanyama-Phiri et al, 2000). This approach takes a conventional mode of research and stretches it. Communication is institutionalized early and often in the project, among scientists, extension staff, NGO workers and farmers. The mother–baby trial design can be carried out at the community scale (Box 4.2). To scale up further, effort must be invested initially in choosing representative communities that will allow meta-analysis and synthesis at the regional scale (Snapp and Silim, 2001).

Meta-scale analysis can also be conducted through watershed-based approaches, such as the case study presented in this volume for Nepal (Schreier and Brown). This illustrates how geographic information systems (GIS) and statistical meta-analysis can help to build on knowledge in an extremely complex environment (Schreier, 1999; Figure 4.1 and see the case study in this volume). Issues raised by the communities in two Nepalese watersheds were addressed using a GIS approach that included overlay stratification, modelling, statistics and socioeconomic surveys. The key factors indicative of climatic conditions (elevation and aspect), the major soil types, and dominant land uses were used to define categories and conduct meta-analysis. Communities were surveyed through rapid rural appraisal (RRA) methods and participated in on-farm research to assess sustainability of nutrient management practices. The case studies by Williams and Peters in this volume illustrate the use of GIS-based information tools to help synthesize lessons from local NRM experience.

Performance of technologies over the long term, and how risky they are in different agroecosystems and climates, can be addressed by nutrient budgeting and modelling (Lightfoot and Noble, 1999). Linkages of models to on-farm experimentation, to explicitly evaluate risk and farmer perceptions is an approach developed in Zimbabwe. These experiences are reported by Rohrbach and Okwach (1999) and closely related work by Snapp and colleagues (1999);

BOX 4.2 FARMERS AND RESEARCHERS PARTNERING IN MALAWI THROUGH MOTHER–BABY TRIALS

Researchers and extension workers are reaching out in Malawi to maintain constant communication with their clients, farmers. In the new mother–baby trials, researchers establish one benchmark on-farm trial in a village, which they manage, in order to gain replicated data for analysis. This is called the mother trial (a metaphor that connects especially well with the highly enthusiastic women farmers). Associated with the mother trial are about 20 baby trials, each managed by a farmer herself, using treatments she has expressed a particular interest in – not just the ones the researchers may want to promote. A baby trial may have as few as four plots, easing the workload while focusing on the 'best-bet' treatments the farmer is most likely to adopt. Farmers manage their baby trials using their own inputs and equipment. They define their own control treatments for comparison to see if the new idea is really an improvement on their previous practices. Surveys are conducted to integrate farmer evaluation of best bet technologies with researcher judgements (Snapp, 1999). Where villages representative of different agroecozones are chosen for conducting mother–baby trials, meta-analysis of technology performance can be conducted over time and space.

Both researchers and farmers learn from this approach. In Malawi, for example, where 300 farmers across five agroecosystems are conducting baby trials, one farmer exclaimed, 'Groundnuts doubled up with pigeonpea is my new basal fertilizer. I grow them before my maize crop and I get a strong crop: I only have to apply a small amount of urea as a side dress.'

The work has impressed upon researchers that any technology – such as legume-intensified maize cropping systems – must have multiple benefits. Farmers are ready to invest in crops that help reduce labour requirements, and have marketing potential. Soil fertility enhancement is not enough on its own. This finding has spurred additional research on market access and legumes that have cash cropping potential, as well as nitrogen-fixation soil benefits.

see also the Zimbabwe case study by Vaughan in this volume. New methodology and knowledge has improved efforts to integrate on-farm evaluation of cropping system performance over time and space. These include multivariate statistical approaches to analysis of variance and nutrient balance methods to calculate nutrient inflows and outflows as sustainability indicators and guides (Brown et al, 1999; Defoer et al 2000; Mutsaers et al, 1997)

As spatial analysis and simulation prediction tools become more widely available, stronger linkages to PAR need to be developed. Empowering communities to improve natural resource decision-making across regions, and countries, is a process being explored by McDougall and colleagues where community forest management is challenged by conditions of rapid change, deforestation and involving multiple stakeholders in Indonesia and other countries (McDougall et al, this volume). CIFOR (the Center for International Forestry Research) has recently carried out initial research to develop and test suitable criteria and indicators to help assess the sustainability of community forest management.

Links to markets and access to inputs are also important components of scaling up, where demand and supply can help facilitate farmer experimentation.

An interesting example is provided by a recent uptake of pigeonpea in new regions of Malawi through a combination of events, including market liberalization and increased market access for smallholder farmers (Jones et al, 2000). This may have long-term positive consequences for soil fertility regeneration: pigeonpea is one of the most effective grain legumes in terms of fixing nitrogen and increasing phosphorus availability under on-farm conditions (Snapp, 1998). Thus, strategic partnerships among private and public organizations to facilitate market demand and access to inputs may be necessary to scale up technology adoption.

Summary

A highly heterogeneous environment that requires locally specific decision-making complicates efforts to improve NRM. Heterogeneity among stakeholders makes it difficult to craft cooperative agreements, and develop effective communication. Further, smallholder farmers and resource-poor rural people cannot always invest in experimentation, and they may not understand all of the interactions and the biophysical principles involved (Bentley and Andrews, 1996). Researchers frequently have knowledge about agroecological principles, but do not know how to apply them to local circumstances or resource bases. A major stumbling block is that those charged with improving local decision-making are frequently unclear about indigenous knowledge or local priorities.

To scale up and move forward, a radical change in the research sequence is necessary. Participatory problem definition needs to start with the farmers' perspectives (Bentley and Andrews, 1996; Heong and Escalada, 1997a). Improved communication tools and PAR methods are becoming available to facilitate this process. Structured means of improving information flow among farmers, researchers, farm advisors and other stakeholders are discussed here. These include relatively practical and rigorous methods that can be adopted immediately by agronomists and soil scientists, such as community nutrient budgeting and mother–baby trials (Kanyama-Phiri et al, 2000). Key components include improving communication through participatory workshops and the linking of action research and synthesis of biological performance and farmer perceptions. Spatial analysis tools such as GIS can play a role in the synthesis of natural resource information and developing indicators at different scales, including those with local and multi-regional importance. Community participation and human resource development approaches may take longer to develop, but are essential to the sustainability of scaling up efforts. Community agricultural research groups, watershed management associations and farmer field schools provide examples of how to develop human capacity and improve NRM decision-making on a grand scale (Ashby et al, 2000).

Reaching many farmers may require learning from nationwide literacy campaigns (Freire, 1970), and understanding how market access and links can be developed. These require major investments in terms of time and resources, which may involve mobilizing the private and public sectors. At the same time,

in cases where relatively simple relationships are apparent, we suggest that one way forward, with short-term impact potential, is for resource management scientists to distil research information into testable rules of thumb. Then clients throughout a country or region can be challenged to evaluate this hypothesis (Cooperrider et al, 2000). Management decision-making framed as heuristics has the opportunity to be disseminated widely by the mass media. Thus, thousands of farmers can become engaged in experimenting to evaluate rules of thumb, and determine validity for themselves (Escalada et al, 1999).

We attempt here to distil information about building quality partnerships, while expanding to reach many people. The case studies detailed here are rich sources of information about what worked and did not work. It is apparent that communication among farmers, researchers and change agents as well as community skills in building in NRM are essential ingredients to sustainability and scaling up; this holds for a range of different information tools and participatory approaches. Maintaining and expanding on these partnerships is part of the challenge of reaching the multitudes.

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Chapter 5

Transforming Institutions to Achieve Innovation in Research and Development

Ann Stroud

'In times of change, learners inherit the earth, while the learned find themselves beautifully equipped to deal with a world that no longer exists.'
Edward Hoffer[1]

Introduction

Researchers around the globe are taking on complex, multi-faceted environmental and livelihood challenges. In doing so, they are searching for, testing and proposing a number of methods and approaches that depart from those normally used in traditional agricultural research. There are several driving forces behind this evolution: a growing dissatisfaction of governments and donors in the limited impact from the substantial investment that has been made in agricultural research; a heightened pressure to deliver and to show that farmers are using the technologies that have been 'on the shelf'; and an awareness that technologies and other research products need supportive conditions, coupled with local innovation and incentives, to enhance adoption. There is also a growing realization by researchers and natural resource management (NRM) practitioners that technologies in themselves are not a panacea to address NRM issues, but need to go hand-in-hand with supportive social, institutional, economic and policy arrangements. It is the major hypothesis of this book that the participatory research and gender analysis (PRGA) approaches promoted by the Consultative Group on International Agricultural Research (CGIAR) will help to address these sorts of concern.

As researchers are being pressured to be more client, impact and results-oriented, research managers are also being pressured to change their organization's

orientation. The changes sought in research practice to more directly address local capacity needs and support sustainable, self-led change require supportive changes in institutional operations, arrangements and values. This path of change should lead to a more 'learning type' research system – one that internalizes the necessary changes in attitudes, structures and research practices so as to increase responsiveness to local community development needs, consideration of economic, institutional and social aspects, and the ability to positively influence policy. Public research organizations are, in fact, currently being challenged to embrace a twofold change: to move towards the use of PRGA approaches in research practice (see Box 5.1); and, to become 'learning organizations' so that they can continue to effectively innovate in the future (see Table 5.1).

To date, the promotion of PRGA methods has been primarily addressed through projects and one-off training programmes. Very few of these projects or programmes are conceived to, or have strategies that, influence the core attitudes or working practices of the institutions, so that many of the experiences remain isolated, and as a result there is still a dearth of public institutional support for these new approaches. However, some researchers are promoting an integrated natural resource management research and development (INRM R&D) approach, which also embraces participatory approaches) (CGIAR INRM Task Force, 2001; CGIAR INRM, 2000; Stroud, 2000, 2001; AHI, 2000). There are now some examples of changes in attitudes,

BOX 5.1 ADDED VALUE AND DIMENSIONS OF PARTICIPATORY APPROACHES TO INRM RESEARCH

Using participatory methods allows for:

- Developing a shared vision of how natural resources should be managed.
- Building confidence and capacity for collective action, advocacy and innovation.
- Using a learning-based-in-action process of enquiry and reflection.
- Acknowledging, enhancing and incorporating local knowledge, beliefs and values.
- Learning from and coping with the perceptions of a broader set of stakeholders.
- Diving deeper into understanding and managing social and biophysical complexity, diversity and dynamics.
- Reaching and including less powerful stakeholders, such as women and disadvantaged groups, focusing on resource access and social equity.
- Fostering interdisciplinary communication and facilitation as a means to dealing with conflict, finding new management arrangements and promoting learning processes.
- Monitoring the results that come from actions derived from the learning-reflection processes.
- Understanding and influencing micro-political processes.
- Operating at different technical, organizational, geographical and temporal scales or levels.
- Managing change in local institutions that favour improved livelihoods and environmental management.

Source: Various chapters in this volume

Table 5.1 *Comparing characteristics of learning and bureaucratic organizations*

Characteristics	*Learning organizations*	*Bureaucratic 'non-learning' organizations*
Strategic thinking and decision-making	• Leadership is committed to innovation and leads a qualitative vision or guiding strategy that goes beyond numbers • There are strong ties to clients and partners so that strategic alliances are supported • Interactive learning is supported, drawing on multiple external sources of information and ideas • There is adoption of an experimental, enquiry-oriented approach to decision-making – that is, adapting decisions and strategies to emerging realities in the field • Actions should be considered as tests of current understandings, models and hypotheses	• Leaders communicate their resistance to new ideas coming from below or from outside and may have defensive reactions to suggestions • Leaders ignore requests for clarification of policy in relation to supporting learning or discourage creative thinking • Leaders may be defensive and protect their mandates even if it fosters confusion and duplication • Risk averse environment; leaders seek uniformity and use directives, meetings and peer pressure to get conformity. • Decisions are according to rules and hierarchies and are generally inflexible
Resource allocation	• New ideas and approaches are supported, some of which might be competing • Long-term actions are supported with resources across sections/divisions	• Resources are allocated to those who follow existing protocols and maintain the status quo • Performance is according to category with little cross-sectional interaction
Human resource management	• Attract highly skilled and creative people and provide them with opportunities for professional growth • Innovators and implementers of innovations receive training, technical support, financial incentives and other rewards • There is an acceptance of error • Relationships should be high on trust and low on defensiveness • There is tolerance of ambiguity and uncertainty, and a critical attitude where questions and analysis are tolerated	• Sort people and events into a limited number of agreed-upon categories to reduce complexity • Managers may hoard information on performance • Cultural norms and assumptions block learning • Managers emphasize control over subordinates and action • There are no rewards for innovative thinking and taking risks in this direction • There is limited exposure to new ideas and procedures

	• Recruitment of diverse personnel and development of procedures for exposing members to diverse viewpoints • Rewards and incentives for addressing and solving recurring problems and challenges	
Structure	• Use small teams that are semi-independent, inter-disciplinary and that are free of administrative constraints • Use integrating mechanisms such as projects, task forces, horizontal links between teams and informal networks that bridge boundaries between functional groups • Strategic alliances provide access to necessary techniques, skills and facilitate risk sharing • Authority is granted on basis of experience and expertise rather than on seniority or formal position • Supportive monitoring and evaluation (M&E) systems to ensure accountability and quality performance	• People are in sections/divisions under one supervisor and there is little cross-sectional work that is sanctioned • Few integrating mechanisms are employed and interactions are mainly within sections and similar functional groups • Strategic alliances and partnerships are difficult to forge without the consent of supervisors • Authority is granted on the basis of degree and seniority, and secondly on experience and expertise

Sources: Harrison and Shiron, 1998; Catacutan and Duque, 2000; Thompson, 1995.

practice and institutional arrangements that have promoted and fostered the incorporation of participatory approaches into research.

There is also some recent, increasing interest by public research organizations in the processes of organizational change and learning as a means for improving the impact of research and of participatory INRM approaches (Gurung, personal communication, 2001; Hagmann et al, 1998a; Hagmann et al, 1999; Jonfa et al, 2001; Hagmann and Stroud 2002). Beyond cultural transformations, changes in managerial and structural terms could include an array of new modes of operating, for example: new forms of leadership, new ways of linking with external agencies and partners, new ways of managing and promoting personnel, new incentive structures, new planning, reviewing, resource allocation and monitoring and evaluation modalities. Two challenges are that there are few organizational change experts working for the public research sector and that change experts tend to draw upon experience derived from private sector organizations in developed countries (Senge et al, 1999; Baum, 2000; Kotter, 1996). However, private organizations have different driving forces to encourage change – for example, profit motivation and market orientation – when compared to public ones (Janssen and Braunschweig, 2002). Many public organizations are led by 'researcher-managers' who are not expert in organizational assessment, and their institutional culture may not include innovation or the creative exploration of new ideas. These institutions are often part of larger, more bureaucratic government structures that do not encourage innovation. Some of these difficulties, as experienced by public institutions in the 'farming systems' research era of the 1970s to early 1990s are documented by Collinson and FAO (2000) and Merrill-Sands et al (1989).

Much of this book has described progress in the use, or development of, participatory methods and practices that encompass gender and diversity concerns. This chapter focuses on aspects and challenges related to changing research organizations so that there is better support for, and use of, participatory methods. The hypothesis put forward in the chapter is *that by employing strategies and processes to create a shared vision of effective research and a learning organizational culture, the development and use of new methodologies, such as PRGA, will be encouraged*. The chapter describes key elements, conditions and processes required for institutional change in research organizations. The chapter focuses on the three main stages of change: 'initiating change', 'sustaining momentum', and 'redesigning and rethinking'. It provides examples to illustrate application in practice, drawing heavily upon the African Highlands Initiative (AHI) experience,[2] and highlights issues and challenges inherent in public institutional change. These ideas are proposed with the understanding that much more than institutionalization needs to take place to enable a PRGA approach to work. Other critical elements include an organized, relatively sophisticated expression of farmer demand, adequate resources for research, good quality services to support farmer demand, and a supportive policy structure. We suggest that the lessons learned and proposed here could be applied not only to public sector R&D organizations, but also to community groups and community-based organizations, as well as non-governmental organizations.

Key elements and conditions to consider when fostering institutional change

Structural and process approaches

Specialists in the field of organizational change have described several useful frameworks and change processes that indicate key conditions, elements and challenges (Kotter, 1996; Gurung, 2001; Hagmann et al, 1997, 1998b; Hagmann et al, 1999; Senge et al, 1999). The two approaches to organizational change discussed here – a 'structural approach' and a 'process approach' – have slightly different emphases, but are not mutually exclusive (Kotter, 1996; Baum, 2000; Gurung, 2001; Hagmann et al, 1999). Kotter (1996) lists three major components of his 'structural' approach to organizational change: structure, systems and culture. *Structure* includes the nature of rules and decision-making hierarchies within the organization, numbers of levels, type of leadership, and the number and complexity of policies and procedures that hinder or serve the organization. *Systems* refers to performance evaluations, information systems, training and other support systems (incentives and rewards) for a wide range of employees. *Culture* refers to the organization's norms of behaviour (common ways of behaving) and values that are shared and are visible within the organization and that tend to shape behaviour (Baum, 2000).

Taking a 'process' approach, Gurung (2001) points out that unless most of these elements are working together towards changed modalities, a mere policy change – for example, offering incentives to change – will not result in organizational change. Likewise, if one only makes structural changes without other functional changes, little behavioural change will occur. This implies the need for a *process* to deal with the whole system and its elements in a logical, but iterative way. Culture is one of the most important but difficult aspects to change as it is nearly invisible, is largely unconscious, is difficult to discuss and to challenge, and has a large influence on human behaviour. The Stroud case study on the African Highlands Initiative, for example, illustrated the repeated need to reinforce and mentor the use of participatory methods as researchers kept reverting back to their original behaviour. The new (PR) approaches involved required the researchers to change their behaviour from: closed to open modes of questioning farmers; working with individuals to working with groups; collecting to sharing information; verbal communication to using more visual means; qualitative to using comparisons; and from 'research to village' information transfer to 'village to village' transfer. The difficulties for researchers to rapidly change their attitudes and practice, given their research organizations' culture, prevented them from making quick progress in applying participatory research methods.

In the *Dance of Change* (1999) Senge et al highlight that 'sustaining any profound change process requires a fundamental shift in thinking'.[3] They make the following points in terms of means and process for change: there needs to be a potential for change; that change is a process that needs to be managed and reinforced; and that one has to be cognizant and understand the constraints or

challenges that can limit growth processes and to attend to these constraints. The latter point is key and requires workable strategies for dealing with these challenges. Several cases discussed change the management of local organizations as a process (Vincent, van Koppen, Pound and CIFOR, among others).

Senge et al (1999) divide the change process into three stages. *Initiating change* occurs as soon as a 'pilot' group(s) begins to conduct its work in unfamiliar ways. In the case of PRGA, many of the participatory INRM practitioners might identify themselves as the 'pilot' group (or 'change team'). The second stage is *sustaining momentum* within the change team and between the team and the larger organization. This concerns confronting 'sceptics' and trying to keep the spirit and practice of change alive within the change team. Thirdly, *redesigning and rethinking* at the organizational level refers to the stage when change initiatives gain broader credibility and confront the established internal infrastructure and practices of the organization. It is at this stage that one actually gets into organizational assessment of strategies, systems and structures (refer to Kotter, 1996 above) and where the organization takes steps in making adjustments in order to change, support a new culture and new ways of doing things. If the organization can adjust itself to become a 'learning organization', it can go through periodic stages of reviewing and renewal.

Organizational change requires various supporting conditions. There must be a *shared commitment*, among leaders, managers and workers. This commitment only develops with collective capability to build *a clear vision and shared values* such as participation, accountability, openness, transparency, ownership and inclusiveness. There should be people who have the *skills to facilitate reflection and enquiry or to use a 'reflective- learning' process*, as this enables those involved to converse about complex, conflictive issues without invoking defensiveness. Other new skills are needed that support the change process, such as *systems thinking, reflective learning, and facilitation*, as well as the skills to carry out any new tasks that might be envisioned. Good *mentoring* or facilitation is required to enable team members to rise to the challenges (ie, helping others to 'complete' themselves) (Senge et al, 1999; Hagmann pers comm). An underlying 'process' thread that feeds the various stages is a *'learning' cycle that promotes a culture of enquiry*. This cycle includes: sparking change, searching for new ways to operate, planning and strengthening capacity, experimenting while implementing, sharing experiences and reflecting on lessons learned, and re-planning (Hagmann et al, 1998c). Senge et al (1999) consider these as basic learning capabilities, which if they are missing will limit sustainable change. Various PRGA cases referred to using the learning process (eg, Nelson, Braun, Stroud).

From the above points, it can be seen that organizational change combines 'inner' shifts in people's values, aspirations and behaviours with 'outer' shifts in processes, strategies, practices and systems. Clearly, the organization must *build capacity* for doing things in new ways; it just doesn't 'do' something new. *Changed thinking is the foundation* so that new strategies, systems and structures can be implemented. In summary, *change is a process*, and the various stages need to be iteratively understood and managed. (Refer to a scheme in Box 5.2 as an example.)

BOX 5.2 ORGANIZATIONAL LEARNING STAGES

Single loop learning: Find ways to improve practices, as judged by current norms and standards – this can produce a dramatic improvement but does not generate the ability to make fundamental improvements in the system. (Initiating change)

Double loop learning: Members review and challenge standards, policies and procedures in light of external changes and their own underlying values. Members learn to learn. Participants consciously alter their frameworks. (Sustaining change)

Triple loop learning: The most far reaching. Breaks current frames and yields fundamental changes in the organization's guiding vision, approach and assumptions about work and ways of organizing. This is where the participants become aware of their own interpretation and frames (mental maps) and prepare to change these as needed. (Rethinking and redesigning)

Source: Harrison and Shiron, 1998

The first stage of institutional change: initiating change

> *'Whatever you can do, or dream you can, begin it. Boldness has genius, power and magic in it.'* Goethe

Four key aspects of initiating change are introduced here, then explored in further detail in the following sub-sections. Various *driving forces* usually initiate change: people feel the need for change; they might be led through an analysis that indicates the need for change; or circumstances and clients may demand change. Change is most successful when the effort is driven by commitment, and where the initiative is driven by the interest in learning. Other driving forces however, usually attend this commitment. Once it is realized by a few that change is needed, a *change process can be designed, catalysed, facilitated and iteratively reviewed*. The change process needs to be linked to the desired outcomes within a conceptual framework, and competence development and iterative reflective learning and action must be linked conceptually and in action to the framework (Hagmann and Stroud, unpublished). As part of the process, one has to think about who is involved, how they are linked to the rest of the organization, what strategies are required, and who is leading and facilitating the process. Visioning and concept development are necessary to enable the change group and others in the organization to visualize alternative ways of working and organizing the work that currently may be beyond their experience. *Visioning and concept development* need to be returned to and deepened over time in a common interest or 'change group'. *Competence development* is an integral part of change and includes management of the reflective learning and action process as well as the development of other new skills that are needed to handle the new dimensions envisioned. The process of change becomes *grounded in the elements of 'experiential learning'* through conceptual development, testing new ways of working through action research, documentation of processes and learning, sharing, reflecting to bring out the lessons and experiences, then re-

planning and redirecting actions as required. There should be many self-discoveries on the way.

Driving forces

Driving forces of change can be, and are often, external (for example, 'donor-driven'), but are best accompanied by the internal drive or felt need to change. According to Senge et al (1999), an internal drive for change usually starts small, and often with people who are open-minded pragmatists, and who may look at their organizational culture from a different perspective or have curiosity in a particular set of ideas. These groups, sometimes referred to as 'change teams', often serve as the 'seeds' for change – developing and applying a shared vision, similar mental models and a willingness to experiment with new ways of doing things. This felt need to change is usually not shared by all factions within the organization, and hence come some of the challenges faced in subsequent stages of change. (Based on the AHI's experience, for example, while the 'change team' trying out new modalities may have deep, extensive experiential learning, if they are not also linked to and supported from the onset by management, they risk delays or even external 'sabotage'.)

The increased use of participatory research methods has been broadly driven by the fact that most research organizations see the need to improve adoption rates and impact. These institutions perceive that the traditional approaches are not achieving this, particularly in the areas of: applying more complex NRM technologies (integrated pest management and integrated soil fertility management); resolving communal resource management issues (irrigation schemes, hillside management); handling varied and multiple stakeholders' needs who operate in varied circumstances with varied agendas (importance of social and institutional processes); and dealing with multiple dimensions and levels (policies, economic conditions at local, regional and national levels) that are hindering change. In addition, an increased application of PRGA is often driven by an enhanced sense of mission – to give more attention to women and the poor. All case studies make reference to these areas. Here we offer four examples, taken from the case studies, that illustrate drivers of change towards using new PRGA approaches in order to have a better impact.

1 External interests are drivers of change in cases where advisory project personnel from externally funded projects or donors see the need for new research approaches that create impact. A shared agenda is sought by the external project in consultation with local R&D organizations and often the external entity tries to influence or assist the local organization in the change process (Jonfa et al, 2001) (cases from Klemick and Jarvis, Vernooy, Nelson, Borrini-Feyerabend, Pound, van Koppen and Gurung).
2 Local interests drive change in cases where a local movement results in empowered farmers and sufficient funds so that locals can make demands on research and other service providers (cases from Garrity, Braun, Dey and Prein).

3 Two-way interactions between research staff and partners from other organizations involved in development can provide an impetus for change. This is where teams (multidisciplinary) and partnerships (multi-institutional) foster change through exposure to other ways of doing things. Partnerships can require intensive sharing of methods and approaches through action and/or the negotiation process. Adjustments in process may be made to enable the relationship to function (Opondo et al, 2001; cases from Snapp, Stroud, Vernooy and McDougall et al, this volume).
4 Internal realizations by the research teams for the need to change can drive the change process; catalysed especially by field research pursuing improved NRM and livelihoods and working directly with local farmers and other stakeholders. This is witnessed in the testimonies from the cases found in this book as well as from others (Opondo et al, 2001; most cases in this volume).

Designing the process

To be successful, efforts towards organizational change require a conscious process and strategy, as well as leadership and facilitation, and should ultimately be supported by institutional structures and procedures. Changed thinking is a key factor underpinning these because it leads to changed attitudes and practice. The change process, for example, needs to explicitly foster the individual desire for learning and to provide personal satisfaction. It requires social dynamics where individuals interact and work together over time, and where they are able to derive satisfaction from teamwork. The AHI experience illuminated the fact that creating a process that focuses on the 'outcomes' of the change process – in other words, what needs to be accomplished, thinking through how to get there and translating this into action – is critical. The outcome provides the compelling vision; the strategy and action translate this into personal and group experiences in the field. The field experiences ground changes in personal experience and support changes in attitude and behaviour. Reflection sessions review these experiences and rethink the strategies and practice (Opondo et al, 2001).

The change process must be led by a *strategy* for expanding lessons beyond the change team, and into the future; this may involve multiple steps and various parts of the organization. For example, while change groups may be useful in planting 'seeds of change' within an organization, these will not take root unless managers adopt and share the new models of practice as examples. Alternatively, if many of the organization members see a need for change, there might be a process put into place that is jointly designed – with a series of task forces, iterative discussion and strategizing and coming to some conclusion (Hagmann and Stroud, unpublished.). Experience has shown that there are several common weaknesses relating to strategies for designing change. There are often structural changes made without a clearly articulated goal and desired outcome. This usually results in a dysfunctional system that does not foster the required behavioural change and learning that are needed for real change. Often the small change teams (based in projects) stay as isolated experiences because they are

not linked to organizational learning. There is usually a weak strategy in place for assisting the 'change team' and for harvesting lessons from these cases. For example, reviews and planning sessions may not be organized for reflection – thus limiting opportunities to make adjustments if things are faltering. These weak modalities provide limited support to changing behaviours and practice, and are most likely why PRGA has not been widely adopted, incorporated and internalized in research organizations.

Leadership and membership in a 'change group' is very important to its success. The literature (Senge et al, 1999; Adamo, 2001; Stroud's case study, this volume) highlights several key groups of actors that might be included in the change team:

- Social networks and existing groups that are characterized by a high level of trust and provide a social framework for coordination, cooperation and mutual assistance.
- Effective internal networkers that can diffuse innovative ideas and practices – these often belong to informal social networks.
- Leaders that are accountable, imaginative, committed and have sufficient authority to undertake change at their local level.
- Those that have a propensity for mentoring, are committed to the learning process and can become mentors and coaches.

Top leadership must be involved in the process in order to create the right organizational environment for the change group(s) to operate and pursue its objectives (in this case to provide a good example of the application of the PRGA approach to INRM). If change is externally driven, the process should be optimally negotiated and designed together with management. This is one of the pitfalls in much of the PRGA work when it takes place in a 'project' mode. If management is not included, one can expect many challenges to arise in the sustaining stages (Hagmann et al; Stroud case). Jonfa et al (2001) discuss the importance of raising awareness of the PR approach at various levels, and used a wide range of strategies, involving a number of actors, in their change process: publicity campaigns, involving a number of key organizations in planning and implementation, using cross-institutional training, creating forums for discussion, organizing monitoring tours and impact studies, and formulating a set of flexible guidelines.

Conceptual and competence development

The start-up phase of a change process should include 'visioning' and 'conceptual development' for the research change team to support the new ways of approaching research. Exploring and broadening concepts (or research paradigms) using 'live' examples can open the eyes of researchers to new ways of working, while reinforcing the validity of the new methods and enhancing understanding of the rationale for change (Hagmann et al, 1996; Hagmann et al, 1998a; Hagmann et al, 1999; Hagmann and Chuma, 2000; Hagmann and Stroud, unpublished). As part of the conceptual development, a skillfully facilitated

visioning process can contribute to broadened perspectives of researchers, help to establish team consensus on directions and rationale for change, and provide a foundation for a cohesive change group, and a plan for joint action. Visioning is particularly useful for starting the change processes in institutions where outsiders may drive change (for example, in public research institutions which may be heavily influenced by donors) because the vision and specification of the desired outcome is created, owned and internalized by those involved. While the intensive work on conceptual development and visioning might start with a change team, eventually this has to be linked to the organization so that all actors are sensitized. The conceptual scaling up should be considered as part of the change design.

In the design and initial stages of institutional change, conceptual and competence development and reflective learning need to be woven together in an iterative way. The change process should generate (as well as draw on examples of) relevant first-hand experience so that those involved can internalize the need for change. The inclusion of 'real life' experiences is critical (see the Stroud, Vincent, Pound, Borrini-Feyerabend cases in this volume; Senge et al, 1999; Opondo et al, 2001). Hagmann (1999) describes such a process that he facilitated in Zimbabwe for improving extension delivery systems and farmer innovation. Developing capacity in participatory research approaches, including mainstreaming gender concerns, goes faster when research teams are interacting and testing methods in the field. This 'real life' experience reinforces and internalizes the concepts and associated practices. Furthermore, by working together as a team, members can draw upon each other's perceptions and skills. Systematic reviews of the work, led by a facilitator in a supportive, innovative atmosphere, can help to build the competences in an iterative way (Hagmann et al, 2000).

Furthermore, the case studies in this book have shown that building competence in PRGA approaches does not come by adding skills via 'one-off' training events but requires consistent mentoring, exchange visits, monitoring processes, and commitment to applying the skills, tools and methods in an action research modality (see the Stroud, Nelson, CIFOR, Pound, Gurung cases in this volume; Jonfa et al, 2001). Change teams and managers of their institutions need to develop strategies to build competence in facilitation and other new skills needed to implement and develop participatory methods (Catacutan and Duque, 2000). Senge et al (1999) refer to five stages of competence development (Box 5.3) but cautions that these 'types' are not 'set in stone'. Organizations that become learning-based can support a competence-building process by investing in mentoring and by creating internal coaching capability, where both lead to a self-reinforcing growth process.

Use of reflective and action learning to propel change

To effectively support institutional change, the 'reflective and action learning' approach should be coupled with mentoring and good facilitation. This process will enable the teams involved to analyse and synthesize lessons and experiences, associate the 'real' work with their goals, and simultaneously build capacity

BOX 5.3 FIVE STAGES OF COMPETENCE DEVELOPMENT

- **New learners** get an awareness of the subject area and gain intellectual understanding of concepts and ideas but cannot easily apply these unless they follow the rules or steps.
- **Advanced beginners** can apply their skills, are more aware of the depth and breadth of the subject and acknowledge their knowledge gaps; they are able to follow the steps as long as it does not deviate from what they have studied.
- **Competent learners** have accomplished the 'know what' and can move beyond the simple rules and procedures; they can adapt to new circumstances but they still lack the 'know how'.
- **Proficient learners** can reliably meet any situation and solve issues with the full grasp of the whole problem; however, actions are still at a conscious level.
- **Experts** can break the rules and surpass the goals as they have totally internalized their practice. Experts continue learning through their interaction with other experts in mentoring relationships.

Source: Senge et al, 1999

(Moyo and Hagmann, 2000). Hagmann and Chuma (2000) stress the need to 'create' conditions for learning, and state that non-directive facilitation can assist groups in self-organization, governance and sharing knowledge – including joint problem and solution analysis – as a way to foster social learning and collective action. During continued facilitation, the group strengthens its capacity for internal negotiation and conflict management, and innovation through interactive construction of knowledge.

In many of the participatory research experiences from the cases in this volume, we see that support for internal coaching and learning has been intentionally included, but often has been pieced together as the process unfolded, and dependent on the commitment of the group members. Jonfa et al (2001) and the Pound, van Koppen and Vincent cases in this volume used a multi-faceted combination of theoretical training and practical hands-on sessions plus research studies, participatory on-farm trials, and cross-institution learning for this purpose. They included practitioners and senior managers in training events, which helped to make the necessary links between practitioners and supporters and helped to build understanding throughout the organization.

Action research and the application of PRGA approaches reinforce growth and change within the research team. As practitioners engage in catalysing community-level change issues in their work, their efforts often result in changes in their own perspectives and approaches. This interchange, mentioned in a number of the cases in this volume, offers an excellent 'push' for the change process in the R&D group and is reinforced by reflection sessions (Hagmann et al 1996, 1998c; Snapp, Stroud, Pound, Vernooy and other case studies in this volume).

Challenges to initiating institutional change

Challenges associated with initiating institutional change begin as soon as the change group starts to conduct its work in unfamiliar ways. These challenges need to be addressed as they appear; this is easier to undertake if the team is aware of their potential emergence before they occur. Teams can anticipate, for example, that staff turnover can slow down the change process and contribute to unequal learning and relationships in community-based work. Many key challenges relate to the time that it may take to create a successful model. For example, facilitation, capacity building, reflective learning, visioning and developing concepts and new mental models will take resources, time and planning energy. Institutional change can require a critical mass of funds, human resources and clear leadership to undertake the work, as well as the ability to articulate a clear focus and need for institutional change. Furthermore, there are often difficulties in changing public organizational procedures where new positions are needed. For example, it took AHI two years to negotiate the position of an INRM coordinator who could integrate research inputs and engage in partnerships. In sum, the change team and other stakeholders must recognize and plan for the fact that change is a process and that sufficient time is needed to initiate and implement it (Jonfa et al, 2001; Stroud, 2001). In Zimbabwe, Hagmann and his team set out to change the extension system; it took about five years. In hindsight, and in a second case of change work going on in South Africa, the process has been speeded up given previous experience (Hagmann, pers comm). This allowed time is critical, especially in the early stages, so that the change team can become proficient and confident in its new role and capacities, and to convince others of the value of change, without alienating them.

The second stage of institutional change: sustaining momentum

> '*The problem with learning from experience is that we get the test before the lesson.*' Alfred E Neuman (*Mad* magazine)

As well as the potential challenges of the 'start-up' phase of change, Senge et al (1999) and others highlight a number of challenges that change teams are likely to face once some level of success has already been achieved. The team may be inexperienced in using new participatory methods, so there may be a 'results gap' between starting to use good practices and impact. The team may face difficulties in communicating their experiences, especially in terms of efficiency and cost-effectiveness, to those who expect 'fast results'. This is compounded by the risks they face by 'experimenting'. The team will likely face internal challenges while they gain skills and confidence in their new ways of working. They will inevitably face criticism, or even sabotage by 'non-believers'. At this point in the change process, there usually is some competence, but perhaps not yet enough to confidently face these challenges (Senge et al, 1999). It is important therefore, to give forethought to strategies to address these so that

the momentum, and potential to further institutionalize the change, can be sustained.

The team challenge

One key challenge is for research team members – who previously worked as individuals – to develop trust and overcome their feeling of vulnerability when working in a team mode. This includes addressing barriers based in institutional (or personal) values relating to independence, competition and the allocation of credit. It is only when these challenges are met that the individuals can function as a team and effectively explore the use of participatory research methods (Opondo et al, 2001). This was true in the AHI experience where the members had to develop team and leadership skills – including the leader's confidence to lead – and the ability to maintain an open and trusting team culture. If these values are not forthcoming, the effort to change working modalities will probably fail because of their pivotal role in long-term learning. Some efforts that enabled the AHI teams to meet these challenges included: holding periodic meetings to air potentially problematic issues and to take stock of progress, tackling small, simple conflicts as they arise, fostering trust and mutual support in daily interactions, the leaders setting examples of desired team values, such as openness, appreciating diversity as an asset (for example, illustrating the contributions of social scientists), continuing skills development, and reasserting the team vision throughout the process. The AHI teams also invested in periodic meetings at pilot sites and across countries, and scheduled explicit sessions to build team capacity and strength, and set up explicit monitoring of teamwork modalities.

It is important for the change team to prove that their new methods work – including where, with whom and for what circumstances. The team has to plan how to balance the time spent in developing (and mentoring for) new ways of working and competences with their implementation, and analysis. The critical reflection needs to be balanced with recognition of gains throughout the process, because this reinforces the new positive patterns and renews the team's energy for the change process.

Fitting in with the status quo while taking new leaps

A second major challenge to teams that are trying to innovate – including implementation of PRGA approaches – is the ubiquitous pressure in research institutions to maintain the methodological status quo. 'New' approaches are often met with scepticism, defensiveness, stubbornness and even sabotage. Key words such as 'participatory' can trigger negative reactions from peers, and these reactions may become more extreme as the team's success and enthusiasm increase. Any perceptions of 'exclusiveness' or 'arrogance' on the part of the change team can alienate others, which can then lead to the change team feeling misunderstood and unappreciated. As innovators are often relatively junior in institutions, they may find it difficult to communicate their goals and findings to their senior counterparts (Opondo et al, 2001). Thus the change momentum may be threatened even though the assessed R&D value of the innovation may be very positive.

Maintaining the change momentum requires change teams to recognize the concerns and criticisms of participatory research made by the 'status quo'. These are many, and of quite varying validity. They include that: many biophysical researchers feel that PRGA approaches are for social scientists only;[4] participatory research is not considered to lead to scientific enquiry and refereed publications; PR is seen as site-specific and costly in time and logistics; agendas arising from farmer-led fora are not considered valid or are too site- or interest-specific for public institutions with broad mandates; ways to judge or ensure quality are not well known or practised; and, these approaches are sometimes considered just the latest 'fad'. The question of scientific validity is a concern. The change team can use this concern in discussion and joint assessment of the new approaches as one strategy to bridge the communication gap between the change team and others representing the status quo. Participatory approaches may require different assessment methods rather than the traditional assessment tools. PRGA approaches, for example, may not yield quantitative data, and therefore might not appear to be 'scientific' to very traditional researchers or clients (eg, credit organizations). Yet discussions of a PRGA methodology and its 'checks' (see Chapter 6 this volume) might illustrate to those outside the team why a set of qualitative methods and 'soft' assessments from farmers and local organizations would be considered more valid than statistical tests. In these cases, farmer impact diagrams might take the place of impact studies (Adamo, 2001). The desire to measure the impact and ensure the quality of participatory research has led to innovative monitoring and assessment methods (Opondo et al, 2001; Sanginga and Opondo, unpublished.). The change team's recognition and commitment to addressing quality and impact can build confidence in their institution in the PRGA innovations.

There are other strategies that can also help to proactively bridge the gaps between the institutional innovators and the traditionalists. One is for the 'change' team to become 'bi-cultural' – that is, to live in, and appreciate, both the dominant and the innovative minority worlds. This was done in the 'mother–baby trials' in Zambia (Snapp's case study in this volume) and in the AHI experiences (in this volume). In the latter, for example, the INRM work was justified using similar protocol formats and review sessions used for more traditional work. As a part of this strategy, innovators should be aware of their choice of language – including avoiding the abundant PRGA jargon – to avoid alienating others. Finally, planning for the change team to present research cases to their peers that have applied the new approaches, including using field visits, is essential in communicating the potential of the innovations (Stroud, 2001; Senge et al, 1999; Pound and van Koppen cases in this volume).

Bringing the organization along with the change team

If one wants to promote organizational change through innovation and learning, one must balance innovation with keeping the organization intact (Harrison and Shiron, 1998). This is very true in PRGA approaches, where new paradigms and practices are often being incorporated with the existing traditional ones. It is also important for change agents to aspire to improve the

effectiveness of their organization while negotiating new systems and practices. The AHI is currently testing a systemic approach where the change team and representatives from the organization identify factors or cornerstones that must work in synchrony for effective research. These factors and associated indicators are linked to the participatory research approach and other strategies needed to accomplish the envisioned impact. These impact indicators can be used to judge the quality of the work and performance level, can assist in making comparisons to characterize the contributions of conventional and participatory research methods (Snapp and Vernooy cases in this volume), and can be used to identify best practices leading to positive impact. If the whole organization can be brought along to use a similar framework, then the change team has an easier time justifying itself and the use of new practices (Hagmann and Stroud, unpublished).

Another challenge within the organizational context is that of dealing with the 'results gap' – in other words, the gap between the results expected based on a status quo approach and the actual results. The results gap in a PRGA approach can be particularly problematic if the project is being assessed by individuals who do not understand the time and resource implications of initiating and arriving at quality results, including the time needed for the reflective learning and experimentation process, competence development, and for the innovation process to take root. These are often not factored in, so the pressure to perform as per the status quo time frame is high, and can create stress for the leadership and in the change team (Brinn, Pound and other cases in this volume). One strategy to deal with this is to build an assessment coalition between the change team and those outside the change team, including the leadership (Hagmann and Stroud, unpublished). This strategy will be tested in AHI's new phase of work. Investment in building capacity for using and appreciating new assessment tools is a second strategy. A third strategy is to set explicit and agreed interim goals. This has proved effective, particularly where participatory methods have been used to set these (Opondo et al, 2001; Senge et al, 1999; AHI, 2000; Sanginga and Opondo, unpublished). Reaching interim goals provides a feeling of achievement for the change team and for those who are watching.

New behaviours, new practices and improved results can appear as threatening to the traditional organizational culture. When combined with a lack of clear communication between the change team and others, these may result in comments such as: 'I have no idea of what those people are doing', or 'Those people are going overboard and have lost their focus' (Stroud, 2000). If paradigm shifts and change are not done strategically, then innovation can actually become an irritant to the organization's staff outside the change team. From experience, the change strategy needs to include ways of informing policy-makers, managers, practitioners involved in the organization – in other words sceptics and non-sceptics alike. Interactions and communication with these different actors and stakeholders often requires skilled facilitation. Many participatory research and INRM ventures have faced this scepticism and have not dealt with it in a strategic way. This has resulted in many 'islands' of good practice that remain disconnected and have no ultimate institutional impact.

The third stage of institutional change: redesigning and rethinking at the organizational level

> *'True leaders are hardly known to their followers. Next after them are the leaders the people know and admire; after them, are those they fear; after them, those they despise. To give no trust is to get no trust. When the work's done right, with no fussing or boasting, ordinary people say, "Oh, we did it".'*
> Lao-tzu

As many change initiatives are supported by projects, a major challenge is to move from a project change mode to a sustainable organization-led change. This stage involves larger-scale changes in the organization and calls for modalities to redesign and rethink all aspects of the organization – the toughest part of which is changing culture. Communication and attitude barriers, for example, often pose difficulties to the transfer of knowledge within the organization and across organizational boundaries. Prevailing government bureaucracies and hierarchies can make this a formidable challenge and one that has to be addressed strategically, openly, and with shared ownership of the change process.

Given the challenges faced in undertaking grassroots development, change might mean changing the whole system, not only the research organization

There are considerable capacity gaps in the wide range of R&D organizations globally; at the same time, there are also difficulties in setting up supportive service structures outside of the normal research domain. Furthermore, institutions face difficulties in addressing facilitation and coordination needs at various levels (policy, technical, operational) and in dealing with multiple institutions and levels (farmers up to policy-makers) (Jonfa et al, 2001; Catacutan and Duque, 2000; Stroud, 2001). The Ugandan government, as one positive example, has realized the need for systemic change, and has created a guiding policy and framework: 'Plan for Modernization of Agriculture' that provides guidance and a 'beacon' for all parts of the system. This is the first step, but most challenging is the implementation.

Let us assume that the 'change teams' have done well, have created good models of practice in the field, and that the interactions within the organization have been orchestrated in a way that the change teams have expanded their reach, and have achieved legitimacy within the organization. The next challenge is how the organization as a whole can undergo a more profound change. In this chapter, we are focusing on a twofold change: incorporating lessons from the change team experiences in PRGA approaches; and, becoming a learning organization so that it can provide the necessary support to sustain further change and renew itself in future. This ultimately requires a process at organizational level that is conscious, strategic and working towards emerging new systems, structure and culture.

Organizational structure is more frequently and easily adjusted than the systems or cultural components of institutions. Structural change is often driven by outside forces such as donor interests and governmental bureaucracies that are disenchanted with the impact of research. This type of change alone, however, does not result in institutionalization of lessons and practices generated by the change team, nor in a learning organization. These types of outcomes require change at this level to be managed as a process (as indicated for change in the change team level). A first step in this direction would be to empower managers to manage change directly by revealing the details of organization components and ways to flexibly and iteratively manage all aspects for impact. Organizational management requires systems thinking because of the various dimensions, complex interactions and consequences of actions/decisions on other parts of the system. These skills may need to be acquired. The attributes noted in the first section of this chapter are still relevant at this scale: a shared commitment of leaders, managers and workers; clear and collectively shared vision and values; the skills to facilitate reflection and enquiry or to use a 'reflective-learning' process that promotes a culture of inquiry; and new skills that can manage and support the change process.

Managing organizational change as a systemic process

Senge et al (1999) and Harrison and Shiron (1998) suggest some useful steps concerning cultural, structural and supporting systems for participatory and process-oriented approaches that enhance institutional innovation and change. Organizational learning and strategic re-orientations require a revision of existing patterns and adoption of new 'mental maps' as the basis for a paradigm shift, or in other words, for a change in the basic attitudes that have been developed through interactions and experience over the years (Senge et al, 1999). Facilitators can assist in this self-examination and identification of values and assumptions to uncover the organizational rationale, and sources of meaning and contradiction. Dealing with the cultural dimension[5] and underlying perceptions and beliefs of the organization and its individuals is one of the most important but challenging aspects in institutional change. The cultural dimension involves the 'language' of the organization – in other words, the shared definitions and assumptions of how things work that shape the way people deal with problems and handle critical organizational processes. It also involves the ways to improve or remedy processes at individual, group and organizational levels including lessons from the past and guides for the future, and shared assumptions about why events occur (such as the way people naturally behave), the ability of people to influence their environment, and capacities for change (after Harrison and Shiron, 1998). Cultural change is a slow process, and one in which it is normal to find internal resistance.

If the size of the organization allows it, cultural change is often best done through a facilitated visioning exercise. Recent experience has illustrated the power of defining the desired or 'impact' state to help identify what the organization needs to do to be effective. During this process, values and principles can also be examined (Hagmann and Stroud, unpublished). This

facilitated process can trigger shared insights, a logical re-creation of new frameworks, institutional arrangements, and general implications for the organizational culture, skills and management processes.

Organizational assessment tools have been developed to assist organizations in examining themselves, as part of the change process (USAID, 2001; Gurung, 2001). For example, an assessment framework can help managers to see their organization as a system with certain characteristics (mission/mandate, structure, human resources) and dimensions (technical, socio-political, cultural) (see Table 5.2). Once their impact areas are clearly defined, organizational managers and staff can use such a framework to review the current state against the desired state and the associated implications. In addition to the internal workings of the organization, they should also consider external forces affecting the organization's policies and their working arrangements with others. It then will take leadership, strategy and an inclusive process to define and implement the desired changes. Hagmann et al (1998) discussed a case in Zimbabwe that illustrates this type of process. In this case, various projects pursuing participatory development acted as a lobby group to bring the participatory development approach into mainstream thinking in a national extension programme. This led to a reform that required substantial changes in the organizational culture, roles, relationships and attitudes. These changes were addressed in an organizational development programme that included a learning process to facilitate behavioural and attitudinal changes.

Gurung (2001) puts forward an explicit strategy for incorporating participatory research as an innovation at the organizational level: establish concrete objectives for change; extend organizational change skills to members, and define indicators to monitor and evaluate the process and output of change. He stresses the importance of developing alternative strategies based on potentials rather than focusing on barriers, being flexible, anticipating possible consequences of certain strategies for the various stakeholders; and listening to the 'silent voices'.

Progress and future challenges

> *'It is not only for what we do that we are held responsible, but also for what we do not do.'* Moliere

Let us return to the original hypothesis put forward in the introduction to this chapter: 'By employing strategies and processes to create a shared vision of effective research and a learning organizational culture, the development and use of new methodologies, such as PRGA, will be encouraged.' Learning organizations, as defined by Senge (1990), are:

> organizations where people continually expand their capacity to create the results they desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning together.

Table 5.2 *Organizational analysis framework*

Organizational dimensions	*Organizational characteristics*		
	Mission/mandate	*Structure*	*Human resources*
TECHNICAL DIMENSION The essential parts	POLICIES AND ACTIONS The *guiding policy* and its operationalization in action plans, strategies/approaches, and monitoring and evaluation systems	TASKS AND REPONSIBILITIES The way people are positioned and the way tasks and responsibilities are allocated and related to each other through *procedures, information and coordinating systems*	EXPERTISE The number of staff and the requirements and conditions to allow them to work, such as *job description, appraisal, facilities, training, etc*
SOCIO-POLITICAL DIMENSION The process or power play	POLICY INFLUENCE The *way and extent management, people from within the organization and people from outside the organization influence policy* and the running of the organization	DECISION-MAKING The *patterns of formal and informal decision-making processes*. The way diversity and conflicts are dealt with	ROOM FOR MANOEUVRE The space and *incentives provided* to staff to give shape to their work, such as rewards, career possibilities, variety in working styles
CULTURAL DIMENSION The personality	ORGANIZATIONAL CULTURE The symbols, rituals and traditions. The *norms and values* underlying the running of the organization and the behaviour of the staff. The social and economic *standards set*	COOPERATION The way the *work relations between staff and with outsiders* are organized, such as working in teams, networking. The norms and values underlying these arrangements	ATTITUDE *The way staff feel and think about their work*, the working environment and about other (categories of) employees. The extent to which staff stereotype other staff. The extent to which staff identify themselves with the culture of the organization

Source: Gurung, 2001

The learning organization concept has a number of underlying values that are very similar to those that participatory methodology is aspiring to meet: empowerment of its members, rewards and structures fostering initiative, to learn from uncertainties and take leaps in experimentation; use local knowledge originating from those in the 'front lines', learning through action, and promotion

of trust, accountability, equity, and quality. The idea of a learning organization rose out of the need to survive in private sector competition where change is constant, rapid and complex. NRM challenges also pose similar challenges but in a different context. Asian experience has shown success in using the learning organization model for community development (Korten, 1980).

Most of the cases referred to in this volume are 'pilots' and as such have operated as 'isolated islands in the sea of NRM research'. There are few examples in the literature where public organizations have focused at a high level on change so as to incorporate PRGA and other innovative approaches. The CGIAR System-wide PRGA programme conducted a recent survey that indicates an upswing in the number of projects in the CGIAR system using elements of participatory research, but these remain isolated with limited learning links. One of the future challenges is to connect these 'islands' to inform practice and to influence institutions in a more profound way. In Africa, we see a few rising examples of this in the recent work by Hagmann and colleagues with extension services in two African countries, Jonfa et al (2001) with research and development organizations in Ethiopia, and AHI's work in Ethiopia and Tanzania.

These examples are starting to bring to life the real world NRM research challenges, and to augment the more theoretical studies and guiding principles provided by the literature (Thompson, 1995; Korten, 1980). These, and other examples, are still relatively young and have not yet been taken to completion. However, as the number of projects promoting PRGA approaches and the pressure of the driving forces increase (eg, reduced resources levels for research and the need to improve impact orientation), there is bound to be more work on institutional change in the near future.

We therefore predict that there will be more attention given to organizational change in the near future in NRM research institutions. Self-evaluation of organizations will be more common – including reviewing the leadership style, reward and incentive systems, the M&E system, policies, decision-making mechanisms and other components. Organizations will be viewed as systems with cultures that can be consciously adjusted to achieve more effective outputs. There will be change processes in place based on shared visions of impact, and linked to change strategies. We envision that the early momentum for change in organizations will be sustained by the necessary support and appreciation for the role of change in enhancing effectiveness and efficiency. Some of the key areas that will emerge given the new institutional behaviour, norms and rules are expected to be:

- Enhanced participation of farmers and local communities in research – including combined use of local and 'scientific knowledge', local priorities, and local analysis – and in direct application of results.
- Increased non-traditional skill areas of researchers, including incorporation of social (gender, wealth, etc) differences, community mobilization and facilitation, public awareness, socio-cultural non-market incentives, policies, social organization, conflict resolution and appreciation of interdependencies.

- Improved ability of research systems to deal with dynamic, complex systems and social diversity: different scales, hierarchies, and ranges of options and management principles for different stakeholders.
- Enhanced local and research capacity, and some local institutional change, local empowerment and evidence of faster uptake of appropriate technology.
- Enhanced research capacity throughout the research system, through the use of partnerships and networking within and across scales.

In an optimistic future, the islands of PRGA practice would no longer be isolated experiences but would be linked and used within viable 'learning' research organizations. These in turn would be providing services to communities so as to enhance local initiatives in improving their environment and management of their livelihoods.

Notes

1 The displayed quotes in this chapter are taken from Baum (2000) *Lightening in a Bottle: Proven Lessons for Leading Change*.
2 This chapter's author is the coordinator of the African Highlands Initiative (AHI).
3 This chapter draws heavily on the framework that Senge et al (1999) put forward.
4 This occurs in organizations largely (or entirely) populated by biophysical specialists.
5 Cultural dimensions include: basic assumptions (unconscious, taken-for-granted beliefs, perceptions and thoughts), values and norms (strategies, goals and philosophies) and behaviour patterns and artefacts (visible organizational structures and processes) (Senge et al, 1999; Harrison and Shiron, 1998).

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Chapter 6

Principles for Good Practice in Participatory Research: Reflecting on Lessons from the Field

Ronnie Vernooy and Cynthia McDougall

Reflecting on practice

In previous chapters our colleagues have described their experiences in exploring new conceptual and methodological grounds in participatory research (PR) in natural resource management (NRM), often as a complement to existing ('traditional') research from both the natural and social sciences. These explorations are producing new and exciting insights into promising alternatives for the management of natural resource systems, including crops, soils, water, trees and animals. These experiences are also resulting in the innovative adaptation of participatory research approaches. Venturing into this still relatively new research terrain of working for rural transformations, however, raises difficult questions about the research process. Researchers are faced with the challenge of critically assessing the kind(s) of participation and processes appropriate to the different stages of the research cycle. This expansion of the research domain and the new knowledge generated require that researchers must be able to identify what is 'good practice' in PR in NRM.

While this challenge is starting to be met in some individual research projects, the emergent learning has been somewhat insular. Perhaps because the experience of doing participatory research in one context is not easily compared to another, shared learning between research institutions about 'what is good practice in PR in NRM' has been slow. We consider that comparisons and the integration of ideas are necessary elements of identifying good practice. The PRGA (Participatory Research and Gender Analysis) Program and the Natural Resources Institute (NRI) NRM workshop in Chatham, England, created an ideal opportunity to begin such a process of shared learning.

In this chapter we draw on the case studies from the Chatham workshop and other literature to generate a number of principles of good practice in PR in NRM and, potentially, beyond this field.[1] The intention is that these principles may be useful in the planning and assessment of the rigour of participatory research methodologies. As such, we aim to contribute to the growing interest in the development of appropriate methodologies for monitoring and evaluating participatory research (eg, Armonia and Campilan, 1997; Guijt et al, 1998; McAllister, 1999; Estrella et al, 2000; Sun Qiu et al, 2000). We argue that this on-going assessment of rigour, and the subsequent refinement of methodologies are integral parts of participatory research.

Following this introduction, the next section highlights the need to conceptually 'situate' all participatory research activities in their own local and research contexts. We suggest a number of key factors that define what is appropriate and feasible in a participatory process. In the third section we present five principles of good practice in NRM research followed by a brief review of other contributions to the definition of good practice. The next section illustrates the principles and associated indicators with (five) Chatham workshop case studies. The final section concludes the chapter with some final thoughts on the potential of the framework; the whole framework of principles and indicators is provided for easy reference in the chapter's appendix.

Understanding the research context

Participatory research needs to be designed and assessed in the context within which it occurs. Various parameters define what is appropriate and feasible in every participatory research project. These guide what we can realistically expect from the process and results of the research (including what form of learning might occur), and therefore need to be considered as the backdrop for any 'guideposts' to good practice, and in monitoring and evaluation. We suggest, and then discuss, five key factors that affect participatory research (Found, 1995; McAllister and Vernooy, 1999):

1 The nature of the research question(s).
2 Researchers' views on participation, learning and the role of science.
3 The social aspects of the NRM system.
4 Experience and capacity of the stakeholders.
5 External contextual factors which enable or constrain participation.

The nature of the research question(s)

The objectives, scale and scope of the research questions influence the appropriateness and feasibility of the participatory research approach, and affect local people's willingness to participate. Some social or biophysical research issues may be adequately addressed by research processes with relatively low participation, such as in cases when the research findings have relatively 'low added value' for the direct participants (eg, an inventory of species in cases

where the local people already have sufficient knowledge for their own purposes). When research questions involve the generation of new knowledge at the local level, then it may be more likely to call for a higher degree of participation. This would include, for example, generating new ideas or testing management practices or processes.

Researchers' views on participation, learning and the role of science

Researchers who apply participatory approaches tend to do so for one, or a combination, of two purposes: functionality and/or empowerment. The former refers to the contribution of participatory approaches to increasing the accuracy and validity of research findings. For example, research on an innovation in a complex natural resource management system may require participatory research in order to effectively apply (and thus experiment with) the innovation. The second refers to the empowerment aspect of participatory research, in which research becomes a means for capacity building and social transformation in the research site.

Related to the latter, the researchers' explicit or implicit assumptions about the role of *learning* in the research also underpin their decisions about whether and what form of PR to use. Van der Veen (2000) and Loevinsohn et al (2000) describe three principal learning theory approaches and their relevance for PNRM research and (rural) development. The first approach, *reproductive learning*, assumes that there is a body of objectively verifiable knowledge and that this can be taught by breaking down content into its essential elements. Frequently, scientist-led research and various types of consultative participatory research involve reproductive forms of learning as the basis for the dissemination phase of the research. An example of this is researchers and extension workers showing users how to apply specific practices or technical options through the dissemination of pamphlets, training, and/or on-station demonstrations. A parallel can usefully be drawn between approaches to learning in research and research approaches (in the sense of 'philosophies' or 'paradigms') themselves. In this case, reproductive learning most closely mirrors the 'logical positivist' (or empiricist) research paradigm, in which research seeks the 'accumulation of *objective* knowledge through the production of empirically testable hypotheses' (Braun, 2001).

The second approach to learning, *constructivist learning*, assumes that important features of the external world are uncertain and disputed, and that people actively construct their understanding of it. (Re)discovery and innovation, not repetition, are essential parts of this construction process. In practice, researchers/development workers often assume roles as facilitators, rather than instructors. They encourage work in groups and shared planning, action and reflection. This type of learning tends to occur in more collaborative forms of participatory research. In terms of parallels to research paradigms, a constructivist learning approach is congruent with a 'social constructivist' paradigm, which views the human mind as the source of knowledge (Braun, 2001). In this paradigm:

> the function of science is the creation of concepts or theories that expand flexibility and choice … [social constructivism] holds that all social action is open to multiple interpretations, none of which is superior in any objective sense… Theory and practice are not viewed as separate moments, but rather as inseparable aspects of a single practice … and theory is a powerful change agent' (Braun, 2001, p9, based on Cooperrider and Srivastva, 2000).

The third learning approach is *transformative learning*. In this approach, 'learners' together build a more integrated or inclusive perspective of the world. Through the learning process, they jointly transform some part of their worldview, for example their understanding of social relations in their own community forest. Such transformation is often stimulated by communicative learning, but goes beyond it, in terms of internalization and transformation of understanding. Manifestations of transformative learning in resource management include, for example, new values or patterns of decision-making that farmers generate and apply outside the immediate arena of the learning intervention. This approach to learning has linkages to the people-centred, emancipatory research approaches, such as participatory action research. This can be understood as an 'emergent paradigm', which draws from and combines both positivist and constructivist views (Fisher, pers comm). Ideally this approach to research integrates knowledge sharing, systematic enquiry and human interpretations of the world. Moreover, it intentionally and consciously *activates* the 'praxis' (the theory and practice linkage that constructivism highlights) as a means of (self-) empowerment for marginalized people and improvements in human systems.

The social aspects of the natural resource management system

Natural resources are governed by complex, overlapping and sometimes conflicting social entitlements and traditional norms such as private versus common property rights, tree versus land tenure, differential security of tenure and use rights. Roles negotiated along lines of gender, kinship, ethnicity, socioeconomic status, age and occupation influence access to decision-making and use of natural resources. Representations of 'community interests' and 'local or indigenous knowledge' in the research process are often produced in the context of struggles over resources through which different parties defend interests and advance claims. Although participatory research processes may provide an opportunity for less powerful groups to contest existing power relations and resource rights, it may also enable more powerful or politically aware groups to assert preferential rights over resources. Researchers need to take this into account, and make continuous adjustments to avoid possible negative repercussions.

Experience and capacity of the stakeholders

Interaction between researchers and local people, and the skills, attitudes and

personalities of researchers have an influence on what local people say, how they feel about the research, and how willing they are to participate. Previous experience of local people with research and development projects, as well as perceptions of potential benefits, can positively or negatively influence community motivation to participate in new research activities, as well as bias their responses. Hence, it is important that researchers be aware of the social and other constraining or enabling factors which influence the interaction process between researchers and local people, and the process of knowledge construction (Long and Long, 1992).

External contextual factors which enable or constrain participation

The political context and the history of local involvement in decision-making will influence the kinds of local participation which are feasible, as well as local people's willingness to participate. The type of questions researchers need to be responsive to in research design include:

- Is the government supportive of participatory processes?
- What is the history of local participation in decision-making?
- What is the history of local control over resources?
- Is there a history of hierarchy or oppression?
- Has there been recent conflict in the country, or within the local area?

Towards good practice: shared learning from experience

The above sections highlight key elements that differentiate research contexts; clearly there is a great need to treat each research experience as unique. Yet at the same time, a review of the literature and shared learning experiences in fora such as the Chatham Workshop begin to indicate patterns of good research practices which cross-cut these differences. At the Chatham Workshop participants were asked to identify elements of what they considered 'best practice[2] in participatory natural resource management research' in each of the case studies presented. This process generated a list of 36 aspects, which were then further distilled down to 18 general elements through critical review by a small working group in the workshop (see Appendix 2). Following the workshop, Vernooy et al further analysed these 18 aspects for their commonalities, and grouped them into *five key principles of good practice in PR in NRM* (Vernooy et al, 2000). These are considered good practice in terms of their contribution to both of the goals of PR in NRM: *positive local impacts* of research; and the generation of *valid, trustworthy, and relevant research findings*. The latter implies that these findings may be generalized, in other words that they contribute learning that can be applied in some way to other areas beyond the research site.

The proposed principles of good practice in PR in NRM are:

1 *The research reflects a clear and coherent common agenda* (or set of priorities) among stakeholders and it contributes to partnership building.
2 *The research addresses and integrates the complexities and dynamics of change in human and natural resource systems* and processes, including local understanding of these.
3 *The research applies the 'triangulation principle'* (multiple sources of information and methods), and links together various knowledge worlds.
4 *The research contributes to concerted planning for the future and social change.*
5 *The research process is based in iterative learning and feedback loops* and there is a two-way sharing of information.

Contributions from the literature: establishing trustworthiness

References to similar collective efforts to identify good practice are scarce. Jules Pretty is one researcher who has discussed in some detail the issue of 'quality control', or the need to establish criteria of *trustworthiness* in participatory research. He developed a 'framework' of 12 indicators to identify parts of the research process and to check whether key elements have been omitted (1994: 42–45; 1995: 1256). Looking at the framework of indicators listed below, we can see that it is possible to group most of these indicators under the five generic principles that resulted from the Chatham case studies. We have added the corresponding number of our proposed principles in parentheses to illustrate the linkages. The indicators are:

- Prolonged and/or intense engagement between various actors involved in the research cycle (1).
- Persistent and critical observation (2).
- Triangulation by multiple sources, methods and investigators (3) (further detailed by Patton, 1990: 464–470).
- Analysis and expression of difference (3).
- Negative case analysis, or the search for and explanation of cases, or examples that do not fit the general pattern (3) (further elaborated by Patton, 1990: 463).
- Positive impact on stakeholders' capacity to know and act (4).
- Parallel investigations and team communications (5).
- Participant checking (5).
- Peer or colleague checking (5).
- Reports with working hypotheses, contextual descriptions and visualizations (5).
- Use of reflexive journals (5).
- Use of an enquiry audit (5).

Other authors have also elaborated upon the meaning of one or more of these indicators. Chambers (1997; 156–161; 1994: 1253–1268), using the term

'principles for participatory learning and analysis,' pays particular attention to the importance of the 'reversal of learning' (researchers learn from local people), 'handing over the stick' (local people take a lead role in facilitation, investigation, analysis and learning), sharing of information and ideas, triangulation, the quality of behaviour and interaction, rigorous observation and reflective judgement. McAllister (1999: 38–39) emphasizes that good participatory research allows for the proper identification of stakeholders, does a sound job in disaggregation, and provides space for the adequate representation of stakeholders. It is encouraging to see that the principles or indicators developed by these authors converge with our five generic principles. What we have not been able to find in the literature, however, are many concrete examples of how these research quality-control criteria are used in assessment, either ex ante or ex post. This seems a difficult task to accomplish, but one that we consider to be of great importance. For this reason, we attempt this task in the following section, drawing out concrete examples of good participatory research practices in action.[3]

Good practice in action: five case studies

Examples of the Chatham case studies that illustrate one or more of the five principles are listed in Table 6.1. We highlight one case study in depth for each principle. The five chosen cases combine different types of research experiences. Three cases illustrate principles 2, 3 and 4 respectively: the International Center for Tropical Agriculture (CIAT) 'Hillsides Project'; the International Maize and Wheat Improvement Center (CIMMYT) 'Risk Management Project'; and the Center for International Forestry Research (CIFOR) 'Adaptive Collaborative Management Research Project'. In these three cases the research highlighted is strategic research initiated by research centres, which then builds an agenda with other stakeholders. Principles 1 and 5, which are illustrated by the International Centre for Research on Agroforestry (ICRAF) 'Landcare Project', and CIAT's 'Comité de Investigación Agrícola

Table 6.1 *Chatham case studies that illustrate the five principles*

Principles	*Case Studies in this volume, which illustrate the principles, by author*
1 Common agenda	Garrity (Philippines); Williams (India)
2 Integration of human and NR complexity	Vernooy (Nicaragua); Williams; Nelson (Peru and other countries); Vincent and Khanal (Nepal)
3 Triangulation of information	Vaughan and Shamudzarira (Zimbabwe and Mali); Stroud (African Highlands)
4 Future planning and social change	McDougall et al (Philippines, Nepal, Zimbabwe); Schreier (Nepal), van Koppen (South Africa); Borrini-Feyerabend (Uganda); Stroud
5 Learning and feedback loops	Braun (various Latin American countries); McDougall et al; Snapp (Malawi and Zimbabwe); Garrity

Local (CIAL) Project' respectively, are both community-based research processes, which experiment in agriculture at the local level.

Principle 1: The research reflects a clear and coherent common agenda

The following 'guideposts' or indicators underscore issues of quality partnerships and collaboration between local stakeholders and researchers and of local empowerment. The latter includes empowerment not only via *outcomes* of research but also through local participation and leadership in the process of the research. As Chambers (1994) expresses it, this requires researchers to have confidence in local abilities and to thus 'hand over the stick'. The indicators include:

1.1 The research (and extension) agenda has been set collaboratively and transparently.
1.2 The research (and extension) design allows space for the meaningful participation of local stakeholders, including marginalized groups, and takes into account potentially differentiated perspectives and interests (based on gender, class, age, ethnicity or other aspects).
1.3 Partnerships among stakeholders have been created and strengthened through dialogue, joint actions and mutual benefits (friendship and fun included).
1.4 The research initiative respects the commitments made with partners, and the follow-through strategy is defined.
1.5 The research includes a clear strategy for action/change, which has been defined in terms of expected material results and increased social capital (or more broadly, for empowerment).
1.6 There is good documentation of the participatory process, including the use of tools.
1.7 The analysis of results and authorship of published materials have been shared between researchers and other stakeholders.

This principle is explored with reference to ICRAF's 'Landcare Initiative' (see Box 6.1 and Garrity's case study, this volume). The first four indicators (all relating to 'partnership') are discussed together here with reference to Landcare[4] as a model and as a research activity. In terms of the original design of the ICRAF research agenda, the decision to study contour hedgerow technologies was initially driven by the research institution, based on experience in these areas. The strategy to address hedgerow stakeholder issues was developed through the researchers' observations and interactions with farmers during the on-going on-farm research. Thus, although not originally conceptually developed in partnership, ICRAF's decision to 'experiment' with Landcare as a dissemination strategy, was sparked by the demands of local farmers. This experimentation, emerging out of a necessity to increase the impact of the 'main research,' was initially viewed as an extension approach. As researchers became aware of the multitude of research questions relating to social capital formation,

BOX 6.1 CASE STUDY: LANDCARE IN THE PHILIPPINES (ICRAF)

ICRAF researchers concluded in the mid-1990s that, despite a decade of contour hedgerow research in the Philippines, farmer's adoption of these technologies remained low. The researchers, therefore, refocused their efforts towards finding *alternative* systems that address the technical and *institutional* issues of conservation farming. At the same time, they recognized that if they were going to have their desired impact, especially in complex social environments, they were going to have to include training and extension as an explicit part of their mandate. In 1996, a group of farmers requested training from ICRAF and then organized themselves to share their learning with other farmers. ICRAF worked with these farmers and others to build on this initiative, and the seeds of the Philippine Landcare movement were sown.

In practice, Landcare in the Philippines is a movement of hundreds of autonomous farmer-led organizations concerned about the long-term health of their land, supported by local governments with backstopping from technical service providers. These organizations share the knowledge they gain through their efforts towards sustainable and profitable agriculture on sloping lands while conserving natural resources. The Landcare movement makes use of a participatory approach to inexpensively and rapidly disseminate conservation technologies through a group-to-group and farmer-to-farmer method. Thus the Landcare groups are not only part of a participatory extension approach, but the Landcare model itself is a long-term participatory action research activity of ICRAF and other partners.

Source: Garrity case study, this volume; Catacun and Mercado, 2001

sustainability, efficiency, and scaling up, however, they engaged increasingly vigorously in Landcare as a form of multistakeholder participatory action research (PAR). The PAR tackles head on the hypothesis that initiatives for sustainable upland development should be able to address both the technical and socioeconomic–institutional constraints faced by poor farmers (Catacatun, pers comm, 2001).

Landcare as an institutional *model* incorporates all four partnership indicators. According to Catacutan and Mercado (2001), Landcare:

> relies on the active participation of participants in building networks and harnessing support for communal activities. Founded by the convergence of common agenda, it enhances the development of social capital among three key actors: the farmers, the Local Government Units, and the Technical facilitators and other service providers. Landcare is not typified as a set of prescribed rules and approaches. However, it aims to maintain and preserve a demand-driven process where the agenda is set by the members themselves and Resource Organizations are there to support their interests… It is about people, and the key to success is based on a mature social capital and a close bond between and among farmers – communities – and governments. (Catacutan and Mercado, 2001, p12)

The extent to which each Landcare group is able to fulfil the indicators, and follow the Landcare model in its ideal form, depends on each group's members, facilitator and processes.

In terms of the fifth indicator, the partnership approach described above is also the basis for a clear strategy for action/change and well-defined empowerment objectives and strategies.[5] The theory underpinning this strategy is the 'convergence model of institutional development'. It suggests that social capital formation is triggered when there is a convergence of interests and desired goals among participating communities, institutions and individuals. The Landcare model offers a forum where the key actors can share the costs and benefits of the programme. Typically, farmers share their time, knowledge, skills and leadership, as well as labour and low-cost materials for group activities and projects. Local governments provide leadership, financial, technical and policy support.[6] Technical facilitators, such as ICRAF staff, and service providers contribute the necessary technical support and facilitation for group formation. The driving force for this social capital formation is the relevance of the issues to the participants. The essence of the concept is that each group 'responds to issues that affect them and are more likely committed to find and implement solutions on their own ways, than those imposed by external agencies' (Catacutan and Mercado, 2001). Landcare groups' interests have embraced such diverse issues as adapting soil and water conservation technologies, stream rehabilitation, education, training and policy advocacy.

In terms of the sixth and seventh indicators (*documentation of the participatory process and shared analysis of results and authorship*), these rely, again, on the motivations and capacities of the local farmer groups and the researchers with whom they interact. Some of the groups in Mindanao are engaged in participatory self-assessment workshops to monitor and assess the maturity stage of their own groups. In terms of the whole Landcare experience, ICRAF has documented many of its experiences in a range of publications; the president of Landcare in Claveria, who is a farmer himself, has also authored two papers on Landcare (Catacutan, pers comm, 2001).

Principle 2: The research addresses and integrates the complexities and dynamics of change in human and natural resource systems

Sound natural resource management research deals with the intersections of biophysical and social forces. It embraces the complexities of resource dynamics, such as multiple and often conflicting uses and users, individual and common property resources, space and time interdependencies and scales, the self-regulating nature of ecological processes, and off-site effects. This not only demands that researchers integrate social and biophysical science, but because of limited time and resources, that they assess and manage the tradeoffs between the various kinds and depth of information (Chambers, 1994).[7] Because of the dynamic nature of ecosystems, NRM research also needs to be adaptive in its approach. Researchers need to critically assess the research design, process, and

BOX 6.2 CASE STUDY: PARTICIPATORY MAPPING, ANALYSIS AND MONITORING IN THE CALICO RIVER WATERSHED, MATAGALPA PROVINCE, NICARAGUA (CIAT)[8]

The second case study brings us to the hillsides of Nicaragua where CIAT has been working with a number of organizations (universities, NGOs and government) on the sustainable management of the natural resource base in the Calico River watershed (Vernooy and Ashby, 1999). The 'Hillsides Project' employs a collaborative participatory research methodology including a natural resources mapping, analysis and monitoring method developed by the team in Nicaragua (Espinoza and Vernooy, 1998; Vernooy et al, 1999). The research addresses questions such as: What is happening, and according to whom, with the natural resource base at the micro watershed level? What are the main problems, (research) gaps and opportunities related to the use and management of land, water, flora and fauna? The multi-tool method is based on the hypothesis that the micro watershed level is a conceptually and practically useful scale at which to work. This was considered to be the case because it represents a space where resource flows and dynamics (eg, soil erosion, pests, water pollution) interact continuously and visibly with socioeconomic relationships, such as land, tree and water tenure/access relationships and labour-exchange ties.

The research team worked with carefully selected small groups of local key informants in each of the 15 micro watersheds. These informants included farmers, local *técnicos* from the various NGOs, *promotores* (from the NGOs and grassroots associations) and assistant mayors better known as *alcalditos*. As much as possible, the research included diverse local people – in other words, women and men, the politically influential and the marginalized, and both landowners and the landless. Despite these efforts, male informants were ultimately in the majority, as it proved difficult to find women who were able or willing to spend a whole day with the project. As a result, researchers also made efforts to capture a gendered perspective through interviews on other occasions, and the involvement of women from the local farmer research groups (CIALs).

Source: Vernooy case study, this volume

learning and outcomes on an on-going basis, and adjust it and themselves accordingly. Indicators for this principle include:

2.1 The analysis balances and integrates *natural* (biophysical) resource dynamics with *human* (social) changes and innovations in NRM. (The latter includes people's relationships with the natural resource system and changes, and their perceptions of it.)
2.2 The analysis gives equal attention to both the inherent site characteristics and to (the impacts of) innovative management practices (locally generated or the results of research interventions).
2.3 The research uses an iterative research and learning approach, in other words cycles of diagnosis–intervention–assessment–diagnosis–intervention–assessment, etc.

This principle is explored with reference to the CIAT 'Hillsides Project' (see Box 6.2 and the Vernooy case study, this volume). The first two indicators (*balancing of biophysical and social science aspects and attention to both the inherent site characteristics and management innovations*) can be explored in the three main aspects of this project's action research activities: natural resource mapping, natural resource analysis, and the application of indicators to the resource systems. In each of these, the researchers made efforts to understand and apply the farmers' perspectives. This perspective inherently integrates social and biophysical aspects of resource management issues.

Each of the studies started with the participatory design of a local resource map (as per the now well-known participatory rural appraisal (PRA) mapping exercises). The maps included the borders of the area according to local definitions, the hills, principal and secondary roads and paths, the rivers, creeks, springs and reservoirs as well as the principal drinking-water pipelines, infrastructure (schools, churches, health-care centres, cemeteries, coffee-washing/drying facilities, haciendas and farms), agroecological zones, production systems, vegetation (forest types) and soil types. With one or two exceptions the maps gave a detailed picture of the micro watershed landscape. All maps were returned to the local cooperators for future use and reference.

The maps also served to define the line for the transect walk, which would criss-cross the major zones and production systems, passing the other important resource features of the area. During the transect walk, the informants (facilitated by the research team) undertook resource analyses, which were recorded in a table. Factors examined included landscape characteristics and use (agroecological zones, and changes over time), the 'state' of forests, water resources, crops, wildlife, domesticated animals, pastures and local soil indicators. In addition, participants identified the limitations as well as opportunities for agricultural production and NRM in the area. The CIAT research team later complemented the information with data from other sources (previous studies, aerial photographs, GIS-based data, local poverty profiles study, and soil analyses).

The third and final step in the micro watershed analysis process constituted the development of a set of 'simple to understand and use' local indicators and values for each of the factors. The set of indicators, for use by inhabitants of the micro watersheds, was developed through the following consultative exercise: a draft set was formulated by the research team based on the findings of the combined 15 resource analyses, reviewed and then refined with the informants, and subsequently applied by the informants to their own micro watershed during a workshop. Values given to the indicators (options were: bad, regular and good) were tabled and grouped together by component (water, forests, crops, etc; note that soils were added based on the outcomes of the soil analyses conducted during the transect walks). In order to compare and discuss results with the informants, a second workshop was organized. The results were discussed both by micro watershed (site comparisons) and by component (resource comparisons).

The third indicator – the use of an *iterative research approach* – is illustrated by the last step of this cycle of the research. Following the indicator development and assessment, the research team and other stakeholders used the research

findings for the selection of potential new sites where CIALs could be formed and other forms of experimentation could be started (in other words they drew on learning from this stage to create the next stage). Among these new initiatives by CIAT and its collaborators are a number of NRM experiments to test alternatives including 'new' crops (for example, soy beans) or crop combinations, and soil improvements. As well as providing this kind of direction to the research project, the outcomes also had external impacts. The research team presented the results to key local decision-makers such as the mayor of San Dionisio, state agencies and NGOs operating in the watershed, as well as to the newly created Association of Community Organizations. Decision-makers discussed priority zones for action where natural resources are in bad shape or are at high risk. The analysis was also helpful as a pre-hurricane Mitch overview of the state of the natural resource base and allowed for comparison with the post-Mitch situation (a study completed in 1999).

Principle 3: The research applies the 'triangulation principle' and links knowledge worlds

Triangulation is a means of increasing confidence in results by assessing and cross-checking findings from multiple 'points', including various sources, various methods or in various conditions. Given the complexity of NRM research, triangulation is particularly important. In the context of participatory research, one potent form of building confidence in results is through the explicit sharing of findings and learning with local stakeholders on an on-going basis. This creates the opportunity for distortions or misunderstandings to be corrected relatively rapidly and easily. Relatedly, research findings will be more sound and more widely accepted if they build on and link the 'best of diverse knowledge worlds'; in other words, they expand beyond scientific views of the world to also incorporate local and traditional knowledge and views. Potential indicators for this principle include:

3.1 The research process links the local, traditional and scientific knowledge worlds.
3.2 The research methodology uses a diversity of methods and tools.
3.3 Information generation is based on multiple sources.
3.4 Information dissemination (sharing of learning and findings) occurs throughout the process through multiple exchanges between researchers and stakeholders, including at the local level.[9]

This principle is explored with reference to CIMMYT's 'Risk Management Project' (RMP) (see Box 6.3 and the Vaughan and Shamudzarira case study, this volume). The first two indicators of this principle relate to the *linking of knowledge worlds* and to *triangulation* through diversity of research methods. In the RMP, we can track these indicators by looking at the project's use of participatory agroecosystem modelling maps as a shared learning and decision-support tool for researchers and farmers to understanding the soil fertility systems. The linking of local and scientific knowledge was not an explicit goal

BOX 6.3 CASE STUDY: IMPROVING FARMERS' RISK MANAGEMENT STRATEGIES, FOR RESOURCE-POOR AND DROUGHT-PRONE FARMING SYSTEMS IN SOUTHERN AFRICA (CIMMYT)[11]

Climatic risk, primarily resulting from erratic rainfall, is a major constraint to the development and adoption of improved technologies for smallholder maize systems in Zimbabwe and Malawi. Beside the constant threat of drought, farmers also face the challenge of declining soil fertility in an economic environment where external inputs are both costly and risky to use. The combined effect of climatic variability and fluctuating market prices often mean that farmers are gambling on an uncertain yield and economic return; they are thus exposed to a high degree of risk and uncertainty. To be attractive to farmers under these circumstances, new productivity-enhancing and resource-conserving soil fertility technologies must not increase farmers' risk, but aim to reduce it; they must be compatible with farmers' risk and livelihood management strategies. The Risk Management Project of CIMMYT works in collaboration with the Universities of Zimbabwe and Malawi, the national agricultural research programmes and the Africa Centre for Fertilizer Development, and has links with ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) and CARE (Cooperative for Assistance and Relief Everywhere). The emphasis is on the evaluation and adaptation of soil fertility-related technologies developed by researchers under the Soil Fertility Network. The project aims to combine computer crop modelling with farmer participatory research to evaluate the different biophysical and socioeconomic performances of a variety of soil fertility technologies. This was conducted in two sites in Zimbabwe and one in Malawi with collaboration between farmers, extension staff and researchers.

Source: Vaughan and Shamudzarira case study, this volume

at the beginning of the project; the experience gained during the methodological process, however, changed this somewhat. The feedback interface stage (in other words, the role playing and discussion of 'if and when' scenarios relating to the model) was critical to the integration of various types of knowledge that did take place. In order to build on the synergy that was created during this stage, the team developed a simplified participatory model that allows for full farmer–researcher involvement in the communication and research process.[10] By linking farmers' and researchers' knowledge, these tools have the potential to contribute to a more holistic and thus effective evaluation of soil fertility management technologies, under highly variable and risky climate conditions. Vaughan (2001, per comm) noted from their experience that it is challenging to keep the integration of knowledge worlds present and functioning if it is not built into the framework of the project from the beginning; ideally a project would incorporate these objectives at the outset, and assess and adjust as needed through a dynamic review process.

In the RMP, a diversity of tools and techniques were used, refined, adapted or discarded as necessitated by the process and project stakeholders. The research team used focus group discussions, transects, soil sampling, agroecosystem maps and climatic timelines to undertake the participatory development of farmers' soil and climate taxonomies (including indications of

production and management practices and constraints by climate and soil type). These were then linked across a matrix format that identifies clustered management practices (rules of thumb) for different typologies of farmers under different soil, climatic and socioeconomic conditions. This enables the model to run different crop, management and climatic scenarios based on each farmer group's classification criteria for soils, climate conditions and management practices. While these methods were needed in order to integrate different kinds of knowledge, they also provided the opportunity to build the trustworthiness of results through triangulation.

The third indicator refers to triangulation by generating information from multiple stakeholders. The RMP used stakeholder analysis at an early stage as the basis for participation in the research; this process is critical to this indicator. The preliminary stakeholder analysis (to identify different institutions and influential individuals with interest or influence in the project) was followed up with the participatory development of farmer typologies utilizing wealth ranking and other methods. This enabled an identification of the key differentiating variables between the various socioeconomic groups, and was predominantly based on seasonal access to resources. As described above, this enabled the project to develop different scenarios for the different farmer groups, based on their various perspectives and management practices. This illustrates the 'spin-off effect' of triangulation of sources; in this case it increased the applicability of the research findings through the diversification of models.

One lesson that emerged from this research experience is that the successful implementation of a multiple knowledge worlds, multi-stakeholder, and multi-research tool approach depends on the team members internalizing a sense of value of this new and time-consuming approach,[12] as opposed to a desire to 'just getting models running'. This, in fact, also relates to the fourth indicator (*dissemination/information exchanges locally throughout the research*), which suggests that researchers need to share their findings locally *during* the research with the explicit purpose of seeking improvement in them.[13] A challenge that can be highlighted from this is that there is a temptation in science to 'keep things in the lab' or 'in the model', and not adequately value the knowledge and input of local people. This includes the temptation for scientists/modellers to undertake into local interactions with the (conscious or unconscious) goal of getting their models validated (as opposed to building them based on field-derived input). This is also closely intertwined with issues of farmer ownership over the research. According to Vaughan (2001, pers comm),

> the process of resource mapping was critical for sharing ideas and getting farmers to have ownership over a systems view of their resources, for collecting and analyzing information, and for providing the modelers with a framework for developing and interpreting model questions and outputs. Conceptually it was a big leap for the modelers and the farmers to do this. The modelers may have initially under-estimated the farmers' ability and level of existing understanding regarding outcomes of their resource trade-offs and allocations. (Vaughan, 2001, pers comm)

In addition, the experience pointed to the value of having social scientists integrated in the team, alongside the more technical researchers, as well as having good access to external support from outside specialists.[14]

Principle 4: The research contributes to concerted planning for the future and social change

The fourth principle relates to the concept of the research contributing in a concrete and grounded fashion to positive future impacts in the research site (indicators 1 and 2) and beyond it (indicator 3). In referring to options and scenarios development, the first indicator implies that the research process should include some means of explicitly considering various options for activities and future directions, and their 'pros' and 'cons'. The second indicator refers to the research being designed so that any related processes and benefits can continue beyond the research project window, including there being a plan for how the research project staff and resources can withdraw without undermining the momentum that has been developed. This is a critical indicator, because if the research project addresses an on-going issue, but does not successfully 'work itself out of a job' at the local level, then it can be argued that it has either: created/contributed to dependency during its work (and thus the process cannot continue without it); or that it has developed a process (as a research 'product') that does not accrue sufficient net benefits to the participants for them to be interested in continuing it after the withdrawal of the external agents (thus there is not sufficient local will to continue, without external incentives). The last indicator of this principle refers to the utility of the findings *for (geographic) areas or (organizational) arenas other than those directly involved in the research*, or in other words, the generalizability of the research results. The indicators are:

4.1 The research process allows for options and scenario development.
4.2 The research methodology has a sustainability focus and an 'exit strategy' built in from the outset.
4.3 The research incorporates a 'scaling up' or extrapolation strategy, including an analysis of the uptake environment.

This principle is explored with reference to CIFOR's 'Adaptive Collaborative Management (ACM) Project' (see Box 6.4 and the case study by McDougall et al, this volume). The first indicator, which refers to options and scenario development, is illustrated in the ACM research project through its use of local visioning exercises, development of local criteria and indicators of sustainability, and simulation modelling. The ACM project action research process integrated the consideration of various future pathways at two levels: the community 'direction setting' level, and the level of 'micro-actions'. At the 'direction setting level', for example, in the research communities in the Philippines, and Nepal,[15] the PAR began with community-based workshops. Participants in the workshops, including women and men of a range of different ethnic (and caste), wealth and interest groups, undertook a joint visioning exercise, in which small groups of participants drew pictures of their ideal future for their forest user

BOX 6.4 CASE STUDY: PARTICIPATORY ACTION RESEARCH ON ADAPTIVE AND COLLABORATIVE MANAGEMENT OF COMMUNITY FORESTS – A MULTI-COUNTRY MODEL (CIFOR)[16]

CIFOR has recently undertaken a multi-country research project called the 'Local People, Devolution and Adaptive Collaborative Management of Forests (ACM) Research Project'. The goal of the ACM project is to enhance the ability of local forest users to jointly make, and follow through on, effective and equitable forest management decisions. The project is exploring several hypotheses including that self- or collaborative monitoring systems can support communities' tracking and learning from human and forest changes in relation to their goals and management strategies, as well as helping to generate and focus constructive dialogue among diverse stakeholders. The objective of the current research at the meta level is to generate insights into three questions:

- Does collaboration among forest stakeholders and conscious social learning processes in forest management lead to improved human well-being and NR sustainability?
- If so, under what conditions does it occur?
- What are the key strategies, approaches and tools to enable these processes?

The research team undertook background studies in 2000, followed by PAR in 2001. The project is currently under way in Indonesia, the Philippines, Nepal, Zimbabwe, Malawi, Cameroon, Ghana, Brazil and Bolivia. This case study focuses on the experiences of the first three of these countries.

Source: McDougall et al case study, this volume

group and community. A facilitator led the process of identifying commonalities that existed across all the visions, and the group also added any other key aspects that were missing from their joint vision. In the Philippines, for example, eight main themes emerged: education, organization, livelihoods, forests and forest management, coastal resource management, infrastructure, health and policy. The participants then used these themes as a framework for developing criteria and indictors for their community forestry self-assessment. In an iterative process, through facilitated small group discussions, participants created possible 'indicators', and refined those through discussions based on the question of 'what if' that was the case – 'would that really get us to where we want to be?' The visioning process was critical to the PAR because it enabled the community members to frame the overall future scenario to which they were jointly aspiring. The development of the criteria and indicators proved to be an excellent process tool to stimulate detailed discussion of the many facets of that vision, including that it made explicit the divergent and convergent local views on the 'ideal' community and resource system. It enabled diverse stakeholders to make explicit their experiences and perceptions on a wide range of forest and community issues; the process then encouraged the accommodation of these diverse views through a negotiated development of specific criteria and indicators.[17]

The research supported options development by the communities at the 'micro level' as well. In the Philippines and Nepal workshops, for example, participants identified the strong and weak aspects of their situation based on their criteria and indicators for self-assessment. They then prioritized several of the weak areas, and set about identifying possible options for actions as part of the action research process. This process of identifying options and assessing them has been followed to date in a preliminary way in these two country sites,[18] and teams are currently considering if and what further forms of 'soft systems' scenario development may be useful in weighing those future options. In Zimbabwe, the researchers are exploring participatory modelling as one option for scenario assessment (as described in PRGA, 2000). The process focused on several levels of analysis, from the local to the rural district council. They are using a framework called FLORES (Forest Land Oriented Resource Envisioning System) to guide them in developing a computer simulation model that will allow the exploration of alternative scenarios for NRM in the three villages where they have been working.[19]

The second indicator addresses the need for local benefits to continue beyond the life of the research project in the field. In the participatory action research phase of the ACM research project, community members and some other supporting stakeholders (such as District Forest Office representatives, and Federation of Community Forest Users in Nepal), worked together to develop a set of agreed and easily understood criteria and indicators, and then jointly assessed their situation. While it is too early in the project to determine its success, the hope is that the PAR has established a locally appropriate *framework* for a monitoring and assessment *process* (embedded in a 'learning approach' to management). Local stakeholders should be able to re-apply and adapt these in subsequent years as a means of continuing a feedback and learning process in the community forest management system. It may thus serve to enhance the responsiveness and effectiveness of local management decisions, and ultimately increase the benefits and sustainability of the community's forest resources.

Clearly, however, a 'technology transfer' of such a self-monitoring process would not be useful if it: (a) was not needed by the community; and (b) did not include a build-up of the necessary local skills and capacities to continue using the self-monitoring system after the end of the research project. The latter was assessed before the workshops, primarily through discussions between community members and the researchers (who had been working in the communities for six months or more and so were familiar with the local situation). In all the communities the local forest management committee and researchers tried to design the workshops in such a way that they maintained a high sense of community ownership. Following the development of the self-assessment systems, the participants expressed that it was a tool that they wanted to continue using on their own. Researchers have initiated the local development of skills and capacities to maintain the initiatives through starting to engage local stakeholders, including community members, as facilitators in this process. This will be further supported through local training in facilitation, as needed. To enable benefits from the research project to continue well beyond the life of the research project, the researchers and community members are integrating

the self-monitoring processes and other ACM elements into the existing decision-making and planning systems in the communities. In this sense, the research outcomes (self-assessment processes) become practical and flexible means of strengthening these local institutions over the long term.

The third indicator, 'producing generalizable results', is also a CIFOR (and thus an ACM project) mandate. Research based on a small number of isolated PAR initiatives would have presented the project with some significant challenges in regard to this goal. In order to address this, the project embedded the PAR in a larger multi-site framework of scientific analysis. Specifically, in all the research sites in every country, researchers have laid the foundations for comparative analysis by conducting a series of parallel background studies.[20] The background studies used a consultative form of participation,[21] but simultaneously allowed researchers the time to build relations and the groundwork with local stakeholders for the main phase of the research. Additionally, to contribute to the larger CIFOR research goal, as well as local recording, processes and learning in all sites are regularly recorded by researchers in a framework and format that is comparable across countries and sites. Furthermore, these site findings are integrated with additional studies being undertaken in each country; less intensive, but more extensive, these shorter studies (which are more consultative in nature, and less action-oriented than the sites), add breadth to the analysis. Other methods are also being used to triangulate the results across sites, countries and regions, key among these being the use of multivariate analysis across all sites, and the analysis of the outcomes of the participatory modelling in Zimbabwe, Indonesia and Cameroon. Whereas the multivariate analysis is expected to provide a quantified picture of key drivers for the success or failure of adaptive collaborative management processes, the analysis of the simulation models (including the discussion with local partners of the scenarios they deliver) is expected to provide insights into the reasons for failure or success arising out of the structure and behaviour of these processes. Ultimately, these elements of the larger framework for analysis will enable greater depth of understanding within each site and highlight findings that emerge across varying community forestry conditions.

Principle 5: The research process is based in iterative learning and feedback loops and there is a two-way sharing of information

Continuous learning (leading to people's increased ability to solve problems) is one of the key features of participatory research. It is therefore crucial that the research design allows for systematic, regular and critical exchange and reflection upon both the research process and the results (learning and outcomes).[22] A central aspect should be the meaningful participation by the different stakeholders in these activities. Indicators for this may include:

5.1 The research includes regular exchange and reflection events involving key stakeholders.

BOX 6.5 CASE STUDY: THE FARMER RESEARCH COMMITTEE (CIAL) AS A COMMUNITY-BASED NRM ORGANIZATION (CIAT)

CIAL is the Spanish acronym for Comité de Investigación Agrícola Local, or Local Agricultural Research Committee. CIALs are a form of local agricultural research group belonging to, managed by and providing a service to a rural community. The research team is made up of volunteer farmers, chosen because of their aptitude for experimentation, supported by a facilitator. The CIAL aims to link farmer-researchers with formal research systems, thus increasing local capacity to exert demands on the formal system and access potentially useful skills, information and research (Ashby et al, 2000). The CIALs create an opportunity for participants to systematically assess research processes and results, and to then translate these reflections into adjustments of the research and management activities. In essence, the CIAL process is one of joint experimentation and learning.

CIALs enable a more rapid and wider spread of technology that is already available. They can also serve as a platform for evaluating, adapting and disseminating new technology. The alternatives tested by a CIAL may originate within the farming community or come from the formal research system, or they may be a hybrid of the two. Once a network of experienced CIALs has formed in an area, the need for intensive coverage by research and extension services is usually greatly reduced, because poor rural communities have successfully assumed the task of testing and adapting technology themselves. The concept of CIALs was developed by a team at the Centro Internacional de Agricultura Tropical (CIAT) in Colombia. There are currently approximately 250 active CIALs in Latin America of various sizes and characteristics.

Source: Braun case study, this volume; Ashby et al, 2000

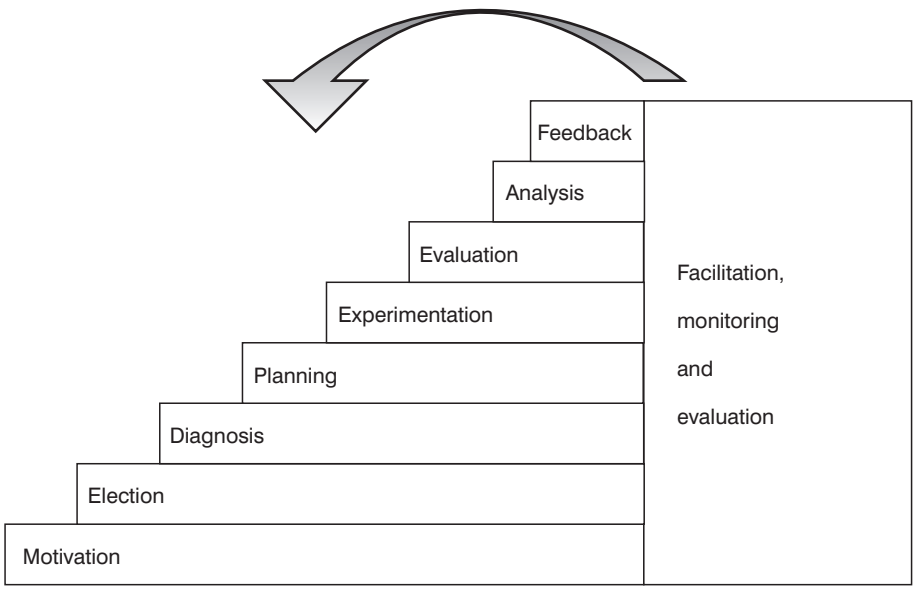
5.2 The research has regular monitoring events, involving key stakeholders.
5.3 The outcomes of monitoring activities are translated into revised actions.
5.4 There is an appropriately high quantity and quality of participation in exchange and monitoring events.
5.5 The flow of information sharing in the research is multi-directional.

This principle is explored with reference to CIAT's 'Local Agricultural Research Committee (CIAL) Project' (see Braun case study, this volume). The first three indicators, all discussed together here, refer to participants in the research meeting regularly to discuss processes and results, systematically assessing the processes and results, and then translating that reflection into adjustments of research process and management activities. The CIALs case offers a clear illustration of these three indicators, because the essence of the CIAL process is that of joint experimentation and learning.[23] CIALs follow a cyclical process (reminiscent of a PAR cycle), often depicted as a staircase (Figure 6.1). It has the following stages:

- *Diagnosis:* The CIAL's research topic is chosen through a group diagnostic process that takes place at an open community meeting. Communities base

their decisions on criteria such as chances of success, the number and groups of beneficiaries and the likely costs of the research. They commonly choose subjects such as the evaluation of new crops or crop varieties, measures for controlling crop pests and diseases, and fertilizer use.

- *Planning:* With the support of the facilitator, and other farmers and resource persons, CIAL members decide on the objectives of the experiment, the treatments and control, the materials and methods to be used, the inputs needed, the data to be collected, and the criteria for evaluating results.
- *Experimentation:* The CIAL members implement the experiment, and collect data, using the CIAL fund to pay for inputs. Other members of the community may assist them.
- *Evaluation:* The CIAL meets with the facilitator to evaluate the data collected. Conclusions are drawn and preparations made to present the results to the community.
- *Analysis:* The CIAL asks itself, 'What have we learned'? This stage in the process is especially important when new crops fail or the experiment produces unexpected results.
- *Feedback:* The CIAL presents its activities, results and expenditures at regular, open meetings of the community. Committee members may support their presentation with simple posters showing research results. If the CIAL feels confident about these results, it may make recommendations based on them. The community then decides whether the CIAL should continue with the experiment, switch to a new topic, or cease its activities altogether.



Source: Ashby et al, 2000

Figure 6.1 *Stages of a CIAL process*

Monitoring and evaluation, like facilitation, take place throughout the CIAL process. The purpose is to ensure that the process operates as it should and that those responsible for it are held accountable. The community monitors the performance of the CIAL and is free to add, remove, or replace committee members at any time. The CIAL is expected to keep records of its experiments and to make these available to community members, upon request. It must also account to the community for its use of the CIAL fund. The CIAL, in turn, monitors the performance of its facilitator, who is held responsible for the quality of support provided. The results of this evaluation are made publicly available. The research process may be adapted based on monitoring findings within this framework. Revision of 'actions' (indicator 3) beyond the immediate CIAL process (for example, 'adoption' of research outcomes) is illustrated most clearly by changes in local farming practices. While not all CIALs would have as high a record, Pescador, Cauca, Columbia, offers a strong example of impact: as a result of CIAL monitoring of its trials, over 80 per cent of the farmers adopted a bean variety recommended by the local committee (Ashby et al, 2000:6).

The fourth indicator refers to the quantity and quality of participation in exchange and reflection events, both of which are critical components of success in participatory research. Both of these are underpinned by Principle 1, indicator 2, which refers to the question of 'who participates':

> The research (and extension) design allows space for the meaningful participation of local stakeholders, including marginalized groups, and takes into account potentially differentiated perspectives and interests (based on gender, class, age, ethnicity or other aspects).

Relatedly, the continuity of the group members can offer some insights into this indicator. As Ashby et al (2000) describe, it is not uncommon for a frequent turnover of members early on in the CIAL process:

> Being a CIAL member is not for everyone. Many groups experience a turnover of at least one of their members in the opening year. CIALs often go through a difficult period during their early development. This typically occurs a few weeks after foundation, when the initial rush of enthusiasm experienced at the motivational and diagnostic meetings has worn off. Some members feel that the research topic chosen by the community does not match their own priorities and lose interest. Others drop out because the CIAL takes up too much time that they would rather spend doing their own farming. Women in particular find it hard to fit in CIAL activities because of their many other commitments. (Ashby et al 2000)

Ashby and colleagues (2000) also note that participation can be affected by 'participation fatigue', for example where past projects in the area have required input by the community, without generating sufficient benefits. This is, unfortunately, an increasingly widespread phenomenon, which reduces the opportunity for future participation in potentially beneficial initiatives.

The fifth indicator, regarding the multi-directional flows of information, can be understood in this case as the regular exchange of information between core and non-core participants of a CIAL. Because the total number of actual CIAL participants is usually small, this type of information exchange is critical because it underlies the goal of providing a service to the community. Adoption of the recommendations of the CIAL also illustrates its effective information flow. Using the same example as above, in Cauca department, Colombia, not only did 80 per cent of the community adopt a variety recommended by the CIAL, but 50 per cent of farmers in three nearby communities with CIALs, and 20 per cent of farmers in four communities without CIALs also adopted the variety (Ashby et al, 2000:6). The other side of this indicator is information seeking by the CIAL. According to Ashby et al (2000:137), 'as CIALs mature they become more proactive in seeking information: in about 57 per cent of the CIALs, individual members have taken the initiative to contact institutions for advice or seek assistance without waiting for their facilitator to help'. Thus, new (information) linkages are built.

Conclusions: a framework for reflection and change

In this chapter, based on the experiences of the research case studies explored during the Chatham meeting, and other literature, we have proposed a set of 'principles and indicators of good practice in participatory research on natural resource management'. We have presented this alternative framework – grounded in concrete field experiences – as a tool, or guidepost, to assess methodological options for participatory research. We view the framework as one that encourages reflection and change, and thus is appropriate to the theoretical and philosophical underpinnings of participatory (action) research. In designing the framework, the aim has been to encourage NRM researchers to explore how, and to what degree, a participatory methodology (and particular tools) influences both the effectiveness of NRM research and empowerment of local resource managers. To do so, we have argued that it is necessary to have a clear understanding of the types of learning that guide the research (from reproductive to transformative) and of the contextual variables that influence participatory research in practice (such as the nature of research questions, and local social dynamics and experiences) so that one can work in an informed way with the 'good practices' suggested here. The framework represents a potential tool for transformative learning for researchers – learning that enables the application of increasingly inclusive or integrative perspectives to participatory research practice. It also serves as a hypothesis-generating tool to guide future research design and planning. As such, it is an integral part of the iterative learning process in and to which participatory research practitioners are engaged and committed. We hope that this framework can be used to engender reflection and improvement in individual research initiatives. Finally, we hope that it enables comparisons across sites, and thereby contributes to the on-going learning process of the larger community of NRM researchers about what research approaches work best, for whom, when and why.

Appendix 1: Principles and indicators of good practice in PR on NRM

Principles	*Indicators*
1 The research reflects a clear and coherent common agenda (or set of priorities) among stakeholders and it contributes to partnership building.	1.1 The research (and extension) agenda has been set collaboratively and transparently 1.2 The research (and extension) design allows space for the meaningful participation of local stakeholders, including marginalized groups, and takes into account potentially differentiated perspectives and interests (based on gender, class, age, ethnicity or other aspects) 1.3 Partnerships among stakeholders have been created and strengthened through dialogue, joint actions and mutual benefits (friendship and fun included) 1.4 The research initiative respects the commitments made with partners, and the follow-through strategy is defined 1.5 The research includes a clear strategy for action/change, which has been defined in terms of expected materials results and increased social capital (or more broadly, for empowerment) 1.6 The research involves good documentation of the participatory process, including of the use of tools 1.7 The analysis of results and authorship of published materials have been shared between researchers and other stakeholders.
2 The research addresses and integrates the complexities and dynamics of change in human and natural resource systems and processes, including local understanding of these.	2.1 The analysis balances and integrates *natural* (biophysical) resource dynamics with *human* (social) changes and innovations in NRM. (The latter includes people's relationships with the natural resource system and changes, and their perceptions of it) 2.2 The analysis gives equal attention to both the inherent site characteristics and to (the impacts of) innovative management practices (locally generated or the results of research interventions) 2.3 The research uses an iterative research and learning approach (ie, cycles of diagnosis–intervention–assessment–diagnosis–intervention–assessment, etc).
3 The research applies the 'triangulation principle' (ie, multiple sources of information and methods), and links together various knowledge worlds.	3.1 The research process links the local, traditional and scientific knowledge worlds 3.2 The research methodology uses a diversity of methods and tools 3.3 Information generation is based on multiple sources 3.4 Information dissemination (ie, sharing of learning and findings) occurs throughout the process through multiple exchanges between researchers and stakeholders, including at the local level.
4 The research contributes to concerted planning for the future and social change.	4.1 The research process allows for options and scenario development 4.2 The research methodology has a sustainability focus and an 'exit strategy' built in from the outset 4.3 The research incorporates a 'scaling up' or extrapolation strategy, including an analysis of the uptake environment.

5 The research process is based in iterative learning and feedback loops and there is a two-way sharing of information.	5.1 The research includes regular exchange and reflection events involving key stakeholders 5.2 The research has regular monitoring events, involving key stakeholders 5.3 The outcomes of monitoring activities are translated into revised actions 5.4 There is an appropriately high quantity and quality of participation in exchange and monitoring events 5.5 The flow of information sharing in the research is multi-directional.

Appendix 2: List of indicators of good practice generated at the Chatham workshop 'Continuing to Learn Together', held at the Natural Resources Institute, Chatham, UK

1 Stimulation of participation by 'forgotten' groups (eg, women, landless, lower caste).
2 Shared agenda setting.
3 Realistic objectives and a related, coherent participatory methodology.
4 A clear strategy for action and change.
5 Realistic expectations for empowerment through research.
6 Partnerships created or strengthened through dialogue and joint actions.
7 An eye for incentives and benefits for all parties involved.
8 Use of multiple tools.
9 An eye for the dynamics of change in natural and human-made systems.
10 The best of the various knowledge worlds linked together.
11 Use of multiple sources and triangulation.
12 A built-in exit or sustainability strategy.
13 Possibilities for extrapolation or scaling up of the methodology and results.
14 Good documentation of the use of tools, the participatory process and the results.
15 Horizontal communication.
16 New professional roles accepted and put into practice.
17 Respect for the commitment made with research partners.
18 Shared authorship of results and publications.

These indicators formed the basis of the new proposed Principles and Indicators Framework:

Principle 1 is based on Indicators 1–7.
Principle 2 is based on Indicator 9.
Principle 3 is based on Indicators 8–11.
Principle 4 is from indicators 12 and 13.
Principle 5 is from indicators 14–18.

Notes

1 In particular, we build on the IDRC discussion paper by Vernooy, Buckles and Schreier, 2000.

2 The term 'best practice' – while it held catch-phrase value – gave a misleading impression that there was a single set of 'correct' practices. In order to reinforce the notion of 'good principles' that can be adapted and applied in a variety of contexts, we opt for the current terminology of 'good practices'.

3 For reasons of limited space in this chapter, we use only one principle per case in our illustrative 'assessment' of good practice. In practice, one would aim to apply all the principles for a well-rounded assessment.

4 The Landcare Case Study is available in the appendix of this book (Garrity, this volume). Key additional information was provided by the discussion paper by D Catacatun and AR Mercado, Jr (2001), and personal communication by D Catacatun (2001).

5 'Well-defined' indicates that they need to be clearly thought out and expressed, and consistent with the research mandate. The actual nature and quality of the empowerment objectives and strategies will, of course, be dependent on the type of PR, and learning and the research goals.

6 In Claveria, for example, the local government has created a legal requirement that it support an annual budget for Landcare-related activities and projects.

7 Chambers (1994) rightly points out the tradeoffs between quantity, relevance, accuracy and timeliness. He notes that this principle includes the notion of 'optimal ignorance – knowing what is not worth knowing, and then not trying to find it out' (Chambers, 1994).

8 This case study information was provided by the chapter author, R Vernooy. The full case is available in the appendix (Vernooy, in this volume).

9 This is in addition to, not instead of, a broader more formal dissemination strategy beyond the site; this external dissemination strategy is covered in Principle 4, indicator 4.3.

10 In addition, through a participatory process, a simple agroecosystem map was developed, with either a group or an individual farmer. This process is iterative and dynamic; in other words, the researchers and farmers together and continually revisit and update the map as necessary. After developing the agroecosystem map the researchers asked farmers to demonstrate their soil fertility resource allocations for the past and present seasons by crop and field types. Further discussion and use of focus discussions elaborated on the factors influencing farmers' targeting of resources. This supported an enabling dialogue between various parties on farmers' decision-making processes.

11 This case study is based on the case submitted by K Vaughan and Z Shamudzarira, CIMMYT at the Chatham meeting, and personal communication. See also Vaughan and Shamudzarira (this volume).

12 The case study elaborates the fact that the use of participatory tools is 'time consuming and can be laborious', but worth it in the end 'once trust is built and the agenda straight …. by backing up (well-documented) participatory field methods with trials based on the PRA work, the research provided some tangible outputs that farmers can use and benefit from' (Vaughan, pers comm, 2001).

13 The RMP did also have a formal external dissemination strategy, although like many projects, this emerged relatively late in the research process. While this may be a limiting factor (shared by many research initiatives), the project has engaged in

multiple levels of dissemination. These include integration of methods into the university curriculum, as well as the development of a shared research site with ICRISAT, farmers, community institutions, extension and CARE to provide a broad social infrastructure for information dissemination at a local level.

14 This kind of diversity on the research team can also enable the productive use of creative alternative research methods and tools, such as role playing and knowledge analysis mapping.

15 For more information, see the full ACM case study (McDougall with R Prabhu and Y Kusumanto in this volume). Input to the case study analysis in this chapter was also provided by H Hartanto and C Colfer of CIFOR. This project was generously supported by the Asian Development Bank (ADB), EU, DFID, IDRC and WRI.

16 The communities involved were: the San Rafael, Tanabag, and Concepcion Multi-purpose Cooperative, Palawan, the Philippines; Deurali-Baghedanda and Bamdibhirkhoria forest user groups in Kaski District, Nepal; and Manakamana and Andheri Bhajana forest user groups in Sankhuwasahba District, Nepal.

17 This process can be viewed as the interlinked transformative learning phenomena of 'divergent thinking' (or 'assimilation'), and 'convergent thinking' (or 'accommodation'), which Van der Veen (2000) describes as central to the concept of perspective transformation.

18 Small groups discussed aspects such as: the history of the issue and lessons learned from past efforts; desired outcomes; possible options for action; and strengths and weaknesses of each option. For the 'best bet option,' some small groups tried to anticipate potential obstacles and ways to address them, as well as plans for monitoring the implementation of the actions.

19 The FLORES Adaptation and Calibration (FLAC) package was used in four workshops in Zimbabwe as a means of facilitating the model's use by non-modelling specialists. Each iteration of the participatory process in FLAC is meant to integrate and acknowledge existing knowledge as the basis for producing a simulation model. A prototype model has been developed and is being subjected to rigorous testing with local partners and against empirical data (CIFOR 2000, Vanclay, 2000).

20 These background studies elaborate stakeholder relations, historical trends, biophysical and socioeconomic contexts and initial levels of adaptiveness and collaboration.

21 The project chose a 'consultative' form of research for the background studies phase of the research, because the research questions in this phase (which were the same across all countries) were primarily of interest to researchers rather than to local people. For example, local people were already well aware of the history of their forests; it was the researchers who needed to learn about this. In this case, using a more consultative and less participatory approach was estimated and intended to minimize the time and energy costs of the research to local people.

22 Note the linkage to indicator 3.4, which refers to on-going sharing and assessment of findings.

23 The CIAL model illustrates these in a 'theoretical' way; the degree to which CIALs implement these indicators in practice, of course, ultimately depends on each CIAL itself.

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Chapter 7

Participatory Research, Natural Resource Management and Rural Transformation: More Lessons from the Field

Linden Vincent

Introduction: why learn lessons on participatory research?

The word 'lesson' can refer to a teaching exercise that is structured to provide facts, skills and information, or to the meaning and awareness that is extracted from an experience. By reflecting on what we are doing and why, we can hope to limit our mistakes and create new ways of seeing, negotiating and resolving problems and opportunities. Lessons are important to the future of participatory research, as the recent critique of participatory development as a 'tyranny' shows (Cooke and Kothari, 2001). They call for a critical review of participatory development approaches and research methods – to study the controls on the processes behind 'participation' paradigms, and to demonstrate why it should be preserved as an approach. However, even ten years ago, Fals-Borda and Rahman (1991) were also warning of the take-up of participatory methods by agencies as a requirement and new form of control and social engineering, that would bring criticism of the role of participatory research methods. They emphasized the need for reflection to counter such outcomes, going on to stress instead how the importance of participatory research might increase in the future. This is through its demonstration of the complexities and stresses of local joint action in changing social and political conditions, at the same time as showing the changes achievable by people in such joint action – to continue to understand the commitment, understanding and support their ever-changing context might require. Although participatory research may also

provide better 'knowledge' for more enlightened action by planners and policy-makers, or create more local civic action, the changes it achieves are part of a more profound self-awareness about the taking of action for change.

This chapter aims to show that this critical review and personal reflection is taking place for participatory research, in both methodological and personal practice, to make it better placed to meet the challenges and critiques of research for transformation in natural resources management (NRM) (see also Hobart, 1994). It illustrates why and how people at the Chatham workshop have continued learning with participatory processes in research supporting development, despite the many stresses in their conduct. Chapter 6 has already reviewed certain key 'good practices' from the case studies, emphasizing 'the field' as a critical alternative to controlled, narrowly focused pilot trials and models of conventional scientific agricultural research. It showed how to build bridges between different research methodologies, both for better work with stakeholders and new learning possibilities for users of natural resources and for those researching NRM. This chapter brings together lessons from the wider range of practitioners at the Chatham workshop, and the wider field of development-related and action-oriented research they represented. These lessons reflect on why participatory research was being done, why collegiate research was important and difficult, how new frameworks help those involved to rethink the relations between action and knowledge, and what 'ownership' means in research terms, going well beyond a 'restatement of methodologies' (Biggs and Smith, 1998). It thus looks beyond the 'learning' discussion of Chapter 6, to look at the complex questions of action if research is to have real transforming power. Much of the recent effort and critique of participatory research has been about recognition and sharing of different knowledge to enable action to be planned, and giving local people a clearer voice However, there is a wider effort and critique within participatory research – to bring understanding and confrontation of social relations and dynamics into the design of action, beyond just those experienced in knowledge and its synthesis. This chapter tries to look at the impact of these new lessons on action, learning and knowledge as presented at the Chatham workshop.

The chapter begins with a review of the new aspects of participatory research as discussed at the Chatham workshop, and then goes on to look at the benefits of putting agricultural research within a 'natural resource management' framework, on how and why agriculture and resources management can be studied together for greater understanding and for better outcomes for livelihoods and ecological stability. The chapter then expands issues of collective action in NRM and stakeholder interaction in groups and forums. Such an issue raises new and fundamental concerns about work with power, stakeholder interests and interfaces between public agencies and local groups in action for change. In its conclusions, the chapter reviews the value of participatory research methods. There are few easy 'impact' criteria, as hoped for by some research agencies to justify the use of participatory versus conventional methods (or their joint use). What changes through truly participatory research is outcomes, and the local explanation of realities and an understanding of the opportunities to change them.

BOX 7.1 THE CHATHAM WORKSHOP AND ITS COVERAGE

Who was there?

The Chatham workshop involved researchers from a variety of backgrounds:

- Many were involved in research programmes of the CGIAR system, and particularly its PRGA initiative.
- Others were associated with bilateral rural development initiatives committed to participatory development processes that also involved participatory research methods, particularly Natural Resources Institute (NRI) staff involved in UK Department for International Development (DFID)-supported projects.
- Some were academics involved with development-oriented research and education.
- Yet others were from non-governmental organization (NGO) groups and independent institutions committed to local empowerment in their regions, as a generic approach to sustainable rural development.
- Some were 'freelance' facilitators and consultants committed to participatory approaches.

Who was not there?

- No spokesperson from any resource users who had been part of a participatory research initiative.
- No one from a government agency involved with any new participatory initiative for NRM, or in any bureaucratic reform.

What were the concepts of 'participation' in use?

This has been discussed in Chapters 2 and 4 (this volume).

What did 'participatory research methods' encompass?

To some, it was contact with local people to facilitate their plans and processes for change, also engaging wider networks of stakeholders to help achieve negotiated change. To others it was better inclusion of people's knowledge, and analysis of social factors through the use of interdisciplinary methodologies and multiple data sets. To others it was the use of sets of techniques using oral and visual methods to actualize local knowledge and interests from group debates.

What kind of case studies on participatory research were presented?

- Collegiate and 'farmer-friendly' procedures for testing plants, and pest control options, technologies or land development options, and disseminating knowledge among resource users/farmers.
- Participatory dialogue and facilitation – to identify issues, build groups and provide knowledge to build capacity and support action on resource management problems.
- Work in 'participatory' donor programmes that had specific requirements in terms either of group formation or of working with existing local organizations, and liaison between group representatives and individual researchers/consultants helping in action research.

- Participation in participatory action research (PAR) with a range of stakeholders (including groups) to solve problems and bring in new solutions.
- Monitoring experiences of participatory action research by 'self-reliant' local groups.
- Experiences in using information and data tools (like geographic information systems (GIS), maps, etc) for participatory research.

Note: 'Participatory action research' (PAR) is defined here as 'actively involving people in generating knowledge about their own condition and how it can be changed' (Fals-Borda and Rahman, 1991). 'Collegiate interfaces' are those with some common ground or mutuality of understanding between at least some stakeholders, which is not automatic with either 'participatory methods' or 'stakeholder analysis' in a field setting (Biggs and Sumberg, 1994).

This chapter is a personal synthesis of the findings and experiences presented by researchers at the Chatham workshop, whose case studies are summarized in the Annexe of this volume. Box 7.1 gives an overview of the participants at the workshop, and the research approaches presented. The workshop brought together people from the Participatory Research and Gender Analysis (PRGA) initiative of the Consultative Group on International Agricultural Research (CGIAR), with others working in different areas of NRM.

The case study papers presented at the Chatham workshop covered a wide range of issues and contexts of participatory natural resource management research, a broad domain hereafter abbreviated as PNRMR. The PNRMR coverage of methodologies was broader than the specific multidisciplinary research approach developing in the CGIAR. The debate of the Chatham workshop is reviewed here, not as any 'toolkit' of research methods and procedures – although methods and frameworks from the case studies are outlined to show innovative ideas and practices from both 'action' and 'applied/strategic' research contexts. The debate synthesized here has the wider aim of showing how participatory research is conscious of its links with social transformation, and can reflect on this in the very design and management of research, knowledge generation and action.

Changing contexts of participatory research

If participatory research is to stay true to its concern for working with local people, then it should adapt to new contexts and new concerns within local society and its environment, as well as maintaining exploration of new research and communication methods.

Understanding new times and new dynamics in resource management

In addressing innovation in resources management strategies, the PNRMR case studies emphasized the people, institutions and technologies (and their inter-relation) involved in managing resources and in shaping access to them. A discussion paper by Hecht (1999), circulated at the workshop, emphasized how

BOX 7.2 CHANGING CONCERNS AND CHANGING PRESSURES

Sustainability of natural resources, livelihoods and food security

New pressures still require understanding of farming systems, agroecosystems and agricultural technology development, and social dimensions of production (in fact even a better understanding than in the past). However, they bring a *new* focus on:

1 Governance reform and social justice
   - Law, practice and organization at different levels.
   - New needs in regional planning.
   - New domains for decision-making and social action.
   - Choices in how new governance is negotiated.

2 People's options and the forces that drive or prevent more civic action
   - New identities, especially ethnicity and life choices, in the face of globalization.
   - Knowledge as a focus in cultural identity and the cultural codification of knowledge.
   - Changing and multiple contexts of exclusion and differentiation.

3 Technological complexity and local innovation and reinvention capacity (creolization)
   - Choices of technology and institutions for resource use, that are assets for identity, empowerment and local survival, not just the intensification of agriculture

4 Group and social network capacity
   - The collective dimension of natural resource management requires conscious reflection of the power of groups and networks to pursue and steer change

5 The social as well as the scientific responsibility of the researcher

new concerns about livelihoods and food security have to be better linked with understanding not only of the environment, but also of policies for management and capacity for action, a concern also recognized more widely by the CGIAR (Vosti and Reardon, 1997; Scherr et al, 1995). New forces of change include widespread state disengagement from agricultural support with increased reliance of local and private sector initiatives, greater awareness of life options and life choices by people, greater uncertainties about globalization, and new concerns about environmental changes through population growth, urbanization and possible climate change.

The case studies are reviewed throughout this chapter for illustrations of the changes in working methods, communication and focus undertaken to meet these new contexts.

A key change highlighted in almost all case studies, and earlier in Chapters 2 and 3, is a shift in research from not seeing women at all, or seeing women as an excluded sector, to seeing them as important local managers, especially in biodiversity management. Several case studies emphasize how women's activities, and the impacts of change on them, must be made part of wider policy studies on rural development. Gurung's case study, in this volume, on the importance of biodiversity for agriculture in Nepal, demanded a critical

consciousness of how women's knowledge in production has been transformed by new crops and technologies. These changes can compromise women – and we must recognize such stresses if we are to promote rural development in areas where women play critical roles in production and resource management. We also need better identification of the strategies adopted by women to counteract their often increasing marginality. Van Koppen's case study, in this volume, on transformation in irrigation management and water rights in South Africa (see Box 7.5) showed how scenario studies of links between water allocation and economic change could – and should – be developed to show the impact of certain scenarios on women.

However, some case studies showed how it is still frequently difficult to reach women, and a commitment to do so requires alternative thinking on ways of communication that can penetrate their often constrained lives. Nelson's case study, in this volume, on working with potato blight in the Andes (see Box 7.4) notes that the requirements of many programmes for change in participation levels are too demanding for women, so that it has been difficult to get women into farmer field schools. An alternative approach was to try different strategies to reach the women, for example through attempts to emphasize health issues in pesticide use, and raise their awareness of the role of microbes in family, animal and plant health.

Methods: collegiate design and the self-awareness of scientists

One clear area of change relevant to this discussion was a movement beyond the simple mapping of local knowledge and comparison of ideas, to 'collegiate design', based on shared knowledge, and serious mutual thinking about the design of research projects and new resource management options. This is not a new issue in participatory research, but it is clearly beginning to be given much more attention in both applied research and action research contexts. Collegiate design is one term from within agricultural research and development (ARD) to describe a process that involves mutual communication and negotiation in shaping new technologies and institutions for NRM. Another term is 'dialogical research' (Fals-Borda and Rahman, 1991), which refers to situations where information is compiled and exchanged through discussion and other media, and not just via experiments, and where priorities and the design of work are developed not only by different groups but also in various forums.

Greater contact with farmers and resource users has opened new ways of seeing and grouping farmers, and of understanding their roles in resource management. Groups are often differentiated along gender, class and ethnic lines, as well as by their agrarian conditions. They are no longer either the beneficiaries of development, or the recalcitrant avoiders of technology. People are seen as stakeholders – those with a stake or claim in resource use (see Ramirez, 2000). The study of their interaction requires understanding of differences of opinion, disagreement and conflict, and scope for consensus building. This moves the review of stakeholder dynamics beyond the description of interaction and differences in knowledge and concern that were once common in agricultural research. This challenge is discussed further in a later section of this chapter.

Collegiate debate in such differentiated contexts requires much more effort at mutual understanding. It requires constant self-evaluation and self-learning by scientists about their approach to people as well as on the method used and the knowledge learned. However, the importance and difficulty of critical self-learning by scientists and its costs were mentioned by some of the case studies, as summarized in Box 7.2. The capacity to confront a research programme and change it to ensure it meets farmers' needs was only systematically mentioned in a few studies. However, this may yet be one of the key facets of a truly PNRMR approach.

One common finding in many community-/group-based research initiatives was the more limited possibilities for data collection. Very often it was found that local people did not consider it necessary to collect a lot of detailed information – often because they can see the benefits without having to collect supporting evidence. Thus many projects had to employ literate monitors to meet the external needs of monitoring and scientific data collection. However, the problem of users telling you what you want to hear – a problem in many local monitoring activities – was not mentioned in any of the case studies. Perhaps the reality of contact in PNRMR will allow problems to be more visible, and this does build a new kind of trust for local action.

Communication: participatory action research and learning with local eyes

The case studies demonstrate the serious attention given to what Fals-Borda (1991) saw as the four critical levels of communication in participatory action research practice:

1 *Collective or 'dialogical' research*, where information is provided through many means and types of group debate, which can not only be objectively verified but also create socially validated knowledge on which a group can subsequently base its actions.
2 *Critical recovery of history*, which includes local knowledge and recognition of roles, rights, relationships and associations that shapes people's involvement in their environment.
3 *Valuing and applying folk culture*, to recognize knowledge, capabilities and core values, and appreciate cultural and ethnic elements, through many forms of expression besides conversation – music, drama, sports, story telling and others.
4 *Production and diffusion of new knowledge*, which aims to reach different kinds of people in groups, and can use many other media besides the written word.

Box 7.4 summarizes how three of the case studies took up these issues of communication, not only to understand and respond to farmers' knowledge but also to extend it across and back into groups through various means.

BOX 7.3 THE STRUGGLE TO SHARE KNOWLEDGE AND FOCUS ON FARMERS' IDEAS

Stroud's case study, in this volume, on Participatory Agroecosystem Management in the African Highlands, documents the difficult struggle to ensure that a project stays participatory. She describes how, after initial diagnostic work, researchers reverted back to their 'original habits' in controlling experiments and ignoring differences identified by farmers. In this case study, the project had to be halted and refocused/concentrated around places and people where a participatory research agenda could work and give useful information to people. Stroud also notes that the new methods were not completely easy to learn: often, older researchers felt uncomfortable and younger researchers felt inexperienced. Institutional support for them was limited, and research review methods could lead to unhelpful criticism from uninitiated colleagues, also making it difficult for researchers to keep up this farmer focus.

Conroy and Rangnekar, in their case study, in this volume, with livestock herders and feed shortages in Gujarat, India, describe their critical struggle to avoid researcher definition of field work, and show how their study was reorganized and redefined as livestock herders articulated the water scarcity problems that accounted for much of the stress associated with feed shortages.

Vincent and Khanal's case study, in this volume, describes a programme to create 'participatory irrigation management' in irrigation systems in Nepal, and discusses the struggle encountered in recognizing different commitments to a participatory approach within a programme team. Also, there were stresses involved in trying to fulfil the villagers' ideas for change in the face of faulty or careless construction that did not produce infrastructure of the anticipated quality or design.

Heong's case study, in this volume, on pest management in the Philippines shows how interactive discussion can transform impressions of pest risk. He demonstrated an approach that gave farmers a chance to explore new knowledge in a practical way without excessively high real costs, and little risk of appearing foolish. He developed participatory experiments, which allowed farmers to present and test the experiential 'rules of thumb' they had about pesticide use. This led to a reduction in unnecessary pesticide use. However, Heong's case study goes on to stress how research peers still see participatory experiments as scientifically 'weak' because they transform and question accepted norms of experimental design – this topic is discussed further in a later section.

A new focus: beyond livelihoods to new resource access and social justice

The issue of rights to use resources remains a key issue, now being fought on new platforms that focus much more clearly on group identity and social justice, and the search for new access and usage rights. The new global forces of privatization and resource scarcity put an intense 'double squeeze' on the poor and excluded. There has been long-standing criticism of the failure of conventional agricultural research to work with the poorest and most vulnerable groups of society. As has been noted in the discussion paper for the workshop by Hecht (1999), in Chapter 2 of this volume and in Vosti and Reardon (1997), agricultural research must now face up to a new mandate for poverty alleviation, and not just agricultural intensification. The workshop case studies showed how

BOX 7.4 COMMUNICATING WITH RESOURCE USERS; COMMUNICATION BETWEEN RESOURCE USERS

The power of visioning

Borrini's case study, in this volume, on the power of visioning for wetland transformation in Uganda, shows how real listening and belief in people creates energy for change, when it is done with an empathy that also leaves people to take their own time and choose their own path. Local people saw their wetland as a source for a wide range of products that they wanted to extract, including fodder, fish, bush foods, clean water and the rice crop to which much of the wetland had been converted. They also wanted the wetland to provide greater flood control. Where there is multi-dimensionality of use, people also want benefits to be shared equally, although there may be different views on how soon access rules can be evolved – and what these rules of use may be.

Let farmers shape learning: farmer field schools

The case study by Nelson, in this volume, on action against blight and potato production gives weight to the value of farmer field schools (FFSs), which are designed to allow farmers to exchange ideas and build their knowledge in the way they want. The schools have allowed farmers to learn about the pest control initiatives they feel could work for them, and are a longer-term initiative that are a step on from farmer-to-farmer training. This case study also highlights the value of seeing how needs differ between developed and developing countries. The former have forecasting/advisory systems for the precision application of fungicides (and also insurance compensation mechanisms for crop failure) but also face concerns about their carcinogenic potential. Farmers in developing countries do not have good mechanisms for working with fungicides; chemicals are often inaccessible and are frequently poorly or dangerously used. This is another situation where it is difficult to reach women, and any commitment to do so requires alternative thinking on methods of communication to reach into women's often constrained lives.

Multiple communication means and increasing dialogue between different stakeholders

Klemick and Jarvis's case study, in this volume, on initiatives to maintain plant genetic resources (PGR) in Nepal, Mexico and Morocco shows the complexity of real interfaces, and also of the formal action required to make participation in PGR real. It was costly in terms of both money and people's commitment, and it needed in-depth work to understand, why, how and which farmers preserve or manage PGR. The role of women was clear, as was the fact that 'household yards' as well as crop fields were important. Klemick and Jarvis emphasize the importance of – and show the potential for – building a recognition of the capabilities of local groups into national policies on biodiversity. They highlight some of the special action being taken in Nepal to promote in-situ conservation and build new interfaces, including Diversity Fairs and Rural Poetry Journeys with ideas being built into songs and verses. They stress the need to ensure that there is a local conservation initiative that matches higher-level advocacy and action in national and international organizations. This shows how socially validated knowledge, built up through various media, can help to construct a local identity and greater resource integrity. This demonstrates the importance of action at all levels – from field to national policy-makers – if biodiversity is to be preserved and kept as part of a viable local agriculture.

several initiatives have shifted the debate from one of advocacy for the excluded, to a more serious commitment to building resilience and local knowledge. A reduction in exclusion is not just an ideological political platform, but a sincere new focus on taking local knowledge seriously, with a commitment to build local rights and respect for previously marginalized groups through the knowledge they have of resources. The new empowerment focus is not simply about rights – it is also about holding onto heritage and knowledge at the local level. This is aptly described by Gurung's case study, in this volume, on the eastern Himalayan initiative on gender, ethnicity and agrodiversity management. This study emphasizes the extent of women's knowledge of biodiversity, and the need to use this knowledge and awareness to build social legitimacy and identity as a vital asset in areas where agriculture is increasingly dependent on women. The case study by Klemick and Jarvis, in this volume(see Box 7.4) also demonstrates this emphasis on the biodiversity heritage as a new platform for action. The new interest in understanding societal dimensions of resource management – and understanding divisions on gender, ethnic and class divisions rather than just land tenure or employment type – have also opened a new discussion about stakeholder analysis and working with different groups. This was most clear in the case studies on water access by van Koppen, Conroy and Rangnekar, and Vincent and Khanal, all in this volume, as described in Box 7.5. No longer is it just the socioeconomic dimensions of production in interdisciplinary research that are analysed – instead a range of societal dynamics and relations come under scrutiny. Rather than just relying on 'scientific' assessments of problems, scientific knowledge and methods also become tools for validating farmers' knowledge and action and understanding their performance.

These kinds of support for 'rights' of use and recognition of management capability remain rare, and until recently were the focus of localized NGO initiatives in small water projects. In India, some NGOs strive for more equal access to water that maximizes biomass rather than profit for greater local livelihood security (Datye et al, 2000). However, there is now a move for action at a national level in the systematic fight for the legal rights of excluded groups– as shown both by the South African case study of van Koppen in this volume (see Box 7.5), and other fights by *indigenistas* for water rights in Ecuador (Pacari, 1998). Negotiating collectively for rights is another new face of the empowerment struggle.

However, despite the clear importance of these issues for land and water resources, few other case studies clearly address the issues of justice and equity in resource allocation, although several address the issue of scarcity in biophysical terms. The difficulty that scientists encounter in facing up to the political dimensions of resource use is discussed further in a later section.

BOX 7.5 PARTICIPATORY RESEARCH TO IMPROVE INCLUSION IN DEBATES AND ACCESS TO RESOURCES

Working on options for the excluded with the excluded

Van Koppen's case study, in this volume, on irrigation and water rights reform in South Africa summarizes how the new government had brought in policies linked with financial reforms that required small-scale black farmers 'to stand on their own feet'. This was leading to smallholders abandoning agriculture as credit, markets and production services, like tractor access, became unavailable to them. Action research in such cases was using scenario studies to understand the effects of these policies, and their impacts on ever-more excluded and marginalized groups. These scenarios of irrigation management transfer looked at who gained access to water, and the likely (desirable or undesirable) paths of agricultural growth and NRM. This case study could also be used by different groups of stakeholders, for both policy development and local action. The scenario studies showed the outcomes of elitist water allocation (production impact substantial but with land concentration and labour replacement) versus inclusive water allocation (giving options to black female farmers) and the gender implications of both.

But at the same time, this research was also proactively identifying what the poor already do in the face of stagnant livelihood situations. It used the scenario studies to gain recognition of how wider changes in land and water access have differential effects on women and the returns for their labour. Van Koppen's case study raises the innovative idea of water associations composed of water users rather than landowners as embodying a new way to social justice. If membership of a water user association was linked to use of water and not to land it would not exclude women, as currently happens when only landownership is considered. This case study on gender-focused poverty alleviation options through irrigation management reform shows how it is necessary to see these different groups in society as different stakeholders. The actions of external agencies may have very different impacts on these different stakeholder groups, depending on the substance and context of the involvement of the different parties.

Let resource users define the stresses of their life worlds

Conroy and Rangnekar's case study, in this volume, on research on feed supplementation in a semi-arid area of Gujarat let livestock herders speak for themselves, and illustrates their key concern for a water trough and storage tank rather than just pastures. This case study also shows how investigation of the 'social' aspects of livestock feed improvement expanded to include personal feelings of stress and fatigue and the struggles of dealing with pasture incursion. Conroy and Rangnekar show how a focus on the livelihood constraints of such different groups in livestock management allows people to construct a better definition and prioritization of their own problems through a 'problem tree' analysis. Their analyses also brought out more complex personal and even psychological issues (such as 'tiredness' and the struggle with encroachment when there was limited forage), which were far removed from conventional socioeconomic analysis of production. Their case study held separate meetings for *Rabari* men and women and also for scheduled caste workers involved in feed security and livestock management. The case study discussed action to promote negotiation between different caste groups, and the owner of the well which would supply water, both over access to water and tank maintenance. There was also discussion of any likely attempts to extend grazing areas if water points were changed.

Conroy and Rangnekar's case study required an input from livestock herders in the construction of a water trough and storage tank, but also made a serious study of the realities of local management of these new community assets after the project had finished. They worked with stakeholders to negotiate a long-term management strategy for the trough and tank installed for livestock watering.

Understanding how technology shapes access and use of natural resources

Vincent and Khanal's case study, in this volume, looks at the struggle that may come into participatory action to improve water delivery, which may require negotiation for improved water access between different parts of an irrigation system as well as between local users, and the challenge of working with often changing ideas and rules, as new water associations form and change their key committee members regularly (see also Box 7.7).

PNRMR: why put agriculture into a resource perspective?

Jim Williams' case study, in this volume, noted how the PNRMR debate is helping in 'mainstreaming the environment' within the sustainable livelihoods approach. We not only learn to see the environment alongside many institutional and livelihood issues. We also learn the complexities of environmental interactions, in which individual technologies or natural resources may be under special focus. PNRMR is concerned with how individuals and communities perceive themselves, and hence act in relation to their wider environment, and also with the environmental externalities of natural resource management. The older focus on production becomes part of a much bigger picture of regional/resource – landscape management – and there are new stakeholders to consider beyond the bounds of the farm, the market and the research programme. Several of the case studies presented summed up a new ethos of concern to increase land/resource productivity sustainably – and not just to seek technology transfer or land intensification. This brings a greater consciousness of time and space into the analysis of production and resource use, and also into the role of technology in controlling resource availability, the two issues reviewed in this section. Issues of governance, negotiation and conflict resolution underpin all these issues, discussed further in a later section.

Space and environmental complexity: landscape and social dynamics

Several case studies explored new spatial frameworks for research, in order to investigate 'landscape scales' as projects moved beyond the farm or community. Another innovation was to work with the idea of the landscape as a mosaic, which was made up of different action areas of people, and not just different

BOX 7.6 LANDSCAPES NEED EXPLORING AS SOCIAL AS WELL AS BIOPHYSICAL MOSAICS

Dey and Prein, in their case study, in this volume, of flood-prone ecosystems in Bangladesh and Vietnam, used the concept of a resource management domain. This is a spatial unit encompassing environmental and socioeconomic characteristics of a recognizable unit of a landscape. This study set a crucial challenge for assistance projects – to evaluate with users whether the project's approach and knowledge can provide help or solutions that are valuable to users, and whether the landscape has the physical condition necessary to sustain the project.

Vernooy's case study, in this volume, from Nicaragua emphasized how PNRMR required new spatial units with which to look at natural resources, and looked at a micro watershed rather than a farmer's field or village zone. Sustainable watershed management was only achieved if coordinated land use for the benefit of individuals and the watershed community is adopted by local institutions – in other words, it requires 'collective vision', and the adoption of coordinated use and management practices in natural resources. Vernooy's case study showed the real leaps being made by sociologists and others to shift agricultural research to the field and away from trial plots. However, thinking about watersheds can still be rather normative unless there is also an examination of the emergent domains of action within a landscape. To avoid such problems, Vernooy uses concepts like social ecology to describe the actions of people and forces in society shaping the transformation of an ecosystem. He also argues that a watershed is 'socially constructed' through the ways in which people choose which technologies and institutions to use in its management.

The case study by Conroy and Rangnekar, in this volume, took these ideas further by mapping the emergent social territories covered by key livestock actors in a Gujarat watershed in their bid to find fodder for their animals.

Stroud, in her case study from the African Highlands, discusses how it is possible to understand variability in an area in social terms (eg, through gender and resource endowment analysis) as well as in physical terms. This can be done alongside other research work to fine-tune an analysis of the resource base and direct activities towards farmers with different endowments. This approach uses 'niche analysis' to find points of focus for applied research, referring to points in the landscape that can be improved, provide a new opportunity or further intensified.

biophysical elements. Although this 'mosaic' idea is becoming more common as a rural planning concept, as mentioned by Hecht (1999) and Moench et al (1999), it was not always easy to operationalize from a governance perspective. Landscape ecology is a mature academic domain, but a new grassroots emphasis on local governance by local groups brings new requirements to the understanding of social control across these landscapes. The case studies showed a variety of experimentation, with new conceptual and practical frameworks to design research, as summarized in Box 7.6. With the new interest in 'landscape scales' came a clear recognition that many habitats have multiple and sometimes conflicting users, as well as multiple uses. NRM involved non-resident as well as resident users. Many case studies also emphasized the use of more integrating tools, such as resource flow maps, resource endowment ranking and livelihood problem trees.

However, there remain some challenges in the 'landscape' approach. Technology and production systems using natural resources create other domains of interaction beyond the farm/village or watershed, that require analysis of other systems within a resource management domain – irrigation systems within a river basin are one example. Vincent and Khanal, in their case study from Nepal (in this volume, see Box 7.7), explored an interdisciplinary 'socio-technical' framework for looking at irrigation systems, whose operation and use both shapes and is shaped by the larger hydrological cycle and river basin dynamics. Agricultural research for new technology is increasingly located in rural environments facing new, contingent and seriously challenging politics in which it is difficult to bring conventional approaches to induced technological change. Work has to be steered by political and social realities and is often less amenable to standard scientific research design and evaluation methodologies. Yet trying to work with these realities has created powerful fields of learning on participatory methods of studying NRM, the production systems using them, and how people innovate in both.

Jim Williams, in his case study, noted how participatory research tends to be 'local and spotty' and community horizons tend to be foreshortened. He made a case for GIS as a way of 'scaling up' around these problems. He also critically reviewed the role of different levels of information technology in providing information, and providing a negotiating tool to communities. GIS-level tools can integrate a lot of information but are expensive, and clear thought has to go into seeing how they benefit communities, rather than just the researcher. Both his review on information tools, and the case study of Schreier on Nepal, in this volume, specifically address the potential political role that information tools – especially GIS – can play in providing new information to local users (and to the state). Both Williams and Schreier convincingly discuss how these new tools can build community-based NRM, improve communication and help build local action and democracy for a wider sphere of livelihood opportunities and civil society development. However, Williams noted how the information tools used may expose hidden issues but not enable their resolution. As with participatory rural appraisal (PRA), irresponsible application may do more damage than good. However, while information technology (IT) tools may empower the researcher and agency more than the community, this is still not sufficient argument to withhold these 'potentially democratizing' tools from community use. A key issue is how to keep them participatory and not let them be used for policing, or precipitating conflict.

Time, resource complexity and technology: systems in evolution and interaction

PNRMR continues to question the whole idea of linear technology transfer central to much earlier agricultural research. However, the Chatham case studies illustrate the greater interest on how technologies intertwine, and also how communities actually adapt, internalize, reinvent and generally 'creolize' technologies so they work in a particular location (Richards, 1996). Thus they create not just specialist 'local adaptations' of a standard technology, but vibrant

new things that have value and commercial potential in a range of local resource domains. The research community is showing more signs of recognizing this local creativity, rather than just looking to research and invent 'on behalf of the people' and disseminate new technologies. Indeed, participatory processes can help to bring this creativity about, through a reference to local knowledge, and especially by allowing local trials and an evaluation of technologies, with serious and non-judgemental commitment feedback by researchers. These are also helped by some of the new research design frameworks discussed in a later section.

The case studies not only emphasized the importance of understanding the history of people's use and rights when looking at NRM, they also emphasized a new commitment to the long term in building up links with farmers, and building real benchmark studies of change. The new frameworks, integrating agriculture and resource use, improve the focus on linkages between resources, technology and products that shape their value. They also give greater attention to time as a factor that shapes outcomes.

The conscious decision to put agriculture and NRM together, also with a greater consciousness of livelihoods, landscapes and habitats raised some new opportunities for looking at technology. Some new perspectives in the case studies emphasized the evolution of, and interaction between, technologies over time and space locally. There was also much greater attention paid to the operational aspects of technology – how to make it work effectively and for the long term. Examples include:

- Seeing the effects of technologies together, and their evolution over time. The case study of Conroy and Rangnekar looked at feed scarcity and water scarcity as inter-related problems. How and where technologies 'touch together' was also considered in the case study by Tutwiler on long-term trials of water use, soil fertility and cultivation practices in irrigated areas of Egypt. This looked at soil fertility as an outcome of soil, water and production choices, with the long-term trials allowing for holistic study over time. The case study was thus focusing on water management and soil fertility, and also relationships between them. Research looked at both the maintenance of fertility in the 'old lands' and the building up of soil fertility ('new lands') under irrigation. The aim was to look at sustainable crop sequence choices, which required a minimum of 12 years study. Although the research was still managed by professional researchers, the monitoring team included local farming organizations, extension staff and participating farmers.
- The 'long-term' view also meant thinking more about cycles of production and local self-sufficiency. Peters' case study on forage improvement in Honduras involved a programme that was thinking about seed replication by farmers locally and not only about the adoption of best species or best practices. Her study showed how farmers and researchers were considering the sustainability of seed supply locally, and not just taking up the offer of new varieties. The programme left farmers free to choose and explore mixes

of grasses and legumes – the former are natural for pastures and soil conservation, but the latter are also useful for cutting and carrying, and can improve fertility. The initiative is designed to help farmers recognize the combination of forage options available, and to build trust and mutual learning to test more complex and risky alternatives in forage species.

- Nelson's case study of potato blight also emphasized how technology needs changes, and should be seen against problems of evolution – of disease, of migrations of more resistant forms, and of different social options for controlling diseases in different places. Pounds' case study of efforts to control potato blight in Nepal (see Box 7.8) reinforces the need to work within the power of local social networks. The demand for technology is never static.
- Technology still has to be financially viable in terms of construction, management and environmental costs. Conroy and Rangnekar, in their case study, describe a project appraisal that conventionally looks at a benefit–cost ratio, also considers benefits to different stakeholders and to the environment. When some potentially negative environmental impacts were identified by the researchers, these were discussed locally. The livestock-keepers and well-owner decided themselves these negative outcomes were unlikely to happen and that they would be able to manage any such consequences. Similarly, the case study of Vincent and Khanal, looked at the requirements for keeping water supply systems operational, rather than simply looking at the technology as a set of components to be disseminated or installed.

Participatory technology development also remains a key commitment – and there is much more serious commitment required in thinking about the institutional needs and management skills that go with the introduction of new technology, and concern for better evaluative criteria. Nevertheless, a small number of the case studies paid a great deal of attention to the real challenge of participatory design of infrastructural technology on the larger scale. Here the difficulties of understanding local wants, negotiating options and bringing them into being often takes participatory action research into a new order of difficulty, requiring a reflection on the whole project and not just on local action. The case study of Vincent and Khanal, in this volume, considered some of these difficulties, as summarized in Box 7.7.

One of the challenges of a PNRMR methodology is that it has not yet moved very far beyond the small-scale technologies that can be tested by individuals and small, local groups. 'Local priorities' are rarely universal, and finding consensus is often difficult, although not impossible. When compromise occurs in order to get something built, it can strain relations even between very open and committed workers and local representatives. To continue work in the context of sensitive social relations is one of the core challenges of participatory technology development.

BOX 7.7 THE STRUGGLE FOR PARTICIPATORY APPROACHES IN IRRIGATION SYSTEM MANAGEMENT REFORM

Large-scale irrigation systems have some particular challenges for PAR. A development support project can involve many people, each having different ideas and different levels of commitment to participatory approaches. The large scale means that discussions have to be made with representative committees (whose key representatives frequently change), as well as with farmers in the field. If there are inequities in water distribution, improvements have to be negotiated at the same time that new organizations are being encouraged to develop. Even when a project can fund the new designs requested by farmers, there is often difficulty in ensuring that contractors build the new infrastructure to the right standard. Currently, many irrigation systems are having their management reformed to make them more 'participatory'. However, to many stakeholders, and particularly to project managers, this means involving farmers more in responsibilities for operation and management, rather than consulting them systematically.

This makes a collegiate participatory approach a demanding one for a field team, if they are to develop truly participatory methods to work within a defined context of participatory management. However, through an awareness of these problems, it is possible to work with farmers and official representatives to improve local infrastructure and institutions for a better irrigation supply. Drawing on ideas from Wield (1999), Vincent and Khanal discussed in their case study, in this volume, how action research in such systems and intervention programmes could be designed by thinking about it as a 'participation complex'. In this, a researcher had to work with:

- different domains of participation, determined by the interactions of water user organizations, farmers in different water courses, contractors and the project organization, in which:
- different practices were in force for how people communicated, negotiated and used preferred technologies and rules;
- different development contexts of participation, which pursued different objectives in innovation (eg, giving more responsibilities to farmers, versus more empowerment, or seeking higher irrigation efficiencies), and often had different participatory methodologies associated with them.

By taking time to identify these different dynamics, a researcher and research group could develop strategies with which methodologies, locations and people can work over time. Such a framework also helped to sound a warning when efforts might be proving less productive, and could also be used to explain problems and to maintain 'learning' between groups, even if the infrastructure and new institutions did not develop or operate as expected.

Building new interfaces for NRM

The engagement of PNRMR with these issues of local self-determination, with space and time in resource management and technology evolution, also means engagement with a much wider range of stakeholders and policy actors, raising new questions of scale. Political changes at the local and national level change the interfaces where contact can take place between different groups, and many resource users actively take up new platforms and new 'windows' to empower themselves.

If PNRMR has its roots in challenges to the neutrality of technology, and demands for a better understanding of farming systems and micro environments, then it is now taking the same challenge through demands for better prospects for new collective action. PNRMR allows a focus on resource use that brings in a wider and very different range of stakeholders than conventional agricultural research. It also has to link clearly with law and politics as well as planning and development policies. Several case studies commented that, while groups are often a central part of new participatory action, it is important too that researchers and facilitators understand the challenges as well as opportunities in building group action. Also, building 'social capital' in new networks and groups may be neither easy nor always as democratic as participatory rhetoric assumes (see also Cooke, 2001).

The case studies also gave recognition to how local interests drive and shape local change, and not just 'external institutional agendas'. Gurung's case study, in this volume, illustrated that there are communities consciously wanting to build on local knowledge for survival, and that require understanding of how production strategies are linked into culture (see also Mosse, 1997; Parajuli, 1998). However, community action may not solve the 'problems' perceived by agencies.

Shaping facilitation: linking people and linking activities

In her case study, in this volume, of change processes on the management of a Ugandan wetland now largely converted for rice production, Borrini discusses some of the stages suggested for motivating local action for participatory management. These are:

- Preparing the partnership.
- Developing the agreements.
- Implementing and reviewing (learning by doing).

In the first phase, discussion is promoted by the community – on present use and management experience with wetlands, and options for improvement. Local 'important people' are pulled in (elders, traditional authorities and landowners). Awareness will increase, and different groups will work out interests and concerns, and organize how to communicate. After 'ritualization of the common vision', it takes time to negotiate a management plan and develop basic rules for extracting resources, with different stakeholders striving for consensus. Borrini proposes the idea of a 'pluralistic management committee' of different people and interests, to guide implementation, which should be taken up as a way of 'learning by doing'.

Through researcher commitment, local needs can also be the starting point for R&D otherwise defined in external terms. Brinn's case study, in this volume, of a programme to facilitate better tsetse fly control in Zambia, describes how such commitment created a 'demand and support model' approach to land use planning, rather than the conventional 'suitability and enforcement' approach. This involved a bottom-up discussion of local needs, and of how to do things

in places where there is demonstrated hostility towards 'government planning'. Brinn describes a phased approach:

- Phase 1, which identified livelihood projects rather than an immediate focus on tsetse control (and related land use planning) to build local support and local coordination. The individual projects were likened to pieces of a mosaic. The projects have individual integrity and ownership but when placed together they constitute a de facto plan (with the idea that external objectives for a plan must link with local wants).
- Phase 2 consisted of building up projects into the plan drawn up at Phase 1.
- Only Phase 3 of the project addressed issues of land use planning such as communal grazing resources, boundaries, procedures for arbitration, etc. Then the initiative could use trust, understanding and confidence built up during the earlier phases.
- Phase 4 re-linked with community needs, supporting community infrastructure provision.

However, Brinn's case study gives a more prosaic view of some of the stresses involved in working with locally constituted committees. He highlights the many advantages of innovative, locally driven, low-cost and sustainable initiatives. He also warns of the risks of unpredictability, slowness, vulnerability to nepotism, and the challenges of too limited control and 'lack of glamour' for researchers and agencies.

Garrity's case study, in this volume, echoes some of these views, stressing the need to think about survival and 'generational change' in local Landcare groups in the Philippines, to ensure they stayed active and responsive to new ideas and opportunities (see also Box 7.8). These case studies are helpful for getting researchers to think about their commitment – and where it may work. They also serve to show that locally triggered change is feasible, and the rewards of locally managed transformation when it is positive.

Building new interfaces for stakeholders in organizations and practices

The new focus on institutions and ways of communication to exchange knowledge and build awareness brought some powerful insights on the complexity and scale of interactions to be addressed, and new ideas on interfaces. Several of the case studies dealt primarily with the interface of farmer–researcher–research institutes, and this has been adequately dealt with in Chapter 5. This section deals with the wider issue of stakeholder network–research organization interactions, that shape outcomes of both research, and resource user's actions. Some key experiences from the case studies are summarized in Box 7.8, although other examples are also found in Boxes 7.4 and 7.7.

There was a great deal of interest in field techniques that gave physical recognition to the value of local knowledge, and in attempts to bring local knowledge and scientific knowledge together, with some examples shown in

BOX 7.8 STAKEHOLDERS: INTERFACES AND ORGANIZATIONS

Stakeholder interactions change in space and time

McDougall et al's Center for International Forestry Research (CIFOR) case study, in this volume, focused on the complex range of stakeholders in a forest zone in East Kalimantan. They emphasize how the stakeholders were not static, but rather formed an evolving group, as different village organizations, users, companies, timber parastatals, NGOs and others entered the region. They promoted initiatives to try to bring these different stakeholders together and bridge gaps between them. These initiatives also looked for criteria and indicators that could track human and forest changes for different stakeholders, and be used as decision support tools for future joint forest management. Adaptiveness and collaboration are commitments that have to be at the heart of adaptive co-management.

Products can have complex significance underpinned by complex social networks

Pound's case study, in this volume, on a programme to control bacterial wilt in potatoes in Nepal, highlights how efforts by individuals or small groups alone would not succeed. It required 100 per cent participation in the implementation of a moratorium on potatoes in infested lands for three years. The study shows how interaction between villages and farmers shaped pest and disease management strategies. It also shows the breadth of these interactions, and the complexities of trying to close off sources of diseased potatoes in a programme to fight wilt – where the role of potatoes as a gift had to be addressed. Complex interfaces between villages and families had to be examined to understand how seed potatoes were produced and acquired – and exchanged. This draconian demand to stop the exchange of potatoes only held in areas where potatoes were of primary economic importance, and where the social networks 'oiled' by potatoes in normal daily life were strong enough to enforce a ban. Pound's case study, in this volume, reminds people of the much broader range of cultural practices that surround resource use and production choices – and the stress of altering cultural practices such as the exchange of potatoes as gifts. This was a timely reminder that poor 'community participation' can forestall change even if it is technically feasible. In addition, it is vital to understand the diverse social and political forces that might lie behind 'poor community participation' in order to achieve greater collective action against pests and diseases.

Building groups is an evolutionary process

Garrity's description of the Landcare movement in the Philippines case study, in this volume, shows how a build-up of locally defined movements can help groups determine which principles and experiences to adopt for themselves, but at the same time it highlights three significant concerns. The first is that the project is sufficiently popular that the initiative becomes 'projectized', attracting more 'top-down' projects that do not fully understand the concepts involved, and ultimately defeat the idea of a farmer movement. The second is that such movements are not easy to maintain, and need external networks and stimulation in the long term. The third concern is that group leadership is a demanding and exhausting task. Garrity emphasizes how both public and NGO support can facilitate group formation through helping members develop managerial capabilities, capture information and even arrange specific funds – without interfering in their decision-making on appropriate action. This illustrates the challenges of keeping the Landcare movement alive so that it can actualize itself locally, without being taken over by top-down approaches. Garrity also highlights the burnout of researchers made possible by the stress of these approaches, which have high expectations.

BOX 7.9 RETHINKING RESEARCH DESIGN: NEW KNOWLEDGE PARTNERSHIPS, NEW METHODS

Snapp's case study on soil fertility research in Malawi and Zimbabwe, in this volume, emphasizes how a commitment to reach farmers not engaging in extension advice had increased discussion and openness regarding the dissemination of broader 'rules of thumb' and guidelines rather than specific facts and instructions. Farmer-to-farmer exchange was probably the most important means of technology dissemination. Mother–baby trials, where a conventional multi-plot trial could be laid out in a village and linked with simpler trials in the same area by local farmers who each replicated just one of the experiments in the multi-plot, was a new form of fused scientific approach.

The Braun et al case study, in this volume, of the Local Committees for Agricultural Research (CIALs) describes how local agricultural research committees were created in eight Latin American countries, with a volunteer research team chosen by the community for their aptitude. Braun and colleagues describe the design and facilitation of these local organizations that can understand participatory design for local needs. The volunteer teams could set out to promote knowledge generated through experience with farming systems showing improvement through participatory generation/modification of technologies. This case study shows how group concerns about research topic selection are often different from those of researchers, covering questions of cost, length, risks, benefits and relevance to the community and what other work is already being done. It describes how the design of experiments had to accommodate local concerns to minimize risks and losses. The researchers also worked to demonstrate technological alternatives that were relevant to the community, rather than testing particular options in order to answer other scientific or ecological questions.

Dey and Prein's case study, in this volume, of the introduction of fish culture in deep water rice (in research sites in Vietnam and Bangladesh) involved technical options designed by researchers in consultation with users and based on users' needs and indigenous knowledge. They used small trials as a basis for discussion, with researchers acting as resource persons, and not just as data managers. Users also designed institutional options for research testing, with a group formed to oversee various duties.

Vaughan's case study, in this volume, on initiatives to improve soil fertility in southern Africa used a framework where more valuable knowledge could be an outcome of interaction between a 'hard system' of knowledge (as in scientific modelling) and a 'soft system' (as in knowledge gained from participatory methods with farmers). In addition to conventional biophysical models, hard systems used farmer-behavioural models based on the likely actions of socioeconomic groups, given their resources and agroecological zone factors. However, these would also be tested and transformed by information from the soft side, to enable a new knowledge set on 'risk management' to guide experiments for improving soil fertility.

Peters' case study, in this volume, on the selection and strategic use of multi-purpose forages in Honduras shows how researchers can think about multiple objectives in research design, combining objectives to improve income and food security, and the conservation of trial species. He also discusses how community-based research can be made complementary to on-station research trials that may still be necessary to understand the constraints and risks associated with new varieties. In community-based work, farmers were offered a range of grasses and legume options. Their choices (which often changed over time as farmers moved from recognized pasture grasses for existing production systems into thinking about grasses for soil conservation and legumes for cut and carry fodder) could help direct and define further germplasm development.

Box 7.9. These cases demonstrated ideas on how to rethink the design and layout of experiments, and the spatial scale for studying resource–livelihood interaction, as well as the interaction of local and scientific knowledge.

Politics and policy-making – the last struggle for participatory research?

Any intervention in local resource management requires an understanding of politics. Politics can be about the struggle for change, or about the pursuit and exertion of power, but it can also be about understanding ways to get things done. Local social and agrarian relations are key factors shaping politics and the contest for resource use. National policies, transformed into new institutions, also shape these possibilities for struggle, for power, and for new strategies of action to emerge. Scherr et al (1995) emphasized the gap in policy research methods to provide insights for change in local organization in NRM, especially to show how and why local organizations are influenced by wider policy actions. They used 'policy factors' to open up a wide range of issues affecting the behaviour of a group. These included not only sectoral policies and their instruments of control, but also legal and institutional factors that shaped organizational dynamics, and political factors that might influence the strength of local organizations and their capabilities for action. Scherr et al felt that the debate about participatory research methods could make a contribution towards this critical area of policy research.

Several of the case studies begin to discuss this policy context. Stroud's case study of the PAM (Participatory Agroecosystem Management) approach in the African Highlands also strives for a much more comprehensive rethink of research design. She sees the need to bring in different kinds of research partnerships, as well as different types of knowledge development for different stakeholders, rather than mapping multiple stakeholders or uses in resource management. The PAM approach emphasizes thinking about the interactions of major elements, including socioeconomic and policy environments, the need for multi-partner and multidisciplinary field work, the use of participatory methods and the use of integrated community action plans where 'learning by doing' is emphasized. The case studies, both in this volume, by Barbara van Koppen (Box 7.5), and Klemick and Jarvis (Box 7.3), also discuss the importance of policy initiatives, including effective central activity to match local initiatives, and decision tools to explore future options for excluded and marginalized groups.

However, only a few of the case studies specifically address the more complex politics that can come into play around transformation in NRM, even when developed in a participatory way. Pound's case study from Nepal (see Box 7.8) on the variable success of communities trying to adopt stringent measures to eliminate potato wilt, offer some insights into local committees and the factors that make them strong or weak in designing and enforcing rules. Vincent and Khanal's case study, in this volume, on irrigation management reform in Nepal (see Box 7.7) documented some of the problems facing both organizations and programme researchers involved in a project for institutional reform of irrigation management. They presented a framework for

understanding how interactions to transform water management will involve many different actors in different domains of an irrigation system and in a project hierarchy. Conroy and Rangnekar (case study, in this volume) worked specifically to understand the needs of groups and how to negotiate improved water supply for livestock between groups with very unequal power relations (Box 7.4).

Surprisingly, there were no case studies on participatory research to drive reform within public agencies supporting NRM, although concern for this is not new (Bagadion and Korten, 1985). Why is this? Sometimes it does seem that while PRGA and PNRMR are very good at promoting a community and group focus, they are rather silent on the politics of intervention and of bureaucracies. The new focus on and commitment to local collective action sometimes seems to make researchers ignore the apparatus of the state and its bureaucracies and political institutions. They are, therefore, sometimes silent on the wider social and political factors that can make collaborative research and project intervention work. Perhaps for agricultural researchers it is still very difficult to research and critique the 'policy environment' when this includes the mandate of the major international research and development agencies that funds them. Social science research in the CGIAR is widening, there is more inclusion of actor and stakeholder perspectives, and PRGA is strongly promoting multidisciplinary approaches. However, it continues to be a struggle to introduce new concepts from political and institutional analysis, and cross-reference to theories that can analyse the real social relations shaping the dynamics of change.

Conclusions

Returning to the beginning of the chapter and Box 7.1, the research debate was clearly moving participatory research towards new concerns in NRM. There was a fresh effort to understand technological complexity and local action in order to achieve more sustainable NRM. Many researchers were becoming more aware of their responsibilities in applied and action research for development with local people. An understanding of people's options and choices to preserve or change natural resource management, and how to facilitate this awareness, was growing. Thus the Chatham workshop demonstrated a significant amount of progress towards the development of a critical concern in participatory research – to recognize and bring together local and external knowledge, and make local needs a key element of concern.

Work on participatory action still has dilemmas and struggles within it. However, the Chatham workshop showed that there was an acceptance of the need to discuss this. Coverage of this topic was present in a serious discussion about collective action and group dynamics, and in a further discussion of participation and policy. A consideration of methods demonstrated a new understanding of how knowledge was part of, derived from, and linked with action – and not just a linear precursor to action in planned change. Awareness and understanding of the stresses in building local management groups and

facilitating networks among politicians and planners was developing. Methodologies such as those identifying actors in local management and stakeholders in the transformation of resource use help to discover who may be involved in initiating change. However, researchers and facilitators are still learning about the support strategies that may help projects, long-term research trials and new local user groups to survive and evolve in the long term. PNRMR gives a new collective dimension to working with local people, but there are no easy blueprints against the stresses of forming and supporting groups. The challenge remains for PNRMR to consider how to facilitate and work with the group formations that are able to actualize change. Many of the case studies discussed this concern, and this consciousness of institutions and dynamic social relations is one important way in which NRM is now turning its attention to the 'social' dimension.

Action research in the context of governance reform and social justice was visible in some work, especially those working with water issues. However, a critical area remains that of research into wider policy initiatives for transforming natural resource management – to understand more about the stresses of interactions between actors at many levels, the uncertainties local people face from their wider social environment, and how to build new policies in the face of them. Some case studies presented new methods of local decision-making. However, no case study gave any detailed analysis of how the governance of resources could be renegotiated beyond the local level. An understanding of politics and how it is enmeshed in NRM, and a critical awareness of the wider societal dynamics in collective action, does remain one of the critical areas of future debate in PNRMR.

The case studies therefore showed that participatory research for development policy and action can also be done with a wider consciousness of the stresses and uncertainties that transformation involves. There was very strong evidence of researchers not allowing participation to be tyrannical, with a high level of self-criticism of own practice. More seriously, these researchers still had to fight the older misconceptions of past non-participatory research methods – of assuming technology is neutral, that problems are capable of technological fixes, that there is no differentiation in uptake and response to new options, and that scientifically defined data collection methods can provide all the data necessary for planning change.

This, then, is the first potential 'value' of participatory research methods, especially in the applied research areas of agriculture and NRM. *If* the results presented at Chatham are taken on board by planners and programme makers, then the use of participatory methods should lessen the likelihood of promoting inappropriate technologies or ideologically determined institutions for the management of natural resources. Examples from the case studies in this volume that already demonstrate this value include the 'mother–baby trials' to help farmers chose the experiments of interest to them. Also, Heong's participatory experimentation did lead to a reduction in unnecessary pesticide use by farmers. The challenge, of course, is contained within this 'if' – that higher-level policy and decision-making in development and applied research agencies take the results on board.

The second potential 'value' of participatory research, especially in an action research context for better resource management, is the way it can transform local knowledge, self-awareness and power to guide action. This power is shown in the work on the CIAL documented by Vernooy and Braun et al and in change in the Uganda wetlands documented by Borrini in her study on feed and water shortages for livestock herders who were helped to locate new water points and negotiate institutions for their long-term use by different groups. The programme reported by Vincent and Khanal gave villagers some new, more easily controlled irrigation structures where they wanted them, even though the construction quality was sometimes lacking. Such participatory research starts to reduce the 'transaction costs' that might be paralysing the search for new resource management options. However, although participatory research may show how to make management and use of resources easier – with less stress on people – it may not make people use their resources more efficiently or sustainably in the short term. It may be a long time before people achieve real change with a 'visible' impact, simply because wider conditions inhibit risk taking. However, many micro shifts may be visible in how people interact and develop local coping strategies.

The biggest 'value' is the change that may come in what people learn about themselves, the people they work with, and their capacity for action if they wish it. This, of course, refers to researchers as well as local people, who may both gain new understanding, and build new capacities for local people, researchers and policy-makers to work together.

Thus, this workshop gave some answers for those hoping to legitimize participatory methods by showing that they will create a better 'impact', or that new criteria for impact monitoring might be generated. However, most of the case studies were more concerned with exchanging ideas about the process of participatory work, and the development of interdisciplinary approaches. Too great a focus on 'impact' and change – both key concerns of a technology transfer mode of thinking – is to miss the most substantive concerns of researchers using participatory methods, which is to create an awareness of sustainable actions for change in local people. What changes through truly participatory research is the chance of better outcomes, and the local explanation of realities and opportunities to change them.

The Chatham workshop brought different groups of researchers together to exchange their experiences. It used the title 'Research f(or) Development' to explore differences in research approaches and in the concerns of different researcher groups, but also to see how each can learn from the other about knowledge generation and social processes for working with rural transformation. Different researchers did show some differences in objectives and concerns. For some, the key focus was still on knowledge generation. CGIAR researchers (and some others) aticulated the fact that they are generally expected to contribute to 'producing generalizable results', which McDougall et al (case study, in this volume) note as a challenge in PAR. The 'specialist' scientific culture, which comes with pressure to publish, places certain constraints on researchers in terms of requirements to collect data in forms suited to statistical analysis and other accepted means of analysis and

verification. However, part of the strength of the workshop, and chapters in this book, was to show how different knowledge generation methods need not compromise each other. Researchers associated with rural development initiatives, NGOs or academic researchers may face fewer institutional conflicts in pursuing PNRMR. However, they may still be more concerned than their local partners with obtaining defendable 'valid' findings and comparative studies. Thus they also need methodological clarity in how they use different approaches to gain knowledge for communication. In some cases, it may appear that formal agricultural research has certain conflicts of interest with development-oriented PNRMR, which may be better able to acknowledge political and social forces. However, sometimes the difference was more apparent than real, especially as both formal agricultural research and development-oriented research are getting more involved in action requested by users.

More seriously, the hybrid knowledge frameworks generated were also recognized as important in showing how, where and why knowledge is used, and action might generate change and new knowledge. This wider concern at Chatham went beyond the discussion of the 'best knowledge' debate, into a discussion on working with people for change, and the stresses and potential tyrannies which can come with the use of new ideas and methods. Several of the frameworks discussed in this chapter show new thinking in this area. Thus, the Chatham workshop also showed the value of exchange between CGIAR and other scientists, and between researchers in research institutes and within development projects, to learn, through discussion and analysis, how to change research practice so that the research process moves from a 'top-down' process to one which involves natural resource users and others in analysis and decisions about natural resource management. All the workshop participants placed a much stronger emphasis on the processes and methodologies of working with people and of creating a debate on learning capability, not just a toolkit for knowledge generation. This book based on the Chatham workshop may help to publicize and further refine participatory research methodologies. However, this has been done with a clear discussion of the difficulties involved, and not just simplistic advocacy or populism. The debate was about a commitment to work within the social reality of change and public action done in its name, and the natural resources and people that are part of this. No one working in this sphere can really consider older research methods, and development initiatives without a user focus or without a capacity to explore dynamic social contexts, even if further challenges remain for work undertaken as participatory research and development.

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Chapter 8

Participation in Context: What's Past, What's Present, and What's Next

Dianne E Rocheleau

Introduction

Since embracing participatory methods in the 1990s, scientists at international and national agricultural research centres and a variety of natural resource management (NRM) agencies have encountered both successes and failures. Innovations have been identified, as well as pitfalls, among the panoply of participatory methods available. The early days of debate for and against the participation of farmers, residents and local land users in research have given way to more grounded discussions about appropriate approaches and specific methods for particular circumstances.

The examples presented in this volume illustrate how far the debate has matured. Rather than advocating one 'brand' of participatory research over another, researchers are innovating and experimenting to match the methods and the situation. They are also working to bring the insights of everyday practice in the field back into the design of new technologies and future research practices, protocols, structures and strategies.

Researchers are not asking if participatory methods should be used, but rather when and how, and which type of method, in combination with which traditional research tools.

The experience and insights of the participants at the Chatham workshop complement those of prior meetings and publications focused on the challenges and potentials of participatory research in practice, targeting technology generation for sustainable agriculture and NRM. This effort is part of a decades-long conversation between social scientists, biological scientists, farmers and forest dwellers on the possibilities for a collaborative science of agriculture, forestry and watersheds (Buck et al, 1998). It is also part of a wider movement to support people's ability to envision, choose and create their own futures. The contributors to this volume have touched upon several recent developments in

the field of participatory research that warrant further attention from individuals and organizations engaged in sustainable agriculture and NRM. Promising trends include:

- A focus on the ethics and power relations involved in participatory research approaches.
- A call for more accountability, standards of practice, codes of conduct and constructive critique among practitioners of participatory research.
- An exploration of research on the process of participation under uneven relations of power, including conflict resolution.
- A shift from participation in technology transfer to collaborative science.
- A creative proliferation of hybrid methods, mixing quantitative and qualitative analysis, and social and biological approaches.
- The experimental combination of geographic information systems (GIS), remote sensing, maps, models and participation.
- A serious effort to scale up, from farm to landscape level, participatory research and an exploration of regional and national applications (Landcare, adaptive co-management, and future-visioning).
- A willingness to place research questions and results in their social and historical context.
- Attempts to link specific practices and information to broader meaning, including interpretations of history and visions of the future, through scenarios and other integrative tools for negotiation and planning.

For the purpose of this discussion I have grouped these points under four themes: (1) ethics and standards; (2) collaborative science; (3) context; (4) scales and vision.

Ethics, standards and professional peers

The experiences and reflections of the contributors to this volume pose several questions about our options and responsibilities in the practice of participatory research. Perhaps the most significant development in this field in the last decade is the recognition that participatory research can be done well or not, and that it matters. Beyond the mere presence or absence of participatory methods, the character and quality of participatory research can affect the health and well-being of people and ecosystems. There can be serious social, economic and ecological consequences of participatory research done badly. Even a good participatory process does not guarantee successful production, conservation and empowerment outcomes. Just as with the choice of research designs within a more traditional set of options, the wrong approach – otherwise well implemented – can lead to problems.

The question of professional standards and accountability, while seemingly mundane, even petty, is crucial to improving the process and the results of participatory research. Most participatory field research in agriculture, forestry and conservation in the 1980s and early 1990s focused on rapid appraisals for

BOX 8.1 PARTICIPATORY RESEARCH APPROACHES ARE SOCIAL TECHNOLOGIES

Participatory research approaches should be treated with all the ethical concern and care that we already urge for GIS, mapping, mechanization, agrochemicals and other technologies that can benefit or threaten the livelihoods and landscapes of rural people.

research or development planning, and over time increasingly involved participatory surveys (quantitative, qualitative and combined) to characterize farmers, landscapes and agroecosystems, and to develop and evaluate new technologies. During the decade since the mid-1990s researchers have gained more experience with the design and management of on-site experiments or sampling and monitoring programmes in partnership with rural people. Many of these researchers have been careful to be less 'extractive', raise fewer expectations and ensure that benefits for poor people follow their involvement and investment in the participatory process. However, most of the documented cases of on-farm technology trials have involved farmers in controlled experiments designed by outside researchers.

Across all of these sub-fields, the publication of results and process has been complicated by two key differences: (1) contrasting research paradigms in rapid appraisal and more long-term experimental approaches; and (2) distinct styles and standards of publications in social process, agroecology and technology generation. Increasingly more collaborative trials have been designed and reported in the literature through such programmes as *Comité de Investigación Agrícola Local*, or Local Agricultural Research Committees (CIALs) (Braun's case study in this volume), mother–baby trials (Snapp's case study in this volume) and adaptive collaborative management (McDougall et al's case study in this volume). Prior efforts by the Institute for Development Studies and the International Institute for Environment and Development, followed by the Overseas Development Institute agricultural and forestry networks, the Sustainable Agriculture and Natural Resource Management Collaborative Research Project (SANREM), and the current Participatory Research and Gender Analysis (PRGA) programme have fostered exchanges among peer groups and networks of participatory researchers and extension workers. The literature has begun to reflect this, though publication venues continue to be dispersed, disparate and subscribe to distinct criteria for evidence and research design. This situation often requires researchers to juggle double and multiple standards of data collection, analysis and reporting (Chambers et al, 1989).

Very little has been published in the way of detailed documentation and analysis of locally initiated trials, experiments and surveys, with a few notable exceptions (Richards, 1985; Posey and Balee, 1989; Scoones and Thompson 1994). The combination of any sort of trial, experiment or survey with historical documentation and analysis is even less common (see Rhoades, 2001; Nazarea, 1999; Schmink, 1999; Flora, 2001 for some of the best examples). Most reporting of rural people's production and conservation science has been

limited to descriptions of existing and/or traditional practice as an accomplished fact. Within forest and wildlife management, rural people's knowledge has been increasingly recognized by outsiders, only to be cast as 'timeless and unconscious ecological wisdom' or as remnants of 'traditional' practice.

Does this mean that only a few researchers have addressed any of these points that seem so simple and based on common sense? On the contrary, thousands of field workers continue to conduct isolated, undocumented research within extension and development programmes in forestry, agriculture and conservation. Likewise, social, ecological and production researchers throughout the world often participate in community organization and institutional innovation to improve their research and attune it to local conditions. However, outside of a small network of participatory researchers neither group is likely to report even the fact itself, let alone the process.

The need to join research and development endeavours is particularly crucial in the rapidly growing number of wildlife management projects that address complex relationships between people and wildlife through separate programmes of biological research and public relations (local and international). Social research and management programmes in this context are often couched in terms of social engineering to achieve conservation objectives. The ecology embedded in local society and the cultural threads that run through the surrounding ecosystems are seldom documented in a collaborative research context for use in planning, technology design and management decisions in conservation projects. While the field is just now emerging, Janis Alcorn (1995), among others, has pioneered social and participatory research in conservation biology, based on local knowledge of wildlife, habitats and surrounding ecosystems.

Beyond the research and development dichotomy we face a series of institutional divides along social/biological, production/conservation and government/non-governmental organization (NGO) lines, which constitute substantial barriers to shared knowledge. The existing institutional structure encourages silence on work at the boundaries between research, development and participation by those who actually know the territory best. As long as the more integrative work is submerged it is also inaccessible to review, constructive criticism and progressive improvement through collective learning and innovation.

Alternatively, we can make the most of opportunities to link these cycles of research and development, social process and technology innovation, to stop spinning our wheels and get somewhere. The potential to link participatory research experience in agriculture and resource management to conservation research also constitutes a major opportunity. And finally, there is a practical need for carefully documented examples that demonstrate how the application of participatory approaches has made a positive contribution to poor people's lives, in order to convince doubting politicians and support those who encourage participation.

Some of our best data and insights are transmitted through stories, a professional oral tradition, and through the skills of our trades. The challenge

will be to distinguish significant stories from mere anecdotes (Rocheleau, 1991, 1998) and to combine them with a classification and description of possible field methods and data analysis tools. From these we need to build a coherent, larger body of shared knowledge and practice accessible (at least in part) to our various domains of science, practice and critique, including those of rural people.

From participatory technology transfer to collaborative science

A second and related change, echoed in this volume, involves a shift in focus as well as intent, from technology transfer to collaborative science, which encompasses a sea change in social relations and scientific practice. The first step is to move from extractive to interactive modes of information collection and use, but to effect real change it will be important to go beyond simply sharing existing information or joint collection of new data to deal with knowledge in the broader sense. Researchers will need to move from extractive to interactive modes of information gathering, which is treated by several authors in this volume.

It is crucial to move beyond information to a focus on knowledge and a respect for multiple approaches to knowing and learning, and to information storage, transmission and testing. This requires a careful re-evaluation and customized design of the full range of scientific practice, from framing questions to interpreting and applying results. This endeavour requires us to recognize that science lives in practice. We need to work in the borderlands between science and practice, research and development, experience and experiment, as epitomized by Stroud (case study in this volume), in previous works by Paul Richards (1985), and in on-going work by Rhoades (2001), Nazarea (1999), Flora (2001), Schmink (1999) and others.

The varieties of collaboration in field experiments

As already demonstrated by the CIAL, adaptive collaborative management, participatory action research (PAR), mother–baby trials and other experiences summarized in the text, there are many productive ways to arrange collaborative field research. The following list clusters the variety of collaborative experiences into six major categories that can be used to respond to a wide range of research questions, mandates and conditions:

- Researcher-designed and -managed trials, usually on-station or special plots. Land users are consulted and their problems are addressed, but their resources, management practices and evaluation are not part of the research design.
- Researcher-designed and -managed trials, on site, in local people's work and production sites, whether individual or shared space. Land users are consulted, their problems are addressed and they evaluate the results. There

BOX 8.2 WORKING ACROSS THE SPECTRUM

The challenge for the future is to cultivate the ability to work, as needed, across this spectrum, rather than cultivating a single specialized approach in any given institution. Alternatively we can develop inter-institutional collaboration to make available a breadth of expertise and a depth of capacity to address specific situations.

is little involvement of land users' management, since all labour and material inputs are planned and paid for by the research institution.

- Researcher-designed and user-managed trials, on-site. This is the same as the case above, with the difference that land users' resources and management are included in the trial, their evaluation and feedback are continuous, and land users' performance and judgement are part of the trial.
- Joint design and management of on-site technology and land use testing by researcher and land users. Local people and outside researcher(s) collaborate in the design of these broad experiments and confer on management decisions. Land users' management and decision-making are explicitly treated as experimental variables, their feedback and evaluation are high priorities in the research endeavour, and they consciously evaluate their own and researchers' decisions.
- Experiments designed and managed by land users, with outside researcher(s) consulting. Outside researcher(s) enter into on-going experiments as occasional consultants or regular collaborators, and document results and/or process. Researchers may or may not alter experimental design.
- Experiments designed and managed by land users, not necessarily under the usual scientific paradigm or formal experimental protocol. With permission, and perhaps in collaboration, outside researchers observe and document existing experiments and on-going innovation. Outsiders and land users also produce documents for local review, revision and use (Rocheleau, 1991).

The example illustrated assumes several types of institutions operating at different scales, engaged in shared activities, playing complementary roles at a single field site. The roles and capabilities of the various actors could also be integrated at a regional scale, rather than a single site. In either case the model links several types of institutions and activities in a broader process of research and action. The editors and contributors to this volume have advanced this agenda. Yet much work remains to be done to share and learn from our collective experience and to improve the quality of both process and results in participatory research, whether conducted by research, development, conservation, extension or multipurpose agencies.

Global and local 'positioning' systems

One of our major remaining frontiers lies in the continued cultivation of institutional and intellectual niches for these processes of learning across cultures as well as across disciplines and across research and development lines. There is a small but growing body of literature

that treats local science and practice as the latest expression of a continuing process of learning and discovery, and provides some basis for comparison and synthesis of experience across places and paradigms.

As we attempt to situate ourselves – and our science – in the field, we encounter a series of difficult larger questions involving both procedure and principle. There is a tendency to want to write down and to count everything that is seen and spoken and to test within one paradigm what is known and claimed by any group of people, anywhere. While professional scientists may find mutually intelligible and acceptable ways to explore and test knowledge with farmers and land users, there is no reason to assume that the process of verification and validation will always belong to one science. We should not expect that all 'ethno science' will be tested and judged on the basis of one set of criteria and processes from a single 'formal' science, or that 'timeless wisdom' will come from indigenous knowledge and all innovations will come from modern scientific invention.

The adage that 'all politics is local' can be applied to science as well: all science is local. What many of us have come to regard as *the* scientific method is perhaps better framed as *a* scientific method. What is arguably a very robust and successful model is not the only or always the best way to acquire, test and apply knowledge about the world. The challenge is to respect multiple ways of learning and knowing, and to get beyond the limitations of a single, dominant paradigm, without simply surrendering all standards or romanticizing any science that is not 'modern'. The point is to clearly state our assumptions and our criteria and to be willing to incorporate or at least to add on, to try out, or to learn from other systems of knowledge acquisition, storage, testing and application.

The work of Robert Chambers, Gordon Conway, Janice Jiggins, Robert Rhoades, and more recently Jacqueline Ashby and Louise Sperling has brought participatory research into the mainstream of agricultural research. They have brought farmers, their knowledge and their judgements into the formal research enterprise, from their neighbours' fields to community meetings to the research station. The work of Sieglinde Snapp (mother–baby structure of nested trials and observation, see Snapp et al, 2002) and the Promoting Local Innovation (PROLINNOVA) programme under the Global Forum on Agricultural Research (GFAR) have brought synergistic designs to combine the more freestyle experimentation by farmers with the more controlled and widely replicated experiments of research stations and researcher-led farm trials.

One crucial challenge at this point is to take the parallel, socially focused, study of existing farmer practices beyond strictly ethnographic or cultural studies or the descriptive classification of traditional or indigenous farming systems as candidates for 'development' and technology transfer. The fast pace of change affecting farmers and their lands requires that we study *with* and *for*, and not just *about* farmers. Even when we are studying about farmers and what they do, we need to involve them as co-researchers and not just as subjects of a scientific inquiry. This is particularly crucial when we begin to analyse the effects of changes in larger social and economic contexts on the everyday realities of rural farmers, their responses to change and their options for the future.

BOX 8.3 COLLABORATION BETWEEN INDIGENOUS AND FORMAL AGRICULTURAL EXPERIMENTATION

Paul Richards' (1989) challenge to the Consultative Group on International Agricultural Research (CGIAR) still stands: to bring the best of the dominant paradigm into conversation with the best of the rest of science, in order to maintain or improve food production and ecological management. His case studies of plant breeders in West Africa suggested that there was ample scope for collaboration between indigenous agricultural experimentation and the formal science of the CGIAR centres and the national agricultural research scientists. However, he also noted a few years later at the Farmer First meeting (Richards, 1989; Chambers et al, 1989) that the existence, utility and legitimacy of indigenous science did not imply a legion of farmers wearing white lab coats and consulting pocket calculators.

While he did argue that many farmers conduct experiments recognizable or intelligible to 'modern science', and that they could comprehend the logic and contribute to the process of formal trials, Richards became concerned about the development of a very narrow, culturally constrained concept of indigenous science assimilated into and completely contained within the dominant model. To counter this trend he advanced the idea of a performance-oriented approach to knowledge as more representative of many rural people's science, rather than a laboratory model. He provided an analogy of a concert violinist responding successfully on stage to a broken string, to explain the kind of art and science that a farmer might invoke to respond to serious drought.

While some criticized this example as frivolous, it is quite respectful of the fact that the farmer would not have the luxury of replication and repetition afforded by the laboratory. He or she would survive or not on the basis of integrating all past personal experience and knowledge about the experience of others into a single decision, under the specific and unique circumstances of the moment, in a particular place. This does not mean the abandonment of comparison and generalization, but rather the incorporation of both prior experience and generalized information derived from comparison of results in a variety of circumstances, into an assessment of the current circumstance and the best way forward, individually or collectively (Batterbury et al, 1997).

We could go further and say that this example of 'experience as experiment' represents carefully situated knowledge. It is based on a very keen awareness of the farmer's own situation, relative to the best sources of information about similar experience. That information may be drawn from the same place in the past, from experiences in other places in his or her own life, or across distant times and places, as related by formal science, stories or other culturally coded signs. That is, the sources as well as application of the information are evaluated with respect to the specific situation, relative to the full range of possible circumstances.

Pioneering work that is tangentially addressed in this volume include adaptive collaborative management approaches under development at the Center for International Forestry Research (CIFOR), human and ecological landscape innovations with SANREM and the Landcare movement facilitated by the International Centre for Research in Agroforestry (ICRAF) and others (Garrity et al, 2002; Rhoades, 2001). Much as the researchers that share their experiences in this volume have brought farmers into partnerships to study their farms, technologies and landscapes, we need to bring people as partners into the study of themselves, as actors, decision-makers, and knowledge-makers.

Context: sedentary science in place or a science situated in time and space

Initially the international agricultural centres of the CGIAR targeted specific grain and root crops and studied food production processes as something out of time and place, not in the context of rural people as food producers and consumers, or in the context of their places. The debates during the founding period of the CGIAR system focused on the relationship between rural farming people and agricultural production on the one hand and growing populations of urban and industrial consumers on the other. A distinct bias towards urban and industrial development gave way to a conscious decision to focus on the food supply at national and international levels rather than the food producers and consumers at the local level. It was that decision that led to a focus on the super-grains of the Green Revolution, the neglect of social and ecological context, and the failure to address smallholders in 'marginal' environments.

Carl Sauer, a geographer and lifelong student of rural culture, land use and landscape, urged the CGIAR founders to centre the research mission on the needs and knowledge of farmers. He advised them to incorporate the full range of species, products, sites and services in complex farming systems rather than increasing the yield of a few grain crops to provide an impoverished if plentiful diet of rice, wheat and a few other major grains to a growing urban population. He argued for nesting the mission of international agricultural research within a vision of the past and future that put rural peoples and their landscapes in the centre, rather than relegating them to serve the interests of urbanization and industrialization.

Recently we have seen a resurgence of interest in complex social and ecological systems, of landscapes and livelihoods, in place, which has broadened the research agenda of international agricultural centres to include farming systems, NRM research, and even studies of community, property, equity and governance. We also need to recognize that many people are mobile and that places are being re-configured in larger processes of industrialization and urbanization, whether in forests, established agricultural regions, or in rural fringe neighbourhoods of metropolitan areas (see Livelihoods Analysis in Conroy and Rangnekar's case study in this volume). The issue can no longer be cast as a choice between rural and urban populations or food producers versus consumers. Throughout the world, longstanding, established farming communities, and the ecologies they both create and inhabit, are locked in close encounters with highways, Free Trade Zone factories, and volatile land markets. They are being transformed by changing race, class and gender relations, and a re-definition of links between production, consumption, location, identity and ecology. Not only does context matter, researchers need to address rapid and complex shifts in the temporal, spatial and cultural context of field problems and their investigation.

So which context and categories make sense? Time or Space, Land or People? Should we study changes in places, in products, or in people's life circumstances? Based on the lessons of history in our own field, we need to study each of these elements in complex contexts to do an honest job of sustainable agriculture, conservation and natural resource management research. Sauer advocated a research approach that was not just a study of farming systems, but about and for farmers as people. Many participatory researchers have returned to this perspective.

To this they have added studying with people, about themselves, their places, their production systems and their possible futures, including their relationship to urbanization and industrialization.

Temporal context

Connecting what's past, what's present, what's next

Memories of history and visions of the future constitute one of the major frontiers of participatory research in sustainable agriculture and NRM. People's interpretation and analysis of history – short- and long-term – informs their sense about current trends and alternative trajectories into the future. These projections in time, both backward and forward, put current events and trends in context.

Individual life histories and community and environmental histories can help to better explain the complex origins of present conditions. Prior experience may also help to formulate coping strategies and solutions to new and recurring problems (Feldstein and Jiggins, 1994). Insight into historical context is valuable whether the topic of concern is drought, famine and famine response, the history of employment and migration related to deforestation, the changing gender division of land and labour with the introduction of new crops, or changes in land distribution related to new irrigation technologies.

Some practitioners of participatory rural appraisal (PRA), as well as land use researchers have used individual and community histories as well as archival information to make sense of trajectories of environmental and technological change and their relationship to social, economic and political change (Thomas-Slayter et al, 1995; Tiffen et al, 1993; Rocheleau, 1994; Slocum et al, 1995; Showers, 1995; Rhoades, 2001). There is ample scope to expand this kind of inquiry in participatory research on agriculture, biodiversity and resource management.

Spatial context

The rise of a keen interest in localities, regions, space and place has focused attention on spatial relationships in agricultural, resource management and conservation research. The creative combination of mapping-as-usual and participatory mapping in GIS can provide a valid vehicle and format for spatially organized social and ecological information, across scales, and can make them mutually intelligible through various formats of visualization. Janice Jiggins (pers comm, 2002) notes that Landsat images and other remote sensing images, including aerial photographs have been used for decades in participatory resource mapping and management. The images can be transposed into land use classifications and natural resource classifications in GIS formats. Regardless of formal 'literacy' many people are able to spot their own homes, fields, water points, and grazing and gathering areas in such images.

Jiggins summarizes several new developments that considerably extend the use of such images and allow for more dynamic analysis of current trends and alternative futures:

- Transposition of the GIS into Multi Agent Modelling software allows images to become the surface over which the agents interact. The consequences over sequential time periods can then be transposed back into GIS format, so that the consequences are apparent in a 'real' landscape.
- Development of the Multi Agent Modelling rules of behaviour and context boundaries is conducted together with those whose context/behaviour/rules are modelled. Rhodora Gonzalez is using these techniques with fisher communities, municipalities and mayors, in the shrimp fisheries/mangrove coasts in the Philippines.
- With the introduction of a 'gaming' element, the multi-agent programme represents the modelled landscape on the surface of wooden blocks. The 'actors' in the Multi Agent system can become real players in a simulation game, with family choices, assets, credit options, etc at their disposal. As the game progresses through sequential decision time periods, the blocks can be rearranged to show impacts on land use and natural resources, also on communities. The decisions made are taken to be the 'rules' which actually govern behaviour. The rules are then fed back into the Multi Agent system, and extrapolated over more seasons to reveal the consequences, and over larger areas.[1]

Jiggins acknowledges that 'this tool does not necessarily allow for the emergence of institutions and rules that might lead to other outcomes'. This model also does not allow for the biological dynamic presumably stimulated by the interactions and consequences simulated. It does allow a platform for dialogue to be constructed, that feeds a learning process that encourages 'emergence'. She concludes that: 'these techniques are fun, powerful and productive. The methods are fairly robust and appropriate for agriculture, biodiversity conservation and resource management.'

Beyond scaling up: crossing scales and envisioning futures

The processes described in several contributions to this volume reach beyond single scales and simple categories to link plot, household, community, region and nation with fields, farms, landscapes and regional ecosystems. What is implied in a number of the case studies is the need for information, in fact for very extensive and robust data sets to facilitate iterative analysis between local and larger systems. Moreover, the kind of data sets and the types of analyses could be specifically designed to better enable processes of interactive analysis, exploration and simulation for negotiation and planning. While the negotiation and planning processes may not be considered research, the nature of the research to inform and fuel such a process is necessarily different from research that is intended to produce a single, fixed technological result.

The need to address processes of analysis and negotiation within and between scales can be seen in the interactions between large and smallholder

farms or between commercial forest plantations and smallholder farmers and gatherers. What are the implications – for smallholders and landless people – of changes in largeholder and commercial systems? For example, the CIFOR forest plantation research team evaluates the social and ecological impact of timber and pulp plantation practices on various groups of people, beyond the direct participants in plantation production. Based on a variety of data collection methods, they analyse the effects on displaced users and residents, current employees, neighbours of timber and pulp plantations, and residents, producers, processors and resource managers living with the regional effects of changes in plantation location, markets and management.

Similar studies in agroforestry and agriculture could use local and regional technology and land use change scenarios to simulate the interactions of change at different scales and under different conditions. We could consider the likely effect on different kinds of farms, ecosystems or groups of people. For example, the introduction of a specific new cash crop into large-scale, commercial farms might result in widespread or selective migration and displacement as well as changes in land use/cover in place. To do justice to this question we would also need to follow individual people and families through history, across places and, in a virtual sense, into possible futures.

The latter could involve anything from stories and maps to quantitative and/or visual computer models and would utilize the imaginations as well as the experience of both professional scientists and people from the affected (or potentially affected) groups. For example CIFOR's use of scenarios in the Adaptive Collaborative Management Program could allow for more comprehensive analysis along these lines. There is also scope to incorporate oral histories of individual lives, households, and communities, including employment and migration, as well as oral histories of landscapes, ecosystems, production systems and markets. The extensive use of history as well as future visioning methodologies is illustrated by Robert Rhoades, Virginia Nazarea, Maricel Piniero, Cornelia Butler Flora, Galo Ramon Valarezo and others in the Ecuadorean Andes (Rhoades, 2001; Borrini-Feyerabend's case study in this volume). The application of this kind of multi-method participatory research at farm and landscape scale and its extrapolation to regional and national agricultural, forestry, conservation and land use planning is a major challenge and opportunity for participatory research in the international and national research centres.

Perhaps the single most necessary and intriguing innovation in this field is the design of research to produce robust and malleable data sets that can be used for simulation and negotiation by diverse groups in a democratic format, for environmental, social and production planning. The process and the results could apply within or across several categories and scales of organization: farm household, community, municipality, region and nation, as well as research and development agency, project, or landscape, watershed and ecosystem.

Participatory research in agriculture and resource management, as we have developed it in the academy and CGIAR system, has served two very distinct purposes: social facilitation of technology transfer and innovation; and social, economic and environmental dimensions of technology change. The latter has

BOX 8.4 SCENARIOS, BEYOND PREDICTION, FOR NEGOTIATION

Scenarios can be used as visual aids, in the literal sense, to picture a range of possible futures on the landscape, or in household production systems or regional ecosystems. We can also use them more broadly to facilitate alternative visions in a number of ways. We can use scenarios to help farmers to imagine and to decide how best to adapt to seemingly inevitable changes based on national and international political and market conditions or specific policies. However, the scenarios can also be used to explore the best policy options to support the desired or acceptable futures of one or more groups of people, or to reconcile the distinct visions of various groups within a mutually acceptable situation.

One potential use of scenarios is the ability to use these in negotiations about possible futures, to envision the cross-cutting effects of changes in production systems, livelihoods, landscapes and ecosystems. These also hold real potential to explore the effects of changes across scales, such as the community-level impact of changes in practice on farms, the landscape and market impacts of changes in largeholder cropping systems, or the distinct social and ecological impacts of international trade policies in countless rural localities across broad regions.

included a focus on the unevenly distributed and distinct consequences of technology and land use change among different groups of people and on distinct elements of surrounding ecosystems. A subset of participatory researchers has addressed social relations of power based on gender, race, class, nationality and other dimensions of identity and difference as forces that shape production systems and ecologies, as well as their social consequences. There is still far more scope to broaden our treatment of culture and politics, to better link these domains to our studies of the biophysical and production dimensions of human ecologies, and to produce results in a format appropriate for planning and negotiations.

Whether we work within the technology transfer paradigm or the more explicitly political and critical perspectives, we need to further explore what it means to work with and *for* people, rather than just study and write *about* them, or dream up new technologies and new rules for them. Maps, numbers, stories and pictures from field experience can recount our empirical observations, analyses and evaluations, and enrich our reflections on process. When creatively combined in simulations and scenarios these multimedia results can mediate encounters between different sciences and enable discussions among distinct groups, including researchers, with interests at stake in production, conservation and resource management decisions.

Conclusion

The experiences, analyses and reflections in this volume show how far we have come since the beginnings of participatory approaches to research in agriculture, resource management and rural livelihoods. The case study and

summary chapters provide a comprehensive overview of the state of the art, with an emphasis on current best practice and on-going innovations to mix scientific rigour with effective and equitable participation. The frontiers of innovation described in some chapters as well as the gaps in coverage within the volume illuminate the way forward in this expanding field. The future lies in a continuation of the best work already in progress, as well as careful and concerted efforts to address five key points: better understanding of people's own short- and long-term goals and their visions of the future; data sets and techniques for use in negotiations and planning processes to define and choose among possible futures; development of practices that allow scientists to work with people to incorporate multiple perspectives into design of production and resource management policy and practice; analytical and process innovations to allow for democratic negotiations and collaboration across scales, from individual to international contexts; and finally, the most neglected as well as the most critical point, to work creatively at the interface between rural land use and livelihood changes and processes of urbanization and industrialization. To realize this vision of participation we may need to expand from a focus on the role of various people in research to a broader focus on the role of research in rural people's lives, and in socially just and viable human ecologies.

Note

1 Jiggins cites Stanislas Boissau sboissau@fpt.vn or sboissau@hotmail.com as a contact on this point. She notes that he is working with these tools in Vietnam.

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Annexe 1: Summaries of Case Studies

Table A.1 *The ecosystem and natural resource focus of the case studies*

Case	*Author*	*Ecosystem/Natural resources*								
		Biodiversity	Water	Wetlands	Grazing lands	Hillsides and highlands	Soil	Woodlands	Watersheds	Fish
1	Stroud		■	■	■	■	■	■		
2	McDougall et al	■						■		
3	Garrity	■	■			■	■	■	■	
4	Braun	■				■	■			
5	Tutwiler		■				■			
6	Jarvis & Klemick	■								
7	Gurung	■				■				
8	Peters					■	■			
9	Brinn				■					
10	Heong & Escalada									
11	Nelson	■				■				
12	Pound					■				
13	Borrini-Feyerabend	■		■						
14	Conroy & Rangnekar		■		■					
15	Dey & Prein		■	■			■			■
16	van Koppen		■							
17	Vincent and Khanal		■							
18	Schreier et al	■			■	■	■	■	■	
19	Snapp	■					■			
20	Sutherland		■				■		■	
21	Vaughan and Shamudzarira						■			
22	Vernooy and Espinoza		■			■	■	■	■	
23	Williams		■				■		■	

Table A.2 *Dimensions of participatory natural resource management highlighted in the case studies*

Case	*Author*	Gender and equity	Institutional innovations	Stakeholder partnerships	Livelihoods and poverty alleviation	Assets and entitlements	Legal frameworks	Policy	Agroecosystem health	Technological innovations	Collective action	Resource monitoring	Social learning	Information innovations	Collaborative planning	Collaborative management	Experimentation by farmers	Negotiation and conflict resolution
1	Stroud	■	■	■				■	■	■	■		■		■		■	
2	McDougall et al	■	■	■							■	■	■		■	■		■
3	Garrity		■	■				■	■	■	■				■		■	
4	Braun	■	■	■	■					■	■		■		■		■	
5	Tutwiler			■					■			■					■	
6	Jarvis & Klemick	■	■	■											■			
7	Gurung	■	■	■				■		■	■				■	■		
8	Peters	■		■	■				■	■					■		■	
9	Brinn	■		■						■		■			■	■		■
10	Heong & Escalada			■					■	■			■	■			■	
11	Nelson	■		■					■	■			■				■	
12	Pound	■	■	■	■			■	■	■	■		■		■	■		
13	Borrini-Feyerabend	■		■	■	■	■	■			■		■		■	■	■	■
14	Conroy & Rangnekar	■		■	■					■	■				■	■		
15	Dey & Prein	■	■	■	■				■	■		■					■	
16	van Koppen	■	■	■	■	■	■	■										
17	Vincent and Khanal	■		■			■	■		■	■		■		■	■		■
18	Schreier et al	■		■								■	■	■				
19	Snapp	■	■	■						■			■				■	
20	Sutherland	■		■	■					■			■		■			
21	Vaughan and Shamudzarira	■		■	■				■	■			■	■	■		■	
22	Vernooy and Espinoza	■	■	■	■			■			■	■	■		■	■	■	■
23	Williams	■		■										■	■	■		■

1 Participatory Agroecosystem Management – an approach used by benchmark location research teams in the African Highlands Initiative Eco-regional Programme

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Background

The AHI aims to help improve land productivity and preserve the natural resource base by developing improved policies and technologies with farmers. Through the Participatory Agroecosystem Management (PAM) approach, synonymous with integrated natural resource management (INRM), the AHI involves women and other stakeholders in maintaining agroecosystem health through collective learning.

The PAM approach calls for major shifts in attitudes and ways of working – from closed to open, from individuals to groups, from collecting to sharing information, from verbal to visual communication and from 'researcher-to-village' to 'village-to-village' information flow. Younger scientists have been particularly interested in this approach. The AHI has embarked upon a capacity-building programme that includes training at the regional level with follow-up mentoring at national research sites.

Approach

The PAM approach is built on four cornerstones:

1 an agroecosystem focus that includes biophysical, social, economic and policy dimensions;
2 multi-partner and multidisciplinary teamwork;
3 participatory methods; and
4 integrated community action plans that emphasize learning by doing.

The first stage of the PAM process is diagnosis and it is critical for building relationships with farmers. The aims of the diagnosis are to:

- View issues from a historical perspective and thus gain a better understanding of the driving forces behind change.
- Develop a better understanding of traditional knowledge and improve links between different sources of knowledge.
- Determine the physical, ecological, social and economic variations in a region, using gender analysis techniques, resource endowment mapping and spatial analysis.
- Understand external factors, particularly public policy and services from a local as well as national perspective, that influence resource management.

The diagnosis phase has various outputs. Secondary information, including maps, is collected and analysed. Farmers and researchers jointly identify research issues and cause–effect scenarios. Other institutional partners are identified and their perceptions are taken into account. Declines in land productivity are described and the major contributing factors are identified according to wealth group. Researchers gain a grasp of the interactions between policy, gender aspects, market forces and other factors. They also come to understand farmers' priorities and their perceptions of productivity declines and the principal production constraints.

The AHI, along with other research initiatives operating in the region, has found that researchers sometimes have difficulty in accepting and learning participatory methods. Older researchers tend to feel uncomfortable with the new style of making decisions and validity of results for scientific publications, while younger ones lack confidence. Institutional support for participatory approaches is often limited. Scientists may therefore have little motivation to adopt these approaches, particularly when colleagues who are unfamiliar with participatory research evaluate them. Largely because of these reasons, after the participatory diagnosis AHI researchers initially reverted to their original habits of controlling the research process, ignoring differences among farmers and working on isolated components of the production system. At that point, the AHI provided further in-depth training in participatory approach stages, followed, where possible, by mentoring and learning by doing. Two regional research fellows (ICRAF and PRGA-CIAT) have developed a monitoring and evaluation (M&E) process to help research personnel and teams evaluate their progress in using participatory research methods. The AHI research group collectively decided to organize the research on a geographic basis to ensure an integrated approach, to work in multidisciplinary teams to get the necessary inputs from a wider range of specialists and to use various participatory techniques such as resource flow maps, 'niche analysis' and farmer research group priority and agenda setting for orienting the research agenda to farmers' varying needs and resources. Niches are areas in the landscape that can be improved, or provide opportunities for further intensification, and can be jointly identified and discussed by the different social and economic groups. The research teams also consciously worked with and strengthened farmer groups, as community representatives for the technology assessment and selection process. When recommended by these representatives, the technologies are more widely spread or shared by the groups.

So far, farmers have been most interested in increasing their returns to land and labour, given they have very small, intensively farmed pieces of land. Assuming that various interventions will do this, researchers are interested in monitoring whether or not it will increase farmers' level of investment to improve or maintain soil fertility and arrest soil erosion or whether increased return will be used for other necessities.

Reflections

The four main tools used by AHI have both advantages and disadvantages. Resource flow maps were found to be of multiple use and a good planning tool. They involved farmers having varying levels of resources and helped researchers understand farmers' indigenous technical knowledge and classification systems. However, analysis was not easy and variation was difficult to handle.

Resource endowment ranking helped researchers appreciate differences and incorporate them into a strategy. Initially, the tool was not used in a way that could capture gender differences. In some cases, results were not always used and integrated into the research programme, and analyses tended to be superficial. Technical scientists, who are not yet used to using these types of tools, need a deeper understanding of social and economic issues. The tool has been useful in raising awareness of these issues and in some cases has made a major difference in research approaches and technologies.

Using farmer research groups enables communication with a greater number of farmers than does working with individuals, as practised in the past. Also, farmers can better impose their own organization and decision-making. On the other hand, researchers do not always know 'who is who' among collaborating farmers and tend to have little knowledge of indigenous groups and their dynamics. A subsequent study is planned to understand group dynamics so as to provide better guidelines to novice researchers.

The PAM approach improves understanding of the agroecosystem and farmer-researcher links. It ensures a greater involvement of farmers in the research process. It was found that initially researchers lacked capacity for and acceptance of the approach and they found it difficult to work in an integrated fashion in teams. This is now changing. The farmer-led experimentation aspects pose the next greatest challenge.

In participatory research, farmers and other actors play significant roles at all stages in the process – identifying and prioritizing research topics; planning, implementing, monitoring and assessing activities; and disseminating research results. Using various tools, the programme has formed a research agenda that is squarely based on issues selected and prioritized by farmers. The AHI expects that the PAM approach will facilitate technology adoption, empower farmers to share in decision-making, improve their problem-solving capacity and build local knowledge, skills and institutions.

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2 Participatory action research on adaptive collaborative management of community forests: A multi-country model

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Acknowledgements

Unfortunately limited space and the involvement of multiple countries prohibits naming the collaborators individually. We therefore extend grateful collective recognition to the many government, research, NGO, and local community partners in Bolivia, Brazil, Cameroon, Ghana, Indonesia, Kyrgyzstan, Malawi, Nepal, the Philippines, and Zimbabwe. This research project was made possible through the generous support of the Asian Development Bank, the European Union, DFID, IDRC, WRI and CIFOR.

Background

In response to a community forestry environment that is complex and rapidly changing, CIFOR began a multi-country research project in 2000, which aims to enhance forest management decision-making at the local level. This research project, 'Adaptive and Collaborative Management of Community Forests' (ACM), explores the potential role of *collaboration* and *social learning* in forest management, including the role of criteria and indicators (C&I) as a tool within that process. Research hypotheses include that self- or collaborative monitoring systems can support communities in deepening their knowledge about local systems and impacts of management strategies, as well as creating and focusing dialogue between diverse stakeholders. The underlying assumption is that these changes can (in some conditions) support equity, effectiveness and adaptiveness in community forestry decision-making.

The objective of the current research at the meta level is to generate insights into three questions. Does *collaboration* among forest stakeholders, enhanced by conscious and deliberate *social learning* processes in forest management, lead both to improved human well-being and to the maintenance of forest cover and diversity? If this is so, under what conditions does it occur? And, what are the key strategies, approaches and tools to enable these processes? These research questions are rooted in the assumption that the challenge of incorporating multiple interests at multiple scales into participatory interventions has not yet been successfully met in NRM.

Approach

The current ACM research is rooted in a participatory action research (PAR) approach. In most communities involved, diverse local people and other relevant stakeholders jointly developed a set of agreed and easily understood C&I. The

process provided an opportunity for communication and learning within and across the stakeholder groups, especially with regard to visions and goals. The C&I set also provided a framework for later monitoring and assessing of key factors and their direction of change. This monitoring process creates the opportunity to feed information and learning back into the community forest management system. It thus serves to guide future action, helping to increase the sustainability of the community's forest resources. It was initially the researchers who offered and provided the framework for the social learning process; since that time local users have begun to adapt and apply these processes themselves. The ultimate goal is to completely transfer these, including the necessary facilitation skills.

Community forestry systems are complex and dynamic settings with multiple stakeholders, overlapping and differing interests, capabilities, and a myriad of challenging livelihood activities and processes. In some countries, such as those in Zimbabwe, the action research focus on collaboration has included power relations and negotiations *between* local peoples and other stakeholders. In other sites, such as Nepal, the focus has been primarily on stakeholder relations and equity *within* the local forest user groups (FUGs). Researchers there have tried to understand the stakeholder diversity within the FUG – based on *overlapping* categories including gender, caste, ethnicity, wealth and geography – in terms of issues of equity, power and access to resources and decision-making. The short-term outcomes of the self-monitoring processes and follow-up actions appear to be contributing to positive change in this area. In follow-up to the monitoring workshops, for example, some of the forest user groups are shifting their committee-based decision-making processes (which were generally dominated by the elite) towards hamlet and interest group-based processes, including building mechanisms for feedback to the committee. Especially given the linkages between hamlets, ethnicity and wealth in some of the FUGs, these changes have the potential to help address some long-standing local equity issues.

A PAR methodology in isolation would present challenges in terms of producing generalizable results (a CIFOR mandate); thus, to enable generalizability, the PAR is embedded in a larger multi-site framework of scientific analysis. Specifically, in all research sites, researchers have laid the foundations for the comparative research by conducting a series of background studies elaborating stakeholder relations, historical, biophysical and socioeconomic contexts and initial levels of adaptiveness and collaboration. The studies took a consultative form of participation, but allowed researchers the time to build relations and the groundwork with local stakeholders for the main PAR phase of the research. Additionally, processes and learning in all sites are regularly recorded by researchers in a framework and format that is comparable across countries and sites. Other methods are also being used to triangulate the results across sites, countries and regions, key among these being the use of multivariate analysis across all sites and the analysis of the outcomes of the participatory modelling in Zimbabwe, Indonesia and Cameroon. Whereas the multivariate analysis is expected to provide a quantified picture of key drivers

for the success or failure of adaptive collaborative management processes, the analysis of the simulation models (including the discussion with local partners of the emergent scenarios) is expected to provide insights into the causality of failure or success arising out of the structure and behaviour of these processes. Ultimately, these elements of the larger framework for analysis will enable greater depth of understanding within each site and highlight findings that emerge across varying community forestry conditions.

Reflections

This is an ambitious project with high local and research expectations, and as such it faces some significant challenges. At the meta level, two of the most critical challenges are those of working across so many diverse sites and countries, compounded by the limitation of a very tight three-year time frame. Key challenges to working at the community level include: complex and pervasive hierarchical local stakeholder relations; low social capital; unstable political climates; and geographical isolation. However, key strengths include that, on the whole, community stakeholders, district and national partners, and field researchers have a high level of commitment to exploring the process and seeking local benefits – both social and environmental. The PAR and collaborative approach to the research incurs time costs to researchers but is enabling lessons to be relatively rapidly shared and incorporated to the research as it progresses.

Past CIFOR C&I research fulfilled its intention of generating useful and valid insights for some national, regional and global stakeholders through traditional social and biophysical research. In that research context, relatively few benefits were intended to accrue, nor did accrue directly to the communities where the research took place. The current research is focused on community-level processes and makes a conscious effort to bring good science into a coherent, integrated framework with local learning and benefits. The outcomes are not yet assured – the approach is new and certainly bears some risk. But the indications so far are that, in the context of these issues at least, a synergy exists between functional and empowering participation that will be well worth the costs.

Reference

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3 The farmer-driven Landcare Movement: An institutional innovation with implications for extension and research

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Background

Watershed degradation does not have to be an inevitable consequence of using sloping land for agriculture. Smallholders can farm and manage natural forest resources in a manner that is both productive and resource conserving. Awareness of this fact has focused attention on evolving approaches to watershed resource management that are demand-driven and community-based. In such approaches, those who occupy the land actively participate in managing and sustainably using their local watershed resources for multiple purposes. Watershed farming systems are enormously variable, and simple recipes do not solve their problems. Often, the issues need to be tackled at a larger scale than the individual household, cooperatively at the community level.

In Asia, the role of local organizations in the management of forest and other common natural resources has received much attention. Joint forest management in India, forest users' groups in Nepal, and community-based forest management in the Philippines are notable examples. Similarly, local organizations may apply knowledge to solve problems in agriculture through improved land husbandry. In countries where power and fiscal responsibility are being decentralized, democracy is reaching the village level, and rural people are acquiring new leadership skills. These skills provide a basis for developing farmer-led organizations that can develop practical ways of achieving a more sustainable agriculture.

Approach

Landcare is a particularly noteworthy model for strengthening local initiatives to reverse land degradation. Through this approach, local communities organize efforts to solve agricultural and environmental problems in partnership with public institutions. Landcare groups are voluntary and self-governing. They engage local communities in a search for innovations that are suited to the diverse and complex environments of smallholder farming. They mobilize communities to address problems of water quality, forest and biodiversity protection, soil conservation and others at the landscape level.

The Landcare movement in the Philippines began in Claveria, Mindanao, in 1996. Now, about 200 village-based Landcare groups are working in Claveria and other municipalities in northern, central, southern and eastern Mindanao, with a membership of several thousand households. The groups have established more than 1500 conservation farms and more than 200 community and household nurseries that have produced hundreds of thousands of fruit and timber tree seedlings, all with local resources.

Conservation farming based on contour buffer strips has become popular as a result of collaboration between ICRAF and Landcare groups in the Philippines. With a view to diversifying farm enterprises, the groups have also established nurseries for new species of fruit and timber trees. At the community level, Landcare has proved itself a powerful force for creating initiatives that protect the whole watershed. Because the group members determine agendas, they have addressed a wide range of issues, including beef and dairy farming, cut-flower production and vegetable crop farming.

Landcare provides important opportunities for improving how farmer participatory research is done. Landcare groups can manage such research, enabling them to diversify their experimentation, ensuring a better understanding of the performance and recommendation domains of technical innovations and offering more effective and less expensive alternatives to technology-transfer approaches. The farmer field school approach for conservation farming is currently being explored as a means of initiating Landcare groups.

These groups exhibit some similar characteristics to the farmer field schools made popular in integrated pest management (IPM). Landcare groups, however, are more formalized and aim at a broader range of land degradation and sustainability issues. Some distinguishing features of Landcare groups are that:

- They develop their own agenda and tackle the range of sustainability issues considered important to the group.
- They tend to be based on neighbourhoods or small watersheds.
- The impetus for formation comes from the community, although explicit support from outside may be obtained.
- The momentum and ownership of the group's program is with the community.

Reflections

The sustainability of the Landcare movement gives rise to three significant concerns. First, given its growing popularity, the movement runs the risk of 'projectizing', that is, attracting the support of projects that do not understand the concept, and that provide funds in a top-down, target-driven mode, defeating the whole basis of a farmer-led movement. Second is the issue of long-term sustainability. Networking and the stimulation from outside contacts are considered to be crucial for long-term success. This can be achieved through Landcare federations, as has evolved locally in Claveria, and through provincial and national federations, which are currently being explored in the Philippines. Third, group leadership is a time-consuming and exhausting task, particularly when undertaken on a voluntary basis. Landcare is still young in both the Philippines and Australia but leadership 'burnout' has already raised concerns.

The ICRAF analysis indicates some steps for further releasing the power of the Landcare concept. Public institutions and NGOs need to facilitate group formation and networking among groups, enabling them to grow, developing their managerial capabilities and enhancing their ability to capture new

information from outside local communities. Such organizations can also provide leadership training to farmer-leaders, thus helping to ensure the sustainability of the Landcare groups. External financial assistance is also needed with an emphasis on the use of trust funds that enable farmer groups to compete for small grants to implement their own local Landcare projects. This approach has been remarkably successful in the Australian Landcare movement.

Experience in the Philippines and Australia suggests that Landcare may provide an effective means of generating and sharing technical information, spreading the adoption of new practices, enhancing research and fostering farm and watershed planning processes. In the southern Philippines, Landcare groups are forming partnerships with local governments and technical research and extension agencies. Local governments are actively assisting the movement through financial and political support. This has attracted the attention of the national government, resulting in a national strategy of watershed management based on Landcare that will spread its principles and experiences to other parts of the Philippines.

4 The Farmer Research Group (CIAL) as a community-based natural resource management organization

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Background

A Comité de Investigación Agrícola Local (CIAL) or Local Agricultural Research Committee is a research service belonging to, and managed by, a rural community. The research group is made up of volunteer farmers, chosen for their aptitude in experimentation. The CIAL links farmer-researchers with formal research systems, increasing local capacity to exert demand on the formal system and to access potentially useful skills, information and research products.

A CIAT team developed the CIAL concept, which was first tested in Colombia. Five CIALs were formed in Cauca, Colombia, in 1990 and NGOs began their involvment in 1991. During 1995–1996, the CIAL project spread to other countries, involving rural communities, GOs, NGOs and universities. At present, over 250 CIALs are active in eight Latin American countries.

Experience has shown that the CIAL can benefit the wider community as well as individual CIAL members. Mature CIALs often launch small businesses, selling improved seed or other products or services. Many take on a broader role in the community, seeking access to credit and training, preparing and submitting proposals and acting as ambassadors in relationships with research and development (R&D) actors.

Approach

The main CIAL principles are:

- Building on experience and learning-by-doing to generate knowledge.
- Mutual respect and accountability and shared decision-making as the foundations of the relationship between the CIAL, the community and external actors.
- Risk shared by partners in the research process.
- Systematic comparison of alternatives for improving farming and natural resource management.
- Research products are public goods.

Each CIAL has at least four elected members (many expand beyond this) and a facilitator. The facilitator may be a trained agronomist from a supportive formal research centre or university, an extension service or an NGO, or a trained farmer, who has served on a CIAL. The facilitator plays a key role in developing the CIAL's competence in the research process, and provides feedback on farmers' priorities and research results to formal research and extension services.

The CIAL process cycles through the following stages:

- Training of facilitators and site selection by committed research organizations, extension services, NGOs, or community-based organizations.
- Mobilization though an initial community meeting and regular interaction between the CIAL and the community as the research process unfolds.
- Election, when the community chooses farmer researchers who are interested in experimenting and willing to provide a service to the community.
- Diagnosis, when the topic or question for experimentation is determined through a group process in an open community meeting.
- Planning, based on information from various sources and on a clear objective for each experiment.
- Experimentation, when the CIAL implements the planned experiment.
- Evaluation, when the CIAL meets with the facilitator to evaluate collected data, draw conclusions and present results to the community.
- Analysis, in which the question, 'What have we learned?' is especially important, ensuring learning from both the process and the results.
- Feedback, for which regular, open meetings are held in the community where the CIAL presents results and expenditures. This ensures that their

research products become public goods. The facilitator is responsible for feedback to the formal research system.
- Regional or national forums where CIALs can exchange information and results are held annually.

Reflections

Ecological interactions and local knowledge gaps are not always considered explicitly in the CIAL process, and no formal mechanism is incorporated to develop an understanding of the agroecological principles and interactions that may underlie the issues being researched. Such knowledge may be essential for the design of meaningful experiments. Methods for analysing the scale of action needed for successful intervention are not sufficiently developed. This can be limiting if the research issues are related to pests, diseases and many NRM situations. Relationships with the community depend strongly on the quality of social capital. In areas where trust is low and association along non-kinship lines is rare, forming and/or sustaining CIALs may be difficult.

However, many advantages accrue. Farmers systematically evaluate technological options such that minimal risk is incurred. They learn basic research principles that provide for developing a common language and two-way communication with research and extension professionals. In some conflict-ridden communities CIALs have provided an entry point for building social capital. Although community-based, the radius of CIAL influence can be increased by forming networks of experimenting communities and creating second-order associations.

A recent impact assessment of the CIAL movement revealed that:

- Many CIALs provide an effective research service to their communities; they report their results publicly and cite widespread testing of these by local farmers.
- In some communities where farmers are applying CIAL recommendations, yields of staple crops have almost doubled. Food security can be greatly improved in CIAL communities. The poorest benefit the most from the increased availability of food during times of scarcity.
- More farmers in CIAL communities are experimenting with soil conservation practices and conduct experiments with a far greater diversity of varieties and crops than in communities without CIALs.
- Innovations identified by the CIALs reach local farmers more rapidly than others and also spread to other communities both with and without CIALs.
- CIALs report positive changes in the attitudes of the R&D professionals working with them.
- Women and marginalized social groups gain social status and respect in their communities as a result of belonging to a CIAL.

The effect of the CIALs on their communities and on formal research services transcends dollars and cents. Nevertheless, CIAT estimates the return on the investment made in developing and applying the CIAL approach at 78 per cent.

The CIAL movement is still young, and its future evolution is uncertain. Properly managed, CIALs can deliver substantial growth and equity benefits. However, their effects on the sustainability of production are less predictable. By allowing adaptive research to be devolved to the farming community, CIALs cut the costs of formal research while increasing its impact.

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5 Long-term natural resource management research in intensive production systems: ICARDA's experience in Egypt

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Background

Since 1994, ICARDA scientists have worked with colleagues in Egyptian research institutions to design and implement a programme of resource management research in key agricultural environments in the country. Researchers carried out literature reviews, rapid appraisals, formal farm surveys and planning before establishing long-term trials at four irrigated sites (one each in the Delta and Middle Egypt, and two in the newly reclaimed desert lands, known as New Lands), and at one rainfed site (near Rafah, North Sinai). Each site has three major research problems. Water (both quality and quantity) is the paramount concern at all sites. Maintaining soil fertility is essential in the old lands of the Delta and Middle Egypt but building up soil fertility is essential for sustained production in the New Lands and rainfed areas. A third issue that the trials address is the choice of sustainable crop sequences for rotational systems. These on-station trials are designed for a minimum of 12 years and are entirely managed by researchers.

Approach

At each site, the long-term trial is integrated with participatory research in surrounding villages and on individual farms. Like the on-station trials, the participatory work, called long-term monitoring (LTM), is intended to have an extended life. Its purpose is to establish a continuing dialogue with farmers concerning their farming practices, management decisions and the related conditions of their natural resource base. The dialogue centres on long- and short-term farmer objectives, their perceptions of the qualitative aspects of the resource base and their technical knowledge of resource management. The

participatory research also involves a longitudinal study of farmers' management of natural resources in response to changing environmental, economic and social circumstances.

As part of their exchange with farmers, researchers are also monitoring changes in the status of natural resources on representative farms through periodic biophysical measurements. Researchers are combining farmer participation with biophysical measurements to provide information about the interaction between natural resource conditions and farmers' management practices. Once institutionalized, the LTM system will provide a mechanism by which researchers and farmers can exchange knowledge on improved management practices and their effects on natural resource health. A multidisciplinary research team is conducting the monitoring at each location. Each team includes members of local farmer associations, local extension staff, researchers from various institutes and participating farmers.

These farmers were selected according to a carefully prepared list of environmental criteria relevant to each location, including hydrological and soil factors and cropping patterns. Socioeconomic factors such as farm size and type, natural resource endowment, social background, level of education and household composition were given equal weight. Farmers were selected at random from lists prepared for each site. They received a thorough explanation of the purpose and activities of the LTM system and were asked if they would like to participate. They were also informed about the amount of time and information required and the need for a long-term commitment. The 85 farmers who agreed to participate in developing the system represent the whole range of social, economic and natural resource conditions at each study location. Without altering the integrity of the research design, the programme made provisions for new participants to join.

For each participating farmer, information on socioeconomic factors, farm management decisions and perceptions of resource conditions and productivity performance are being collected every six months, after the main winter and summer cropping seasons. Natural resource conditions are measured on different schedules according to scientific requirements. In addition to basic information about crop sequences and rotations, management practices, input use, productivity and economic returns, data are collected on labour use and sources, household composition, income sources and household investment patterns. This information will explain why farmers make the decisions they do and thus should help develop profitable and sustainable production practices.

A review workshop is held once a year to bring together the research teams, including farmer members, for discussion of results and trends in the information collected.

Reflections

Through this work, Egyptian farmers, researchers and extension workers are building and testing a new holistic approach to studying agricultural production, including socioeconomic and biophysical factors and their effects on the natural resource base over time.

6 Management of plant genetic resources in agroecosystems: *in situ* conservation on-farm

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Acknowledgements

Participating farmers, local and national institutes and organizations and partners of Nepal, Vietnam, Burkina Faso, Ethiopia, Hungary Mexico, Morocco, Nepal, Peru and Turkey, participating international institutes, and SDC, NEDA, BMZ, IDRC, FAO, JICA, GEF.

Background

In 1995, national partners in Burkina Faso, Ethiopia, Hungary, Mexico, Morocco, Nepal, Peru, Turkey and Vietnam together with IPGRI initiated a global project, 'Strengthening the scientific basis of *in situ* conservation of agricultural biodiversity'. The purpose is to strengthen the scientific basis, institutional linkages and policies that support the farmers' role in conservation and use of crop genetic diversity. Projects are implemented by linking existing national plant genetic resource (PGR) programmes with other partners such as universities, national institutes, agricultural extension workers, NGOs, community-based organizations (CBOs) and farmers. An expected result is the creation of a channel for input from these sources into national agricultural research agendas.

A cross-section of case studies includes 'Creating a national framework' (Nepal), 'Understanding farmer preferences' (Morocco), 'Gendered participation in *in situ* conservation' (Mexico) and 'Participatory methods to add value to PGRs' (Nepal).

Approach

On-farm conservation of traditional crops is carried out by farming communities for farming communities. The primary task for those concerned with conservation and with the maintenance of traditional crop diversity *in situ* is to understand when, where and how this will happen, who will maintain the material and how those maintaining the material can benefit. Four areas of investigation were identified that set the necessary scientific agenda needed to support farmers and local communities in *in situ* conservation on farm:

1 What is the extent and distribution of the genetic diversity maintained by farmers over space and over time?
2 What are the processes used to maintain the genetic diversity on-farm?
3 Who maintains genetic diversity within farming communities (men, women, young, old, rich, poor, certain ethnic groups)?

4 What factors (market, non-market, social, environmental) influence farmer decisions on maintaining traditional varieties?

Formulating and answering these questions required a participatory approach at all stages of the process. Participatory methods, such as key informant interview, focus group discussions, spatial mapping and matrix ranking served to include farmers' knowledge on local social-cultural, economic and agroecological conditions, their crop and seed management practices and the characteristics and origins of their varieties into project data. Information from participatory research is complemented by household, market and seed system surveys, field trials on-station and on-farm and genetic diversity measurements in the field and in laboratories by economists, sociologists, ethnobotanists, agronomists, ecologists and populations geneticists, often in collaboration with farmers and extension workers.

A preliminary 'exploratory approach' (not based on preliminary hypotheses) was used first, because it did not presuppose or assume the different categories or reasons underlying farmers' knowledge and it enables farmers to employ their own values and standards of measurement. Hypothesis testing followed, to answer specific questions that would support the scientific basis of on-farm conservation. The different sources and levels of information include the variety, crop, parcel or plot, household, village or community, landscape or region. Information is collected, disaggregated by gender and in some cases by wealth categories and ethnic groups. Moreover, information from one aspect may be useful to answer more than one question. Understanding the relationship between what farmers recognize as or name a variety and the genetic distinctiveness of this unit is key to understanding the amount and distribution of crop genetic diversity managed by farmers. The information collected in only one year at the level of the household or farmer's plot may not be the appropriate scale for analysis or for agrobiodiversity conservation. Thus, information is analysed at different spatial and temporal scales.

Implementing the project involved developing multi-institutional, multidisciplinary collaboration at international, national and local levels. This included ensuring that trained national male and female personnel were available to carry out the work at central and local levels, and that the teams promoted equity at all project levels. In addition, because the project is largely community-based, time was devoted to building or creating rapport with the farmers in whose fields much of the work is being undertaken, and whose experiences and knowledge provide a central component of the project. Key has been separate male and female farmer cross-site visits for promoting exchange of information by gender.

Linking research to development is central to the project. A range of activities in the different countries ensures that the project benefits national conservation programmes, partner institutions and the participating farmers. The information collected is used to mainstream the use of local crop genetic resources into the agricultural development arena. In contrast to research and analysis methodologies that have widespread application, actual interventions to include management of crop genetic diversity in agricultural development

activities are found to be site-specific. The project is creating a portfolio of options, based on many case studies from participating countries, to which national programmes may refer for ideas for increasing the benefits to farmers from local crop diversity.

Reflections

The method has some disadvantages. Time is needed to formulate proper hypotheses to avoid unnecessary data collection that can result because of the complexity of research and number of issues to be addressed. Integrating quantitative and qualitative data (empirical versus farmer knowledge) is a challenge. Time is also needed to build linkages between disciplines and formal and informal sectors and these linkages are vulnerable to continuing cultural, economic and environmental change.

Advantages of the research are that it focuses on locally important crops and builds on local knowledge. The gender disaggregated approach to data collection, cross-site visits and actively pursuing gender equity in employing local project team members and managers has enabled the project to more clearly address issues of livelihood improvement and empowerment and address gender and equity concerns. Farmers take ownership for their own resources. The method recognizes the achievements of both male and female farmer-breeders as 'keepers of diversity'. They in turn guarantee sustainability in that they perpetuate the process, continuing it when 'intervention' has finished. The process also channels farmers' voices into national agricultural research and extension systems and fosters cooperation between local, national and international levels and GO and NGO sectors.

Innovative approaches were developed for participatory NRM (PNRM), including developing frameworks to support the recognition, conservation and improvement of farmer-developed PGRs *in situ*. An understanding was gained of the appropriate scale for data collection, aggregation and analysis and for different stakeholders' management decisions. The process revealed the importance of taking time to strengthen farmer informal and formal linkages, integrating on-farm conservation into national PGR programmes as part of their regular annual plans and including agricultural extension staff at national and local levels in participatory training and project implementation.

Plant genetic resources are a natural resource fundamental to agricultural production. Most conservation efforts to date have focused on *ex situ* options (eg, in gene banks or botanical gardens). However, this method of conservation recognizes crop germplasm as the evolutionary product of the continuing interaction between farmers and their environments. As farmers continue planting, harvesting, selecting and storing seed, PGRs are renewed and developed. Non-use of PGRs leads to their loss from their surrounding environments. Acknowledging the dependence of crop PGRs on human use highlights the necessity of a participatory approach as inherent in the goal of conservation.

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7 Eastern Himalayan initiative on gender, ethnicity and agrobiodiversity management

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The International Development Research Center (IDRC) and members of the Eastern Himalayan Network.

Background

Diversity in the natural ecological systems of mountains has contributed extensively to maintaining biological diversity in the farming systems of the eastern Himalayan region. Typically, many crop and animal species, varieties and breeds are found on farms. Subsistence farmers of the region, besides producing many crops (mainly landraces), rely extensively on wild plants to meet their needs for fibre, shelter, food, medicines, tools and household implements. For the various ethnic groups residing in the region, survival requires extensive use and management of natural resources. More particularly, it necessitates incorporating natural resources into farming systems. By incorporating biological resources at the genetic, species and agroecosystem levels, mountain communities possess extensive knowledge of their environment.

The project is situated in the eastern Himalayas, and covers four sites: east Nepal, Sikkim, Bhutan and Nagaland in north east India. The overall purpose of the project is focused on building the capabilities of indigenous mountain populations to better represent themselves in the development dialogue. The process for achieving these objectives is to:

- Develop, through research, a better understanding of the linkages that exist between the way that gender and ethnicity are constructed and then to examine how such constructions affect the management of mountain agrobiodiversity.
- Build upon the existing experience of a network of researchers, who themselves are members of ethnic mountain communities, and increase their capabilities through skill development in research and analysis and community development concepts and practice.
- Include indigenous knowledge on agrobiodiversity management (particularly that of women) in the policy planning of national governments.

An advisory group consisting of scientists and planners from the region has been assembled to advise on effective strategies through which these can be achieved.

Approach

The strategies for capacity building work through research, skill development for network members and advocacy. The aims are to:

- Identify and document the extent of women's knowledge related to plant genetic resources.
- Examine changes in women's knowledge in terms of how changes in the last 200 years have transformed production strategies while introducing new crops and technologies. How have such changes been consistent with changes in ideology and how have they compromised the role of mountain women?
- Identify strategies adopted by women to counteract their increasing marginality, especially in the context of their roles as managers of agrobiodiversity on one hand and the 'gender blindness' inherent in extension and development policies of national governments on the other.

Skills of network members are developed through training and learning workshops that build conceptual clarity and analytical skills in research and help develop writing skills. Training is given on gender analysis and for facilitation and community development skills. Participatory rural appraisal (PRA) skills are included for a programme especially developed for rural planning called Village Initiated Planning. The process requires community involvement in identifying problems and in research and analysis. It includes problem prioritization, project planning (proposed action, objective, developing M&E criteria, financial management) and designing implementation procedures (methods and approaches, group formation, types of training required, guiding principles, implementation and M&E).

The advisory group, comprised of scientists, planners and development professionals in the region, propose strategies that focus on bringing an awareness of gender issues and farmers' rights to the nation's policy-makers and high-level officials via links to biodiversity planning bodies at national level and other means.

The development of a participatory video documenting the process of a participatory crop improvement (PCI) initiative that builds on farmer-led approaches in eastern Nepal also helps to diffuse the method.

Reflections

While capacity building is part of an on-going process, a preliminary assessment, particularly in the PCI initiative conducted at one site, demonstrates that certain activities are more easily adopted than are others. For instance, a participatory seed management initiative conducted in eastern Nepal demonstrates the

potential for dissemination of methodologies to other sites in the eastern Himalayas. The action research project was based on the following hypotheses:

- The development and enhancement of seed management technologies will occur most effectively through a process of interactive learning between indigenous and formal systems of agricultural development.
- Access to improved technologies can be most effectively sustained through community action. Thus existing technical skills for seed improvement and the organizational capacities of CBOs need to be enhanced to ensure community access to improved technologies.
- The success of community action to manage development processes will depend fundamentally on the ability to control processes of knowledge production, design and implementation of interventions.

In the 18 months since the project's implementation, members of the local CBO effectively adopted the knowledge of seed management for maize, and the community developed a seed bank with their own production of maize seed. Another significant outcome is the dissemination of the seed technology through the activities of the CBO that is presently working with over 50 farmers from adjoining communities.

Lessons generated from the farmer-led seed management initiative in east Nepal have helped in developing a similar management initiative in Sikkim. Over the last few years, the spread of disease in ginger has severely hampered production of this important cash crop. The new participatory approach is based on experimenting with farmer-identified 'best' practices for disease management. A central component is through the development of local organizational capacity to more effectively participate in the research process.

Finally, members of the CBO in eastern Nepal have emphasized their interest in developing plant breeding skills, especially for maize varieties (landraces) whose seed quality has deteriorated because of factors such as the introduction of high-producing modern varieties that are available through research stations.

It is still too early in the project to assess the extent to which local knowledge of mountain communities can inform national policy planning, especially in terms of agricultural development for marginal mountain communities.

Reference

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8 Participatory selection and strategic use of multipurpose forages in hillsides of Central America

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Acknowledgements

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Background

The objective of working with rural communities is mainly to enhance interaction with local stakeholders and to achieve an impact in the initial intervention sites. The partnership with nationally based institutions is the basis for a wider distribution of results and for multiplication of farmer-selected forage seeds – seed availability being a major bottleneck for the adoption of improved forages.

Conceptually, this activity relies on farmer–researcher–institutional linkages. The aims are to use forages to:

- Increase the income of smallholders mainly through direct effects on livestock production.
- Increase income and food security through, among others, improved soil fertility, soil conservation, breaking pest and disease cycles and reducing the competition of weeds.
- Ensure conservation of natural resources.

In 1998 the study began in Honduras in the CIAT reference site of Yorito, department of Yoro. Work has since been extended to other countries in Central America. Further diffusion depends greatly upon partners.

A team of researchers drawn from forage genetic resources, geographic information systems (GIS), participatory research and soils carries out the project. Together with farmers, local grassroots organizations, NGOs and other relevant institutions in and outside the region, the project develops forage-based technologies and identifies forage germplasm adapted to the needs of different types of farmers.

Approach

Farmers are offered a range of grass and legume options for livestock feeding, soil fertility improvement and soil conservation. For those forages immediately attractive to farmers, seed is provided in a limited amount to enhance testing, utilization and, eventually, adoption. At the same time, smallholders are encouraged to produce seed themselves. If seed production is not feasible on-site, alternative sites for production are sought.

The described approach cannot be implemented by using a single research method. The research builds on an interaction between several partners and includes the application of diagnostic tools (including both biophysical and socioeconomic aspects) to understand the production systems. To allow farmer selection of the different forage options, a combination of open evaluations and preference ranking is used.

To initiate this process of participatory selection of improved forage options, several training and planning activities with the different partners were carried out in 2000 and are continued in 2001. Several types of trials for the agronomic evaluation and simultaneous participatory selection of improved forages were established in Honduras, Nicaragua and Costa Rica. Multipurpose germplasm including grasses, herbaceous legumes, shrub legumes and cover and green manure legumes have been offered to farmers.

Thirty-nine trials were established in three reference sites in Honduras, Nicaragua and Costa Rica. The sites were selected using participatory approaches and in some cases complemented by interested farmers themselves. Each of the ten trial sites is represented by a group of 10–15 farmers. More than 100 farmers are so far involved in the project. To support this work methodologically, a procedure for the participatory selection of forages is being developed. A participatory diagnosis was done in three communities in the Department of Yoro, Honduras. Similar diagnoses are in process in Nicaragua and Costa Rica. These define the participating communities and help incorporate them in the planning process.

Reflections

Although initial results are highly promising, data have to be interpreted with care.

Results obtained in specific locations will be extrapolated using a GIS-based decision-support tool, which will be made available to a range of research and development institutions.

Preliminary results indicate that farmers selected in the first place 'improved' grasses for their pastures. Several farmers were also interested in legume species. High interest is shown in incorporating forages for soil conservation, while demand for cut-and-carry legumes is still low. However, the use of shrub legumes for dry season feeding is gaining the interest of some farmers, confirming similar experiences of CIAT research in the region. A more reserved attitude of farmers towards the legume options can be expected because in most cases the use of legumes means a change of the existing production systems.

The combination of different forage options of varying complexity is believed to be instrumental in building trust among farmers to test more complex and thus higher risk alternatives.

The community-based NRM research is seen as complementary to on-station research activities and vice versa. This study is building on this concept: the positive aspects of community-based research counterbalance the negative aspects of on-station research. For example, in on-farm research the lower control of the experimental conditions is balanced by the better insight obtained in the real-life situation.

The biggest limitation of the approach at the moment is to match the demand and supply of seed. In order to maintain farmers' confidence it is important to stress that new forage options bear certain risks and that their introduction and succesful application is a long-term process. The development of appropriate approaches is indispensable.

The approach goes beyond offering farmers a range of forage options for selection; it initiates rather a dynamic, continued process. Farmer-selection of particular grass and legume ecotypes will allow researchers to better define plant characteristics requested by farmers. Adoption of new technologies is in the first place determined by the client's requirements. These demands should help to define and direct further forage germplasm development. The interactive work with farmers may open possibilities to develop forage technology options which go beyond the immediate scope of farmers and researchers. These technologies could contribute significantly to the development of profitable and sustainable production systems. Of particular attention in this study is the search for forage options to directly or indirectly improve the well-being of less privileged groups in the rural society, such as women and small farmers (even those without livestock).

Reference

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9 Focus on integrating methods and approaches to increase gender/stakeholder involvement, collaborative management of natural resource management, and decision-making support

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Acknowledgement

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Background

Tsetse control operations commenced in the Chiawa area of Zambia in 1991. Prior to that date, no cattle were kept in the area because of tsetse, although cattle were kept in surrounding tsetse-free areas. Tsetse control dramatically increased the agricultural options in the area but also presented the challenge of how to realize the benefits without over-exploiting the environment.

Typically, 'land use planning' is seen as the means of meeting this challenge but the record of conventional approaches to land use planning under communal tenure systems in southern Africa has not been impressive to date. Over the period 1994–1997, Chiawa was selected to pilot alternative approaches. The overall objective was to increase stakeholder involvement through decision-making support in order to achieve collaborative management of natural resources.

Approach

In Phase 1, community leaders and government and NGO representatives were consulted. Scheduled community meetings were held. A review was made of existing documentation. Rapid air-photo interpretation and rapid field surveys of farming systems, vegetation and soils were also carried out. The results of the field surveys were incorporated into a simple GIS. Consultations revealed that an alternative approach was needed with improved stakeholder involvement as the primary objective. They clearly identified the importance of responding rapidly to demand-driven initiatives as opposed to imposing externally conceived 'solutions'. Thus, a 'demand-led and support' model was developed in contrast with the more familiar 'suitability and enforcement' model of land use planning.

The approach was based on the following principles:

- The community, not outsiders, proposes the planning initiatives.
- The community evaluates initiatives and assesses them for environmental impact.
- Coordinators from *within* the community run the scheme.

- The community undertakes most of the implementation. External support is largely confined to technical advice and loans of equipment.
- Communities must demonstrate 'commitment' to projects before any external support is provided.

Female and male 'local community workers' (group promoters) were recruited by advertising locally and selected by interview. Training was provided that included periods of attachment to experienced community workers within Zambia. By clearly explaining the principles of the scheme to all involved from the outset, false expectations were avoided and 'ownership' of the initiatives reinforced.

In Phase 2, the community workers convened a series of small meetings at which problems and solutions were discussed. A scheme for supporting small projects that were both maintained by the community and environmentally benign was jointly developed. The process of local approval was agreed during these initial meetings. A wide range of projects was proposed, including fish-ponds, cattle paddocks, vegetable gardens, handicraft production, marketing of local tourist attractions, well construction and poultry production schemes. The proposals were documented and passed to the relevant authorities for evaluation. Environmental impact was assessed during site visits and from information collected during Phase 1. Approved projects were supported through a variety of means, including technical assistance, loans of equipment and short study tours.

Interaction with the community during this process provided valuable guidance for parallel components of the planning process. Phase 3 addressed issues of communal grazing resources, boundaries and procedures for arbitration of disputes. Trust, understanding and confidence were built during the scheme's development that enabled more productive debate and subsequent actions than would otherwise have been the case. Phase 4 examined options and outlined costs for community infrastructure provision such as roads, schools and clinics.

Reflections

Three main lessons were learned:

1 The process takes time. Frequently, land use planning consists of a time-bound period of data collection and consultation. This can result in distortions in the perceptions of planners. The presence of community workers over a longer time scale serves to correct rushed generalizations. Their involvement and continuous presence serves to maintain momentum and act as a two-way conduit between the community and others.
2 The experience and capability of the local coordinators has a key influence on the direction of the planning effort. Careful selection, support and training are essential. The disadvantages of selection from the local community include lack of objectivity, favouritism and possibly diminished respect because of familiarity. The advantages of local selection overall

outweigh the disadvantages and include a positive slant on these in terms of understanding and familiarity combined with the commitment to improve their own community.

3 Initially groups, as opposed to individuals or families, were targeted because of the greater numerical impact. Typically, group initiatives started well and initially made rapid progress but, in several cases, social tensions reduced their effectiveness over time. In contrast, individual and family initiatives took longer to start up but once established were all sustained.

A 'demand-led and support' model was seen as an effective entry point in developing a participatory land use planning process, initiated by stakeholder involvement. The approach provided decision-making support and encouraged the collaborative management of natural resources. The community enthusiastically received the scheme. Eighteen months after its initiation, 35 projects were operating independently. The transfer of coordination to a local NGO demonstrated the success of the approach. Proposals to establish a small revolving fund to support further initiatives were made.

The individual projects were likened to pieces of a mosaic. The projects have individual integrity and ownership, but when placed together they constitute a de facto land use plan.

10 Farmer participatory experiments in pest management

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Acknowledgement

Swiss Agency for Development and Cooperation (SDC).

Background

Farmers use their perceptions of crop losses caused by pests to decide when to spray insecticides. This can lead to overestimating the seriousness of highly visible pests or damage symptoms. In making these decisions, farmers often rely on heuristics, or rules of thumb. Developed through experience and guesswork as to possible outcomes, heuristics may have inherent faults and biases. Farmers' decisions about leaf folder infestations in rice provide a case in point. Many farmers spray to control this pest, even though it does not cause yield losses, especially when it attacks in the early crop stages. Farmers' reactions to visible damage or insect presence may be caused by faults in their heuristics.

An approach for solving this problem is to analyse how farmers make these decisions, develop a corrective heuristic, frame it as a hypothesis and motivate farmers to participate in an experiment to test it.

Approach

Researchers at IRRI and ViSCA initiated participatory experiments in collaboration with technicians from the local Department of Agriculture and village leaders in Leyte, the Philippines. Half-day group meetings were held in each village for 10–25 invited farmers and a facilitator. The meetings began with general discussions about rice growing and related problems. Later discussions focused on leaf folders, the damage and losses that they caused, methods of control and their costs and effectiveness. Researchers facilitating the meetings eventually led the discussions as to whether control was needed at all and to the benefits of not spraying.

Next, volunteers were invited to test the heuristic 'We do not need to spray insecticides in the first 30 days after transplanting'. The volunteer farmers marked out an area of about 100 square metres in their fields that would not receive any insecticides during the first days of the crop cycle. They followed their usual practices in the rest of their fields. At the end of the season, participants reported their results in a workshop and received a certificate of participation. Farmers from both the participating village and neighbouring ones were invited to the workshop. Pre- and post-experiment surveys were conducted to monitor changes in farmers' beliefs and intentions. These variables included farmers' beliefs, intentions, spray frequencies, timing and targets, yields, inputs and other management practices.

Rice yields in about 80 per cent of the experimental plots were equal to or greater than in the main plots. The number of insecticide applications fell from three to two per season. The percentage of farmers applying insecticides in the first 30 days of crop growth fell from 70 per cent to 20 per cent.

Reflections

The benefits of such experiments are that they are usually inexpensive and easy to conduct and they facilitate farmer learning by actively 'testing' a new idea, making participants more likely to adopt successful innovations. The approach provides a mechanism for scientists to learn about farmers' decision constraints, determine research needs, use research information and 'distil' them into testable hypotheses for farmers. It provides a means of exploring changes in farmers' beliefs, behaviour and practices. It is particularly useful for introducing a 'new' idea to a community.

Participatory experiments of this kind may have some disadvantages. They can prove expensive if the process is to be conducted over a large population. The use of media to motivate farmers' participation has been successful in Vietnam and may be an alternative to face-to-face training. Farmers participating in the experiments may risk losses and require compensation. The approach aims to introduce a testable hypothesis to farmers and thus may be viewed by some as 'top-down'. The presence of scientists may influence farmers differently. Thus scientists applying this approach will need to acquire and use facilitating skills. Peers may view this type of participatory experiment as agronomically 'weak' because some of the controls may not be easily

implemented. Because the main objective of the approach is to evaluate farmers' responses to new ideas rather than agronomy, data collection of variables on belief, behaviour and practice changes needs to be emphasized.

The adoption of innovations such as seeds and machines is often discussed in the literature. Less is known about the adoption or adaptation of information into farmer decisions. Because much of resource management is in the form of information and how to adapt and integrate it into decisions and practices, investing in decision research, an emerging field of applied social psychology, will enhance delivery and communication information.

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11 Farmers' ability to manage a devastating plant disease – potato late blight

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Acknowledgements

CARE-Peru; CARE-Cajamarca; FAO's Global IPM Facility; farmers of San Miguel, Cajamarca, Peru; CIP's late blight project team.

Background

Resource-poor farmers have substantial difficulty in managing the diseases that affect their crops. Potato late blight (LB) is particularly devastating for small-scale producers. Because of recent worldwide migrations of more virulent and fungicide-resistant strains of the pathogen, potato farmers face a problem that behaves differently than before. Poor farmers have little knowledge of the disease, in part because the organism that causes it is essentially invisible. Late blight is usually managed through the use of fungicides, some of which are suspected carcinogens. In developing countries, effective disease management strategies are best devised locally, because of the tremendous variation in human, environmental, host and pathogen factors among potato agroecosystems.

As the result of decades of resistance breeding, potato varieties and breeding lines with promising levels of resistance are available. Although efforts are made to breed for durable resistance, varietal diversification is desirable to reduce the erosion and breakdown of resistance. Getting improved varieties to the farmers is, however, a significant challenge because of the limitations inherent in a vegetatively propagated crop. Deployment of promising breeding lines in marginal and heterogeneous environments without formal seed systems is particularly difficult. Participatory approaches are essential because they help

integrate varietal selection with other elements of disease and crop management strategies, and they contribute to the improvement of informal seed systems.

The Food and Agriculture Organization (FAO) developed the farmer field school approach (FFS) for training in IPM. Since 1997, CIP has been working with several research and extension institutions to develop and implement FFSs with farmer groups in the Andes and elsewhere. The original FFS approach was found to require substantial adaptation for potato. In potato production, farmers make many of their key decisions before the start of the growing season. The variety that they choose and their source of seed are key issues in managing LB and other potato pests. We incorporated a substantial element of farmer participatory research (FPR) into the FFS format, and therefore designated our approach 'FPR-FFS' to distinguish if from the FFSs that focus principally on training.

Approach

To initiate the development of an FPR-FFS focused initially on potato late blight, CIP convened a series of local and national meetings and an international workshop to develop a strategy and to define available materials. An FPR-FFS curriculum, embodied as a field guide for facilitators, was drafted. A baseline study on LB was conducted in Ecuador, Peru, Bolivia and Uganda. This study confirmed that LB is the most important production problem for potato farmers and provided insight into farmers' knowledge and practices.

In an FPR-FFS, a group of about 10–35 farmers from a given locality meets regularly over the course of one to three cropping seasons (or longer), usually twice a month for a half-day session. Helped by a trained facilitator (usually from a local NGO), the farmer group conducts field experiments and hands-on learning activities. They use direct experimentation and observation to improve their knowledge, and use this expertise to improve their crop and pest management. The field experiments have included testing of promising varieties and/or breeding lines, testing different fungicide strategies for varieties with different levels of resistance, working with varieties derived from true potato seed and comparing IPM and conventional practice. By sharing data among communities through field days and workshops, the groups amass substantial data and can proceed with decisions such as varietal selection with relative confidence.

The programme has expanded in Peru and elsewhere. In 1997, CIP and CARE-Peru initiated FFSs on a pilot scale in four communities of San Miguel, Cajamarca, in northern Peru. Eight FPR-FFSs were conducted during 1998–1999 in San Miguel, and 13 were conducted in 1999–2000. In parallel, pilot-scale FPR-FFSs were established elsewhere in Peru, as well as in Ecuador, Bolivia, China, Bangladesh, Uganda and Ethiopia through the collaboration of researchers, extension organizations (mainly NGOs) and farmer groups. Parallel efforts by other organizations in coordination with CIP led to further efforts in potato. Facilitators from Bolivia, Ecuador and Peru were formally trained in FFS methods through the FAO, and national IPM projects emphasizing the FFS methodology were established in Peru and Ecuador.

Reflections

Farmers have much to learn about the microbial world. Because they cannot see the organism that causes plant disease, they do not understand disease processes well. They are poor at diagnosis and inefficient at managing the diseases that affect their potato crops. However, given the opportunity, they are quick to learn and improve their management decisions. They are keen to try new varieties and are appropriately conservative about making decisions regarding varietal change. Participatory evaluation gives farmers a meaningful basis on which to make decisions about varietal choice.

The FPR-FFS approach is demanding on both farmers and researchers. Farmers must be strongly motivated to improve their potato production if they are to participate successfully. Because potato is a high-value crop and the losses caused by LB are often devastating, LB is a suitable entry point. However, farmers face numerous problems with their potato crops and other agricultural enterprises, and prefer integrated approaches that allow them to cope with multiple problems at a given time. The FPR-FFS method forces researchers, who often have narrow technical interests, to expand their horizons. Researchers and farmers have complementary roles in the evaluation of potential new varieties. Linkages between research and extension organizations increase the potential impact of knowledge-intensive technology.

In the Andes, the FPR-FFS has attracted many young men while older men and women with young children often found participation more challenging. This could result, in part, from the limited role that women play in potato production in the northern Peruvian Andes. However, women have a stake in successful crop and disease management for potato, and in selection of appropriate potato genotypes. In participatory evaluation of varieties and breeding lines conducted through the FPR-FFS, the opinions of men and women participants were sometimes significantly different. This reinforced the importance of involving both men and women in the activity. Efforts are being made to improve the training curriculum to enhance its utility for female participants.

The FPR-FFS approach is still evolving, and from the outset has had much in common with the CIAL methodology. With support from the International Fund for Agricultural Development (IFAD) and the Organization of Petroleum Exporting Countries (OPEC) Fund for International Development, pilot-scale FPR-FFSs are now being established in seven countries, through collaboration among researchers, NGOs and farmer groups. More emphasis is being placed on gender analysis (assisted by the PRGA programme), and the impact of the FFS is being assessed (PRGA and the World Bank). Preliminary observations indicate that the FFS is highly effective in stimulating farmer learning and varietal diffusion.

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12 Developing and implementing an innovative community approach to the control of bacterial wilt (*Pseudomonas solanacearum*) of potatoes (*Solanum tuberosum*)

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Acknowledgement

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Background

This case study is set in the mid-hills of Nepal and draws on the experience of researchers, extensionists and farmers in developing and implementing an innovative community approach to the control of bacterial wilt (*P solanacearum*) of potatoes (*S tuberosum*). The architects of the approach were the development scientists of Lumle Agricultural Research Centre.

The high hills of Nepal have traditionally been a source of supply for seed potatoes to the mid-hill and lowland (*terai*) potato producers of Nepal because of the low incidence of viral diseases in the high hills. Bacterial wilt is a serious disease that can survive in the soil for several years and can be spread through infected seed potatoes. It threatened the trade in seed potatoes (and the production of potatoes as an important hill staple) from the late 1980s, as it became established in the villages where seed was produced. The villagers themselves did not know the life cycle of the disease, nor what control measures to take. Lumle Agricultural Research Centre held the research mandate for the area and devised a strategy for addressing the problem in collaboration with the affected communities.

The whole process has been an integrated effort between natural and social scientists working together with communities. However, the Samuhik Bhraman (see below) carried out at the start of the project was probably the key to understanding the interaction between the social, cultural, physical and biological factors.

Approach

The Samuhik Bhraman is a type of rapid rural appraisal (RRA) that evolved in Nepal during the 1980s and involves a multidisciplinary team of researchers, extensionists and villagers in exploring a defined subject. In this case, it was focused on the seed-potato production system. The appraisal uses a range of RRA/PRA tools, with team members changing each day between subgroups to promote cross learning. Each evening a reflection period is held when subgroups discuss what they have learned and decide tasks and responsibilities for the next day. The team lives in the community for the duration of the study

and confirms its findings through community meetings. Through this method it was possible to define the geographic and temporal distribution of potato production, the production and storage methods used, the constraints and the economic imperatives. Relevant social and ethnic structures and cultural practices (such as exchange of potatoes as presents and the sharing of tools and livestock for draft) were also identified.

Four seed-producing villages were selected, with contrasting social characteristics and size. A Samuhik Bhraman confirmed bacterial wilt as a major problem. Major reasons for the fast spread of the disease were lack of awareness of the disease, frequent movement of potatoes between and within villages, short crop rotations, poor plant hygiene and the use of volunteer potatoes for tuber yield. A multidisciplinary team comprising phyto-bacteriologists, agronomists, extension workers and socioeconomists devised a plan for management of the disease in 1990. Farmers were involved in monitoring the disease, and meetings held with villagers to create awareness of it. Each pilot village created a 'Cropping System Improvement Committee', which was responsible for the programme within its village. The project took special pains to provide training to women and men of different social groups (eg, by giving training in the evenings when women could be present).

Key components of the approach to integrated management of the disease were:

- Eliminating infected planting materials from the village.
- Providing a pathogen-free seed multiplication programme in the community for a regular supply of healthy planting materials.
- Prohibiting cultivation of potatoes or other solanaceous crops for at least three years in infected fields.
- Rouging of volunteer potatoes.
- Educating farmers on the symptoms of the disease, its transmission, control measures in field and store and sanitary aspects of disease management.
- A support programme bringing alternatives to potato production.

To compensate for the loss of potato production, alternative (non-host) crops had to be provided. Demonstrations of nursery raising and vegetable production, seed supply and technical advice were therefore important components of the support programme to project villages. In addition to vegetables, cold-tolerant rice was to become an alternative to potatoes. The posting of a facilitator/extensionist to each of the project villages as liaison between researchers and the Committees assisted the process.

Reflections

Control of bacterial wilt is technically feasible. However, it was difficult to achieve the required level of community participation essential to ensure long-term success. Success in containing or eliminating the disease varied among villages before 1996. Jhilibarang village, where community cohesion was strong, continued disease-free seed potato production for the three years of the project.

In Ulleri, community cooperation was difficult to manage, and the disease appeared from year 2 of programme implementation. The programme was terminated in Ghandruk after year 2 (a village with a lucrative tourist trade and less dependent on agriculture) and the disease reappeared in Sabet when farmers resumed their normal cropping patterns and grew potatoes in traditional fields.

The communities vary greatly in their levels of cohesion (those with greater 'jaat' (caste) diversity were less cohesive) and the socioeconomic environment and the existence of alternatives to agriculture (eg, incomes from tourist trekking routes) reduce the need for community compliance. The high dependency on potatoes makes some farmers take action for short-term gain that results in long-term disaster. Constant changes in social equilibrium and the influences of exogenous and endogenous forces require careful monitoring and response.

Village workshops, training and cross visits need to be provided to broaden the level of thinking and to improve participation based on understanding. These have to be sensitive to the needs of women and the poor who cannot easily leave their duties to attend training. It has to be recognized that 100 per cent cooperation is very difficult and grievances of non-cooperating members need to be targeted and understood. Key elements to success are a coordination mechanism, a monitoring system and a supportive policy framework. Scaling up from the pilot project to wider application requires comprehensive information followed by a massive awareness/training/support programme.

The method leads to community cohesion and an effective use of awareness raising and training. Good support is given by a well-established and well-respected research and extension service. A further benefit is the identification and support of alternative NRM options with excellent multidisciplinary support from technical and social scientists.

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13 Participatory management of Kapuwai's wetland (Pallisa District, Uganda): A clear need and some steps towards fulfilling it

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Background

From the top of the hill we could see the landscape far into the hazy horizon. Dark clouds threatened a thunderstorm, so we quickly finished drawing our map of the territory and moved down the immense granite stone where we had been

standing. We had been discussing problems of the local wetland – not easily visible from our vantage point because it had shrunk so much to make room for rice fields. Stanley mentioned that since my last visit, seven years before, people had introduced several innovations. They reduced tree cutting and planted trees in the boundaries between their fields. Many families had successfully tried out ways of intensifying agricultural production. They had built contour ridges around their fields, introduced black ants that feed on aphids, spread ashes on crops, weeded at better times, selected their best seeds for planting, and introduced new activities such as rabbit raising or bee-keeping. Some had even gone so far as to plant the highly beneficial but difficult-to-raise *neem* trees. Yet, the government was still encouraging rice growing by individuals, and the wetland had kept shrinking, seemingly on its way to total disappearance.

Amos began explaining why this was a problem. 'When the big rains come, the wetland acts like a sponge. Before, even in heavy rains, it protected our village from flooding. Now the wetland has shrunk so much that even a little rain floods the fields and our homes in Kapuwai.' During the dry season, water shortage is becoming more critical. Daniel said, 'We need more watering points for people and animals. We need more fish from the wetland and the medicinal plants that grow close to it and are now getting hard to find.' Extensive rice growing was causing problems of all kinds, from loss of biodiversity to the loss of schooling for the children who spent days surveying the fields for birds.

The community was convinced that the wetland was important for everyone and needed to be used carefully and not destroyed. However, members were still unclear about what to do. Anne said, 'our Association dreams of managing the wetland together, as a community'. People felt that they could do so by taking advantage of their traditional management skills and of the skills the local Association had acquired while managing common resources in agricultural production.

That evening, we ate together in the light of some candles and paraffin lamps that sent a pungent smell into the small room of the health centre. Later, more people joined our small group and we held a larger meeting. The topic of discussion was the management of the wetland. We went far into the night discussing the beginning of a positive vision that the whole community might be willing to share.

Approach

We met again the next morning. The participants in the evening discussion agreed to call a larger meeting where the whole community would discuss the vision for the future of the wetland. In particular, they agreed on calling various 'stakeholders' to present their individual views and to negotiate a basic agreement on rules to be respected and activities to be carried out. As the discussion continued, we identified three key elements in the participatory management process for the Kapuwai wetland:

- preparing for the partnership;
- developing the agreement(s); and

- implementing and reviewing the agreement(s)/'learning by doing'.

In the first phase, discussion on the wetland issues ('social communication') would be promoted in the community. In this preparation time, people would begin to clarify what they needed to know for sound management and the reasons why the wetland was useful for them.

In the second phase, stakeholders would be invited to set aside their immediate interests and develop together a long-term vision for their wetland. A facilitator would help at this stage. Once a common vision was reached, a ritual would make it intangible and sacrosanct. Clan elders and traditional authorities would perform the ritual and every 'stakeholder' would be asked to re-affirm the desire to work together to reach the common vision.

After the ritualization of the common vision, it would be time to negotiate a management plan, some basic rules for the use of wetland resources and other needed accompanying initiatives. All stakeholders would be invited to meetings and they would strive to work by consensus – not by majority vote – and to be totally transparent about information and all kinds of decision-making.

In the third phase, the committee would be acting on the basis of its duties, and the agreed plans would be implemented. This would be far from supine implementation, however! The Kapuwai people stressed that implementation should be taken up as a way of 'learning by doing'; thus they would have to plan in advance for regular reviews and discussions of management results. They felt that the whole community should be allowed to participate in such meetings.

Reflections

We were conscious that several difficulties needed to be overcome for successful results. A few members of the local Association and others needed to make a substantial investment of their time to set up the process that would lead to participatory management. The interests of landowners needed to be respected but also seen beside the community interests as well. Many thought that the Council of Elders should be involved from the very beginning of their wetland initiative. Alternative ways of raising income (in place of rice cultivation) needed to be provided. Effective facilitation and support was also to be secured during the organizing and negotiation process.

We expected the participatory management of the Kapuwai wetland to increase the sustainable use of the wetland resources and to protect the biodiversity remaining in the area. A more equitable use of wetland resources was also to produce negotiated specific benefits for all the stakeholders. Early discussion and agreements on the regulations of wetland use would prevent social conflicts and problems. Other envisaged benefits were the enhancing of local capacity for wetland management, the fending off of exploitation from outside interests and the enhancing of the vitality and 'identity' of the Kapuwai community.

When the time came for us to leave, our friends' eyes were lit with enthusiasm. They had just charted for themselves a way towards a better future for their wetland. With luck, patience, and personal effort, they would succeed

in following it up together, for the benefit of everyone. I still vividly remember when they waved us goodbye with broad smiles on their faces, surrounded by a large and cheering group of family members, friends and children …

The above account refers to July 1999, more than three years ago. Since then, I received some information via email, as Stanley manages once in a while to travel to Kampala.

Our friends – who are organized in a local association called PACODET – set up several workshops in ten relevant local parishes. The workshops were widely attended (women representatives, clan leaders, local leaders, church leaders, youth representatives, extension workers, district councillors … more than a hundred people in each workshop!) and dealt with what should be done with the wetland, also in the light of the national Land Act provision.

The majority of participants were not happy with the practice of clearing and draining large wetland areas for rice growing, and agreed this was killing the wetland and denying to the communities benefits such as water, grazing, fish, firewood and grass for thatching. They also reported that many water sources had dried up because of the wetland draining. The Land Act provision states that wetlands are a public resource, which should be sustainably used to the benefit of all stakeholders. The local authorities were requested to support the implementation of this provision, but some of them own land in the wetland areas and are opposed to it.

In the meantime, an Environment Officer was recruited by the district, and environment committees were called to form at all levels, from the district to the parish. The association of our friends decided to work within the newly created system and concentrated efforts to lobbying key district and sub-county officials, environment committees and the Environment Officer to support the de-privatization of the wetland and its management and sustainable use by the local communities. PACODET also identified a number of activities that could be demonstrated in and around wetland areas, in support of both livelihoods and conservation (eg, bee-keeping, woodlots, grazing, some restricted cultivation of selected crops) and wrote proposals to raise funds to set them up.

In a nutshell, the local association has done the groundwork of social communication on the issues and is now focusing its energy on lobbying the local authorities for supportive action and mobilizing resources for community-based demonstration activities. The main obstacle to continuing their work in participatory action research for the management of the local wetland is a clear one: private ownership of land.

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14 Participatory research at the landscape level: The Kumbhan water trough case

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Acknowledgements

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Background

The present case study is based on collaborative work between NRI and BAIF Development Research Foundation on the research project 'Easing seasonal fodder scarcity for small ruminants in semi-arid India, through a process of participatory research'. The project was funded by the UK Department for International Development's Livestock Production Programme.

In the project village of Kumbhan in Bhavnagar District, Gujarat, livestock-keepers said that seasonal water scarcity was their main constraint: mean annual rainfall in Bhavnagar is about 500 mm and is concentrated in the period of July–September. During the summer season the number of water points is limited, and there are none near the main grazing area, so herders and their animals are forced to walk long distances. The researchers considered water and feed scarcity constraints to be inter-related, and hence research on water scarcity was within the remit of the project.

The Rabari livestock-keepers proposed the construction of a water trough and storage tank adjacent to a privately owned well, in the vicinity of the *main dry season* grazing area. The owner of the well was agreeable to supplying water to the trough. The trough was constructed in April 1999, in time for use during the late dry season in May and June. The researchers monitored various parameters (eg, milk production) before and after the trough came into use.

Gujarat is a vegetarian state in which meat production and consumption are socially unacceptable in rural areas. Thus, milk and manure are the main livestock products. The Rabaris specialize in livestock production (mainly cattle and goats), and livestock herding is the full-time occupation of some male Rabaris This group was keenly interested in the work from the outset, because it addressed the priority livestock production problem that they identified, and because they had proposed construction of the trough.

Approach

The water scarcity issue was raised during a semi-structured group interview with Rabari men, as part of the initial survey work on livelihood system characterization and needs assessment. They identified and ranked their main livestock production constraints as:

- water scarcity (dry season);
- feed scarcity (dry season); and
- disease.

Frequent informal contact occurs between BAIF local staff and the villagers because BAIF has an office in Kumbhan and is involved in other development activities there. This provided additional information. Livestock production constraints – and the relationships between causes, core problem and effects – were further elucidated through a participatory problem tree analysis undertaken by Rabari men in November 1998. It is a diagrammatic tool for analysing problems and gaining a more in-depth understanding of their nature. This is important for assessing the implications of interventions: because constraints are often inter-related, easing one or more can lead to the alleviation or exacerbation of others. The tool involves identifying a core problem, the factors causing it and its effects.

The problem tree constructed by the Rabaris incorporated both biophysical and socioeconomic factors and showed how they inter-relate. The Rabaris identified reduced milk production and disease as two specific effects of water scarcity in the dry season. They also identified the impact on themselves (ie, walking considerable distances in the intense heat, with lack of drinking water at times, leading to exhaustion at the end of the day). They expected a general improvement in the performance of their animals due to the saving of energy from the reduction in herding distances.

Before deciding whether to proceed with construction of the water trough, the local BAIF staff collected data that would enable an informed appraisal to be made. The data included:

- Current daily herding routes and distances and livestock-keepers' estimates of the effect of the trough on these.
- The number of herders and livestock (by type) expected to use the trough.

A BAIF consultant made a detailed estimate of the trough cost. The NRI socioeconomist used this to do a simple cost–benefit analysis, in which the benefit was expressed in terms of time saved by herders. This suggested that the trough would pay for itself in little more than one dry season.

The researchers wanted evidence of the livestock-keepers' commitment from the outset, and wanted them to be responsible for the trough in the future. Thus, the latter provided the construction labour voluntarily; and also agreed to form a management group that would take full responsibility for the future maintenance of the trough.

Evaluation meetings were held in late July – with Rabari women and men separately – at which they were asked for their views and observations on the impact of the trough.

Reflections

The evaluation meetings confirmed that the expected benefits to both animals and herders had been realized. The women revealed that before the water trough came into use their husbands tended to be tired, irritable and argumentative when they returned home in the evenings. Since then they had been less irritable, and if there was a disagreement between husband and wife it could be resolved amicably.

The use of participatory problem tree analysis proved highly useful. It reveals how farmers or livestock-keepers perceive problems and relationships, which may be different from how outsiders see them. For example, livestock scientists tend to focus on how constraints affect the animals, whereas these livestock-keepers were also concerned about the impact of water scarcity on themselves.

There were some problems with the collection and analysis of monitoring data. First, the design of the monitoring system was researcher-dominated: the Rabaris themselves did not consider it necessary to collect such detailed quantitative data. Second, the BAIF field staff were not used to conducting research and did not analyse the data themselves. As a result, they were unaware of puzzling differences in milk production trends that could have been usefully discussed with the Rabaris. This highlights the need for field staff to be proficient in simple techniques for analysing and inspecting monitoring data.

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15 Participatory research at landscape level: Flood-prone ecosystems in Bangladesh and Vietnam

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Background

Uncontrollable seasonal flooding affects over 10 million hectares, or 15 per cent, of the total rice land in south and south east Asia. During the dry season, land ownership is fixed according to tenure arrangements. In the rainy season, farmers grow deepwater rice and capture fish in the flood-prone areas. At this time, fish are considered a common resource, and community members are traditionally allowed access to private property for fishing.

Since 1997, ICLARM and the International Rice Research Institute (IRRI) have been undertaking an interdisciplinary and PAR project. The project is being implemented in collaboration with various governmental organizations and NGOs. The aim is to increase and sustain the productivity of rice and fish in the seasonally flooded ecosystem in Bangladesh and Vietnam as a demonstration for the entire region. The project strategy combines indigenous resource management techniques with semi-intensive fish culture and management technologies for the increased income of normal households.

Approach

The unit of analysis used is the resource management domain (RMD) at the landscape level. The RMD covers the environmental, social and economic characteristics of a recognizable unit of land and takes into account its inherent natural variability.

The steps followed in the participatory problem analysis are to:

- collect and analyse secondary data;
- conduct a diagnostic field survey;
- conduct baseline socioeconomic, biophysical and institutional surveys;
- analyse data;
- present data;
- hold group discussions involving users, researchers and NGO representatives;
- identify problems and potential solutions.

The users/stockholders include landowners and other community members, at all levels, reliant on the landscape for fishing during the rainy season. To identify its clients, the project held meetings with farmers from different wealth groups, landless labourers and members of local organizations. The steps followed in assessing users' needs were (a) scientists and representatives from local-level organizations conducted a diagnostic survey, (b) baseline surveys were made of socioeconomic, institutional and biophysical conditions, and (c) group discussions were held with users. A main objective of the baseline survey is to later enable analyses of the project impact over time.

The concept of managed fish culture in deepwater rice fields is new. Thus, researchers designed technical options consulting users on their needs and taking into consideration their indigenous knowledge. Small-scale experiments were first initiated in Vietnam to show the potential of the technical options. These initial trials were then used to generate discussions between researchers

and users about various aspects of trials to fine-tune the technical options. Users tested site-specific technical options with minimum support from researchers during 1997–2000. The project provided financing support, as seed money, during the first two years to cover material costs. Users deposited part of the proceeds from the experiments (eg, fish sales) to cover future project expenditures.

Researchers monitored water and soil quality, profitability, input use, fish consumption, group performance and sharing arrangements. Based on this information, the project analysed the impact of the technological innovations and the project processes. The results indicate that community-based fish culture in flood-prone ecosystems in Bangladesh and Vietnam is technically feasible, economically profitable, environmentally non-destructive, and socially acceptable. For the overall system, an additional income of US$150 per hectare in southern Vietnam to US$690 per hectare per year in Bangladesh is achieved, which is an increase of 20 to 160 per cent over the previous profitability.

Reflections

Deficiencies of the process are that it is researcher-initiatied and -dominated and not very participatory in areas where users have only a limited knowledge of the subject. On the other hand, in subsequent years the technology has been copied by neighbouring communities but often with differing arrangements. The approach does not work well in areas where group action is not viewed positively.

The experiments are on an appropriate scale for representing the real world situation, and thus may be used for up scaling. The design and testing of the technological options included user participation. As regards sustainability, the community is less dependent on the project for funds and has an arrangement for group saving.

Problem analysis using the landscape-level resource management domain (RMD) as a unit has provided a better understanding of the integration of the biophysical and socioeconomic factors. A project implementation committee was established at each project site, including representatives from each user group. The committee oversees project implementation, prepares budgets, manages project accounts, negotiates sharing agreements (including participating members, responsibilities, access to the wild fish in the flood period, necessary guarding duties, etc), settles conflicts, supervises fish sales and distributes the proceeds from experiments. With support from researchers and NGO staff, different user groups have designed their own organizational arrangements for community-based fish culture in flood-prone rice ecosystems.

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16 Water management, agricultural development and poverty eradication in the former Homelands of South Africa

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Background

Different modes of NRM have far-reaching consequences for the well-being of poor farmers. The variation is clear indeed for irrigation, as illustrated for South Africa. In the arid and semi-arid regions of South Africa, irrigation is key to increasing the agricultural productivity and incomes of farmers. White farmers on large-scale private holdings use most of the country's irrigation water. The former Homelands, where most black South African farmers live, have only limited access to irrigation. A few hundred irrigation schemes were developed under the apartheid policy. However, parastatal agencies and private companies derived income from these schemes and dominated agricultural operations and water management. Poor black farmers received few benefits and were excluded from decision-making.

Since 1994, the new government has reversed apartheid policy and withdrawn agricultural support for schemes such as Arabie-Olifants. Black farmers, who are mostly women, are now expected to 'stand on their own feet'. This sudden change has led most households to abandon irrigated agriculture altogether, with negative impacts on their income and well-being. Few households were able to find alternatives to previous sources of credit, ploughing services and access to markets. Those few who returned to agriculture were often frustrated by breakdowns in the irrigation infrastructure.

The government has also started privatizing the ownership of the irrigation infrastructure and all rights and financial and managerial responsibilities for water management. Current users, or anyone interested, can buy. However, smallholders in these schemes, who already lack access to other inputs and markets, have no capital for buying. Instead, a small entrepreneurial 'elite', whose members are relatively well off, literate, mobile, male and well connected to policy networks, tend to be the owners of the new irrigation infrastructure. In such cases, the terms of production for the former producers become even more disadvantageous.

Approach

Worldwide, IWMI has conducted comparative research on participatory irrigation management in state-supported schemes. International and South African research findings have been input in a continuous dialogue with government officials and other actors influencing policy in South Africa. International comparison showed that the above-described pattern is typical in government-supported smallholder schemes in developing countries that are brusquely abandoned. The first generic conclusion is that irrigation management transfer in formerly state-supported schemes can only work if smallholder irrigated agriculture is profitable enough to bear the extra burdens of scheme operation and maintenance. So forging forward and backward linkages, credits and training are essential components, besides transfer of management, of an overall policy for the uplift of smallholder irrigation. Second, the process of transfer should be gradual; while inclusive, accountable member organizations are to be created.

Policy workshops and international comparison have led the government to launch an encompassing national policy for water for rural poverty alleviation and the re-vitalization of smallholder irrigation schemes. The IWMI's research serves as an intermediate stage between the key stakeholders in state-supported irrigation, linking poor farmers and irrigation policy-makers and implementing agencies.

Reflections

Comparative research on gender in irrigation in South Africa identified issues that will be relevant for the future creation of inclusive water users' associations. First, most farm decision-makers in smallholder schemes are women; irrigated agriculture is a female farming system. This is related to the cultural division of tasks within households and the state's gendered off-farm employment and homeland policies. Second, although some women have plots in their own names, others have long-life tenure security to the land of their male kin. Elsewhere in irrigation management, water rights and membership of water users' associations are commonly vested in landowners, rather than land users. However, the National Water Act (1998) of South Africa leaves the option open to disconnect water rights from primary land titles. Hence, farm producers and users of a portion of land can become members of the new water users' associations. This would especially benefit women farmers. From both a gender and poverty perspective, the challenge is to organize producers, irrespective of type of land rights, in a bottom-up way, and to ensure transparent elections of committees that remain accountable to their constituencies.

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17 Innovation in irrigation – working in a 'participation complex'

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Background

Irrigation management has some particular challenges in participatory research because it involves collective action where different interests may be present. Large-scale irrigation systems create particular challenges in participatory approaches to innovation, because of the large number of water users and the different ideas on participation and innovation present with different stakeholders involved in transforming irrigation practices. Using examples from an irrigation management reform programme in the Terai of Nepal, this case study summarizes operational elements of the socio-technical approach to irrigation research, which can show how technology acts as a controlling and mediating factor between biophysical and societal conditions. It is also useful as a method to identify stakeholders, their work practices and their interactions.

The socio-technical approach to irrigation research is directed at understanding how irrigation systems are designed, operated and used by people to provide water. It focuses on three areas of stakeholder actions: the social construction of technology, social conditions of use and social impacts. Other research concepts include the study of domains of interaction in irrigation management – strategic interfaces where people come together to determine water supply. These are emergent and often specific to individual irrigation systems. This broad approach has proved particularly helpful for an adaptive design consistent with the knowledge and preferences of farmers.

Approach

Action research in irrigation development or reform nearly always involves the researcher in a *participation complex*, where the researcher has to work in (1) different domains of participation and (2) different development contexts of participation. In the first, key interfaces with different stakeholders must be understood, in terms of their sphere of influence and local representation, their interests in participation and their practice in relation to water supply and water users. In a large irrigation system, participation is not only with farmers directly. More commonly, negotiation will also be done through water user organizations (whose representation often changes), as well as with system operators and the contractors who often implement new construction. These different domains

present different opportunities and challenges to participatory approaches. Successes in some areas, such as working with farmers to agree new designs and irrigation schedules, may be tempered by problems in other areas, such as failing to get good quality construction under contracts. The researcher (and designer or implementer) has to work across these domains and interfaces – to get farmers' ideas put into practical reality. The different development contexts of participation have different concepts of innovation and different sets of participatory methodologies linked with them, as outlined below. These different development contexts can all occur in one programme – although often one may dominate depending on the objectives of projects and individuals. Conscious recognition of points of consensus and differences on participation-thinking can also help programme design and build better action between stakeholders.

Development Context 1: economic development and modernization

Participation is an approach (by agencies) to induce increases in performance or impact through providing conditions or incentives that enable farmers to take on new responsibilities and opportunities. Innovation is new activities that improve linkages between resource use and production – new techniques, artefacts or institutional relations that increase productivity, efficiency and economic returns, or reduce wastage and degradation. The participatory methodologies, criteria and activities (often more 'criteria focused') are:

- RRA;
- problem inventory;
- village credit camps;
- beneficiary targeting;
- participatory irrigation management (PIM);
- cost-sharing;
- accountability mechanisms;
- user-manageable design;
- on-farm trials;
- capacity building;
- farmer-to-farmer training.

This is often a context of induced innovation and needs participatory approaches that allow local negotiation and evolution of change, rather than blueprint models.

Development Context 2: joint planning and problem-solving

Participation is a process through which stakeholders influence, share control and work together to achieve desired change. Innovation is shown through the changed behaviour of the people involved and the sharing of knowledge and skills. The participatory methodologies, criteria, activities (often more 'methodology focused') are:

- PRA;
- collegiate engineering;
- 'process' project planning;
- managing knowledge systems;
- consensus building and knowledge sharing;
- demand-driven development intervention;
- participatory technology development;
- networking to build platforms;
- stakeholder identification and interaction mapping.

This context works best at a small scale, and may only work where consensus is possible.

Development Context 3: social inclusion, improved equity and reduced vulnerability

Participation is organized effort to increase control over resources and regulative institutions in given situations on the part of groups and movements of those hitherto excluded (a definition from an Swiss International Labour Office programme). Innovation is the delivery of different benefits to different people. The participatory methodologies, criteria and actions (often more 'action-focused') include the methods of point (2) above, but also 'empowerment principles' as summarized below:

- conscientization of farmers and representatives;
- a deliberately long time frame;
- working with local 'advisors' that have continuity, as well as current stakeholders;
- capacity building and user-focused design highlighting equity and basic water needs;
- uses a range of kinds of contact (not just PRA group exercises or consensus workshops);
- political and legal action for excluded groups;
- conflict removal as well as consensus building (recognize that consensus may be impossible);
- tolerate/recognize pluralism in many areas – law, science, technology use;
- work with local practices to adapt known science and technology;
- keep construction controlled or strongly supervised by the users.

This context recognizes the tensions and complex politics of negotiating change in many different arenas but needs highly motivated and conscientized actors to empower change.

Reflections

Development intervention is said to have three practical needs – explanation of the development problematic, information on which to develop action and

conceptual tools for designing action. We need to think about typologies of action and not just methodologies for designing action to bring farmers' requirements into reality. The socio-technical approach – and the concept of a 'participation complex' in action research – helps the design of participatory research and enables researchers to think about both the 'problem environment' and the 'project environment' in which they are working. These shape the participatory methods that people can use and the emergent challenges of working with different stakeholders. Conscious recognition of different methods to achieve objectives – and the problems that may come from failures in any area and reasons for them – can help to actualize desired and agreed innovations.

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18 Methods used to address resource issues in integrated watershed management in Nepalese watersheds

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Background

This case study attempts to integrate sustainable principles into watershed management in two Nepalese watersheds (Jhikhu Khola and Yarsha Khola). These Middle Mountain watersheds are some of the most intensively used landscapes on earth and exhibit all the resource problems that are now of major concern in developing countries. Water shortages, water pollution, soil fertility deterioration, deforestation, lack of animal feed, stagnating biomass production, inequity, poor food security, poverty, increasing workload for women, few alternative economic options and poor infrastructure support are all part of the overall problem being addressed.

The challenge is to arrive at methods that are adaptable to complex conditions and that facilitate integration and interdisciplinary activities, and build linkages between researchers, farmers and local and national institutions. Access to long-term funding from IDRC (and more recently SDC) over an eight-year period has allowed us to develop a comprehensive resource database for the watershed and helped make the transition from a basic, science-driven project to one that is primarily participatory. We use the watershed (not the community) as our unifying unit for research because we can model landscapes, water, sediment, nutrient dynamics and climatic change effects at that scale.

Approach

The community-based NRM approach (CBNRM) begins with a rapid PRA to identify common concerns and issues in the communities within the watershed. Then a GIS database is built consisting of geology, soils, topography and land use layers. In the field we establish monitoring stations for climate, hydrometry, soil fertility and soil erosion. The issues raised by the communities are addressed using a GIS approach that includes overlay stratification, modelling, statistics and socioeconomic surveys. Key factors indicative of climatic conditions (elevation and aspect), the dominant bedrock and superficial material types and dominant land uses are identified. These are then divided into unique categories (two for elevation, two for aspect, three or four for contrasting rock type and usually four for land use type). The combination of these factors plays the dominant role in shaping and using the landscape and this 2x2x3x4-combination matrix is then used to divide the landscape into 48 possible landscape combinations. The GIS overlay technique is applied to show the dimension and location of each combination. Ten farmers and ten members of forest user groups are then randomly selected in each of these 48 classes of landscape and a participatory survey is conducted. Samples of the dominant soils in each chosen farm or forest are collected and analysed and information is obtained on farm and soil inputs, production, socioeconomics, gender and equity and forest use and management practices.

Collaborative participatory farm interventions are then initiated to address the farmers' concerns. Based on this approach we have identified that only one-third of all farmers apply enough nutrients (N and P) to a maize crop in double rotation and in these farming systems the long-term soil fertility is not sustained. At the same time, we can show that the nutrient deficits in an irrigated crop rotation system of rice, wheat and maize is only prevalent in about 40 per cent of all farms. This can now be expanded to other cropping rotations by examining the nutrient balance situation and economic consideration when cash crops such as potatoes and tomatoes are introduced into the rotation. We can also apply scenarios to these systems and simulate possible outcomes.

Our most interesting and most challenging research lies in how to correct problems and how to rehabilitate sites, not just in identifying and quantifying the problem, or in determining the rate of degradation. Highly degraded sites often occur on common land where the prospects for rehabilitation are poor because of the great effort needed to establish biomass and the low possibility of short-term economic returns. However, we demonstrated that up to 40 per cent of the total annual sediment load in the river originates from such sites and the impacts on irrigation systems downstream are large. These areas provide an opportunity for researching how to develop community forests and grazing lands that eventually can become biodiversity gardens.

Reflections

The methodologies used are more complex and require newer skills than are traditionally available at educational institutions. Thus, much effort has to be

spent on training and education. This delays diagnostic and intervention research but has more long-term benefits. Working in an interdisciplinary manner is also much more difficult and demanding. Putting together the right team configuration and matching it with the right personalities is probably the biggest challenge. The approach is highly time consuming, thus project funding should be assured for longer time periods than the traditional 3–5 years. The focus tends to be around communities at the expense of integration within larger more natural units such as watersheds and coastal or ecological zones. Another disadvantage is that scaling up cannot easily be accomplished when not incorporated into the research activities at the outset.

The advantage of this method is that it covers all environmental conditions in the watershed and enables us to determine how much each individual factor contributes to the overall variance of key resource indicators. Based on this sampling design, the analysis of variance or non-parametric significance tests can be used in quantifying potential causes and rates of degradation. The social factors are not stratified in a statistical manner but, because we look at all types of biophysical conditions, we capture members from most of the socioeconomic spectrum in the watershed. The initial effort is large but the payback is enormous because this type of survey can be done once every 5–7 years in the same watershed. Provided all the information is geo-referenced, it gives us the opportunity to document the dynamics of land use, soil fertility and socioeconomic conditions.

The CBNRM approach addresses the immediate concerns and issues of the community, providing a better forum for communication among researchers, community participants and the general public. The focus is on the poorer fraction of the society and this allows more emphasis to be placed on issues of gender and ethnicity. Gender is of particular interest because the workload of women in Nepal has increased with agricultural intensification and off-farm employment by men. Conducting research that focuses on reducing the workload of women (eg, improving fodder and fuelwood supplies, facilitating access to safe drinking water, improving soil nutrient management) can therefore have immediate effects in improving the livelihood of rural families. Well-chosen interventions and dissemination of successful results can be facilitated and applied more rapidly using a CBNRM approach. Issues are addressed in a more interdisciplinary manner and this should lead to a better understanding of the environmental system and result in more holistic and permanent solutions. The involvement of stakeholders that play an active part in the research provides a reality check on the relevance of the research. The approach can facilitate conflict resolution because stakeholders are incorporated into the research from the start. It leads to more effective public education and forces researchers to communicate better with the public in explaining why the research is important and what the results mean. The act of supporting credible research helps build intellectual and scientific legitimacy for political reform. The CBNRM approach has stimulated internal discussions leading to more open policies. It is flexible and can readily be adjusted to a wide range of conditions.

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19 A comparison of farmer participatory research methods

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Acknowledgements

ICRISAT, Bulawayo, Zimbabwe and ICRISAT, Lilongwe, Malawi; Concern Universal, Dedza, Malawi; University of Malawi, Bunda College of Agriculture, Lilongwe, Malawi; Ministry of Agriculture and Irrigation, Extension and Research Departments, Government of Malawi, Lilongwe, Malawi; Department of International Development, London, UK; The Rockefeller Foundation, New York, NY; CIMMYT, Lilongwe, Malawi.

Background

In Malawi and Zimbabwe, ICRISAT is developing new research methods for improving soil fertility. The Institute is also building partnerships among national scientists, extension advisors in NGOs and the public sector and farmers. The aim is to improve the ability of national research programmes to develop 'best bet' NRM technologies for poor farmers by obtaining their input at earlier stages.

New technologies are needed that improve human nutrition while enhancing soil management and enabling communities to rehabilitate degraded environments. The main innovations introduced so far are intensification with long-duration and indeterminate legumes and integrated use of organics and inorganics. In Malawi, farmers are testing and adapting options such as maize grown in rotation with a doubled up legume intercrop of pigeonpea and another grain legume. Combining small amounts of fertilizer with manure and pigeonpea residues is also being tested.

Approach

A novel aspect of the programme is its evaluation of several participatory approaches applied in parallel in different villages. The results are compared with baseline data from villages having no known relationship with researchers or farm advisors from NGOs or extension services. This approach enables researchers and farm advisors to address their concern that farmer adoption of fertilizer and integrated nutrient management has been practically nil, despite a decade of on-farm research and the recent focus on participatory research and extension as well as training-for-transformation empowerment approaches.

Costs, as well as benefits, will be assessed for different methods of partnering. Some researchers and senior extension staff are also concerned that extension rarely reaches female-headed households and women farmers, nor do their concerns enter into agronomic research.

The methods being compared include farmer empowerment approaches led by NGOs, extension-led demonstration trials and farmer participatory research, each conducted in a different village in the case study areas. The study is determining which of the approaches are best at building institutional linkages and improving the peer relationship among stakeholders, for different locations. All of the partners involved evaluate the effectiveness and costs of each approach. Researchers are also determining how well each approach addresses the needs of female-headed households. Project partners conducted comprehensive surveys to provide a baseline for, and developed methods of, comparison. They agree that the comparison should indicate which methods are working best, as reflected in perceived cost-effectiveness and the satisfaction of researchers, extension advisors and farmers. Farmer adoption and adaptation of technologies, farmer empowerment and improved soil management will be assessed for each method.

The 'mother–baby' trial design is one method for improving communication between farmers and researchers that has so far proved successful. The approach was originally created to facilitate farmer collaboration in testing soil fertility technologies. Further, it was conceived as a practical means for researchers to rigorously incorporate farmer evaluations of technologies at every step in the development process. The approach links together two trial types: a replicated one that fits researchers' needs and a simpler trial that meets farmer needs, rather than attempting to compromise and meet all objectives in a single trial. Researchers first design 'best-bet' technologies, attempting to take into account farmers' priorities and resources. Then mother–baby trials are planted in each participating village. The 'mother' is a replicated experiment designed by a researcher. Farmers plant and manage the baby trials, which are single replicates of the mother trial. For this purpose, each farmer selects a best-bet technology from the mother trial and adjusts the level of inputs and equipment according to his or her preferences. Farmer evaluation is documented through surveys, community discussion and ranking exercises, which facilitate researcher incorporation of farmer input. The trials have led to improved spontaneous experimentation among farmers and give researchers and extension advisors the chance to observe and learn from farmers.

Reflections

The larger context of the different case study areas where the approaches are being tested is difficult to assess. For example, the market opportunities and historical extension–farmer relationships may vary markedly among the areas and determine the relative success of different methods. The trial and demonstration approach probably has the least emphasis on farmer knowledge, while facilitation of farmer learning and experimentation, the farmer-led approach, has the most. The changes in the researchers and extension staff to

encompass a broader, more participatory approach is proving difficult to document. Further steps, such as how to facilitate farmer training and communication with other farmers on guidelines, are not explicitly part of any approach although this may develop.

Farmer-to-farmer communication is probably the most important means of technology dissemination and is not treated explicitly in any of the approaches, except perhaps the farmer empowerment approach (which some professionals view as too costly for large-scale work). This point is difficult to evaluate but should become clearer with time. A survey is underway to evaluate researcher and extension attitudes and beliefs regarding effective ways to communicate with farmers and work together to develop soil management options and to improve farmer experimentation. Surveys documenting farmer assessment of the process and farmer adoption are also on-going.

All of the partners involved in the methods' comparison systematically evaluate methodology approaches and efforts to facilitate farmer–researcher-extension linkages and technology best-bet options. Also, the concerns of women farmers and female-headed households are specifically addressed. This took time to build, in part because almost all of the researchers and extension staff involved were men and no gender sensitivity training or discussion was attempted at initial stakeholder meetings. Attention to including women farmers in the technology development process was almost nil at first but has increased over time, particularly at the Malawi sites. This adds value to on-going efforts in the area. The mother–baby trial and farmer empowerment approaches attempt to facilitate farmers' learning basic research principles, to expose farmers to a range of new options and to empower them to value their own knowledge. This appears to have improved communication among farmers, researchers and extension staff.

A conundrum is that extension staff and researchers mostly see the trial demonstration approach as the only cost-effective way to scale up dissemination. Yet this approach does not facilitate farmer experimentation or joint learning. Staff at NGOs also state that their work on farmer and community empowerment is only cost-effective in isolated areas. They believe that they need to go to trials and demonstrations to reach more people, although both groups express frustration with the lack of effectiveness of demonstrations led by extension or farm advisors.

The goal of this case study is to measure long-term impact and changes in how research and extension staff conduct their work. Stakeholders designed this village-based comparison of methods and are involved in evaluating the pros and cons of each participatory method over time. Meetings are held annually for assessment. Strong links are built because researchers, extension staff and NGOs were already carrying out most of this work and through the case study we are attempting to facilitate self-reflection on the value of different approaches to the stakeholders. In Malawi, 400 farmers are assessing best-bet technologies at seven sites around the country through baby trials and their own experimentation. In the process, they are satisfying researchers' need for sound quantitative experiment results.

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20 Soil and water conservation – historical and geographical perspectives on participation

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Acknowledgement

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Background

The Promotion of Soil Conservation and Rural Production (PROSCARP) is a national-level project aimed at improving the nutrition and health of smallholder farmers in Malawi. Since 1995 it has worked through Catchment Area Development Committees (CADCs), which have mostly been elected in village meetings and which cover a defined area. In 1999 these numbered over 300, scattered throughout the country.

The project aims to work in a participatory mode with the CADCs and with other agencies. This is recognizably difficult because of the large size of the project and because of the historical legacy of a national extension system that has been top-down and, while it has adopted a participatory ethos, it is currently underresourced and demoralized. The project offers a range of soil- and water-related technology options to farmers, including realignment of ridges on the contour, vetiver grass, green manure crops, legume rotation crops, agroforestry and minimum tillage. In order to encourage uptake, the project has also used incentives such as providing free seeds and seeds on loan, paying for labour on vetiver grass nurseries and providing village wells and pit latrines.

Approach

During 1999, a small study team met with the CADC members, local extension staff and other members of the community over periods of 1–3 days per area. Discussions were held with individuals and with focus groups and included some ranking and time-line exercises. Focus groups (village headmen, male and female CADC members and other villagers) were encouraged to share their findings with each other and to discuss further the implications for the soil and water conservation programme in their area.

The use of various soil and water conservation technologies has evolved over time. Village headmen who remembered events from the 1940s were able to describe and quantify some of the main changes in physical soil conservation

and this exercise helped to place the current activities of the CADCs within a historical context. A notable feature of the changing soil and water conservation practices was a focus on physical structures at field level initiated by external agencies (changes taking place as a result of initiatives by individual farmers were hardly mentioned). This is not surprising, given that during the colonial period the village headmen were instructed to oversee and enforce the construction of soil and water structures. However, it raised questions about how conservation technologies were introduced and perceived. Were the changes largely a response to external threats and incentives? Were physical structures regarded more as significant innovations than changing cultural practices? A discussion around why some people had realigned ridges, while others had not, provided insights into how the local CADC operated and the role of incentives in the uptake of new conservation technologies.

Three main reasons accounted for the slow spread of technologies. First, a technology was adopted in order to receive an incentive. Second, difficulties occurred in access to technologies and the licence to distribute those that were available. The technologies such as vetiver grass were seen to be the property of the project and its CADCs, and therefore it was felt that approval from above might be needed in order to pass these on to communities outside of the defined catchment area. Third, some of the technologies had not yet shown clear benefits (eg, agroforestry species) and others were not suited to local conditions (eg, crop rotation in areas of very limited land).

The CADCs were found to function rather differently in each area, depending on how they had been established and how the local people (including local extension agents) had taken them forward and interpreted instructions from the project. Some had been negatively affected by village politics, a fact of life in rural Malawi. The CADCs were most functional when they had effectively incorporated local village leadership, and least so when used as a vehicle for one faction to challenge the current village leadership. This further raised the issue that committees based on support from local political positions (based on people groups) often did not correspond with ideal geographical areas for integrated (above field level) soil and water management.

Most local extension workers acknowledge that they spent a disproportionate amount of their time on project-related work, rather than on their general duties. They justified this in terms of project resources and farmer interest in the CADC areas. They also noted that they had impossibly large areas to cover and even without a more intensive project would not be able to cover all their mandate area. This raised the issue of the potential side effects of introducing more intensive extension approaches in the context of an expanding rural population and a shrinking number of extension staff, lacking in mobility.

The donors, concerned that insufficient project resources were going directly to the community, raised the issue of how to stimulate soil and water conservation in a sustainable manner. More direct payments to communities may have the effect of being a disincentive to neighbouring communities not directly involved but potentially benefiting through extension and farmer-to-farmer dissemination. It was recognized that extension staff needed to be

rewarded for their good work as facilitators and encouragers. The question is raised as to the compatibility of the two project objectives of poverty alleviation (in the short term) on the one hand and soil and water conservation that is both participatory and sustainable (in the longer term) on the other.

Reflections

Several issues of concern have arisen during implementation of the project including:

- The spread of technologies to neighbouring communities has been much slower than expected, limiting geographical impact.
- Information on how the individual CADCs function on a day-to-day basis is not comprehensive but there are indications that some CADCs are perceived as operating like exclusive clubs – restricting benefits to a few community members.
- The local extension workers may be spending too much (from the perspective of their line managers) or too little (from the project perspective) time in the catchment areas.
- A high proportion of project costs is spent on administration and related recurrent costs (travel and field allowances) compared to the amount that reaches the communities directly.
- Provision of incentives to targeted groups has discouraged technology uptake by a wider group of farmers over a larger geographical area.

The project management is concerned that implementation should be more participatory. Thus studies at village level using PRA tools were conducted to explore this point and the above concerns. Expectations were raised, both for villagers and local field staff, during meetings. It is unclear whether the project will have the capacity to address the issues raised, particularly the plans of the local community and field staff to further expand the project's geographical scope in response to demand from neighbouring communities who have perceived the benefits.

Despite these concerns, benefits accrued from the project. Many farmers were exposed to a range of technologies, and a significant number of them received benefits in terms of cash payments and increased production from using the technologies provided. Front line staff increased their technical skills and skills in working through local committees and training farmers to train other farmers. Farmers were trained in soil and water conservation techniques. The village-level studies placed project activities in a historical context, both for the local community and for the project staff.

21 Improving farmers' risk management strategies for resource-poor and drought-prone farming systems in southern Africa

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Background

Small farms of less than 5 hectares account for about 70 per cent of southern Africa's maize production. Although new technologies are available for improving production in smallholder maize systems, widespread adoption faces major constraints – particularly the constant threat of drought and declining soil fertility. In Zimbabwe and Malawi, the soils in smallholder areas tend to be sandy, with limited organic matter, low nutrient content and low water-holding capacity. Farmers have only limited access to organic manure and cannot usually afford inorganic fertilizers.

The threat of drought, combined with fluctuating market prices, means that farmers are gambling on an uncertain yield and economic return. Therefore, to be attractive to farmers, new technologies for improving soil fertility must be able to reduce production risk. They must also be compatible with farmers' diverse and complex livelihood strategies. To support the development of appropriate soil fertility technologies, CIMMYT's Risk Management Project (RMP) evaluates their biophysical and socioeconomic performance through a combination of computer crop modelling and farmer participatory research in Malawi and Zimbabwe.

Approach

The RMP employs both hard (quantitative) and soft (qualitative) approaches to explore the links between agroecosystems and the socioeconomic environment. A participatory research subproject conducts systems diagnostics, identifies stakeholders, determines farmers' soil and climate taxonomies, describes farm families' livelihood strategies and fosters farmer experimentation with soil fertility management practices. A modelling subproject collects data to validate the computer model and fosters its use to examine the long-term biophysical performance of soil fertility management practices under specific soil and climate conditions. By integrating the two sets of activities, RMP can use farmers' soil and climate taxonomies to develop soil and climate profiles for running the model. Further, the model can be used to evaluate farmer-developed

technologies, and farmers can evaluate the model's outputs and participatory technology field trials within the context of their livelihoods and risk management strategies. This enables farmers with diverse resource endowments and diverse livelihood strategies to verify options within their own environments.

The RMP collaborates with focus groups from the Universities of Zimbabwe and Malawi, national agricultural research programmes and the Africa Centre for Fertiliser Development. Researchers and farmers evaluate soil fertility technologies being developed by the focus groups. Through this integrated approach, researchers can draw on one another's experience and that of farmers. The RMP also has links with ICRISAT and CARE. The CIMMYT and ICRISAT centres jointly fund researchers and field activities and share information. Farmer groups established by CARE link the RMP to communities and provide a social framework for broader dissemination of successful technologies.

One of the activities is to design a framework for running simulation models based on farmers' soil management practices. The goal is to develop an interface that permits discussion of outputs and key management variables, involves farmers in assessing scenarios developed by the model and enables them to ask questions of the model.

Focused planning meetings are conducted to enhance the team's organization. Participants develop common work plans and research frameworks for all project stakeholders. The RMP began with a macro-systems diagnostics approach, which enabled it to identify key stakeholders, secondary data and partners for implementing project activities and to identify appropriate techniques for fieldwork. The RMP has thus created a strong network of research partners throughout the region.

Fieldwork activities concentrated on forming or strengthening farmer groups at two sites in Zimbabwe and one in Malawi. Farmers, extension staff and researchers formed new groups for the 1999–2000 crop season. Activities included participatory wealth ranking, the development of farmer taxonomies of soils and climate, inventories of management options and practices for different resource endowments and varying soil and climatic conditions.

A key collective learning and decision support tool is the use of participatory modelling maps of agroecosystem resource flow or resource allocation maps (RAMs). These demonstrate key household and community resources and inter-relationships within a systems context. Farmers and researchers together develop the maps and use them to record, monitor and analyse data and decision-making, which then enables them to understand the systems' context of soil fertility. The methodology development for the modelling and FPR interface is considered an iterative and dynamic process, with a diversity of tools and techniques being used, refined, adapted or discarded as the process and project stakeholders require. This is an immensely creative and ambitious research agenda. This kind of interaction is highly unusual but holds great promise for a more effective evaluation of soil fertility management technologies, under highly variable and risky climate conditions.

Reflections

Biophysical crop modelling enables evaluation over time, including different variables such as climate, soils and management. However, the models are only as good as the data and the agenda that are used in their development and are highly data-intensive to establish. Models are often narrowly focused compared to farmers' multi-faceted and complex livelihoods and cannot handle socioeconomic variables. Some factors affecting crop and soil performance are also beyond the model's capabilities. The model-to-farmer interface integrates disciplines and can bring modellers and farmers together with quick feedback. This can be used to promote collaborative learning and as a decision support tool because it makes it easier to identify and target key research priorities. It has some knowledge gaps with outputs highly subject to interpretation as to by whom and how the research agenda is driven. Linking modelling with GIS and farmer land types for scaling up is being explored but entails expensive start-up costs and questions of data ownership.

On-farm participatory testing of technologies allows farmers more freedom to experiment and helps bring stakeholders together. It serves to develop a better understanding of farmers' priorities and natural resource and socioeconomic factors affecting technology performance, also capitalizing on farmers' indigenous knowledge. On-station testing is easier to manage and provides rigorous controls and designs that reduce variables affecting crop performance. However, socioeconomic variables associated with management are excluded and a long time frame is needed.

This integrated research method and process enables a learning forum to be developed whereby the very different mindsets and approaches of all the actors involved in the research can begin to envision a common environment. They can then develop a platform to work together on common problems and solutions within a participatory process

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22 Participatory mapping, analysis and monitoring of the natural resource base in small watersheds: Insights from Nicaragua

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Background

A watershed is a natural ecosystem in which the relationships between different resources influence land use patterns at different scales – from the plot to the farm to the watershed level. Watersheds are drained by a single watercourse that encompasses water, soil and vegetation and links uplands with downstream areas. These ecosystems are also an arena for conflicting interests, which points to the importance of analysing the *social* construction of landscapes.

Two features of watershed management make this a particularly complex task. First, the interests of people inhabiting the watershed are interdependent but asymmetrical. Upstream use of land and water directly affects people downstream, and many resource management problems (eg, deforestation, soil erosion, pests and diseases) cross natural and human-made boundaries. Second, the interdependence of upstream and downstream interests creates uncertainty. Downstream users do not know how upstream users will behave or whether they will consider the downstream effects of their actions. Under these circumstances, collective action is vital for achieving sustainable resource management. In turn, this means involving local organizations in ways that allow less privileged people (eg, women, ethnic minorities and the landless) to gain more control over resources and to influence policy-making at the regional or national levels.

Research was undertaken in the Calico River watershed, Matagalpa Department, Nicaragua – a reference site of CIAT's Hillsides Project.

Approach

To create a collective vision for managing the Calico River watershed, a participatory workshop was held during September 1997 near the town of San Dionisio in Matagalpa Department. It brought together 30 men and women farmers, NGO staff, local government officials and researchers from CIAT. The group identified problems and conflicts affecting land management and described livelihoods at the community and watershed levels. Among the problems were land degradation (resulting in lower crop yields), deforestation

(leading to soil erosion and loss of wildlife) and both water scarcity and pollution (identified as the most important constraint).

The workshop provided an overall and general view of conditions in the watershed and some insights into key issues. However, more detailed information was needed to understand what was happening to whom (eg, upstream and downstream dwellers, land-rich and land-poor households, women and men) and to identify research opportunities. The CIAT Hillsides Project began seeking methodological tools to help answer questions about the dynamics of 'resources and people'. Eventually, the project produced a combination of tools for resource mapping, transect analysis and indicator-based assessment.

By March 1998, small teams of local informants who knew the area well had completed 15 participatory micro watershed studies. They made special efforts to capture the perspectives of men, women and other user groups on land use and the state of forests, water resources, crops, wildlife, domesticated animals, pastures and soils. The local research team identified limitations and opportunities for improving livelihoods and NRM in the area. Each study began with the development of a local resource map, whose boundaries were defined according to local criteria. The maps were used to define transects across major agroecological zones, production systems and other important resource features. During a transect walk across each micro watershed, informants analysed resources (access, use, misuse), with assistance from the CIAT Hillsides Project team.

The next step was to develop user-friendly resource use monitoring indicators through a consultative process. The research team prepared a draft set of indicators based on the combined findings of 15 resource analyses. The informants reviewed and refined the indicators and then used them to assess the state of their own micro watersheds, assigning qualitative values for each indicator. The results were organized by different resource and landscape features and then presented in a second workshop.

Reflections

Results were presented to local decision-makers, including the mayor, state agencies, NGOs operating in the watershed and a recently created association of community organizations. The information provided decision-makers with a better basis for taking action by pointing to areas where natural resources are highly degraded or under risk or where rapid improvement could be achieved. Resource assessment is key for improving resource management practices and regulatory arrangements. To achieve better resource management through collective action, rules and sanctions, local people and their cooperators need to start with a good understanding of resource dynamics. Monitoring also helps raise awareness among local decision-makers about the interdependence of resources. If monitoring is done collectively, it can also impart skills and create ownership and confidence.

The participatory mapping and monitoring tools that were used are relatively simple ones that local people can use to analyse the local situation, discuss

constraints, problems and opportunities, take action and monitor results. In some situations the tools could be a constraining factor because they are time and energy consuming.

A challenge for the future is to design and implement landscape-level experiments that address transboundary problems, such as soil erosion, pests and water pollution. Experiments are now underway in the Calico River watershed to apply the insights gained from the participatory mapping and resource analysis. A key actor in this research is the Calico River watershed's network of CIALs. These community-based research services are the subject of another case study in this annexe.

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23 Observations on the use of information tools in participatory contexts: Access to information and empowerment

Jim Williams, NRI, UK

Acknowledgements

This case study owes much to many people. It is a sympathetic compilation of the experiences of others, rather than a synthesis of direct first-hand results. Sources include: the Department for International Development (DFID) social watershed development projects in India, the work of national and state government agencies and NGOs in India, a GIS participatory workshop held at NRI, studies undertaken for the European Commission (EC) and the British government on the use of environmental information, and the diverse experiences of colleagues.

Background

Because participatory research tends to be 'local and spotty' and community horizons tend to be foreshortened, this case study looks at aspects of information tools (ITs) and their applicability in participatory approaches for 'up scaling'. The study considers, among other factors, the scale of analysis for decision-making, using soil and water rehabilitation issues as an example, and explores the roles of IT decision support for the different stakeholders. Gender issues are considered here to be a subset of equity issues but the possible need to take them into account is accepted.

Approach

The qualities of the method (tools) for integration of biophysical and socioeconomic concerns depends on the stakeholder. Researcher, mediator (eg, NGO) and community views are likely to differ.

Traditional maps are usually cumbersome and inappropriate because they are too non-specific but they may be better than nothing. Village maps tend to emphasize the biophysical because of the ease of representing these aspects in a model or map. They can be useful for bringing out gender and (lack of) equity issues.

In Andhra Pradesh, satellite remote sensing is used successfully to help 'guide' the community PRA process and to ensure that watershed rehabilitation interventions are focused in the areas where greatest biophysical impact can be achieved within the socioeconomic priorities of the community. How greatly equity and gender considerations are involved is unclear.

The use of GIS would appear to have major potential. However, if significant impact is to be achieved with communities at village level, considerable scope is entailed and there is a need for innovative research and new approaches to spatial representation of social and economic indicators. The process of incorporating PRA-generated data into GIS is still rudimentary. Important issues are involved in integrating qualitative with quantitative data and then scaling up from local enquiry. This is an area where GIS may be able to give valuable assistance. Joint planning and interdisciplinary working by GIS and PRA (or equivalent) practitioners is essential for practical success in combining the two methods.

Information technology (such as PRA, remote sensing, etc) is only as good as the people and institutions that use it and local politics permit. If the planning process is not responsive and accessible to local people, then IT may have limited value. Other software tools for 'modelling' decision-support are still severely constrained but could have enormous impact as 'expert guidance systems' in the future.

Reflections

Participatory IT could enable communities to face issues and to be better capable of taking themselves forward towards resolution before crisis point is reached. This is potentially an issue for useful research. While, inevitably, ITs empower the researcher and other centralized agencies more than communities, this argument is insufficient to withhold these 'potentially democratizing' tools from community use. A simple village photograph from the air may comprise the only form of land registration and demonstration of tenure available to the community. Although access to such information is usually empowerment, it also carries downside risks through (1) exposure of the communities and their knowledge base to more powerful centralized powers and (2) destabilizing existing information and power structures without developing appropriate alternatives.

Sector-planning applications of participatory IT approaches are available at the country level that donors should take up in project design. The monitoring capacity of IT needs to be more rigorously approached, for example as an M&E system for long-term social development projects and watershed management information, which needs to be integrated into the M&E process. Further development of IT applications is needed in community forestry, strengthening tenure over community participatory research and in the M&E of impact of community-based/participatory resource management. Risks lie in that centrally applying IT for M&E will degenerate into a policing of management plans or precipitating conflict. Thus we need to ensure an equitable balance in stakeholder inputs to and uses of IT and appropriate mechanisms for assuring easy access.

A priori understanding and management of landscape-scale resource issues would appear to be difficult without community access to improved information (tools). New spatial scale issues and time/change issues will probably need to be brought into the domain of livelihoods and stakeholder awareness, ownership and decision-making processes. The more useful ITs are potentially powerful (information content) agents of change but they are merely tools and need to be used with caution. Their use may expose hidden issues but not enable their resolution. As with PRA, irresponsible application may do more damage than good.

Projects in India have successfully demonstrated the value of ITs in participatory watershed management, particularly the role of remote sensing, for bringing wider landscape issues (eg, soil and water rehabilitation, management of wastelands and common property resources) into consideration by local communities. Their successes warrant careful examination, because they appear to consistently outshine other programmes.

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