CAPRi WORKING PAPER NO. 19

USER PARTICIPATION IN WATERSHED MANAGEMENT AND RESEARCH

Nancy Johnson, Helle Munk Ravnborg, Olaf Westermann, and Kirsten Probst

CGIAR Systemwide Program on
Collective Action and Property Rights
www.capri.cgiar.org

Secretariat:
International Food Policy Research Institute
2033 K Street, N.W.
Washington, D.C. 20006 U.S.A.

IFPRI

SEPTEMBER 2001

ABSTRACT

Many watershed development projects around the world have performed poorly because they failed to take into account the needs, constraints, and practices of local people. Participatory watershed management—in which users help to define problems, set priorities, select technologies and policies, and monitor and evaluate impacts—is expected to improve performance. User participation in watershed management raises new questions for watershed research, including how to design appropriate mechanisms for organizing stakeholders and facilitating collective action. Management of a complex system such as a watershed may also require user participation in the research process itself. An increasing number of watershed research projects are already participatory, however challenges remain to institutionalizing user participation in both watershed management and research.

KEYWORDS: watershed, participatory watershed management, participation, research, collective action

TABLE OF CONTENTS

USER PARTICIPATION IN WATERSHED MANAGEMENT AND RESEARCH

Nancy Johnson[1], Helle Munk Ravnborg[2], Olaf Westermann[3], Kirsten Probst[4]

1. INTRODUCTION

To succeed, watershed management has to be participatory. This is one of the lessons coming out of decades of failures of centrally-planned watershed development projects through which local people have been either coerced or paid to undertake terracing, bunding, destocking and other technical measures that external experts believed would cure watershed degradation (IDB, 1995; Kerr, Sanghi and Sriramappa, 1996; Pretty and Shah, 1999; Rhoades, 1998). Thus, participation is expected to achieve what coercion and subsidies could not, namely to make watershed development more successful and sustainable.

Success will likely require that all stakeholders in watershed management—including users[5], policymakers, researchers, and others—recognize that participation is not simply another way to deliver the same technological solutions. Commitment to participatory approaches may demand significant changes in the way we think about both the theory and practice of sustainable watershed management. Participation implies that stakeholders will work together to set criteria for sustainable management, identify

---

[1] Senior Research Fellow, International Center for Tropical Agriculture (CIAT).
[2] Senior Research Fellow, Centre for Development Research.
[3] Research Fellow, International Center for Tropical Agriculture (CIAT).
[4] Graduate Student, University of Hohenheim, Institute for Social Sciences of the Agricultural Sector, Dept. of Agriculture.
[5] Users are defined as those who use watershed resources such as land, water, or trees. Farmers are a subset of users. Users can be located both inside and outside the watershed.

priority constraints, evaluate possible solutions, recommend technologies and policies, and monitor and evaluate impacts.

User participation clearly has implications for watershed management research, broadening the agenda in terms of technologies, institutional innovations, and methods of doing research. User involvement in setting priorities, evaluating technologies, and monitoring outcomes clearly implies their active participation in the research process as well.

This paper examines the role of resource users in watershed management and research. Section 2 summarizes the arguments for participatory watershed management, and identifies important research issues that arise from user participation. Section 3 introduces some concepts in participatory research and discusses their usefulness in different aspects of watershed research. Section 4 provides some empirical evidence on the current use of participatory methods in watershed management research projects, and identifies some challenges to increasing and institutionalizing the use of participatory methods. Section 5 summarizes and concludes.

2. WHAT DOES PARTICIPATORY WATERSHED MANAGEMENT IMPLY FOR WATERSHED MANAGEMENT RESEARCH?

WHY PARTICIPATORY WATERSHED MANAGEMENT?

Early soil and water conservation programs in the United States, Eastern Africa and South Asia promoted a very narrow range of technical solutions such as terracing and contour bunding to control soil erosion. Two key assumptions appear to underlie the design of such programs. The first is that soil conservation practices were universally-

applicable, that what works in one place will work in another. The second assumption is that local farmers are unaware of erosion and ignorant of its causes and consequences (Pretty and Shah, 1999).

More often than not, both assumptions turned out to be false. Program technologies were frequently both ecologically and economically incompatible with local farming systems, especially with regard to labor availability. Moreover, by being imposed on people as *the* way to prevent erosion, they came to replace rather than supplement local methods of soil and water management in places where these had been practiced. Often, the result of these centrally-controlled soil and water conservation programs has been more erosion rather than less, either because the new structures were not maintained or because they were simply technically inferior to existing practices (Pretty and Shah, 1999; Kerr et al. 1996).

Disappointingly, these same assumptions are still evident in the design of many current watershed development projects, successors of the earlier large scale soil and water conservation programs. Farrington and Lobo (1997) report that in Indian context, where a great deal of emphasis has been placed on watershed development, 99 percent of watershed development projects are still based on conventional approaches emphasizing physical planning without attention to local economic, social, or ecological conditions.

However, a small but growing number of watershed development interventions are involving farmers and other users in the design of projects (Hinchcliffe et al. 1999; Farrington et al. 1999). By soliciting information from users about their understanding of resource degradation, the adequacy of current resource management practices, and their

criteria for potential new technologies, these projects seek to improve appropriateness of resource management technologies and policies promoted by the projects.

As much as watersheds are more than the sum of their different patches of land and streams of water due to the biophysical processes through which they interact, watershed development is not just about individual farmers taking measures to improve productivity on their own plots. Managing a watershed involves taking into consideration the interaction in time and space not only of individual plots but also of the common pool resources such as forests, springs, gullies, roads and footpaths, and vegetative strips along rivers and streams (Swallow et al. 2000). Watershed resources provide different services to different users, and these users are differentially affected by resource use decisions. This implies that participatory watershed management will often involve a process in which stakeholders jointly negotiate how they will define their interests, set priorities, evaluate alternatives, and implement and monitor outcomes.

IMPLICATIONS OF PARTICIPATORY WATERSHED MANAGEMENT FOR RESEARCH

Involvement of users in watershed management has significant implications for watershed research, principally that improving the sustainability of watershed management will require not only better technologies and policies for resource use, but also better organizational mechanisms and processes through which stakeholders can come together to make decisions. There is a large literature on collective action in natural resource management. However, the size of the geographic area, the diversity of

resources and users involved, and the combination of both common and private property make watersheds somewhat unique.

As noted in many of the cases of participatory watershed management from Asia, Africa, Latin America and Australia reported in Hinchcliffe et al. (1999), even in cases when watershed users stand to gain from coordinated management, collective or coordinated watershed management rarely emerges on its own. Campbell, Grice and Hardy (1999) describe a Landcare group that had successfully revegetated its watershed, yet acknowledged that it would probably not have done so if the group had not existed. "They knew something would need to be done eventually, but there were other priorities on individual farms. The opportunity to work together [created by the National Landcare Programme] has made them reconsider the importance of conserving the productive potential of their farms" (p. 346).

Three issues of particular relevance to organization for watershed management are:

1. scales and boundaries,
2. the roles and costs of facilitation, and
3. development of indicators and monitoring systems so that the impacts of changes in land use can be assessed by the group.

These areas could benefit from conceptual and empirical research, beginning with a systematization of past experience.

As noted by Rhoades (1998) and Guijt and Sidersky (1999), watersheds[6] rarely coincide with any units of the 'social landscape'. As an example, in the Colombian Andes, there is a notorious mismatch between watersheds and socio-political units. People tend to settle along the mountain ridges, making rivers and depressions the borders between communities. In contrast, watersheds include both sides of rivers but are divided by mountain ridges. Moreover, communities may often be too big to constitute an effective forum for collective action in managing a resource, which to a large extent relies on face-to-face contact to build and maintain mutual trust and understanding (Cernea, 1988; Uphoff, 1996; Ravnborg et al. 1999). Sustaining effective participation in watershed resource management may require flexibility in allowing watershed users to identify the boundaries and scales at which they prefer to organize themselves without insisting on geo-hydrological or existing social and political boundaries and scales. Second-level organizations may be required to reach watershed coverage.

The second issue where further research is needed relates to the roles and costs of facilitation – the transaction costs of participatory watershed management. In the presence of conflicting perspectives and interests within a group, third party facilitation can be instrumental to help foster and sustain public negotiation (Ravnborg and Guerrero, 1999; Steins and Edwards, 1999). Many of Australia's Landcare groups have opted to employ a group coordinator to network within the group, between the group and other organizations, and to sustain momentum of the group (Woodhill et al. 1999). Similarly,

---

[6] While we use the term "watershed" to be consistent with the literature on participatory watershed management and research, we are technically speaking of catchments, as defined in Swallow et al. (this volume).

the Indo-German Watershed Development Programme described by Farrington and Lobo (1997) has apparently assumed a large part of the transaction costs involved in the establishment and operation of the Village Watershed Committees. Careful documentation and comparative analysis of the effectiveness, efficiency, and sustainability of external facilitation under different circumstances is necessary in order to establish its role in participatory watershed management.

In many ways, watershed management is about 'managing the invisible' in the sense that, up to a certain point at least, the outcomes of changes in natural resource management practices are incremental and often not immediately observable. Sustaining participatory watershed management when the outcomes of people's efforts are not visible is hard. Thus, an important contribution of research to participatory watershed management is, as expressed by Woodhill et al. (1999) 'to make the invisible visible'. This has been the aim of the Australian land literacy campaigns that have encouraged community groups and schools to learn more about their landscape in systematic and replicable ways (Woodhill et al. 1999).

Obviously, there are great differences between Australia and, for instance, sub-Saharan Africa when it comes to the infrastructure for launching such land literacy campaigns. Yet, the need for people to sense that their efforts actually produce an outcome in terms of e.g. more and cleaner water, less erosion and more water retained in the fields, less risk of flooding and landslides, is equally great. Thus research is needed on how to develop locally-relevant ways of teaching basic principles of agro-ecosystem behavior, as well as simple indicators and measurement methods that can be used to help users monitor the outcome of their management efforts. Farmer Field Schools are one

methodology that has been shown to be effective in increasing farmer understanding of complex issues like pest ecology or integrated crop management (Rola et al. 2001; van de Fliert et al. 2001). Methodologies are also available for the development of local indicators of the quality of watershed resources such as soils (Turcios et al. 1999).

3. PARTICIPATORY RESEARCH AND ITS POTENTIAL CONTRIBUTION TO WATERSHED MANAGEMENT AND RESEARCH

To address the technical and institutional challenges in participatory watershed management, new research approaches may be needed. Research outputs clearly need to be consistent not only with users' economic demands and constraints, but also with their goals and social realities. This suggests that user input will be necessary in the research process as well.

SOME CONCEPTS FROM PARTICIPATORY RESEARCH

The field of participatory research looks at the involvement of the intended beneficiaries of research in the research process. While researchers rarely operate in total isolation from the potential users of their discoveries, the extent to which researchers have accurate information about the needs and priorities of users varies. Lack of information is most likely to be a problem when there is not direct accountability between researchers and beneficiaries, as is the case with most publicly-funded agricultural and natural resource management research. In such cases, incorporating beneficiary perspectives as part of the research process can improve the efficiency of research. Soliciting user knowledge and feedback regarding specific aspects of a research process

is referred to as functional participation since its purpose is to improve the functioning of conventional research processes. Functional participation would be expected to have its largest impacts where research beneficiaries have unique knowledge or insights otherwise unknown to researchers (Ashby 1996).

Others see the objective of incorporating users into the research process as a way to encourage changes among beneficiaries themselves. As a result of participation in the research process, users may improve their technical and analytical skills. Depending on how research is carried out, benefits can also go beyond strengthening human capital to the strengthening of social capital and community cohesiveness. Empowered users may not only adapt and adopt technologies and engage in spontaneous experimentation, they may also recognize the importance of research and begin to exert more effective demands on the public research and extension systems that exist to serve them. Empowering participation, as this type of participation is generally called, is concerned not only with generating appropriate technologies but also with developing capacity for innovation in individuals and communities over the longer term. Empowering participation would be expected to have the greatest impacts where there is high diversity and complexity among beneficiaries, and where substantial and continuous local adaptation of innovations would be expected. While functional and empowering participation are not necessarily mutually exclusive in their impacts, they do generally imply very different methods for organizing and implementing research.

USER PARTICIPATION IN WATERSHED MANAGEMENT RESEARCH

As suggested above, the appropriate level of user participation in research depends on the specific goals and circumstances of the project and its expected beneficiaries. In the case of participatory watershed management, the research needs are diverse, and different levels of participation appropriate. For example, the systematization and comparative analysis of experiences with external facilitation in participatory watershed management called for in Section 2 is likely to be carried out primarily by researchers. To the extent that researchers are not able to identify all the types of costs, input from users, perhaps generated through cross-site visits, could be useful. Similarly, the development of new technologies and tools such as computer simulation models of the impacts of alternative land uses may involve some user input and feedback but are likely to be mainly driven by formal researchers due to their technical nature. At the other end of the research process, the adoption of soil conservation practices by farmers usually involves some adaptive research in which the technologies are tried out and adjusted to fit into specific economic, social, and ecological circumstances of individual farms (Bunch and Lopez 1999). Users usually carry out this process alone, though some scientist participation may improve the efficiency of the farmer adaptation and provide researchers with a better understanding of farmer's needs and constraints.

While these researcher- and user-led innovations can make important contributions to the development of tools and technologies for sustainable management of watershed resources, a growing number of scientists argue that sustainable management of watersheds will require a fundamentally different and more empowering

approach to participatory research. The reason is that watersheds are dynamic, complex systems, and our "ability to make precise and yet significant statements about their behavior" is limited (Zadeh 1973 as cited in Campbell et al. 2000: p. 4). Conventional research methods may improve our understanding of certain aspects of these systems, but may not be sufficient to characterize watershed systems with enough precision to permit meaningful yet broadly applicable conclusions about how watershed resources should be managed.

Management of a complex system like a watershed must be associated with a process of individual and social learning (Campbell et.al. 2000), which Pretty (2000) defines as "a process that fosters innovation and adaptation embedded in individual and social transformation." As users learn more about their ecological and social systems, they may change their ideas about desirable and feasible resource management alternatives. However, the actions and interactions of different stakeholders during the learning process have impacts—intended and unintended—on the systems, changing the set of desirable and feasible management alternatives. Such a system calls for adaptive management—defined as a continuous process of design, action, monitoring and evaluation, and reflection and revision. In addition to this process of action and reflection, social learning also incorporates political processes related to conflict management among a number of stakeholders (Maarleveld and Dangbégnon 1999).

Research thus forms one part of a continuous cycle of problem identification, solution, action, and evaluation. "Ultimately, in the ideal scenario, there is no distinction between management and research" (Campbell et al. 2000). If researchers want to play a direct role in supporting sustainable participatory management of watersheds—as

opposed to producing innovations that may contribute to the improved management of specific watershed resources—they must become part of the social learning process, willing to learn along with other stakeholders and to recognize that their own presence will affect the system's evolution (Vernooy 1996). Important research questions related to the goals of watershed management and the form and distribution of impacts may need to be addressed from within this social learning process.

USING PARTICIPATORY RESEARCH IN A WATERSHED MANAGEMENT RESEARCH PROGRAM: AN EXAMPLE FROM CIAT

The International Center for Tropical Agriculture (CIAT) uses a combination of research methods to develop technological and institutional innovations for sustainable watershed management in the hillsides of tropical America. Integration of different research activities is obtained through stakeholder planning workshops, held annually at each of CIAT's reference micro-watersheds. These workshops convene stakeholders from inside and outside the watershed to come together to set goals, identify problems, define activities, and evaluate outcomes.

One critical aspect of making this approach successful is to assure local interest and capacity to participate actively. In the early 1990s, CIAT facilitated the formation of a consortium of stakeholders around a watershed in southwestern Colombia. The organization, known by it Spanish acronym CIPALSA, contained representatives of major stakeholders in the watershed, including research and development organizations, national and local government agencies, NGOs, and local groups. The idea was to

improve the coordination among organizations in terms of priority setting and implementation of activities.

While CIPASLA as an organization functioned well, it became apparent that the quality of representation of all stakeholders within the group was not equal. Specifically, local resource users needed a stronger and more coherent voice in their negotiations with better organized internal and external organizations. This led to the formation of a watershed users group, FEBESURCA, which focused on concerns of local individuals and groups such as farmer groups, women's groups, schools, and village officials. The lesson from this experience was that an effective local organization was an important prerequisite to effective interactions with external organizations. When CIAT established a reference site in Nicaragua in 1996, it began working with the local people and organizations, with plans to move towards second-level organizations once local capacity is sufficient. The lessons learned from experience with local level organization is included in a methodological guide for facilitating local organizational processes (Beltrán et al. 1999)

One of the main natural resource management conflicts in the Rio Cabuyal watershed concerned conservation zones along principal watercourses (Ravnborg and Ashby 1996). It was believed that deforestation along waterways in the upper watershed led to problems with water supply below. National policy required that forest cover along rivers be maintained, but these requirements were not enforced. Upper watershed residents were poorer than lower watershed residents, and did not see why they should forego income and production for the benefit of the better-off communities below. After CIPALSA took up the problem, CIAT scientists carried out a GIS analysis that found that

small tributaries located throughout the watershed contributed as much to ground and surface water availability as the streams and rivers of the upper watershed (Knapp et al. 1994; Knapp et al. 2000; Ashby et al. 1999). On the basis of this information, CIPASLA began to re-evaluate conservation policy. An agreement was reached with regional policy makers to permit narrower barriers along principal waterways, while additional conservation measures were taken up on small streams and springs.

While the new regulations did lead to forest conservation along rivers, at one point a mysterious fire burned down a large part of the protected area. It was later discovered that the fire was set by landless residents who depended on the riverine areas for forage and firewood (Ravnborg and Ashby 1996). This incident showed that even the establishment of the watershed users association had not been sufficient to capture all local interests, and demonstrated the importance of being able to systematically identify all stakeholders in a particular problem before any action is taken. A method for stakeholder identification and analysis for collective action in natural resource management was subsequently developed (Ravnborg et.al. 1999).

A traditional method for conduct on-farm technology testing was also adapted to suit a watershed focus. Initially, genetic resource and natural resource management scientists conducted their field trials independently within the reference watershed. In an attempt to better integrate that work over time and space, joint research plots were established, with a commitment to working over the long term and to analyzing interactions within and between plots. This idea has grown into what is now known as the Supermarket for Options for the Hillsides, or SOL. Today the SOL includes not only

technologies from CIAT scientists, but also from other research and extension organizations such as national programs or NGOs, as well as locally-generated ideas.

Technologies tested in the SOL are available to local farmers to test on their own. To increase the utility of these farmer trials for both farmers and researchers, the SOL collaborates with local farmer research committees called CIALs (Ashby et.al. 1999). These community-based committees carry out experiments with the support of a simple methodology for experimentation and an extension agent from national program or an NGO. The SOL and CIALs facilitate the process of developing and testing new technologies, ensuring that they are linked to local needs and that local communities play a role in selection and adaptation. The SOL and CIAL methodologies also help enhance the development of local knowledge and capacity. As local institutions, CIALs are represented in the local watershed users group, helping to maintain a connection between technology testing and broader watershed issues.

The sustainability of these efforts depends critically on their perceived success. Some obvious indicators include measurable increases in forest cover, adoption of CIAL- and SOL-recommended technologies, or the ability of organizations like CIPALSA to obtain internal and external funding for their activities. However impact should go further, improving living conditions and strengthening human and social capital at the community level. In 1999, CIAT began to work on a conceptual and empirical framework for documenting and understanding a broad range of impacts in the reference sites (Gottret and White 2001; Gottret and Westermann 2000). Using both conventional and participatory methods, the goal is to help both researchers and other stakeholders better understand the changes that are taking place and learn from the experience.

4. INSTITUTIONALIZING THE USE OF PARTICIPATORY RESEARCH IN WATERSHED RESEARCH: CURRENT PRACTICES AND CHALLENGES

CURRENT USE

A recent survey of international agricultural centers found that 8 of the 17 watershed research projects reported some user participation (http://www.cgiar.org/capri/project.htm). This relatively high number suggests that researchers recognize the importance of user input in developing technologies and practices for watershed resource management. However few current watershed management research projects can be described as fully empowering, meaning that they do not share authority and responsibility with users at all or even most of the stages of the research process.

As part of the CAPRi-sponsored workshop on watershed research, a working group of scientists from international agricultural research centers discussed the type of participation used in watershed projects at their institutes (Table 1; Knox and Gupta 2000). To facilitate the discussion, centers analyzed their projects using a typology of participation based on authority for decision making: consultative, collaborative and collegial (Lilja and Ashby 1999). In consultative research, users seek input from users but retain ultimate authority for decisions and for assessing outcomes. In collaborative participation, researchers and resource users share control over decisions and accountability for outcomes. In collegial participation, both responsibility and authority for project activities and outcomes rests with users, who seek input from researchers as needed. In this typology, consultative participation would be considered functional, while collaborative and collegial would be considered to be empowering.

Scientists at the workshop evaluated their participation at five stages of the research process—diagnosis, priority setting, planning, implementation, and monitoring and evaluation. Programs generally used more than one type of participation, but the tendency was for researchers to dominate the research process at most stages. Users were active in priority setting and project implementation, while researchers dominated diagnosis, planning, monitoring and evaluation. This type of user participation is likely to improve the relevancy of project activities and in doing so increase the chance that they may be adopted to address specific problems. Such a process is not, however, likely to get significant user buy-in, nor generate a self-sustaining process of continuous innovation on the part of users.

CHALLENGES TO INCREASED USE OF PARTICIPATORY RESEARCH

If participatory research is going to realize its potential as a way to help organize and empower communities around sustainable management of watershed resources, users may need to be more actively involved in these activities. Yet, even among those committed to the principles of PR, there are many challenges to increasing participation in agricultural and NRM research, not the least of which is empirical demonstration that the promise can in fact be achieved (Rhoades 1998). In the remainder of this paper we complement that work by discussing several challenges that are particularly relevant to researchers and research organizations working on participatory watershed management. They include research methodologies, researcher skills and capacities, and role of different types of research organizations.

Participatory research is not new, and a wide variety of tools are available for doing it (Harrington 1996; PRGA website: www.prgaprogram.org). This does not mean that new methodologies—especially for addressing issues above the plot level (Ashby et.al. 1999)—are not needed. However there is also a need to systematize and assess experiences with existing tools and methods in order to document benefits and identifying best practices. Work is underway in this area, and within the next few years there may be much more information available with which to assess the appropriateness of different participatory (and conventional) methods. The CGIAR's Systemwide Program for Participatory Research and Gender Analysis (PRGA) is currently involved in inventorying and analyzing the use and impact of participatory methods in natural resource management research projects by national and international research centers, universities, NGOs and other organizations around the world, including watershed projects (www.prgaprogram.org).

Using participatory research methods, especially for empowering participation, is not always just a question on applying tools. Scientists may have to acquire new skills, either themselves or within their research teams, in order to work effectively in a participatory environment. We often use the term "facilitation" to describe scientists' contribution to what is needed to make multi-stakeholder partnerships work effectively, but as Hagmann (2000) points out, more work is necessary to define and operationalize what we mean by it.

Finally, the need for greater participation does not imply that no division of labor exists among researchers. Different actors in the research process—international and national research centers, extension, NGOs, policy makers, local producer and user

groups, farmers, etc.—have different skills and interests and would be expected to make different contributions. For participatory research to be broadly institutionalized, care must be given to defining these roles, both conceptually and in practice. Many researchers on natural resource management at international research centers are already reporting a shift in their roles and activities, especially an increase in their role as facilitators and providers of information (Probst et al. 2001). Such activities can be consistent with the strategic research mandate of the international centers, if they are coupled with rigorous comparative analysis of outcomes in order to draw lessons for policy and research.

One class of actors that appears to be under-represented in what scanty literature exists on participatory watershed research are the national agricultural research systems (NARS). The important role of NARS in applied and adaptive research and their connection, via the extension service, to local communities and farmers makes them a potentially very important actor in a research system where researchers play a significant role as facilitators and where the flow of information is two way between farmers and researchers. One reason that NARS may not be involved is that their agendas are generally focused on goals of agricultural production and poverty alleviation rather than improved resource management. In most countries, the agriculture ministry is responsible for soil erosion. Broader natural resource management is seen as the responsibility of a number of other ministries, especially environment, wildlife and tourism, water, energy, and local government. The multiple user, multiple user nature of watershed resources argues for inter-agency cooperation in watershed management and research. However government agencies confront the same conflicts of interest and high

transactions costs as other watershed stakeholders in organizing for collective watershed management. Lessons on how to stimulate and structure cooperation are urgently needed, especially regarding the roles of internal vs. external and top-down vs. bottom-up pressure for change.

5. CONCLUSIONS

User participation is increasingly being recognized as critical for success in watershed development and management projects. Local residents were often not considered in the formulation of top-down watershed projects, resulting in plans and technologies that were inconsistent with people's needs and ignorant of local peoples vast and detailed knowledge of land and land use practices. Empirical evidence suggests that giving users a role in managing their own watershed resources can lead to projects that are more efficient and effective than their top down predecessors.

User participation also has implications for watershed management research. In addition to changing the way technologies and practices are developed and disseminated, participation broadens the research agenda, bringing in new topics like organizational behavior, collective action and conflict resolution. There is a great need for further research on these topics as they relate to land and watershed management, beginning with a synthesis and comparative analysis of past experience in areas such as boundaries and scale, transactions costs of facilitation, and the development of indicators.

Participatory management that is not firmly linked to research—understood as a process of knowledge generation that supports technical and institutional innovation—is often hindered by a lack of appropriate technical options, information, and institutions.

One way to provide that link is through participatory research methods, in which formal researchers and end users work together to define problems, evaluate solutions, and develop and disseminate technologies and other innovations.

The nature of the interaction between researchers and users will vary depending on the objectives of the research and the capacity and interest of different stakeholders. Establishing collective research or learning capacity in local communities may be particularly important to achieving sustainable participatory watershed management because of the importance of local institutions and collective action in the watershed environment. The research or learning process can be a way to united diverse stakeholders around common interests and goals.

The use of participatory methods in watershed projects is growing, but there is still a ways to go to institutionalizing use of participatory methods or achieving user empowerment through research. There is a need for both workable methodologies and systematic evaluation of the experience with existing methods and tools. Beyond methodologies, there is also a need for a re-evaluation of the implications of participatory research for the role of researcher and research organizations. New skills may be required for researchers and/or research teams. Institutionalization of participatory research and the ability to achieve widespread impact will depend on incorporating all stakeholders in appropriate roles.

REFERENCES

Ashby, J. A., J.A. Sanz, E. B. Knapp, and A. Imbach. 1999. CIAT's research on hillside environments in Central America, *Mountain Research and Development*, (19) 3, 2-18.

Ashby, J. 1996. What do we mean by participatory research in agriculture? In *New frontiers in participatory research and gender analysis*. Proceedings of the International Seminar on Participatory Research and Gender Analysis for Technology Development, September 9-14, Cali, Colombia, CIAT publication no. 294, 15-22.

Beltrán, J. A., D. Tijerino, and R. Vernooy. 1999. *Developing organizing processes at local level for collective management of natural resources*. Guide 9 of the series Methodological instruments for decision taking in natural resource management, CIAT, Cali, Colombia, 147 p (in Spanish).

Bunch, R.and G. Lopez. 1999. Soil recuperation in Central America: How innovation was sustained after project intervention. In *Fertile Ground: The Impacts of Participatory Watershed Management,* ed. F. Hinchcliffe, J. Thompson, J. N. Pretty, I. Guijt., and P. Shah, London, UK: Intermediate Technology Publications Ltd., 32-41.

Campbell, B., J. Sayer, P. Frost, S. Vermeulen, M. Ruiz Perez, A. Cunningham, R. Prabhu, S. Waddington, and E. Chuma. 2000. *Evaluating the impacts of integrated natural resource management (INRM) research,* paper presented at the international workshop on INRM: Integrated Natural Resource Management in the CGIAR: Approaches and Lessons, 21-25 August 2000, Penang, Malaysia

Campbell, A., P. Grice, and J. Hardy. 1999. Local conservation action in Western Australia. In *Fertile ground: The impacts of participatory watershed management*. ed. F. Hinchcliffe, J. Thompson, J. N. Pretty, I. Guijt., and P. Shah. London, UK: Intermediate Technology Publications Ltd., 340-353.

Cernea, M. 1988. Alternative social forestry development strategies. In *Deforestation, Social dynamics in watershed and mountain ecosystems*, ed. J. Ives and D.C. Pitt. London, UK: Routledge: 159-190.

Farrington, J., Turton, C., and. A.J. James, eds. 1999. *Participatory watershed development: Challenges for the twenty-first century.* New Delhi: Oxford University Press.

Farrington, J., and C. Lobo. 1997. *Scaling up participatory watershed development in India: Lessons from the Indo-German Watershed Development Programme*. London: Natural Resource Perspectives Overseas Development Institute.

Gottret, V. and O. Westermann. 2000. *Evaluación de impacto en los sitios de referencia de laderas en Centro America*, Colombia: CIAT, Informe de Viaje.

Gottret, V. and D. White. Assessing the impact of integrated natural resource management: Challenges and experiences, *Conservation Ecology* (forthcoming)

Guijt, I., and P. Sidersky. 1999. Matching participatory agricultural development with the social landscape of Northeast Brazil. In *Fertile ground: The impacts of participatory watershed management.* ed. F. Hinchcliffe, J. Thompson, J. N. Pretty, I. Guijt., and P. Shah. London, UK: Intermediate Technology Publications Ltd., 273-287.

Hagmann, J. 2000. *Quality aspects in management and facilitation of learning process interventions in participatory research*. Keynote address at PRGA III International seminar Uniting science and participation in research, Nairobi, Kenya, Nov 6-9, 2000.

Harrington, L. 1996. Doctors, lawyers and citizens: Farmer participation and research on natural resources management, In *New Frontiers in Participatory Research and Gender Analysis*. Proceedings of the International Seminar on Participatory Research and gender Analysis for Technology Development, September 9-14, Cali, Colombia: CIAT publication no. 294, 53-64.

Hinchcliffe, F., J. Thompson, J. N. Pretty, I. Guijt, and P. Shah, eds. 1999. *Fertile ground: The impacts of participatory watershed management.* London, UK: Intermediate Technology Publications Ltd.

Inter-American Development Bank. 1995. *Concepts and issues in watershed management.* Washington, DC: Inter-American Development Bank, Evaluation Office, EVO.

Kerr, J.M., N.K. Sanghi, G. and Sriramappa. 1996. *Subsidies in watershed development projects in India: Distortions and opportunities*. IIED Gatekeeper Series 61. London: International Institute for Environment and Development.

Knapp, E.B., J. Ashby, H. Ravnborg, and B. Bell. 2000. A landscape that unites: community led management of watershed resources in the Andean hillside watersheds. In *Integrated Watershed Management in the Global Ecosystem*, ed. Lal, R. Boca Raton, FL: CRC Press.

Knapp, E.B., J. Rubiano, and J. White. 1994. Análisis de impacto ex-ante empleando la simulación como herramienta para priorizar el uso de tierras agrícolas de la comunidad a nivel de la cuenca hidrográfica, In *Memorias de 11 Encuentro Nacional de Informática Universitaria, Palmira*, Valle del Cauca, Colombia, p. 1-11.

Knox, A. and S. Gupta. 2000. *CGIAR System-wide Program on Property Rights and Collective Action*, *Working Paper No. 8.* CAPRi technical workshop on watershed management institutions: A summary paper. International Food Policy Research Institute: Washington, DC.

Lilja, N. and J. A. Ashby, 1999. *Types of participatory research based on locus of decision-making*. In Participatory research and gender analysis working document (PGRA) No. 6. PRGA, Cali, Colombia: CIAT

Maarleveld, M. and C. Dangbégnon. 1999. Managing natural resources: A social learning perspective. In *Agriculture and Human Values*, 16: 3, 267-280.

Pretty, J. 2000. *Social learning: prerequisites, challenges and outcomes*. Summary of keynote address at PRGA III International seminar Uniting Science and Participation in Research, Nairobi, Kenya, Nov 6-9, 2000, 2.

Pretty, J. and P. Shah. 1999. Soil and water conservation: A brief history of coercion and control. In *Fertile Ground: The Impacts of Participatory Watershed Management,* ed. F. Hinchcliffe, J. Thompson, J. N. Pretty, I. Guijt., and P. Shah. London, UK: Intermediate Technology Publications Ltd., 1-12

Probst, K., M. Fernandez, J. Hagmann, and J. Ashby. 2001. *Participatory natural resource management research: Perspectives and challenges.*

Ravnborg, H. M. and J. Ashby. 1996. Organising for local-level watershed management: Lessons from Rio Cabuyal watershed, Colombia*. AgREN Newsletter, No. 65* ODI, July 1996,

Ravnborg, H.M. and M. del Pilar Guerrero. 1999. Collective action in watershed management - Experiences from the Andean hillsides, *Agriculture and Human Values*, Vol. 16, 257-266.

Ravnborg, H.M., M. del Pilar Guerrero, and Westermann, O. 1999. Acción colectiva para el manejo de los recursos naturales. Manual para identificar grupos de interés. CIAT publication no. 310. Cali, Colombia: CIAT

Rhoades, R.E. 1998. *Participatory watershed research and management - Where the shadows falls,* International Institute for Environment and Development, Gatekeeper Series no. 81

Rola, A.C., J. Quizon, and S. B. Jamias. 2001. *Do farmer field school graduates retain and share what they learn? An investigation in Iloilo, Philippines* (unpublished manuscript).

Steins, N.A. and V. Edwards. 1999. Platforms for collective action in multiple-use common-pool resources, *Agriculture and Human Values*, Vol. 16, 241-255.

Swallow, B., D. Garrity, and M. V. Noordwijk, M.V. 2001. The effects of scales, flows, and filters on property rights and collective action in catchment management. CAPRi Working Paper, No. 18, Washington, DC: International Food Policy Research Institute.

Turcios, W., M. Reynaldo, T. Tulio, E. Barrios, and H. Barreto. 1999. *Participatory method for identifying and classifying local soil quality indicators at watershed level*, Guide I of the series methodological instruments for decision taking in natural resource management, Cali, Colombia, CIAT, 146p (in Spanish).

van de Fliert, E., N. Johnson, R. Asmunati, and Wiyanto. 2001. *Beyond high yields: the impact of sweet potato ISM farmer field schools in Indonesia*, CIP Program report, Lima, Peru: International Center for Potato Research.

Vernooy, R. 1996. Do you know the python? Moving forward on the participatory research methodology development path, in *New frontiers in participatory research and gender analysis*. Proceedings of the International Seminar on Participatory Research and gender Analysis for Technology Development, September 9-14, Cali, Columbia. CIAT publication no. 294, 23-36.

Woodhill, J., J. Frankenburg, and P. Trevethan. 1999. The challenges of change for the West Hume Landcare group. In *Fertile ground: The impacts of participatory watershed management.* ed. F. Hinchcliffe, J. Thompson, J. N. Pretty, I. Guijt, and P. Shah. London, UK: Intermediate Technology Publications Ltd., 354-368.

LIST OF CAPRi WORKING PAPERS

01 *Property Rights, Collective Action and Technologies for Natural Resource Management: A Conceptual Framework*, by Anna Knox, Ruth Meinzen-Dick, and Peter Hazell, October 1998.

02 *Assessing the Relationships Between Property Rights and Technology Adoption in Smallholder Agriculture: A Review of Issues and Empirical Methods*, by Frank Place and Brent Swallow, April 2000.

03 *Impact of Land Tenure and Socioeconomic Factors on Mountain Terrace Maintenance in Yemen*, by A. Aw-Hassan, M. Alsanabani and A. Bamatraf, July 2000.

04 *Land Tenurial Systems and the Adoption of a Mucuna Planted Fallow in the Derived Savannas of West Africa*, by Victor M. Manyong and Victorin A. Houndékon, July 2000.

05 *Collective Action in Space: Assessing How Collective Action Varies Across an African Landscape*, by Brent M. Swallow, Justine Wangila, Woudyalew Mulatu, Onyango Okello, and Nancy McCarthy, July 2000.

06 *Land Tenure and the Adoption of Agricultural Technology in Haiti*, by Glenn R. Smucker, T. Anderson White, and Michael Bannister, October 2000.

07 *Collective Action in Ant Control*, by Helle Munk Ravnborg, Ana Milena de la Cruz, María Del Pilar Guerrero, and Olaf Westermann, October 2000.

08 *CAPRi Technical Workshop on Watershed Management Institutions: A Summary Paper*, by Anna Knox and Subodh Gupta, October 2000.

09 *The Role of Tenure in the Management of Trees at the Community Level: Theoretical and Empirical Analyses from Uganda and Malawi*, by Frank Place and Keijiro Otsuka November 2000.

10 *Collective Action and the Intensification of Cattle-Feeding Techniques a Village Case Study in Kenya's Coast Province*, by Kimberly Swallow, November 2000.

11 *Collective Action, Property Rights, and Devolution of Natural Resource Management: Exchange of Knowledge and Implications for Policy*, by Anna Knox and Ruth Meinzen-Dick, January 2001.

12 *Land Dispute Resolution in Mozambique: Evidence and Institutions of Agroforestry Technology Adoption*, by John Unruh, January 2001.

13 Between Market Failure, Policy Failure, and "Community Failure": Property Rights, Crop-Livestock Conflicts and the Adoption of Sustainable Land Use Practices in the Dry Area of Sri Lanka, by Regina Birner and Hasantha Gunaweera, March 2001.

14 *Land Inheritance and Schooling in Matrilineal Societies: Evidence from Sumatra*, by Agnes Quisumbing and Keijuro Otsuka, May 2001.

15 *Tribes, State, and Technology Adoption in Arid Land Management, Syria*, by Rae, J, Arab, G., Nordblom, T., Jani, K., and Gintzburger, G., June 2001.

16 *The Effects of Scales, Flows, and Filters on Property Rights and Collective Action in Watershed Management*, by Brent M. Swallow, Dennis P. Garrity, and Meine van Noordwijk, July 2001.

17 *Evaluating Watershed Management Projects,* by John Kerr and Kimberly Chung, August 2001.