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APPLICATION OF PARTICIPATORY RURAL APPRAISAL METHODS FOR ACTION RESEARCH ON WATER MANAGEMENT

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Purpose of the Series

The *Short Report Series on Locally Managed Irrigation* is designed to disseminate concise information on the role of local management in irrigation and irrigation management transfer or turnover experiences and policies. The *Series* is distributed worldwide to a broad range of people—policy makers, planners, researchers, donors, and officials in both public and nongovernmental organizations—who are concerned with the irrigated agriculture sector. IIMI's goal is not to promote policies such as irrigation management transfer, but to enhance the knowledge base available to decision makers and advisors as they face questions of policy adoption and strategies for implementation.

Locally managed irrigation can be of many types, such as traditional farmer-constructed diversion or tank schemes, indigenous and often new lift irrigation, government-constructed but farmer-managed irrigation systems, and systems where management is or has been transferred from an outside agency to a local user organization.

By "irrigation management transfer" we mean some degree of transfer of responsibility and authority for irrigation management from the government to farmer groups or other nongovernmental entities. This generally involves contraction of the role of the state and expansion of the role of the private sector and water users in irrigation management. In other words, there is a shifting upstream of the point where management responsibility and control of the water supply are transferred from the irrigation authority to local management. This may involve changes in policies, procedures. practices, and the performance of irrigated agriculture. It may or may not involve "privatization" of ownership of the assets of the irrigation system. The *Short Report Series* addresses questions such as the following:

What are the necessary conditions which support viable locally managed irrigation?

What socio-technical conditions, institutional arrangements, and change processes lead to sustainable locally managed irrigation?

What is the range of different models that are being applied worldwide for turnover or transfer of responsibility for local management for recently developed irrigation?

What are the effects of management transfer on the pmductivity, pmjitability, financial viability, equity, efficiency, and sustainability of irrigated agriculture?

What are the perspectives of farmers, managers, policy-makers, urban consumers, and other stakeholders in irrigated agriculture about irrigation management transfer?

What adjustments in government may be needed as a result of turnover to provide support to locally managed irrigation system and to improve pmductivity in the public sector?

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Editors' Note

In recent years, there has been a considerable amount of study and writing about Participatory Rural Appraisal (PRA) and its promotion. The basis for this interest apparently lies in the perception that these methods significantly enhance the ability of professionals in rural development to: 1) elicit the knowledge, values, and aspirations of rural people, 2) facilitate participatory planning and Research and Development (R&D) processes, 3) be more multidisciplinary in analysis, and 4) reduce the time and cost requirements for project appraisals. PRA is a collection of techniques (many of which were derived from applied anthropology) to facilitate structured group discussion and decisionmaking and to graphically depict local knowledge and preferences. It is distinguished from its precursor, Rapid Rural Appraisal, by its slightly less concern for rapidity and greater emphasis on involving farmers as partners, rather than mere subjects, in the appraisal process.

This report summarizes recent experiences with the application of PRA methods in the fields of irrigation and water management in Sri Lanka, Pakistan, India, Kenya, Estonia, and Zimbabwe. Methods of group dynamics, sampling, semi-structured interviewing and dialogue, visualization and diagramming are explained, with examples. The authors attempt to clarify some confusion about PRA that exists, and offer several recommendations about how it can be used—not as a replacement but as a complement to other conventional methods of appraisal—to enhance processes of research and development in the fields of irrigation and water management in developing areas.

APPLICATION OF PARTICIPATORY RURAL APPRAISAL METHODS FOR ACTION RESEARCH ON WATER MANAGEMENT

Paul Gosselink[1] and John Thompson[2]

INTRODUCTION

The aim of this report is to present and analyze recent innovative applications of participatory rural appraisal (PRA) methods in irrigation and water resource management, and to assess the lessons they offer for research and development. The report begins with an examination of the defining characteristics of participatory appraisal methods that distinguish them from more conventional approaches. This is followed by a review of the participatory methods available to researchers, practitioners, and local people as they carry out their joint analyses, planning activities, and development efforts. After this, attention is turned to cases in which the application of participatory approaches have produced valuable insights and important outcomes. The cases are drawn from a wide range of countries, from South Asia to Eastern Europe, and a diverse array of socio-technical contexts, from irrigation performance assessment to watershed management and conservation. They illustrate the growing use of participatory approaches for both research and development work, and offer lessons for their possible use in other countries and contexts in the future.

Despite the sense that the agricultural sciences and rural development are in the midst of a methodological revolution—one in which local people are viewed not as "beneficiaries" or "clients," but as "partners" in the process—many questions remain unanswered about the problems and potential associated with participatory methods. For this reason, the closing section of the paper is devoted to an assessment of the emerging challenges and opportunities surrounding the use of participatory methods for research and development in the imgation and water resource management sectors.

Local People's Participation in Research and Development: Means and Ends

Participatory methods are flexible methods for exchange of knowledge that has k e n developed in order to better realize high levels of community participation in official development programs. Participation, as a principle, is now commonly accepted as an important component of people-centered research and development programs, although the term itself means different things to different people. Notions of participation in research and development projects range from "passive participation" (where people are simply told what is going to happen to them or manipulated into doing something that someone else wants them to do), to "self-mobilization" or "collective action'' (in which local people are active agents of change independent of external organizations: Cornwall 1995; Pretty 1995).

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The participatory methods described here are intended to facilitate higher levels of participation in which local people have greater control over the research and development process. They have, in general, been initiated by practitioners and agencies concerned that the development agenda has been defined by professionals. Participatory methods are intended to facilitate the integration of local people into development and, in some cases, to enhance local control of resource allocation and decision-making processes. They include a range of different activities designed to:

- increase awareness and understanding among the key primary and secondary stakeholders;
- improve the quality and quantity of information available about local conditions;
- identify viable local research and development options;
- mobilize local and external resources to support such options;
- enable local people to analyze problems and opportunities, set priorities, and take action;
- strengthen the self-confidenceand capacities of local organizations; and
- develop and support mechanisms to manage conflicts and enhance cooperation.

To most water development professionals, these methods represent a marked departure from standard practice. In a growing number of organizations, extractive research and top-down planning activities are giving way **to** interactive and enabling initiatives in which local people are active partners in the process. These methods are being used not just to enable local people to inform outside researchers or development workers, but to stimulate local people's analysis of their own conditions, constraints, and capacities.

The ideas and experiments of numerous professionals around the world have led to multiple methodological innovations, and the emergence of many variations in the way these participatory methods have been developed and applied. Nevertheless, these methods all share a number of common characteristics (see Box on page 3). Fundamental to these methods is their emphasis on joint learning and action.

Participatory Learning and Action

In recent years, the creative ingenuity of researchers, practitioners, and local people in many parts of the world has increased the range of participatory research and development approaches in use. Many have been drawn from a wide range of contexts, and were adapted to new needs (see, for example, Annex I on fanner participatory research). Others are innovations arising out of situations where practitioners have applied a methodology in a new setting, the context and people themselves giving rise to the originality.

The methods common to many participatory approaches may be grouped into four categories: (1) improving group dynamics and building strong teams; (2) identifying and sampling various interest groups within a community (e.g., poor and vulnerable groups, key informants. etc.); (3) facilitating effective interviewing; and (4) stimulating joint analysis through visualiza-

Core Characteristics of Participatory Research **and** Development Approaches

- A *Systematic* Methodology **and** Interactive Learning Process: The focus is on systematic analysis and learning by all the participants, which occur in an iterative and cumulative manner. Given the nature of these methods as systems of joint learning and action, their use, by definition, has to be participatory.

- *Multiple* Actors, Multiple Perspectives: A central objective is to seek diversity, rather than characterize complexity in terms of average values. The assumption is that different individuals and groups have different "stakes" in the management of resources and decisionmaking. These stakeholders make different evaluations of situations, depending on their sociocultural and political economic conditions, which, in turn, lead to different outcomes.

- **Group** Learning Process: Possibilities for cooperation and collective action emerge through joint analysis and interaction. There are three ways of mixing participants—by different disciplines, different sectors, and by place of origin (i.e., local people or outsiders).

- Context-Specific: Although they are applied in a systematic manner, the methods are flexible and adaptable **to** suit each new set of conditions and actors.

- Facilitating Experts *and Stakeholders*: The methodologies involve the transformation of existing research and development practices to bring about changes that all stakeholders in a situation regard as improvements. The role of the "expert" is to create conditions in which local people carry out their own diagnostic analyses and planning. The facilitating experts may be stakeholders themselves.

- *Sustained Action*: The process leads to debate about change, which in turn changes the perceptions of actors and their readiness to contemplate action. Action is agreed, and implementable changes will therefore represent an accommodation between the different competing, sometimes conflicting, views and interests. The process of negotiation identifies changes and seeks **to** motivate people to take action to implement the changes. This strengthens local organizations, increasing the capacity of people to initiate and sustain action on their own.

Adapted from Pretty 1995 and Guijt and Thompson 1994.

tion and diagramming (Table 1). It is the gathering of these methods into particular works for learning and action (e.g., for farmer participatory research, local-level adaptive planning, irrigation system performance assessment, and so on) that constitutes participatory research and development methods.

To ensure that the perspectives **of** competing interest groups are investigated and represented, practitioners must be clear about who is participating in the research or development process. Communities are rarely, if ever, homogenous and there is always the danger of assuming that those participating in a particular discussion or analysis are representative of the larger community. All too frequently, however, those who are missing (and therefore unseen and unheard) are usually the poorest and most disadvantaged people (frequently women). Sampling methods are, therefore, an essential part of participatory methods, as they help analysts recognize differences in local people's access to resources and power.

Table 1. Participatory methods for alternative systems of learning and action.

Group dynamic methods	Sampling methods	nterviewing and dialogue	Visualization and diagramming methods
• Team contracts • Teamreviewsand discussions • Interview guides and checklists • Rapid report writing Energizers • Work sharing (taking part in local activities • Shared presentations by villagers, and • Process notes and personal diaries	• Transectwalks • Wealth ranking and well-being ranking • Social maps • Interview maps • Interview chains	Semistructured interviewing Direct observation Focus groups Key informants Ethnohistories and biographies Oral histories Local stories, portraits, and case studies	• Mapping and modeling • Social maps and wealth rankings • Transects • Mobili maps • Seasonal calendars • Daily routines and activity profiles • Historical profiles • Trends analyses and timelines • Matrix scoring • Preference or private ranking • Venn diagrams • Network diagrams • System diagrams • Flow diagrams • Pie diagrams

Facilitating sensitive interviewing and constructive dialogue between different groups is the third element of participatory learning and action. For ideas and opinions to be revealed, the conventional dichotomy between the interviewer and respondent should not be permitted to develop. Interviewing is, therefore, structured around a series of methods that promote a beneficial dialogue. This should appear more like a structured conversation than a formal interview, and aim to give local people greater control of the interview process and the information that it generates.

The fourth element is the emphasis on diagramming and visual analysis of complex ideas and issues. In conventional surveys, the interview is controlled and conducted by the interviewer, who collects information from various "respondents" or "informants" based on predefined sets of questions, then analyzes, interprets, and makes decisions about that information apart from those who provided it in the first place. By contrast, diagramming by local people gives them a share in the creation and joint analysis of the ideas and information generated during a participatory analysis. providing a focus for dialogue that can be sequentially modified and extended.

Local categories, criteria, and symbols are defined and applied during these diagramming activities, which include mapping and modeling of resource management changes and social relationships, charting of daily, seasonal, and historical trends and changes, scoring and ranking of priorities, problems, innovations, strategies, and options, and analyses of resource flows, organizational connections, and livelihood systems. Rather than answering questions that are directed by the interests and inclinations of the external researcher, local people are encouraged to explore creatively their own versions of their worlds. Visualization, therefore, helps to balance dialogue and increase the depth and intensity of discussion and debate. Even those people who are considered functionally illiterate are able to contribute constructively to the proceedings, as they too are encouraged to draw on their own "visual literacy" (something all human beings share) to represent and analyze complex ideas and issues.

Using these methods local people have shown a greater capacity to observe, diagram, and critically examine their own conditions, constraints, and capacities than most professionals had anticipated.

In the next section, attention is turned to how these methods have been applied to support participatory research and development activities on irrigation and water resource management. Some of these innovative applications have been undertaken by programs supported by the International Imgation Management Institute (IIMI), while others have been initiated by government agencies, nongovernmental organizations, and international agencies. Together, these cases provide insights into the possible uses of participatory methods in these sectors, and offer lessons for their application in the future.

EXPERIENCES FROM THE FIELD

Efforts to put the new participatory research and development methods into practice are well under way in the imgation and water resources fields. All emphasize the process of reflexive learning leading to action and new roles and relationships for external researchers, development practitioners, and local water users. Several case studies are presented below, which shed light on the complexities of implementing these methods within the irrigation and water sectors. The examples are drawn from Sri Lanka, Pakistan, India, Kenya, Estonia, and Zimbabwe.

Participatory Rural Appraisal (PRA) in Water Resources Planning (Sri Lanka)[3]

In the Dry Zone of Sri Lanka, many efforts have gone into the development and rehabilitation of small reservoir irrigation facilities. The results of several projects to improve small tank (reservoir) systems have been disappointing, however, due to a poor understanding of tank hydrology and the variability of water supplies in the Dry Zone. The approach adopted by the International Irrigation Management Institute (IIMI) in two recently implemented area development projects focused on (sub)watersheds and tank cascades, rather than the individual tank as a starting point of analysis.

A typical Dry Zone tank cascade is a chain of tanks, one located above another within a subwatershed. Tanks located in cascades are almost fully dependent on water flows from the catchment area. Drainage from one tank forms the major inflow to the next lower tank. Typically, the lowest tank in the cascade receives water from several tanks above it. These hydrological interconnections imply that changes in one tank may affect other tanks and water users.

In Sri Lanka, improvement efforts have focused exclusively on isolated tanks, because tanks were traditionally seen as independent entities belonging to one village. Recent participatory research has made clear that water users were thinking along the same lines, and appeared to be confined to the limits of village jurisdiction. Water supply was perceived as the major constraint in imgated agriculture. This called for a planning process at the *cascade* level, as improvements of water distribution among tanks in the cascade might improve the overall water supply situation.

Thus, IIMI researchers designed a three-stage process to conduct PRAs: (1) participatory action research with water users to analyze problems and opportunities associated with village tank development and management and stimulate discussion about the concept of cascade planning; (2) multi-village meetings (3-4 villages); and (3) meetings attended by all villages under the

[3]This case is drawn from Jinapala, Brewer, and Sakhtivadivel (1996).

cascade, Participatory mapping was used to facilitate the discussion at cascade level, which appeared to be something they were not used to. The maps turned out to be extremely useful as they allowed water users to visualize how water flowed from tank to tank.

Village-level meetings: Focusing on the local

During a series of meetings, it was realized that water users were hardly aware of cascade tanks under the control of other villages and that they had not grasped the hydrological relations of the tanks, streams, and wells of the cascade or the watershed as a whole. This meant that the suggestions for improvement by the villagers were mainly directed towards their own village tanks, rather than towards other tanks or the cascade system as a whole.

Multi-village meetings: Seeing the whole system

These were held with representatives from the 6 to 12 villages that form a typical cascade system. During participatory mapping exercises, water users were requested to analyze the current status and use of key natural resources in the cascade (water and land), existing resource management mechanisms, and problems and proposals to improve the management of cascade resources. This led to a series of detailed maps and multilevel analyses of water resource problems and opportunities at sub-cascade and cascade levels. Water users combined their knowledge of individual tanks and the connections between them. In this way, water users categorized the cascade tanks and agro-wells into groups on the basis of agricultural performance, water availability, and quality. Local indicators of low performance were developed, and cultivation practices and the institutional arrangements at the cascade level were critically debated.

Plans developed during these meetings were depicted in several maps and included proposals for water management improvements in the cascade. These included recommendations for tank system improvements, redistribution of water among cascade tanks, capturing additional water, and using excess water from another cascade. Proposals were also made for the development of new land and a management organization to handle the water resource.

These inter-village exchanges were not free of conflicts, and sometimes passions would run high as representatives of different localities pressed their claims for access to and control of vital resources. For example, when members of several villages proposed a diversion of spill water to irrigate additional land in their area, representatives from villages using a downstream tank challenged their proposal. A complex series of negotiations ensued before the issue was resolved. The villagers were able to reach agreements about a range of initiatives to enhance catchment and command area development, institutional management, and home garden development.

Cascade-level meetings: Making connections

Representatives from each village discussed the proposals of the multivillage planning meetings, which had made potential conflicts clear to the participants. While all water users understood the idea of cascade development, time was required to explain the setting of the whole cascade with its constituent parts. After this interchange of information, the actual negotiation of the final plan among the farmers tended to be rapid and straightforward. The result of this cascade-level planning was the adoption of proposals that benefited the greatest number of tanks and involved the most appropriate and least expensive construction.

The participatory action research process influenced the nature of the water resources development proposals considerably. The original village-level suggestions concentrated almost exclusively on repair and improvement of individual tank systems, while the new plans define possibilities to augment water supply to tanks from within and outside the cascade. system Through this process, farmers realized that their original ideas would have little effect on agricultural production, as shortage of water—the major problem—was not addressed. Only augmentation could lead to the opportunity of increased cropping intensity or command area.

The benefits of participatory rural appraisal (PRA) are evident and relate to the increased awareness of concepts of watershed hydrology and the felt-need of farmers for representative and effective institutions to manage water resources at the cascade level. As Sri Lankan farmers have an awareness of the basic principles of hydrology they were in a position to contribute substantially to the concept of cascade-level planning on the basis of local historical knowledge.

These activities illustrate the possibilities of joint planning with water users. Water users contributed their share of information on cascade hydrology and other local factors, which formed the basis for the water resources development plans. IIMI staff helped facilitate and provide organizational support for the meetings. While the final decisions were left to the water users, IIMI facilitators contributed to the farmers' discussions and conclusions in a fundamental way. The concept of cascade-level planning enabled farmers to address the weaknesses of earlier rehabilitation efforts and encouraged them to take account of the interconnectedness of village tanks. Water users recognized the value of this integrated approach to water resource management, and showed a willingness to collaborate with farmers from other communities and with IIMI.

This multilevel, participatory appraisal method enabled local water users to develop their own management plans, with the help of the IIMI team. It has allowed farmers to identify their own indicators for monitoring and evaluating the performance of their organizations. In conventional rehabilitation and water resource development efforts, local knowledge and potential for conflict is often overlooked. In this case, PRA provided constructive dialogue and information sharing among the full range of local stakeholders and led to the accommodation of different needs and interests related to. water resource management, with only limited external involvement. The case also provides an example of how PRA for participatory planning can be done at the supra-village level.

Performance Indicators from Water Users' Perspectives (Pakistan)[4]

IIMI has conducted participatory research in Pakistan to examine water users' perspectives of irrigation performance. An important objective of IIMI's Performance Assessment Program is to develop and disseminate methodologies to enable policy makers and irrigation system managers to select indicators of performance. This includes indicators of irrigation performance derived by water users. These are compared with indicators used by policy makers and system managers.

The objectives of this study were to analyze imgation supply from the perspectives of water users, identify performance indicators used by water users, understand how these indicators are used in monitoring water supply performance, and examine the impact of different levels of performance on water users' decisions. PRA was adopted as the methodology for conducting the diagnostic analyses and planning. The field activities in the Punjab, which were undertaken by interdisciplinary teams of social scientists and technicians, took about 4 weeks. The following were achieved:

[4]For more information, see Gosselink and Hoeberichts 1996 and Hoeberichts 1995.

- ***Identification of performance indicators:*** Joint analyses with water users from several tertiary command areas were initiated to identify irrigation-related problems and opportunities, performance indicators, and actions undertaken as a reaction to observed performance levels.

- ***Water users' perceptions of irrigation system performance:*** A series of group meetings with water users for cross-checking and consensus-building along one watercourse enabled all parties to clarify issues and resolve misunderstandings.

- ***Field testing of water users' indicators:*** Farmers were asked to use the indicators identified in group meetings to evaluate their own water supply performance.

- ***Analysis of irrigation system performance from water users' perspectives:*** Group meetings were held at which the water users' analyses of irrigation system performance were presented and their findings were compared and contrasted with those of **IIMI.** This stimulated detailed discussions about the potential changes needed to improve system performance.

A range of participatory techniques was used during the exercises (for examples, **see** Annexes II and III), such as Venn diagrams, trend lines, resource maps, transects, systems diagrams, and cause-effect diagrams. The application of these techniques led to the identification of indicators used by farmers (e.g., adequacy and timeliness of water delivery, etc.), ranking of water supply problems, analysis of local responses to poor performance, and identification of constraints to irrigation water supply performance.

The research raises a number of challenges for IIMI's work with water users in the future: (i) Can **IIMI** gain new insights about irrigation system performance by applying this methodology in areas where it has already collected a great deal of information? and (ii) How can researchers interact effectively with water users to improve irrigation system performance through participatory analysis?

Water Users' Perceptions of Salinity and Sodicity (Pakistan)[5]

IIMI is involved in another participatory action research initiative as part of a research project entitled, "Managing Irrigation for Environmentally Sustainable Agriculture in Pakistan" (DGIS 1994). A special component of this activity is research on salinity and sodicity, which presents widespread environmental problems for Pakistan's imgated agriculture. The project examines water users' perceptions and irrigation management practices related to salinity and sodicity and their impact on the physical environment and fanning systems.

A first step in the research was to document water users' perceptions, and strategies and practices to cope with salinity and sodicity in a selected watercourse in Punjab (Fordwah distributary). The field data for this case study were collected through application of selected PRA tools, namely participatory mapping exercises, historical trends analyses, semi-structured interviews of key informants, and focus group discussions. The participatory mapping was conducted on a base map of the watercourse, which provided details such as blocks, irrigation canals, and location of tubewells. Water users were invited to indicate different salinity and sodicity charac-

[5]Information drawn form Kielen 1996.

teristics, to elicit their knowledge about causes and effects, and the processes through which salinity and sodicity occur.

Several mapping exercises were conducted in the field, starting with a group of elderly water users. With their detailed information, it was possible to generate a good deal of background information about the historical development of soil salinity and sodicity, and the changes that took place during recent decades. Other farmers from different locations along the watercourse mapped the present soil conditions. Research facilitators elicited farmer perspectives and coping strategies through semi-structured interviews. This information was contrasted with secondary information collected during earlier research. Water users' strategies were evaluated against the opportunities and constraints of the farming system.

The resource mapping exercise proved to be an efficient method for obtaining complex insights into changing soil conditions and salinity/sodicity processes. The historical analyses and interviews revealed further details about water users' strategies to cope with salinity and sodicity, and changes in their irrigation management and farming practices over time.

One of the outputs of the PRA exercises was a set of indicators water users apply to recognize soil problems. They differentiate between indicators based on the physical characteristics of the soils (physical indicators) and those which relate to crop performance (impact indicators). Some of the former indicators reflect the application of poor quality irrigation water, while others identify soil salinity and sodicity problems (Annex IV). Water users defined six salinity/sodicity classes to differentiate between the different types and levels of saline, sodic, or waterlogged soils.

The research concluded that water users possess a profound knowledge of the causes and consequences of soil salinity and sodicity, and have a detailed understanding of related agronomic processes (e.g., salinization due to the use of poor quality tubewell water, capillary salinization from high and saline groundwater tables, etc.). The research also demonstrated that despite this understanding, water users are not always able to design effective strategies for reducing salinity and scdicity levels as their actions are often constrained by their limited access to canal water. In general, however, their practices are in line with those recommended by scientists.

Participatory Watershed Management (India)

The issue of sustainable natural resources management is nowadays intrinsically linked with the involvement of local communities. Thus participatory methods play an important role in the implementation of watershed management projects. In the Shared Control of Natural Resources (SCOR) project in Sri Lanka, IIMI applies PRA for diagnosis of problems related to natural resources management. Specific participatory tools are used as planning, and monitoring and evaluation methods (see Wijayaratna 1995). The case presented here refers to a participatory soil and water conservation program in India, implemented by the Aga Khan Rural Support Program (AKRSP), as reported by Shah (1994). The case demonstrates that the adoption of flexible and long-term approaches that build upon local systems, knowledge and skills, involvement of villagers in technology generation, and the use of village facilitators for appraisal, planning, implementation, and monitoring can lead to remarkable results in terms of crop and livestock productivity and wider economic benefits. A crucial element at the start of the process is that AKRSP spends a considerable amount of time working to enable village communities to participate in appraisal and planning, technology generation, adaptation, and diffusion.

The process begins with a participatory appraisal and inventory of all natural resources in the village, traditional use practices, local institutions, and existing management systems of the

village. Initially, the village, not the watershed, is used as a unit for interaction and appraisal with the community. The appraisal process involves the following methods.

Base map preparation. Villagers use various locally available materials (seeds, twigs, leaves, etc.) to prepare their village map, which shows major natural resources, landmarks, boundaries and divisions, drainage points, status of these resources, and community assets or infrastructure (such as ponds, drinking water wells, tanks, and individual wells, both functional and dysfunctional). Annex V shows how local watershed users perceive the changes in their watershed over a long period.

Transect walk. A transect walk mainly focuses on observation of physical characteristics (e.g., erosion, waterlogging, soil depth, condition of irrigation infrastructure and moisture retention, etc.) and involves discussions on people's perception of these issues. This is done while walking along a route selected jointly by local people and facilitators, which covers different resources, such as private and public lands, forest lands, grazing areas, canals, rivulets, gullies, etc.

Thematic maps. Thematic maps are drawn by local "key informants" who have specialized knowledge of water resource management, local land use classifications, cropping patterns, aquifers, etc. These maps lead to questions about problems and constraints faced in effective utilization of resources and help focus attention on possible solutions. People are encouraged to present solutions that they have tried out earlier, both those that worked and those that did not, along with their reasons for failure. People are also asked the reasons for not trying out some solutions that they have identified. Older key informants can also create historical maps to compare resource conditions over time (see annexes for examples).

Opportunity identification matrix. Opportunity identification matrices are diagrams produced during the transect showing local land-use classifications, the existing state of resources, constraints to efficient management of these resources, solutions tried and options identified by the people for solving resource management problems, and the development potential of each resource. This matrix is used as a facilitating input to other methods used subsequently.

Equity appraisal and well-being ranking. The next phase of the approach looks at equity issues in the village. To ensure that wider consultation is carried out and that poorer and less articulate sections of the village community are involved, a well-being exercise is carried out to identify the various social groups in the community. The more important aspect of this exercise is finding the criteria used by the village to differentiate themselves. This helps in identifying those groups that have been unrepresented or underrepresented in the mapping or transect exercises. It also helps to identify focus groups for further discussions.

Focus group discussions. Based on the outputs and the process started earlier, semi-structured interviews are conducted with different groups separately. These groups could include:

- resource owners
- resource users
- resource nonowners and users
- resource nonowners and nonusers
- groups facing a common problem related with a resource
- women

- socially disadvantaged groups
- groups left out of the initial appraisal process

A focus group discussion builds on the information collected on maps and during transects. Each problem identified is discussed in depth. New problems and possible solutions are analyzed. People also indicate the likely conflicts that might arise in implementing solutions and begin to set priorities. Seasonality and livelihood analyses involving variables such as rainfall, food, fuelwood and fodder availability, human, animal, and crop diseases and pests, and income and employment are carried out to identify major constraints to adoption of certain priorities.

Organization of village meeting and presentaiion by focus groups. It is important that overlapping or conflicting visions are expressed either publicly or indirectly, when more vulnerable groups fear open confrontation. Therefore, the next step is to organize a village meeting where most local residents participate and most groups in the village are represented. Each group nominates a representative to present their problems and priorities at the meeting.

Prioritization of options and appraisal. At this stage, discussions are initiated with the community members to identify priority options under the resource management plan. This leads to conducting shorter but intensive topical appraisal exercises, which include transect walks with the focus groups concentrating in detail on local solutions identified by the people. Aspects considered during the appraisal exercise are technical feasibility of the proposed solutions, financial viability, extent of benefits and their impacts on poorer groups, resource investment, expected contributions by the community, and institutional support and training inputs required.

Preparation of proposals and presentations to the external agencies. Depending on the activities identified, a formal proposal is developed by the community. This proposal is then shared with the external agencies who wish to support the implementation of the plan. This village natural resource management plan also becomes a future reference or baseline for monitoring and evaluation.

The performance of AKRSP's participatory watershed management program has been analyzed using economic indicators, such as area developed each year, investments made, contributions by the community, overhead costs, net income increases, and so on, and it has shown that such an approach can bring significant increases in productivity and income generation over a relatively short period of time. Additional benefits consist of strengthened village institutions, reduced out-migration, higher school enrollments, and improved nutrition and health standards.

Participatory Impact Assessment and Self-Evaluation (Kenya)

This section summarizes key objectives and findings of a number of participatory impact studies and self-evaluations of the catchment approach to soil and water conservation (SWC) as undertaken by the Soil and Water Conservation Branch (SWCB) of the Ministry of Agriculture, Livestock Development and Marketing, Kenya (Thompson and Pretty 1996; Pretty, Thompson, and Kiara 1995). The study was conducted jointly by a team of officers of this ministry and local farmers in six catchments in different agro-ecological and sociocultural settings in western and central Kenya.

The SWCB introduced the Catchment (or Area of Concentration) Approach to accelerate the rate of implementation of soil and water conservation across the country. The objective was to concentrate resources and efforts within a specified catchment area (typically 200-500 hectares) for a limited period of time, thus conserving all farms and leaving small adjustments and mainte-

nance to be carried out by local extension agents and the community itself (Mwenda **1991).** Subsidies were removed, and resources allocated instead, to extension, training, tools, and farmer trips.

Local communities are now involved in the analysis of their own SWC problems, and decisions and recommendations are made with their active participation. Community mobilization and participation are achieved through interaction with farmers by the planning teams, the formation of catchment committees by farmers themselves, and intensified publicity and training through field-days, *barazas* (public meetings), demonstrations, and tours. This helps pass information widely to the catchment inhabitants, to develop better understanding of the conservation problems specific to each area, and to cultivate closer collaboration between fanners, the Ministry of Agriculture (MOA), and other ministries and departments.

The PRA methods are used during the Rapid Catchment Analyses (RCAs) by interdisciplinary teams of between six and ten people from various government ministries and departments to assess (1) the present state of land use and land degradation in microcatchments (200-500 hectares), (2) help form Catchment Conservation Committees (CCCs) made up of locally elected farmers (both women and men), and (3) establish detailed action plans for implementing soil and water conservation activities. Each RCA is coordinated by an officer from the SWCB/MOA.

Typically the RCAs involve 1 day of orientation, introductions, and reconnaissance, 2 to 3 days of intensive fieldwork, and a final *baraza* during which findings are presented to, and analyzed with, local farmers. Catchment reports are prepared at the end of these activities and serve as baseline documents for later planning, implementation, monitoring, and evaluation. The CCCs receive support in the form of basic tools, equipment, and technical training and advice from ministry staff. In turn, the CCC members assist their fellow farmers in planning and implementing various individual and group soil and water conservation activities.

Participatory impact analyses

This impact study took the catchment as its point of reference for measuring change. It used participatory methods such as group and team dynamics, sampling, interviewing and dialogue, and visualization and diagramming. PRA methods employed were used in the ways described in Annex 1.

Several methodological innovations emerged during the impact analysis. For instance, historical matrices were used widely with different groups to explore changes since the 1950s, including changes in land use management and conservation practices prior to and after the implementation of the Catchment Approach. These showed a variety of interesting relationships, such as (1) increased levels of conservation and agricultural productivity coinciding with increased population, (2) crop diversity falling with adoption of modem varieties of maize, then rising after the Catchment Approach, (3) increases in manure use as fertilizer prices rose rapidly, and **(4)** soil and water conservation, high in the 1950s when enforced, disappearing in the 1970s-1980s, then reappearing due to the Catchment Approach. Venn diagrams showing historical changes in institutions, historical farm sketches and farming system diagrams, and seasonal labor demand diagrams were all helpful in understanding changes in resource use and conditions over time.

Triangulation (obtaining data on the same thing from multiple sources) on all the indicators was done extensively, since each catchment team had four or five research teams working in parallel in the field. The findings were shared in daily review meetings, which produced vigorous discussion and a deeper understanding of issues. For example, where there was disagreement between two groups over an indicator, it was often found that both were correct and that conditions differed between farmers (e.g., yields were increasing for some farmers, but falling for others).

The diagrams were produced on the ground in the communities and then recorded on large sheets of paper. These were used as a focal point for the SWCB *team's* discussions during the post-fieldwork write-up. Drawing on this material, each sub-team analyzed impacts according to a set of commonly agreed general indicators. There was no need to lead the discussion; team members took a great deal of time cross-checking and triangulating their information. In this way, they drew together trustworthy evidence and rejected dubious information because of concerns over the manner and context in which it was collected (e.g., such as in cases where local people's analyses may have been influenced by the statements or actions of team members of the ministry).

Sustainability indicators

Participatory methods were selected to measure six key indicators of change, some of which were physical while others were social or institutional: (1) changes in productivity; (2) changes in resource degradation; (3) changes in local resilience and decreases in vulnerability; (4) changes in self-reliance of local groups and communities; (5) diffusion (spread) to non-project sites; and (6) changes in the operational procedures of the ministry and attitudes and behavior of soil and water conservation professionals.

The SWCB team used the six sets of indicators to assess the impacts of the Catchment Approach in six catchments in western and central Kenya. The study revealed that impacts varied according to the quality of the interaction between extension staff and local people. When participation in planning and implementation was interactive, the impacts were substantially greater than when participation was simply consultative. In the interactively planned catchments, an interdepartmental PRA was wnducted to launch the conservation work. This included open *barazas* for presenting findings and developing plans. The Catchment Conservation Committee (CCC) was freely elected and involves both men and women. Fanners participated with the Divisional Planning Team (comprising one soil conservation officer and two technical assistants) in planning and laying out the conservation measures on their farms. A final *baraza* was held to formally hand over the conservation work to the community after implementation. After the catchment was completed, the CCC remained active and committed to maintenance and replication.

Drainage Rehabilitation and Participatory Social Assessment in an Economy in Transition (Estonia)[6]

Drainage systems that were constructed over the past 40 years enabled Estonian farmers to raise the productivity of 740,000 ha, or 66 percent of the country's arable land. As was characteristic of Soviet agriculture, drainage systems were engineered to the scale requirements of collective farms and were centrally managed with little or no input from fanners.

Formation of Land and Water Associations

The Government of Estonia has requested funds from the World Bank to rehabilitate drainage systems in five counties (districts) on 60,000 ha of the most productive land. To ensure that these investments have sustainable results, farmers are required to form Land and Water Associations

[6] See Thompson 1996

(LWAs). The LWAs in these five counties will negotiate with the government on the design of improvements, collect fanners' contributions of 20 percent of the rehabilitation costs (in cash or kind), and assume responsibilities for managing and financing drainage system operation and maintenance in the future.

It was unclear whether all the farmers in the identified catchment areas would continue fanning, as some are moving out of agriculture because it is perceived to be unproductive, or whether the uncertainty over landownership would be a major disincentive to investment in drainage improvements. The Ministry of Agriculture reasoned that if farmers did not consider drainage rehabilitation a priority, and were unable or unwilling to pay construction and O&M costs, or were disinterested in acting collectively through LWAs, then the proposed investment would not he feasible or sustainable.

Participatory *Social Assessments*

To fill in the information gaps with the involvement of farmers, the Ministry of Agriculture (MOA) designed a program to carry out Participatory Social Assessments (PSAs) in the five counties. The broad objectives of the PSAs were to: (1) identify key stakeholders and obtain their views: (2) collect information on social factors for selecting and screening appropriate sites; (3) strengthen the MOA's ability to communicate with fanners and understand local priorities and capacities: (4) develop a process to enable farmers to identify drainage problems, analyze constraints, and propose viable solutions; (5) identify procedures for decision making and planning of LWA activities; (6) anticipate the types of support (such as training and technical assistance) required by LWAs; and (7) generate fanners' participation in drainage rehabilitation and management.

The program was divided into three phases. During Phase I, training was provided to key stakeholders in PSA and participatory planning, and a PSA process was launched in two of the five counties selected for drainage rehabilitation. Phase II, which was implemented in late 1996, was conducted in three other counties; and Phase III, scheduled for early 1997, will focus on consolidation of stakeholder knowledge and participation through workshops and farmer-to-fanner exchange events.

As part of Phase I, an intensive, national-level workshop on Participatory Social Assessment was organized by the Amelioration Unit of the MOA in October 1995. Participants represented a range of professional and academic disciplines, including agronomy, anthropology, amelioration planning, drainage engineering, land management, and rural sociology.

During the training and fieldwork, the participants were introduced to a wide variety of methods and worked with farmers to prepare catchment drainage maps (where drainage problems were identified and tenure issues were discussed), farm profiles, seasonal diagrams of agricultural production, labor demand and income and expenditure, rankings of priority projects in pairs, network and Venn diagrams of institutional linkages and information flows, and so on.

Unexpected results and lessons for future action

PSAs of Phase I produced several unanticipated findings and clarified a number of issues. For example:

- Farmers' perceptions of land tenure issues appeared to be less of a constraint to LWA formation than anticipated.

- Prior to the PSAs, the MOA and the World Bank expected the formation of the LWAs and their operation to be standardized across the counties. The social diversity apparent during Phase I illustrated the need for a more flexible and contextualized approach if farmers were to develop a sense of trust and remain committed to their LWA.

- Farmers were most concerned with local contractors' expertise and the possible impact of poor rehabilitation work on their future maintenance obligations and costs.

The PSAs conducted during Phase I led to the following outcomes. First, farmers' interests and needs were more clearly identified and understood. The farm profiles provided the basis for identifying household assets and the conditions that affect potential ability of LWA members to utilize improved drainage and apply new farming practices. This information will be available to LWAs, MOA facilitator?., and design engineers when planning and budgeting for the rehabilitation works.

Second, a participatory planning process was set in motion. The participatory analyses became a means for giving voice to farmers. The catchment mapping enabled farmers to articulate their priorities and assess how they could cooperate with and agree on the modalities for LWAs.

Learning from the past, building for the future

Since October **1995,** 15 LWAs have been formed with the help of the National Training Team (NTT), a small group of trainer-practitioners drawn from various departments of the MOA, and the county Amelioration Units. The use of the PSAs has enabled MOA staff to screen the selected sites according to social criteria—primarily indicators of readiness to form and manage an LWA—and to develop a continuum of sites primed for collaboration in the program. The Land Board of Estonia has endorsed and supported the screening process by accelerating their assistance for land titling in those **areas** selected for rehabilitation.

The social assessment process also established an enabling environment for the MOA facilitators, by systematically including local-level stakeholders in the training events and social assessments undertaken so far, so that all interest groups were aware of the planning and requirements for LWA formation.

PARTICIPATORY RESEARCH AND DEVELOPMENT FOR IRRIGATION AND WATER RESOURCES MANAGEMENT'

Recent experiences from the field illustrate the increasing use of participatory methods for research, planning, and impact analysis of irrigation and water resource management programs. In general, results have been encouraging, but it is clear that more in-depth studies are needed if we are to understand the longer-term outcomes of participatory methods, especially regarding differential access to water resources by different subgroups, and the implications of this for sustainable resource management.

'This section draws on Guijt and Cornwall 1995; Backhaus and Wagachchi 1995: Chambers 1995: Guèye 1995: Mosse 1995; Richards 1995: Schreckenberg 1995; Shah and Kaul Shah 1995: and Thompson 1995.

Participatory Research and the Analysis of Difference (Zimbabwe)

Participatory research conducted in Zimbabwe by Redd Barna, a Norway-supported NGO, included the analysis by separate groups of men and women of how they expected a planned river-fed irrigation scheme to affect their lives. Through a series of discussions and the use of impact diagrams (Annexes VI and VII), they examined people's perceptions of potential positive and negative outcomes of the scheme. Particularly striking was the concern about mismanagement of funds. Welbourn (1993) writes:

> ***(The women) feared that if they were not in charge of the sales of their produce, their husbands would pocket the earnings and squander the cash on beer: If this happened, they would divorce their husbands, and they were ready to stand up in public to declare this threat.***

The young men's analysis revealed similar concerns, with jealousy, witchcraft, and death identified as other anticipated problems. They also noted that the extra money that irrigation might provide could lead to arguments with their spouses—and even divorce. It is unlikely that many irrigation engineers would have foreseen such connections without this type of interaction.

This example shows the kinds of social and economic problems that may result from an intervention that does not effectively address conflicts and competition over resources. The danger remains that participatory planning and development activities stop with simple consultation. The surge of renewed interest in using the word "participatory" to describe any form of planning or research has resulted in it meaning all things to all people. The adoption of participation as a guiding principle has been driven by both ideology and pragmatism. Many institutions with explicit mandates to reach the "poorest of the poor" employ methodologies consistent with their ideology, involving intended "beneficiaries" or "clients" in the process. It is a commonplace for donors and development agencies to require the participation of beneficiaries as a condition for provision of development assistance.

Summary of Issues, Challenges, and Opportunities for PRA

Despite their proven effectiveness, concerns remain about the application of participatory research and development in different agro-ecological and socioeconomic contexts. These concerns relate to unclear definitions and contradictory objectives, concerns over the role of professionals, questions over complementarity of methadologies, the influence of politics and power, measurement of impacts, and the challenges of going to scale and institutionalize participatory approaches in large, government bureaucracies.

We address each of these concerns below, and examine the challenges and opportunities for improving the practice of participatory research and development for water resource management.

Confusion over definitions

Issue. Participatory research approaches have variously been described as methodologies, techniques, a basket of tools, and a menu of methods. Whatever approach is employed, they usually involve a series of group interactions in public spaces, which may or may not involve separate activities with different groups and individuals with competing interests.

Challenges and Opportunities. Within the water sector, innovation in participatory research and development is underpinned by a commitment to principles of equity and empowerment, and to enabling people to express themselves in their own terms.

Confusion over objectives

Issue: Rapid appraisal and participatory approaches frequently rely on similar methods, but are generally used to pursue different objectives. Rapid appraisal offers planners, researchers, and pmject staff the tools with which to gain an understanding of local conditions, constraints, and capacities in a short amount of time. Information is then processed and analyzed by external professionals and fed into formal research, planning, programming, or policy-making arenas. At the local level, participants may play an active role in the collection of information, but agendas continue to be set elsewhere, offering local people limited opportunities to take part in decision making and planning for themselves.

With participatory methods, the emphasis is not only on local-level analysis but also on enabling people to set their own agendas, pursue their own priorities, and play a more prominent part in decision making. In short, it is about allowing local people to at least partially control the research and development process.

Challenges and Opportunities. Policy change in imgation and water resource management may require strategies that appear "extractive," but can ultimately bring wider benefits. And rapid data collection can be a stepping stone to more engaged and participatory work at the local level over the longer term. The selection and sequencing of methods will depend on the nature and purpose of the research or development initiative.

Overemphasis on methods

Issue. Even where participants begin to work in more interactive ways with local people, a preoccupation with methods (maps, matrices, systems diagrams, etc.) and their immediate results (for reports, research agendas, plans, etc.) has led to a neglect of the contexts and interactions that give rise to these outputs. In many cases, the participatory methods continue to be used to seek "facts" rather than to explore stakeholders' agendas and sets of interests. Information is taken out of the complex social and micro-political contexts in which it arose. Different people in different settings may choose to represent their situations to facilitators and each other in different ways.

Challenges and Opportunities. A major challenge for water management professionals is to try to understand the local context better and to see that social interactions are *part* of the "data," and indeed influence what is and what is not said. Training needs to concentrate more on developing skills of facilitation, observation, and analysis, and on enhancing practitioners' and researchers' abilities to reflect on their own personal biases to recognize the influence they have on outcomes.

Confusion over the role of professionals

Issue. Mastering the use of participatory methods is the easy part. Acquiring the skills of communication and facilitation with which to apply them is far harder. Exposure to participatory approaches involves a learning process that can be deeply challenging, on both professional and personal levels. Many of those who are now being trained in participatory research and develop-

ment in the water sector have spent much of their working lives in formal institutional hierarchies with rigid rules and highly bureaucratic decision-making procedures. Professional advancement in such settings often depends on acquiring specialized knowledge, demonstrating "expertise," and accumulating power. Participatory methods actively challenge these boundaries and may be perceived by some as a threat to their status and even their jobs. As many participatory trainers can testify, resistance. confusion, and frustration often arise in training sessions as participants try to adapt to these new roles.

Challenges and Opportunities. Water development professionals cannot "deliver" empowerment, but they can create opportunities for people to empower themselves. Knowing what professionals bring to a participatory process (such as financial resources, information and technical knowledge, long-term support. and links with external organizations) can help local water users to change their expectations of such professionals and establish the basis for a more constructive partnership.

Dealing with politics and power

Issue. Conflict is a fact of life. It occurs in all communities and all groups, and is manifest in a variety of ways, sometimes constructively, and at other times destructively. The practice of participatory research and development in such settings is never value neutral. Participatory processes generate expectations, which agencies and individuals may find difficult to meet. Choices need to be made and sides taken, raising ethical and political dilemmas. If consensus is sought, whose interests are served and whose voices are heard? In settings where there is competition over access to and control of water resources, local political structures may prove to be the biggest obstacle to the empowerment of marginalized groups. Moreover, when choices are made to work with the less powerful, what repercussions might this involve? Practitioners are often not equipped to deal with some of the conflicts that participatory analyses may expose or provoke,

Challenges and Opportunities. Bringing about fundamental shifts in the social relations of power requires not only sustained interaction with the various stakeholders, but also the willingness to take risks that may generate contlict. External agencies involved in water management must be prepared to mediate and arbitrate disputes over resources when they arise. This will require developing new skills and capacities in conflict management as well as in the use of participatory research and development approaches.

Measuring impacts

Issue. While there is no lack of reports of short-term outputs of participatory processes, there is still little documentation of what takes place over the longer term. Much of what is written about participatory research and development is the result of one-off or short-term research or training experiences, rather than sustained analyses of intensive engagements with communities over extended periods. To improve practice, detailed accounts of the processes that take place in longer-term participatory work are needed. The paucity of such studies in the irrigation and water sectors leaves doubts about the effectiveness of participatory research and development work in achieving equity and empowerment, and bringing about measurable improvements in the productive. equitable. and sustainable use of water resources.

Challenges and Opportunities. In assessing the impact of participatory approaches. it is important to look beyond whether or not they have produced more efficient (and cost-effective) programs or enabled agencies to meet *their* objectives. It is essential to examine the perceptions

local people have of participatory work. What impact do they feel it has had on the quality of their lives? And what indicators do they use to assess changes and measure improvements? Opportunities exist for developing participatory monitoring and evaluation (PM&E) systems to improve irrigation performance. This will involve identifying the key indicators for which the water users, as well as managers, engineers, and other stakeholders, judge system performance and make management decisions, then employing these indicators in new PM&E systems to improve irrigation management.

Complementarity of methodologies

Issue. In some settings and for some purposes, conventional research methodologies (such as survey questionnaires and environmental impact assessments) may be more appropriate than participatory methods. In others, the reverse may be true. In still others, conventional and participatory methods may be complementary. Exploratory work using a participatory approach may, for example, identify issues that require further investigation using a short, focused survey. Or conventional approaches may be used to establish the basis for future participatory planning and development work.

Challenges and Opportunities. Ultimately, participation rests on questions about who sets the agenda and who controls the process. As part of a process led and managed by local people, "non-participatory" methods can complement participatory methods as means to ends defined by the people themselves. In the irrigation and water sectors, further field testing and experimentation are needed to learn more about potential methodological complementarities and conflicts,

The problem of scale and institutional change

Issues. Originally intended for and developed around use at the community or local level, recent attempts to apply participatory methods in national research and development programs and institutionalize their use in large government bureaucracies have raised new problems and opportunities. The expansion of participatory training on a large scale also raises pressing concerns about quality assurance and capacity.

Challenges and Opportunities. The challenge for large public institutions attempting to employ participatory methods at a national scale is to facilitate the emergence of new ways of knowing and behaving so as to manage change creatively. This will offset growing concerns over the co-opting of the term "participation" by those with short-term time horizons and narrow agendas who may be promoting the status quo, rather than change. Participation must be seen as something that is not only good for local people, but also good for government agencies and research institutions.

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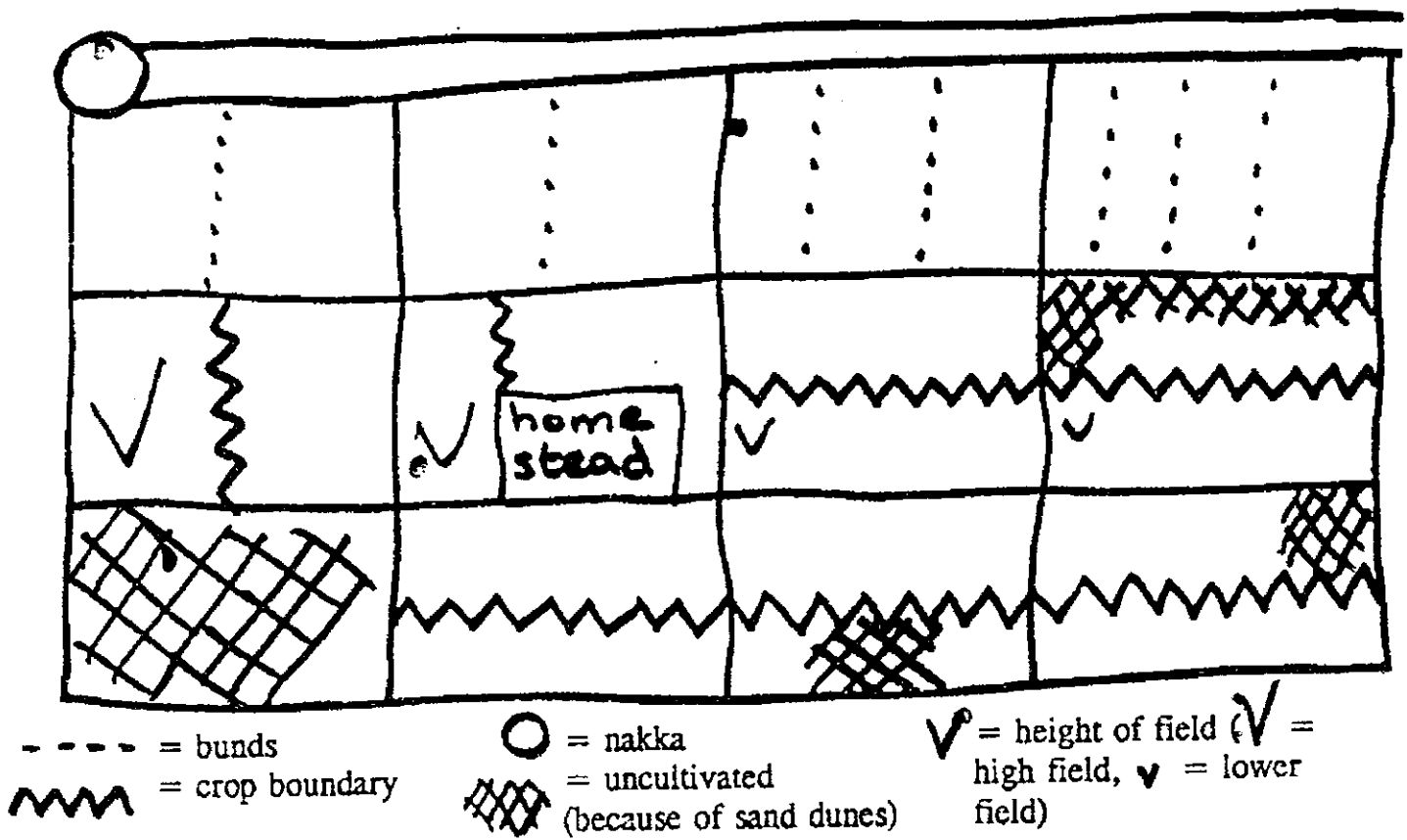
Annex I: PRA Methods for Farmer Participatory Research on the Impacts of a Soil and Water Conservation Program

Method	*Applications*
System diagrams of catchments and individual livelihoods	* impact of catchment approach * changes in livelihoods before and after intervention
Participatory mapping	* location of adoption and adaptation of new technologies * identification of households, land use patterns, tenure, etc. * inventory of resources in catchment or villages * spread of technologies and practices into neighboring communities
Wealth ranking	* changes in welfare of primary stakeholders * identification of focus groups and key informants * distribution of outcomes and impacts on various farm families and individuals from different wealth categories
Resource maps: before and after	* changes in productivity of fields and plots * changes in intensity of resource use * changes in levels and patterns of farmer adoption, adaptation, and rejection of technologies and practices * changes in water availability
Venn diagrams	* strength of interactions between catchment committee and other organizations inside and outside the catchment * frequency and coverage by government agencies and NGOs * training received by committee members. number of farmer-to-farmer exchange trips * organization and federation of local groups * local perceptions of heir institutions and external agencies' support * linkages to neighboring communities
Mobilitymaps	* changes in migration patterns * changes in access to markets, external information, and resources * labor opportunities before and after intervention
Time lines	* development of village institutions * key historical events and interventions
Presentations to community members	* triangulation of preliminary findings * enmuraging joint analysis
Focus group discussions	* changes in agricultural productivity and land degradation * changes in input costs, wage labor rates * investment in soil and water conservation measures * activities and impacts of key individual and institutional actors
Trend analyses and historical profiles	* impact of external institutions on local ones * resource management trends and changes/past, present and future
Seasonal calendars	* seasonal variations in labor demand, income and expenditure. cropping,patterns, etc. * seasonal changes in water availability and demand
Matrix scorings and rankings	* comparisons of technologies, strategies, practices, etc. * analysis of costs and benefits of these according to locally generated criteria
Team contracts, reviews and discussions	* interdisciplinary teamwork and effective group dynamics * assigning of clear roles and responsibilities * cross-checking of data sources and information

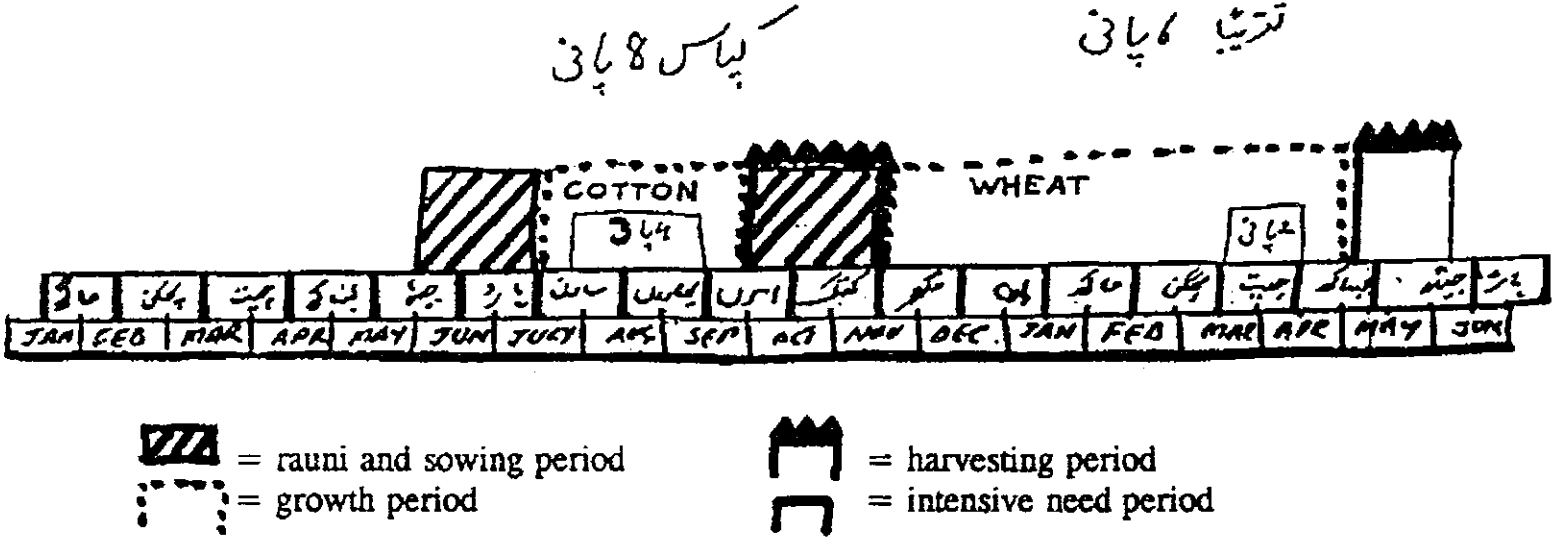
Source: Thompson and Pretty 1996.

Annex II: Field Map, Fordwah 46-R (Punjab), Pakistan



Source: Hoeberichts 1995.

Annex III: Cropping Calendar, Fordwah 46-R (Punjab), Pakistan



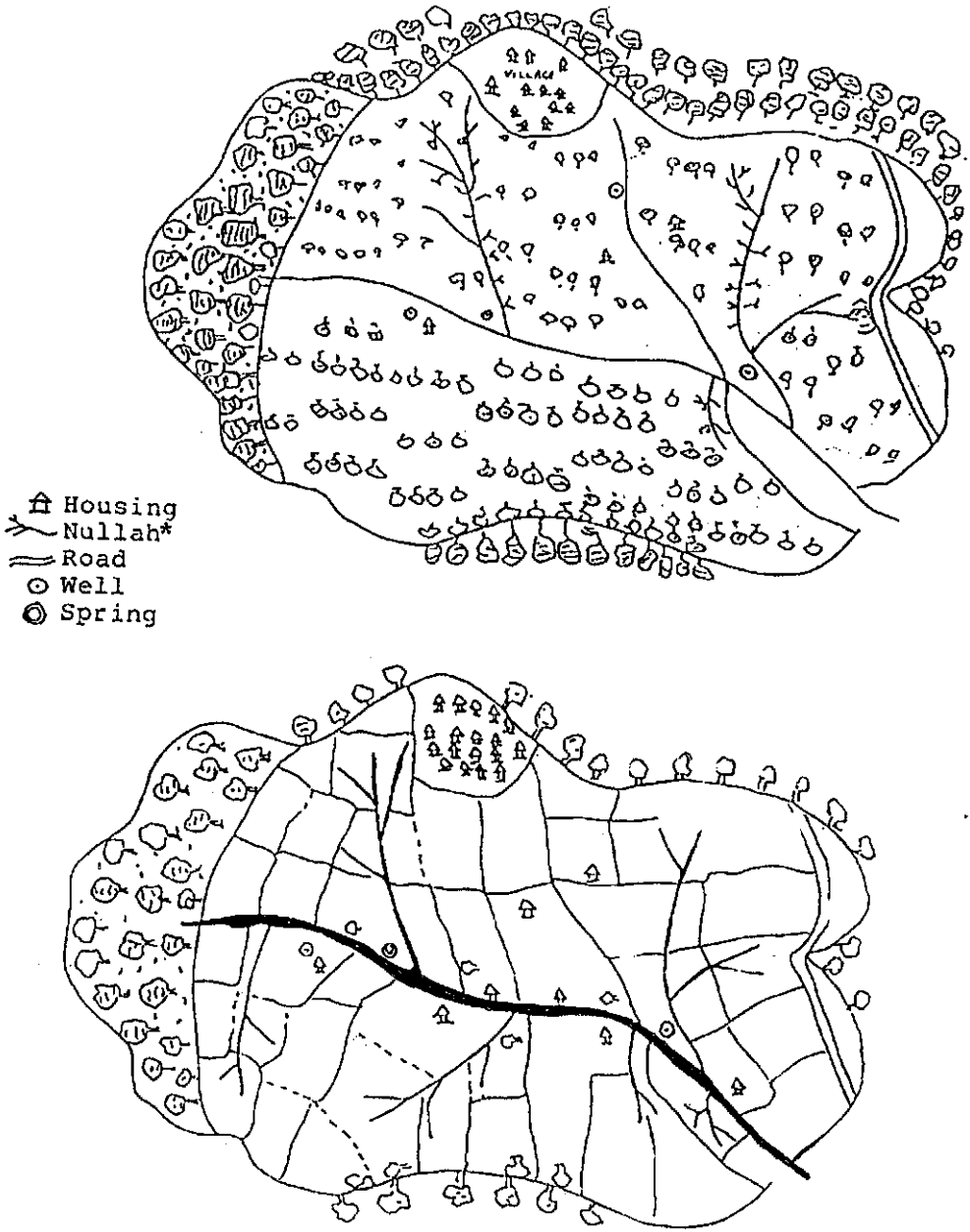
Source: Hoeberichts 1995.

Annex IV: Water Users' Perceptions of Soils, Salinity, and Sodicity

Indicator	Water Users' Description
Physical Appearance	
Standing water in the field 3 to 4 days after irrigation	If this occurs after application of good quality irrigation water, it indicates soil problems
Soil cracks after irrigation	With a good soil structure before inigation. the water users know they used poor quality irrigation water and the soil will turn hard.
Different sound of walking through the fields after irrigation	Application of poor quality water leading to a flour-type layer on the soil surface, below which a 1 inch hard layer has developed
Oily looking foot prints	Saline soils
White appearance of the soils	White salinity after irrigation with poor quality water, or appearing after a long period without irrigation.
White patches on the surface	White salinity on high spots in the field, either caused by poor quality irrigation water or by the soil itself
White soil surface	White salinitv. as above
Black color of the soils	Severe salinity problems, very difficult to grow crops
Muddy soils (but due to a white flower type surface. the soils look dry)	Waterlogged and very saline soils, difficult to grow crops — includes black salinity
Crop Performance	
Poor germination	Salinity, and used by farmers for a wide range of different salinity levels (black and white)
Irregular crop growth	Salinity
Stunted crop growth	Salts appear deeper in the profile. Crops do grow, but when the roots reach the salt crops are severely affected.
Yellow leaf burn	Too much salt in the soils will bum the crop yellow.

source: Kielen 19%.

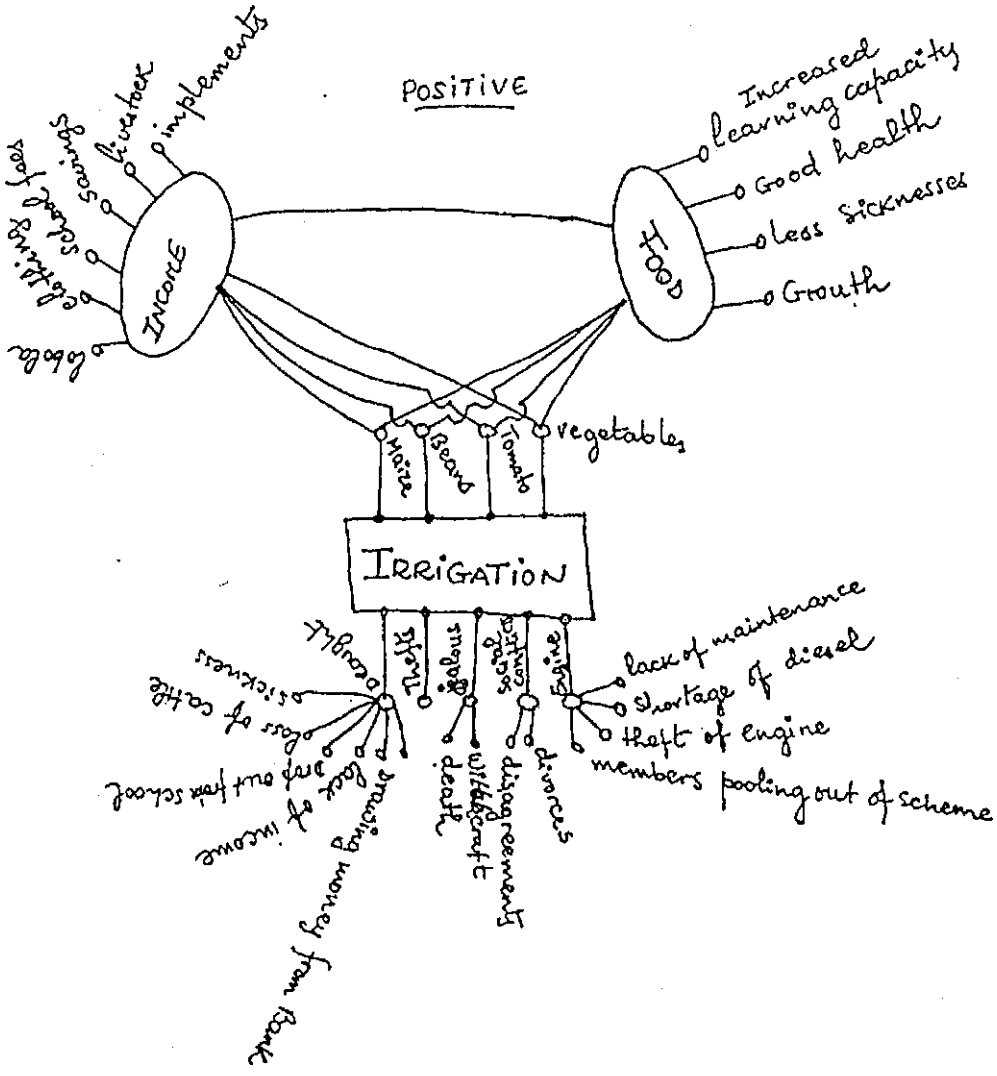
Annex V: Two Watershed Models, 50 Years Ago and Today, Ardan Arypura Village, Karnataka



Notes: *Nullah = Stream

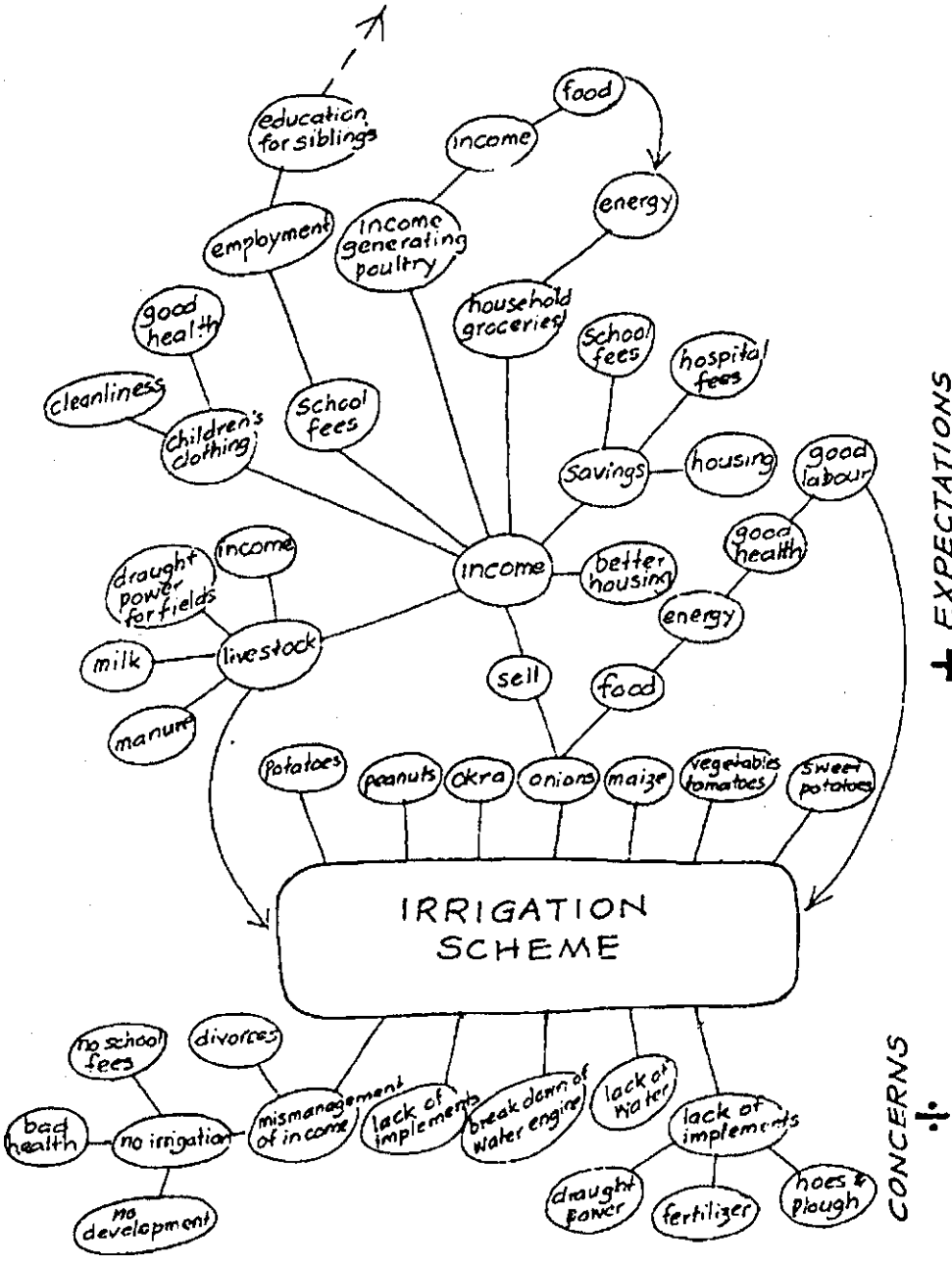
Source: Mascarenhas and Prem Kumar 1991

Annex VI: Expected Impacts of Irrigation as Perceived by Young Men, Mavenge Village, Zimbabwe



Source: Redd Barna 1993.

Annex VII: Expected Impacts of Irrigation as Perceived by Young Women, Mavenge Village, Zimbabwe



Source: Rcdd Barna 1993.