Full text versions of case studies presented at

Participatory Research for Natural Resource Management: Continuing to Learn Together

A Joint CG-PRGA/NRI Workshop

1st – 3rd September 1999 Chatham, England

Participatory Management of Kapuwai's Wetlands (Pallisa District, Uganda): a clear need and some steps toward fulfilling it

by Grazia Borrini-Feyerabend
Ancienne Ecole

From the top of the hill we could see the landscape far into the hazy horizon… the vibrant green of cassava, the tired colour of the harvested stems of millet and maize, the few patches of forest, the *mavule* trees standing high and alone, the pressed earth of the family compounds, a few oxen dragging a plough into dark soil... We did not have much time there, as dark clouds were amassing towards us, threatening a vigorous thunderstorm to hit the huge granite stone on top of which we were standing. We had brought some paper and pens and we quickly drew a map of the territory but soon, rather than focus on improving the map, we went into a discussion of the key issues at stake for the local wetland. From up there we could not really see it– for it had shrunk so much to make room for rice fields– but people pointed at its general direction, and we decided to visit it on foot in the afternoon.

Pointing at green features in the landscape, Stanley mentioned that, since my last visit and joint participatory assessment exercises, seven years ago, people had reduced tree-cutting and started actually planting trees in the boundaries between their fields. Some crops proved to do very well under shade, and the soil fertility had generally improved under protected conditions. Many families had tried out with success various other ways of intensifying agricultural production. They had built contour ridges around the fields, introduced black ants that feed on aphids, spread ashes on crops, weeded at better times, selected their best seeds for planting, and introduced new activities, such as rabbit raising or bee-keeping. Some had even gone so far as planting the very beneficial but difficult-to-raise *neem* trees. The wetland problem, however, which was already serious seven years ago, had not improved in any substantial way. The government was still encouraging rice growing by individuals, and the community– despite being convinced that the wetlands were important for everyone and needed to be used carefully and not destroyed– was still unclear about what to do.

What was the problem, exactly? Amos explained: "When the big rains come, the wetlands act as a sponge. Because of that sponge, even very big rains, in the past, did not cause floods in the village. Now that the wetland has shrunk so much, even a small rain inundates our fields and homes in Kapuwai." In contrast, during the dry season, Daniel said there was less and less water. They badly needed more watering points for both people and animals. They needed more fish from the wetland (fish was appreciated by everyone but also a food of last resort, freely collected by children, the elderly and the poor). And they needed more of the kind of medicinal plants that grow close to the water, and were now becoming very difficult to find. Coming down the hill quite fast, the first drops of rain and rolling thunder already on top of us, Anne said that it was a dream of their Association to succeed in managing the wetlands together, as a community. Could we discuss together a plan to go about that?

In the afternoon, as we walked towards the wetland area, I could see that where I remembered kids fishing only seven years ago, there were now only the remnants of recent rice harvests. The ground was hard under our steps and Daniel stamped upon it forcefully: “Do you feel how hard it is? Now come with me towards that other patch, up there. Feel how it is soft, and clogged with water?” (indeed, despite having moved uphill from the hard ground, I could feel water under my feet… and had to protect myself from the insects that now swarmed at every step..) “This ground has never been planted with rice, this is why it is so different!” he explained. I was sincerely amazed. Then Taghi asked: “Who grows the rice down there?” “Some poor families.” replied Stanley. “They come and obtain permission from the clans and individual land owners… often in exchange for a share of their harvest.” He actually knew that system well, as his own father had loaned land in that way. But there were problems with the system, for instance conflicts between the rice farmers and the owners of cattle, who now found their access to water blocked. “They should leave some corridors for the animals to reach their drinking spots,” said Anne, “but they forget to do it. Even the ones who own animals of their own forget that they need to leave them space to pass.” Despite his own family interests in the matter, Stanley was clear about one point: “The wetland should belong to the whole community, not to some individuals. We need to manage it together!”.

As we advanced towards the core of the wetland, we could see a few elevated “islands” surrounded by a sea of dried-up rice fields. Every small island seemed to host burned and scarred remnants of trees. There were children on the islands, and some came running towards us when we got close. “Why aren’t these kids at school?” I asked. The answer was that they could not go, as they were needed to scare the birds that would have eaten up too much rice otherwise. And since the trees harboured the birds, the trees had been burned and cut down, devastating the biodiversity of the small islands. These islands had originally been large termite mounds, slowly developing into special biotopes in the middle of the wetland. Indeed, the extensive rice growing was causing all sorts of problems… from loss of local biodiversity to impoverishment of the children!

That evening we ate together, in the light of some candles and paraffin lamps that sent a pungent smell into the small room of the health centre, where later we were to hold a larger meeting. Slowly, more people joined Stanley, Anne, David, Amos, Tom, Taghi and myself. The topic of the discussion was going to be the management of their wetlands With the impulse and help of their local Association, the community had already proved capable of solving health problems and organising a successful scheme for collective trading of agricultural products. It was about time they would tackle the wetland issue. Soon we were far into the night discussing the beginning of a positive vision for the wetland, a vision the whole community may likely be willing to share. Some women listed the products they wanted to be able to extract from the wetland: crops such as rice, but also grazing fodder, medicinal herbs, fish, bush foods and clean water for people and animals. They also wanted the capacity for flood control in the territory. These benefits, others insisted, should be shared in a fair way. Could a proper management assure all these? How should they go about it? Some people wanted to put guidelines in place, to regulate wetland uses and land reclamation. Others added that these should have a by-law status and that everyone in the community should be reporting bad behaviours. Other people, however, did not feel comfortable in establishing guidelines yet. Who would establish those? On what basis? They wanted to carry out some experiments first, to do research on what would be the best ways of managing the resources. Others believed that the first thing to do was to set up a responsible committee. The committee would take care of what needed to be done. Others wanted first of all a community discussion of the benefits brought about by the wetland.

After a night of exciting thinking and late sleeping, we met again the next morning, to sketch out a plan for the participatory management of the wetland. The participants in the evening discussion agreed that they would call a larger meeting where the vision for the future of the wetland would be discussed by the whole community. In particular, they agreed on calling every distinct “stakeholder” to present their views, and to negotiate with others some basic rules to be respected and activities to be carried out. If possible, they would develop a Management Committee, uniting various clans, cultivators, fishermen, cattle owners, and so on. They would also identify a pool of benefits to manage for the interest of the whole community. Taghi had told stories about Community Investment Funds in Sudan, and people were excited about the possibility of shared enterprises between the community and some specific groups or individuals.

As the discussion went on, we identified three key elements in the participatory management process for the Kapuwai wetlands:

- Preparing the partnership
- Developing the agreement(s)
- Implementing and reviewing the agreement(s)/ “learning by doing”

In the first phase of preparation of the partnership, discussion on the wetland issues (“social communication”) would be promoted in the community. One of the themes of the discussion would be whatever exists in terms of management systems and traditional entitlements and practices at the present time. Another theme would be what problems people experience with the wetland, and what opportunities they see for improving their management. Local elders, traditional authorities and landowners in the wetland area would all be invited to participate in the discussion, but so would be the residents at large . Awareness of benefits from the wetland would increase, different groups would figure out their own interests and concerns, and they would then organise to communicate these to others. In this moment of preparation, people would also begin to clarify what they need to know for sound management, and to get that information together. For instance, some could study an issue in detail and/or begin some action-research and experimental study.

In the second phase, the stakeholders would be invited to set aside their immediate interests and "positions" and develop—together— a long-term vision for their wetland. This would be done with the help of a facilitator, who would ask everyone to describe their vision of the wetland they would like to leave behind to their children and grandchildren. Once a common vision would be reached, a ritual would make it intangible and sacrosanct. The ritual would be performed by the clan elders and traditional authorities, and every "stakeholder" would be asked to re-affirm the desire to work together to reach the common vision. In our evening meeting, many believed that the village would develop a long-term vision of the wetland as an element of wealth of the whole community, not a system of resources to be exploited by some individuals, and that only that sort of a vision would allow them to manage the wetland with prudence and fairness.

After the "ritualisation" of the common vision, it would be time to negotiate a management plan, some basic rules for extraction of resources and other needed accompanying measures and initiatives. People felt they could do so by taking advantage of their traditional management skills in the community, but also of the skills the local Association had acquired while managing common resources in agricultural production. They would probably hold a series of meetings in which ideas and options would be thrown into the discussion and would be compared with their alternatives. All "stakeholders" would be invited to the meetings, and they would strive to work by consensus—not majority vote, and to be extremely transparent about information and all sorts of decision making. On the basis of the common vision and agreed plans and initiatives, a pluralistic management committee could also be put in place. Perhaps even other bodies could be formed, such as an Advisory Council. Someone, however, thought that this body existed already: it was the Council of Elders, which was to meet in about three months' time. Many thought that the Council of Elders should be involved from the very beginning of their wetland initiative.

In the third phase, the committee would be acting on the basis of its duties, and the agreed plans would be implemented. Far from static implementation, however! The Kapuwai people stressed that implementation should be taken up as a way of "learning by doing," and that, to do so, they would have to plan in advance for regular reviews and discussions of management results. They felt that the entire community should be allowed to participate in these meetings, and express views. No doubt, there would be problems. Some people would be in need of more land to cultivate; some landowners would want profits from their property-- could they be convinced to work with others and forego immediate benefits for a prosperous wetland in the long run? Also, there would be technical questions to be solved. For instance, would it be good or bad to plant trees in the wetland area? And surely there would be many adjustments to be made with time in distributing the benefits and costs of management (including "opportunity costs"). These were serious issues, but the participants in our meeting felt that—if those would be faced straight in the negotiation phase, and if people would learn from experience—all problems would meet their solutions.

As we were leaving Kapuwai– unfortunately we could not stay as long as we wished– our friends had a light of enthusiasm in their eyes. They had just charted for themselves a way towards a better future for their wetland, a unique and highly appreciated element of wealth for the whole community. With luck, patience, and personal effort, they would succeed in understanding it, protecting it and using it together, for the benefit of everyone. They waved towards us with broad smiles on their faces, surrounded by a large and cheering group of family members, friends and children.

August 15, 1999
(the narrative above refers to July 1999; thanks to M.T. Farvar who commented an earlier version of this case study)

The case study refers to:

- Methods and approaches to increase stakeholder involvement
- Collaborative management of natural resources
- Collective learning

The case study also includes the "description of a method which has facilitated the users to understand the integration of the bio-physical and socio-economic concerns". The method is an on-site, joint discussion of relevant problems and opportunities, followed by a planning session facilitated by external professionals (in the Kapuwai case, myself and Dr. M.T. Farvar).

Here is the table you requested (I believe there are no "cons", only some "costs" and difficulties to overcome)

Participatory management of the Kapuwai wetland:

Expected pros, benefits	**Expected costs, difficulties**
More sustainable use of the wetland resources	Substantial investment of time by a few members of the local Association and others to set up the process that would lead to participatory management
Protection of biodiversity still left in the area	Need to overcome the vested interests of the relevant landowners
More equitable use of wetland resources (negotiated specific benefits for all the stakeholders)	Need to secure the support of the Council of Elders and traditional authorities
Prevention of social conflicts and problems by early discussion and agreements on use regulations	Need to provide alternative ways to raise income (in place of rice cultivation in the wetland)
Increased local awareness of problems and opportunities related to the wetland management	Need to secure effective facilitation and support during the participatory management process
Enhanced local capacity for wetland management	
Fending off of exploitation from outside interests	
Increased sense of security and stability in the community, sense of "local empowerment" in dealing with common problems	
Enhanced vitality and "identity" of the Kapuwai community	

The Farmer Research Committee (CIAL) as a community-based NRM organzation

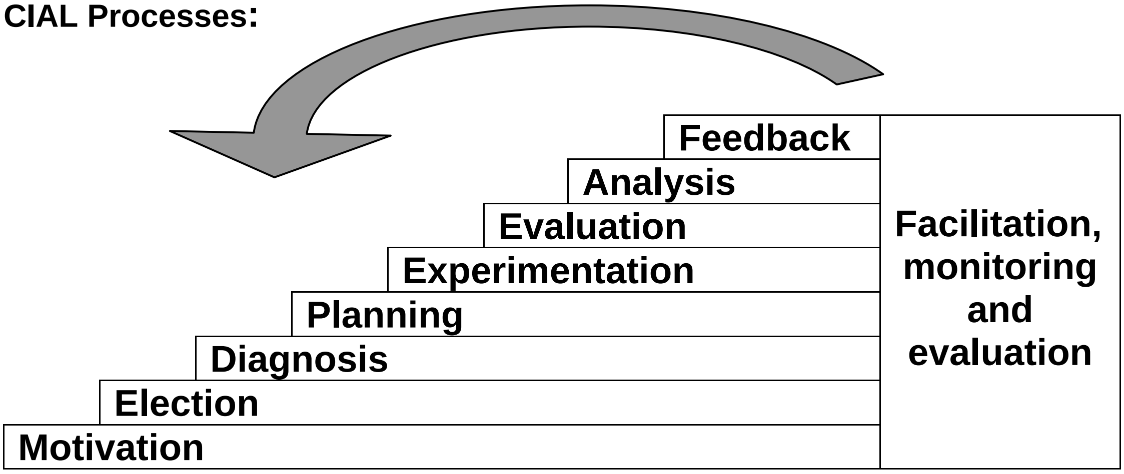
What is a CIAL?

- CIAL is the Spanish acronym for *Comité de Investigación Agrícola Local*, or "Local Agricultural Research Committee."
- A CIAL is a research service belonging to and managed by a rural community. The research team is made up of volunteer farmers, chosen because of their aptitude for experimentation. The CIAL links farmer-researchers with formal research systems, increasing local capacity to exert demand on the formal system and to access potentially useful skills, information and research products.

CIAL Principles:

- Knowledge is generated by building on experience and learning by doing
- Mutual respect and accountability and shared decision-making are the foundations of the relationship between the CIAL, the community and external actors.
- Partners in the research process share risks
- Research involves systematic comparison of alternatives.
- Research products are public goods

CIAL Processes:



Facilitation: Each CIAL has four elected members and a facilitator. The facilitator may be a trained agronomist from a supportive formal research centre or university, an extension service or an NGO. Alternatively, he or she may be a trained farmer, who has served on a CIAL. The facilitator plays a key role in developing the CIAL's competence in the research process, and provides feedback on farmers' priorities and research results to formal research and extension services.

Training, through regular visits by the facilitator, continues until the CIAL is able to manage the entire research process independently. It equips the farmer research team to conduct experiments that compare alternatives with a control treatment, and that employ replication in time and space. Training familiarises farmer-researchers with terminology that gives results credibility with formal researchers. It also builds skills in planning, management, running of meetings, monitoring and evaluation, record-keeping and basic accounting.

Facilitation of a CIAL requires profound changes in attitudes and relationships among farmers, rural communities and agricultural professionals. Training of facilitators includes a sensitisation process and learning to ask open questions that permit true two-way communication. After a two-week course, facilitators continue in-service training where they form a CIAL, supported by an experienced trainer who visits at key moments and provides feedback on strengths and weaknesses.

Facilitators are expected to respect the research priorities established by the community, and the decisions made by the farmer research team in defining experimental treatments and evaluation criteria, generating recommendations, and managing research funds.

As the CIAL becomes proficient, the facilitator reduces the frequency of visits, from two visits per month initially to one every three or four months. Facilitators visit mature CIALs for feedback on research priorities and results, and to provide access to technology under development by formal research services.

Motivation: The facilitator invites everyone in the community to a meeting where the nature and purpose of a CIAL is discussed. Farmers are invited to analyze what it means to experiment with agricultural technology. Local experience in experimentation and its results are discussed. The possibility of accessing new technology from outside the community is also mentioned.

Election: Farmer researchers are chosen by the community. A key criterion for selecting a CIAL member is that the farmer is experimenting on his/her own and is able ad willing to provide a service to the rest of the community. CIAL members agree to serve for a minimum of one year and agree to take part in a regular training and capacity-building process. They can recruit and involve other volunteers in the research that they conduct on behalf of the community.

Diagnosis: The topic or question for experimentation is determined through a group diagnostic process in an open community meeting. The starting point is the question: “What do we want to do research on?” The objective of the diagnosis is to identify researchable questions of priority to the community. The prioritization of potential topics is oriented by asking questions about the likelihood of success, who and how many are likely to benefit and the estimated cost of the research.

Research

Planning: The objective of the experiments conducted by the research team is to generate information about alternative local or external technologies that are of interest to the community. The experiments are not for the purpose of demonstrating technologies or teaching principles.

The facilitator helps the committee obtain the information required to plan its experiments. Other farmers and resource persons from formal research and extension systems are often consulted. The facilitator helps the CIAL formulate a clear objective for each experiment. Based on the objective, the CIAL decides what to compare, how and when to evaluate, experimental variables, criteria for evaluating results, data to be collected, and measurement units.

<u>Experimentation</u>: The farmer research team implements the experiment it has planned, using the CIAL fund to pay for inputs. The timing and manner of the data collection depends on the objectives of the experiment.

<u>Evaluation</u>: The farmer research team meets with the facilitator to evaluate the data collected. Conclusions are drawn and preparations are made to present the results to the community

<u>Analysis</u>: Analysis by the farmer research team includes the question "What have we learned?" This is especially important when an innovation is not successful, or when unexpected results are obtained. This ensures learning from the process as well as the results.

<u>Scale:</u> The CIAL pays careful attention to the scale of their experiments. The scale balances the need to minimize risk against the plot size required to obtain a meaningful result. The research process begins with a small-scale experiment (often called the exploratory trial) whose purpose is to screen out technological options that are unlikely to perform well under the local conditions. The experimental plot is kept as small as possible so that the risk of loss is minimized. If the CIAL's first experiment involves evaluating germplasm, it may include 8-10 different lines or varieties including at least one local control. The most successful treatments from the exploratory trial are planted with the local control in a slightly larger "validation" trial, which may consist of 10 rows 10 m long, for example. Finally, the best option from the validation trial is tested once more in a "production" plot. Not all research questions framed by the community may be amenable to this strategy of minimizing plot size. The exploration of management options for pest and disease problems are a good example of a research topic that may require a larger scale.

Feedback: Regular, open meetings are held in the community in which the farmer research team presents its activities, progress to date, and justifies its expenditures. This insures that their research products become public goods.

Recommendations to other farmers are based on the experiments and are explained in this meeting. Facilitators are responsible for ensuring that feedback about farmers' research priorities and results reaches the formal research system.

Regional or national forums in which farmer research teams can exchange information and results are held annually.

Monitoring and Evaluation: The main purpose of monitoring and evaluation is to insure mutual accountability among the partners in the CIAL process. The performance of the research team is evaluated by the community and any CIAL member can be replaced.

Accountability is created by expecting the CIAL to report on the results of experiments and their use of resources in regular community meetings. Records of the experiments are kept, which belong to the community and can be shown to outsiders if desired.

The research team is required to account for its use of the CIAL fund. This ensures that their decisions about acceptable levels of risk, input levels, scale of experimentation, and when to make recommendations based on their results, are made with CIAL resources and are not distorted by subsidies or gifts from outsiders.

Representatives from the CIALs evaluate the support provided to them by their facilitators and these results shared publically.

Assuring sustainability: The conditions for sustainability are created through the establishment of the CIAL fund. This fund, which is owned by the community, helps absorb research risks. The seed money for its establishment usually comes from a one-off donation from a formal R&D organization, but may originate from a rotating fund managed by an association of CIALs. The committee uses the fund to procure inputs for experiments and to compensate members for losses. When an innovation proves successful, the CIAL may add to the fund by selling the harvest or the products of research (eg. seed). As the fund grows, the CIAL can expand its research, share earnings with participants, invest in new equipment or services, or launch a small enterprise. The community is responsible for assuring that decapitalization of the fund does not occur, and is expected to contribute to it through collective fund-raising efforts.

Is the CIAL a community-based natural resource management organization?

The management of natural resources may require support for collective decision-making and the negotiation of solutions that consider the often conflicting priorities of different stakeholders. It also requires understanding of ecological processes and the development of analytical skills and problem-solving capacity focused at increasing biophysical scales and complexity levels.

Since research priorities are determined by the community, improved management of natural resources may or may not fall within a CIAL's objective. Nevertheless, the CIAL is a good starting point for the evolution of a community-based NRM organization. It builds a platform for:

- **collective learning** through the experimentation and community feedback elements)
- **decision making** support by providing experience-based training in evaluation of alternatives)
- **farmer/researcher institutional linkages** by creating a common vocabulary and two-way communication flow through farmer/researcher co-learning

Some strengths and weaknesses of the CIAL approach are summarized in Table 1. Taking the CIAL as a starting point for improving natural resource management would imply developing complementary mechanisms that address some of the specific issues related to scale and the understanding and management of complexity.

Experimentation in CIALs is focused on comparison of technological alternatives for the plot or field scale rather than on the higher level scales and complexity requried in many natural resource management situations. Experimentation for the purpose of discovering patterns and processes related to agroecosystem function is not an explicit part of the CIAL approach. Because of the importance attached to minimizing the biasing of farmer priorities by external actors, CIAL experimentation is largely based on farmers' current knowledge.

Discovery of agroecological principles, integrated analysis of management options at the community landscape level, and fostering collective action are strengths of the Farmer Field School (FFS) approach that could complement the CIAL approach and contribute to improving community-based management of natural resources. A comparison of the two approaches and a strategy for applying the CIAL and FFS jointly is discussed in Braun *et al*. (1999, 2000).

References

ASHBY, J.A., A. BRAUN, T. GRACIA, M.P. GUERRERO, L.A.H. Hernandez, C.A. QUIRÓS; and J.I. ROA. 2000. Investing in farmers as researchers: experience with local agricultural research committees in Latin America. Centro Internacional de Agricultura Tropical. Cali, Colombia.

BRAUN, A., G. THIELE & M. FERNANDEZ. 1999. La Escuela de Campo para MIP
y el Comité de Investigación Agrícola Local: Plataformas complementarias para fomentar decisiones integrales En la agricultura sostenible. Manejo Integrado de Plagas (Costa Rica). 53:1-23.

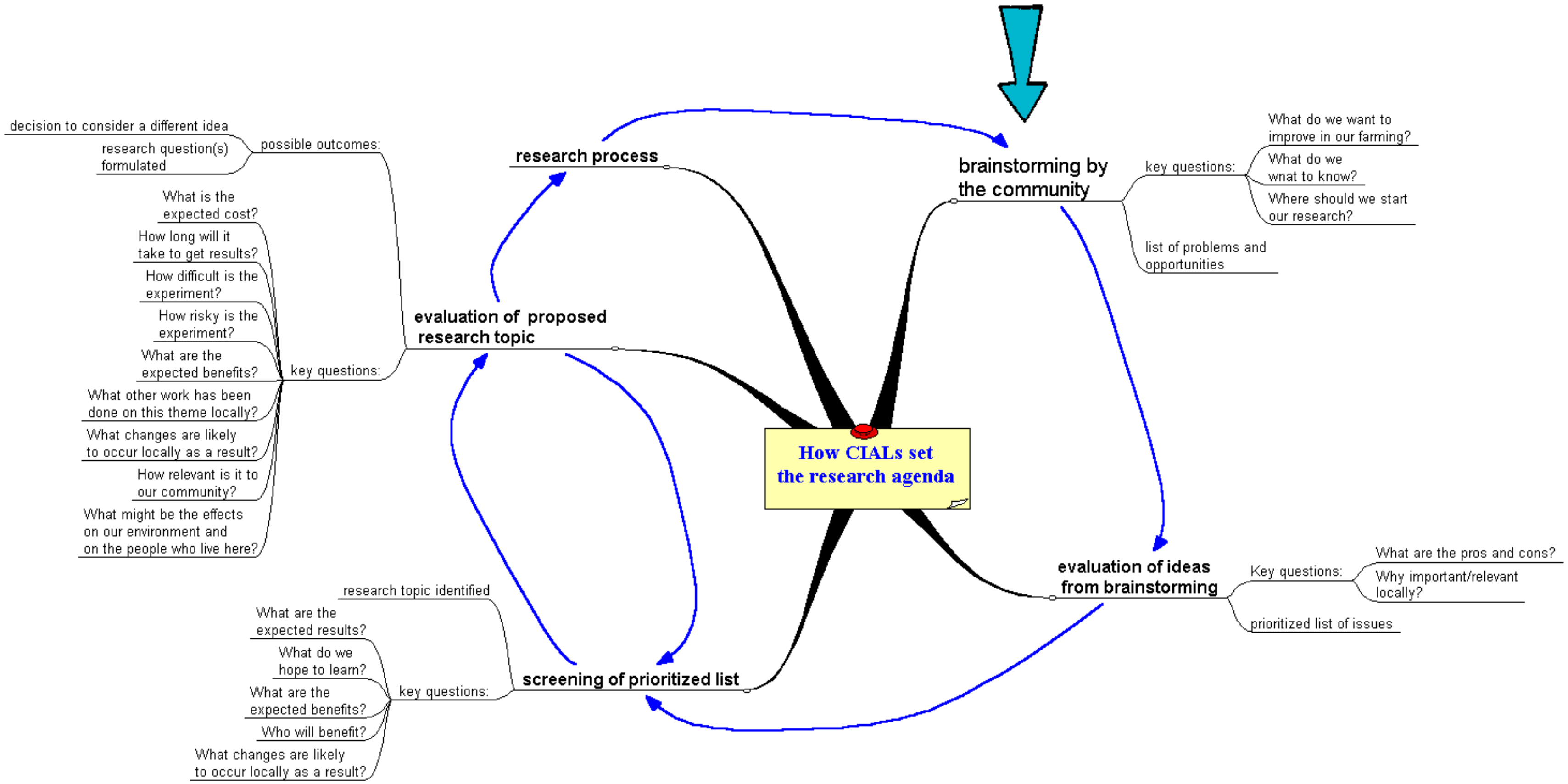
Braun, Ann R., Graham Thiele and Maria Fernandez. (2000). Farmer field schools and local agricultural research committees: complementary platforms for integrated decision-making in sustainable agriculture. AgREN Network Paper No 105. ODI, UK.

	Pros	**Con**s
Content	Technological options are systematically evaluated by farmers in such a way that the risk incurred is minimized.	Ecological interactions are not considered explicitly and no mechanism is incorporated to develop understanding of the agroecological principles which may underlying the problems being researched. Knowledge of these may be essential for the design meaningful experiments
Type of experimentation	Farmers learn basic research principles, including the function of the control and of replication; This provides for the development of a common language and two way communication with research and extension professionals	Farmer research committees do not learn skills for analysis of pattern and relationship;
Collection y analysis of data	Simple symbols and (eg.. Faces to indicate rank; good/netural/poor) used in analysis and and written materials are prepared, fostering recordkeeping skills	Drawings of field observations for the purpose of analyzing interactions are not used
Local knowledge in gaps		Not treated explicitly
		The scale of action needed to solve a problem is not analyzed explicitly. This can be a limiting factor if the problem is related to pests, diseases and many natural resource management situations
Relationship with the community		Depends very much on the quality of social capital. In areas where trust is low and association along non-kinship lines is rare, it may be difficult to form CIAL and/or sustain CIALs
Continuity	CIALs provide a permanent research service to their communities	

	Pros	**Con**s
Link to the formal research system	Strong links are developed with the formal research system, thereby increasing the demand for prototype technologies which are then subjected to local scrutiny	
Area of influence	CIALS are community-based but the radius of their influence can be increased through the formation of networks of experimenting communities and the creation of second order associations	

benefits

The process for setting the CIAL research agenda is an example of a method that has facilitated better integraion of biophysical and socioeconomic concerns



Peter Brinn, Natural Resources Institute, UK.

1. Case Study

Focus on integrating

- Methods and approaches to increase gender/stakeholder involvement.
- Collaborative management of natural resource management.
- Decision-making support.

Introduction

Tsetse control operations commenced in the Chiawa area of Zambia in 1991. Prior to 1991 there were no cattle in the area because of tsetse, although cattle were kept in surrounding areas where tsetse were not present. Tsetse control dramatically increased the agricultural options in the area but also presented the challenge of how to realise the benefits without over- exploiting the environment.

Typically, “land use planning” is seen is the means of meeting this challenge, but the record of familiar approaches to land use planning under communal tenure systems in southern Africa have not been impressive to date (Dalal-Clayton and Dent, 1993).

Chiawa was selected to pilot alternative approaches to land use planning with the objective of :

Increasing stakeholder involvement, through decision making support in order to achieve collaborative management of natural resources.

Approach

Phase I

Consultations with community leaders, Government and NGO representatives. Attendance at scheduled community meetings. Review of existing documentation, rapid air-photo interpretation and rapid field surveys of farming systems vegetation and soils. The results of the field surveys were incorporated into a simple GIS.

These consultations revealed considerable and consistent hostility toward perceived “Government” planning objectives for Chiawa. The area had experienced social disruption during the Liberation War in neighbouring Zimbabwe and had subsequently been subjected to a series of failed development initiatives, corruption and land allocation scandals. Against this hostility attempting to initiate a prescriptive land use plan would have been futile. An alternative approach was needed with improved stakeholder involvement as the primary objective.

Phase II

Phase I consultations clearly identified the importance of rapidly responding to demand driven initiatives as opposed to imposing externally conceived “solutions”. As a result a “demand led and support” model was developed in contrast with the more familiar “suitability and enforcement” model of land use planning. The approach adopted forms the core of this case study.

The approach was based on the following principles :

- Initiatives to be proposed by the community, not by outsiders.
- Initiatives to evaluated by the community and assessed for environmental impact.
- The scheme to be run by co-ordinators from **within** the community.
- The majority of implementation to be undertaken by the community. External support to be largely confined to technical advice and loans of equipment.
- Communities have to demonstrate “commitment” to projects, before external support is provided.

Female and male “Local Community Workers (group promoters)” were recruited by advertising locally and selection by interview. Training was provided which included periods of attachment to experienced Community Workers within Zambia.

By clearly explaining the principles of the scheme from the outset false expectations were avoided and “ownership” of the initiatives established.

Implementation

The community workers convened a series of small meetings at which problems and solutions were discussed. A possible scheme to support small projects which were both supported by the community and environmentally benign was explained. The process of local approval was agreed during these initial meetings.

A wide range of projects were proposed including, fish ponds; cattle paddocks; vegetable gardens ; handicraft production; marketing of local tourist attractions; well construction and poultry production schemes.

The proposals were documented and passed to the relevant authorities for evaluation. Environmental impact was assessed during site visits and information collected during Phase I.

Approved projects were supported through a variety of means including technical assistance e.g. the design of fish ponds and the evaluation of livestock carrying capacity. Assistance with the transport of bulky materials, study visits and training.

Impact

Eighteen months after the starting the scheme 35 projects were operating independently.
The scheme was enthusiastically received by the community. The success of the approach has been demonstrated by the transfer of co-ordination to a local NGO and proposals to establish a small revolving fund to support further initiatives have been made.

The individual projects were likened to pieces of a mosaic. The projects have individual integrity and ownership but when placed together they constitute a *de facto* plan.

Links to subsequent Phases

Interaction with the community during this process provided valuable guidance for a parallel components of the planning process. *Phase III* addressed issues of communal grazing resources, boundaries and procedures for arbitration of disputes. Trust, understanding and confidence was built during the schemes development which enabled a more productive debate and subsequent actions than would have been the case without it.

Phase IV examined options for community infrastructure provision such as roads, schools and clinics.

Conclusions

A “demand led and support” model was seen as an effective entry point in developing a participatory land use planning process, initiated by stakeholder involvement. The approach provided decision making support and encouraged the collaborative management of natural resources.

2. Some general advantages and disadvantages (it depends on your perspective) of the Chaiwa approach

Advantages	Disadvantages
Demand -led	Unpredictable
Locally managed	Limited control
Iterative	Uncontrolled
Small-scale	Too local
Innovative	Misunderstood
Locally driven	Vulnerable to nepotism
Sustainable	Slow process
Low cost	Not sufficiently glamorous

Specific lessons include

It takes time : Frequently, land use planning consists of a time bound period of data collection and consultation. This can result in distortions in the perceptions of planners. The presence of community workers over a longer time scale serves to correct rushed generalisations. Their involvement and continuous presence serves to maintain momentum and act as a two-way conduit between the community and others.

Selection of local co-ordinators : *The experience and capability of the local co-ordinators has a key influence on the direction of the planning effort. Careful selection and training is essential. The disadvantages of selection from the local community include lack of objectivity, favouritism and possibly diminishes respect due to familiarity. The advantages of local selection generally outweigh the disadvantages and include a positive slant on these* viz. *understanding and familiarity combined with the commitment to improve their own community.*
Retired teachers frequently make good candidates.

Groups vs. individuals : Initially groups, as opposed to individuals or families were targeted because of the greater numerical impact. Typically group initiatives started well and initially made rapid progress but, in several cases social tensions reduced their effectiveness over time. In contrast individual and family initiatives took longer to start up but once established were all sustained.

3. Specific method : Catchment change modelling

Background

This method was used during a series of community meetings to discuss livestock carrying capacity and water resources in the Zambezi Valley and Eastern Province of Zambia. Discussion of the processes of environmental change following the introduction or reintroduction of livestock benefited from building simple field models to illustrate the processes and also by supporting local environmental monitoring techniques.

Objective

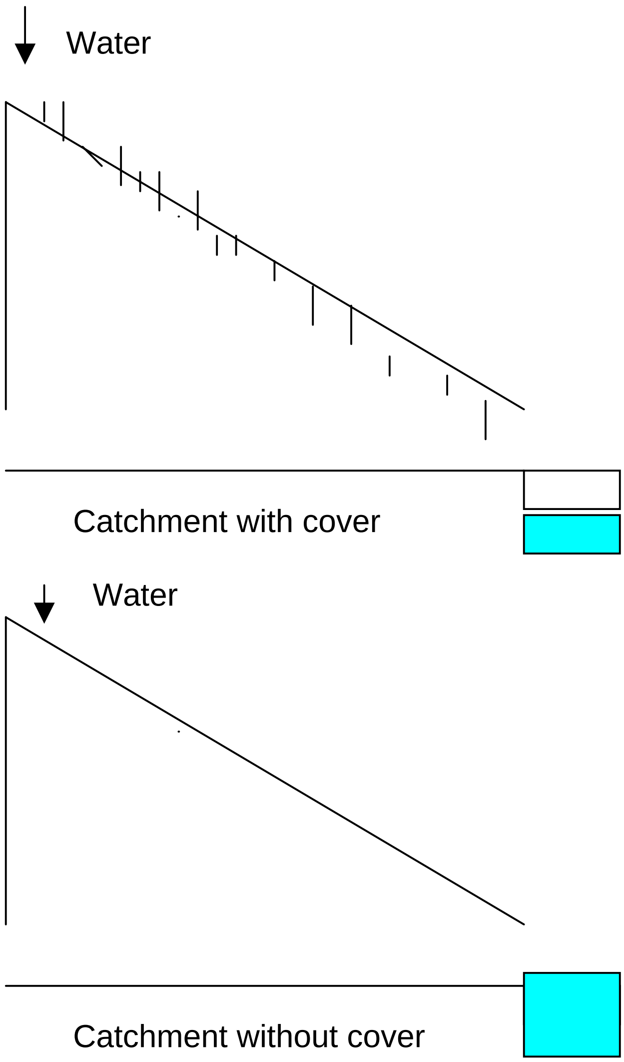
To explain the physical process of catchment degradation and its consequences and examine risk reduction strategies.

Resources required

Water supply, soil with sufficient clay content to mould, grass stalks, containers, spade plus a propensity to enjoy playing with mud and water. We found the best locations for these demonstrations were on the banks of a stream within the catchment in question. This is best carried out at the end of the wet season.

Method

The consequences of uncontrolled grazing on a catchment water supply in a seasonally dry climate can be illustrated by building a physical small-scale model. Two slopes of between 20-30% slope are found in the stream bank or constructed as necessary. A container is embeded a the bottom of the slope. One is left bare while the other is “planted” with 5cm grass stalks. Water is then slowly poured down both slopes from the top. As shown below.



With luck you collect less water in the catchment with cover than the catchment without, as with all demonstrations I advise you to try it on your own first. The consequences of loss of perennial streams and flash floods can then be examined.

Benefits

Involvement, demonstration, simulation. We found this much more effective than abstract debate on the possible consequences of overstocking and overgrazing. It was particularly effective in developing ideas surrounding the consequences for down-stream activities such as small-scale irrigation.

In several cases community decisions to prohibit gazing on certain sensitive catchments were reinforced by using these models. In others alternative livestock watering drinking points were constructed away from key catchments. It was fun too.

PARTICIPATORY RESEARCH AT THE LANDSCAPE LEVEL: KUMBHAN WATER TROUGH CASE STUDY

Czech Conroy (NRI) and D.V.Rangnekar (BAIF)
31 July 1999

1. Background

Since October 1997 the Natural Resources Institute (NRI) and BAIF Development Research Foundation have been collaborating on a research project entitled "Easing Seasonal Fodder Scarcity for Small Ruminants in Semi-Arid India, through a Process of Participatory Research". During 1998 on-farm trials took place in four villages to examine the effect of feed supplementation during the dry season.

In one of the trial villages (Kumbhan in Bhavnagar District, Gujarat) the livestock-keepers said that seasonal water scarcity is a more serious problem for them than seasonal feed scarcity: mean annual rainfall in Bhavnagar is about 500 mm and is concentrated in the period of July-September. They said that they have to walk long distances during the hot dry season (March-June inclusive), because of a lack of water near their main (communal) grazing area, which obliges them to go elsewhere for drinking water, thereby limiting the amount of time they can spend in the grazing area. The livestock-keepers proposed the construction of a water trough and storage tank near to a privately owned well, in the vicinity of the grazing area, whose owner was agreeable to supplying water to the trough. He was already supplying some water to a channel in his field, but its capacity was small.

Although the research project is focusing on feed scarcity, rather than water scarcity, the researchers decided to support financially the construction of the trough, since water scarcity and feed scarcity appeared to be closely inter-related. First, inadequate water intakes would be expected to have a negative impact on feed intake per se, and hence direct and indirect effects on animal productivity. Second, the longer distances covered by the livestock in search of water would increase their feed requirements; and, third, reducing the time spent walking would increase the amount of time available for grazing.

Once the decision had been made (in November 1998) to proceed with the trough, some more detailed baseline data were collected (in late 1998 and the first quarter of 1999), regarding animal numbers, types, daily activity patterns. The trough was constructed in April 1999, and came into use on 9 May. The researchers involved represent a range of disciplines and experiences. Three NRI staff have contributed – a socioeconomist (project coordinator for NRI), and two livestock nutritionists. Two of the senior BAIF staff (including Dr Rangnekar, project coordinator for BAIF) are veterinarians by training, whereas the field staff's qualifications are broader (agriculture, rural science). All the BAIF staff have general experience of livestock and rural development, but the field staff's experience of research was limited.

2. Stakeholder Involvement in Problem Identification

Gujarat is a vegetarian state in which meat production and consumption are socially unacceptable in rural areas. Thus, milk and manure are the main livestock products. There are two groups of goat-keepers in the village: the *Rabaris*, a caste specialising in livestock production (mainly cattle and goats); and the Scheduled Castes (SCs), whose main livelihood enterprise is wage labour or share-cropping, and who keep 2-3 goats to produce milk for subsistence, and as liquid assets. Livestock-herding is the full-time occupation of some male Rabaris, and this group has been keenly interested in the work from the outset, since it addresses the priority livestock production problem that they identified, and since they proposed the construction of the trough.

Initially, the *Rabaris* identified the impact on themselves (i.e. walking considerable distances in the intense heat, with lack of drinking water at times, leading to exhaustion at the end of the day) as being as important as the effect on their animals. SCs do not experience this problem, as they either pay Rabaris to herd their goats or have different feeding systems. Those SCs who pay the Rabaris said that they expected their goats to benefit directly from the water trough. In a problem tree analysis (see later), the *Rabaris* identified reduced milk production and disease as two specific effects of water scarcity in the dry season, and they expected a general improvement in the performance of their animals due to the saving of energy from the reduction in herding distances.

2.1 Methods The water scarcity issue was raised during a semi-structured group interview with Rabari men in late 1997, as part of the initial survey work on livelihood system characterisation and needs assessment. They were asked to identify and rank their main livestock production constraints, which were: 1. water scarcity (dry season); 2. feed scarcity (dry season); and 3. disease. In addition, BAIF has an office in Kumbhan, and is involved in other development activities there, so there is frequent informal contact between its local staff and the villagers. Livestock production constraints - and the relationships between causes, core problem and effects - were further elucidated through a participatory problem tree analysis undertaken by *Rabari* men in November 1998 (see attached note on Participatory Problem Tree Analysis).

3. Project Appraisal

Before a decision was taken on whether to proceed with construction of the water trough, the local BAIF staff collected data that would enable an informed appraisal to be made. Given that the ‘project’ was small (capital cost about $300), the appraisal was a simple ‘quick and dirty’ one. The data included:

- current daily herding routes and distances, and livestock-keepers’ estimates of the effect of the trough on these; and
- the number of herders and livestock (by type) expected to use the trough.

3.1 Financial cost/benefit analysis A detailed estimate was made by a BAIF consultant of the cost of the trough. This was used by the NRI socio-economist to make a back-of-the-envelope cost/benefit analysis, in which the benefit was expressed in terms of time saved by herders: this suggested that the trough would pay for itself in little more than one dry season.

3.2 Discussions with different stakeholders **The trough would be situated between Kumbhan and another village, called Anida, so discussions were held with the Anida villagers to ascertain how the trough would affect them, if at all – for example, whether they had any concern that it might enable the Kumbhan livestock-keepers to extend their grazing into areas until then used only by Anida people. Discussions were also held with the farmer who owned the well that would supply the water.**

3.3 Environmental impact assessment Three potential negative effects of the trough were identified by the researchers, namely on:

- the condition of the land area immediately around it
- the water table and
- the condition of the grazing resource nearby.

Discussions were held with the livestock-keepers and the well-owner about these issues. It was concluded that none of these was likely to occur, and that appears to have been borne out.

4. Stakeholder Involvement in Implementation of Intervention

The researchers wanted to see evidence of the livestock-keepers' commitment, from the outset, and wanted them to be responsible for the trough in the future. Thus, the following agreement was negotiated with them, and subsequently implemented:

- the project would cover the material and skilled labour costs of constructing the trough;
- the livestock keepers would provide the construction labour voluntarily;
- they would also form a management group that would take full responsibility for the future maintenance of the trough.

5. Monitoring and Evaluation

The monitoring system has a number of elements. From late March to late June there was monitoring every two weeks of:

- routes and distances covered by herders and their animals;
- the daily activities of the animals (detailed breakdown of time spent on each);
- milk offtake (as an indicator of milk production) of 12 goats and 12 cows; and
- monthly group meetings between researchers and livestock-keepers.

This was a classic case of researchers' data requirements being different from those of farmers, and the design of the monitoring system was researcher-dominated. The Rabaris themselves did not consider it necessary to collect such detailed quantitative data, as they were able to observe the benefits of the trough through normal everyday observations. Finding literate monitors was difficult, even though the project was going to pay them, and schoolboys from other castes were hired and trained to undertake the task. Payment of the monitors caused some resentment among the Rabaris.

5.1 Collective learning

The monthly group meetings were intended to provide a forum within which the researchers and Rabaris could share their observations of the effect of the trough and can discuss any management issues. They played this role to some extent, but more time appears to have been spent discussing other livestock production issues. This is partly because of the Rabaris' lack of interest in the monitoring data, and partly because the research team were not able to analyse and interpret the monitoring data properly until the monitoring period was over: as a result of the latter, certain trends that could have been usefully discussed in this forum were not. In particular, we were not aware of the fact that milk production of some goats increased after the trough came into use, while that of others was unaffected. These contradictory trends have only just been identified, we do not as yet have any explanation for them, and we are planning to discuss them with the Rabaris in the near future.

In late July three brief and preliminary evaluation meetings were held - with Rabari women, Rabari men and SC men separately - at which they were asked for their views and observations on the impact of the trough, and on matters relating to its use and management.
These confirmed that the expected benefits to both animals and herders had been realised. More specific issues, such as the above-mentioned one, will be the subject of more in-depth discussions.

TABLE Summary of Pros and Cons of the Water Trough as a Case of Participatory

NRM Research

	Pros	**Cons**
NR problems researched (water & feed scarcity) were identified by Rabaris as their priority livestock production concerns	✓	
Project 'treatment' (trough) proposed by Rabaris	✓	
Livestock-keepers contribute through free construction labour and responsibility for maintenance	✓	
Research aspect of water/feed scarcity relationship only important to researchers		✓
Design of monitoring system researcher-dominated		✓
Monthly joint researcher/livestock-keeper meetings facilitate collective learning	?	
Joint evaluation of water trough impact	✓	

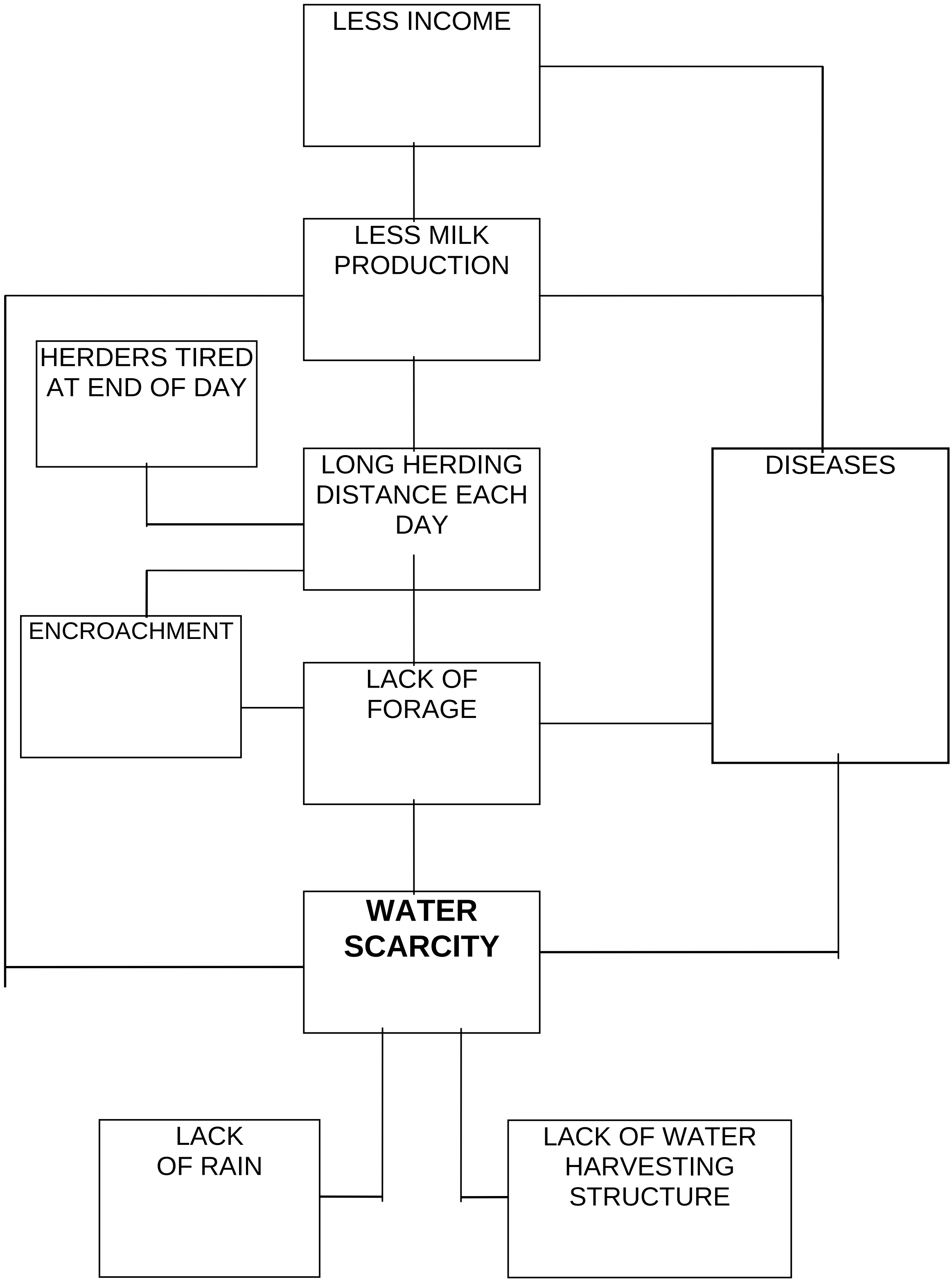
METHOD – PARTICIPATORY PROBLEM TREE ANALYSIS

Problem trees are a very useful diagrammatic tool for analysing problems and gaining a more in-depth understanding of their nature. They also reveal how farmers or livestock-keepers perceive problems and relationships, which may be different from how outsiders see them. They involve identifying a core problem, the factors causing it, and the effects that it has. The core problem is represented as the trunk of the tree, the causes as its roots and the effects as its branches. When explaining the technique to livestock-keepers it is helpful to emphasize the analogy, preferably by pointing to a tree or a picture of one.

One of the advantages of a problem tree is that is shows the **relationships** between different factors, or how livestock-keepers perceive those relationships. This is important for assessing the implications of interventions, since the fact that constraints are often inter-related means that easing one or more can lead to the alleviation or exacerbation of others. The problem tree constructed by the Rabaris of Kumbhan is reproduced as Figure 1. *It incorporates both bio-physical factors (such as, low rainfall and disease) and socioeconomic ones (encroachment[1], fatigue), and shows how they are inter-related.*

[1] Encroachment is the illegal privatisation of common lands - in this case grazing land.

FIGURE 1 PROBLEM TREE CONSTRUCTED BY RABARIS IN KUMBHAN, GUJARAT, SHOWING WATER SCARCITY AS THE CORE PROBLEM



PARTICIPATORY RESEARCH AT LANDSCAPE LEVEL : FLOOD-PRONE ECOSYSTEMS IN BANGLADESH AND VIETNAM

Prepared by Madan M Dey and Mark Prein of ICLARM for NRM Scientist's Meeting, 1-3 September, NRI, U.K.

CASE STUDY

Background:

Over 10 million hectares, or 10% of the total riceland in Asia suffer from uncontrollable seasonal flooding. In the rainy season, farmers grow deepwater rice and capture fish in the floodprone areas. During the dry season, land ownership is fixed according to tenure arrangements. At the time of floods during the rainy (wet) season where land is not bounded, fish are a community property granting members access to fish in all the communities' areas. Since 1997 the International Center for Living Aquatic Resources Management (ICLARM) and the International Rice Research Institute (IRRI) are undertaking an interdisciplinary and participatory action research project aimed in increasing and sustaining the productivity of rice and fish in the seasonally flooded ecosystem in Bangladesh and Vietnam as a demonstration for the entire region. The project aims to combine 'indigenous' resource management techniques with semi-intensive culture and management technologies for increased income of normal households. The project is being implemented in collaboration with various governmental and non governmental organizations.

Identification of Landscape/Stakeholders:

After collecting relevant information on potential sites through review of secondary sources and reconnaissance field visits by multidisciplinary teams, we conducted several rounds of group discussions with the users in each potential site. In selecting project sites, we considered both the agro-ecological condition of the landscape and the socio-economic-institutional aspects of the users of the landscape. The unit of analysis of our project, thus, is the resource management domain (RMD) at the landscape level. As suggested by Dumanski and Craswell (1998), Resource Management Domain (RMD) is the spatial unit encompassing the environmental and socioeconomic characteristics of a recognizable unit of land, including the natural variability which is inherently characteristic of the area. In selecting project sites, we seek the answers to the following questions through group discussions:

Does the RMD have the problem?
Is the problem a high priority?
Does the project 's approach offer the best solution to the problem?
Does the landscape have the physical condition necessary to sustain the project?
What can the project realistically provide to communities?
Do the communities have (or can they build) an organization that can carry out the project?

The users/stockholders include landowners as well as other people of the community who rely on the landscape for fishing during the rainy season. In identifying users, we talked to representatives from various classes of the society (i.e. poor farmers, rich farmers, landless laborers of the nearby communities, and members of local organizations).

Assessment of Users' Needs:

The steps followed in assessing users' needs are: (a) diagnostic survey conducted by scientists and representatives from local level organizations (i.e. NGOs in Bangladesh, local agriculture extension offices in Vietnam), (b) baseline surveys of socio-economic, institutional, and bio-physical conditions, and (c) group discussions with users. Preliminary results of diagnostic and baseline surveys were presented and discussed during the group meetings. One main objective of the baseline survey is to analyze the impact of the project over time.

Participatory Design and Testing of Technical Options:

Technical options were designed by researchers in consultation with users based on users' need and indigenous knowledge. As the concept of managed fish culture in deepwater rice fields is new, small scale experiments were first initiated in Vietnam to show the potential of the technical options. These initial trials were subsequently used to generate discussions between researchers and users about various aspects of trials which were subsequently utilized in fine tuning the technical options.

Site specific technical options are being tested by users with minimum support from researchers. Users are providing labor, managing experiments and collecting simple experimental data (e.g. input use level). Researchers are basically acting as resource persons. The project has provided financing support, as seed money, during the first two years to cover material costs. Users have deposited a certain portion of the proceeds from the experiments (e.g. fish sale) to cover the future project expenditures.

Participatory Design and Testing of Institutional Options:

Users have designed institutional options (e.g. group formation, sharing arrangement) for testing technical options; researchers and NGO workers are acting as facilitators. Users include participating farmers, non-participatory farmers, and practicing non-farmers who used to rely on the landscape for fishing. Groups have been formed with more or less homogenous users. Group numbers per site vary from 1 to 4 depending of the size of landscape and number of beneficiaries. A Project Implementation Committee (PIC) has been formed in each site with representatives from different users' categories, local organizations (e.g. NGO in Bangladesh), and the research team. The functions of the PIC are : (1) preparation of a budget, (2) finalization of sharing agreement, (3) overseeing the implementation of the project, (4) settlement of conflicts, (5) supervision of fish sales, (6) distribution of proceeds from experiments, and (7) management of project account.

Monitoring and Evaluation:

Various bio-physical (e.g. water quality, soil quality), socioeconomic (e.g. profitability, input use level, fish consumption) and institutional (e.g. group performance, sharing arrangement) aspects are being monitored. This information will be used in analyzing the impact of both the technology and the process. As users are not very interested in collecting all the detailed information, the monitoring is done mostly by researchers and NGO representatives.

Reference : Dumanski, J. and E. Craswell. 1999. Resource management domains for evaluation and management of agro-ecological system, p. 1-13. In J.K. Syers and J. Bouma (eds.) International Workshop on Resource Management Domains. Proceedings of the Conference on Resource Management Domains (Kuala Lumpur, Malaysia, 26-29 August 1996). Bangkok, Thailand. IBSRAM Proceedings No. 16.

PROS AND CONS OF THE APPROACH BEING USED IN PARTICIPATORY MANAGEMENT OF THE FLOOD PRONE ECOSYSTEM IN BANGLADESH AND VIETNAM

PROCESS ITEM	PRO	CON
Size of experiment	Appropriate Scale; represent real world situation; could be used for scaling up	
Design of experiments/ technical options		Not very participatory in areas where users have limited knowledge on the subject
Testing of technical options	Collegial participation of users	
Design and testing of institutional options	**Collegial participation of users**	
Feedback mechanism	Group meeting every fortnight/month	
Monitoring and evaluation		Researcher dominated
Sustainability/community	Less dependent on project funds; arrangement for group saving	
Conflict management	Through formation of homogenous groups and Project Implementation Committee	
Dependence on existing institution		Does not work properly in areas where group action is not viewed positively (e.g. South Vietnam)

Method for Integrating Bio-physical and Socio-Economic Concerns

Problem analysis using landscape level resource management domain (DMD) as a unit has provided a better understanding of the integration of the bio-physical and socio-economic factors.

The steps followed in participatory problem analysis are as follows:

(1) Collection and analysis of secondary data

(2) Conduct of diagnostic field survey

(3) Conduct of baseline socio-economic, bio-physical and institutional surveys

(4) Analysis of data by researchers

(5) Presentation of data by researchers

(6) Group discussion (users, researchers and NGO representatives)

(7) Identification of problems and potential solutions

The Farmer-Driven Landcare Movement:
An institutional innovation with implications for extension and research

Dennis Garrity
Principal Agronomist and Regional Coordinator
International Centre for Research in Agroforestry
Southeast Asian Regional Research Programme
Bogor, Indonesia

There is a sound basis for assuming that watershed degradation does not have to be an inevitable consequence of using sloping land for agriculture. Small holders can engage in farming and management of natural forest resources in both a productive and resource-conserving manner. Awareness of this has focused attention on evolving demand-driven, community-based approaches to watershed resource management, in which those who occupy the land actively participate in management and sustainable utilization of their local watershed resources for multiple purposes. A look at current prescriptions for more sustainable farming systems in Asian watersheds reveals an enormous variability in conditions, and consequently a high degree of technical uncertainty about the effectiveness of the solutions proposed. The problems are not solved by simple recipes. Often, the issues need to be tackled at a scale bigger than the individual household, cooperatively at the community level.

In Asia, much attention has been given to the role of local organizations in forest management and management of other common natural resources. This is exemplified by the progress in Joint Forest Management in India, Forest Users' Groups in Nepal, and Community-Based Forest Management in the Philippines (Poffenberger and McGean, 1996). But local organizations may also be a means to mobilize knowledge to solve problems in agriculture through improved land husbandry. Particularly in countries where decentralization of power and fiscal responsibility is occurring, and democracy is becoming institutionalized down to the village level, leadership skills in the farming population are maturing. These skills provide a basis for the evolution of organizations led by farmers that address practical ways of overcoming their problems in creating a more sustainable agriculture.

Among the organizational models for enhancing local initiative in attacking land degradation, one of particular interest is called 'Landcare'. Through this approach local communities organize to tackle their agricultural problems in partnership with public sector institutions. The distinguishing characteristics of Landcare groups are that they voluntary, self-governing, and focus on problem-solving resources within the community. Experience in the Philippines (200 groups) and Australia (4500 groups) suggests that such an approach may provide a means to more effectively share and generate technical information, spread the adoption of new practices, enhance research, and foster farm and watershed planning processes. These groups exhibit some similar characteristics to the farmer field schools made popular in integrated pest management. Landcare groups, however, are more formalized and aim at a broader range of land degradation and sustainability issues. Some distinguishing features of Landcare groups are:

They develop their own agenda and tackle the range of sustainability issues considered important to the group.
They tend to be based on neighborhoods or small sub-watersheds.
The impetus for formation comes from the community, although explicit support from outside may be obtained.
The momentum and ownership of the group's program is with the community.

Farmer-driven approaches show promise of being more effective and less expensive than current transfer of technology approaches. In the southern Philippines, farmer organizations became the basis for a successful grassroots approach to finding new land care solutions, partnering with local government, pulling in outside technical and financial resources, and diffusing new information throughout the community (Garrity, 1999).

The Landcare movement in the Philippines began in Claveria, Mindanao, in 1996. There are now about 200 village-based Landcare groups in Claveria and in other municipalies in northern, central, southern and eastern Mindanao, with a membership of several thousand households. They have established more than 1500 conservation farms, and more than 200 community and household nurseries that produced hundreds of thousands of fruit and timber trees seedlings, all done entirely with local resources. The movement has attracted the attention of the national government. The national watershed management strategy has now been based on Landcare as a foundation upon which to build an effective community-based approach to sustainable agriculture and natural resources management (Figure 1). This has provided the opportunity to scale-up Landcare principles and experiences to other parts of the Philippines. The experience suggests that there is potential for enhancing this grassroots approach elsewhere in Southeast Asia.

There are signs that institutions like this could help transform extension systems. Extension agents move from role of teacher of individual farmers one-on-one, to that of being a facilitator to whole farmer groups (Campbell, 1994). Conservation farming based on contour buffer strips was one practice that was popularized through Landcare in the Philippines. Another has been nurseries for growing new species of fruit and timber trees to diversify the farm enterprise. But since the agenda of the groups are determined by their own members, we observe a wide range of issues taken up by difference groups, including dairy and beef farming, cut flower production, and problems in vegetable crop farming, among others. Landcare groups have also gained significant influence at the local political level. Local governments are actively and enthusiastically assisting the movement with budgetary allocations and solid political support. At the community level, Landcare has proven to be a powerful force for evolving initiatives that protect the whole watershed. The collaborative structure of Landcare is fostered through mutually supportive relationships among the farmers' organizations, local government, and technical support agencies in research and extension. The approach of farmer field schools for conservation farming is currently being experimented with as a method through which community groups may be initiated.

We are only beginning to exploit the opportunities that Landcare provides for enabling major innovations in the way on-farm participatory research is done. We see the prospect for research to be carried out through, and managed by, Landcare groups. This would multiply the amount of work, and the diversity of trials, that can be accomplished, ensuring more a robust understanding of the performance and recommendation domain of technical innovations. Currently we are conducting surveys through the Landcare groups to get a grassroots feedback on the priorities for research, from the farmers' perspective. In Australia, public sector research institutions such as CSIRO are adjusting to the new reality that through Landcare, farmers sit on, and may even dominate, the boards that decide on research project funding. This is having a galvanizing effect on focusing researchers on problems that farmers are concerned about.

We may summarize by listing four hypothesized functions of farmer-led knowledge-sharing landcare organizations:

Enhanced efficiency of extension or diffusion of improved practices (more cost-effective “conventional” extension functions)
Community-scale searching process for new solutions or adaptations, suited to the diverse and complex environments of smallholder farming (a unique aspect of landcare)
Enhanced research through engagement by large numbers of smallholders in formal and informal tests of new practices
Mobilization process at the community level to understand and address landscape-level environmental problems related to water quality, forest and biodiversity protection, soil conservation, and others

There are three significant concerns about the sustainability of the Landcare movement. One is that the Landcare concept is sufficiently popular that there is a definite risk of 'projectizing' the movement, ie attracting support projects that do not understand the concept, and provide funds in a top-down, target-driven mode that defeats the whole basis of a farmer-led movement. The second is the issue of how do such movements sustain themselves in the long run. Networking, and the stimulation from outside contacts, is widely considered to be crucial in the longterm success of such institutions. This can be provided through Landcare Federations, as has evolved locally in Claveria, and through provincial and national federations, which is currently being explored in the Philippines. Third, group leadership is a time-consuming and exhausting task, particularly when its done on a voluntary basis. Landcare is still very young in both the Philippines and Australia, but increasingly leadership 'burn-out' is discussed as a concern.

Our analysis indicates that the following needs to be done to further release the power of the Landcare concept. The public sector and non-government sector can assist in facilitating group formation and networking among groups, enabling them to grow, developing their managerial capabilities, and enhancing their ability to capture new information from the outside world. They can also provide leadership training to farmer leaders, helping ensure the sustainability of the organizations. Cost-sharing external assistance can also be provided. For this, the use of trust funds should be emphasized, where farmer groups can compete for small grants to implement their own local landcare projects. This has been remarkably successful in the Australian Landcare movement.

References Cited

Campbell, A. 1994. Landcare: Communities Shaping the Land and the Future. Allen and Unvin, St Leonards, New South Wales, Australia. 344 p.

Poffenberger, M and McGean, B (eds). 1996. Village Voices, Forest Choices: Joint Forest Management in India. Oxford University Press: Oxford, UK. 356 p.

Garrity, D P. 1999. Participatory approaches to catchment management: Some experiences to build upon. Proceedings of the Managing Soil Erosion Consortium Assembly. International Board for Soil Research and Management, Bangkok, Thailand. (in press).

Summary: Eastern Himalayan Initiative on Gender, Ethnicity and agro-biodiversity Management.

Barun Gurung

This project is situated in the eastern Himalayas, and covers four sites: east Nepal, Sikkim, Bhutan, and Nagaland in N. E India. While the general purpose of the project is focused on building the capabilities of indigenous mountain populations to better represent themselves in the development dialogue, the process for achieving these objectives have been conceptualized in three particular ways:

1) to develop, through research, a better understanding of the linkages that exist between the way that gender and ethnicity are constructed and then to examine how such constructions effect the management of mountain agro-biodiversity.
2) A second objective is to build upon the existing experience of a network of researchers, who themselves are members of ethnic mountain communities, and further facilitate their capabilities through skill development in research and analysis and community development concepts and practice
3) A third and final objective is to advocate for the inclusion of indigenous knowledge on agro-biodiversity management (particularly of women) in the policy planning of national governments. Towards this, an advisory group consisting of scientists and planners from the region has been assembled to advise on effective strategies through which these can be achieved.

Background: Why Mountains, Ethnic Groups and Women's Knowledge?

Mountain regions are characterised by their extreme altitudinal variation which, when combined with changes in temperature and precipitation and difference in soil conditions that are further augmented by various aspects and exposures, create a striking vertical zonation in the natural vegetation. The Himalayan range in particular, acting as a barrier to the movement of species between the north and south provides a migratory route from east to west, where vegetation varies according to the monsoonal climate. As a result, the botanical wealth of the Himalayas in India and Nepal includes 8000 flowering plants belonging to 180 families and the total number of species of plants in the Hindu Kush Himalayan region is estimated at 25,000, equating 10% of the world's flora. More specifically, the eastern Himalayan region is an area rich in forest resources, which by some estimates contain over 9000 species (Myers, 1988). Besides endemic species, this region is also known to hold relic species from Gondwana flora.

The diversity in natural ecological systems of mountains has contributed extensively to the maintenance of biological diversity in farming systems of the eastern Himalayan region. Typically, a large number of crop and animal species, varieties and breeds are found on farms. Subsistence farmers of the region besides producing many crops (mainly landraces), rely extensively for their subsistence on wild plants to meet their needs for fiber, shelter food, medicines, tools and household implements.

For the various ethnic groups residing in the eastern Himalayan region, survival in general necessitates the extensive use and management of natural resources. More particularly, it necessitates the incorporation of natural resources into farming systems. Biomass production on private lands is achieved through agroforestry while subsistence requirements for fodder, fuel, food and medicinal plants are supplemented by natural resources from forests. Consequently, by incorporating biological resources at the genetic, species and agroecosystem levels, mountain communities possess extensive knowledge of their environment.

The Context of Knowledge Production

Empirical knowledge that underpins various subsistence strategies is embedded in processes of social, cultural and historical processes which determine the production of knowledge in several ways. In the first instance, production strategies, while following the logic of environmental principles, become embedded in symbolic reproductions of culture. These symbolic representations act as the cultural idiom upon which notions of ethnicity and gender are constructed and thus, such processes cannot be separated from the political implications of power relations, both within and without the group. Because, implicit in the process is the appropriation of cultural symbols by certain groups or individuals to legitimate social symmetries based on kinship, gender, and ethnicity.

Thus in the broadest sense, knowledge systems become more than the mere sum of empirical experiences. Instead they become local discourses which are produced through value-bound interactions of different actors and networks, involving both processes of interpretation and negotiation. Implicit to these processes are aspects of control, authority and power that determine and legitimate social asymmetries within a given group. Moreover, knowledge as local discourse can also be viewed as a powerful medium of resistance by a group to counter its cultural and political subalternity to larger hegemonies.

Problems of Mountains, Ethnic Groups and Women: A Summary

1. In the last 200 hundred years, several events have emerged in the Himalayan region to determine and define the farming practices of ethnic mountain communities. With transformations in farming practices and subsequent changes in knowledge systems, there has been a general tendency among mountain communities to devalue their traditions. This manifests most profoundly in changes in values and beliefs, socio-cultural institutions and crop preferences and cropping patterns. Underlying the transformations is the general inability of mountain communities to organize themselves to adequately manage their own resources and orient development to their advantage
2. Another significant aspect of definition and change is the transformation in traditional gender relations. These manifest in the ways that gender

constructions are influenced by low-land ideologies as well as the increasing burden assumed by women in mountain subsistence systems, as the men migrate to urban centers in search of employment. Moreover, while women's responsibilities are increasing, their status is becoming compromised, both in the traditional household unit and in the policies of governments and development programmes

3. Finally, there is a general discrepancy in the interface between existing perspectives on mountain development and the indigenous knowledge systems of mountain groups, especially women. As a consequence, knowledge systems are often conceptualised through representations that are formulated in the idiom of the dominant development discourse that ignore local contexts in which knowledge is produced.

Strategies for Capacity Building: A Summary

1 Research

Research will address the following questions;

- identification and documentation of the extent of women's knowledge related to plant genetic resources
- examine transformations in women's knowledge in terms of how changes in the last 200 hundred years have transformed production strategies, while introducing new crops and technologies. How have such changes been consistent with changes in ideology and how they have compromised the role of mountain women
- identification of strategies adopted by women to counteract their increasing marginality, especially in the context of their roles as managers of agro-biodiversity on the one hand and the "gender blindness" inherent in extension and development policies of national governments.

2 Skill Development for Network Members

- training/learning workshops for building conceptual clarity and analytical skills in research
- training on gender analysis
- workshops to develop writing skills
- training for facilitation and community development skills. This includes PRA skills for a specially developed program for rural planning called Village Initiated Planning. This process includes involvement of the community in identification of problem, research and analysis including prioritization of problem, project planning (proposed action, objective, developing monitoring and evaluation criteria, financial management), designing implementation procedure (methods and approaches; group formations, types of training required, guiding principles; focus on what issues), Implementation, M& E.

3 Advocacy

- through the development of strategies proposed by the advisory group comprised of scientists, planners and development professionals in the region. These strategies will focus on bringing an awareness of gender issues and farmer's rights to the nations' policy makers and high level officials through links to national level biodiversity planning bodies and other means.

- the development of a participatory video documenting the process of a Participatory Crop Improvement (PCI) initiative that builds on farmer-led approaches in Eastern Nepal

PRGA Program
Natural Resource Management Scientists' meeting
1 – 3 September, 1999, University of Greenwich, UK.

K.L. Heong
International Rice Research Institute
MCPO Box 3127, Makati City 1271, PHILIPPINES

Farmer participatory experiments

Farmers' decisions to spray insecticides are based on their perceptions of losses caused by pests. They tend to overestimate the seriousness of highly visible pests or damage symptoms. When making these decisions farmers often rely on heuristics, or rules of thumb to simplify information processing and decision-making (Kahneman & Tversky 1973). Heuristics are developed through experience and guesswork about possible outcomes and may have inherent faults and biases (Slovic et al 1977). Although research has shown that leaf folder damage, especially in the early crop stages, do not result in any yield loss, many farmers spray insecticides to control these insects. Farmers' reactions to visible damages or pests may well be due to faults in their beliefs and heuristics they use (Bentley, 1989). One approach is to analyze farmers' heuristics related to the problem, develop a corrective heuristic, frame it as a hypothesis and motivate farmers to participate in an experiment to test it.

The participatory experiments were initiated in collaboration with the local Department of Agriculture technicians and village heads. In each village, 10-25 farmers were invited and the scientist, acting as the facilitator, conducted a half-day group meeting. The meetings began with general discussions about rice growing and related problems. Later discussions then focussed on leaf folders, their damages and losses, methods of control, their costs and effectiveness. Eventually the discussions led to whether control was at all needed and benefits for not spraying. Volunteer participants were then invited to test the heuristic: "Spraying insecticides in the first 30[2] days after transplanting is not needed". The volunteer farmer marked out an area of about 100 m^2 in his or her field that did not receive any insecticides in the first 40 days of the crop. The rest of his or her field received normal treatments. At the end of the season, a workshop was organized where farmer volunteers reported their results. A certificate of participation was presented to each participant. Farmers from the village and neighboring villages were invited to the workshop. Pre and post surveys to measure variables, such as beliefs, intentions, spray frequencies, timing and targets, yields, inputs and other practices, were administered to monitor changes.

Yields of farmers' experimental and main plots were statistically not significantly different ($t=1.01$ $p>0.05$). About 77% of the farmers had either the same or higher yields in their experimental plots. Mean farmers' insecticide sprays per season reduced from 3.1 to 2.1 and proportion of farmers applying insecticides in the first 30 days decreased from 68% to 20%. Details are shown in Table 1.

[2] The participating farmers determined the number of days.

Table 1: Changes in selected variables before and after participating in the experiment.

	Before		After
	1992	1993	1994
Mean number of insecticide sprays/season	3.2	2.1	2.0
Number of sprays of most farmers (mode)	3	2	1
% farmers spraying in first 30 days after transplanting	68.4 %	19.8%	11.3%
% farmers who did not spray at all	0	9.9%	7.2%
Beliefs	% farmers believing		
Leaf feeding insects cause severe damages		77.2	27.7
Leaf feeding insects cause yield loss		75.2	8.9
Leaf feeding insects must be sprayed early in the season		62.4	9.9

References

Bentley, J.W. 1989. What farmers don't know can't help them: The strengths and weaknesses of indigenous technical knowledge in Honduras. *Agric. Human Values,* **6**, 25-31.

Kahneman, D. and Tversky, A. 1973. On the psychology of prediction. *Psychol. Rev*., **80**, 237-251.

Slovic, P., Fishhoff, B. and Lichtenstein, S. 1977. Behavioural decision theory. *Annu. Rev. Psychol*., **28**, 1-39.

Table 2: Pros and cons of participatory experiments

PROS	CONS
Inexpensive and easy to conduct	An be expensive if such a process is to be conducted over a large population. Farmers participating in experiments may be at risk of loss.
Facilitates farmers’ learning by actively “testing” a new idea.	New “idea” introduced externally and may not be appropriate. May be viewed as top down.
Provides a mechanism for scientists to learn about farmers’ decision constraints, determine research needs, use research information and “distill” them into testable hypotheses for farmers.	Farmers may feel intimidated by presence of scientists.
May be used as a means to explore changes in farmers’ beliefs, behavior and practices.	Participatory experiments may be viewed as scientifically “weak” by peers as some of agronomic controls may not be easily implemented.

Method which has facilitated researcher and farmer to better understand the integration of bio-physical and socio-economic concerns involved.

Participation in a computing exercise

In the case of the stem borers, farmers' perceived benefits from spraying was highly exaggerated with an estimated benefit-cost (B/C) ratio of 13:1, while the B/C ratio under farmers' worst attack, was about 4:1 (Heong and Escalada 1999). An analysis of farmers' heuristics regarding stem borer control showed that there was a tendency to overestimate loss from the highly visible damage symptom, "white head". Farmers' estimate of the worst attack (mode 10 white heads/m2) was also high and occurs quite rarely. Research has shown that crops with < 5% white heads usually do not yield less than crops with no white heads, and it is rare to have > 5% white heads. Normal stem borer infestations in farmers' fields are usually less than 2% white heads. One approach to reduce farmers' perceived benefits and improve their decision-making regarding stem borer management is to motivate them to participate in a computing exercise.

Ten to fifteen farmers are invited to attend a meeting to discuss stem borers. At the meeting the scientist, acting as a facilitator, would determine from the participants the number of white heads in a square meter they feel would be extremely serious (Y) when no control measures are implemented and how much loss in yield will be incurred. In addition, the scientist would obtain from the farmers (or assist farmers in deriving the answers, if farmers are unable to provide) the following:

1. Number of rice grains per panicle (n);
2. Grain weight (in grams) of 1000 grains (w);
3. Cost of control (Cn);
4. Farm gate price of paddy (p).

The facilitator uses a step by step method on a flip chart or white board to compute the loss in grain weight for the white heads and value per hectare using these formulae and the facilitation framework:

Total number of grains lost per ha (G)	= Y*n*10,000
Total loss per hectare (kg/ha) (W)	= G*(w/1000) kg
Loss in value (local currency/ha)	= C*p
Cost of control per ha	= Cn

After the calculation, the facilitator will stimulate discussions about benefits from cost of control, pros and cons of control methods and other concerns. Pre and post variables of farmers' responses to this exercise may be monitored.

Reference

Heong, K.L. and Escalada, M.M. 1999. Quantifying rice farmers' pest management decisions: beliefs and subjective norms in stem borer control. *Crop Protection*, **18**, 315-322.

Framework to facilitate computing exercise.

Computing exercise in stem borer management for farmers' participation			
	Worst case	Last year	Case x
Number of WHs with no control per sq m (Y)	10	5	
Number of grains per panicle (n)	70	70	
Total number of grains lost per ha	7000000	3500000	
1000 grain weight in gram (w)	26.3	26.3	
Total loss from WHs in kg per ha	184.1	92.05	
Farm gate price for paddy per kg (pesos)	8	8	
Loss in pesos	1472.8	736.4	
Cost of implementing control (in pesos)	684	684	
Farmers' perceived loss with no control (kg)	592	592	
Perceived loss in pesos	4736	4736	

Participatory Management of Plant Genetic Resources: *In Situ* (On Farm) Conservation

Heather Klemick and Devra Jarvis

IPGRI, Rome

Agrobiodiversity as a Natural Resource

Plant genetic resources (PGR) are a natural resource fundamental to agricultural production. Most conservation efforts to date have focused on *ex situ* options (e.g., in genebanks or botanical gardens). However, this method of conservation does not recognize crop germplasm as the evolutionary product of the continuing interaction between farmers and their environments. As farmers continue planting, harvesting, selecting, and storing seed, PGRs are renewed and developed; it is through non-use that PGRs are lost from their surrounding environments. Acknowledging crop PGRs' dependence on human use highlights the necessity of a participatory approach as inherent in the goal of conservation.

In situ *(on farm) Conservation*

The International Plant Genetic Resources Institute (IPGRI), along with partners in nine countries, formulated the global project "Strengthening the Scientific Basis of *In Situ* Conservation of Agricultural Biodiversity" in 1995. The overall goal of the *in situ* conservation research project is to understand the conditions under which farmers themselves maintain and develop local crop varieties. The countries participating in the project are Burkina Faso, Ethiopia, Hungary, Mexico, Morocco, Nepal, Peru, Turkey, and Vietnam. Projects are implemented by linking existing national PGR programs with other partners such as universities, national institutes, agricultural extension workers, NGOs, community based organizations, and farmers (see case study 1). One expected result of the networking of farmers, NGOs, and agricultural extension workers into national PGR programs is the creation of a channel for their input into national agricultural research agendas.

The global project includes the collection of a data set over space and time to link natural and human factors to crop genetic diversity. Research is segregated into six components:

- Socioeconomic, cultural, and biological influences on farmer decision-making
- Population structure and breeding system
- Environmental selection factors (natural and managed)
- Agromorphological characters, description, and selection criteria
- Seed/ germplasm exchange and storage systems
- Adding value to local crop systems through participatory plant breeding, policy recommendations, and effects on crop genetic diversity

The wide scope of data collection necessitates multi-disciplinary teams, as well as analysis at different scales: household, plot, farmer's named variety, and farmer's seed sample. Thus, scale of data collection is centered around farmers' management units. These units of analysis can be aggregated to the scales of community and market, landscape, populations of the named variety from multiple communities, and seed samples from multiple communities, respectively.

The project recognizes two categories of data in each of the research areas: farmer knowledge and empirical data. Information on farmer knowledge and perceptions of local PGRs is crucial to understanding the characteristics farmers' value in their varieties, and hence to promoting conservation of these PGRs (see case study 2). Understanding farmer knowledge necessitates participatory and innovative methods that are disaggregated by gender, ethnicity, and other socio-economic categories (see case study 3). The final component of the project involves adding value to farmers' PGRs to ensure that maintenance is attractive to users. Adding value may involve participatory plant breeding as well as strengthening market and non-market based incentives (see case study 4).

Case Study 1

Nepal: Creating a National Framework

The institutional complexity and innovative approaches required to implement a national program that conserves PGR at the farm level is illustrated by the experience of Nepal. The Nepal project commenced with a Memorandum of Understanding between the Nepal Agricultural Research Council (NARC) and IPGRI. The Memorandum of Understanding stipulated the formation of a Technical Coordination Committee chaired by the director of NARC and including representatives from the Nepal Ministry of Agriculture, Department of Agriculture, and a local NGO with experience in biodiversity and farmer participation— consequently initiating NARC's first partnership with an NGO. Local Initiatives for Biodiversity, Research and Development (LI-BIRD) was chosen to fulfill this role. The Technical Coordination Committee works to ensure links between the different levels and institutions involved in the project: local, national, and international; government, NGO, and community based organisation/ farmer groups.

Along with its multi-institutional approach, the project required multi-disciplinary teams to cover the areas of crop biology, social science, community participation, gender, and participatory plant breeding. A national multi-disciplinary group was created, consisting of experts in these areas from NARC, LI-BIRD, Ministry of Agriculture, and Department of Agriculture. Local multi-disciplinary groups for each study site were composed of District Agricultural Development Office representatives, local scientists, locally-recruited LI-BIRD staff, and Agricultural Service Center (the District Agricultural Development Office extension service) representatives. Finally, local multi-disciplinary groups networked with existing farmer groups and community based organisations and facilitated the formation of such groups in communities where none existed as a means of reaching farm households.

Case Study 2
Morocco: Understanding Farmer Preferences

All national partners involved in the *in situ* project have acknowledged the importance of integrating socio-economic research into data collection at all stages, beginning with site selection. The socio-economic dimension of Morocco's *in situ* project fulfills teams' key objectives of identifying partner farmers in the target communities, characterizing farmer environments, and understanding farmer knowledge and perceptions of local varieties. Household and cropping system data was gathered from farmers to determine correlations with measurable crop biodiversity. In addition, information on farmer knowledge of target crops, management practices, and preferred variety characteristics was gathered—essential in illuminating the priorities driving farmer management of PGRs and hence in determining how PGR conservation can best be fostered. The Morocco project is concerned with obtaining input from women and men farmers on household and field level data, preferred characteristics, and management practices.

Case Study 3
Mexico: Gendered Participation in* In Situ *Conservation

In the Mayan "Milpa" farming system of the Yucatan, Mexico, preliminary investigation has revealed that women's household responsibilities are particularly significant in the conservation of local landraces. First, household yards are women's domains, where they cultivate a diverse array of non-staple crops, including vegetables, fruits, and herbs. Also important is their responsibility for household food needs. Women's particular concern for crops' consumption characteristics, such as taste and cooking quality, affects households' variety selection. Women may thus promote the maintenance of landraces with particular value for ceremonial or everyday dishes.

The Mexico *in situ* project has proposed further investigation into women's roles in PGR management through case studies and group interviews, as well as participatory interventions targeting them. In particular, a compilation book of local women's recipes has been proposed as a method to promote conservation of landraces through building on women's expertise, cultural values, and pride in local cuisine.

Case Study 4
Nepal: Participatory Methods to Add Value to PGRs

The *in situ* project recognizes that farmers maintain local PGRs if they remain competitive with other options. Working to increase the attractiveness of landraces through technical, market-based, and other means is a challenge undertaken by the project that also serves to improve farmers' livelihoods. The Nepal project has developed a variety of innovative, participatory initiatives to increase landraces' value for farmers. Participatory plant breeding (PPB) is one strategy to enhance the PGRs themselves. In addition, the Nepal project has focused on public awareness, market incentives, socio-cultural and non-market incentives, and community mobilization as means to support *in situ* conservation of PGRs. Market-based incentives have been developed through the formation of farmer cooperatives to network with regional agro-product companies. Community awareness and mobilization and the cultural value of biodiversity have been particularly promoted through Diversity Fairs and the Rural Poetry Jouney (*Gramin Kabita Yatra*). The Diversity Fair focused on locating agrobiodiversity in the community, categorizing landraces based on rarity, recognizing farmers who maintain high agrobiodiversity, and conscientizing community members as to the importance of local agrobiodiversity. The Rural Poetry Journey brought local poets into the *in situ* project to create topical poems, which were then shared with communities through readings and publication in local papers. A compilation of local poetry and folk songs about agrobiodiversity is also planned.

Participatory Elements

Participatory methods are integral to the *in situ* project on many levels, as is highlighted in the above case studies. To sum up, participatory aspects include:

- Focus on community-specific crops and contexts
- Networking of national and international institutions with NGOs, CBOs, and farmer groups
- Data collection: farmer knowledge and validation with empirical data
- Recognition of farmer knowledge, development, management, and ownership of PGRs
- Recognition of cultural and non-market values of PGRs
- Adding value: PPB, market and non-market incentives

Lessons Learned

- Innovative approaches for Participatory Natural Resource Management: Developing frameworks to support the recognition, conservation, and improvement of farmer-developed PGRs *in situ*.
- Understanding the appropriate scale for data collection, aggregation, and analysis and for different stakeholders' management decisions
- The importance of taking time to strengthen farmer, informal, and formal linkages
- Integrating on-farm conservation into national plant genetic resource programs as part of their regular annual plans
- Including agricultural extension staff at national and local levels in participatory training and project implementation
- Gender and stakeholder analysis: Disaggregated and participatory data collection
- New directions and evaluation of Participatory Natural Resrouce Management: Crop PGR conservation *in situ*; Understanding changes in farmers' use of local PGRs over time

Participatory Methods: Pros and Cons

	Pros	Cons
Research	Focus on locally important crops	Danger of wasting resources on unnecessary data collection (e.g., anthropological monograph type) due to complexity of research and number of issues to be addressed
	Builds on local knowledge	Challenge of integrating quantitative and qualitative data (empirical data vs. farmer knowledge)
Outputs	Livelihood improvement and empowerment objectives address gender and equity concerns	Vulnerability to continuing cultural, economic, and environmental change
	Farmers take ownership for their own resources	PGRs less accessible to breeders for R&D of new varieties
	Recognizes achievements of farmer-breeders/ “keepers of diversity”	
	Channels farmers’ voices into national agriculture research and extension systems	
	Fosters cooperation between local, national, and international levels, and GO and NGO sectors	
	Sustainability: Farmers perpetuate the process, so it will continue when “intervention” is finished	

References

Jarvis, Devra I. and Toby Hodgkin, eds. *Strengthening the scientific basis of* in situ *conservation of agricultural biodiversity on-farm. Options for data collection and analysis*. Proceedings of a workshop to develop tools and procedures for *in situ* conservation on-farm. 25-29 August 1997, Rome, Italy. Rome: IPGRI, 1998.

Joshi, K.D., D.K. Rijal, R.B. Rana, et al. Adding Benefits 1-Through PPB, Seed Networks and Grassroots Strengthening: Nepal. In *Strengthening the Scientific Basis of* In Situ *Conservation of Agricultural Biodiversity On-Farm: Creating national management frameworks, cross-thematic and cross-country data integration, and enhancing the benefits from local crop diversity to all stakeholders*. Devra Jarvis, Bhuwon Sthapit and Linda Sears, editors. Draft Proceedings of the Third Participants workshop to develop tools and procedures for *in situ* conservation on-farm, 5-12 July 1999, Pokhara, Nepal. Rome: IPGRI, 1999.

Morales Valderrama, Carmen and Teresa Quinones Vega. Women's Participation in Biodiversity Conservation in the Maya "Milpa." In *Strengthening the Scientific Basis of* In Situ *Conservation of Agricultural Biodiversity On-Farm: Creating national management frameworks, cross-thematic and cross-country data integration, and enhancing the benefits from local crop diversity to all stakeholders*. Devra Jarvis, Bhuwon Sthapit and Linda Sears, editors. Draft Proceedings of the Third Participants workshop to develop tools and procedures for *in situ* conservation on-farm, 5-12 July 1999, Pokhara, Nepal. Rome: IPGRI, 1999.

Nassif, Fatima. Socioeconomic Data Collection and Analysis: Morocco. In *Strengthening the Scientific Basis of* In Situ *Conservation of Agricultural Biodiversity On-Farm: Creating national management frameworks, cross-thematic and cross-country data integration, and enhancing the benefits from local crop diversity to all stakeholders*. Devra Jarvis, Bhuwon Sthapit and Linda Sears, editors. Draft Proceedings of the Third Participants workshop to develop tools and procedures for *in situ* conservation on-farm, 5-12 July 1999, Pokhara, Nepal. Rome: IPGRI, 1999.

Upadhyay, M.P. and A. Subedi. Methods Used to Create a Framework for Implementation and Management of *In Situ* Conservation On-Farm: Nepal. In *Strengthening the Scientific Basis of* In Situ *Conservation of Agricultural Biodiversity On-Farm: Creating national management frameworks, cross-thematic and cross-country data integration, and enhancing the benefits from local crop diversity to all stakeholders*. Devra Jarvis, Bhuwon Sthapit and Linda Sears, editors. Draft Proceedings of the Third Participants workshop to develop tools and procedures for *in situ* conservation on-farm, 5-12 July 1999, Pokhara, Nepal. Rome: IPGRI, 1999.

Participatory Action Research on Adaptive Collaborative Management of Community Forests: A Multi-country Model

Cynthia McDougall with Ravi Prabhu and Yanti Kusumanto
Center for International Forestry Research (CIFOR)

Acknowledgements

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

Background

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

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

Approach

The current ACM research is rooted in a participatory action research approach (PAR). In most communities involved, diverse local people and other relevant stakeholders jointly developed a set of agreed and easily understood C&I. The process provided an opportunity for communication and learning within and across the stakeholder groups, especially with regard to visions and goals. The C&I set also provided a framework for later monitoring and assessing key factors and their direction of change. This monitoring process creates the opportunity to feedback information and learning into the community forest management system. It thus serves to guide future action, helping increase the sustainability of the community's forest resources. It was initially the researchers who offered and provided the framework for the social learning process; since that time local users have begun to adapt and apply these processes themselves. The ultimate goal is to completely transfer these, including the necessary facilitation skills as well.

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

A PAR methodology in isolation would present challenges in terms of producing generalizable results (a CIFOR mandate); thus, to enable generalizeability, the PAR is embedded in a larger multi-site framework of scientific analysis. Specifically, in all research sites, researchers have laid the foundations for the comparative research by conducting a series of Background studies elaborating stakeholder relations, historical, biophysical and socio-economic contexts and initial levels of adaptiveness and collaboration. The studies took a consultative form of participation, but allowed researchers the time to build relations and the groundwork with local stakeholders for the main PAR phase of the research. Additionally, processes and learning in all sites are regularly recorded by researchers in a framework and format that is comparable across countries and sites. Other methods are also being used to triangulate the results across sites, countries and regions, key amongst these being the use of multivariate analysis across all sites and the analysis of the outcomes of the participatory modeling in Zimbabwe, Indonesia and Cameroon. Whereas the multivariate analysis is expected to provide a quantified picture of key drivers for the success or failure of adaptive collaborative management processes, the analysis of the simulation models (including the discussion with local partners of the emergent scenarios) is expected to provide insights into the causality of failure or success arising out of the structure and behaviour of these processes. Ultimately, these elements of the larger framework for analysis will enable greater depth of understanding within each site and highlight findings that emerge across varying community forestry conditions.

Reflections

This is an ambitious project with high local and research expectations, and as such it faces some significant challenges. At the meta-level, two of the most critical challenges are those of working across so many diverse sites and countries, compounded by the limitation of a very tight 3-year timeframe. Key challenges to working at the community level include: complex and pervasive hierarchical local stakeholder relations; low social capital; unstable political climates; and geographical isolation. However, key strengths include that, on the whole, community stakeholders, district and national partner, and field researchers have a high level of commitment to exploring the process and seeking local benefits—both social and environmental. The PAR and collaborative approach to the research incurs time costs to researchers but is enabling lessons to be relatively rapidly shared and incorporated to the research as it progresses.

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

Reference

CIFOR (2001) ‘Learning to Learn’, *CIFOR News* 29:4-5,:
http://www.cifor.org/News-Online/Nepal.htm

Rebecca Nelson, International Potato Center

A case study focusing on:

- Collaborative learning
- Decision-making support
- Participatory research in integrated pest management
- Inter-institutional, inter-sectoral collaboration in participatory research
- Methods and approaches for increasing gender/stakeholder involvement

---

Problem focus: farmers' ability to manage a devastating plant disease

Potato late blight (LB) is a particularly devastating plant disease that often causes complete crop loss of the potato crop. As a result of recent, worldwide migrations of more virulent and fungicide-resistant strains of the pathogen, potato farmers are confronting a problem that behaves differently than it did previously. Resource-poor farmers have little knowledge of the disease, perhaps because the organism that causes it is essentially invisible.

On a global basis, the disease is basically managed through the use of fungicides. In industrialized countries, forecasting and advisory systems are available to help farmers apply fungicides with ever-greater precision. Current pathogen populations, however, are resistant to one of the most important fungicides, metalaxyl. There is rising concern about the carcinogenic potential of available fungicides. In developing countries, fungicides have never been an adequate solution; the chemicals are often inaccessible or utilized inefficiently and in ways that endanger human health. Further, late blight epidemiology and management are very different in temperate countries and in the highland tropics, so little useful guidance on disease management can be gained from the vast literature on the disease. Effective disease management strategies are best devised locally, due to the tremendous variation in human, environmental, host and pathogen factors among potato agroecosystems.

Although effective components of integrated management of late blight (IPM-LB) are sadly few, knowledgeable farmers can manage the disease well through the use of resistant varieties and the appropriate use of fungicides. Farmers must also avoid a range of errors. Approaches that work well with other diseases (nutrient management, plant spacing, intercropping) are not very effective for LB. Sanitation, which is extremely important for IPM-LB under temperate conditions, is not effective in the tropical highlands because of the year-round presence of high levels of inoculum.

After decades of resistance breeding, potato varieties and breeding lines with promising levels of resistance are available. Although efforts are made to breed for durable resistance, varietal diversification is desirable to reduce the erosion and breakdown of resistance. Given the difficulties associated with this vegetative-reproducing crop, it is a significant challenge to get improved varieties to the farmers who could benefit from them. Deployment of promising breeding lines in stressful and heterogeneous environments without formal seed systems is particularly difficult. Participatory approaches are essential to breeding, implementation of integrated disease and crop management strategies, and improvement of the efficiency of informal seed systems.

Approach

The farmers' field school approach has been widely used and appreciated over the past decade, particularly in rice pest management in Asia. In an FFS, a group of ~25 farmers from a given locality gets together over the course of an entire cropping season (or longer), meeting once a week for a half-day FFS session. With the help of a trained facilitator, they conduct field experiments and hands-on learning activities. An example of a learning activity would be the collection and functional analysis of insects, to determine what one each eats (plant or pest?), and which life-cycle stages belong to which. A central activity is "agroecosystem analysis", in which small groups of farmers (~5) work together to observe their crop and take detailed notes on the occurrence and frequency of various associated organisms. They record their observations in the form of a poster, depicting the status of soil and water, plant, and weather. On one side they draw the pests and their numbers per plant, and on the other side, the natural enemies and their numbers. Based on their presentation and discussion of their observations, the farmers decide pest management actions to be taken. The farmers use direct experimentation and observation to improve their knowledge, and use this expertise to improve their crop and pest management.

Between 1994 and 1996, while I was working at the International Rice Research Institute in the Philippines, I collaborated with the FAO's IPM program and the Vietnamese National IPM program to develop a FFS season focusing on management of rice blast. This was conducted as a follow-up course for groups of farmers who had already been through a basic season-long FFS covering general rice IPM. The disease management course involved experiments on resistant varieties, varietal mixtures, plant densities, and nitrogen. The course thus gave farmers knowledge of disease processes, access to varietal diversity and resistance, and helped them to modify their agronomic practices so as to reduce disease problems.

When I arrived in Peru to work on potato late blight, I thought it would be worthwhile to consider a similar approach. The approach was not new to CIP; Ann Braun and colleagues at CIP had also been using this approach for integrated management of sweetpotato in Indonesia. Our "adaptation of the FFS approach" is still very much evolving, and from the outset has had much in common with the CIAL methodology. Our initial focus has been on late blight and the participatory evaluation of promising breeding lines, but has taken on additional content in response to the demands of our counterparts (farmers and extensionists). The FFS approach is increasingly appreciated at CIP as a way various types of technology can be made accessible to farmers for their use and improvement.

A brief account of progress to date

Over the past three years, we have undertaken to develop and implement IPM-LB by working with farmers groups in the Andes and elsewhere. We have been combining farmer-based research and training through an adaptation of the farmers' field school (FFS) approach. We began by holding a series of regional and national workshops to develop a strategy and to define available materials. The workshops involved research and extension institutions (mostly non-governmental organizations doing development work), and included one international workshop for Latin America, and several national workshops in Peru and other countries. An

FFS curriculum (field guide for facilitators) was drafted (and continues to be further elaborated), involving experimentation and various learning activities.

In 1997, we started FFS on a pilot scale in Cajamarca, Peru, in collaboration with CARE-Peru. FFS were conducted in the 1997-1998 cropping season four with communities in San Miguel, Cajamarca, Peru. Two full-time CARE facilitators conducted the FFS, in partnership with researchers. In parallel with the first season of pilot FFS, a baseline study on late blight was conducted in Ecuador, Peru, Bolivia and Uganda. This study confirmed that LB is the most important problem for potato farmers, and provided insight into farmers' knowledge and practices. After the first season, two students from the Netherlands resided in two of the communities for two months to conduct an assessment of the pilot FFS. Their reports and thesis provided valuable feedback on the experience.

The FFS Field Guide was revised and expanded to involve material on management of insect pests. The program was redesigned to cover two seasons, to allow the farmers to take more control over the research agenda for the second season, and to expand the subject matter to other crops/agricultural problems. Another eight pilot FFS were conducted in the 1998-1999 field season. Two communities continued their work from the previous season (Season II), and six communities began with Season I.

With support from the International Fund for Agricultural Development (IFAD) and the OPEC Fund for International Development, pilot-scale FFS are now being established in seven countries, through collaboration among researchers, extension organizations (NGOs) and farmer groups. The participating countries are Peru, Bolivia, Ecuador, China, Bangladesh, Uganda and Ethiopia. With the support of the PRGA program, more emphasis is being placed on gender analysis. With the support of the PRGA and the World Bank, the impact of the FFS is being assessed. Preliminary observations indicate that the FFS is very effective in stimulating varietal diffusion.

With the support of the FAO's Global IPM Facility and the FAO, a regional Training of Trainers was recently conducted for 35 extension workers (~10 each from Ecuador, Peru and Bolivia). This three-month practical course provided the participants with an understanding of the FFS approach. Each participant is committed to conducting FFS upon return to their posts.

Lessons learned

1. Farmers have a lot to learn about the microbial world. Because they cannot see the organism that causes plant disease, they do not understand disease processes well. They are poor at diagnosis of the diseases that affect their potato crops, and are not efficient at managing these diseases. However, given the opportunity, they are quick to learn and improve their management decisions.
2. Farmers are keen to try new varieties, and are appropriately conservative about making decisions regarding varietal change.
3. The FFS approach is demanding, and farmers should be well motivated if they are to participate successfully. Because potato is a high value crop and the losses due to late blight are often devastating, late blight is a suitable entry point. However, farmers face numerous problems with their potato crops and other agricultural enterprises, and prefer integrated approaches that allow them to cope with multiple problems at a given time.

4. We have been less successful at reaching women than men. Many young men are excited by the discovery process built into the FFS, but the many of the women have found the process daunting. This may reflect the fact that Andean women play less of a key role in many stages of potato production. We will try alternative strategies to reach women better, including an attempt to emphasize the health effects of pesticides exposure, and the importance of understanding microbes in family, animal and plant health.

1) Pros and cons

a) The PROINPA Foundation in Bolivia has shown that training farmers in improved fungicide management is extremely profitable. Helping farmers to select disease resistant varieties, and to manage them well, should pay off even more.

b) The activity described above is currently under development. When impact assessment studies have reached their conclusions, we will be able to spell out the pros and cons in a quantitative way.

c) I am not certain that I grasp the intent of this part of the assignment. Nonetheless, here is a try:

Aspect	Pro	Con
Varietal deployment	Researchers and farmers have complementary roles in evaluation of potential new varieties. Participatory evaluation gives farmers a meaningful basis on which to make decisions about varietal choice. It works well.	Phytosanitary problems may arise, if seed production is managed by farmers.
Impact	Linkages between research and extension organizations increases the potential impact of knowledge-intensive technology.	Transaction costs are high. Different institutions do not have the same priorities and mentalities.
Development of IPM-LB	Pest management can only really be integrated in a meaningful way in the specific context of the farmers' field.	Can't see any…
Research focus	Researchers, who often have narrow technical interests, are forced to expand their horizons.	Researchers, who often have narrow technical interests, are forced to expand their horizons.

2) Method to facilitate integration of bio-physical and socio-economic aspects.

   a) The FFS is aimed at improving farmers' decision-making. This requires that they have a solid understanding of disease and other bio-physical processes. Making sound decisions requires that the farmers combine this knowledge with an understanding of their conditions, options and constraints.

   b) In a "classic" FFS, this integration is largely handled through an activity called "agroecosystem analysis". This method involves farmers making quantitative observations (on the plant, the pests and natural enemies, weather, etc.) in their fields, and summarizing their data through a poster. The poster is then used as a platform for discussion, enabling the group to contemplate the situation and arrive at a set of rational management decisions.

   c) In our situation, many of the key farmers' decisions are taken before the season. The variety chosen and the source of seed are key issues for managing late blight. Because varietal evaluation and choice are longer-term decisions, we are working on ways of helping farmers to use experimental data to support improved decision-making regarding varietal choice. The FFS curriculum involves a season-long varietal evaluation experiment, which includes a session on economic analysis. Subsequent seasons of testing and follow-up will allow the farmers to confirm their results and explore the consequences of various decisions.

Case study

Participatory selection and strategic use of multipurpose forages inn hillsides of Honduras

The case study reported is based on results from only one year of investigation. Though initial results are highly promising, care therefore needs to be taken in the interpretation of data. Conceptually this activity is relying on Farmer-Researcher-Institutional Linkages. The goal is to use forages to: a) improve the income of smallholders mainly through direct effects on livestock production, b) improve income and food security through indirect effects on soil conservation and improvement of the resource base in terms of availability of capital and nutrient cycling, and c) ensure conservation of natural resources.

Integrating social, economic and environmental sustainability ensures Agro-Ecosystem health. In this context system health is seen only feasible if human and environmental aspects are reconciled.

Farmers are offered a range of grass and legume options for feeding of livestock and soil fertility improvement and soil conservation. This is the start of a holistic process. For those options immediately attractive to farmers basic seed is provided in a limited amount to enhance utilisation and eventual adoption. However, at the same time the necessity for seed production by the smallholders themselves is promoted. If seed production is not feasible on-site, alternative sites for production are sought.

From preliminary results farmers selected first grasses for pastures, as these are natural components to improve the existing production systems. However, several farmers were also interested in legume species. There is also a high interest for the incorporation of forages for soil conservation and some demands for legumes for cut and carry. The more reserved attitude of farmers for the legume options is expected as interventions are targeted not only to improve but also to change existing production systems. It is anticipated that the combination of different forage options of varying complexity will be advantageous to build trust among farmers to test more complex and thus higher risk alternatives.

The approach does not stop at offering farmers a range of forage options for selection but is rather an initiation of a dynamic, continued process. The selection by farmers of particular grass and legume ecotypes will allow researchers to better define plant characteristics requested by the farmer. Demands by the client are the ultimate reasons for adoption and non-adoption. These demands should help define and direct further forage germplasm development. It is also anticipated that the interactive work with the farmers will open possibilities to develop forage technology options beyond the immediate scope of farmers and researcher which, could be the basis for development of profitable and sustainable production systems. Of particular attention in this study is the search for forage options to directly or indirectly improve the well-being of less privileged groups in the rural society, like women.

In this research effort CIAT is collaborating both with rural communities and national organisations. The first is seen mainly to enhance interaction with local stakeholders and to achieve an impact in the initial site of intervention. The partnership with nationally based institutions is the basis for a wider distribution of results and for multiplication of seeds of forage selected by farmers, which is one of the most important bottlenecks for adoption of improved forages. Even though the final goal is seed production by farmers, with this approach we ensure a back up of seed and time for identifying areas favourable for seed multiplication.

Finally, results obtained in specific locations will be extrapolated through a GIS-based Decision Support Tool, which will be made available to a range of Research and Development Institutions.

Pros and Cons of community-based NRM research

We see the community-based NRM research as complementary to on-station research activities. The study described is building on this concept and therefore the positive sides of community-based research are balancing the negative sides of on-station research. For example, the lower control of on-farm research is balanced by the insight obtained from the real-life situation. Therefore, we are hesitant to design a table with 'Pros' and 'Cons', in particular as the case study is only one year old. The biggest limitation of our approach at the moment is to ensure the availability of seed. To maintain the trust of farmers it is also important to clarify to them that new forage options will bear a certain risk of failure. Thus in this context it is even more important to ensure a long-term approach to be able to react to problems caused by interventions.

Methods

There is not one research method that can be used to implement the approach described. The research builds on an interaction with several partners and includes Diagnostic Tools to understand the production system – which need to include biophysical and socio-economic aspects. Based on this initial diagnosis the research cycle is initiated. For the selection by farmers of the best forage options a combination of open evaluation and preference ranking is used, which allows to maintain a dynamic and flexible interaction with farmers.

For the GIS-extrapolation of results we will develop methods as simple as possible, but that provide sufficient accuracy and that are useful to test locally in order to enhance efficiency of limited resources

.

<u>Case study</u> for the PRGA/NRI workshop on participatory methods for NR management at the landscape scale; NRI, UK: 1-3 September 1999

Barry Pound, Farming Systems Agronomist, Natural Resources Institute, Chatham Maritime, Chatham, Kent ME4 4TB, England

Introduction

This case study is set in the mid-hills of Nepal, and draws on the experience of researchers, extensionists and farmers in developing and implementing an innovative community approach to the control of bacterial wilt (*Pseudomonas solanacearum*) of potatoes (*Solanum tuberosum*). The architects of the approach were the development scientists of Lumle Agricultural Research Centre. The various biophysical ands socio-economic aspects of the experience are detailed in Pradhanang and Elphinstone (1997).

The high hills of Nepal have traditionally been a source of supply for seed potatoes to the mid hill and lowland (terai) potato producers of Nepal due to the low incidence of viral diseases in the high hills. Bacterial wilt, a serious disease which can survive in the soil for several years and can be spread through infected seed potatoes, threatened the trade in seed potatoes (and the production of potatoes as an important hill staple) from the late 1980s as it became established in the villages where seed was produced. The villagers themselves did not know what the life cycle of the disease was, or what control measures to take. Lumle Agricultural Research Centre held the research mandate for the area, and devised a strategy for addressing the problem in collaboration with the affected communities.

Process

Four seed-producing villages were selected, with contrasting social characteristics and size. A Samuhik Bhraman (a type of RRA) confirmed bacterial wilt as a major problem. Major reasons for the fast spread of the disease were: lack of awareness of the disease; frequent movement of potatoes between and within villages; short crop rotations, poor plant hygiene and the use of volunteer potatoes for tuber yield. A plan was devised for management of the disease in 1990 by a multi-disciplinary team comprising phyto-bacteriologists, agronomists, extensionists and socio-economists. Farmers were involved in monitoring the disease, and meetings held with villagers to create awareness of it. Each pilot village created a “Cropping System Improvement Committee”, which was responsible for the programme within its village. Training was given to villagers by the project.

It was realised that efforts made by individuals or small groups would not succeed in controlling the disease due to the fragmentation of land holdings, the frequency of potatoes in the cropping cycle, the long survival of the disease in the soil, and its spread between plots by runoff, shared tools and the movement of livestock and field workers.

To succeed required 100% participation by the community in the implementation of a moratorium on potato production in infested lands for three years. Key components of the approach to integrated management of the disease were:

- Elimination of infected planting materials from the village
- Provision of pathogen-free seed multiplication programme in the community for a regular supply of healthy planting materials
- Prohibition of cultivation of potatoes or other solanaceous crops for at least three years in infected fields
- Rouging of volunteer potatoes
- Education of farmers on the symptoms of the disease, its transmission, control measures in field and store, and sanitary aspects of disease management
- A support programme bringing alternatives to potato production

The last point also included altering cultural practices such as exchanges of potatoes as gifts between families and communities. The volunteer “Cropping Systems Improvement Committee” was crucial in the implementation of the programme to influence villagers actions through information and policy enforcement (where necessary). This required the Committee to be fully empowered to act in these capacities.

To compensate for the loss of potato production it was necessary to provide alternative (non-host) crops. Demonstrations of nursery raising and vegetable production, seed supply and technical advice were therefore important components of the support programme to project villages. In addition to vegetables, cold-tolerant rice was to become an alternative to potatoes. The process was assisted by the posting of a facilitator/extensionist to each of the project villages as liaison between research and the Committees.

Results

Up to 1996 there had been a varying degree of success between villages in containing or eliminating the disease. One village (Jhilibarang, where community cohesion was strong) continued disease-free seed potato production for the three years of the project. In Ulleri, community co-operation was difficult to manage, and the disease appeared from the second year of programme implementation. The disease was severe in the third year due to the planting of infected material by some farmers. The programme was terminated in Ghandruk after the second year (this village is less dependant on agriculture having a lucrative tourist trade), and the disease reappeared in Sabet when farmers resumed their normal cropping patterns and grew potatoes in traditional fields.

Lesson learned

- Communities vary greatly in their levels of cohesion and socio-economic environment
- The constant changes in social equilibrium and the influences of exogenous and endogenous forces require careful monitoring and response
- Provision of village workshops, training and cross visits are vital to broaden level of thinking and improve participation based on understanding
- Recognition that 100% co-operation is very difficult, and the need to target and understand the grievances of non-co-operating members
- Importance of providing alternatives through a support programme (note that the building of a suspension bridge to improve communications and market access was an extreme instance of support to Jhilibarang village)
- Scaling up from the pilot project to wider application requires comprehensive information followed by a massive awareness/training/support programme. Key elements to success are a co-ordination mechanism, a monitoring system and a supportive policy framework.

Conclusion

Control of bacterial wilt is technically feasible. However it was difficult to achieve the required level of community participation essential to ensure long-term success.

Reference

Pradhanang, P.M. and Elphinstone, J.G., eds. (1997). Integrated Management of Bacterial Wilt of Potato: Lessons from the Hills of Nepal. Proceedings of a national workshop held at Lumle Agricultural Research Centre, Pokhara, Nepal, 4-5 November 1996. 119pp

Advantages and disadvantages of community-based NR management in the Nepal case-study

Advantages[1]	Disadvantages
1. Community cohesion 2. Effective use of awareness raising and training 3. Institution of “Cropping System Improvement Committees” 4. Good support from a well-established and well respected research and extension service 5. Identification and support to alternative NR management options 6. Excellent multidisciplinary support from technical and social scientists	1. Divided communities with ineffective internal policy enforcement 2. Existence of alternatives to agriculture reducing the need for community compliance 3. High dependency on potatoes, necessitating some farmers to take actions for short-term gain, but resulting in long-term disaster 4. Complex and daunting task of scaling up from pilot to wider application

Note [1] In this case study, a community approach was thought to be essential to control of bacterial wilt, so the columns really refer to elements that assisted or hindered that approach.

Method that has facilitated the researcher and farmers to better understand the integration of the bio-physical and socio-economic concerns involved.

The whole process has been an integrated effort between natural and social scientists working together with communities. However the Samuhik Bhraman carried out at the start of the project was probably the key to understanding the interaction between the social, cultural, physical and biological factors. The Samuhik Bhraman is a type of RRA that evolved in Nepal during the 1980s, and involves a multi-disciplinary team of researchers, extensionists and villagers in exploring a defined subject. In this case it was focused on the seed-potato production system. The Samuhik Bhraman uses a range of RRA/PRA tools, with team members changing each day between sub-groups to promote cross learning. Each evening there is a reflection period when sub-groups discuss what they have learned and decide tasks and responsibilities for the next day. The team lives in the community for the duration of the study, and confirms its findings through community meetings.

Through this method it was possible to define the geographic and temporal distribution of potato-production, the production and storage methods used, the constraints and the economic imperatives. Relevant social/ethnic structures and cultural practices (such as exchange of potatoes as presents and the sharing of tools and livestock for draft) were also identified.

The Samuhik Bhraman defined the need for 100% community involvement in this particular case of NR management, and identified the requirement for a fully empowered local Committee to implement, monitor and, if necessary, enforce the programme. It also recognised the need for alternatives to potatoes, and that a support programme would be required to provide practical access of farmers to these alternatives.

PRGA/NRI Workshop at the University of Greenwich, September 1-3, 1999

Methods Used to Address Resource Issues in Integrated Watershed Management in a Nepalese Watersheds:

Hans Schreier
Institute for Resources and Environment, University of British Columbia, Vancouver, Canada

Our team has been trying to integrate sustainable principles into watershed management in Nepal, Bhutan, India and China, but the case-study discussed here is mostly from two Nepalese watersheds (Jhikhu Khola and Yarsha Khola watersheds). These Middle Mountain watersheds are some the most intensively used landscapes on earth and exhibit all the resource problems that are now of major concern in developing countries. Water shortages, water pollution, soil fertility deterioration, deforestation, lack of animal feed, stagnating biomass production, inequity, poor food security, poverty, increasing workload for women, few alternative economic options, and poor infrastructure support, are all part of the overall problem we are trying to address.

1. Methodological Issues; Case Study Examples

The challenge is to arrive at methods that are adaptable to complex conditions and that facilitate integration, interdisciplinary activities, and build linkages between researchers, farmers, and local and national institutions. We have been fortunate to have had access to long term funding by IDRC (and more recently SDC) over an 8 year period. This allowed us to develop a comprehensive resource database for the watershed and enabled us to make the transition from a basic science driven project to one that is primarily participatory. We use the watershed (not the community) as our unifying unit for research, because it is at that scale that we can model landscapes, water, nutrient dynamics, and climatic change effects. We first conduct a rapid PRA to identify the common concerns and issues in the communities within the watershed. Then we build a GIS database consisting of a geology, soils, topography, and land use layer and we establish simple climate, hydrometric and soil erosion monitoring station. The issues raised by the communities are then addressed using a GIS approach that includes overlay stratification, modelling, statistics, and socio-ecomomic surveys. The key factors indicative of climatic conditions (elevation and aspect), the domionant bedrock/surficial material types, and dominant land uses are identified and the factors are then divided into unique categories (2 for elevation, 2 for aspect, 3-4 for contrasting rock type, and usually 4 for land use -irrigated and rainfed agriculture, forests, grazing, others). The combination of these factors play the dominant role in shaping and using the landscape and this 2x2x3x4 combination matrix is then used to divide the landscape into 48 possible landscape combinations. The GIS overlay technique is applied to show the dimension and location of each combination. Ten farmers and ten members of forest user groups are then selected in each of these 48 classes of landscapes and a participatory survey is conduced to sample and analyze the dominant soils in each chosen farm or forest, and to obtain information on farm and soil inputs, production, socio-economics, gender and equity.

The advantage of this method is that it will cover all environmental conditions in the watershed and this enable us to determine how much each individual factors contributes to the overall variance (using the analysis of variance or non-parametric significance tests). It does not stratify the social factors in a statistical manner but because we look at all types of bio-physical conditions we capture members from most of the socio-economic spectrum in the watershed. For example: we interview members that use the high elevation, south facing forests on acidic bedrock originating on quartzite. These are usually the least productive and most degraded sites and are most often used by the poorest fraction of the farmers who have no other alternative source for fuelwood and fodder. In contrast, the low elevation alluvial sites under irrigation are the most desirable and productive farming areas and are usually owned by the richest segment of the society. Based on this type of survey we can then produce nutrient budgets (from the socio-economic survey and the measured soil nutrient status) for each farm. These models can then be coupled with the GIS overlay technique to scale up to the sub- or watershed level. Similarly, we can measure gross margins for each farm and upscale to the watershed scale to arrive at economic indicators at the semi-regional scale. The initial effort is large, but the payback is enormous, because this type of survey can be done once every 5-7 years in the same watershed. As long as all information is geo-referenced, it provides us with the opportunity to document the dynamics of the land use, the soil fertility, and socio-economic conditions.

Collaborative participatory farm interventions are then initiated to address the farmers concerns. Based on this approach we have identified that only 1/3 of all farmers apply enough nutrients (N and P) to a corn crop in a double rotation and in these farming systems the long term soil fertility is not sustained. At the same time we can show that the nutrient deficits in an irrigated triple crop rotation system of rice, wheat and corn is only prevalent in about 40% of all farms. This can now be expanded to other cropping rotations by examining the nutrient balance situation and economic consideration when cash crops such as potatoes and tomatoes are introduced into the rotation. We can also apply scenarios to these systems and simulate possible outcomes.

Water quality and quantity has been identified as key problems in the watershed by most farmers, and this can also be addressed using this combination of “GIS - socio-economic survey -field monitoring” approach.

Our most interesting and most challenging research is not in the identification and quantification of the problem, or the determination of the rate of degradation, but in how to correct problems and rehabilitate sites. Very degraded sites often occur on common land, where the prospects for rehabilitation are not very good, because of the large efforts needed to establish biomass, and the poor prospects of short term economic returns. However, we were able to demonstrate that up to 40% of the total annual sediment load in the river originate from such sites and the impacts on irrigation systems downstream is large. These areas provide researchers with the opportunity to develop community forests and grazing lands that eventually become bio-diversity gardens. Re-vegetating such sites will effectively reduce downstream sediment problems, provides new biomass from areas not previously used, and such sites can then be used to demonstrate how participatory research works. Both the researchers and the farmers, who are initially skeptical that such rehabilitation is possible over short periods, are intimately involved in the work. Our experience in this area has been very positive because it gives the researcher a chance to experiment with methods on how to restore soil fertility, how to produce biomass for consumption under very difficult conditions, and how to develop agro-biodiversity. In such projects farmers participation is usually restricted to the poorer fraction of the society because the rich farmers often do not want to be bothered with marginal sites. The involvement of women in these projects is particularly important because of their traditional role in managing the fodder, fuelwood and litter resources.

The results of all of this research were combined into a multi-media CD-ROM, which now serves as an excellent communication tool. It combines text with pictures, graphics, GIS maps and anecdotal information. We will try to give you an opportunity to view the CD-ROM during the workshop.

2. Identification and comparison of the Pros and Cons of community based resource management approaches.

I recently finished an external review of IDRC's Community Based Natural Resource Management (CBNRM) Program and derived the following Table (Table 1) as a general comparison of advantages and difficulties. Hopefully this is of use to the workshop.

Table 1. Advantages, disadvantages and risks in using the CBNRM approach

Advantages of using the CBNRM approach	**Disadvantages of using the CBNRM approach**	**Risks associated with using CBNRM**
Addresses the immediate concerns and issues of the community	Methodologies are more complex and require new skills that are not traditionally available at the educational institutions	The success is highly dependant on the individuals that make up the team (needs good leadership, and compatible personalities)
Provides a better forum for communication between researchers, community participants and the general public	Working in an inter-disciplinary manner is much more difficult and demanding. It requires a combination of human and subject matter skills and knowledge that is not readily available	The focus is often on the immediate concerns and conflicts of the community (short-term) and this might be at the expense of more long-term concerns (e.g climate change, soil fertility decline, degradation)
The focus is on the poorer fraction of the society and allows to place a greater emphasis on gender and ethnicity	To achieve the right team configuration and to match them with the right personalities is probably the biggest challenge	External factors that are currently not considered to be of importance might be ignored. Anticipation of future problems requires early recognition of issues well ahead of those anticipated by the community
Interventions have a more immediate effect and dissemination of successful results can be facilitated and applied more rapidly	CBNRM is much more time consuming which requires that project funding should be assured for longer time periods than the traditional 3 –5 years	The CBNRM approach is dependant on the willingness of the political system to give community groups more power to manage their local resources

Advantages of using the CBNRM approach	**Disadvantages of using the CBNRM approach**	**Risks associated with using CBNRM**
Issues are addressed in a more interdisciplinary manner and this should lead to a better understanding of the environmental system and result in more holistic and permanent solutions	There is a danger that too many issues have to be addressed and this leads to increased complexity and problems of integration	Finding the right balance between diagnostic and intervention research, and between social and biophysical science is difficult
Involvement of stakeholders that play as active part in the research provides a reality check on the relevance of the research	The focus tends to be around communities at the expense of integration within larger more natural units such as watersheds, coastal of ecological zones	Some pertinent development issues cannot effectively be addressed with the CBNRM approach alone (e.g. climate change, international hydro-irrigation schemes, air and water pollution, epidemics, global economic factors)
CBNRM can facilitate conflict resolution since stakeholders can be incorporated into the research from the start	Up-scaling cannot easily be accomplished if it is not incorporated into the research activities from the beginning. (A common problem in most research).	There is the danger that too much effort is spent on participatory research at the expense of basic research that is also needed.
Leads to a more effective public education and forces researchers to better communicate with the public in explaining why the research is important and what the results mean	Much effort has to be spent on training and education because the necessary skills are not readily available within the academic institutions. This will delay diagnostic and intervention research (but will have more long term benefits).	There is a need to develop quantitative participatory methods because there is an over-emphasis on rapid surveys and assessment procedures, that are not necessarily representative of the communities
The act of supporting credible research helps build intellectual and scientific legitimacy for political reform. CBNRM has stimulated internal discussions which leads to a more open policies	Some communities are amorphous and not well suited for the CBNRM approach	
The CBNRM approach is flexible and can readily be adjusted to a wide range of conditions		

FPR METHODS COMPARISON

Case study for PRGA NRM Meeting 1-3rd September, 1999

Sieglinde Snapp, Soil Fertility/Agronomist
ICRISAT-Zimbabwe s.snapp@cgiar.org

The focus of the ICRISAT soil fertility research program in Malawi and Zimbabwe, Southern Africa, is to develop new institutional linkages and research methods. We aim to build partnerships among national scientists, extension farm advisors in the NGO and public sector, and farmers. The outputs focus on increasing early farmer input into national research programs and improved dissemination of "best bet" natural resource management technologies that are practical for resource poor farmers. The goal of the best bets are to improve human nutrition as well as improve farmer soil management and rehabilitation of community environments. Legume intensification and integrated use of organic and inorganic nutrient sources are the primary technology interventions so far.

A novel aspect of this program is a direct comparison in case study areas, using different participatory approaches in parallel villages. The goal is to, over time, allow stakeholders to evaluate effectiveness of different methods. The partners include farmers, national research scientists from Universities and Ministry of Agriculture in Malawi and Zimbabwe, farm advisors from three NGOs (one international and two indigenous) and the extension service in both countries. The methodology comparison builds on the strong concerns of researchers and farm advisors that farmers adoption of their recommendations is almost nil, both for fertilizer recommendations and integrated nutrient management involving organic sources of nutrients, primarily legumes and manure. This is a bleak picture, despite a decade of research efforts carried out on-farm, and in recent years a focus on incorporating participatory research and extension approaches and training for transformation empowerment approaches. Some researchers and senior extension staff are also concerned that female headed households and women farmers are rarely reached by extension, nor are their concerns articulated or part of the professional discourse on agronomic research.

Our goal is to improve soil fertility management by farmers, and to build research/extension/farmer communication, and partnerships. We are building on the field methods or participatory approaches that have been initiated over the last three years in the case study areas (see Table 1). Of these different approaches, each conducted in a different village in the case study area, we are in the process of determining which are best at building institutional linkages and improving the peer relationship among stakeholders, for different locations. The effectiveness, and costs, of each approach will be evaluated by all of the partners involved. The different participatory methods being tested range from farmer empowerment approaches led by NGOs, to trial demonstration and field visit research/extension approaches, to new farmer participatory research methods e.g., the satellite trial design (which is described in more detail below as a method to facilitate researcher and farmer communication). Comprehensive baseline surveys were conducted, and recently a meeting was convened to formalize this methods comparison to meet the needs of the stakeholders. There was strong support for this effort to evaluate what research/extension/farmer methods of working together are most effective, in terms of researcher, extension and farmer satisfaction, farmer uptake and adaptation of technologies, farmer empowerment and improved soil management in the area.

Table 1. Description of on-going work in three villages in each case study area. Not all approaches are represented in all areas. Note that the baseline surveys included a control village at each site as well. In the control villages there is no known on-going intervention by researchers or extension/NGO farm advisors.

	Researcher-led RFE partnership (e.g., development of best bet technologies on-farm; linkage approaches through satellite “mother/ baby” trial designs)	Extension-led RFE partnership (e.g., on-farm trials and demonstrations conducted by extension workers or selected farmers, Action group 1 in Malawi)	Farmer-led RFE partnership (e.g., empowerment of farmer experimenters, or facilitating farmer testing of fertilizer management package in Zimbabwe)
Malawi case areas:			
1. Chisepo	Best bet options testing (3 years)	Ministry of Agriculture Action group one trials (3 years)	IDEAA farmer empowerment (2 years)
2. Dedza	Best bet options testing (2 years)	“ “	Concern Universal NGO (2 years)
3. Mangochi	Best bet options testing (3 years)	“ “	Tulimbe NGO (for 4 years; now gone)
Zimbabwe case areas:			
1. Tsholotsho	Best bet manure options testing (1 year)	Ministry of Agriculture research trials/demos (3 years)	No NGO
2. Gwanda	“ “	“ “ (in the past)	Indigenous Tech. NGO
3. Mashvingo	Cons/land prep. soil management option testing (2 years)	“ “	CARE community empowerment (2 years)

Table 2. Pros and Cons of Snapp Case Study

	Pros	**Con**s
Overall Goals	Improved soil management by farm families and to build research/extension/farmer communication, and partnerships. Different approaches are being carried out in paired villages in case study areas and are in the process of being evaluated by the partners involved.	Community management is not explicitly facilitated in most of the "participatory" work being currently carried out in the targeted areas of Malawi and Zimbabwe, so are not included in this compared in this methodology comparison
Content	Methodology approaches and efforts to facilitate farmer-researcher-extension linkages and technology best bet options are systematically evaluated by all of the partners involved. The concerns of women farmers and female headed households are specifically addressed. This adds value to on-going efforts in the area	Larger context of the different case study areas where the approaches are being tested is difficult to assess. For example, the market opportunities and historical extension/farmer relationships may vary markedly among the areas and determine the relative success of different methods.
Types of experimentation and participatory research/extension approaches	See table 1 above. All of the approaches attempt to facilitate farmers learning basic research principles, exposure to a range of new options as well as empowered to value their own knowledge, and to improve communication among farmers, research and extension staff.	The trial and demonstration approach probably has the least emphasis on farmer knowledge, facilitation of farmer learning and experimentation, the farmer-led approach the most.
Developing specific recommendations versus broad guidelines	The research and extension staff often emphasize the need for specific recommendations; however, the process of participating in the researcher-led and the farmer-led approaches has increased discussion regarding the need for disseminating broader "rules of thumb" and guidelines rather than specifics.	The changes in the researchers and extension staff to encompass a broader approach is difficult to document and further steps, such as how to facilitate farmer training and communication with other farmers on guidelines is not explicitly part of any approach though it may develop.

	Pros	**Con**s
Scaling up issues	This interacts with above, broad versus specific recommendations. The trial and demonstration approach is widely seen by extension and researcher as the only cost effective way to scale up dissemination. The NGO staff also express that the farmer and community empowerment work they do is only cost effective in isolated areas and that they need to go to trial and demo to reach more people – at the same time both groups express frustration with the lack of effectiveness of trials and demos as currently done.	Farmer to farmer communication is probably the most important means of technology dissemination and is not treated explicitly to a great extent in any of the approaches, expect perhaps the farmer empowerment approach (which some professionals view as too costly to do on a large scale)
Sustainability, long-term impact and links to the formal research/ extension systems	Long-term impact and changes in how research/ext staff conduct their work is the goal of this case study. Stakeholders designed this village-based comparison of methods, and are involved in evaluation of the pros and cons of each participatory method over time. We meet annually for assessment. Strong links are built as researchers and extension, NGO were carrying out most of this work already, and through this case study we are attempting to facilitate self-reflection on the value of different approaches to the stakeholders.	This is difficult to evaluate, but should become more clear with time. A survey is only now being developed to evaluate researcher and extension attitudes and beliefs regarding effective ways to communicate with farmers and work together to develop soil management options and improve farmer experimentation.

3. Description of method which has facilitated researcher, extension and farmer communication

Mother/baby satellite trial design: participatory methodology to improve farmer-researcher communication - S. S. Snapp

Farmer input and consultation is seen as important by agronomists in Southern Africa, but there have been few methods which allow quantitative commentary by farmers. In recent years reconnaissance surveys have been used to help prioritize research, and trials are often located on farmer's fields. For example, fertilizer recommendations in Malawi are being revised with the involvement of about 2000 extension field assistants conducting on-farm verification trials (Benson, 1997). Extensive on-farm research in Southern and Eastern Africa has included studies of variety adaptation, crop rotations and agroforesty systems (Kanyama-Phiri, et al., 1998; Sperling, 1993). However, there is still a lack of practical methods for rapid documentation of farmer perceptions of new technologies (Onduru, et al., 1998). Researchers often conduct informal discussions with farmers to assess technologies. Informal consultation may incorporate unacknowledged bias. For example, an assessment of bean research in Malawi suggested that historically researchers and extension staff have worked with men farmers, missing perceptions of women farmers. Yet women are widely responsible for growing beans and have a store of indigenous knowledge about bean varieties (Ferguson, 1994).

In Malawi and Zimbabwe, ICRISAT is venturing into developing methods that allow input by farmers early, and often. A promising method to improve communication between farmers and researchers is the satellite "mother/baby" trial design (Figure 1; and see Snapp, 1999). The steps taken in this approach are outlined in Table 1. The methodology facilitates farmers and researchers working together to test best bet soil fertility technologies, in purposively chosen pilot villages representative of different agroecosystems in Malawi. The best bet technology options under evaluation are designed initially by researchers with farmer priorities and resources in mind. In Malawi the best bets being tested and adapted by farmers include doubling up on grain legumes, and combinations of small amounts of fertilizer with manure and pigeonpea or maize residues.

This participatory research approach is being carried out with national research partners at five of the major agroecozones in Malawi (Figure 2). The satellite trial design is conducted at each village site. It consists of two types of trials, linked together like satellites around a planet. One trial type is the researcher designed, within- site replicated "mother trial". The other trial type are the satellites which are farmer managed, one farmer, one replicate, simply designed "baby trials" (Figure 1). This mother/baby trial design links farmer assessment of technology performance with researcher assessments of biological performance. Farmers chose which of the researcher "best bet" technology options to assess on their farm, through a baby trial. The baby trial is conducted with farmer-realistic levels of inputs and equipment, and with farmer-defined controls. The goal is also to catalyze and improve the on-going experimentation by farmers as well. Researchers assess input from farmers through surveys, farmer ranking of technologies, and by monitoring farmer adaptations and spontaneous experimentation. Further, researchers and extension observe and learn from what farmers are doing on their farms to learn from the continuing experimentation and adaptation by farmers.

In Malawi 400 farmers are assessing some of the most promising best bets at seven sites in the country, through the satellite baby trials and their own experimentation. Farmer experimentation has increased in the legume intensification areas (table 2). At the same time, researcher objectives to conduct quantitative and peer-acceptable research are met at the sites through conducting the within-site replicated trials (mother trials), that test a wide range of technologies and research hypotheses.

In contrast to some approaches which advocate merging research validation of technologies and farmer demonstration objectives, the goal of the mother/baby satellite trials approach is to facilitate links among different approaches to experimentation and information flows among the partners.

Initial results from this approach are seen in Table 3, which presents quantitative assessment by farmers of best bet soil fertility technologies. Grain legume intensification technologies were a big hit with all farmers surveyed, across a wide range of agoroecozones. As one farmer said recently “Groundnuts doubled up with pigeonpea is my new basal fertilizer, I grow them before my maize crop and I get a strong crop: I only have to apply a small amount of urea as a side dress”. The advantage of the mother/baby satellite trial approach is that the farmers surveyed have all carried out baby trials, and so were experienced judges of the technologies.

The satellite trial design presented here facilitates communication, linkages and systematic cross-checking among researcher, extension and farmers. This trial design is currently being evaluated in the field through a comparison of effectiveness with other participatory research and extension approaches in paired villages. Experimentation will continue with satellite trial designs and related farmer participatory methods. Please feel contact me regarding any related approaches or experiences you might have to share.

References:

Benson, T.D. 1997. Spatial and temporal variation in fertilizer recommendations for maize grown by smallholders in Malawi. p. 135-144. *In* Maize Commodity Team Annual Report. Ministry of Agriculture, Department of Agricultural Research, Chitedze Research Station, Lilongwe, Malawi.

Ferguson, A. 1994. Gendered science: a critique of agricultural development. American Anthropologist. 96:540-552.

Kanyama-Phiri, G.Y., Snapp, S.S. and Minae, S. 1998. Outlook on Agriculture. Partnership with Malawian farmers to develop organic matter technologies. 27: 167-175.

Onduru, D., Gachini, G.N. and Nandwa, S.M. 1998. Experiences in participatory diagnosis of soil nutrient management in Kenya. Managing Africa's Soils, Working Paper No. 3, IIED, London, UK 17 pp.

S. Snapp. 1999. Mother and baby trials: a novel farmer participatory trial design and methodoly being tried out in Malawi. Target Vol. 17:8

Table 1. A case study of a satellite trial design to facilitate farmer/researcher partnerships

Step	Activities
Selection of location	Selection of representative, clustered villages in agroecosystems of interest
Problem identification	Researchers, with farmer input through reconnaissance survey
Initial design of best bet options to test	Researchers, based on past on-farm research results and farmer problem identification through participatory approaches to local communities and empowerment exercises
Objectives of research with farmers	1. To assess best bet options performance 2. To quantify farmer assessment of best bets 3. To improve farmer experimentation by providing information and technology options, including access to new varieties
Site Characterization	Current farmer experimentation and soil fertility management practices, farming system history, early season sampling of topsoil and analysis of pH, texture and nitrate
Design of on-farm trials	Mother/baby satellite trial design: Within-site replicated RCB "mother" trials (1 per location) and one-farmer, one-replicate "baby" trials (~20 per location) Figure 1.
Biological data monitored	Trial operation dates, plant population, grain yield, residue biomass and quality analysis, soil analyses.
Socioeconomic data monitored	1. Surveys of farmers, extension farm advisors and reseachers to assess socioeconomics, indigenous knowledge, current priorities in soil management and experimentation 2. Farmer assessment of best bet technologies through: matrix ranking, rating of positive and negative technology traits 3. Economic analysis – partial budgets

Table 2. *Farmer experimentation in case study areas of Central and Southern Malawi*

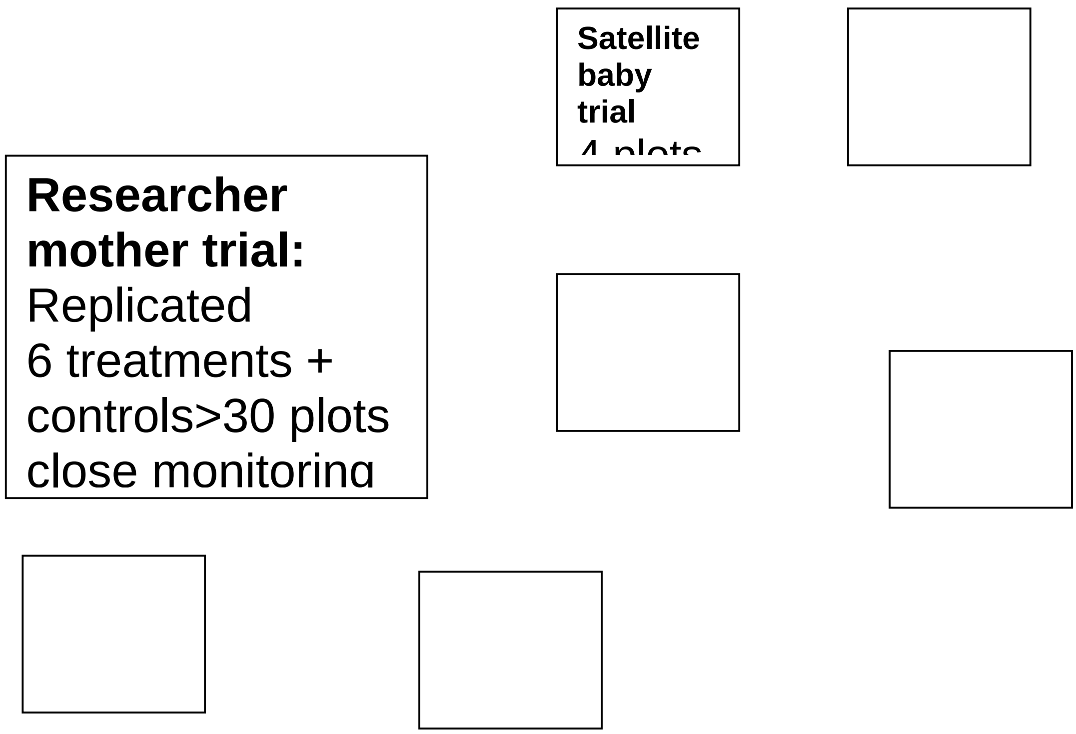
Year/Site	Farmer-initiated experiments (#)	Description
1997/98	*Total: 17*	
♦ Mangochi	Pigeonpea & groundnuts: 8 Manure:2 Mucuna: 2	**- Intercrops & rotations** - **Variety trials** - **Fertility experiments, targeted**
♦ Chisepo	Pigeonpea: 2 Manure:2 Mucuna: 1	**- Intercrops** - **Variety trials** - **Fertility experiments, targeted**
1998/99	*Total: 96*	
♦ Mangochi ♦ Chitala ♦ Songani	Pigeonpea & groundnuts: 26 Manure:3 Mucuna: 8 Fertilizer:10	**- Intercrops & rotations** - **Variety comparisons** - **Fertility experiments, targeted** - **Staking mucuna**
♦ Chisepo ♦ Mpingu ♦ Mitundu	Pigeonpea, soyabean & g'nuts: 19 Manure:2 Mucuna/Teph: 9	**- Intercrops** - **Variety comparisons** - **Fertility experiments**
♦ Bembeke	Soya/p'pea:4 Mucuna: 5 and fertilizer 10	ditto

Table 3. Farmer rating of technology traits across all sites in Malawi 1998. Result from farmer participating in baby trials, where scale used for rating was Very low=1, Low=2, High =3, Very high=4. Technologies were rated independently. Matrix rankings were also conducted, where farmers were asked to compare the four technologies.

Technology	Weeding Requirement	Seed availability	Contribution to food security	Contribution to cash sales	Contribution to soil fertility	Matrix ranking (Γ/Ε farmers)
Mz	3.1	3.3	2.2	2.3	1.5	0.5/0.9
MzPP	2.5	1.9	3.4	2.9	3.1	2.6/2.1
GPP*	2.2	1.7	3.3	3.4	3.1	2.1/2.1
MzT	2.8	1.3	2.0	1.9	1.8	1.2/1.0
LSD	0.4	0.5	0.4	0.6	0.5	0.3/0.2

*GPP = groundnut/pigeonpea rotation technology except where soyabean was the shortduration grain legume substituted for groundnut.

Figure 1. Satellite trial design: mother researcher trial with satellite farmer-led baby trials



Participatory Agroecosystem Management (PAM) – an approach utilized by benchmark location research teams in the African Highlands Ecoregional Program (AHI)

Dr Ann Stroud

Introduction

The following areas are discussed: integration of agroecosystem components, methods to increase gender/stakeholder involvement in maintaining agroecosystem "health" through collective learning and improved linkages. The focus of this case study is on the "diagnostic" portion of the participatory research process.

The AHI goal is to improve and enhance land productivity in a sustainable manner by working with farmers to evolve policy and technologies that will increase agricultural production while maintaining the quality of the natural resource base. Due to various shortcomings identified in the current research processes, it was decided by AHI's partners that researchers should embark on using participatory research methods. The "PAM" approach[1] has 4 cornerstones: an agroecosystem approach that recognizes the interactions between major sub-systems, between components of the sub-systems, and includes the socio-economic and policy environment; the need for multi-partner and multi-disciplinary team work; use of participatory methods; and use of integrated community action plans where "learning by doing" is emphasized. Participatory research has been interpreted as sharing control with farmers (and other actors) in all stages of the research and dissemination continuum: identifying and prioritizing researchable areas; planning and implementing activities; monitoring and assessing activities; and finally dissemination. It is hypothesized that the "PAM" approach will facilitate technology adoption; empower farmers so they share in decision-making, enable farmers by improving their problem solving capacity, and build on and support local knowledge, skills and institutions.

The approach calls for new processes, attitudes and a reversal of ways of interacting: from closed to open, from working with individuals to groups, from collecting information to sharing, from verbal communication to using more visual means, from qualitative to using comparisons and from "research to village" information transfer to "village to village" transfer. The interest in this approach and request for training in methods has been high, particularly by younger scientists. As a result, AHI embarked on a capacity building program that includes regional and site training events and followup with the site teams. This was deemed necessary to start the process and has delayed actual field implementation by 1-2 seasons.

Diagnotic work

The diagnostic work was considered as the first stage of the research process and formative in terms of starting a relationship with farmers. The expectations of this work included:

- viewing issues from an historical perspective to understand driving forces behind change and the results of actions to extrapolate to other areas or into the future;
- developing a better understanding of traditional knowledge and improving

[1] Coined by Dr Cary Farley, previously working as a consultant for CIAT (AHI)

linkages with other sources of knowledge;
- understanding the variation inherent in the area (physical and socio-economic) using gender analysis techniques, resource endowment mapping and spatial analysis; and
- understanding external factors that influence resource management, particularly public policy and services.

Initial outputs coming from this work included:
- collection and analysis of secondary information including maps;
- research issues and cause-effect scenarios identified by farmers and researchers;
- other institutional partners identified and perceptions understood;
- joint understanding and description of land productivity decline and major contributing factors by different wealth categories;
- interactions of policy, gender aspects, market forces, among others, understood by researchers;
- farmers' perception of productivity decline, their priorities, and principle constraints.

After conducting the diagnostic work, researchers reverted back to their original "habit" of deciding on experiment themes, controlled implementation, ignoring differences identified among farmers, and working as individuals on fragmented components of the system. At this point, the research program was halted upon agreement that further training in the use of participatory research methods in other phases of the research process was required. It was decided to geographically concentrate research, to work in a multi-disciplinary team, and to use resource maps and a "niche" analysis to help integrate and better orient the research agenda according to varying needs and resource levels of the farmers. There were a series of tools designed and implemented (see table below). The specific information has been written up by most of the benchmark locations. The various activities have led to the identification of research areas that have been prioritized and selected by farmers.

There is still need to fine tune the analysis of the resource base and to direct the activities towards farmers with different endowments. We are learning that participatory methods, particularly when using them in the research process, are not easy to learn. There are multiple points where decisions have to be made – especially in experimentation – that older researchers feel uncomfortable with and younger scientists feel inexperienced. The institutional support is limited – research review sessions where uninitiated colleagues critique the methods, make it difficult for the new practitioners to defend their research designs.

Agroecosystem health focusing on soil fertility maintenance and improvement from the perspective of different resource endowed groups

We have found that farmer generated diagrams (cause-effect trees, system nutrient flow maps, and the like) clearly show the inter-related aspects of their system. We have tried looking at the various scenarios from a farm perspective, a wealth group perspective and from a community perspective.

The “wealth” groups (we prefer to call these resource endowment groups) were delineated by key informan members of the community. The method is adapted from the methodology developed by Barbara Grandin in the early 1980’s. It entails using a village residency list, putting these on cards and having key informants sort them into piles of people/families with “like” conditions. The final step is to have them describe the reasons or criteria they used to delineate the different groups. These groups were the starting point for focused group discussions and resource mapping. From individual maps one can see the degree of variation within a given group and composite group maps provide additional information. Researchers can get ideas of common versus specific interventions that people can implement according to the resources available and potential implementation constraints. The diagrams are therefore be an entry point for discussion, can serve as a “baseline”, and can serve as a planning mechanism where farmers can add in arrows where they suggest changed or new flows of nutrients, etc. (The Kabale site is complicated by the fact that a catchment is managed by non-residents as well as residents.)
As management of soil fertility is related to many aspects of land use and management including socio-economic factors such as labor, land use rites, bylaws, markets (for inputs and products) as well as off-farm aspects, the researchers and farmers complete a fairly wide analysis of the whole agroecosystem. One cannot improve soil fertility without understanding the context in which the technology might be used and to identify various leverage points in the system. We have found niche analysis to be useful and this helps farmers also to think of leverage points. Niches, that are areas in the landscape that can be improved, provide an opportunity, or be further intensified are jointly identified and discussed by the different socio-economic groups. So far farmers have been most interested in increasing their returns to land and labor, given they have very small pieces of land. Assuming that various interventions will do this, researcher’s are interested in monitoring whether or not this will increase farmer’s level of investment to improve or maintain soil fertility or whether increased returned will be used for other necessities.

Most of the benchmark teams have now finished this process and have embarked on research with farmers who have organized themselves into group on things that are of a high level of interest to them. The tool table below describes the process that was used.

Method or Process	Pros	Cons or difficulties
Resource flow maps	Multiple uses; farmers involved; good planning tool; researchers understand farmer ITK & classification systems	Variation difficult to handle; analysis not that easy
Resource endowment ranking	Helps researchers appreciate differences & incorporate into strategy	Did not capture gender differences; results kept separate & not always used; somewhat superficial & deeper understanding of SE issues needed

Method or Process	Pros	Cons or difficulties
Farmer research groups	In touch with greater number farmers than if worked with individuals; farmers can better impose their own organization & decision making	Researchers don't always know who is who with collaborating farmers; researchers have little knowledge of indigenous groups
PAM	Improves understanding of agroecosystem; farmer-researcher links improved; greater involvement of farmers in the process	Lack of capacity & acceptance by researchers; difficult for researchers to work in an integrated fashion in teams; experimentation aspects pose the largest challenge.

Diagnostic TOOLS

Objective	Activity	Details	Tools
Understand: community level resources , organization and information sources	Community maps and organizational diagramming	Identify overall land use types Community perception of resources Niches in landscape - good and problematic ones Resource sharing issues and related stakeholders and their viewpoints	Community map Information source diagram Institution organization diagram (local and "service")
Understand resources of various resource endowment "profiles" including variation within and between profiles and relationships between profiles	Farm level resource inventory and flows a> individuals in each profile b> joint profile c> plenary	Using on-farm mapping cover: land types (ownership, renting in & out); labour flows, food stocks (temporal), livestock feeding mgmt (consider spatial and temporal dimensions), manure, crop residue, etc. use, nutrient management (consider ITK), water. Make an inventory of plants (consider indigenous knowledge, uses, abundance)	Farm maps Plant inventory Temporal diagrams of food stocks, livestock feed availability & sources
Analyze resource base and use to identify sufficient and deficit areas. For deficit areas look at impact and coping strategies	Using farm and community maps analyze resources a> profile groups b>community	Identify "good" and "problematic" areas at farm and landscape levels in time & space. Find out current coping strategies and use causal analysis if problems are multi-faceted & complex	Focus discussions Causal analysis if needed
Discuss solutions to issues bringing farmer and researcher perspectives/knowledge together	Inventory potential solutions and potential impacts on farm and landscape	Prior to activity researchers should take stock of what technologies are on the shelf that would be of interest to farmers and related to problems identified	Consider possible need of helping farmers visualize interventions (farmer visits, key informants, "technology market", videos?) If can't be done at this time, consider as a possible activity in action plan
Develop a vision of the future given discussion of various options and understanding developed of potential impact	Use farm maps & diagrams to visualize future change	Consider intensification options to: increase income, food security, feed for animals and improve NRM	Maps and focus group discussions with community and profile groups
Jointly develop action plan	Community action plan	Discuss starting land husbandry "committee" and develop plans for near future activities: identify options, training of farmers in scientific principles on related subjects, sensitization of technology, screening of species, seed/planting material multiplication, farmer and researcher experiments	Depending on interest plan in large or small groups.

Soil and Water Conservation – Historical and Geographical Perspectives on Participation

Alistair Sutherland

1. Case Study Overview

1.1 Project context

The Promotion of Soil Conservation and Rural Production (PROSCARP) is a national level project with the objective of improving nutritional and health of smallholder farmers in Malawi. It works through Catchment Area Development Committees (CADCs), which have mostly been elected in village meetings and which cover a defined area. These currently number over 300 and are scattered throughout the country. The project aims to work in a participatory mode with the CADCs, and also with other agencies. It recognises that this is not easy because of the large size of the project, and the historical legacy of a national extension system that has been top-down in nature and is currently under-resourced and demoralised. The project offers a range of soil and water related technology options to farmers including realignment of ridges on the contour, vetiver grass, green manure crops, legume rotation crops, agroforestry and minimum tillage. In order to encourage uptake also uses incentives such as free seeds and seeds on loan, payment for labour on vetiver grass nurseries and provision of village wells and pit latrines.

1.2 Issues of concern to donors and project management

Several issues of concern have arisen during implementation of the project including the following:-

- The spread of technologies to neighbouring communities has been much slower than expected, limiting geographical impact
- It is not clear how the CADCs function once they have been elected, but some have been perceived as operating like exclusive clubs – restricting benefits to a few community members,
- The local extension workers may be spending too much time (from the perspective of their line managers), or not enough time (from the perspective of the project) in the catchment areas.
- A high proportion of project costs go on administration and related recurrent costs (travel and field allowances) compared to what reaches the communities directly.

The project management is concerned that implementation should be more participatory, and studies at village level using PRA tools were conducted in order to explore the above concerns.

Overview of the study findings

Villages were visited and a small study team met with the CADC members, local extension staff and other members of the community over periods of one to three days per area. Discussions were held with individuals and with focus groups, and included some ranking and time-line exercises. Where different focus groups met to discuss specific topics, they were encouraged to share their findings with each other, and discuss further the implications for the soil and water conservation programme in their area.

Reasons for the slow spread of technologies included the fact that some were related to the incentives provided; a technology had been adopted to receive an incentive. Another reason was access to technologies and licence to distibute those that were available. The technologies such as vetiver grass were seen to be the property of the project and its CADCs, and therefore it was felt that approval from above might be needed in order to pass these on to communities outside of the defined catchment area. Another reason was that the technologies had not yet showed clear benefits (e.g. agro-forestry species) or were not suited to local conditions (e.g. crop rotation in areas of very limited land).

CADCs were found to function somewhat differently in each area, depending on how they had been established and how the local people (including local extension agents) themselves had taken them forward and interpreted instructions from the project. A number had been negatively affected by village politics, a fact of life in rural Malawi. CADCs were most functional when they had effectively incorporated local village leadership, rather than being used as a vehicle for one faction to challenge the current village headship. This raised further the issue that committees based on support from local political positions (based on people groups) often did not correspond with ideal geographical areas for integrated (above field level) soil and water management.

Local extension workers most acknowledge that they spent a disproportionate amount of their time on project related work, rather than their general duties. They justified this in terms of the resources from the project and interest from farmers in the CADC areas. They also noted that they had impossibly large areas to cover, and even without a more intensive project would not be able to cover all their mandate area. This raised the issue of the potential side effects of introducing more intensive extension approaches in the context of an expanding rural population and a shrinking number of extension staff lacking in mobility.

The donors concern that insufficient project resources were going directly to the community raised the issue of how to stimulate soil and water conservation in a sustainable manner, without paying local people to participate. More direct payments to communities may have the effect of being a disincentive to other communities not included. It was recognised that extension staff needed incentives and to be rewarded for good work done as facilitators and encouragers. Are poverty alleviation (in the short-term) and participatory and sustainable soil and water conservation compatible project objectives?

2. Pros and Cons

These relate to the general design and effect of the project, and specifically to the study commissioned into issues of concern.

Pros - general

- A large number of farmers have been exposed to a range of technologies
- A significant number of farmers have received benefits in terms of cash payments and increased production from using the technologies provided,
- Front line staff have increased their technical skills and also skills in working through local committees, and training farmers to train other farmers.
- Farmers have been trained in soil and water conservation techniques.

Cons - general

- Technologies have not been systematically adapted to local conditions through a participatory research process,
- Local field staff and farmers have not been effectively empowered to evaluate new technology and reach out and initiate wider spread of appropriate technologies,
- Provision of incentives to targeted group has discouraged technology uptake by a wider group of farmers over a larger geographical area.

Pros – specific to study

- Communities involved were encouraged to reflect on their experiences with the project, and to look ahead to the time the project finishes,
- The project activities were placed in historical context, both for the local community and for the project staff,

Cons – specific to study

- Expectations were raised, both for villagers and local field staff, during the meetings.
- It is not clear whether the project will have the capacity to address the issues raised, particularly the plans of the local community and field staff to further expand the geographical scope of the project in response to demand from neighbouring communities who have perceived the benefits.

3. Method example – Time-line chart of soil conservation in the community

During the CACD study, the team was conscious that local headmen may dominate group discussions with CACD members and other farmers. At the same time, most of them being elderly and travelled have considerable historical knowledge of their area. At a meeting with the headmen, they were asked to compile a time-line of soil and water conservation in their area. Later on they were asked to estimate what proportion of the community had implemented the conservation measures described in the time-line. . This was done on the ground and later transcribed. The results for one community are shown below:-

Village Headmans' estimates on proportion of households using different soil conservation measures – Mchilawagalu Catchment 23 October, 1998.

Type of technology	Before 1947	1947- 75	1975-1992/3	1992/3-1998
Akatatu (mounds); the indigenous method to prevent crops being destroyed by runoff during heavy rain.	100%	30-40%	20-30%	10-20%
Widely spaced larger ridges; advocated and enforced by the colonial authorities.	-	50%	30-40%	20-30%
1 Yard apart straight ridges; as part of hybrid maize planting recommendations.	-	-	40-50%	10-15%
Realigned marker and contour ridges (as part of PROSCARP project)	-	-	-	69% on PROSCARP sites and 50% on non PROSCARP sites

The chart was discussed with the headmen at first, and later with a larger group. A striking feature was that the changes in soil and water conservation practices documented related to physical structures at field level. Cultural practises to improve soil structure and fertility were not mentioned, and neither were larger structures (such as cut-off drains). Furthermore, the changes listed were all those initiated by external agencies. There was no mention of processes and innovations that had taken place as a result of local initiatives. This raised important concerns about "ownership" of technologies, and indeed about the technical efficacy of the technologies that had been promoted at different periods. Was soil conservation merely seen as a response (more of less willing) to external pressures and incentives, as opposed to a local effort to improve productivity and conserve soil for the future? A discussion around this, and why some people had realigned ridges while others had not provided a lot of information about how the local CACD operated and the role of incentives in uptake of new technology.

**Long-term Natural Resource Management Research in Intensive Irrigated Systems:
ICARDA's Experience in Egypt.**

Richard Tutwiler

Since 1994, ICARDA scientists have been working with colleagues in a number of Egyptian research institutions to design and implement a program of resource management research in key agricultural environments in the country. After a process of literature reviews, rapid appraisals, formal farm surveys, and planning, log-term trials were established at four irrigated sites (one each in the Delta and Middle Egypt, and two in the newly reclaimed desert lands, known as New Lands) and at one rain-fed site (near Rafah, North Sinai). There are three major research problems at each site. Water (both quality and quantity) is the paramount concern at all sites. Maintaining soil fertility is essential in the old lands of the Delta and Middle Egypt, but building-up soil fertility is essential for sustained production in the New Lands and rain-fed areas. The most sustainably productive crop sequence choice within rotational systems is the third issue addressed in each trial. These on-station trials are designed for a minimum of twelve years and are entirely managed by professional researchers.

Integrated with the long-term trial (LTT) at each site is a participatory research component rooted in surrounding villages and individual farms. Called Long-term Monitoring (LTM), this component is also designed to have an extended life beyond most participatory research activities. The purpose is to establish a continuing dialogue with farmers concerning their farming practices, management decisions, and the related conditions of their natural resource base. Long- and short-term farmer objectives, perceptions of the qualitative aspects of the resource base, and producer technical knowledge of resource maintenance and utilization are critical aspects of the dialogue. The most important objective is a longitudinal study of the resource management practices followed by farmers in response to changing natural, economic, and social circumstances.

Directly linked to the dialogue with farmers is the documentation, through periodic biophysical measurements, of changes in the status of natural resources on representative farms over time. The purpose of combining farmer participation with biophysical measurements is to develop information, communicated to the participants, on the interaction between natural resource conditions and farmers' management practices, in full recognition that the interaction is not uni-directional. An institutionalized LTM system will provide a mechanism for the two-way interaction and exchange of knowledge to farmers on improved management practices and their effects on natural resource health. A multi-disciplinary research team is carrying out this monitoring work at each location. Each team includes members of local farmer associations, local extension staff, professional researchers from various institutes, and participating farmers whose resources are being monitored and who provide information on production and management practices.

The selection of farmer participants started with a carefully prepared list of environmental criteria relevant to each location, including hydrological and soils factors and cropping patterns. Socioeconomic factors like farm size and type, natural resource endowment, social background and education level, and household composition, were given equal weight. A random selection of farmers was made from lists prepared for each site. The farmers were visited and the purpose and activities of the LTM system were thoroughly explained. Farmers were asked if they would like to participate, were informed of the amount of time and information required, and were told that it would be a long-term commitment. The eighty-five farmers who agreed to join during the initial years of developing the system represent the range of social, economic, and natural resource conditions found at each study location. In anticipation of changes in participation over the ten years, provision has been made to allow new participants to join while maintaining the integrity of the research design. During the first year of full-scale research activities, only one farmer dropped out. Three new farmers petitioned to join the research team in their areas.

For each of the participating farmers, socioeconomic information, farm management decisions, and perceptions of resource conditions and productivity performance are being collected every six months, after the main winter and summer cropping seasons. Measurements of natural resource conditions are done on different schedules according to scientific requirements. In addition to basic information on crop sequence, crop rotation and management practices, input use, productivity and economic returns, data are also collected on labor use and sources, household composition, income sources, and household investment patterns. This information will explain why farmers made the decisions they did and so facilitate the tailoring of recommendations and regulations to promote profitable and sustainable production practices that are realistic and practicable. A review workshop is held once a year to bring together the research teams, including farmer members, to discuss the results and any observable trends in the information collected. In the venture described here, Egyptian farmers, researchers and extensionists are together building and testing a new research paradigm by which the processes of agricultural production, both socioeconomic and biophysical, and their effects on the natural resource base, are studied holistically over time.

Case Study NRM –Scientists Meeting 1-3 September 1999

Water Management, Agricultural Development and Poverty Eradication in the Former Homelands of South Africa

by
Barbara van Koppen
International Water Management Institute

16 August 1999

1. Stakeholder involvement and gendered poverty eradication; pros and cons of cb-nrm; the need for water rehabilitation.

The following case specifies the 'stakeholders' along gender, class and ethnic lines. Secondly, the case shows that 'stakeholder involvement' and its corollary of involvement by external agencies, can have very different impacts on smallholders, depending upon the *substance* and *context* of the 'involvement of the different parties'. Thirdly, the case addresses competition in resource use under increasing scarcity of the resource. These specifications allow identifying the relationship between NRM, stakeholder involvement in water resource management, and gendered poverty eradication. Pros and cons of cb-nrm in the light of poverty eradication are evaluated taking these specifications into account.

The Arabie/Olifants Scheme in the former Lebowa Homeland, Northern Province of South Africa

In the arid and semi-arid regions of South Africa, as in many other countries, irrigation is a key to increase farmers' agricultural productivity and incomes. In South Africa, most irrigation water resources are used by large-scale white farmers on their private farms. Irrigation in the former Homelands, where most of black South African farmers live, has hardly been developed. In the few schemes that were developed under Apartheid, such as the Arabie/Olifants Scheme in the former Lebowa Homeland (2000 ha for 1650 smallholders), parastatal agencies and commercial companies used to dominate agricultural operations and water management and also derived an income from such schemes. Active farm decision-making and benefits for poor black farmers on these plots were limited. For the former policy makers in these homelands, agriculture was primarily meant to provide a reserve of male migrant labor needed for the upcoming mining and mineral industries. So agriculture should just provide some subsistence to women, the main farmers, and enable them to take care of the children, the sick, and the migrants who returned at their old age, or –as increasingly the case- the returning young men who are retrenched.

However, since 1994, the new government has drastically rejected the Apartheid era, including the support to schemes like the Arabie/Olifants scheme. Black farmers, the large majority of whom are women, should now 'stand on their own feet'. In the larger part of the Arabie/Olifants Scheme, this sudden change has simply led to complete abandonment of agriculture with negative impacts on smallholders' income and wellbeing. These smallholders were not able at such short term to find a replacement for their former access to loans, plowing services and markets. The recent interest of the Land Bank to provide loans to irrigators only concerns those farmers who have considerable additional income for loan repayment. They are not the poor.

The few farmers who tried to take up agriculture again, found themselves confronted with break-downs in the infrastructure. Due to a lack of funds, the parastatal that still has formal ownership and responsbility for repair and maintenance, did not repair either.

In smaller portions of the Arabie/Olifants Scheme, however, the traditional (male) chiefs succeeded in establishing contacts with LONRHO, a commercial cotton enterprise, for contract farming on their own plots and those of neighboring farmers.

Irrigation Management Transfer

The government currently prepares Irrigation Management Transfer of smallholder irrigation schemes, including the Arabie/Olifants Scheme. This implies that ownership of the infrastructure of black irrigation schemes and all rights and responsibilities for water management are transferred to the users. The South African Water Act of 1998 enables smallholders to organize into Water Users Associations, as was already done by the white Irrigation Boards. The WUA is recognized as the legal entity for ownership of infrastructure.

It is very relevant that, formally, membership of such WUA is related to water use on a specific portion of land, rather than to ownership of that land. Almost everywhere else in the world, the formal rule that water rights are vested in land owners rather than water users, excludes the majority of the women who tend to farm on their in-laws land, and many poor male and female tenants as well. It is also significant that the South African government goes further than most other governments, in actually considering the transfer of *ownership* of infrastructure, and not just some management tasks without much rights, as many governments elsewhere do. Thus, the potential rights for women smallholders under irrigation management transfer in South Africa are stronger than anywhere else.

However, it is obvious that ownership of infrastructure that is basically a liability to the government, does not help poor women smallholders in the Arabie/Olifants Scheme who still have no access to other inputs and markets which are indispensable to use these water resources productively.

2. Research, networking and joint learning: scenarios of NRM and policy design for gender-balanced poverty alleviation

One of the missions of IWMI's Policy, Institutions, and Management Program (under which the Gender, Poverty, and Water Project falls) is to analyze current and potential forms of natural resoure, cq. water management, design policies and identify the possible impact of different policy-options and interventions on poor women and men. To that end IWMI is in a continuous dialogue with government officials and NGOs from field level to the Minister to foreign donors, and is often pivotal in facilitating cross-communication between different institutions, such as the Department of Agriculture and the Department of Water Affairs and Forestry in the present case.

At this moment IWMI develops comprehensive Irrigation Management Transfer scenarios, which try to build upon likely, either desirable or undesirable paths of agricultural growth and NRM. The following future development and impact on gendered poverty eradication in Arabie/Olifants Scheme seems likely, especially if the process of Irrigation Management Transfer is largely implemented in isolation and through the male elite only. In fact, the first field-level initiatives up to now point in that direction.

Exclusive NRM
In this scenario, agricultural production and water management in Arabie/Olifants Scheme will become 'exclusive', in the sense that irrigated farming will be confined to a minority of an entrepreneurial 'elite' (who still cannot be compared to the white large-scale irrigating farmers). This elite are relatively better off, are literate, mobile, male, and well embedded in policy networks, and therefore, succeed in overcoming current constraints of capital and input provision, access to land and water, marketing strategies. Thus they establish more productive and larger-scale agriculture. The impact on the productivity and the wellbeing of the poor can be substantial, through trickle-down effects, such as wage labor creation, and employment in spin-off economic development like trade, improved demand for services, etc. On the other hand, further land concentration, which is needed for the expanding farm sizes of this 'elite', and net labor replacement with mechanization may also negatively affect the agriculture-dependent non-elite who cultivated those plots themselves before the government withdrew its services.

This growth path will be irreversible because the competition for water is strongly growing. Although the South African Water Act favors redressing inequities along gender and race lines of the past, the implementation of this law will be troublesome. It is the more difficult as current water users in the basin will have to give up their current water rights. Concretely, this means that new entrants who want to obtain licenses for the installation or rehabilitation of new water infrastructure at the expense of current license holders, are hardly able to get those.

Inclusive NRM
The challenge if one aims at gendered poverty eradication is to explore another path of NRM, which is more 'inclusive'. This means that it enables a majority of current smallholders with limited access to land to be included as new owners of the irrigation infrastructure but also to get new access to loans, inputs, and marketing channels. Local leaders or entrepreneurs play an important role as driving force in those innovations, but at the same time they serve the needs for such access by a majority of their fellow farmers. The leaders remain accountable to them.

An important element of both scenarios is how they affect gender relations within the farm household. A possibility which is most likely in the inclusive path of growth, is that the semi-autonomous intra-household sub-systems as they exist now, develop into further individualized sub-systems, managed by either men but mainly women. Another possibility, that would reinforce exclusion, is that men increasingly become the farm managers when agriculture becomes more productive, relegating women to a position of underpaid family labor. Or forms of joint and egalitarian farm management could evolve.

An inclusive growth path, if it is realized, is not only likely to better fit the stated policy aims of poverty alleviation for a large number of people. It also holds the promise of higher land productivity, conform evidence world-wide that shows a negative relationship between holding size and productivity per unit of land.

A participatory analysis to identify problems and the responses that poor farmers in Arabie/Olifants Scheme themselves are developing towards the current stagnant situation, is one important part of this scenario development, and the sound basis for action. Bottom-up information, organization and transparent election of committee members are likely ingredients of the establishment of WUAs and leadership, that should expand beyond water management only. Mediating exchange, analysis, and comparison of solutions that elsewhere in the Northern Province, or the world, have been found for similar problems is the typical contribution of an international research institute.

Kit Vaughan CIMMYT Zimbabwe.

Case study: *CIMMYT Southern Africa Risk Management Project (RMP*)
Improving farmers risk management strategies, for resource poor and drought prone farming systems in Southern Africa.

Overall project objective

"*Evaluate the climatic and socio economic risk implications of soil fertility technologies being developed by members of the Southern Africa Soil Fertility Network through the combined use of crop simulation models and farmer*

Context

Climatic risk, primarily resulting from erratic rainfall is a major constraint to the development and adoption of improved technologies for smallholder maize systems in Zimbabwe and Malawi. Some 70 % of regional maize production originates from predominantly rainfed smallholder farms of less than 5 ha. Beside the constant threat of drought, farmers also face the challenge of declining soil fertility in an economic environment where external inputs are both costly and risky to use. The combined effect of climatic variability and fluctuating market prices often mean that farmers are gambling on an uncertain yield and economic return, they are thus exposed to a high degree of risk and uncertainty. The soils in Zimbabwe and Malawi's smallholder areas tend to be sandy with limited organic matter, low nutrient content and low water holding capacity. Farmers access to organic manure is limited and inorganic fertiliser costly and difficult to secure. To be attractive to farmers under these circumstances, new productivity enhancing and resource-conserving soil fertility technologies must not increase farmers risk, but aim to reduce it. Such new soil fertility technologies must thus be compatible with farmers' risk and livelihood management strategies.

Biophysical themes: *Soil and water rehabilitation*

Declining soil fertility has been identified as a key constraint to fostering production increases within resource poor maize based farm systems of Southern Africa. The project emphasis is thus focused on the evaluation and adaptation of soil fertility related technologies developed by researchers under the Rockefeller funded soil fertility network. The Risk Management (RMP) project aims to combine computer crop modelling with farmer participatory research to evaluate the different biophysical and socio-economic performances of a variety of soil fertility technologies.

Historically, feasibility assessments of different soil fertility technologies have been limited by a lack of agricultural and socio-economic data. Past research has focused primarily on a singular approach to the problem of declining soil fertility. Work has often ignored farmer's indigenous knowledge, failed to understand the dynamics and systems complexity of soil fertility problems and rarely considered farmers own integrated nutrient management practices. These problems are further compounded by the long timeframe (at least three years) often needed to evaluate soil fertility technologies. Computer models of crop growth permit the simulation of a range of different soil fertility technologies across different seasons, soils, and cultural practices and throughout time. This can drastically reduce the need for long-term trials, as model scenarios can be developed of crop performance and soil sustainability over a thirty-year period. The participatory work enables a systems perspective to be adopted on soil fertility related problems and solutions. Farmers, researchers and extension agents all play an active role in defining soil fertility problems, outlining possible solutions and identifying key research priorities. Coupling the extensive data sets generated by the modelling work, with findings from the participatory research activities, enables assessment of the attractiveness of the different technologies to different farm environments

Crosscutting concerns*: Integration of agro-ecological systems components*

Past soil fertility research in Zimbabwe and Malawi has often ignored the complexity of inter-relationships existing between the different agro ecosystem components and the socio-economic environment. The RM project utilises a systems perspective approach that tries to incorporate a hard (quantitative) and soft (qualitative) systems approach. This approach aims to explore the linkages between Agro-ecosystem factors and the socio-economic environment. The participatory research sub-project conducts systems diagnostics, identifies stakeholders, elicits farmer taxonomies for soils, farmers and climate, uncovers farm family livelihood strategies, and fosters farmer experimentation on soil fertility management practices. The modelling sub-project collects data for the APSIM computer model validation and fosters APSIM model use in examining the biophysical performance of well-defined soil fertility management practices under specific soil and climate conditions.
By marrying the two sub-projects:

- farmers' own soil and climate taxonomies can be used to develop soil and climate profiles for model runs;
- farmer developed technologies can be evaluated by the model;
- Model outputs can be evaluated by farmers within the context of their own livelihood and risk management strategies.

Methods and processes for building partnerships: *Collective learning decision making support and Farmer- researcher- institutional linkages*.

The RM project works in collaboration with focused groups drawn from the University of Zimbabwe and Malawi, The National agricultural research programmes and the Africa centre for fertiliser development. Support is given to improve partners capacity to better assess the risks associated with alternative maize system and soil fertility management practices under varying climate, soil and socio economic conditions. Grants are provided by the project to cover research costs and support and training is given in modelling and participatory research techniques. The project also has links with ongoing ICRISAT and CARE. Activities. Evaluation of the focus groups soil fertility technologies is undertaken in conjunction with researchers and farmers, this integrated approach allows researchers to draw on their own and farmer's experiences in a shared learning environment.

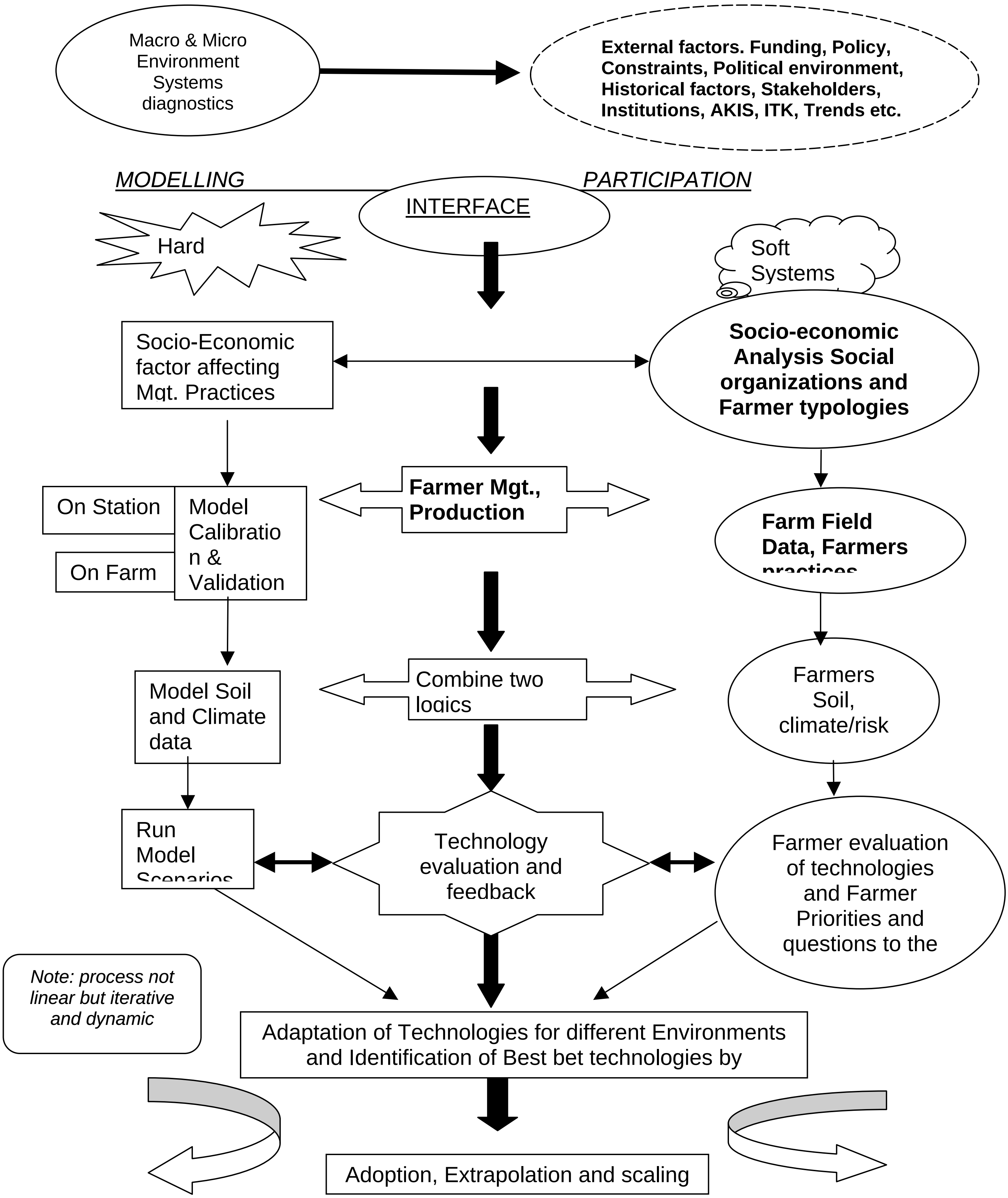
Activities include designing a framework whereby we can run simulation models based on farmers behavioural management patterns (based on different socio-economic groups, resource availability and AEZ factors etc. The idea is to develop an interface that enables the discussion of outputs and key management variables between the model and farmers, with farmers involved in assessment of model output scenarios and with farmers in turn asking questions to the model.

Focused planning meetings are conducted to enhance the organisation of the team. Time is spent on developing common workplans and research frameworks for all the project stakeholders. Due to the highly original nature of the project, it was decided to start first with a macro systems diagnostics approach. This process enables the identification of key project related stakeholders, secondary data, partners for implementation and scaling up and partners for identifying appropriate tools and techniques for fieldwork. Discussions were held with a diversity of stakeholders in Zimbabwe and Malawi including the World Bank, DFID and individuals within a variety of research institutions. This process also enables the establishment of a strong network of contacts throughout the region and the identification of key stakeholders for project related activities

Fieldwork activities have concentrated on forming or strengthening existing farmer groups. This was conducted in two sites in Zimbabwe and one in Malawi with collaboration between farmers, extension staff and researchers to set up further groups for the forthcoming 1999/2000-crop season. Activities also included participatory wealth ranking, the development of farmer taxonomies of soils and climate, together with indications of management options and practices, for differently resourced farmers under varying soil and climatic conditions.

A key collective learning and decision support tool is the use of participatory Agro ecosystem modelling maps (see methods below). This enables farmers and researchers to utilise a common learning tool for understanding the systems context of soil fertility. The methodology development for the Modelling and FPR interface is considered to be an iterative and dynamic process, with a diversity of tools and techniques being used, refined, adapted or discarded as necessitated by the process and project stakeholders. This is an immensely creative and ambitious research agenda. This kind of marriage is highly unusual, but holds great promise for a more effective evaluation of soil fertility management technologies, under highly variable and risky climate conditions.

CONCEPTUAL OVERVIEW OF THE RISK PROJECT MODELLING AND FPR INTERFACE



Pros and cons of Risk Management Project process

Process and Methods	Pros	Cons
Computer biophysical crop modelling	Enables evaluation through time, different variables including climate, soils and mangement. Quick and relatively cheap?	Only as good as the data that is used in development. Cannot handle socio economic variables. Data intensive to establish. Some factors effecting crop performance outside of models control. Who are the model users and how to integrate them into the NARS?
Model to farmer interface	Integrates disciplines and can bring modellers into contact with farmers and visa versa. Quick feedback times. Can be used a s a collaborative learning and decision support tool.Possibile to identify and target key research priorities	Knowledge gaps, outputs highly subject to interpretation. Are farmers questions relevant to the models capabilites?. Are model outputs in any way useful to farmers?
Use of GIS	Useful for scaling up. Links different landscape levels thus community to district to region. Can link to LUP and targeted zonation.	Expensive start up costs, who owns and generates the data? Can be top down and seek to centralise information owned and accessed by experts
On farm testing (participatory technology development and evaluation)	Allows farmers greater freedom to experiment. Brings stakeholders together. Develops greater understanding of farmers priorites and NR and SE factors effecting technology performance. Captitalises on farmers IK.	Can lose controls, difficult to manage and without rigorous controls hard to identify variables effecting crop performance. Requires greater level of researcher farmer interface, this assunes resources or motivation is there to do this.
On station	Rigorous controls and design reduce variables effecting crop performance.Staff more familiar with process. Infrastructure often exists and easier to manage.	Long timeframe, excludes socio economic variables associated with mangement. Controlled environment
Participatory field techniques (wealth ranking, transects, etc)	Enables a diversity of actors from different SE groups and instittions to work together. Capitilises on IK Relatively simple, cheap?and quick.	Subject to fuzzy responses. Aplicable to what scale? Lacks rigorous frameworks and safeguards Little immediate direct benefits to participants.
Participatory Agro ecosystem Modelling	Allows for a common shared learning arena, enabling different stakeholders to work together. Can develop diffeerent scenarios for varying NR and SE conditions.	Time consuming, how representative of different scales, NR and socio economic environments?
Working with partners	Enables closer integration of specialisms. Transfer of knowledge and skills. Important for scaling up. Fosters learning and acceptance of new approaches	Assumes partners are keen to cooperate. Often focus on specific technologies not on integrated nutrient mangement approaches.

<u>Methods for increasing Stakeholder Participation</u>

In relation to the RMP project case study, the RMP team are designing and evaluating the interface to link bio physical computer crop modelling with farmer's logic.
(See diagram above)

The first step in the research process is a stakeholder analysis to identify different institutions and influential individuals with interest or influence in the project. This is then followed up with the participatory development of farmer typologies utilising wealth-ranking etc. This enables an identification of the key divisive variables between the various Socio economic groups and is predominantly based on seasonal access to resources. Using focus group discussions, transects, soil sampling, agro ecosystem maps and climatic timelines, the team undertakes the participatory development of farmers soil and climate taxonomies, with indications of production and management practices and constraints by climate and soil type. These are then linked across a matrix format that identifies clustered management practices (e.g. rules of thumb) for different typologies of farmers under different soil, climatic and socio economic conditions. This enables the model to run different crop, management and climatic scenarios based on farmer's classification criteria for soils, climate conditions and management practices.

The second stage is the feedback interface between model outputs and farmer questions to the model. We have used a number of role playing "*if and when* "scenarios to develop discussions on key areas. In order to integrate the process and bring all stakeholders together, we are developing a simplified participatory model that allows for full farmer- researcher involvement in the communication and research process between farmers, modellers, field researchers and extension agent's etc.

Through a participatory process a simple Agro ecosystem map is developed, with either a group or an individual farmer. This process is iterative and not seen as a one off but rather a dynamic process whereby the researchers and farmers can together, continually revisit and update the map as necessary. The map depicts the key components of the farm agro-ecosystem system (field types and location, crop types and patterns, livestock etc) and their basic resource flow inter-linkages. On the resource flow there is a particular focus on soil fertility related practices, whether this be fertilisers or the role of crop residues etc. Using simple symbols or artefacts representing different soil fertility inputs e.g. inorganic N, manure, crop residues, labour, termite soil etc, you can ask farmers to demonstrate the allocation of inputs and crop management practices to different parts of the farm system. This can then be expanded to demonstrate different scenarios under different climatic conditions e.g. drought, and farmers responses to changing climatic conditions or to elaborate on household resource availability etc.

After developing the agro-ecosystem map we ask farmers to demonstrate their soil fertility resource allocations for the past and present season by crop and field types. Further discussion and use of focus discussions elaborates on the factors influencing farmers targeting of resources. This creates an enabling dialogue between all parties on farmer's decision-making processes. This fits with the project approach, that aims to combine hard and soft systems methodologies for forging a stronger link between applied technical scientists, social scientists and farmers. This method and process enables a forum to be developed in a participatory process, whereby the very different mindsets of all the actors involved in the research can envision a common environment and develop a platform to work together on common problems and solutions.

Participatory mapping, analysis and monitoring of the natural resource base in micro-watersheds: insights from Nicaragua[3]

Ronnie Vernooy

Background: about (micro)watersheds

Recently, interest in watersheds and watershed management has gained new ground. Agricultural and social sciences (eg rural sociology) in a variety of countries have moved beyond the plot, farm/household as well as community levels. The complexity of natural resource management problems have made scientists aware that the best of agronomy, ecology, policy research and socio-economic research needs to be brought together to understand resource (flow, use and degradation) dynamics. New insights and methodological tools from landscape ecology, systems theory, actor-oriented rural sociology and learning theory are brought together to provide more adequate and useful knowledge. The International Centre for Tropical Agriculture's (CIAT) "Hillsides project," to which we will refer here, is but one example of a project that uses this new approach to deal with the multiple aspects of natural resource management questions.

Watersheds are considered a useful unit of analysis and action, because they represent a basic natural system in which soil-water interdepencies condition land-use patterns at different scales, from the plot to the farm to the micro-watershed and watershed level. Hence, watersheds are a useful unit for physical reasons : they are drained by a single water course flowing downhill -irrespective of political boundaries- that holds inter-related natural resources (water, soil, vegetation) linking uplands and downstream areas. They are also a unit of multiple and interdependent, sometimes conflicting, interests.

Two key elements should be considered when dealing with watershed *management* : 1) the different interests of people in the watershed (users) are assymetrically interdependent (example : upstream use of land and water will directly affect downstream use options) and many problems related to resource management are trans-boundary (eg deforestation, soil erosion, pests and diseases) ; 2) a degree of uncertaintly exists as to the impact of this interdependence (example : downstream users do not know for sure how upstream users will behave, whether they will or will not consider downstream effects of their actions).

---

[3] This paper is based on fieldwork carried out during 1997-1998 as part of a professional secondment from the International Development Research Centre (IDRC), Canada, to the International Center for Tropical Agriculture (CIAT). Home-base for the secondment was Nicaragua. The field-research was funded by IDRC and the Swiss Development Cooperation (SDC). A special acknowledgement goes to Nohemi Espinoza with whom the participatory mapping, analysis and monitoring was designed and implemented.

The issue of scale and decision-making hierarchies therefore is a complex one. There is a need to look at spatial complexity : plot-farm-minicatchment-watershed-agroecological zone-hillsides as well as at organizational complexity : individual(s)-household-usergroup-community-municipality-department-country-international system.

Transboundary effects (and related assymetrical externalities, i.e. unevenly impacting on landholders or stakeholders) along these scales that characterize watersheds mean that sustainable management requires collective action in some form. Hence, the logic for building and involving local organizations as a means to change the ways in which local groups interact with each other as well as with the broader society. An involvement that is expected to lead towards greater and more equitable control over resources - amplifying the range of options the less privileged people have (eg women, ethnic minorities, the landless)- while enhancing local people's involvement in policy making process at the regional or national levels -providing space for more people to make their voices heard, eg small farmers, women, artisans, as well as improving the quality of their involvement.

It is important to realize that the process of social organization in which people living in a watershed are emerged, does not necessarily overlap with the biophysical lines or boundaries ; for example, trade and exchange networks often connect across the wider ecoregion, eg along a mountain range, or into a neighbouring valley. The achievement of watershed management therefore is above all a matter of social relations, cooperation and coordination. Jacqueline Ashby, CIAT's director of Natural Resource Management, introduced the concept of social ecology (of watersheds) to capture this. Another way to capture this is the concept of the *social construction of watersheds*: sustained watershed management can only be achieved if coordinated land use for the benefit of the individual and the watershed community is adopted by local institutions. In other words, it will require a collective vision and the adoption of coordinated natural resource use and management practices.

With this in mind, research got underway in the Nicaraguan site of CIAT's "Hillsides" research project: the Calico River watershed in the department of Matagalpa. We will present here the development and use of one of the "Hillsides'" research tools.[4]

First step: an appraisal of problems, conflicts, and opportunities

In September 1997, a participatory workshop on watershed management brought together a mixed group of thirty men and women (farmers, NGO staff, and local government officials) from the Calico River watershed, who identified the key problems affecting land management and the livelihoods of people in the Calico area at various levels — community, microwatershed and

[4] The project also operates in Colombia and Honduras. The Calico watershed covers approximately 170 km2 and 3,800 households distributed over 17 communities and the town of San Dionisio.

watershed. These problems included land degradation leading to lower yields, deforestation causing soil erosion and loss of wildlife, water scarcity, and water pollution. Survey data collected in 1997 as part of a watershed-wide study on poverty confirmed these findings. The following tables present the analysis made by the participants through a *lluvia de ideas* (literally: rain of ideas) exercise, of the soils, water and forest conditions:

Soils: “Soils are the most important [resource] because we depend on them to feed ourselves.”

Problems	Causes	Consequences
low fertility	inadequate practices	unproductive
lack of nutrients	deforestation	low harvests
degraded	no conservation	
prone to erosion	farmers hardly practice organic agriculture	
over-used	over-use of agro-chemicals	
contaminated	lack of reforestation	
arid	carelessness	
quality keeps going down	expansion of the agricultural frontier	
	burning without control	

Source: CIAT-Hillsides (adapted from Vernooy, 1997: 7)[5]

Water: “We need more water.”

Problems	Causes	Consequences
a lot of contamination		
bad quality		
sectors without access		
rivers dry up	over-use of agro-chemicals	
diminishing levels in wells	deforestation	reduced human consumption
shortage from February until May	burning	need to chlorinate
the Calico River dries up in the summer	no treatment	
the wells dry up in summer		
droughts		
bad management		

[5] Vernooy, Ronnie. (1997) Memoria del taller “Manejo sostenible de cuencas: una introducción.” Managua, Nicaragua. CIAT. 40 p.

Source: CIAT-Hillsides (adapted from Vernooy, 1997: 8)

Forests: "If we would manage our trees well, we would not have the problem of water shortage."

Problems	Causes	Consequences
complete deterioration of our forests	deforestation	
extinction of native species	burning without control	
forest destruction	abuse	disappearing forests
shortage of fuelwoood	accelerated cutting	extinction of flora and fauna and precious woods
	bad management and use	
	migratory agriculture	
	lack of technical knowledge	
	lack of law enforcement	
	weakness in the law enforcers	
	lack of education	

Source: CIAT-Hillsides (adapted from Vernooy, 1997: 9)

Conflicts

The main conflict identified by workshop participants is access to and use of drinking water. Tensions have arisen between the owners of land in the upper reaches of the river and downstream communities that depend on these sources for their supply of drinking water. Downstream users complain about negligence of the landowners in terms of water source maintenance and deforestation of the surrounding areas. They are also regularly faced with threats by the landowners to cut off the water supply.

A second area of tension is between neighbouring communities where one depends on the other for its drinking water; an example of this situation occurs between the community of Susuli, where a water source is located, and the community of El Jicaro #2 which does not have its own source but depends on Susuli for water.

Several of the Drinking Water Committees are disliked by consumers because they stress the need for water-conservation.

Some farmers use river water illegally for irrigation, a practice prohibited by municipal law. Municipal authorities are powerless to stop this practice or do not bother to get involved or intervene. Downstream users complain because water flow is reduced, limiting the amount available for domestic use and human consumption.

Some people use explosives to cath fish in the Calico River, a practice many disapprove.

Access to and use of land was identified as another source of conflict. Uncertainty about the legality of the agrarian land reform process and its results continues to cause trouble, in particular for farmers organized into cooperatives. Several cooperatives in the watershed have received expropriation notices from former landowners who have returned to Nicaragua after the 1996 election of the neo-liberal, President Arnoldo Alemán Lacayo. Landless farmers complain about the unwillingness of large landowners to rent land. The Indigenous Association of Matagalpa has a conflict with the mayor of San Dionisio about landclaims and landtaxes.

Proposed reforestation activities of areas surrounding water wells in the upper watershed by down-stream users are turned down by the owners of the land where wells are loated.

A third resource for conflicts conern trees.Municipality and government authorities criticize illegal loggers and fuelwood collectors. Government authorities are criticized by communities for handing out logging permits to businessmen who do not care about the area.

We examined the results of this workshop and the general analysis of the situation in the watershed above all in terms of opportunities for action:

- for looking at natural resource management problems at the watershed and microwatershed levels;
- for improving participation (by people from the rural communities) in decision-making at the municipality level;
- for stimulating coordination among NGOs, the Municipal Development Council and ministries (to increase the impact of efforts and avoid duplication); and
- for facilitating *concertación*, where relevant, focusing on the resolution of conflicts over natural resources and, perhaps, the development of an integrated natural resources management plan.

Second step: zooming in on the 15 micro-watersheds

The September 1997 workshop on watershed management provided a general picture of the conditions of the natural resource base at the watershed level as well as some inroads into the main issues related to use, management and conservation. However, we felt that more detail was needed to answer the questions of What is happening, and according to whom ? What are the problems, (research) gaps and opportunities ? In order to get a better understanding of both the “resource and people” dynamics, we started looking for a methodological tool that would allow finding answers to these questions at the micro-watershed level.

We hypothesized that the micro-watershed level would be, both conceptually and practically, a good level or scale as it represents a space where resource flows and dynamics interplay continuously with socio-economic relationships, such as family and labour-exchange ties (known as *mano vuelta*). An image we used in the fieldwork was that of a jigsaw puzzle in which the pieces are the micro-watersheds that together form the watershed. Interestingly, this image was very helpful and easily understood by local people. [6]

The first participatory micro-watershed took study place at the end of 1997, and the 15 studies were completed in March 1998. To carry out the studies, we involved, in each of the micro-watersheds, a small groups of local key informants selected whenever possible based on their knowledge of the area. These informants included male and female farmers, local *técnicos* from the various NGO-s*, promotores* (from the NGO-s and associations) and assistant mayors better known as *alcalditos.* Male informants were in the majority, as it proved difficult to find women who were able or willing to spend a whole day with us in the field. Efforts were made, however, to capture a gendered perspective on natural resource use, management and monitoring.

Factors being examined include land use (agro-ecological zones), the state of forests, water resources, crops, wildlife, domesticated animals, pastures, and local soil indicators. In addition, participants identified the limitations as well as opportunities for agricultural production and natural resource management in the area.

The results of these analyses have been presented to key local decision-makers such as the mayor of San Dionisio, state agencies and NGOs operating in the watershed, as well as to the recently created Association of Community Organizations. The results will allow decision-makers to identify priority zones for action where natural resources are already in bad shape or are at high risk or, on the other hand, offer opportunities for alternatives. The analyses will also be helpful as a pre-hurricane Mitch overview of the state of the natural resource base and will allow for comparison with the post-Mitch situation (this study has almost been completed).

Resource mapping

Each of the studies started with the design of a local resource map in the line of now well-known PRA mapping exercises. The maps include the borders of the area according to local definitions, the hills, principal and secondary roads and paths, the rivers, creeks, springs and reservoirs as well as the principal drinking water-pipelines, infrastructure (schools, churches, health-care centers, cemeteries, coffee-washing/drying facilities, haciendas and farms), agro-ecological zones, production systems, vegetation (forest types), and soil

[6] Reviewing the Spanish literature in particular, we only found a few references about approaches or tools that we considered useful, eg Fundación-Banhcafé (1996), De Campesino a Campesino/ UNAG (1997), Sertedeso/Saúl San Martín (1998) and Unión Mundial para la Naturaleza/IUCN (1997). Building upon these references, we developed a more comprehensive, participatory tool covering mapping, analysis and monitoring. At a later stage, we also included the use of certain GIS tools to strengthen the usefulness and scope (see the training manual: Ronnie Vernooy, Nohemi Espinoza and France Lamy (1999) Mapeo, analísis y monitoreo participativos de los recursos naturales en una micro-cuenca. Cali, Colombia. CIAT.).

types. With one or two exceptions the maps gave a detailed picture of the micro-watershed landscape. They also served to define the transect for the transect walk during which a resources analysis was made (see below).

For almost all informants or cooperators this was the first time that they drew their environment. Some did not hesitate to pick up the pencil and start sketching the maps. Others were more hesitant and in some occasions, we helped them draw the boundaries as a first step. Some of the maps resulted very detailed. All maps were returned to the local cooperators for future use and reference.

Resource analysis

The maps were used to define a transect crisscrossing the major zones and production systems and passing other important resource features of the area. During the transect walk, if possible in a site with a good overview of the landscape, a resource analysis was made by the informants facilitated by the research team. These analyses were documented in a table. An example is given below.

Table: Micro-watershed natural resources analysis of El Zapote

Water	About 80% of the community of El Zapote has direct access to drinking water. The drinking water project started originally in 1986 and in 1996 was amplified to include more families.The watersource that provides drinking water is located in Susuli (the neighbouring community); additional water comes from El Chile. Water quality is regular. In the summer season there are frequently shortages due to the low levels in the sources. February-April are the critical months. Five small creeks make up the micro-watershed; they run east-west and flow into the larger creek that originates in the Piedra Colorada micro-watershed. Only one of these small creeks retains water all year long; the other four dry up in summer. Water from the creeks is used for domestic purposes such as washing and to give to animals as well. The water is also used to mix with agro-chemicals, and farmers regularly wash their spraying bombs in the creeks after use -an important source of pollution.
Forests	Very few forest patches remain; only along the creeks small areas still exist. About 35 years ago, forest still covered most of the micro-watershed, but due to the avancement of the frontera agricola, trees were cut to make place for basic grains and pastures. Trees were also cut for construction and to satisfy the increasing fuelwood demands. Species that actually can be found include: Chaperno, Matapalo, Carao, Miliguiste and Jiñocuabo. Species that have dissappeared or of which very few amounts are left include: Chilante, Laurel, Genízaro, Madero negro, Cedro and Pochote. For fuelwood use, the most used species are: Madero negro, Guacimo and Sarguayan.
Crops and harvests	Corn and beans are the most important crops. Current corn harvests are approximately 30-40 quintales/manzana; five years ago these were 55-60 quintales/manzana. Current bean harvests are 15-25 quintales/manzana; five years ago they reached 27-30 quintales/manzana. The main reasons for this reduction in productivity are: soil fertility loss, poor soil management (no crop rotation or diversification), poor and “fatigued” crop varieties (seeds), and over-use of agro-chemicals.
Animals	Only two farmers have cows, between 20-30 heads each, the species are Brahmans and creoles. Milk, cream and cheese are sold locally only. Very few families possess horses or mules; there is not enough land to herd them. Most families own chicken, for auto-consumption (eggs and meat). Wildlife is scarce. Animales have dissappeared due to the deforestation in the area and also because of over-hunting practices. Animals that still can be found include: chameleons, squirrels, rabbits, monkeys, foxes.
Pastures	The predominant species is Jaragua, but it is in general badly maintained. A few parcels of sugarcane can be found, used for feeding of cows.
Conflicts	There is problem with the owner on whose land the watersource of the community is located: the owner is cutting the trees surrounding the source. Another problem concerns the landtenure insecurity, in partiuclar for the cooperatives. There are also some problems about land inheritance on private properties.
Organizations	CARE, Popolvuh, FAMAGRO, Ecogranos, the Indigenous Association and the Coffee-growers Association, and CIAT are present with projects in the area of agriculture and natural resource management. Local organizations include: the artesanal cooperative El Malinche (leather products), the Drinking Water Committee, the Comarca Committee, the Committee of parents, and the Community Board for Progress and Charity.
Limitations	Land shortage, lack of credit, attacks of insects (crop damage), bad roads, and not enough houses.
Advantages	Good area for basic grains production, good climate, accessible for commercialization of products.

Source: adapted from Espinoza and Vernooy, 1998: 62-63.[7]

Resource use indicators

The next and final step in the micro-watershed analysis process constituted the definition of a set of “simple to understand and use” indicators and values and the application of these indicators to the fifteen identified micro-watersheds. The set of indicators was developed through a consultative exercise: a draft set was formulated by the research team based on the findings of the combined fifteen resource analyses, reviewed and then refined with the informants, and subsequently applied by the informants to their own micro-watershed during a workshop. Values given to the indicators (options were: bad, regular and good) were tabled and grouped together by component (water, forests, crops etc.; note that soils were added based on the outcomes of the soils analyses conducted during the transect walks) in order to compare results and the table was presented to and discussed with the informants in a second workshop. (In some micro-watersheds, there are clearly distinguished agro-ecological zones; in those cases two analyses were carried out, one for the upper and one for the lower part.) The table, which can be interpretated both horizontally by mirco-watershed and vertically by component, as prepared by the researchers, is presented below.

Table: Synthesis of natural resources indicators by component: the Calico River watershed

	Water	Fores	Soils	Crops	Anim	Pastu	Wildli	Orga	Other	Total
El Carrizal	14	8	20	5	6	3	2	7	10	75
Quebrachal-upper part	15	9	21	6	6	4	1	7	8	77
Quebrachal-lower part	14	9	22	4	6	3	2	8	8	76
El Zarzal-upper part	5	8	20	6	5	4	2	3	10	63
El Zarzal-lower part	8	6	25	5	8	4	2	4	10	72
El Corozo	13	7	23.5	5	8	5	2	5	11	78.5
Piedra Colorada-upper	7	8	26	5	6	4	3	5	12	76
Piedra Colorada-lower	6	6	17	5	6	5	1	6	13	65
Susuli-upper part	15	8	25	6	5	5	3	5	10	82
Susuli-lower part	13	8	20	6	6	4	2	7	13	79
El Jicaro #2	9	5	20	5	5	5	2	8	11	70
El Zapote	11	6	20	3	7	5	1	7	13	73

[7] Nohemi Espinoza y Ronnie Vernooy (1999) Las 15 micro-cuencas del río Calico, San Dionisio , Matagalpa. Managua, Nicaragua. CIAT. 99 p.

Wibuse/El Jicaro upper	9	9	23	5	6	4	2	5	8	74
Wibuse/El Jicaro lower	9	9	23	5	6	4	2	9	12	79
Los Limones	13	7	20	7	7	6	2	7	11	80
El Junquillo-Cuchillas upper part	8	10	24	5	8	5	2	5	13	80
El Junquillo-Cuchillas lower part	7	9	18	5	6	4	2	6	10	67
El Cobano	13	5	22	6	6	7	2	8	12	81
Ocote arriba	8	8	24	5	6	4	3	5	12	75
Ocote abajo	10	5	23.5	5	3	4	2	5	9	65.5
Piedras Largas upper	7	8	24	5	3	6	2	6	8	69
Piedras Largas lower	10	7	19	5	6	5	3	9	11	75

Source: adapted from Espinoza and Vernooy, 1998:92.
Noe 1: The soils component includes 12 indicators, such as fertility, color, texture, water retention capacity, structure. Values were defined by the informants in the field during the transect walks with the help of soil samples dug out in situ, at informant-selected representative soil sites/types, at least two for each watershed. The table presents average total values.
Note 2: The "Other" set of indicators include average inclination level, landtenure situation, infrastructure, electricity, access, and well-being level.

Concluding comments (pros and cons)

Natural resource management research requires an interdisciplinary perspective; for example, soils and micro-watershed analyses need to be placed within the socioeconomic context of user groups and multiple interests. It also requires understanding the interconnectedness of various levels, e.g. plot, farm, community, microwatershed, and watershed. Users of the resources can play a key role in the analysis of resource dynamics. Farmer experimenters, local leaders, *promotores*, and extension workers can make a contribution together with the *técnicos* and researchers from NGOs and government ministries.

A combination of "diagnostic" research (dividing the watershed into agroecological zones, identification of critical areas for intervention) with participatory action-oriented research (the formation of associations of local groups, the development of indicators to be used by local people) enables a focus on providing information about the state of the resource base at various levels and the involvement of users of these resources in problem and opportunity analysis to facilitate action that can be developed quickly.

Participatory mapping and monitoring are relatively simple tools that local people can use to analyze the local situation, discuss constraints, problems, and opportunities, take action, and monitor results. The microwatershed seems to be a useful level for intervention to develop and test these types of tools.

Local-level monitoring of resource use is required to ensure compliance and regulation. To achieve better resource management practices through cooperative action, rules, and sanctions, it is important that local people and those cooperating with them have a good understanding of resource dynamics: for example, soil dynamics, nutrient flows, water cycles. Resource assessment and resource use monitoring are, therefore, key activities in any effort to improve management practices and regulatory arrangements. Monitoring will also help to raise awareness among local decision-makers about the interdependence of resources and, if carried out collectively, can easily impart skills and credibility and create a sense of ownership and confidence.

Participatory tools such as the mapping, analysis and monitoring approach described here, are time and energy consuming which in some situations may be a serious constraining factor.

A challenge is to carry out landscape level experiments that deal with crossbounary problems such as soil erosion, pests, or water pollution. Experiments are now underway in the Calico watershed to apply the insights gained from the participatory mapping work.

INNOVATION IN IRRIGATION -
WORKING IN A 'PARTICIPATION COMPLEX'

Linden Vincent[8]

Irrigation has some particular challenges in participatory research, because it involves collective action where very different interests may be present. Large-scale irrigation systems create particular challenges in innovation to meet changing bio-physical and societal conditions. This paper first summarises operational elements of the sociotechnical approach[9] to irrigation research. This approach can show how technology acts a controlling and mediating factor between bio-physical and societal conditions. It is also useful as a method to identify stakeholders, their work practices, and their interactions. It then summarises a related tool for action research – the idea of a PARTICIPATION COMPLEX. A brief story from Nepal illustrates these concepts.

The sociotechnical approach to irrigation research is directed at understanding how irrigation systems are designed, operated and used by people to provide water for production, and is thus inherently a participatory research approach. This approach has focused on three areas of stakeholder actions: the social construction of technology, social conditions of use, and social impacts. Other research concepts include the study of *domains of interaction* in irrigation management - strategic interfaces where people come together to determine water use. These are often emergent and specific to individual irrigation systems. It also looks strongly at *practice* – repeated actions – not only in water management and production, but also in farmers' understanding of their landscape and water supply, and resultant design and operation of systems. It also uses a broad agro-ecological approach, to include study of cultural and political relations in ecology, alongside bio-physical relationships, to study technology, water management, and production in agro-ecosystems. This broad approach has proved particularly helpful for adaptive design consistent with existing knowledge and preferences of farmers.

Action research in irrigation development or reform nearly always involves the researcher in a PARTICIPATION COMPLEX, where the researcher has to work with:

- ***different domains of participation* in which *practices* must be understood (not only working with farmers, but also water user organisations, system operators, and the contractors who often implement new construction). These different domains present**

[8] Professor of Irrigation and Water Engineering at Wageningen University, The Netherlands.

[9] Irrigation can be seen as a sociotechnical system within the larger natural resource system of the water cycle. The technology of the system shapes, and is shaped by, the bio-physical system and society. Technology is a capacity for transformation, through the use of artefacts and their products. The actual transformation that takes place reflects the appropriateness of technology given local ecology and society.

different opportunities and challenges to participatory methodologies. The researcher also has to work across them – to get farmers' ideas put into practical reality.
- **different *development contexts of participation*, which do have different concepts of *innovation* and different sets of *participatory methodologies* linked with them. Table 1 summarises three different contexts of participation.**

A brief illustration now follows. Mr A. is a motivated engineer committed to work with farmers. He wants to help a particular disadvantaged group – tailenders - and to increase representation of small farmers and female-headed households. He works in action research- and development - in an intervention programme in the Terai region of Nepal, to transfer irrigation management in large-scale systems to user organisations. The project has an institutional development and a technical rehabilitation component, and this engineer works in both. He realises that the situation for him contains all three development objectives and participation contexts. However, the primary control is that of the 'modernisation approach' to induce institutional innovation. This will first shape the methods he can use, the data to collect, the targets to meet and way he can act for certain groups.

The scale of systems means that most consultation is through discussion with water user associations (WUA), not individual farmers. These are not always representative. As well as PIM type methods and capacity-building, Mr. A tries to works with the consensus-building methods of type-2 participation. However, these prove inadequate for practical decisions about new field-level institutions. Discrete use of type-3 tools – using many places for discussion, and quiet conscientisation of farmers – also helps to bring change. Also problematic are frequent changes in key WUA representatives due to political elections – with new representatives often changing their predecessors' ideas! Mr. A learns to work with admired local advisors with continuity, who can 'hold the development' in the WUA despite personnel changes.

Mr. A, works hard with farmers to study how infrastructure can be improved, and to plan the specific reconfiguration and relocation of structures, consistent with new institutions set up by the WUA. The system suffers from relative water scarcity, and thus has a situation where collective negotiation can bring positive changes. The WUA decides to reorganise the rotation of water to improve tail-ender conditions, requiring some re-siting of structures. Engineer A designs a 'tamper-proof' gate, which many farmers like- but some want a more sophisticated design seen elsewhere. Problems emerge for the siting of new structures – farmers do not want them on or close-by, their land. The actual construction is also to be done by contractors. Engineer A has seen many problems of misplaced infrastructure and poor construction. He works especially hard to make links between contractor and farmers beyond the WUA, to ensure the standard of work

executed. However, some structures get built with poor quality cement and deteriorate immediately, and Engineer A gets blamed.

Through consciousness of the 'participation complex' in which he worked, Mr. A used a range of methods and actions to study means for - and encourage - better performance, problem resolution, and greater equity into the system. He refused to be limited by one view of participation and the tools promoted, but was thoughtful of how other methods could be brought in, to keep the project environment stable. The achievements of the team in institutional reform were considerable. Despite heroic efforts, however, the changes in artefacts and operations, were not quite as hoped – mainly from difficulties of work across the 'participation domains' between farmer, researcher, institution and contractor.

Development intervention is said to have three practical needs – explanation of the development problematic, information on which to develop action, and conceptual tools for designing action. We need to think about typologies of action, and not just methodologies for designing action, to bring farmers' requirements into reality. The sociotechnical approach – and the concept of a 'participation complex' in action research – helps the design of participatory research and development in situations where more than one development problematic is present. It helps the researcher to think about the 'problem environment' and the 'project environment' in which they are working. These shape the participatory methods which people can use, and the emergent challenges of working with different stakeholders.

Table 1 Participation concepts and methodologies related to development objective

1. Economic development and modernisation.

Participation… is an approach (by agencies) to induce increases in performance or impact through provision of conditions or incentives that enable farmers to take new responsibilities and opportunities

Innovation is … new activities which improve linkages between resource use and production – new techniques, artefacts or institutional relations that increase productivity, efficiency and economic returns, or reduce wastage and degradation

PARTICIPATORY METHODOLOGIES, CRITERIA AND ACTIVITIES (CRITERIA FOCUSED)

* RRA	* Cost-sharing
* Problem Inventory	* Village credit camps
* Participatory Irrigation Management (PIM	* Farmer-to-farmer training
* Capacity building	* Accountability mechanisms
* User-focused design	* Beneficiary targeting
* On-farm trials	

2. Joint planning and problem solving. **Participation is… a process through which stakeholders influence, share control and work together to achieve desired change** **Innovation is shown through changed behaviour of involved people and sharing of knowledge and skills** **PARTICIPATORY METHODOLOGIES, CRITERIA, ACTIVITIES (METHODOLOGY FOCUSED)** *** PRA** *** Managing knowledge systems** *** Participatory technology development** ***Collegiate engineering** *** Consensus-building and knowledge-sharing** *** Networking to build platforms** *** ‘Process’ project planning** *** Demand driven development intervention** *** Stakeholder identification and interaction mapping**
3. Social, inclusion, improved equity and reduced vulnerability. **Participation is…organised efforts to increase control over resources and regulative institutions in given situations, on the part of groups and movements of those hitherto excluded** **Innovation is the delivery of different benefits to different people.** **PARTICIPATORY METHODOLOGIES, CRITERIA AND ACTIONS (ACTION-FOCUSED)** **Methods of (B) but also** *** Conscientisation of farmers and representatives** *** Working with local ‘advisers’ that have continuity, as well as current stakeholders** *** Deliberate long time frame** *** Capacity-building and user-focused design highlighting equity and basic water needs** *** Uses a range of kinds of contact (not just PRA group exercises or consensus workshops)** *** Political and legal action for excluded groups** *** Conflict removal as well as consensus-building (recognises that consensus may be impossible)** *** Tolerate/recognise pluralism in many areas – law, science, technology use** *** Work with local practice to adapt known science and technology** *** Keep construction controlled or strongly supervised by users**

Observations on Use of Information Tools (IT) in Participatory Contexts: Access to Information and Empowerment

Jim Williams, NRI

Context

1. The subject of the meeting is of critical importance for the purposes of ‘mainstreaming the environment’ within the sustainable livelihoods approach to development. It concerns how people/communities perceive themselves and hence act in relation to their wider environment, NR management and environmental externalities included.
2. Since participatory research tends to be ‘local and spotty’ and community horizons tend to be foreshortened, this case study looks at aspects of information tools and their applicability in participatory approaches for ‘scaling up’.
3. The study considers inter alia the *scale of analysis for decision making*, using soil and water rehabilitation issues as an example, and explores the *roles of information tools in decision support* for the different stakeholders.
4. Gender issues are considered here to be a subset of equity issues, but it is accepted that there may be need to take into account the gendered landscape.
5. This case study however owes much to many people: it is more a sympathetic compilation of the experiences of others, rather than a synthesis of direct first hand results. Sources include DFID social ‘watershed’ development projects in India, the work of national and state government agencies and NGO in India, a GIS participatory workshop held in NRI, studies undertaken for EC and UK on use of environmental information, and the diverse experiences of colleagues.

Thought Points

1. A priori, understanding and management of landscape scale resource issues would appear to be very difficult without community access to improved information (tools). There is likely to be a need to bring new spatial scale issues and time/change issues into the domain of livelihoods and stakeholder awareness, ownership and decision making processes.

2.Shoot the pianist not the piano: The more useful of the information tools (see Table) are potentially powerful (information content) agents of change. But they are just tools and need to be used with caution. Their use may expose hidden issues but not enable resolution of the issues raised. As with PRA, irresponsible application may do more damage than good.

3. Win-Not Lose = Win-Win? While inevitably, information tools empower the researcher and other centralised agencies more than communities, this is not a sufficient argument to withhold these ‘potentially democratising’ tools from community use. A simple village photograph from the air may comprise the only form of land registration and demonstration of tenure available to the community. While access to such information is usually empowerment, it also carries downside risks through a) exposure of the communities and their knowledge base to more powerful centralised powers, b) destabilising existing information and power structures without developing appropriate alternatives.

4. Participatory Remote Sensing: The value of information tools in participatory watershed management, and the role of remote sensing in particular for bringing wider landscape issues (soil and water rehabilitation, management of wastelands and common property resources) into consideration by local communities has been successfully demonstrated in India. Their successes warrant careful examination, as they appear to consistently outshine other programmes. Mather's work with aerial photography in Nepal resonates well.

Table of Pros and Cons: Stakeholders and landscapes: Communities, development support agencies and researchers

TOOLS	PROS	CONS	COMMENTS (Pros can be Cons for different participants)
Traditional Gov. produced Maps	Hardcopy: touchy feely: Usually available and easy to transport and add more information to.	Difficult to interpret if much writing (and symbols difficult too). Often out of date	Ideally suited towards top down planning by central/district government
	Cheap to reproduce but	Expensive to keep up to date with changes	
		Poor scale and lack of appropriate detail	
Village participatory maps	Ownership: home grown: 3D but not temporal Part of process not an output.	Don't travel well (pro: keeps it in context) Difficult to integrate (from one village to the next) across the landscape	Ideally suited for community use if all community involved (women, landless….). How about change management?
	relative importance of features to informants (sub groups as women or landless represented?)	Figurative: non 'uniform' scale: difficult to keep track of changes : not so good for M&E	
		Exclude the wider landscape features	
Remote Sensing including aerial, satellite, video and digital photography from the air (ADP)	Landscape scale view with some externalities	Unusual view for many people	Designed for the remote, centralised authority, but useful at community level if ... Can be useful in mediated conflict resolution (Niger pastoral). ADP excellent for detailed change process monitoring by researchers and local NGOs.
	More value neutral? Easier for people to relate to landscape features and navigate than a map. Good for structural plans in relation to NR by management community	Difficult access: whose interpretation? 2D plus texture/colour. False colour can be misleading, as it is NOT a photograph. Detail threatens illegal activities.	
	Good for showing (some) changes over time and emphasising the finite nature of resource and impact of activities: homogeneous M&E over whole area	Can be very expensive and slow (project cycle) much better at biophysical than socio-economic representation.	

Geographical Information Systems	If participatory improves shared access to (a type of) information within community. Useful for planning PRA within landscape with authentic geocode, and as a tool in participatory planning	Centralises: top down and expert driven: risk that it empowers external agencies (policing), young, and literate most but visualisation can involve non literate in planning process.	The 'globalised' versus 'localised' information argument is seminal. Other types of 'feature based' GIS may be more informative of change processes. Much better at biophysical than socio-economic representation. Access to outputs and validation of layers are critical issues.
	Enables shared stakeholder agenda and inter-disciplinary convergence: framework for consensus (and process may be more important than outcome)	Illegitimatises other ways of viewing the situation: 2D? tends towards static view on production of features.	
	Links community to district = a more articulate voice in planning process and greater coherence. in US GIS aids participation in urban planning process	Slow start up. Who pays the significant costs? Who maintains an open access system? Institutional sustainability. Who owns the data?	
	Brings out suppressed community level issues. Useful for scaling up and for M&E	Does not address issues raised: irresponsible empowerment? Losers will exist.	
Process Modelling Software: decision support	Enabling mechanism for technical decisions to be made in a social context by (NGO &) community	Villages don't have PCs yet, and often no electricity: large development cost Only suitable for very special (simple) cases?	Useful for explaining options and trade-offs in community by NGO

Qualities of Method (tools) for integration of biophysical and socio-economic concerns. (depends on stakeholder: researcher, mediator (e.g. NGO) and community views are likely to differ)

1. Traditional maps: generally cumbersome and inappropriate: too non-specific but may be better than nothing

2. Village Maps: tend to emphasise the biophysical because of the ease of representing these aspects in a model/map. Can be useful for bringing out gender and (lack of) equity issues.

3. Remote Sensing: in Andhra Pradesh satellite remote sensing is used successfully to help 'guide' the community PRA process and ensure that watershed rehabilitation interventions were focussed in the areas where greatest bio-physical impact would be achieved within the socio-economic priorities of the community. It is not clear how much equity and gender considerations figured.

4. GIS: would appear to have major potential but considerable scope and need for innovative research and new approaches to spatial representation of social and economic indicators if major impact is to be achieved with communities at village level. The process of incorporating PRA generated data into GIS is still rudimentary (?). There are important issues involved with integrating qualitative with quantitative data, and then scaling up from local enquiry: GIS may be able to assist with great value here.

5. Joint planning and interdisciplinary working by GIS and PRA /PLA practitioners is essential for practical success in combining the two methods

6. GIS (like PRA, remote sensing etc.) is only as good as the people and institutions which use it and local politics permits. If the planning process is not responsive and accessible to local people then information tools may have limited value.

7. Other 'modelling' decision support software tools are still severely constrained but could have enormous impact as 'expert guidance systems' in the future.

Next Steps[10]

1.Participatory IT could enable communities to face issues and be better capable of taking themselves forward towards resolution before crisis point is reached. This is potentially an issue for useful research. Does the experience of participatory IT provoke problems, help identify latent problems or provide a mechanism for bringing difficult issues into perspective for resolution, increasing peoples access to information?

2.There are country level sector planning applications of participatory IT approaches which donors should take up in project design. The monitoring capacity of IT needs to be more rigorously approached e.g. as M &E system for long term social development projects and watershed management information, which needs to be integrated into M & E process.

[10] This section in particular owes much to the contributors to the Workshop on GIS and Participatory Methods, held at NRI in July 1999, as written up by Julian Quan. In many cases GIS integrates the other Information tools, so for IT one can read GIS. Mather also referred to above was a contributor to the workshop.

3. Further development of IT applications in community forestry, strengthening tenure over CPRs and in M&E of impact of community based / participatory resource management. Risks of centralised application of IT for M&E degenerating into policing of management plans or precipitating conflict: need to ensure an equitable balance in stakeholder inputs to and uses of IT, and appropriate mechanisms for assuring easy access.

===