Farmers' Practices and Soil and Water Conservation Programs

International Crops Research Institute for the Semi-Arid Tropics

Abstract

Citation: Kerr, J.M. (ed.). 1991. Farmers' practices and soil and water conservation programs: summary proceedings of a Workshop, 19-21 Jun 1991, ICRISAT Center, India, Patancheru, A.P. 502 324, India: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and Winrock International. ISBN 92-9066-211-5.

Researchers, government and NGO officials, and farmers met to discuss and document indigenous soil and water conservation (SWC) practices and to share experiences of participatory SWC programs. Recommendations were made for changes intended to bring more flexibility, relevance, financial viability, and adaptability into SWC programs, and to introduce indigenous knowledge and participatory methodologies into education curricula.

Résumé

Référence: Kerr, J.M. (éd.). 1991. Les pratiques paysannes vis-à-vis des programmes de conservation du sol et de l'eau : comptes rendus d'un Atelier, 19-21 juin 1991, Centre ICRISAT, Inde, Patancheru, A.P. 502 324, India : International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) et Winrock International. ISBN 92-9066-211-5.

Des chercheurs, des responsables du gouvernement et des organisations non-gouvernementales, ainsi que des paysans se sont réunis à cet Atelier dans le but d'examiner et de documenter les pratiques indigènes de conservation du sol et de l'eau, et de partager les expériences des programmes de conservation à participation. Des recommandations ont été faites pour des changements destinés à améliorer la souplesse, la pertinence, la viabilité financière et l'adaptabilité des programmes de conservation. Les recommandations ont également visé l'introduction des connaissances indigènes et des méthodologies de participation dans des programmes de l'éducation.

Resumen

Citación: Kerr, J.M. (ed.). 1991. Práticas de agricultores y programas de conservación de suelo y agua: resúmen de memorias de un Taller, 19-21 junio 1991, Centro ICRISAT, India, Patancheru, A.P. 502 324, India: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) y Winrock International. ISBN 92-9066-211-5.

Investigadores, oficiales del gobierno y de organizaciones no gubernamentales, y agricultores se juntaron para discutir y documentar práticas indígenas de conservación de suelo y agua y para compartir experiencias de programas participatorios de conservación de suelo y agua. Se hicieron recomendaciones para cambios que intentan traer más flexibilidad, relevancia, viabilidad financiera, y adaptabilidad dentro de los programas de conservación de suelo y agua, y para introducir conocimientos indígenas y metodologías participatorias dentro del curriculum de educación.

Cover: A meeting between farmers and MYRADA officials to plan a soil and water conservation project in Gulbarga district, Karnataka, India. The stone wall in the foreground was built by a farmer to gradually trap silt in a gully, thus creating a productive field. (Photo: J.M. Kerr.)

PN-ABK-865
IN 7011 25

Farmers' Practices and Soil and Water Conservation Programs

Summary Proceedings of a Workshop

19-21 Jun 1991
ICRISAT Center, India

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics,
Patancheru, Andhra Pradesh 502 324, India

Winrock International Institute for Agricultural Development
Route 3, Box 376, Morrilton, Arkansas 72110-9537, USA

1991

Scientific Editor: **J.M. Kerr**
Publication Editors: **Usha Raman** and **Susan D. Hall**
Cover Design: **G.K. Gugiani**
Typography: **T.R. Kapoor** and **K.K. Purkayastha**

The International Crops Research Institute for the Semi-Arid Tropics is a nonprofit, scientific, research and training institute receiving support from donors through the Consultative Group on International Agricultural Research. Donors to ICRISAT include governments and agencies of Australia, Belgium, Canada, People's Republic of China, Finland, France, Germany, India, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, United Kingdom, United States of America, and the following international and private organizations: African Development Bank, Asian Development Bank, Deutsche Gesellschaft für Technicche Zusammenarbeit (GTZ), International Board for Plant Genetic Resources, International Development Research Centre, International Fertilizer Development Center, International Fund for Agricultural Development,The European Economic Community, The Opec Fund for International Development, The Rockefeller Foundation, The World Bank, United Nations Development Programme, University of Georgia, and University of Hohenheim. Information and conclusions in this publication do not necessarily reflect the position of the aforementioned governments, agencies, and international and private organizations.

Winrock International Institute for Agricultural Development is an autonomous, nonprofit organization based in Arkansas, USA. Its mission is to reduce poverty and hunger in the world through sustainable agricultural development. The India Natural Resource Economics Program is funded by grants from the Ford Foundation and the Rockefeller Foundation. It is coordinated by Winrock International and hosted by ICRISAT.

The opinions in this publication are those of the authors and not necessarily those of ICRISAT or Winrock. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of ICRISAT concerning the legal status of any country, territory, city, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. Where trade names are used this does not constitute endorsement of or discrimination against any product by either Institution.

Contents

Inaugural Session

Objectives

The Workshop brought together representatives of four broad groups: farmers, researchers, government officials from development departments, and non-governmental organizations. Their discussions and presentations focused on three main objectives:

- to document and analyze indigenous soil and water conservation (SWC) practices in terms of effectiveness and adoption levels;
- to document participatory planning and implementation efforts in SWC projects, and the success/failure of such projects; and
- to jointly arrive at strategies to make SWC programs more effective by taking into consideration indigenous approaches and participatory planning.

Introduction

J.M. Kerr and N.K. Sanghi

ICRISAT Center hosted a Workshop on "Farmers Practices and Soil and Water Conservation Programs" from 19 to 21 Jun 1991. The meeting was sponsored by Winrock International under a grant from the Ford Foundation to the Indian Natural Resource Economics Programme. About 35 participants represented four broad groups: farmers, researchers, government officials, and nongovernmental organizations (NGOs). Each of these groups has experience of special relevance to the Workshop's objectives.

The Workshop drew on the growing interest in seeking alternatives to large-scale watershed development programs which have apparently achieved only limited success in promoting soil and water conservation (SWC). Recent research has suggested that indigenous technical knowledge can help form the basis of SWC efforts. Likewise, experiences with participatory planning and implementation have shown promise as a means of increasing adoption and maintenance of SWC practices. The Workshop sought to document these observations and experiences and draw guidelines for future SWC programs.

In many ways the NGOs are pioneers in bringing farmer participation into watershed development, particularly in soil and water conservation programs. They have learned about past obstacles and future opportunities from their constant contact with farmers. The Aga Khan Rural Support Program (AKRSP) from Gujarat, MYRADA from Karnataka, and Youth for Action (YFA) from Hyderabad contributed a great deal by sharing their insights with other participants.

Farmers from three regions were invited to present their own technologies and experiences with SWC programs. To emphasize the point that we can learn by working with farmers, it was important that we demonstrated this participation in the Workshop itself. An articulate, confident group of farmers addressed the participants through interpreters, using slides to illustrate their points. Unfortunately we could not arrange for simultaneous translation into the several languages spoken by the farmers in the group, so discussion was limited. However, one farmer from Karnataka raised questions about a slide depicting a certain technology shown by a farmer from Gujarat, and a lively debate about its merits followed.

Representatives of two government watershed development programs, from Andhra Pradesh and Karnataka, described their recent experiences with participatory planning and implementation methods. They displayed convincing evidence that flexibility can be achieved in government programs if the effort is made.

Unfortunately we missed the presence of two eminent government officials, Dr S.L. Seth, Director of the Watershed Programme, and Mr S. Ray, Develop-

ment Commissioner of Andhra Pradesh, who were forced to excuse themselves at the last minute to perform unexpected duties in the aftermath of the Lok Sabha election. Their insights and comments would have contributed greatly to the workshop. However, we hope these proceedings will contribute in some way to their future planning.

Researchers came from many institutions, including agricultural research institutes, and state agricultural universities. They represented a multitude of experiences and approaches, and each contributed significantly. No representatives could be present from the Central Soil and Water Conservation Research and Training Institute in Dehra Dun, whose contributions would have been valuable.

The diverse gathering itself provided an excellent framework for the Workshop, although admittedly some groups were underrepresented. The Workshop underscored the value of interaction with peers from different disciplines and approaches, extensive field observations, and input from farmers, in order to understand the multiple dimensions of SWC. These proceedings incorporate summaries of the papers presented at the Workshop.

Full papers are available from the Economics Group, Resource Management Program, ICRISAT Center.

We hope that the results of this Workshop will attract the attention of the directors of development departments associated with soil and water conservation programs, and professionals working on all aspects of watershed development. As Dr A. Vaidyanathan emphasized in his 1991 Founders' Day address to the Society for Promotion of Wasteland Development, watershed development plans can succeed only if they emphasize the "workable" as opposed to the technically optimal. Workable programs require adoptable technologies, and this can best be done by incorporating farmer's inputs at every stage.

Welcome Address

L.D. Swindale

Good morning to you all and welcome to ICRISAT Center. I would particularly like to extend the welcome to our farmer visitors who are participating in this Workshop and who will later give us the benefit of their experience and wisdom. I also welcome the professionals who are here for the first time, and hope that they will take an opportunity outside the meeting to learn a little more about ICRISAT. Only a fraction of the Institute's work will be touched upon in this meeting and I hope that they and the farmers will have an opportunity to learn a little bit more about our activities during their visit.

While I am talking about farmers and ICRISAT activities I would like to put in a word for Farmers' Day, which will be held on 5 Oct this year. We would be very happy if the farmer participants in this meeting could come back and be with us again on that occasion.

So far, this year at ICRISAT we have had 270 mm of rainfall, approximately a third of the total rainfall that we normally expect in a year.

We had it nearly all in the month of June at a time when the soils were bare, and when sowing was in process. I am sure there has been quite a lot of soil loss from many farms that have had similar rainfalls in the last few weeks. So this is a good time to talk about soil conservation, and to learn about soil conservation practices.

Why indeed is this meeting being held? ICRISAT has considerable interest in the subject of soil and water conservation (SWC) as part of its research in resource management, and of course there are many organizations and agencies within India that have the same and greater interest. I am very pleased to pay particular note to Dr Sanghi, Zonal Coordinator (Transfer of Technology), ICAR, who works in cooperation with so many ICRISAT programs in India. I thank him for his help. There has been a lot of research carried out on the subject and the results are not so successful as we would like. For that very reason, ICRISAT, Winrock, and the Extension Division of ICAR organized this meeting, to better understand the indigenous soil conservation measures in India in the hope that research can become more relevant, and improve upon what is already done, and to point towards future conservation measures that may be more effective and more acceptable to farmers.

A better understanding of such indigenous practices could tell us why farmers accept and undertake soil conservation measures and hopefully, therefore, help to improve dissemination of new practices. There is some research at ICRISAT that suggests that farmers are so concerned about the present or the forthcoming season that they give little thought to the future, and as a result are not interested in long-term measures. That research does not seem to be correct. Neither intuitively nor in practice do we observe that situation. If it

were true no farmer would ever plant a tree, but in fact farmers do plant trees, and they do undertake conservation measures. So there is something wrong in that methodology. As we learn about indigenous SWC practices, I hope some clues emerge as to why those results seem to be coming out wrongly.

The best way to incorporate farmers' knowledge into SWC programs is by planning in cooperation with the farmers themselves. That seems a very obvious sort of remark, but I can assure you that while it is obvious for scientists to say things like that, it is not so common for them to do it.

We here at ICRISAT, I think, have had a fairly good record of farmer participation in our work. In the last few years we have tried to step up our efforts to learn from farmers and practitioners and to incorporate that learning into a scientific methodology. I can remember we had a most excellent meeting on farmer participation in farming systems research in West Africa a few years ago. When ICRISAT Center first started its work it was interested in formulating and disseminating certain combinations of farming practices involving seeds and fertilizers, land and water management, and new implements. In order to carry out that work we had a number of meetings with farmer participants. Today I feel that we are doing better and being more efficient in this activity because we are trying to incorporate the farmers' knowledge, not just into giving us some ideas, but actually incorporating them into scientific methodology.

In this Workshop you will have three main tasks. Firstly, to document indigenous SWC practices, in order to find out the circumstances under which farmers invest in them. Secondly, to learn from the experience of participatory watershed development programs to draw guidelines, as I said, for successful approaches. And finally, to draw on the collective wisdom and experience of those gathered here to chart possible strategies for extending such methods to government programs. I wish the Workshop success. I hope all of you benefit from working together, and I particularly hope that our farmer visitors will enjoy participating, and that they will enjoy their stay at ICRISAT Center.

Farmers' Practices, Professionals, and Participation: Challenges for Soil and Water Conservation

R. Chambers

Changing Ideas in Rural Development

Approaches and ideas in rural development have been gradually changing over the past 20 years, bringing into play actors and factors that were barely mentioned before. Many of these changes have been expressed in the concept of "sustainable livelihoods" as a central objective to be jointly realized by rural people and policymakers. "Sustainable" refers to the maintenance or enhancement of resource productivity on a long-term basis. Livelihoods are diverse and often complex, but they depend directly or indirectly on natural resources and agriculture.

One of the crucial changes in approaches towards rural development is the recognition that researchers and planners have much to learn from the people who make a living in rural areas, that programs must take their ideas and experiences into account if they are to be truly relevant. Many failures on the part of rural development professionals are basically due to ignorance, short time horizons, and scientific reductionism.

Ignorance. In general, professionals worldwide have tended not to notice, or to neglect, what farmers themselves do and what farming systems entail, including their often creative approaches to the protection and exploitation of microenvironments. All too often, professionals have been unaware of their own ignorance. Soil conservation programs all over the world have provided examples of ignorance and insensitivity, of imposing standardized, bad practices on rationally resistant farmers.

Short time horizons. Despite the stated long-term perspective of rural development professionals, we actually tend to have short-time horizons. Economists dominated by discount rates undervalue the future; commercial interests want quick returns; and government programs tend to aim at physical targets by the end of a project/plan period.

Scientific reductionism. Professionals simplify complex reality into its parts, assume uniformity, and apply abstract controls to unpredictability. As a result, their solutions are standard packages that do not suit complex, diverse and risk-prone agricultural systems. Specialization and disciplinary training channel scientific efforts into narrow ruts. Most agricultural problems, how-

ever, require a broad, interdisciplinary approach that takes into account many factors and variables.

Farmers as Solution

There are three respects in which farmers, both men and women, are a key to finding solutions: their knowledge, their time horizons, and their analytical capabilities. In terms of their farming practices, priorities, and constraints, farmers have an advantage over professionals. They are continuously creating and managing their farming systems, so they are the experts on their situations. There is now a growing recognition of the value of this indigenous technical knowledge.

While it is true that farmers desperate to survive may take the short-term view, as a rule farmers who are secure in their tenure and rights have a propensity to take the long-term view and invest for future benefits. The professional's mistake has been failure to recognize, utilize, and enhance farmers' analytical capabilities. Recent experience suggests that if rapport, methods, and materials are right, farmers have a greater ability than outsiders have supposed to make intelligent analyses and evaluations.

A telling example of the contrasting perceptions of farmers and professionals relates to deposition fields. Farmers build these over the years by progressively trapping silt with stone barriers in gullies, to finally make flat, fertile fields on which they grow high-revenue crops. In the Gulbarga District of Karnataka, farmers have for some time been making deposition fields in gullies. Recently, a government program constructed standard gully checks which the farmers did not favor. Instead they have developed their own design, which meets their priority of concentrating soil, water, and nutrients for higher, more stable production. In doing so, they had technology to fit local conditions, investing for the long term. Professionals and researchers, on the other hand, have generally failed to recognize deposition fields as an important SWC technology. In fact, they are rarely found on the artificially-levelled research stations, undulations and gullies being seen as problems rather than opportunities to exploit.

Conservation versus Concentration

In general, professionals tend to think in terms of conserving soil, of keeping it where it is; they see erosion as bad. Farmers too see erosion as bad, but they also think in terms of concentrating soil, water, and nutrients together in microenvironments. In their approach, erosion can be used to move and concentrate soil at zero cost, to places where they will increase and stabilize production. Apart from deposition fields, farmers employ several methods to achieve this.

The Importance of Participation

Since participation has been recognized as crucial to the success of rural development efforts, three main strains of innovation have emerged: farmer participatory research, participatory rural appraisal, and community participation.

Farmer participatory research emphasizes the "farmer first" approach, where the standard transfer-of-technology package is replaced by choices from which farmers can select for their diverse and complex farming conditions. A function of the formal research system is therefore to help generate such choices for farmers.

Participatory rural appraisal, a relatively recent development, encourages rural people to undertake activities which earlier were done entirely by outsiders. An example is participatory mapping and modelling, where the role of the outsider now is to facilitate mapping by villagers themselves. This has revealed maps far more detailed and accurate than anything an outsider could quickly achieve. Farmers are empowered right from the start, with this approach, using their own appraisal and knowledge.

Community and group participation includes such activities as group management of such common resources as natural resources, funds, and services; holding trials and experiments; and collective lobbying.

These participatory approaches are particularly significant in the generation of sustainable livelihoods, especially in view of the following aspects:

1. The intensification and complication of farming systems, that increases with population density.
2. Farmers' own priorities are best expressed and understood by farmers themselves, and only through participation can their demands produce relevant research.
3. Security is a precondition to a long-term perspective. Participation can enhance their security and encourage farmers to invest in long-term solutions.
4. Farming conditions are forever dynamic, forcing farmers to be alert, adaptable, and innovative if they are to succeed. Participation can enhance such competence through individual and community action, effective communication, and analysis.

Challenges for the 1990s

The methods and approaches to SWC, which have so far been heavily researcher-oriented, must now become more farmer-oriented, in terms of behavior and attitude. Indigenous technology, and farmers' experience in adoption, innovation, and analysis must be recognized as valuable.

The importance of making SWC programs relevant must be understood by the major implementing authority—the government—if they are to achieve success on a large scale. For scaling up through government, the challenge is to find the right approaches that will encourage field-level officers to better appreciate farmers' practices and priorities so as to enable them to get more of what they want and need.

Indigenous Soil and Water Conservation Technologies

The Logic of Recommended and Indigenous Soil and Water Conservation Practices

N.K. Sanghi and J.M. Kerr

While researchers and farmers both understand the importance of soil and water conservation (SWC) measures, their perceptions regarding the worth of each other's practices differ. If future strategies for research and development are to be truly relevant, these differences in approaches and perceptions must be understood and reconciled.

Recommended Practices

The two main practices recommended by researchers for SWC in the plains are contour bunding (for low-rainfall areas) and graded bunding (for high-rainfall areas). The essential features of these technologies include diversion drains, continuous bunds, contour farming, centralized water courses, stone checks in gullies, and water harvesting in farm ponds.

Field experience in Andhra Pradesh has indicated that conventional graded bunding is not suitable for small farms. The centralized water disposal system creates a clash among the participants, as the farmers whose fields are located towards the terminal end of each bund suffer due to the diversion of water from the upper fields.

Farmers' Practices

The main features of the farmers' SWC efforts are:
- Field bunds and drains on boundaries,
- Boundary waterways along the major slopes,
- Criss-cross cultivation where the desi plow is used,
- Gully control structures on boundaries for soil deposition, and
- Water harvesting measures depending on rainfall and soil type.

Soil conservation. Farmers minimize soil erosion in cultivated fields with:
- Field bunds with or without waste weirs,
- Perennial vegetation on field bunds,
- Small stone checks across rills in fields,
- Subdividing land holdings into smaller fields, and
- Diversion drains for safe disposal of runoff from upper reaches.

Previous Page Blank

Moisture conservation. The major water conservation practices include:
- Deep plowing in summer,
- Sowing across the major slope,
- Furrowing and cross-plowing,
- Shallow interculture or tied ridging,
- Compartmental bunding, and
- Short-term or rainy-season fallowing.

Runoff disposal. The excess runoff is disposed of through boundary waterways (in high-rainfall areas) and from field to field (in low rainfall areas). In both cases water flows through stone waste weirs located at suitable places on the boundary bunds.

Gully control. Farmers generally consider this to be an economically viable practice leading to direct production benefits. Loose boulder checks with occasional vegetative barriers on the boundary lines help "harvest" the soil.

Over the years, the height of these barriers is increased so that eroded lands can be reclaimed and new patches of cultivable land are created within the gullies.

Water harvesting. Depending on rainfall and soil type, farmers have evolved different water harvesting systems. In high-rainfall areas, individual farm ponds are used for supplemental irrigation, and in medium-rainfall areas, percolation tanks are used to recharge groundwater aquifers. *Khadins* or earthern embankments across gullies are observed in areas with low rainfall and deep soil. These help to harvest moisture in the root zone during the rainy season so as to raise a crop under residual moisture in the postrainy season.

Differences in Perceptions and Approaches

Farmers' perceptions and approaches to SWC differ from those of scientists, mainly in the following respects:
- Bunding on field boundaries rather than on the contour,
- Concentration of soil rather than conservation,
- Short- and long-term advantages rather than only long-term,
- Small and gradual investment as opposed to large and one-time investment,
- Conservation of resources plus increased production rather than conservation alone,
- Multiple objectives rather than a single objective, and
- Reclamation rather than stabilization in case of gully erosion.

Field observations indicate that researchers and extensionists have much to learn from farmers regarding cost-effective and relevant methods of SWC, particularly on small farms. Hence future planning must involve a proper blending of indigenous and recommended practices.

Economic Determinants of Soil and Water Conservation Investments

J.M. Kerr and N.K. Sanghi

Economic factors have shaped the evolution and design of indigenous soil and water conservation (SWC) technologies, and also their patterns of adoption.

Important economic considerations include relative availability and opportunity cost of different resources and the constraints of small, fragmented farms, where the focus tends to be on individual rather than group action.

Hypotheses

Field observations have led us to the following hypotheses:

1. Farmers clearly perceive soil erosion and believe that it reduces yields.
2. Their main concern is with the loss of water and soil nutrients rather than just reduced soil depth.
3. Farmers' investment in SWC depends on certain factors including:
   - Opportunity cost of their time,
   - Land tenure arrangements,
   - Access to resources, and
   - Land quality.
4. SWC measures designed around boundary lines are more likely to be accepted than contour bunds that run through fields.
5. SWC measures are more likely to be adopted if they also increase short-term productivity.
6. Farmers tend to invest in SWC in a stepwise, gradual manner, adding year by year.
7. There is scope for limited group action, but little evidence of large group action to conserve soil.

Awareness of Soil Erosion and its Consequences

Farmers list three main harmful effects of soil erosion: loss of soil, loss of water, and loss of nutrients [farmyard manure (FYM) and fertilizer] from their fields. They stress that large-scale soil loss is unacceptable. However, when erosion is mild, they are more concerned about losing water and nutrients than losing soil, suggesting that short-term concerns are more important to them than long-term ones.

Opportunity Cost of Time

Farmers with substantial off-farm incomes tend to invest less in SWC than others. This appears to be because the opportunity cost of their time is greater, i.e., the returns from alternative investments are greater. This opportunity cost of time changes seasonally, being high during sowing and harvesting, and low during the slack season. There may also be fluctuations during different times of the day.

In Aurepalle village, a high opportunity cost of time was observed among the surveyed farmers who earn additional incomes from such activities as herding animals or tapping toddy. These part-time farmers tend to devote less time to their fields, which are more degraded than others. This is also true of absentee landlords with other sources of income. On the other hand, large landowners with plenty of long-term hired labor have better-tended fields, as do poor farmers whose exclusive activity is farming.

Land Tenure

Farmers who cultivate their own land are much more likely to invest in SWC than those renting or sharecropping another's land. Short-term tenants do not invest in long-term land productivity because they are unlikely to benefit from the returns.

Land degradation problems on absentees' land suggests a need for policies to encourage better land care. For example, longer-term tenancy could be legalized. Absentees could be subsidized to adopt SWC measures or grow perennial vegetation on their land. If erosion affects neighboring lands, those affected should be given access to repair such damage. An absentee tax might encourage land sales to full-time farmers who would tend to the land better.

Access to Resources

Farmers often say that they cannot conserve soil because they lack the resources to do so. Further study is required to identify the exact resource constraints and to distinguish between cases where SWC is constrained by lack of resources and where it is simply unprofitable.

One way farmers overcome resource constraints is by making stepwise investments in SWC. An example of this is the stone gully plug which traps silt that moves through the gully, gradually building up a fertile plot. As silt accumulates slowly, at first only a small structure is needed, which can be enlarged every 1-3 years. Our observations show that the construction of ordinary field bunds often follows a similar pattern.

Improving credit facilities for profitable SWC practices might ease farmers' cash flow problems somewhat, although there is very little evidence to suggest that farmers take loans for SWC. Other investments seem to have priority for borrowed funds.

Land Characteristics

Costs and returns of soil conservation vary with land characteristics. Conservation is least expensive on land abundant in required resources. The pattern of investment observed implies that SWC programs should take advantage of local resources, and could focus on transporting resources to areas where they are lacking.

Farmers are generally more concerned about erosion on good land with higher fertilizer and FYM inputs. Irrigated land also receives higher soil conservation investment, the main objective being water management, with soil conservation as a byproduct.

Willingness to Cooperate

Soil conservation often requires collective action among farmers, especially when an erosion problem transcends farm boundaries. Observations show that there is much scope for limited group action among farmers sharing boundaries. The tendency has been for them to follow certain local norms set by the village. However, for technologies such as contour bunding that transcend farm boundaries, group action has not been forthcoming. Such technologies lead to unevenly distributed benefits, therefore the "losers" have a tendency to undermine the system.

SWC programs should, as far as possible, focus on technologies that require minimal group action. A good technology that can be introduced on an individual basis is likely to be adopted more easily than an excellent one that requires cooperative efforts. Further research and experimentation are needed to determine the scope for collective action.

Indigenous Erosion Control Systems in the Mid-Hills of Nepal

G.J. Gill

In the Jhikhu Khola river watershed in the mid-hills of Nepal there are indigenous systems of soil erosion control that have been working well for many years. Questioning the conventional view that "opening up" such an area will lead to rapid resource degradation, we examine the role of indigenous management systems in checking such degradation, trying to draw lessons of wider applicability.

The study is based on observations across a transect of the Nepali mid-hills that includes the Jhikhu Khola watershed. Here, the general trend is that on many classes of agricultural and other land, there have been two- to three-fold increases in tree cover in the last 10–12 years. Several locally developed systems of breakwaters have been applied to check river silt erosion resulting in a buildup of the river bank in places where erosion could have been most serious. Some of these technologies are quite modern but are neverthless indigenous, springing entirely from local initiative. Such technological and organizational dynamics in indigenous systems can be observed throughout the watershed.

An important factor here is the incorporation of "outside" industrial elements for the improvement of indigenous technologies, maybe because many of the crops cultivated in the area are from the "outside". However, even where such foreign elements have been introduced, their incorporation is done in such a way that the system as a whole must still be called indigenous, though not traditional.

This research has found that indigenous management systems can:

- Halt, or even reverse resource degradation (through afforestation), or limit damage by terrace construction and silt harvesting,
- Incorporate elements of the outside economy as either supplements or substitutes for traditional ones, increasing the efficiency of resource use, and
- Offer an impressive example of self-motivated expansion and modification of local systems, testifying to their dynamic and nontraditional nature.

In every system studied in this watershed, two common features dominated:

1. The observed changes result from local, not outside, initiative, and
2. "Foreign" technologies and processes have generally been selectively incorporated into rather than indiscriminately substituted for elements of the indigenous system.

It is important to recognize the difference between the terms "traditional" and "indigenous" when applied to process-related aspects of such systems. Traditional systems may be characterized as inward-looking, static, and equilibrium-seeking. Conversely, indigenous systems here are outward-looking, dynamic, and improvement-seeking. Further, there is another category that we shall call "nontraditional": systems that have emerged as a result of the dynamics between the traditional, indigenous, and modern. Figure 1 illustrates these relationships, that need to be fully understood before any attempt is made to introduce or improve existing systems.

Figure 2 diagramatically represents the complementarity of the skills and advantages of the farmer and the scientist. This is also important in the effort to improve any existing system. The farmer represents the "indigenous" while the scientist, the "nontraditional", and cooperation between the two will increase the overlap between the two segments (as in Fig. 1).

The Jhikhu Khola watershed therefore provides evidence of more than just indigenous technical knowledge: the agriculture-related activities add up to a complete system that includes technologies, processes, and the organizational structures that link them together.

Traditional

Traditional systems are:

- o Inward-looking
- o Static
- o Equlibrium-seeking

Indigenous

Indigenous systems are:

- o Outward-looking
- o Dynamic
- o Improvement-seeking/evolving

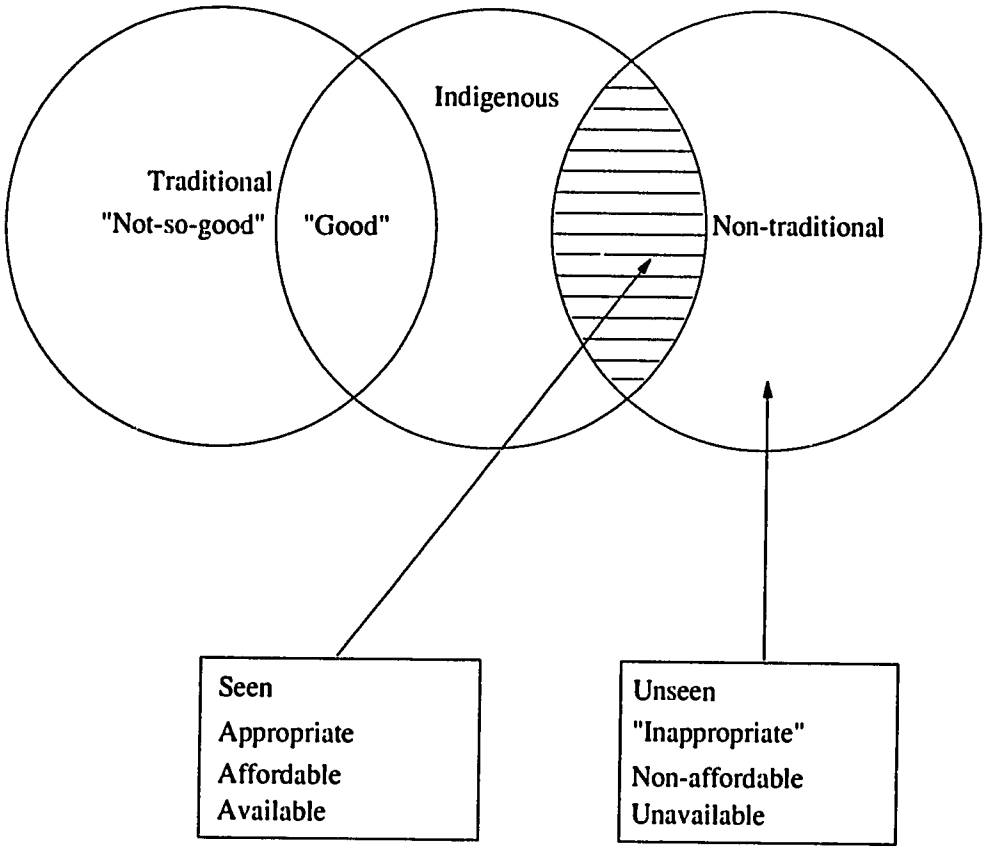

Figure 1.Traditional and Indigenous Systems

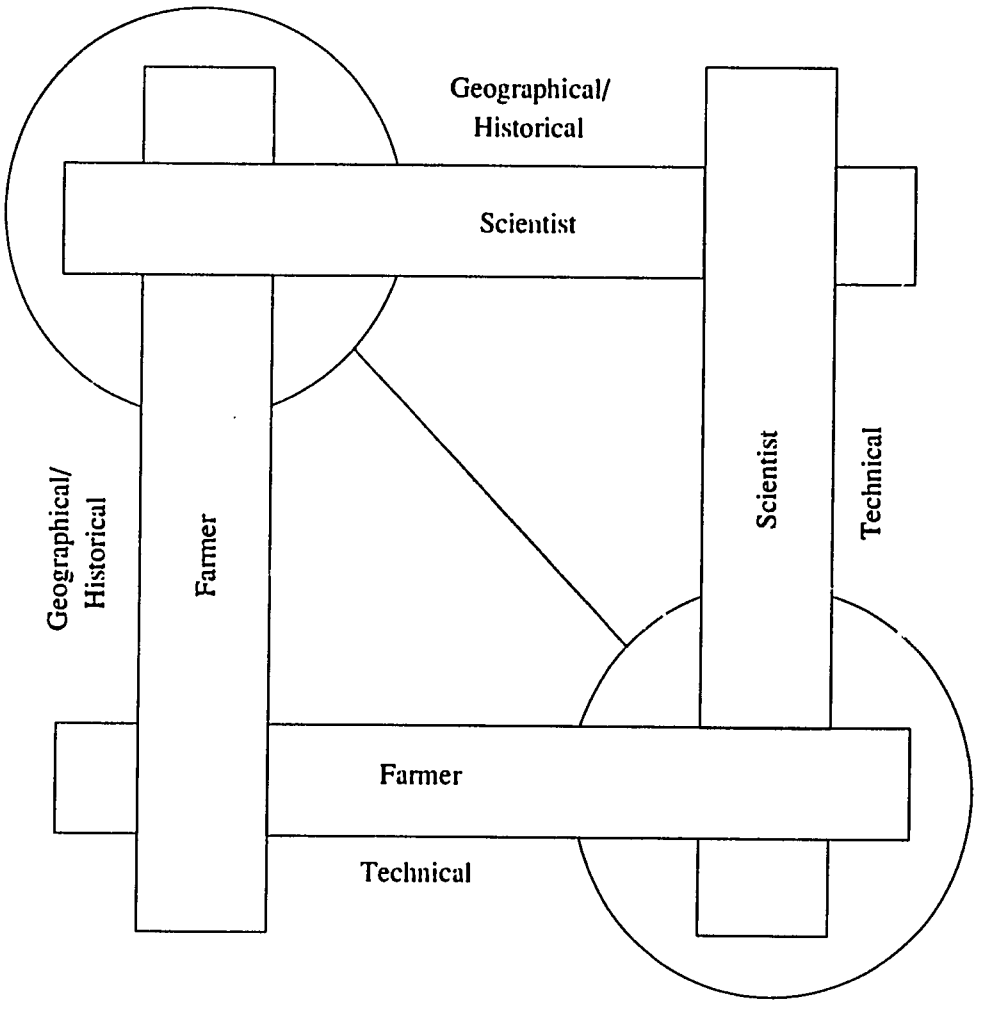

Figure 2.Complementary Roles of Farmers and Scientists

Technologies

Successful indigenous technologies in the Jhikhu Khola watershed include:

- Shaping field ridges in long or complex patterns to suit the variations in slope and the water requirements of the crop,
- Variations in the shaping of terraces to suit topographical differences, production potential, and varied moisture requirements,
- Effective measures by the valley farmers to harvest eroded soil from the uplands,
- Use of the inverted siphon principle to transport irrigation water, and
- Use of synergistic combinations of organic and inorganic fertilizers.

Nontraditional elements that have been incorporated into these technologies include, at the farming system level, plastic sheeting, gabion wire, agrochemicals, and exotic cultivars; and at the irrigation scheme level, plastic and concrete piping. Some of these technologies have drawn on, and developed from elements of the industrial economy, such as chemical fertilizers and plastic piping.

Processes

The manner in which indigenous technologies have evolved implies that farmers in this watershed experiment and try out new ideas, lending to the system a dynamic and outward-looking nature that serves a productive purpose. In fact, their continuous practice of testing and adopting modern technologies from the outside world suggests a process that is similar to applied scientific research.

Institutions

A remarkable degree of institutional and organizational development lies behind the success of the indigenous systems in this watershed. It has shown that so-called "uneducated" farmers are capable of creating and maintaining large and complex multi-member systems to achieve mutually beneficial results. Here, too, are detected elements from the outside world, such as the maintenance of written records and the presence of a committee structure.

Scientists and other change agents can help farmers improve indigenous systems by bringing new ideas to the farmers' attention and by helping to systematize their process of discovery of such outside elements. They can also use their wider technical knowledge to create appropriate and affordable technologies specific to farmer needs.

Indigenous Soil and Water Conservation Practices in Arid Rajasthan

J. Venkateswarlu

Arid Rajasthan has many constraints to crop production, the major one being water, because the annual precipitation is so low (100–400 mm). Soil erosion by wind is another serious problem with the strong winds and predominantly light soils of the region. Farmers deal with both problems in their own way.

A review of existing soil conservation practices reveals that farmers of the region have developed a two-tier system. They include large peripheral bunds about 1-m high and 70–75-cm wide at the base. This is the first line of defense. In areas where it is possible to strengthen the bunds with vegetation, grasses such as *Sachcharum munja* are grown. In highly arid situations intra-plot soil conservation practices are followed for in-situ rainwater harvesting. These practices ensure some crop, perhaps even fodder if not grain, every year.

From a study of farmers' water conservation practices it is evident that they are acutely conscious of the value of rainwater and try to use it to grow at least one good crop during the year. *Khadin* is one such system, whereby rocky catchment areas are used to collect runoff water in a valley by constructing a bund across the flow. The water thus collected is allowed to percolate, after which an assured postrainy-season crop can be grown. But what is now happening to *khadins* is disturbing. There is an effort to make bricks out of the fine soil accumulated in the *khadins*. If this is continued, *khadins* will become dysfunctional, and a valuable traditional practice may disappear.

For areas that will always be dependent on rainwater, this water harvesting practice has great relevance.

Rela farming is another water-conservation practice that aims to channel water from ephemeral *nalas* (streams) in the hills to terraced farms on the edge of the adjacent plains. The water enters the upper fields and gradually flows down into the lower reaches. Good management is required to ensure that the *rela* system distributes water equitably, without causing waterlogging and salinity on certain fields. *Rela* farming provides secure water supplies in drought-prone areas, and should be extended wherever possible.

Tal farming is found where runoff rainwater flows into low-lying valleys, forming stagnant pools. During the monsoon the water is sometimes lifted and used in adjacent fields. After the monsoon, a crop is sown under residual moisture in the *tal* bed when the water has evaporated and percolated. *Tal* farming is confined to the interdunal plains west of the 250 mm rainfall isohyte. It appears that to date, these practices have sustained crop production in Rajasthan despite low and variable rainfall.

The Use of Crop Combinations in Reducing Soil Erosion and Degradation

K.G. Kshirsagar

In the face of rapid degradation of soil and natural resources, many farmers adopt constructive measures that integrate conservation with their agricultural practices. Growing crops in combinations is one such means of reducing soil erosion and degradation. This paper focuses on crop combinations, in an attempt to review their effectiveness and future prospects. The study is based on 10 years of data collected from farmers' plots in semi-arid districts of Maharashtra and Andhra Pradesh.

Results and Discussion

Rainfall is the main cause of soil erosion in these areas. Crop combinations are a safeguard against the highly variable rainfall, and they reduce soil losses during high rainfall years. In general, the farmer is successful in managing soil erosion on smaller plots. On the larger plots, farmers grow different crop combinations in order to check erosion and maintain soil fertility.

A major advantage of growing crops of different durations together is control of soil erosion. This is because the soil is protected by leaf cover and root mass for long periods. Splash erosion by raindrops may be reduced by as much as 90%. The roots of various species in crop combinations feed at different depths in the soil, thereby helping to reduce rill and gully erosion.

Such combinations are employed more in Andhra Pradesh than in Maharashtra, perhaps to protect the erosion-prone Alfisols found in Andhra Pradesh.

Legume crops play an important role in crop combinations, due to their ability to fix atmospheric nitrogen and increase the soil organic matter content, thereby improving the structure of the soil. This in turn enhances internal aeration and drainage, and improves the storage of soil moisture and nutrients, thus favoring plant root growth and, indirectly, limiting soil erosion.

These practices illustrate the farmers' awareness of the correlations between soil, environment, and physical resources, and how they can be used complementarily to reduce degradation.

However, in recent years, some of the complex crop combinations have become less profitable, and the number of crops grown in combinations has been reduced. Important crop components that help maintain the natural resource base are vanishing from the combinations. These practices evolved in the context of a low-population, subsistence-oriented farming system in which crop combinations were by nature resource extensive. In today's changed circumstances, the same systems cannot remain effective.

However, these traditional strategies continue to offer important pointers for future adaptive research that aims to find solutions which will be readily acceptable to farmers.

Indigenous Practices for Soil and Water Conservation: A Study from Karnataka

S.T. Somasekhara Reddy

Attempts to introduce changes in farmers' practices in a watershed in Karnataka have led to conflicts, as a consequence of which structures built by the Watershed Development Agency have been either tampered with, or destroyed. Such programs as the National Watershed Programme have been hampered by a lack of understanding of the causes of farmer apathy towards their recommended practices, and a tendency to ignore the benefits of the farmers' traditional practices. These traditional solutions are often highly suited to the ecology of the region and the class of farmers concerned. This paper examines farmers' practices in an effort to understand the rationale behind them.

Farmers classify their lands based on proximity to the village, fertility, and the crops to which they are allocated. The best fields according to these criteria are called *sarige* and *kadaganu,* and they receive the highest investment in SWC. *Theriga* lands rank lower, and hence have received less investment. This physical classification of land varies slightly within the region, and often relates to proximity to a water source. In general, farmers are particularly interested in new SWC investment on both *kadaganu* and *theriga* lands as this is where erosion is relatively severe.

Land classification also determines the kind of crop grown in a certain field. For instance; foodgrains are generally grown in *sarige,* commercial crops in *kadaganu,* and minor millets in *theriga.* There are exceptions however, for example, when a farmer owns only one particular type of land.

In this region, the major problem farmers face after the hot summer is to break the hard crust formed on the soil surface, in order to make it cultivable. Farmers achieve this by furrowing before the planting season, because this practice also helps to capture rainwater in the field.

Water harvesting in a field is done according to the needs of a crop at various stages of growth. A structure called *niru oni* or *niru hingu,* (an outlet for each field) is used to control runoff. The size and type of outlet depends on the type, size, and location of a certain field. Surface runoff in a field is controlled according to a timetable which normally coincides with growth of the crop and various cultural operations.

Farmers' Concept and Practices of Indigenous Soil and Moisture Conservation: A Case Study

B.J. Rajasekhara and B.R. Hegde

Soil and water conservation (SWC) programs implemented by development agencies would have more impact if they incorporated aspects of farmers' existing practices. A case study of farmers in the high-rainfall, red soil region of southern Karnataka revealed interesting perceptions, varied SWC practices, and pointed to certain important socioeconomic factors.

Perceptions

Farmers were generally knowledgeable about the effects of soil erosion and water loss. The predominance of bunds of different kinds underlined this awareness. They understood the benefits of cultivating across slopes and of hoeing to keep soil loose. Boundary waterways were observed on most farms, to drain off excess water. Farmers were concerned about containing gullies but felt that government agencies should take up responsibility for them. Most farmers also understood that the loss of rainwater should be minimized but they did not have a clear idea of how it could be utilized for their own benefit, or for the community.

Practices

The SWC practices commonly observed in red soil regions are:

- Diversion drains to separate arable from nonarable land.
- Bunds of various sizes, built mostly on slopes, sometimes provided with outlets to prevent water stagnation. Enquiries into earlier bunding programs revealed that to begin with, farmers built bunds across the slope. Later, when the property was divided among the children, the land was divided along the slope so that each portion would have rich as well as poor soil. This indicates that farmers had an idea of the changes in fertility status and soil depth along the slope.
- Farmers generally provide outlets on bunds, at a level slightly higher than the lowest point. This allows the water to stand before spilling over, leaving the silt behind.
- Boundary waterways seem to have been widely constructed in earlier times, but are now either absent or rudimentary in upper plots and more defined in plots lower in the toposequence.
- Water is harvested in private or community ponds, and by channeling it

along gradients toward a domestic garden.
- Cultivation is done across the slope in order to conserve water.
- *Khus* (vetiver grass) is often grown on the boundary to check soil erosion. It strengthens earthern bunds and provides fodder.

Sociocconomic Dimensions

Adoption of SWC practices depends on a variety of socioeconomic factors, such as the size of a land holding, the economic status of the farmer, and land tenure.

A Note on the Socioeconomic Aspects of Tree Growing by Farmers

V. Ballabh

It is well known that permanent vegetation such as tree cover helps to reduce erosion. Therefore it is important to understand the circumstances under which farmers cultivate trees and perennial vegetation, as opposed to annual crops. Toward this end, the Institute of Rural Management, Anand, organized a workshop on the 'Socioeconomic Aspects of Tree Growing by Farmers'. The major objectives of the meeting were to understand:
- Why farmers had originally planted trees, and how far their objectives had been achieved,
- Why some farmers planted trees and others did not, and how these two groups differed socioeconomically,
- The profit farmers derived from selling trees rather than agricultural crops, and the competitiveness of farm forestry with agriculture by land type,
- The nature of the wood market, and
- The future prospects for farm forestry.

The Workshop identified two distinct patterns of tree growing by farmers, traditional and modern. The traditional patterns varied widely, having evolved to meet specific local needs and circumstances.

Table 1 briefly describes the differences between traditional and modern approaches.

Table 1. A comparison of traditional and modern approaches to tree g··· ·ing by farmers.

Characteristic	Traditional	Modern
Purpose	Subsistence	Income through sale
Location	Homesteads or bunds	Farm lands and bunds
Species	Mainly fruit species, or those which grew naturally in that area	Eucalyptus/casuarina/ subabul (*leucaena*)
Investment	Negligible in trees	Extensive use of land capital through trees
Regional	More trees in high rainfall areas; some in arid and semi-arid areas with little or no irrigation	More in agriculturally dynamic areas
Rate of adoption	Slow, declining due to pressure to bring land under agriculture	Very fast in the first 5 years but declining later
Pattern of planting on farm lands	Usually on bunds but also interspersed in field	Mostly monoculture
Number planted in year	Restricted to a few, often less than 20; naturally germinated and retained	100 to 10 000 per farmer
Effect on agricultural crops	Relationship was complementary, or supplementary	Trees often replaced annual crops or resulted in a decline in agricultural production in areas where agriculture is prosperous

It is obvious that a variety of factors contribute to the adoption of tree growing by farmers, and change agents must understand these dynamics if forestry schemes are to be successfully promoted. Basically, resource-poor farmers will plant and protect trees under the following circumstances:

- In semi-arid regions, where trees are a part of the farming system, to increase land productivity and sustainability, thus complementing agriculture;
- In regions of high rainfall and good soil, to augment the farmers' income;
- Where agricultural productivity is limited and uncertain, to provide an additional source of income that requires little labor input; and

- On land that cannot support agriculture but will produce a tree crop.

There exists enormous, untapped potential to improve the lot of the farmers through agroforestry. The main reasons why farmers have yet to plant trees on poor lands are:

- Insecurity of land tenure,
- Legal problems in harvesting and selling trees,
- Market imperfections,
- Lack of extension services, and
- Problems in the tree *patta* schemes.

It is unrealistic to expect that poor farmers will plant trees for purely ecological and environmental reasons. They will only do so if they see an economic benefit from such plantings. Evidence over the past 15 years suggests that farmers who have planted trees have done so for profit. It is important to integrate the traditional attributes of tree growing with modern approaches and relate them to economic gains, if farm forestry is to be successfully promoted.

Participatory Soil and Water Conservation Programs

Participatory Impact Monitoring of a Soil and Water Conservation Program in Gujarat

P. Shah, G. Bhardwaj, R. Amberstha, N.P. Gautam, Khan Bhai, and Ram Singh Bhai

The Aga Khan Rural Support Program (AKRSP) supports village institutions in undertaking soil and water conservation (SWC) on farmers' land as part of their watershed management program. Extension volunteers, nominated by the village institutions, are responsible for appraisal, technology generation, adaptation and diffusion, implementation, management, and monitoring.

Impact monitoring involved the farmers to the maximum extent possible, with extension volunteers providing guidance and support. Farmers made detailed ground maps of fields, mapped all the SWC treatments carried out, diagrammed impact indicators after the treatments were completed, and indicated changes taking place after the treatments. Such "before and after" maps were collected from all the farmers in the village. Farmers and extension volunteers together analyzed the benefits and drawbacks of different SWC treatments. Specific recommendations are being developed for each region of the village based on this exercise.

Participating farmers suggested that information be gathered on the following factors: (a) erosion controlled; (b) land reclaimed; (c) moisture retention in the soil; and (d) productivity and income generation.

The farmers of the Jullunder watershed area, which is covered by the program, were originally living in the Gir Forest, making a living mainly in husbandry. The area under the watershed was allotted to them by the Government of India in 1972 but most of it was lying fallow until the watershed development program was started 2–3 years ago.

The Planning Process

Participatory impact monitoring involves the following steps:

1. Discussion with each farmer on his field,
2. Deciding on the variables to be observed in consultation with farmer groups,
3. Ground mapping of baseline and impact maps,
4. Paper mapping using symbols,
5. Presenting these findings to watershed outlet groups,
6. Preparing aggregate maps based on the total information collected, and
7. Presenting these findings to the village community, leading to a joint discussion about:

Previous Page Blank

- Investments and returns,
- The technologies tried out, and the conditions of their success or failure,
- Local variations and diversities,
- The range of available options,
- The variables on which to experiment,
- Future plans and directions, and
- Generation of a technology domain suitable for the village.

In the Jullunder watershed, farmers were encouraged to contribute up to 50% of the costs of SWC measures, and the use of locally available materials was emphasized. The program was started on an individual basis, with willing farmers, and taken up with others as they became motivated. The extension volunteers, who were paid by AKRSP, were responsible to both AKRSP and the watershed society.

Identification of Appropriate Technology

The main features of the SWC technologies identified jointly by AKRSP and the farmers were:
- diversion drains,
- stone bunding,
- contour farming, and
- loose boulder checks in water courses and gullies.

These measures have increased the productivity of cultivated fields, brought fallow land under cultivation and created new fields through deposition of silt behind gully checks and waste weirs. The overall expenses for watershed development, including SWC, crop management, etc. works out to Rs 1600 ha^{-1}. The economic analysis showed that this cost was recovered by farmers within 2–3 years. The AKRSP team indicated that they were successful with soil conservation measures but not with water harvesting ponds because the water leaked out of the ponds.

In the discussion that followed the farmers' presentation, the following points were emphasized:
- Stone bunding, a traditional technology has been implemented in this watershed in a more systematic manner since the inception of the AKRSP program.
- Stone bunds are most suitable for this area because the soil is shallow, and stones are available within or near the fields. They are also more effective than earthen bunds in sloping fields.

Relevance of Participatory Impact Monitoring to Conservation Projects

A participatory approach facilitates cooperation, thereby encouraging farmers to adopt new practices that may be more suitable. It also helps extension volunteers understand existing practices. Specific advantages are:

- Monitoring becomes a dynamic process that is directly linked with planning and future action;
- Diagrams and maps help farmers understand the results of their experimentation;
- Farmers are better equipped to understand the results of their experimentation;
- Farmers are able to discuss such issues as generation, adoption, and evaluation of new technologies;
- Farmers are able to analyze the results of their experimentation within a framework, and to look at productivity and management of scarce resources with more understanding; and
- Observing phenomena like moisture retention in furrows, erosion control, reclaimed gullies brought under cultivation, and overall increase in productivity has prompted deeper economic analysis by the community, with the result that the costs of development programs have been reduced.

Community Organization and Participatory Learning Methods in the Watershed Context

J. Mascarenhas, J. Jangal, P.D. Prem Kumar, Ramachandran Rathod, Devalu Naik, and Maidrappa

Participative Integrated Development of Watersheds (PIDOW) is a project that aims to evolve a replicable strategy for participatory, integrated, equitable, and sustainable rehabilitation of small watersheds in semi-arid areas. It is a tripartite arrangement among the Swiss Development Corporation, the Government of Karnataka, and MYRADA.

The Project Area

The PIDOW project is located at Kamalapur, in the Gulbarga District of Karnataka. The area receives an annual rainfall of 780 mm, and is characterized by an undulating terrain with a large number of micro-catchments. Acute deforestation and insufficient soil conservation measures have led to heavy soil erosion, particularly on the upper slopes.

The PIDOW Approach

The major emphasis of the Project was on making the village community an effective fourth partner in the development exercise. This required understanding of local social dynamics, and traditional resource management and farming practices in the area. It was also necessary to create the appropriate people's institutions to develop and manage the watershed resources, which would be separate and different from existing village institutions. Finally, it was necessary to encourage a productive working relationship between the government and the community, in which governmental institutions would be responsive to the people's demands.

The Role of Government and MYRADA

After a few initial teething problems, MYRADA was able to work out an effective partnership with government to suit the objectives of PIDOW. The main governmental link since 1989 has been the Karnataka State Drylands Development Board (DLDB). The DLDB has vast experience in the technical, planning, and implementation aspects of watershed management, with the advantages of resources and manpower. MYRADA, on the other hand, is experienced in community organization, soil and water conservation, forestry, horticulture, and dryland agriculture. The two organizations therefore can play complementary roles.

Community Organization

MYRADA's usual approach to community organization involves the mobilization of small, functional, homogenous interest groups in the village. In the case of PIDOW, the context shifts from the village to the watershed. Therefore, there are many more affected groups, as practically the entire community forms part of the watershed and uses its resources. The various categories of people include:

- Those who have land and live within the watershed,
- Those who live within the watershed but have land outside,
- Those who have land in the watershed but live outside,
- Those who live within the watershed, and own land both within and outside,
- Those who live outside, and have land both within and outside the watershed, and
- The landless.

These categories are important especially in terms of the distribution of program benefits. Such information is collected locally, from official and personal records in the area.

The major task in organizing the community was to reconcile the main characteristics of the microwatershed and the very large size and heterogeneity of the community as a whole, creating manageable, small, homogenous groups. Microwatershed *sanghams* (MWS) or groups were formed, then subdivided according to location, culture, social/caste lines, economic status, and gender. The larger microwatershed functions as an informal apex group for these subgroups. This strategy helps preserve the participatory and functional character of the groups while maintaining the advantage of size that is required for lobbying with outside agencies and government.

In order to train the groups to be socially functional, MYRADA organizes regular evening meetings in the villages. These meetings serve to build awareness of watershed ecology and resource management, to discuss new types of institutions, their roles and functions, and foster group cohesiveness and cooperation. In the case of the less privileged groups (such as tribal people and women), the program also aims to create an awareness of their rights, empowering them toward action.

The project currently involves 34 associations in 7 micro-watersheds, of which 19 are men's and 15 are women's groups, with a total of 861 members.

Our experience has provided insights into the way in which people are encouraged to participate and empower themselves.

The Credit Management Program

Credit is a critical need of the people in the area. The *sanghams* are encouraged to promote savings among members, apart from creating resources in the form of a common fund. Capital formation is accelerated by offering subsidies and incentive grants that are linked to savings, and group loans from banks. Various income-generating programs are also underway, linked to asset formation through conservation activities. Villagers are therefore gradually freed from dependence on moneylenders and landlords, borrowing instead from the common *sangham* fund for their needs. Capital formation and management plays a key role in the development of the watershed in economic, environmental, and social terms. Community organization also aids the formation and development of institutions that help restore and manage the resources of the watershed in a creative and sustainable way. The *sanghams* are encouraged to develop their own working rules and regulations; MYRADA assists only in such technicalities as book keeping.

Participatory Learning Methods

The essence of PIDOW is community participation, facilitated by participatory learning methods (PALM), indicating joint learning and a shared understanding of the local situation. This is in contrast to the often biased and one-sided assessments by outsiders, where the information is rarely shared with the villagers. PALM is based on four major principles:

1. The relationship between the outsider and the villager is as between equals, both being professionals of a different nature.
2. The emphasis is on participation of people in their own development.
3. The outside agency must have a constant presence in the rural area, so as to fulfill its obligations to the community.
4. PALM does not stop with appraisal but goes beyond, into shared analysis and understanding of rural situations.

The PALM exercise has provided many valuable insights for watershed planning in particular, and overall development in general. Interaction on a personal level with villagers also provides a current and realistic picture of land ownership, use, etc., as in most cases official records tend to be dated and incomplete. This discovery of the actual situation adds a new dimension to microplanning, forcing authorities to tackle irregularities and resolve them.

From participatory learning, then planning, the community is led toward implementation. The final plan is an outcome of consensus between the community, MYRADA, and DLDB. The plan, which has five major components (treatment, budget, scheduling, implementation, and management) is implemented by the *sangham* through committee action. The conflicts that are bound to arise are dealt with by the committee or by the *sangham* itself, often in consultation with MYRADA staff.

This approach to watershed development has greatly enhanced MYRADA's understanding of rural situations. The next step is to move further in the direction of development, formalizing the concept of appropriate, participatory institutions in watershed development.

The Farmers' Experience in Gulbarga

The main features of the soil conservation practices implemented in the watershed are:

- diversion drains,
- series of stone checks in *nallas* (gullies) for the creation of deposition fields,
- boulder bunds on field boundaries,
- earthern bunds with waste weirs on field boundaries, and
- pitching of stones into gullies.

It was possible for the entire work in the watershed area to be designed and implemented by the local people through the *sangham*. The concerned farmers paid 25% of the total cost. In addition, the farmers also contributed to the

sangham at the rate of Rs $2m^{-1}$ for boulder bunds and Rs $1m^{-1}$ for diversion drains. This arrangement resulted in improving the financial resources of the *sangham* as they obtained Rs 180000 from contributions from individual farmers in addition to orders for work worth Rs 25000 in one year.

The experience in Gulbarga showed us that:

- The earlier concept of cooperatives in the concerned villages did not succeed due to inadequate education regarding the organization of society, interference by outsiders, involvement of Government money, etc.
- Further study is needed to understand conflict resolution between different communities, equity issues, and the clash between scientific recommendations and individual needs, particularly in the case of land use.

Participatory Methods: The Only Way to Achieve Sustainability

E. Venkat Ramnayya, Narsimha Reddy, Venkat Reddy, and Naganna

Participatory planning is now recognized as being essential to the development process. Involving the local population in project planning leads to sustainable productivity. Youth For Action (YFA) has applied this approach with successful results in the Mahbubnagar district of Andhra Pradesh.

The tools we use to encourage participation include both formal and informal methods. Semistructured interviews with farmers/villagers, studying the agroecological system of the village, mapping and modelling farmers' fields with the farmers themselves, etc., enable us to get first-hand information about local conditions and needs from the people themselves. This is in contrast to most projects where the involvement of the farmers is negligible and therefore they have little or no interest in their success. Development is basically a process whereby people learn to participate constructively in finding solutions to their own problems.

We used participatory methods in recent projects in the Vipinganda and Veltoor watersheds in Mahbubnagar district where the villagers are involved in the planning and implementation of conservation programs. These watershed areas are characterized by shallow red soil, low rainfall, and a mild slope.

Specific projects undertaken include soil conservation, water harvesting, and social forestry. Methods used take into consideration local choices and needs, particularly of less-privileged groups.

The main features of YFA's approach are:

- Participatory rural appraisal to learn from farmers not only about their needs but also about solutions;
- Formation of a number of small homogenous *sanghams*, and also a composite watershed *sangham* in each village;
- Planning of soil and water conservation programs on an individual farmer basis through joint field visits;
- Social equity through internal contribution of water and land resources by the beneficiary to the landless; and
- Substainability through diversification of land use and proper management of land and water resources.

The soil and water management technologies being implemented include:

- Diversion drains for safe diversion of water to ponds and tanks;
- Field bunds on boundary lines with waste weirs;
- Disposal of water from field to field or by boundary waterways;
- Farm ponds for percolation and irrigation; and
- Gully checks.

The concern for social equity was an important feature of YFA's approach. The beneficiaries of individual farm ponds contributed not only 25% of the overall cost but also gave a part of their land and water to the landless families identified by the local *sangham*.

The watershed program has improved the productivity of cultivated land, bringing fallow land under the plow, increasing the area under irrigation through efficient use of run-off, water and hence improving the sustainability of the system. This experience with implementation of a watershed program through individual farmers, *sangham* and local-village level workers has been found to be successful. The experience emphasized that:

- The earlier program implemented by the Government did not succeed because farmers were not involved in the planning process, and unsuitable SWC technologies were introduced.
- There is a lot to learn from farmers about efficient soil and water management practices for their situations.
- There is a need for flexibility in the formation of a *sangham*, choice of technologies, and tackling social equity issues so as to achieve a 'local fit'.

The participatory approach emphasizes the identification of location-specific needs and community responsibility in a project.

Participatory Planning in the Kabbalnala Watershed Development Project

K. Ramakrishnappa

The Kabbalnala Watershed Development Project for Rainfed Farming in Karnataka was initiated in 1984 with World Bank assistance, with the overall objective of integrated development of arable and nonarable lands in the watersheds.

During the initial stages of the Project, integrated plans were prepared at the grassroots level by an interdisciplinary team from the forestry, agriculture, and horticulture sectors. The people's participation was limited, being restricted to consultations during the implementation of these plans.

Though the implementation proceeded in a systematic manner, sustainable progress could not be achieved as the community's real needs and priorities had not been adequately understood.

Consequently, plans were made in consultation with the local people.

This involved the formation of microwatershed *sanghams* to encourage participation. This was found to be successful in homogeneous (single community) villages, but in heterogeneous (multiple community) villages, the approach met with only limited success mainly because the project staff were not familiar enough with heterogeneous village situations. In order to further their understanding of the village and the community, project staff extended the planning period by 6 months, spending time "learning to unlearn" their previous misconceptions.

Workers stayed in the villages, studying first hand their socioeconomic and political dynamics. This exercise also helped to establish rapport between extension workers and villagers.

To emphasize community involvement in the Project, planning was entrusted to the people themselves.

Resource persons were identified from each group in the village. They were responsible for planning with technical guidance from project staff.

These village resource persons (VRPs) were trained in watershed management activities, with the help of farmers who had participated in the earlier project, and members of older *sanghams*. The VRPs in turn organized community participation through meetings with their interest groups. They also collected basic information on land ownership, patterns of use, credit facilities, etc.

Guided by project staff, they identified problem areas and issues in the watershed, identified traditional resource management and conservation practices, and noted farmers' priorities and needs.

Following this exercise, the VRPs and project staff together prepared integrated microwatershed plans for both arable and nonarable lands indicating

inputs required and treatments for different plots. Soil erosion estimates and other environmental factors were also considered. Each microwatershed team worked out a budget for their plan. These individual microwatershed plans were consolidated into a larger project plan covering the entire year. This was directly approved by government authorities, and implemented without any modification. The plan was entirely a people's plan, based on local needs and priorities, and created by local representatives for successful and sustainable development of their own watershed.

"LEARN": The Anantapur PRA Approach

K. Chandramouli

Planning and implementing rural development programs with proper participation is considered a key to sustainable rural development. This paper describes the application of the Participatory Rural Appraisal (PRA) method to watershed management in Anantapur, Andhra Pradesh.

Anantapur receives an average annual rainfall of 544 mm, the lowest in the state. The area is drought prone, and the incidence of droughts has increased considerably since 1950. Past efforts in such sectors as forestry, irrigation, and soil and water conservation have met with very limited success.

Analysis reveals that among the main reasons for this lack of success are:

- Some of the government-built structures for water conservation, such as check dams and percolation tanks, have not been maintained by the villagers because they are perceived as government property, which therefore should be maintained by the government.
- The farmers' real needs appear to have been inadequately understood; for instance, many of the bunds are located where they do not serve the purpose of conserving soil. Given a choice, farmers say they would have constructed the bunds elsewhere and differently.
- Trees planted under the forestry program have since been felled by the villagers for fuel, as there seems to be inadequate understanding of the importance of afforestation.

It was apparent that the farmers were not consulted during planning, nor were they involved in the execution of SWC and forestry programs.

The PRA Approach

Watershed teams were constituted in 16 microwatersheds in the district. These teams included one representative each from agriculture, irrigation, forests,

sericulture, fisheries, groundwater, animal husbandry, and horticulture sectors, Three different participatory models were attempted:

1. The entire team conducted the PRA in one selected village in the watershed,
2. The team split into two groups to conduct the PRA in two villages, and
3. One officer conducted the PRA in each village.

It should be remembered that the success of any approach depends on the caliber of the staff by whom it is implemented. In each model, the representatives arrived in the village unannounced, on foot, so as to avoid drawing attention. Various attempts were made to break down social barriers once interaction with the villagers was initiated. Once this was done, the villagers participated eagerly in working on mapping the watershed, willingly providing information and ideas so that a truly relevant SWC plan could be put together. As the interaction between the outsiders and the villagers continued beyond "business", social barriers quietly disappeared and a cooperative relationship was established. The villagers played a major role in enumerating important problems, and in identifying solutions. There was remarkable enthusiasm on every side, and there was no appreciable difference in the results achieved by the three models.

Thus the "LEARN" approach was found to be a definite success in Anantapur. The approach means that SWC program officials should;

L - listen carefully to farmers,
E - encourage farmers to speak,
A - ask questions without interrupting,
R - review whatever farmers say, and
N - note everything down for planning.

The Drought Prone Area Plan (DPAP) plan for 1990/91 was prepared on the basis of this exercise and is now being implemented. It is too early to say anything about the outcome, but given the enthusiasm shown during planning, it should be a success.

Technology Choice and Participation of the Rural Poor in Programs of Sustainable Agriculture and Rural Development in a Semi-Arid Region

K.R. Datye

For more than a decade, the Centre for Applied Systems Analysis and Development (CASAD) has been looking into the constraints to adoption of sustainable agriculture, and the development and maintenance of land and water re-

sources. Programs of technology development for soil and water conservation suffer from the isolation of the "outsiders" (researchers and planners) from the realities confronting the rural poor. The outsiders and the villagers differ widely in their perceptions, time horizons, priorities, and norms of perception. The only way these limitations can be overcome is to create a common understanding among the participants about the needs, and the ways in which these needs are to be met.

This paper considers the important goals and performance norms of agricultural and rural community development programs (including natural resource management programs), and outlines the process of interaction between outsiders and the rural community, illustrated by these case studies.

This interaction should lead to participatory appraisal of constraints, developmental alternatives, and relevant technologies introduced in natural resource management programs. Unfortunately, however, the established mode of functioning limits phased, participatory development.

The major shared goals of development include creating sustainable livelihoods and setting up self-reliant and participatory local institutions that empower the rural poor. Development programs should strive to create permanent productive assets to attain a biomass surplus after meeting subsistence needs of food, fodder, and fuelwood. Once such goals are agreed upon, it should not be difficult to arrive at a common understanding on norms of performance.

The process of interaction should involve, in a phased manner, programs to create awareness among both villagers and program officials, participatory appraisal to assess the needs of all the villagers and develop a strategy for conflict management, and to scale up accepted techniques. The importance of local skills and traditional knowledge should be recognized, while applying judicious external inputs of energy and materials, and taking advantage of modern technology.

Baliraja Water Distribution Society

In this Program, irrigation technology was introduced after being screened by farmers. A local water user's group was created to manage irrigation. The farmers used water extensively rather than intensively, and adopted water conservation practices, thus minimizing water use per farm and distributing the benefits of irrigation as widely as possible. Processing industries were developed for the surplus agricultural production, multiplying the employment created by the Program.

Organization of Rural Poor in Solapur District

This agricultural development program for persons of scheduled castes arose following the failure of efforts to replicate a model employed in advanced farming communities. The Program's focus is on women, who were found to be

the most highly motivated group in the community. Empowering them to set the Program's agenda and choose its methods, and helping them gain access to irrigation technology, will stimulate agriculture in this community.

Organization of Nomadic Tribes in Solapur Town

Efforts to assist this rural community of former nomads now settled on the outskirts of Solapur town focus on increasing biomass production and developing market linkages and value-adding activities to exploit the nearby market. The Program produces high quality, inexpensive building materials, since construction is the favored occupation of many people in this community. The emphasis on market linkages gives non-farmers a stake in the agricultural development program.

These experiences have shown us that exclusive reliance on local knowledge and resources would inordinately delay the creation of opportunities for resource-poor groups. With adequate external inputs, the conflict between short-term survival and long-term sustainable productivity could be resolved.

Participatory Research with Women Farmers

M.P. Pimbert

This video conceived by the Principal Entomologist, Legumes Program, ICRISAT and directed and produced by Development Perspectives, Hyderabad, India, deals with ways of involving farming communities in the production of pest-resistant cultivars for the complex, risk-prone agriculture of the semi-arid tropics. While its subject is not soil and water conservation, the participatory rural appraisal (PRA) methods portrayed in the video are similar to those for the SWC projects described by many of the participants in this Workshop. The video shows that these methods are relevant to research, project planning, and project implementation.

The video is designed as an education tool which:

1. Explains why farmers should be involved in the evaluation of pest- resistant crop genotypes developed on research stations where conditions differ from those on farmers' fields in the semi-arid tropics;
2. Shows how scientists can facilitate a process whereby resource-poor farmers access genetic material grown under their farm circumstances and with their own management. Farmers are effectively involved in a decentralized research mode that seeks to complement the transfer of technology model of agricultural research and development.

Through its focus on participatory research with women farmers the video implicitly or explicitly invites reflection and public debate on the following topics:

- The choice of research styles that best support diversity as a means to sustainability and food security in risk-prone, complex environments.
- The need to acknowledge and formally reward women farmers for their contributions to the creation, conservation, and use of genetic diversity as part of their food-providing activities.
- The integration of formal plant breeding and local seed selection in ways that ensure biological diversity at the farm level and democratic control over the information built into seeds—the first link in the food chain.
- The changes in institutions, attitudes, and behavior that would allow people to learn and create knowledge through mutual dialog and collective enquiry.

> "The issue of concern is who makes the choice of technology. Normally, those least affected by the choice are the ones responsible for determining that choice, while those who are forced to live with the technology have the least say in the matter."
>
> - Noeleen Heyzer

Recommendations

Working Group Recommendations

Working groups were constituted for each of six main aspects of soil and water conservation (SWC) programs. Each group, after detailed discussions, presented a set of recommendations, outlined here.

I. Technology

1. The negative reaction of farmers towards currently recommended SWC practices does not stem from an ignorance of soil erosion, but rather from the fact that the recommended practices are technically and/or economically unsuitable for their small farms. Traditional SWC practices, on the other hand, are particularly suitable for small farms. For instance, indigenous technologies have generally developed on the ownership boundary, an approach that particularly benefits the small-holder farmer. These practices differ considerably from region to region depending on soil type, rainfall, topography, etc., and are often modified by the local farmers themselves, indicating that indigenous technology is dynamic.

   While NGOs have made efforts to promote indigenous technologies, such efforts by government departments have been rare, primarily due to lack of scientific data and organized information. Therefore there is a need to systematically document indigenous technical knowledge on soil and moisture conservation in different agroclimatic regions. This should include not only the various practices, but also the farmers' perceptions. Particular emphasis should be laid on understanding the process behind the generation of these indigenous practices. Such studies should be carried out by teams comprising a crop scientist with training in SWC, an economist/social scientist, and a representative of a local NGO/extension department.
2. There is also a need to compare the relative technical and economic efficiency of indigenous and currently recommended practices. This comparison should be done simultaneously on the research station and in the farmers' fields. The farmers' criteria and perspectives should be borne in mind while evaluating these practices.
3. It was recognized that while most farmers are concerned about erosion and aware of indigenous practices to overcome it, only a small percentage of them actually adopt these practices. It is essential to identify the conditions under which farmers will adopt indigenous SWC methods. Such investigations should also explore the future role of outside agencies including government departments, banks, voluntary organizations, etc., in promoting indigenous technologies.
4. A clear profile should be prepared of three categories of farmers: those who adopt SWC practices, those who neglect erosion problems, and those who are in between the two, so that future interventions can be planned accordingly.

Previous Page Blank

5. There seems to be a large difference in perspective between researchers and farmers with regard to erosion control measures. SWC scientists seem to focus only on long-term gains and on achieving the single objective of conserving soil and water, while farmers concentrate on both short- and long-term gains and multiple objectives, including increase in productivity from cultivated fields, fodder production from bunds, boundary demarcation, convenience in operations, division of land for future generations, etc., besides the main objective of overcoming the erosion problem. In this context, there is a need to critically examine the reactions of farmers towards recommended SWC practices. Where farmers' reactions have been negative, recommended practices should not be further implemented until suitable modifications have been made.
6. Given that many indigenous practices are sound at the field level, they should be included among recommended practices (particularly in government-supported programs) so that farmers have more choice. Both direct and indirect methods of conservation should be considered and included in development programs.
7. Many indigenous practices can be implemented either on an individual basis or with limited group action. Therefore, a beginning could be made with willing individuals or small groups rather than forcing all the farmers in a watershed to participate.

II. Subsidies and Credit Programs

1. More research must be done to:
   a. Identify profitable soil and water conservation (SWC) practices, and
   b. Determine the circumstances under which subsidies can be justified. Currently too little information of this kind is available to enable prescriptions to be made.
2. Assessing whether technologies are bankable requires a calculation of their costs and benefits. Costs must be measured under a variety of circumstances, depending on the use of family versus hired labor, access to materials, etc. Measuring benefits requires isolating the impact on yields of SWC measures, as opposed to those of weather and crop inputs. It also must account for uncertainty resulting from weather variations.
3. Regarding the design of credit programs, banks should deal with the *sangham* rather than with individual farmers. This reduces the bank's administrative costs and risks. The *sangham* should be entitled to additional loans only after repayment, relying on group pressure to encourage repayment. Lending through the *sangham* encourages flexibility, since the *sangham* can authorize a technology that meets site-specific requirements. The *sangham* can work with state watershed authorities, which in turn will provide the bank with cost estimates to guide credit limits. Various models should be tested to identify efficient ways to deliver credit.

4. A major effort is required to develop strong *sanghams*. NGOs can help in this regard. This is an important prerequisite to developing an efficient system for financing SWC investments.
5. Farmers in SWC programs should be contracted to work on their own land in order to reduce costs and improve performance. They should be paid by the job, not the hour or day, in order to reduce costs. Where information and motivation are constraints to adoption, these should be provided to farmers by state watershed authorities and NGOs.
6. Subsidies should be offered only when net social returns to soil conservation exceed net private returns. This should not be assumed to be the case; research is needed to examine the circumstances under which it is so.
7. Likewise, subsidies should not significantly replace private investment, but should be designed to encourage maximum adoption at minimum cost. Thorough investigation of private practices is needed to ensure that government programs do not pay for investments that would in any case be made privately. NGO programs can study the extent to which farmers are willing to contribute.
8. Cost-effectiveness, high adoption, and equity can best be achieved through a subsidy that allots more funds to poorer farmers. This could be done with a flat rate subsidy that allots funds per family rather than per acre. Alternatively, a sliding scale with a declining subsidy per acre, reaching zero after five acres, might prove more effective. Small-holder farmers would thus receive a higher subsidy per acre than large-scale farmers, who may be able to afford to spend more. (While landholding size is not the best indicator of willingness or ability to pay for soil conservation measures, it may be the most practical proxy. NGOs can experiment to achieve more accurate targetting).
9. In principle, subsidies should be given at a fixed rate rather than as a percentage of total costs, in order to encourage less expensive technologies. NGO programs should experiment with this and other innovative subsidy schemes to determine the best ones.

III. Flexible SWC Programs

1. Watershed officials must recognize that farmers are their primary clients.
2. Watershed plans must be based on surveys carried out through a participatory approach with local farmers. For this purpose the village community should be grouped into smaller homogeneous units so that their different needs and perspectives can be understood and addressed.
3. Indigenous SWC practices should be incorporated in the watershed plan. Further, indigenous knowledge from different agroclimatic zones must be documented and circulated to implementing agencies to create greater awareness and appreciation.
4. Watershed works should be executed by beneficiaries under the auspices of

the local *sangham,* rather than by contractors.

5. The watershed plan should not be hastily implemented. The usual tendency to exhaust funds and achieve physical targets within a financial year does not facilitate quality performance. A proper flow of funds must be ensured, with a provision to carry over the budget to the following year if necessary, without too much difficulty.
6. Where technically feasible, farmers prefer to invest in erosion control measures in a phased manner rather than all at once. This approach helps to reduce costs, and should also be considered in government-supported watersheds. Therefore budget provisions should also be phased.
7. There is a need to provide outside technical help to consult on the design of indigenous SWC structures, and to implement effective SWC measures on common and public land. However, on private land, farmers must give their final approval on the design of structures in their fields.
8. There should be a provision for incentives and awards for watershed authorities to implement cost-effective programs. This will encourage innovativeness and high-quality work, and will help counter opposition from watershed authorities who stand to lose from altering the current incentive structure.
9. NGOs can play a role at different stages of watershed planning, execution, and evaluation. Their major contribution could be at the motivational and organizational level. They can train watershed authorities in participatory planning and implemention methods and help strengthen the *sangham,* which will play an important role in flexible programs.
10. Assistance for watershed development, both internal and from abroad, should not dictate the type of materials and technical designs to be used. Watershed plans must be location-specific because geographical, agroclimatological, and socioeconomic conditions, vary, as do preferences.
11. Multidisciplinary watershed teams should be constituted and brought under a single authority for administrative controls. The current system, in which different line departments act in isolation from each other, often creating contradicting plans, must be abolished.

IV. Education and Training

1. The need to learn about indigenous SWC practices from farmers cannot be overemphasized. However, a prerequisite for this learning is a willingness to learn, and the realization that farmers have something to offer. Thus, effective learning has to be preceded by a change in attitudes and behavior towards the farmer.
2. The process of attitude change has to start from the top, from teachers in universities to policymakers/implementers in government. Policymakers can be reached through workshops, seminars, newspaper articles, lobbying by special interest groups, and donor agencies. In addition, books and jour-

nal articles are useful to target teachers and researchers. This group can also be encouraged by research awards and grants to study indigenous knowledge using innovative methods such as participatory rural appraisal (PRA). Positive reinforcement through proper recognition is important to promote learning from farmers.

3. The development of relevant training and educational material is important. This should include videos, slides, books, and textbooks. Dependence on technical manuals should be avoided as they tend to standardize information. This creates reluctance to deal with any information or observation that does not fit into the standard format of the manual. Training materials should be reasonably priced, to ensure easy access to all categories of potential users.
4. A major hurdle is the shortage of training capacity, which must be increased. The present system of extension education was considered inadequate for two reasons. Firstly, it is confined to state agricultural universities. Secondly, the inability among teachers and students to realize that extension workers have anything to learn from farmers. This again underlines the need for a change in attitude towards farmers.
5. Funding for research awards, textbook development, etc., is available through many international agencies. National organizations such as the University Grants Commission, the Indian Council of Social Science Research, etc., must provide more funding for research on indigenous knowledge and PRA methods. It is hoped that some of this research will lead to the development of training and teaching materials.

V. Management of Common Property Resources

Development of common property resources requires community participation and organization; therefore NGOs have a special role to play.

1. There is a need to categorize the community into a number of small homogeneous groups so that every group's interests are understood and addressed. A separate, composite watershed *sangham* should be formed comprising of two or three representatives from each homogeneous group.
2. A thorough analysis of the present distribution of benefits of common property resources in a watershed must be made before any new development program is started.
3. The concept of "perceived equity" should be the main guiding force in the identification of future beneficiaries of the developed common property resource. Special consideration should be given to women and the landless.
4. Particular efforts are needed to develop fodder, fuel, and raw materials for the common land resource so that it may help generate additional employment for landless families, particularly during lean employment periods. This is crucial to encourage them to protect vegetative cover and so conserve soil and water on common or public land.

5. Research and experimentation are needed to identify circumstances under which diverse farmers will cooperate in the implementation of SWC measures on common lands, and to identify and strengthen mechanisms to resolve conflicts when interests clash.

VI. Legal Issues Affecting SWC

1. A change is required in tenancy rules so that tenants may retain land for longer periods, while at the same time protecting landlords' rights on their property. This will encourage tenants to take a longer-term view and give them an incentive to invest in conservation measures.
2. Absenteeism must be discouraged, as absentees and tenants invest little in SWC. Alternatively, absentees should be encouraged to plant perennial vegetation on their land.
3. In order to encourage planting trees and perennial vegetation, the laws restricting cutting and transporting trees must be relaxed.

Summary Recommendations

I. Researchers

1. Indigenous technical knowledge on soil conservation must be systematically documented.
2. Indigenous practices should be tested under actual small farm conditions, and judged according to farmers' criteria.
3. Conditions under which farmers invest or do not invest in soil and water conservation must be documented and understood.
4. Research is needed to identify profitable SWC technologies and practices.
5. Farmers' reactions to recommended practices must be clearly documented and understood.
6. Research and experimentation are needed to identify circumstances under which farmers will cooperate with each other.
7. Fodder and fuel resources must be developed to reduce pressure on soil-conserving perennial vegetation.
8. Research and experimentation are needed to understand the circumstances under which farmers and other villagers protect perennial vegetation.
9. Research is needed to identify when net social returns to SWC exceed net private returns.

II. Policymakers

1. Policymakers and teachers need to participate in PRA exercises, workshops, and field visits to gain a greater appreciation for indigenous knowledge and participatory development planning.
2. Innovative research methods should be taught at universities to encourage better understanding of rural decision-making. Funding is required to develop suitable teaching materials. Grants should be made for research on indigenous knowledge using such creative research methods as PRA.
3. Credit should be made available for economically viable SWC technologies, including those that are indigenous.
4. Such credit should be extended to farmers indirectly through the village *sangham*, to reduce costs and risks, and to increase flexibility. Various models should be tested to identify efficient ways to deliver credit.
5. The *sangham* must be established and/or strengthened for this approach to be feasible.
6. Subsidies should be offered only when net social returns to soil conservation exceed net private returns. Research is needed to examine the circumstances where this is so. Likewise, subsidies should not replace private investment.
7. Watershed programs should not be guided by physical targets, but by the objective of achieving sound, cost-effective results. Incentives to watershed authorities should be designed with this in mind.
8. Longer tenancy must be legalized to encourage tenants to take a longer-term view of land care.
9. Absentees should either be encouraged to grow perennial vegetation or implement SWC measures, or to sell their land.
10. Laws that restrict cutting and transporting trees must be relaxed to encourage farmers to plant trees.

III. SWC and Watershed Authorities

1. Watershed authorities must recognize that farmers are their primary clients.
2. Watershed programs should be planned and implemented with farmers' full participation.
3. Watershed authorities should be willing to support indigenous technologies.
4. Farmers must be contracted to work on their own land to reduce costs and improve performance.
5. Watershed programs should not be guided by physical targets, but by the objective of achieving sound, cost-effective results. Incentives to watershed authorities should be designed with this in mind.
6. Watershed programs should facilitate stepwise investment where feasible, in order to be more cost-effective.

7. Technical assistance is needed to ensure the construction of sound structures. However, farmers should give final approval of the design of structures in their own fields.
8. Watershed authorities should seek assistance from NGOs to help motivate and organize villagers, and establish and/or strengthen the *sangham*. They should also seek training in participatory planning and implementation methods.
9. Watershed teams must be multi-disciplinary and brought under a single administrative authority, to coordinate efforts of different line departments.
10. In planning SWC programs, varying interests of different groups and the distribution of benefits among them must be analyzed and addressed.

IV. NGOs

1. NGOs' comparative advantage in promoting SWC lies in motivating and organizing farmers, and in developing and refining techniques for participatory planning and implementation of projects.
2. NGOs should work in cooperation with government programs to share their strength in promoting participatory methods.
3. NGOs should work with government to establish and/or strengthen the *sangham,* so that they can facilitate implementation of flexible SWC programs.
4. Research and experimentation are needed to identify circumstances under which farmers will cooperate with each other.
5. Research and experimentation are needed to understand the circumstances under which farmers and other villagers will protect perennial vegetation.
6. In planning SWC programs, varying interests of different groups and the distribution of benefits among them must be analyzed and understood.

Participants

India

V. Ballabh
Institute of Rural
Management (IRMA)
P.O. Box 60
Anand 388 001
Gujarat

R. Chambers
Visiting Faculty
Administrative Staff College
of India (ASCI)
Bella Vista
Hyderabad 500 049
Andhra Pradesh

R. Chand
Department of Agricultural Economics
Y.S. Parmar Agricultural and
Horticultural University
Nauni, Solon 173 230
Himachal Pradesh

K. Chandramouli
Project Director
District Rural Development Agency
Anantapur 515 001
Andhra Pradesh

P.N. Chowdary
Joint Director of Agriculture
Maheswaram Project
Sivam Road
Hyderabad 500 044
Andhra Pradesh

K.R. Datye
Centre for Applied Systems Analysis
in Development (CASAD)
"Ganesh Kutir", 1st Floor
Prarthana Samaj Road,
Vile Parle (East)
Bombay 400 057
Maharashtra

N.P. Gautam
Programme Organizer
(Watershed Development)
A-14, Meenari Apartment
Opposite Rayon Mill, Veraval
Junagadh District 362 001
Gujarat

Khan Bhai and
Ram Singh Bhai
Farmers
Junagadh District 362 001
Gujarat

S.L. Ghosal
Director of Agricultural Extension
National Centre for Management of
Agricultural Extension (MANAGE)
Rajendranagar
Hyderabad 500 030
Andhra Pradesh

J. Jangal
Project Coordinator
PIDOW-MYRADA
Aiwan E-Shahi
Gulbarga 585 102
Karnataka

Mohd. Abdul Kareem
Research Associate
National Centre for Management of
Agricultural Extension (MANAGE)
Rajendranagar
Hyderabad 500 030
Andhra Pradesh

P.D. Prem Kumar
PIDOW-MYRADA
Aiwan E-Shahi
Gulbarga 585 102
Karnataka

Ramachandran Rathod,
Devalu Naik, and
Maidrappa
Farmers
Gulbarga District 585 101
Karnataka

J. Mascarenhas
Programme Officer
PIDOW-MYRADA
Aiwan E-Shahi
Gulbarga 585 102
Karnataka

V.K. Misra
Managing Director
Rashtriya Vriksha Mitra Sahyog
Limited (RVMS)
National Dairy Development
Board Campus
Anand 388 001
Gujarat

Narsimha Reddy,
Venkat Reddy,
Naganna
Farmers
Mahboobnagar District
Andhra Pradesh

P. Bhaskara Prasad
Director, Drought Prone Area
Program (DPAP)
Office of the Commissioner
Panchayatraj and Rural Development
Abids
Hyderabad 500 001
Andhra Pradesh

K. Ramakrishnappa
Project Director
Kabbalnala Watershed
Development Programme
Bangalore Rural District
Kanakapura 562 117
Bangalore

E. Venkat Ramnayya
Director, Youth for Action (YFA)
1-8-702/26/1
Shankermath
Hyderabad 500 044
Andhra Pradesh

P.J.V. Rao
Team Leader, Spearhead Team
Rashtriya Vriksha Mitra Sahyog
Limited (RVMS)
Tirupathi 517 507
Andhra Pradesh

M. Vithal Rao
Deputy Director of Agriculture and
Soil Conservation
Mahboobnagar 509 001
Andhra Pradesh

J. Krishna Reddy
Assistant Director of Agriculture
and Soil Conservation
Nalgonda District
Deverakonda 508 248
Andhra Pradesh

B.G. Rajasekhara
Professor
University of Agricultural Sciences
Gandhi Krishi Vidyan Kendra (GKVK)
Bangalore 560 065
Karnataka

S.T. Somasekhara Reddy
Research Fellow
Indian Institute of Management
Bannerghata Road
Bangalore 560 076
Karnataka

N.K. Sanghi
Zonal Coordinator
Central Research Institute for
Dryland Agriculture (CRIDA)
Santoshnagar
Hyderabad 500 659
Andhra Pradesh

S.C. Tewari
Professor and Head
Department of Agricultural Economics
Y.S. Parmar Agricultural and
Horticultural University
Nauni
Solon 173 230
Himachal Pradesh

T.G. Tiruvengalachary
Assistant Director of Agriculture
Office of Soil Survey
Gandham Vari Gudem
SLBC
Nalgonda 508 001
Andhra Pradesh

J. Venkateswarlu
Director
Central Arid Zones Research
Institute (CAZRI)
Jodhpur 342 003
Rajasthan

Nepal

G.J. Gill
Program Leader
Winrock International
P.O.Box 1312
Kathmandu
Nepal

USA

T. Patel
Yale School of Forestry and
Environmental Studies
205 Prospect Street
New Haven, CT 06511
USA

ICRISAT

L.D. Swindale, Director General
J.M. Kerr, Assistant Principal Economist, Resource Management Program
M.P. Pimbert, Principal Entomologist, Legumes Program
K.G. Kshirsagar, Senior Research Associate, Resource Management Program
A. Gupta, Research Fellow, Resource Management Program

Working Group Participants

I. Technology
J. Venkateswarlu
N.K. Sanghi
M. Vittal Rao
E. Venkat Ramnayya
B.G. Rajasekhara

II. Subsidies and Credit Programs
J.M. Kerr
R. Chand
M. Ashokan
N.P. Gautam

III. Flexible SWC Programs
P. Bhaskara Prasad
K. Ramakrishnappa

IV. Education and Training
R. Chambers
G.J. Gill
S.L. Goshal
A. Gupta
Mohd. Abdul Kareem
S.C. Tewari

V. Management of Common Property Resources
K.R. Datye
S.T. Somasekhara Reddy
V. Ballabh
T. Patel

VI. Legal Issues Affecting SWC
K.R. Datye
S.T. Somasekhara Reddy
V. Ballabh
T. Patel