

**STATE OF ART ON METHODOLOGICAL PACKAGES FOR
PLANNING AND IMPLEMENTATION OF NATURAL RESOURCES
CONSERVATION PROJECTS FOR RURAL DEVELOPMENT**

AND

**MODERN WATERSHED MANAGEMENT CONCEPTS
FOR DEVELOPING COUNTRIES**

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PART I

STATE OF ART ON METHODOLOGICAL PACKAGES FOR PLANNING AND IMPLEMENTATION OF NATURAL RESOURCES CONSERVATION PROJECTS FOR RURAL DEVELOPMENT

RESUME

A state of the art discussion of the salient methodologies used in the soil and other resource conservation projects aimed at rural development for rural poverty alleviation, is presented for upland watershed areas in the developing countries. Recent global trends, status and problems faced in available methodological packages for planning and implementation of soil and other resource conservation projects for sustaining upland rural development are discussed. It includes the farmer first verses transfer of technology (TOT) model of extension. Techniques of Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) for learning conservation oriented local technology knowledge (LTK) from farmers are compared for easier extension of traditional conservation practices. Problems in using text book methods of land use planning are presented. Need for including land titling in the soil conservation projects is emphasized. In absence of better substitutes for subsistence agriculture within the reach of the upland poor farmers, emphasis on managing the existing use by simple traditional methods and agro-forestry practices is presented. The need for reintegrating rural development in resource conservation projects for their successful implementation is reviewed. The transfer of technology model of extension which was successfully used during green revolution by resource rich farmers under assured water availability conditions has not been successful in fragile eco-systems like steep lands and with poor and small farmers. However the Farmer First approach so far tried only on small scale as an alternative has not yet been replicated on a national level any where in the world. Finally essential elements for peoples' participation and need for conservation incentives is presented. The application of all these methods in soil conservation so far has been limited and their need is only recently being realized.

KEY WORDS: Rapid Rural Appraisal, Participatory Rural Appraisal, Transfer of Technology verses Farmer first approach of extension, Land Use Management, Rural Development by natural resources conservation, Conservation incentives, peoples participation

1. INTRODUCTION

Many new developments have taken place in the recent times in the field of natural resources conservation for rural development (FAO,1985). Many international conferences have also been dedicated to the related issues (FAO/RAPA, 1984;1985;1986;1988; Khon Khen University, 1987, Chambers et al., 1989, Bakker, 1992, etc.). This has been influencing many national and international institutions in many developing countries which are trying to re-orient their institutions and actions accordingly. In the IV Guelph-Wageningen-CATIE conference on "Global trends and sustainable integrated rural development (IRD) planning and implementation", many case studies were presented on the methodological (Bakker, 1992; Miller, 1992; Ferran/Sharma, 1992), institutional (Dusseldrop, 1992, Xuan, 1992) and structural adjustment (Fuller and Bor, 1992; Simples and Tossou, 1992) aspects. All these recent experiences allow a fresh look at a wide range of issues ranging from agricultural development to environmental protection through rural development. These advances (Chambers et al. 1989, Gupta, 1990;1991; Sharma, 1990; Young,1989) permit a comparative study of the status, problems and range of methodologies available for planning and implementation of natural resource conservation and rural development projects and programs.

The objective of this article is to present a state of the art discussion on salient aspects of the subject. Thus, this report gives the (1) Recent global trends, status and problems faced in available methodological packages for analysis of rural area projects with special emphasis to issues of natural resource conservation and sustainability, (2) their application to natural resource conservation for rural development project planning and implementation. The discussion in this article is only oriented towards developing countries.

2. RECENT GLOBAL TRENDS

In the past, many natural resource management (Sanders, 1990) and rural development projects (Ambrosius, 1992; Fallas, 1992; Republica de Costa Rica, 1991) have been unable to sustain themselves due to methodological problems faced in their planning and implementation (Chambers et al., 1989; Sharma, 1991). These projects often were designed top down without really taking into account the priorities, needs and resources available with the people. This has often resulted into non participation of the community where these projects were executed. Similarly, many of the agricultural/forestry, soil conservation, natural resource management projects have (Sanders, 1990; Sharma, 1991) realized that without the base of appropriate rural development actions (FAO, 1985), their efforts also have often not resulted into success. This has resulted into new thinking globally which can be

summarized as:

- (1) peoples' participation is essential to the success of any rural development related project. Thus, it needs to be designed into the rural development plans through research, training, incentives, appropriate technology and other socio-economic and cultural means (Chambers et al, 1989),
- (2) for any environmental protection project to be successful, rural development is to be their base (FAO, 1985, Sharma, 1992a), and
- (3) all actions planned through rural development, agricultural/forestry, natural resources management/ environmental protection projects should be sustainable on-farm level as well as community level.

The above can be achieved if the actions planned are very low cost so that they can be within the reach of the rural populations. They should result into short as well as medium term direct tangible benefits so that these benefits are seen by the people (Sharma, 1993b). The actions should result into conservation of the farmers' and community's resources so that their production potential can be sustained on a long term basis (Mollendihhr, 1989).

Based on these global trends which orient the natural resources conservation and rural development actions toward sustainable actions, many new methodologies have become available in the recent past e.g. rapid rural appraisal (RRA) methods (Khon Khen University, 1987; Lavelance, 1987; Chambers, 1987; Grandstaff, 1987), participatory rural appraisal (PRA) methods (IIED, 1992) or PALM (MYRADA, 1992), agro-forestry practices (Nair et al, 1991, Young, 1989, Sharma, 1990) etc. Other methods related to appropriate sustainable land use planning (FAO/RAPA, 1986) have been available but are now being recast into the new trend eg. use of local technology knowledge (LTK; Gupta, 1990; 1991) of the farmers for rural area development and conservation, simple methods for land use planning as seen by the farmers in their own context rather than as seen by the technical personal (Sharma, 1993b; Sharma and Molina, 1993).

3. STATUS OF METHODOLOGIES

3.1 AVAILABLE METHODOLOGIES

I do not wish to make a resume of all possible methodologies related to rural development through natural resources conservation but only the salient ones that have been emerging in the last decade or so and which have generated new thinking and actions, recently.

3.1.1 FARMER FIRST VERSUS TRANSFER OF TECHNOLOGY (TOT) MODEL

The farmer first approach came to be recognized as an established approach in research, education and extension only recently (Chambers et al., 1989). The approach is considered as complimentary rather than as an alternative or complete substitute to the traditional on-station and in-laboratory research. There is a danger of orthodoxy and extremism in using this approach which need to be avoided. While farmers' traditional practices and methods in many cases are more realistic and applicable, it should not be taken for granted that every problem is solvable by farmers' indigenous technology knowledge (ITK) and methods.

The TOT model has served well in industrialized agriculture and green revolution agriculture for resource rich farmers in irrigated or assured rainfall areas around the world (Chambers', 1989). The reason for this is that it was high cost technology driven and needed assured weather conditions or assured water supplies for realizing the production potential of the technology being transferred. In other words the TOT approach failed to help the resource poor farmers as well as in fragile eco-systems (eg. semi-arid, arid, sloping lands, mountainous areas etc.) and rainfed areas. Thus, it was recognized that the problem is neither the farmer nor the farm, but the technology. The faults of the technology can be traced to the priorities and processes which generated it (Chambers, 1992).

It is by now well recognized that many local technology knowledge (LTK) components are still very valid and useful in the context of the resource poor farmers and in fragile eco-systems (Chambers, 1989; Gupta, 1990,1991; Sharma, 1990; Sharma and Mantilla, 1992; Lal, 1989; Pandey, 1991; Halls, 1987). Thus, a lot can be learned from the poor farmers to make these fragile ecosystems sustainable. Also the farmers' capability to adjust to extreme adverse conditions through traditional ways of innovation is recognized. Thus, farmer is seen as an innovator in a very dynamic situation in the Farmer First approach. To learn from the farmer quickly and correctly RRA and PRA/PALM are recognized as appropriate methods.

3.1.1.1 RAPID RURAL APPRAISAL (RRA) METHODS

These methods started becoming available in the early 1980's and by now are well accepted (Chambers, 1987; Grandstall, 1987; Khon Khen University, 1987; World Bank, 1992; RAPA/FAO, 1988). The RRA's help in bottom-up planning by integrating the farmers' views, needs, priorities, technology knowledge and preferences in the plans. They are also conducted to design on-farm actions so that the implementation of activities is done on the basis of the farmers' understanding, desires and basic needs. However, it should be recognized that RRAs' should not be allowed to degenerate into development tourism. This could some times happen due to very

little time allowed by donors for planning or project preparation. In such a case an RRA done in a hurry will lead to disastrous conclusions.

In the RRA an outside team learns from the farmers and then tries to integrate farmers' knowledge and priorities into the plans or into actions to be implemented. While this is a great step forward compared to the earlier top down planning methods, the farmers' direct participation in the decision making on the plans or the actions to be executed still remains minimal (Chambers, 1992). Thus the PRA approach becomes very important (IIED, 1992; WRI, 1992; NES, 1989; Miller, 1992; Mascarenhas, 1992).

3.1.1.2 PARTICIPATORY RURAL APPRAISAL (PRA) METHODS

In the PRA approach the rural populations themselves make their action plans in their own traditional ways and implement them as much as possible through their traditional knowledge. The action agency (generally an outside national or international agency) helps strengthen the actions by providing critical components. The method is a reflection of the innovative power of the farmers (Gupta, 1990; 1991). It is hoped that it will come to be used more widely in the future.

This methodology has a great potential not only as a tool for appraisals and planning but also for implementation of rural development, forestry, natural resources management and upland development projects by community participation (Chambers, 1992).

3.1.2 LAND USE PLANNING

One of the major causes of degradation of the land resources of the farmers and the countries as a whole is inappropriate use of the lands which makes them unsustainable in the long term. Methodologies for appropriate land use planning have been available since the 1960's (Klingebiel and Montgomery, 1961; FAO, 1976; 1983; 1985; 1989). These have also been used some times in planning and land distribution decisions. However, in general land reforms have often not been based on land capability analysis, but solely on political considerations (Sharma, 1992a). Since most methodologies for determining land capability have been relatively complex, they remained out of the reach of the farmers. Simplified versions of these concepts as seen by the farmers are now available (FAO, 1989; Sharma, 1990; 1993a,b; Sharma and Molina, 1993). The concept of slope and soil depth being major determinant factor for a given climate and soil type (Sheng, 1989), and simple tools to implement this (eg. A-frame) concept in the field are now being defused by some natural resources management action projects in the field.

3.1.3 LAND TITLING

Most countries around the world had or are having some type of

land reforms or the other. This is a result of heavily skewed land tenancy as it has existed in the past or still existing in many countries in most Latin American and Central American countries. In the developing countries, since most rural populations are agriculturalists or survive on land resources, various ways of land reform have been tried. More successful have been those where the landless farmers have been given land titles. All natural resources conservation agencies and projects have also by now recognized that land titling is an integral activity for appropriate management of natural resources (Gob. de Honduras/OEA/BID, 1991). Methods for land titling have been available in most countries. In countries where cadastral maps do not exist, cadastral surveys are required to be integrated in to rural development related projects. This often represents substantial cost increments into projects (Ferran/Sharma, 1992) that earlier were not used to treat land titling as an activity. Vietnam is a good example in which by providing land use titles to the small farmers significant increases in rice yields have been obtained (Xuan, 1992). Also for national forestry lands 50 year land use titles are being offered to the rural people. It is hoped it will help arrest deforestation in Vietnam (Sharma, 1992).

3.1.4 LAND USE MANAGEMENT FOR SUSTAINABILITY

Inappropriate land use due to population pressure have always been recognized to be a major cause of ecosystem degradation and unsustainable farming systems. However, so far superior options do not exist as an alternative to subsistence agriculture on fragile ecosystems. Hence, while it is difficult to change the inappropriate land use, there are many methods (indigenous and non indigenous but adaptable to traditional cultures) that have been available to manage this over use of lands so that the subsistence agriculture can be sustained (Halls, 1987; Lal, 1989; Pandey, 1991; Sharma, 1993b; SWCS, 1990). Mechanical methods of soil conservation are costly hence often not acceptable to the farmers unless they are a part of the traditional culture of these farmers (e.g. terracing in some countries in Asia and Latin America). Many traditional methods have been available to the farmers to resolve this problem but have become less used due to pressure on the land. These include traditional methods of minimum tillage (crop planting by stakes) and mulch, appropriate crop rotations, diversification of crop combinations, use of organic materials for soil fertility improvement, appropriate soil cover management for soil protection and on-farm water conservation, relay cropping and inter cropping, traditional agro-forestry systems for fuel-wood and soil conservation, live tree barriers for soil conservation etc. (Sharma, 1993a). These methods are not expensive, are known to the people in many cases and can be implemented within the resources of the poor people to a large extent. Lot more can be learned from farmers through RRA/PRA in this respect.

3.1.5 AGRO-FORESTRY PRACTICES

Many agro-forestry methods have traditionally been used by the farmers for diverse purposes on-farm level (Steppler and Nair, 1987; Sharma and Mantilla, 1992). More intensive agro-forestry methods are now available which improve soil fertility, conserve soil and water on-farm level if managed correctly in the form of a barrier, give fuel-wood, fodder and fruits (Nair et al., 1991, Young, 1989). Thus appropriate intensive agro-forestry methods have a potential for making even sloping lands sustainable (Sharma, 1990). Many successful experiences are now available in many countries in this field though they are still on a small scale globally.

3.1.6 REINTEGRATION OF RURAL DEVELOPMENT IN RESOURCE CONSERVATION PROJECTS AND VICE VERSA

Rural poverty and environmental degradation have been recognized as vicious causes and effects for a long time, in developing countries. ~~The recognition of the need for rural~~ development as a basis for agriculture, forestry and other natural resources conservation actions is relatively recent. In past 10 years or so, efforts like tropical forestry action planning (TFAP) on a world wide basis have tried to take this as a base (FAO, 1985). This trend has definitely influenced the recent projects on watershed management, upland conservation, natural resources management, forestry development etc.. This need to be encouraged and rural development planners need to integrate themselves in these efforts so that full potential for rural development through these actions on environmental protection can be realized.

The reverse of the above statement is also true. Most often, in the past, IRD projects have included rural infra-structural development, roads, schools, clinics, land reform and agricultural development (Fallas, 1992; Rep. de Costa Rica, 1991). But, they also need to integrate natural resources conservation concerns, otherwise the rural areas will continue to degrade due to unsustainable agricultural practices. Thus, rural development planners and project managers need to make a serious effort in this direction. There is a need to reintegrate known traditional technologies of production oriented conservation practices and other conservation aspects into the socio-economic and cultural practices of the farmers.

3.1.7 EXTENSION

Many of the countries in the Central American and Latin American region, and other parts of the world have very top heavy (TOT model) agriculture/forestry extension organizations or no organizations at all. This has resulted into high costs of these organizations but little action at farm level. Most often, these organizations are not at all represented at the rural area level.

To reverse this, an extension organization based on the no. of rural families living in a rural area grouped into beneficiary groups through traditional forms of village level organizations are being proposed in many Latin American countries (Ferran/Sharma, 1992; GDH/OEA/BID, 1991). This is based on the model of identifying village level workers (VLWs) from the beneficiary group for rural development through agro-forestry activities as the most basic element of an extension organization. These VLWs are back stopped by technically qualified personnel. In this extension system each and every family is attended on a regular basis within a given time frame. Farmers and the village level workers are the most important elements in this system. Rest of the technical and bureaucratic officialdom is to support them only. This model have been successfully used in India since the green revolution. However, the overhead costs and corrupt practices often followed by the technical and bureaucratic staff have generally siphoned off even upto 85% of the rural development funds. Thus making the rural development activities often very costly. When more powers and financial resources were given to village level leaders directly in Ghana (Simples and Tossou, 1992), similar corruption by village leaders was found prevalent though the overhead costs are reduced. Thus, due to these problems and lack of appropriate technology being transferred to the resource poor farmers and in fragile eco-systems, this green revolution model of extension is very inefficient and often has failed to meet the objectives. The farmer first approach proposes the use of traditional technologies as far as possible and then giving the farmers sufficient incentives to use them. This is back stopped by a team of experts to help the farmers thus eliminating the bureaucratic costs completely. However, so far this has been only tried at very small scales and the model has no where been replicated at a national level (Overseas Development Group, 1991). Farmers informal education programs are an essential part of this extension strategy for teaching them sustainable models of rural/agriculture/natural resource development and conservation using traditional practices as far as possible.

3.1.9 ELEMENTS FOR PEOPLES' PARTICIPATION IN RURAL DEVELOPMENT

There is no universal methodology for creating peoples' participation which can be considered a receipt for success. However, every country need to develop its own approach based on their own cultural, social and political reality. Some of the important ingredients for assuring popular participation could consist of the following elements based on recent experiences:

- (a) A desire for change and willingness among the people to work for it is a precondition. If it does not exist, it is better to have a program to make the people aware of the problems rather than trying to plan/implement a rural development program.
- (b) Political will and support to rehabilitation of the

degraded rural areas is also a precondition (Ambrosius, 1992; Sharma, 1992b). It needs to be cultivated otherwise serious efforts at generating mass movements for rehabilitation can fail. The political will should also be reflected in generating funding (national or international) for these actions.

- (c) A well defined system of incentives to the people involved in rural development and conservation, particularly in the uplands. These incentives are fully justified by the off-site tangible and non-tangible benefits generated by the rural development actions in the uplands (Sharma, 1993b).
- (d) Integration of people in planning through RRA/PRA and simple and low cost technology (preferably local), to make the rural areas sustainable. Some of it is available in the traditional farming systems, some need to be adapted to them.
- (e) Intensive village level extension service based on farmers' traditional forms of organization and education ~~programs for them by the farmer first approach.~~
- (f) The objective of a rural development project and time frame to achieve them should be realistic from farmers' angle.

The above are considered to be important ingredients to a strategy for peoples' participation. However, they need to be adapted or modified to suit local socio-cultural conditions.

3.1.10 INCENTIVES

Different type of on-site and off-site benefits can be generated by sustainable rural development, particularly in the uplands. The off-site benefits generated justify incentives as a cost sharing between different beneficiaries (Brooks and Gregson, 1986). As a strategy, direct incentives for conservation for a temporary period can very quickly initiate peoples' participation. However, these incentives should, over the duration of the project, result into a long term revolving fund or other mechanism which will guarantee availability of the incentives (to those who did not avail this during the project period) even after a particular project has terminated.

The incentives to the farmers should be given on the basis of:

- (i) their request for it rather than throwing them on the farmers,
- (ii) their acceptance of its purpose, (iii) their need for it, and
- (iv) only for activities related to those components of technology implementation which are not normally a part of the day to day activities of farmers i.e. those which result in extra costs/labor or different cultural practices (Sharma, 1991b).

4. APPLICATION OF METHODOLOGICAL PACKAGES

Many of the methods described above and others not mentioned here have been available for a long time. Others like RRA and PRA, land use management and agro-forestry are relatively new. However, their use in planning and implementation have been variable. The concept of sustainability through various conservation methods have also been there for long time, although they are now being advocated more vigorously in the overall context of sustainability and equity. These methods are only now finding their way into rural development programs. Also, the natural resources conservation programs have only recently (max. last 5-7 years), started implementing them from rural development angle. These are encouraging trends, however much more need to be done to propagate them on a large scale.

5. SUMMARY

Many new methodologies for research, planning, extension, and implementation of soil and other natural resource conservation projects for sustaining rural areas in steep lands have become available in the last 10 years or so. However, their use by the soil conservation profession have been limited due to lack of exposure and training. Most steep lands in the developing countries are under unsustainable subsistence agriculture today. This is so because practically no other better land use alternative is available to the poor users of these lands with in their scarce financial resources. But some of these people have lived and survived on these lands for ages. Thus, there are many local soil conservation practices that have been used by these people, which often are not included into implementation projects by the professionals. However, these conservation practices have started disappearing due to extra ordinary population pressure on then in last 50 years. To quickly learn from the farmers and to assure their participation in conservation of their natural resources on steep lands by their own methods or by methods adapted to their limitations, rapid rural appraisal and participatory rural appraisal methods are now available. Local agronomic, cultural and agro-forestry practices for managing farmers subsistence agriculture have better chance of being implemented by the farmers that costly mechanical methods even though they may be relatively inferior in their effectiveness. The overall impact of a less efficient practice but widely applicable within the limitations of a farmer is far superior compared to a non implementable, more efficient but costly practice. Finally appropriate conservation incentives will help create peoples participation in conservation of their own soil and other natural resources for sustaining steep land agriculture. This all need to result into appropriate upland rural development since only soil conservation as an activity has little chance of being accepted by the steep land farmers as their first priority.

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PART II

MODERN WATERSHED MANAGEMENT CONCEPTS FOR DEVELOPING COUNTRIES

RESUME

Based on the experiences of many successful and unsuccessful watershed management and natural resources management projects, latest thinking on the subject of watershed rehabilitation through peoples' participation, is discussed. The role of planning is put in right perspective. The controversies on conservation verses production are discussed. Role of forests, agro-forestry systems, tree hedge rows and live barriers for soil conservation along with the social-economic-cultural constraints in resource conservation technology transfer, are also discussed. Finally, traditional land use management techniques by agronomic, cultural, mulch, cover crop management and agro-forestry methods are presented as a more acceptable alternative to the farmers. Some essential elements for creating peoples' participation are also presented.

1. PLANNING IN WATERSHED MANAGEMENT

In the past, most countries in the Central American region and elsewhere have treated watershed management planning as an end in itself rather than a tool for action. A watershed management plan not resulting into its implementation is a waste of effort and money. Watershed management planning is seriously being criticized today because most planning exercises in the region have been either theoretical or designed for donors, who often have not agreed to fund them. The planning exercise should only be started when a funding source (national budget or others), donor (bi-lateral or multi-lateral) or an investment agency (e.g. private, national banks, World Bank or any of the other regional banks) requests it officially. Such requests are hard to come by even after continued lobbying. Due to lack of funding for watershed management projects, the need of the day is such watershed management action plans, which can be implemented within farmers' and national resource limitations. Thus, rather than developing top down large scale watershed rehabilitation plans, small bottom up (from the level of farmers and field extensionists) watershed rehabilitation plans (which can be implemented with local resources only) are required.

These plans should address the watershed degradation problem as perceived by farmers and give economically viable, environment-

ally sustainable production oriented, conservation alternatives. In this respect, simple concepts of appropriate land use and conservation technology based on the traditional farming systems, which can be directly understood and implemented by farmers without much external technical or financial assistance, play a very important role. Use of GIS models is also helpful for large watershed areas although the most important is to transfer the concept to the farmers in simple words and in simple set of actions which can help them take correct land use related and other decisions. It is with this back ground that all steps in planning from identification of problems, appropriate simple alternatives, economic, environmental and social evaluation and constraints to implementation should be followed when planning. In summary, the whole planning process should be used as a tool to develop implementable plans within the constraints of the farmers and national realities.

2. SOME NEW CONCEPTS IN WATERSHED MANAGEMENT

The experiences of various projects executed in tropical countries around the world show that there has not been many examples of successful projects. This has forced a rethinking on the approach to solving watershed degradation problems in the recent past. Some of the new concepts, which has come to be accepted, only in the past 5-7 years, are summarized below.

2.1 CONSERVATION VERSUS PRODUCTION

Traditionally, most rehabilitation programs have been only conservation oriented with little emphasis or contribution to improving the productive capacity of the lands on a short term basis. Hence, the present day thinking is that unless a conservation program results into short term benefits in production also, its chances of success will not be high. In this respect, the management of farmers' land use (crops, pastures, coffee, forests etc.) takes a priority over purely conservation programs. The land use management (in other words the management of cover on the surface of the land), which was often neglected in conservation programs, becomes an important tool for improving production and conservation at low costs. In the past, millions of dollars have gone into conservation without ever implementing this component fully, which has often resulted into complete termination of the projects or programs soon funding terminates (Moldenhauer, 1889; Sanders, 1990).

2.2 ROLE OF FORESTS IN SOIL CONSERVATION

Not all forest plantations necessarily conserve soil and water resources, which is more a function of the protective cover immediately above the surface of the soil called mulch. If a

forestry system does not provide mulch or if mulch is destroyed or if a forestry system is not multi-story, then it does not have much effect on soil and water conservation (Hamilton, 1986; Nair, 1986).

2.3 AGRO-FORESTRY FOR SOIL AND WATER CONSERVATION

Agro-forestry systems can contribute to soil and water conservation through its mulch (if applied) or if they are planted as live barriers or if a barrier is created across the lines of the trees by knitting its branches on its base, on contour. The standard alley cropping practices with considerable distance between the trees do not by themselves conserve soil and water. Thus only appropriately managed (mulch, base knitting or as live barriers) agro-forestry systems can conserve soil and water (Nair, 1986; Sharma, 1990).

2.4 LIVE BARRIERS VERSUS MECHANICAL METHODS OF SOIL CONSERVATION

The mechanical methods of soil conservation, control soil erosion and conserve water by completely stopping the flow of water and then disposing off the excess runoff safely. The live barriers of trees achieve soil and water conservation by reducing the velocity of overland flow. Thus in live agro-forestry barriers, additional drainage for excess runoff disposal is not needed. Thus agro-forestry barriers can be planted even on isolated farms without being much effected by up-stream conditions. In purely mechanical methods for conservation, control of up-stream runoff by a cutoff drain becomes essential for isolated on-farm level works (Sharma, 1990). Grasses has an important complimentary role in soil conservation but examples of only grass live barriers doing soil and water conservation are rare to be found. Although a lot of grass barrier can be found in different Central American countries, it is hard to find physical evidence of soil conservation immediately above them.

2.5 SOCIO-ECONOMIC AND CULTURAL RESTRICTIONS ON TECHNOLOGY TRANSFER

There is a need to adapt available known technologies of production oriented conservation practices to the socio-economic and cultural practices of farmers. Otherwise the possibilities of quick transfer of technology are small. Thus, even though the traditional conservation oriented farmers' practices may be less efficient in conservation, their chances of transfer to farmers' fields are better in a shorter time frame (Mollendihhr, 1989; Chambers, 1987; Sharma, 1990). Thus, on a global basis they can be more effective.



3. LAND USE MANAGEMENT

The major cause of natural resources degradation on upland watersheds has been inappropriate use of lands. While most often socio-economic conditions may not permit reverting back these lands to their appropriate uses, there are a lots of things that can be done to manage their use so that it is more conservation oriented. However, most watershed management programs in the past have tried to control their degradation through the US model of soil conservation, which is mainly through mechanical methods of soil conservation. This may not necessarily be very suited to the socio-economic conditions of the tropical countries, unless they are a part of their traditional culture (e.g. terracing in many Asian and some Latin American countries). This often has led to only a few very successful programs unless they were fully subsidized. The management of the land use, which can be very cheap and can be easily adopted by the farmers within their own resources, received little attention in the past. Thus the problem of inappropriate land use was tried to be solved without improving the use itself. Some of the methods of managing the land use for production oriented soil and water conservation by maintaining appropriate cover on the surface of the soil, are (Sharma, 1991):

- Appropriate timing of crop planting so that a cover on the soil surface is always maintained during the rainy period

- Land preparation and crop planting on contour. Use of broad beds and furrows on low slopes for crops and horticulture

- Application of organic material/compost or residues

- Minimum tillage (manually, by animal power or mechanically as appropriate to the farmers' conditions) for least soil disturbance coupled with application of mulch for soil cover

- Semi-perennial or perennial cropping with appropriate mulch, inter-mixing of trees or live barriers of trees for soil conservation on steep slopes

- Agro-forestry methods (live barriers or hedge rows) for improving soil fertility, fuel wood and for soil and water conservation through their appropriate management

All above methods have significant impacts on soil erosion control and water conservation, even if used solely. Their effectiveness can further be improved if used with appropriately managed agro-forestry methods or with certain mechanical methods. They are low cost and often have positive effect on net soil

productivity. Also, they are easy to transfer to the farmers.

4. ELEMENTS FOR CREATION OF PEOPLES' PARTICIPATION IN WATERSHED MANAGEMENT

In Part I, basic elements for peoples' participation have been identified. If these basic ideas are applied, peoples' participation in watershed management can be successfully created. Incentives for conservation form an integral part of the strategy. This also have been out-lined in the Part I.

5. CONCLUSIONS

A change in traditional watershed management project implementation methodology is required for watershed rehabilitation works to be successfully accepted and implemented by the farmers effectively on a large scale. As far as possible, traditional methods of the farmers which can easily be found by an RRA of the rural areas, ~~should be modified and used for upland watershed rehabilitation.~~ These methods will be easily acceptable to the farmers as they can implement them with little technical assistance, and they require little investment. These methods may be less efficient in conservation but will prove to be more widely applicable, hence more effective on a global basis.

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