

**IMPACT OF NATIONAL WATERSHED DEVELOPMENT  
PROJECT FOR RAINFED AREAS (NWDPA)  
IN MAHARASHTRA**

**R. S. DESHPANDE**

**N. RAJASEKARAN**

**AGRO ECONOMIC RESEARCH CENTRE  
GOKHALE INSTITUTE OF POLITICS AND ECONOMICS,  
(DEEMED TO BE A UNIVERSITY)**

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Gokhale Institute of  
Politics & Economics,  
(Deemed to be a University)  
Pune 411 004

R. S. Deshpande  
N. Rajasekaran

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## CHAPTER I

### INTRODUCTION

#### 1.1 Introduction

National Watershed Development Programme for Rainfed Agriculture (NWDPA) emerged out of the synthesis of the many on-going programmes in the country during eighties. Analysts of the agricultural development of India indicated several constraints and some of the important bottlenecks. These included (i) the slow growth regions and crops, (ii) inability of the seed-water-fertilizer technology to reach some of the unreached regions and classes, (iii) slow pace of growth in technology and lack of appropriate technology, (iv) inadequate infrastructural support for the development of the sector and (v) absence of the long term perspective on policy front (Rao, C.H.H., Subbarao, and Ray (1988), Bhatia (1988), Rao and Deshpande (1991), Deshpande and Reddy (1991a)). These constraints necessitated to have a fresh look at the agricultural development strategy of the country. The immediate focus of the policy initiative was to bring the slow growth regions of the country into mainstream of development.

On the resource front, many of these regions had a severe natural resource constraint. The adverse water balance and the weak agricultural base, compelled the agriculturists to depend on forest and pastures. As a result, the depletion rate of these resources increased at a very fast rate and compounded the existing problem of low productivity. Given the climatic

and resource structure of these regions, it was felt necessary to introduce a technology which would optimize the returns with the given resource base and at the same time helps in enhancing it. Thus the focus was on the sustainable technology and the regions identified were the rainfed regions of the country. Thus while indicating the strategy for rainfed area development, the Eighth Plan emphasized the farming system approach for making scientific and optimum use of land and water resources to increase their incomes. The Plan strategy also calls for diversification of the agricultural production system with scientific management of land and prevent soil erosion to achieve better in situ moisture conservation (Govt. of India, 1972 ).

### 1.2 A Brief Review of Studies

There are basically three groups of studies which deal with the core problems relating to rainfed agriculture. The first group of studies includes the analyses pertaining to dry-farming (rainfed farming) practices in India. The second group of studies mostly deals with the impact of watershed treatment in different regions mainly focussing on the technical aspects of the treatments. The third group of studies specifically deals with the analysis of the on-going watershed development programmes implemented by the State Government as well as by the non-governmental agencies. All these reviews are attempted in different studies (Deshpande and Reddy, 1991(a), Deshpande and Reddy, 1991(b), Deshpande, 1994, GOI, 1986(b)). We give below a brief outline of the indicators from these reviews.

Technological developments in rainfed agriculture can be

broadly classified into four developmental phases. The first initiative came through the starting of experimental stations under Bombay dry farming practices. This attempt continued even after Independence and upto the mid-sixties and till then no necessity was felt about reviewing the progress of rainfed farming technology in India. Risk mitigation technologies which included crop varieties, cropping systems, pest and disease management, sharing of risk and diversification of farming activities, marked the second phase in the process. This phase was also characterized by the drought mitigation measures. An important component during this period was the public investment in soil conservation. With the experience of the green revolution, the focus was shifted towards an area based development policy. Thus the third phase marked the starting of the Drought-Prone Area Programme and Hill Area Development Programmes. These programmes had all the components of the rainfed farming but emphasized more on employment generation. The resource centred technological development under the dry farming practices was introduced first time during this phase. Thus the emergence of an integrated cropping system approach initiated the fourth phase. The expanse of the rainfed farming technologies here included dry land horticulture, silvicultural practices, pasture development and allied activities. The development of the farming practices under rainfed condition, therefore, went through a process more or less marked with the need oriented technological advances. Hence, most of the technological solutions indicate only the symptomatic treatments indicated for the problems faced during the specific period.

A quick review of the development of dry farming technology in India reflects five major issues (GOI, 1986b; Jodha, 1979; Rao, 1991). Firstly, the approach of the technologies developed was more compartmentalized and unitary than holistic. Often the technological solutions were addressed only to the problems of a specific nature and sought solutions for these. The lack of holistic technological development as a result arrested the growth in adoption of technology. Secondly, the technological options rarely offered precise plans and more often the yield gaps at the experiment station were unbelievably higher than those on the farmer's field. This had resulted into the third important issue, namely, the weak nature of the technological options. The alternatives offered were either not cost effective or involved cumbersome procedures. Fourthly, the technological options were developed, more often neglecting the environmental heterogeneity across the spread of dry farming tracts in the country. Therefore, the replicability of the technology across the different regions of the country was naturally constrained. Lastly, the transfer of the technology from laboratory (experimental stations) to field had its own problems. In the presence of the technological options for irrigated tracts as well as well endowed commercial crops, the extension efforts for the rainfed farming options always remained neglected. This had resulted into the languid societal responses.

The review of the technological development in the rainfed agriculture above indicated mainly the constraints faced

in the development. But despite the constraints, dry farming technological development options were developed and the extension of the practices did take place, though it was restricted to certain pockets. While reviewing the dry land agricultural research in India for the decade 1971-80, it was noted that the technology needs to be site-specific and training should be need-based matching with the available resources. The farmer's participation in development as well as adoption of the technology was underscored (ICAR, 1982). The Planning Commission's Report on Dry land farming noted that the basic problems faced by the dry land farmers are poor resource base, moisture scarcity and uncertainty leading to unemployment and low and uncertain incomes. Public investment and intervention on a scale comparable to that in irrigated areas are called for (GOI, 1986a).

A holistic development plan of an interdependent system of resources confined to a well defined region and based on the major resource parameters can only be a solution for the rainfed areas. Water and land are the two basic resources which interact with the bio-system and thus a programme of proper management of this system should lead to optimum production along with least environmental damage. Watershed is defined as an area enclosed in a catchment boundary of a river basin. It is an eco-system or a bio-geo-physical unit in which the interdependence of renewable and non-renewable environment is closeted. Barrow (1987) describes watershed as a unit where physical and biological resources are linked by a complex of processes and any change in one of them can cause effects on the other. It is a

"resource region" where there are close systemic interdependences and a proper biological balance can lead to optimum resource potential. Therefore, major objective of any watershed management programme is to design a sustainable resource use so as to provide optimum production potential for the agro-eco-system.

The management of a watershed involves utilization of land, surface water flow and vegetation so as to conserve and utilize these for a sustainable flow of benefits in view of the aggregate welfare optimization. Broad objectives of any watershed programme can be summarized into three major components.

1. Preventing and retarding the process of degradation of renewable as well as non-renewable natural resources, while optimizing the production potential.
2. Preparing and implementing a holistic plan of conservation and use of resources by exploring as well as utilizing the potential of inter-dependent systems.
3. Establishing a symbiotic relationship between use of resources and regeneration of resources by establishing a perfect linkage.

Watershed can appear in different sizes and shapes. The ridge line marks the boundary and the direction of the run-off helps to plan the treatment. The treatments vary from the ridge to valley and the composition depends on the local conditions of each of the watershed. Thus a treatment complex for any watershed would depend upon five important constituents, namely, (i) Quantum and span of rainfall with water availability period, (ii) Level of degradation of the natural

resources, (iii) Slope of land and type of soil including other parameters such as depth, pH, fertility, etc., (iv) Type of vegetation in the arable and non-arable land, (v) Socio-economic factors such as level of commercialization, industrial locations and types, urbanization, etc. The treatments in the watershed vary from ridge to valley and these will cover seven inter-dependent systems, namely, (i) Silvicultural, (ii) Silvi-pastoral, (iii) Silvi-horti-pastoral, (iv) Horti-pastoral, (v) Horti-agri-pastoral, (vi) Low density rainfed agricultural, (vii) Protectively irrigated high density agricultural. These systems cover arable as well as non-arable lands and are accomplished with the help of various sub-components of the treatments.

A review of the watershed development programme in India attempted in the earlier study indicated quite a few important issues (Deshpande and Reddy, 1991). The first group of studies mainly dealt with the impact of the individual soil conservation components as well as water harvesting structures. Most of the studies reviewed in Deshpande and Reddy's work earlier indicated favourable impact of the conservation measures. However, the problem of segregating the impact and assigning the incremental benefits to the individual treatment is riddled with difficulties.

Impact assessment of watershed technology can best be accomplished by incorporating all the components in one or more aggregate impact parameters. Such studies are of recent origin. A study of Sukhomajari watershed by Deep Joshi and David Seckler (1981) and Kenchan Chopra et al (1989) showed exemplary results



of the integrated programme. The incremental benefits included more environmental parameters apart from income and employment. It may be noted that this project was fully supported by Central Soil and Water Conservation Research and Training Institute. Another technically competent experiment at similar level conducted by ICRISAT also noted stabilization of cash flows and substantial increase in the productivity and incremental income (Sarin and Ryan, 1983). Walker et al. (1989) also reviewed the overall impact of the application of watershed based technologies at different locations in Maharashtra, Madhya Pradesh and Karnataka. The benefit-cost ratios worked out ranged between 1.08 and 3.81 across locations.

In an analysis of the State level Comprehensive Watershed Development Programme (COWDEP) of Maharashtra, Deshpande and Reddy (1990) noted significant changes in the household economy. It was noted that the cropping pattern, intensity of cropping, proportion of wastelands and yield per hectare changed substantially. The programme has also helped in increasing the moisture availability in the treated regions when compared with the non-benefited zone. Another study by Deshpande and Reddy (1991a) covered the expanse of the impact of the National Watershed Development Programme for Rainfed Agriculture. The results of this study are quite interesting for the purpose of the present work. Three watersheds were chosen for the purpose of the study covered under Scarcity zone, Moderate rainfall zone and Assured rainfall zone. The impact parameters in the three zones were quite different. The watershed in the Scarcity zone

showed a slow pace of impact along with longer gestation period and it was noted that the watershed treatment led to higher diversification and risk spreading. The Moderate rainfall region watershed showed comparatively better results in terms of increased income, yield improvement with stability and employment increase along with level of wages. The impact of the treatment on Assured rainfall zone watershed clearly brings out two-pronged changes, namely, cautious commercialization with risk spreading. The gross income thus increased at the cost of reduced productivity. In sum the study indicated location specificity of the watershed approach as well as the longer gestation period required to review the impact.

Among the other location specific studies, the work by Katar Singh on Mittemari Watershed in Karnataka is quite a notable study (Singh, 1994). Four important highlights are noted from the impact study. Firstly, the technology of watershed management has to be properly supported by organizational structure. Secondly, the watershed programme does not necessarily need high investment, but pooling the funds across various on-going programmes can meet the requirement. But this needs to be supported by a horizontally integrated organizational structure. Thirdly, the benefits in crop sector are quickly discernible as compared to horticulture or livestock sector, and lastly the most important determinant of the success of any watershed programme is the participation of the beneficiaries in sustaining the programme.

In another study of degraded Aravali foothills of

Haryana, the authors have noted the B-C ratio of the watershed treatment as 1.90 and the same for different components range between 1.68 and 4.91 (Arya, S.L., R.C. Kaushal and S.S.Grewal, 1994). It was further noted that the project helped to generate employment to the extent of about 70 thousand mandays on about 1095 hectares of project area. The study brings out clearly that the programme of watershed development is not only economically viable but also welfare oriented as can be seen from the changing income distribution parameters.

The Indian Society of Agricultural Economics at its annual conference in December 1991 discussed various aspects of watershed development (IJAE, 1991). Among the various issues discussed, four issues assume importance. Firstly, the watershed technology package should be location specific with complete flexibility in the management process. Secondly, the investment in watershed should be taken as a cost of preventing degradation rather than a cost for increasing output. Therefore, the benefits should be examined in the context of the extent of loss in natural resources that could have caused in the absence of the watershed programme. Thirdly, the most vital aspect of the successful watershed development programme is the participation of the beneficiaries. The initial investment should come from the public funds but the local people should be involved in planning and implementation. It should not be difficult to motivate people to bear a part of the expenses. Lastly, the role of proper institutions to plan, monitor, implement as well as supporting the watershed activities is

the most crucial aspects of the watershed treatment (Singh,1992).

The above review indicates the most important issues involved in the watershed development approach. Among the various pointers emerging out of the analysis of the studies, four assume significance in the context of the present study. Firstly, the watershed impact analysis has to be closely location specific and the impact parameters across locations need not be the same. Secondly, the best method of quantifying the impact of watershed treatment is to identify the most important key variables, where the impact parameters are aggregated at one place. Thus the impact can best be assessed in terms of major indicators especially in the absence of the non-quantifiable benefits in the context of loss aversion of the natural resources. Thirdly, the very fact that not all the benefits and costs are easily discernible, one has to depend on the bold changes due to the watershed technology. This finally rules out any viability analysis in cost-benefit framework simply because there is nothing like a matching control. Moreover, the complex of tangible vis-a-vis non-tangible benefits, uncertain gestation period, the non-linearity in the flow of benefits and the difficulties in ascribing price to the level of degradation averted, make it difficult to fix the problem into usual project analysis framework. Lastly, the participation of the beneficiaries in the programme is the most crucial aspect. Higher participation can be induced only when the technology is simple, affordable, replicable and viable, in the view of the beneficiaries.

### 1.3. An Overview of the Efforts Towards Watershed Development

Initial efforts towards watershed development in India began in terms of soil conservation activities. During the framing of the First Five Year Plan and early in the Second Five Year Plan, a group of nine Soil Conservation Research, Demonstration and Training Centres were established (Dehradun, Chandigarh, Ootacamund, Bellary, Kota, Vasad, Agra, Hyderabad and Chattrra). These centres were established during 1954-56 and were transferred to the Indian Council of Agricultural Research in the year 1967. One of the major objectives of the soil conservation programme was "the conservation of land and water resources under different land use systems" (Tripathi and Singh, 1993). The work of the soil conservation programme cannot be equated to the present days watershed development programme, however, about 10 million hectares of area was covered under this till the beginning of the Fifth Plan. All India Coordinated Research Project for Dryland Agriculture was started during this time. Similarly, Integrated Dryland Agricultural Development Project was also launched at 24 locations in the country. The Drought-Prone Area Development Programme (DPAP) was initiated and it also included some aspects of the watershed development technology. The Technical Committee on DPAP and DDP (1994) under the chairmanship of Dr. G.H. Hanumantha Rao stressed the need for a holistic participatory approach to dryland development emphasizing a well designed watershed development programme (GOI, 1994).

The subject of development of watersheds was transferred to State sector in the year 1979. Immediately, during the early eighties, Pilot Project for Propagation of Water Conservation/Harvesting Technology for Rainfed Areas on watershed basis and Popularization of Seed-cum-Fertilizer drill programmes were taken up (GOI, 1992). Almost at the same time, the Government of Maharashtra started the scheme of Comprehensive Watershed Development Programme (COWDEP), which was rather a mutation of the on-going soil conservation programme and taken up under Employment Guarantee Scheme and the Centrally sponsored Scheme (see Deshpande and Reddy, 1990). This was followed by the introduction of the first phase of National Watershed Development Programme for Rainfed Agriculture. During this phase, other similar programmes were also operating in the country as well as in the State.

The various programmes implementing watershed development under various sectors can be broadly grouped into six major groups. First group of programmes includes the extension of the work of the soil conservation department under the revised State schemes such as COWDEP of Maharashtra. The second group covers the projects aided by the World Bank under special grants to the State Governments to initiate pilot projects for watershed development. The technical guidance, feasibility as well as the weightage of the components was guided and monitored by the World Bank. Third group of projects includes the Operational Research Projects taken up by the State Agricultural Universities on one hand and the specialist research organizations.

like ICORISAT, AICRPDA, etc., on the other. These projects were technically superior but had operational bottlenecks. Fourth group incorporates the projects undertaken by voluntary organizations (Non-Governmental Organizations) with or without external support. These projects have, to their credit, a perfect and effective implementation but the scale of such projects is too small and face difficulties in replication. Fifth group of watershed projects are those taken up by the State Governments with their own resources (pooling resources from various schemes). Last group includes the Central Government sponsored scheme under National Watershed Development Project for Rainfed Areas (NWDPRRA) introduced during the Seventh Five Year Plan covering 99 districts in 16 States. The scheme was improved in the year 1990 following the recommendations of the Committee of Secretaries constituted for this purpose.

The NWDPRRA was administratively approved by the Government of India, vide Ministry of Agriculture, Department of Agriculture and Cooperation's letter No. 6-13/85-CAV dated 3rd July 1986. The programme was sanctioned for four years with a total outlay of Rs. 239 crores of which the Central Government would be contributing Rs. 120 crores and the rest has to come from the State funds. The programme was further extended upto 1994-95. Extensive changes were introduced during the year 1990-91. While bringing out the importance of the NWDPRRA, the Eighth Plan Document records that "A holistic approach towards the development of rainfed areas,

which forms the *raison d'etre* for the restructured National Watershed Development Programme for the Rainfed Areas cannot be over-emphasized" (GOI, 1992, p. 11), and further "It is only by making NWDPA a truly people's movement that the problems of the rainfed region can be successfully overcome" (GOI, 1992, p.17). While maintaining the emphasis, it was decided that the Central assistance for the implementation of the programme should be liberalized with 75 per cent of the amount to be given as clear grants to the State Government and 25 per cent as loan. The NWDPA envisages that a micro watershed will be taken up for the purpose of development in every block having less than 30 per cent irrigated area under assured sources of irrigation. The programme re-emphasizes a holistic approach for development of micro-watersheds which include diverse production systems. NWDPA strongly advocates the participation of beneficiaries in planning, development and execution of various activities. Out of the total Central sector outlay on Agriculture and Allied sectors of Rs. 11,105 crores, the soil and water conservation accounts for Rs. 800 crores (GOI, 1992). The guidelines for the NWDPA prepared and modified upto 1992 (WARASA) puts the allocation proposed for the Eighth Plan at Rs. 1080 crores and additional Rs. 20 crores for innovative activities to be taken up by the State Governments during the course of the project (GOI, 1992, WARASA, p. 99). The Government of Maharashtra receives the second highest allocation among the States.

The guidelines and the structure of the NWDPA underwent a complete change during the year 1990-91. The revised



guidelines, published under the title WARASA, include all the details of the programme to be implemented by the State Government. We shall be attempting a detailed analysis in the next chapter, here only <sup>the</sup> important aspects can be noted. Firstly, the emphasis of the programme is towards conservation, upgradation and utilization of the natural resources. Secondly, the employment and production aspects are emphasized equally as done in the earlier programmes. Thirdly, a significant component of planning at watershed level is included in the programme. This was not included earlier. Fourthly, the project emphasized the role of people's participation and intended to accomplish this with the help of "Mitra Kisan" and "Gopal". Lastly, the major focus of the project is redefined to develop the natural resource base, sustain its productivity, improve the standard of living and endeavour for restoration of ecological balance (GOI, 1992; WARASA).

#### 1.4 Objectives and Methodology

In an earlier study on the evaluation of National Watershed Development Project conducted during 1989-91, four major issues were analysed. These included the methodology of the impact analysis and the design of the programme (pre-1990 guidelines), administrative structure for the watershed programme and methods to obtain an integrated administrative structure, measurement of the impact parameters and finally to bring out the constraints of the programme. The changes incorporated through the new guidelines of 1990 have changed the composition of the programme and participation as well as

planning were incorporated in the structure. Keeping in view the studies conducted on the watershed programmes in the country as reflected through the review of literature and the changed emphasis in implementation, we intend to set forth a five-fold objective for the present study.

The specific objectives of the study are:

- i) To examine the present status of the available technology and the extent of its adoption by farmers.
- ii) To identify the factors responsible for productivity changes and to ascertain the major impact parameters.
- iii) To locate the constraints in the project implementation in terms of infrastructure, technology and other factors.
- iv) To evaluate the impact of vegetative measures, soil and water conservation structures and other components of the programme.
- v) To suggest strategies for removal of the constraints faced by NWDPRAs.

In the earlier study conducted on NWDPRAs, Deshpande and Reddy (1991a) had chosen three watersheds falling in three distinct agro-climatic zones of Maharashtra, namely, Scarcity Zone, Moderate Rainfall Zone and Assured Rainfall Zone. The results indicated location specificity of the impact parameters and need for people's participation. For the purpose of the present study, we have selected two watersheds falling in two distinct agro-climatic zones in Maharashtra. The first watershed is selected from the Scarcity zone. This watershed comes

under Parner taluka of Ahmednagar district. The second watershed is selected from the Transition Zone II, which falls on the eastern slopes of the Western Ghat region. This watershed comes under Satara taluka of Satara district. These two watersheds present good contrast for the purpose of comparison.

The logic behind the choice of the watersheds from two distinct agro-climatic regions is to test the hypothesis that the combinations of treatments are different across agro-climatic zones but the impact parameters move in the same direction. It is possible that the magnitude of the impact is different. Moreover, the carrying capacity of the region in terms of the balance between natural resources and demand for such resources is different. Therefore, the impact parameters would also show distinct structures.

### 1.5 Methodology of Impact Assessment

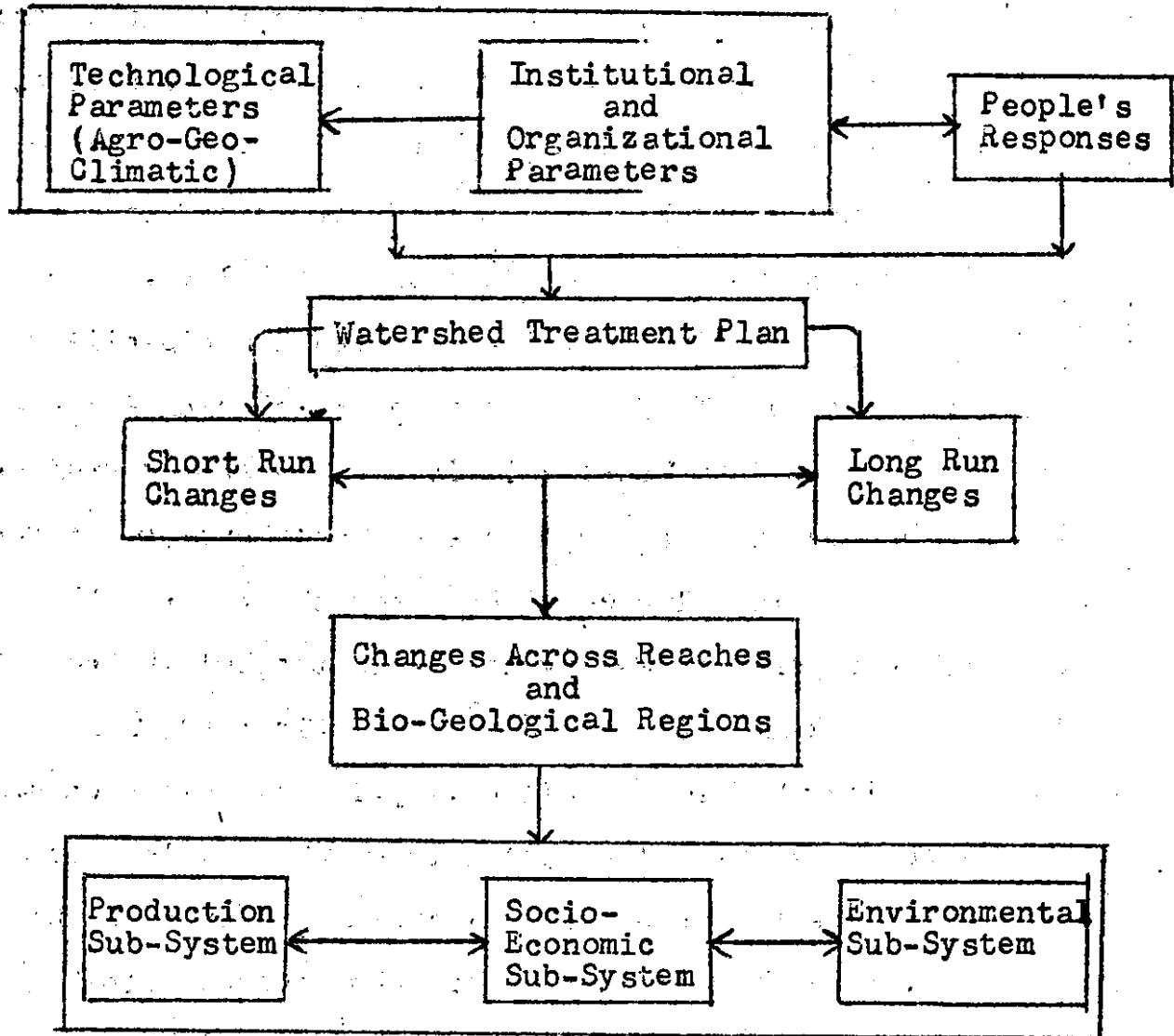
The methodology of the assessment of impact, of an area development programme in general and watershed development programme in particular, is different. The usual tools of project analysis are not adequate and possibly misleading in the case of watershed development projects (Curry and Weiss, 1993). Among the several factors causing such difficulties in the impact assessment, five are of higher significance. Firstly, the watershed development project has a strong location specificity and therefore the cost as well as benefit flows are dictated by the local conditions. Secondly, the time profile of the benefit as well as cost of a watershed development programme differs across regions. A highly degraded land

takes longer duration to recoup the soil health and yield the intended results as compared to a better soil profile. Thirdly, the most important impact parameter involves the positive externality of the project and since the environmental impact is the most crucial component of any watershed treatment, the positive externalities have to be added on benefit side. The complex situation thus created is the pricing of the natural resources like soil or water. Fourthly, the quantification of the impact parameters is riddled with intrinsic difficulties. For example, the stoppage or aversion of the soil loss due to run-off or the changes in the moisture retention capability of the soil are difficult to judge and generalized even for a small watershed of about 1000 hectares. Lastly, watershed treatment is always a component of a larger system treatment at national level. Therefore, in a larger river basin the treatment of watersheds/<sup>in</sup>the upper reaches may not yield tangible benefit based in the same area but can always help in arresting the silt flow or enhancing the water availability in the lower reaches. Thus in aggregate terms a locational treatment may lead to benefits which are not necessarily location and/or time specific.

In any impact analysis of watershed treatment, the impact signals are concentric but impulses transmitted across the sectors are quite important. The stability of the impact parameters depends on many aspects like composition of the treatment, bio-technological factors, people's interaction with different technological components and markets as well as other institutions. The impact analysis attempted here is

under a structured Watershed Impact System Model (WISM). The model indicates the impact of watershed treatment on two distinct regions.

Figure 1.1 : Watershed Impact System Model



The system is self-explanatory but as a brief description it can be noted that the organizational and the institutional structure along with the technological parameters decide the composition of the treatment. The composition of the treatment also gets modified in the light of the responses

of the participating beneficiaries. The changes due to watershed treatment are both of short run and long run nature. In fact the treatment is a continuum of the processes and does not have a completion as such. These changes are guided by the position of treatment in terms of reach according to the slope, bio-geological region and agro-climatic parameters. Among the major sub-systems for impact assessment, the production, socio-economic and environmental sub-systems are the most important ones.

The present study is designed in the above method of analysis. This is a second study conducted on the National Watershed Development Programme for Rainfed Areas and hence should be viewed along with the earlier study by Deshpande and Reddy (1991). Our sample here is drawn with the help of a Systematic Random Sampling method with probability proportion to size. Fifty beneficiaries and twenty-five non-beneficiaries are selected for the purpose of study. The data pertain to the year 1993-94. The study is spread over five chapters. The next chapter analyses the design of the NWDPA and major programme parameters at macro level besides setting the background for the analysis of the primary data. The third chapter deals with the impact of watershed treatment in the scarcity region, this is followed by the fourth chapter analysing the impact in the transition zone. The fifth chapter brings together the findings of the study and indicates policy implication.

## CHAPTER II

### NATIONAL WATERSHED DEVELOPMENT PROGRAMME FOR RAINFED AGRICULTURE: ANALYSIS OF DESIGN AND IMPLEMENTATION

#### 2.1 Introduction

Maharashtra is one of the States having largest area under rainfed conditions and a conspicuous distinction with large area categorized under drought-prone tracts. The State has only 16 per cent area under irrigation and only a few talukas can claim the proportion of irrigation above 30 per cent. As a consequence, the growth rates in the agricultural sector are not very high. Moreover, the problem of soil degradation and deforestation are also quite severe in the State. It is expected that by the end of the Eighth Plan the State shall achieve a foodgrain production target of about 150 lakh tonnes. Though this looks to be a formidable task, it can be achieved only if concerted efforts are directed towards the potential of the vast rainfed areas. Given the present status of surface and groundwater irrigation, the case of an integrated approach to rainfed farming becomes stronger.

The efforts towards improving the production potential of the rainfed areas in Maharashtra began in the pre-independence period (Kanitkar, Sirur and Gokhale, 1960). The Bombay dry farming practices developed at the dry farming research centres of Solapur and Bijapur, were quite commendable but could not register a widespread adoption due to various factors.

Different components of the watershed technology were introduced separately but no efforts were made to integrate these into a single programme. Maharashtra is known for its soil conservation programme, which began during mid-fifties coinciding with the starting of the Soil Conservation Research Demonstration and Training Centres. These centres were later on transferred to ICAR for complete monitoring and administration (Tripathi and Singh, 1993). The soil conservation programme, in the State of Maharashtra, was pursued vigorously and by 1979 the State had the distinction of largest size of area treated (84.28 lakh hectares) among the States in the country (Singh et al., 1981).

The State Government undertook the programme of Comprehensive Watershed Development (COWDEP), initially under Employment Guarantee Scheme and later on supported by the Centrally sponsored scheme. The COWDEP programme covered 27198 watersheds across the districts of the State from the beginning (1982) to 1990. The results of the COWDEP were quite encouraging and a sizable number of watersheds, about 12000, were completed (Deshpande and Reddy, 1990). Initially the National Watershed Development Programme for Rainfed Areas was taken up in the State as an extension of COWDEP but received specific attention in the immediately following year.

## 2.2 Design and Objectives of NWDPR

Maharashtra was among the first few States to have had an on-going programme exactly parallel to NWDPR. The COWDEP covered a large number of watersheds almost on similar lines and thus the NWDPR was recommended by the Central Government



as approved in the Seventh Plan Document through its order No. 6-13/85-CAV dated 3rd July 1986. The programme was initially sanctioned for the period 1986-87 to 1989-90 at a total cost of Rs. 239 crores. The earlier on-going programmes were merged with this programme. The programme envisaged the expenditure to be shared by the Central and the State Governments (see for the share of allocations Deshpande and Reddy, 1991a). The objectives of the NWDPRAs set forth in the 1986 guidelines were:

1. Taking the watershed as a basis to conserve and upgrade crop lands and waste lands as a vital natural resource;
2. to develop and demonstrate location specific technologies for proper soil and moisture conservation measures and crop production-stabilization measures required under different agro-climatic conditions;
3. to augment the fodder, fruit and fuel resources of the village communities by use of appropriate alternative land use system" (GOI, 1986).

These objectives incorporated conservation and augmentation of natural resources. The guidelines of 1986 also indicated a few important considerations for selection of watershed. These included: the size of watershed of less than 1000 ha, unit cost not to exceed Rs. 2000 and the staff cost to limit at 25 per cent, avoid the irrigated blocks, priority for watersheds where the small and marginal farmers are in majority and where the farm tested technology is available (GOI, 1986).

The analysis of the programme initiated during the Seventh Plan period by the Committee constituted for that purpose as well as other studies indicated quite a few changes in the on-going NWDPA programme (GOI, 1992; Eighth Plan 1992; Deshpande and Reddy, 1991a). The suggestions included six most crucial changes in the on-going programme. Firstly, an integrated holistic approach was suggested not only to develop natural resource base but also to sustain its productivity and quality of life. Secondly, each of the watersheds must begin with a complete plan of its development including the treatment on arable as well as non-arable lands. The involvement of the beneficiaries should be envisaged from the planning stage itself. Thirdly, the participation of beneficiaries must be ensured right from the initial stage and through the implementation of the programme. Fourthly, the sharing of the cost of watershed and the norms suggested by the Government of India are quite complex and hence the entire cost of the watershed should either be borne by the Central or the State Government. Fifthly, there must be a strong component of training for a selected number of farmers. Such training would help to propagate the information to the farmer level in the villages. Lastly, the monitoring and evaluation of each of the projects is essential in order to incorporate the mid-course corrections. Such corrections also give sufficient flexibility to the administrators at local level.

The project guidelines prepared by the Central Government keeping in view the suggestions made by the Committee of

Secretaries and a working group of the Planning Commission set forth a five-fold objective for the NWDPR. It includes:

- "i) Conservation, upgradation and utilization of natural endowments like land, water, plant, animal and human resources in a harmonious and integrated manner. This will aim at perpetual availability of food, fodder, fuel, fibre, timber and bio-mass for rural and cottage industries to meet the growing demands of human and livestock population through diversified land use system.
- ii) Generation of massive employment during the project period and regular employment after the project completion for enhancing the employment opportunities in the backward rainfed areas to ensure livelihood security particularly for underprivileged sections of the rural population like small and marginal farmers, landless labourers, tribals, etc.
- iii) Improvement of production environment and restoration of ecological balance through scientific management of land and rain water. In the process in situ moisture conservation, introduction of scientific production system, network of runoff management structures and devices for recharge of groundwater will ensure enhanced availability of water for human and livestock drinking purposes, domestic consumption, life saving irrigation and

raising of appropriate cash crops according to agro-climatic potentials.

- iv) Reduction of inequalities between irrigated and rainfed areas. Ultimately, stable production and processing of bio-mass would contribute towards better life in rural areas. This will reduce large scale migration from rural areas to the cities.
- v) In addition to food, fuel and fodder, the project would endeavour to enhance cash flow to the rainfed farmers and landless agricultural labourers through increased casual employment, marketable surplus of agricultural and dairy produce, growing of cash crops like vegetables, coriander, cumin, medicinal plants, etc., in suitable areas" (GOI, WARASA, 1992).

The objectives stated above are more akin to generalized objectives of any developmental programme for rainfed agriculture, except a few references to the exact focus of NWDPRRA. Thus, it seems that the objectives envisage a larger coverage and therefore less focussed. Such a large coverage assumes an inter-sectoral balance and intends to achieve it through the given programme. The task set forth by these objectives is not a formidable task but difficult to achieve in short or medium term and only through a <sup>single</sup> programme like NWDPRRA. The approach and the strategy of the NWDPRRA, however, have a clear focus than the objectives.

### 2.3 Approach, Strategy and Components of NWDPRRA

The approach and strategies indicated in the guidelines

of NWDPRA are more clear and transparent to implement as compared to the objectives. The approach and strategy is spelt out in five different categories. Firstly, the integrated and holistic approach of the strategy is spelt out indicating all its components. Secondly, the guidelines emphasized on projectization of the programme both as a bench mark as well as a blue-print of the works to be undertaken. This component is introduced first time in the guidelines of any watershed programme. Thirdly, adequate emphasis is given on the people's participation in the programme. It is intended to be achieved through the Mitra Kisan, training for beneficiaries, institutional contacts and group activities. Fourthly, the organizational structure and the administrative details are discussed in the guidelines. These include the indicative cost structure for the management of the programmes. Finally, the guidelines also indicate the steps in monitoring of the project. We shall critically discuss below each of these five broad steps in the Guidelines specifically from the view of their application at field level in Maharashtra.

Integrated and holistic watershed planning has been clearly incorporated under NWDPRA. The treatments include arable as well as non-arable land and the network of natural drainage lines. Thus, three sub-sectors dominate the treatments. More specifically, the treatments include:

1. Basic Activities:

- a) Establishment of Nursery - composite nursery
- b) Kisan Nursery
- c) Survey and Projectization

## 2. Arable Land Treatments:

- a) Vegetative Filter strips in place of diversion drains.
- b) Contour-vegetative hedges upto 4 per cent slope.
- c) Contour-vegetative hedges supported by trenches upto 8 per cent slope.
- d) Repairs of existing conservation measures.
- e) Gully control measures.  
Gabian structure, brush wood dam, loose boulder structure, vegetative systems, etc.
- f) Reclamation of ill-drained soils.
- g) Incentives for opening contour dead furrows.
- h) Contour cultivation.

## 3. Non-Arable Land Treatment:

- a) Filter strips in the place of diversion drains.
- b) Live Fencing.
- c) Gully control measures with vegetative supports:  
Gabian structure, Brush Wood Dam, planting of shrubs, planting trees, drainage line treatment, Removal of Nalla congestion, Live check dam, Loose boulder check dam, Small dig-out ponds, Gully plugging - earth/stone, Earthen structure with vegetative support.
- d) Over-seeding of Grass.
- e) Planting of Trees and Shrubs.
- f) Run-off Management with dug-out ponds.

## 4. Livestock Management:

- a) Castration of bulls.
- b) Other means of population control.
- c) Promotion of cultivated fodder production.
- d) Improvement of breeds.
- e) Training.

## 4. Agro-Forestry and Related Activities.

## 5. Training and Visit System :

- a) Training of watershed activities.
- b) Demonstrations.
- c) Agro-forestry training.
- d) Organic farming.
- e) Kitchen Garden.
- f) Innovative Schemes.

## 6. Construction of Chetana Kendras.

## 7. Other Activities.

The list of treatments given is quite an exhaustive. Mainly three sub-components are operated under the farming system, namely, (i) Food sub-component, (ii) Fodder sub-component, and (iii) Fuel sub-component, of the overall sustainable farming system. The most important and interesting aspect of the guidelines is the flexibility of the components across districts and between watersheds. Each of the watersheds has its own composition of the components and this differs across the agro-climatic zone. However, an important rider of this is that the flexibility is allowed within the technically suggested programmes. Another bottleneck faced while implementing the programme is not only the local level (lower than district level) flexibility of the technology and composition of the components but also the norms, related to the unit costs recommended and/or projectized, are non-flexible. Two often confronted cases are in the treatment of non-arable land with slope above 8 per cent and the brushwood dam or loose boulder structures in the resource-strained areas.

Another important step relates to projectization of the scheme. The earlier scheme of NWDPRRA did not involve any projectization and most of the decisions were centralized. The projectization incorporated in the NWDPRRA involved two objectives covering a survey to collect data on the structure and quantum of resources as well as to create a bench-mark survey for the purpose of the impact study. This involved three components, namely, (A) Resource Inventory, (B) Production System, and (C) Socio-economic Survey. A project report is thus prepared for

each of the watersheds and for the district giving the benchmark parameters and the proposed watershed programme. The components of benchmark / done quite hurriedly and do not provide enough data. The reports rather concentrate more on the programme formulation. The benchmark characteristics of the district are assigned very little space both in the watershed level report as well as district report (GOM, 1992). In fact, the report prepared at watershed level is superior compared to the one consolidated at the district. The watershed level report contains: (i) Land holding and land use, (ii) Vegetative resources, (iii) Socio-economic characteristics such as infrastructure, livestock, etc., (iv) Soil survey, (v) Physical characteristics and cost structure of the watershed, (vi) Incremental income and cost-benefit ratio, and (vii) Treatment maps. Though, the watershed level reports seem to be better organized and contain larger information, these have been completed in a very short time duration. Therefore, sometimes the presumptions at the time of the benchmark have undergone/ change during implementation. The project guidelines both issued by the Central Government as well as the State Governments do not provide for any mid-course corrections. A continuous project-ization is needed especially for the purpose of the proposed treatments. The project reports prepared thus help in understanding the watershed level features but the reports at district level do not reach the expected level in Maharashtra.

Another crucial factor introduced in the new guidelines of NWDPR is the participation of people in the programme. The



guidelines emphasize that "The project will be planned and implemented with active participation of the concerned village communities in association with voluntary agencies wherever possible" (GOI, WARASA, 1992, p. 23). This is intended through the 'Mitra Kisan' (contact farmer) and 'Gopal' (contact dairy farmer). These identified 'Mitra Kisans' and 'Gopals' were expected to keep a continuous contact with the cultivators and dairy farmers. They will receive training at the Krishi Vigyan Kendras and the knowledge gathered through such training will be passed on to the cultivators in the village.

The expectations about the participation could not be achieved fully as the Mitra Kisan and Gopal do not necessarily keep contacts with the other farmers. In the absence of any feedback mechanism about the dissemination of knowledge, it is difficult to monitor the participation process. It was also indicated that the training imparted to the 'Gopal' is inadequate and therefore does not serve the purpose. Further, the involvement and participation of the cultivators is neither sought nor forthcoming in the planning stage. In fact, the time allocated, to prepare the plans both at watershed level and their consolidation at district level, was so inadequate that it was not possible for the lower level functionaries to prepare the plan in consultation with the cultivators.

Training is another component of properly involving the beneficiaries in the process of watershed development. The Krishi Vigyan Kendras and the Farmers' Training Centres shall form the focal points. It was planned to impart training for

the contact farmers twice a year, i.e., before kharif and rabi season. Apart from this, the feedback sessions are also arranged. The response to the training component was not very encouraging. It was expressed that the training should incorporate innovative new methods rather than a repetitive course in the cultivation practices. As expected the management of community assets does not form major part but most of the times the training is tailored to the availability of teachers as well as the level of competence at the training centre, rather than the farmers' needs.

The guidelines proposed to operate the participation through the democratic village institutions. Government of Maharashtra through its GR No. JLY 1193/CR 284/JL 7 dated 18th December 1993 decided that the Chief Executive Officer of Zilla Parishad will coordinate the NWDPRAs. Similar democratic bodies both at village and taluka level are assigned the coordination work of the watershed programme. The District Coordination and Monitoring Committee was assigned the monitoring role. The functioning of these committees began in the early 1994.

Appropriate organizational structure holds the key to successful planning as well as implementation of a programme like watershed development. The organizational structure has three dimensions and five tiers. The first dimension is the technical composition of the team, planning and implementing the watershed development programme. It is necessary that all the disciplines involved in the watershed programme are adequately represented in terms of the technical competence.

Second dimension is the horizontal integration of the various line departments participating in the planning as well as implementation of the programme. Thirdly, the vertical integration of the various bodies at village/watershed, taluka, district and State level. If all these three criteria are satisfied then the implementation faces few bottlenecks. The administrative structure recommended under the guidelines has five layers, namely, (i) Policy support at State level, (ii) Directions for the policy, (iii) Planning and implementation to be accomplished by a multi-disciplinary watershed development team for each watershed in consultation with the farmers, (iv) Apprenticeship of post-graduate Agricultural University students, one each in a micro-watershed, and (v) Monitoring and evaluation by an external agency. All these steps lead to a cohesive control and integrated implementation of a watershed project. In Maharashtra, the watershed level technical group is not constituted and the responsibility of projectization, etc., rests with the Sub-Divisional Soil Conservation Officer. Similarly, the horizontal coordination is expected to be obtained through the district/taluka level committees constituted for that purpose. A technical cell constituting the watershed development team at the State level supports the technical needs of the process of implementation. Monitoring of the project is accomplished within the department and there are no external agencies involved in monitoring the progress. Absence of concurrent evaluation and monitoring does not allow any continuous projectization and thus can

hamper the progress of the programme. The State Government has been following the formats of the quarterly and annual reports.

Fixation of unit cost for various components of the watershed is another important problem. The guidelines (GOI, WARASA, 1992, p. 49), recommend aggregate unit cost of the project not to exceed Rs. 3500 in plain areas (which includes Rs. 500 towards management) and Rs. 5000 for the undulating hilly areas. To qualify for hilly area the watershed should have more than 75 per cent of its area with higher than 8 per cent slope. The recommended unit cost is an aggregate average for the State and consequently the State Government is given the flexibility to allow increased unit cost in some areas and effect savings in other areas. The project is financed by the Government of India in the form of 75 per cent grants in aid and 25 per cent loan to the State Government. The project guidelines envisage some financial contribution from the beneficiaries.

#### 2.4 NWDPRA : An Overview of the Programme in Maharashtra

The State Government of Maharashtra implemented the programme of NWDPRA starting from 1986. At that time there was an on-going programme of COWDEP in Maharashtra. Given the short time for planning and a clear indication through the guidelines of 1986 that "... the approach under the scheme is to give maximum flexibility to the State Governments ..." and "Preference should be given to those areas where already soil survey and soil conservation programmes have been undertaken..."

(GOI, 1986a, P. 4), the Government of Maharashtra chose 20 watersheds out of each district, which were earlier undertaken for development under COWDEP. Three hundred and eighty watersheds were taken up under 19 districts for development under NWDPRAs. The programme was administratively implemented and handled by the Department of Soil Conservation under the Directorate of Agriculture (Appendix Table 2.1).

There was a substantial change in the set up of the Department of Soil Conservation as well as the implementation of NWDPRAs. The Government of Maharashtra started a new department as well as a Ministry of Rural Development and Water Conservation. The Department of Soil Conservation was brought under this Ministry with a Director of Soil Conservation and Watershed Development / <sup>coordinating the</sup> development programme. Under the Eighth Plan programme of NWDPRAs the Government of Maharashtra identified 266 watersheds for the purpose of development. The geographical area covered by these watersheds is about 465 thousand hectares and the treatable area out of this is 444 thousand hectares (see Appendix 2.2). The cost involved for the development of these watersheds is Rs. 12787.53 lakhs, or about Rs. 48.07 lakhs per watershed and Rs. 2881 per hectare of treatable area. The choice of the watershed and planning for the treatment was entirely done by the Department of Soil Conservation. The initial estimates were revised and the area to be treated was extended by including some area falling near the watershed, especially including the micro-catchments in the neighbourhood. The programme for the Eighth Plan for

the State and the achievements by components is given in Appendix 2.3. Following is the gist of the financial targets and achievements till February 1995.

**Table 2.1 : Plan Allocation on NWDPRM by Activities and Expenditure Incurred Till February 1995**

Sr. No.	Activity	Plan Allocation (Rs. in lakhs)	Expenditure Incurred (Rs. in lakhs)	Per cent Achievement
1.	Arable land - Conservation measures	3186.75	1061.80	33.32
2.	Arable land - Production	3003.81	1088.58	36.24
3.	Non-Arable land - Conservation	1170.83	488.70	41.74
4.	Non-Arable land - Production	740.79	286.27	38.64
5.	Treatment of Drainage Line	6883.66	3356.33	48.76
6.	Livestock Management	1335.80	230.56	17.26
7.	Basic Activity	1418.22	1050.26	74.05
	<b>Total</b>	<b>17739.86</b>	<b>7562.50</b>	<b>42.63</b>

Source: Government of Maharashtra, Directorate of Soil Conservation and Watershed Management, Pune, 1995.

Table 2.1 indicates the achievement across the groups of activities in the State. The achievement under Basic activity which includes: survey projection, Nursery, Training, Establishment, Research support and Innovative components is highest. The basic activities begin almost with the initial year but some of the components continue throughout the project

period. The basic activity includes a survey at the time of the starting of the project but does not include any monitoring of the project. In fact the unspent grant can be used for monitoring or the State Government should have freedom to divert the funds to other activities. Overall, the progress seems to be about 40 per cent of the target and as expected it is slightly higher in the non-arable lands than the arable lands. The treatments have to start from ridge to the valley and therefore higher expenditure on the treatment of the non-arable land is not surprising.

The district level achievements are shown in the Maps for the Arable and Non-Arable lands. It can be seen that the clusters of the districts indicate a pattern in the State. The districtwise achievements for all the major components is presented in Appendix 2.4. The lagging regions in achievements are parts of Nagpur-Amaravati Division, Marathwada and Southern Maharashtra. The per hectare cost of treatment also varies across the regions. There are four watersheds which have the cost of treatment below Rs. 1500 per hectare. Nine watersheds have the cost of treatment in the range of Rs.1500 to Rs.2000. One hundred and forty-three watersheds indicated this cost in the range of Rs. 2000 to Rs. 3000. Similarly, eighty-seven watersheds fall in the cost range of Rs. 3000 to Rs. 3500 and twenty-seven claim the highest cost of treatment exceeding Rs. 3500. It is clear that the projectization has assumed varying cost for the treatments in different agro-climatic zones. Most of the watersheds falling in the Western Ghat

region or having higher slopes have shown higher cost of treatment.

From the State level analysis of the progress of NWDPR it is clear that there is a specific pattern of development in the programme across district. There are some districts with very good achievements (at least in terms of the financial and physical progress) and at the same time we have certain regions with lower achievements. Apart from the agro-climatic conditions and people's participation, these districts should also be examined for their method of projectization. In the absence of any external monitoring, as well as flexibility for mid-course corrections, the poor achievements are not very surprising. There are four important implications which stem out of our analysis above as well as from the discussions with the implementing agencies. Firstly, flexibility in projectization upto the last unit of planning (here watershed) is essential for a good implementation. The flexibility should be available in terms of changing the composition of the components, re-allocation of funds or inclusion of any new component in the treatments at watershed level. Secondly, the norms indicated about the internal allocation of the sanctioned funds for a watershed (WARASA, Annexure I, p. 53), are difficult to adhere to and these should be left to respective State Governments. Thirdly, the guidelines indicate both internal as well as external monitoring but this is not practised. Such monitoring should also include the possibility of changing the given programme components and reallocation of the expenditure.



Lastly, the involvement of the local level NGOs may help in effective implementation of the programme.

## 2.5 Sample Region: Some Basic Indicators

As indicated earlier we have chosen two watersheds falling in two distinct agro-climatic regions. The first watershed comes under the scarcity zone of Maharashtra characterized by the fragile resources and weak agro-production system. Here the water balance is extremely poor and therefore the conservation would help to restore the bio-system. The second watershed comes under the transition zone II in Southern Maharashtra. This region is characterized by moderate rainfall with a commercialized cropping systems in the neighbouring regions. The slope of land is slightly higher and therefore the treatment balance favours the non-arable lands more than the arable lands. The degraded lands are more in the upper reaches and the lower reach is bestowed with good soils.

The watershed under the scarcity zone is located in the drought-prone district of Ahmednagar. The annual precipitation received in the district ranges between 500 and 700 mm. Parner taluka is also included in the chronically drought-prone area of the State. The selected watershed falls in the Parner taluka covering Bugewadi village. The village has a geographical area of 1659.20 hectares, with 936 hectares of area under cultivation. The total non-arable land in the village is 719.00 hectares, thus the treatment area adds upto 1655 hectares.

Table 2.2 : Achievements Under the Project: Bugewadi Watershed

Sr. No.	Activity	Unit	Target for 8th Plan (July '94)	Completed works	Per cent achievements
1.	Basic Activity	Rs. lakhs	2.00	0.23	11.5
2.	Arable Lands:				
	a) Vegetative filter strips	Nos.	3500	1000	28.6
	b) Contour and Vegetative Hedges	"	200	100	50.0
	c) Repairs of Existing Bunds	"	2500	500	20.0
	d) Gully Control Measures	"	300	100	33.3
	e) Incentive for Opening dead furrows	"	1100	300	27.3
	f) Contour cultivation	No. of farmers	1630	547	33.6
3.	Non-Arable Land:				
	a) Live Fencing	Mtrs.	7500	5000	66.7
	b) Drain Lines	"	8000	3050	38.2
	c) Vegetative Contour Hedges with furrows	Nos.	1319	719	54.5
4.	Treatment of Upper Reach:				
	a) Live check dams	Nos.	200	52	26.0
	b) Brushwood dams	"	200	50	25.0
	c) Loose Boulder Check Dams	"	325	150	46.2
	d) Small dug out sunken ponds	"	Nil	-	-
5.	Treatment of Middle Reach:				
	a) Earthen structure with vegetative support	Nos.	380	104	27.4
	b) Loose boulder structure	"	225	50	22.2
	c) Run-off Management dug out ponds	"	35	30	85.7
6.	Treatment of Lower Reach:				
	Limited No. of Dug out Runoff Management Ponds	Nos.	33	13	39.4
7.	Livestock Management	Rs. Lakhs	3.05	-	-
Total Cost of the Project		Rs. lakhs	33.98	12.38	36.4

The project cost is worked out as Rs. 33.98 lakhs which includes Rs. 9.47 lakhs for the treatment of arable lands, Rs. 3.05 lakhs for the livestock management, Rs. 7.20 lakhs for basic activities and the remaining amount for other activities. The project proposal prepared by the Soil Conservation Department puts the cost of treatment at Rs. 2050 per hectare and the benefit-cost ratio at 1.27 (Short Note on NWDPR, Bugewadi). The activities indicated in the project report include: (1) basic activity, (2) treatment of arable land, (3) treatment of non-arable land, (4) drainage line treatments, and (5) livestock management.

The achievements of the project in the first three years have been satisfactory and vary across the components. The project needs to be revised keeping in view the changing cost structure and availability of labour. The highest number of beneficiaries come under the programme of repairing the contour and other conservation measures, followed by vegetative contour hedges. The major changes visualized include the shift in cropping pattern, increase of cropping intensity, horticultural plantation, pasture in the upper reach and water conservation structures. Among the environmental effects the prominently noted changes include: change in the moisture availability period, increased water-table, availability of fodder, increased green canopy effect, and control of soil run-off.

The second watershed chosen for the study belongs to the Transition Zone II, falling on the eastern slopes of the Western Ghat region. The watershed covers totally seven

villages/hamlets, namely, Nune, Goudi, Sarkhal, Sablewadi, Beblewadi, Inglewadi and Thombrewadi. The geographical area of the watershed is about 1322 hectares of which only 664 hectares is under cultivation. Total area under the watershed treatment is 1010 hectares and the project envisages an expenditure of Rs. 31.74 lakhs. The per hectare development cost of the watershed is Rs. 3143 per hectare.

The watershed has about 346 hectares of non-arable land and the vegetation on the hill slopes mostly include local grasses, *Acacia nilotica*, *Azadirachta indica*, *Vitex negunde* L., *Leucaena leucocephala*, *Ziziphus maurilana* Lamk, *Pongamia pinnata*, *Erythrina variegata* and *Prosopis juliflora* Sw. The slope in the watershed area ranges between 2 and 8 per cent. Total number of farm families in the watershed are 508 of which 452 are small farmers. The soils are medium and shallow with medium to high level of permeability.

The achievements under the Nune-Goudi watershed are given below for the major groups of activities.

Activity	Financial Allocation (Rs. lakhs)	Actual Expenditure (Rs.lakhs till Sept. 1993)	Per cent achievement
1. Arable Land Treatment	8.67	3.58	41.3
2. Non-Arable Land Treatment	6.01	1.60	26.6
3. Basic Activity	7.80	0.18	2.3
4. Treatment of Drainage	6.51	8.34	128.1
5. Livestock Management	2.75	1.67	60.7
Total	31.74	15.37	48.4

Source: Government of Maharashtra (1993), NWDPR - Nune-Goudi Watershed Progress Report.

The expenditure on treatment of drainages has exceeded the sanctioned amount whereas the allocation on basic activities seems to have not crossed even 5 per cent. Specially, here the necessity of inter-activity reallocation seems quite pertinent. The activitywise expenditure shows only one side of the achievement whereas, the physical achievements are given in Table 2.3. It can be observed from the table that the average achievement <sup>as</sup> /percentage of the aggregate project is 48.4 per cent but there is a wide variation across components. There are quite a few components where the achievement has exceeded the targeted programme by 2 to 5 times. This shows problems regarding proper projectization or either the survey of field was not elaborately conducted. It may also happen due to the mid-course corrections incorporated by the project staff. Overall, the achievement has been about 48 per cent and the projected benefit-cost ratio of the project is 1.79.

## 2.6 Summary

National Watershed Development Project for Rainfed Agriculture started as a result of the experience gathered through various programmes. Initially it was the Drought-Prone Area Development Programme was taken up in selected districts along with the State level programmes in various States. These programmes have laid down their own separate guidelines, norms, funding patterns and technical competence. The experience of these programmes give chequered results and it is difficult to generalize them across the country.

**Table 2.3 : Achievements Under the Project: Nune-Goudi Watershed**

Sr. No.	Activity	Unit	Proposed Programme	Completed Work (Sept. 1993)	Per cent Achievement
<b>1. Arable Lands:</b>					
<b>A) Conservation Measures:</b>					
a)	Contour Vegetative Hedges upto 4% slope	Ha.	20	94	4.7(times exceeded)
b)	Contour Vegetative Hedges 4 to 8% slope	Ha.	10	31	3.1(times exceeded)
c)	Vegetative Filter strip	Mtrs.	1000	3000	3.0(times exceeded)
d)	Repair of existing bunds	Nos.	20	8	40.0
e)	Gully Control Measures	Nos.	152	92	60.5
f)	Agro-Forestry (Trees)	Nos.	15000	10000	66.7
g)	Horticulture (Trees)	Nos.	3000	1500	50.0
<b>B) Production System:</b>					
a)	Crop Demonstrations	Nos.	1500	300	20.0
b)	Agro-Forestry (Trees)	Nos.	36000	13100	36.4
c)	Compost Pits	Nos.	1250	90	7.2
d)	Kitchen Garden	Nos.	900	30	3.3
e)	Household Production	Nos.	142	21	14.8
<b>2. Non-Arable Land:</b>					
a)	Live Hedges	Mtrs.	4000	7000	1.8
b)	Contour Vegetative Hedges	Mtrs.	150	133	88.7
c)	Gully Control Measures	Nos.	110	145	1.3(times exceeded)
d)	Over Seeding of Grass	Ha.	250	50	20.0
e)	Forming of Shrubs by Seeds	Nos.	1000	-	-
f)	Planting of Trees on Nalla Bank	Nos.	275	-	-
g)	Nalla bank Stabilization	Mtrs.	500	480	96.0
h)	Live Check Dam	Nos.	10	-	-

(continued)

Table 2.3 : (continued)

Sr. No.	Activity	Unit	Proposed Programme Work	Completed Work (Sept. 1993)	Per cent Achievement
3. Treatment of Drainage:					
A) Upper Reaches:					
a)	Brushwood Dam	Nos.	15	-	-
b)	Loose Boulder Structures	"	600	633	1.05 (times exceeded)
c)	Small sunken pond	"	1	1	100.0
B) Middle Reaches:					
a)	Earthen bunds with vegetative supports	Nos.	50	15	30.0
b)	Loose Boulder Structures	Nos.	100	459	4.59 (times exceeded)
c)	Earthen nalla bunds	Nos.	20	20	100.0
d)	Khus Nursery	Ha.	10	1	10.0
4.	Livestock Management	Rs. lakhs	2.75	1.67	60.7
5.	Basic Activity	Rs. lakhs	7.80	0.18	2.3

Source: Government of Maharashtra (1993), National Watershed Development Project for Rainfed Area - Nune-Goudi Watershed, Progress Report (Marathi).

However, it was strongly felt that the programmes should be resource generating/conserving leading to sustainable development. While reviewing the DFAP and DDP in the country, the Committee headed by Hanumantha Rao reiterated that harmonious management of resource region, proper development

and utilization of land, water and vegetative resources on watershed basis and the creation of complementary opportunities should form the essence of these programmes (GOI, 1994).

Keeping in view the experience gathered out of the NWDPRA, introduced in the middle of the Seventh Five Year Plan, the Government of India decided to issue fresh and detailed guideline while continuing the programme during Eighth Plan. Comprehensive guidelines were prepared and circulated to the respective State Governments. The total programme envisaged was allocated a sum of Rs. 1100 crores. Fundamental differences in the earlier NWDPRA and the programme introduced during the Eighth Plan can be pointed out in terms of five factors. Firstly, the new programme detailed all the components in detail under five main headings, namely, (1) basic activity, (2) development of arable land, (3) development of non-arable land, (4) treatment of drainage line, and (5) livestock management. Optimum share of allocation based on per cent share to total cost of the project is indicated in the guidelines. Secondly, the earlier concept of 'contact farmers' used at the time of Community Development Programme and later on followed through the Training and Visit system, was introduced here under a new name called 'Mitra Kisan' and 'Gopal'. These 'contact farmers' were to receive a three phase training and were expected to transfer this to the other beneficiaries. The attempt seems to have derived mixed success. Thirdly, the programme also included training of the farmers and expects to evince larger participation through such training.



Fourthly, the new guidelines are quite elaborate about projectization of the programme and give a complete blueprint for the preparation of the project reports. But at the State level time allocated for preparation of such projects was quite inadequate and this has reflected in preparing a faulty project plan. The difficulty is compounded by the absence of mid-course corrections through monitoring or concurrent evaluation. Lastly, the guidelines are quite clear about the involvement of beneficiaries from planning stage and for implementation. This is planned to be achieved through the 'contact farmers', training, T and V system and village level meetings.

The programme response in Maharashtra was quite encouraging. The achievements across different components range upto 48 per cent in the first three years of the Five Year Plans. There are lagging and leading regions as well as components. Among the regions, some districts of Vidarbha and Marathwada have lower performance as compared to other districts. Among the various activities, the activities on arable and non-arable land have better achievements as compared to the 'basic activities'. Lower expenditure in the 'basic activities' is mainly due to the short duration of time allocated for the survey.

The sample watersheds were selected from two distinct agro-climatic regions in order to bring out the contrast in the impact parameters. The treatment as well as the approach towards development in these two regions is totally different.

Among the two watersheds the secondary data analysis indicates that the watershed falling in the scarcity zone almost totally adhered to the project plan. But the watershed in the transition zone seems to have faced several problems in implementation of the planned activities. This could be seen from the variation in achievement rates across activities.

Appendix 2.1:- NATIONAL WATERSHED DEVELOPMENT PROGRAM FOR  
RAINFED AGRICULTURE : Seventh Plan Targets.  
(Ha)

Sr No.	Districts	No. of Watersheds	Area of Watershed		Total
			Arable	Non Arable	
1	Ahmednager	20	13848	430	14278
2	Solapur	20	17434	1248	18682
3	Satara	20	9925	569	10494
4	Sangli	20	13622	525	14147
5	Nasik	20	13729	577	14306
6	Dhule	20	12155	369	12524
7	Jalgaon	20	14579	287	14866
8	Aurangabad	20	14505	330	14835
9	Jalna	20	16161	96	16257
10	Parbhani	20	16152	184	16336
11	Beed	20	15704	393	16097
12	Nanded	20	14730	---	14730
13	Osmanabad	20	14754	233	14987
14	Latur	20	19755	731	20486
15	Amaravati	20	15184	35	15219
16	Akola	20	14996	196	15192
17	Yawatmal	20	15017	107	15124
18	Buldhana	20	16726	32	16758
19	Wardha	20	18636	1106	19742
Total		380	287612	7448	295060

Source:- Government of Maharashtra (1989),  
Statement about Targets & Achievements,  
Directorate of Agriculture, Pune.

Appendix 2.2:- Districtwise Programme Under National Watershed  
Development Project for Rainfed Areas: Eighth Plan Targets.

Sr No.	Districts	No. of Micro-Watersheds	Geographical Area Covered (Ha)	Treatable Area (Ha)	Cost Approved Rs. in Lakhs	Cost in Rs. Per Hectare
1	Thane	7	12210	11490	393.20	3422
2	Raigad	13	23535	21567	685.01	3176
3	Ratnagiri	8	13158	12390	512.37	4135
4	Sindhudurg	7	13335	12949	445.19	3438
5	Nasik	12	19121	18444	567.80	3078
6	Dhule	10	17805	17698	584.59	3303
7	Jalgaon	10	14678	14452	429.70	2973
8	Ahmednagar	9	15770	14645	398.84	2123
9	Pune	12	22485	19423	575.20	2967
10	Solapur	11	22078	20458	717.80	3509
11	Satara	11	20900	20694	498.10	2407
12	Sangli	8	14762	13818	460.04	3329
13	Kolhapur	11	22848	21921	665.93	3238
14	Aurangabad	8	13563	12725	394.54	3100
15	Jalna	4	6355	6235	176.94	2838
16	Parbhani	6	10816	10714	304.65	2994
17	Beed	7	11922	11380	340.53	2992
18	Wanded	8	13217	13123	419.13	3194
19	Osmanabad	6	10207	10107	268.01	2652
20	Latur	5	9241	9090	240.97	2651
21	Buldhana	13	19493	19458	453.80	2332
22	Akola	12	19284	19150	485.85	2537
23	Amarawati	13	19951	19616	398.27	2030
24	Yavatmal	14	21738	19431	442.18	2276
25	Wardha	8	11243	10911	273.38	2506
26	Nagpur	13	25251	23374	696.41	2979
27	Bhandara	6	12902	12332	343.45	2785
28	Chandrapur	7	10519	9837	321.70	3270
29	Gadchiroli	7	17017	16395	293.95	1793
30	State Total	266	465404	443827	12787.53	2881

Source: Government of Maharashtra (1992), Statement Showing the Geographical Area and Cost Approved by State Level Sanctioning Committee for Micro-Watersheds Selected Under NWDPPA, Directorate of Soil Conservation and watershed Management, Pune.

Appendix 2.3 : National Watershed Development Project for  
Rainfed Areas Statement Showing Total Programme  
for the VIIIth Five Year Plan and Achievements  
Since Beginning Upto February 1995

No.	Item	Physical		Financial(In Lakhs)	
		Target	Achievement	Target	Achievement
1	2	3	4	5	6

A) Arable Land :

(a) Conservation measures:

1	Vegetative filter strips in place of diversion drain (Nos)	1916691	907823	247.58	76.01
2	Contour Veg.hedges upto 4% slope (ha)	238723	136146	638.16	205.53
3	Contour Veg.hedges(upto 4% to 8% slope) (ha.)	52022	24689	200.35	50.26
4	Repairs of existing Cons. measures (Nos.)	217625	85746	340.23	93.64
5	Gully control measures (Nos.)	243570	68292	1146.14	288.88
6	Incentive for opening contour dead furrows. (Nos.)	28269	20499	33.45	5.72
7	Contour cultivation(Nos)	17954	90866	-	-
8	Any other measures :	23710	106831	580.84	341.04
	Total			3186.75	1061.80

(b) Production :

1	Crop Demonstrations(Nos.)	292974	206516	1320.77	623.76
2	Agro Forestry : (Nos.)	6921412	3824410	506.76	164.01
3	Dry Land Horticulture (Nos.)	623710	-	97.90	-
4	Organic Farming (Nos.)	168723	85503	181.41	74.94
5	Home Stead Garden (Nos.)	136071	34638	144.40	69.90
6	House Hold Production (Nos.)	79500	20103	749.57	156.50
	Total			3003.81	1088.58

Appendix 2.3 : (Contd.)

1	2	3	4	5	6
<b>B) <u>Non Arable Land :</u></b>					
<b>(a) <u>Soil Conservation Measures :</u></b>					
1 Live Fencing (Rmt)	2785872	179544	273.48	109.42	
2 Vegetative Filter Strip (Rmt)	1626119	876555	212.83	70.20	
3 Vegetative Contour Hedges (Rmt)	79303	47768	323.40	106.57	
4 Gully Control Measures (Nos.)	106730	41218	352.26	160.35	
5 Gabian Structure(Nos.)	121	19180	7.89	42.16	
Total			1170.83	488.70	
<b>(b) <u>Production :</u></b>					
1 Overseeding of grasses (Ha)	104527	191329	236.49	119.08	
2 Planting of shrubs(Ha)	15565616	3630197	142.33	36.41	
3 Planting of trees (Nos)	5363144	3085977	361.77	130.78	
Total			740.79	286.27	
<b>(c) <u>Treatment of Drainage Line Upper Reaches:</u></b>					
1 Bank Stabilisation(Rmt)	2258893	1294656	224.19	106.91	
2 Live Check dam(Nos.)	97751	40177	82.65	25.99	
3 Brushwood dams(Nos.)	71267	35607	93.81	35.13	
4 Loose boulder check dam (Nos.)	103992	52697	625.58	358.39	
5 Small dug out sunken ponds (Nos.)	11036	1906	144.95	45.39	
6 Loose Boulder structures	82155	95997	1913.33	1027.21	
7 Earthen Structures (Nos.)	65508	34157	734.09	334.01	
8 Run off Management (Nos.)	5576	1390	409.78	195.93	
9 Limited Dugout sunken ponds (Nos.)	11302	5357	2621.51	1227.41	

Appendix 2.3 : (Contd..)

1	2	3	4	5	6
10 Removal of nalla cong. (Nos.)		35070	-	33.77	0.26
	Total			6883.66	3356.33
<b>C) <u>Live Stock Management:</u></b>					
1 Construction of scrub bulls (Nos.)		219154	34544	72.83	11.06
2 Other means of popula- tions control (Nox.)		154069	23432	154.30	30.20
3 Cultivated fodder production		128423	83490	1108.67	165.98
	Total			1335.80	230.56
<b>D) <u>Basic Activities :</u></b>					
Survey Projection		-	-	350.52	146.54
Nursery		-	-	493.72	148.57
Training		-	-	841.08	133.82
Establishment		-	-	1704.19	599.93
Research Support		-	-	492.18	-
Innovative reserve		-	-	536.53	21.40
	Total			1418.22	1050.26

Source : Government of Maharashtra (1995), Statement of the Target and Achievements under NNDPRA, Directorate of Soil Conservation and Watershed Management, Pune

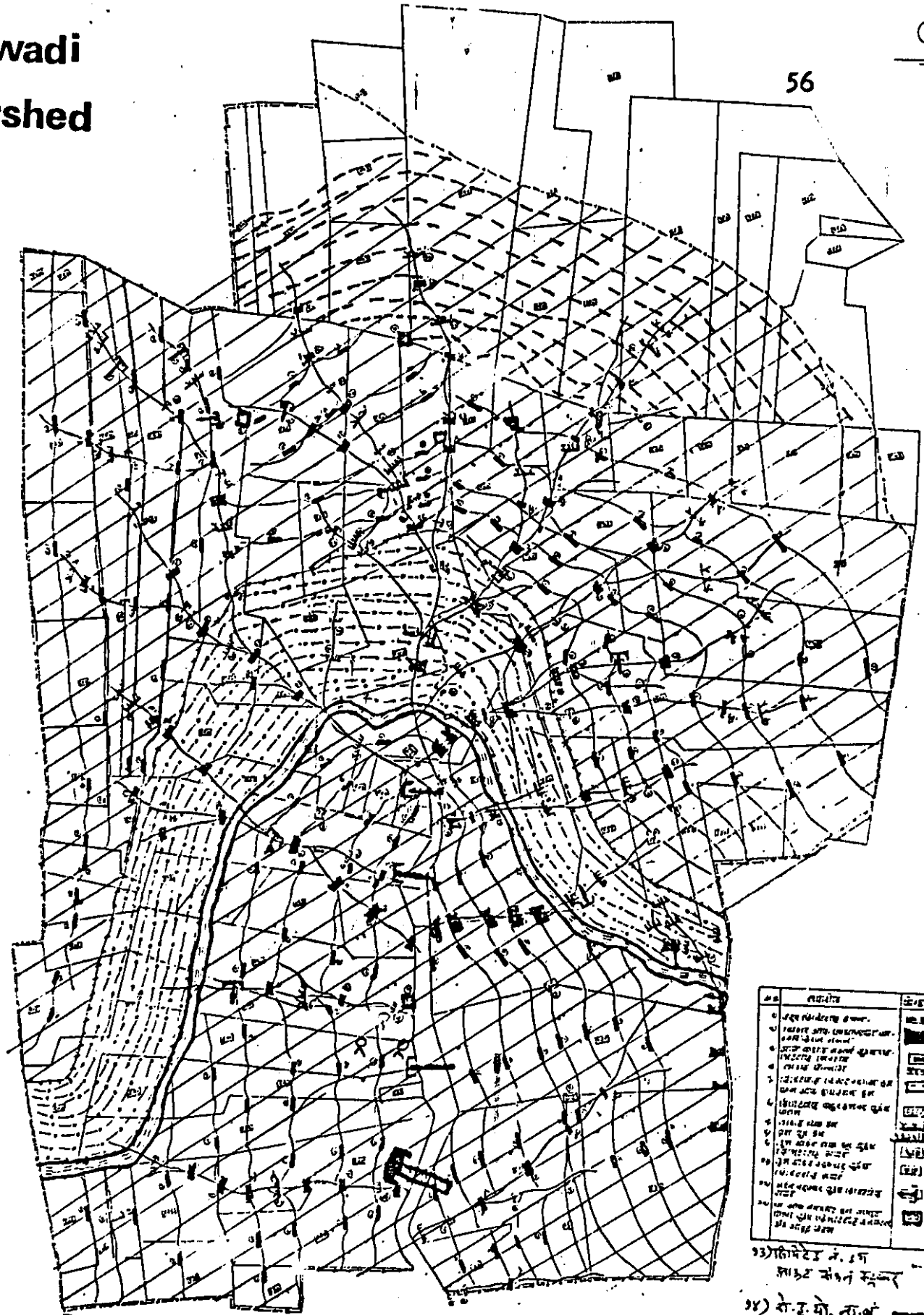
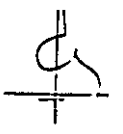
Appendix:-2.4 National Watershed Development Programme For Rainfed  
Areas : Districtwise Componentwise Achievements  
(Percent to Target)

	RASTC ACTIVITY	ARABLE LAND	NON-ARABLE LAND	LIVESTOCK	T O T A L
1 Thane	133.14	14.22	58.61	14.54	46.77
2 Raigad	62.72	17.80	45.36	7.83	37.29
3 Ratnagiri	87.08	22.35	39.48	9.88	34.58
4 Sindhudurg	98.57	5.53	24.86	18.50	22.90
5 Nashik	15.86	21.42	45.49	11.77	36.71
6 Dhule	14.77	18.96	66.37	28.33	46.48
7 Jalgaon	12.92	24.63	49.72	23.84	37.87
8 Ahmednagar	8.02	59.96	46.88	70.68	49.44
9 Pune	5.52	89.05	50.69	71.54	56.53
10 Solapur	9.08	60.73	48.77	91.35	54.18
11 Satara	100.00	25.57	67.27	21.83	50.53
12 Sangli	100.00	18.30	43.32	32.27	35.17
13 Kolhapur	100.00	19.40	45.21	14.04	34.62
14 Aurangabad	14.54	42.91	62.61	13.98	48.79
15 Jalna	21.14	42.91	48.04	33.29	43.65
16 Beed	2.86	24.44	47.70	9.70	31.23
17 Latur	RRR	34.95	67.75	0.00	53.87
18 Osmanabad	0.00	51.44	67.43	0.00	53.05
19 Nanded	28.78	25.99	45.85	19.78	37.19
20 Parbhani	1.19	29.12	68.38	0.88	44.35
21 Buldhana	7.65	38.59	32.23	18.10	27.99
22 Akola	5.31	29.43	38.08	19.00	24.17
23 Amaravati	7.30	22.35	26.22	33.03	20.19
24 Yavatmal	4.39	39.26	43.06	29.59	4.68
25 Nagpur	100.00	21.24	56.96	100.00	57.85
26 Wardha	100.00	14.75	26.07	100.00	39.53
27 Bhandara	100.00	64.20	254.40	100.00	84.03
28 Chandrapur	100.00	29.21	36.15	100.00	49.50
29 Gadchiroli	100.00	60.10	5.48	100.00	46.75



# Bugewadi Watershed

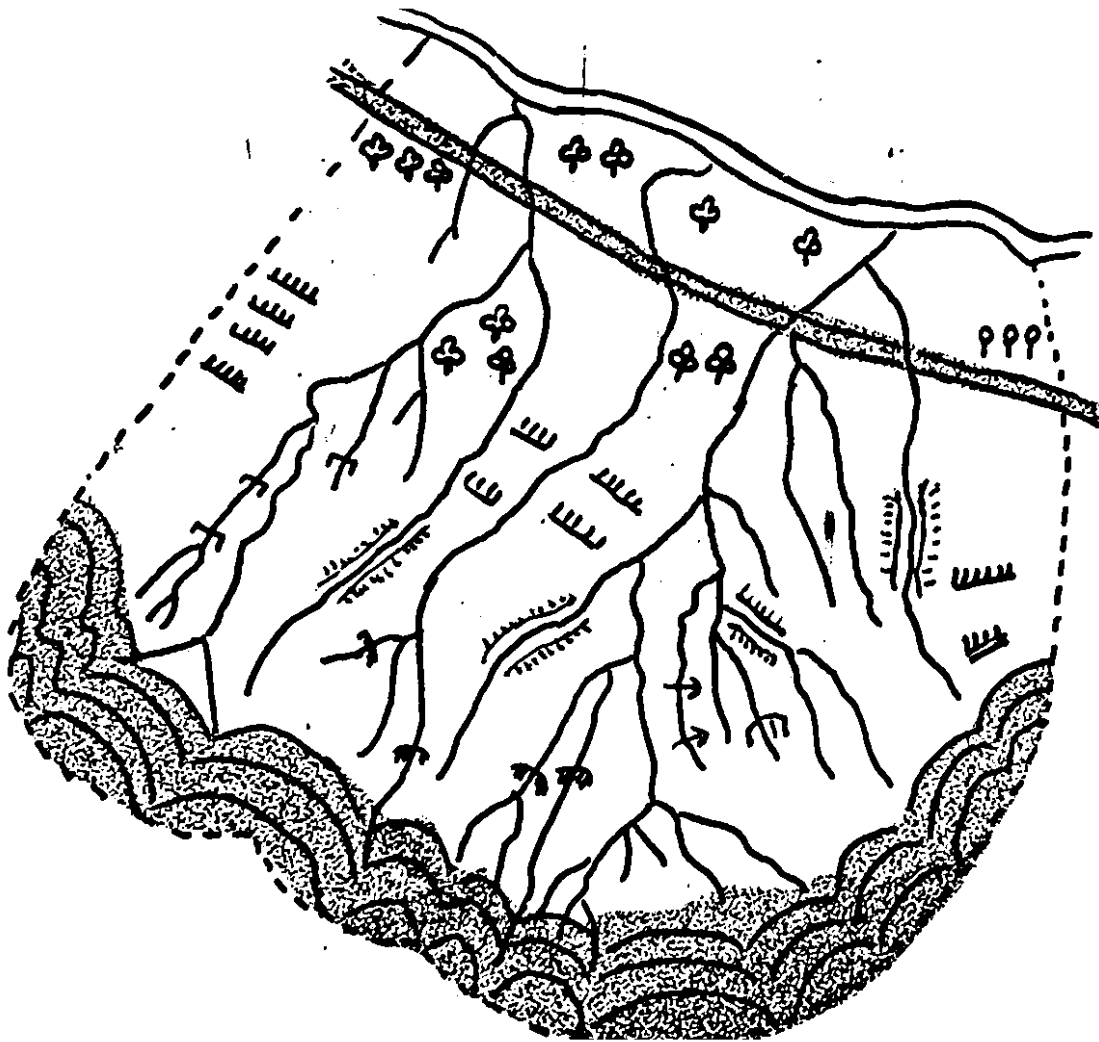
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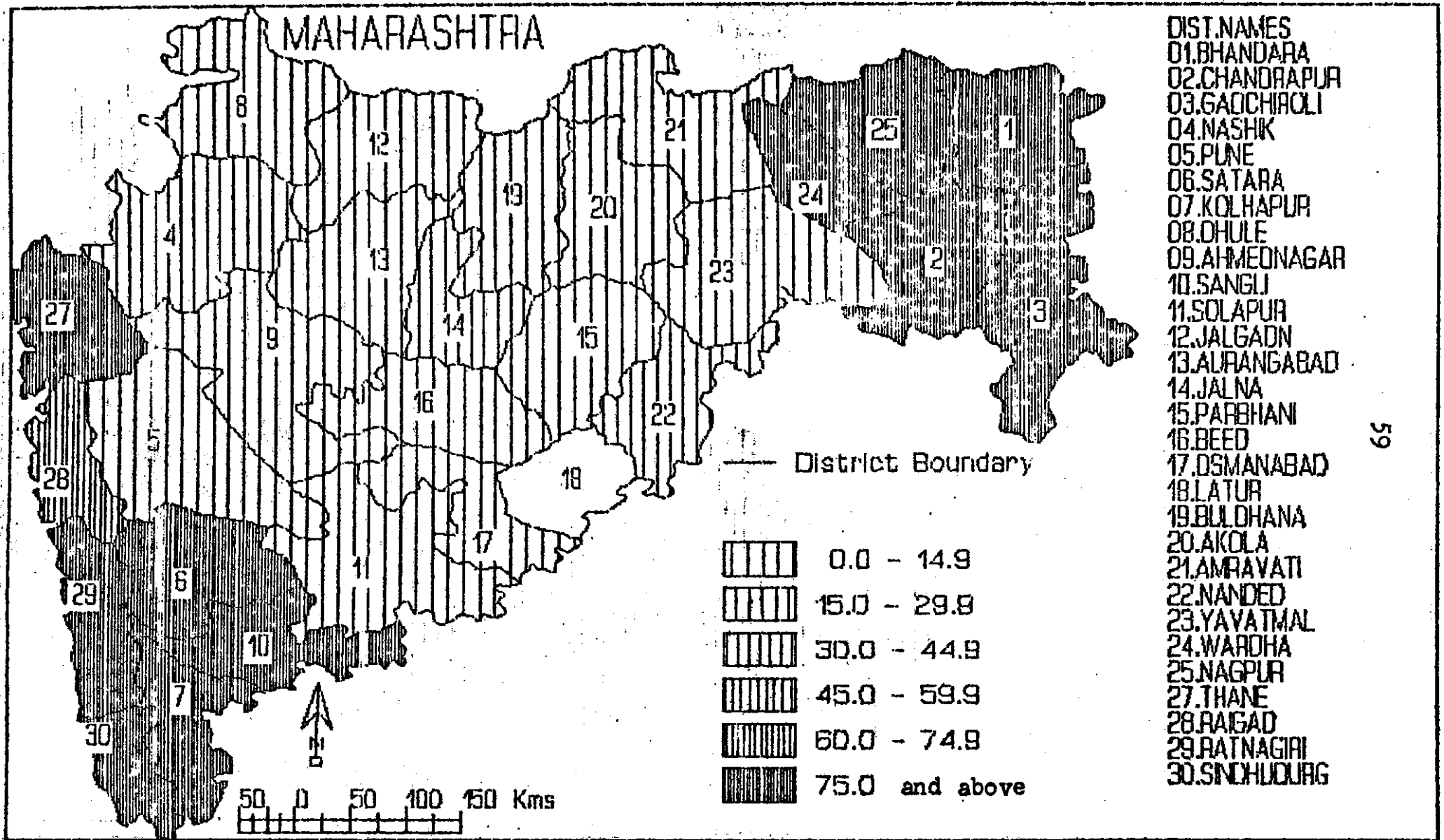
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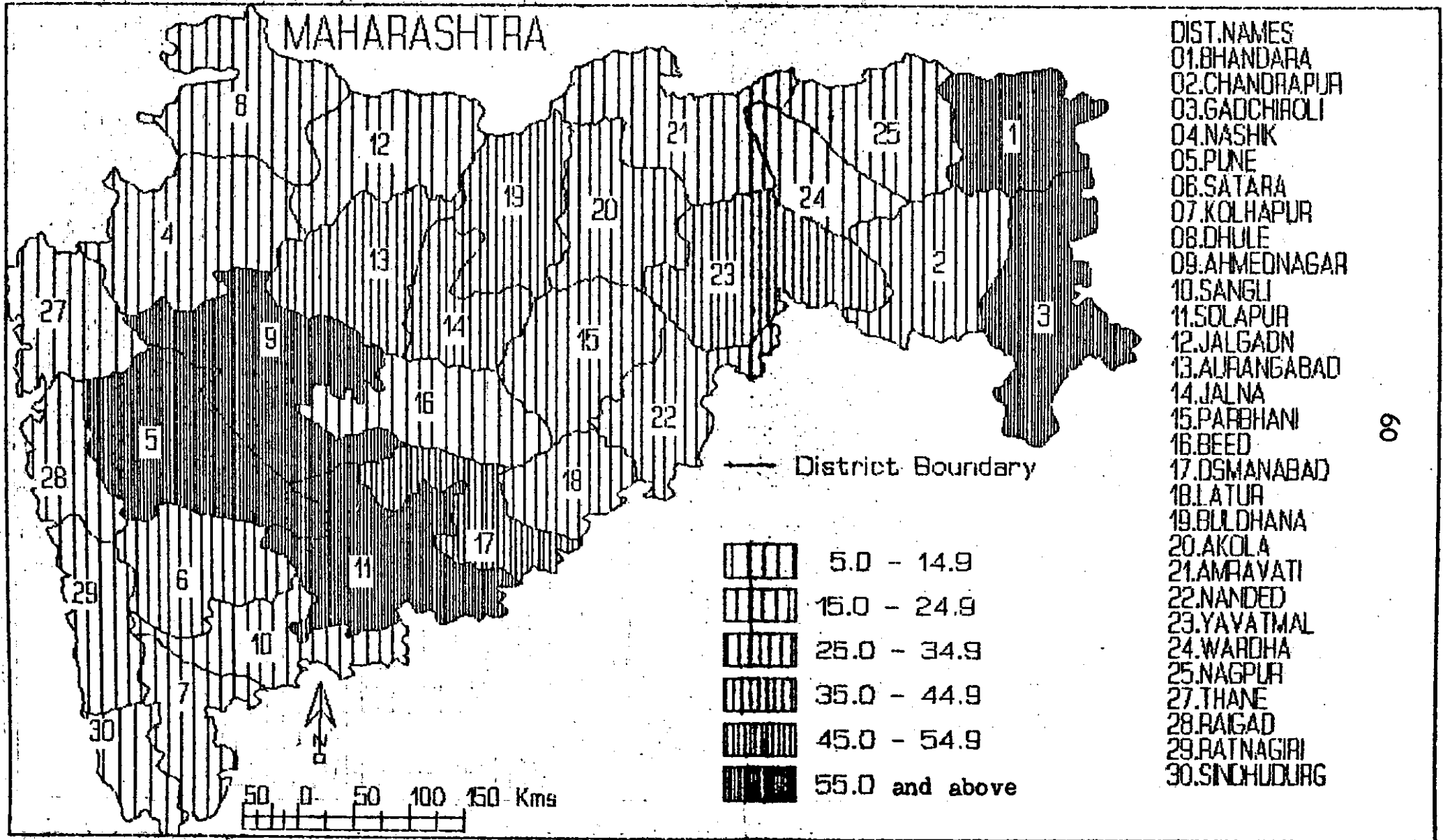
# NUNE-GOUDI Watershed



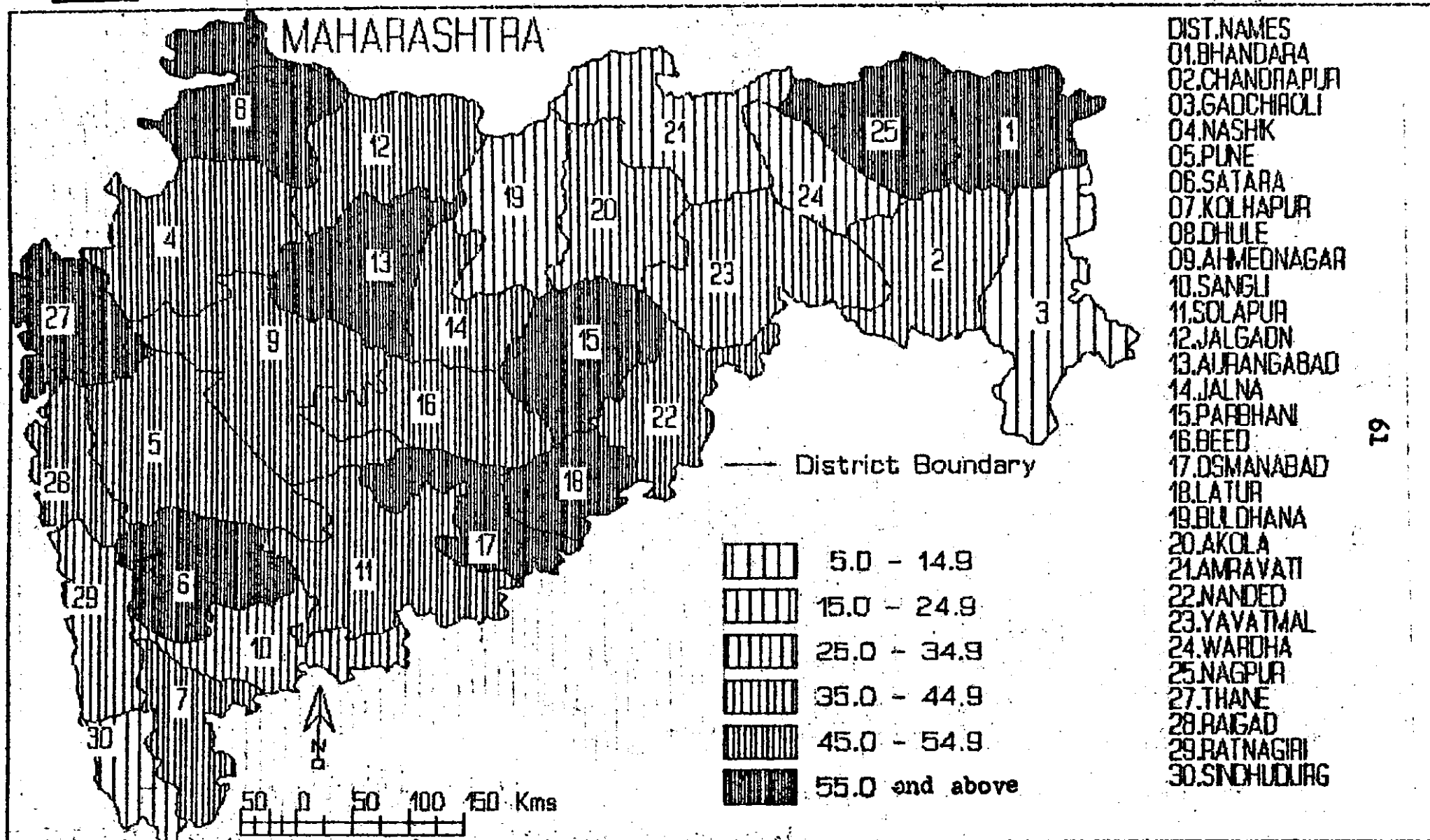
Map 3 : Basic Activity : Per Cent Achievement to Target



Map 4 : : Arable Land : Per Cent Achievement to Target

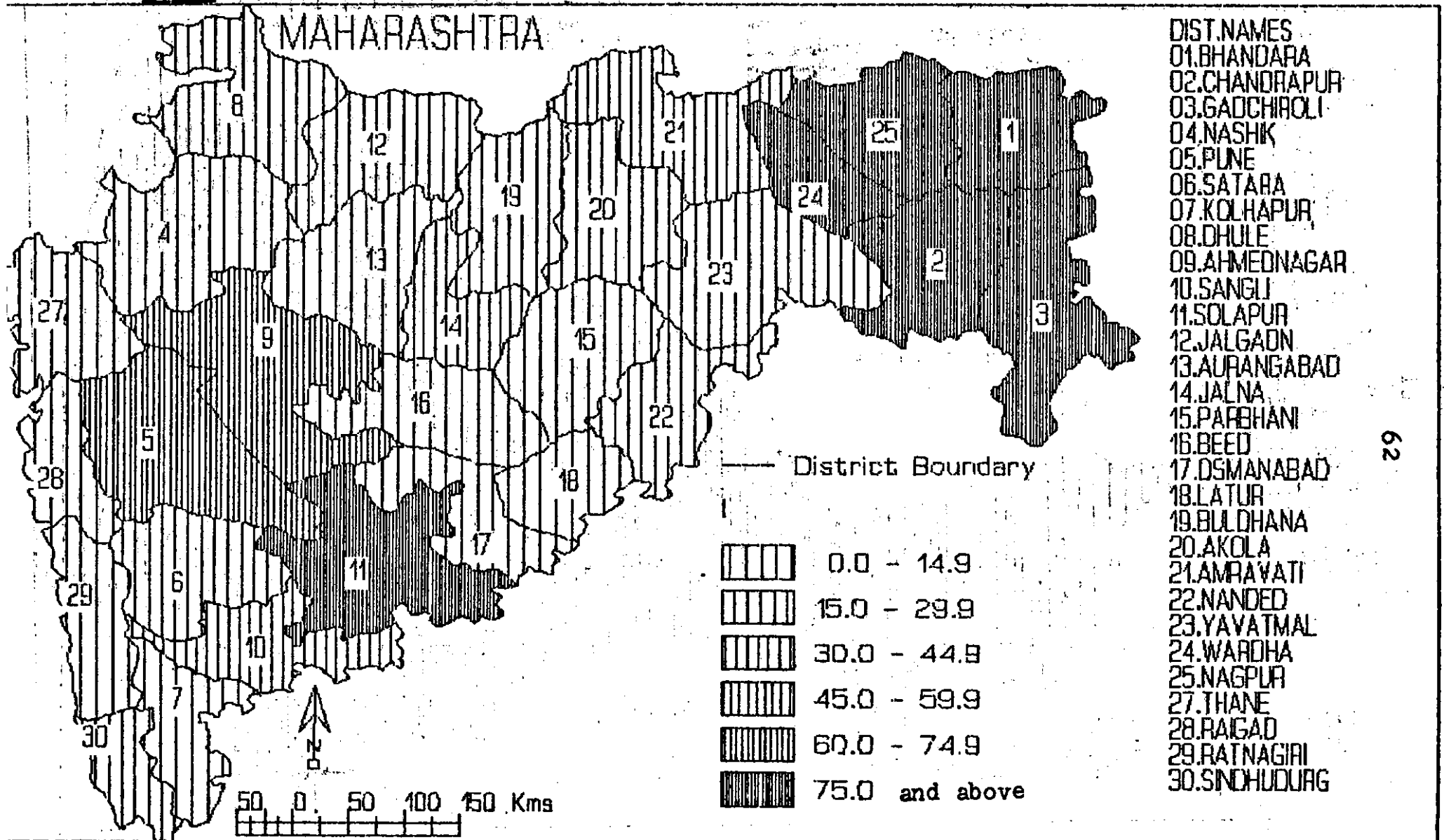


Map 5 : Non-Arable Land : Per Cent Achievement to Target

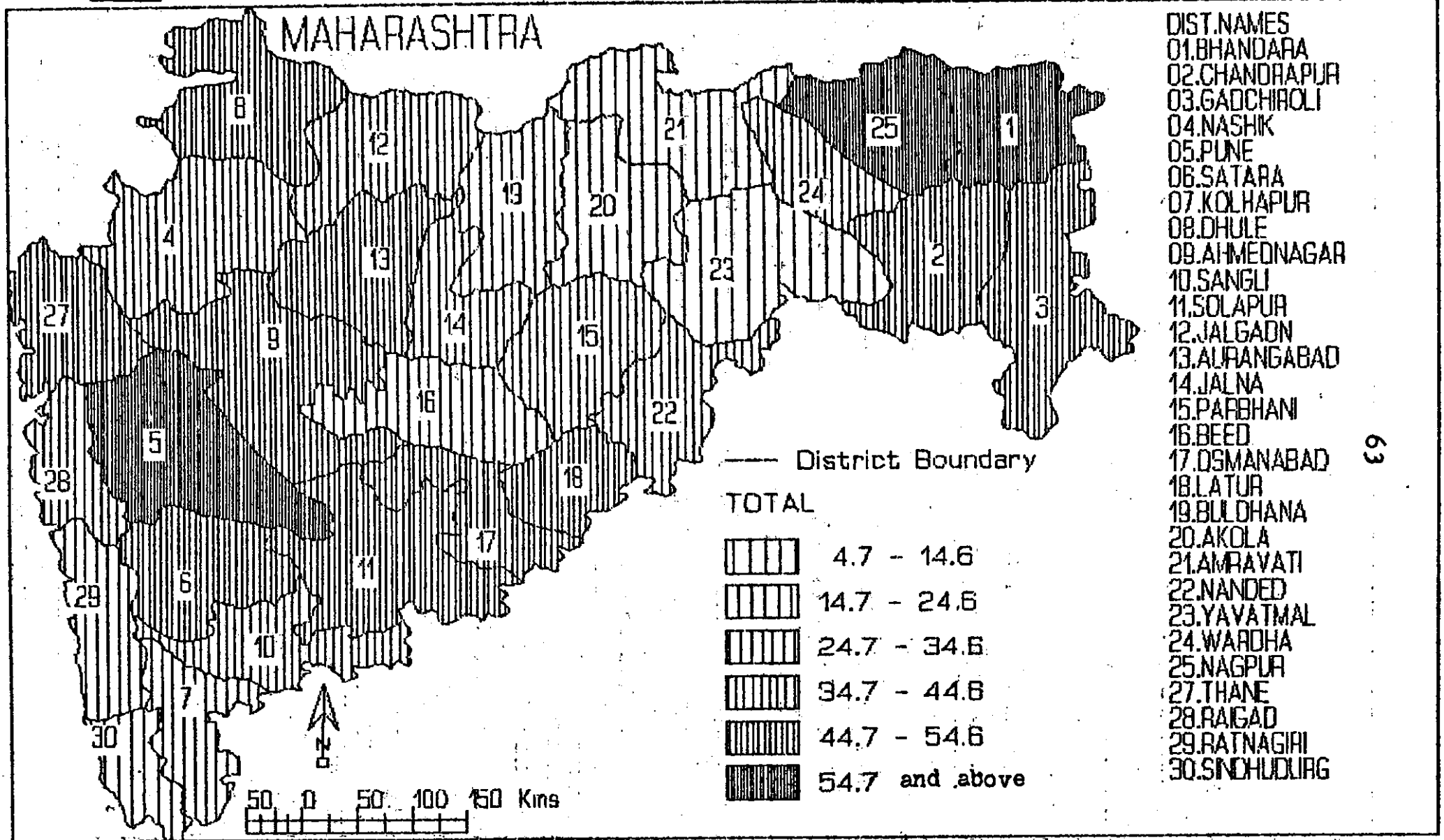


- DIST. NAMES
01. BHANDARA
  02. CHANDRAPUR
  03. GADCHIROLI
  04. NASHIK
  05. PUNE
  06. SATARA
  07. KOLHAPUR
  08. DHULE
  09. AHMEDNAGAR
  10. SANGLI
  11. SOLAPUR
  12. JALGAON
  13. AURANGABAD
  14. JALNA
  15. PARBHANI
  16. BEED
  17. DDMANABAD
  18. LATUR
  19. BULDHANA
  20. AKOLA
  21. AMRAVATI
  22. NANDED
  23. YAVATMAL
  24. WARDHA
  25. NAGPUR
  27. THANE
  28. RAIGAD
  29. RATNAGIRI
  30. SINDHURG

Map 6 : Livestock : Per Cent Achievement to Target



Map 7 : Total Achievement to Target



## CHAPTER III

### SCARCITY REGION : BUGEWADI WATERSHED

#### 3.1 Introduction

The agro-climatic zones are mainly delineated on the basis of rainfall and the regions which fall under scanty rainfall level (below 750 mm average annual rainfall) are included in the category of scarcity region. As a consequence of this, these regions are found with thin or no vegetation, fully eroded top soil and the poor livestock conditions. The causal relationship between rainfall and other specificities of the scarcity region attracts the attention of people from different walks of life, starting from researchers to policy-makers and environmentalists as well as social activists. While the poor economic condition causes concern to the social activists, the poor vegetation and erosion of top soil attracts the environmentalists. One of the important methods for dealing with these problems together is the soil-water conservation through watershed management approach. Watershed treatment not only helps in conserving the soil-water resources but also helps in building up the resource structure and economy of the region.

Ahmednagar district falls in the Scarcity Zone of Maharashtra State. The rainfall is not evenly distributed during the entire monsoon period. The district receives on an average



500-700 mm of rainfall with intermittent long dry spells. The soils of the district are alkaline in reaction, clayey in texture and quite high in calcium carbonate. The main physiographic feature of the district is the chain of western range of hills with spurs and ridges towards the east. The three important ridges are the Kalsubai, the Balaghat and the Harischandragad. This district falls in the core drought-prone area of Maharashtra State. Only about 10 per cent of the cultivable-land is irrigated from canals and wells and the irrigated area is concentrated only <sup>in</sup> a few talukas. The main cash crop of the district is sugarcane and the principal cereal crops grown are bajra in kharif and, jowar and wheat in rabi season. Out of the nine watersheds identified under NWDPR in this district, one watershed, Bugewadi, is taken up for intensive analysis of the impact of watershed in the Scarcity Zone.

Treatment of watershed in scarcity zone has quite a few specificities. As the scarcity zone is resource constrained and at a higher level of degradation the watershed treatment becomes the first priority programme. The treatments in the scarcity zone have to be a direct determinant of the level of degradation. The constraints usually faced under the condition of scarcity zone include highly eroded top soil, low fertility status and water retaining capacity, low value crops dominating the crop pattern, irrigation water mostly getting priority for crops like sugarcane, constrained groundwater availability due to hard rock strata and all this culminating into low as well as

unstable cash flow. Thus the prime objective of any watershed treatment in scarcity zone is to arrest the process of degradation and at the same time stabilise as well as increase the income and/or employment. The gestation period for realising the benefits of the watershed programme in this region would depend on the pace of the aversion of degradation and establishing income flow.

### 3.2 Bugewadi Watershed

Bugewadi watershed is located at a distance of 115 km towards north-east side of Pune city and 20 km away from the Pune-Ahmednagar State Highway. The project area is 40 km away from district headquarters. It is situated in the Parner taluk of Ahmednagar district covering the entire Bugewadi village.

The topography of the village is very undulating with a range of small hills around the watershed. The temperature varies from 28°C to 44°C and the rainfall is scanty, i.e. 450 to 600 mm. The soil is very shallow and fertility is very low, which constrains the potential for increasing the yields.

Inadequacy and uncertainty of rainfall leads to failure of the crop. The soil type of the watershed area is light to medium having maximum soil depth upto 45 cm only. The NPK contents of the soil are low, medium and high respectively.

The total population in the village is 1285 and there are 191 farm families. The average size of holding is 3.47 hectares, one third of the farmers are small, the rest are marginal farmers. Table 3.1 presents the land use pattern

**Table 3.1:- Land Use Pattern In The Bugewadi Watershed (Scarcity Zone)  
(Area In Hectares)**

Sr. No.	Land Use Category	Before Project	Current Position
1	Total Geographical Area *	1659.20	1659.20
2	Pastures (Gayran) Revenue Land	719.00	627.00
3	Non Agricultural Land (Road & Building)	4.20	4.20
4	Arable Land	936.00	1028.00
5	Area Under Irrigation	145.60	213.50
6	Horticulture	N A	4.50

**Notes:-**

- \* Area Under Forest And Wasteland Is Included Here Under Gayran And Revenue Lands.
- NA- Not available

**Source:-** Short Note on NWDPR 1991-92 TO 1994-95, Scarcity Zone, Bugewadi, Dept. of Agriculture, Govt. of Maharashtra.

**Table 3.2:- Average Yield Of Principal Crops  
(Quintals/Ha.)**

Sr. No.	Crops	Before Project	Current Position
1	Bajra	3.50	8.00
2	Jowar	4.50	11.00
3	Green gram	3.00	5.50
4	Gram	8.90	10.50
5	Wheat	10.00	12.50
6	Tur	6.00	9.00

**Source:-** Short Note on NWDPR 1991-92 TO 1994-95, Scarcity Zone, Bugewadi, Dept. of Agriculture, Govt. of Maharashtra.

both before the project period and the present condition in the watershed area. This exhibits that while some of the non-arable and waste lands have been brought under arable category, higher proportion of the arable lands are getting irrigated seemingly due to watershed activities. Recently some area has been shifted to horticulture, particularly to mango cultivation. The increase in area under irrigation due to watershed treatment also caused a positive shift in the yield of the principal crops in the region. It can be observed from Table 3.2, which indicates that the yield per hectare has increased by more than 100 per cent. This increase in yield can be attributed largely to the emphasis given to the scientific crop production system, moisture conservation and vegetative conservation measures through watershed treatment. To see the impact of this at the household level, randomly 50 households among the beneficiaries and 25 beneficiaries from the non-treated areas were selected.

### 3.3 Changes in the Land Use Pattern

The land utilization pattern of the sample households has been analysed by taking the proportion of area under different crops to the total area owned. In other words, this is the proportion of area under the land use to the average size of holdings. The results are presented in Table 3.3. The table shows that the average size of holding is greater among the non-beneficiaries than the beneficiaries. This conforms to the generally observed phenomenon in rainfed agriculture that the size of holding is higher in the rainfed areas than in the

Table-3.3 Land Utilization Pattern In the Watershed Area and Non Benefited Area

Sr.No.Items	0-1 Ha.		1-2 Ha.		2-4 Ha.		ABOVE 4 Ha.		ALL Ha.	
	B	NR	B	NR	B	NR	B	NR	B	NR
1 Avg. Size Of Holding Under Watershed (Ha.)	0.69	0.87	1.50	1.80	2.55	3.04	5.73	10.76	3.15	3.98
2 Net Cropped Area %	97.63	92.31	92.73	95.24	85.27	88.82	80.45	68.77	83.39	78.87
3 Net Irrigated Area %	75.73	0.00	23.40	9.52	10.06	1.64	17.80	5.58	17.66	4.73
4 Area Cropped More Than Once %	74.27	38.77	34.59	31.75	10.84	6.25	4.12	3.72	10.70	8.75
5 Area Irrigated More Than Once %	26.82	0.00	0.00	0.00	0.00	0.00	2.77	0.00	2.45	0.00
6 Cultivable Wasteland %	2.37	7.69	7.27	4.76	14.79	10.53	19.55	29.74	16.61	20.12
7 Current Fallows %	0.00	0.00	0.00	0.00	0.00	0.66	0.00	1.49	0.00	1.01
8 Gross Cropped Area %	171.90	123.08	127.33	126.98	96.05	95.07	84.56	72.49	94.10	87.63
9 Cropping Intensity %	176.00	133.00	137.00	133.00	113.00	107.00	105.00	105.00	113.00	111.00
10 Irrigation Intensity %	135.00		100.00	100.00	100.00	100.00	116.00	100.00	114.00	100.00

Notes:-

1. B-Beneficiary, NR- Non-Beneficiary
2. Figures From Serial No. 2 to 8 Are Expressed as PerCent To Total Area Owned.
3. Cropping Intensity = Gross Cropped Area/Net Cropped Area  
Irrigation Intensity = Gross Irrigated Area/Net Irrigated Area

irrigated area, for the value of land is cheaper and the poor people cannot afford to keep the unproductive assets. The net cropped area also substantiates a similar trend by exhibiting higher proportion of net cropped area in the lower size of holding and lower share of net cropped area in the higher size of holding among the non-beneficiaries. On the whole, the beneficiaries have higher proportion of net cropped area in the total area than the non-beneficiaries. This clearly brings out two things; that the size of holding is small and the proportion of net cropped area in the total is larger among the beneficiaries, both possibly due to the watershed treatment.

Net irrigated area also depicts an expected trend that the beneficiaries have an edge over the non-beneficiaries. This may be possibly because of the importance given to the water conservation and water harvesting structures in the treatment of the watershed. The non-beneficiaries do not have any irrigated area which is cropped twice like the beneficiaries. Perhaps this may be because the non-beneficiaries bank on the rain water totally for irrigation. The cultivable waste land and current fallows explicate that the beneficiaries utilise the lands judiciously in comparison with the non-beneficiaries. The aggregate influence of all these things is noticed on the gross cropped area. It exhibits a noticeably higher proportion of gross cropped area under the beneficiary group than that for the non-beneficiary group. The irrigation intensity and cropping intensities are also relatively higher for beneficiaries than the non-beneficiaries group.

**Table 3.4:-Respondent's Perceptions About Land Quality, Soil Type  
And Slope of The Land.**

(Percent To Total Respondents.)

	Item	B	NB
1	Land Quality:		
	Good	29.59	14.63
	Average	44.90	58.54
	Poor	25.51	26.83
2	Type Of Soil:		
	Black	26.42	28.13
	Black+Red	62.26	34.38
	Red	9.43	37.50
	Stone Mix/and Other	1.89	0.00
3	Slope Of Land:		
	Steep	12.12	0.00
	Moderate	72.73	88.89
	Plain	15.15	11.11

Notes- B-Beneficiary, NB-Non-Beneficiary.

This variation in land utilization and intensity of cropping among beneficiaries and non-beneficiaries can occur due to the quality of soil and suitability of land for cultivation with limited irrigation. The quality of land, type of soil and slope of the land were quantified by taking the response of both beneficiaries and non-beneficiaries. The distribution of respondents on the basis of their responses on land and soil characteristics is given in Table 3.4. The table shows that the beneficiaries own slightly better quality of land and also have been located more on plains. Black soil is predominant in the project area with almost equal share of black mixed with red soils. This type of soil is suitable for cultivation purposes and the moisture content in this soil will also be relatively better. The qualitative difference in soil coupled with watershed treatment goes definitely in favour of the farmers for taking advantage of the watershed treatment.

#### 3.4 Changes in Cropping Pattern

The changes in the cropping pattern in both irrigated area and unirrigated area have been calculated for different crops by taking the pre-watershed project period cropping pattern and the present cropping pattern of the respondents. The changes in the cropping pattern in the irrigated area for both beneficiaries and non-beneficiaries have been illustrated in Table 3.5(a). It can be noticed that while the major food crops like wheat and local jowar have recorded a decline in the share of area among beneficiaries, it has increased significantly for



Table-3.5(a) Changes in Irrigated Cropping Pattern For Beneficiaries And Non-Beneficiaries.

Crops	0 TO 1 Ha.		1 TO 2 Ha.		2 TO 4 Ha.		ABOVR 4 Ha.		All	
	B	NR	B	NR	B	NR	B	NR	B	NR
Wheat	5.88	-	-51.22	0.00	-25.42	-	21.41	150.00	-4.23	37.50
Local Jowar	5.56	-	100.00	-	133.33	-33.33	-24.05	0	-6.63	100.00
Bajra	0	-	-	-	-	-	-	-	0	-
Maize	-	-	0.00	-	-	-	0	-	200.00	-
Green gram	0	-	-	-	-	-	-	-	0	-
M. Gram	-84.00	-	0	-	-42.86	-	-25.00	-	-38.03	-
G'Nut	-	-	0.00	-	0	-	0	-	400.00	-
Sunflower	-	-	0	-	-	-	-100.00	-	-57.45	-
Safflower	-	-	-	-	-	-	0	0.00	0	0.00
Onion/Ghevada	0	-	-	-	-	-	-87.50	-	50.00	-
Other Trees	-	-	-	-	0	-	0	-	0	-
Sugarcane	-	-	0	-	0	-	0	-	0	-
Lusarn	0.00	-	-	-	-	-	-	-	0.00	-

- Notes: (1) Figures Are Percentage Changes Over The Base Year Value  
(2) '0' Increasing Trend From Zero, '-ve' Decreasing Trend, '0' Both Values Same.

Table-3.5(b) Changes in Irrigated Cropping Pattern For Beneficiaries And Non-Beneficiaries.

Sr.No.	Crops	0 TO 1 Ha.		1 TO 2 Ha.		2 TO 4 Ha.		ABOVE 4 Ha.		ALL	
		B	NR	B	NR	B	NR	B	NR	B	NR
1	Wheat	-	0	100.00	0	-60.00	200.00	-8.33	-	-10.53	350.00
2	Local Jowar	0.00	0.00	12.50	20.00	1.47	10.00	3.33	14.63	3.80	13.59
3	Bajra	-18.99	66.67	-4.55	64.29	25.78	36.59	10.53	39.13	12.53	42.99
4	Maize	-	-	0	-	-	-	200.00	-	250.00	-
5	Tur	-23.15	-	100.00	0.00	-13.73	150.00	-25.00	14.29	-13.22	31.03
6	Green gram	6.25	-	-15.38	83.33	-37.08	325.00	-25.58	41.67	-24.06	104.55
7	Kulith	-	-	50.00	0.00	0.00	0	-12.50	0	-3.12	550.00
8	Matki	-	-	-54.55	300.00	0.00	-	0.00	-	-5.41	300.00
9	Udid	-	-	-	-	-	-	-100.00	-	-100.00	-
10	H. Gram	-	0	-	0.00	200.00	-	-30.00	250.00	8.33	233.33
11	G'nut	-	-	0	0.00	-	-	50.00	0.00	75.00	0.00
12	Sunflower	0.00	-	-	-	-20.00	66.67	0	0.00	181.82	28.57
13	Karale	-	-	-	-	0.00	-	-	-	0.00	-
14	Safflower	-	-	-100.00	0.00	-33.33	0.00	0	-	40.00	0.00
15	Other Trees	0	-	0	-	0	-	0	-	0	-

Notes: (1) Figures Are Percentage Changes Over The Base Year Value

(2) '0' Increasing Trend From Zero; '-ve' Decreasing Trend; '0' Both Values Same.

the same crops among the non-beneficiaries. The released area under these crops has been diverted largely towards groundnut, maize and other vegetables. Some new crops like sugarcane, horticultural trees and safflower have been recently introduced. This is presumably due to the increased availability of moisture in the treated lands, and the increase in irrigation potential in the watershed area. There is some change under the area share of wheat, local jowar and safflower among the non-beneficiary group. But the change in the share of irrigated area is quite considerable in the watershed region when compared with the control region.

The cropping pattern in the unirrigated area also showed interesting changes towards commercialisation in the project area by allocating more land to the non-food crops and reducing it under the food crops. This can be seen from Table 3.5(b). It explicates that in the project area, most of the food crops barring local jowar, bajra, maize and horse-gram registered a decline in the area allocated. This change is also higher among the higher size group of land holding. The land withdrawn from these food crops seem to have been consciously diverted to highly lucrative drought-resistant commercial crops like sunflower, safflower and groundnut. The change in the area under crops among non-beneficiaries exhibits a considerable positive change in all the crops irrespective of food or non-food crops. The reason is that the total area under each of the crops except local jowar and bajra is around one hectare. Hence,

even a small change in the actual area has brought out a considerable change in the proportion of area allocated. The change is also found only among the higher size category of land holding. As has been discussed earlier, the size of holding in the unproductive dry region is higher than the relatively better productive dry region. This difference in productivity of land is noticed between the project area and non-project area for all the crops.

The yield per hectare for all the crops cultivated in the project area and non-project area has been computed and presented in Table 3.6. It clearly comes out that the productivity of all the crops except mung and kulith is noticeably higher among the beneficiaries than the non-beneficiaries. Perhaps, this is one of the direct positive effect of the watershed, for the control area is selected with such a care that only difference should be found in the different activities of the watershed programme. Hence, the difference could be certainly attributed to the watershed programme. One more interesting observation can be made from the table is that the productivity of the small size group of land holding of the beneficiaries is higher than the larger land size category. There exists a clear negative relationship for all the crops except onion. But this is just otherwise in the case of non-beneficiaries for most of the crops. This is perhaps due to the overall improvement in the project area, for the improved situation can encourage the small farmers to take the risk of putting in more efforts in

Table 3.6:-Productivity of Principal Crops Per Hectare For Beneficiaries And Non-Beneficiaries.

Sr. No.	Crops	(Kgs per hectare)									
		0 TO 1 Ha.		1 TO 2 Ha.		2 TO 4 Ha.		ABOVR 4 Ha.		All.	
		B	NR	B	NR	B	NR	B	NR	B	NR
1	Wheat	2111.11	1000.00	1333.33	714.29	961.54	750.00	1280.39	1600.00	1342.40	975.00
2	Jowar	1214.69	750.00	548.39	937.50	756.58	900.00	1060.47	714.29	892.10	829.17
3	Rajra	1767.24	575.00	1166.67	880.43	765.91	741.07	976.19	679.69	951.05	725.49
4	Maize			0.00				200.00		153.85	
5	Tur	843.37		1071.43	500.00	664.77	550.00	559.52	395.83	690.21	447.37
6	Green gram	842.11		681.82	545.45	535.71	588.24	640.63	823.53	654.14	666.67
7	Kulith			333.33	500.00	464.29	666.67	500.00	750.00	467.74	692.31
8	Matki			0.00	287.50	500.00		250.00		285.71	287.50
9	H. Gram	1500.00	500.00	750.00	500.00	562.50		576.92	464.29	625.00	475.00
10	G'Nut			875.00	500.00	500.00		625.00	200.00	645.83	250.00
11	Sunflower	1000.00		1800.00		500.00	300.00	568.18	250.00	578.13	277.78
12	Karale					187.50				187.50	
13	Safflower				250.00	500.00	500.00	307.69	142.86	333.33	200.00
14	Onion/Ghevada	16363.64						25000.00		17083.33	
15	Other Trees	0.00		0.00		0.00		0.00		0.00	
16	Sugarcane			90909.09		76923.08		60000.00		66202.09	

Notes:-

1 B-Beneficiary, NR-Non Beneficiary.

2 '0' Refers to crop failure or no production but area under the crop is there.

Table 3.7:- Per Household Assets For Beneficiaries and Non-Beneficiaries.

Size Class->	(Rs. per Household)									
	0 TO 1 Ha.		1 TO 2 Ha.		2 TO 4 Ha.		ABOVR 4 Ha.		All.	
	B	NR	B	NR	B	NR	B	NR	B	NR
Farm Assets	4346	4125	6596	2544	4222	3653	6687	7450	5427	4390
Non-Farm Assets	18938	18333	19436	17333	26911	16422	31871	29880	26275	20210
Livestock	10686	6067	9814	6625	11253	8390	15200	17900	12120	9914

cultivation. But in uncertain environment, only large farmers with higher resources can extract groundwater potential or other resources and depict a risk taking behaviour to deal with the weather hazards. Hence, it appears that the asset size is also one of the major determinants of productivity. The asset structure of the respondents has been divided into farm assets, non-farm assets and livestock. The average size of the assets of different categories of respondents has been calculated and shown in Table 3.7. It can be seen from the table that the major chunk of the assets is in the form of non-farm assets. This is same for both the groups viz. beneficiaries and non-beneficiaries. Livestock asset is one of the major income yielding activity in the dry area and particularly where large expanse of fodder/pastures in the form of common property resources are available.

### 3.5 Asset Structure and Input Use

Among the respondents, the inequalities in the ownership of assets is higher among non-beneficiaries. Table 3.7 explicates that the difference between the lowest category and highest category is almost double in both farm assets and livestock assets. Even in the non-farm assets, more than 50 per cent difference persists. But in the case of beneficiaries, though there is some inequality, it is not as high as that in the non-beneficiary group. This appears to mean that in addition to environmental impact, the watershed has got some egalitarian effect also.

The increase in moisture content in the profile of the soil due to watershed programme encourages the farmers to apply more of chemical inputs and machine labour in comparison with non-project area. This also ensures a higher pay-off from lesser input. The use of family labour both human and bullock is phenomenally higher than the hired labour, for the livestock assets owned is higher among the beneficiaries as well as the non-beneficiaries. The cost of cultivation per hectare has been computed for both beneficiaries and non-beneficiaries and depicted in Table 3.8. It exhibits that the use of family labour both human and bullock is significantly higher in both the project area and the non-project area than the hired labour use. This has the justification in the opportunity cost of family labour, for the opportunity cost of the family labour in uncertain production environment is quite low. But the use of hired labour burdens them heavily in the case of crop failure which is not uncommon. Among the different categories of farmers, the use of family labour is higher in the lowest category for both beneficiaries and non-beneficiaries. It is otherwise in the case of hired labour. This is probably because they make use of their own labour which has low opportunity cost. But the difference in the quantum of labour used between the project area and non-project area is sizeable.

Similarly, the use of machines and other material inputs also exhibits a higher input use among the lowest category of holding of the farmers in both the project area and non-project

Table 3.8 Cost of Cultivation for Beneficiaries and Non-Beneficiaries

(In Rs./ hectare)

Sr. No.	Items	Beneficiaries					Non-Beneficiaries					
		I	II	III	IV	V	I	II	III	IV	V	
1	Human labour											
	(a) Hired	632.09	877.99	689.05	619.46	667.38	106.25	653.75	410.90	346.28	415.39	
	(b) Family	2426.61	1145.69	1040.05	740.56	975.85	1346.88	740.00	851.04	659.23	762.97	
2	Bullock labour											
	(a) Hired	225.05	322.37	228.88	264.00	256.77	328.13	175.00	240.83	82.05	160.85	
	(b) Family	1692.76	729.67	860.41	736.45	832.18	562.50	472.50	654.67	735.39	653.96	
3	Machinery											
	Hired	51.86	4.19	42.43	24.29	29.49	42.19	7.50	13.84	11.54	12.69	
4	Material											
	(a) Purchased	670.94	336.42	508.55	420.19	454.09	279.69	236.66	264.60	296.08	274.01	
	(b) Owned	688.85	570.57	511.12	430.07	484.73	375.00	336.25	290.66	225.13	272.79	
5	Other inputs											
	Purchased	582.66	137.56	142.25	37.10	112.74	0.00	62.50	17.99	29.10	30.48	

Notes: I - 0 to 1 ha; II - 1 to 2 ha; III - 2 to 4 ha; IV - Above 4 ha; V - All



area but the quantity of inputs used is noticeably higher in the project area. This is also because the use of fertilizers and pesticides is increasing on certain crops both food and commercial. The difference in the use among different categories of farmers is possibly because the large farmers allot more land for certain horticultural tree crops and other crops which do not need the periodical attention. Since the cost of cultivation is taken per hectare and the gross area subsumes the area under perennial crops also, the cost of cultivation may be higher for small farmers in the case of material inputs, machineries and other inputs purchased. This clearly establishes that the watershed treatment has enabled the farmers to adopt improved farming practices in certain crops which are responsive to the yield increasing inputs.

### 3.6 Adoption of Improved Farming Practices

The improvement in the moisture availability period in the profile of the soil, increased water-table and improvement in the cropping systems have equipped the farmers to adopt the improved farming practices to reap the benefits of the transformation. The improved farming practices subsume not only the application of yield increasing inputs but also the changes in the cropping system and cropping pattern. The proportions of beneficiaries adopting the improved practices in both cultivation and cropping system have been presented in Table 3.9. It explicates that the adoption of improved farm practices in general is quite satisfactory, barring a few practices like

Table 3.9 Proportion of Beneficiaries Adopting Improved Farming Practices

(Percent to total in the respective groups)

Sr. No.	Activity	Size Classes of Land Holders				
		0-1 ha	1-2 ha	2-4 ha	above 4ha	All
1	Seed treatment	87.50	100.00	94.44	88.24	92.00
2	Ploughing/Sowing	87.50	100.00	100.00	100.00	98.00
3	Sowing implement	100.00	100.00	100.00	100.00	100.00
4	Manure use	100.00	100.00	100.00	100.00	100.00
5	Fertilisers	87.50	85.71	88.89	88.24	88.00
6	Pesticides	12.50	28.57	44.44	52.94	40.00
7	Harvesting	87.50	100.00	94.44	100.00	96.00
8	Post Harvest	62.50	42.86	50.00	47.06	50.00
9	Cropping system					
	(a) Strip cropping	----	28.57	----	----	4.00
	(b) Inter cropping	100.00	85.71	100.00	94.12	96.00
	(c) Sequence cropping	25.00	28.57	5.56	11.77	14.00
10	Contour Bunds	87.50	100.00	77.78	88.24	86.00
	(a) Graded bunds	37.50	42.86	44.44	29.41	38.00
	(b) Vegetative bunds	75.00	100.00	94.44	100.00	94.00
	(c) Keyline formation	----	14.29	11.11	5.88	8.00
11	Planting of trees					
	Silviculture	25.00	71.43	55.56	52.94	52.00
	Horticulture	50.00	71.43	50.00	41.18	50.00
12	Development of Pasture	25.00	----	5.56	11.77	10.00
13	Other	12.50	28.57	27.78	29.41	26.00

Note:- Those who expressed positive opinion are only considered here.

pesticides, sequence cropping, keyline formation and pasture development. In the case of cultivation practices starting from seed treatment to harvest, the adoption of improved technology is quite attractive. This may be possibly because of the improvement in the moisture retention capacity of the soil and the consequent improvement in the fertility. Among the cropping systems, intercropping is widely popular among the beneficiaries, for the failure of a crop can be compensated by the higher yield of another drought-resistant crop. The other systems particularly sequence cropping cannot be adopted because the moisture content in the soil is available only for very short period. It may provide sustenance only for one crop.

Analogous to this, the adoption of other improved land development and other vegetation developments is also encouraging. The contour bunding activity was adopted by majority of the farmers in the treatment area, for it facilitates an easy percolation or leaching of rain water into the soil by impounding the rain water. Among the bunding activity, the vegetative bunds are quite popular, as it has the double advantage of protecting the bunds from breaching in addition to impounding the rain water. The planting of silvicultural and horticultural trees are also practised since both are drought-resistant, and provide vegetative cover to the arable land in addition to generating income and employment. The pasture development is taken up, though not on a large scale, as it provides fodder for the livestock. The present status of the technological

inputs seem to have been quite appropriate as reflected from the adequacy status as well as adoption level.

Akin to adoption, the usefulness of programme also records a similar trend. Table 3.10 presents the proportion of respondent expressed usefulness of the activities. It appears that majority of the respondents who have adopted improved farming practices realised the usefulness of the programme. Among different practices, the usefulness of improved cultivation activities scores high in comparison with the practices. Among the respondents, there were only slight differences which prevailed in the response of usefulness of the programme. The higher size of holding group expressed better response when compared with the other two size classes. Among cropping systems, inter-cropping is found more useful than other systems. Though contour bunds as such were found highly useful by 60 per cent of the farmers among the bunding activities, vegetative bunding was found to be a better alternative to other bunding activities. In the planting of both silvicultural and horticultural trees also, nearly a half of the beneficiaries found it very useful, for it gives fuelwood, some fruits and vegetative cover to the totally exposed land. Thus, large number of practices emphasized under the National Watershed Programme were adopted and these were found to be highly useful from the point of view of the majority of the farmers. Hence, the success of the programme lies in introducing the relevant activities as a part of the watershed programme.

**Table 3.10 Perception of Beneficiaries  
Regarding Usefulness of the Programme,  
(Percent to total in the  
respective groups)**

Sr No.	Activity	Size Classes of Land Holders				
		0-1 ha	1-2 ha	2-4 ha	above 4ha	All
1	Seed treatment	75.00	85.71	66.67	76.47	74.00
2	Ploughing/Sowing	25.00	85.71	61.11	82.35	66.00
3	Sowing implement	75.00	71.43	88.89	82.35	82.00
4	Manure use	100.00	100.00	72.22	76.47	82.00
5	Fertilisers	62.50	71.43	77.78	70.59	72.00
6	Pesticides	12.50	28.57	44.44	29.41	32.00
7	Harvesting	50.00	85.71	61.11	82.35	70.00
8	Post Harvest	62.50	28.57	22.22	35.29	34.00
9	Cropping system					
	(a) Strip cropping	----	28.57	-----	-----	4.00
	(b) Inter cropping	50.00	71.43	72.22	76.47	70.00
	(c) Sequence cropping	----	28.57	-----	11.77	8.00
10	Contour Bunds	62.50	57.14	55.56	64.71	60.00
	(a) Graded bunds	12.50	14.29	27.78	23.53	22.00
	(b) Vegetative bunds	62.50	71.43	66.67	70.59	88.00
	(c) Keyline formation	-----	14.29	5.56	5.88	6.00
11	Planting of trees					
	Silviculture	25.00	71.43	44.44	47.06	46.00
	Horticulture	37.50	71.43	50.00	41.18	48.00
12	Development of Pasture	12.50	-----	5.56	5.88	6.00
13	Other	12.50	28.57	27.78	29.41	26.00

Note:- Those who expressed positive opinion are only considered here.

### 3.7 Relevance, Adequacy and Sustainability of the Programme

Though the adoption rate of most of the activities of watershed programme is marginally higher for large farmers, and the beneficiaries also endorsed the implemented programmes positively, the success of the programme counts on the relevance, adequacy and sustainability of the programme.

The relevance of the programme is quantified by enumerating information from beneficiaries about each of the activities implemented through watershed programme. The proportion of those with positive responses to total number of beneficiaries is presented in Table 3.11. It can be seen that all the land development activities and on-farm developmental activities implemented are considered as relevant by majority of the beneficiaries. It was also found that water conservation measures undertaken by the watershed project are highly relevant for all categories of beneficiaries. Among the land development activities, contour bunds and vegetative bunds score better responses. This also goes with the adoption rate discussed in the earlier section. Similar observation can be made about the fuel trees, horticultural crops and water conservation measures. Since most of the activities are meant for water conservation, it also appears to conform with the objectives of watershed programme. The relevance of each of the activities indicates the need felt by the respondents but it does not necessarily indicate whether the relevant programmes are implemented adequately or not.

Table 3.11:- Distribution of Beneficiaries on the Basis  
of Their Opinion on the Relevance of the Programme.  
(Percent to Total)

Sr No.	Activity	Size Classes of Land Holding				
		0-1 ha	1-2 ha	2-4 ha	Above 4	All
1	Land Development					
	(a) Contour Bunds	10.00	14.00	36.00	34.00	94.00
	(b) Graded Bunds	6.00	10.00	30.00	30.00	76.00
	(c) Vegetative Bunds	8.00	14.00	36.00	34.00	92.00
2	Land Shaping	4.00	10.00	14.00	18.00	46.00
3	On-Farm Development					
	(a) Fuel trees	6.00	10.00	24.00	22.00	62.00
	(b) Horticulture trees	8.00	14.00	34.00	32.00	88.00
	(c) Pasture	4.00	8.00	30.00	14.00	56.00
4	Nalla Training (Near Farm)	4.00	8.00	28.00	18.00	58.00
5	Broad Bed & Furrows	4.00	6.00	24.00	12.00	46.00
6	Water Conservation Measure	12.00	14.00	34.00	30.00	90.00
7	Soil Reclamation	4.00	6.00	12.00	14.00	36.00

Notes: 1 Figures are in percentages to total beneficiaries.  
2 Only those who expressed the programme as relevant  
are considered here.

Table 3.12:- Distribution of Beneficiaries on the Basis  
of the Adequacy of the Programme.  
(Percent to Total)

Sr No.	Activity	Size Classes of Land Holding				
		0-1 ha	1-2 ha	2-4 ha	above 4	All
1	Land Development					
	(a) Contour Bunds	10.00	14.00	36.00	34.00	94.00
	(b) Graded Bunds	6.00	10.00	30.00	30.00	76.00
	(c) Vegetative Bunds	8.00	14.00	36.00	34.00	92.00
2	Land Shaping	4.00	10.00	14.00	18.00	46.00
3	On-Farm Development					
	(a) Fuel trees	6.00	10.00	24.00	22.00	62.00
	(b) Horticulture trees	8.00	14.00	34.00	32.00	88.00
	(c) Pasture	4.00	8.00	12.00	14.00	38.00
4	Nalla Training (Near Farm)	4.00	8.00	10.00	18.00	40.00
5	Broad Bed & Furrows	4.00	8.00	8.00	12.00	32.00
6	Water Conservation Measure	10.00	14.00	32.00	30.00	86.00
7	Soil Reclamation	4.00	8.00	12.00	14.00	38.00

The adequacy of the activities provided through watershed programme is quantified with the help of the responses about the adequacy of the activities which they have received directly or indirectly, for they are the better judge of the activities implemented around them. Activitywise proportions of beneficiaries who expressed affirmative opinion about the adequacy of different activities are presented in Table 3.12. The proportion of relevance of the activities and adequacy do not match. This indicates that the relevant programmes are not necessarily adequate. Though in the land development and on-farm development more or less similar trend is found, the water conservation measures and other run-off reduction as well as soil reclamation activities do not get adequate attention in line with its relevance. While all the land development programmes received enough attention, the land shaping programme did not receive the required attention. Though it is one of/<sup>the</sup>major contributing factors to conserve water and reduce run-off of soil, it was not rated highly relevant and not adequately implemented, possibly because it does not bring direct short run benefits to the beneficiaries. Pasture development was given due weightage by both beneficiaries and implementing agencies since it helps in improving the stock of their ruminants both small and large. Perhaps, possibly due to the common property nature of this work, both farmers and implementing agencies do not want to stretch their hands beyond a certain level to avoid conflicts. Akin to this, Nalla training, broad bed and furrows, and soil reclamation did



not get sufficient attention. Perhaps, the same argument may suit to this situation also. Another dimension of implementing these programmes, particularly the activities of common property nature is the sustainability of the programme.

The sustainability of the programme has been quantified by collecting the responses pertaining to the beneficiaries' willingness to sustain the activities after the government machinery is removed. The proportion of beneficiaries with positive responses from different land size categories are presented in Table 3.13. It shows that the beneficiaries will sustain the activities implemented in their land like the bunding, horticultural tree species planted and water conservation measures undertaken in their land. The beneficiaries do not show keen interest in taking care of the activities undertaken in the government land, non-arable land and other common land, even though the **incidence of benefits** of these activities is higher, they do not want to do it since the benefits are equally distributed to all the beneficiaries in the region. Hence, there is a need for combined effort of all the people under a leader to take care of these activities. The differences in the response is mainly due to the fact that the benefits from these programmes are not directly visible at least in short run.

The level of satisfaction is examined to see the extent of difference between the activities implemented on the own land of beneficiaries and the government lands. This has been

Table 3.13:- Distribution of Farmers on the Basis of Their Perception About Sustainability of the Programme.

Sr. No.	Activity	Size Classes of Land Holding (Percent to Total)				
		0-1 ha	1-2 ha	2-4 ha	Above 4	All
1	Land Development					
	(a) Contour Bunds	10.00	14.00	36.00	34.00	94.00
	(b) Graded Bunds	6.00	10.00	26.00	26.00	68.00
	(c) Vegetative Bunds	8.00	14.00	34.00	30.00	86.00
2	Land Shaping	4.00	10.00	14.00	18.00	46.00
3	On-Farm Development					
	(a) Fuel trees	6.00	10.00	22.00	18.00	56.00
	(b) Horticulture trees	8.00	14.00	34.00	30.00	86.00
	(c) Pasture	4.00	8.00	12.00	12.00	36.00
4	Nalla Training (Near Farm)	4.00	8.00	10.00	16.00	38.00
5	Broad Bed & Furrows	4.00	8.00	8.00	12.00	32.00
6	Water Conservation Measure	10.00	14.00	28.00	26.00	78.00
7	Soil Reclamation	4.00	8.00	12.00	14.00	38.00

Note: Only those who expressed the willingness to look after the programme after the initial implementation is considered here.

Table 3.14:- Distribution of Beneficiaries on the Basis  
of Their Level of Satisfaction.

(Percent to Total in  
the Respective Groups)

No.	Activity	Size Classes of Land Holdings.									
		0-1 ha		1-2 ha		2-4 ha		above 4 ha		All	
		A	B	A	B	A	B	A	B	A	B
1	Land Development										
	(a) Contour Bunds	6.00	4.00	12.00	2.00	22.00	14.00	20.00	14.00	60.00	34.00
	(b) Graded Bunds	4.00	2.00	6.00	4.00	16.00	8.00	14.00	12.00	40.00	26.00
	(c) Vegetative Bunds	6.00	2.00	10.00	4.00	22.00	12.00	16.00	14.00	54.00	32.00
2	Land Shaping	4.00	---	6.00	4.00	10.00	4.00	14.00	2.00	34.00	10.00
3	On-Farm Development										
	(a) Fuel trees	6.00	---	8.00	---	14.00	4.00	12.00	2.00	40.00	6.00
	(b) Horticulture trees	6.00	2.00	10.00	4.00	20.00	8.00	16.00	8.00	52.00	22.00
	(c) Pasture	4.00	---	8.00	---	10.00	2.00	12.00	---	34.00	2.00
4	Walla Training (Near Farm)	4.00	---	8.00	---	10.00	---	16.00	2.00	38.00	2.00
5	Broad Bed & Furrows	4.00	---	8.00	---	8.00	---	12.00	---	32.00	---
6	Water Conservation Measure	6.00	4.00	14.00	---	20.00	8.00	14.00	10.00	54.00	22.00
7	Soil Reclamation	4.00	---	8.00	---	10.00	---	12.00	2.00	34.00	2.00

Note: A stands for highly satisfied  
B stands for moderately satisfied.

done by collecting the responses of beneficiaries on the level of satisfaction from different activities of watershed programme. The relative positive responses of highly satisfied and moderately satisfied are considered for the purpose of our analysis. The proportion of these responses are shown in Table 3.14. It can be seen that most of the beneficiaries are highly satisfied with the activities undertaken as a part of the watershed development programme. Similar to the responses on sustainability, adequacy and relevance, the level of satisfaction on the land development schemes and other on-farm development schemes are relatively higher than the other programmes. Among the different categories of beneficiaries, the level of satisfaction is higher among the beneficiaries with higher size of land holding. Particularly in the case of activities undertaken in the government lands or common lands, the level of satisfaction is extremely high among this class since the incidence of such benefit is higher to these categories.

This analysis in aggregate explained that the relevance of the on-farm development activities land development activities and the water conservation measures is quite intensive. The implementation of these programmes is better in comparison with the other programmes.

### 3.8 People's Participation in the Programme

The success of watershed programme rests on the participation of people in the region since the programme is area specific. It necessitates the participation of the people at

three stages, viz., at the planning stage, at the implementation stage, and at the sustainability of the programme stage.

The participation of beneficiaries at different stages is illustrated in Table 3.15. It can be seen that a half of the beneficiaries participated in the planning of different activities of the watershed programme. The participation is relatively high among the category of higher size of holding. Similar trend is also found in the training programme. The benefits of the training have been mainly availed by the large farmers. More than a half of the respondents participated in the activities along with the Mitra Kisan. Nearly two-third of the participants in this category are from large farmers group. This seems to mean that the participation in the planning and formulation stage of different activities of the watershed programme is quite encouraging and it is highly appreciable among the large farmers. Perhaps, it may be a weakness on the part of planning agencies to assign more importance to large farmers. Similarly, the participation in the implementation stage is also quite encouraging. Table 3.15 shows that nearly three-fourth of the beneficiaries meet the visiting NWDPR staff and extend help in implementing the various activities of the watershed programme. The beneficiaries also organise village level meeting to discuss about the sustainability of the activities undertaken by the NWDPR. On the whole, the participation of beneficiaries is quite substantial.

The participation of beneficiaries in different

Table 3.15:- Participation of Beneficiaries in Watershed Planning, Implementation and Training.

(Percent to Total)

Sr No.	Activity	Size Classes of Land Holding				
		0-1 ha	1-2 ha	2-4 ha	Above 4	All
1	Participation in Planning	4.00	8.00	20.00	18.00	50.00
2	Participation in Training Conducted under NWDPR	---	2.00	10.00	6.00	18.00
3	Participation in Mitra Kisan	12.00	10.00	20.00	14.00	56.00
4	Visit & Meeting of NWDPR Staff	14.00	14.00	24.00	18.00	70.00
5	Discussion about Watershed in Village Level Meeting	4.00	6.00	12.00	8.00	30.00

Note: The percentage are to the total beneficiaries.

Table 3.16:- Distribution of Beneficiaries On the Basis of Their Participation In Different Activities of Watershed Programme

Sr. No.	Activity	Size Class of Land Holding				
		0-1 Ha	1-2 Ha	2-4 Ha	Above 4 Ha.	All
1	Bunding Activity	16	14	34	32	96
2	Vegetative Bunds/Keyline	14	14	36	32	96
3	Contour Cultivation	16	14	36	34	100
4	Planting Trees	12	4	24	16	56
5	Pasture Land Development	4	-	10	8	22

Note:- Percentages are to the total beneficiaries

activities depicted in Table 3.16 shows that the participation of beneficiaries in land development activities is total, while in other activities it is quite encouraging. The bunding activities vegetative bunds/keyline and contour cultivation activities have received good cooperation from the beneficiaries. Whereas, in the case of activities like planting trees and pasture development do not get the same level of attention because the benefit incidence is almost equally distributed among the residents of the region.

Holistically, one can generalise that the participation of the beneficiaries in different stages of watershed development programme is quite commendable. Naturally, the impact of involvement of the people can be noticed in many spheres. Particularly the indirect effects of this programme can be traced in the environment sphere.

### 3.9 Environmental Impact of the Programme

In addition to the quantitative improvements made in the production, vegetative development and other assets, the watershed development programme also contributes towards the qualitative improvement in the soil fertility and moisture content in the profile of the soil. While the bunding activities and percolation ponds facilitate the percolation of impounded water, the planting of horticultural or fuel trees and vegetative keylines eases the leaching of rain water along the roots of trees and the reduction of run-off of soil by reducing the spate of rain water. Hence, the positive externalities

can be noticed in moisture availability, reduction in run-off of soil and soil fertility.

The positive externalities of the watershed programme on the environment have been enumerated from the beneficiaries by directing questions on the change in moisture availability, run-off of soil and water recharging. The positive responses either significantly or moderately have been analysed here and presented in Table 3.17. It can be seen that there is only uni-directional externalities in all the environmental systems in which the programme was implemented. While the bunding activities have improved the moisture content in the soil and reduced the soil loss, the vegetative keylines have equipped the beneficiaries with fertile soil and better groundwater availability. While the bunding activities showed-up a moderate impact on moisture retention and soil loss, vegetative bunds were found to have significant impact in the project area. Akin to this, the contour cultivation has also contributed its share in enhancing the moisture availability, reducing the soil loss. The impact is felt evenly as the proportions are same between significant and moderate impact categories.

Nevertheless, it appears to mean that the watershed programme has only unidirectional/<sup>positive</sup> externalities and there are no noticeable<sup>positive</sup> negative externalities. These/externalities possibly can be noticed<sup>in</sup> / the long run more conspicuously than the short run in qualitative improvement in the region.



Table 3.17:- Effect of Conservation Measures on the Beneficiaries  
in Reducing the Soil Loss and Improving Water Conservation.

Sr No.	Activity	Size Classes of Land Holdings									
		0-1 ha		1-2 ha		2-4 ha		Above 4 h		All	
		S	M	S	M	S	M	S	M	S	M
1	Bunding Activity										
	(a) Increase in Moisture Retention	25.00	75.00	12.50	87.50	27.78	72.22	50.00	50.00	32.00	68.00
	(b) Reducing Runoff/ Soil loss	37.50	62.50	37.50	62.50	27.78	72.22	31.25	68.75	32.00	68.00
2	Vegetative Bunds/Keyline Reduction in soil loss, runoff, and water conservation *	87.50	----	100.00	----	100.00	----	100.00	----	98.00	----
3	Contour Cultivation										
	(a) Moisture Conservation	50.00	50.00	75.00	25.00	61.11	38.89	47.06	52.94	58.00	42.00
	(b) Reducing Soil loss	50.00	37.50	75.00	25.00	61.11	38.89	52.94	47.06	60.00	40.00
	(c) Base in Inter- Cultivation	50.00	37.50	50.00	25.00	38.89	50.00	47.18	52.94	44.00	46.00
	(d) Other	25.00	----	25.00	----	----	----	----	----	8.00	----

Note: 1 'S' refers to Significantly  
'M' refers to Moderately.

2 \* Those who expressed positive significant  
impact are given here.

### 3.10 Income Generation and Other Changes

Though the changes in most of the economic and environmental parameters have been observed, the major economic parameter relates to the change in income. The changes in income occur both due to efficient allocation of resources in a production environment and also diversifying in the cropping system. Just as the production environment undergoes positive changes due to the watershed programme, it undermines the uncertainties in the agricultural income. The changes in agricultural income due to watershed can be ascertained by comparing the difference in agricultural income from the non-watershed area.

The per hectare and per household income from agriculture (including by-products) have been compared for beneficiaries and non-beneficiaries and illustrated in Table 3.18. The agricultural income trend across the size classes of holding seem to be supporting the hypothesis of inverse relationship between land size and productivity. The agricultural income consistently comes down as the size of land holding increases. But this is not true in the case of non-beneficiaries. In the case of per household agricultural income, both beneficiaries and non-beneficiaries have registered an increasing trend in line with the size of holding. The agricultural income in the watershed area per hectare is found to be 48 per cent higher than the non-project area. The agricultural income per household in the project area is higher by 41 per cent than the non-project area. Perhaps, this is possibly due to the larger size

Table 3.18:- Per Hectare and Per Household Income from Agriculture and by Products for Both Beneficiaries and Non-Beneficiaries.

Size Class	Beneficiaries		Non-Beneficiaries	
	Agriculture Production	By-Products	Agriculture Production	By-Products
<b>Per Hectare</b>				
0-1	8683.95	909.98	2218.75	289.06
1-2	5161.48	590.31	3384.38	628.13
2-4	4696.79	648.16	3049.14	619.38
Above 4	4017.32	585.23	3151.28	369.23
All	4625.31	624.83	3125.95	496.84
<b>Per Household</b>				
0-1	11093.75	1162.50	2366.67	308.33
1-2	10787.50	1233.75	7735.71	1435.71
2-4	13252.78	1828.89	8812.00	1790.00
Above 4	22331.25	3253.13	24580.00	2880.00
All	15418.00	2082.80	10890.80	1731.00

of land among all the categories of farmers in the control village than the project area.

The inequality in the income is quite noticeable in the control village when compared with the project area. The per household income for different categories of holding size for the respondents given in Table 3.18, explains the deviation in income conspicuously. In the case of beneficiaries, the difference between the income of the lowest land size category and highest land size category is about two times. And it is lesser for other categories with the highest land size category. But in the case of non-project area, the difference between income in the lowest size of holding and the highest size of holding category is more than 10 times. Even the comparison among other categories to the highest land size category also reveals considerable gap. This seems to convince the egalitarian effect of the watershed development programme.

In addition to all these major economic and environmental changes, the beneficiaries also perceived change in some other areas. Some of the important areas on which the perceptions made are listed in Table 3.19. It shows that the major change is noticed in demand for labour or employment generation. The absorption of both family labour and hired labour in agriculture has increased by 16 per cent and 10 per cent respectively. Another major positive change is noticed in the area under horti/silvicultural land. Watershed programme has also helped in increasing the area under pasture land and vegetative cover.

Table 3.19:- Distribution of Beneficiaries on the Basis  
of Their Perception on Changes in other Components,  
(Proportion to Total)

Items	Land Size Class Categories				
	0-1 ha	1-2 ha	2-4 ha	Above 4 ha	All
1 Changes in Marginal Land Brought Under Cultivation	---	---	2.00	---	2.00
2 Area Under Horticultural/ Silvicultural Land	---	2.00	4.00	---	6.00
3 Area Under Pastures	2.00	---	2.00	---	4.00
4 Availability of Fuel	---	---	---	---	---
5 Availability of Fodder	2.00	---	2.00	---	4.00
6 Number of Hired Labour Per Year	2.00	---	6.00	2.00	10.00
7 Number of Family Days on Own Farm	---	4.00	4.00	8.00	16.00
8 Increase in Livestock Production	---	2.00	---	2.00	4.00
9 Reduction in Seasonal Outmigration	---	---	---	---	---
10 Increased Participation in Village Industry	---	---	---	---	---
11 Increase in Vegetative Cover	2.00	---	2.00	---	4.00
12 Increase in Diversified Activity	---	---	2.00	---	2.00
13 Increase in Credit Availability	---	---	2.00	---	2.00
14 Increase in Income From Other Sources	---	---	4.00	---	4.00

In addition to all these, it has extended a helping hand to the beneficiaries by supplementing their income through increasing the income from livestock and other sources. On the whole it appears that the watershed programme has helped in increasing the income of the people in the region by bringing qualitative changes in other related socio-economic aspects.

### 3.11 Constraints in Implementation

Successful implementation of a watershed development programme requires a proper support through infrastructure and institutions. Thus the inadequacy of infrastructure in terms of input availability, technology, marketing facilities, training etc. can cause a bottleneck in successful implementation of the programme. The major constraint faced by the beneficiaries is the timely availability of inputs like fertilizers and seeds. It was expressed that seeds of good quality safflower, sunflower and bajra were not available and the farmers had to travel to Parner to get these. The second important constraint faced by the beneficiary respondents is the proper channel for marketing of their produce. Since there is no cooperative society in the watershed region, the farmers have to depend on private traders and transporters. This causes considerable loss in the income generated through crop production. Third constraint of credit through nationalised banks for the structures like farm ponds, if the farmers would like to take these structures on their farm at their own cost. Fourth constraint related to the dissemination of the information through the 'Mitra Kisan' or

'Gopal'. Many of the respondents felt that the information collected by these contact farmers is not systematically passed on to the peers. Lastly, the target specific implementation of the works, sometimes causes shortage of labour and this either results in incomplete work or labour shortage.

Among the constraints faced by implementing officers, four assume greater importance in terms of the successful implementation of the programme. Firstly, the watershed level flexibility in the inter-component transfer of funds, unit costs of certain components and inclusion of new treatments in the mid-course correction is one of the constraints. Secondly, the shortage of labour and the target specificity of the project sometimes puts the implementing officers into difficulty. Thirdly, Bugewadi area has a new type of grass (called Bhalu Kusali in local language) which can be easily planted on the vegetative bunds and serves the purpose of Khus (Vetiver Grass), but since this does not adhere to the earlier plan, it was not allowed as a replacement. Lastly, the implementing authorities at project level felt the need of continuous projectisation or in other words larger scope for mid-course corrections. This is not incorporated in the project and hence many times the total allocation is not spent.

### 3.12 Summary

Bugewadi watershed represents a watershed in the scarcity zone in Maharashtra or Agro-climatic Zone No.6, the results of this study can be generalised for estimating the impact of

watershed in the scarcity zone. The changes observed can be attributed to the watershed treatment because the impact of watershed has been segregated with the help of the control village. The secondary data available for the pre-project period and post-project period has confirmed the increase in the arable land and also increase in the irrigated area. Similarly, a considerable increase in the area under horticultural crops particularly under mango was also noted. The secondary data also substantiates the increase in the yield per hectare.

The primary data also supports these observations about the impact. The analysis of the land utilisation data for beneficiaries has brought out two important observations. Firstly, while the size of holding is small among the beneficiaries, the proportion of net cropped area to the total is higher than the non-beneficiaries indicating intensive land use. Secondly, net irrigated area is higher in the watershed region than the non-watershed area signifying higher moisture availability. In the case of gross cropped area also, the beneficiaries have registered a noticeably high figure than the non-beneficiaries. Similarly, many of the irrigated crops in the project area have gained in terms of area after the implementation of the watershed programme. In the unirrigated zone of watershed, the area share of food crops has been consciously reduced to reallocate the area to more profitable drought resistant commercial crops like sunflower, safflower and groundnut in the project area. But the non-project area presents a mixed picture. Yield per



hectare also registered encouraging results in the project area in comparison with the non-project area. One more interesting thing in the project area is the higher productivity among the small farmers. But this is not true in the case of the control village. The composition of the asset structure indicates that the major share of assets constitute the non-farm assets for both beneficiaries and non-beneficiaries. But the across group variation in the asset holding between the size group of land holding is higher in the case of non-beneficiaries than the beneficiaries.

In the case of inputs, the use of family labour is higher in the lowest size class of land holding for both beneficiaries and non-beneficiaries. This is probably because they make use of their own labour which has very low opportunity cost. But the quantum of labour used in the project area is higher than the non-project area. The use of machineries and other material inputs is noticeably higher in the project area. But it is surprising that the higher use of machines and materials comes from the lowest size class of farmers. This is due to the differences in allocation of land across crops by the large farmers. In addition to this, the adoption of improved land development activities and other vegetation development is substantial. Similarly the adoption of improved farming practices is also quite encouraging.

The water and soil conservation measures and other on-farm development activities under the NWDPR were found to be

relevant and appropriate. Though most of these programmes were felt as most relevant, the implementation is not adequate enough to provide for the expected outcome. The beneficiaries are keen as well as quite cooperative to look after the programme components after the government machinery is withdrawn from the project area. Due to the inconsistency in level of relevance and lower implementation (as revealed from the farmers' perception), the level of satisfaction exhibits a mixed response. Similar to this, people's participation at different stages of planning, implementation and sustainability of the programme is quite appreciable. And the participation in implementing bunding and land development activities is also very encouraging.

In addition to all these quantitative changes, a qualitative improvement is also noticed in the soil fertility, moisture content in the soil profile and the water table. The different components of watershed programme have thus an unidirectional positive externalities on the environment and the quality of life of the people. The income differentials between different categories of farmers is minimal in the project area in comparison with the non-project area. The agricultural income and land size have negative relationship in the per hectare yield in the project area. On the background of the positive size productivity relation in the non-project area, this result is encouraging towards higher equity. The other changes noticed in the project area is the increase in demand for labour both for family and hired labour.

On the whole, the watershed programme has contributed towards improvement in all the expected fields in the scarcity regions where it is needed intensively. There were some constraints in the form of inadequate infrastructural facilities, inaccessible villages and insufficient credit facilities. By giving adequate attention to this and effecting mid-course corrections, the benefits of the programme could be enhanced by manifold.

## CHAPTER IV

### TRANSITION ZONE - NUNE GOUDI WATERSHED

#### 4.1 Introduction

Unlike the scarcity zone, the transition zone is relatively better endowed with natural resources, rainfall and soil. While the rainfall ranges between 700 mm and 1250 mm, the soil type subsumes medium black, calcareous soils from trap and brown to dark soils. In the cropping pattern, both kharif and rabi crops are cultivated with the rainwater. The land is also relatively plain in comparison with scarcity zone. The density of vegetation is also comparatively thicker. The specificities of transition zone presents a picture of better endowed naturally than the scarcity zone with dry area. The watershed programmes are initiated in this zone to develop the vegetation, water potential and the quality of life of people. To assess the contribution of watersheds towards these goals, one watershed was selected randomly from the transition zone.

Watershed treatment in the transition zone is guided by five factors. Firstly, the agro-climatic set up of the transition zone is of a mixed type. It has a sizeable precipitation but the distribution is such that the water availability period is not long enough. Secondly, the cropping pattern is thus guided by the climatic parameters, specially dominated by

milletts and seasonal crops. The tree/fruit crops also show their presence. Thirdly, the region would be characterised by undulating slopes and hills. This would cause a fast run off and soil loss in the upper reaches and large silt deposits in the lower reach. Therefore, in the transition zone, we can find rich alluvial soils in the lower reaches and shallow sandy soils in the upper reach. Fourthly, the vegetation and the forest cover in the upper reach sustains the population in the watershed through livestock activity as well as minor forest products. Therefore the level of sustenance will be decided by the magnitude of degradation in the upper reach and the intensity of economic activity (livestock) in the lower reach. Lastly, being highly elevated regions of the hard rock areas, the availability of groundwater is limited here but at the same time this region offers good scope of water harvesting structures.

Keeping in view the specific characteristics of the transition zone, the watershed treatment here would need to concentrate on nine components namely (i) proper drainage system, (ii) water harvesting structures, (iii) contour cultivation and strong bunds across the contours, (iv) brushwood dams, (v) gully control measure, (vi) direction drains, (vii) planting of pastures, trees and shrubs, (viii) livestock activities and (ix) other forest based activities. These together would help to strengthen the watershed development programme.

Nune-Goudi watershed is selected for the purpose of

assessing the impact of watershed in the transition zone. This watershed is named after the village in the mainland Nune and the village in the upper reach Goudi. The size of the watershed is also quite large with 1322 hectares. The land available for agricultural use and other use including the forest, revenue land and wasteland form equal proportion. This watershed also covers five more villages/hamlets apart from the Nune and Goudi. These are Sablewadi, Beblewadi, Ingalewadi, Thombrewadi and Sarkhal. This watershed falls in the transition Zone No.II or Agro-climatic Zone No.5. It has Venna river as the north-west boundary. The slope of the watershed ranges from 2 to 8 per cent with an average at 6 per cent. The average rainfall is 791 mm (GOM, undated, Nune-Goudi).

The geographical area of the Nune-Goudi watershed is evenly distributed between arable land and non-arable land. The non-arable land comprises of area under forest, revenue land and wasteland. The major chunk of the geographical area (76.40 per cent) is treated with various activities of watershed programme. The land use pattern in the watershed area for pre-project period and after project has been illustrated in Table 4.1. It explicates that after implementing various activities of watershed programme, the land use pattern has effected a considerable change by reducing the waste land and bringing more revenue land under irrigation. A noticeable change was observed in the horticultural crops. In the case of non-arable lands, the area reduction in revenue land and

Table 4.1 :- Land Use Pattern In The Nune Goudi  
Watershed (Transition Zone)

Sr. No.	Land Use Category	Before Project	Current Position
1	Total Geographical Area	1322.00	1322.00
2	Area Under Forest	301.34	333.34
3	Gayran/ Revenue Land	186.46	164.46
4	Waste Land	160.00	150.00
5	Non Agricultural Land (Road & Building)	10.00	10.00
6	Arable Land	664.20	664.20
7	Area Under Irrigation	50.00	72.00
8	Horticulture	N.A.	44.00

Notes:- NA- Not available

Source:- Project Report on NWDPR, Nune Goudi; Dept. of  
Agriculture, Govt. of Maharashtra.

Table 4.2:- Cropping Pattern in Watershed Area  
(Area in Hectares.)

Sr. No.	Crops	Before Project	Current Position
1	Jowar	420.00	345.00
2	Gram	50.00	65.00
3	Wheat	50.00	35.00
4	Paddy	45.00	45.00
5	Groundnut	53.00	60.00
6	Tur	15.00	20.00
7	Other Pulses	20.00	28.00
8	Safflower	11.20	20.00
9	Other oilseeds	1.00	8.00
10	Sugarcane	1.00	4.50
11	Vegetables	3.00	9.20
12	Horticulture	N.A.	44.00
13	Fodder	2.00	15.00

Notes:- NA- Not available

Source:- Project Report on NWDPR, Nune Goudi; Dept. of  
Agriculture, Govt. of Maharashtra.

waste land was found to have increased the forest land. The better use of arable land was noticed due to increase of area under irrigation, horticultural crops and shift in the cropping pattern.

The cropping pattern for the pre-project and post-project period depicted in Table 4.2 exhibits a strong tendency of crop diversification towards commercial crops. It explains that major food crops like jowar and wheat have lost a portion of their share of land in the arable land to the commercial crops like gram, groundnut, safflower, vegetables and horticulture. The fodder crops also made their presence noticed, for there is a special emphasis on fodder crops in the watershed programme. These changes could be effected through a qualitative improvement in the land and soil condition.

The soil survey conducted in the watershed region by the State Soil Survey Organisation noticed that the soil is mostly shallow to medium type. In the watershed area, more than 60 per cent of the soil is Class II and Class III type, while the rest of the soil is Class IV and Class VII type. The hydrological data shows that the water table is 3 meters bgl. in rainy season, that in winter is 3 to 4 meters bgl, while in summer it goes down to 10-12 meters bgl. The hydrological data also recorded that maximum precipitation is received in the month of July and August and on an average 10 floods are noticed in the rainy season.

The treatment/activities implemented in the transition



zone also differ from other zones particularly scarcity zone, for the precipitation though sufficient it is not evenly distributed. Hence, the major components of the watershed treatment followed to tap the flood water are (a) contour vegetative hedges, (b) contour cultivation, (c) pasture/agro forestry development, (d) vegetable contour strip and (e) livestock and animal husbandry. The impact of these components has been noticed in many spheres viz., production, input use, asset creation and environment. To assess the impact on these spheres, a sample survey consisting of both beneficiaries and non-beneficiaries was conducted.

A sample of 50 beneficiaries was selected from the watershed area. The sample was distributed among three categories of farmers, for there was no farmer with more than 4 hectares of land holding. But in the control village, Dhavadshi, sample could be found in all categories of farmers.

#### 4.2 Changes in the Land Use Pattern

The changes in the land use are observed in three ways, viz., (1) bringing more land under cultivation, (2) diversification in cropping pattern and (3) intensity in cropping. Table 4.3 presents the land utilisation pattern of both beneficiaries and non-beneficiaries in all these three aspects. It shows that unlike Bugewadi, the average size of holding is very small among all the categories of beneficiaries. But there is similarity in the average size of holding of the beneficiaries in comparison with the non-beneficiaries. In both the

villages, the average size of holding is higher in the case of non-beneficiaries than the beneficiaries. In addition to this, even in net cropped area, net irrigated area, cultivable waste land and cropping intensity, Nune watershed is exhibiting a weaker picture than Bugewadi watershed. This is possibly because the other side of the watershed or down to Nune village is totally irrigated by Venna river. Hence, farmers pay more attention to the lands in the irrigated area than in the area treated by watershed. Table 4.3 exhibits that only 70 per cent of the total land owned is cultivated among the beneficiaries whereas, it is more than three-fourth in the case of non-beneficiaries. The balance in both the cases is found in cultivable waste land. The net irrigated area is very low for both beneficiaries and non-beneficiaries in comparison with Bugewadi watershed. Resultantly, both cropping intensity and irrigation intensity have also shown a very insignificant level.

The land and soil characteristics in the Nune Goudi region has been quantified by eliciting the perception of the farmers pertaining to these aspects. The distribution of respondents on the basis of the responses is depicted in Table 4.4. It explicates that while 95 per cent of the respondents expressed the land quality as average to poor in the project area. It is little lesser among the non-beneficiaries. In the case of type of soil, it is largely black mixed with red and red in the treatment area. Whereas, it is mainly black and black mixed with red soil in the control village. Similarly, while the

Table-4.3 Land Utilization Pattern in the Watershed Area and Non Benefited Area

Sr.No.Items	0-1 Ha.		1-2 Ha.		2-4 Ha.		ABOVE 4 Ha.		All Ha.	
	B	NR	B	NR	B	NR	B	NR	B	NR
1 Avg. Size Of Holding Under Watershed (Ha.)	0.53	0.70	1.23	1.56	2.48	2.74	5.20	1.56	2.08	
2 Net Cropped Area %	79.07	90.48	70.15	77.91	70.62	69.39	100.00	71.49	76.13	
3 Net Irrigated Area %	14.95	14.29	14.53	15.12	17.61	14.74	0.00	16.70	8.09	
4 Area Cropped More Than Once %	39.73	23.81	20.96	15.12	18.92	11.30	76.92	21.70	19.64	
5 Area Irrigated More Than Once %	3.86	0.00	0.00	0.00	0.32	0.00	0.00	0.66	0.00	
6 Cultivable Wasteland %	20.93	9.52	28.17	22.09	28.58	29.88	0.00	27.62	23.49	
7 Current Fallows %	0.00	0.00	1.68	0.00	0.80	0.73	0.00	0.88	0.39	
8 Gross Cropped Area %	118.80	114.29	91.11	93.02	89.55	80.69	176.92	93.20	95.76	
9 Cropping Intensity %	150.00	126.80	130.08	119.00	127.00	116.00	177.00	130.00	126.00	
10 Irrigation Intensity %	126.00	108.00	100.00	100.00	102.00	100.00	100.00	104.00	100.00	

Notes:-

1. B-Beneficiary, NR- Non-Beneficiary
2. Figures From Serial No. 2 to 8 Are Expressed as Percent to Total Area Owned.
3. Cropping Intensity = Gross Cropped Area/Net Cropped Area  
Irrigation Intensity = Gross Irrigated Area/Net-Irrigated Area

Table 4.4:-Respondent's Perceptions About Land Quality, Soil Type And Slope of The Land.

(Percent To Total Respondents.)

	Item	B	NB
1	Land Quality:		
	Good	5.27	18.00
	Average	57.89	44.00
	Poor	36.84	38.00
2	Type of Soil:		
	Black	9.62	16.00
	Black+Red	63.46	76.00
	Red	26.92	8.00
	Stone Mix/and Other	0.00	0.00
3	Slope of Land:		
	Steep	4.44	0.00
	Moderate	93.33	85.19
	Plain	2.22	14.81

Note- B-Beneficiary, NB-Non-Beneficiary.

slope of the land is moderate in the watershed area, it is moderate to plain in the non-project area.

#### 4.3 Changes in the Cropping Pattern and Productivity

As the qualitative change occurs in the land and soil, the dominant food crops find it hard to maintain the share, for the attitude of the farmers in the decision-making process tends towards lucrative commercial crops. Hence, the farmers favour a set of productive and profitable crops to the traditional crops. The change in dry area is normally in favour of drought resistant commercial crops like oilseeds and pulses.

The change in cropping pattern is computed separately for both irrigated area and unirrigated area. The cropping pattern in irrigated area explains an interesting phenomenon in conformity with the objectives of the watershed programme. The percentage change in the cropping pattern of irrigated area presented in Table 4.5 reveals that there is an increase in the area under some crops cultivated earlier and some new crops have been introduced recently. This amounts to mean that there is a considerable increase in the irrigated area in the project region. In the treatment area, the cultivation of vegetables, groundnut and other tree crops have been introduced after the project period and particularly due to the increase in water level and moisture content in the soil profile.

Contrary to the irrigated area, the unirrigated area exhibits a different picture. The changes in the cropping

Table:-4.5 Changes in Irrigated Cropping Pattern For Beneficiaries And Non-Beneficiaries.

Sr.No.	Crops	0 TO 1 HA.		1 TO 2 Ha.		2 TO 4 Ha.		ABOVE 4 Ha.		A.T.L.	
		B	NR	B	NR	B	NR	B	NR	B	NR
1	Rice	0.00	-	-	-	0.00	-	-	-	0.00	-
2	Wheat	-	-	-	-	32.00	-100.00	-	-	32.00	-100.00
3	Local Jowar	0.00	0	75.00	50.00	-23.26	87.50	-	-	-6.09	80.00
4	R. Gram	-4.76	-	-	-100.00	250.00	-100.00	-	-	197.03	-100.00
5	G'Nut	0	-	-	-	-	-	-	-	0	-
6	Sunflower	-	-	0.00	-	-	-	-	-	0.00	-
7	Safflower	-	-	0.00	-	-	-	-	-	0.00	-
8	Onion/Ghevada	-	-	-	-	0	-	-	-	0	-
9	Other Trees	0	-	0	-	-	-	-	-	0	-
10	Sugarcane	-	-	-	-	22.22	-	-	-	22.22	-

Notes: (1) Figures Are Percentage Changes Over The Base Year Value  
(2) '0' Increasing Trend From Zero, '-ve' Decreasing Trend, '0' Both Values Same.

pattern of unirrigated area depicted in Table 4.6 tends to show that the dominant food crops do not maintain the same share in the project region. The cropping pattern is shifting more towards commercialised crops. Most of the dominant food crops like rice, HYV jowar, green gram and horse-gram registered a decline in the area share. This shifted area is diverted to groundnut, udid, local jowar and other tree crops. While this trend is higher among the beneficiaries with larger land size category, it is not so among the lower land size category. Perhaps, the beneficiaries in the lowest category are basically of subsistent nature and hence their dependence upon food crop grown in their own land could not be shaken by any other extraneous factors. But it is just otherwise in the case of non-beneficiaries. Most of the crops have recorded a negative change in the cropping pattern. The area reduced under these crops is found in only two staple food crops viz., HYV jowar and green gram. This seems to explain two things firstly that the qualitative change in the quality of land and soil in the project area has produced sufficient food materials in lesser size of land than before, secondly increase in moisture availability might have given certainty for yield in certain vulnerable commercial crops. All these together have brought in an increase in the productivity of the crops.

The productivity of the crops computed for both beneficiaries and non-beneficiaries is illustrated in Table 4.7. It appears from the table that except for rice and HYV jowar,

Table:-4.6 Changes in Unirrigated Cropping Pattern For Beneficiaries And Non-Beneficiaries.

Sr.No.Crops	0 TO 1 Ha.		1 TO 2 Ha.		2 TO 4 Ha.		ABOVE 4 Ha.		A.T.F.	
	B	NB	B	NB	B	NB	B	NB	B	NB
1 Rice	-14.29	-	-44.12	-7.94	1.89	0.00	-	-	-15.84	-5.38
2 Local Jowar	65.79	-33.33	-23.21	-25.93	40.00	-26.32	-	0.00	22.38	-15.94
3 H. Jowar	34.22	33.33	2.60	29.28	-17.85	17.91	-	0	-8.73	29.90
4 Tur	-	-	-	-	0.00	-	-	-	0.00	-
5 Green Gram	0	-	-100.00	-	-100.00	0.00	-	400.00	-70.00	200.00
6 Udid	33.33	-	-	-100.00	100.00	-53.95	-	400.00	77.78	-5.88
7 H. Gram	-	-	-	-	-100.00	-	-	-	-100.00	-
8 G'Nut	3.55	33.33	9.72	7.50	41.21	3.70	-	-56.25	27.77	-9.30
9 Onion/Ghevada	-60.00	-57.14	83.33	0.00	-13.11	3.57	-	0.00	-7.95	-5.08
10 Other Trees	0	-	0	-	*****	-	-	-	*****	-

Notes: (1) Figures Are Percentage Changes Over The Base Year Value  
(2) '0' Increasing Trend From Zero; '-ve' Decreasing Trend; '0' Both Values Same.



Table 4.7:-Productivity of Principal Crops Per Hectare For Beneficiaries And Non-Beneficiaries.  
(Kgs per hectare)

Sr. No.	Crop	0 TO 1 Ha.		1 TO 2 Ha.		2 TO 4 Ha.		ABOVE 4 Ha.		All	
		B	NR	B	NR	B	NR	B	NR	B	NR
1	Rice	857.14		2736.84	1465.52	1327.59	3166.67			1457.14	2045.45
2	Wheat					1727.27				1727.27	
3	Local Jowar	664.16	1100.00	1000.00	1078.95	1097.56	1443.85		350.00	965.69	951.00
4	H. Jowar	1920.53	1500.00	1500.97	1777.00	1926.14	2177.22		1750.00	1826.05	1956.52
5	Tur					500.00				500.00	
6	Green gram	666.67					625.00		250.00	666.67	312.50
7	Udid	0.00				625.00	666.67		250.00	468.75	406.25
8	H. Gram	0.00				785.71				733.33	
9	G' Nut	817.57	1250.00	987.34	860.47	1005.19	1196.43		428.57	872.04	982.91
10	Sunflower			0.00						0.00	
11	Safflower			500.00						500.00	
12	Onion/Ghevada	166.67	666.67	1045.45	857.14	981.82	741.38		200.00	939.76	669.64
13	Other Trees Rs.	2307.69		173.09		1168.00				916.17	
14	Sugarcane					95454.55				95454.55	

## Notes:-

- 1 B-Beneficiary NR-Non-Beneficiary.
- 2 '0' Refers to crop failure or no production but area under the crop is there.

the productivity of all the crops is noticeably higher in the project area than in the non-project area. These two crops are also not major crops in the project area and the share of land under these crops is also gradually coming down. The comparison of productivity between the different categories of respondents divulges that it is higher among the larger size of holding unlike in the scarcity zone. The noticeable difference in the yield per hectare is found in green gram, onion and udid between project and non-project area. It is clear from this that the watershed activities have effected a noticeable change in the productivity of major crops. And it is perhaps possible that it would have played the role of catalyst to make the input use more efficient.

#### 4.4 Input Use

With the increase in the moisture availability in the soil profile and the improvement in the water availability increases the yield per hectare, the use of improved practices and biochemical inputs also increases. This also ensures a high pay-off from limited use of inputs. Consequently, the structure of input use also undergoes a change in the changing environment due to watershed development activities. The structure of input use for both beneficiaries and non-beneficiaries is depicted in Table 4.8. It shows that the use of human labour both family and hired is higher among non-beneficiaries than the beneficiaries. But in all the other inputs, the beneficiaries have maintained a noticeably higher level than

Table 4.8:- Per Household Assets For Beneficiaries and Non-Beneficiaries.

Size Class->	(Rs. per Household)									
	0 TO 1 Ha.		1 TO 2 Ha.		2 TO 4 Ha.		ABOVE 4 Ha.		All.	
	B	NR	B	NR	B	NR	B	NR	B	NR
Farm Assets	963	1500	2156	3343	2348	1925		10700	2104	3067
Non-Farm Assets	29456	11933	24925	24600	26085	24550		30000	26919	23276
Livestock	8405	15000	11655	14250	8448	20089		7000	9277	16377

Note:- B-Beneficiary, NR-Non-Beneficiaries.

Table 4.9 Cost of Cultivation for Beneficiaries and Non-Beneficiaries.

Sr. No.	Items	(In Rs./ hectare)							
		Beneficiaries				Non-Beneficiaries			
		0-1 ha	1-2 ha	2-4 ha	All	0-1 ha	1-2 ha	2-4 ha	All
1	Human labour								
	(a) Hired	873.85	1113.48	873.99	920.65	691.67	1283.75	866.31	927.42
	(b) Family	1495.09	913.66	827.54	945.67	1883.33	1136.25	986.99	959.03
2	Bullock labour								
	(a) Hired	861.68	738.67	466.36	579.46	1000.00	617.81	596.21	512.36
	(b) Family	650.04	310.77	636.92	575.33		523.75	570.01	538.00
3	Machinery								
	(a) Hired	32.88	116.25	95.91	90.30	106.25	54.69	55.01	47.21
	(b) Family	6.05		3.69	3.33				
4	Material								
	(a) Purchased	965.91	1248.32	1179.59	1160.55	955.42	985.06	1050.86	977.68
	(b) Owned	468.63	553.27	414.19	449.57	26.25	287.31	463.87	314.64
5	Other inputs								
	Purchased	35.83	13.30	26.31	25.22	166.67	42.50	51.27	44.53

Note:- In the case of non-beneficiaries, the 'above 4' cat not given separately but included in the average of total due to lack of comparability.

the non-beneficiaries. This seems to explain that most of the cultivation operations are done manually in the non-project area in comparison with project area. In the case of human labour, the use of family labour is noticeably higher among the lowest size of holding. This is also similar in the case of bullock labour. In the case of highest size class of land holding, the input use shows a lower value than the other classes. The reason may be that the economies of scale and the averaging of the total input over the land holding (but some land is put under other tree crops which do not entail any input at all). This difference in input use between beneficiaries and non-beneficiaries also vividly corroborates the productivity change and the role of watershed in it.

#### 4.5 Asset Structure

The asset structure of the watershed in the transition zone presents a different picture from the scarcity zone watershed area. While scarcity zone exhibited an overall higher value in all the assets than the non-project area, the Nune-Goudi watershed area shows a higher value only in the non-farm assets. The asset structure of Nune-Goudi watershed is illustrated in Table 4.9. It explains that the non-beneficiaries have higher asset holding in farm assets and livestock than the beneficiaries. This may be possibly due to the absence of higher land size category among the beneficiaries. The higher non-farm assets among the beneficiaries explains the changes taking place in the project area. There is no

significant difference in the asset holding structure across size classes.

#### 4.6 Adoption of Improved Farming Practices

The adoption of improved farming practices depend generally on the certainty of yield and yield per hectare. When these two are assured, a higher level of adoption of improved techniques of production can be anticipated. Just as the improvement in moisture availability and water table equips the land to be more responsive to improved farming practices, so is the case in adoption of these techniques. As in the scarcity region, all the components of yield increasing inputs, cropping system and cropping pattern area accommodated for the analysis.

The proportions of beneficiaries who have adopted improved cultivation practices and cropping system have been presented in Table 4.10. It appears from the responses of the beneficiaries that the adoption of improved cultivation practices in all the activities in general is substantial. But the beneficiaries do not prefer the use of pesticides and also the use of sowing implements, for the existing situation does not entail the use of these inputs in many cases. Just as the negative externalities of some chemicals is pestilant in the dry situations, so is the case in the watershed area for pesticides. The use of sowing implements is high only among the large farmers. This shows that the adoption of sowing implements is perforce need/<sup>based,</sup> unlike the adoption of other inputs.

Table 4.10:-Percentage of Beneficiaries Adopting Improved Farming Practices With Watershed Area.

Sr No.	Activity	Size Classes of Land Hold			
		0-1 ha	1-2 ha	2-4 ha	All
1	Seed treatment	75.00	83.33	77.27	78.53
2	Ploughing/Sowing	87.50	83.33	90.91	87.25
3	Sowing implement	---	33.33	86.36	39.90
4	Manure use	93.75	100.00	100.00	97.92
5	Fertilisers	93.75	75.00	95.46	88.07
6	Pesticides	56.25	58.33	63.64	59.49
7	Harvesting	81.25	83.33	72.73	79.10
8	Post Harvest	6.25	8.33	36.36	16.98
9	Cropping system				
	(a) Strip cropping	---	---	4.55	1.52
	(b) Inter cropping	75.00	91.67	86.36	84.34
	(c) Sequence cropping	31.25	16.67	36.36	28.09
10	Contour Bunds	37.50	25.00	54.55	39.02
	(a) Graded bunds	18.75	50.00	31.82	33.52
	(b) Vegetative bunds	62.50	83.33	86.36	77.40
	(c) Keyline formation	12.50	25.00	13.64	17.05
11	Broad Bed/ Furrows	---	25.00	4.55	9.85
12	Planting of trees				
	Silviculture	18.75	41.67	22.73	27.72
	Horticulture	43.75	66.67	63.64	58.02
13	Development of Pasture	---	---	4.55	1.52
14	Other	31.25	41.67	31.82	34.91

Note:- 1. The percentages are to the total beneficiaries in each category.

2. Only those who expressed positive response are considered here.

Similarly, the cropping pattern and bunding activity also present a very encouraging picture. The adoption of inter-cropping practices and vegetative bunds is quite high. But in the other cases, it registers only a reasonable adoption rate except for strip cropping and broad bed and furrows. This shows that the adoption rate of these practices which ensures direct benefit to the beneficiaries is relatively higher. This is true in the case of planting trees also. The plantation of horticultural trees is double than that of the silvicultural trees. The development of pasture is also not preferred by many beneficiaries. This makes two things clear that, the adoption rate of activities which have a direct bearing on the beneficiaries is substantial, and the practices of common property nature, where the incidence of benefit is distributed over a period, are not generally preferred. This amounts to mean that <sup>the</sup> short run usefulness of the programme decides the rate of adoption.

The usefulness of the various activities of watershed programme has been analysed by eliciting the responses on the absolute usefulness and relative usefulness of the activities. The distribution of these responses is displayed in Table 4.11. It demonstrates that the usefulness of all the direct crop cultivation processes are phenomenally higher than the other practices. The responses are also highly skewed towards very useful. Similar to the responses in the adoption, the usefulness of pesticides is also not rated positively. In line

Table 4.11: Perception of Beneficiaries Regarding Usefulness of the Programme.

(Percent to total in the respective groups)

Sr No.	Activity	Size Classes of Land Holdings							
		0 - 1 ha		1 - 2 ha		2 - 4 ha		A 1 1	
		U	RU	U	RU	U	RU	U	RU
1	Seed Material	81.25	18.75	66.67	33.33	66.67	33.33	71.53	28.47
2	Seed treatment	62.50	18.75	58.33	25.00	54.55	22.73	58.96	22.16
3	Ploughing/Sowing	75.00	12.50	66.67	16.67	68.18	22.73	69.95	17.30
4	Sowing implement	75.00	25.00	66.67	33.33	77.27	22.73	72.98	27.02
5	Manure use	81.25	12.50	100.00	---	81.82	18.18	87.69	10.22
6	Fertilisers	87.50	6.25	75.00	---	86.36	13.64	82.95	6.63
7	Pesticides	56.25	---	50.00	8.33	54.55	9.09	53.60	5.81
8	Harvesting	75.00	18.75	75.00	25.00	72.73	13.64	74.24	19.13
9	Post Harvest	6.25	18.75	25.00	8.33	9.09	27.27	13.45	18.12
10	Cropping system								
	(a) Strip cropping	---	---	---	---	---	4.55	---	1.52
	(b) Inter cropping	68.75	6.25	75.00	16.67	72.73	13.64	72.16	12.19
	(c) Sequence cropping	25.00	6.25	16.67	---	22.73	13.64	21.47	6.63
11	Contour Bunds	18.75	25.00	16.67	8.33	40.91	13.64	25.44	15.66
	(a) Graded bunds	18.75	---	50.00	---	31.82	4.55	33.52	1.52
	(b) Vegetative bunds	43.75	25.00	58.33	25.00	63.64	22.73	55.24	24.24
	(c) Keyline formation	12.50	6.25	16.67	8.33	9.09	---	12.75	4.86
12	Broad Bed/Furrows	6.25	6.25	25.00	---	4.55	---	11.93	2.08
13	Planting of trees								
	Silviculture	18.75	6.25	8.33	33.33	9.09	13.64	12.06	17.74
	Horticulture	43.75	6.25	41.67	16.67	50.00	13.64	45.14	12.19
14	Development of Pasture	6.25	6.25	---	---	4.55	---	3.60	2.08
15	Other	31.25	---	33.33	8.33	27.27	4.55	30.62	4.29

Notes:- 1. 'U' Stands for Very useful.

2. 'RU' Stands for Fairly useful.



with the adoption, the usefulness of inter-cropping only was found to be substantial and for all the other cropping system the response was very discouraging. Among the bunding activities, the vegetative bunds received good response from the beneficiaries, for it assists the farmers in many ways and the modus operandi is also very convenient. The response was otherwise in the case of other bunding activities. This appears to mean that the beneficiaries weigh a programme useful, only when the activity yields direct benefit or tangible benefits. But the intangible benefits or the long run benefits are certainly higher than the tangible benefits. In the case of planting of trees, and pasture development also, similar tendency was noticed. On the whole, it seems that the adopted programmes are found to be equally useful. There is a positive relationship between the adoption and usefulness of the programme, though the beneficiaries assign higher weightage to the direct and short run benefits.

#### 4.7 Relevance, Adequacy and Sustainability

Since the adoption of all the useful activities is stupendous, the success counts on the implementation of relevant programmes, adequacy of the programme and the sustainability of the programme. The relevance of all the activities, viz., the land development, on-farm development and other water conservation measures has been considered for the analysis.

The relevance of the programme has been quantified by eliciting responses from the beneficiaries on the various

activities of the programme. The distribution of beneficiaries on the basis of their responses on positive relevance of the programme is displayed in Table 4.12. In contrast with the scarcity region, the relevance of all the programmes implemented is very high. Particularly, the land development programmes implemented in the watershed region are highly pertinent and the responses are near total. A similar trend is also noticed in the case of on-farm development activities. Among the on-farm development activities, the pasture development did not receive good response, for the development of pasture in the own arable land may not yield so much as the other crops and the benefits of it may be overlapping. The pertinence of the activities undertaken in the proximity of the own lands, like land shaping, broadbed or furrows and nalla training is rated relatively lower. As discussed earlier, this may be due to the common nature of the benefits of these activities. The relevance of water conservation measures and soil reclamation activities is also found to be very high. Holistically, the relevance of all the activities undertaken as a part of watershed programme is found to be very high in the transition zone in comparison with the scarcity zone.

Though the activities implemented are highly pertinent, the adequacy of the implementation is not encouraging. The adequacy of the implementation is enumerated by eliciting the perception of beneficiaries. Table 4.13 presents the distribution of beneficiaries on the basis of their perception on the

**Table 4.12:-Distribution of Beneficiaries on the Basis of Their Opinion on the Relevance of the Programme (Percent to Total)**

Sr No.	Activity	Size Classes of Land Holding			
		0-1 ha	1-2 ha	2-4 ha	All
1	Land Development				
	(a) Contour Bunds	30.00	24.00	44.00	98.00
	(b) Graded Bunds	26.00	18.00	36.00	80.00
	(c) Vegetative Bunds	32.00	24.00	44.00	100.00
2	Land Shaping	22.00	22.00	26.00	70.00
3	On-Farm Development				
	(a) Fuel trees	26.00	24.00	44.00	94.00
	(b) Horticulture trees	28.00	22.00	44.00	94.00
	(c) Pasture	24.00	18.00	36.00	78.00
4	Nalla Training (Near Farm)	20.00	22.00	36.00	78.00
5	Broad Bed & Furrows	20.00	18.00	34.00	72.00
6	Water Conservation Measure	30.00	22.00	36.00	88.00
7	Soil Reclamation	26.00	18.00	34.00	78.00

Note:- The percentages of only those who felt the activities relevant are given.

**Table 4.13:- Distribution of Beneficiaries on the Basis of the Adequacy of the Programme (Percent to Total)**

Sr No.	Activity	Size Classes of Land Holding			
		0-1 ha	1-2 ha	2-4 ha	All
1	Land Development				
	(a) Contour Bunds	30.00	22.00	40.00	72.00
	(b) Graded Bunds	10.00	12.00	18.00	40.00
	(c) Vegetative Bunds	26.00	16.00	32.00	74.00
2	Land Shaping	14.00	14.00	16.00	44.00
3	On-Farm Development				
	(a) Fuel trees	10.00	10.00	22.00	42.00
	(b) Horticulture trees	18.00	14.00	22.00	54.00
	(c) Pasture	4.00	2.00	12.00	18.00
4	Nalla Training (Near Farm)	10.00	10.00	12.00	32.00
5	Broad Bed & Furrows	2.00	---	8.00	10.00
6	Water Conservation Measure	24.00	16.00	26.00	66.00
7	Soil Reclamation	20.00	12.00	24.00	56.00

Note:- Figures denote the percentages of beneficiaries

adequacy of the programme. It shows that the implementation of even the highly relevant activities is inadequate. Though all the land development activities were highly pertinent, the implementation is only to the level of less than a half of the expected level or two-third of the total implementation expected. In the other cases, the implementation of the programme is very discouraging and disappointing. It is very low in the case of on-farm development activities, though these activities are found to be highly pertinent alternatives for dry land development in the watershed region. Water conservation measures and soil reclamation activities also claim high response. This seems to mean that only the bunding activities and water conservation measures have been given adequate attention in the transition zone. But at the same time some of the highly relevant activities did not get sufficient attention of the implementing authorities.

Unlike the adequacy of the programme in the implementation, the sustenance of the relevant programmes does not seem to be a burden to the beneficiaries. The beneficiaries' perception about looking after the programme after withdrawing the government machinery was elicited to assess the sustenance of the programmes implemented in the watershed area. Table 4.14 carries the distribution of the beneficiaries on the basis of their perception on sustainability. It appears that the sustenance of the land development activities particularly contour bunds and vegetative bunds do not entail much exertion.

Table 4.14:- Distribution of Farmers on the Basis of Their Perception About Sustainability of the Programme. (Percent to Total)

Sr No.	Activity	Size Classes of Land Holding			
		0-1 ha	1-2 ha	2-4 ha	All
1	Land Development				
	(a) Contour Bunds	30.00	22.00	42.00	94.00
	(b) Graded Bunds	10.00	12.00	16.00	38.00
	(c) Vegetative Bunds	26.00	16.00	32.00	74.00
2	Land Shaping	14.00	12.00	16.00	42.00
3	On-Farm Development				
	(a) Fuel trees	14.00	16.00	18.00	48.00
	(b) Horticulture trees	22.00	14.00	32.00	68.00
	(c) Pasture	6.00	4.00	12.00	22.00
4	Nalla Training (Near Farm)	8.00	8.00	12.00	28.00
5	Broad Bed & Furrows	4.00	---	6.00	10.00
6	Water Conservation Measure	24.00	16.00	28.00	68.00
7	Soil Reclamation	20.00	12.00	26.00	58.00

Note:- Only those who expressed willingness to look after the activities after the initial implementation are considered here.

to the beneficiaries. Similarly, the beneficiaries seem to be interested in looking after the horticultural and fuel trees planted on their land under the watershed development programme. The same tendency is also noticed in the case of water conservation measures and soil reclamation. But the beneficiaries are not volunteering to look after the other programmes spontaneously. This appears to mean that the beneficiaries are making conscious efforts to take care of the pertinent and productive activities in comparison with other less relevant and activities with long gestation period.

Since the success of the programme rests on the relevance, adequacy and sustainability, and there is no proper coordination in these aspects, the level of satisfaction of beneficiaries on these activities undertaken seems to demonstrate a mixed trend. Though the relevance and sustainability are perceived to be high for certain activities, due to inadequate implementation, the level of satisfaction does not match on account of these aspects. The level of satisfaction is analysed by eliciting the perception of beneficiaries on the level of satisfaction (viz. high, medium or negative) for all the activities. The distribution of the positive perceptions is illustrated in Table 4.15. It explicates that the perception on the level of high satisfaction is greater than the moderate satisfaction in the case of bunding activities. The level of satisfaction is also higher for contour bunds and vegetative bunds. But among the on-farm development activities,

Table 4.15:- Distribution of Beneficiaries on the Basis of Their Level of Satisfaction.

Sr No.	Activity	Size Classes of Land Holdings							
		0-1 ha		1-2 ha		2-4 ha		All	
		A	B	A	B	A	B	A	B
1	Land Development								
	(a) Contour Bunds	8.00	12.00	10.00	8.00	22.00	20.00	40.00	40.00
	(b) Graded Bunds	2.00	6.00	6.00	2.00	8.00	6.00	16.00	14.00
	(c) Vegetative Bunds	8.00	8.00	10.00	6.00	14.00	16.00	32.00	30.00
2	Land Shaping	6.00	4.00	6.00	6.00	8.00	8.00	20.00	18.00
3	On-Farm Development								
	(a) Fuel trees	2.00	6.00	2.00	6.00	6.00	10.00	19.00	22.00
	(b) Horticulture trees	8.00	6.00	2.00	10.00	12.00	18.00	22.00	34.00
	(c) Pasture	2.00	4.00	---	2.00	4.00	8.00	6.00	14.00
4	Nalla Training (Near Farm)	4.00	2.00	6.00	2.00	6.00	4.00	16.00	8.00
5	Broad Bed & Furrows	2.00	2.00	---	6.00	2.00	6.00	4.00	14.00
6	Water Conservation Measure	8.00	6.00	4.00	12.00	10.00	16.00	22.00	34.00
7	Soil Reclamation	8.00	4.00	4.00	6.00	6.00	16.00	18.00	26.00

Note: A stands for highly satisfied.  
B stands for moderately satisfied.

the score of 'moderate level of satisfaction' is considerably higher than the 'high satisfaction'. The overall satisfaction level of these activities except horticultural trees is also not very encouraging. This also goes with the perception on the adequacy of the activities implemented through watershed. The same trend is noticed in land shaping, broad bed and furrows, water conservation and soil reclamation. Nevertheless, the level of satisfaction in general is quite appreciable in land development activities and on-farm development activities.

On the whole, it appears to mean that though the programmes implemented are relevant and sustainable, the inadequacy in implementation constrained the success of the programme. The level of satisfaction is relatively less in the transition zone in comparison with the scarcity zone due to the above said reason. Hence, the success of the programme counts on each one of these three aspects and particularly participation holds the key.

#### 4.8 People's Participation in the Programme

As discussed in the last chapter, the participation of the beneficiaries at all the stages of formulation, implementation to sustainability of the programme is indispensable particularly in the area specific programmes like watershed. It is also needed that the participation of people from different walks of life is quintessential to realise the benefits of the programme. Particularly, it necessitates the



participation of the government machinery to build up infrastructure, business people to make the inputs available and market to dispose the produce, and also the enlightened farmers (contact farmers) to conscientize the other co-farmers about the advantages of the programme.

The participation of beneficiaries in watershed planning, implementation and other activities is presented in Table 4.16. It shows that participation in planning is quite impressive. Participation of the poor farmers is quite substantial in comparison with the scarcity zone. Similarly, they maintain a higher participation than the well-endowed beneficiaries in the training programmes conducted under NWDPRA. This seems to explain the significance given to watershed programme by the less endowed farmers. Similarly, the participation in 'Mitra Kisan' activities is also substantial. Even among the different categories of beneficiaries, it is evenly distributed. Meeting the NWDPRA staff who visit the farmer's field to oversee the working of these programme has been highly appreciated. This appears to mean that farmers do give importance to get more information about the innovations introduced in the watershed programme. The attendance in the village level meetings to discuss the watershed programme particularly implementation and sustainability aspects is quite encouraging. This seems to explain the impressive group behaviour in taking care of the programme. On the whole, participation in general is quite impressive and encouraging in the formulation, implementation

Table 4.16:- Participation of Beneficiaries in Watershed Planning, Implementation and Training.

Sr No.	Activity	(Percent to Total)			
		Size Classes of Land Holding			
		0-1 ha	1-2 ha	2-4 ha	All
1	Participation in Planning	20.00	16.00	24.00	60.00
2	Participation in Training Conducted under NWDPR	10.00	6.00	8.00	24.00
3	Participation in Mitra Kisan	20.00	14.00	30.00	64.00
4	Visit & Meeting of NWDPR Staff	26.00	20.00	40.00	86.00
5	Discussion about Watershed in Village Level Meeting	20.00	12.00	30.00	62.00

Note:- The figures deal with those who participate in the mentioned activities.

Table 4.17:- Distribution of Beneficiaries On the Basis of Their Participation In Different Activities of Watershed Programme.

Sr. No.	Activity	Size Class of Land Holding			
		0-1 Ha	1-2 Ha	2-4 Ha	All
1	Bunding Activity	32	24	44	100
2	Vegetative Bunds/Keyline	22	24	42	88
3	Contour Cultivation	28	24	44	96
4	Planting Trees	6	12	24	42
5	Pasture Land Development	---	---	6	6
6	Desilting Activities	6	4	6	16
7	Water Logging	12	10	4	26

Note:- Percentages are to the total beneficiaries

and sustainability in this watershed.

Similar to the general trend, participation in implementing different activities of the watershed programme is also commendable. The participation of beneficiaries in different activities is presented in Table 4.17. It exhibits that the participation in bunding activities and contour cultivation activities is near total. This also goes with the relevance, adequacy and level of satisfaction noted earlier. Other than these, only in the planting of trees, a noticeable participation was registered. The pasture land development received negligible participation from the beneficiaries. But the scarcity zone recorded a noticeable participation in the pasture development. This appears to confirm the earlier discussion that the beneficiaries give special emphasis on the activities which give high direct benefit incidence and they neglect the activities for which the benefit incidence is evenly distributed.

Holistically, it appears that the participation in different stages of the watershed development programme in general is quite encouraging and participation in activities which give direct tangible benefits is quite high. It is also in line with the participation in scarcity zone. But the riddle is why the participation is so indifferent in activities which give indirectly benefits or yield only intangible benefits.

#### 4.9 Environmental Impact of the Programme

Unlike the other area specific programmes, watershed programme contributes towards improvements in both quantitative and qualitative terms. In quantitative terms, it was found increasing the arable land, production, vegetation and other assets. The qualitative improvement is noticed in the overall improvement in the environmental factors like increased moisture availability, reduction in the soil loss, increased ground water level and ease in inter-cultivation. The qualitative improvement is made possible through bunding activities, percolation ponds, and the planting of horticultural trees along with other activities. As discussed earlier, while the bunding activities and percolation ponds impound the water by reducing the run-off of water, the horticultural and fuel trees facilitate the leaching of the impounded water along the roots of the trees. Hence, the positive externalities of the programme are manifold.

The effects of the conservation measures on the environment have been assessed by eliciting the perception of the beneficiaries on the availability of moisture, reduction in run-off of soil and improvement in water table due to the watershed activities. For the analysis, only positive responses 'significant and moderate impact' are taken into account. The distribution of beneficiaries on the basis of their perception is illustrated in Table 4.18. It exhibits that the positive externalities of all the three activities

Table 4.18:- Effect of Conservation Measures on the Beneficiaries  
in Reducing the Soil Loss and Improving Water Conservation.

Sr	Activity	Size Classes of Land Holdings							
		0-1 ha		1-2 ha		2-4 ha		All	
		S	M	S	M	S	M	S	M
1	Bunding Activity								
	(a) Increase in Moisture Retention	56.25	37.50	25.00	75.00	40.91	59.09	42.00	56.00
	(b) Reducing Runoff/ Soil loss	31.25	62.50	25.00	75.00	36.36	59.09	32.00	64.00
2	Vegetative Bunds/Keyline Reduction in soil loss, runoff, and water conservation *	87.50		75.00		100.00		90.00	
3	Contour Cultivation								
	(a) Moisture Conservation	43.75	43.75	58.33	41.67	50.00	50.00	50.00	46.00
	(b) Reducing Soil loss	43.75	43.75	58.33	41.67	50.00	50.00	50.00	46.00
	(c) Ease in Inter- Cultivation	37.50	43.75	58.33	41.67	36.36	63.64	42.00	52.00
	(d) Other	12.50	6.25	16.67		9.09		8.00	6.00

Note: 1 'S' refers to Significantly

'M' refers to Moderately

2 \* Those who expressed positive significant  
impact are given here.

are phenomenally impressive. The bunding activities role in increasing the moisture retention and reduction in soil loss and run-off is perceived by all the beneficiaries, though majority of them felt it as 'moderate impact'. Similarly the vegetative bunds/keyline also helped in containing the soil loss and improving the water table. Here too, the perception is near total. In the same line, the contour cultivation has also effected a considerable improvement in the moisture conservation, reducing the soil loss and in easing the inter-cultivation. Though the perception is asymptotically total, the responses are evenly distributed between 'significant effect' and 'moderate effect'.

Hence, the positive externalities of the watershed programme are unidirectionally positive. It is also in conformity with the observation in the case of scarcity zone. This appears to be convincing that the society can look forward to watershed development programme for the development of dry region and it can be a better alternative strategy than the others.

#### 4.10 Income Generation and Other Changes

As discussed in the scarcity zone, the income generation is one of the ultimate objectives of any developmental programme without exception. The watershed programme attempts to accomplish this by undermining the uncertainties in the agricultural production process and by enabling efficient allocation of scarce resources. The resultant changes in

agricultural income is noticeable in the project area in comparison with non-project area.

The per hectare and per household income from agriculture and by-products have been tabulated for both beneficiaries and non-beneficiaries to see the impact of watershed on the income change. The figures presented in Table 3.19<sup>4</sup> explain a different picture than that of scarcity zone. Unlike Bugewadi watershed, the agricultural income increases as the size of holding goes up. This seems to support the hypothesis of positive relationship between land size and productivity. While the income per hectare goes consistently upwards in the project area, it is a mixed trend in the control area. It is just otherwise in the case of income from by-products. Whereas the income from by-products goes down along with the size class consistently in the non-project area, it has a mixed trend in the project area.

Similarly, the per household income from agriculture also increases as the size of holding increases in both the cases. The increase is quite substantial from one category to another for both project and non-project area. Similar is the case with the by-products also. The difference in the total income between project area and non-project area is very less in the Nune-Goudi watershed in comparison with Bugewadi. While it is 34.25 per cent in the case of per hectare agricultural income, it is only 14.97 per cent in the per household income.

The inequality in income is surprisingly noticeable in both the project area and non-project area. While the

Table 4.19:- Per Hectare and Per Household Income  
from Agriculture and By-Products for Both  
Beneficiaries and Non-Beneficiaries.

Size Class	Beneficiaries		Non-Beneficiaries	
	Agriculture Production	By-Products	Agriculture Production	By-Products
<b>Per Hectare</b>				
0-1	5028.72	797.05	6041.67	775.00
1-2	6354.03	561.51	5372.50	678.13
2-4	8462.22	590.46	6983.29	672.99
Above 4	-----	-----	2603.26	391.30
All	7529.99	616.18	5609.57	627.46
<b>Per Household</b>				
0-1	4158.13	659.06	4833.33	620.00
1-2	8996.25	795.00	7814.55	986.36
2-4	21897.91	1527.96	15461.00	1490.00
Above 4	-----	-----	23950.00	3600.00
All	13124.78	1074.00	11160.80	1248.40



difference in income between categories per hectare is not significant in both the areas, the difference in income per household between categories is substantial in both the villages. While the income of the highest group of land holding is more than five times higher than the lowest group of holding in the project area it is nearly to 5 times in the non-project area. This seems to explain that the inequality is higher in the case of project area than the control area. This may be due to the adoption of improved farming practices and viability of some of the programmes only in the large farms. This may be also true that the land distribution is more even in the case of project area as the above 4 hectare category is not found in the village.

In addition to these, the changes are perceived in other related fields also. Some of the significant changes are listed in Table 3.20. Unlike scarcity zone, in this zone the changes are noticed in many fields. The major aspect of changes pertain to area under horticultural and silvicultural trees and the consequent increase in the green canopy or vegetative cover development in the villages. Watershed also helped in bringing the marginal land under cultivation. Like Bugewadi watershed, Nune-Goudi watershed also effected a considerable increase in the demand for labour both family and hired labour. This is possibly due to the increase in the diversified activities. Above all, it has promoted credit availability in the project area, perhaps by ensuring certainty in the agricultural income.

Table 4.20:- Distribution of Beneficiaries on the Basis  
of their Perception on Changes in other Components.  
(Proportion to Total)

Sr No.	Items	Size Class of Land Holding			
		0-1 ha	1-2 ha	2-4 ha	All
1	Marginal Land Brought Under Cultivation	14.00	10.00	20.00	44.00
2	Area Under Horticultural/ Silvicultural Land	18.00	18.00	22.00	58.00
3	Area Under Pastures	6.00	6.00	2.00	14.00
4	Availability of Fuel	----	2.00	2.00	4.00
5	Availability of Fodder	----	4.00	4.00	8.00
6	Number of Hired Labour Per Year	14.00	16.00	10.00	40.00
7	Number of Family Days on Own Farm	12.00	8.00	14.00	34.00
8	Increase in Livestock Products	4.00	2.00	----	6.00
9	Reduction in Seasonal Outmigration	6.00	6.00	8.00	20.00
10	Increased Participation in Village Industry	2.00	----	----	2.00
11	Increase in Vegetative Cover	18.00	16.00	14.00	48.00
12	Increase in Diversified Activity	10.00	14.00	12.00	36.00
13	Increase in Credit Availability	10.00	12.00	14.00	36.00
14	Increase in Income From Other Sources	16.00	12.00	10.00	38.00

Ultimately, the aggregate effect of all these changes could be noticed in the increase in income from other sources. Thus, it appears to be convincing that watershed has helped not only in qualitative improvement in the land and environment but also quantitative changes in the major economic parameters.

#### 4.11 Constraints in Watershed Programme

As discussed in the scarcity region watershed, the inadequate infrastructural facilities and inefficient technology can impede the effective implementation of the programme. Since the villages in the watershed area are isolated, the accessibility to these facilities constrains them from more efficient use of economic institutions. Though the needs of the people in the region are limited, the infrastructure is not provided for adequately. The major constraints noticed are availability of inputs, access to market, transport and the credit facilities.

Unlike the Bugewadi watershed, the input availability particularly fertilizer and seed is not a major constraint. It is available within the village or in the nearby town. But at times, particularly during peak season, the beneficiaries have to depend on neighbouring town. It is uniform among all the categories of beneficiaries. Generally cooperative society and private people supply the chemicals and seeds, though the cooperative society supply is very limited and to members only. Similarly, the marketing of the harvested produce is also found to be difficult, for the market is about 25 km away from

the village. In general, only groundnut is marketed by most of the beneficiaries irrespective of the categories. The mode of transportation is only tempo, though two of the beneficiaries count on their bullock cart. The major constraint is the access to the market. While the dusty reel in the road makes the movement of vehicle even bullock carts very hazardous in the off-season, the mud in the rainy season makes it inaccessible.

In addition to these, the availability of credit facilities also constrains them from making permanent investment on land and cultivating the land in time. Only a half of the beneficiaries could avail loan facilities from the cooperative societies. The loan was also short term crop loan amounting about Rs.1,000 with 13 per cent interest. Only advantage of it was the subsidy element of 33 per cent of the loan. The other half of the beneficiaries distributed evenly among categories could not get these loan facilities even. This inadequacy or inaccessibility constrained many of them from adopting the new cultivation practices in time.

#### 4.12 Summary and Conclusion

The representativeness of a transition zone could be found in Nune-Goudi watershed as it satisfies all the specificities of a transition zone. A perfect control is also found in Dhavadshi village. The land utilisation in the watershed area registered a reduction in waste land after the implementation of the watershed activities. A noticeable change

was also noted in the area under horticultural crops. The area reduced in revenue land and waste land was brought under forest (tree) cover. In the arable land, more area has been brought under irrigation. In the cropping pattern also, a shift towards commercial crops has been noticed. Perhaps, these developments could be attributed to the qualitative improvement in the land and soil conditions.

Similar to this, the primary data also corroborated the general phenomenon. While the average size of holding is small in the transition zone in comparison with the scarcity zone beneficiaries, the size of holding is higher in both the zones for non-beneficiaries than beneficiaries. The net cropped area and net irrigated area for beneficiaries is noticeably low in comparison with Bugewadi watershed. The consequences of it are found in very low cropping intensity and irrigation intensity. The resultant cropping pattern has been noticed to be shifting in favour of the drought resistant commercial crops like oilseeds and pulses. In the irrigated area, a considerable increase in the area under the existing crops and introduction of some new crops was observed. Particularly, the cultivation of vegetables, groundnut and other tree crops have been taken up after the project period. Perhaps, it may be due to the increase in water table and moisture availability for longer period. Unlike this, in the unirrigated area, the drought resistant commercial crops have replaced the dominant food crops. But it is otherwise in the control situation. In

the case of productivity, the project area recorded a noticeably higher yield per hectare for most of the crops than the control area. The productivity is higher among the large size of land holding category. The reason may be the higher use of material inputs and machine labour in this category of beneficiaries. But in the case of small farmers, the use of human labour particularly owned labour and bullock labour is higher than the larger size of holding. Similarly in the case of asset structure, the non-farm assets form the major chunk of the assets owned by the respondents. In the case of farm assets and livestock assets, the non-beneficiaries have higher asset holding than the beneficiaries.

The adoption of improved farming practices and cropping systems was also found to be very high in the project area. Among the improved farming practices, except application of pesticides and use of sowing implements, the adoption of all other practices is generally high. While the use of pesticide is pestilant to both the crops and the farmers in the dry region due to hot climate, the use of sowing implements is need based and it is accepted mainly by the large farmers. Similarly the adoption of inter cropping practices and vegetative bunds is also quite high. Holistically it shows that the adoption rate of practices are favourable to the practices which offer direct benefit to the beneficiaries. This can be found in planting of horticultural trees which is almost double of that of the silvicultural trees. And it is also true

in the case of pasture development. This is possibly because the benefit incidence is evenly distributed among the beneficiaries and it spreads over a longer period. The beneficiaries also reported high usefulness of the adopted practices which is quite encouraging. The usefulness of vegetative bunds, inter-cropping and other cultivation practices is rated as substantial.

In addition to adoption, the success of the programme counts on the relevance, adequacy of implementation and the sustainability of the programme. The relevance expressed by the beneficiaries of most of the activities implemented is quite high. The land development activities implemented in the watershed area are found to be 'highly pertinent'. Among the on-farm development activities, except pasture all the other activities are rated as 'highly relevant'. Similarly, the relevance of water conservation measures is also noticed as very high. Unlike this, the implementation of the relevant programmes is not adequate. Even the implementation of highly relevant land development, on-farm development and water conservation activities is found to be inadequate and insufficient by the beneficiaries. In addition to this, the sustenance of the programme after withdrawing the government machinery does not seem to be a problem for the beneficiaries and they are interested in looking after the relevant programmes. The level of satisfaction is quite encouraging only in land development activities and on-farm development activities. The level of

satisfaction is relatively less in the transition zone in comparison with the scarcity zone.

As <sup>any</sup> /area specific programme counts on the people's participation for its success, the watershed programme could get advantage of the voluntary participation of people in all the stages of the programme starting from formulation to sustainability. Even implementation of bunding activities and contour cultivation, the participation is near total. The aggregate effect of all these things are found in the qualitative change in the environmental factors like moisture availability, reduction in soil loss and increase in groundwater level. The agricultural income per hectare as well as per household, increases along with the size of holding. This observation goes exactly against the results obtained for the scarcity zone, where the size-productivity relationship was inverse. This is not conducive to reduce the inequalities in income though the inequalities in land size has come down. Over and above, some change is perceived in other fields like horticultural tree planting, vegetative cover development, increase in demand for labour and resultantly the increase in income from other sources.

On the whole, the watershed development programme seems to have contributed positively towards the production and environment sector. It might have increased the income disparity which is possible due to higher level of commercialisation in the transition zone.



## CHAPTER V

### SUMMARY AND CONCLUSIONS

#### 5.1 An Overview

Agricultural development experience, after the technological change of mid sixties, was characterised by the wide regional disparities. Among other problems that emerged during this phase of development, the environmental problems as well as the dead weight character of the fragile resource regions, were quite prominent. The regions bypassed by the technological change, were handicapped both on the account of the weak natural resource structure as well as the character of the technology. Low level of irrigation development, improper water harvesting, largely degraded soils and bio-resources, predominance of low value crops and the commercial character of agriculture in the small neighbouring regions, together placed these regions in a vulnerable position. Thus the experience of the droughts during seventies and eighties had a severe impact on the agricultural production system of these regions. Vast area of the Central India covering large parts of Maharashtra, Karnataka, Rajasthan, Gujarat and some parts of other neighbouring states can be included in this vulnerable tract. Availability of irrigation in some patches, has changed the cropping system and developmental trends but not without

the associated environmental cost. Proper rainfed farming technology with an aggregate cropping system approach, seemed to be the answer to the problems of these regions.

A review of the development of rainfed farming in India indicates four phases of development. During the first phase of development, the efforts were directed more towards soil conservation experiments conducted at the research stations meant for that purpose. The impact of these efforts, was quite encouraging but the magnitude of the task involved as well as the thin spread of these experiments, were not sufficient to tackle the problem. At the same time the crop sector remained totally neglected. The second phase can be characterised by its emphasis on the development of suitable crop varieties as well as the cultivation practices. The results at experiment stations, were quite encouraging but failed to replicate the same yield gap on farmers' fields. Therefore, the adoption rates of these practices as well as varieties were quite low. The major problems of the low response, was the location specificity of the technology as well as the nexus between technology adoption and risk aversion of the farmers of this region. Thus, a holistic planning was felt necessary. The third phase in the development of rainfed farming thus involves the holistic watershed planning experiments initiated by various organisations and the state governments. These works were taken independently across large number of regions and hence did not have a common framework. Further, the problems

of implementation as well as technology were different and thus the feedback of one experiment did not necessarily contribute to the other. At the time of the mid-term review of the Seventh Five Year Plan it was felt that a programme of development of the rainfed agriculture can be taken up on the basis of watershed in the country. Consequent to this decision a programme of National Watershed Development Project for Rainfed Areas, was taken up covering 99 districts in 16 states of the country. This programme was modified during 1990, based on the feedback from the respective state governments and on the basis of the suggestions made by a committee of secretaries.

The new programme of NWDPA had four specific changes. Firstly, the new programme recommended a holistic and integrated approach including not only the development of natural resource base but also to sustain the productivity as well as improve the quality of life. Secondly, planning of the watershed was given prime importance. A complete developmental plan of the watershed was to be prepared covering all the treatments on arable and non-arable lands, unit costs of the treatment, socio-economic characteristics of the watershed and the expected benefits. Therefore, projectisation became an important aspect of NWDPA. Thirdly, the project rightly emphasised the crucial aspect of people's participation. It was recommended that the involvement of the beneficiaries should be ensured from the planning stage and continued through the implementation stage. This was expected to be achieved through

'Mitra Kisan', 'Gopal' (Contact farmers and Contact Dairy farmers) and watershed level committees. Training of the farmers was introduced as an important aspect. Lastly, the funding arrangements were changed and the Central Government undertook to extend 100 per cent finance to the project of which 75 per cent was in terms of grants and 25 per cent as the loan component. Monitoring and concurrent evaluation was also introduced as a major activity in the project.

Government of Maharashtra had initiated the NWDPRAs in the earlier phase under the 1986 guidelines. Before 1986, a Comprehensive Watershed Development Programme (COWDEP) was in operation in the State. It became easier to superimpose the NWDPRAs during 1986 on the ongoing COWDEP programme. Twenty watersheds were earmarked for the purpose of development from each of the 19 districts selected for the purpose. An impact analysis of this programme conducted earlier suggested six important need based changes namely: (i) location specific technology, (ii) proper projectisation, (iii) participation of the beneficiaries from planning to the implementation stage, (iv) funding arrangements and flexibility in unit cost across regions, (v) flexibility at watershed level to alter the programme, (vi) continuous monitoring and evaluation. The new guidelines prepared during 1990 completely changed the NWDPRAs approach and incorporated some of the above issues.

Under the new NWDPRAs, 266 watersheds were identified in the State of Maharashtra covering about 465 thousand hectares

of geographical area and 444 thousand hectares of treatable land (arable and non-arable land). The initial cost estimated for the project was Rs. 12787.53 lakhs, or about Rs. 48.07 lakhs per watershed and Rs. 2881 per hectare of treatable area. These estimates were revised by including some area falling in the neighbourhood of the selected watersheds. The total allocation of the funds was revised to Rs. 17739.86 lakhs as in 1995.

## 5.2 Objectives and Methodology

The project on NWDPRAs focussed on four main components. Firstly, to conserve and upgrade the land and water resources in the selected regions by adopting soil-water conservation technology. Secondly, to augment the availability of food, fodder, fruits and fuel in the selected region by inculcating a proper land use. Thirdly, to enhance the quality of life by supporting the income flows and strengthening the crop economy to withstand the weather uncertainty. Lastly, to generate the participation of the local population in the overall developmental efforts through the watershed activity.

Keeping in view the focus and the objectives as well as approach stated in the guidelines prepared for NWDPRAs, the present study was undertaken with the following objectives:

- (i) To examine the present status of the available technology and the extent of its adoption by farmers.
- (ii) To identify the factors responsible for productivity changes and to ascertain major impact parameters.
- (iii) To locate the constraints in the project

implementation in terms of infrastructure, technology and other factors.

(iv) To evaluate the impact of vegetative measures, soil and water conservation structures and other components of the programme.

(v) To suggest strategies for removal of the constraints faced by NWDPRA.

The methodology for the analysis of an area development programme and specifically a watershed development programme has to be different as compared to the methods of analysis of other programmes. The usual tools of project analysis are not only inadequate but possibly misleading in the case of an evaluation of a watershed. Any watershed development project, has a strong component of location specificity and therefore, the cost and benefit flows are governed more by the local conditions. Therefore, generalisation in terms of cash flows are difficult. Similarly, the time profile of the cost and benefits depend on the level of degradation, geo-climatic conditions and people's responses. Some of the benefits in terms of positive externalities such as regeneration of soil or pasture and increased percolation, are not easily amenable to pricing. Thus, their inclusion in the stream of benefits even in a micro-catchment of a few hectares is difficult and therefore, it becomes a formidable task for a watershed of a few thousand hectares. Moreover, the watershed treatments are inter-dependent as well as mutually supporting, generating

concentric impact signals. Any watershed project is a component of the larger river basin system where, geo-climatic factors are closely inter-related. This makes the segregation and measurement of impact difficult.

The impact analysis attempted here, is under a structured Watershed Impact System Model. The organisational and institutional structures along with the technological parameters decide the composition of treatment of a watershed. The changes in the watershed are both of short run and long run nature. It is also difficult to define a boundary of such changes as well as time span of each of these changes, as these would depend on the factors like level of degradation, slope, soil type, precipitation, bio-geological resources and people's interaction. Therefore, the best method to ascertain the impact signals would be to identify the changes in the important parameters in terms of pre-project and post-treatment situations, as well as compare the project situation with that of the control. The perceptions of the beneficiaries about the impact, is also another effective method of obtaining its correct direction.

For the purpose of the present study, we have selected two watersheds falling in two distinct agro-climatic zones of Maharashtra. The first watershed is selected from the Scarcity Zone. This watershed covers Bugewadi village of Parner taluka falling in Ahmednagar district. The second watershed is selected from the Satara taluka of Satara

district, falling in the Transition Zone II. This covers a few small villages and hamlets situated on the eastern slope of the western ghat. The logic behind selecting the watersheds falling in two distinct agro-climatic zones is to test the hypothesis that even with different combinations of treatments across agro-climatic zones the impact parameters move in the same direction and that the magnitude of the treatment varies with the agro-climatic parameters.

After obtaining a list of the beneficiaries from the implementing officers, we selected 50 beneficiaries from each watershed with the help of Systematic Random Sampling method with Probability Proportion to size. Similarly, 25 non-beneficiaries were selected from a carefully chosen control village falling close to the watershed. The data collected refer to the year 1993-94. The study is spread over five chapters. The first chapter sets the problem in macro-perspective aided by the review of literature of the studies on development of rain-fed farming technology and the issues in watershed management experience. This is followed by a chapter analysing the design and implementation of the NWDPR. The chapter brought out the major constraints in design and implementation of the programme, keeping in view <sup>the</sup> experience gathered from Maharashtra. The following two chapters deal with the impact analysis at micro-level for the selected watersheds. The present chapter brings together the findings of the study.



### 5.3 Summary of Findings

5.3.1 A review of the selected studies on dry land farming and watershed development indicated broadly three phases of development intersecting each other. The results of the soil-conservation works in the country were quite encouraging but dealt only with one aspect of soil-conservation. The DPAP and DDP programmes, along with the dry farming technological advances pointed out to a need for integrated approach. This marked the second phase of development. The third phase involved watershed development approach. Different programmes, with varying compositions in terms of technology, focus, organisation and impact, began in the country. A review of the impact of these programmes pointed out to four factors. Firstly, the impact analysis of a watershed is quite a complex process and the project analysis framework may not yield dependable results. The issue gets more complicated when one has to deal with the problems of pricing of natural resources. Secondly, the review suggested necessity of an elaborate project planning, involving all the significant components of the project. A complete plan of any watershed significantly helps in its proper implementation. Thirdly, the heterogeneity of environmental factor calls for location specific technology. Lastly, the participation of the beneficiaries from planning to implementation of the project helps in realising full impact of the programme. This also needs a support in the form of a proper implementing organisation and village level institution.

5.3.2 Analysis of design and implementation of the programme of NWDPR in Maharashtra suggested quite a few important issues. The NWDPR taken up during the seventh plan period (1986 guidelines) concentrated on 19 districts of the state but covered 380 watersheds. The districts chosen were mostly in the rain-fed drought susceptible regions of the state. The revised programme suggested during the eighth plan (1992 guide lines), had an increased spread covering thirty districts but restricted to 266 watersheds. On this background, it seems/better if the programme was to concentrate only on the fragile resource region (like the core drought-prone districts), than spreading it across the state. The watershed development programme in Maharashtra is taken up in continuation with the earlier programme of COWDEP. In the post 1992 period, a separate Directorate of Soil Conservation and Watershed Management was started by the State Government, renaming the earlier Department of Soil Conservation. This offered a different administrative set up with a little flexibility. It would have been better, if the administrative set up was inter-disciplinary involving the other relevant disciplines. Such an inter-disciplinary team, with a perfect horizontal integration could offer better results especially when the other developmental programmes are net-worked with the watershed development programme. The preparation of the watershed level projects has proved to be an important step in the implementation of NWDPR. But the time allocated for the project preparation and the expertise provided should be

modified during the next phase. It would also be quite helpful, if the watershed level functionaries are given the flexibility to modify the project plan, according to the felt needs and even during the course of implementation. Furthermore, the flexibility to reallocate the funds across components, in the case of needs, should help a long way in completing the works in time. The objectives set forth in the guidelines of 1992, are more development programme objectives and hence lack the required focus. It is only the strategy and approach, which clearly spells out the method of project implementation. Lastly, the guidelines clearly suggest monitoring by internal as well as external agencies, which can be taken up under the basic activity.

5.3.3 The projectisation of the two selected watersheds has been quite satisfactory and actually better than the district plans. Both the watershed plans, Bugewadi (Scarcity Zone) and Nune-Goudi (Transition Zone II), indicate all the technical components and intended allocations as well as the time required for implementation. The bench-mark survey characteristics are however, hurriedly compiled and do not give elaborate information. It was noticed that the time available for undertaking the survey and preparation of the project was not sufficient. Therefore, the need for continuous projectisation has to be underscored. The watershed project cost in the Scarcity Zone (Bugewadi) worked out at Rs.33.98 lakhs with about one-third allocation going to the development of arable

lands. The cost of treatment per hectare works out to Rs. 2050 per hectare. The achievements differ substantially across components. The achievements vary between 20 to 85 per cent of the initial plan. The highest achievement is in the 'Run-off Management and Dug-out Ponds' followed by 'Vegetative Contour Hedges with furrows'. Thus the conservation measures have better achievements especially in the non-arable lands. Overall the project has covered about 36 per cent of the intended work.

Another watershed project falling in the Transition zone covers a few villages/hamlets and it is named as Nune-Goudi Watershed. The projectization of Nune-Goudi watershed has a few problems basically due to the inadequacy of time at the project preparation level. The total cost of the project is worked out at Rs. 31.74 lakhs, with per hectare developmental cost as Rs. 3143 per hectare. The watershed has larger area under non-arable component than arable lands. The overall achievement of the project (till September 1993) works out to be 48.4 per cent. But there are wide differences in the rate of achievement across components. Quite a few components have exceeded the target and these include: (i) contour and vegetative hedges upto 4 per cent and 4 to 8 per cent slopes, (ii) vegetative filter strips, (iii) over seeding of grass, and (iv) loose boulder structure. In fact, the loose boulder structures taken in the middle reach exceed by about 4.59 times the target number of structures. All this indicates

the need of an external monitoring and concurrent evaluation as well as continuous projectisation.

5.3.4 The analysis of the primary data at the watershed level indicated quite a few interesting impact parameters. From the trends observed of the secondary data analysis, the increase in, area under horticulture, yield per hectare, area irrigated under wells and cropping intensity, were noticeable. The primary level data also substantiated the increased intensity of cropping as well as area under irrigated crops. The changes in the cropping pattern in the irrigated area show a favourable area allocation to commercial crops whereas, in the unirrigated area the drought resistant rainfed crops like sunflower, safflower and groundnut have gained in their area share. The productivity increase was observed in most of the crops which resulted in higher income generation in the watershed area. This is both due to increased input intensity as well as higher adoption rates in improved farming practices. The farmers' perceptions about the improved farming practices as well as the major components of watershed technology indicated that the components and technology are quite relevant. However, their implementation has to keep pace with the requirement. It was quite encouraging that the beneficiaries showed keen interest in participating in the programme and were also ready to look after the watershed structures even after the withdrawal of the implementing agency. One of the interesting results in the Scarcity Zone, is the reduction in the inequality

which is mainly due to the inverse size productivity relationship. The major constraints faced at the watershed level by the implementing authorities as well as the beneficiaries include: (1) local level non-flexibility in planning of the watershed components, (2) non-availability of labour as well as other resources for certain treatments, (3) time schedule of the work on certain components, (4) inability in correcting the project framework during implementation, (5) difficulties in coordination of different administrative agencies such as Department of Forest, Department of Agriculture and Department of Soil Conservation, (6) non-availability of sufficient infrastructure for marketing of inputs and products.

5.3.5 The impact of watershed in the Transition Zone, has been quite different than that in the Scarcity Zone. The secondary data analysis indicated achievements of about 48 per cent of the planned activities. However, there was a wide variation in the achievements across the components. This indicated problems, either in the phase of projectisation or during the process of implementation. The prominent changes noticed while analysing the secondary data include, increased area under horticultural crops, reduction in the waste lands, change in the cropping pattern in favour of commercial crops and availability of irrigation.

At the primary level, the results from the Transition Zone have corroborated the evidence reported in the earlier study (Deshpande and Reddy, 1991(a)) about Assured Rainfall

zone. The cropping pattern change has favoured commercial crops and the drought resistant rainfed crops. This has occurred many times at the cost of the reduction in area under food crops. The input intensity has substantially increased and this has led to higher yield per hectare in most of the crops. Another important reason for the increased productivity has been the widespread adoption of the new farming practices as well as the watershed development practices. The beneficiary perceptions about the relevance, adequacy and sustainability of the new technology along with watershed development practices indicated encouraging results. Most of the beneficiaries have indicated high relevance about the new farming practices as well as the water conservation practices. But it was felt that these technologies are not adequately available. Surprisingly, the transition zone shows positive relationship between income per hectare and the size of holding. This may influence and lead to higher inequality. The important constraints faced in the Transition zone include: (1) non-flexibility across components, (2) absence of continuous projectisation, (3) treatment of areas above 8 per cent slope falling under the control of the Forest Department, (4) non-availability of sufficient infrastructure relating to inputs and product markets, (5) inability to transfer surplus funds from one component to the other.

#### 5.4 Policy Implications

5.4.1 The spread of NWDPRAs across all the districts has helped in disseminating the watershed development technology

across a large area. This is a welcome feature, however, there has to be some prioritisation in the implementation of the programme. Highly degraded lands and the fragile resource regions should get priority and therefore, it would be beneficial if more number of watersheds are taken for development under NWDPR in the 88 drought-prone talukas of Maharashtra.

5.4.2 The guidelines give allocation of the share of funds across components. Probably this is only indicative but many times followed strictly as a rule. It is quite possible, that one watershed would require larger funds under certain activity depending on the local conditions such as drainage lines, slope, vegetation etc. (e.g., some watershed may have higher proportion of non-arable land than arable land and hence larger allocation should be for the latter). Therefore, flexibility in the inter-component allocation of funds should rest with the watershed level administration. This can be accomplished with the help of the technical officers of Watershed Development Team (WDT) at the state level.

5.4.3 The question of local level flexibility in planning and implementation was raised by most of the implementing officers. Such flexibility will simplify the work procedures as well as the achievements can be better compared to the present level. Many times certain component cannot be taken due to field level difficulties and therefore, at that time the field staff can plan (in consultation with the technical officers at WDT) an alternative component in the place of the projectised plan



component. Therefore, flexibility in implementation schedule may be allowed at watershed level.

5.4.4 The guidelines for NWDPRAs indicate an organisational structure based on an inter-disciplinary horizontal cooperation. Most of the watershed teams in the state have staff trained under soil conservation and not under other disciplines. The state level WDT provides the required technical input, but the WDT has to cater to 266 watersheds across the state. The Government of Maharashtra has introduced some institutional structures adequately represented by administrators and public representatives, at taluka and district level. The functioning of these bodies began only in the early 1994 (when NWDPRAs were half way through) and the experience about horizontal coordination was inadequate to judge the effective functioning of these bodies.

5.4.5 The guidelines of the NWDPRAs recommended internal as well as external monitoring of the project. The departmental monitoring is carried out with the help of the staff of the department at taluka and district level but the external monitoring is not taken up in the state. The presence of external monitoring would help in diagnosis and solutions of the local level problems without any time lapse.

5.4.6 There is a sizable amount of saving effected in the 'Basic Activity' component. This has occurred because of the little amount (money and time) spent on the benchmark survey. Thus, causing difficulty in the preparation of the project

reports. It is quite possible that the savings under 'Basic Activity' can be used for the training purposes either for the project staff or for selected contact farmers. This can also be used for external monitoring purpose.

5.4.7 The concept of 'Mitra Kisan' and 'Gopal' have shown encouraging results but the training component of these 'contact farmers' has to be innovative and should focus more on the needs of the watershed development approach. It was expressed that the involvement of the Agricultural Universities must increase and some of the technical officers should also address village level meetings. The number of 'Mitra Kisan' and 'Gopal' can be increased depending on the needs in the watershed and according to the size of the watershed.

5.4.8 For a successful watershed development programme, it is essential that the beneficiaries also extend some contribution either in terms of labour or share of the expenses for the work done on their land. This would go a long way in depriving complete participation from the beneficiaries. Such participation can be accomplished by initiating what can be named as 'Watershed Panchayat'. This body may be assigned the powers to collect contributions and open an account with a nationalised/cooperative bank. The functioning of this organisation can be similar to a 'Village Panchayat' or may be called as one of the important bodies of the 'Village Panchayat'.

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