DRY LAND WATERSHED DEVELOPMENT AND MANAGEMENT: A CASE STUDY IN KARNATAKA

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CONTENTS

PREFACE

This case study was sponsored and funded by the Society for Promotion of Wasteland Development (SPWD), Mew Delhi. The study was commissioned in February 1988 and the field work was conducted in the months of March, April and May 1988.

The main objective of the study was to describe and analyse the experience of the Karnataka State in the field of dry land watershed development and management and to draw lessons that might be relevant to other State governments in India as well as other national and international organisations engaged and/or interested in this kind of work. Three sub-water-sheds, namely, Mittemari in Kolar district, Joladarasi in Bellary district and Wadagera in Gulbarga district were purposively selected for indepth study and analysis purposes. These three watersheds together fairly represent the agro-climatic conditions obtaining in the Karnataka State.

Watershed constitutes the most appropriate basic unit for natural resource use planning and management and the watershed-based approach is now considered the most effective method of drought-proofing. The Government of Karnataka has taken quite a few pioneering steps in the field of dry land watershed development and management and is much ahead of the other states in this regard. Therefore, it is hoped that the lessons that we have

drawn from the experience of Karnataka State and presented in this report will be useful to other organisations and agencies in India and abroad interested in this work.

The main conclusion of the study is that appropriate technology, appropriate organisation structure, adequate financial resources, technically competent, trained and motivated manpower, reasonably good basic supporting infrastructure, people's participation, committed bureaucracy and political support are crucial determinants of success of watershed development programmes as also of any other development programmes. The lesson is that an organisation, in order to succeed in watershed development and management, should try and create an environment in which all these or most of these factors are present and act in complete unison,

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EXECUTIVE SUMMARY

This case study of dryland watershed development and management in the Karnataka State established that the watershed approach to development of dryland agriculture is technically, organisationally, and financially feasible to adopt on a large scale. However, there is need for quantitative measurement of people's participation in the programme and for decomposition of the effect of various components of watershed technology on crop yields and other parameters. The Karnataka's experience revealed that appropriate technology, appropriate organisation structure, technically competent, trained and highly motivated manpower, adequate financial resources, reasonably good supporting infra-structure, people's participation, committed bureaucracy, political will and support at all levels are the major prerequisites for success of a watershed development programme. Wherever these prerequisites are present or can be created and fostered, there are very high chances of successful replication of the Karnataka's model which is essentially a scientific procedure/method of identifying and resolving various problems in watershed development and management.

The Central government, the State governments, the agricultural universities, the Indian Council of Agricultural Research and its constituent research institutes, financial institutions and international

research and development agencies can all play important roles in promoting the watershed **approach to** development of dryland agriculture based on **the** Karnataka's experience. The major constraints in replication of Karnataka model in other states in India seem to be lack of political will and of a nodal agency at the State level to plan, direct, coordinate and oversee the programme.

CHAPTER 1

INTRODUCTION

1.1. The Watershed Approach to Development of Dry Land Agriculture

The rainfed areas in the arid and semi-arid tropics of India are called dry farming areas (DFA). The DFA account for about two-fifths of the country's total geographical area, about 70 percent of its total cultivated area and one-third of its total population. Currently, some 42 percent of the country's total food grains production comes from the DFA and some 60-80 percent of the total area under coarse grains, pulses, oilseeds and fibre crops belong to this category of land. Roughly, 75 percent of the total production of pulses, oilseeds and cotton in India is contributed by the DFA. The need for development of dry land agriculture on a high priority basis is also justified on the ground that despite the creation of 2-2.50 million ha of irrigation potential every year and even after the realisation of the ultimate irrigation potential, half the arable land in India will continue to be rainfed. This implies that if food production is to increase sufficiently enough to meet the demands of the growing population, crop production in the rainfed areas will have to be increased. It is primarily for these reasons that dry land agriculture occupies the

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1. Government of India, Sixth Five Year Plan, 1980-85, p.103.

first place in the 20-Point Programme of the Prime Minister of India.

Despite their important place in India's economy, the DFA have, in the past, not received their fair (proportionate) share of resource allocation for research and development. The irrigated areas have been given a disproportionately high share of resources and a high priority for development. For instance, around two-thirds of the total government and bank funds have been made available to about one-third of the farmers who have access to irrigation facilities.[2] The neglect of the DFA is not only anti-production but also anti-poor because most of the India's rural poor live in these areas.

Of late, the Central and the State governments have recognised the need for allocating higher share of their research and development resources to dry land agriculture. The launching of the All India Coordinated Research Project for Dryland Agriculture (AICRPDA) in 1970 by the Indian Council of Agricultural Research (ICAR) which is now institutionalised in the Central Research Institute for Dry land Agriculture (CRIDA), Hyderabad, the establishment of the Central Soil and Water Conservation Research and Training Institute at Dehradun in 1974 with 8 regional stations in the

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2. Agricultural Production in India: Statewise and Crop-wise Data : 1949-50 to 1984-85, Centre for Monitoring Indian Economy, Bombay, February 1986, p.. vii.

major agro-climatic regions of the country and of the International Crops Research Institute for Semi-arid Tropics (ICRISAT) at Hyderabad in 1972 are a few of the major steps forward in the direction of advancement of dry land agriculture. The current strategy of development of dry land agriculture is two-pronged comprising (1) intensive efforts towards integrated development of selected micro-watersheds; and (2) extensive efforts towards wider adoption of available new technology, i.e., improved and drought resistent seeds, fertilizers, inter-culture/weeding, seed-cum-fertilizer drills, agro-forestry etc.

In 1982, the Government of India sanctioned 46 model watershed projects to be implemented in the dryland areas of the country. These projects are being implemented by the state governments and the technical back up is provided by the AIGRPDA, CRIDA and the Central Soil and Water Conservation Research and Training Institute. CRIDA and AICRPDA scientists are responsible for monitoring of 30 of these model watershed projects.

In July 1986, the Union Ministry of Agriculture and Rural Development launched the National Watershed Development Programme (NWDP) for rainfed agriculture as a centrally - sponsored scheme. It is currently in operation in 16 states in the country covering 99 districts. The criteria for selection of districts are

(1) the annual rainfall should be 500-1125 mm; and (2) the irrigated area should be less than 30 percent of the cultivated area. The programme has been taken up on a watershed[3] basis. The main objective of the programme is to optimally utilise the available rain water and minimise the risk of crop failure. The programme is financed by the Central and the State governments in the 50:50 ratio. The programme uses a project approach and has two broad components, namely, (1) land management; and (2) crop management. The land management systems are primarily intended to harness rain water for sustained crop production and include provision of interceptor bunds, ridges and furrows on grade, land smoothening, diversion channels for storm water disposal, farm ponds etc. The crop management system includes simple and easily implementable crop production practices based on a cropping system that has been successfully tried in the region.

Besides the centrally sponsored NWDP, there are many other dryland development projects underway in a number of states. These projects are financially supported by the State governments concerned and cooperative land development banks and commercial banks. In the years to

3. A watershed may be defined as an area drained by a river system or a tributory of the main river. A watershed has a clear conceptual identity in hydrology, physical geography and other natural sciences but in social sciences, the use of this term is of rather recent origin. The word is used synonymously with two other terms, namely, catchment and basin. The watershed approach requires that each and every piece of land falling within a watershed be treated with required soil and water conservation measures to restore its productive capacity.

come, the watershed approach to the development of dryland agriculture is likely to receive increasingly higher priority and higher allocation of resources than in the past.

A watershed constitutes the most appropriate basic unit for natural resource use planning and management. It is now considered the most effective method of drought proofing. The Government of Karnataka (GOK) have taken quite a few pioneering steps in the development of appropriate models for dry land watershed development and management. A project in Integrated Watershed Development was launched in 1983 in a selected watershed, Kabbalnala, in Bangalore district with the financial aid from the World Bank. The Kabbalnala model of watershed development was extended to one watershed in each of the 19 districts in the State in 1984-85. The State Government have constituted one State level and four divisional level bodies to plan, direct, coordinate and supervise the dry land watershed development projects which now are underway in all the 19 districts of the State. It is hoped that the lessons of Karnataka's experience will be useful to other State Governments in India as well as other organisations interested in dryland watershed development and management.

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4. See G. S. Tolley and F.E. Riggs (Eds.), (1961), Economics of Watershed Planning, Ames : Iowa State University Press, pp. 59-67.

1.2 Genesis of **the** Study

At the behest and with the financial support of the Ford Foundation, the Society for Promotion of Wasteland Development (SPWD), New Delhi, decided to sponsor a few case studies of selected dry land watershed development projects in the major ecological zones of India and to organise some time in August 1988 a workshop to discuss the case studies highlighting India's experiences in dry land watershed development and management and distill lessons that might be useful in improving the efficiency and effectiveness of the dry land watershed development programmes in the future. The SPWD constituted a Preparatory Committee to formulate guidelines for the proposed case studies. The Preparatory Committee had four meetings in the SPWD's office in New Delhi and finalised a set of guidelines for conducting the case studies. The SPWD commissioned nine case studies including the one reported here.

This case study was commissioned in February 1988 and the field work was conducted in the months of March, April, and May 1988.

1.3 Objectives of the Study

The main objectives of this study were as follows:

(a) To study and analyse the processes of planning, organising, executing, monitoring and controlling of dry land watershed development projects;

(b) To examine the role of local people in the design and implementation of the dry land watershed development projects;

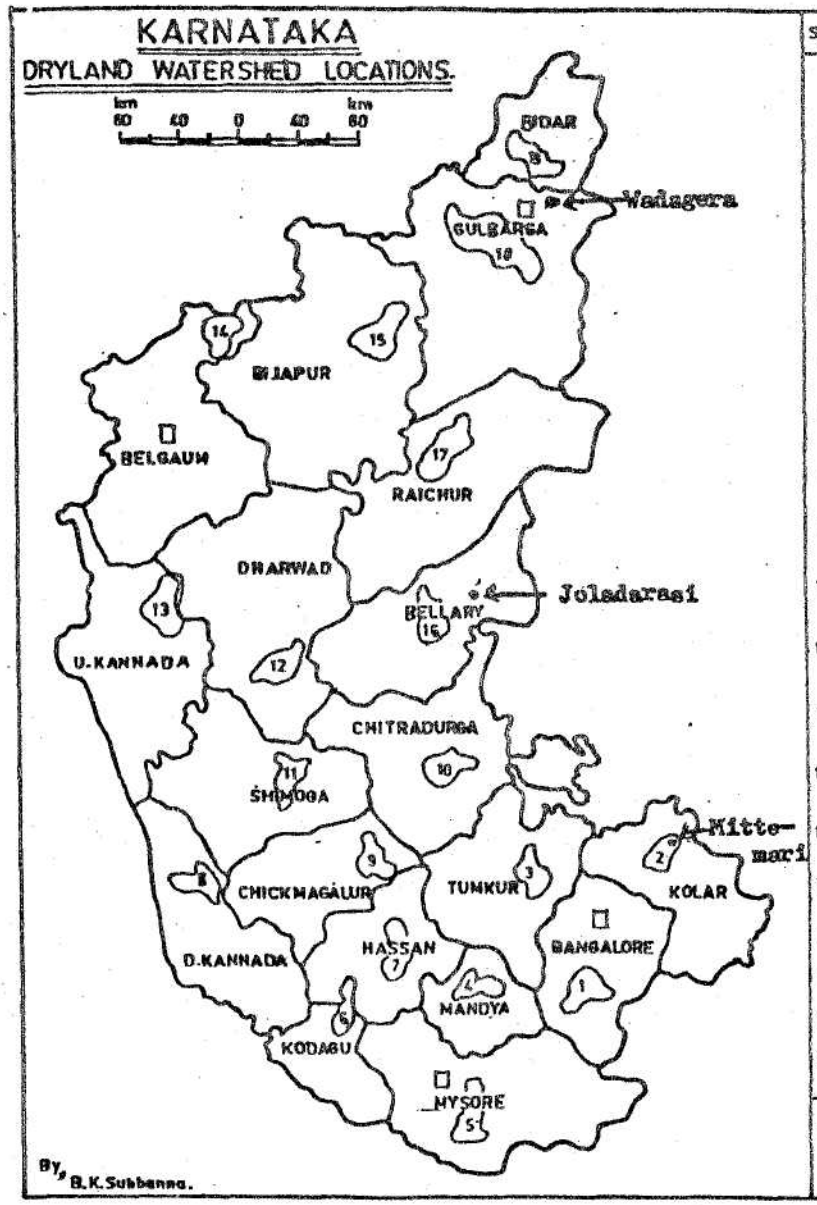
(c) To assess the direct impact of the dry land watershed development projects on crop yield rates, income, employment etc. of the participating households; and

(d) To draw from the Karnataka's experience lessens that might be useful to other State governments and organisations.

1.4 Selection of the Study Areas

The . Karnataka State was purposively selected for the case study because of its pioneering work in dryland watershed development and management. Karnataka recently got the first and the third awards instituted by the National Productivity Council for watershed projects. It was hoped that the lessons from the Karnataka's experience would be useful to other State Governments and organisations interested in this type of work.

In Karnataka, three subwatersheds, namely, Mittemari in Kolar district, Joladarasi in Bellary district, and Wadagera in Gulbarga district were selected purposively (see Map 1). The Mittermari project, which was launched in January 1984, is considered a model to be emulated in



Sl.No.	District	Name of the watershed	Taluks covered
1	Bangalore ☐	Kabbalaala	Kanakapura, Malavalli.
2	Kolar	Chitravathi	Chickballapur, Sidlaghatta, Bagepalli, Gudibanda.
3	Tumkur	Kallambella	Tumkur, Koratagere, Gubbi, Sira.
4	Mandya	Bidarahalli Lakkapura	Nagamangala, Mandya, Pandavapura.
5	Mysore ☐	Arasinakere	Nanjangud, Gundlupet, Chamarajanagar.
6	Kodagu	Shanivarasanthe Hale	Somvarpet.
7	Hassan	Doddahalla	Hassan, Arasikere.
8	Dakshina Kannada	Seetanadi	Udipi, Coondapur, Karkala.
9	Chikkamagalur	Mugalihatte	Kadur.
10	Chitradurga	Ganjikunte	Chitradurga, Challakere, Hiriyur.
11	Shimoga	Hirehalla	Honnali, Shimoga, Shikaripura.
12	Dharwad	Asundinala	Ranibennur, Byadgi, Hirekerur.
13	Uttara Kannada	Tattihalla	Haveripeda I
14	Belgaum ☐	Hirehalla	Athani.
15	Bijapur	Chandikhevatha	Sindgi.
16	Bellary	Sanna-Bembrahalla	Kudligi, H.B.Halli, Hadagali.
17	Raichur	Hirehalla	Kustagi, Yelburga.
18	Gulbarga ☐	Hutchimillanvalla	Gulbarga, Aland, Chittapur.
19	Bidar	Doddahalla	Basavakalyan.

☐ D.L.D.B. Divisions

Map showing the locations of the Watersheds selected under DWDP and the three sub-watersheds selected for the study.

other watersheds. It is one of the 46 model watershed projects sponsored by the ICAR. It is a fairly well developed and well documented project in which, besides the Departments of Agriculture, and Forestry, GOK, scientists from the University of Agricultural Sciences, Bangalore, CRIDA, Hyderabad , and ICRISAT, Hyderabad are also involved. Agro-climatically, it represents the eastern dry zone of Karnataka State.

The Joladarasi project was launched in 1984. Like Mittemari project, this project is also one of the 46 model watershed projects sponsored by the ICAR. The Central Soil and Water Conservation Research and Training Institute, Research Centre, Bellary is responsible for planning, monitoring, evaluation, and supervision of the project and GOK for its execution. Since the ICAR is a national level organisation involved in a big way in dry land watershed development, it was considered desirable to study in detail the ICAR project in Bellary district and draw lessons useful to other similar projects elsewhere. Agro-climatically Bellary district represents the northern dry zone of the State.

The Wadagera mini-watershed project in Gulbarga district was launched in mid 1986. It is a people-centred and a multi-agency endeavour in which a voluntary agency, MYRADA, the Government of Karnataka (GOK), and the Swiss Development Cooperation (SDC) are collaborating. The project is still in its infancy and is facing a number

of teething problems. Since the MYRADA model attaches the highest priority to participation of people, it was hoped that a detailed study of this model would yield useful lessons for other projects, particularly the lessons useful in enlisting people's participation in dry land watershed development and management. Gulbarga district represents the north eastern dry zone of the State.

To sum up, the three selected sub-watersheds represented three distinct approaches to watershed development and management, namely, the GOK - UAS Model, the ICAR Model, and the GOK-MYRADA-SDC Model. These three models taken together represent quite a comprehensive, integrated, science and technology-based and people-centred approach to dryland watershed development and management.

1.5 Research Procedure

The technique of Rapid Rural Appraisal (RRA) was used in conducting the case studies in the three selected sub-watersheds. RRA is an emerging new methodology which seems to hold high promise for improving the cost-effectiveness, timeliness, and quality of rural development-related research. RRA involves the deliberate selection and combination of a number of research methods, tools, and techniques to suit particular research needs. For the purpose of this study, we employed a combination of direct observations, semi-structured interviews and discussions

with individuals and groups of individuals, participation in meetings, use of published and unpublished materials, key informants etc. Direct observations and interviews were conducted in two rounds - March 25 to April 5, 1988 and May 25 - 31, 1988.

A PROFILE OF THE KARNATAKA STATE

2.1 General

The present State of Karnataka, formerly known as Mysore, came into existence in 1956. It is the eighth largest state in India both in terms of its area and its population. Karnataka has a total geographical area of 1,91,791 sq.km. (5.84% of India's total) and its population according to the 1981 Census was about 37 million (5.4% of India's total) with the average density of 193 persons per sq.km. The literacy rate was 38 percent in 1981.

The State is situated in the western part of the Deccan Peninsula of the Indian Union and is located in between 11^{o} and 19^{o} North latitudes and 74^{o} and 78^{o} East longitudes. The State is bounded by Maharashtra and Goa on the North, Andhra Pradesh on the East and Tamil Nadu and Kerala on the South. On the West, it opens out on the Arabian sea. Physiographically, the State can be divided into four regions : (i) the Coastal region; (ii) the Malnad; (iii) the Northern plains; and (iv) the Southern plains.

2.2 Climate

Climate in most parts of this region is mild due to its relatively high altitude. Being situated relatively

close to the Equator and the sea, this region has a small range of temperature variation during the year. The mean temperature of the hottest month (April) is 27.3 °c, and the mean temperature of the coldest month (December) is 20.5 °c. The average annual rainfall is about 1200 mm. The rainfall highly fluctuates from year to year and from place to place within a year. The rainfall decreases from west to east. The south-west monsoon sets in the first week of June and continues its sojourns for four months.

The State receives the maximum rainfall during the four months of June through September. The north-west monsoon also brings a few centimeters of rainfall during the winter months.

2.3 Natural Resources

The State has a relatively smaller area (15%) under forests when compared with the national average of 22 percent. The two important river systems of Karnataka State are the Krishna and its tributaries (Bhima, Ghataprabha, Malaprabha, Tungabhadra and Yedavati) in the north and the Kaveri and its tributaries (Hemavati, Shimsha, Arkavati, Lakshmana Thirtha and Kabini) in the south. Both these rivers flow eastward and fall into the Bay of Bengal, the Krishna passing through Andhra Pradesh and the Kaveri traversing Tamil Nadu.

A number of smaller rivers flow westward into the Arabian sea. Of these Sharavati, Kalindi, and Netravati are important to Karnataka. They are being tapped for hydro-power generation.

Red soils and black soils are the two major types of soil found in the State; the former occupy nearly 55 percent of the total geographical area of the State. Red soils are generally shallow have low moisture retention capacity and are highly erodable. Black soils vary greatly in terms of depth and texture. Deep black soils are very productive if managed well.

2.4 Agriculture

The economy of Karnataka is predominantly agrarian and rural with about 80 percent of its work force dependent on agricultural and allied activities for their livelihood. In 1985-86. the total cultivable area in the state was about 14 million ha, the net area sown 11 million ha and the irrigated area was about 22 percent of the net area sown. The ultimate irrigation potential was estimated at 5.5 million ha. Canals are the most important source of irrigation in the State, followed by wells and tanks. Food crops account for about 61 percent of the cultivated area and the non-food crops for the remaining 39 percent. The major food crops grown in the State are rice, ragi, jowar, bajra, maize, wheat, pulses, and minor millets. The non-food crops grown in the State include groundnut, castor,

sugarcane, arecanut, dry chillies, tobacco, cardamom, coconut, cotton, pepper, coffee, rubber and cocoa.

Among the food crops, Karnataka accounts for 47 percent of the country's ragi production, 16 percent of jowar production, 10 percent of small millets production, 9 percent of tur production, 7 percent of maize production and 5 percent each of rice and bajra production.

Among non-food crops, coffee is the most important as it accounts for 59 percent of the country's total production. Karnataka accounts for 86 percent of the raw silk produced in the country. Apart from silk, its sandal soap and sandal oil are well known in the world markets.

Since crop production in some 78 percent of the total cultivated area in the State depends on rainfall which is highly uncertain and erratic, crop yields are not only low but fluctuate widely from year to year depending upon the fluctuations in rainfall. Low and uncertain crop yields result in low and uncertain income from crops which in turn results in low or no investment in agriculture which is the main cause of low yields. Thus, a typical dry land farmer in the State, as also in other DFA in the country, is trapped in a vicious circle of low and uncertain yields - low and uncertain farm income - low or no investment in land and water resource development - low yields. How to help the dry land

farmer get out of the vicious circle remains the most challenging task facing the agricultural planners and administrators in the DFA.

According to the Agricultural Cenus 1976-77, there were 38.11 lakh agricultural holdings in the State covering an operational area of 113.57 lakh hectares. The small and marginal holdings accounted for nearly 23 percent and 33.52 percent respectively and together accounted for 56.52 percent of the total holdings in the State.

2.5 Livestock and Dairy Development

Karnataka's cattle population in 1951 was 11.52 million constituting about 6 percent of the total cattle population in the country. The number of cattle and buffaloes per 1000 persons was estimated around 594. Although numerically large, the cows and the buffaloes in the State are very low yielding. Consequent to the low production of milk, the per capita availability of milk in the State was barely 57 gms in 1956-57. Hence, in the first two Five Year Plans, emphasis was laid on the general improvement of livestock through better breeding, feeding, animal health care and management. During the period, 1956-1983, the average annual growth rate for cows was 0.47 percent and for buffaloes 1.45 percent. Karnataka has the India's largest population of cross-bred cattle.

A dairy development project was launched in four selected milksheds in the southern part of Karnataka,

namely, Bangalore, Mysore, Hassan, and Tumkur, in 1974 with the financial aid from the International Development Association (IDA) which is a soft loan window of the World Bank. Like the India's Operation Flood programme[5], the project sought to replicate in the selected milksheds the Amui model of dairy development. Although, the IDA-aided project was closed in September 1984, the dairy development activities initiated under the project are now part of Phase III of the Operation Flood programme which has been extended to many other milksheds of the State.

2.6 Development Administration

The GOK has recently taken a pioneering step in decentralising development administration. In the new system, all the necessary financial and administrative powers have been transferred from the state level to the district level and the Zilla Parishads at the district level have been assigned a prime role in planning and implementation of various development programmes. Although it is too early to assess the suitability of the new system, it would be fair to say that it is a major step forward in the direction of people-centred strategy of development.

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5. Operation Flood (Phase I) was launched in 18 selected milksheds in 10 States in July 1970. Now, Phase-Ill of the programme is underway in some 160 milksheds in the country.

CHAPTER 3

WATERSHED DEVELOPMENT PROGRAMME IN KARNATAKA : AN OVERVIEW

3.1 Genesis of the Programme

The Karnataka State has a very long history of research in dry land agriculture. The Imperial Council of Agricultural Research had established three dry land research centres at Bijapur, Hagari, and Raichur in the early 1930s. In 1954, the Central Soil and Water Conservation Research and Training Institute, Research Centre, was established in Bellary. These four centres catered to the needs of black soils. For red soils, no such facilities existed. The establishment of a Dry-land Agriculture Research Centre at GKVK in Bangalore in 1970 under AICRPDA filled the gap. Since then, the University of Agricultural Sciences (UAS) has been involved in research and development work relating to dryland watersheds and has developed a few model watersheds each ranging from 500-1000 ha in size. Each model watershed development project was conceived and planned by a multi-disciplinary team of UAS scientists and implemented with the help of local officers of the various line departments of the Government of Karnataka (GOK) concerned with watershed development. The UAS scientists have over a period of time evolved, tested and refined a package of new technologies for dry land watershed development. But due to lack of an appropriate organisational and administrative structure,

the new watershed development technologies could not be transferred and utilised to the desired extent in other watersheds in the State. Although the GOK had been supporting the dry land watershed research work of the UAS scientists since the very beginning, the real turning point came in the year 1984, when the Government recognised the need for replication of the dry land watershed development models through out the State, created an organisational structure for the purpose, and launched a District Watershed Development Programme (DWDP) in 19 selected watersheds - one in each district. The DWDP seeks to replicate the methodology developed in the World Bank - aided Kabbalnala Watershed Project in Bangalore district. The selected watersheds are treated as Pilot watersheds or field laboratories for testing the feasibility under farmers' conditions of the new watershed development technologies, and generating information useful for replication of the model elsewhere within and outside the State.

Besides the DWDP, the following other watershed projects are also currently underway in the State:

(i) 47 projects under the National Watershed Development Programme

(ii) 4 Model Watershed projects sponsored by ICAR/CRIDA

(iii) 263 Taluka Model Micro Watershed projects

(iv) 260 watershed projects around rain gauge stations

(v) GOK-MYRADA - SDC project in Gulbarga

(vi) Western Ghat watershed projects

(vii) DPAP - financed watershed projects

These projects are located in different Departments/Directorates of GOK and there is no mechanism established so far to coordinate their activities. Ideally, all these projects should be administered by a single unified authority or agency.

3.2 Objectives of the Programme

The main objectives of the DWDP are as follows:[6]

1. To achieve increased production from arable land and thereby enhance the income of the participating households;

2. To achieve increased production of fodder, fuelwood, fibre, fruits and timber from non-arable land so as to meet the local requirement of these products; and

3. To attain long-run stability in land productivity at a higher level mainly by using

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6. See Programme and Progress of Watershed Development Programme: An Overview, Government of Karnataka, State Watershed Development Cell, Bangalore, August 1987, p.6.

appropriate moisture and soil conservation measures, land use pattern and crop production technologies.

Although a concern for the local people is implicit in these objectives, there is need for an explicit statement that special efforts would be made to secure people's participation in the programme. This, we believe, would help keep the programme planners and implementers conscious of the need to assign the people a central place in the programme.

3.3 Coverage of the **Programme**

The DWDP was launched in 1984-85 and is currently underway in one selected watershed in each of the 19 . districts of the State. It is the single largest programme of its kind in the country. The total reported geographical area of all the 19 districts of the State is 190.50 lakh ha of which 140.40 lakh ha (74%) is cultivable. Exhibit 1 contains the names of selected watersheds, total area of each watershed, arable land as percent of total watershed area and the area covered as of 1986-87 under the agricultural, forestry, and horticultural components of the programme, It can be seen from the Exhibit that the total area of the selected watersheds was 5.95 lakh ha of which 70 percent (4.16 lakh ha) was arable. The arable land of the 19 watersheds account for about 6 percent of the total arable land of the State. In the first three years of

Exhibit 1 : Coverage of Watershed Development Programme as of March 1987

Sl.No.	District	Selected Watershed	Total area of the watershed (ha)	Arable land as % of the total area the watershed	Area covered under the programme since inception (ha)	Area covered as % of the total area
1.	Bangalore	Kabbalnala	29,803	53	5,143	17.26
2.	Kolar	Chitravathy	43,794	44	7,806	17.82
3.	Tumkur	Kallaabella	24,363	67	8,550	35.09
4.	Chitradurga	Ganjigunte	29,000	86	17,830	61.48
5.	Shimoga	Hirehalla	34,500	71	10,095	29.26
6.	Mysore	Arasinakere	35,935	81	7,741	21.54
7.	Mandya	Bindenaballi-Lokapavani	33,526	64	6,490	19.36
8.	Kodagu	Shanivara-Santhehole	13,500	57	10,112	74.90
9.	Dakshina Kannada	Sheethanadi	30,152	43	3,067	10.17
10.	Hassan	Devihalla	34,988	57	582	1.66
11.	Chikamagalur	Mugalikatte	23,600	63	337	1.43
12	Belgaum	Hirehalla	40,439	88	9,596	23.73
13	Dharwad	Asundinala	25,203	80	8,281	32.86
14.	Bijapur	Chandakavathe	28,016	33	10,920	38.98
15.	Uttara Kannada	Tattihalla	23,875	25	1,750	7.33
16.	Gulbarga	Mutchkullanala	35,000	77	4,316	12.33
17.	Raichur	Hirehalla	42,860	98	11,590	27.04
18.	Bellary	Sannabombrahalla	39,010	69	6,846	17.55
19.	Bidar	Doddahalla	27,785	61	8,780	31.60
State total			5,95,349	70	1,39,832	23.49

Source : Computed from Programme and Progress of Watershed Development Programme : An Overview, Government of Karnataka, Bangalore, August 1987, pp.18-20.

the programme, i.e., 1984-85, 1985-86 and 1986-87, 23.49 percent of the total area of the selected watersheds in the State had been covered. The extent of the coverage varied from watershed to watershed with the lowest coverage in Chickamagalur (1.43%) and the highest coverage in Chitradurga (61.48%). The poor coverage in many watersheds was mainly due to late start of the programme and partly due to inadequate staff in position. The horticultural activities were added in the third year and the forestry activities were taken up in only 4 of the 19 watersheds in the first year of the programme.

At the current pace which is about one lakh ha per year, it will take some 80 years to cover all the 80 lakh ha of dry lands in Karnataka. This is too long a period vis-a-vis the urgency of the problem. Therefore, there is need to step up the pace of work atleast four times so that the entire area can be covered in 20 years or so. The proposed higher pace seems to be financially and administratively feasible.

3.4 The Planning Process

Initially, in each revenue district, a dry land watershed (having less than 30% of its area under irrigation) comprising 25-30 thousand ha of land is selected. This size of watershed is based on the working norm of one unit of Sub-Divisional Soil Conservation Officer and one unit of Assistant

Conservator of Forests with the assumption that 80 percent of the total area of watershed is arable and 20 percent non-arable and that the entire area is to be covered in seven years. Then, a benchmark or a baseline survey is conducted in each selected watershed to furnish information required for planning as also to set up a benchmark for evaluation of the programme in the future. A document containing the results of the baseline survey is prepared for each watershed. The baseline survey report contains information about the natural resource endowment, human population, animal population, land use pattern, crop pattern, input use, yield rates of crops etc. Finally, a seven-year master plan is prepared for each selected watershed. The master plan is prepared on the basis of the resource - endowment of the watershed, felt-needs of the inhabitants of the watershed, and objectives of the programme; availability of financial and manpower resources is not considered at this stage. The master plan outlines the approach to be adopted for development of the watershed and identifies the technologies appropriate for the watershed. It is, of necessity, general in nature and does not contain operational details.

3.5 Project Formulation and Phasing

With the financial, manpower, and administrative resources available, it is not possible to treat all of the area of a watershed in one,shot. Therefore, for

operational purposes, each watershed is divided into a number of sub-watersheds, usually 7-10, each measuring 1000-3000 ha. Every year, 1-2 sub-watersheds are taken up such that the entire watershed could be. treated over a period of seven years. Thus, typically, every year 3000 to 5000 ha of watershed is treated with various recommended measures. For each sub-watershed taken up for treatment in a particular year, a detailed project is prepared and the implementation of the project is phased over a period of 4-5 years. Phasing is necessary because of the technical requirements of many activities, e.g., forestry and horticulture, which cannot be completed in one year and also because of the limited manpower and financial resources available for the purpose. Thus, the activities included in the project that was launched in 1984-85 were phased out for implementation from 1984-85 to 1988-89, those included in the project launched in 1985-86 from 1985-86 to 1989-90 and so on and so forth. This means that the activities implemented in a particular year consist of (1) the carry over activities of the earlier projects; and (2} the activities of the current project earmarked for that year. The State Watershed Development Cell (SWDC) refers to the projects launched in the years 1984-85, 1985-86, 1986-87, and 1987-88 as Projects O, I, II, and III respectively. The projects launched in the current year, i.e., 1988-89 are accordingly referred to as Project IV.

The SWDC has prepared and issued detailed guidelines for formulation of projects under the Project IV series.[7] These guidelines include, interalia, prescribed proformas and maps which are required to be filled in and prepared as part of the project. The guidelines have been developed on the basis of the experience gained in the formulation, phasing, and implementation of the watershed development projects in the pilot watersheds during the period, 1984-85 to 1986-87. The Dry Land Development Boards (DLDB) at the revenue division level and the Watershed Development Teams (WDTs) at the district/project level are responsible for planning, project formulation, phasing and implementation of the programme. While both the DLDB and the WDT follow these guidelines in performing the tasks assigned to them, they have enough freedom to take operational decisions including selection of sub-watersheds, choice of technology, and determination of mix of agricultural, forestry and horticultural activities for the selected sub-watersheds.

3.6 Mapping

After a sub-watershed is selected and delineated, five different types of maps are prepared to facilitate the tasks of planning, project formulation, phasing, implementation, monitoring, and control. Samples of these maps are included in the Planning Guidelines and

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7. See Planning Guidelines for the Watershed Development Programme, Government of Karnataka, State Watershed Development Cell, Bangalore, October 1987.

are reproduced In Appendices I - V. In Map 1, the selected sub-watershed is marked on a map of the watershed drawn on a topo. sheet. This map facilitates the demarcation of the selected sub-watershed such that there is only one point through which it drains and helps in locating a specific project and its specific activities with reference to important land marks existing in the sub-watershed/watershed. Map 2 is a drainage map of the watershed showing the locations of various projects taken up under the programme. Map 3 is the drainage map super-imposed on the revenue map of the sub-watershed. In this map, villages falling within the watershed are shown and individual fields are marked and identified by their survey numbers as assigned by the Revenue Department. This map is supplemented by two statements - one indicating the names of villages and their geographical area falling within the watershed and the ownership status of the land and one specifying the survey numbers partially or fully included in the project area. Map 4 is a soil and land capability map. It shows various kinds of soils obtaining in the sub-watershed and land capability classes. This map is helpful in determining the types of treatments necessary to restore different types of land and in preparing land use plans. Map 5 is called the Treatment Map. This map shows the treatment(s) to be applied to each and every survey number. For preparing this map, a multi-disciplinary team of officers from the Departments of Agriculture, Forestry and Horticulture goes round the

project area, surveys each and every field (survey number) and identifies the treatments necessary to restore it.

3.7 Choice of Technology

Final decisions about the treatments to be applied or technology to be adopted are jointly made by the U.A.S. Scientists and GOK officials in consultation with the farmers concerned and keeping in mind the soil and water conservation requirements of the entire project area. After the treatment map is finalised, a consolidated statement is prepared for the project. This statement shows, for both public and private lands separately, the treatments to be applied and the area of land in which each treatment is to be applied. The recommended treatments are grouped under Agriculture, Forestry and Horticultural Sectors.

Generally, the recommended treatments in each of the sectors are as follows:

1. Agricultural sector : Graded bunds, contour bunds; land smoothening; land levelling; bench terracing; land shaping, strengthening of existing bunds; farm ponds; grassed water ways with drop structures; diversion channel/bund; gullychecks; nala bunding, vegetative bunds with khus (vetiver grass), small section bunds, ridges and furrows, compartment bunding, contour cultivation, fall ploughing, crop systems etc.

2. Horticulture sector : Trenching and planting; pitting and planting; planting in gullies and nala beds; dry-orchards in private marginal lands; school gardens; planting around water harvesting structures; planting on bunds, raising of grafts/seedlings etc.

3. Forestry sector : Trenching and planting;; pitting and planting; establishment of contour hedges with bushes or with grass like khus (vetiver) etc., planting in gullies and nala beds; farm forestry in marginal lands; seeding/planting on bunds; avenue plantations; shelter belts; grass/pasture land development; brush-wood dams; raising seedlings for distribution, planting of khus in gullied areas, along water courses and the FRL of tanks etc.

After the treatments to be taken up in each sector are finalised, they are phased out over a period of five years. Water budgeting is an important item which is not included in the project proposal currently. It should be an integral part of the watershed development plan.

3.8 Financing

The district watershed development programme is estimated to cost about Rs.12 crores annually which is mainly financed by the funds made available from the

Rural Labour Employment Guarantee Programme (RLEGP),

partly by bank loans, and partly by the participating farmers themselves. Thanks to the initiative and efforts of the GOK, Karnataka is the only State in India where the Government of India (GOD have permitted the use of RLEGP funds for watershed development purposes. The GOK and GOI funds subject to a limit of Rs.250G per ha are made available to the participating farmers as 50 percent subsidy and 50 percent loan repayable over a period of 15 years in equal annual instalments as per the provisions of the Karnataka Land Improvement Act 1961. The marginal and small farmers and SC/ST beneficiaries are exempted from recovery of the loan/cost. Thanks to adoption of cost effective technology, the average cost of resource development works has come down from Rs.2500 per ha in 1384-85 to about Rs.1800 per ha in 1986-87 and the trend is likely to continue. Short term crop loans are available to farmers from various sources like cooperative credit societies, Regional Rural Banks etc. An innovative scheme of cyclical credit has been recently launched under the DWDP. Under this scheme, the farmer is assured of regular supply of crop loan even when he is not able to pay back his earlier loan due to bad weather conditions and resultant crop loss. Funds for soil conservation works and horticultural and forestry activities on government land and village community lands (Gomal land) are made available as 100% grant. For meeting watershed development expenditure, a

revolving fund of Rs. one lakh has been created for each watershed selected under DWDP.

Besides, the World Bank has been financially supporting the Kabbalnala watershed project in Bangalore district since its inception and the Swiss Development Cooperation has been supporting a project in Gulbarga district in which MYRADA is also involved. Recently, the Danish International Development Agency (DANIDA) has also agreed to finance the watershed development programme in the State. The GOI supports the projects launched under the National Watershed Development Programme. The other projects are supported by the GOK through plan provisions for various schemes dealing with rural employment like Drought Prone Area Programme (DPAP), National Rural Employment Programme (NREP) etc. The National Bank for Agricultural and Rural Development (NABARD) now permits refinancing of watershed development projects.

So far, the Programme has not suffered from any financial constraints. In the words of the Secretary, Agriculture and Horticulture, "we have plenty of funds available from various sources" - internal and external for the Programme. As a matter of fact, a stage has come when we may have to say a polite 'no' to some of the agencies offering funds to support the Programme'.

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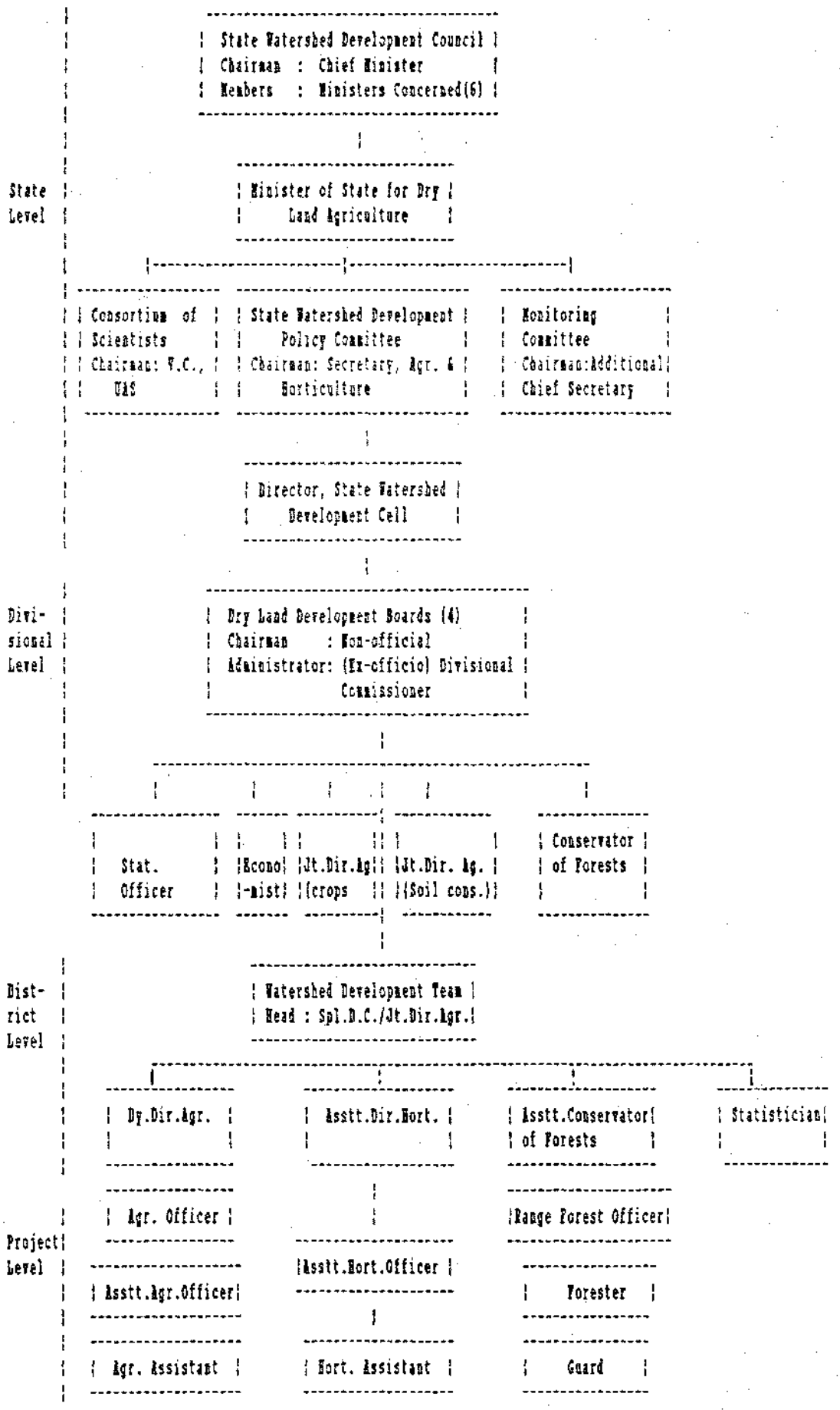
8. Based on the author's recollection from a personal interview with the Secretary, Agriculture and Horticulture, on March 25, 1988.

3.9 Organisation and Administration

The GOK has evolved an ingenious organisation structure for administering the DWDP (Chart 1). At the State level, the State Watershed Development Council (SWDC) with Chief Minister as Chairman and Ministers incharge Agriculture, Rural Development, Forests, Horticulture, Dry Land and Animal Husbandry as members is the highest policy making body. The Secretary, Agriulture and Horticulture, GOK, is the Secretary of SWDC. Most of the routine matters are, however, handled by the Minister- of State for Dry Land Agriculture. The SWDC is supposed to meet normally once a year but as of April 1988, it has met only once after its constitution in 1984.

The SWDC is assisted in the matters of choice of technology by a Consortium of Scientists which is chaired by the Vice-chancellor, University of Agricultural Sciences, Bangalore and in monitoring and controlling the Programme by a Monitoring Committee which is headed by the Additional Chief Secretary, GOK. The State Watershed Development Policy Committee (SWDPC) is responsible for scrutinising project proposals and according sanctions. The SWDPC is headed by the Secretary, Agriculture and Horticulture, and is virtually the apex policy making body. The Director,

Chart 1: Organisation Structure for District Watershed Development Programme in Karnataka



State Watershed Development Cell (SWDC) plays the key role in directing and overseeing the Programme, coordinating the activities of the various departments and agencies involved, ensuring that every project is adequately staffed, reviewing the progress of the programme, rectifying deficienies in the Programme and resolving operational problems as and when those are reported to him. Despite the key role assigned to the SWDC, it has only two officers - one Director himself who is an Indian Administrative Service (IAS) officer and one credit specialist who is on deputation from a commercial bank. However, the SWDC liberally draws upon, as and when needed, the technical manpower available with the DLDB, Bangalore whose office is also located in the same building in which the SWDC is housed.

At the divisional level, the GOK has constituted four Dry Land Development Boards (DLDB) - one for each of the four revenue divisions, namely, Bangalore, Mysore, Belgaum and Gulbarga. Chairman of DLDB is a non-official, usually a member of the Karnataka Legislative Assembly or a member of the Parliament from the division. Divisional Commissioner is ex-officio Administrator of DLDB. The DLDB is assisted by a multi-disciplinary team of specialists in the areas of agriculture, soil conservation, forestry, economics, and statistics. The team is responsible for selection of appropriate technology, technical scrutiny of project

proposals, and guidance and supervision of the Watershed Development Team. The main function of the DLDB is to coordinate the activities of various line Departments involved in the Programme. It also releases the funds earmarked for various approved projects, supervises the implementation of the projects in progress, and maintains necessary liaison with the SWDC and other GOK Departments at the State level.

At the district watershed level, a Watershed Development Team (WDT) headed by a Special Deputy Commissioner/Additional Collector or a Joint Director of Agriculture and comprising specialists in agriculture, horticulture and forestry is responsible for programme planning, project formulation, phasing, survey and mapping, implementation and monitoring of the DWDP. The WDT identifies sub-watersheds for inclusion under the DWDP, conducts a baseline survey in each selected sub-watershed and prepares a seven-year Master Plan for each selected sub-watershed. The success of the DWDP depends to a very large extent on the technical competence, motivation and morale of the members of the WDT.

At the project level, a team of agricultural assistants, horticultural assistants and foresters is responsible for actual execution of various works as per the approved plan. Construction of physical structures on non-arable government and/or community land is normally done by contractors. Like the WDT, the field level

functionaries also play an important role in the DWDP in the sense that they can make or mar the programme at the critical stage of its execution. It is the field staff who provides the crucial link between the people and the GOK. Technical competence, training, aptitude, motivation and integrity of the field staff are perhaps the most crucial determinants of success of the DWDP and therefore deserve the highest possible attention of their superiors in the respective line departments.

3.10 Staffing and Personnel Policies

The DWDP is staffed at all levels by the staff on deputation/secondment from the concerned line Departments like Agriculture, Forestry etc. There is no separate cadre created for the Programme. There are no special project allowances permissible to the staff although they have to do more difficult jobs and spend more days in the field than their counterparts in most of the line Departments. Yet, the morale and enthusiasm of most of the staff seemed to be fairly high. The Progamme has not yet become a dumping ground for the unwanted staff of the line Departments as normally happens when a new programme is launched and staff taken on deputation without any special allowance.[9] Initially, there was a proposal to provide some monetary incentive

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9. In a personal interview with Mr. C.S.Kedar, former Director, SWDC, I was told that there were a few attempts made by the line Departments to get rid of their unwanted staff, but those were thwarfted by him some how or the other, going out of way many a time.

to the Programme staff but that had to be dropped later. The usual GOK personnel policies apply to the Programme staff as well. But there seems to be a bit more flexibility and freedom available to the staff at all levels and things move faster in the programme than in the line Departments. This probably keeps the staff enthusiastic about their jobs. But we do not know for how long this enthusiasm would continue.

The Programme provides for training of Divisional and field level staff as well as farmers in each watershed. Selected officers of DLDB and WDT are sent out for training both within and outside the State. Training materials on watershed management and Planning Guidelines are issued by the SWDC in consultation with the consortium of scientists. Training programmes for selected farmers are conducted by the WDT. The main aim of farmers' training is to make them aware of the underlying philosophy of the programme.

3.11 People's Participation

People's participation is the bedrock of the DWDP. People's participation is sought through various means like village meetings usually at night, voluntary contributions in cash and/or kind, informal and formal consultations with villagers in such matters as selection of tree species for social forestry purposes, protection of community assets etc. The DWDP puts special emphasis on social fencing, and equitable

sharing of benefits from community assets/resources like fuelwood, fodder, water etc. with special preference/concessions to the rural poor. In a few selected mini-watersheds in Gulbarga district, MYRADA is experimenting with different ways and means of enlisting people's participation in the DWDP. It is hoped that the results of MYRADA's experiment would be applicable in other watersheds also. No systematic study has been conducted to assess the extent and nature of people's participation in the Programme but my impression, which is based on my village visits, is that people's involvement in the programme has not been upto the desired extent and that the programme could be made more effective by involving people fully and actively.

3.12 Monitoring and Evaluation

Monitoring of the DWDP is done regularly at the State, Divisional and district levels. As already mentioned, at the State level, a high powered Monitoring Committee is responsible for monitoring and overseeing the Programme and for problem shooting. At the Divisional level, statisticians and economists posted under the Programme are entrusted with these tasks. At the district level, monitoring is done by monthly staff meetings and field visits. Adherence to the monthwise schedules of operations prepared on the basis of approved Annual Action Plan is the main criterian for judging whether or not the programme is progressing satisfactorily.

The SWDC has developed a set of criteria for evaluating the overall performance of each project. Each project is awarded marks for its performance in terms of (1) planning, (2) implementation, (3) monitoring, (4) team spirit, and (5) people's participation. Each of the five components carries a maximum of 20 points. The total points secured by a project are converted into a letter grade such that a project securing 50-60 points is awarded an A, 40-50 points a B, 30-40 points a C and below 30 a D. There are no objective criteria developed so far for awarding points to each of the five components; the evaluation/grading is based on personal judgement of the Director, SWDC.

Impact of the DWDP on land productivity is measured in terms of yield rates of the major crops grown in the watershed. For measuring yield rates, crop cutting experiments are conducted by the Directorate of Economics and Statistics, GOK, in consultation with the DLDB Economists posted under the Programme. The crop cutting experiments are planned and conducted according to the random sampling technique. The crop cutting experiments are conducted in farmers fields both within and outside the watershed and incremental yield due to the programme is computed by deducting the average yield outside the watershed from the average yield within the watershed. As of 1986-87, a total of 3,114 crop cutting experiments covering seven Kharif crops and three Rabi crops had been conducted in all the 19 watersheds. The

average yields of the crops were markedly higher within the watersheds than outside the watersheds.[10] There are plans to analyse the yield data further to isolate and measure the effect on yield of each of the contributing factors.

So far, no formal and systematic evaluation of the DWDP has been been done to determine its economic and financial viability and to assess its impact on land productivity, income, employment, etc. Both the Secretary, Agriculture and Horticulture, and the Director, SWDC, are aware of the need for a systematic evaluation of the Programme and have already entrusted the job to the Institute of Command Studies and Irrigation Management, Bangalore.

3.13 State Level Forum for Interaction

The GOK very rightly recognised, soon after the launching of the DWDP, the need for establishing a forum where the practitioners/implementors, scientists, technologists, policy makers and administrators directly or indirectly associated with dry land agriculture could meet, discuss, interact, and share their experiences and ideas. Accordingly, a series of Annual State Level Interaction sessions was launched by the GOK in 1986. So far, three State Level Interaction Sessions have been organised by GOK. The first annual State Level

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10. See Turning Challenge into Opportunity, a Government of Karnataka Publication, pp. 5-6.

Interaction Session was held in July 1986 at the U.A.S., Bangalore, the second on April 24 and 25, 1987 again at the U.A.S., Bangalore, and the third on May 5 and 6, 1988 at the U.A.S., Dharwad. The topics and issues for discussion at the Interaction Sessions are decided mostly on the basis of feedback received from the field staff as well as from the scientists who have had opportunity to visit the projects. These sessions have turned out to be mutually useful to all categories of the participants. In general, after the Interaction Sessions, the practitioners were more knowledgeable about the latest developments in watershed research and technology and scientists about the problems in applying recommended technologies in farmers' fields than they were before.

3.14 Conclusions

On the whole, it would be fair to say that the DWDP in the State is making steady progress. Tangible achievements have been made in identifying appropriate technologies for watershed development and efforts are on for reducing their cost. A functional organisation structure has been established to administer and manage the programme. Most of the programme staff seem to be enthusiastic about their jobs and have developed requisite expertise in project planning. There is recognition and reward for good work. People's participation in the programme is not yet upto the desired extent. It is too early to assess the impact of

the programme on rural economy but there is evidence available from many watersheds that the programme has had a positive impact on crop yields, more so in drought years.

CHAPTER 4

MITTEMARI SUB-WATERSHED PROJECT

4.1 Introduction

Mittemari sub-watershed is located in the drought prone area of Bagepalli tehsil/taluka in Kolar district of Karnataka. It is a sub-watershed of Chitravati watershed which is one of the 19 watersheds selected under DWDP. It comprises three villages, namely, Mittemari, Chinnobaiahgari Palli, and Chokkam Palli. The sub-watershed was selected under the Model Watersheds Programme of ICAR in 1983 and watershed development activities were initiated in January 1984 by a team of scientists of the Dry Land Agriculture Project, U.A.S., Bangalore with the active collaboration of the Soil Conservation Wing of the Department of Agriculture, GOK. In February 1985, the Operational Research Project for Resource Management was launched in the sub-watershed. The sub-watershed is monitored by CRIDA. ICRISAT is also doing some studies on measurement of run off and sediment load under different tillage practices and effect of contour trenching on the yield of groundnut and red gram in the sub-watershed. The sub-watershed has been given an award by DLDB, Bangalore for its exemplary efforts.

4.2 Objectives of the Project

The main objectives of the Mittemari project are as follows:[11]

(1) To improve the productivity of soil under rainfed conditions through improved soil and water management practices;

(2) To impart stability to crop yields through proper run-off management, restructuring of cropping pattern and land use;

(3) To improve the economy of the inhabitants through resource conservation, afforestation, dry land orcharding, and pasture land development; and

(4) To restore the ecological balance of the watershed.

These objectives do not include evaluation of alternative farming systems, identification and analysis of gaps and constraints in the adoption of new watershed technology and creation of employment opportunities which are included in the objectives of the Model Watersheds Programme.[12]

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11. See Status Report of the Model Watershed, Mittemari, Dryland Agriculture Project, University of Agricultural Sciences, G.K.V.K., Bangalore, April 1988, pp.1-2.

12. See Shriniwas Sharma and S.P. Singh, Status Report on Model Watersheds, 1986-87, CRIDA, Hyderabad, p.2.

4.3 Project Activities

The following three types of activities were taken up in the sub-watershed to achieve the project objectives:

1. Physical/engineering structures/measures for *in situ* soil and water conservation.

2. Improved production technologies for enhancing production of food, fodder, fuelwood etc.

3. Alternate land use systems for efficient use of various types of land as per its physical capability for enhancing and stabilising yield rates.

4.4 A Profile of the Sub-watershed

General: The Mittemari sub-watershed has a total geographical area of about 1245 ha. The general slope of the terrain ranges from 0 to 3 percent with distinct topo sequences. The sub-watershed is basin-shaped and is interspersed with small hillocks. The area drains into Chitravati river through sub-surface flow. The general slope of the sub-watershed is in the East-West direction.

Climate: The sub-watershed has semi-arid sub-tropical climate. The average annual rainfall is 731 mm. Most of the rainfall occurs during the months of May through November. The probability of receiving less than 75

percent of the normal rainfall is 0.3, i.e., thrice in ten years. Dependable annual rainfall with 0.9 probability is around 570 mm. January is the coldest month with the average minimum temperature of about 18 °c and May is the hottest month with the average maximum temperature of about 36 °c.

Soils: The soils can be classified under Alfisols with topo-sequence of uplands, medium lands, and low lands. The soils have been formed in situ from granite-gnesis parent materials. The soils vary in texture from loamy sand to sandy loam. The surface soil in the uplands and medium lands is gravelly. Nitrogen content of the soils is low and phosphorus and potassium contents are medium. The soils are eroded to varying extent and are poorly managed. The undulating topography and along-the slope-cultivation have resulted into severe soil erosion which is evident from numerous rills and gullies in the area.

Land Use: Of the total geographical area of 1245 ha, 583 ha is cultivated, 167 ha is forest land and the rest is non-arable rocky wasteland. Roughly, 10 percent of the cultivated area is irrigated mainly by seven small irrigation tanks situated along the natural water courses. Besides, there are 13 open wells also. The water table is very low. The area under various land capability classes was as follows: Class II - 66 ha, Class III - 493.50 ha, Class IV - 23.50 ha, Classes VI & VII - 167 ha and Class VIII - 495 ha. There was no land under Classes I & V.

Crops and Crop Yields: Since 90 percent of its total cultivated area is rainfed, crops are grown in Kharif season only when rain water is available for crop production. The major crops grown in the area are finger millet and groundnuts. Traditionally, pigeon pea is inter cropped with both the major crops, i.e., finger millet and groundnuts. In the bench mark year of 1983-84, the average yield of finger millet grown under traditional practices was 6 q/ha and of groundnuts 3 q/ha. Use of fertilisers and improved seeds was rare. The average yields of these crops in demonstration plots in which improved dry land practices were used were 20 q/h and 10 q/ha respectively. This shows that there is substantially high potential for increasing yield rates of crops in the area.

Human Population: At the time of the bench mark survey (1983), the total population of the three villages lying within the boundaries of the sub-watershed was 2325 of which nearly 18 percent belonged to the SC and ST. The total number of households was 710 of which 510 were landed and the rest landless. About 10-15 percent of the landless labourers temporarily migrate to Bangalore, Tirupati, Hyderabad and other cities in search of jobs during off-season every year.

Land Holdings: There were 510 land holdings in the area in 1983 and the average size of holding was about 1.50 ha. Some 193 holdings (38% of total) were less than 2

ha in size, 140 (27%) had 2-4 ha of land, 90 (18%) 4-10 ha and 87 (17%) 10 ha or more. Thus, the distribution of land in the area was not as uneven as in many irrigated areas in the country.

Live Stock: In 1983 there were 115 cows, 153 buffaloes, 500 draft animals, 1600 sheep, 1150 goats, 410 pigs and 1450 poultry birds in the sub-watershed villages. Thus, the average number of bovine animals per ha of total geographical area was around 3 and per ha of cultivated area around 6. Most of the community grazing lands have been encroached upon and privatised and this has increased the pressure of animal population on arable land for supply of fodder. In years of low rainfall, the area suffers from acute fodder shortage and most farmers are compelled to sell their animals.

Infra-structure: All the three villages in the sub-watershed are easily accessible by all-weather motorable roads and are electrified. Mittemari had one farmers' credit service society, one Gramin Bank, one milk producers' cooperative society, one high school, one primary health centre, one post office and an agriculture office. Besides, 6-7 staff members of the Model Watershed Project and the Operational Research Project for Resource Management were also based in the village. However, with effect from April 1988, the ORP staff has been relocated in Chickaballapur.

4.5 Choice of Technology

Decisions about the type, size, and design of various soil and moisture conservation structures, about crop production technology and about tree species to be adopted in the sub-watershed were taken jointly by the UAS scientists and the GOK officials in consultation with the farmers. In general, the predominant type of soil conservation work recommended for adoption in the sub-watershed was strengthening of existing bunds and construction of small section bunds across the slope at an interval of 10 m. Wherever soil conservation measures were required to be introduced afresh, either graded bunds or open end contour bunds were recommended. In both the cases, waterways with grassed outlets were provided for safe disposal of excess run-off. The trials conducted under ORP in the sub-watershed demonstrated that the small section graded bunds at a distance of 20-30 m were most cost effective. Similarly, strengthening of existing bunds was found to be less expensive and more acceptable to farmers as compared to contour bunds.[13]

Similarly, introduction of improved varieties of fingermillet and groundnuts along with recommended dose of fertilisers and other management practice was found

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13. See Status Report of the Model Watershed, Mittemari, Dryland Agriculture Project, University of Agricultural Sciences, G.K.V.K. Bangalore, April 1988, p.29.

to be more profitable and acceptable to farmers as compared to the local varieties grown with traditional practices. Inter cropping of groundnut with red gram was also a new cropping system introduced in the area -- which was very profitable and hence acceptable to the farmers.

Many improved agricultural implements like seed-cum-fertiliser drill and mould board plough were introduced in the project area and their advantages demonstrated in trials in the farmers' fields. But very few farmers have adopted the improved implements inspite of heavy subsidies on them.

In the social forestry sector, tree species, namely, Acacia auriculiformis, Dalbergia sissoo, and Acacia nilotica are recommended for adoption by farmers to meet their fuel wood and timber requirements. All these tree species thrive well in the area and are acceptable to the farmers. Fruit trees like Jack fruit, tamarind, cashew, and ber have also been successfully tried and introduced in the area.

4.6 Programme Planning and Project Formulation

As mentioned earlier, the Mittemari sub-watershed was selected under the model watersheds programme of ICAR in 1983. It was the first model watershed taken up by GKVK, UAS, Bangalore. The sub-watershed was selected because (1) the Soil Conservation Wing of the Department

of Agriculture, GOK, had already done some work there and had established an office in Mittemari village; and (ii) the villagers were willing to cooperate and participate in the project.

After a rapid topographic survey of the area, a Master Plan was prepared jointly by a team of the UAS scientists and the GOK staff and the project activities started in January 1984. The salient features of the Master Plan are presented in Exhibit 2. As shown in the Exhibit, originally, the project had a total outlay of Rs.25 lakh out of which about 88 per cent was earmarked for subsidies and the rest for meeting miscellaneous project expenses. Besides, there was a provision of Rs.650 per ha under the District Watershed Development Programme for conducting demonstrations in the farmers' fields in the sub-watershed.

Initially, the Model Watershed Project was sanctioned for a period of three years, 1983-84 to 1985-86. For 1986-87, the DPAP authorities made available a sum of Rs.3 lakhs from their unspent balance for completion of the spill-over works. As of March 1987, the sub-watershed had been nearly fully saturated with required treatments. The ORP now has been extended upto 1989-90.

4.7 Project Implementation and Financing

The Soil Conservation Wing of the Department of Agriculture, and the Department of Forestry, GOK, are primarily responsible for implementing the project.

Exhibit 2 : Salient Features of the Master Plan of the Mittemari Sub-watershed Project*

Sl. No.	Item/Activity	Unit	Target (original)
I.	Plan for Physical Works		
1.	Soil and Water conservation measures	ha	588.8
2.	Land smoothening and bunding	ha	588.8
3.	Grassed waterways	m	5000
4.	Diversion channels	m	1000
5.	Farm ponds	No	8
6.	Gully checks	No	100
7.	Afforestation	ha	167
8.	Fodder production (Leucaena)	ha	1.5
II.	Financial Plan		
9.	100% subsidy for soil conservation measures and afforestation	Rs.	1114690
10.	75% subsidy for farm ponds	Rs.	60500
11.	75% subsidy for seeds, fertilizers, chemicals, implements, sprayers and dusters	Rs.	1013000
12.	Contingencies, fuel, project evaluation, stationery etc.	Rs.	311810
13.	Total outlay for the project	Rs.	2500000

* Source : Status Report on Economics and Adoption Levels of Dry Land Technology in Model Watershed At Mittemari, CRIDA, p.6.

Technical guidance in implementation is provided by the staff of the Dryland Agriculture Project of the U.A.S. Bangalore. In February 1985, an Operational Research Project (ORP) for Resource Management was launched in the sub-watershed and special staff under ORP was posted in Mittemari to help and guide the GOK staff in

implementing and monitoring the project. Besides, the Chief Scientist, Dryland Agriculture Project, GKVK campus, U.A.S, Bangalore and his colleagues and CRIDA scientists also visit the project area occasionally and provide on-the-spot guidance in implementation. I had an opportunity to visit a couple of sites in the project area in the last week of March 1988 along with the Director, SWDC, the Chief Scientist, Dryland Agriculture Project, UAS and 12 NABARD officers and found that in most of the cases, the soil and water conservation structures were properly designed and were in good shape. Funds for implementation of the project are provided by the ICAR and by GOK out of DPAP allocation for Kolar district. The ICAR funds were used for meeting the establishment cost and contingent expenditure incurred on adaptive research conducted in the project area. The GOK funds were used for soil and water conservation structures, crop demonstrations, and afforestation purposes.

All the community works like diversion drains, waterways, gully plugging, nala bunding etc., were executed entirely at the project cost.

All the works taken up on individual holdings like construction of field bunds, strengthening of existing bunds, land shaping, farm ponds within the holdings etc., were executed at 75 percent subsidy and 25 percent contribution by the farmers either in cash or work. In case the farmer was not able to contribute in either of the ways, the work was got executed at project cost and

recovery of the farmer's share of 25 percent was to be made as per the Karnataka Land Improvement Act, 1961 and Rules of 1962 except from marginal and small farmers and SC and ST beneficiaries.

To make the farmers convinced of the benefits from use of modern inputs like fertilisers and pesticides, the same were supplied at 75 percent subsidy only once during the implementation of the project. The total expenditure per ha on this account was not permitted to exceed Rs.750 per ha.

The low cost implements like plough, land development equipment, seed drills and plant protection equipment were supplied to all the willing farmers at 75 percent subsidy. The maximum benefit per farmer on this account was restricted to Rs.500.

For farm forestry, social forestry and horticultural programmes, seedlings were provided free of cost. The pattern of subsidy on other inputs in case of horticultural and sericulture programmes remained as in crop production programmes.

The total budget envisaged for land development, crop production, horticultural and afforestation programmes was 21.06 lakhs over a period of three years.

The implementation of the programmes was done by different developmental departments of GOK to whom the required budget was directly released by the Project Director, DPAP, Kolar.

4.8 Training

To improve the skills of the project staff responsible for implementation, practical training was imparted to them. The contents of the training programme included alignment and construction of bunds, working out seed and fertilizer requirements, demonstration of use of improved implements and selection of crop varieties. Farmers of the project area were also trained in key line formation, use of improved implements including sprayers and dusters and identification of pests and diseases. Village Meetings of farmers - both men and women - were organised for creating awareness among them about soil erosion problems and the need for adoption of soil conservation measures and alternate land use patterns suited to physical capability of land. Farmers' visits were organised at crop harvest time and they were shown the gains from adoption of recommended crop patterns and crop production technologies. Despite these efforts, there was no significant input from farmers in the programme.

4.9 Project Monitoring and Control

As per the ICAR guidelines, the following three Committees have been constituted to review and monitor the progress of the project:

1. State Level Review Committee headed by the Agricultural Production Commissioner, GOK.

2. District Level Review Committee headed by Special Deputy Commissioner/Project Director, Kolar.

3. Village Resource Development and Management Society (not yet registered but model bye-laws are ready) having the Scientist S-2, ORP, as its Convenor.

As mentioned earlier, CRIDA is responsible for monitoring this project. CRIDA has prepared a Guide for monitoring the Model Watersheds Programmes and has prescribed formats for reporting annual progress of the programme. The formats are being used for the purpose. Exhibit 3 contains the revised targets and cumulative achievements as of 1986-87 of soil conservation works, cropping plan and alternate land use plan for the Mittemari project. A perusal of the Exhibit would show that most of the targets had been achieved and that in many cases, there were no specific targets set but the activities were taken up and good progress recorded. There were a few deviations from the original targets as set in the Master Plan. Special attention was given to tree plantation on government lands and foreshores of community tanks.

As regards utilisation of funds, as per the Status Report of the Model Watershed, Mittemari, (April 1988) of the Dryland Agriculture Project U.A.S., a sum of Rs.21.07 had been spent on the project by March 31,

Exhibit 3: Targets and Achievements of Soil Conservation Works, Cropping Plan and Alternate Land Use Plan in Mittemari Project, as of 1986-87 *

Particular		Revised Target	Cumulative Achievement
Soil Conservation Works			
1.	Contour bunds	50 ha	50 ha
2.	Diversion channels	11,500 m	12,620 m
3.	Grassed water ways	Nil	296
4.	Gully checks	69	69
5.	Strengthening of bunds	513 ha	449 ha
6.	Land smoothening	513 ha	350 ha
7.	Farm ponds	8	11
8.	Check dams	326	430
9.	Minor Engineering structures	1	1
10.	Drop structures	Nil	268
11.	Contour border strips	Nil	13 ha
12.	Zing terracing	Nil	190 ha
13.	Small section bunds	Nil	370 ha
14.	Waste weirs	Nil	9
15.	Graded bunds	Nil	4 ha
16.	Graded border strips	Nil	4 ha
II. Cropping Plan and Alternate Land Use Plan			
17.	Distribution of subsidised inputs	-	444 ha

* Source : Shriniwas Sharma and S.P. Singh, Status Report on Model Watersheds (1986-87), Central Research Institute for Dryland Agriculture, Hyderbad, Appendixes II and III, pp. 25-32.

contd.....

18.	Distribution of saplings of fruit plants to farmers (No.)	500	500
19.	Afforestation	167 ha	167 ha
20.	Rabi jowar	Nil	270 ha
21.	Bajra	N.A.	145 ha
22.	Improved cropping pattern	Nil	259 ha
23.	Distribution of improved implements	Nil	425

1987. Of the total expenditure of Rs.21.07 lakh, Rs.9.33 lakh were spent on soil and water conservation works, Rs.3.39 lakh on cropping programme and Rs.8.35 lakh on afforestation.

4.10 Impact Evaluation[14]

A study aimed at evaluation of the impact of the Mittemari Model Watershed Programme was commissioned by CRIDA in 1984-85. Using the principle of 'With and Without', the study was conducted in four villages within the sub-watershed (Project) and four villages outside the sub-watershed (Control) at two points in time, 1984-85 and 1986-87. In 1984-85, a sample of 99 farm households each was selected from the Project and the Control villages and the 1986-87 sample consisted of 87 farm households from the Project villages and 74 from the Control villages. Although, it is not wholly correct to attribute all the differences in the values of selected parameters observed between the Project

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14. This section is largely based on Y.V.R. Reddy and K. Pandurangaiah, 'Status Report on Economics and Adoption Levels of Dryland Technology in Model Watershed at Mittemari', CRIDA, Hyderabad.

villages and the Control Villages to the project, the observed differences give the best possible estimates of the impact of the project presuming that all other factors affecting the performance variables were comparable in the two types of villages. It is not possible to attribute the observed differences in yield rates to various factors like graded bunds, improved seeds, fertilisers etc without using a sophisticated econometric technique like the multi-variate analysis which is beyond the scope of this study.

The main findings of the evaluation study are summarised below:

1. Cropping Pattern: Exhibit 4 shows the crop pattern in the Project and the Control villages in the years 1984-85 and 1986-87. In 1984-85, which was the first year of implementation of the project, there were no significant differences in the crop pattern between the Project and the Control villages except that the area under the inter-crop of groundnut and pigeon pea was markedly higher in the Control villages than in the Project villages.

   However, in 1986-87 (third year of the project), area under the high yielding varieties of groundnut in both the sole crop as well as inter-crop was much higher in the Project villages than

Exhibit 4: Crop Pattern in Watershed (Project) and Non-Watershed (Control) Villages*

Sl. No.	Crop	Percent area under crop			
		1984-85		1986-87	
		Project Villages	Control Villages	Project Villages	Control Villages
	Kharif Season				
1.	Groundnut (L)@	2	1	-	1
2.	Groundnut (HYV)+	4	4	8	3
3.	Finger millet (L)	3	2	-	8
4.	Finger millet (HYV)	8	8	4	4
5.	Groundnut (L) + Pigeon pea	10	14	1	3
6.	Groundnut (HYV) + Pigeon pea	26	32	37	31
7.	Finger millet (L) + Pigeon pea	12	5	1	12
8.	Finger millet (HYV) + Pigeon pea	30	28	43	29
9.	Other crops	5	6	6	9
	Rabi Season				
10.	Groundnut (L)	-	-	-	-
11.	Groundnut (HYV)	24	24	14	18
12.	Finger millet (HYV)	56	59	52	18
13.	Maize	14	13	30	26
14.	Other crops	6	4	4	8

* Source : Status Report on Economics and Adoption Levels of Dry Land Technology in Model Watershed at Mittemari, CRIDA, Hyderabad, Table 1, p. 20.

@ L = Local

+ HYV = High Yielding Variety

in the Control villages. Similarly, area under high yielding varieties of finger millet in the inter-crop with pigeon pea registered a marked increase in 1986-87 in the Project villages over the 1984-85 acreage whereas there was no marked change in the Control villages over the same period. The higher acreage under high yielding varieties of groundnut and finger millet in the Project villages may be attributed to the supply of seeds at subsidised rate and training of farmers in dry land technology and production under the project.

2. Adoption of New Crop Technology: Improved seeds, fertilizers, pesticides, and improved weeding practices are the four major components of dry land crop technology which affect yield levels directly and substantially. The study revealed that both the number of adopters as well as the level of adoption of these four elements of new technology were markedly higher in the Project villages than in the Control villages and higher in the year 1986-87 than in 1984-85. Of all these items, use of pesticides was the lowest in both the Project and the Control villages apparently because there were no serious insect/pest problems in the area in both the years, i.e., 1984-85 and 1986-87.

3. Yield Rates: Exhibit 5 shows incremental yields due to the project of the major crops grown in the

Exhibit 5: Incremental Yields of Crops due to the Watershed Programme in Mittemari Sub-Watershed *

		Incremental Yield (Q/H)					
		1984-85		1986-87		Two-year Average	
		Main Crop	Inter Crop	Main Crop	Inter Crop	Main Crop	Inter Crop
1.	Groundnut (L) @	1.68	-	N.A.	-	1.68	-
2.	Groundnut (HYV) +	1.99	-	0.38	-	1.19	-
3.	Finger millet (L)	0.88	-	N.A.	-	0.88	-
4.	Finger millet (HYV)	1.89	-	2.91	-	2.40	-
5.	Groundnut (L) + Pigeon pea	2.00	1.11	3.35	1.53	2.68	1.32
6.	Groundnut (HYV) + Pigeon pea	4.16	1.00	4.68	0.95	4.42	0.98
7.	Finger millet (L) + Pigeon pea	1.40	0.33	2.38	0.20	1.89	0.27
8.	Finger millet (HYV) + Pigeon pea	4.26	1.57	6.19	2.11	5.23	1.84

* Status Report on Economics and Adoption Levels of Dryland Technology in Model Watershed at Mittemari, CRIDA, Table 7, p.26

@ L = Local

\+ HYV = High Yielding Variety

sub-watershed in 1984-85 and 1986-87. Yield of a crop is considered the best index of extent of adoption of new technology in crop production; in general and other things remaining the same, higher the yield, greater the extent of adoption of new technology. As can be seen from the Exhibit, incremental yields were higher in the inter-cropping systems than in the sole crops in both the years and the 1986-87 yields of inter-crops were higher than the 1984-85 yields. The higher incremental yields in 1986-87 seem due partly to the higher level of adoption of new technology in the Project villages in 1986-87 and partly to better weather conditions in 1986-87 than in 1984-85. Another important observation is that the incremental yields of the high yielding varieites were higher than those of the local varieties for both groundnut and fingermillet and in both the years.

Without looking at the incremental costs, it is not possible to comment on the economic desirability of the incremental yields. We examine the incremental net returns from various crops in the following section. Before we close this section, we would like to make a comment that the random crop cutting method yields more reliable crop yield data than the survey/interview method which was used in the study under reference. Therefore, while interpreting and

using incremental yield data, this observation should be kept in mind.

4. Incremental Net Returns and Benefit-Cost Ratio:

Exhibit 6 presents incremental net returns and incremental benefit-cost ratios for the major crops grown in the area. It can be seen from the Exhibit that the incremental net returns were the highest for the groundnut (HYV) + Pigeon pea crop As shown in the Exhibit, income from agriculture combination in both 1984-85 and 1986-87 and so also the incremental benefit-cost ratio. The incremental benefit-cost ratios for the crops considered were significantly greater than 1.00 indicating that the new crop technology was financially viable. A similar conclusion is reached by looking at the figures of the incremental net benefit presented in the Exhibit. Therefore, we can infer that the new dry land crop production technology was financially viable in terms of private benefit-cost calculus of the participating farmers.

It would be desirable to do a social benefit-cost analysis of the entire project to determine its social desirability but that is beyond the scope of this study.

Exhibit 6 : Incremental Net Benefit and Incremental Benefit Cost Ratio for Different Crops in Mittemari Sub-Watershed *

Sl. No.	Crop	1984-85		1986-87	
		Incremental net benefit (Rs./ha)	Incremental benefit-cost ratio	Incremental net benefit (Rs./ha)	Incremental benefit-cost ratio
1.	Groundnut (L) @	475	2.25	NA	NA
2.	Groundnut (HYV) +	972	-	36	4.27
3.	Finger millet (L)	146	2.25	NA	NA
4.	Finger millet (HYV)	124	1.64	NA	NA
5.	Groundnut (L) + Pigeon pea	1513	13.30	2167	6.57
6.	Groundnut (HYV) + Pigeon pea	2194	5.01	3276	7.30
7.	Finger millet (L) + Pigeon pea	708	5.37	334	1.84
8.	Finger millet (HYV) + Pigeon pea	1402	5.90	1697	3.50

* Source : Computed from the 'Status Report on Economics and Adoption Levels of Dry land Technology in Model Watershed at Mittemari', CRIDA, Hyderabad, Table 7(a).

@ L = Local

+ HYV = High Yielding Variety.

5. Level and Sources of Household Income: In the study under reference, an attempt was made to estimate annual household income from various sources in both the Project and the Control villages. In 1984-85, household income was estimated for agricultural labour households only and in 1986-87 for farm households only. Hence, the income estimates for 1984-85 and 1986-87 are not comparable. Here, we present only 1986-87 income figures. The study revealed that in 1986-87, the average annual income in the Project Villages was Rs.12,907 per household as compared to Rs.10,367 in the Control villages (Exhibit 7). and from services, trade etc. was markedly higher in the Project villages than in the Control villages whereas income from wages and from livestock was higher in the Control villages. Higher income from agriculture in the Project villages can be attributed to the improved crop technology introduced under the project.

An indirect but beneficial effect of the project was increased recharge of ground water in the area. As a result, the number of open wells and bore wells had increased from 5 in 1983 to 28 in 1987-88 and area irrigated from 60 ha to 150 ha over the same period. Rearing of fish in percolation tanks has also become possible at many sites in the area.

Exhibit 7 : Level and Sources of Annual Income of Farm Households in Project and Control villages in Mittemari Sub-watershed, 1986-87*

Sl.	Source of income	Annual Income (Rs./household)			
		Project villages		Control villages	
		Rs.	% of total	Rs.	% of total
1.	Farm wages	1659	13	2303	22
2.	Non-farm wages	893	7	860	8
3.	Services, trade etc.	810	6	401	4
4.	Agriculture (crops)	8481	66	5510	53
5.	Livestock	1064	8	1293	13

* Source : Status Report on Economics and Adoption Levels of Dry land Technology in Model Watershed at Mittemari, CRIDA,, Table 16, p. 36.

4.11 Awareness and Opinions of Farmers:

To find out the extent of awareness and opinions of the farmers about the project, we interviewed a sample of 55 farmers randomly selected from the three villages in the sub-watershed. The sample constituted roughly 10 percent of the total number of farmers in the sub-watershed and comprised 23 marginal farmers (<2.50 acres), 20 small farmers (2.50 - 5.00 acres), and 12 medium and big farmers (>5 acres). The number of farmers selected from each size group of land holding was in proportion to the total number of farmers in that group. Exhibit 8 summarises the results of the interviews. As shown in the exhibit, all of the sample farmers were aware of the project and were participating

Exhibit 8 : Awareness, and Opinions of Farmers About the Mittemari Project.

Item	Percent of Sample Farmers Reporting			
	Marginal farmers (<2.50 acre)	Small farmers (2.50-5.00 acres)	Medium and big (> 5 acres)	All farmers
1. Total number of respondents	23	20	12	55
2. Aware of the project	100	100	100	100
3. Participating in the project	100	100	100	100
4. Benefited from free/subsidised inputs	87	90	75	85
5. Increased crop yields	83	50	42	62
6. No marked change in crop yields	17	50	58	38
7. Increased income from crops	96	75	75	84
8. No marked change in income from crops	4	25	25	16
9. Increased employment	26	10	17	18
10. No marked change in employment	74	90	83	82

in it in the sense that each one had adopted atleast one of the recommended technologies. Most of the respondents, however, did not have a clear understanding of the watershed approach to development of dryland agriculture; to them, the project meant construction of bunds, use of improved seeds and fertilisers, distribution of free or subsidised inputs like improved seeds and fertilisers etc. and planting of trees in marginal lands.

Some 85 percent of the respondents reported that they had benefited from the free and/or subsidised inputs and farm implements such as improved seeds, fertilisers, mould board ploughs etc. made available under the project.

Some 62 percent of the respondents reported that their crop yield rates had gone up markedly after the launching of the project but they attributed the increased yields to improved seeds and fertilisers and not to the graded bunds or graded border-strips. As a matter of fact, most of the farmers reported that the bunds were constructed in their fields without their consent and that in most cases the bunds have been washed away due to lack of necessary repairs. We were also told by many farmers that in quite a few cases no new bunds were made by the GOK staff but the payment was received against the bogus bills.

Some 84 percent of the respondents reported that their income from crops had markedly increased after the

launching of the project and this is consistent with the increased crop yields reported here and with the CRIDA research findings reported in the preceding section. The remaining 16 percent of the sample farmers reported no marked changes in their income.

There was no significant impact of the project on employment; about 82 percent of the respondents opined that there had been no marked change in the level of employment as a result of the project. This seems to be due to the fact that all the soil and water conservation structures were constructed by hired labour which was employed by the GOK soil conservation staff and that there were no other labour intensive new practices adopted by the farmers.

Chandrakanth et.al[15] in a study of 30 farmers selected from the sub-watershed found, interalia, that (1) the farmers' involvement in the programme was low; and (2) perceptions of GOK and ORP staff and of farmers about what constitutes watershed technology differed markedly. For instance, sinking of irrigation wells was not a recommended watershed management practice but 77 percent of the respondent perceived it that way. Similarly, bunding of farm lands was a recommended watershed management practice but only 53 percent of the sample

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15. See Chandrakanth, M.G, Jeff Romm, Gilless, J.K., and Deshpande, R.S., Public Choice Analysis of a Watershed Program in India, paper to be presented at XX International Conference of Agricultural Economists, Buenos Aires, Argentina, August 26 - September 2, 1988.

farmers perceived it to be so. This shows lack of intensive extension education effort in the area. Therefore, there is need to educate people in the area about each and every component of the recommended watershed development and management technology.

4.12 Strengths and Weaknesses

Strengths: The following seem to be the major strengths of the project:

1. A strong technical back up by the U.A.S., Bangalore, CRIDA, Hyderabad and ICRISAT, Hyderabad.
2. A functional monitoring and review system set up by CRIDA.
3. Provision for adaptive research and evaluation under the Operational Research Project for Resource Development.
4. Administrative and financial support by the GOK under DPAP and DWDP and effective coordination between the UAS and GOK.
5. A multi-disciplinary ORP team functioning in the sub-watershed since February 1985 with the objective of evolving appropriate technologies for the area.
6. Sub-watershed easily accessible by all-weather motorable roads.
7. Existence of a branch of Gramin Bank, Kolar and of a farmers' service society which was defunct for a long time but has been reactivated recently.

Weaknesses: The following seem to be the major weaknesses of the project:

1. Lack of adequate involvement and participation of farmers at various stages of the programme.
2. Lack of transport and storage facilities in the village which are so necessary for ensuring timely supplies of farm inputs.
3. Lack of a leader to guide and coordinate the activities of GOK staff.
4. Lack of inter-department coordination at both planning and implementation stages.
5. Inadequate facilities for intensive training of field staff responsible for implementation of the programme.
6. Lack of studies on tree species to determine their suitability under the agro-climatic and socio-economic conditions prevailing in the watershed.
7. Lack of close monitoring of behaviour of various soil and water conservation structures.
8. Lack of a comprehensive social benefit-cost analysis of the entire project by an external agency.
9. Omission of animal husbandry activities in the project.

10. Lack of necessary repairs and maintenance of various soil and water conservation structures by both the GOK as well as farmers.

4.12 Conclusions and Suggestions

On the whole, the Mittemari Model Watershed Project seems to be progressing well and has already made a marked positive impact on crop yield rates in the area. The technical back up available from the UAS and the CRIDA is good and so also are the arrangements for monitoring and review of the programme. There is close and effective coordination between the GOK and the UAS at the State level but the same is not true at the Project level. Availability of funds has not been a constraint so far. But there is need to make definite arrangements for doing necessary follow-up of certain activities particularly on the non-arable land. There is need for closer involvement and participation of people in the programme and for a social-benefit cost analysis of the entire project by an external agency. MYRADA's experience in the PIDOW Project in Gulbarga district may be drawn upon to secure people's participation in the Project. Nomination by the GOK of a Project Leader will help improve the follow up of project activities and coordination with the ORP staff.

CHAPTER 5

JOLADARASI WATERSHED PROJECT

5.1 Introduction

The Joladarsi watershed is located between latitude 15^{o} 8'0" and longitude 77^{o} 6'0" to 77^{o} 8'30" on the northern side of the Bellary - Guntakal road some 25 km away from Bellary. The watershed has an altitude ranging from 421 m to 486 m above the mean sea level. The watershed falls within the administrative jurisdiction of the Bellary taluka of the Bellary district which is a drought prone area. The watershed spreads over an area of 569.5 ha and has only one village, Joladarasi, located in it. The watershed was selected under the Operational Research Project (ORP) of ICAR in 1982 and the project activities started in 1984. The Central Soil and Water Conservation Research and Training Institute, Research Centre, Bellary, was entrusted with the responsibility of preparing a Watershed Plan for the watershed. The Bellary Research Centre (BRC) is one of the eight centres established in the 1950s by the Government of India in different agro-climatic regions of India to develop effective soil and water conservation technologies. The BRC was established in 1954 to tackle the problems of black soils of the semi-arid areas covering the States of Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra. The BRC is now under the Administrative Control of the

Central Soil and Water Conservation Research and Training Institute, Dehradun which is an ICAR institute.

5.2 A Profile of the Study[16]

Physiography and Drainage: The watershed is situated on a uniform sloping terrain. There is a small hillock occupying an area of about 50 ha situated on the south-west corner of the watershed. There is a ridgeline running from East to West in the watershed sloping on both the sides. The entire watershed drains into Hagari river through seasonal nalas (rivulets) located on the southern and northern sides. There is one pond of approximately 25 m x 25 m size on the southern side. Surface run-off from agricultural lands is impounded in this pond and is used for meeting the drinking water requirements of Joladarasi village population.

Climate: The climate in the watershed is arid to semi-arid with an average annual rainfall of 526 mm distributed over 30-35 rainy days in the months of May through October. The year to year fluctuations in rainfall have been between 263 mm(in 1923) and 1075 mm (in 1975). Similarly, distribution of rainfall within a year is also highly uneven and erratic. Normally, September and October months account for as much as 45 percent of the total annual rainfall and 85 percent of rabi season rains. September - October rains are

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16. A benchmark survey of the watershed was conducted by the BRC in 1982-83, the year before the project was launched. This section is wholly based on the survey findings.

considered most dependable. The probability of receiving 40 mm and 120 mm rainfall in September is 0.91 and 0.54 respectively.

The area receives abundant subshine with a maximum of 10.6 hours in February and a minimum of 5 hours in July. April and May are the hottest months with a mean maximum temperature of 38 ^{o}c and December and January are the coldest months with a minimum temperature of 16 ^{o}c. Temperature and humidity variations within a year are rather low except in the months of April, May and December. Hence, there are no distinct kharif and rabi seasons in the area; it is a kharif-rabi continuum. The area experiences high winds from mid May to mid September with an average velocity of 22 kmph.

Soils: Soils of the watershed are mostly deep black. Mixed and gravelly soils are found in the foot hills which occupy about 5 percent of the total area of the watershed. Shallow soils occur in the base of the hillocks and deep and very deep black soils occur in the depressions. The soils are badly eroded as most of the area is denuded of vegetative cover. In general, soils of the watershed are deep and heavy in texture and their clay content increases with depth. The soils crack heavily after losing moisture and suffer from low infiltration rates which cause heavy run-off and soil loss. Nitrogen and phosphorus contents of the soils are low but bases are present in plenty.

Land Capability Classification: This means grouping of soils according to their physical capability/suitability for crops, pastures, forestry or wild life. It is necessary for determination of appropriate land use pattern for an area. There are eight land capability classes, the first four (I-IV) are suitable for cultivation of crops whereas the remaining four classes (V-VIII) are unfit for cultivation but can be used for pasture, forestry, and wild life development. The land capability classes are represented on a map by standard codes and colours. There were no classes I, V and VIII lands existing in the watershed. The area under the other classes was 77.78 ha in Class II, 213.25 ha in Class III, 218.20 ha in Class IV, 50.18 ha in Class VI and 10.09 ha in Class VII.

Ground Water: Ground water in the watershed occurs at a depth of 10 to 15 m and only one irrigation well existed there. The area commmanded by the well was only 0.8 ha due to its low discharge. One well is located in the village and its water is used for drinking purposes. The quality of water in general is good except that it is saline.

Land Use: Of the total geographical area of 569.5 ha of the watershed, 531 ha (93%) is arable of which 433 ha (81.5%) is cultivated in rabi season and the rest 98 ha in Kharif season. About 38 ha (7%) of the total area is hilly terrain and is not fit for cultivation. There were no forests in the watershed.

Land Holdings: There were 96 families in the watershed and all of them owned and cultivated land. The average size of ownership holding was 5.28 ha and of operational (cultivated) holding 5.31 ha. About 28 percent of the farm households had land holdings of less than 2 ha and they accounted for about 6 percent of the total cultivated land. About 34 percent of the farm households had 2-4 ha of land, 21 percent 4-8 ha and 17 percent 8 ha or more. The households having 8 ha or more land accounted for about 52 percent of the total land.

Crops and Crop Yields: Crops in the watershed are mostly grown only in rabi season. Jowar, which is the staple food in the area, was the main crop grown in the watershed before the project. It accounted for about 55 percent of the cultivated area. The remaining 45 percent of the cultivated area was devoted to corriander, safflower and other minor crops. Pulses were conspicuously absent in the cropping pattern. The watershed had only 2.12 ha of land under irrigation which was devoted to cultivation of an improved variety of jowar, CSH-5, wheat and bringal . In 1982-83, the average yield of improved variety of jowar under rainfed conditions was 796 kg/ha, of jowar (local) 520 kg, corriander (improved) + safflower, 240 kg + 511 kg, corriander (local) + safflower, 193 kg + 148 kg, and irrigated jowar (CSH-5), 2729 kg. Use of fertilizers and pesticides was almost negligible; most (81%) of the farmers used farm yard manure/compost; only one farmer

used fertilizers. The watershed has considerable potential of improving crop yields; technology is available to increase the yield by 100-200 percent and this has been demonstrated in the farmer's fields by the BRC under its National Demonstrations programme which was launched in Joladarasi village as early as 1977.

Demography: In 1982-83, the total population of the watershed was 642 of which 447 were adults and 195 children. The sex ratio (number of females per 1000 males) among adults was 854 and among children 1074. The total number of households was 96 and the average size of family 6-7. The literacy rate was 50 percent. About 31 percent of the heads of the households were illiterate. About 77 percent of the households had agriculture as their main occupation and the remaining 23 percent were engaged in pottery, carpentry and other agricultural based activities apart from farming. About 33 percent of the households belonged to the Scheduled Tribes, 6 percent to the Scheduled Castes and the remaining 61 percent to other castes.

Livestock: In 1982-83, the total livestock population of the watershed was 479 which consisted of 82 cows, 85 buffaloes, 168 bullocks and 140 other animals like goats, sheep etc. Thus, the average number of bovine animals per ha of total geographical area was 0.84 and per ha of cultivated area 0.90.

About 59 percent of the cows and 61 percent of the buffaloes were milking in 1982-83 and the combined

average milk production per milking animal was 390 l per year. Of the total milk production, about 64 percent was consumed, 33 percent converted into ghee and the remaining 3 percent sold.

Household Income: In 1982-83, the average annual household income in the watershed was Rs.7,726. Of the total household income, 75 percent was contributed by crops, 10.5 percent by livestock, 10 percent by farm wages and other earnings, and 4.5 percent by non-farm sources. Some 54 percent of the households were in debt and the average debt for household was Rs.764. About 42 percent of the debt was due to the commercial banks, 21 percent to money lenders, 18.5 percent each to cooperative societies and agriculturists.

Food Consumption Pattern: The average value of various food items consumed in the watershed in the year 1982-83 was Rs.998.70 per capita. Of the total value of consumption, cereals contributed about 39 percent, pulses 6 percent, edible oils 8 percent, milk 16 percent, vegetables 4 percent and other items 27 percent. The share of purchased items in the total quantity consumed was 7 percent for cereals, 51 percent for pulses, 29 percent for vegetables, 80 percent for edible oils, 34 percent for milk, and 97 percent for others. The average per capita daily consumption of various items was : cereals 606 g, pulses 38 g, edible oils 14 ml, and milk 199 ml which was below the standard requirements fixed by nutritionists.

Infrastructure: The watershed is well connected to Bellary in Karnataka and Guntakal in Andhra Pradesh through by a State high way. There is a regular and dependable bus service operating between Bellary and Guntakal and Bellary and Anantpur which passes by Joladarasi. There is one cooperative society in the village which is lying deficient but is attached to another viable society in the Chellagurki village which is located about two km away from Joladarasi. Joladarasi is also served by the Tungabhadra Grameena Bank which is also located in the Chellagurki village. The village gets its drinking water supply from one pond and one well. The village is electrified, has a primary school and a farmers' youth club.

Problems Identified: Severe soil erosion, low and unstable crop yields, low milk yield, lack of scientific resource management practices, and low family incomes were identified as the major problems of the watershed requiring immediate attention. The watershed development plan was designed to resolve these problems.

5.3 Programme Planning and Project Formulation

As mentioned earlier, the BRC was entrusted with the responsibility of preparing a master plan for Joladarasi watershed development. The BRC first of all constituted a Project Planning Committee[17] and then conducted a

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17. The Project Planning Committee consisted of Mr.S. Chittaranjan, Scientist S-3 (Engineering), Coordinator, Dr. M.S. Rama Mohan Rao, Scientist S-4 (Soil Science), Mr.A.K. Srivastava, Scientist S-1 (Agronomy), Mr. S. Subbayan, Technical Officer (Forestry), and Mr. N.S. Jayaram, Scientist S-1 (Soils). The Committee was assisted by three technical assistants and one draftsman.

benchmark/baseline survey of the watershed in 1982-83. The profile of the watershed presented in the previous section of this case study is based on that benchmark survey. The survey was quite comprehensive and covered all the relevant aspects of the watershed. The survey data were properly analysed and presented so as to be useful for watershed development planning purpose. Technical problems in soil and water resources development, afforestation and grassland/pasture development, and crop production and land use planning were identified and recommendations made to address these problems. These recommendations as also the results of the baseline survey were put together in a document, Watershed Management Plan for Village Joladarasi, which was brought out by the Central Soil and Water Conservation Research and Training Institute, Research Centre, Bellary. The Watershed Management Plan (WMP) is a comprehensive and self-contained document complete with all the necessary maps and designs. A summary of the major recommendations made by the Project Planning Committee for development of the watershed is presented in Exhibit 9. As shown in the Exhibit, the Plan had four major components, namely, soil and water conservation measures, afforestation, agriculture, and animal husbandry and the total estimated expenditure worked out to Rs.10,18,538 or say Rs.10,20,000.

5.4 Choice of Technology

The technical contents of the plan seemed to be appropriately determined keeping in view the

Exhibit 9 : A Summary of Joladarasi Watershed Management Plan

Sl. No.	Item/Activity	Unit	Target	Estimated expenditure (Rs.)
I.	Soil and Water Conservation Measures			
1.	Graded bunds	m	43866	63716
2.	Grassed waterways	m	24310	194308
3.	Diversion drains	m	2468	3073
4.	Farm ponds	No	4	32651
5.	Stone checks	No	243	311982
	Sub-total	-	-	605730
II.	Afforestation and fruit tree plantation	ha	69	75200
III.	Agriculture including two wells fitted with pumpsets	ha	500	247608
IV.	Animal Husbandry	No.of families	30	90000
	All			1018538
			Say-----	1020000

peculiarities of the watershed and the felt needs of the farmers. For example, the guiding principle in determining soil and water conservation measures for the watershed was safe disposal of excess water through

grassed water ways rather than allowing it to pond against level bunds. Hence, graded bunds with grassed waterways were recommended instead of conventional contour bunds. This seems to be the most appropriate technology for black soils which are characterised by low infiltration. Similarly, farm ponds were recommended not only because they serve as a source of water for human and animal consumption and for supplemental irrigation but also because they serve to prevent erosion and regulate run-off on down stream side and thereby help reduce expenditure on gully control works. The plan provided for only four farm ponds although atleast 15 ponds were needed for the watershed.

Similarly, afforestation and fruit tree plantation programme for non-arable land and cropping plan for arable land were developed keeping in view the physical characteristics of the land, climatic conditions, and needs and resources of the local people. An important feature of the recommended crop pattern was introduction of pulse crops and allocation of higher acreage to oilseeds and spices; before the project no pulse crops were grown in the watershed. Contingency crop patterns were also recommended for aberrant weather conditions. In the animal husbandry sector, the plan recommended replacement of local breeds of cows and buffaloes by high yielding improved/cross-bred animals and reduction in the number of sheep by their replacement by improved breeds of cows and buffaloes.

An attempt was also made in the plan to project the estimated costs and returns from various activities. But no ex-ante benefit-cost analysis was done for the project as a whole. The project also did not propose any organisation structure/mechanism for execution, monitoring and evaluation of the programme.

5.5 Project Implementation

The Soil Conservation Wing of the Department of Agriculture, GOK, was primarily responsible for execution of the Watershed Management Plan. But the BRC was expected to monitor and oversee the implementation and provide technical guidance and supervision. No additional staff and other facilities were provided to the BRC for taking up this additional responsibility. Consequently, the BRC felt constrained on this account and had to over-stretch its limited manpower and other resources to cope with this situation. Since the Joladarasi watershed is not part of the watershed in the Bellary district selected under the District Watershed Development Programme, there was no special/additional staff provided by GOK to implement the project. Implementation was done by the regular district level staff under the leadership of the Principal Agriculture Officer (PAO). Deputy Director of Agriculture (Soil Conservation) guides, and supervises the soil conservation work in the district including the work in the Joladarasi watershed. Crop production programme is

looked after by the P.A.O, horticulture by the Assistant Director (Horticulture), forestry by the Assistant Conservator of Forests and animal husbandry by the Assistant Director (Animal Husbandry). The district level staff are assisted by a complement of technical staff. At the project level, agricultural assistants, horticultural assistants, and foresters are responsible for execution of the activities/works as per the approved project. The soil and water conservation works are done departmentally by contract labour. Due to shortage of labour in Village Joladarasi and other neighbouring villages, a bulldozer was hired at the rate of Rs.345 per hour from the Karnataka Agro-Industries Corporation for constructing farm ponds and graded bunds. Shortage of labour was caused due to migration of labour from this area to the irrigated cotton tract of the state where wage rates were higher being Rs.14-15 per day vis-a-vis Rs.9.50 per day in the area. As a matter of fact, use of bull-dozer proved to be very useful in the sense that the construction of farm ponds and graded bunds was completed in a record time of 30 days and the funds did not lapse.

Progress as of October 1987 of the various activites initiated under the Project is presented in Exhibit 10. The project activities were phased for implementation over a period of two years, 1984-85 and 1985-86. As of October 1987, most of the targets had been achieved excepting that no activities could be initiated under the horticultural and animal husbandry sub-sectors.

Exhibit 10: Progress of Various Activities of Joladarasi Watershed Development Programme as of October 1987 *

Sl.	Activity/item	Physical progress	Financial progress (Rs.)	Unit Cost (Rs.)
I.	Soil and Water Conservation Works			
	1. Diversion drain	1250 m	7538	6.03
	2. Graded bunds	500 ha	107923	215.84
	3. Stone checks (No)	273	211978	776.47
	4. Land smoothening	250 ha	27160	108.64
	5. Grassed Waterways	481m	5700	11.85
	6. Farm ponds (No)	10	75385	7538.00
	7. Check dams	Nil	Nil	-
II.	Afforestation/Plantation Programmes			
	8. Graded bunds	2590 m (1900 plants)	N.A.	N.A.
	9. Drop structures (No)	253 (4870 plants)	N.A.	N.A.
	10. Waterways and eroded area	2590 m^2 (1420 plants)	N.A.	N.A.
	11. Cultivated fields	8500 m^2 (1200 plants)	N.A.	N.A.
	12. Vegetative bunds	5000 m^2 (2400 plants)	N.A.	N.A.
	13. Alley cropping	10000 m^2 (4 kg (Leucaena seed)	N.A.	N.A.
	14. Around ponds (No)	4 (120)	N.A.	N.A.
III.	Horticultural Programme	Nil	Nil	Nil
IV.	Crop demonstrations	Nil	Nil	-
V.	Supplemental irrigation through recycling of run off	1.38 ha	N.A.	N.A.

* Source : S. Chittaranjan, Progress Report of Joladarasi Watershed, The Central Soil and Water Conservation Research and Training Institute, Research Centre, Bellary.

This was because of the indifferent attitude of the GOK officials concerned. At the State level, the Secretary, Department of Agriculture and Horticulture, and other officers in the concerned line Departments of GOK were not even aware of the existence of the Joladarasi project. This can be attributed to lack of necessary initiative on the part of BRC to secure the involvement of the State level officers of GOK concerned. But for the active interest taken by the Project Coordinator, Mr. S. Chittaranjan, we doubt if the progress in implementation had been as satisfactory as it has been now.

No data were available to determine the extent to which the recommended cropping plan was adopted by the farmers. But my impressions,gathered from my visit to Joladarasi village and from my group and individual interviews with farmers there, are that no significant changes have taken place so far in the cropping pattern. Yields of the crops grown in the village had been very poor in the previous three years, i.e., 1984-85, 1985-86, and 1986-87 due to drought. But the year 1987-88 was normal, and so were the crop yields. In the opinion of the President of the Village Panchayat, "yields have increased recently due to use of chemical fertilizers but effects of the soil and water conservation measures are not yet visible". This perhaps sums up the over-all impression of the villagers about the impact of the project.

My field visit and interview with a group of 15 farmers of Joladarasi village in the evening of April 2, 1988, revealed the following about the implementation of the project:

1. Graded bunds should be dressed with murrum, otherwise the bunds would be washed away in 2-3 years. For this purpose, it will be necessary to increase the unit cost ceiling of graded bunds. The Assistant Director of Agriculture, Bellary, who is a native of village Joladarasi and who was present in the meeting, told us that the GOK had been requested to raise the unit cost but so far no action had been taken.

2. The Project Coordinator, Mr. S. Chittaranjan, told the group that if farm ponds are accepted by the farmers, murrum would be available as a by-product and could be used for dressing of graded bunds. I personally visited four farm ponds that had already been completed and saw that there was a lot of murrum that had come out when the excavation was done for constructing the ponds.

   One of the big farmers whose fields we visited was interested in having both a farm pond constructed and his land levelled using the bull-dozer that was hired for constructing farm ponds under the programme. But since land levelling was not included in the project, he

was denied the use of the bull-dozer for the purpose. Consequently he decided not to have a farm pond as well.

3. One of the ponds had some water still available in April which was being used by the villagers for drinking purpose. All the four farm ponds as also six others that had been completed under the project belonged to big farmers who perceived them as useful. But small farmers did not seem to be convinced about the utility of farm ponds and waterways. They argued that these structures take so much of the land and there were no tangible benefits from them. In the years of scanty rainfall, there is not enough runoff to fill up the ponds, and in the years of good rainfall, they do not need the water that is stored in the ponds, so they said.

4. I also saw that most of the waste weirs, which were constructed earlier before the project was launched, had collapsed and no repairs had been done. This has created a bad impression among the farmers about the technical expertise of the GOK soil conservation staff. Repairs could not be undertaken because there were no government funds available for the purpose and the farmers did not consider it worthwhile to invest their money in the repair work. The villagers had all praise for the quality of the waste weirs

constructed when the Bellary district was part of the Madras Presidency.

5. Although the plan was good, there were problems in its execution due to lack of proper training of the staff responsible for implementation.

Funds for implementing the project were made available by the GOK from the plan provisions for DPAP. The BRC wanted the project to be treated as part of DWDP but the GOK did not agree to the proposal. Works on non-arable lands owned by the GOK or the village community and on the holdings of marginal and small farmers and SC/ST households were done at 100 percent GOK cost whereas works on big farmers' holdings were subsidised to the extent of 50 percent and the remaining 50 percent of the cost was treated as a long term loan repayable in 15 annual instalments as per the provisions of the Karnataka Land Improvement Act 1961. No funds are available for land smoothening. Needy farmers can avail of the short term crop loans that are available from the farmers' service cooperative society and the Tungabhadra Regional Bank both located in Chellagurki village which is 2 km away from Joladarasi village. Under the Model Watersheds Programme of ICAR, there is a provision of Rs.200 per beneficiary for a total of 100 demonstrations in the project area. However, there is not money provided in the ORP for conducting adaptive trials in the watershed. This is considered by the BRC as a constraint in evolving appropriate technologies for the watershed.

5.6 Monitoring and Evaluation

The BRC is responsible for monitoring the programme. A progress report is brought out annually and field visits are made by the Project Coordinator and members of his team from time to time to supervise and guide the field work. No review or coordination committees existed at any level. The Operational Research Project staff of the BRC conducted in 1987-88 a survey of all the 96 farmers in Joladarasi village and of 80 farmers in other neighbouring villages outside the Joladarasi Watershed to assess the impact of the project on yield rates of the major crops grown in the project area. Exhibit 11 summarises the yield data collected through the personal interviews of the selected households. The yield data are based on recollections of the respondents and hence are perhaps not as reliable as the ones based on random crop cutting experiments are believed to be. Also, 'Before and Now' comparison of yield data is meaningless because the year before the project was launched, 1983-84, was a normal crop year whereas the year (Now) under reference, 1986-87, was a drought year. Hence, we have made no attempt to compare the yield data on the 'Before and Now' basis. In Exhibit 11, the yield data are compared on the 'With and Without' basis and the observed differences in yield rates between the Project (within the watershed) and the Non-project (outside the watershed) villages are attributed to the project assuming that all other factors affecting crop yields were comparable for the two sets of villages.

Exhibit 11 : Yield Rates and Net Returns of Major Crops Within and Outside Joladarasi Watershed, 1986-87*

Crops		Yield (Kg/acre)		Net Returns (Rs/acre)		Percent increase of within over outside	
		Within the water shed	Outside the water shed	Within the watershed	Outside the watershed	Yield	Net Returns
1.	Jowar	282	231	406	260	22	56
2.	Coriander	63	60	630	666	5	-5
	+	+	+			+	
	Safflower (Inter crop)	93	97			4	
3.	Coriander	52	46	422	365	13	16
	+	+	+			+	
	Safflower (Mixed crop)	74	78			-5	
4.	Safflower (local)	141	134	163	125	5	30
5.	Bengalgram (improved)	110	97	-320	-337	13	5
6.	Bengal gram (local)	100	NA	-321	NA	-	-

* Source : Records of Joladarasi Operational Research Project, Central Soil and Water Conservation Research Institute, Research Centre, Bellary.

As shown in the exhibit, the average yield of jowar, which is the staple food crop of the area, was markedly (22%) higher in the watershed than outside the watershed. Similarly, the average yield rates of coriander, safflower (mono crop) and Bengal gram were also higher in the watershed. However, the average yield of safflower, when inter-cropped and mixed-cropped with coriander, was marginally lower in the watershed than outside the watershed. That the higher yield rates of crops in the watershed were economically desirable is evident from the last column of the exhibit which shows that the net returns from all the crops considered except coriander + safflower (inter-crop) were markedly higher in the watershed than outside the watershed. This shows that the project had a positive impact on the yield rates of most of the crops grown in the area. Attribution of the observed impact to individual factors, ie., improved seeds, fertilizers, field bunds etc., is not possible without using the technique of multi-variate analysis with dummy variable and that is beyond the scope of this study.

5.7 Awareness and Opinions of Farmers

To find out the extent of awareness and opinions of the farmers about the project, we interviewed a sample of 22 farmers randomly selected from Joladarasi village. The sample constituted roughly 22 percent of the total number of farmers in Joladarasi village and comprised 3 marginal farmers (< 2.50 acres), 3 small farmers (2.50

- 5.00 acres) and 16 medium and big farmers (> 5.00 acres). The number of farmers selected from each size group of land holding was in proportion to the total number of farmers in that group. Exhibit 12 summarises the results of the interviews. As shown in the exhibit, all the respondents were aware of the project, and were participating in it in the sense that each one had adopted atleast one of the recommended technologies. Most of the farmers interviewed, however, did not have a clear understanding of the watershed approach; to them, the project meant distribution of free or subsidised improved seeds and fertilisers and construction of bunds, water ways, and farm ponds.

All of the marginal farmers, 67 percent of the small farmers and 75 percent of the medium and big farmers interviewed reported that they had benefited from the free and/or subsidised inputs like improved seeds, and fertilisers, distributed under the project. Those who did not benefit from the project did not complain about it.

Most of the respondents (59%) reported that there were no marked changes in the crop yield rates after the launching of the project. Some 41 percent of the sample farmers said that their crop yields had gone up after the project came into being and this, they attributed to improved seeds and fertilisers. Most of farmers believed that use of fertilisers under the conditions of uncertain rainfall which prevail in the watershed was

Exhibit 12 : Awareness and Opinions of Farmers About the Joladarasi Project, 1987-88

Item	Percent of Sample Farmers Reporting			
	Marginal farmers (< 2.50 acres)	Small farmers (2.50-5.00 acres)	Medium and big farmers (> 5 acres)	All farmers
1. Total number of respondents	3	3	16	22
2. Aware of the project	100	100	100	100
3. Participating in the project	100	100	100	100
4. Benefited from free/subsidised inputs	100	67	75	77
5. Increased crop yields	34	0	50	41
6. No marked change in crop yields	66	100	50	59
7. Increased income from crops	66	0	75	64
8. No marked change in income from crops	34	100	25	36
9. Increased employment	100	66	25	41
10. No marked change in employment	0	34	75	59

not beneficial. This belief was based on their own experience; they used fertilisers provided free under the Model Watershed Programme and by a fertiliser company but, due to drought, their entire crop failed. So, they argue that if they use purchased inputs

particularly fertilisers and if there is not adequate rainfall, their loss is increased by the amount expended on the purchased inputs. This seems to us the main reason why farmers in the rainfed areas do not use purchased inputs at all or use at very low levels. In our opinion, crop insurance is the only answer to this problem; extension education and crop demonstrations have not produced the desirable results.

Some 64 percent of the respondents reported increased income from crops after the launching of the project whereas 36 percent of them said that their income from crops did not change markedly. So far as employment is concerned, 59 percent of the respondents reported no change in employment and 41 percent said that employment had gone up after the project came into being. During the course of our interviews with the farmers, we came to know that they are, in general, averse to doing physical work even in their own farms and in most cases they depend upon hired labour or share croppers to get various farming operations done. As a result there is acute shortage of labour in the village and that is why a bull-dozer had to be hired by the project implementing authority for constructing graded bunds and farm ponds in the watershed. Another reason for shortage of labour in the village is seasonal migration of village labour to the irrigated tracts in the state where they get much higher wages than in the village.

5.8 Strengths and Weaknesses

Strengths: The following seem to be the major strengths of the project:

1. Good technical back up from the BRC and a good technical plan prepared by the BRC staff after conducting necessary surveys and analysing all relevant data.

2. Easy access to the watershed by both the BRC and the GOK staff.

3. Generally cooperating attitude of the villagers and its leaders.

4. Successful demonstration of the utility of farm ponds in farmers' fields along with graded bunds and grassed waterways.

5. Substantial scope for development of oilseeds, spices, horticulture and animal husbandry (cow and buffalo) sub-sectors.

Weaknesses: The project seems to be suffering from the following handicaps:

1. Shortage of labour for construction of soil and water conservation structures.

2. Lack of technical training and motivation on the part GOK staff responsible for execution of the project and consequently their low credibility among the villagers.

3. Lack of flexibility at the project level particularly in the financing scales/norms which in most cases are not realistic vis-a-vis the conditions obtaining in the watershed.

4. Lack of association of social scientists at the stages of project formulation, project implementation and project monitoring and evaluation.

5. No formal linkages between the State Watershed Development Cell and the project and between the GOK and the BRC.

6. Weak coordination between the planning (BRC) and the implementing agencies particularly the Zilla Parishad and the Mandal Panchayat.

7. Lack of active involvement of villagers in the programme.

5.9 Conclusions and Suggestions

On the whole, the Joladarasi Watershed Development Project demonstrates that for good results it is necessary that not only the plan be technically sound but it be implemented faithfully by the staff who are technically competent, properly trained and adequately motivated. Government support and People's involvement at all the stages of planning, implementation, monitoring and evaluation are also crucial factors affecting the success of a watershed development

programme. MYRADA's experience in the PIDOW Project in Gulbarga district may be drawn upon to secure people's participation in the Project.

The project should have been treated as part of the Karnataka's District Watershed Development Programme and its execution given more importance by the GOK than what it actually received. The technologies and the expertise available with the Bellary Research Centre could be better utilised by the GOK for improving the technical contents of its watershed programme in the State. For this to happen, it will be necessary for the GOK to take the initiative and establish good working relationship with the Research Centre and to financially support its Operational Research Project activities at least partially, if not fully.

CHAPTER 6

WADAGERA PROJECT OF MYRADA'S PIDOW PROJECT

6.1 Introduction

The Mysore Resettlement and Development Agency (MYRADA) is a voluntary agency headquartered in Bangalore. MYRADA specialises in rural development projects. Participative and Integrated Development of Watersheds (PIDOW) is a tripartite project jointly initiated by the GOK, the Swiss Development Cooperation (SDC), an agency of the Swiss Government and MYRADA. PIDOW was formally launched in Gulbarga district of Karnataka in September 1984 after the agreements had been signed between the GOI and the Government of Switzerland (GOS) and between SDC and MYRADA and GOS had cleared the funds. The PIDOW Project is located in an area which is not part of the watershed selected under the DWDP in Gulbarga district.

6.2 Project Area of PIDOW

The Gulbarga district authorities originally in 1983 selected 20 villages in the Kamalapur revenue circle of Kamalapur taluka in Gulbarga district for inclusion in the PIDOW project. In March 1985, MYRADA proposed and the other two partners agreed to redefine the project area by including all the 26 villages of the Kamalapur circle and one village outside. These 27 villages have 36 hamlets (tandas) and are spread over four watersheds, namely, Dongergaon, Sonth, Jeevangi, and Kamalapur.

MYRADA soon realised that people could never effectively participate in planning and management of watersheds in such a large area and MYRADA would not be able to effectively play its intended role of encouraging people's participation and promoting among them awareness of the on-going government rural development programmes. Therefore, after a workshop in May 1986, with the PIDOW staff located in Gulbarga, it was decided to concentrate the project activities in three mini-watersheds which were neither too large nor too small. A fourth mini-watershed was added later in 1987. These four mini-watersheds are located within the jurisdiction of the original four watersheds. Details of the four mini-watershed selected under PIDOW project are given in Exhibit 13. We selected the Wadagera mini-watershed for detailed study.

Exhibit 13 : Geographical Area and Number of Families in PIDOW Project Area by Mini-watershed*

Sl.No.	Mini-watershed	Total geographical area (ha)	No. of families
1.	Wadagera	148	70
2.	Bhagwantanda	250	65
3.	Bandankera	375	104
4.	Harjee	342	107

* Source : PIDOW GULBARGA, People's Participation in the Management of Mini-watersheds: The "P" in PIDOW, Rural Management Systems, Paper 6, MYRADA, March 20, 1988.

6.3 A Profile of Wadagera Mini-Watershed

General: Wadagera village is located in the Gulbarga taluka of the Gulbarga district in Karnataka which is a drought prone district. It is 40 km away from Gulbarga and 5 km away from Kamalapur which is its revenue circle and Mandal Panchayat headquarters. Wadagera mini-watershed is one of the four mini-watersheds where the PIDOW project of GOK - SDC - MYRADA is underway since May 1986. The mini watershed has land owned by families living in four villages, namely, Wadagera, Kamalapur, Basavana tanda and Bangara. The watershed drains into the western tributary of Benithora river.

Climate: The climate of the area is semi-arid to arid with an average annual rainfall of about 650 mm distributed over six months from June through November. Year to year fluctuations in rainfall are quite high ranging from 50 percent to 200 percent of the normal rainfall. September is the wettest month, December the coldest and May the hottest. The mean daily minimum temperature in December is around 15 ^{o}c and the mean daily maximum temperature in May around 42 ^{o}c. The period from December to May is the driest part of the year. Winds are generally light to moderate.

Soils: The soils found in the area are shallow to very shallow on the flat tops and slopes and shallow to medium in the flat bottoms of the valleys. The soils consist of black clayey loams, red sandy loams, and laterites. The soils are prone to heavy water and wind

erosion. Degraded lands consisting of rocks, boulders and stones are found on the tops of hillocks and along the steep slopes, gullies, and nalas. The terrain is undulating with altitude ranging from 500 to 660 *m* above the mean sea level.

Land Use: The mini-watershed has a total geographical area of about 148 ha of which about 100 ha (67 percent) was cultivated, about 33 percent was partly wasteland and partly pastures. There were no forests in the mini-watershed nor any revenue lands. Most of the land was privately owned. No land capability classification of the mini-watershed has been done.

Agriculture: As mentioned before, about 100 ha (67% of the total area of the watershed) was cultivated. About 12 ha of the cultivated area was irrigated in suminei only from seven irrigation wells. Some 16 farmers shared the irrigation water from these wells. The majoi crops grown in the mini-watershed included jowar, bajra, maize, tur, groundnut, sunflower, castor, soyabean anci cotton. In some areas paddy and wheat crops also were grown. Yields of crops grown with traditional practices were low but recently high yielding varieties of paddy, cotton, wheat, maize and bajra have been introduced anci as a result, yields have gone up.

Land Holdings: The total population of the mini-watershed was 651. The total number of families having land within the mini-watershed was 65 of which 47 were

living within the mini-watershed and 18 outside. There were five landless families living within the mini-watershed. About 41 percent of the farmers were big, 9 percent small and the rest 50 percent marginal. The average size of cultivated land holding was about 1.50 ha.

Livestock: The total number of animals in the mini-watershed was 370 which consisted of cows (140), buffaloes (51), bullocks (69), and goats (110). Thus, the average number of animals per ha of cultivated area was 3.7.

Infrastructure: Wadagera has reasonably good infrastructure. It is electrified, is linked to Kamalapur by an all-weather motorable road, has a primary school, one community well for drinking water and a community television set. All other facilities are located at Kamalapur which is within the mini-watershed area some 5 km away from Wadagera.

6.4 Objectives of PIDOW[18]

1. To support farmers and village communities in their own efforts to improve their livelihood in semi-arid rural areas;
2. To develop an approach for participative and integrated rural development, based on small watersheds, with the scope for adapted replication;

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18. Based on Annex 1 of the report, PIDOW : Joint Assessment 1987, GOK, SDC, MYRADA, October 1987.

3. During Phase 1, the project shall:

- support financially a selected number of on-going government programmes for dry land agriculture, water management, village forestry, village health and rural artisans;

- encourage people's participation in such programmes and promote development awareness with the support of a voluntary agency;

- conduct action research and undertake pilot implementation in above-mentioned fields of activities in close cooperation with concerned government agencies;

- give preference to the involvement of rural households below poverty line and acknowledge the important role of women in rural development.

4. To make the Government systems and programmes more appropriate and effective through people's involvement in planning, implementation, and feed-back.

6.5 Project Initiation, Formulation, and Planning

The origin of PIDOW can be traced to the Agreement on Technical and Scientific Cooperation between GOI and GOS signed in 1966. It was under this Agreement that the SDC and GOK established contacts for cooperation in Integrated District Development. In August 1980, the

District Rural Development Society (DRDS) of Gulbarga, at the behest of the Secretary, Planning Department, GOK, prepared an Outline of Development Project. This Outline reflected GOK's aim to provide a supplementary assistance to less developed districts. The Outline was forwarded to the Department of Economic Affairs (DEA), Ministry of Finance, GOI, in August 1980. In May 1982, DEA cleared the project proposal and requested the SDC for financial assistance. In December 1982, SDC sent a fact finding mission to Gulbarga which had discussions with the concerned heads of departments. Subsequently, intensive discussions and exchange of letters took place between SDC and GOK to reach a common understanding on the desired nature of cooperation. Both the parties agreed that the benefit of the project should mainly reach the weaker section of the population and that the activities of the project should be coordinated or matched with the on-going government programmes in the project area. SDC stressed, in addition, that emphasis be given to active participation of people, particularly the women and children.

Accordingly, a Revised Project Proposal was prepared by DRDS, Gulbarga and forwarded to SDC in July 1983. Further discussions between SDC and GOK resulted in the formulation of a Project Outline by SDC which was handed over to GOI and GOK in July 1984. The outline proposed a tripartite partnership between GOK, SDC, and MYRADA aiming at promoting people's participation in integrated rural development on a watershed basis. MYRADA was

assigned the task of creating awareness and fostering proper organisation of people in close cooperation with the concerned GOK officials.

The outline proposed the following phasing: (1) Pilot Implementation-cum-Action Research (2 years); (2) Integrated Area Development on Watershed Basis (3 years); and (3) Replication (from the Sixth year onwards). An understanding was reached between GOI and GOS on the need for a Pre-project Phase from September 1984 to March 1985. In September 1984, GOS cleared the funds which was followed by the signing of a contract between SDC and MYRADA.

The purpose of the Pre-project Phase was to identify the needs of the people, to initiate the cooperation between the partners and to appraise the feasibility of the watershed approach in the project area. The Phase had to be extended upto July 1985. An SDC Mission appraised the progress of work in February-March 1985 and contributed to the design of Phase 1. It commented, among other things, on the lack of a conceptual framework for a participative watershed approach. Subsequently, a Swiss Project Advisor was located in Gulbarga in June 1985 and he established contacts with the MYRADA Team which had already been formed in September 1984 and the Gulbarga district authorities to support them in the preparation of a programme for Phase 1 of the project.

Despite the necessary follow-up by SDC and GOK, the proposed Bilateral Agreement between GOI and GOS could not be signed as scheduled. However, it was decided to start Phase 1 of PIDOW by extending the contract between SDC and MYRADA and by seeking informal support from the GOK departments in Gulbarga for joint actions.

At last the Agreement between GOI and GOS was signed on September 2, 1986, with retrospective effect from July 1985 and valid until March 1988.

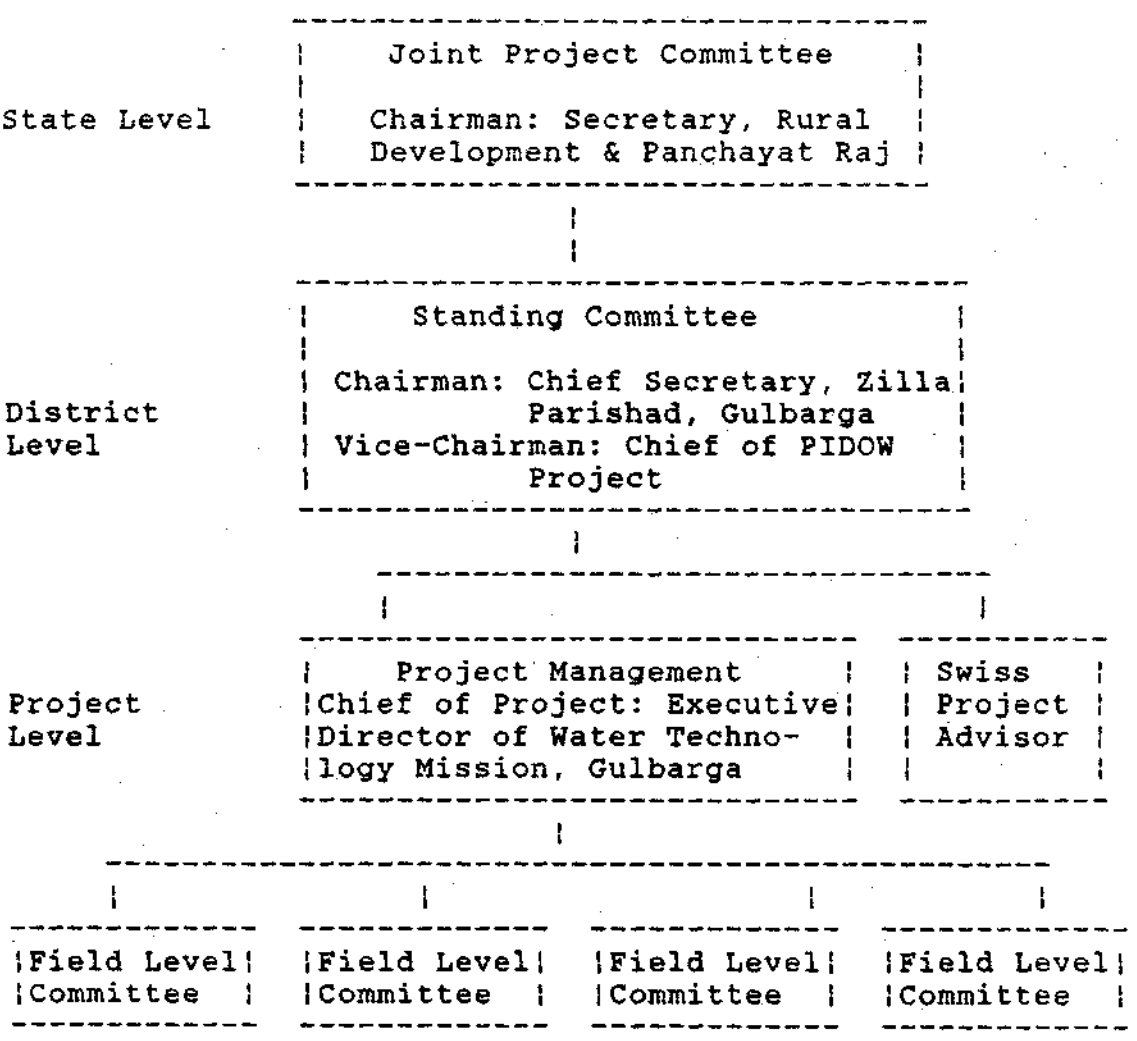
The GOK departments in Gulbarga formulated, in collaboration with the Swiss Project Advisor and the MYRADA staff, programmes for soil and water conservation, drinking water, forestry and road construction. The other programmes of PIDOW included bio-gas plant repairs and construction, formation of Village Development Associations, Women's groups (Mahila Mandals), Youth Groups, Labourers' Groups, Groups of Handpump mechanics and other skilled persons, planting of trees along avenues, fodder growing, construction of soakpits etc.

6.6 Project Organisation and Management

The project organisation is a three-tier structure (Chart 2). At the state level, a Joint Project Committee (JPC) which is chaired by the Secretary, Rural Development and Panchayat Raj and is located in the Directorate of Area Development Programmes, is responsible for policy decisions, and for overseeing,

directing and monitoring of the project. JPC also approves the annual plan and budget of PIDOW. At the district level, a Standing Committee which is headed by the Chief Secretary, Zilla Parishad, Gulbarga, is responsible for programme planning, coordination and monitoring of the project. The third tier consists of the Project Management which is headed by the Executive Director of the Water Technology Mission and is based in Gulbarga. It is assisted by four field level Committees, one for each of the four mini-watersheds. The Project Management is responsible for implementation

Chart 2 : Organisation Structure of PIDOW Project



of the PIDOW programmes in close collaboration with the concerned GOK departments. It prepares work plans and budgets for submission to the JPC. It manages the funds of the PIDOW Project. It consists of the Chief of Project, the Swiss Adviser and the MYRADA Team Leader in Gulbarga. But strangely, it neither has an office nor any staff which are so necessary for its effective functioning. The first and the third tiers are tripartite having representatives from GOI, GOS, and GOS. After the Zilla Parishad Act came into force in April 1987, PIDOW has come under the Zilla Parishad system. The Zilla Parishad now is responsible for the over-all supervision, coordination, and integration of all development schemes at the taluka and the district levels and for preparation and execution of district development plans.

Under the Zilla Parishad Act, the Mandal Panchayats are assigned the responsibility of preparing plans for development of areas within their jurisdiction. The Wadagera mini-watershed comes under the jurisdiction of Kamalapur Mandal Panchayat. The three-tier organisation structure of PIDOW does not include the Mandal Panchayat as a separate entity but includes the so called field level committees in the project area as part of the district level Project Management. The role of the field level committees vis-a-vis the Mandal Panchayats is not clearly defined at present. Similarly, it is also not clear whether the GOI funds for PIDOW would be channeled through the Zilla Parishad or directly through

the Chief of Project in the Project Management. All these things need to be clarified to ensure smooth functioning of the Project.

The Chief of Project is responsible for the management of inputs and funds provided by GOI. He is a member of JPC and heads the district level Project Management. The present incumbent took charge in June 1987.

The Swiss Project Advisor is responsible for the management of funds provided by GOS. He is a member of the Project Management. He maintains liaison between PIDOW and other projects and organisations, assists the partners in planning, implementing, monitoring, and evaluation of the PIDOW programmes. The Swiss Advisor assumed office in June 1985 and had left the project in March 1988 at the close of Phase 1 of the project.

6.7 Project Implementation and Monitoring

The GOK district level departments now under the control of the Zilla Parishad, Gulbarga, and MYRADA Team at Gulbarga are responsible for formulation and implementation of PIDOW programmes under the over-all guidance and supervision of the Project Management and the Standing Committee. The following officers, departments, and agencies of GOK are involved in implementation and monitoring of the PIDOW programmes:

1. Deputy Director of Agriculture (Soil Conservation)
2. Executive Engineer, Zilla Parishad (Public Health Engineering)

3. Karnataka Land Army Corporation (Village roads/drainage)
4. Principal Agricultural Officer (Dry land agriculture)
5. Deputy Conservator of Forests (Social Forestry)
6. Senior Assistant Director of Animal Husbandry and Veterinary Services
7. Karnataka Milk Federation (Fodder Development)
8. Deputy Director of Sericulture
9. District Horticulture Officer
10. District Health Officer (Primary Health)

Unlike the DWDP which is administered by a special organisation structure created by GOK, the PIDOW Project is administered by the normal development staff of GOK provided at the district level and enumerated above. From the list, it is clear that the GOK departments/agencies implemented programmes in such areas as agriculture, soil conservation, horticulture, sericulture, public health engineering, primary health, village roads, social forestry etc. In two meetings of the PIDOW Standing Committee held so far, progress of the Project was reviewed, plan of action approved and funds released to the concerned departments.

A MYRADA Team was formed in Gulbarga in September 1984 for formulating and implementing the PIDOW programmes assigned to MYRADA. MYRADA's tasks were to promote people's participation mainly through community development and training programmes and to experiment

with different options for participative development; to function as a spear-head agency for implementation of government programmes; and to experiment with new approaches and technologies in the fields of relevance to PIDOW. The MYRADA team is supervised by a Programme Officer from the MYRADA headquarters in Bangalore. At present the MYRADA Team at Gulbarga is headed by a Project Coordinator who is assisted by a Deputy Project Coordinator. The technical staff consists of 9 subject matter specialists and watershed managers including one woman and 19 extension workers. The Team has a head office in Gulbarga and a field office in Kamalapur where most of the technical staff is located.

Since the PIDOW Project is not part of the DWDP, there is no effective working relationship between the MYRADA staff and the DLDB, Gulbarga staff. The normal development staff at the district level do not take necessary interest in the project.

The Project Coordinator, PIDOW, told me during my visit to Gulbarga that he had been trying for quite some time to obtain from the block development officer (BDO), Kamalapur, and other GOK departments, copies of rural engineering survey reports and development plans which the GOK/Zilla Parishad staff are understood to have formulated for the Project area but the GOK officials have not provided the needed documents so far. A similar attitude towards the PIDOW Project prevails at the State level. Both the Secretary, Department of Agriculture and Horticulture, and the Director, State Watershed Development Cell, do not seem to appreciate

the significance of the project in general and of MYRADA's role in particular.

No uptodate information was available with MYRADA about the progress of various works taken up by GOK staff in the Project area. However, some of the achievements of the project are as follows. Under special Drought Relief programme sponsored by CARITAS, Switzerland, and initiated in the project area in early 1986, 44 borewells fitted with handpumps have been constructed. Consultancy missions to explore the possibility of fodder development, agro-forestry, handicrafts design and soil conservation and water management were organised to help the PIDOW project staff to understand the problems and potentials in these areas. In February 1987, a joint SDC/MYRADA/CRIDA mission organised a planning workshop for the MYRADA staff. A support mission in July/August 1987 prepared reports on MYRADA Staff Development and on the Design of Conservation Structures. A resource person from CRIDA followed up the agricultural trials and demonstrations. A workshop on Human Behaviour and Interpersonal Relationships was conducted with the MYRADA Team by a professor of the Indian Institute of Management, Ahmedabad.

I visited along with the MYRADA Team and the Project Coordinator Bandankera village on March 31 and Wadagera village on April 1, 1988 and had discussions with villagers -- both men and women -- to find out what they think about PIDOW and its activities. The following

points emerged out of my village visit and meeting with some 30 villagers in Wadagera village:

1. There were six smokeless chullahs, one biogas plant, and one compost pit constructed in the village under PIDOW. My interview with one of the six beneficiaries of the smokeless chullah revealed that he and his wife were both satisfied with the new device which, in their opinion, saved them 50 percent of the fuelwood and did not harm the eyes of the house wife because the smoke was safely emitted out through the chimney. The total cost of the chullah was Rs.170 of which Rs.50 were granted by MYRADA, Rs.50 were made available as a loan from a bank the rest Rs.70 were contributed by the beneficiary. But surprisingly, the beneficiary's brother next door did not have a smokeless chullah nor was he interested in having one apparently because of his poverty and lack of conviction about the benefits.

2. Block plantation was done on 3 ha of land in the village and the growth of plants was satisfactory. A small nursery was established in the village to raise saplings to plant on the bunds.

3. Approximately, 20 - 25 percent of the privately owned land in the village was still unbunded. The farmers did not seem to be convinced of the benefits from bunding; as a matter of fact, one of the farmers complained that due to removal of top

soil for making the bunds, his yield went down last year when the bunds were formed.

4. Farmers opined that bunds should better be made of stones which are locally available and not of good top soil. This suggestion, I was told by the Project Coordinator, was already being implemented.

5. The villagers narrated many cases where the soil and water conservation structures were wrongly designed. During my field visit, I personally saw many such structures including one in Bandankera village where a nala bund (check dam) built at a cost of over Rs.90,000, failed to stop water from seeping and the incident became a matter of big joke among the villagers and brought a bad name to the Soil Conservation staff of GOK.

6. A poor woman in Wadagera village complained that her 18 gunthas of land was taken away for installing a community bore well without any compensation paid to her.

7. Farmers were not aware of any soil and water conservation plan said to have been prepared by the Agriculture Department for the mini-watershed.

8. Many farmers complained that the border bunds were not stable; there were too many slips.

9. The farmers told us that under normal weather conditions and with traditional practices, jowar

yield is 4-5 q/acre, groundnuts 2-3 q/acre and tur 2-3 q/acre. They further said that yields can be easily doubled if improved seeds and fertilizers were used. Crop yields in 1987-88 were low due to drought, they told us.

MYRADA had successfully organised four groups in the Wadagera mini-watershed. Of these groups, the Wadagera group in which all the 52 families living in the village are represented was doing very well. The group was socially functional, had included all the five landless families in the village as its members and given them loans out of the common fund raised through savings, group contribution and recovery of loans given for crop production in the village. Besides, MYRADA has trained quite a few female community health promoters in the village. To clarify various conceptual issues involved in developing and implementing a participative approach to watershed development, MYRADA had as of March 1988 prepared and issues six papers. These papers serve as guidelines in implementing the PIDOW programmes.

The MYRADA Team at Gulbarga comprises young, hard working, enthusiastic, technically competent and reasonably well motivated persons. However, they need more experience to develop confidence. They also need training in project formulation, monitoring and evaluation. They visit all the project villages regularly, hold night meetings there, provide information to villagers about PIDOW and other

development programmes, educate and train them, help them with their personal problems and enthuse them to adopt new appropriate technologies. The Project Coordinator, who is a retired GOK Joint Director of Agriculture, enjoys himself very much talking to villagers and narrating stories and incidents from great epics like Geeta, Mahabharata and Ramayana to illustrate his points.

Monitoring at the project level is done formally through monthly staff meetings and informally through visits and feedback received from various sources. Operational problems are identified soon after they crop up and remedial action taken expeditiously.

Two-thirds of the funds (Rs.40 lakhs) for implementation of the PIDOW programmes in Phase I (October 1986 to March 1988) came from SDC and one-third (Rs.20 lakhs) from GOK. Pending clearance of SDC for Phase II of PIDOW, the Zilla Parishad has agreed to release its share (30 percent) of the total project cost estimated at Rs.99 lakhs for a period of three years. So far, availability of funds has not been a constraint in the successful implementation of the project but there have been delays in the release of GOK funds.

Two distinct patterns of financing soil and water conservation works co-exist in the project area. If the work is done under the PIDOW project, the beneficiary contributes or hires approximately one-third of the

labour required for the work. Wages for the remaining labour and other inputs are provided by the project. But if the work is done by the GOK staff, all inputs and labour are provided free to the beneficiary. Besides, crop loans are available from the cooperative society and loans and subsidies for purchasing milch animals are available from IRDP. In Wadagera village, soil and water conservation works were done by GOK and a bulldozer was hired for the purpose.

6.8 Strengths and Weaknesses

Strengths: The PIDOW project seems to have the following strengths:

1. Association of a voluntary agency, MYRADA, to handle the most complicated and most difficult task of involving people in watershed planning and management. Government departments/agencies cannot handle this aspect as effectively as a non-governmental agency.

2. Innovative and flexible approaches used by MYRADA in planning and implementing the programmes assigned to it.

3. Close and mutually beneficial rapport with people established by MYRADA.

4. Association of SDC as a source of funds, as a guide, as a catalyst, and as a partner.

5. Training of hand pump mechanics, community health promoters, and field level staff and organization of people for credit management.

Weaknesses: The following factors seem to have detracted from the effectiveness of the PIDOW project:

1. Late entry of GOK (in January 1987).
2. Lack of a project document clearly elaborating the objectives, approaches, activities, and roles of the three partners involved, i.e., GOK, SDC/GOS and MYRADA.
3. A weak data base on project area and people living there.
4. Uncertainty about the location of PIDOW in the GOK system after the introduction of Zilla Parishad Systems.
5. Lack of necessary technical back up.
6. Lack of motivation on the part of field level staff of GOK responsible for implementing various programmes like soil and water conservation, soil forestry etc.
7. Lack of close monitoring of behaviour of newly constructed soil and water conservation structures;
8. Lack of arrangements for training of MYRADA and GOK staff engaged in the implementation of the project.

9. Uncertainty about flow of GOK funds.

10. Lack of effective coordination between MYRADA and GOK.

11. Lack of in-built monitoring and evaluation system.

6.9 Conclusions and Suggestions

PIDOW has demonstrated, in a relatively short period of time, that it is very difficult and time consuming to harmonise the convictions, interests and ideologies of government departments, a voluntary agency and a foreign government agency and arrive at a mutually acceptable strategy of development and a mutually accepted common goal. Perceptions, visions and expectations of the three partners involved in the project continued to differ and that was reflected in the lack of a coordinated, integrated and people centred approach to watershed development and management.

Despite many teething problems that it had to face, MYRADA was, however, successful in establishing workable rapport with people and in organising them around some economic activities and in training of hand pump mechanics, community health promoters and its own field level staff. However, MYRADA could not initiate any worthwhile income generating programmes in the project area. SDC seems to have played its role as a financier, an adviser and a catalyst allright. GOK was not able to make its intended contributions to the

project due to its late participation in the venture and its attitude of indifference towards the project.

There is need to document and analyse the MYRADA's experience in organising people, mobilising their resources and securing their participation in rural development activities, to draw lessons from the experience and make them available to the GOK and other potential users within and outside the State. The GOK and the SDC should enable MYRADA to do this. Implementation of the Project could be improved if it becomes part of the District Watershed Development Programme which is underway in Mutchkullanalla watershed in Gulbarga district.

CHAPTER 7

LESSONS, IMPLICATIONS AND SUGGESTIONS

From the three watershed case studies and the overview of the Karnataka's District Watershed Development Programme presented in this report, we can draw many lessons. Some of the important lessons, their implications and my suggestions are presented below:

7.1 Selection of Watershed

The watershed approach to development of dry land agriculture requires that eventually every dry land watershed should be treated with appropriate soil and water conservation measures, and its land used according to its physical capability. Since the financial and manpower resources available for the purpose are often limited, ordering of all the watersheds in a state, district by district, in terms of urgency of treatment is necessary for cost-effective implementation of any watershed development programme. The watersheds may be arranged in a descending order of urgency of treatment and taken up for treatment in that order. Urgency of treatment is mainly determined by the extent of degradation of natural resources of the watershed; higher the degradation, greater the urgency. A watershed selected in this manner may be too large to be manageable. Therefore, further delineation and ordering of sub-watersheds/mini-watersheds in a selected watershed using the same criterion may be necessary for effective implementation of the treatment plan. There

are no hard and fast rules for determining the optimum size of a watershed that should be taken up for implementation. There is an upper limit to the size jointly determined by the requirement of people's participation and availability of resources and a lower limit jointly determined by indivisibility of both the watershed and managerial and technical staff below a certain level. The actual size will need to be determined within these two limits considering the availability of resources and ecological and socio-cultural heterogeneity of the watershed. For organising people and securing their involvement and participation in the programme, MYRADA has found it convenient to work with relatively homogeneous groups of 80-100 families. However? this need not unnecessarily reduce the size of a project to make it managerially un-viable. For people's participation purposes, more than one association or organisation can be created, if necessary, within a project area without compromising with the managerially viable size of the project.

7.2 Choice of Appropriate Technology

Technology for development of agriculture, horticulture, forestry and other related activities in the dry farming areas of India is now available with agricultural universities, research centres of the Central Soil and Water Conservation Research and Training Institute, other ICAR research institutes, CRIDA, ICRISAT etc. What is needed now is a large scale transfer of this technology to its potential users and its adaptation to

suit thi pteuliar ecological., toei^-cultural and institutional conditions of various regions/zones of the country. For this, a watershed approach of the Karnataka's DWDP type seems to be most appropriate and is worth emulating in other states. Needless to emphasise, the technology selected for transfer to farmers' fields should be simple to understand and apply, profitable and dependable and farmers should be trained to use it properly. A state level organisation is necessary to serve as a screening and clearing house for dryland watershed technology. Screening of the technology may be done on the basis of its projected effects on crop yields, income, income distribution, employment, and ecology.

7.3 Programme Planning and Project Formulation

A two-step procedure of diagnosis and prescription should be followed for this purpose. For diagnosis, a benchmark or baseline survey should be conducted by a multi-disciplinary team of specialists in agricultural and social sciences to assess the quantity and quality of the natural and human resources of the selected watershed, determine resource productivity, input use pattern, income, employment etc., identify felt needs of the- local people, and constraints on and opportunities for future development. After having diagnosed the strenghts and weaknesses of the existing system and felt-needs of the local people, a comprehensive master plan complete with maps, charts and exhibits should be prepared by a multi-disciplinary team of specialists

keeping in view the felt needs of the peoples, their resources, their constraints and their opportunities. The plan should indicate for each and every survey number/field in the watershed what soil and water conservation treatments are necessary, which crops can be grown successfully where, what inputs would be necessary to apply and in which quantities, how much produce would be available from each land use etc. The master plan should, then, be presented to the people to allow them opportunity to vet it and modify it to make it realistic. Then, the plan should be phased out, in consultation with the people, and annual action plans prepared for implementation.

The physical master plan should have a financial counterpart, i.e., a financial plan showing total requirement of funds, sources of funds etc. The plan should be subjected to tests of financial, economic, commercial, and organisational feasibility.

The master plan should also provide for monitoring and evaluation by both project personnel and an external agency of good repute.

The master plan should also specify as to how the plan should be implemented, i.e., who is going to implement, what, when, how, and where. Thus, planning should be integrated with implementation.

Ideally, a master plan should also have a contingency plan incorporated in it to cope with situations of

exceptionally bad or good weather conditions. This is all the more necessary for a dry land watershed development plan because dry land agriculture, being dependent on erratic and uncertain rains, is more risky and uncertain than the irrigated agriculture and hence requires appropriate safety measures to guard itself against the niggardly nature.

If the members of the planning team do not have requisite experience in dry land watershed planning, they should be sent for training at a place where needed expertise is available. It would also be worthwhile in such cases to seek the assistance of a professional development planner having relevant experience in this field.

7.4 Project Organisation and Management

A vertically integrated three-tier organisation structure with a state level Watershed Development Council, a divisional level Watershed Development Board and a project level Watershed Development and Management Team, all on the lines of Karnataka seem to be an appropriate machinery for watershed management. Besides, at the project level, farmers should also be organised into some kind of association, say, Watershed Development Association (WDA) so that their voice can be heard and they can have from the planners what they want. The coordination/management committees at all the three levels should have representatives from their constituent WDAs, besides technocrats, bureaucrats, bankers and academicians. All funds meant for watershed

development should be channeled through these coordination/management committees. Ideally, all programmes of agricultural and rural development should be implemented on a watershed basis and there should be no unnecessary duplication of scarce resources and facilities. A unified strategy of agricultural and rural development based on the watershed approach should be adopted all over the country. At the state level, a Directorate of Watershed Development may be created to direct, coordinate, and monitor the programme in the state. For operational convenience, the Directorate may be located in the Department of Agriculture. The concerned line departments should function like different divisions of a corporation at the state level, forget their traditional inter-departmental jealousies and work in unison towards a common goal.

7.5 Project Implementation

As mentioned in section 7.3, a good plan should specify how it should be implemented. Since implementation is the most crucial determinant of success of a plan, it should receive utmost attention and resources. Staff for implementation should be carefully selected, appropriately oriented/trained and reasonably well compensated. Implementation also needs planning and the implementation plan should be formulated in consultation with all the parties involved including, of course, the people. Implementation should not be left to the lowest level functionaries alone as it is done currently, but

the higher level staff should also be closely associated with implementation. It is necessary to streamline the implementation process so as to minimise the leakage of funds.

7.6 Monitoring and Evaluation

As mentioned in section 7.3, monitoring and evaluation should be an integral part of the project. Formats for monitoring should be designed carefully keeping in view the nature of information required for decision making at various levels and the frequency at which it is required. Important parameters of the project that need monitoring weekly, monthly, quarterly and annually should be identified in consultation with the decision makers at various levels and formats designed accordingly. Targets/standards of performance should also be specified so that progress of the project could be evaluated against the standards and deviations from the standards, if any, highlighted. There should be a provision for deviation analysis so that causes for the deviations could be identified and remedial actions taken to remove the constraints. There is need to evolve better methods of monitoring and controlling the expenditure on soil and water conservation structures.

Both concurrent and ex-post facto evaluation should be done by both project personnel and a renowned external agency so that lessons of experience with the implementation of the project could be available and fed back to improve the effectiveness of planning and

implementation processes. It is necessary that the effect on crop yields and other parameters of each of the components of recommended watershed technology be isolated and measured quantitatively so that proper priorities in their delivery and management could be s-i t.

Ideally, there should be an independent unit for monitoring and evaluation adequately staffed and headed by a professional rural development manager. The unit could be located at the divisional level so that its services are available to all the projects in the division. The unit should be given full autonomy to evaluate the project objectively and express its views and opinions freely and frankly.

7.7 Research and Technical Back Up

Every watershed development programme should have a strong and dependable research and technical back up either from an agricultural university or an ICAR institute. Agricultural scientists and technologists from the university/ICAR institute identified for the purpose should be closely associated with the programme and should preferably be associated with the tasks of survey, planning, mapping, monitoring and evaluation. The watershed programme should provide some funds to supplement the facilities and manpower resources of the agricultural university/ICAR institute to be associated with the programme and allow the scientists to do some relevant operational research in the project area. This

kind of association would be mutually beneficial to both the university and the project. The project would benefit from the expertise available with the university and the university scientists would have a live laboratory in the field to test the relevance of their research findings, to get new ideas for further research and to train their students in field research methodology. This would ensure upgradation and adaptation of watershed technology on a continuing basis.

7.8 People's Participation

People's participation in a watershed development programme is crucial for its success because every family living and having land in the watershed must cooperate with the programme to make it successful. Every field/patch of land in the watershed should be treated with appropriate soil and water conservation measures and used according to its physical capability. For this to happen, every family owning land should accept and implement the recommended plan.

It is generally believed that government functionaries are not appropriately oriented and motivated to do a good job of securing people's active participation in government programmes. However, GOK has demonstrated in its DWDP that government functionaries too can do a reasonably good job of educating people and enlisting their involvement in a development programme provided if they are properly oriented, trained, guided and assisted by their superiors. To secure people's involvement, GOK

adopted quite a few innovative measures like night meetings with villagers to have the annual action plans vetted by them, promoting farmers' forums for exchange of experiences, informal and formal consultation with people, etc. Despite the not-so-good experience of MYRADA in the PIDOW project in interacting with GOK and in securing people's active participation in the watershed development activities, I would venture a suggestion that government efforts in involving people could be supplemented and complemented by a professionally managed non-governmental voluntary agency which is technically competent and willing to take up this kind of job. But there are very few such voluntary agencies existing in India at present.

Yet another suggestion is that the state government should try and organise farmers into some form of informal or formal association and through it seek their participation in the programme. The Anand pattern dairy cooperative structure seems to be an appropriate organisational form for organising farmers in a watershed for planning and management of its natural and human resources.

7.9 Role of People's Representatives

Peoples's representatives in the government and in other. committees and forums can play a very important role in making a watershed development programme successful. They can articulate people's problems, seek redressal of their grievances, prevent adverse policies and decisions

from being implemented, help make right policies and decisions and make sure that the gov®r«ffi©nt providaa necessary financial, manpower, and administrative support to the programme. To enable them to appreciate the importance of watershed development programmes and to play their role effectively, short-term orientation courses may be organised for them preferably at a place located within a watershed. A joint interaction session/workshop of scientists, technologists, academicians, bureaucrats, and people's representatives may be organised once every year preferably in May/June to review the progress, and problems of the programme and determine a strategy for the next year.

7.10 Role of Government

No development programmes including a watershed development programme can be successfully implemented on a large scale without the active support and involvement of the government. The government has been in the past and will continue to be in the foreseeable future a dominant actor in the field of agricultural and rural development. Willingness, interest and ability of the government are crucial determinants of success of a development programme. Therefore, it is necessary for the success of a watershed development programme that the state government is not only willing and able to support the programme but takes active interest in it and creates a congenial environment through appropriate policy measures. The government should be responsive to people's needs and aspirations, open to their

suggestions and sympathetic to their problems. Short-term orientation courses in watershed development and management would be very useful to those government officers associated with the programme but not having any previous exposure to this field of activity. The courses may be organised in an agricultural university/ICAR institute which has sufficient expertise in watershed development and management to mount such a programme. The government may provide financial support to a potentially good institute to enable it to build and/or strengthen its research and training capacity in watershed development and management, if it does not already exist anywhere in the state.

7.11 Role of International Agencies

International development agencies having interest and expertise in watershed development and management can help the state governments/project authorities with technology, experts, training, planning and management, and funds. However, due to differences in perceptions, visions, and expectations of international agencies and the Central and state governments, it is very difficult to arrive at a commonly acceptable approach and strategy and hence there are problems and bottlenecks at every stage of the project. If a foreign donor is associated with a programme, the project authority becomes somewhat complacent and starts expecting more and more funds from the donor on a continuing basis but does not like the strings attached thereto. So, the project authority should carefully weigh the advantages and disadvantages

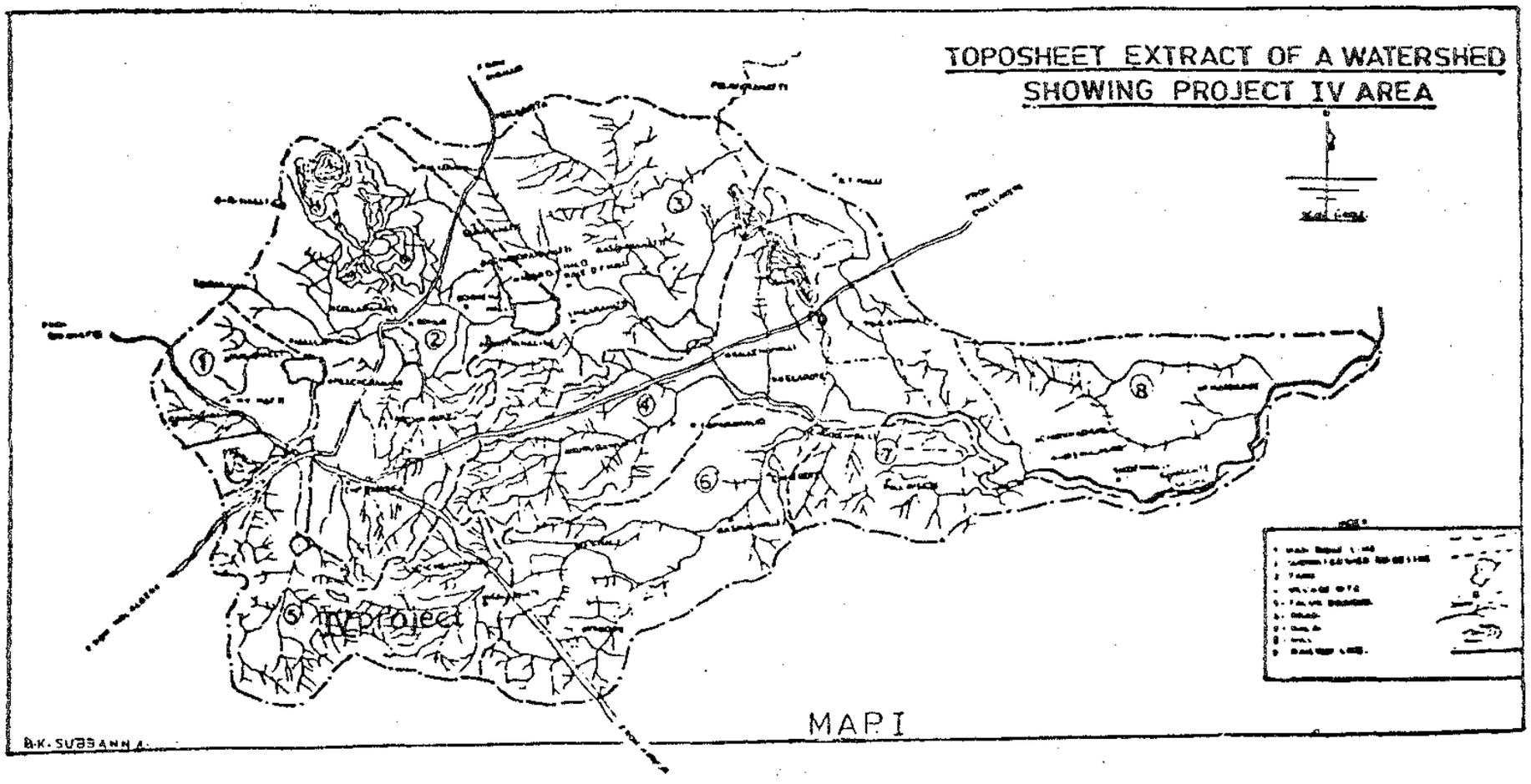
of foreign collaboration and only if the perceived advantages significantly exceed the disadvantages should it go in for involvement of an international agency in the programme.

7.12 Replicability of the Karnataka Model

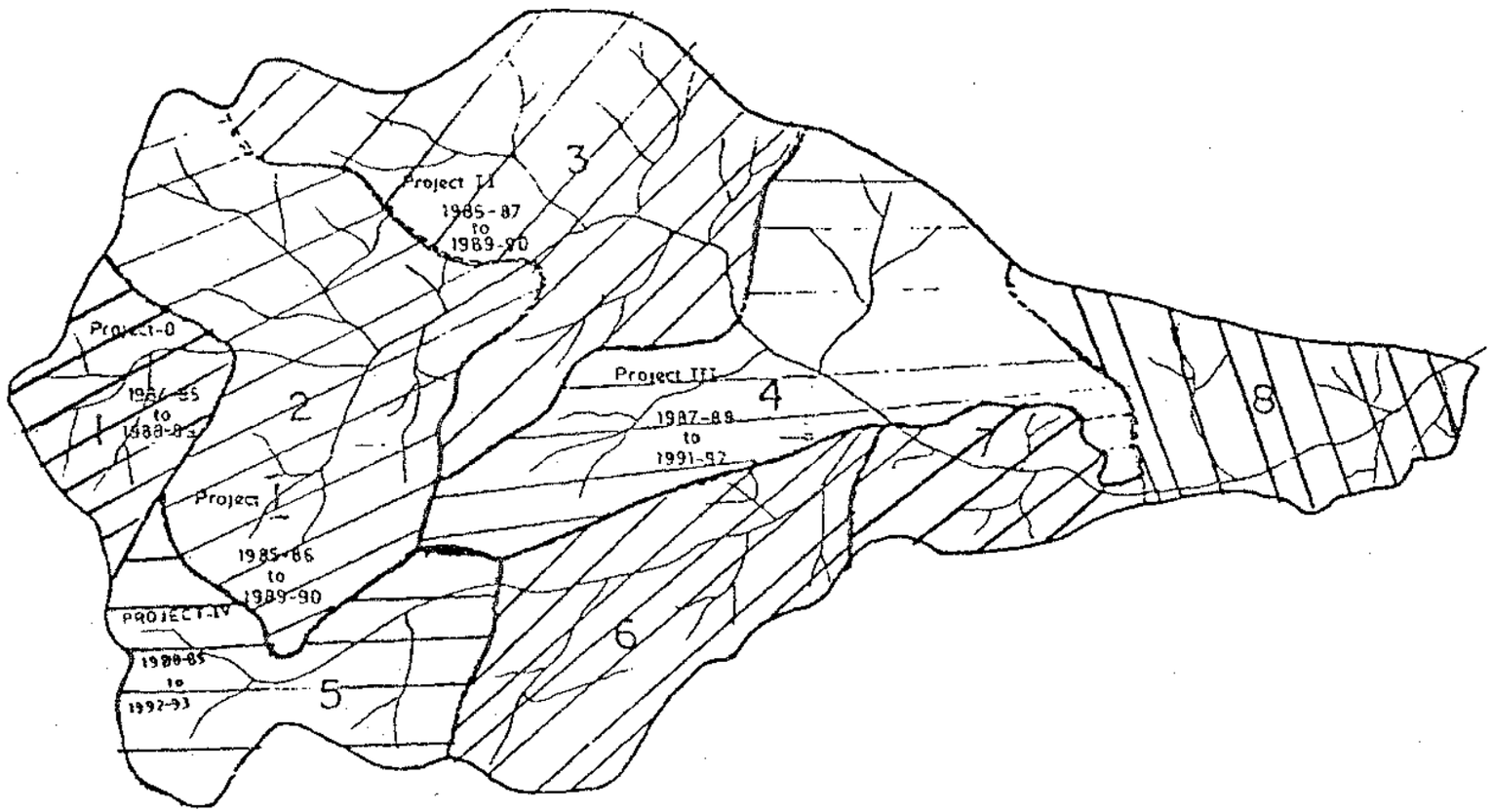
There cannot be a universally applicable model of dryland wátershed development and management. So, any search for such a model is bound to be futile. What should be abstracted from the Karnataka experience with dry land watershed development and management is a methodology or a procedure, or a process, which, if followed judiciously, could help achieve the social goals in managing dry land agriculture and other related activities. Briefly, the major components of such a methodology include problem identification/diagnosis, an inventory of resources, constraints and opportunities, identification of appropriate technologies, means or measures for resolving the problems identified, formulating a plan incorporating the measures selected, implementing the plan, monitoring the progress and problems in implementation, taking remedial actions tc alleviate the problems, evaluating the impact of. the project as it progresses, and making mid course corrections, if necessary. Adoption of this methodology requires political will and support at all levels, commitment of bureaucracy to the methodology, availability of profitable and dependable technology, technically competent, trained and motivated msnnower.

people's involvement and participation and access to adequate financial resources. If these conditions are already present or can be created in an area, the methodology outlined here and elaborated in the case studies presented in this report can be successfully adopted. The methodology is still evolving and needs refinement based on the lessons from its applications under different conditions. Political will and creation of a nodal agency at the State level seem to be two of the crucial requirements for replication of the Karnataka model in other states in India.

APPENDIX I

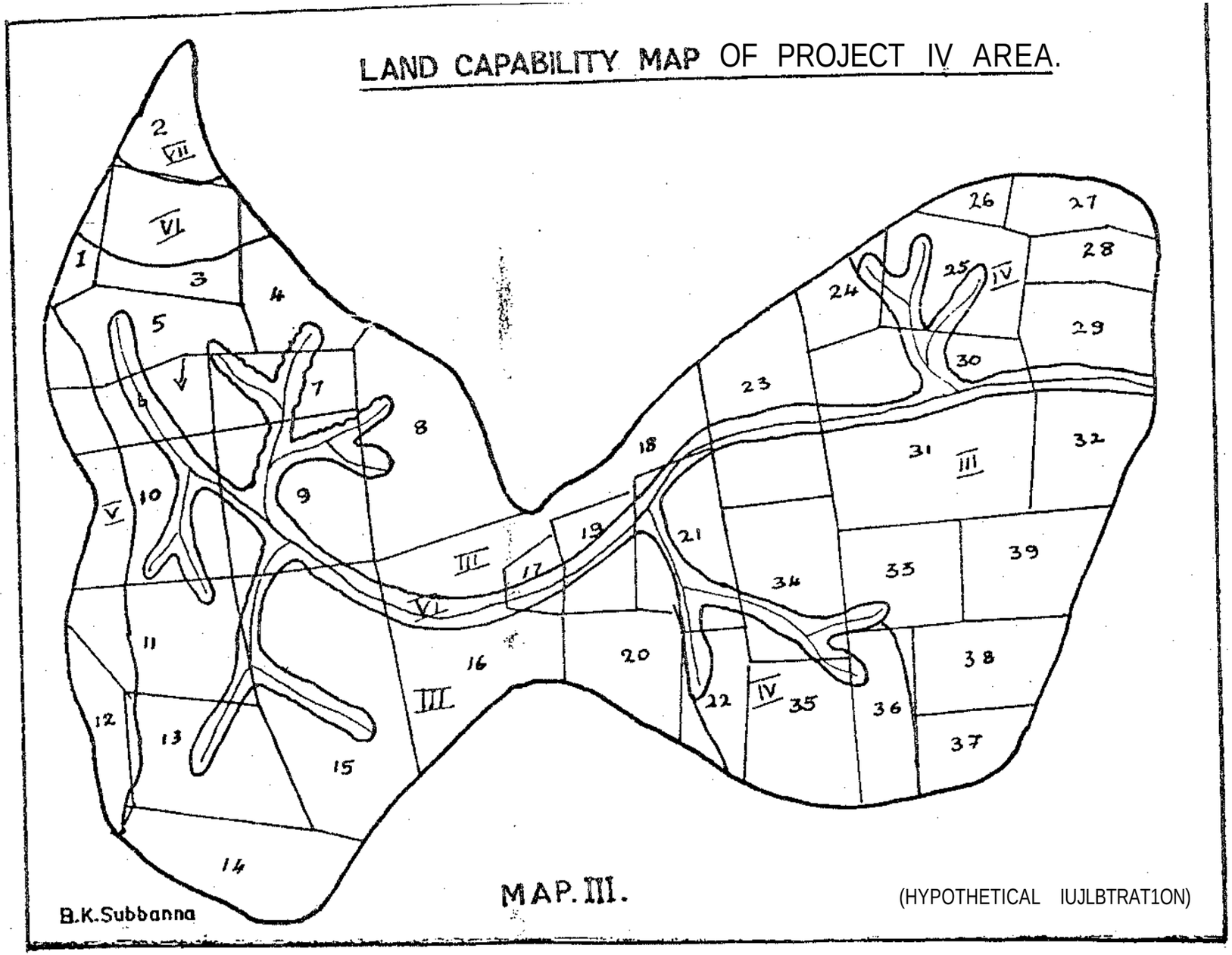

TOPOSHEET EXTRACT OF A WATERSHED
SHOWING PROJECT IV AREA
Project
MAP I
B.K. SUBBANNA

DRAINAGE MAP OF WATERSHED DEPICTING AREAS UNDER PROJECT O, I, II, III, & IV.



MAP II.

BKS


LAND CAPABILITY MAP OF PROJECT IV AREA.
2
VII
VI
1
3
4
5
6
7
8
9
10
V
III
VI
11
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IV
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IV
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III
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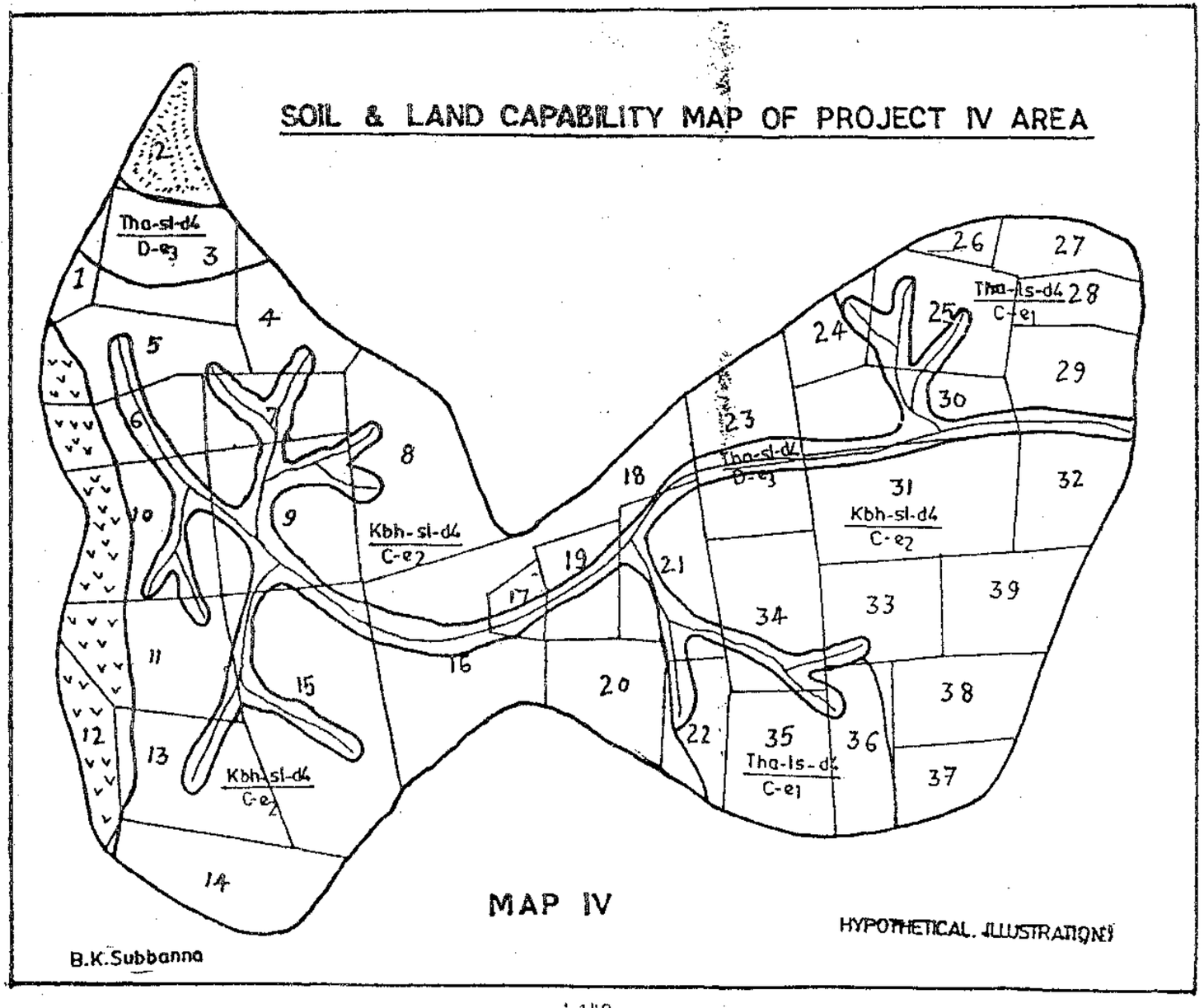
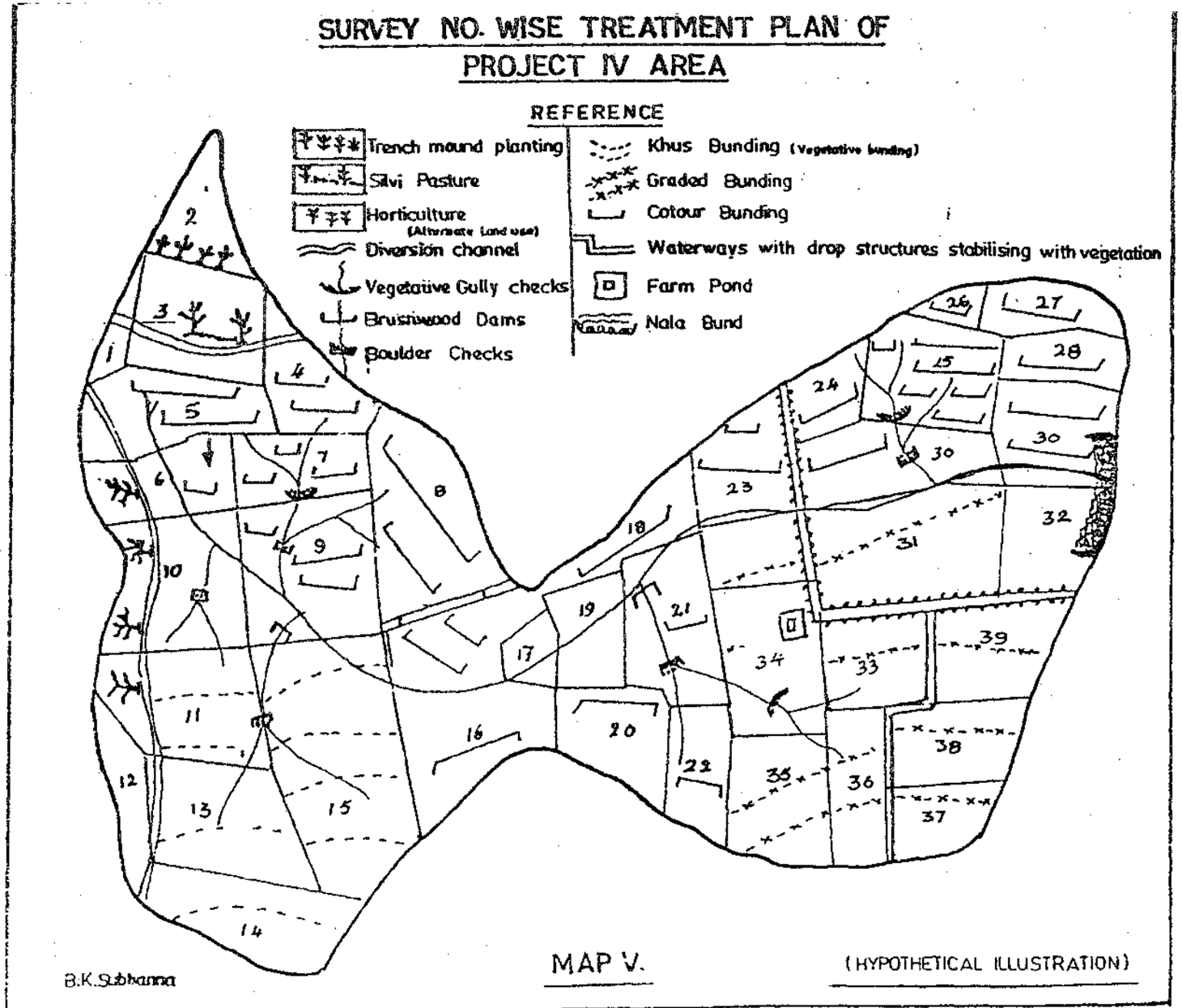
B.K.Subbanna
MAP. III.
(HYPOTHETICAL IUJLBTRAT1ON)


SOIL & LAND CAPABILITY MAP OF PROJECT IV AREA
Tha-sl-d4 / D-e3
Kbh-sl-d4 / C-e2
Tha-ls-d4 / C-e1
Tha-sl-d4 / D-e3
Kbh-sl-d4 / C-e2
Kbh-sl-d4 / C-e2
Tha-ls-d4 / C-e1
MAP IV
HYPOTHETICAL ILLUSTRATION
B.K.Subbanna

SURVEY NO. WISE TREATMENT PLAN OF PROJECT IV AREA



MAP V.

(HYPOTHETICAL ILLUSTRATION)