WATER FOR PEOPLE: PROMOTING EQUITY AND SUSTAINABILITY THROUGH WATERSHED DEVELOPMENTS IN RURAL MAHARASHTRA

by

Vijaya A. Pastala

Bachelor of Arts
Mount Holyoke College
(1989)

Submitted to
The Department of Urban Studies and Planning
in Partial Fulfillment of the
Requirements for the Degree of

MASTER IN CITY PLANNING

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June, 1991

Signature of Author _____
Department of Urban Studies and Planning,
May 1991.

Certified by _____
Judith Tendler, Thesis Supervisor.

Accepted by _____
Phil Clay, Chair, M.C.P. Committee.

WATER FOR PEOPLE: PROMOTING EQUITY AND SUSTAINABILITY THROUGH WATERSHED DEVELOPMENTS IN RURAL MAHARASHTRA

by

Vijaya A. Pastala

Submitted to The Department of Urban Studies and Planning
in Partial Fulfillment of the Requirements for the
Degree of Master in City Planning

ABSTRACT

Despite the spread of an extensive canal irrigation system in Purandhar taluka of Pune district, reocurring droughts highlight a contrasting social picture of poverty of rainfed agriculture on one had and small islands of perennial irrigation of sugarcane cultivation on the other. Control over water resources in this region, where farmers with access to water prefer to cultivate sugarcane, is the foundation of both political and economic power. Sugarcane is not simply a highly profitable crop, but it also concentrates political and economic power in the hands of its cultivators.

The Pani Panchayat, was developed as a response to this, with the idea that in a drought-prone area no individual should be deprived from a rightful share of limited water resources. Control over water resources, in the case of the Pani Panchayat, pivots on communal power and equity.

The Pani Panchayat method of allocating water on a per capita volumetric basis rather than on acreage has drastically reduced the amount of water received by larger farmers in the area. The prohibition of sugarcane cultivation by the Pani Panchayat has further reduced their income. What made the larger farmers, who are the economically and politically powerful agree to become part of the Pani Panchayat scheme and accept to take a reduction in the amount of water they received.

In answering these questions, I contend that ecological factors particularly scarcity and risk are the most important. I argue that cooperation around a scarce resource occurs only when external costs are high - when in other words, the interdependencies in production are such that any one cultivator is exposed to a high risk of crop loss and social conflict as a result of the activities of other people and himself or herself.

Thesis Supervisor: Dr. Judith Tendler

ACKNOWLEDGMENTS

My experiences in the villages of Purandhar, taught me the essentiality of encouraging and developing a community's self-reliance and addressing issues of people participation. I am grateful to the farmers of these villages who figure in the following pages and were kind enough to answer my questions and welcome me into their homes.

During the research and writing of this thesis, many people gave me information, advice, shelter and encouragement.
I would first like to thank my advisor Judith Tendler, who made me think critically and formulate my ideas onto paper. Many of the ideas and questions raised in the following pages reflect the knowledge and insight she shared with me. I would also like to thank Bish Sanyal who graciously agreed to be my reader and Louise Dunlap who guided me in writing a thesis with a logical outline; I also thank Paul Smoke, who provided me with invaluable advice and support during the writing of this thesis and throughout my graduate education.

I am greatly indebted to Mr. Salunke and his family, without whose help and advice this thesis could not be. He shared with me his experiences in the creation of the Pani Panchayat model and the necessity of sectoral planning in India. I thank the Das family, especially Suprito, for making me feel at home while I was in Pune. I am grateful to the following persons, who shared their knowledge with me in conversations or correspondence: Kedekar, R.D. Deshpande, Vinod Menon, Ratna Reddy and Daryll D'Monte.

To my friends, who called me, sent me E-Mail, letters, and care-packages - you reminded me I was not alone, thank you. Inca, I specially thank you for the use of your computer, your phone calls and E-Mails that I did not reply to; Alex, for your care packages and Sunday phone calls; Michelle, Debbie and Amit for your E-Mail uplifts and Anne for keeping in touch; and lastly Avantika for your intensity and keeping me in touch with Oyster soap operas and home.

A special thanks to all of you at Apartment 4, the sudo-vegetarian, politically correct household, that I love and hate; especially Sandra, for your editing skills, Jude for always being around, and both of you for your support.

Most importantly I would like to thank my family, without whose support and inspiration nothing would be possible.
I dedicate this thesis to you, mother and father, for always being there and for being the best.

TABLE OF CONTENTS

Glossary and Conventions

allocation	the assignment of rights or allotments of water to water users, either individually or grouped
appropriation	the act of acquisition of water
bund	an earthen dam across a stream to impound water when it rains
communal system	an irrigation system managed by the irrigators
crore	ten million
delivery	distribution through the controlled movement of water from a point of origin (such as a diversion weir of reservoir) to point or points of handover
gross irrigated area	area of land irrigated in one year (two irrigation seasons counting as two)
hamlet	a residential section of a village; usually caste-based
headenders or headreachers	farms that are situated at the source of canals, branch canals, distributeries, pick-up wiers or field water courses
hectare	a metric unit equal to 2.471 acres
1 hectare CM	the amount of water required to cover 1 hectare to a depth of 1 centimeter
kharif	the summer southwest monsoon season in India with onset of rain mainly in June and withdrawal of rain mainly in September
lakh	one hundred thousand
lift irrigation	irrigation where water is pumped up before distribution. Groundwater is the most common source, but water is also lifted from canals, reservoirs, drains and other sources
major irrigation scheme	that with a culturable command area of over 10,000 hectares

medium irrigation scheme	that with a culturable command area of over 2,000 hectares but less than 10,000
minor irrigation scheme	that with a culturable command area of less than 2,000 hectares
nallah	small gully or stream usually seasonal
net irrigated area	area of land surface that receives irrigation water in a year (two irrigation seasons counting as one)
pani	literally means 'water' in Marathi
predictable	(of a water supply) assured, known to be assured, and known about in advance as to timing, flow rate(s) and quantity. A water supply is more, or less, predictable to the extent that these conditions are met. Here predictable, means predictable to irrigators
protective irrigation	the minimum irrigation required to sustain a maximum output in crop production
quintal	50 kilograms or 23 lbs (approx.)
rabi	the 'winter' cropping season
rainshadow	the leeward side of a mountain range
seepage	the infiltration of water downwards or laterally into soil or sub-strata from a source of supply such as reservoir or irrigation canal or channel
tailenders	farms situated at the ends of main canals, branch canals, distributeries, pick-up wiers and field water courses
taluka	a administrative sub-unit, in block planning
warabandhi	a system of equitable water distribution by turns according to a pre-determined schedule specifying the day, time and duration of water supply to each irrigator in proportion to the land acreage of the farmer
watershed	a ridge of high land dividing two areas draining rain water run-offs into a river, river system or body of water

ABBREVIATIONS

G.G.P.	Gram Gourav Pratisthan
E.G.S.	Employment Guarantee Scheme
F.I.T.	Forum of Industrial Technologists
D.P.A.P.	Drought Prone Area Programme

The currency quoted here in the context of first hand reports and from data provided by the Gram Gourav Pratisthan is the Indian Rupee. The market rate for $1 was Rs.19.04 on May 13, 1991 and Rs.18.75 in January of 1991, while I was in Purandhar (Source: Thomas Cook Foreign Exchange).

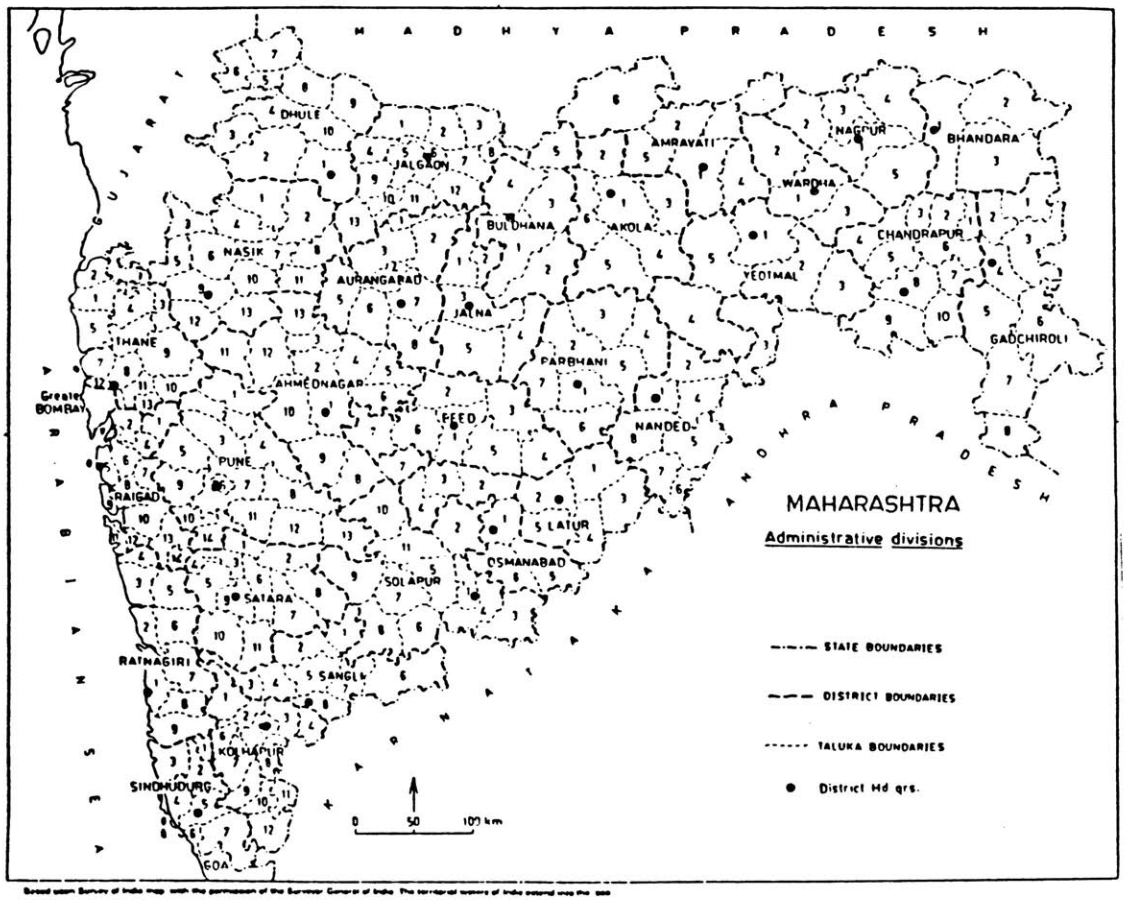
Areas are sometimes given in acres, but most often I have used hectares. For guidance, one hectare equals 2.47 acres.

The Indian lakh and crore are used throughout: one lakh is equal to one hundred thousand, and one crore equals ten million.

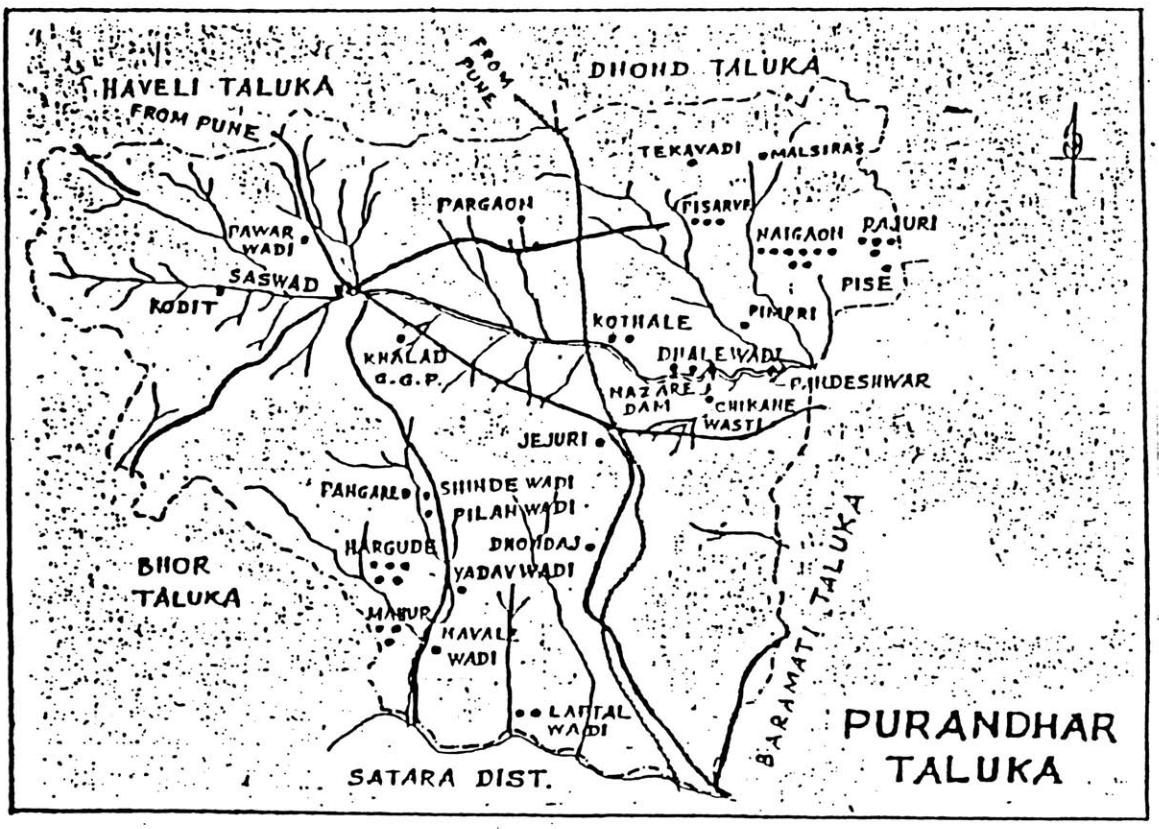
INDIA


(Line of control)
(Occupied by Pakistan)
(Occupied by China)
(Occupied by India)
JAMMU AND KASHMIR
HIMACHAL PRADESH
ARUNACHAL PRADESH
PUNJAB
HARYANA
New Delhi
MEGHALAYA
UTTAR PRADESH
SIKKIM
ASSAM
NAGALAND
RAJASTHAN
Jamuna R.
MANIPUR
BIHAR
Ganges R.
MIZORAM
GUJARAT
MADHYA PRADESH
TRIPURA
Calcutta
ORISSA
MAHARASHTRA
WEST BENGAL
Bombay
GOA
ANDHRA PRADESH
KARNATAKA
TAMIL NADU
KERALA
Miles
0
500

MAHARASHTRA STATE - ADMINISTRATIVE DIVISIONS



PURANDHAR TALUKA



Note: Pani Panchayat Schemes are identified thus *

INTRODUCTION

The reoccurrence of droughts, despite the spread of extensive canal irrigation systems in the districts of Western Maharashtra state in India, highlight a contrasting social picture of poverty of rainfed agriculture on one hand and small islands of perennial irrigation of sugarcane cultivation and sugar co-operatives on the other. Control over water resources is the foundation of both economic and political power in Western Maharashtra.

The *Pani Panchayats* (water users councils) of Western Maharashtra are a village-level movement to distribute water equitably in drought-prone areas. The water is shared equitably by members of the community on the basis of family number and not according to the size of land holdings. The Pani Panchayat model offers an example of a community's ability to organize farmers, large and small, to manage water as a scarce and valuable common property resource. Control over water resources, in the case of the Pani Panchayat, pivots on communal power and equity. This effort has created an awareness of water as a common natural resource, as well as changed the relationship between people within a community. How have the Pani Panchayats been able to do this?

Background

The first Pani Panchayat was started in 1980 in the village of Naigaon in Purandhar *taluka* (an administrative sub-district). Purandhar taluka is situated in the district of Pune in Maharashtra state. Building on the experience of the first Pani Panchayat scheme, seven others were established in Naigaon itself. With its success in Naigaon, the concept of equitable water distribution became the basis of a movement which has set up 61 Pani Panchayat schemes in 31 villages around Purandhar taluka and parts of Maharashtra. This effort has brought over 3,000 acres under protective irrigation covering 1,500 families and over 7,500 people.

Large parts of Maharashtra, including Purandhar, have been identified as drought prone. Because Purandhar lies in the rain-shadow of the Sahyadri Mountains, it receives an average annual rainfall less than 500 mm. Even annual rainfall is erratic, so the region experiences periodic droughts every three to four years which recur with increasing intensity. In addition, Maharashtra's groundwater supplies are unpredictable because of its volcanic sub-stratum and 33 percent of the state's total cultivable land is prone to drought.

In Purandhar, as in other drought prone areas, the crucial issue is water. The many irrigation schemes previously set up by the government in Purandhar taluka, do not efficiently address the problems of water shortages in the area. First, the potential for impounding water for irrigation purposes in Purandhar is not being fully exploited, and only a fraction of land actually receives reliable water supplies. The Nazare dam in Purandhar for example, has been able to irrigate only

three villages, instead of the intended 30 villages, which is only ten percent of its command area.

Second, little attention is given by the Maharashtrian government to the equitable distribution and allocation of water. This lack of attention demonstrates a conflict between community interests and the interests of a few individuals. As the use of water in Purandhar is determined on a first-come first-served basis only few individuals are in a position to capture the bulk of the irrigation water. In this scenario geographic location is privileged, as farmers who are situated at the head of government irrigation systems have first access to water and cannot be prevented from taking as much as water as they want for themselves. Furthermore, the Maharashtrian government has priced lifting water out of government irrigation canals or tanks in Maharashtra based on the land area that receives irrigation not on the volume or quantity of water used. Farmers can therefore choose to maximize their returns per hectare of irrigated land without regard to the amount of water they use.

Farmers who do have access to reliable water supplies in Purandhar taluka have a strong preference for growing sugarcane as it is among the highest value crops grown in the region. This is because the cultivation of sugarcane requires relatively little labour input, and furthermore the government offers subsidized credit to finance the inputs for sugarcane production. All this compounded with subsidized transportation and processing costs together with easy access to marketing facilities makes the cultivation of sugarcane profitable for most farmers

in Purandhar who have access to reliable free water supply.

Sugarcane, however, is the most water intensive crop grown in the region. While one hectare of sugarcane requires 300 hectare cm[1] of water, the same amount of water will irrigate 30 hectares of millet, 8.5 hectares of maize or wheat, and 4.2 hectares of onion. Continuous cultivation of sugarcane can reduce the already unpredictable ground water resources in Purandhar and increase salination of the land, causing the marginalization of productive lands and resource alienation. Therefore, the planting of other non-water intensive crops common to the area would enable the allocation of water over a larger area of land and increase the benefits to a larger number of farmers.

The critical division in Purandhar is not between the landed and the landless, but rather, between those few farmers with irrigation and the many farmers without it. Consequently, it is the distribution of water, rather than land per se, that is the key to both productivity and equity within this region. With this in mind, the Pani Panchayat model was developed centered around the idea that no individual should be deprived of his or her rightful share of the limited water supplies. Crucial to the Pani Panchayat model is that equity is allocated on a family logarithm.

The Pani Panchayat, developed with specific organizing principles put forth by the community itself, serves as an instrument through which community members ensure equitable water distribution. These principles secure each family,

---

[1]1 hectare CM = the amount of water required to cover 1 hectare to a depth of 1 centimenter.

at minimum, enough water for its own staple food requirements, plus a small income from non-water intensive cash crops.

Under these principles, the allocation of water is proportionate to the number of people in a family and not to the size of holdings or the kind of crop grown. The measurement of half an acre (0.20 hectare) of irrigated land per person for water distribution, with a ceiling of one hectare per family, permits even landless labourers to participate in the Pani Panchayat as sharecroppers. All members of Pani Panchayat schemes are prohibited from cultivating sugarcane or other water intensive crops.

Establishing the allocation of water distribution on a per capita volumetric basis rather than on acreage has changed the hierarchical structure of the community involved in the Pani Panchayat scheme and in their access to an essential resource. The method of allocating water has drastically reduced the amount of water received by larger farmers in the area. The prohibition of sugarcane cultivation by the Pani Panchayat has further reduced their income. What made the larger farmers, who are economically and politically powerful in the area agree to become part of the Pani Panchayat scheme and accept to take a reduction in the amount of water they received? Why have they continued to abide by the principles of the Pani Panchayat that prohibit the cultivation of sugarcane?

The social basis of sharing water has become the central issue of conflict not only in the villages of Purandhar taluka but around rural Maharashtra. With

the help of the Gram Gourav Pratishthan (GGP) many communities around the state and in neighbouring states in India have set up similar Pani Panchayat schemes. Why have these communities agreed to create institutions that share water in proportion to households and not land holdings? What is the social basis of sharing irrigation water over a larger area and amongst a greater number of cultivators as one moves away from the cultivation of a socially and environmentally costly crop such as sugarcane, to protective irrigation of traditional coarse grain subsistence crops?

Basis of Findings

With this central question in mind, I visited the Pani Panchayats of Purandhar taluka in January, 1991. I lived in the village of Naigaon for four weeks with the Kedekar family. I visited 26 Pani Panchayat schemes but chose to focus my research on the schemes in the villages of Naigaon and Dhalewadi. I chose Naigaon because the Pani Panchayat movement evolved there. Naigaon's eight Pani Panchayat schemes harvest rain-water into a percolation tank by trapping run-offs by the building of *bunds* (small dams) and *nallahs* (gullies). Farmers from Dhalewadi's had assured water supplies, as they were situated in the command area of the Nazare dam. Most of these farmers previously grew sugarcane. I was interested in the Pani Panchayat schemes set up in Dhalewadi to help answer my central research question as to the reasons why the larger farmers would agree to an arrangement whereby the amount of water they received would be reduced. While in Purandhar, I conducted more than 40 interviews with

farmers, large and small, and attended four organizational meetings. I also interviewed seven officials from the Central Water Resources Commission and the Office of the Irrigation Secretary.

Conclusions

My answer to these questions is that several factors bear on the situation. The factors relate to ecology and a history of environmental calamities, internal social structure and demographic composition, the apparatus of the state, and an individual's social reputation. Of these, I contend that the ecological factors, particularly scarcity and risk, are the most important. I argue that cooperation around a scarce resource occurs only when external costs of not doing so are high - when in other words, the interdependencies in production are such that any one cultivator is exposed to a high risk of crop loss and social conflict as a result of the activities of other people and himself or herself.

Theorists of "collective action" define various reasons for different socio-economic groups coming together to cooperate on a selective issue. In his famous "Tragedy of the Commons," Hardin argues that a group of persons who are placed in a situation where they could mutually benefit if they all adopted a rule of restrained use of a common resource, would only do so in the presence of an external enforcer of agreement.[2] Smith responds that the only way to avoid the tragedy of the commons in natural resources and wildlife is to end the common

[2]Hardin, Garrett, 1968, "The Tragedy of the Commons." Science 162 (Dec), p1344.

property system by creating a system of private property rights.[3] Another school, however, is equally emphatic that only the allocation to the state of full authority to regulate the commons can hope to succeed. Ophulus, for example, argues that "because of the tragedy of the commons, environmental problems cannot be solved through cooperation...and the rationale for government with coercive powers is overwhelming...."[4]

Yet in villages in rural Maharashtra, and expanding into other parts of India, communities have constituted an authority to impose rules of restrained access to water usage. In these cases, people who face problems have joined with persons who created the problems and have been able to devise and sustain rules which serve to keep environmental costs and social conflicts within tolerable limits.

---

[3]Smith, Robert, 1981, "Resolving the Tragedy of the Commons by Creating Private Property Rights in Wildlife. CATO Journal, 1(2), p467.

[4]Ophulus, William, 1973, "Leviathan or Oblivion," in Herman Daley (ed.), Toward a Steady State Economy. San Francisco: W.H. Freeman, p229.

CHAPTER I

Maharashtra's Water Crisis

A PROFILE OF THE STATE

Maharashtra is the third largest state in India in terms of its area and population. According to the 1981 Indian Government census, the population of Maharashtra is 62 million, of which over 65 percent live in the rural regions of the state.[5] Though the richest state in India, in terms of gross domestic product and per capita income, Maharashtra is not so privileged in agriculture. The state suffers from the adverse effects of its physical conditions, with the result that out of the state's total geographical area of 307.48 lakh hectares only 198.60 lakh hectares is under cultivation. Maharashtra accounts for 13 percent of the cultivated and 4.5 percent of the irrigated area of the country, and is the largest producer of *jowar* (millet) and the second largest producer of sugarcane in India.

[5]All Population statistics in thesis from:
Census of India 1981 - Maharashtra Series, 1982, Final Figures of Total Population, Scheduled Caste Population and Sheduled Tribe Population. Bombay: Director of Census Operations. and

Maharashtra, India (state), Bureau of Economics and Statistics, 1984, Basic Facts about Backwards Areas of Maharashtra State. Bombay: The Bureau, Government of Maharashtra.

Physio-graphical Characteristics

Maharashtra's physio-graphic characteristics have a significant impact on the agrarian economy of the state. The single most important factor to bear on the proportion of land under cultivation is relief. Climatic conditions and soil type also affect area under cultivation, but not to the extent relief does.

Physio-graphically Maharashtra may be divided into three main regions: (i) the narrow Konkan coastal strip running north and south between the Sahyadri mountains in the east and the Arabian sea on the West. This strip that includes Bombay is undulating and infertile and has less than half its area under cultivation; (ii) the Deccan plateau, lying in the rain-shadow of the Sahyadri mountains, is a semi-arid region intercepted by rivers rising in the hills and flowing eastwards. This region, where Purandhar taluka is situated has the highest density of irrigation in the state and yet only 50 percent of its land area is under cultivation; and (iii) the trough of the river Tapi, which is the transition between central India and the Deccan and is identified as being an arid region has 42 percent its area under cultivation.

Rainfall Pattern

Although in the direct part of the south-west monsoon which occurs during the months of June, July and August, only 12.7 percent of Maharashtra receives assured rainfall. This region, the Sahyadri mountains receives the heaviest precipitation which often exceeds 6,500 mm. East of the Sahyadris' the decrease in rainfall is distinct and regions that lie 15 kms from the mountains receive only

1,200 mm of rainfall. Further east, rainfall is very low. An area of 30 km by 50 km, running parallel to the Sahyadri mountain range, receives an annual rainfall of less than 650 mm and in some places even below 500 mm. This semi-arid region, which is extremely prone to drought and crop failures, is regarded as a scarcity or drought-prone zone by the Maharashtrian government. Paradoxically, the least productive and drought-prone areas of Maharashtra have the highest percentage of their area under cultivation (see Figure 1.1).

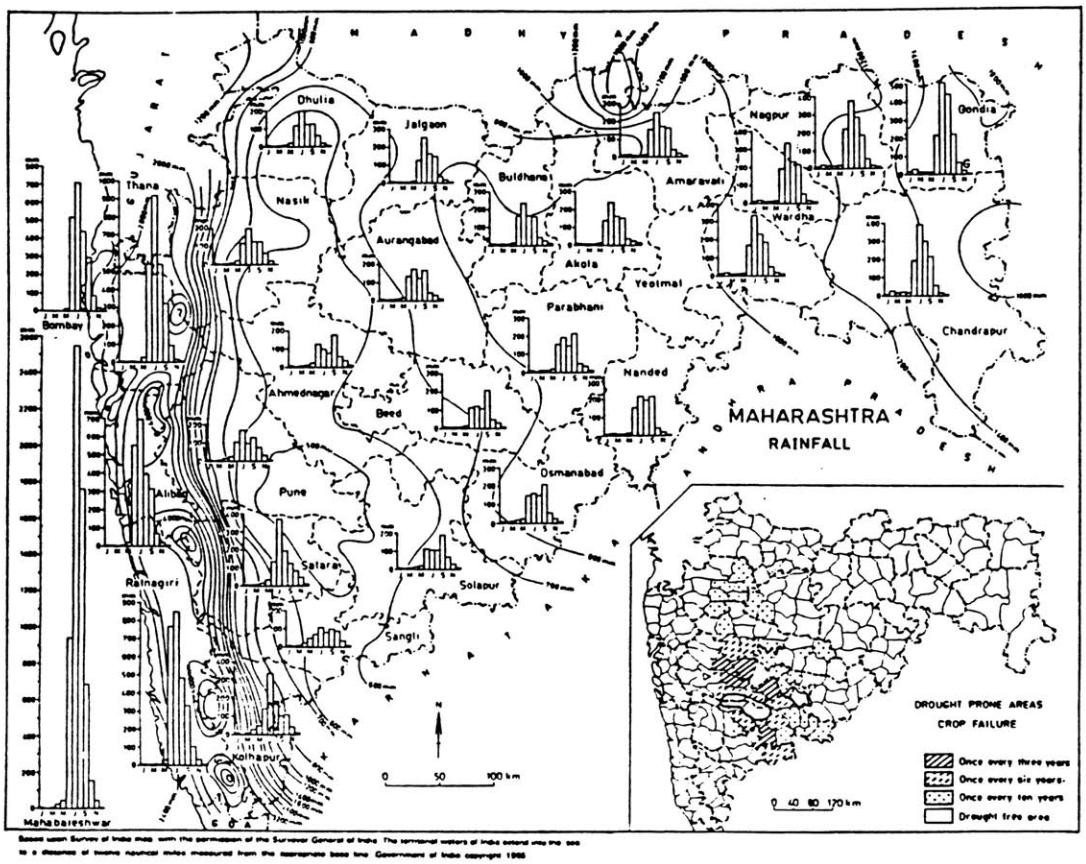
Drought Prone Areas

33 percent of Maharashtra's total cultivable land has been classified as drought prone. In identifying an area as drought prone, the Government of India and the Irrigation Commission rely on a single criteria - meteorological data. Established on meteorological data, rainfall over a 60 year period (1901- 1960) in an area is measured and an area is then identified as being drought-prone, based on 20 percent probability of rainfall departure of more than (-) 25 percent from the normal.

The drought-prone areas in Maharashtra lie in the semi-arid western part of the state and occupy portions of eleven districts - Ahmednagar, Aurangabad, Bhir, Dhule, Jalgaon, Nasik, Osmanabad, Pune, Sangli and Satara and a large part of Sholapur. Over 7,000 villages in 87 talukas in these districts are affected. 80 lakh hectares of the villages cultivable land is affected. This drought-prone area of 112.84 lakh hectares has one-third of Maharashtra's population living in the area (see Figure 1.1).

FIGURE No. 1.1

RAINFALL PATTERNS AND DROUGHT-PRONE AREAS IN MAHARASHTRA



PURANDHAR TALUKA OF PUNE DISTRICT

Pune district, which has nine of its 14 talukas identified as drought-prone, occupies a total geographical area of 15.62 lakh hectares with a cropped area of 10.95 lakh hectares. Of the total cropped area, only a total of 1.16 lakh hectares is irrigated, of which nearly half is irrigated by wells and tanks and 40 percent by government canals. The district, which has 1,530 villages, has a total population of 4.2 million, of which 52 percent are rural. The rural population is made up of 65 percent cultivators, 16 percent landless labourers and 19 percent that perform other services. The nine talukas of Pune district that are identified as drought prone have a population of 2 million, covering 1,19,425 hectares.[6]

Purandhar taluka, situated in the eastern part of Pune district, is one of the nine drought-prone talukas of the district. The taluka, which has a geographical area of 1,10,481 hectares with a population of 1.6 lakhs has the characteristics of a drought- prone area through its population, its climate and of the crops that are cultivated. The average rainfall according to government statistics in Purandhar is 18 inches per year, which identifies it as a semi-arid region.

The farming population in Purandhar is largely composed of *Marathas*. The scheduled castes also have some agricultural land but their holdings being uneconomic, the land is cultivated by Marathas, since the scheduled caste people have neither the finances nor the infrastructure to engage themselves in agriculture.

---

[6]Gandhi, P.R., (Chief Engineer and Joint Secretary to Irrigation Department, Government of Maharashtra), 1985, Distribution of Water Resources and Water Management in the Drought Prone Areas in Maharashtra State. Bombay: Irrigation Department, Government of Maharashtra.

The Marathas and the *Mali Maratha*, an occupational caste division of the Maratha community, holds three-fourth of the agricultural land. They can be divided into the *Bagaitdars* (sugarcane plantation owners), who control the economic and political power in the rural areas of Western Maharashtra or the average cultivator who practices *jirayat* (rain-fed) cultivation.[7]

Purandhar, like other drought-prone regions of Maharashtra characteristically consists mainly of small and medium farmers. Large farmers, who make up 14 percent of Purandhar's population, own between 15 to 25 hectares including 5 to 10 hectares of irrigated land. Medium landholders in Purandhar taluka own 5 to 10 hectares with 1 to 2.5 hectares of irrigated land. Small farmers only own non-irrigated land in the taluka and depend on the rains for their irrigation. In drought-prone areas the holdings per family tends to be high and it is not uncommon for small farmers to have holdings of more than two hectares. Most large farmers in Purandhar have access to reliable water supplies either through private tube-wells, wells or percolation tanks on their lands or they are situated in the command area of the government administrated canal irrigation schemes.

[7]Lele, Jayant, 1980, "On Class, Caste and Hegemony: Classes in Rural Maharashtra," in N.K. Wagle (ed.), Images of Maharashtra: A Regional Profile of India. London:Curson Press. pp74-76.

TABLE No 1.1

WORKERS AND THEIR DISTRIBUTION, PURANDHAR TALUKA

Total population	Workers			
	Cultivators	Agricultural Labourers	Others	Total workers
161,409	39,996	12,202	15,592	67,791
Percentage to total workers	59	18	23	

Source: Based on the data provided by the Gram Gourav Pratisthan.

Purandhar taluka is a *rabi* (winter season) crop growing area. The black volcanic soils in the area are retentive of moisture and suitable for growing rabi crops such as wheat, *gram* (pulses), *rabi jowar* (millet), *bajra* (sorghum) and sugarcane. The taluka has two government administered dams, Nazare and Vir, but apart from a small area around the dams that grow sugarcane, the rest of the taluka is without access to irrigation facilities. Farmers in Purandhar grow mainly rain-fed coarse grain crops such as *bajra* (sorghum) and *jowar* (millet). Those who have access to water prefer to grow sugarcane, the cash crop of Maharashtra.

IRRIGATION IN MAHARASHTRA - INDIVIDUAL VERSUS COMMUNITY INTERESTS

No part of Maharashtra receives rainfall all year round, nor is there any region where enough moisture in the soil is retained to sustain the crops all year around. 93 percent of Maharashtra is occupied by sub-stratum volcanic rocks, that

create unconnected groundwater pools, pockets or mini-basins. There is no sub-soil water table and as groundwater depends on rainfall, Western Maharashtra has scarce unpredictable groundwater resources.

Today about one-tenth of the cultivated area in Maharashtra is under irrigation. In Western Maharashtra, which has the highest density of irrigation networks in the state, irrigation can be divided between government administered irrigation canals, percolation and storage tanks, and private canals and wells.

TABLE NO. 1.2

AREA IRRIGATED BY SOURCE IN MAHARASHTRA 1970-75

Sources of Irrigation	1970-71	1974-75	Percentage of the net irrigated area
Government Canals	2,688	3,193	19.81
Private Canals	190	195	1.21
Wells	7,679	9,358	58.05
Tanks	2,051	2,321	14.40
Other sources	861	1,051	6.52
Net area irrigated	13,469	16,121	100
Gross area irrigated	15,703	19,328	

See Appendix E: Irrigation by Different Sources
Appendix F: Area Irrigated Under Different Crops.
Source: Maharashtra State Irrigation Commission Report, 1976.

Irrigation projects in Western Maharashtra were originally designed for protective purposes, that is, to supplement rainfall, in order to achieve minimum crop yields in drought years. These irrigation resources were also earmarked for crops requiring light irrigation. Government irrigation systems in Western Maharashtra were designed with the idea of maximizing output for the given water resources by maximizing output per unit of water so as to eliminate crops needing heavy irrigation during the summer months. However, the crop patterns that have emerged in Western Maharashtra have become oriented towards a heavy use of water all year round.[8]

The experience of government irrigation schemes in Western Maharashtra demonstrates the conflict between community interests and the interests of those few individuals in a position to capture the bulk of the irrigation water. Districts of Western Maharashtra have the highest density of canal irrigation networks in the state and yet parts of them are chronically drought-prone and a majority of their population do not have access to these water supplies.

Canal Irrigation and Common Property Rights

The basic issue on water distribution in Western Maharashtra is equality in distributing water supplies to different farmers. Two doctrines on accessing water supplies from government irrigation works are present in Western Maharashtra: (i) that of prior appropriation; (ii) and proportionate equality. The doctrine of prior appropriation is that whoever first exploits a resource establishes a right to

---

[8]Sathe, M.D., 1986, "Social basis of Sharing Irrigation Water," Economic and Political Weekly, Vol XXI, No 17, April 26.

continue to do so. Inequality in the denial of the resources to others is a consequence of the exclusiveness of the right. Topenders, or early comers to an irrigation project, gain customary usage to water which they regard as their right.

In Western Maharashtra, farmers owning land closest to the canal or storage tank outlets have first access and cannot be prevented from taking as much water as they wish by those further away from the irrigation source. Most farmers in the areas commanded by canals do not necessarily depend on the underground water that might be naturally available, but virtually draw from the water going underground by seepage from the canals. The deprivation in water supply to tailends is notorious in this region. Deprivation takes many forms and is reflected through various indicators including water supply, intensity, crops grown, cultivation practices, yields and incomes. In Western Maharashtra, tailend deprivation occurs as a result of the scarcity in water supplies and the cultivation of a water-intensive sugarcane crop which is concentrated in headreaches. More often than not, headenders generally grow more profitable crops and use more inputs, while tailenders grow less profitable and less risky crops and apply fewer inputs. Yields and income almost always decline from head to tail.[9]

Offsetting the doctrine of prior appropriation, and often conflicting with it, is the widespread doctrine of proportionate equality based on the traditional *warabandi* (rotational water distribution) system present in Northwest India and Pakistan. Adapted by the Irrigation Commission in 1972, the new warabandi

---

[9]Chambers, Robert, (1988), Managing Canal Irrigation: Practical Analysis from South Asia. Cambridge: Cambridge University Press, pp16-23.

system is defined as a "system of equitable water distribution by turns according to the pre-determined schedule specifying the day, time and duration of supply to each irrigator in proportion to land holdings in the outlet command."[10] The new warabandi system being followed in Western Maharashtra identifies equality with the supply of water proportion to land surface area. In this doctrine, the inequality of landholding is accepted and water is allocated to each farmer in proportion to land holding size. Thus those who are already better off with more land get more water; and those who are worse off with less land get proportionately less water and those who are worst off with no land get none at all.[11]

Government Irrigation System Performance in Western Maharashtra

Two phenomena are evident in the government irrigation schemes in Western Maharashtra. First, only a fraction of the land in the intended command areas of these schemes actually receives reliable water supplies; i.e. the potential for impounding water for irrigation purposes is not being adequately exploited. Second, those farmers who do obtain water have a strong preference for growing sugarcane.

The state Irrigation Department is responsible for regulating water allocation between each outlet from government irrigation canal source (and so between each village: normally each village has several outlets, each of which normally supplies water to the land of that village alone). In practice, however,

---

[10]Singh, K.K., 1981, Warabandhi for Irrigated Agriculture in India. New Delhi: CBIP, Publication No. 146, June pp46-49.

[11]Chambers, 1988:37.

the Irrigation Department is not strong enough to regulate effectively at this level of the network. As a result, farmers towards the head of the system intervene - illegally - to improve their own group or individual supply.

Apart from the problems in the irrigation delivery system, two other factors, singular to irrigation in Western Maharashtra, further account for the transformation in cropping patterns to water intensive crops. The rising pressures from farmers, particularly at the head of the canal network to cultivate water-intensive crops, motivate farmers to maximize their output per unit of land. Farmers do this by applying water intensively per acre, rather than maximizing output per unit of water by spreading it thinly over a relatively larger area or growing crops that are not water intensive.

Second, the price charged for lifting water allows farmers to follow the above method. Pricing of lifting water out of government irrigation canals or tanks in Western Maharashtra is not based on the volume or quantity of water used, but the land area that receives irrigation. A flat rate is charged for the power with reference to horsepower of the engine, rather than for the amount of power used for pumping water. Under this method of measurement, the marginal cost of pumping water for an individual farmer becomes virtually zero, thereby encouraging water-intensive cropping patterns in a low rainfall area.[12]

---

[12]Rao, Hunumantha, Susanta Ray and K. Subbarao, 1988, Unstable Agriculture and Droughts. New Delhi: Vikas Publishing House. p76.

IRRIGATION, INEQUITY, AND SUGARCANE CULTIVATION

Traditionally, the economy of Western Maharashtra was agrarian, growing rainfed coarse food grains like *jowar* and *bajra*. Beginning in the 1960's, canal-based flow irrigation in Western Maharashtra influenced farmers to shift from growing traditional rain-fed coarse grains to a profit oriented irrigated cash crop - sugarcane. Sugarcane cultivation has had a major impact on the agriculture sector of this region, transforming Western Maharashtra from a subsistence to a cash-cropping economy.[13]

A network of canals carry water from reservoirs in the Sahyadris' to drought areas in Western Maharashtra. But ironically, the canal waters are not being used for ameliorating drought conditions like ensuring harvests of subsistence crops in as wide an area as possible, providing fodder and possibly drinking water. It is used instead to irrigate sugarcane.

TABLE No 1.3

MAHARASHTRA - AREA UNDER SUGARCANE CULTIVATION
1961-1982

Years	Area under sugarcane cultivation (well irrigated) hectares.
1961-62	3,248
1971-72	6,990
1981-82	17,612

Source: Ministry of Agriculture, Government of Maharashtra, 1983.

[13]See Appendix A: Maharashtra - Agriculture: Area under Cultivation and Output of Principal Crops.

Farmers in Purandhar taluka who have access to reliable water supplies have a strong preference for growing sugarcane, as it is the highest value crop grown in the region and requires relatively little labour input. Furthermore, government subsidized credit is available to finance the inputs for sugarcane production. All things considered, the rational economic choice for most farmers, who have access to limited water supplies of essentially free water, is to plant sugarcane.

The critical constraint on irrigation is the amount of water available. Of all the crops grown in the region, sugarcane which normally takes 18 months to mature and requires regular large waterings, demands the most water. It requires one and a half times as much water per hectare as the next most water-demanding crops, fruit trees and grapes. The same water required for one hectare of sugarcane will irrigate 30 hectares of millet, 10.7 of groundnut, 8.5 of maize or wheat or 4.2 of onion.[14]

[14]Salunke, S.P., (Col), 1983, Pani Panchayat: Dividing Line between Poverty and Prosperity. Pune:Gram Gourav Pratisthan.

FIGURE No 1.2

HECTARE OF A GIVEN CROP THAT CAN BE IRRIGATED WITH 300 HECTARE CM OF WATER

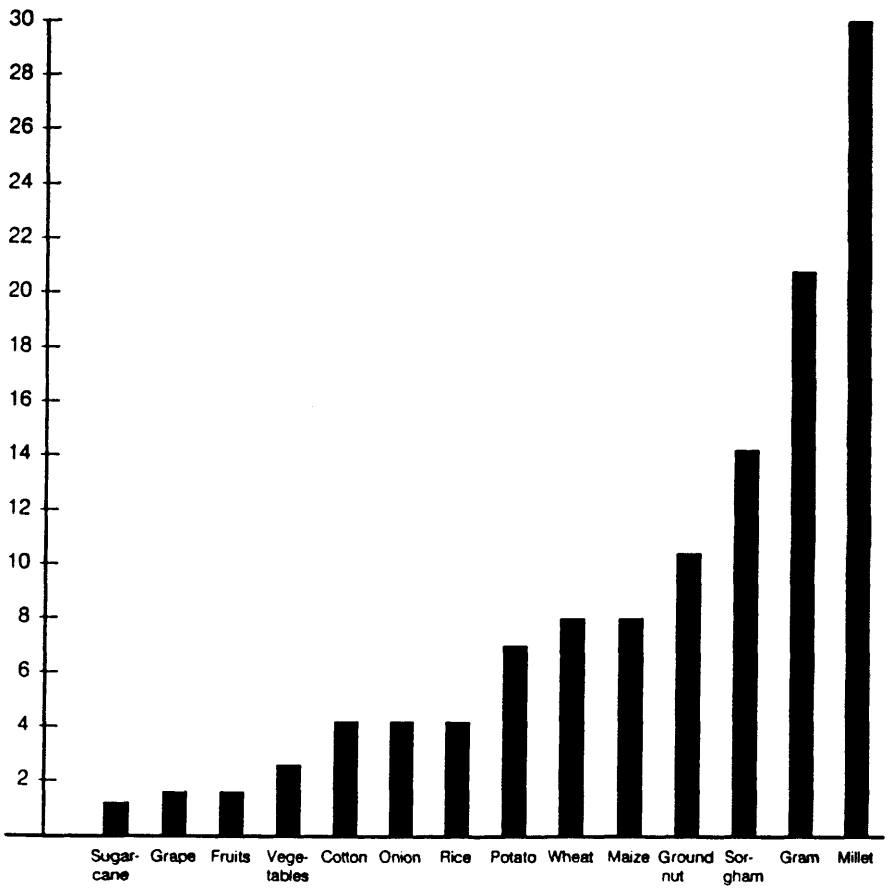


TABLE No 1.4

WATER REQUIREMENTS PER HECTARE BY CROP

Crop	Qty of water required per irrigation per hectare in Hectare CM	Total number of irrigations per season	Total water required hectare in Hectare CM
Sugarcane	10	30	300
Grape	7	28	196
Fruits	7	28	196
Vegetables	7	15	105
Cotton	7	10	70
Onion	7	10	70
Rice	7	10	70
Potatoes	7	6	42
Wheat	7	5	35
Maize	7	5	35
Groundnut	7	4	28
Sorghum	7	3	21
Gram	5	3	15
Millet	5	2	10

Note: 1 Hectare CM = the amount of water required to cover to a depth of 1 centimeter

Source: Based on the data provided by the Gram Gourav Pratisthan

TABLE No 1.5

PRODUCTION PER HECTARE BY CROP

Crop	Produced in Quintal	Value per Quintal (Rs.)	Total value (Rs.)
Sugarcane	1000	25	25,000
Grape	200	300	60,000
Fruits	100	300	30,000
Vegetables	100	100	10,000
Cotton	20	500	10,000
Onion	200	60	12,000
Rice	35	200	7,000
Potatoes	200	75	15,000
Wheat	20	200	4,000
Maize	300	25	25,000
Groundnut	15	350	5,250
Sorghum	20	180	3,600
Gram	10	250	2,500
Millet	17	250	4,250

Source: Based on the data provided by the Gram Gourav Pratishtan.

More important from the standpoint of community need, is the fact that the production of one hectare of sugarcane generates a demand for only 360 man-days of labour compared to 90 man-days for one hectare of millet or 400 man-days for one hectare of onion.[15] In a community with a serious labour surplus as in Purandhar this has important social significance.

[15]This is certainly not to suggest that community interest would be best served if irrigation water were committed only to the production of millet or onion. Not all land can be economically reached by irrigation. The amount of labour absorbed might well exceed availability, especially on a locality specific basis. The returns to labour are quite low as well, providing little opportunity for more than a bare subsistence living - though preferable to starvation.

TABLE No 1.6

VALUE AND EMPLOYMENT GENERATED BY 300 HECTARE CM OF WATER

Crop	Area irrigable with 300 ha CM of water (in Hectares)	Value per hectare in Rupees	Value of production from area irrigated	Man-days work generated from area irrigated
Sugarcane	1.0	25,000	25,000	360
Grape	1.5	60,000	90,000	2,160
Fruits	1.5	30,000	45,000	1,080
Vegetables	2.8	10,000	28,000	1,080
Cotton	4.2	10,000	42,000	630
Onions	4.2	12,000	50,400	1,680
Rice	4.2	7,000	29,400	420
Potatoes	7.1	15,000	106,500	1,278
Wheat	8.5	4,000	34,000	1,020
Maize	8.5	7,500	63,750	765
Groundnut	10.7	5,250	56,175	963
Sorghum	14.2	3,600	51,120	1,704
Gram	20.0	2,500	50,000	1,800
Millet	30.0	2,500	75,000	2,700

Source: Based on the data provided by the Gram Gourav Pratishtan.

From the standpoint of total benefits to the community, sugarcane is probably the least environmentally and socially desirable choice among all the crops grown in Purandhar. By planting any other crop common to the area, water could be allocated over a larger area of land. This would then benefit a larger number of farmers, who could produce other crops of higher total value per unit of water while productively absorbing substantially more of the area's surplus labour.

The cultivation of sugarcane as the irrigated cash crop has developed small

islands of prosperity in Purandhar taluka which derive their fields with water from canals set up by the government. Except for a small area around Purandhar's two dams that grow sugarcane, the rest of the taluka is without access to irrigation facilities. The concentration of land occurs together with the concentration of water in Purandhar.

Sugar Politics

Sugarcane has not only changed the cropping pattern, agricultural productivity and the landscape in Western Maharashtra, it has also introduced new dimensions in the rural politics of the state by creating a powerful pressure group of *bagaitdars*, the sugarcane planters. The entire economic and political structure of Western Maharashtra revolves around sugar cooperatives and rural politics in Western Maharashtra is essentially sugar-based politics. Sugarcane is not simply a highly profitable crop, it also concentrates political power because of the organization of sugar production through huge, capital intensive cooperative sugar factories. Maharashtra has over 75 sugar factories, the large majority of them sugar co-operatives, of which 55 are situated in Western Maharashtra. Few politicians from Western Maharashtra can hope to survive in state politics without the backing of those that have command over these factories and the resources they represent. As a result there is intensive pressure to spread the cultivation of sugarcane, to grab water for its use, and to build more and more sugar factories.[16]

The issue of water distribution has now began to figure in almost every

[16]Omvedt, Gail, 1985, "Fighting Famine," Economic and Political Weekly, XX, (44), November 2.

public rural meeting in Maharashtra. In one such meeting, a politician cum sugar baron, Yaswant Mohite, declared that cane was central to Maharashtra's agricultural and rural industrial development and that more sugar factories should be built. He further said, "We will not give one drop of water from sugarcane; instead a canal of blood will flow; cane and sugar factories are the glory of Maharashtra."[17]

CONCLUSION

In Western Maharashtra the reoccurrence of droughts with its increasing intensity I believe, is not a result of natural causes such as less rainfall, but of social causes - specifically the destruction of an environmental balance caused by a profit-oriented agricultural system, a mistaken crop pattern, and a misuse of the existing scarce water resources.

Western Maharashtra provides a dramatic illustration of how changes in land use are linked with water usage. An increase in areas identified as drought-prone from 16 percent in 1972 to 30-40 percent in the last decade and a half by the Indian National Institute of Rural Development, indicates that the over-exploitation of water for the cultivation of a water-intensive cash crop sugarcane is the primary cause for the growing scarcity of water for drinking and protection

[17]Conversation with Gail Omvedt July 26, 1990.

from the repeated failures of food crops.[18] Drought control in Western Maharashtra is ultimately linked with prudent and just uses of water.

[18]Jaiswal, N.K. and N. V. Kolte, 1981, Development of Drought Prone Areas. Hyderabad: National Institute of Rural Development.

CHAPTER II

The Pani Panchayats of Purandhar Taluka - a response to Maharashtra's water crisis

THE ORIGINS OF THE PANI PANCHAYAT

THE DROUGHT OF THE 1970s[19]

Maharashtra faced a severe drought between 1970 and 1973. A total failure of the monsoon for three consecutive years created a threat of famine throughout the rural areas of the state. Out of the total number of 35,778 inhabited villages in Maharashtra, 23,062 villages were affected by the drought in 1970-71, 14,687 in 1971-72, and 30,878 in 1972-73. 68 percent of villages in Maharashtra had no drinking water or fodder supplies. The rural population that was affected during the three years of the drought ranged between 1.5 crores to nearly 3 crores, constituting from 43 per cent to 86 percent of the rural population. Production of food grains in the state was less than normal by about 18 percent in 1970-71, 29 percent in 1971-72, and 54 percent in 1972-73.

[19]Drought Statistics from Maharashtra, India (State), Fact Finding Committee for Survey of Scarcity Areas, 1973, Report on the Fact Finding Committee for Survey of Scarcity Areas, Maharashtra State. Bombay: Government of Maharashtra. and

Subramanian, V., 1975, Parched Earth: the Maharashtra Drought 1970-73. Bombay: Orient Longman Ltd.

Farmers, large and small, were forced to leave their barren fields and migrate in search of work either as agricultural labourers to the sugarcane fields in Southern Maharashtra, or to work in the textile mills in Bombay. Most of the drought affected population were forced to take refuge with emergency relief and Employment Guarantee Schemes (EGS) organized by the Maharashtrian government. The EGS initiated as an emergency measure by the Maharashtrian government provided employment at a stipulated wage to persons who were affected by the drought and focused the relief works on road construction. The attendance in the relief schemes were 14.60 lakhs in September 1971, and by 1972-73, the height of the drought had increased to 35.05 lakhs which later increased to 49.47 lakhs by the end of the drought.

Purandhar taluka of Pune district and the drought

Purandhar taluka was one of the talukas in Pune district to be worst affected by the drought. The region received only 470 mm of rainfall during the drought years which was deficient by 21 percent and 43 percent from the normal rainfall of 900 mm. The physical impact of the drought on the different sections of Purandhar's population was significant. Large farmers were little affected by the drought. Only a small percentage of large farming households took part in the relief efforts. Most of the wells on the land of the medium farmer dried up during the drought as their wells are not as deep as the larger farmers' bore wells, which were not affected by the drought. 50 percent of medium landholders were forced to work in government sponsored relief schemes, or mortgage or sell their lands.

Some had to face partial starvation. Small landholders with only un-irrigated land were among the worst affected by the drought. 60 percent of small farmers had to sell their livestock or send them to cattle camps and sell or mortgage their lands. 50 percent of them were classified as starving. Landless labourers were the worst affected by drought.

During the first year of the drought, the persons who sought employment in the government organized relief works were mainly landless labourers who found themselves deprived of agricultural work. There were also few medium and small landholders. As the drought continued into its second consecutive year, all small landholders who owned non-irrigated land sought employment in the relief schemes. In the third year, the drought affected most of the medium and some large farmers in Purandhar.

An analysis of consumer expenditure in rural households in the ten most drought affected districts, including Pune, revealed a sharp change in the main source of livelihood in many of the cultivating households. In large cultivating households (households possessing more than 15 hectares), as many as 25 percent had to seek work in activities other than cultivation during the drought as against 6 percent in the normal year (1967-68). In a normal year 61 percent of Purandhar's population depended on agricultural cultivation. This dependence was reduced to 35.2 percent during the drought years of 1970-73.

Forum of Industrial Technologists (FIT) and Government Collaboration

The Maharashtrian government in 1972 collaborated with a voluntary organization, the Forum of Industrial Technologists (FIT), consisting of engineers from Pune city to study the drought affected areas, evaluate the government relief schemes and provide the government with the technical assistance needed in designing schemes that would provide a solution from the drought.

Mr. V.B. Salunke, a self-employed engineer and a founding member of FIT, visited Purandhar taluka, one of the worst affected regions in the district of Pune, in 1972, to study the region and evaluate the government relief schemes. In his evaluation of the relief schemes, Mr. Salunke concluded that the relief programmes were attacking the symptoms of the drought rather than the causes of rural poverty and were largely futile. Rather than formulating plans to guarantee the availability of water to all farmers, the schemes laid emphasis on guaranteeing employment to them. According to Mr. Salunke, the EGS were not community oriented and in effect provided a dole to the affected persons rather than addressing the problem of drought and water supply.

Salunke believed that the emphasis of relief schemes should be on increasing rural productivity, in particular through an improved management of water resources. By conversing with farmers participating in the relief schemes, Salunke realized that they wanted ways of capturing and storing rain water run-offs. In Salunke's evaluation of the existing irrigation schemes, he established that the potentials for impounding water for irrigation were not being adequately

exploited and where irrigation facilities were already developed, little attention was being given to the equitable distribution of water. At the same time, he observed successful efforts by some farmers who were bunding their fields to reduce soil erosion, improve moisture retention and speed the recharging of percolation wells.

Acting on the insight of these observations, Salunke proposed to the government officials to concentrate their food for work programs on improving facilities for local soil and water management instead of road construction, which did not address the issue in the problems of water scarcity in the area. The Forum designed its participation and collaboration with the Maharashtrian government in a manner that progressively laid a greater emphasis on the creation of productive assets that would eventually provide a permanent solution to the recurring problem of drought. A programme for the construction of percolation tanks, nallah bunding and minor irrigation tanks was undertaken by the government under supervision from Mr. Salunke.[20]

THE EXPERIMENT AT NAIGAON VILLAGE

Because of his first-hand experiences during the drought, Mr. Salunke believed that a solution to end the recurring droughts was essential. He felt that an equitable water distribution method, different from the doctrine of proportionate equality, was critical especially in regions with scarce water resources. He wanted

[20]Personal Interview with Mr. Salunke, January 12th 1991.

to establish an experimental farm in a drought prone-area to test the ultimate potential of improved soil and water management practices. This farm would then serve as an experimental and training site for the development and dissemination of tested management practices appropriate to the region.

Why Naigaon?

Mr. Salunke chose Naigaon village as it was one of the worst drought affected villages in Pune district. Naigaon is situated 60 kms south of Pune city in Purandhar taluka and has a population of 1,600. The village, which has 300 households, occupies a total area of 1,537 hectares. A small seasonal *nallah* (gully) runs north-south cutting the village into two halves.

TABLE No 2.1

LAND USE PATTERN IN NAIGAON
(in Hectares)

Forests	Unirrigated	Irrigated (wells)	Not available for cultivation	Total
Nil	1099	329	109	1,537

Source: Gram Gourav Pratishthan according to 1981 Census.

In 1974, Mr. Salunke was able to acquire on a fifty year lease 16.18 hectares of barren unirrigated land. As the land belonged to the village temple it was designated as village common land. The land was considered unsuitable for crop cultivation and was being rented for Rs. 400 per annum as grazing land. As the rent from the land went towards the maintenance of the village temple, the

villagers were delighted to accept Mr. Salunke's offer of Rs. 1,200 per year for fifty years.

Formation of the GGP

In 1974, Mr. Salunke established a non-governmental voluntary organization in the form of a charitable trust called the *Gram Gourav Pratishthan* (GGP), which means "village pride." The trust, which was funded by two non-governmental organizations, Food for Work of USA and Novib of the Netherlands, was defined with the objectives of providing relief to the farmers in Purandhar and in other drought-prone areas by improving their economic conditions through improved water distribution and better moisture retentive techniques.

The experiment

The 16.18 hectare plot was located on a micro-watershed of about 80 total hectares. During heavy rains the precipitation from the 80 hectares would run into this water shed. To impound this water, a percolation tank capable of storing a million cubic feet (cft) of water was constructed on the land. The fields were contoured bunded, leveled, ploughed, and stones were removed. An open well was dug at the base on the downstream side of the percolation tank and a 7.5 horsepower (h.p.) diesel pump was installed and pipes laid underground to distribution chambers. The key to the design followed was the theory that water collected in the tank or used in higher fields would percolate into the ground and raise the water table of land at lower elevations.

The Salunke family conducted experiments in water and soil conservation

to help design a low-capital cost community minor irrigation scheme for eight months of the year. For five years, they tested alternative cropping patterns, which changed from bajra, jowar, pulses combination to bajra, jowar, cotton, groundnut, onion and grapes. Improved seeds, fertilizers and pesticides were used to determine which would provide an optimal production of food and income.

During the early years of the experiment, the villagers of Naigaon showed little or no interest, convinced that the Salunkes were engaged in a futile experiment. But gradually successful results became apparent. Of the total 16.18 hectares of previously discarded land that had been used for grazing, 9.71 were brought under cultivation with protective irrigation to grow food grains, 2.4 were forested with local forest species, and the remaining four were occupied by the percolation tank, well, field bunds, tracts and other infrastructures. The area under cultivation produced 200 quintals of food grain, while 16.18 hectares of a Naigaon farmer's land could hardly produce 10 quintals per year. Besides food grain production, the farm was able to provide full-time employment for 15 people, support 16 heads of cattle. There were 4,000 trees of local forest species on the once barren rocky rimlands and 2,000 fruit trees along the farms field bunds.[21]

Enforcing a new method of technology does not usually get ready acceptance in rural India. This is because of the risk aversion and the skepticism about the expected incremental returns. The barrier takes its own time to break.

---

[21]Salunke, S.P. (1983).

-- Personal conversations with Mr. V.B. Salunke. January 1991.

However, farmers have a high receptivity towards demonstration effect, especially when the new technology is used by a fellow cultivator. The successful results from the experimental farm in Naigaon made farmers realize that irrigation from the rain water run offs could be harnessed through improved moisture conservation techniques. In time farmers of Naigaon, mainly small and medium, requested Mr. Salunke to start similar schemes in their hamlets.

FORMATION OF THE PANI PANCHAYAT

The first meeting for the formation of a water users cooperative was held in Naigaon in 1976, by forty small and medium farmers who had been the worst affected during the drought of the 1970s. The key to increasing agricultural productivity and the income of these farmers was an improved water distribution system. Mr. Salunke's experimental farm made these farmers realize that they could increase their farm output through the creation of irrigation facilities. It also made them aware of their rights in accessing the water from the government percolation tank or the seasonal stream in Naigaon. The water from the tank and the stream remains full eight to nine months of the year. Larger farmers were mainly using the water to grow sugarcane as their farms were situated in the command area of the tank. Some of these farmers had drilled bore wells on their land and were virtually drawing from the water going underground by seepage from the tank or the stream.

Due to the frequent environmental instabilities in Western Maharashtra, geographic mobility was an inevitable fact of life and has had important consequences for the social order of rural life in the villages of Purandhar taluka. Environmental instability was not only a threat to the continuity of villages but were even more threatening to the continuity of individual families. Rural society in Western Maharashtra had to be flexible in order to cope with the frequent environmental crises. Co-operation in Maharashtrian villages therefore became vigorous and essential and cut across caste and class lines. The co-operation that did occur in the village was however functionally conditioned and selective.[22]

Access to irrigation facilities would improve the lives of the small and medium farmer. Small farmers owned only non-irrigated land. Often during the drought they had to sell or mortgage their lands or migrate to cities. The medium farmers had their own private wells but because of lack of resources could not dig deep wells. Their wells often dried up during the end of the cropping season. They had to compete with the larger farmers for access to the water from the tank or the stream, a battle they usually lost. An alliance between the medium and small farmer through a water users cooperative would enable them to receive an assured supply of water through better infrastructure and increased finances.

---

[22]Attwood, D.W, 1988, "Risk, Mobility and Co-operation in Maharashtrian Villages," in D. W. Attwood, M. Israel and N. K. Wagle, (eds.) City, Countryside and Society in Maharashtra. Toronto:Center for South Asian Studies, University of Washington.

Organizing Principles and their conception[23]

Small and medium farmers formed the Pani Panchayat with the central idea that in a drought-prone area, no individual should be deprived of a rightful share of the limited water resources on which his or her life and livelihood depended on. Mr. Salunke, through his early discussions with farmers from Naigaon, realized that farmers, especially small and medium farmers, wanted a podium through which they could have a voice in water-use decisions.

Having witnessed the problems in the irrigation networks administered by the government, the small and medium farmers wanted rules that would insure their water rights and discourage the larger farmers from taking advantage or accessing their water supplies. The Pani Panchayat was thus created as a community administered scheme, where each Pani Panchayat is a community based resource management system with a lift irrigation scheme serving a specific community. A village can have more than one Pani Panchayat.

The Pani Panchayat was created as an instrument through which all members of a community could have a say in water-use decisions within set principles that ensured an equitable distribution of water. Farmers from Naigaon framed these principles around discussions and meetings between themselves and Mr. Salunke. The design of these principles insured each family, at minimum, enough water for its own staple food requirements plus a small income from cash

[23]Personal Interviews with farmers from Naigaon who were took part in the conceptualization and the creation of the 1st Pani Panchayat and conversations with Mr. Salunke. January 1991.

crops.

1. Assistance would be provided only for group schemes.

The *Gram Gourav Pratisthan* (GGP) established as a charitable trust would provide financial and technical assistance only to group schemes. This was intended to help foster a sense of shared community responsibility. By doing this Salunke introduced a communal system of irrigation where the rain water could be harnessed and distributed to all.

2. A per capita based water distribution system.

The traditional method of water distribution in force in Maharashtra follows the doctrine of proportionate equality or many times that of prior appropriation (both mentioned in Chapter I) Both these methods discriminate against the small and medium farmer and especially the landless labourer. Inequality in land distribution is reinforced through water distribution. The small and medium farmer wanted a form of measurement that would be equal in theory and practice.

The various experiments conducted on the experimental farm proved that with the proper methods of water conservation and distribution, an individual could sustain on crops grown on 0.20 hectare or half an acre of irrigated land. Through discussions with farmers from Naigaon and other villages, Mr. Salunke came to the conclusion that an individual farmer could only take care of half an acre of land without help from his or her farm animals, labour or machines. Water shared on the basis of the number of family members, irrespective of age, and not in proportion to the size of land holdings, would incorporate the principle of equity

and avoid reinforcing the income imbalance. As the average size of a family in Naigaon was five, creating a ceiling of one hectare per family would encourage intensive cultivation of the irrigated land, producing much higher returns per unit of water.

3. The rights to water belong to each Pani Panchayat scheme.

In discussions at the first meeting, small farmers spoke of having to sell or mortgage their lands to larger farmers during droughts. Many had done so during the previous drought. Small farmers wanted a way of ensuring against larger farmers taking advantage of them. The farmers created a principle guaranteeing that water rights belonged to the community involved and not the individual farming household. Each farmer thereby had a water right based on his or her per capita to increase his or her individual agricultural income. However, if the farmers chose to sell their land, the right of water reverted back to the Pani Panchayat scheme concerned.

4. Beneficiaries would share 20 percent of the cost of the lift irrigation scheme.

In Western Maharashtra and in other parts of India, beneficiaries do not contribute towards the implementation of minor irrigation schemes. This often leads to neglect in the maintenance and the operations of the schemes. To make themselves fully responsible for the administration and operation of the Pani Panchayat scheme, the small and medium farmers decided to contribute 20 percent towards the capital cost of the schemes. The remaining 80 percent was expected

to be recovered from the Drought Prone Area Programme - Minor Irrigation Extension Programme and the GGP.

This personal investment of 20 percent by the farmers themselves, towards the implementation of the scheme guaranteed the farmer direct control and involved him or her in decisions of the scheme. Mr. Salunke introduced this concept in the discussions as he felt that it was essential for each individual family to pay towards their welfare to insure their continued active participation.

5. Beneficiaries would administer and run all schemes.

Having witnessed the problems that occur in the government irrigation schemes due to the lack of attention paid by the irrigation department, farmers wanted to administer and operate their own specific scheme. This would insure an efficient running of the scheme but more importantly would not allow the larger farmers to free ride. It would also encourage and enhance rural leadership skills, especially of the smaller farmers.

6. Cultivation of water intensive crops like sugarcane was prohibited.

When Mr. Salunke asked farmers if they had enough water to cultivate one hectare, what would they choose to grow on it, almost all small and medium size farmers chose to grow foodgrains. The experience of the drought, which had forced small and medium farmers to work for a food wage, defined their importance towards food crops rather than cash crops.

7. Landless have same share of water rights to that of the landed.

Realizing that inequity in water distribution follows the inequity of land

distribution, Mr. Salunke felt it was important to include agricultural labourers into the Pani Panchayat community. Landless agricultural labourers were the worst affected population group during the drought. These labourers wanted water rights, as it would improve their economic and social situation. Access to water rights would enable the landless labourers to gain full employment in the village itself by entering into share-cropping arrangements with farmers who have an abundance of un-irrigated land. This arrangement would also reduce their migration to other villages in search of employment. It would be to the advantage of the landed farmers with excess land to agree to a sharecropping agreement as they could receive additional output from their land.

Why did the beneficiaries choose the word 'panchayat' and does a Pani Panchayat differ from the traditional village Panchayat?

The Pani Panchayat is a water users cooperative. The beneficiaries however chose not to organize it as a cooperative nor call it one, because to them a cooperative was exemplified by the sugar cooperatives - where power was concentrated only in the hands of the wealthy and politically powerful individuals and the poor did not have a say in the decision making processes.

Pani which means water in Marathi was incorporated with the word *Panchayat*, meaning traditional village council. The beneficiaries of the Pani Panchayat chose to use the word Panchayat as it meant non-hierarchical representation. The Pani Panchayat, is different from the traditional village Panchayat, mainly because it is not involved in what is normally identified as the

central task of the village panchayat. The village panchayat is responsible for the settlement of disputed claims and the administration of justice. It is a governmental representation of and for the village, whereas the Pani Panchayats are part of a non-governmental organization. While the Pani Panchayat is a community based resource management system within specific boundaries set by the command area of the lift irrigation scheme or the village itself, resource management is not identified as a usual function of village panchayats.[24]

A PANI PANCHAYAT SCHEME

The creation of a community based resource management system was essential to the small and medium farmers in Naigaon. Direct control in the administration of a Pani Panchayat scheme would enable farmers to have a voice in water use decisions. By formulating principles that directed community level participation within the Pani Panchayat scheme, each group became solely responsible for the administration of its own scheme from the start.

Operational Rules and Administration of a Pani Panchayat Scheme

To ensure an awareness of each beneficiary that took part in a specific scheme and to inhibit the larger farmers from taking advantage of their lift irrigation schemes, the small and medium farmers set up uniform operational rules with the help of Mr. Salunke.

---

[24]Wade, Robert, 1988, Village Republics: Economic Conditions for Collective Action in South India. Cambridge:Cambridge University Press, p8.

These rules were:

(i) To provide a management structure for the Pani Panchayat scheme, the benefiting members of each scheme would have to select a *Panch* (five) Committee from the benefitting community. This would include a *Gat Pramukh* (group leader) and four others.

(ii) The beneficiaries should donate a piece of land on which the community well would be dug and the pump house and water tank installed. Beneficiaries should also donate land on which pipe lines would be installed. No compensation was to be paid.

(iii) No new wells were to be dug in the command area of the scheme.

(iv) The GGP would charge each Pani Panchayat scheme *Pani Patti* (water charges). Pani Patti would include the monthly pay for the *Patkari* (water distributor), electricity bill and water charges to the irrigation department. It would also include management fees charged by the GGP and a contribution to the reserve fund. The Pani Patti would be collected in two yearly installments, the first at Diwali (the Hindu New Year) and the second before the Kharif season. Those that did not pay the Pani Patti would not receive their share of water the next season.

(v) Beneficiaries were jointly responsible for the maintenance of the pump machinery and field channels. This would be covered by the Pani Patti.

(vi) All beneficiaries would have to give a written consent to open a joint bank account of the GGP and *Gat Pramukh.*

(vii) Beneficiaries should strictly adhere to the directions of the *Panch* Committee and GGP representatives jointly.

The *Panch* Committee, selected by the benefiting community, is responsible for financial and administrative decisions. The Panch Committee and the Gat Pramukh would work together to resolve disagreements or disputes and tensions that may arise between beneficiaries. The Panch Committee also ensures the recovery of the Pani Patti installments, the repayment of the GGP interest free loan or the repayment installments of the bank loans. The group leaders of several schemes in a particular area meet every Sunday with a representative of the GGP. They are also responsible for holding meetings with their own groups at least twice a month to discuss system management, cropping patterns and most essentially to set up timings for the allocation of water to each farmer.

The farmers adapted the traditional rotational warabandhi system of allocating water to suit their own requirements in the Pani Panchayat scheme. During the bi-monthly community meetings, the members of the specific scheme set timings for the allocation of water to each farmer. On an average, water was made available to each farmer's one hectare at the rate of three hours per half an acre of share. The water from the lift source was distributed to various farmers in pipes that were laid underground. By doing this farmers were able to avoid non-participating farmers from using the Pani Panchayat's water.

Every Pani Panchayat scheme appointed a *Patkari* (water distributor) who was trained by the GGP in the management and technical skills needed to operate

the lift irrigation scheme. The Patkari is responsible mainly to assure fair daily allocations of water to all of the scheme's beneficiaries. He is also responsible for the management of maintaining the scheme, attending the machinery, and recovery of the Pani Patti. The Patkari is usually from a neighbouring village, and not directly involved in the scheme itself. He is paid a stipend of 200 rupees per month.

Financial Planning

By making each benefiting farming household contribute 20 percent of the capital cost (estimated) in cash before the implementation of the scheme, the small and medium farmers ensured a commitment from each other on forming a Pani Panchayat scheme. 50 percent of the capital cost was expected to be recovered from the Maharashtrian government under the Drought Prone Area Programme (DPAP) - Minor Irrigation Extension Programme. The balance of the capital cost was to be provided by the GGP from its trust funds as an interest free loan to the benefitting community. The interest free loan was to be paid back in suitable annual installments in a seven or ten year period depending on the community.

According to the DPAP programme, the rules for subsidizing the Minor Irrigation Extension Programme was 50 percent of the cost for farmers holding less than 7.5 acres, 40 percent for farmers owning more than 7.5 upto 15 acres. Backward class farmers were entitled to a 66 percent subsidy. Farmers with more

than 15 acres were not entitled to any subsidy.[25]

Procedures used for implementation of Pani Panchayat schemes

A procedure was established by the GGP with advice from farmers in Naigaon for the formulation of rules to help set up new Pani Panchayat schemes. A preliminary discussion was first set up by the GGP with the community that wanted the Pani Panchayat scheme to establish whether the group was unified in its resolve to develop a water-users scheme on a co-operative basis.

The land area of the benefitting community was then surveyed to determine whether adequate water supply was available through a nearby stream, government built irrigation tanks or canals or if the area was situated within a watershed. A survey was also conducted on the general layout of the command area including the number of hectares to be served and the extent to which they were reasonably contiguous. After the completion of the survey and the first meeting, detailed plans and cost estimates are prepared by the GGP.[26] The possibility of obtaining permission from the government to lift water from irrigation canals and tanks was accessed and the contingency of obtaining a power connection.

The first meeting established the total number of beneficiaries interested in forming the Pani Panchayat scheme. Large communities of more than 40 persons

---

[25]Deshpande, R.S. and V. Ratna Reddy, 1989, Evaluation study of the Centrally Sponsored Scheme of Assistance to Small and Marginal Farmers for Increasing Agricultural Production. Pune:Agro-Economic Research Centre, Gokhale Institute of Politics and Economics.

[26]The GGP continues to engage the services of students from the Engineering College of Pune in preparing the plans of the schemes. They receive a small stipend from the GGP for their work.

was divided into two different schemes. The smaller the number of users the better the chances of success and higher the chances of the scheme operating more efficiently. Before the actual work of the scheme was undertaken, it was essential that the specific group deposit with the GGP an amount equal to 20 percent of the estimated capital cost. Each beneficiary had to raise and deposit their share with the *Gat Pramukh* based on the amount of their land that would benefit from the scheme. This often involved considerable sacrifices on the part of the smaller farmers. Self-contribution towards a community scheme however has helped bring about a feeling of commitment and a sense of true ownership with the individual farmer.

Crop Planning and Irrigation Techniques Used

The right planning for growing crops is extremely important for the small and medium farmer in a drought prone area. The farmer has to strike a balance between cash crops and food grain crops. The principles of the water distribution method followed by the Pani Panchayat insured water distribution enough to cultivate the household's staple food requirements and a small income from a cash crop.

Beneficiary members of the Pani Panchayat have some freedom in selecting the crop they would like to grow. The principles of the Pani Panchayat model however prohibit the cultivation of all water-intensive crops. This includes sugarcane, tumeric and bananas. Most of the crops grown by the beneficiaries of the schemes are common to the region. Cash crops that are cultivated cater to the

wants of people in local towns and Pune city. The principal crops grown in the rabi season are jowar, wheat, onion (late), gram (pulses) and vegetables. During the summer months, *wal* and *chavli* (types of vegetables) are grown in areas with water supplies. The cultivation of wal and chavli continue into the Kharif season when farmers also cultivate flowers (Marigold, Chrysanthemum and Zenia) Onion (early) and Bajra.

The concept of equitable distribution of water practiced by the Pani Panchayat is that 0.20 hectare of irrigation water is provided on a per capita basis with a ceiling of one hectare. Depending on the availability of water for the particular scheme during a specific season there is a wide variation in the distribution of water. On an average, water is made available at the rate of three hours per 0.20 hectare of share. During the Rabi season, most of the Pani Panchayat schemes are able to fully utilize the irrigation water over more or less the entire command area of the scheme. Utilization of irrigation water is reduced during the summer and kharif season. Few schemes have water available for irrigation during the summer months.

The members of each Pani Panchayat scheme are responsible for attending to the maintenance and cleaning of the water channels. Usually a day is set when the members contribute their voluntary labour for the upkeep of the channels. Those members who are unable to contribute their voluntary labour contribute in cash to pay towards the cost.

WHY DID THE LARGER FARMERS AGREE TO JOIN THE PANI PANCHAYAT SCHEME?

My answer to this question, with help from my conversations with larger farmers of Naigaon, is that several factors bear on the situation. The factors relate to ecology and a history of environmental calamities, internal social structure and demographic composition, the apparatus of the state and an individual's social reputation. Of these, I contend that the ecological factors, particularly scarcity and risk, are the most important. I argue that cooperation around a scarce resource occurs only when external costs are high - when in other words, the interdependencies in production are such that any one cultivator is exposed to a high risk of crop loss and social conflict as a result of the activities of other people and himself or herself.

The belief that one farmer's gain must be another farmer's loss

In 1978, small and medium farmers from Naigaon set up the first Pani Panchayat scheme with help from the GGP. This scheme, the Mhasoba Pani Panchayat scheme is situated in the nallah which runs through the village and on which the government percolation tank was already constructed. The water available in the stream had increased due to the construction of the percolation tank. Larger farmers of Naigaon, whose farms were situated in the command area of the stream and tank, were using the water seepage to cultivate sugarcane. When the scheme was being implemented, the larger farmers objected to the scheme. As the Mhasoba scheme was lifting water from the same source, the larger farmers

feared the implementation of the scheme would adversely affect their water supply. The larger farmers took the problem to court. The case however, was decided in favour of the Mhasoba scheme.

Chambers (1988), suggests that farmers who are selfish in private - that is who waste water and will not make an effort to use water more efficiently as long as no issue is made of this - will be more generous when everyone's behaviour of using water is made a public issue through group discussions and decisions. The court decision against the large farmers of Naigaon made public and condemned the exploitative usage of water by them. The large farmers in Naigaon joined the Pani Panchayat schemes after five other Pani Panchayat schemes had been already set up in the village. Afraid that the cooperation between medium and small farmers of Naigaon would drastically reduce not only their water supplies but also their social standing in the village, the larger farmers felt it would be better for them to join the water users cooperative than suffer the risk of social ostracism and less water supplies.

The exclusion technology used by the Pani Panchayat Scheme

The members of the Pani Panchayat schemes chose to distribute water from the lift site to the field through pipes that were laid underground on the benefitting farmers land. The higher the costs of exclusion technology the better the chances of success, argues Wade (Wade, 1988). Strict control was administered over the water resources through a trained water distributor, who controlled who received water and when, the distribution of water through underground pipes and the

benefitting communities' direct involvement. All this made it easy to detect rule breaking, free riders and farmers who were not members of the scheme utilizing the scheme's resources. A larger farmer therefore had to join the Pani Panchayat scheme to benefit from it as they could not free ride the schemes benefits.

Less water, a better delivered and assured water supply

Some of the large farmers chose to join the Pani Panchayat schemes because they were assured of a better delivered and reliable water supply. Many of the larger farmers cultivated sugarcane as a cash crop because they were able to access reliable water supplies. During droughts, however, these farmers were forced to shift from the cash crop cultivation to traditional foodgrains as their water supplies became unreliable and limited.

In 1984, when Purandhar taluka experienced another drought, the already implemented Pani Panchayat schemes demonstrated their anti-drought effectiveness. The farmers in the scheme did not have to shift from cultivating an onion cash crop and were higher income earners than the larger farmers. The larger farmers from the village of Dhalewadi chose to join the Jai Malhar Pani Panchayat Scheme because they felt that it was better for them to join the scheme and take a reduction in water supplies. A guaranteed adequate and timely water supplies was better when the overall water supplies in the region were variable and unreliable.

CHAPTER III

The Impact of the Pani Panchayat Movement

Since the implementation of the first Pani Panchayat scheme in the village of Naigaon, 61 other schemes in have been implemented around Purandhar taluka and parts of Maharashtra. Of these schemes, 55 are located in Pune district, 1 in Latur district, 2 in Sholapur district and 3 in Satara district. Of the 55 Pani Panchayat schemes in Pune district, 49 are located in Purandhar taluka. These 61 Pani Panchayat schemes are located in 31 villages in drought-prone rural Maharashtra. Nearly 2,000 families are members in these schemes.[27]

The Pani Panchayat experiment has created an in-depth community awareness, strong interdependence, collective decision making, resource literacy and above all an incremental income for better living conditions. In this chapter, I will discuss the results of the concept of distributing water on a volumetric per capita basis and its effects in particular to the schemes in Naigaon and Dhalewadi

[27]Kolhe, A.K., N.R. Paranjape, A.K. Gupte, and M.D. Sathe, 1986, Pani Panchayat: a part of common property resources of land and water projects. Pune: Yashodhan Development Group.

See Appendix J: Pani Panchayat Schemes till 1988

villages of Purandhar taluka.

To help analyze the impact of the Pani Panchayat schemes on the lives of farmers and their villages in Purandhar taluka, I studied the experience of four schemes in considerable depth: the Mhasoba and the Chondkar Pani Panchayat Schemes in Naigaon and the Jai Malhar and Dr. Ambedkar Pani Panchayat Schemes in Dhalewadi. This has provided useful insights into the early benefits and challenges involved in initiating a new irrigation system and the experiences in adaptation to irrigated agriculture that most of the farmers had experienced for the first time.

The Mhasoba Pani Panchayat scheme in Naigaon was the first Pani Panchayat scheme to be set up. The scheme benefits 34 families or 300 persons and cost 1 lakh rupees to set up and irrigates 37 hectares. The work for the scheme, which started in October of 1978 and was completed with the help of government subsidies from the DPAP in February of 1979. The Chondkar Pani Panchayat Scheme also located in Naigaon village, had its water supply fairly assured as it was located in the headreach of the percolation tank. The scheme that benefitted 43 households or 300 persons was able to irrigate 31.62 hectares in the rabi season and 24.8 in the Kharif season. Work on the Chondkar Lift Irrigation Scheme began in May 1980 and was completed after only one year.[28]

The village of Dhalewadi about ten kilometers from Naigaon, is situated in the command area of the Nazare dam in Purandhar taluka. As the water supply in

[28]See Appendix H: Pani Panchayat Schemes in Naigaon

the area is fairly assured, the farming population in Dhalewadi are of a higher socio-economic group than those of Naigaon. Almost all the large farmers in the area have dug-wells or tube-wells on their lands. With access to reliable water supplies many large farmers previously cultivated sugarcane. During the drought of the 1970s, the population of Dhalewadi which is 654 were not severely affected by the drought due to the proximity to the Nazare dam.[29]

The Jai Malhar Pani Panchayat scheme in Dhalewadi is situated in the command area of the Nazare dam. It began with 34 members and later expanded to 67 members or 450 persons when larger farmers in Dhalewadi chose to join the scheme. The proximity of the dam and the ability of the scheme to obtain government permission to lift water from of the dam's pick up wiers assured the scheme an all year round water supply. The lift irrigation scheme which was completed within a year after being started in October 1981, was able to irrigated 38.6 hectares in the Rabi season and 28.3 in the Kharif season and 15.06 through out the year. Today with the inclusion of some of the larger farmers, the scheme irrigates 57.2 hectares in the Rabi season, 48.6 in the Kharif season and 28.3 through out the year. The second scheme in Dhalewadi, is the Dr. Ambedkar Pani Panchayat scheme, all of whose members are Harijans, the scheduled caste. This community received land from the Maharashtrian government under the "Land to the Tiller" programme in 1970 where each family has a 0.20 hectare. Even though the lands of these Harijans were situated on the banks of a government built

[29]See Appendix I: Pani Panchayat Schemes in Dhalewadi

storage tank of a field canal of the Nazare dam the farmers were unable to have full access to the waters as they lacked the necessary finances needed to implement a lift irrigation scheme. Work on the Dr. Ambedkar scheme started in November of 1981 and was completed in May of 1982.

FARM LEVEL CHANGES DUE TO GROUP IRRIGATION SCHEMES

On-farm changes in the schemes in Naigaon and Dhalewadi have been quite substantial and have increased both income and employment of their members. All the members of the scheme had no problem adapting to the introduction of a new crop technology -irrigated agriculture. Cropping patterns and crop intensity have changed favourably avoiding the usual backlashes of irrigation where access to irrigation motivates farmers to shift to the cultivation of water intensive crops.

Changes in Cropping Patterns

Before the implementation of Pani Panchayat schemes, small and medium farmers had to depend on the uncertain and meager rainfall or small dug-wells that dried before the end of the cropping season to irrigate their crops. Access to irrigation facilities has improved the stability of agriculture on their farms. Food production has increased. Previously, production output of rainfed bajra or jowar was only 50 kilograms per 0.40 hectare, today this has increased to four to five quintals. Production of staple foodgrains is now being used for home consumption and has reduced the farmers market purchases. The production of pulses has also

increased and some farmers are experimenting by growing oil-seeds for their own consumption and as a cash crop earner.

The prohibition in the cultivation of sugarcane has increased the cultivation of other cash crops as an income earner. Onions, a traditional crop in Purandhar and a high income earner in urban markets, is now being cultivated extensively. Because of access to irrigation facilities, farmers are often able to have two harvests per year. This helps the farmers earn similar monetary compensations as they did grow when they cultivated sugarcane.

The Mhasoba scheme: Interviews with 13 members from the Mhasoba scheme produced a very disappointing picture with respect to the cultivation of cash crops during the early years. All 13 had undertaken onion cultivation. Seven of these families suffered heavy losses during the early years when they found there was no water to support the crop after transplanting. The remaining six who did receive water earned 500 to 2000 rupees per acre. Only two members made a net profit on cotton, but the two who tried vegetables earned nothing due to inadequate water supplies.

Water supplies in Mhasoba were quite unreliable from year to year and this caused difficulties during the early years of the implementation of the scheme. Though the command area had been estimated at 100 acres, the results of the first two years of experience suggested that the actual potential was much less. While it was reported that water availability had been a good deal better for 1979-80, the maximum area under irrigation at any one time for the 1980-81 growing seasons

was just over 24 acres. The problem was corrected by drilling a four-inch bore well to a depth of fifty feet inside the open well built for the lift irrigation scheme. This considerably increased water yield even during the summer months and enabled operation of the pumps for an additional six hours a day. The results for the Mhasoba scheme did improve substantially with further experience. The average family in the scheme was able to increase its gross income with irrigated farming ten-fold over the pre-irrigation experience.

TABLE NO 3.1

MHASOBA SCHEME - VALUE OF MEMBER PRODUCTION, 1979-1984

Members	Value of Crops/Member					
	1979	1980	1981	1982	1983	1984
34						
Average	279	389	688	883	1,757	2,927
Low	180	200	300	700	1,000	1,900
High	500	600	900	1,200	3,000	4,000

Source: Based on the data provided by Gram Gourav Pratishtan.

The Chondkar Scheme: I examined six large farmers who had chosen to join the scheme, to examine the changes in cropping patterns which had resulted with the reduction of irrigation water. The farmers, who previously grown sugarcane, were cultivating three new crops onion, groundnut and cotton, with the main intention of producing cash income. Intensive cultivation of onion as a cash crop produced net returns of 5,000 to 7,000 rupees per 0.40 hectare - demonstrating the potential for

this crop. Larger farmers having higher incomes than the smaller farmers were able to use purchased inputs for cash crops, and thus generate profits.

As farmers could only irrigate a maximum of one hectare, the extra land was sharecropped with Naigaon's landless population. The landless labourer chose to grow staple cereals and the larger farmer did not have to purchase foodgrains from the market. Two larger farmers chose not to have any share-cropping arrangements with the landless as the water in their previously constructed wells had increased with the incorporation of the moisture retention techniques. These two households cultivated enough food grains to sustain themselves and their families with the waters from these wells on their land.

The rest of the 37 Chondkar scheme farming households had previously no access to irrigation water. Prior to receiving irrigation they had been able to produce barely half a quintal per 0.40 hectare of bajra or jowar in a reasonably good year. When I met them in January 1991, they reported production from five to six quintals per 0.40 hectare for these crops. The farmers reported that the increased production of foodgrains had allowed them to reduce the amounts of food grains they would otherwise have to buy to sustain themselves and their families. A new crop that was introduced with irrigation in the fields of these farmers was wheat. Wheat, a high-status crop in rural areas of Maharashtra and India, is only consumed by low income farmers during celebrations and festivals. The introduction of wheat for home consumption was considered by the farmers an improvement in their quality of life, as it demonstrated a higher income earning

capacity and shift from the dependence on the coarser jowar and bajra (which have higher nutritional value) as their staple grain.

TABLE No. 3.2

CHONDKAR SCHEME - VALUE OF MEMBER PRODUCTION, 1979-1984

Members	Value of Crops/Member					
	1979	1980	1981	1982	1983	1984
43						
Average			4,404	5,065	6,162	7,958
Low			1,500	1,500	2,000	3,500
High			8,500	8,500	11,000	12,500

Source: Based on the data provided by Gram Gourav Pratishtan.

The Jai Malhar Scheme: Most of the medium farmers in this scheme had already experienced irrigated agriculture. Previously these farmers had cultivated traditional staple cereal crops such as sorghum and millet and some sugarcane. The introduction of intensive cultivation and improved moisture retention techniques by the Pani Panchayat model, along with the assured yearly irrigation water supply due to the scheme's proximity to Nazare dam, the production output of crops in Dhalewadi increased tremendously. As these farmers were of a higher income group than other farmers from the taluka, they could afford to purchase improved seeds and use more appropriate quantities of manure and chemical fertilizers to increase their crop production. Onions and marigolds were their main cash crops. During the rabi harvest season of 1989-90 the onion crop valued at

25,000 rupees per hectare. Of the 60 hectares under irrigation, onion is cultivated on 32 hectares during rabi season making the annual income of the scheme from the onion crop to be 8 lakh rupees. As a result of the improved production of crop due to a year long assured water supply, the Jai Malhar scheme was able to repay the GGP loan in four years.

TABLE No 3.3

JAI MALHAR SCHEME - VALUE OF MEMBER PRODUCTION, 1982-1987

Members	Value of Crops/Member					
	1982*	1983	1984	1985	1986	1987
67						
Average	6,267	10,653	21,306	42,612	85,224	1,70,448
Low	4,500	7,650	15,300	30,600	61,200	1,22,400
High	9,000	15,300	30,600	61,200	1,22,400	2,44,800

* 1982 to 1985 had only 34 medium farmers as members. The larger farmers joined in 1985.
Source: Based on the data provided by Gram Gourav Pratishtan.

Dr. Ambedkar Scheme: The scheme receives water all year round and the introduction of irrigated agriculture has improved their lives so impressively that these poor Harijan members were able to repay the GGP their interest free loan in time.

With access to year round water, the members of this scheme have been to cultivate all year round, including the summer months. The main crops grown

during the rabi season is onions and bajra, with some marigold. In the Kharif season the farmers grow onions, wal and chavli while some farmers choose to grow jowar. During the summer months the farmers grow mainly wal and chavli. As each member only owns 0.20 of an hectare the cultivation is very intensive and the land is fully utilized. Some farmers divide their fields into two halves and grow the staple cereal on one half and an onion cash crop on the other. Some chose to grow the onion cash crop in the center of the field and the staple cereal around it. All farmers grow marigolds around the rim of their lands.

TABLE No 3.4

DR. AMBEDKAR SCHEME - VALUE OF MEMBER PRODUCTION, 1982-1987

Members	Value of Crops/Member					
	1982	1983	1984	1985	1986	1987
35						
Average	224	245	332	450	640	860
Low	200	200	250	300	350	400
High	300	325	450	600	775	975

Source: Based on the data provided by Gram Gourav Pratishtan.

The results of increased farm production from the fields in Naigaon and Dhalewadi, demonstrate the very sustainable difference that a small amount of irrigation water can make to the income of a household. In Naigaon, the highest value of farm production of any household prior to the introduction of irrigation

was Rs. 600, with the average for the largest and poorest group being only Rs. 212. Families that had as much as six to ten hectares of unirrigated land reported farm production valued at 200 rupees or less. By the third year, the average value of household farm production had increased by more than three-fold, this also includes the larger farmers who had been previously cultivating sugarcane with water from the government percolation tank.[30]

The results from the schemes reveal the length of the learning curve for an individual village in gaining full benefit of the irrigation resource. The increases in the value of crops produced during the first and second year of a particular scheme's operation were relatively modest compared to the increases achieved in subsequent years.

Three reasons for the impressive outyear performance of the Mhasoba, Chondkar and the Jai Malhar schemes point to the many variables bearing on system performance. First, 1984 and 1985 received greater than average rainfall making more water available for irrigation. Second, market prices for their cash crops improved. Third, increased incomes allowed farmers to use more appropriate quantities of manure and chemical fertilizers and to use insecticides. Fourth, farmers were able to purchase improved seeds rather than using the seeds produced in their own fields as they did during the first three years.

[30]Salunke, 1983

Changes in Migration

An important feature from a social view point is that the introduction of irrigation facilities can have two good effects on migration: stopping previous out-migration and attracting in-migration. Access to irrigation facilities has reduced the migration of persons from Dhalewadi. The Dr. Ambedkar scheme offers this example. All the households taking part in the scheme previously has a minimum of two male members working in the textile mills of Bombay or doing odd jobs in Pune. The introduction of irrigated agriculture has made the migrants return home to work in their own fields.

In-migration has also increased with the introduction of assured irrigation facilities. Farmers from the Jai Malhar scheme reported the increase of migrating labourers from other parts of Pune district in search of work in the fields of the Pani Panchayat members. Many of the members from the Jai Malhar scheme employed these migrant labourers during the harvesting of the onion crop.

Quality of Life

Many aspects, both tangible and intangible, of the quality of life are affected with the introduction of assured irrigation supplies. While increased income and employment through the changes in cropping patterns with access to irrigation dominate, secondary effects are also important. Labourers' hassle is likely to diminish and labour relations maybe transformed, with a shift in balance of power towards the labourers. For example, without access to irrigation facilities, small farmers from the Mhasoba and Chondkar scheme often had to

depend on going out daily for wage labour in the uncertain hope of getting work. With irrigation from membership with the Pani Panchayat scheme, they need to go out less, to go less far and spend less time searching and supplicating for work. Labour relations have changed from begging to bargaining, as larger farmers are actively looking for labourers to sharecrop their lands. Farmers are spending more time on their lands instead of working as agricultural labourers on the farms of the larger farmers. Some beneficiary families have constructed thatched huts on their lands so that they could live there during the cultivating season to spend more time on agricultural work.

Among the less tangible social outcomes was an increased sense of community spirit. Some groups had used their lift irrigation system to solve their drinking water problem. By installing tap outlets in their hamlets, women's time and labour was saved and the extra time used in tending to the fields. This, however, could be experienced negatively as it would mean more unpaid work for women and the spread of dowry and higher dowry prices as reported by Agarwal (Chambers, 1988).

The introduction of irrigation facilities reduced out-migration and thereby dis-integration of the family. As a result of the community's increased income, farmers were able to afford better infrastructure facilities like improved health facilities, education and drinking water supplies. The Kafinath Pani Panchayat scheme in Navalewadi village, for example, provides tap water for drinking purposes to the door of each of its members. Each family in Naigaon and

Dhalewadi has a cow and some goats. With the additional income, few families have more than one milch cow. The additional milk is now being sold in the nearby town's dairy for additional income. Some of the rich farmers have started cultivating fruit trees on their additional acreage. This is providing them with additional income.

Community involvement has increased as farmers became members of a Pani Panchayat scheme. This has had a positive impact on community participation, group decision-making processes, communal harmony across caste and class groups, and an awareness in each farmer of their legal and political right. This has in many ways increased the economic and political power of the smaller farmers. One Pani Panchayat scheme, for example, the Laxmi scheme in Hargude village, was implemented under the leadership of a person belonging to the Harijan caste though the rest of the scheme's members belonged to higher castes. Another scheme, the Indira Pani Panchayat scheme in the village of Rajuri is under the leadership of a woman. This woman, Shrimati Sable, also mobilized farmers in implementing three more schemes in the same village.

TABLE No 3.5

FARM LEVEL CHANGES DUE TO GROUP IRRIGATION SCHEMES

Sr No.	Impact Variable	Before the schemes	After the schemes*
1.	Cropping pattern	Food crops Jowar, Bajra Maize	Maize, HYV Bajra HYV Jowar, Wheat Onion, Groundnut, cotton, grapes vegetables
2.	Crop intensity	Much below 100%	Ranges from 108% to 283%
3.	Yield per acre	Below one quintal of foodgrains	Between 2 to 3 quintals of foodgrains
4.	Net returns per acre	—	Ranges from Rs.100 to Rs.2,000 (all crops together)
5.	Employment	Public relief works,migrate to cities or irrigated farms for wage labour	Out-migration stopped.On-farm work sufficient for a family
6.	Average money wage rate**	Rs.3 to Rs.5	Rs. 10 to Rs 20

* Ranges are given to indicate variations from scheme to scheme and drought year to normal year.

** for agricultural labourers

Source: Based on the data provided by the Gram Gourav Pratishtan.

The GGP has demonstrated the feasibility of a common management approach to water management in drought prone areas. An analysis of the original six Naigaon schemes by the GGP concluded that the per hectare capital cost of the schemes was generally comparable to those of small-scale government irrigation schemes, even though the former took a more comprehensive approach to (i) land development and land shaping; (ii) field channel development and maintenance; (iii) group action; and (iv) extension services. And unlike conventional government schemes, the costs of development were borne in part by the beneficiaries which has increased the commitment of the members towards the schemes and by increasing their direct involvement in water-use decisions increased their economic and political power. The GGP, however, holds serious doubts as to whether Pani Panchayat schemes can be made viable on a wholly self-financing basis.

The capacity for the implementation of the Pani Panchayat model on a significant scale is limited, particularly in face of constraints such as the availability of electricity and access to water supplies from government created reservoirs. The government controls many of the critical resources and sets the policies on which the success of programs such as those of the GGP depend. Therefore it might be argued that the lead in implementing community management approaches is more logically left to the government - that is if the government were able to demonstrate a capacity to work effectively with the poorer elements of the community in ways that contribute to their empowerment.

CHAPTER IV

Conclusions

THE PANI PANCHAYAT AND ITS SUCCESS

Robert Wade lists six points that define what successful collective action depends on. The Pani Panchayat was successful in implementing a new concept of water distribution, vis. the distribution of water based on per capita rather than on the size of landholdings, because it had the characteristics of a successful collective action group. Below is a list of reasons why a community effort by small and medium farmers became successful and in doing so was able to include as its users the larger farmers who were the villains in the arena of drought-prone Purandhar.[31]

The Resources

The smaller and more clearly defined the boundaries of the common-pool resources the greater the chances of success. Each Pani Panchayat scheme was a singular lift irrigation scheme serving a specific community with its resources boundaries defined by the members farms and the water source.

[31]Wade, 1988:215-216.

The Technology

The higher the costs of exclusion technology the better the chances of success. By using underground RCC pipes to distribute water to each member, the Pani Panchayat schemes were able to exclude the non-members. The exclusion technology forced many large farmers to join the Pani Panchayat scheme and avoid taking a risk of losing their water supplies. Because of the use of pipes for distributing water the larger farmers could not take advantage of the benefits of the scheme.

Relationship between Resources and User Groups

(i) Location: the greater the overlap between the location of the common-pool resources and the residence of the users the greater the chances for success. A Pani Panchayat scheme was set up by utilizing land from the benefitting community.

(ii) Users demands: the greater the demands (upto a limit) and more vital the resource for survival the greater the chances for success. The Pani Panchayat provided benefitting farmers access to irrigation facilities. Previously small and medium farmers did not have easy access to irrigation. The disastrous drought in the 1970s had created a situation which forced farmers to find some solution to their problem of inadequate water supply. The alternative demonstrated through the Pani Panchayat consisted of a no-lose situation for these farmers. They have accepted it because their lives have improved through it.

(iii) Users knowledge: the better their knowledge of sustainable yields the greater

the chances of success.

User Group Size

The smaller the number of users in a group the better the chances of success. A Pani Panchayat scheme had no more than 40 members to enable the scheme to run efficiently and evade the problem of too many members to little water.

Noticeability

The ease of detection of rule-breaking free riders, the more noticeable is cheating on agreements and cheating by non-members the better the chances of success. The Pani Panchayat scheme by creating it into a community administered scheme made cheating easily detectable.

Homogeneity

Agro-climatically most of the schemes are located in the same region - Purandhar taluka. The accessibility to reliable irrigation facilities in an area of scarce and unreliable rainfall is in many ways a miracle. The economic conditions of most of the farmers who took part in the Pani Panchayat schemes were similar. The majority of the farmer population of the schemes was made up of small and medium landholders. Larger farmers did participate in most schemes but they did not make up a majority of the population.

The importance of caste and community is critical for the success. All members of the Pani Panchayat scheme belonged to the same caste community, the Maratha caste. Cooperation on a selective resource in Purandhar cut across class

line while sticking to and incorporating community and caste lines

Cost Efficiency

The low cost of the lift irrigation schemes (below Rs. 3,000), is one of the plus points of the Pani Panchayat schemes. The low cost which averages about 600 rupees per farmer, allows all small and medium farmers to take part in the scheme.

Water rights

The principle of allocating water rights to individuals on a per capita basis (0.50 acre per head with a maximum of 2.5 acres per family) counteracted the 'refraction effect' which is the root cause for the failure of the cooperative system in India. The extension of these water rights to the landless, in reality removes the problems of inequity with water distribution. Usually, when there is equitable water distribution it is proportion to acreage and therefore the larger farmer get the largest amount and this reinforces the inequality in income distribution. In the traditional water distribution system, the landless remained without access to water and therefore remained the lowest income class.

Commitment

The mandatory share of 20 percent of the capital cost for the implementation of the Pani Panchayat scheme by the beneficiaries keeps them economically committed to the scheme. As a sense of ownership is activated, the individual farmer is more likely to maintain the scheme.

Equal Distribution

The distribution of water on a volumetric per capita basis is equitable. It is done on the basis of area and the allotted share of beneficiaries instead of the land acreage and the crops grown. The quantity of water to be shared is decided on the basis of a general assessment of the availability of water in the wells in the preceding one or two weeks. Accordingly every member gets irrigation on a given day at a given hour every week which changes to day and night alternately. Moreover the distribution of water starts from the tailend rather as it is usually done from the headreach.

Leadership

Mr. Salunke played a crucial role in the development of the Pani Panchayat. He indirectly brought about an awareness in the farmers that there was an alternative to rain-fed agriculture. By demonstrating his experiment of protective irrigation and effective land use management, he helped them come together and ask for a solution to their problems. Seeing the increased food-grain output from Salunke's land helped the farmers accept the concept of the Pani Panchayat.

THE PANI PANCHAYAT SCHEMES TODAY

There are a variety of ways to manage a scarce common resource. Three have been widely discussed in the literature: (i) use market forces by changing fees; (ii) give responsibility for allocation to a strong central authority; or (iii) establish community based mechanisms for self-enforcement by users according to mutually agreed norms. A fourth model, based on the queuing principle or the doctrine of prior appropriation together with the doctrine of proportionate equality is applied in the case of government irrigation schemes in Western India. Under these models the first in line takes as much as he or she likes, passing the unwanted remainder to the second in line and so forth. The application of these doctrines result in the least equitable and socially optimal allocation of the available resource.

In theory a balance between equity and productivity might have been achieved through an exercise of a strong central administrative authority to enforce equitable distribution of water on a per capita basis, but administrative practice especially in rural India commonly diverges dramatically from theory in the direction of favouring more economically and politically powerful interests over those of the poor.

It can therefore be argued that in most respects for the type of allocation problem addressed in this thesis, reliance on a community management mechanism provides important advantages over other alternatives. While allocation on the basis of equal shares may not produce the most economic result in terms of the

highest value added per unit of resources, it provides a considerable stimulus to increased productivity while recognizing the right of every individual to access those resources basic to life and livelihood. Furthermore community management approaches do have a considerable potential for adapting to diverse and changing local conditions and enforcing rules that are honoured in fear of social ostracism. This is a capacity that may be crucial to achieving improvements in the living standards in resource poor drought prone areas.

Access to irrigation facilities through the Pani Panchayat schemes has not changed landholdings in Purandhar taluka. A large farmer remains a large farmer, a small farmer remains small and the landless labourer remains landless. Thus although the landless labourer and the small and medium farmers are made better off than before with access to irrigation, absolute wealth and income differentials are accentuated. The greatest potential for creating livelihoods with irrigation facilities is not better water distribution but the redistribution of irrigated land. In India, however, that appears politically improbable at present on any scale. While that remains so, the next best option is to seek other, more realistic, ways in which the poor, small and medium farmers and tailenders can gain.

APPENDIX A

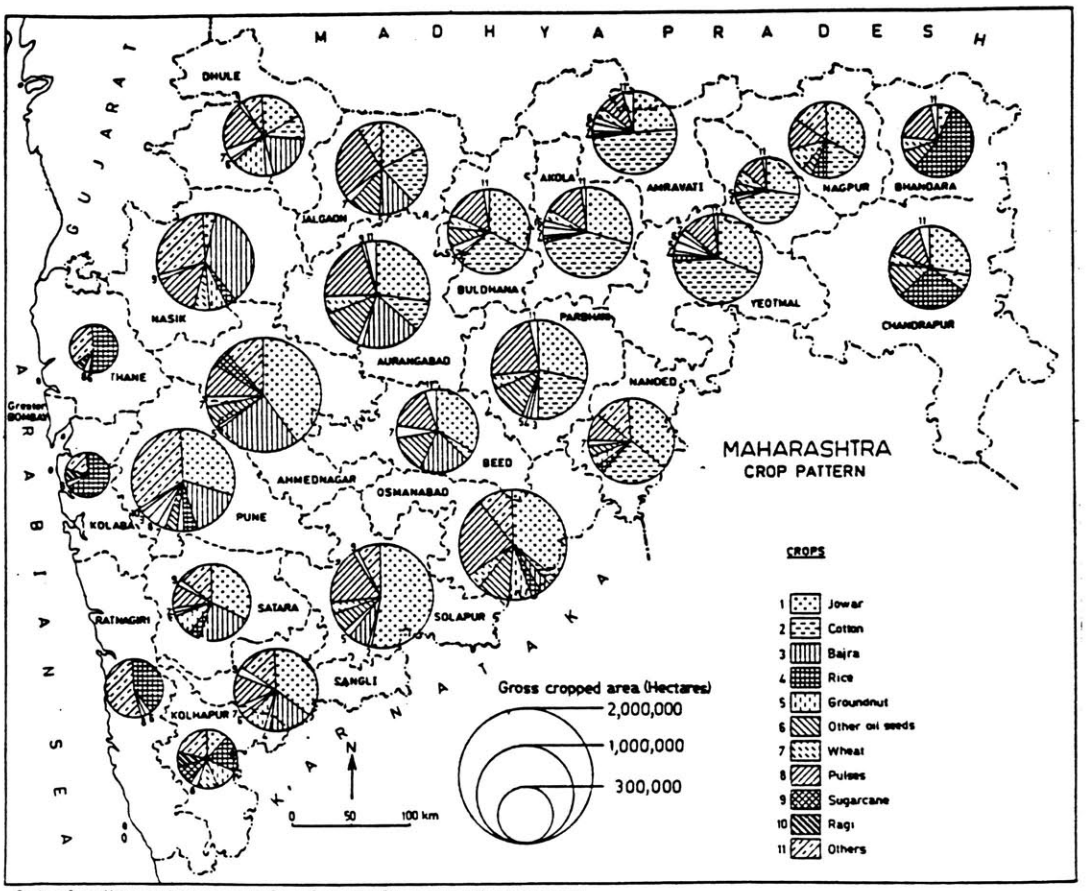
MAHARASHTRA:
AGRICULTURE AREA UNDER CULTIVATION
AND OUTPUT OF PRINCIPAL CROPS
(Averages for years 1980-81, 81-82, 82-83)

Crops	Area ('000 hectares)	Output('000 tonnes)
Rice	1,502	2,248
Wheat	1,077	907
Jowar	6,554	4,657
Bajra	1,617	661
All Cereals	12,247	8,904
All Pulses	2,711	944
All Foodgrains	13,958	9,849
Groundnut	808	677
Sugarcane	293	13,619
Cotton	2,677	247

Source: Handbook of Basic Statistics of Maharashtra State, 1983.
Government of Maharashtra, Bombay.

APPENDIX B

MAHARASHTRA - CROP PATTERN



APPENDIX C

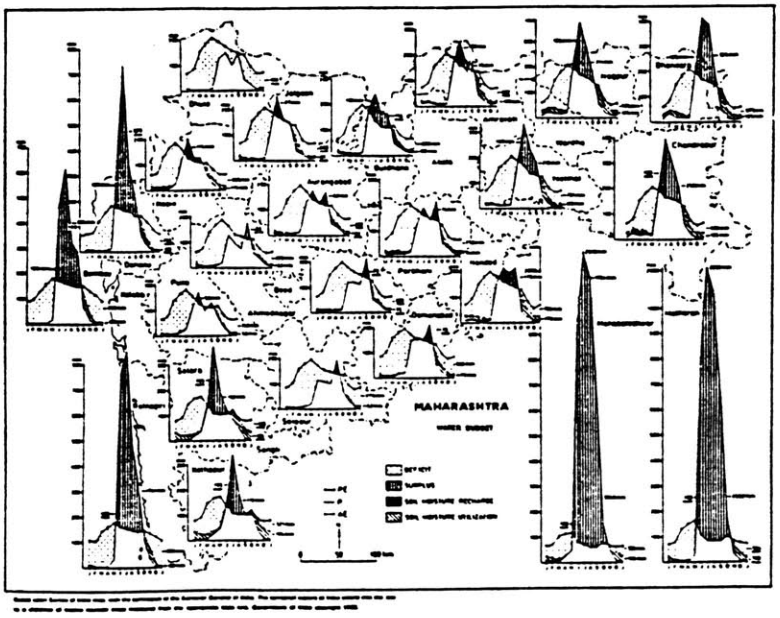
RAINFALL PATTERN IN NAIGAON VILLAGE, PURANDHAR TALUKA

Year	Annual Rainfall (in mm)
1984-85	671
1975-76	594
1979-80	500
1977-78	467
1983-84	457
1981-82	401
1976-77	340
1978-79	340
1980-81	267
1982-83	216

Source: Gram Gourav Pratishtan.

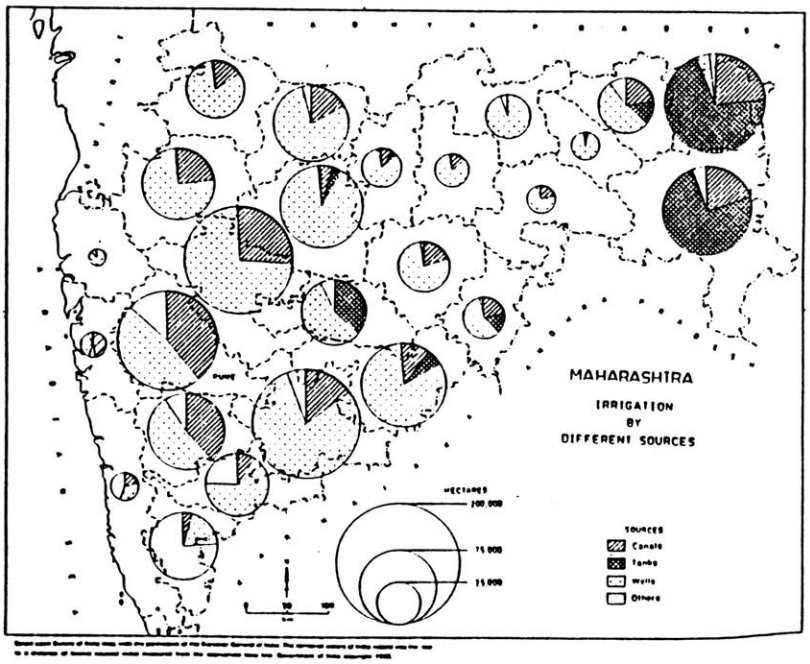
APPENDIX D

MAHARASHTRA - WATER BUDGET



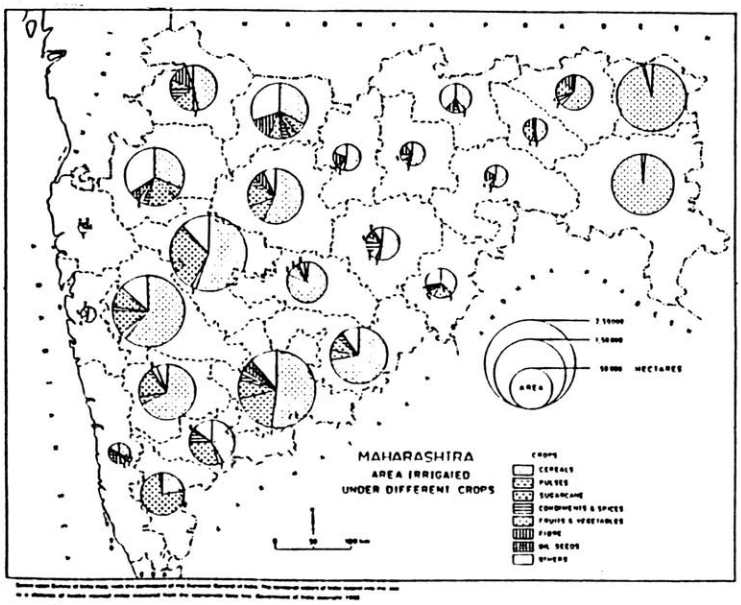
APPENDIX E

MAHARASHTRA - IRRIGATION BY DIFFERENT SOURCES

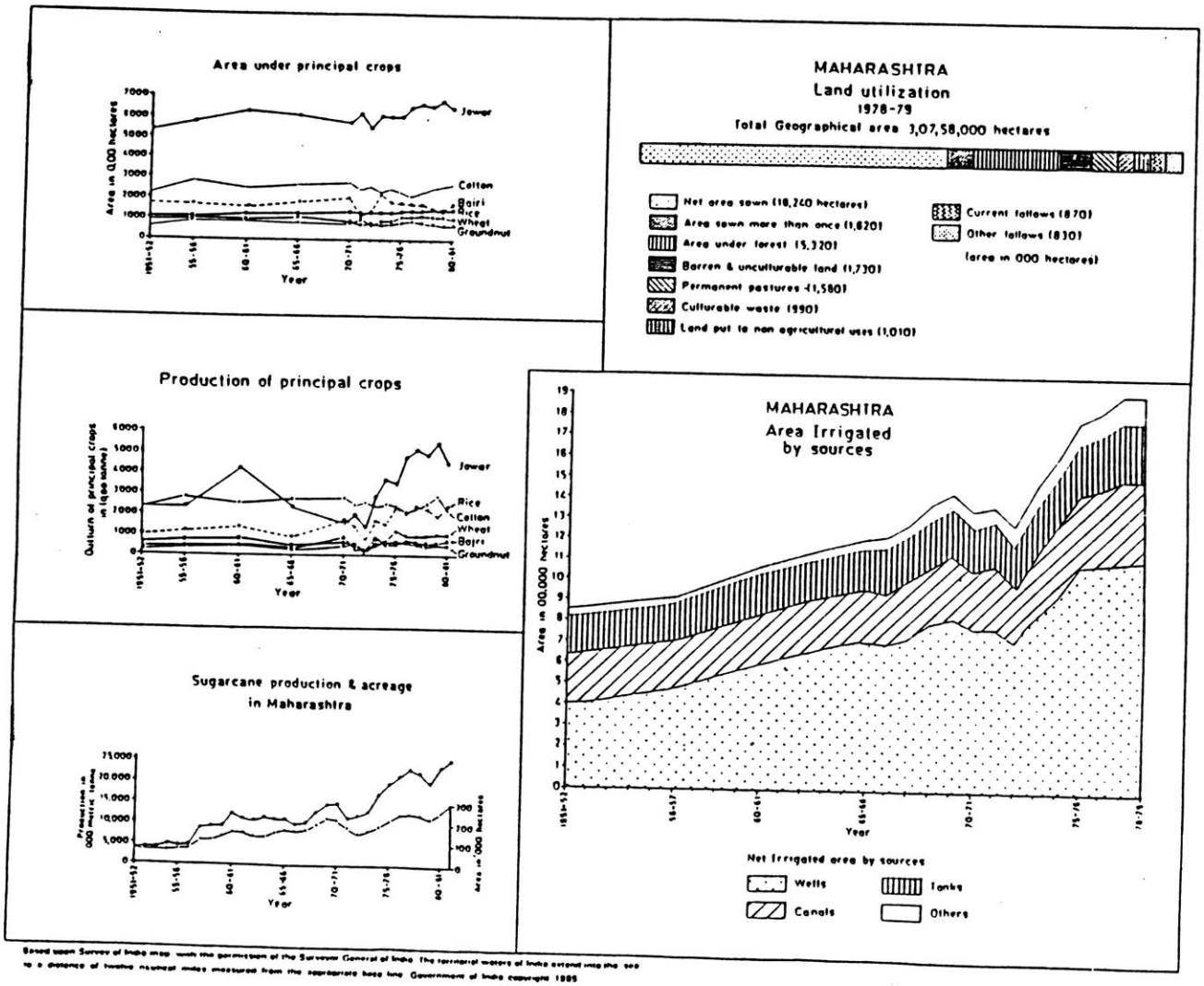


APPENDIX F

MAHARASHTRA - AREA IRRIGATED UNDER DIFFERENT CROPS



APPENDIX G



APPENDIX H

PANI PANCHAYAT SCHEMES IN NAIGAON

Sr. No.	Name of Scheme	Work started irrigated	Work completed	No of members	Area
1.	Mhasoba	Oct. 1978	Feb. 1979	34	87.10
2.	Khese	Oct. 1979	Sept.1981	28	36.20
3.	Mahatma Phule	Feb. 1980	May 1980	13	4.06
4.	Thawal	Mar. 1980	May 1980	24	10.06
5.	Annasaheb	May 1980	May 1980	18	7.00
6.	Chondkar	May 1980	June 1981	43	31.62
7.	Khandoba	Nov. 1980	Nov. 1982	14	12.00
8.	Shrinath	Dec. 1980	June 1981	12	9.00

Source: Based on the data provided by the Gram Gourav Pratishtan

APPENDIX I

PANI PANCHAYAT SCHEMES IN DHALEWADI

Sr. No.	Name of Scheme	Work started	Work completed	No of members	Area irrigated
1.	Jai Malhar	Oct. 1981	Dec. 1982	34	40.00
2.	Dr. Ambedkar	Nov. 1981	May 1982	35	4.40

Source: Based on the data provided by the Gram Gourav Pratishtan.

APPENDIX J

PANI PANCHAYAT SCHEMES TILL 1988.

Sr. No.	Item	Schemes with subsidy	Schemes without subsidy	Total
1.	Number of schemes	36	25	61
2.	Schemes not commenced	6	9	15
3.	Number of beneficiary families	997	847	1,840
4.	Irrigated area (ha)	732.21	755.93	1479.14
5.	Estimated cost (Rs.)*	32.99	73.77	106
6.	Actual cost	37.83	20.37	58.20
7.	Cash contributions	6.17	3.88	10.05
8.	Voluntary labour	--	1.44	1.44
9.	Subsidy from Govt.	15.63	--	15.63
10.	GGP loan	14.69	12.52	27.21
	Loan from Bank	1.47	3.05	4.52
	Total loan	16.16	15.57	31.73
11.	Cost per beneficiary based on total (Rs.)	3,792	4,189	3,991
12.	Cost per beneficiary (minimum - maximum)	1,305-10,489	2,054-7,088	
13.	Cost per acre based on total (Rs.)	2,091	2,924	2,508
14.	Cost per acre (minimum-maximum)	1,102-6,247	1,024-5973	
15.	Pattern of Finance based on total: Contribution:subsidy:loan	16:41:43	--	--
	Contribution:labour:loan	--	19:7:74	--

*Rs. Lakh.

Source: Based on the data provided by the Gram Gourav Pratishtan.

BIBLIOGRAPHY

Attwood, D.W.. 1988, "Risk, Mobility and Cooperation in Maharashtrian Villages." In (eds.) D.W. Attwood, M. Israel and N.K. Wagle, City Countryside and Society in Maharashtra. Toronto: Center for South Asian Studies, University of Toronto.

Attwood, D.W., M. Israel and N.K. Wagle (eds.). 1988. City Countryside and Society in Maharashtra. Toronto: Center for South Asian Studies, University of Toronto.

Census of India 1981 - Maharashtra Series. 1982. Final Figures of Total Populati on, Scheduled Caste Population and Scheduled Tribe Population. Bombay: Director of Census Operations.

Chambers, Robert. 1988. Managing Canal Irrigation: Practical Analysis from South Asia. Cambridge: Cambridge University Press.

Deshpande, R.S. and V. Ratna Reddy. 1989. Evaluation Study of the Centrally Sponsored Scheme of Assistance to Small and Marginal Farmers for Increasing Agricultural Production. Pune: Agro-Economic Center, Gokhale Institute of Politics and Economics.

Deshpande, R.S. and V. Ratna Reddy. 1990. "Social Dynamics and Farmers' Society: A Case Study of the Pani Panchayat." Indian Journal of Agricultural Economics, Vol. 45, No. 3, July-September.

Gandhi, P.R. (Chief Engineer and Joint Secretary to Irrigation Department, Government of Maharashtra). 1985. Distribution of Water Resources and Water Management in Drought-Prone Areas in Maharashtra State. Bombay: Irrigation Department, Government of Maharashtra.

Hardin, Garrett. 1968. "The Tragedy of the Commons." Science, 162 (December).

Jaiswal, N.K. and N.V. Kolte. 1981. Development of Drought-Prone Areas. Hyderabad: National Institute of Rural Development.

Jayal, Nalini D. 1987. "Research Priorities for Planning Water Resource Development." In (eds.) J.G. Nelson and K. Drew Knight, Research, Resources and Environment in Third World Development. Waterloo: Department of Geography Publication Series No. 27, University of Waterloo, Canada.

Kolhe, A.K., N.R. Paranjape, A.K. Gupte and M.D. Sathe. 1986 Pani Panchayat: A Part of Common Property Resources of Land and Water Projects. Pune: Yashodhan Development Group.

Lele, Jayant. 1980. "On Class, Caste and Hegemony: Classes in Rural Maharashtra," In (ed.) N.K. Wagle Images of Maharashtra: A Regional Profile of India. London: Curzon Press.

Maharashtra, India (state). 1973 Report on the Fact Finding Committee for Survey of Scarcity Areas, Maharashtra State. Bombay: Fact Finding Committee for the Survey of Scarcity Areas, Government of Maharashtra.

Maharashtra, India (state). 1974. Basic Facts about Backward Areas of Maharashtra State. Bombay: The Bureau of Economics and Statistics, Government of Maharashtra.

Maharashtra, India (state). 1974. Droughts in Maharashtra State. Bombay: Maharashtra Economic Development Council, Government of Maharashtra.

Maharashtra, India (state). 1976. Regional Imbalances in Mahrashtra State. Bombay: Maharashtra Economic Development Council, Government of Maharashtra.

Maharashtra, India (state). 1983 Handbook of Maharashtra State. Bombay: The Bureau of Economics and Statistics, Government of Maharashtra.

Omvedt, Gail. 1985. "Fighting Famine," Economic and Political Weekly, XX (44), November 2. Bombay.

Ophulus, William. 1973. "Leviathan or Oblivion," in (ed.) Herman Daley Toward a Steady State Economy. San Francisco: W.H. Freeman.

Rao, Hunumantha, Susanta Roy and K. Subbarao. 1988. Unstable Agriculture and Droughts. New Delhi: Vikas Publishing House.

Salunke, S.P. (Col. retd.). 1983. Pani Panchayat: Dividing Line between Poverty and Prosperity. Pune: Gram Gourav Pratishthan.

Sathe, M.D.. 1986. "Social Basis of Sharing Irrigation Water: A Central Issue in the Well-being of the Poor," Economic and Political Weekly, Vol XXI, No 17, April 26.

Singh, K.K. 1981. Warabandi for Irrigated Agriculture in India, New Delhi: Central Board for Irrigation and Power, Publication No 146, June.

Subramanian, V. 1975. Parched Earth: the Maharashtra Drought 1970-73. Bombay: Orient Longman.

Wade, Robert. 1988. Village Republics. Cambridge: Cambridge University Press.

Wagle, N.K. 1980. Images of Maharashtra: A Regional Profile of India. London: Curzon Press.