I. INTRODUCTION

This study on water and drought proofing was motivated by reports of out-migration and other drought related distress that poured in from all over the country in 2000, including the newly formed state of Chhattisgarh. It was intriguing, as well as challenging, to inquire into why a region like Chhattisgarh, which was always known as the rice bowl of Central India, should be reporting high and growing distress over the decades. Of course, nationwide the annual average precipitation has declined in the nineties. This notwithstanding, rainfall data shows that most parts of Chhattisgarh have been receiving an average annual rainfall that cannot be characterized as chronic rainfall deficiency, which is a hallmark of many regions in the North, Northwest and West India. The chronic rain-shadow areas in Kawardha and Rajnandgaon are exceptions to this observation.

I

1.1 THE CONTEXT AND OUR APPROACH

1.1.1 Drought Proofing[1]

Conceptually, drought proofing[2] means the capacity to meet the basic material and physical needs of the local population - human and animal - in a drought period so that there is minimal distress. Drought is a problem of insufficient water supply, relative to normal demand. Drought[3] is defined as a temporary harmful and widespread lack of available water with respect to specific needs. The drought damage to crops is induced by the loss of water balance within the body of the plant. When effective moisture in the soil decreases to a certain degree, plant roots are hindered from absorbing moisture and the plant begins to wilt. Drought brings about disasters through damaging the moisture balance in the soil-plant atmospheric system.

Drought proofing an area then implies that the local natural and human production resource base can provide a certain desirable amount of food, fuel, fodder, drinking water and livelihood resources during a drought. Drought proofing cannot totally protect the normal years' water supply patterns during the lean periods. In a drought year the production system operates at a lower level, irrespective of the drought-proofing efforts. Drought proofing must, therefore, aim at enhancing water availability during a drought so that the fall in production can be minimized.

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a. K. Mathur & N.G. Jayal: Drought, Policy and Politics -- The need for a long-term perspective, Sage Publications, New Delhi, 1993.
b. Report of the Task Force on the Drought-Prone Areas Programme and Desert Development Programme (M.S. Swaminathan Committee), New Delhi, Ministry of Rural Development (MORD), GOI, New Delhi, 1982.
c. _____: Report of The Technical Committee On Drought Prone Areas Programme And Desert Development Programme, (C.H. Hanumantha Rao Committee), (MORD), GOI, New Delhi, 1994
d. Task Force of the Planning Commission on Integrated Agricultural Development in Drought-Prone Areas (Minhas Committee) in 1973

[2] Ravi Chopra, A Ravindra, Salil Das (1995), **Drought Proofing Palamu**, People's Science Institute, Dehra Dun

[3] World Meteorological Organisation, 2000, **Validation of Information Requirements on Irrigated Crops and Soils,** Geneva

As a process, drought proofing is a continuing one that spans lean and normal years. The nature of drought-proofing works and activities during the two periods can be quite different. Water-use patterns in normal years can increase or decrease an area's vulnerability to droughts. High water-consumption patterns are more vulnerable to rainfall deficits, than lower ones. Excessive withdrawal or inadequate recharge in normal rainfall periods also increases the vulnerability during dry spells. Thus, the normal year's water-use patterns form an integral part of drought-proofing strategies. In normal years, land and water management must focus on enhancing the biomass on lands of marginal farmers and on landless people. During droughts, they must be targets of employment generation programmes. During a drought year, drought-proofing activities include supply-side measures like conserving water use or bringing water, food or fodder from outside. On the demand side, it involves ensuring entitlements, i.e., protecting the purchasing power of the local population through employment generation works, which, in turn, can be used to provide drought-proofing infrastructure.

In sum, water availability, water use and entitlements are the three basic elements for comprehensive drought proofing. Water availability has to be assessed and developed, water use has to be monitored and conserved, and entitlements have to be ensured for the vulnerable sections of the population, at the appropriate time.

Drought proofing was enunciated as a policy goal for the first time in 1987, although scarcity management has been an important part of the administrative and policy agenda of independent India. The early policy responses of gratuitous relief and emergency disaster management have given way to a more comprehensive and pre-emptive policy for protection against meteorological droughts. This shift from symptomatic fire fighting to protective and more proactive prevention of scarcity was a step in the right direction.

1.1.2 Decentralised Local Area Planning

Watershed planning must imply decentralisation of the planning process[4]. 'Watershed area planning' would initially call for considerable labour. Both increased employment and higher incomes could result from carefully devised 'watershed area planning' in a village (or cluster of villages). The devolution of power and authority to village *panchayats* would also enthuse the local populace to generate more resources, leading to significantly higher levels of real investment, in turn leading to increased incomes, increased demand and a resultant increased economic activity in backward areas.[5]

Two reviews of the DPAP and the Desert Development Programme (DDP), in 1980 and 1993-94, have highlighted the lack of political will and the absence of adequate delivery systems as causes for their failure. People's participation, *a sine qua non* of various government and non-government development programmes, at the operational level, remains an ill-defined and vague concept. Many programmes whose success depends on the local community's involvement, therefore, begin to flounder after some time.[6]

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[4] See Arun Ghosh(1992) **Planning in India: Challenge for the Nineties**, Sage, New Delhi
Joy Eleman et al (2000) **Watershed Based Master Plan: An Approach to Reinforce Local Level Development in Kerala,** SPB

[5] ibid

[6] Ravi Chopra, A Ravindra, Salil Das (1995), **Drought Proofing Palamu**, People's Science Institute, Dehra Dun

NGOs all over the country have undertaken several micro-level initiatives for drought proofing through watershed management. Drought proofing has become synonymous with these, without any serious attempt to address the issue of their wider application. These localised success stories are heavily dependent on NGO initiatives in institutional, financial and technological aspects and are, for many reasons, not immediately amenable to location specific scaling-up in different states of India. It has been difficult to bridge this distance between scale and quality. Policies tend to remain overarching and broad, which, because of their very nature and the attempt to be flexible to suit country-wide variations, end up as vague efforts, and remain ineffective at the level of implementation. The issue of scaling up NGO efforts is ignored, left to the preambles and directive principles of most drought proofing plans. NGOs too have not given serious thought to this issue.

One reason for non-reproducibility of watershed plans is the lack of institutionalisation of people's control and participation. The 73rd and 74th constitutional amendments provide the opportunity to empower elected local bodies and gram *sabhas* with the requisite finances, functions and administration to become the institutions underpinning drought proofing. We will therefore suggest a state level strategy to empower statutory local bodies with the capabilities for decentralized natural resource management, linking democratization and decentralized governance with sustainability.

In our view drought proofing is a concept, which is not amenable to a simple 'pristine environment' approach. It cannot be achieved simply through water, soil and land conservation. Water scarcity in an iniquitous society has a pronounced social dimension. Landless people and marginal farmers are more vulnerable. Hence drought-proofing also needs to take account of the factors determining overall water availability and use, within a multidisciplinary approach that combines issues of macroeconomics, agro-ecology, and socio-economic power. Socio-economic inequity, macroeconomic policy and other issues in political economy, such as condition of the peasantry, balance of power between agriculture and industry, etc. become fundamental in understanding and conceptualising a water policy for drought-proofing, because they in turn affect the vulnerability of the people and the environment, and the possibility or feasibility of institutionalising long-term sustainability and drought-proofing.

Sometimes it is argued that traditional practice is the best and only way to achieve large-scale drought proofing. However, modern scientific and technological advances must be enmeshed with traditional practices through the demystification of modern science and appreciation of indigenous systems, in all their advantages and limitations. Approaches that are either expert-based, or solely emphasize indigenous systems result in the denial of access to modern advances in science and technology and fail to empower people. Drought proofing offers a meeting point for science and society. For a proper drought-proofing policy, we need to appreciate more fully the holistic approach of traditional practices for a protective irrigation and food production system, which has three components:

- Surface and groundwater management (extraction and recharge) through diversion channels, surface-drainage watershed systems, wells, etc.
- Land reclamation;
- Land use and agricultural practices.

Their simplicity is deceptive - products of generations of experience, they require great expertise in maintenance. The crude structures often form interconnected chains that appropriate every bit of run-off water flowing through vast landscapes for irrigation.

> "Proper utilisation of natural resources requires proficiency in many different aspects related with it. The real difference between the so-called modern and traditional methods is that the former, with an independent start, need gradual attainment of the proficiency, while the latter must have perfected those over centuries, otherwise those would not have survived. Detailed knowledge of traditional resource management method therefore, may not only help in better formulation of new development projects but can hasten rectification of the existing problems projects are facing."[7]

1.1.3 Scale Of Intervention

The selection of a state as the locale for policy formulation within a federal polity such as India marks a move away from perfectly designed but very small scale and micro interventions, on the one hand, and the necessarily broad and sweeping approach of a national water policy, on the other. The state is an intermediate unit between the local and the national, which has its own relative autonomy in fiscal and policy matters. More importantly, most functions related to social and economic development rest with the state governments. While the state offers a tractable unit in functional, administrative and financial terms, it has sub-regional and location-specific variations in agro-ecology, physiology and the biophysical system. Therefore, in order to formulate a significant and relevant state level policy, a smaller biophysical terrain offers an essential input and testing ground for the feasibility and relevance of the policy. This is made easier with the availability of Geographical Information Systems based computational and processing tools and remote sensing data that significantly increase the ability to handle large database. In other words, a sub-regional planning exercise and the regional policy formulation are iterative rather than distinct processes.

1.1.4 'Development Of Underdevelopment'

The tribals in India are spatially clustered and concentrated in areas, which have suffered from isolation historically and where the environmental setting is by and large unsuited to sedentary agriculture.

> " The physical layout of India is such that all regions are not equally suited to settled agriculture at a low level of technology…differences in relief and in the distribution of rainfall and the forest cover have resulted in some areas continuing to be centers of perennial attraction while others remaining more or less negative from this point of view. These isolated negative areas happen to co-incide with the enclaves of tribal concentration, marked by low social development and economic stagnation… Constrained by rigorous environments which have fostered physical and social isolation for ages, …independence…marked the beginning of the process of economic development of a qualitatively new kind…(this) penetration of exogenous forces into the tribal areas has resulted into two main developments. First, these forces have initiated the process of transformation of the tribal societies on a scale unprecedented in history. Secondly, the exposure of the tribes to the non-tribal social institutions has generated among them new urges and aspirations... The major problems which the tribes face today essentially flow from the inadequacy of the process of structural change in independent India as well as from the distortion … introduced…within the tribal areas through …tribal …and regional development policies. Their Old World is dead; and the new has not yet been born"[8].

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[7] Nirmal Bannerji, 1985, Irrigation: Traditional versus Modern, EPW November

[8] Moonis Raza & Aijazuddin Ahmed (1990) **An Atlas of Tribal India**, Concept, New Delhi, pg 5

Indian development has been unsuccessful in integrating tribal areas and people into mainstream development. The symbiotic relation between the people and their habitat has been ruptured, and pre-existing foundations of tribal livelihoods have been undermined without mitigation or sustainable alternatives. This has led to highly unequal and uneven economic development across regions. Tribal development is the biggest challenge to development planning today. In order to address this challenge, ecologically informed planning is essential.

1.1.5 Need For Multi-Disciplinary Planning

This implies that a uni-dimensional and narrow compartmentalized approach is doomed to fail. The authors of the **Atlas** are scathing in their critique of the 'anemic tradition of interdisciplinary concerns', and the unique inability of social scientists to cross the *lakshmana rekha* drawn by the colonial tradition is sharply manifested.[9] In fact almost all writings on tribal development, sustainability, natural resources and drought proofing underline the need for multidisciplinary approaches, which are lacking.

For instance, in our exercise geology helps understand the sub-surface rock formations and therefore the way aquifers behave and the potential they offer for recharge. Soil morphology would help arrive at the percolation capacity of the soil and hence determine the water harvesting technology. Depth and extent of moisture retention by the soil can help work out the cropping pattern and irrigation requirement in normal and scarce years, so that biomass potential and output growth can be optimised. Water treatment, water recycling and low water using process technologies for industry need technologists and engineers. In other words, growth with equity and sustainability requires huge multi-disciplinary efforts.

1.1.6 DROUGHT, DROUGHT PRONENESS AND DROUGHT VULNERABILITY - Conventional Definitions And Points Of Departure

Three concepts that are used distinctively in this work — drought, drought vulnerability and drought proneness — must be understood clearly. Definitions of drought are enormously complicated, not least because of the huge variety of climatic, geographical, socio-economic and cultural contexts within which a drought occurs.

According to the National Drought Monitoring Centre (NDMC), USA, in most areas that experience drought `drought is a normal, recurrent feature of climate', that is to say, it is not a rare and random event. They also say that `drought is a temporary aberration and differs from aridity since the latter is restricted to low rainfall regions and is a permanent feature of climate'. What constitutes a temporary aberration is vastly different, for example, in areas with a seasonal rainfall pattern (central and north-western India), as compared to areas that have extended periods without rainfall (parts of Rajasthan and Gujarat). The NDMC distinguishes between different definitions of drought: conceptual, operational and disciplinary. The conceptual definition that they offer is `Drought is a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield'. The disciplinary ones incorporate impacts of deficient rainfall: meteorological, hydrological, agricultural and socio-economic (or ecological). Put simply, they refer, respectively, to rainfall, water levels (in dams, soils, etc.)

[9] ibid pg 7

effects on crop harvest, and effect on communities and the eco-system. The point is that one stage need not necessarily lead to the next stage: a host of factors come into play[10] and intervene. Similarly, the impact of drought can vary according to which 'sector' is looked at. The impact of drought may diminish

rapidly in the agricultural sector because of its reliance on soil water, but linger for months, or even years, in other sectors dependent on stored surface or subsurface supplies. Ground water users, often the last to be affected by drought during its onset, may be the last to experience a return to normal water levels.

In India policy approaches to drought and drought proneness rely on three aspects: rainfall, soil moisture and irrigation. Soil moisture and water balance lie at the heart of how we understand the related concept of dryness and drylands. Soil moisture depends on several factors: rainfall, temperature, moisture retentivity and porosity of soil, run off of rainwater, vegetation, etc. Drought has been classified into several categories viz., meteorological drought, agricultural drought and hydrological drought. There are two approaches to identifying drought in India, based on the methodology given by the Irrigation Commission[11] and the National Commission on Agriculture[12]. The Irrigation Commission derives its definition from the Indian Meteorological Department's (IMD) definition of 'drought' as a situation occurring in an area in the year when the rainfall is less then 75 per cent of the normal. 'Moderate drought' is defined as a situation when rainfall deficiency is between 25 to 50 per cent and 'severe drought' when rainfall deficiency is above 50 per cent. The areas where drought has occurred in at least 20 per cent of the years examined, are classified as 'drought prone areas' and those where drought has occurred in more than 50 per cent of the years examined are considered as 'chronic drought areas'. This definition of drought does not take into account the effect of irrigation in effective mitigation of the drought on agricultural production. The Irrigation Commission considered both rainfall and irrigation as factors in identifying a drought. It recommended that areas with more than 30 per cent coverage of irrigation should be excluded from being listed as drought prone areas.

The declaration of drought or as a `scarcity affected area' for providing relief to the population is done by the Revenue Department of the state government, on the basis of estimation of the prospective harvest. The assessment is based on the '*annawari system*' (crop being assessed on the basis of '*annas*'). If the prospective harvest is estimated to be up to 12 *annas* (75 per cent) the crop is normal; and below it up to 6 *annas*, (37 per cent), the crop is below normal. A scarcity situation is declared when the crop prospects are less than 6 *annas*.

The National Commission on Agriculture, defines drought as `an occasion when the rainfall in a week is half of the normal or less, when the normal weekly rainfall is 50mm or more.

[10] An example, to illustrate the point is that, India has shown an increased frequency of water shortages in recent years because land use changes have occurred within the country. Land use change is one of the ways human actions alter the frequency of water shortage even when no change in the frequency of meteorological drought has been observed.

[11] Government of India, Ministry of Irrigation and Power, Report of Irrigation Commission, Vol. 1, Part IV, 1972, New Delhi.

[12] Government of India, Report of the National Commission on Agriculture, 1976, Part IV, PP-35-36.

Agricultural drought is a period of 4 such consecutive weeks in the period from middle of May to middle of October or 6 such consecutive weeks during the rest of the year'.

A *drought prone area* is one that has a rainfall history that indicates a high probability of experiencing meteorological drought, which may result in the drying up of groundwater, surface water and soil moisture. If drought proneness describes areas that are likely to face soil moisture deficiency, irrigation must be taken into consideration as it offers important mitigation to shortcomings in precipitation. Drought prone areas must be those whose water balance is subject to frequent stress that is not mitigated by irrigation. Since availability of irrigation is a crucial determinant of soil moisture, the Drought Prone Area Programme (DPAP) has identified drought prone blocks on the basis of temporal fluctuations around normal rainfall with an irrigation cut-off of 30 per cent of gross sown area.
Such concepts and definitions provide a very useful framework in analysing droughts and in building up a stock of knowledge. However, when employed on their own in specific situations, they are of very limited use in terms of assessing impact on the people, and requirements for effective intervention. This is so because most of these definitions, and the institutions involved in drought assessment and mitigation, are divorced from the way that populations in drought prone regions experience, conceptualise and respond to droughts. Furthermore, there tends to be a wide gulf between policy makers employing `objective' methodologies and the reality on the ground. This difference goes to the heart of the issues involved in drought preparedness and mitigation work that has been done in the country, which is mostly prescriptive in nature, and does little in terms of creating long term assets for the community.

In our view several factors go into the making of a drought, including ecology, production conditions, socioeconomic conditions, etc. Rainfall deficiency (quantum, distribution and reliability) need not necessarily result in distress and shortages. The effect of rainfall deficiency depends on the policy, technology and land-ownership regime in the area and is an outcome of a complex interaction between socio-economic, agro-ecological and policy issues. The ability of the people and the land to withstand rainfall, hydrological and even agricultural deficits depend to a large extent on their status preceding the event or series of events of shortfalls of rain. This status is in turn determined by a large number of factors.

Our points of departure with respect to the above definitions are two fold. We introduce an agro-meteorological criterion of drought-proneness to place it on a sounder theoretical footing, by also considering the timeliness and subsequent distribution of rainfall over the season in relation to the cropping pattern of the area. In addition to the meteorological and soil moisture related predisposition to drought (*drought proneness*) we add the concept of *drought vulnerability*: namely, the ability (or inability) of the land and people to withstand drought or soil moisture distress and experience lower crop failure, out-migration, land alienation, livestock distress, water shortage, hunger and starvation, poor health, etc.. This, in turn, would identify the priority areas for intervention for drought proofing.

1.1.7 Drought Proneness

It is well known that the timeliness, distribution and reliability of rainfall are as important as, if not more so, the total quantum of rainfall. We incorporate these into the definition of drought proneness by taking into account long-term rainfall data on:

- the probable time by which summer monsoon rains in a region would build up enough soil moisture to commence sowing, namely commencement of sowing rain (CSR), and
- the inter-spell duration of specified periods during the months of June, July and August[13] to assess and identify the probability of occurrence of next favourable rain spell for the commencement of the re-sowing when the first CSR is missed.

A drought prone area is defined as one, which has a high statistical probability of a consecutive number of intervals where the value of the weekly rainfall throughout kharif lies below a given threshold or truncation level, where the CSR is late and the inter-spell gap is high. This is an important step, which goes beyond the typically mean or normal rainfall analysis of DPAP and IMD.

1.1.8 Drought Vulnerability - (In) Ability To Withstand Effects Of Drought

Drought vulnerability expresses itself as shortfalls in food, fodder, fuel, water and livelihood. We wanted to identify those most drought prone areas that are highly vulnerable, in the sense, that if rainfall displays any shortcomings with regard to timeliness or quantum, there are one or several reasons why particular areas may suffer greater distress than others. These may be as seemingly disparate as poverty, landlessness, inadequate infrastructure, high run off rates of groundwater, etc. Rainwater is retained at different rates on the plains and on the hills as soil moisture or groundwater. Hence, the condition of the location where the rain falls is an important consideration in determining interventions. Rain shadow areas with investment in sound water management strategies and extensive irrigation may experience less crop failure or out-migration than higher rainfall sugarcane growing areas. Grain banks and a good network of the public distribution system may prevent hunger and starvation. High forest and vegetative cover will reduce fodder shortages and livestock loss. Timely commencement of drought relief works and food for work programmes can halt or reduce distress out-migration on account of drought. Similarly, if groundwater is recharged and aquifers are saved for drinking and domestic use, drinking water crises such as have been witnessed in many areas in the past decade during drought may well become a feature of the past. Land and income transfers to the destitute, the poor and the assetless may go a long way in increasing their ability to withstand the harmful effects of drought.

We also wanted to see whether different causes of drought vulnerability resulted in very different types of distress — crop failure, migration, land alienation, livestock losses, hunger and starvation, poor health, etc. We argue that drought vulnerability differs for different regions on account of aspects other than meteorological and irrigation performance. In a related exercise, we show that drought is experienced and expressed in different ways, depending upon the determinants of vulnerability. In some contexts, migration is the predominant expression of distress; in others, it is crop failure. Do different causes of drought vulnerability then necessitate

[13] These are the three main months for sowing, re-sowing and monsoon occurrence.

markedly different types of interventions? This is another significant point of departure in this work and leads directly to distinct recommendations, depending upon the expression of drought vulnerability.

1.1.9 Ecological Typologies

Another important point of departure of our work relates to the categorization of blocks into ecological typologies in order to determine a common matrix of interventions within each typology. Hitherto, exercises in regionalisation have focused essentially on agro-climatic zoning, with landform and terrain as the most important factor that defines or holds together a zone comprising contiguous areas. In a significant departure from this approach, *we have classified and clubbed geographically dispersed areas into common typologies.* This required intensive and meticulous analysis of ecological features (rain, soil, slope, cover, geology), and led to the generation of a common matrix of drought proofing interventions within each typology. This is unprecedented in its scale, detail and range. It is important for another reason: it demonstrates the possibility and desirability for such an exercise in other states with similarities, like Jharkhand, Orissa, etc in Central and Eastern Peninsular India.

An approach such as the one delineated above generates an extremely rich database for planning that addresses sub-regional specificities and classifies blocks on the basis of drought proneness, drought vulnerability, ecological typologies and drought distress. In each case the approach and treatment marks a step forward from what exists.

1.1.10 OBJECTIVES

Bearing in mind the preceding discussion, the study had broadly four objectives.

1. To identify the more **drought-vulnerable blocks** in Chhattisgarh through a multi-disciplinary approach to the problem of drought that takes into account socio-economic, agricultural and ecological causes of drought vulnerability.

2. To identify the more **drought prone blocks** in terms of agro-meteorological characteristics that manifest as proclivity to soil moisture deficit in the absence of assured irrigation.

3. To classify the most drought-prone and drought vulnerable blocks into different **ecological typologies** amenable to a similar matrix of interventions.

4. To evolve a **water policy** to mitigate drought vulnerability depending on the different sets of causes.

1.1.11 METHODOLOGY

The rationale for the selection of a state as the locale for policy formulation, as well as for a sub-regional exercise has been discussed earlier.

Methodologically, the study involved the following four steps:

1. The generation of a **block level database** of socio-economic, ecological and production system related variables. The database will necessarily contain spatial or map-based data and attribute or numeric data.

2. The **combination and conversion of the spatial data**, which usually followed ecological boundaries (landform, watersheds, rivers, etc), with the **numeric data** for an administrative unit like a block or district so that both could be analyzed together.

3. **Primary field survey** in a few villages and households to understand fully the existing situation and the way drought vulnerability manifests itself.

4. **Analysis of policy documents** and literature for formulating the alternative.

1.1.12 Secondary Data Analysis

GIS software was used to generate and manage the digital spatial database. Numeric attribute data was attached to each spatial/geographical unit, in our case the development blocks[14].

Analytically, the first challenge was to identify key variables that are most important and primary determinants of drought status. The aim was to select strategic variables that together serve as indicators and represent a more comprehensive set of variables. The selection had to be analytically sound as well as satisfy statistical requirements. In order to arrive at the indices for drought vulnerability and drought proneness for the blocks, the second analytical requirement was to understand the direction of causality—how does the increase or decrease in the magnitudes affect vulnerability?

In the case of many variables the raw data required extensive analysis and processing, and captures different features and aspects. For example, daily rainfall data may be subject to any number of hydro-meteorological and agro-meteorological analyses. Drainage analysis too can throw up several results. Assigning priority to the determinants of drought vulnerability depends to a large extent on the purpose of the whole exercise. The selection of the appropriate features of each variable remained a very important theoretical concern right through the study. Both these concerns, namely, the selection of the appropriate variables and their analysis to generate strategic features that best capture the attributes of drought vulnerability and drought proneness are interrelated. Further, they essentially involve finding the golden mean as it were between too few variables (and features) that abstract so much that they remain meaningless for policy, or too many variables (and features) that are so specific that each block becomes an independent type and hence incomparable. Once we had a good idea of what fundamentally determined drought vulnerability and of the direction of causation, the remaining task prior to ranking was to assess the extent of impact that different variables have. To some extent, given the very nature of the exercise a degree of arbitrariness will always remain. However, to the extent possible we would want our weights to capture and approximate reality.

Another very important element in the identification of more vulnerable and drought prone blocks was the 'testing' or validation of the composite index of drought vulnerability. The difficulty was that as far as vulnerability is concerned, it is a dormant feature or a quality that can remain repressed without necessarily manifesting as drought related distress without the occurrence of drought. Therefore, we needed to first identify areas that were both drought prone

[14] Geographical Information System (GIS) is a composite of computer based decision support tools for the integration of spatial data from different sources for the analysis, manipulation and display of these data. In other words, it is a system to merge and compose different types of data for the same location. Integration, in the context of GIS, is the synthesis of spatial and non-spatial information within the framework of an application. It is, therefore, an excellent tool for the management of large bodies of spatially extensive data, with all the advantages of a computer environment, namely precision, consistency and absence of computational error.
The topographical sheets, soil map, forest map, geological maps, administrative boundaries, landforms etc., layers were digitised. After map cleanup and assigning global co-ordinates and image registering, edge matching was done to create final coverage for overlay analysis. Overlay analysis of the various layers was performed to identify areas, which are amenable to similar kind of treatment from the point of drought vulnerability.

and drought vulnerable and then see if our identified blocks fare the worst as far as drought related distress is concerned.

1.1.13 Field Survey

It was essential to translate the commonsensical concept of drought vulnerability to meaningful indicators that could be subject to analytical and statistical rigour. We had to observe and understand, in a first hand and direct way, the dynamic and dialectical relationship between ecology, production conditions and state intervention in diverse settings. In order to unravel the complex interaction between all our variables and identify the most significant indicators, and capture ground realities, we undertook field surveys in three different blocks falling under different typologies in our classification, as well as in different agro-climatic regions of India as identified by the Planning Commission. These were all highly prone and vulnerable to drought. This gave as an opportunity to identify three features not captured by the secondary data: chronic hunger, indebtedness, land alienation and dispossession reflecting socio-economic deprivation; low infrastructure development, on-farm investment, productivity and wages reflecting inadequate development status; reduction in non-timber forest produce (NTFP) and soil erosion, reflecting environmental degradation.

The field survey also looked at the issues that drought proofing must address in two different broader typologies, namely the plains and the hills. The Scheduled Caste landless labourers of the plains required employment guarantee directly, quite apart from whatever irrigation that may be provided to support *rabi*. In the hills, infrastructure development, protection of *kharif* and increase in agricultural productivity was vital to address the phenomenon of cultivators in poverty. A universal and effective public distribution will be required in both settings.

II

1.2 EVOLUTION OF WATER POLICY IN CHHATTISGARH

Two important developments, besides the drought, marked the beginning of this decade for the Chhattisgarh region, one positive and one negative. *State formation*, with its promise of greater attention to the needs of this historically neglected and exploited region, was the positive development. The negative development that accompanied this was a *crisis in fiscal federalism* and paucity of state finances; in part, due to pressure from the well-entrenched doctrine of fiscal contraction by the state and, in part, from the increased pampering of the rich and unwillingness to tax or even recover bank defaults, etc. This reduced to dust the promise of development for the state and created a fertile ground for accepting two completely erroneous views. The first was that 'private' and 'public' investment are substitutes rather than complements, and the second that 'user charges' and reduced subsidy are the way out of the inability to discipline the rich and mobilize taxes or recover public debt from defaulting capitalists. Many state government, when pushed into fiscal crises, end up taking loans from the ADB or World Bank on terms and with conditionalities that, ironically, erode the possibility of the development in whose name the loans were negotiated in the first place. In this background we analyze the different theoretical approaches to the formulation of a water policy for drought proofing, and the prospects of each realizing its aims.

1.2.1 Profit, Protection Or Development: Colonial Principle And Nehruvian Contradiction

The prospects of potentially higher profit from land revenue and irrigation charges guided the colonial government's investment decisions in irrigation. At the very least, the British government demanded that the expenditure on irrigation for protection against drought should ensure a substantive saving on famine relief expenditure. The imperial government made very little investment in the Central Provinces as a whole (including Chhattisgarh). Where the terrain was amenable to profitable investment, the heavy clayey soils did not allow it, as in the cotton and wheat tracts of Narmada valley. Where the soils were light and well drained, as in much of the rice tracts of Chhattisgarh, the undulating and broken terrain, the purely rain fed rivers, and the existing technology did not allow lucrative irrigation investment. Yet, in these very same rice tracts, traditionally irrigation had been a means to cope with the repeated and long breaks in monsoon rainfall and the early ending of the rainfall season. Despite this tradition and familiarity with irrigation, except for a few cases in the region, the British found it financially prudent to spend on famine relief when required rather than invest in what were considered unviable ventures from the profit motive. Thus, there were three reasons why the Imperial government chose drought relief over the expansion of irrigation:

- The dispersed and low population density;
- The inapplicability of the blueprint for irrigation, prepared by their civil engineers and the public works department, to the ecology (in particular, rainfall and terrain) and production system (upland paddy cultivation, broadcast sowing and traverse intercropping) of the region;
- The assessment of low profit from the more costly traditional structures, which did not seem to have bright prospects for higher revenue, water cess and savings on drought relief.

After Independence, the water policy should have been guided more by concerns of development, or at least protection, rather than profit. After all, Chhattisgarh met all the preconditions for the launch of a
massive public work's programme for drought proofing. It had rich potential from tested and reliable traditional systems, which could be most effectively upgraded with the help of modern science and technology. It had soils and crops that had a history of successful irrigation; it had an undulating terrain that offered a rich array of natural sites for small scale impoundment, often with natural embankments and spillways, with a small but vital requirement for constructing masonry sluices and an appropriate distribution system. Rainfall was by and large plentiful except in a few rain shadow areas, although it was erratic in commencement, distribution and withdrawal. Above all, there was immense need for such a programme, because of the extreme vulnerability of the low-productivity rain-fed agriculture, on the one hand, and the existence of upland tribal farmers dependent on agriculture, on the other. However, this potential was not realized. However, it must be understood that this continuing neglect of Chhattisgarh's need for protective irrigation in the postcolonial period was for reasons very different from those in the colonial period.

During the Nehruvian period development, rather than profit, guided the investment policy of the State, and there was consensus on the primacy of the State in ushering development. However, due to several interrelated reasons, areas like Chhattisgarh served as the 'periphery' or 'hinterland' and suffered neglect, becoming victims of somebody else's development. These reasons ranged from political insignificance despite their natural wealth to obsession with infrastructure for large storage and canals that were inappropriate and expensive for these ecologically diverse and fragile drylands; continuing regional disparities and concentration of growth; unwillingness to discipline the rich and mobilise resources for investment; inability to create the decentralized institutional basis for appropriate water resources management, etc.

During the colonial period, the Maikal Hills area in the north was penetrated and exploited far more than the Bastar plateau in the south. After Independence, the money from the Tribal Sub-Plans was pumped into construction of roads in the central part of the Bastar plateau and its isolation gave way to exploitation. From the Nehru years right up to the nineteen eighties, modernization became synonymous with development, and also became associated with large structures and storages. There was little search for creative alternatives even where this technology was not feasible. At the end of the nineteen eighties, forty years of experience with large structures combined with a rich body of dryland-specific alternatives, once again created the environment for pursuing decentralised and location-specific irrigation. In 1993, the Seventy Third Amendment provided the missing link — the institutional basis for such a strategy. However, once again this was not to be. By the early nineteen nineties, we had gone round full circle and today, development has once again given way to profit. The difference is that profitable investment by the colonial state has given way to profitable private investment as the criterion for investment decisions in the irrigation sector. Where this is unlikely, it is assumed that 'self help' will take care. It is to the issues of this debate of the nineteen nineties that we now turn attention.

1.2.2 Some Core Policy Debates Over Water Resources Management In The Past Decade

As we saw in the preceding section, water management has been a hotly contested terrain for a long time. The macroeconomic issues in water resources development that lie at the heart of the contestation are a matter of central concern to this study. Contributors to the debate have different approaches that stand apart in their theoretical foundations and, hence, in their technical, institutional and financial prescriptions. In the following paragraphs we review the terms of debate and the policy prescriptions flowing from each perspective.

This debate has had contributions from broadly four quarters:

- International consultants like Price Waterhouse Coopers and multi-lateral funding agencies like the World Bank and the Asian Development Bank, all of whom represent the anti-state *marketist-privatization* approach;
- Anti-market, anti-state and anti-privatization NGOs and issue-based social movements that represent the *'communitarian'* perspective, wherein the role of state is restricted to financing;
- The *statist* post-Nehruvian advocates of development, who stand for an interventionist, but decentralized and accountable state.
- There is a fourth point of view that is muted and hesitant and comprises *federalists* who have a very strong developmental perspective, but are pessimistic about the prospects of resource mobilization by the state. Therefore, they swing in a see-saw between multilateral financial agencies, on the one hand, and NGOs and private players, on the other. For this reason, they are unable to articulate a coherent position with confidence and continue to be sidelined. This is the group to whom we address this study.

1.2.3 Agreement On Symptoms

There is little disagreement on a few important symptoms of the shortcomings and what has gone wrong in the sector. The first set of issues relates to the *installation, utilization* and *health* or upkeep of water infrastructure. These are:

- Unevenness in the installation and spread of irrigation capacity across the country, as well as within regions;
- Failure to harness even a fifth of the ultimate irrigation potential in states like Chhattisgarh;
- Under-utilization of existing irrigation potential in almost all parts of the country;
- Abysmally poor performance in repair and maintenance due to lack of adequate resources;
- Reduction in the life of structures due to deforestation and the degradation of catchments;
- Shift to water intensive crops in command areas of irrigation projects and overexpolitation of groundwater resources
- Loss of fertile tracts due to waterlogging, salinity, etc.

The second set of issues relates to the fundamental role of water resources development in *agricultural growth* and *food security*. Land use intensity and productivity is positively correlated to the level of irrigation. There is also a high degree of complementarity and connectedness between irrigation and the use of other inputs. Both these associations imply that agricultural production, and consequently, food security depend to a large extent on the availability and extent of irrigation. The relationship between water and food security is most manifest in the areas of low irrigation: in the peninsular rain-fed dry lands that lack snow-fed rivers and have high run off from steep slopes. Here, soil, water and vegetation are bound

together in a dynamic relationship with each other giving rise to the forward and backward linkages between poverty and eco-degradation and are vital determinants of human survival. In such environments traditional and innovative interventions are far more appropriate for irrigation and *in situ* measures. This is so for two reasons: the extreme fragility and location-specificity of the dry lands; and inappropriateness of large storage and groundwater-dependent irrigation structures.

The third set of issues pertains to the failure to institutionalize participatory water resources management and decentralized development, accompanied by neglect of research and development into sustainable
dry land technology, for areas where, both, the large reservoir-based single point storage model and the groundwater-dependent green revolution strategy are not techno-economically feasible. Apart from strictly technical considerations of viability, the widespread displacement and dislocation on account of large dams, largely of tribal farmers, is also a matter of grave concern.

1.2.4 Disagreement On Solutions: The Colonial Debate Resurfaces

However, there are fundamental disagreements regarding of the underlying causes of the existing situation as well as solutions for these. The communitarian and the marketist perspectives begin with a wholesale rejection of the Nehruvian model. They argue that the Nehruvian interventions in the water sector were problematic on all fronts: the choice of technology in favor of 'modern' and big structures; the huge misery it caused to millions of displaced people and communities, largely in the tribal areas; the primacy it accorded to the state in development planning, financing, delivery and regulation; and the perpetuation of a centralized administrative and institutional machinery with built-in incentives for corrupt and non-accountable governance. The statists argue that while much was wrong with the *dirigisme*, the central core was based on a national consensus on development through an interventionist state. One of the most fundamental shortcomings of the regime was its inability to carry out land reforms and institute an accountable and democratic state. This does not in any way undermine the importance of a developmental state; rather, it underlines the importance of democratization of the state, both, through property reform (through land redistribution and progressive taxation) and institutional reform (as envisaged under the *panchayati raj* legislation).

A related issue is the relationship between *public and private investment.* While many argue that public investment has a 'crowding in' effect on private investment and is, in fact, a prerequisite for private investment, neo-classical and neo-liberal economists opine that this Keynesian insight is wrong and public investment has a 'squeezing out' effect on private investment. This is rooted in the pre-Keynesian notion of a fixed pool of savings. Therefore, neo-classical and neo-liberal economists consider public investment an undesirable policy intervention.

The other vexing question, which invokes great passion, is how to achieve *sustainability*. The relationship between growth, sustainability and equity unfolds, often in markedly different ways, in specific contexts. Sustainability in the use of water would result in a reduction in drought vulnerability. However, the question arises as to what macroeconomic policy environment would be conducive to sustainability, and which one would erode the possibility or feasibility of sustainable development. Moving beyond the reductionist and static view that growth is inimical to sustainability, we are of the view that growth may not be detrimental to sustainability. The

determining factor here is the choice of technology rather than growth *per se*. Often, sustainable development itself is a prerequisite for growth. Furthermore, and this is a thesis that underpins this work right through: *under many circumstances, the absence of growth (through appropriate technology and public works) can itself become a cause of environmental degradation.* Similarly, inequality itself may be a cause of unsustainable growth. Thus, the reasons behind unsustainable development may be the same as the ones that have stalked these economies and made economic growth difficult, namely, inadequate public investment and absence of adequate re-distributive measures. This is more so in a poor Third World country like ours, where plunder of natural resources has been the source of accumulation from areas like Chhattisgarh. This would imply that, contrary to the argument of ecological economists like Daly, growth (with equity) might in fact be a prerequisite rather than a detriment inimical to environmental sustainability.

One solution is to pursue a strategy of water demand management through market based incentives and disincentives. The underlying assumption is an elastic demand curve for water, or infinite substitutability between all factors of production, including natural resources. In practice this implies is high *pro-rata* pricing so that prices are high enough to push farmers out of irrigated agriculture. The price at which the disincentives become operational depends on the status of the farmers. The alternative to this market approach is the argument that all rights should be vested in the community, which has traditional methods of ensuring sustainable water use, which, in turn, can be revived with the help of NGOs. The third strategy for ensuring sustainable water use involves public investment in decentralized natural resource development through institutions of local self-government; subsidized availability of water saving devices and large-scale support to dry land crops. The policy question then shifts from 'getting the prices right' to what combinations of price and procurement support, input subsidy, credit and technological support can promote an appropriate crop mix.

Yet another related set of issues concerns the 'ills' of the green revolution strategy. Several well-known and now accepted criticisms of the strategy are as follows: it was concentrated in the well-endowed regions and restricted to the better off farmers; the water logging and salinity it caused in many parts of the country where the inherent irrigability of the soil conflicted with the application of water under this strategy; the over extraction of groundwater through energized tubewells in many parts of the country; chemicalization of the soil that destroyed the inherent fertility of the land, etc. They were undesirable because they resulted in greater inequality and unsustainability. But these are not the concerns of the present critique of the green revolution strategy. The current criticism is on the *universalized subsidy* for chemical and monetized inputs like fertilizers and pesticides, as well as the non-recovery of water, power tariff, and operation and maintenance costs from users. The new thinking is that subsidies should be seen as a means of income transfers to the poor, and hence, should be *well targeted*.

The counter-argument to this is that the *output responsiveness to irrigation and fertilizer use* is very high, and that application of fertilizers is highly price responsive. Furthermore, the application of fertilizers is also very sensitive and dependent on irrigation. For this reason universal input subsidy to farmers is desirable for agricultural growth, food security of farmers as well as for national self-sufficiency in food production. In addition, targeting has other problems: leakage through corruption; exclusion of the needy and wrong identification of the poor;

precariousness of the 'above poverty line' status of the near poor. It takes very little for many of the non-BPL families to fall into poverty, a phenomenon described as knife-edgedness. Finally, while poverty figures are under debate, there is little doubt that the percentage of people not meeting their minimum calorific requirement is a shockingly high 70 per cent.

The other issue under debate is the reason behind the under-utilization of irrigation potential and low private investment in agriculture. One issue is that the estimates of the installed capacity are themselves suspect, based as they are on all kinds of unrealistic assumptions and norms. There are other critical issues as well. This discussion has taken on the form of a dispute between *public investment versus good governance* to solve the problem of capacity utilization. Macroeconomic thinking in the Keynesian and Kaleckian tradition has always seen public investment as the prime mover for growth and capacity utilization. In the Indian context this argument is extended to the creation of a wider economic base of growth through the dispersal and deepening of purchasing power in the hands of the rural and urban poor Agricultural growth is constrained by two factors: public investment in rural works and infrastructure; and inequality and landlessness due to the absence of redistributive measures like
land reforms. Both these features result in the lack of private investment in agriculture and underutilization of irrigation potential in many parts of the country. *This is one of the most contentious issues today, marking the point of departure in the thinking on water policy in this decade.*

The international financial institutions that are very influential in policy making today argue that the cause of lack of private investment in agriculture and underutilization of the irrigation potential is not inadequate public investment, but too much public investment, which has squeezed out private investment. Furthermore, administered prices, including subsidy on savings and cheap credit, have resulted in far reaching market distortions, which again discourage private investment. Bad governance, inefficient delivery systems and unresponsive management — all of which can be clubbed under the broad rubric of 'governance' — have resulted in underutilization of capacity. Finally, the highly subsidized tariff structure where even operational and maintenance costs are not recovered has made the entire irrigation sector a grotesque financial black hole.

They therefore argue that there are two options for the irrigation sector. One is the present structure with the state playing the central role in financing, provisioning and delivery of water at subsidized rates, with the flip side of inefficiency, delays and unreliability. The other option is more timely, reliable and efficient irrigation through a combination of the private corporate sector and water users' associations, with the flip side of higher costs and tariffs. In this choice between inefficiency and price, the argument concludes, the farmers prefer higher prices with greater efficiency and reliability. *However, it can also be argued that (a) the state is not inherently or necessarily inefficient and can become more accountable and decentralized, and (b) that higher prices and private sector participation do not ensure efficiency and timeliness.*

There is technological and institutional dualism in the prescriptions put forward by the marketist approach, which explains the somewhat jarring similarity one sometimes finds between the communitarian and the marketist perspective. Large structures for storage of water will be undertaken by the private sector and water resources controlled by them through mega projects

like interlinking of rivers, while a few small ventures left to the community's self help with a little seed money from the state. Both parts of the duality are anti-state, which in any case forms the underlying bondage between the market and the communitarian approaches. However, it is evident that the international financial institutions are promoting two completely contradictory strategies: the 'communitarian' measures with accompanying homilies about traditional knowledge and the highly centralized and gigantic structures with private sector control. Both are guided by the profit motive, and have little to do with people's empowerment.

Does irrigation serve the objective of drought proofing or protection in any way? Or is the primacy to irrigation in itself at best peripheral and perhaps even inimical to protection? It is true that the estimates of utilization of irrigation potential are not achieved, in part, because irrigation brings in its wake a change in cropping patterns, towards more water intensive crops. This phenomenon has given rise to skepticism about irrigation and greater emphasis on 'water demand management'. The latter is achieved not just through price measures, but also by an exclusive or primary technological focus on soil moisture conservation (in combination with groundwater management) for drought proofing the dry lands, rather than on direct irrigation. The argument is that groundwater recharge, soil moisture conservation and biomass optimization are undermined if irrigation remains the exclusive focus in an *irrigation versus conservation* conflict. We see them as concomitants and not alternatives, both as part of an integrated and comprehensive water resources strategy. We look at this issue not so much in terms of 'irrigation versus soil moisture conservation' but one of *choice of technology in specific locations*.

Sometimes, in the hills agriculture is on un-bunded fields on sloping land with loose gravelly soils and productivity is extremely low, often not equaling even a third of the state average, which are in any case lower than the Indian figures. It is argued that such fields are unsuitable for bunded and ploughed cultivation and may do best under a regime of pastoral farming or agro-forestry rather than remaining fallow. While this may be correct on purely technical considerations, however, the ends of food security will not be served by such an approach. Our field survey brought home the fact that this was unacceptable and impractical in places that did not have a reliable and unfailing public distribution system, as well as an effective and functional employment guarantee scheme.

A related but dangerous set of questions has re-emerged from the annals of history in the new marketist context, shrouded in the concern for sustainability. Once again it is being argued that maximizing the returns on investment in water resources development should become the prime mover of investment decisions, not protection or production. That the strategic aim of national food self sufficiency is a mistaken one; it is argued in a neo-Ricardian fashion that temperate countries have an advantage in cereal production. That we should focus on maximizing the returns to investment in water by growing spices and other high value tropical crops, or unirrigated millets and coarse cereals. Finally, we are told that water productivity is what needs maximization, not land or labour. We disagree with each one of these prepositions, especially in the context of Chhattisgarh, a backward tribal region of the country where a high proportion of the dispersed working population is engaged in agriculture, as cultivators and as agricultural labourers. Much of this agriculture is under dry and upland conditions. Therefore, the water policy is closely linked to the spread of growth and livelihood security to the most vulnerable

areas in the state. We will argue that dispersed and location specific irrigation, the engine of growth, will serve the twin aims of protection and development.

Apart from small farm ponds, trenches, dykes and farm bunds, protective irrigation in a state like Chhattisgarh, with upland paddy cultivation, will often require storage at lower levels and its lifting when required. Therefore, the availability of affordable and reliable power supply and infrastructure is an important concomitant of any drought proofing strategy. We will argue that both state-provisioned irrigation and *panchayat*-led watershed development for soil moisture conservation must necessarily be a part of any comprehensive drought proofing water policy for Chhattisgarh.

1.2.5 OUTLINE OF THE STUDY

The study is presented in three sections. Section one is an excursion through the specificities of Chhattisgarh and its sub-regional characteristics. It presents the *block-level ecological profile, production conditions and socio-economic* characteristics of the state. The ecological profile includes total *rainfall* and its distribution and reliability; *geology* and groundwater potential; *soil* particle size, depth, drainage, erosion, etc; *slope* and *landform*; vegetation and *forest cover*; watershed and *drainage* characteristics to understand run off rates; etc. *Production conditions* include *yield, cropping pattern*, source-wise *irrigation, groundwater potential, utilization* of ultimate and existing *irrigation potential, land use patterns*, etc. *Socio-economic status* looks at *land distribution, poverty, workforce* characteristics, composition by *caste* and *tribe*, etc.

The second section presents the statistical exercises conducted on the secondary data. The exercise on identification of the most drought prone and drought vulnerable blocks of Chhattisgarh follow this. The ecological sub-regionalisation comes next, wherein the blocks have been categorised into different *typologies* amenable to a common matrix of interventions**.** The final section presents the *field survey* in three distinct typologies spread over twenty odd villages.

The final section is a *policy review* of the water sector in the region, where we look at the historical debates on water resources development for drought proofing agriculture in Chhattisgarh. This discussion is embedded in the overall macroeconomic policy environment within which the specific sectoral policies are set. It examines the *role of state*; the prospects of *profit* as the guiding principle for investment decisions in water works; the *potential of effective drought proofing* by mitigating natural shortfalls through water management strategies; the importance of *power resources* development for water management in the hills; debates around identification of technically feasible solutions; plough versus broadcast in the uplands; pastoral and agro-forestry versus upland paddy, coarse cereals and millets in the light soils on sloping hills; etc. The existing policy, financial allocations and performance are examined critically in order to identify lacunae and suggest specific interventions and their financing. We conclude by suggesting a water policy and implementation strategy for Chhattisgarh. In particular, we work out an employment guarantee scheme for the impoverished Scheduled Caste labourers in the plains and a labour-intensive, watershed based drought-proofing package for the tribal cultivators living in penury in the hills.

It is our hope that this work will pose a challenge to the other ideologues identified earlier on. Namely, those who put forth neo-liberal policies that rest on the erroneous theoretical foundations of neo-Ricardian comparative advantage, which argues against food self sufficiency in favour of high value tropical spices and aromatics; those who propose pre-Keynesian contractionary fiscal policies that argue against state intervention and public investment; and those for neo-Malthusian ecological macro-economics that pits growth against conservation with price as the only saviour. We hope that the state government will revert to its correct position adopted at the time of state formation and abandon the marketist prescriptions of Price Waterhouse Coopers and others of their ilk. The prescriptions flowing from the market-based approach are doomed to fail and the promise of development of the region will remain a chimera.