EXECUTIVE SUMMARY

This study was motivated by reports of drought related distress that poured in, in 2000, from even the newly formed state of Chhattisgarh. It was intriguing that a region, which was always known as the rice bowl of Central India, should report high and growing distress. Most parts of Chhattisgarh receive adequate rainfall, except for the few chronic rain-shadow areas in Kawardha and Rajnandgaon. The problem is more to do with water management and land use planning rather than chronic deficiencies per se. Despite the declaration of drought proofing as a policy goal in 1987, state intervention to overcome ecological constraints and low investment capabilities of the tribal farmers bypassed Chhattisgarh. This was, in part, due to the inability of governments to evolve the location specific technological solutions that could tackle the diversity in the fragile ‘ecologies’, characterized by low productivity agriculture.

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.

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, essentially containing 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 **literature, state finances** and **policy documents** so that what we recommend is not only desirable but also feasible.

Definitions of drought and drought proneness rely on three aspects: rainfall, soil moisture and irrigation. Our points of departure 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) to withstand drought and experience lower crop failure, out-migration, land alienation, livestock distress, water shortage, hunger and starvation, poor health, etc. These are a consequence of not just the ecology, but are also related to socio-economic and production conditions. This, in turn, would identify the priority areas for intervention for drought proofing. 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 The block level database has the following parameters and variables. The table also shows the direction of causality with drought vulnerability.

Relationship with Drought Vulnerability		
Parameter	***Variable***	*Direction of Causality*
Rainfall	Seasonal rainfall intensity	Positive
	Annual rainfall intensity	Positive
	Average seasonal rainfall	Negative
	Average annual rainfall	Negative
	Percentage frequency distribution of Inter-spell gap 8 to 20 days	Positive
	Percentage frequency distribution of Inter-spell gap greater than 8 days	Positive
	Percentage frequency distribution of commencement of sowing rains 15 to 28 June	Positive
Drainage	Drainage density	Positive
	Bifurcation ratio	Positive
	Stream frequency	Positive
	First order stream frequency	Positive
	Second order stream frequency	Positive
Geo-hydrology, Parent material and Groundwater	Recharge potential of parent material	Negative
	Utilisable groundwater potential	Negative
Forest	Area under forests as percentage of geographical area	Negative
Soil	Soil type (*Bhata, Matasi, Kanhar, Dorsa* etc.)	Negative
	Soil texture	Negative
	Soil particle size	Positive
	Soil depth	Negative
	Soil drainage	Negative
	Soil erosion	Positive
Landform and Slope	Surface form (higher values to hills and ridges)	Negative
	Slope	Positive
Demography	Percentage of Scheduled Castes in total population	Positive
	Percentage of Scheduled Tribes in total population	Positive
	Population density	Positive
	Percentage literacy	Negative
Workforce	Percentage agricultural labour	Positive
	Percentage cultivators	Positive
	Forest dependency	Negative
	Percentage agricultural dependent workers	Positive

	Percentage marginal workers	Positive
Poverty and Equity	Percentage BPL families	Positive
	Gini coefficient of land distribution	Positive
Production System	Average rice yield	Negative
	Cropping intensity	Negative
	Percentage area irrigated	Negative
	Utilisation of irrigation potential	Negative
	Percentage Rabi area irrigated	Negative
	Percentage Kharif area irrigated	Negative
	Source wise irrigation (well, tubewell, tanks, canals and o	
	Fertilizer use (NPK) in kgs per hectare	Negative
Landuse	Percentage culturable wasteland	Positive
	Percentage area not available for cultivation	Positive
	GCA as a ratio of cultivable area	Negative
	Percentage fallows	Positive
	Percentage cultivable area	Negative
Verification	Extent of crop failure	
	Extent of migration due to drought	

After rigorous statistical exercises and analytical deliberations, the following variables were selected for Principal Component Analysis.

Socio-economic	***Production System***	***Ecology***
Percentage Scheduled Tribes	Cropping intensity	Percentage forest cover
Percentage Scheduled Castes	Percentage area irrigated	Landform
Percentage literacy	Level of groundwater development	Soil parent material
Percentage agricultural labour		Soil particle size
		Soil taxonomy
		Annual average rainfall

After a detailed analysis of ecological data relating to soil, slope, forest cover, hydro-geology and rainfall, we classified the state into the following block level typologies.

Typology	Number of Blocks	Inter-spell	Forest cover	Topography	Soil	Soil Drainage
1	36	Low	High to moderate	Ridges, dissected, and rugged	Skeletal loamy to loamy	Excessive
2	24	High	Low to sparse	River valleys, plains and level land; rolling valleys	Loamy to clayey loamy	Well-drained soils
3	19	High	Moderate	Ridges, dissected, and rugged	Skeletal loamy	Excessively
4	9	High	High to moderate	Ridges, dissected, and rugged	Clayey loamy to loamy	Poor to moderate
5	25	Low	Low to sparse	River valleys, plains and level land; rolling valleys	Clayey loamy to clayey	Fairly well to poorly
6		High	Moderate to	Undulating, rolling	Loamy clay to loamy	Poorly to

	21		low	valleys to plains	to skeletal	excessively
7	13	High	Moderate to low	Dissected, undulating to rolling valleys	Skeletal loamy	Excessive

Note: Interspell gap subsumes total rainfall since it looks at the deviation from the minimal requirement over the paddy growing period.

We show that there is a dynamic and dialectical relationship between ecology, production relations, technology and state intervention. Productivity in agriculture is extremely low and variable, and all the production system development indicators too move together and are best in the plains and valleys. The cause of low productivity is soil moisture stress due to low and variable rainfall or high run-off, inadequate protective irrigation, and the tribal cultivator's inability to invest due to paucity of resources. Land use intensity is very low too, on account of mono-cropping and a high proportion of fallows.

The *Scheduled Tribe* population is concentrated in the most adverse agro-ecological settings. Poverty is more evenly spread out, with a large proportion of tribal cultivators-in-poverty, who do not have the wherewithal even for subsistence. This makes productive investment in the absence of state support a distant possibility. The Scheduled Caste population is concentrated in the relatively more developed blocks that are conducive to stable and productive agriculture. Greater landlessness and a higher proportion of agricultural labourers characterize these areas. Further, poverty is concentrated amongst the landless and marginal cultivators.

The relationship between poverty, equity and location translates into diverse situations that require different interventions for drought proofing. In case of the 'tribal cultivators in poverty' in the hilly areas, the cause is underdevelopment fostered by state neglect, and in the case of 'assetless Scheduled Castes in poverty' in the plains the reason is dispossession and unemployment. For the cultivator-poverty of tribal peasants, state investment in irrigation, infrastructure, extension services and agricultural development suitable to the highly variable local conditions is the primary solution. For the Scheduled Caste labourers-in-poverty, the principal solutions will have to be employment generation and redistributive measures.

The household survey was conducted in 12 villages in Kondagaon and Marwahi blocks and 8 villages in Dondi Block. The villages were selected on the basis of drought vulnerability and terrain. We found that 'cultivators in poverty' and widespread malnourishment are typical of the region. Unemployment and underemployment too are pervasive. The landless are, expectedly, the worst off, followed by marginal and small farmers. Land alienation and indebtedness are the widespread outcome of low productivity agriculture and underdeveloped agricultural technology.

Agriculture is the backbone of economic development in Chhattisgarh, for workforce absorption and for food security. The average rainfall varies from a maximum of 60 inches to a minimum of 35 inches, with a state average of 45 inches. This falls between 20th June and 30th September, which are the three months when rainwater harvesting and storage are possible. Despite this quantum of rainfall, the state is characterised by low productivity and mono-cropping. Low productivity is caused by absence of protective irrigation to overcome the soil moisture stress during the growing period, arising from uneven distribution of rainfall and rapid run off. Cropping intensity is low due to inadequate spread of irrigation and its complementary requirements. In this way, low productivity and mono-cropping are both related to inadequate asset creation and water management. **In order to address these farming situations, the**

superiority of decentralized, location-specific state-led minor irrigation and multi-purpose projects is indisputable.

Therefore, we make a case for retaining the focus on irrigation through labour-intensive, appropriate and dispersed techniques for drought proofing. The integration of employment guarantee and livelihood security with water resources development is essential. If 5-10 per cent of the area in all villages was under water bodies to store the rainwater, a large part of the problems would be solved. By the very specificity of the situation, some structures have to be constructed on private land, especially. the *dabris* or farm ponds on the higher elevation plots. In areas where ecological conditions are not conducive to location specific micro and minor irrigation, *in situ* soil moisture conservation, biomass optimization and erosion control through watershed development must be accorded primacy. In other areas soil moisture conservation must be a concomitant and not substitute for appropriate irrigation.

We recommend that drinking be the first charge on all groundwater resources. Following this, farmers who have lesser access to canal irrigation on account of geographical or socio-economic factors should be given priority. Land use planning to optimize production of fiber, food, fodder and fuel-wood, for income and food security is one aspect that is crucial for drought proofing. Increase in land use intensity will also stabilize livelihoods. Therefore, agro-forestry, agro-horticulture and silvi-pastoral systems must be promoted in the fallow uplands and midlands as viable alternatives to poor upland crops like small millets and horse gram. This must accompany work on in *situ* measures, rainwater harvesting and watershed management.

Under no circumstances should the supply of power for farmers in upland farming situations be subject to tariff hikes from existing levels, as this would threaten agricultural production, food security and livelihood security. The policy must declare the farmer's need for power in underdeveloped hilly areas as the first charge on the state's power resources.

Public investment and state support is indispensable. Tribal cultivators-in-poverty in the hills, on the one hand and Scheduled Caste agricultural-labourers-in-poverty in the plains, on the other, both require huge programmes of employment generation. This can happen best through public investment in mobilizing surplus labour for the installation of irrigation capacity, and for creating rural infrastructure that facilitates its utilization.

A related issue is decentralized state provisioning in drought proofing through *Panchayat*-led organizations, selected in and accountable to *gram sabhas*. Water has both, a common property and a public good character, and in order to protect the common property rights of users, ownership rights are best vested in *gram sabhas*. The legal framework and regulations for this must be developed by the state**.**

The price of water has to be administered on the basis of benefits derived by the cultivators and their ability to pay and priority of need. An appropriate pricing and subsidy package for irrigation-water must keep in mind the central role of irrigation in on-farm employment generation, food security and poverty alleviation, on the one hand, and the ineffectiveness of interpersonal or inter-household targeting, on the other. There should be no inter-household differential pricing.

Government regulation and monitoring are irreplaceable. The state must retain its discretionary powers over pricing so that these vital concerns may be addressed through pricing policy. Finally, given the poverty and resource crunch of direct producers in most parts of the state, no body autonomous of the government must be entrusted with the vital task of tariff regulation. The state government must oppose the establishment of an autonomous River Basin Organisation, where the state government's existing powers and control over water resources become subsidiary to the overarching powers of any such independent body. Major irrigation projects or large storages must be a matter of last resort after every other possibility has been explored. In general, all perennial rivers and rivulets should have diversion canals and anicuts. Greater attention should be paid to some basins, in particular Son, whose water is at the moment not properly utilized. The interlinking of rivers must be rejected as detrimental to the interests of the state. The state government must, instead, demand that its share in these funds be devolved to it for decentralized water resources development, with a far higher employment component.

We recommend a policy package for encouragement of dryland crops, including dispersed and wider reaching minimum support and procurement operations, which will serve the dual purpose of reaping benefits from regional comparative advantage and promoting an environmentally conducive crop mix. The state must increase the profitability of those desirable crops that are also water saving crops. This requires dispersal of the technical and knowledge base to *panchayats* and *gram sabhas*. We therefore recommend that the Indira Gandhi Agricultural University (Raipur) be designated as the nodal agency, with the affiliate field and zonal centers as partners as well as NGOs.

After an analysis of the plans and budgets, we conclude that central assistance is vital. Contrary to the Government's own Draft, minor irrigation has been relegated to the background, and investment for the expansion of irrigation potential is concentrated in major and medium schemes in the plains and valleys. To correct this, there must be an increased the flow of credit through the co-operative lending sector, the central government must reduce the interest burden of states and fund an Employment Guarantee Scheme. There must be immediate release of food stocks from Food Corporation of India for a massive food for work programme to create employment and rural infrastructure. We propose that approximately 12-15 per cent of the total expenditure of the state at current levels in real terms be earmarked for different components of drought proofing.