CONCLUDING REMARKS

Water resources are utilized in a number of ways in agriculture in Chhattisgarh. This is in keeping with the extreme location specificity in the state. In the uplands with better and moderately deep soils with suitable sub-strata for drainage, embankments or high farm bunds on small '*doli*' farms are the norm. In uplands where the soils are thin and light or lateritic with impervious sub-stratum, farm bunds are more or less non-existent. *Bahara* lowlands have characteristically high farm bunds with good tree cover, but this often proves to be counter-productive when the soils are not well drained or the sub-stratum is impermeable. Farm ponds or *dabris* are especially prevalent in the uplands adjacent to the central plains in all directions, and small diversions on perennial streams are common in the traditionally double cropped area in the plains. Tank irrigation is the mainstay of the cultivated area that is adjacent to the catchnments and ridge areas around the small alcoves of level and rolling plains area all over the state. Apart from these traditional interventions, the British introduced one large reservoir and canal based systems as well as a few diversion schemes along with a few large irrigation tanks. Recent years have seen an increase in groundwater extraction in very few pockets in the central plains.

Except for the large schemes (which suffer from rapidly eroding capacity due to siltation as well as lack of irrigation canals in many places), most other surface storages are non-perennial and dependent on the current seasons rainfall. Though they are not too effective in years of extreme deficiency, this is not the primary problem in Chhattisgarh. The problem here is seasonal distribution (late commencement, long dry-runs, early termination, high intensity showers), which is effectively mitigated by traditional structures. However, these structures are in urgent need of repair and up-gradation. Drinking water as well as water for domestic use is most precarious in the uplands, and in Marwahi we found people still used open shallow wells for drinking water of dubious quality. The wells and tanks dry up by summer, and the pre-monsoon months witness extreme scarcity.

Analysis of the spatial and numeric data at the block level for Chhattisgarh threw up several interesting insights for how water policy can effectively address drought. In particular, it emphasized the central role of state intervention in mitigating drought vulnerability and proneness. The state intervention is vital to undermine some of the constraints posed by ecology through development of infrastructure and other enabling conditions for growth of productivity. No less important is the role of state in effecting land reforms and other redistributive measures in order to ensure greater equity in the access to means of production of subsistence.

Three observations of great significance, regarding the relationship between ethno-demographic, socio-economic and agro-ecological features emerge from of this study. The first is that the Scheduled Tribe population is concentrated in the most adverse agro-ecological settings in terms of landforms and soil characteristics. It is true that the forest cover in these areas is high and rainfall in the tribal blocks falling in the Bastar Division is also high. Outside of Bastar, the rainshadow areas are, more often than not, predominantly tribal. However, the level of development, captured by cropping intensity, irrigation, groundwater development and percentage literacy, is very low. Although proportion of agricultural labourers is low in the high agriculture dependent workforce, poverty is higher. This indicates a large population of tribal cultivators-in-poverty. Poverty is more evenly spread out amongst the population.

The second is that the Scheduled Caste population is concentrated in the relatively more developed blocks that are characterized by greater landlessness and a higher proportion of agricultural labourers. Most ecological parameters (apart from forest cover, and, in some cases, rainfall) are more conducive to stable and productive agriculture. The overall socio-economic development indices are positively correlated to the percentage of Scheduled Caste population. This indicates that Scheduled Caste populations are concentrated in the better-developed blocks. Poverty is more differentiated and restricted in most cases to the landless and marginal cultivators.

The third aspect, which is easy to understand in the light of the preceding discussion is that the correlation coefficient between percentage Scheduled Caste and percentage Scheduled Tribe population is negative and significant. These two deprived and marginalized sections of the population are spatially separated. As we shall see below, both are in poverty, but for different reasons and under different circumstances. Both require different solutions to mitigate their respective poverty and drought vulnerability.

In the case of the 'tribal cultivators in poverty', the cause falls under the broad rubric of 'state neglect' and in the case of 'assetless Scheduled Castes in poverty' in the plains the reason is dispossession, inequality and exploitation. In the case of difficult ecological regimes characterized by cultivator-poverty of tribal peasants, state investment in infrastructure and agricultural development suited to the highly variable local conditions is the primary solution. In the case of the plains area where the Scheduled Castes dominate, drought distress is more unequally distributed, following the unequal distribution of assets, the primary being land. In fact, landlessness and lack of off-farm employment are the reasons for the high agricultural labour by the Scheduled Caste population and high out-migration from these areas. Here, the principal solutions will have to be employment generation and redistributive measures. Land reform and livelihood security through employment generation are most important to protect the vulnerable people. More effective coverage by the Public Distribution System and the Antyodaya schemes are of course concomitants.

From the correlation matrix it is clear that the cropping intensity (gross cropped area as a percentage of net sown area) is lower in areas with high concentration of Scheduled Tribe population, high forest cover and high annual average rainfall. This is in keeping with the thesis that areas of tribal concentration are underdeveloped in terms of the concomitants or preconditions for high cropping intensity, namely irrigation and level of groundwater development. In areas under higher forest cover, land use intensities ought to be higher since less land is available for cultivation. However, the absence of public investment and the high incidence of poverty in these areas make it very difficult for private investment to emerge as the engine of economic growth in the absence of state-supported enabling infrastructure like institutional credit. Low density of population facilitates the low land use intensities and extensive cultivation.

Cropping intensity is positively correlated to all the ecological parameters except annual rainfall and forest cover. The two ecological features that should encourage intensive agriculture — high forest area and rainfall — do not translate into the experience of higher cropping intensity

because state intervention is inadequate. The other group of variables that moves together are the production system variables (cropping intensity, irrigation intensity, groundwater development), landform and soil-related variables, the social development population variables (percentage literacy and percentage agricultural labour) and percentage Scheduled Castes. All these variables are positively correlated with each other. This adds substance to the thesis that Scheduled Caste populations — the second ethno-demographic group that is characterised by socio-economic deprivation — is located in the plains and valleys, where they constitute the large army of agricultural labourers. These areas are more developed in terms of the production system and literacy, and overall poverty is lower. The soils and terrain in these areas are better from the viewpoint of stable and productive agriculture. These variables are negatively correlated with the set of variables isolated earlier, namely percentage Scheduled Tribes, percentage area under forests and average annual rainfall.

No single factor by itself is capable of determining vulnerability. If every other factor was to remain the same, ecological parameters should be fundamental in determining drought vulnerability. However, our study shows how two factors have emerged decisive in determining the persistence or undermining of ecology. These factors are 'development' and 'equity'. Not surprisingly, we find that both these factors are related to the ethno-demographic profile of the workforce. The predominance of 'middle farmers' in the agriculture dependent population in the more equitable tribal areas in the hinterland is a contrast to the higher proportion of landless or marginal Scheduled Caste agricultural labourers in the more unequal plains areas.

The regional concentration of development too has a clearly ethno-demographic basis — areas of tribal concentration in the ecologically difficult terrains have suffered from state neglect, and public investment is the prime mover in the dispersal of development. Therefore, a higher weight to variables that capture these causes of vulnerability is very important. Tribal areas, due to neglect, and Scheduled Caste areas, due to assetlessness, would be more vulnerable to drought. The reasons for vulnerability emanating from these different sources are, therefore, different.

The areas marked by greater inequality in landownership and preponderance of Scheduled Caste agricultural labourers in the agriculture dependent population, where the incidence of poverty is more localized to this section, are typically a feature of the plains and valleys. In such areas meteorological drought has an immediate impact on the Scheduled Caste labourers-in-poverty, whose food stocks are virtually non-existent at the family or community level, and who now find themselves without employment or means to cultivate their small holdings (if any). The immediate impact here is large-scale out-migration on account of food insecurity and low employment. Even in areas with irrigation, which are less vulnerable to immediate rain shortfall, the employment elasticity of production is very high and even small shortfalls result in large unemployment. The failure of *rabi* is particularly detrimental to the population dependent on agricultural labour.

The tribal areas have more equal landownership and the agriculture-dependent population predominantly comprises cultivators with a large section of middle farmers. Non-timber forest produce is a very important fallback and source of supplementary family income and subsistence. However, unlike their Scheduled Caste brethren in the plains, the poverty afflicted people in the rugged hinterland are tribal cultivators. Here, drought pushes the marginal and

small farmers out as distress migrants, and the agriculture, which is almost entirely rain-dependent, suffers through widespread crop failure. Often, vulnerability finds expression less as out-migration and more as crop failure.

The resultant food insecurity is the same in both cases, but arises from different sources. In the case of the plains and valleys, the vulnerability is far more restricted in terms of the people who bear the brunt of it. In the tribal hinterland, vulnerability is more dispersed across the population. The irony of this different experience of drought-induced food and livelihood insecurity should not be lost on anyone: in the areas of greater equity, poverty too is more dispersed. In the areas of greater concentration, poverty too is concentrated to the landless and marginal agriculturists. This would be a banal statement, except for the fact of a far higher incidence of poverty in the tribal middle and small cultivator dominated areas. Therefore, the poor are more dispersed across the landless, marginal, small and middle farmer categories in the tribal areas; a phenomenon that changes in the agriculture labour and marginal farmer dominated plains and valleys where the poor fall in the landless or small holder category and are most often members of the scheduled castes.

An important point to note from the discussion above is that 'extent of crop failure' and 'extent of out-migration' due to drought may not be correlated with each other. This may appear odd at first sight. After all, when the crop is doomed, and if few or no alternatives for income exist, people should migrate out in search of subsistence, especially in areas of high poverty. However, once we accept the importance of land distribution and equity as a variable that explains drought vulnerability, this puzzle of a lack of significant connectedness between extent of crop failure and extent of out-migration becomes clearer.

The 'undulating and rugged' Northern Hill and Bastar area may have a relatively higher and more stable rainfall pattern, but the steep gradient, high rainfall intensity on the shallower soils on hard rock strata results in high run off. The higher precipitation does not translate into higher retention on account of a higher ecological predisposition to rapid run off. These then are two circumstances of drought vulnerability: the lower rainfall in the drought-prone plains and the higher run off in the drought-vulnerable hills. There is yet another situation, namely the rainshadow areas in the hilly tribal tracts, marked by both high run off and 'low and variable' rainfall. This again points to very different causes and therefore requires different strategies for mitigation of drought.

In each of these situations, the interventions to mitigate drought vulnerability will need a different thrust. In fact in high run-off areas with good rainfall profile where there has been public investment in rainwater harvesting measures, the drought vulnerability of cultivators has reduced. Since cultivators dominate the workforce, the phenomenon of 'cultivators in poverty' is checked.

Similarly, in the 'low and variable' rainfall areas with hard rock and high run-off, location specific soil moisture and groundwater conservation become critical. Where this has happened, drought vulnerability has been arrested. In the 'plains and valleys', the focus of irrigation support thus far, irrigation cannot by itself deliver. Massive public works programmes; off farm employment and land redistribution become crucial.

A few interesting observations can be made:

1) The strong negative correlation between 'landform' and 'crop failure', indicating higher crop failure in more rugged topography
2) The strong positive correlation between proportion of tribal population and 'crop failure', indicating higher crop failure in tribal areas
3) The strong positive correlation between outmigration and percentage scheduled castes.
4) The weak negative correlation between landform and outmigration.
5) The very insignificant correlation between outmigration and crop failure, for which reason we did not attempt a composite index.
6) The high positive correlation between drainage density (an indicator of run off rates) and crop failure.
7) The high negative correlation between yield and crop failure

The picture that the data confirms is one of high rain-dependence in the tribal areas, in areas of both 'good' and 'poor' rainfall profiles. This is so for three reasons: one, the high run off rates in many of the good rainfall areas; two, the low investment in irrigation and concomitants; three, of course, the lower and more unstable rainfall in the rainshadow areas. The problem of drought in Chhattisgarh is not so much due to rainfall inadequacy, except in a few pockets. The problem is of development initiatives for appropriate water and land management. The rain-dependent, middle peasant-dominated upland cultivation situations suffer from low and variable productivity and stabilizing agriculture and production becomes the priority. The problem in the plains is out-migration by the dispossessed.

The drought proofing and conservation measures and treatments would vary from block to block depending upon their characteristics, viz. geographical locations, climatic conditions, soil types, other socio economic indicators, etc. Thus to suggest policy guidelines for areas which are amenable to similar kind of treatment the identification and classification of blocks into broad groups was done. Generally speaking, ecological, production system and socio-economic parameters are considered to be the three most important components in typology formulation. For building the ecological typologies, our first step was to identify the key or primary characteristics that would form the basis of classification. Overlay analysis of landform types and the soil drainage characteristics and a separate overlay analysis of soil particle size and the inter spell gap in rainfall of greater than 8 days was done. Another overlay was carried out with the landform types and the percentage of forest cover within the blocks. Then a matrix was generated with twelve possible combinations of the landform features and the percentage of forest cover. These categories were further clubbed together to evolve five broad typology of landform and forest cover interface. In this way, we arrived at seven typologies.

We then introduced the concept of vulnerability and identified areas that were both prone to meteorological drought and vulnerable to this becoming an agricultural and hydrological failure. The blocks identified for immediate and top priority intervention include Lohanandeguda, Abujmar, Makri, Pendra, Marwahi, Dantewara, Bijapur, Konta , Sukma, Nagri, Nagri, Dhoundhi, etc.

The field survey brought out the manifestations of drought and precarious livelihoods very sharply. The loss of operational control and/or ownership of land by the poor and indebted Scheduled Caste and adivasi landowners in satellite hamlets, against paltry debt, to upper caste and better-off farmers in the main village or Marwaris in the nearby towns is reported to be growing at an alarming rate, both in Marwahi and in Kondagaon. In village after village this story repeated itself. Over the years, they were pushed into occupying forest and other government land for a combination of reasons: indebtedness, low productivity, low employment and wages and land alienation. The reasons remain, but the access to the forestland has gone, with the new thrust to hi-tech commercial and fenced plantation and the ousting of these farmers. In the last two years this has combined with low productivity and poor infrastructure to place survival itself under severe threat.

Three important observations can be made from the Dondi survey. First and foremost, livelihood security for most farmers and landless families is precarious, except in the case of large and middle farmers in a few villages. In other words, the backwardness of the region translates into a more generalized experience of food and livelihood insecurity. Villages with more unequally distributed land in low gradient areas do exhibit a difference, but by and large, the experience of poverty and income deficiency is more universal in the more difficult terrains.

Secondly, an average of two months of employment generation for the workforce can go a long way in building rural infrastructure and productive assets, which will increase agricultural production and yields by bringing more fallows under cultivation, by increasing double cropping and protecting soil moisture. Reduced distress out-migration will finally help small farmers gain from the one factor that they own in abundance: more intensive application of family labour. Increased incomes and infrastructure will also support higher complementary on-farm investment. Eventually, the surplus labour so mobilized will translate into higher productivity and lower dependence on this kind of wage employment.

Thirdly, the shortfall in livelihoods is greater in the higher gradient villages, which are crying out for attention. Higher gradient and crest villages generally have a lower proportion of bunded fields and higher proportion of fallows than lower gradient and low-lying villages. Small and marginal farmers have a systematically higher proportion of bunded land, though this declines with increasing elevation and slope. These are also the areas of lower productivity and higher fallows. The fragility of the ecology is under severe test as deforestation and neglect coexist. This also compels farmers to migrate to areas outside the village in search of work, to local catchment areas where wheat and gram are cropped during *rabi*, or outside.

There is very high and suppressed hunger. The crises of both, malnourishment and low incomes, results from this interaction between state apathy towards economic and infrastructure development; anti-Adivasi eviction policies of the Forest department; land alienation on account of usury; and low productivity. These socio-economic circumstances, production conditions, and ethno-demographic conditions very quickly translate themselves into extreme drought vulnerability under adverse ecological conditions.

This in turn means that under drought conditions, starvation hangs on their heads like the

proverbial sword of Damocles, unless the public distribution system and food for work programmes are adequate and quick to respond. We find that poverty, low productivity, indebtedness, land alienation and extremely stark exploitation of the Scheduled Caste and poor adivasi peasantry and agricultural labour is commonplace in these areas, resulting in poverty and hunger. This makes the area and its people, extremely vulnerable to a lot of distress in times of drought. However, the problem lay not so much in the lack of feasible solutions, but in the inattention in mainstream policy to the specificities and requirements of these forgotten people, a mainstream that in the pursuit of its own development and interests has of course never hesitated in exacting a very heavy price from these very same people. We now turn attention to policy issues

In order to address this situation, the state government had essentially two approaches to water resources development to choose from 2001-2002, as it adopted a development vision for the decade ending 2010. One was contained within the Draft State Water Policy of Chhattisgarh, 2000 (DSWPC) and international development consultants Price Waterhouse Coopers suggested the second in 2001. The state government chose to go along with Price Waterhouse Coopers, abandoning its own Draft in the process.

After careful consideration, it is our view that the state government is making a grave error of judgment in rejecting the DSWPC. There is a need for modification of an otherwise sound Draft. The DSWPC has several problems, the most important one being the neglect of decentralized local government and a clear strategy for resource mobilization, but the rejection of the Draft is a case of throwing the baby out with the bathwater.

The Price Waterhouse Coopers report and the DSWPC are separated by no more than a few months, but there is an enormous distance in their prescriptions. The DSWPC focuses on location specific minor irrigation works and small scale multipurpose projects for augmenting irrigation potential, utilization, drought proofing and balanced intra-regional development. The lynchpin of the PWC document is increased tariff rates and tariff collection; operation and maintenance of the canal system through farmers' organizations, funded by user charges; and private sector participation.

The biggest casualty of the PWC influence on state policy in Vision 2010 has been the abandoning of all three principles of: location specificity, decentralization; and multipurpose water resources development. It is replaced instead by state-sponsored groundwater exploitation, which though undeniably underutilized is also most fragile in Chhattisgarh's geo-hydrological setting. Any water policy for Chhattisgarh must focus on location specific minor irrigation works and small scale multipurpose projects for augmenting irrigation potential, utilization, drought proofing and balanced intra-regional development. The lynchpin has to be the spread of protective irrigation to the tribal hinterland with rigorous terrain, shallow soils, and hard rock strata.

The maximization of irrigated area using appropriate technology towards creating further potential is therefore essential. This will address the state's drought proneness, backwardness and

rural development. This policy must focus on micro and minor irrigation for drought proofing; and a very explicit integration of meeting drinking water and hydro-electricity needs.

The State Water Policy must address two aspects of Chhattisgarh's development experience that are relevant for the water resources sector. The first is the backwardness of vast parts of the state and the high inter-block disparity and unevenness in the percentage of irrigated area. This is especially true for tribal blocks and remote and high gradient terrain in the rimland. It must recognize the critical role of water resources development in balanced regional growth in areas that are predominantly agricultural and have a very high agriculture dependent population. The second is that large parts of the state are affected by drought due to which every year some part or the other is declared drought affected.

Reduction of drought vulnerability is therefore related to the choice of technology. Chhattisgarh suffers from the multiplicity of water deficiencies: high run off in unevenly distributed rainfall areas. It has also has many rain shadow areas and agriculture is often in upland situations. For this, two sets of interventions are required as far as the water policy is concerned. The first is a massive boost to soil, groundwater and soil moisture conservation measures and rainwater harvesting for micro-irrigation. The second is land use planning to increase fodder and vegetation and to reduce run off rates. Drought relief works should be in the future directed towards this kind of drought proofing. 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* and the legal framework and regulations for this must be developed by the state. The pricing policy must be based on the benefits derived by farmers and their ability to pay and not the cost of supply or cost recovery as is advocated by PWC. Finally, no authority autonomous of the state should have powers autonomous to decide on policy matters.

The opportunity offered by state formation must be seized upon to address the pressing developmental needs of the people of this 'rich land of poor people'. It is our fear that a failure to do so even after almost six decades of Independence will not be treated lightly by history.