IX. RECOMMENDATIONS FOR WATER POLICY FOR DROUGHT PROOFING CHHATTISGARH

Background

The problem of drought for most parts of the state (except the chronic rain-shadow areas in parts of the central belt lying mostly in the districts of Kawardha, Rajnandgaon and Mahasamund) has more to do with policy, technology and equity (infrastructure, land use planning, access to resources, public investment in appropriate water resources development, purchasing power) rather than chronic water deficiencies *per se*.

Productivity in agriculture is extremely low and variable, and all the production system development indicators are best in the plains and valleys. The causes of low productivity are soil moisture stress, due to low and variable rainfall or high run-off, inadequate infrastructure and lack of protective irrigation, and inability of the tribal cultivator to invest due to poverty and paucity of resources.

The Scheduled Tribe population is concentrated in the most adverse agro-ecological settings. The Scheduled Caste population is concentrated in the relatively more developed blocks conducive to stable and productive agriculture. Thus, two deprived and marginalized sections of the population are spatially separated. Both are vulnerable to drought and are in poverty, but for different reasons and under different circumstances. Both require different solutions to mitigate their respective poverty and drought vulnerability.

For the poverty of the tribal cultivators, measures such as state investment in irrigation, infrastructure, extension services and agricultural development suited to the highly variable local conditions, are the primary solution. For the Scheduled Caste labourers-in-poverty, the principal solutions will have to be employment generation and redistributive measures. Therefore, protective irrigation, agricultural growth, land reforms and enhancement of purchasing power through employment generation must be integrated to protect drought vulnerable people. Of course, more effective coverage by the PDS and the Antyodaya schemes are concomitants.

The State Water Policy needs to take into consideration at least six important aspects. The first is the backwardness and underdevelopment of vast parts of the state and the low and uneven irrigation facility, especially in tribal blocks in remote and high gradient terrains. Of the total utilizable surface water resources, the existing irrigation potential utilizes only 23 per cent. The corresponding figure for groundwater is an even lower 4.3 per cent. Whatever irrigation capacity exists is highly concentrated in the ‘plains and valleys’ and better developed areas. 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. The third is the high variability of agro-ecological and other features or extreme location specificity of the causes, which therefore warrants location-specific solutions. The fourth aspect is the requirement of energy and power for even small-scale irrigation in the hilly tracts. Fifth, the cultivators are caught in a vicious cycle of poverty, low purchasing power, inability to undertake productive investment and low productivity, which relentlessly repeats itself due to low public investment, poor extension services and poor infrastructural development. Agricultural labourers are faced with unemployment and lack of

resources and purchasing power. Water resources management is, therefore, crucial for livelihood and employment in the state. Finally, we have argued, that the major causes for incomplete projects is lack of clearance from the Department of Forests and Ministry of Environment and Forest (MoEF) and inadequacy of funds.

Price Waterhouse Cooper's advice to the state government is based on the following three policy instruments. The first is a participatory irrigation management Act, to extract higher irrigation tariffs and water charges; the second modality is a water policy that facilitates a framework for raising tariffs, privatization and reducing state regulation and public investment. The third is the setting up of an independent regulatory body for tariff collection and management, signaling an end to government discretion (affirmative action, etc.) and regulation.

This strategy will not help overcome unevenness and underdevelopment in the water resources sector, which is vital for drought proofing. Worse still are higher charges and reduced public investment, which together strike a severe blow to agricultural growth and food security. Raising the price of irrigation for operation and maintenance without compensatory transfers to farmers, which results in a reduction in agricultural production and employment, thereby increasing poverty and drought vulnerability. This, of course, will happen where irrigation exists in the first place. Where it does not, it is not very clear how the market or private sector is expected to deliver because the profit-driven private investor is not likely to invest in these remote and backward areas, inhabited by resource strapped tribal cultivators, without state guarantees.

Private corporate investment demands state financing and state regulated monopoly pricing and compliance. The investment made by the private corporate sector comes from the public sector banks, often with every conceivable concession like low interest rates, market monopoly rights, profit and price guarantees, etc. Therefore, corporate privatization is fully underwritten by the state, and comes at a very heavy price for consumers. Secondly, these firms have low compliance with safety norms and environmental standards. Thirdly, cultivators do not have resources or infrastructural support to invest. In these areas that have been historically bypassed, it seems very naïve to expect the private sector to install the infrastructure.

The biggest casualty of the PWC influence on state policy in Vision 2010 has been the abandoning of all four principles vital to overcome backwardness and imbalanced intra-regional development: public investment; location specificity; decentralization; and multipurpose water resources development. The goal of spreading protective irrigation to the tribal hinterland with their rigorous terrain, shallow soils, and hard rock strata seems to have been abandoned by the state. We suggest policy measures for a decentralised democratic state, which are essential for development and drought proofing.

Areas like Chhattisgarh have remained underdeveloped and suffered from severe historic state neglect under all regimes. The formation of the new state should signal greater need for attention and a national commitment to mobilize and direct central resources for development in these hitherto neglected areas. The central government must take initiatives to ensure adequate resource mobilization and devolution of finances to state governments to enable them to deliver. State governments must initiate a more people-oriented planning, regulating and provisioning of development.

Chhattisgarh was known as the 'rice bowl of Central India', but is now reduced to a 'rich land of poor people'. The government must fulfill the expectations that people have of a new state such as this. The state is well endowed in water resources, and appropriate water resources management holds the key to development, that which enables people to have work, food and livelihood security to overcome human poverty and more effectively withstand droughts.

Agriculture is the backbone of Chhattisgarh's economic development, workforce absorption and 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 agriculture in 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, due to 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. It is this, rather than rainfall deficiency *per se,* which adversely affects agriculture in Chhattisgarh. Based on such observations, our recommendations are as follows:

1. Retain 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. Depending on the specificity of the situation, some structures may have to be constructed on private land, especially the dabris or farm ponds on the higher elevation plots. Suitable, but cautious modifications in scheme guidelines must be permitted for such interventions, as has been done in the case of the Indira Hariyali Yojna.

1.1 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.

1.2 The existing level of groundwater development is extremely low in most parts of Chhattisgarh, except for a few blocks in the plains. Further, most of the state is hard rock with low recharge potential. Further, groundwater provides the vital buffer in times of drought and remains the only source for drinking water. For many poor farmers in undulating areas that are outside the command areas of irrigation projects, the conjunctive use of farm ponds, fed by run-off from a higher elevation recharging groundwater in shallow dug wells at a lower level, is the optimal technology. The second group of people excluded from canal irrigation is tail-enders in the plains (typically small or marginal farmers from Scheduled Castes). Therefore, 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. Groundwater development should be an adjunct of surface water development and rainwater harvesting, since often rainfall by itself may not replenish groundwater reserves. This is more so in dry, hard rock areas low in rainfall and aquifer recharge. Additionally, credit, with at least 50 per

cent subsidy, should be provided to farmers in hilly tribal areas for farm pond- cum-shallow dug well facilities and accompanying pump-sets. For irrigation purposes, tubewells must receive the sanction of the Panchayat-led water protection committee; depths and motor horsepower should be specified by the district CGWB office and monitored by the Panchayat-led water protection committee.

There are two issues pointing towards an imminent crisis on the groundwater front. The first is in the coal mining areas of Surguja, Korea, Bilaspur and Rajgarh, due to rapidly falling levels in at least a 10 km radius around the coalmines. The second pertains to the Gram Ganga Yojana, an important, but unfortunately, not fully worked out scheme, undertaken by the state government in order to halt outmigration and provide water for bathing, etc. in tanks. Under this scheme, groundwater is used to fill up village tanks in the summer months after Holi. This is an extremely wasteful exploitation of what is often the only source of drinking water. Not only has this scheme resulted in very high power costs and waste due to high evaporation losses. A number of these tanks are no longer cleaned by the natural process of drying or by the community, and are infested with all kinds of worms. Hence, the extracted water is no longer fit for drinking. We suggest the simple alternative that instead of filling up the open tanks, covered cement/plastic tanks could be used far more economically and judiciously.

1.3 We also recommend promotion of fish-cum-tank technologies. Suitable technology for minimizing the percolation losses and optimization of pond size for different size holdings should be worked out. Appropriate package for introducing and increasing the productivity of fish under different depths and durations of water availability should be developed.

1.4 As detailed in earlier sections, a large proportion of the high elevation uplands and high slope midlands remain fallow or under coarse cereals and pulses, due to high drainage density and shallow gravelly/coarse soils, which are sometimes acidic too. The productivity and profitability of cultivation on these soils is low. Land use planning to optimize fiber, food, fodder and fuel-wood for income and food security is one aspect that is crucial for drought proofing in such areas. Increase in land use intensity will also stabilize livelihoods. Another equally important aspect is catchment area or ridge area treatment to reduce soil erosion, run off and siltation. While the former will enhance livelihoods directly, the latter will improve the water harvesting capability of watersheds as well as increase the life of structures. 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, rain-water management and watershed management.

1.5 In all cases, the guiding principle in selecting interventions and thrust areas for drought proofing must be location specificity, de-concentration and dispersal of development to cover underdeveloped areas and socio-economically marginalized people.

1.6 Both, gravity guided micro irrigation and in situ soil moisture conservation are fundamental and reliable in protecting at least one crop and in reducing the dependence of small farmers on inputs outside their control, like power, etc. However, while gravity flow must guide

irrigation planning to the extent possible, a high proportion of cultivation in the uplands and fallow midlands requires power to lift surface water from streams where the water is stopped by small dams, to be stored in tanks at some height. The distribution is by gravity flow. This need for power implies three things: one, an expansion of the rural electrification network through conventional infrastructure development; two, assured and cheap power by state owned utilities to the areas of upland cultivation in elevated and rugged terrains; and three, a special focus on small-scale integrated power and irrigation multipurpose projects. Under no circumstances should the supply of power for farmers in these 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 farmers' need for power in underdeveloped hilly areas as the first charge on the state's power resources.

1.7 A large number of minor irrigation schemes are pending because they involve submergence of Forest Department land. As a first step we recommend that minor schemes, where the submergence involves small amounts of degraded or denuded forest land that are recommended by the *gram sabha*, be re-examined on a case by case basis in tribal areas. In all cases where clearance is granted, the Irrigation Department and *panchayats* must undertake compensatory afforestation.

1.8 Close collaboration between the department of water resources, department of power, department of fisheries, department of rural development, department of horticulture and department of forests is essential, given the above-mentioned imperatives of dependable and affordable power, multipurpose projects, fish breeding, land use planning and ridge area treatment.

2. Public investment and state intervention are primary. In the absence of public investment and infrastructure, neither farm nor infrastructure related private investment would be forthcoming. Public investment in the installation of irrigation capacity; in creating infrastructure; building an extension network that facilitates its utilization; as well as a package to promote dryland cultivation and increase employment while reducing poverty and hunger, are all important.

3. After an analysis of the plans and budgets, we concluded that:

- The state government cannot follow a policy of 'self sufficiency' and balance budgets from its own resources and plan funds. Central assistance is vital. Incidentally, it is also a right of the states.
- In contradiction to its own Draft water policy, minor irrigation, which is the most cost-effective and employment-intensive avenue for installing irrigation potential, has been relegated to the background.
- There is inadequate provision under non-plan expenditure for operation and maintenance.
- Investment for the expansion of irrigation potential is concentrated on major and medium schemes.
- These schemes are largely in the plains and valleys.

- Similarly, most proposed schemes, which are in the pipeline or under dispute with the Department of Environment and Forests are concentrated in the plains and valleys.

To correct these distortions and develop water resources for drought proofing, we recommend:

- The state government must requisition the central government to do the following:

    1. Increase the flow of credit through the co-operative lending sector to generate livelihood security and work.
    2. State governments are today paying 14 per cent on many loans, while housing loans are available at 8 per cent. The center must issue suitable guidelines to reduce the interest burden of states.
    3. Fund an Employment Guarantee Scheme in the state that covers unemployed and underemployed workers.
    4. The immediate release of food stocks from Food Corporation of India for a massive food for work programme to create employment and rural infrastructure.

We therefore propose that the central government take immediate steps to relieve the fiscal crisis that many states find themselves in. One obvious starting point for resource mobilization is the tax and bank loan default by leading industrial houses.

- Expansion in irrigation potential preferably through labour intensive minor and micro irrigation, undertaken first in underdeveloped areas. The financial commitment for this and for the increasing operation and maintenance costs must gradually rise from the present 5 per cent of total expenditure at current levels in real terms to 7 per cent at the end of the decade.

- Location specific drought proofing through *in situ* watershed development in drought prone and vulnerable areas on a priority bases, through an employment-intensive approach. This too requires 5 to 6 per cent of the total expenditure at present for three years to cover the most vulnerable blocks.

- In addition, we recommend another 1.28 per cent at current levels as limited employment guarantee for creating jobs and infrastructure for agricultural labourers in the identified areas for at least two months a year per labourer.

- All funds of government programmes and schemes for rural development, poverty alleviation and employment generation should be geared towards labour-intensive infrastructure development through *panchayats*.

- The government of Chhattisgarh made a provision of Rs 85.63 crores, devolving 2.9 per cent of total state revenue of Rs 3003.80 crores, as recommended by the MP State Finance Commission in 1996-97. This works out to Rs 93,697 for each of the 9139 *panchayats* in the state. We recommend that the entire watershed component be

devolved to *panchayats*, with full technical and administrative support from the state government and identified resource centers.

We therefore propose that approximately 12-15 per cent of the total expenditure of the state at current levels in real terms be earmarked for these components of drought proofing.

3. Both, the tribal cultivators-in-poverty in the hills, and the Scheduled Caste agricultural-labourers-in-poverty in the plains, 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.

4. A related issue is decentralized state provisioning in drought proofing, through *Panchayat*-led organizations selected in and accountable to the *gram sabhas*. As we said earlier, water has both a common property and a public good character. 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.

   Recognising this, Section 7 of the *Panchayati Raj* Act empowers the *gram sabha* To lay down the principles for identification of schemes and their priority for economic development of the village; to approve all plans including Annual Plans, programmes and projects for social and economic development before such plans, programmes and projects are taken up for implementation by the *gram panchayat*. Section 129-C (3) empowers *gram sabhas* in Scheduled Areas to manage natural resources including land, water and forests within the area of the village, in accordance with its tradition and in harmony with the provision of the Constitution and with due regard to the spirit of other relevant laws for the time being in force. Section 129-D (3,4,5) amplifies this further and empowers *gram panchayats:* To plan, own and manage minor water bodies upto a specified water area situated within its territorial jurisdiction; To lease out any minor water body upto a specified area for the purpose of fishing and other commercial purposes; To regulate the use of water of rivers, streams, minor water bodies for irrigation purposes. While these are far reaching recommendations, capacity building and administrative and financial devolution must accompany them.

   a. In rural areas, farmer co-operatives must be encouraged especially, in lift irrigation schemes that must be reserved for the co-operative sector. Subsidized credit may be provided for the same from NABARD; etc.

   b. In line with the letter and spirit of the State *Panchayati Raj* Act, water resources ownership or development must not be privatized at the local or regional level. 'Monopoly' pricing administered by the private sector should not be permitted at all.

   c. Water users' associations constitute a parallel structure to the *Panchayat* and *gram sabha*. We recommend that the government immediately empower *gram sabha*s to elect a 3 member 'water protection committee' or 'jal suraksha samiti' with an elected *Panchayat* representative as secretary. Their role would be to

develop and monitor water resources on behalf of the *gram sabha*. Adequate funds must be devolved for this.

d. Planning of irrigation projects must be a collaborative exercise between the local government institutions and the Irrigation Department. Only when the LGIs are unable to form organizations to undertake implementation may contractors be given projects, in consultation with the water protection committee.

e. In those blocks where watershed development for *in situ* soil moisture conservation is essential, *Panchayats* must be designated as the implementing agency. All finances should be devolved to *panchayats*. Projects must be given to organizations of poor households from the *gram sabha*, thereby circumventing contractors. Five per cent of the total budget may be kept towards the training expenses.

f. Non-government organizations should be identified as resource centers and work in collaboration with the Indira Gandhi Agricultural University (Raipur). They should be encouraged to provide training and field support, and to the extent possible, be brought under the distance learning programmes of the government.

5. Farmers in the ecologically intractable areas and from socio-economically deprived sections have low and dwindling surpluses from cultivation for productive investment and cultivation. The price of water has to be administered on the basis of benefits derived, 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.

    a. All irrigation pricing must be based on the principle of benefits derived by farmers from irrigation in the most amenable terrains. Prohibitive or disincentive pricing to regulate water demand must not become the basis of pricing, nor should cost recovery become the guiding principle.

    b. All rates should be on the basis of acreage. No volumetric *pro rata* pricing system should be introduced for irrigation water in any part of the state, and certainly not in the drought vulnerable and drought prone blocks.

    c. Drinking water must be free in rural areas.

    d. No cess or tariff should be charged on groundwater extraction for drinking and household purposes through handpumps.

    e. For irrigation purposes, a one-time cess may be charged at a rate decided by the *gram sabha*.

f. The rates for blocks in the plains and valleys may cover operational and maintenance costs after three years of installation, and a percentage of fixed costs each year. This should be instituted once the benefits from irrigation are realized by farmers.

g. In the more intractable terrains, once benefits are realized, the rates must not exceed the rates in the plains and valleys, which might involve higher subsidy of fixed costs in the hills if the per hectare investment is higher here.

h. Suitable provision must be made for maintenance and operation expenditure that have till now been non-plan. For the vulnerable blocks in particular, maintenance expenditure should be completely borne by the state for the next ten years. After ten years, and provided the structures have been repaired and farmer incomes have stabilized, all micro-irrigation earthen structures can be transferred to *panchayats*, with an adequate financial provision to cover half operation and maintenance costs. *Panchayat*-led water protection committees may recover the remaining operation and maintenance costs from farmers after this time period and completion of works.

i. The private sector must be kept out of the water resources sector everywhere, particularly in drought prone and drought vulnerable areas. All fixed and current cost expenditure on irrigation schemes as well as *in situ* watershed projects must be borne by the state.

6. Given the public good and common property character of water resources, government regulation and monitoring become irreplaceable. Further, given the vital role of water in food self-sufficiency, backward area development, poverty alleviation and employment generation, 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 autonomous body of the government must be entrusted with the vital task of tariff regulation.

7. There are four avenues of slack in the existing system. The first is the large number of incomplete medium and large projects in Chhattisgarh, both from plan funds and special assistance/relief funds of the. Forest Department objections and disputes over compensation are as important causes for this, as inadequacy of funds and cost and time overruns. The second is the underutilization of potential due to no budgetary outlay for this in the annual plans, which implies that all of it comes under non-plan expenditure. This results in poor upkeep and maintenance. The three critical areas of neglect are embankment repair, non-replacement of missing irrigation gates and desiltation. The third is the skewed and inadequate rural electrification network. Towards this, greater collaboration with the electricity department for the expansion of the conventional power supply infrastructure, and installation of small hydroelectric projects where hydrology and terrain permit are required. This will increase the profitability of irrigation projects as well as encourage expansion of facilities. Multi-purpose projects are obviously more financially viable. The fourth is poor development of the command area in terms of land leveling, water distribution, etc. This is

on account of low investment in this and poor management and administration in operations and maintenance. *Panchayati raj* institutions, *gram sabhas* and municipalities must be designated as the bodies that overcome this and adequate financial provisions must be devolved to the local bodies for this.

8. River water sharing with neighbouring states — Madhya Pradesh, Uttar Pradesh, Jharkhand, Orissa, Andhra Pradesh and Maharashtra — is over four rivers and their tributaries, across the basins of Mahanadi, Godavari, Narmada and Ganga, in which Son sub-basin is also important. In order to reduce disputes over sharing of river-water with neighbouring states and to ensure speedy settlement and resolution when they do arise, it is essential to devise fair and easy guidelines for water sharing so that states do not have to go running to Courts or suffer delays in project development. The suggestion of Chhattisgarh, which is sound, is that the share of each state be determined according to the ratio of its watershed area in the total basin. The fact is that previously Chhattisgarh was a fairly neglected part of Eastern Madhya Pradesh, and neighbouring states made their irrigation projects without any real consultation or regard for Chhattisgarh's needs and its geology, economy and social system. Now that Chhattisgarh has become a separate state, all existing, ongoing and planned projects involving inter-state river sharing should be fully scrutinized and reviewed.

   The looming crisis of Indravati is a matter of deep concern on the Orissa-Chhattisgarh border. Due to erosion and siltation, the Zora *Nala*, which flows into the Indravati river, which flows to Bastar, has fallen to a lower elevation than the main river. The result is that if a weir is not constructed soon, Indravati may change its course and begin to flow into the *nala*. This will result in flooding of the Zora *nala*, along with the drying up of Bastar. However, this simple enough solution gets complicated because the site where the weir should ideally be constructed falls in Orissa, in whose perception the changed flow might in fact benefit the state and is something to be welcomed rather than preempted. This is an interstate matter and requires immediate solution. At the moment, the prospect of sugarcane cultivation in a hitherto dry area seems to influence the hesitation on Orissa's part.

9. The state government must oppose the establishment of an autonomous River Basin Organisation mooted in the Draft National Water Policy by the Ministry of Water Resources, where the state government's existing powers and control over water resources becomes subsidiary to the overarching powers of any such independent body to whom these powers are transferred.

10. Major irrigation projects or large storages must be a matter of last resort after every other possibility has been explored. Several rivers, including Mahanadi, Sheonath, Son, etc, transect the state. Of these, Sheonath in any case has no dam sites on it. Apart from technical feasibility, in any case the preferred options to large dams (especially. for Sheonath and Hasdeo) are weirs that are constructed every 10-15 kms. 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 not at the moment properly utilized.

11. The interlinking of rivers must be unequivocally rejected, as it is detrimental to the interests of the state. Instead 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.

12. In rehabilitation and displacement, the issue is not one of compensation alone. Their economic condition must improve and the re-settlement must be attractive enough to give confidence and persuade the displaced to move. The first beneficiaries of the project must be the displaced persons, and these persons must be re-settled in the command area. To ensure that planners and funders take resettlement and rehabilitation seriously, the construction of projects must await settlement of displaced persons and the expenditure on compensation must be built into the project cost. The three primary issues are equity and enforcement, rehabilitation as precedent to project completion; compensation on the principle of 'land for land', and where payable, should be for appropriation of both property as well as livelihoods. Here, the issues of non-land costs of displacement and relocation must be explicitly mentioned as a factor in reckoning monetary compensation.

13. We recommend a policy package for crop diversification and encouragement of dryland crops. The first component of this is more 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. However, if inter-crop parity in minimum support price and cost of production is to be maintained, as indeed it should be, then the efficacy of procurement policy as an instrument to influence cropping patterns depends crucially on the relative profitability of water-intensive crops and dryland crops that need to be encouraged. Though important, several other factors determine the overall profitability and choice of crop besides assured purchase at per unit output prices that cover cost of production. The most important in this case is the land productivity under the water intensive crop *vis a vis* the dry crop. If the cost of production is covered in both cases but the water intensive crop has higher productivity, the key determinant becomes the relative investment intensity and the resource base of farmers. Finally, risk bearing ability, which in turn depends on resource base, is also an important factor if the new crop produces a higher but more variable and hence risky output.

    Therefore, we recommend other non-price interventions like input subsidies and even transfers to farmers to continue or adopt water saving crops, despite lower productivity and profitability, in the interest of environmental sustainability. Though comparatively high yielding varieties have been identified, seed of these varieties are not available. We also suggest the availability of credit on easy terms to encourage investment in water-saving devices like sprinklers and drip sets, especially in drought prone areas.

14. One of the most neglected areas is research and development in dryland techniques. We recommend far greater attention to several aspects, including: *in situ* watershed and water harvesting technologies; farming practices for productivity increase and stabilization; and crop diversification and land use planning to increase fuel/fiber/food/fodder and encourage appropriate cropping patterns.

    Agricultural practices, implements and inputs must be developed so that work on improving drainage and development of pest and disease resistant high yielding varieties of soybean,

gram, pigeon pea and linseed may be strengthened Simultaneously, traditional agricultural practices most suitable to the specificities of upland cultivation need to be investigated and understood from the perspective of up-gradation and innovation. Intensive study on judicious use of harvested water in farm ponds is required. There is need to develop a suitable technology of minimizing the percolation losses. Optimal pond size for different size holdings must be also worked out.

15. Each technological solution obviously has training requirement. A micro-irrigation cum soil moisture conservation approach such as the one we are suggesting involves working with statutory local bodies. Location specific decentralized planning in the drylands requires dispersal of the technical and knowledge base to *Panchayats* and *gram sabhas*. The mandate and structure of the Indira Gandhi Agricultural University fits in best with the requirement of training. We therefore recommend that it be designated as the nodal agency, with the affiliate field and zonal centers as partners.

    However, it is well known that despite the mandate, most State Agricultural Universities (SAUs) have not lived up to this task and fulfilled the expectations of them, in terms of combining research, teaching, training and dissemination to the villages. IGAU is no exception to this failing. Therefore, the rich experience of the Rajiv Gandhi Watershed Mission and NGOs that have executed watershed projects for CAPART and other funding agencies can help provide the link between IGAU and villages.

    Therefore, an advisory cum monitoring body, comprising leading experts/institutions with experience in training for drought proofing, must immediately be constituted. The Chairperson of the Committee should be of Secretary, Government of Chhattisgarh rank, and preferably not belong to the Irrigation Department but be an experienced agricultural economist or watershed expert. This regulatory body can have the following terms of reference:

    (1) Identification of sources for funding this training exercise.
    (2) Additional manpower, infrastructure and financial requirements for IGAU for this task.
    (3) Identification of experts, resource centers, including NGOs, for preparation of training material.
    (4) Identification of trainers and resource persons from NGOs, Universities and Training Centers from the state and other parts of the country.
    (5) Systems for facilitating close collaboration between IGAU and other relevant departments like Irrigation, Power and Electricity, Forest, Food and Civil Supplies, etc.
    (6) Regular consultations, monitoring and feedback about the training.