REPORT OF THE WORKING GROUP

ON RAINFED AREAS FOR

FORMULATION OF XI FIVE YEAR PLAN

PLANNING COMMISSION

GOVERNMENT OF INDIA

NEW DELHI

CONTENTS

EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

1. STATISTICAL REVIEW OF RAINFED AGRICULTURE

- Out of an area of 329 m.ha the gross sown area during last 15 years remained almost stagnant at 184.5 m.ha
- The net sown area is gradually decreasing from year 1999.
- During the corresponding period, increase in area sown more than once (10.69%), area under non-agricultural uses (9.85%), fallow land (12.73%), current fallows (16.51) was observed.
- Reduction in permanent pasture and grazing land (4.80%), culturable waste land (8.50%).
- The production of coarse grains did not show any significant trend during 1980-2003 in the country as well as rainfed regions. The moderate growth in productivity levels could not neutralize the delivering trend in production caused by shrinking area.
- In case of millets, the productivity enhancement for rainfed areas was 0.29%, whereas the area in rainfed regions reduced by 2.17% resulting in overall decline in production from rainfed regions by about 2%.
- In use of oilseeds, though there is a decline (0.56%) in production at national level, productivity enhancement (0.75%) and increase in oilseeds area (3.10%) under rainfed conditions resulted in increase in production (3.87%) from rainfed areas.
- Production growth rates comparison for the period 1980-90 and 1990-2003 indicate lower growth rates during 1990-2003 in case of coarse grains (1.91% & 1.47%) and millets (3.31% & 0.29%) and

marginally higher growth rates for pulses (0.32 % & 0.39%) and oilseeds (0.70 % & 075%).

- During past 15 years, net rainfed area decreased by about 9.8% with a corresponding increase in irrigated area by about 12.1%. the increase in irrigated area is mainly due to increase the net irrigated from tube wells (15.1 m.ha to 25.1 m.ha).
- About 70% of ultimate potential of ground water is utilized in the country.
- In states of Rajasthan, Punjab and Haryana, the ground water utilization compared to ultimate potential is about 90% in Gujarat and Maharashtra.
- Surface water schemes including tanks, lift schemes play a singnificatn role in Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Maharashtra, Karnataka and Orissa.
- As minor irrigation schemes play a significant role in rainfed areas, priority may be given for better utilization of potential created through improved management systems (reduction in correspondence losses, micro irrigation and crop diversification).
- Crop diversification (i.e., changes in cropping pattern) with more balanced and sustainable cropping systems should be taken up to over come problems of soil fatigue, vulnerability reduction in rainfed agriculture.
- Promising diversified cropping systems identified by CRIDA & PDCSR for various agro-eco regions need to be promoted.
- During last 15 years, the Government of India gave importance to rainfed area developmental programmes through DPAP, DDP, NWDPRA etc. covering on watershed basis. The evaluation of these programmes by various agencies indicated the promise of watershed programmes for improving rainfed areas.

- The results also indicated the need for integration of livestock in the cropping system in different rainfall regions.
- For low rainfall regions (<500mm) livestock based farming system should be encouraged. Fodder needs can be met by growing grasses in soils with low to medium soil depth. Priority should be given for ensuring drinking water facility even during lean season. In situ conservation coupled with farm/field boundaries should be given emphasis. Deep soils only should be encouraged for cultivation.
- In case of regions with rainfall of 500-700mm, crops can be grown in medium to deep soils with high available water content. Runoff harvesting could be possible in few cases for critical/supplemental irrigation. Horticulture can be promoted to a larger scale. Land capability based land use planning with emphasis on alternate land use need to be promoted.
- For regions with rainfall of 700-1100mm, Farming systems can be promoted. Medium to deep soils with medium to high available water Content can be promoted for cultivation. Cropping and livestock based systems can be promoted. Runoff harvesting is possible on small farms also. *In-situ* conservation with water harvesting for supplemental irrigation can be planned with in watershed. In few cases, residual moisture with in fields or pre sowing irrigation for rabi crop is also possible and there is a need to explore the possibilities based on location specificity. In areas where the rainfall of 1000-1100 mm is received through south west monsoon, integrated farming system with fisheries in medium to low lands of rainfed rice also can be encouraged.
- Accounts for over six per cent of GDP, just a little under a third of the contribution of agriculture and allied sectors.

- About 18 million people derive their livelihood from livestock
- Women continue to play a key role in livestock production at the household level, with over 71% of the labour force being women.
- While total population and density of livestock has increased over time, the number per rural household has declined.
- There was a drastic decline of bullocks post eighties, with the corresponding share of farm animals in power supply declining from 71% in 1961 to less than 23% in 1992.
- Working cattle in rural areas declined by 25% between 1991-92 and 2002-03. There has been a corresponding shift in composition of the bovine population from cattle to buffalos.
- A mere 56% of the households reported ownership of at least one livestock in 1998-99, decline in livestock holding being sharpest amongst landless households. Only 15-20% of households own sheep and goat.
- There has been an increasing dependence on irrigation for the livestock economy, adding to unsustainable use of ground water.
- There is a tremendous increase in the crossbred cattle in the country ie. 22.8%. However, the indigenous cattle declined by 10.2% during the inter-censal period from 1997 to 2003 and the total cattle population has decreased by 6.9%.
- With the increased attention to livestock issues in watershed programmes, it is also necessary to address issues like drinking water for cattle, fodder etc., in different agro-climatic regions. Silvi-pastoral systems on CPRs and wastelands could be promoted. There is also need for crop-livestock integrated farming systems with emphasis on agricultural crop waste. Horti-pastoral model can be promoted for small ruminant production on a larger scale. Perennial grasses and fodder trees needs to be promoted on CPRs.

2. LEARNINGS FROM INDIA'S WATERSHED PROGRAMME AND FRAMING OF COMMON GUIDELINES

- This chapter outlines the lessons learnt from the watershed programme in the country so far and the ways in which the programme needs reform.
- Perhaps the most critical weakness of watershed programmes in India is that they operate almost as if groundwater does not exist. It enters only as something to be recharged and replenished. But it appears to play almost no role at all in watershed planning. Watershed planners forget that just as there is a surface water catchment, there also exists a groundwater catchment.
- We always define a watershed with reference to the surface water catchment alone. Even if we continue to do this, there is a need to recognise and study the contours of the groundwater catchment and variations in hydrogeology, at the earliest stages of planning a watershed project. This is important for several reasons – location of structures, ensuring equity and sustainability of the resource and developing a sustainable groundwater use plan as an integral part of the watershed action plan
- We summarise the lessons learnt on issues of participation, transparency and equity. Informed participation is the ideal we propose. Here participation is seen as a two-way process of intense dialogue between the local people and the outside agency, be it government, NGO or professionals. We see the watershed action plan as neither a romanticisation of people's knowledge nor a debunking of the expert. Rather a process of demystification of expertise in the process of valorising popular understanding, through a creative dialogue between the two.

- The principles of equity must extend to conflict resolution, beneficiary selection, benefit sharing etc.
- Special provisions must be made for the landless and the dalits. Close attention needs to be paid to developing common lands and making sure that landless/dalit access to them is not reduced as in many watershed projects so far.
- Mere lip service to the interests of women will not do. We suggest 50% representation of women in the Village Watershed Committee and separate Women's Watershed Council that will be a vehicle for mobilizing women and articulating and protecting their interests in the watershed programme.
- Voluntary contributions need to be genuine and made progressive according to differential capabilities of watershed families
- Transparency and accountability must be ensured. For this we suggest mandatory presentation of the action plan for approval at the Gram Sabha meeting, all labour payments must be made in public, regular jan sunwayis (public hearings) must be held where detailed accounts are presented to the people, including all documents – sanction and release letters, pass books, cheque books, muster rolls, vouchers etc.; boards should be put up in public places and at each major site, which display details of work done, costs, volume of water harvested, employment generated etc.
- Watershed development in India has been one-sidedly preoccupied with supply augmentation. Little attention has been paid to the end-uses of harvested rainwater. In this respect it has failed to break with the dominant development paradigms of the 20th century, all of which are characterised by supply-side solutions. These solutions are caught in the infinite regress of forever trying to catch up with ever-expanding demand.

- What is required is to find ways of not just increasing water supply but much more critically reducing demand and regulating end-uses. For this a package of sustainable dryland agriculture practices must be mandatorily incorporated into the watershed programme.
- A great deal of promising work in this direction has already been done at ICRISAT and centres belonging to the network of Agriculture Universities spread all over the hinterlands of India; also by field research stations of the ICAR and IARI. The problem is that these centres work in isolation from the farms for which their research is meant. The packages developed by these scientists are in crying need of field-testing. Without this they remain ideal-types lacking the cutting edge of real-world trials.
- In spite of its importance for the poor, watershed programmes in India have not systematically integrated livestock management as one of the central interventions.
- Experience of many projects shows that with the implementation of watershed programmes, the village share of small ruminants kept by the poor decreased and that of milch animals and cross-breds increased
- Watershed investments should incorporate activities such as development of fodder banks in order to meet the increased demand for stall-feeding. This could also involve promotion of leasing arrangements of common lands to the landless for cultivation of fodder crops.
- With the demand for milch animals increasing, dairying emerges as a major 'watershed plus' activity. The existing marketing networks of milk and other dairy products need to be strengthened during watershed implementation. Marketing is an activity that farmers' co-operatives and the SHG Federations can take up.

- Along with livestock, improving the productivity of other land-based livelihoods should also be brought into the focus of watershed programmes. Fisheries in newly created water sources is one such land-based activity
- Watershed development is not merely a matter of harvesting rainwater. Its success crucially entails working out collective protocols of equitable and sustainable use of surface and ground water, bringing together of scientists and farmers to evolve a dryland agriculture package and a host of other livelihood options, detailed land-use planning at the micro-watershed level and the mobilisation of rural communities in the direction of the disadvantaged. Many NGOs in India have set examples in one or more of these challenges.
- We, therefore, believe that the role of NGOs can be very important. But it is clear that two problems need to be addressed: how to find genuine NGOs with quality and how to ensure that NGOs do not end up becoming mere oases of excellence.
- A very interesting innovation in this regard has been attempted by CAPART through its Support Voluntary Organisation (SVO) programme. SVOs have also set up an excellent system for capacity building and field-support.
- Our review of training institutions all over India shows that the training input has suffered from the following deficiencies: training is conducted at locations completely cut off from the context where it is to be applied; these institutes are run by personnel who speak a language which is largely incomprehensible to the people and whose attitude is didactic rather than dialogic; a very serious lacuna has been the absence of any kind of follow-up to ensure that the benefits of training are materialised at the field-level for which it was meant.
- The CAPART SVO programme is an exception in this regard. Of

course this a very small initiative. For it to be able cover the national watershed programme would need a major upscaling of the SVO concept. A major effort in this direction was initiated by the Ministry of Rural Development, GoI in 1999 through the formation of a National Committee on Watershed Training. The Committee was engaged in working out the precise modalities of extending CAPART's innovative SVO concept to the national watershed programme.

- The idea was that each state would have one or more (depending on training needs) SVOs who could help develop one or more Master Trainer Organisations (MTOs) at the district-level. MTOs would in turn take up the responsibility of training PIAs within the district.
- Each MTO could cater to the training and support requirements of about 5-10 new PIAs each year. These MTOs must have a proven record in terms of social mobilisation and technical competence. The intermediary rung of MTOs would ensure that training is achieved at the requisite scale without compromising on the uniform standards of performance within each state.
- These ideas must be carried forward so that a national initiative for training all levels/kinds of functionaries at different stages of the programme in specific subjects (already worked out in detail by the Eswaran Committee) can be carried out on a war-footing, so that the watershed programme can attain requisite quality within a reasonable time-frame.

New Integrated, Unified Approach

In light of the experiences that the area development programmes have had and the learnings that have been enunciated above, an initiative has been taken by the Ministry of Rural Development to formulate Common Guidelines to be applicable for all Ministries implementing the watershed programme for enabling different implementing agencies to have a **common unified perspective**. The new approach would have the following salient features.

Livelihood Orientation

The livelihoods perspective is to be incorporated at the planning stage itself rather than as an add-on after the physical works have been completed. Resource development and usage will be planned to promote farming and allied activities to promote local livelihoods while ensuring resource conservation and regeneration. The new approach would systematically integrate livestock management as a central intervention and encourage dairying and marketing of dairy products. In the rain fed areas, the animal resources become a major source of income for the people. When effectively integrated with the Integrated Watershed Management Programme (IWMP), a comprehensive animal husbandry component would contribute significantly to ensuring a better and sustainable livelihood for the people of the rain fed areas.

Three Tier Approach

A three-tier approach would be adopted in the implementation of the IWMP. The upper reaches, which are mostly hilly and forested, the onus of implementation of IWMP would lie with the Forest Departments and the Joint Forest Management Committees (JFMC).

The second tier is the intermediate tier or the slopes, which are just above the agricultural lands. Some of these are being used for rainfed agriculture and for non-cereal crops and plantations and similar activities. In the intermediate slopes, the IWMP would address all the necessary issues by looking at all the best possible options including treatment, cropping pattern, horticulture, agro-forestry etc.

As to the third level of the plains and the flat areas, where typically, the farmers are operating, there would be a large concentration of labour intensive works, the IWMP would be dovetailed with the employment generating programmes.

Cluster Approach

Since the concept of developing a fixed area of 500 ha under a specific project excludes many important areas within the watershed from treatment, a broader vision of natural hydro-geographical units of average size of 4,000 to 10,000 hectares comprising of clusters of micro-watersheds would be taken as a project for development under IWMP.

Scientific Planning

The new approach will look at the incorporation of scientific planning methodologies as indicated below:

GIS based data regarding watershed programmes would be consolidated at different levels and placed in the public domain.

Remote sensing inputs with a judicious mix of Geographical Information System (GIS) and Global Positioning System (GPS) would help in resource characterization, prioritization of areas for treatment, detailed project and regional planning, preparation of DPRs, and monitoring of targets and outcomes.

An MIS with GIS web based application for online monitoring as a part of National Database (National Programme for Comprehensive Land Resource Management, NPCLRM) would be used as a tool for planning and monitoring from National level down to district/micro-watershed level.

Convergence and Synergy

Activities pertain to wage employment under taken in the IWMP would be converged with NREGS and SGRY (so long as it is operational) for sustainable livelihood opportunities. The IWMP would be linked to the related initiatives of other Ministries and Departments such as the National Horticulture Mission, National Bamboo Mission etc.

Institutional Framework

At the national level, there will be a dedicated agency with a technical Secretariat, which will be called the **National Watershed Management Agency** (NWMA). This will be a professional and output-oriented agency with autonomy and functional freedom that will be responsible for managing the watershed programme.

At the State level there will be a State Watershed Management Agency (SWMA) with requisite professional support.

At the District level, there will be a dedicated team, which will be fully involved with the implementation of the programme from start to finish. They will provide technical as well as administrative inputs and will ensure high levels of quality with respect to the deliverables.

Delegation

The State Level Agency would be empowered to scrutinize and sanction projects within the State. A representative of the MoRD will be a member of this Committee. The day-to-day management will be done by the State Level Agency with district level interaction.

Cost Norms

In line with the considered suggestion of the Parthasarathy Committee, the Department would make a suitable recommendation for enhancement of the cost norms.

Capacity Building

Capacity building is a crucial component for achieving the desired result of livelihood enhancement through natural resource management. Each State will have an Annual Training Plan to be approved and monitored by the SWMA. Similarly, each DWMC will prepare a training plan for the district which will incorporate the training plan prepared by each PIA for capacity building of the various functionaries at the watershed level. These plans will be regularly monitored and reviewed at the state and district level.

Role of PRIs

A key role would be given to the Panchayati Raj Institutions (PRIs) at the Gram Panchayat, intermediate panchayat and Distt. Parishad levels. They would have full responsibility to oversee implementation of the programmes and they would provide all governance and administrative support.

Role of NGOs

The role of NGOs would be recognized for creation of awareness, social mobilization and capacity building.

This Working Group fully endorses this initiative of the Ministry of Rural Development and strongly recommends that the Common Guidelines be prepared as early as possible. Once the Guidelines have been formalized, they may be placed before the National Rainfed Area Authority so that they receive endorsement at a higher policy level and are then fully adopted by all implementing ministries/ departments and agencies.

3. Role of Panchayati Raj Institutions in Rainfed Area Development

Major strengths of Panchayati Raj Institutions in Rainfed Areas Development

(a) The so-called comparative disadvantages of PRIs can be addressed effectively through proper design of Panchayati Raj. These design features have already been arrived at by the Ministry of Panchayati Raj through a national consensus achieved through 7

Round Tables of State Ministers of Panchayati Raj and the same ought to guide design of Rained Area programmes.

(b) Approaches to rainfed area development should focus on strengthening governance institutions, particularly Panchayats. A decentralized strategy towards rained area development would essentially be aimed at aiding PRIs to identify, implement, operate and maintain their own priority investments in the direction of improving delivery of services that benefit the poor, within a given budget. Initiatives in strengthening Panchayati Raj Institutions to implement rainfed area development strategies ought to be in the following seven areas:

(i) Enhancing the quality of people's participation in grassroots level institutions such as the *Gram Sabha* and *Gram Panchayats*

(ii) Delineating the roles, functions and responsibilities of each tier in the PR system so that there is greater clarity and thus lesser overlapping,

(iii) Strengthening mechanisms that ensure downward of PRIs accountability to the people that they serve,

(iv) Adopting appropriate measures of fiscal decentralisation so that PRIs are empowered to deliver what they have been entrusted to;

(v) Decentralising the planning process so that plans and programmes of PRIs reflect the aspirations of people;

(vi) Clarifying the relationship between elected representatives and staff working in PRIs so as to bring in greater managerial professionalism and accountability of the staff to elected bodies;

Recommendations on Activity Mapping

(a) While States are responsible for activity mapping for better functional demarcation, Ministries of the Government of India that deal with various facets of rainfed agriculture, such as the Ministry of Agriculture, Water Resources and Rural Development should undertake an Activity-Mapping exercise that clearly sets out, in accordance with the subsidiarity principle, what they need to do at their level and what can be done at the state level, and by the panchayats. Once Central Ministries undertake activity mapping individual scheme guidelines that deal with rainfed farming must to be in tune with their Activity Mapping and those of the states.

(b) The plan prepared for rainfed farming at the district level, by the District Panchayat ought to be consolidated into the District Plan in the manner as prescribed in the guidelines on district planning of the Planning Commission dated 25-8-06. Schematic guidelines of the Ministries concerned will need to state this out explicitly.

(c) Financial devolution by placement of the funds pertaining to Watershed development should be placed directly with the level of the Panchayat concerned, which has been assigned the task of performing the function, in accordance with Activity Mapping. It is only when financial devolution follows activity mapping that the lines of accountability of Panchayats would be clear.

(d) The Working Group suggests a detailed activity mapping in respect of Rainfed area and Watershed development.

Recommendations on linkages between NGOs and PRIs

(a) While developing multiple institutional options for improving delivery, it is necessary that they should be made accountable to the local community. These must, as a rule, be sub-committees of the local Panchayats so that they can draw up and implement need based local level plans. They should also be made accountable to the gram sabhas right from their inception. The following programme approaches therefore have to be strictly eschewed in the design of development strategies for rainfed areas:

(i) Central Guidelines that mandate the implementation of Watershed programmes through CBOS even after these functions have been devolved to Panchayats,

(ii) State Line agencies continuing to implement Watershed programmes through CBOs by-passing elected PRIs,

(iii) CBOs utilizing funds and performing functions in the legitimate sphere of PRIs without their knowledge,

(iv) CBOs having not even symbolic accountability to elected PRIs even when they are using public funds or utilizing the natural resources of the locality.

(v) CBOs being nurtured as developmental substitutes of PRIs through generous infusion of funds even while starving the PRIs of resources.

(b) Competent NGOs could assist PRIs in planning of various programmes, providing professional guidance and support to PRIs. The scope of such support should be clearly stated out in schematic guidelines dealing with implementation of such schemes. It must be made clear that the ultimate decision makers will be the PRIs, and NGOs will be accountable to them.

(c) Panchayati Raj laws of States ought to provide flexibility for Panchayats to form collaboration with each other or with outside NGOs. Technical skills could be provided through autonomous bodies formed through collaborations between NGOs and PRIs,

(d) Government could empanel or accredit NGOs into a pool, which could be used to provide technical, training and handholding support to Panchayats for implementation of Rainfed Area programmes.

Modalities to enable Gram Panchayats to access funds under NREGA for development of rainfed agriculture

(a) A professional agency or professional services may be obtained by each District Panchayat to assist in participative planning processes at the Panchayat level. A panel of NGOs may also be created for the purpose to provide support to Panchayats at the Intermediate and Village levels.

(b) NREGA must also be used for maintenance of assets created, while also providing rural employment. Special emphasis must therefore be given under NREGA plans at the village level to the repair and maintenance of assets.

4. COVERAGE AND STRATEGIES IN THE PARADIGM OF AGRO-CLIMATIC REGIONAL POLICIES IN INDIA

- This chapter summarises various attempts at mapping India's land and water resources and identifying suitable cropping patterns and biomass production strategies for different regions.
- Such assessments are particularly important in understanding the constraints and opportunities in our rainfed areas. The range and diversity of the rainfed areas presents a qualitatively complex set of problems, which needs delicate handling. We must give up the one-size-fits-all approach and focus on fine-tuning and matching our interventions to the subtle variations in local contexts.
- As compared to relief against rainfall failure, the need is for yield enhancing water supplies in water stress periods. This is possible through access to ground water. Nevertheless over exploitation of ground water and falling water tables have disastrous impact. Therefore, ground water stress is an important source of agrarian

distress.

- The ground water distress can be alleviated by mounting well-designed ground water recharge programmes through dug-well recharge, tank recharge and strengthening of water harvesting structures in watershed programmes. These efforts should be supported by a strong education, information and communication component.
- The **moisture index** approach uses the balance between annual rainfall (P) and the potential evapo-transpiration (PET) construct a Moisture Index (MI) to demarcate agro-climatic zones. Water availability and crop production potential in areas with similar P and PET values can vary considerably depending on the composition of the soil of the area. Soils and their characteristics mediate the impact of climatic factors on crop production potential. In the **modified MI approach**, differences in depth and structural properties of soil are taken into account to calculate the water balance of the soil. Several soil climatic zones were delineated on this basis.
- The soil-climatic classification did not, for many years, become the basis for any policy level intervention. The much needed shift in strategy was pioneered by the Planning Commission, at the end of 1980s, when it initiated a growth strategy based on the **agro-climatic regional planning approach**. The purpose of this exercise was to identify broadly the crop mixes and types of land use that is best suited to the available resources of climate, soil, topography, water resources and irrigation facilities in each region. This implied a serious departure from the legacy of crop-centred research, which culminated in the Green Revolution.
- A more comprehensive attempt towards delineating **agro-ecological regions** in the country has been attempted by the National

Bureau of Soil Survey and Land Use Planning). This approach followed the FAO methodology of a sequential layering of information on maps. Each contains areas of uniform physiography, climate, length of growing period and soils, and has similar hydrological and ecological responses.

- The major weakness of the agro-ecological regions approach is that it focuses mainly on climatic, topographic and edaphic factors, without sufficiently emphasising the role of **irrigation** in modifying bio-climates and the length of growing period (LGP). While its use of LGP is an improvement over rainfall as an indicator of moisture availability, the model has no way of assessing crop performance across regions with similar LGP ranges. It also does not attempt to directly assess the extent of **vegetative cover** over land surface.
- Taking the agro-ecological region classification as the basis, a new approach to agro-climatic planning has been suggested by the Parthasarathy Committee (PC). The PC has suggested a method by which crop production potential and the extent of drought vulnerability could be assessed **at the block level** using **a composite drought index** combining bio-climates, rainfall, irrigation and extent of vegetation. For this, weighted index of drought vulnerability and weighted irrigation index are calculated separately and then combined into one composite drought index. Based on these weightage factors the composite drought index is estimated: $Y= 0.70X_1+0.30X_2$
- The higher the value of the composite drought index, the more drought-prone the block will be. Using this approach, drought vulnerability can be delineated at the block level and appropriate strategies could be visualised.
- A further specification needs to be introduced to the notion of "irrigated area". The official reported data gives equal weightage to a

unit area irrigated under sugarcane and, say, kharif maize. It is clear that sugarcane is an annual crop and has large irrigation requirement whereas kharif maize is a seasonal crop needing one or two protective irrigations only. Therefore, irrigated area under different crops should be ascribed different weights depending on irrigation depth ("delta") or the sum of number of waterings per unit area irrigated.

- This helps get closer to the real consumption of water. Once depth of irrigation figures are available cropwise, these can be mutiplied by the area irrigated to arrive at the volume of water used for irrigation of each crop in every district and block. Summing up this figure for all crops in each district, we got the total volume of water used for irrigation in the district or block.
- The PC suggests a new method of utilising remote sensing data from NRSA to develop a Normalised Difference Vegetation Index (NDVI) for each block, to validate the composite drought index. Fluctuations of crop condition as triggered by weather and water supply conditions determine the agricultural drought proneness in a given area. The relative deviation of NDVI from that of normal and the rate of progression of NDVI within the season gives the indication about the agricultural situation in the district which is then complemented by ground situation as evident from rainfall and sown area.
- The Working Group recommends the following:

1. The method of delineation of drought-prone blocks as suggested by the Parthasarathy Committee should be adopted. This method should be made part of the existing models of agro-climatic regional planning in India for drought monitoring and crop planning.
2. Work on construction of a composite drought index must be initiated.

3. The weighted irrigation index should be further fine-tuned to local variations by introducting depth of irrigation into it. Data on number of waterings cropwise should be made part of calculations.
4. The major gap in the existing database (data on cropwise waterings) must be bridged by introducing this crucial distinction into the reporting schedules by asking questions about the number and source of each watering.
5. The delineation of blocks should be validated through the NDVI method. Long term NDVI database consisting of extreme drought events and normal season must be developed for quantification of NDVI variability, which directly indicates drought vulnerability.
6. NDVI data should be correlated with other secondary information about the blocks as well as primary surveys to verify the extent of actual vegetative cover on the ground.

5. Economic and Financial Incentives for Rainfed Areas

- We should strongly consider the pricing model adopted by China to address the situation of water scarcity in India. Water should be treated as an economic good and therefore its ***price should reflect the full cost of water supply*** as in the case of the Chinese model. The enforcement mechanism should be strengthened so as to facilitate efficient use of this scarce resource.
- However, any taxation policy should bear in mind the fact that most farmers in India are impoverished. We suggest that the taxation policy should be of a progressive nature. For instance it is the case that upstream farmers have better access to water than downstream farmers. Hence water taxation policies must take into consideration the economic condition of the farmer.
- We should allow third party investment in micro irrigation projects.

Currently farmers take on loans and install the micro irrigation facilities (drip irrigation, sprinklers etc). Under the suggested scheme, third parties should be welcomed to undertake micro irrigation projects on farm holdings.

- Since land holdings are fragmented, the area could be demarcated like telecom circles (area wise) rather than on a per project basis. 3-5 enterprises could be allowed in each circle so that monopolies do not exist while at the same time, these enterprises could enjoy economies of scale.
- The projects could be seen as third party loans to farmers and relegated as land development projects. The enterprises could act as leasers of the infrastructure to farmers in contiguous farms and would be involved in maintaining the infrastructure.
- The projects could be put up for tendering by bidding process by interested parties (either public or private or in partnership). The enterprises could also access the capital markets through tax free bonds since the micro irrigation projects can be given the status of infrastructure. With regard to the water used for irrigation, the enterprises can invest in water banks / reservoirs to supply water to the farms.
- For drip irrigation facilities, which are spread over a large area, it becomes necessary to install systems and checks to ensure that water pressure all through out the network is at the same level. For small farms such checks and systems are not necessary and should be done away with. In fact, IIT engineers have come up with a less expensive drip irrigation system for small farms.
- The specific recommendations with regard to the efficient promotion of Drip and Sprinkler irrigation in India can be found in *Appendix A*.
- The NABARD experience of empowering user communities has been

most productive & fruitful. We should avoid adding new institutions to solve old problems. It is better to empower existing institutions and communities (SHGs & Microfinance institution). Efforts should be focused on capacity building in local institutes. Financial weakness of single institutes can be got around by pooling resource of in contiguous areas.

- NGOs and other organizations working in rural areas must be encouraged to disseminate water literacy among the farmers. Suitable extra allocations could be made in the Panchayat budget.
- To give an impetus to the projects on water and soil, agri-clinics must be established at least at the block level and be manned by Agricultural graduates. This could again be on a PPP-entrepreneurial model with finance from the banking system at low rates of interest. NABARD is already doing some work in this area. The canvas can be expanded with a capital subsidy mechanism built into it.
- Incentives for irrigation need to be given at different levels such as source, transportation, storage and utilization.
- We looked into the possibility of having a BOT (Bill Operate and Transfer) system in the case of water on similar lines as the power model and whether subsidies can be allocated for different stages such as the generation, operation and distribution of water.
- There must be transparency in the water planning system where the water bodies are held accountable for the efficient allocation of the water resources.
- India too can derive significant benefits from converting its paper based manual system of land record maintenance to a fully computerized demat system. The benefits that can be garnered from such a move are manifold and include: first less land disputes.

Second, security for credit, business growth and investment third greater control over any illegal use of land and finally allows monitoring of land markets.

- The Government should therefore take advantage of technologies that facilitate the cataloguing of records and flagging and retrieval of information.
- The Ministry for IT has given priority & incentive to develop an online system for land titles & deeds. According to the Committee it was a question of when rather than how. Electronic holding of land records and registration will make the credit process easier.
- We recommend that all land should be registered by a cut-off date beyond which electronic registration is made compulsory. All states should have its separate depository like NSDL. Another suggestion was to allow private parties to assist in the land registration process (e.g. Birla Sun Life in pan card registration).
- Successful cases of implementation of e-registration of land records by Indian states are:
    - Maharashtra: *SARITA*- (*Stamp and registration with Information Technology Applications*). This is a case of a public private partnership. The private sector has been contracted to build operate and maintain SARITA across all SRD offices, five years after which it would be transferred back to the state.
    - Andhra Pradesh: CARD (*Computer Aided Administration of Registration Department*) project: Land registration offices throughout the state are equipped with computerized centres under *CARD*.
    - Karnataka : public private initiative of e-governance called *KAVERI(Karnataka Valuation and E-registration Project)*

  - Tamil Nadu is also another state where land ownership records have already been digitalized.
- Such cases of successful electronic registration of land records must be extended to the remaining states in the country.
- It was agreed cropping pattern should be primarily decided by market and land, water resources. Crop patterns should not be decided by National/State priority.
- Efforts should be undertaken to collect and make available to the community agriculture related data. The importance of data warehousing can not be denied. Agri-intelligence units have an important role to play in this regard.
- Futures prices can be used by farmers as signaling devices for crop sowing pattern. Sowing decisions may be taken based on futures, rather than spot prices to enable better returns at the time of harvest.
- Private sector participation can be encouraged in both the above models through land leasing arrangements to allow accelerated technology transfer and capital inflow and assured markets for crop production. Private investment in agriculture can be encouraged in areas like agricultural research, post harvest management and marketing.
- In fact we should explore the export potential of crops which *can* grow in the rain fed areas. E.g. yellow peas which are grown as an export crop in Canada. Zones targeting foreign markets should be given full benefits of infrastructure (electricity, transport etc), marketing and finance (access to credit). Enterprises which allow for forward linkages should also be encouraged.
- Industry should be welcomed to develop such regions without the farmer losing his right of land. The concept of commercialization of

agriculture through Agri Export Zones should thus be given a thrust.

- Cropping patterns under contract farming needs to be directly linked with user industries in the region or nearby areas. Such linkages are the only answer in the long run for sustaining crop prices and farmer interests.
- Also the creation of multiple livelihood opportunities will go a long way in improving the capacity of the farmer to experiment with cropping patterns.
- Another important factor that contributes to the farmer's ability to decide the cropping pattern is his knowledge about the likely scenario in respect of a crop. The community service centers which have been planned by the Government have a major role to play here. There are differences in perception as regards the model to be used for these centers. These need to be resolved and a region-specific model with participation from the local community which it seeks to serve (an inclusive model) needs to be adopted.
- The specific guidelines for changing cropping patterns can be found in Appendix B.
- Access to markets is the key to viable farming. Any form of farming (co-operative, contract or corporate) should be encouraged with proper safe guards for the farmers rights.
- This system of exchange traded options on commodities can not only provide the farmer with a floor price for his commodity with out the obligation to sell at the floor price (thus acting as an MSP) but also help him take the benefit of any rise in prices.
- Futures help farmers mitigate their price risk during both pre and post harvest phases of their crop cycle. Futures assure farmers of a firm realization level.

- Weather derivatives are a superior alternative to both weather insurance and traditional crop insurance since it solves the problems of adverse selection, moral hazard, insurable interest and correlating rainfall with crop yield. It thus provided an efficient mechanism to cover the volumetric risk of the farmer.
- We agreed on the importance of a security against which a credit line can be issued. We also debated on how the credit line could be extended against a 'social' collateral as against 'physical collateral'. Self-help groups could be targeted to advance this idea.
- With regard to policy support
    - first, the role of the state needs to be redefined. The 'state' should have a sovereign right over a scarce necessity like water. People have well defined rights which recognize the principles of justice, social equality and ecological security. The state acts as a facilitator and provides for a regulatory framework & mechanism.
    - Second, incentives to conserve water must be linked to observable and measurable performance.
    - Third, creation of new institutions should be avoided as far as possible. The role and scope of existing institutions can be redefined to meet objectives. It is generally the case that establishment costs will dispose off 80% of the total funds. Vested interests crop up which are unfavorable to the achievement of the targets. It would be better to strengthen existing Panchayati Raj institutions and its agencies.
    - Fourth, the management and overseeing needs to be structured such that there is no overlap of jurisdictions or duplication of responsibilities. Also, structure should be decentralized and with minimum supervisory control.

  - Fifth, incentive packages should be such that it is easily monitored. Therefore it would be better to rely on the market mechanism to reduce corrupt practices.
  - Sixth, creation and maintenance of a comprehensive database in the public domain. The ideal database should cover institutions and their finances, land registration, cropping pattern, water consumption and usage patterns, etc.
  - Seventh, water audit and budgeting should be practiced. This would, of course, require capacity building.
  - Lastly food Security is the main driver of agri-policy & agri-produce pricing. It should be driven by market mechanism and optimal utilization of scarce resources like land and water.
- *Households should be regarded as the key to the credit assessment scenario rather than the enterprise undertaken by the individual.* We should remove the focus from agriculture to composite loans so that farmers can use his discretion to allot money to various enterprises that he wishes to take up.
- On the topic of the creation of Rural Financing Agency, the general consensus was that there was no need for the creation of new institutions. It would be better if we developed greater co-ordination and co-operation between the existing agencies. A new Rural Financing Agency institute may not solve the problem of increasing credit to the rural economy.
- We are of the opinion that there are few fiscal instruments available for promoting private participation in rain fed areas. The incentive structure can revolve around
    - tax holidays
    - tax rebates
    - depreciation

- These incentives can be extended to private participation in
    - Manufacturing water saving devices
    - Sourcing of raw materials from Producer Companies which have invested in water management techniques
    - Invest in research and developmental activities in rain fed areas
- We believe that the Tobin negative income tax appears to be a practical way to solve the problem of water efficiency. It would at the same time induce water conservation efforts and augment rural incomes.
- It was suggested that the negative Tobin tax be computed on the basis of the existing water rates. The tax could be computed as a reimbursement of a fixed percentage of the water tax rate to the farmers or communities involved in the water conservation process. The financial outlay for the scheme will have to be calculated estimating how many such projects can be undertaken in the rain fed areas (see Annexure C).
- We recommend the development of a water credits market which will go a long way in providing incentives for better use of water.

6. Challenges and Opportunities of International Trade in dryland Agriculture

- The growth experience of Indian agriculture after mid 1990s was different than the experience before mid 1990s. GDP of agriculture sector showed annual growth rate of 3.16 percent during 1990-91 to 1995-96, after which it declined to 1.75 percent.
- Growth rate of fishery between the pre and post WTO periods declined from 7.49 percent to 2.72 percent.
- Growth rate in output of livestock sector decelerated from 4.25 percent to 3.47 percent.

- Likewise, growth rate in output of crop sector after 1996-97 plummeted to less than half of what it was during 1990-91 to 1995-96.
- As a result, crop sector, which forms largest segment of agriculture, showed poorest growth during post WTO period in the history of independent India.
- Within crop sector, growth rates of all commodities and crop groups except paddy and onions showed a declining trend after 1996-97.
- Thus, while initial years of reforms were somewhat favourable for growth of agriculture sector, in the period after 1995-96 the sector showed very poor growth rate
- There is a continuous deceleration in the growth rate of livestock output after 1995-96.
- Growth rate in output of horticultural crops kept increasing till 1998-99 after which slowdown set in.
- Decline in growth rates is clearly visible in cereals, pulses, oilseeds, cotton, sugarcane, fishery, milk and eggs after 1995-96.
- Export earnings doubled in three years between 1992-93 and 1995-96.
- Imports also increased at almost the same pace and net surplus generated by agriculture trade increased from $2012 million during 1992-93 to $4337 million during 1995-96.
- However, after 1996-97 earnings from agricultural exports started moving downward. This downturn continued till 2001-02 after which exports showed some recovery. However, the increase in exports seen during these years was neutralised by the sharp increase in imports in the same period.
- Annual import of agricultural goods increased from $1190 million in the three years preceding WTO to $1996 million in the first triennium

after WTO.

- Across the same period, exports increased from $ 3725 million to $ 6530 million and resulted in increase in net trade surplus from $ 2534 million to $ 4534 million.
- This led to increased trade orientation of Indian agriculture.
- Share of agricultural imports in GDP agriculture increased from 1.49 percent to 2.01 percent and share of agricultural exports in GDP agriculture increased from 4.76 percent to 6.60 percent.
- Surplus generated by agriculture trade increased from 0.32 percent of GDP agriculture to 0.46 percent. Despite sharp rise in imports with the implementation of WTO agreement, exports required to finance imports fell to 30.57 percent compared to 31.96 percent in the pre WTO period.
- These favourable changes seen in the initial years of WTO did not last long. During 1998/99 to 2000/01, average agricultural export declined by 7 percent whereas agricultural imports increased by 64 percent as compared to initial years of WTO.
- Trade surplus generated by agriculture declined to 0.27 percent of GDP agriculture – lower than that recorded in the pre WTO period.
- The three years ending 2003/04 have seen some increase in agricultural exports but this is much smaller compared to the growth in imports. Consequently, exports needed to finance imports increased to more than 57 percent compared to around 30-32 percent in the pre WTO and initial WTO periods. Trade surplus generated in this period remained at 0.27 percent of GDP agriculture (more or less the same as in 1998/99 to 2000/01).
- The disaggregated analysis of the commodity-wise and year-wise details indicate that exports from agriculture are spread over a larger number of commodities while imports are confined to a fewer

commodities.

- Exports of wheat and rice have risen sharply. Share of foodgrains in total value of exports has more than doubled. Share of tea has collapsed from nearly 15% to a mere 5%. Oil meals share fell sharply between 1995-97 and 2002-04.
- The period saw a massive jump in imports of edible oils (2000 percent). Their share in agri-imports rose from 15 to 51 percent. Edible oils, which account for almost two-thirds of the total agri-imports, are the single largest item of agri-imports in the country. The dominant share of this commodity continued to persist even in 2003-04. Imports of pulses nearly tripled and remained between 10-20 percent of agri-imports. Raw cotton imports rose dramatically.
- The main reason for adverse impact on farm export and increase in import is sharp decline in international prices of almost all major agricultural products after 1997.
- International prices had slumped to their lowest levels during this period primarily because of the weight of the subsidies granted by the major players in the markets for agricultural commodities, in particular the United States and the members of the European Union.
- In the case of imports, liberalisation of trade in the initial years of implementation of WTO agreement did not cause much difficulty because international prices of bulk products were quite high in the first three post WTO years. Subsequently, as international prices started falling, India’s imports started rising.
- A feature of the subsidies being granted by the US and the EU has been the targeting of products that are of export interest to them. The members of the European Union have traditionally been using very high does of subsidies on specific products which include wheat, corn and sugar besides dairy products.

- In addition to these subsidies, the EU members were also using export subsidies to gain control over the global markets. The United States, on the other hand, increased the subsidies it was granting to specific commodities, after the WTO was established in 1995.
- In case of rice, subsidies increased from close to US $ 12 million to more than US $ 700 million between 1995 and 2001, while for soybeans, the increase was from US $ 16 million to more than US $ 3.6 billion during the same period. These figures clearly show the extent to which countries controlling global agricultural markets are introducing distortions in these markets, leading to increased levels of uncertainties for farmers in developing countries.
- The ongoing agriculture negotiations in the WTO have brought to the fore the severe pressures on India to reduce its tariffs on account of India's bound tariffs (i.e. maximum tariffs allowed under the WTO regime) being high.
- **The Working Group makes the following recommendations:**

1. It is important for India to retain tariffs on products that are critical from the point of view of maintaining food security and livelihoods, given that the international prices of many of these commodities have remained sticky at low levels in recent years
2. Pulses are very important for India’s rural economy, particularly because they withstand dryland conditions. They also constitute a major component of the diet of the poorest of the poor. It is important to protect the domestic production of pulses and supplies have to be assured. There is adequate cushion between the applied and bound rates. Import duty on pulses has to be fixed taking these factors into account.
3. For pulses, concerted efforts should be made to attain technological breakthrough in substantially increasing yield rates from their

current levels.

4. Greater emphasis will have to be put on the development of High Yielding Varieties (HYV) of seeds by the research institutions so as to attain a high degree of self-sufficiency in production of pulses.
5. Low cost production strategy (specially in case of oilseeds) has been successfully adopted by some Asian countries such as Indonesia, Malaysia and Vietnam. The cost structure and also other relevant parameters attained by these countries should be studied by DES/CACP so that this could be replicated in India.
6. MSP related domestic cost of edible oils are not adequately protected by the current levels of tariffs. Tariffs on edible oils should be revised upwards for sustaining the minimum level of price support to oilseed growers.
7. Policy can be designed to establish a level playing field between highly subsidized imported and domestic cotton for the Indian yarn manufacturer. This can consist of automatic setoffs for the producer.
8. Considering the fact that the MSP regime essentially reflects the cost of production of relatively low cost domestic producers, it is essential that levels of import tariffs be so fixed that these provide adequate protection to at least these producers. Here the role of CACP needs to be expanded to recommend levels of import tariffs.
9. Import tariffs must be varied with world prices. Based on the logic of minimum protection, an automatic and transparent policy of variable tariffs on agricultural imports linked to the deviation of spot international prices from their long-run trends needs to be introduced. Such variable tariffs are imperative not only for stabilization of prices of all agricultural commodities in open market but also for sustaining the MSP.

10. Introduction of a system of variable tariffs requires a new institutional arrangement under which world prices as well as import trends could be monitored on a real time basis and tariff calibrated accordingly.
11. Review of tariffs must be undertaken more frequently than the current practice of doing this exercise annually on the eve of budget presentation or at the time of declaration of EXIM policy.

CHAPTER - I

INTRODUCTION

1. **Setting up of the Working Group on Rainfed Areas for the Eleventh Five Year Plan.**

A Working Group on Rainfed Areas for the Eleventh Five Year Plan was set up by the Planning Commission under the chairmanship of Dr. Y.K. Alagh, vide order No.M-12018/1/2005-RD dated the 2nd March, 2006 with the following composition and terms of reference:

1.	Dr. Y.K. Alagh, Former Member of Planning Commission & ex-Minister, Government of India Ahmedabad.	Chairperson
2.	Shri M.L. Mehta, IAS(Retd.) ex-Chief Secretary, Rajasthan	Member
3.	Shri Pradeep Jena, Coordinator, UNDP, Bhubaneswar (Orissa)	Member
4.	Shri Harnath Jagawat, Director, N.S. Sadguru Trust Dahod, Gujarat	Member
5.	Dr. Bhaskar Gaikwad, Chief Scientist, Krishi Vigyan Kendra,Babhaleshwar, Ahmednagar, Maharashtra	Member

6.	Prof. G.Kadekodi, Director, Institute of Ecnomic & Social Change, Bangalore.	Member
7.	Shri Tushar Shah, Principal Scientist, International Water Management Institute, Elecon, Gujarat.	Member
8.	Shri Deep Joshi, Executive Director, PRADAN, New Delhi.	Member
9.	Dr. Ravi Kumar, CMD, National Commodity & Derivatives Exchange Limited, Mumbai.	Member
10.	Dr. Ramesh Chand, National Centre for Economic Analysis and Policy, ICAR, PUSA, New Delhi	Member
11.	Dr. A.K. Singh, Director, Giri Institute of Development Studies,	Member

Lucknow.

12.	Dr.Y.S. Ramakrishna, Director, Central Research Institute for Dryland Agriculture, Hyderabad	Member
13.	Dr. Sudarshan Iyengar, Vice Chancellor, Gujarat Vidyapith, Ahmedabad.	Member
14.	Smt. Renuka Viswanathan, Secretary, Ministry of Rural Development, Govt. of India, New Delhi.	Member
15.	Smt. Radha Singh, Secretary, Department of Agriculture & Cooperation, Govt. of India. New Delhi.	Member
16.	Shri Prodipto Ghosh, Secretary, Ministry of Environment & Forest, Govt. of India, New Delhi.	Member
17.	Shri J.S. Samra, Dy. Director General, Indian Council of Agricultural	Member

Research,
New Delhi.

18. Shri Lambor Rynjah, Additional Secretary, Department of Land Resources, Govt. of India, New Delhi. — Member - Convener

1.2 Terms of Reference of the Working Group

The Terms of Reference of the Working Group are as follows :-

1. Measures for harmonization of incentive programmes and organisation for land and water development at agro-climatic sub region levels and its integration at higher levels.
2. Suggest economic and financial incentives for sustainable land and water development programmes.
3. Suggest suitable policies for technological support and economic & financial policies for integrating tree crops, bio-fuels etc.
4. Review and widen watershed based framework for implementation of integrated Natural Resource Management in rainfed areas with emphasis upon participatory village and family based planning and diversification of land use and farming systems.
5. Suggest the programmes for marketing, infrastructure & policy support for income generation in post water harvesting phases such as market integration support possibilities, value addition strategic linkups between farmers and producers associations and corporate and profit making groups engaged in national and global markets.

6. Suggest modalities to enable Gram Panchayats to access funds under National Rural Employment Guarantee Act for development of rainfed agriculture.
7. Any other Terms of Reference that may be decided by the Working Group in its first meeting.

1.3 A copy of Government of India, Planning Commission (Rural Development Division) order No.M-12018/1/2005-RD dated the 2nd March, 2006 setting up the Working Group on Rainfed Areas for the Eleventh Plan is at Annexure-I.

2. Formation of Sub-Groups

The Working Group at its first meeting held on 19.04.2006 formed five sub-group with specific topics assigned to each to give focus to the recommendation of the Working Group.

Sub-Group I

A) Topic: Review of existing strategies for development of rainfed areas

Mihir Shah	-	Chairperson
Deep Joshi, PRADAN	-	Member
Bhaskar Gaikwad, KVK, Babhaleshwar	-	Member
Prof. R.S.Deshpande, ISEC, Bangalore	-	Member

Terms of Reference:

1. Review the existing rainfed area development programmes being implemented by the Central as well as the State governments.
2. Develop case studies of best practices and assess their replicability elsewhere.

3. Examine the successful strategies and find out the circumstances under which these strategies would work.
4. Examine the unsuccessful strategies and find out the circumstances under which these strategies would not work.
5. Evaluate the experiences in agro-climatic regional planning in the country, update projections and suggest a suitable model for agro-climatic regional planning, specifically for rainfed areas.

B) Topic : Statistical Review

K P R Vittal, CRIDA, Hyderabad - Chairperson
A K Singh, GIDS, Lucknow - Member
Dr. V.Ratna Reddy, CESS, Hyderabad - Member

Terms of Reference:

1. Analyse the land-crop-population interactions in rainfed areas.
2. Analyse temporal changes in land use and population in rainfed areas
3. Updation of data base and design a GIS framework for development of rainfed areas.
4. Examine the existing policy framework for development of rainfed areas and build in sustainability considerations into it.
5. Suggest suitable strategies for development of rainfed areas in future.

Sub-Group II :

Topic: Economic and Financial Policy Support

Ravi Kumar, NCDE, Mumbai	-	Chairperson:
Ramesh Chand, NCEAP, New Delhi	-	Member
V R Panchmukhi, Economist	-	Member
(for optimal cropping patterns in an open economy)		
A. Karnik	-	Member
(for financial inputs)		
For corporate strategies	-	Member to be Co-opted by Chair

Terms of Reference:

1. Suggest economic and financial incentives (subsidy, collateral and investment requirements) for sustainable land and water development programmes..
2. Derive optimal cropping patterns and other economic activities in a liberalizing economy.
3. Suggest the programmes for marketing, infrastructure and policy support for income generation in post water harvesting phases such as market integration support possibilities, value addition, strategic linkups between farmers, producers associations and corporate and profit making groups in national and global markets.
4. Assessment of asset financing companies for re-financing activities.
5. Incentive and disincentive strategies for sustainable rainfed area development.

Sub-Group III :

Topic:Tree crops, animal husbandry and similar activities for rainfed areas development

Prof. Kanchan Chopra, Dir.IEG	-	Chairperson
Representative of DSC, Bhopal	-	Member

Terms of Reference:

1. Strategies for integration of tree crops, animal husbandry and other such activities into rainfed farming systems.
2. Analysis of suitable institutional frame work like JFMCs.
3. Strategies for drinking water management.
4. Economic analysis of tree tariff and marketing policies.
5. Suggest suitable policies for technological support and economic and financial policies for integrating tree crops, bio-fuels etc.

Sub-Group IV :

Topic: Framework for watershed development

M.L. Mehta, Jaipur	-	Chairperson
Deep Joshi, PRADAN	-	Member
Harnath Jagawat, Sadguru trust	-	Member
Piruz Khambatta, Rasna, or nominee	-	Member

Terms of Reference:

1. Measures for hamonization of incentive programmes and organization for land and water development at agro-climatic sub-region levels and its integration at higher levels.
2. Defining/re-defining watersheds.
3. Review and widen watershed based framework for implementation of integrated natural resource management in rainfed areas with emphasis upon participatory village and family based planning and diversification of land use and farming systems.
4. Livelihood support strategies in watershed development
5. Suggest models of corporate sector/producer associations
6. Analysis of strategic alliances amongst different stake holders
7. Review of best practices in watershed development
8. Analysis of strategies for export promotion

<u>Sub-Group V</u> :

Topic : Role of PRIs in rainfed area development

Harnath Jagawat, Sadguru trust	-	Chairperson
Vijay Mahajan	-	Member
Shri T.R. Raghunandan, JS (M/o PR)	-	Member

Terms of Reference :

1. Analysis of major strengths of PRIs in rainfed area development
2. Identification of support system that can be provided by voluntary sectors in rainfed area development programmes.

3. Strategies for government (PRI)- Non-government (NGO) collaboration in rainfed area development programmes.
4. Strategies for capacity building of PRIs and other stake holders for rainfed area development.
5. Functional demarcation between ZP, Block Panchayat, Gram Panchayat and voluntary agencies.
6. Suggest modalities to enable gram panchayats to access funds under NREGA for development of rainfed agriculture.

3. Deliberations of the Working Groups

3.1 The first meeting of the Working Group was held on 19.04.2006 under the chairmanship of Dr. Y.K. Alagh in Yojana Bhavan, New Delhi Delhi to deliberate the terms of reference of the Working Group and five sub-groups were formed. The chairperson of the Working Group authorized the chairpersons of the sub-groups to co-opt any other member of the Working Group or outside expert/ professional at their discretion. The chairperson of sub-group III co-opted Shri K.B. Thampi, IG Forest, Ministry of Environment & Forests, New Delhi, Shri Pramod Tyagi, SPWD, New Delhi, and Shri Girish Sohani, BAIF, Pune, the chairperson of sub-group IV co-opted Smt. Archana Singh, DIG(F), Deptt. of Land Resources, New Delhi and Smt. Anjali Prasad, JS(Trade), Deptt. of Agriculture & Cooperation, New Delhi and the chairperson of sub-group V co-opted Shri Venkat Rao Ghorpade, former A.P. President, Bellary Distt, Karnatak and Smt. Savita Rathi, Gram Panchayat Pradhan, Churu Distt.

3.2 The second meeting of the Working Group was held on 23.08.2006 under the chairmanship of Dr. Y.K. Alagh in Yojana Bhavan, New Delhi where different sub-groups made presentations on their approach and plan of action to the Working Group. These were discussed and appropriate suggestions made. The chairman desired that the sub-group should meet at least two times before the next meeting of the Working Group and submit their reports by the last week of September, 2006.

3.3 The report submitted by the sub-groups were discussed with the chairpersons of the sub-groups by the chairman of the Working Group in its meeting held on 14.12.2006 in the Committee Room of Department of Land Resources, NBO Building, Nirman Bhawan, New Delhi and several suggestions were made for incorporation in sub-group reports. It was also decided to hold a brain-storming session on NDVI indices and Shri Pramod Tyagi (SPWD, New Delhi) was assigned the job of integrating the finalized reports of the sub-groups, in the light of suggestions made at the meeting, and bring out preliminary draft report by 25.12.2006. The final meeting of the Working Group was held on 16.01.2007 where the deliberations on the preliminary draft report took place and different members were asked to finalise different chapters and recommendations of the Working Group and submit the same to Shri Mihar Shah, Secretary, SPS to integrate all the chapters and submit the consolidated draft including recommendations to the chairperson for finalisation.

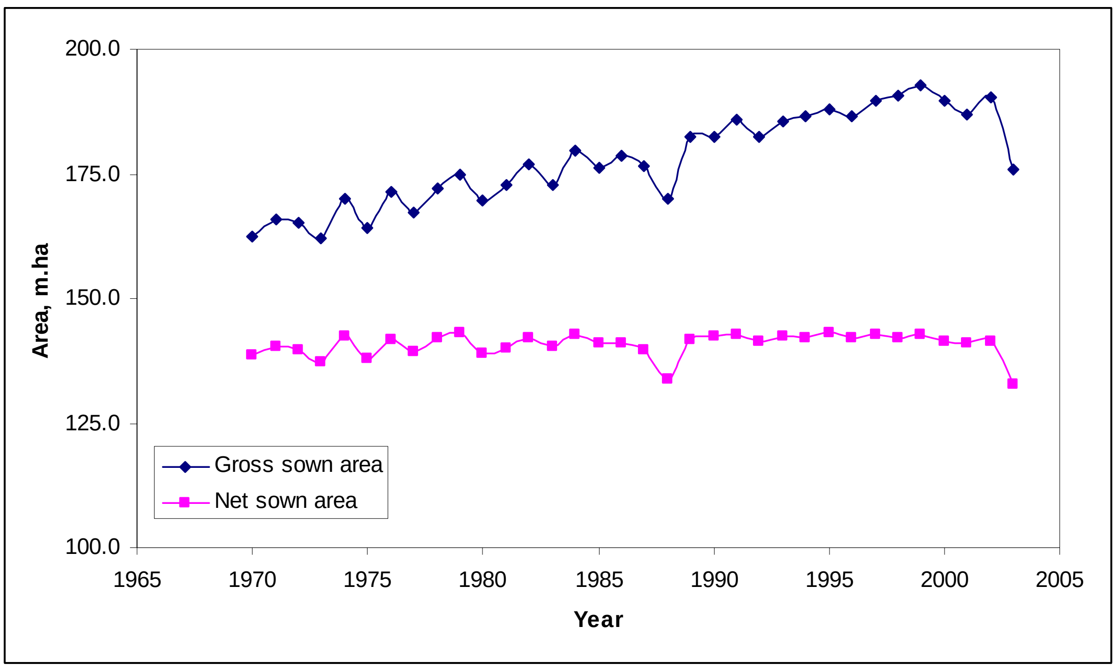
3.4 The report approved by the chairpersons was submitted to the Planning Commission on 16.4.2007

CHAPTER - II
STATISTICAL REVIEW

Land use Pattern

The geographic area of the country is 32,87,263 sq.km. and the population density is 304 people per km^2. The country has a forest cover of 6,75,538 km^2. Recent shanges in land use and irrigation are dramatic.

Net sown area is gradually decreasing, was roughly constant in the Nineties, but is now falling. About 2% reduction in set sown area is observed in recent years (Fig.1).



Source: CMIE database

Fig.1. Changes in Gross and Net Sown Area

In 2002/03, the last year for which we have a number, the Net Sown Area in India was 132.86 million hectares (Table2). Planning Commission studies had earlier predicted that net area sown would be stuck at 141 million hectares and growth needs would need to be sourced from productivity and more intensive cropping. Growth in net area sown at around 1% annual in the early period of planning fell to around 0.6% and then to 0.3% in subsequent decades and was then not growing at all. It was reasonable to assume that the geographical area of the country or the extensive land frontier for exploitation had reached its limits and the Planning Commission had correctly projected that the net area sown or arable land of the country would remain constant. But now for the first time in Indian economic history we are told that net area sown, rising slowly earlier and constant since the early nineties has gone down by eight million hectares. The last year in which NAS was less than the 2002/03 number was in 1958/59.

Table2

Net Area Sown in India 1999-2002

(also years after 1960/61 with NAS below 135 million hectares)

S.No.	Year	NAS (million hectares)
1.	1987/88	134.09
2.	1991/92	141.63
3.	1999/00	141.10
4.	2000/01	141.08
5.	2001/02	141.40
6.	2002/03	132.86

Source: *Government of India, Ministry of Agriculture, Nov.2005, Agricultural Statistics at A Glance:2005, Table 14.2, p.176.*

It would be imprudent to brush aside the decline in cropped area as a consequence of the drought of 02/03. It is true that in the South West Monsoon, 2002, 21 meteorological sub-divisions out of 36 had deficient/scanty rainfall. In the earlier drought in the late Eighties, NAS also fell and the severity of the drought in 1986/87 and 1987/88 was comparable. But in the Eighties even in the second year of drought NAS was 134 million hectares and it was 139.58 million hectares in 1986/87. More basic factors seem to be now at play. We need to disentangle the 'drought' effect from these more basic factors leading to diversion of land from agriculture and this needs analysis with statistical and GIS data and field level verification, but at a more general level soil degradation, urbanization and slow down of irrigation have been suggested as reasons. (For details of the issues discussed below, see Yoginder.K.Alagh, S.K.Dey Centenary Memorial Lecture, NIRD, Journal of Rural Development, July-September 2006, pp.304-325)

Soil degradation has been extensively studied. (Ratna Reddy has done considerable work in this area. Also see the summary of studies in G.K.Chaddha, S.Sen and H.R.Sharma, Land Resources, Delhi, Academic, 2004.)

It is now being suggested that urbanization is proceeding much faster than earlier estimates of scholars like A.Kundu, who worked with the low urbanization growth rates of the Census 1991/2001 period. For example for Gujarat, Yoginder.K.Alagh and P.H.Thakkar worked out that a number of habitations which met the Census 2001 criteria of urbanization were still classified as 'villages'. According to Population

Census-2001, Census Towns are non-statutory towns and are actually rural areas, but satisfy the *following criteria:*

(A) Minimum population of 5,000

(B) Density of population of at least 400 persons per sq. km.

(C) 75 per cent of the male working population engaged in non-agricultural activity.

It was found that in the decade 1991-2001, in Gujarat, rural non-agriculture main workers increased more than urban non-agriculture main workers. As per the 2001 Population Census, there were 122 big villages in Gujarat, each of them satisfying the three Census criteria of non statutory towns. These villages had a total population of 11.21 lakhs. If this is taken as a correction factor, then the revised estimate of degree of urbanization of Gujarat for the period 1991-2001 will be nearly 39.57 per cent (earlier estimate being 37.36 per cent and the correction factor being 2.21 per cent).

Table 3
Level and Growth of Urbanization in Gujarat

Year	**Number of Towns**	**Population (in Million)**		**Urbanization (in %)**
		Entire State	**Urban Areas**	
1	**2**	**3**	**4**	**5**
1961	181	20.63	5.32	25.77
1971	216	26.70	7.50	28.08
1981	255	34.09	10.60	31.10
1991	264	41.30	14.25	34.49
2001	242	50.67	18.93	37.36
2001 Revd	364	39.46	30.14	39.57

Source: Yoginder.K.Alagh and P.H.Thakkar, ***Short Notes on Urbanization Levels,*** *Ahmedabad, SPIESR, 2006*

The level of urbanization in Gujarat has therefore not increased by 2.87 % points, but 5.06% points (Table 3), which is close to double the earlier estimated change and makes a big difference in policy and forecasting work, since it is well known that urban projections are based on urban-rural growth differences and changes in first differences of the magnitudes considered can make big impacts on outcomes. Earlier land use studies found little effect of urbanization on land use. For example decadal release of land for urbanization was generally less than 5%. This may now change.

Water

There is an intimate relationship between cropping intensity, land use and water development. Irrigation permits the possibility of multiple cropping by bringing additional land under cultivation and the same land to be used more than once. Application of new technologies in the past was related to assured water supply. The new technology obviously raises productivity. But on account of photo insensitivity properties, newer technologies permit shorter duration crops, which also is associated with increase in cropping intensity. The use of these kinds of relationships has been common in Indian agricultural policy and plan models, since the mid-Seventies when the first agricultural sub-model of Indian planning was formulated for grain self reliance and is used in the current generation of water forecasting models also.

In the Nineties arable area had stopped growing and so the land constraint was far more severe. Growth was seen as now to be sourced from double cropping and yields.This fundamental relationship was used to project the intensive resource base of the economy. Table 3 shows that it was projected that by the end of the decade India would have used up most of its balance water reserves, with the irrigated area reaching around 114 million hectares by 2010. Projections for 2020 were a requirement of irrigation of 122 million hectares. (K. Chopra and B. Golder, Sustainable Development Framework for India: The Case of Water Resources, Delhi, Institute of Economic Growth, 2001. Table 2.6)

The projections assume a vastly improved performance on the land and water management frontiers. It needs to be remembered that the balance ground water reserves are now more limited. A very dramatic effort will be needed to harvest and carefully use the available water.

Meanwhile in actual fact in this decade irrigated area stopped growing. (Table 5)

Table 5

Irrigated Area in India 1998/99-2002/03(mn.hec.)

S.No	Year	Net Irrigated Area	Gross Irrigated Area	Irrigation Intensity
0	1	2	3	4
1.	98/99	56.51	77.64	121.13
2 .	99/00	56.76	77.99	121.23
3.	00/01	54.83	74.29	119.46
4.	01/02	55.88	77.00	121.12
5.	02/03	53.07	70.67	117.60

Source: Government of India, Ministry of Agriculture, Nov.2005, Agricultural Statistics at A Glance:2005, Table 14.2, p.176.

6.

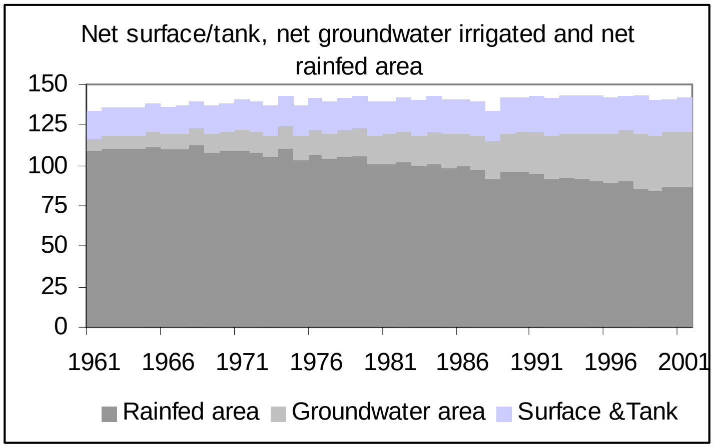
Table 4
Perspectives on Land and Water

Variable	1991/2	1996/7	2001/2	2006/7
Population (millions)				
a. Planning Commission•	856	938	1016	1099
b. UN (Unrevised)	874∂	955	1042	1130∂
Net Area Sown (mn. hec.)				
a. Planning Commission estimate	140	141	141	141

b. Revised		141	141	141
Gross area sown (mn. hec.)				
a. Planning Commission estimate	182	191	197	203
b. Revised	183	191	197	205
Gross Irrigated Area (mn. hec.)				
a. Planning Commission estimate	76	89	102	114
b. Revised	64	78	92	107
Cropping Intensity				
a. Planning Commission estimate	1.30	1.35	1.40	1.44
b. Revised	1.30	1.35	1.40	1.45
Gross Irrigated Area as % of Gross Area Sown				
a. Planning Commission estimate	41.5	46.9	51.7	56.1
b. Revised	35.0	41	46	51

- *Source:Uma Lele,Y.K.Alagh, et.al., Forestry in India: An Evaluation, Washington, World Bank, 2000, Annex H*

Forecasts that cropped area would remain constant were wrong, (Table: 4) but the planners were right in the warning they gave. The decline in canal irrigated area is equally recent and shocking, having been discovered by Tushar Shah of the International Water Management Institute in this neat little picture copied from the IWMI website.



We really do not have a detailed analysis of the debacle in irrigation. The first issue is the failure of the Advanced Irrigation Benefit Programme. This programme for completing on going irrigation projects was started in the mid-nineties .It was started because we have a long history of successes with such programmes. The first such programme was started in 1975/76, when we had formulated a plan for food self reliance. Table 6 shows that it worked and irrigated area went up by 5 million hectares and irrigation intensity from 108.77 to 110.25. We then reinvented it in 1987/88 when the late Rajiv Gandhi wanted a Plan for stepping up stagnating agricultural production. It again worked and over a brief period irrigated area went up by around 5 million hectares and irrigation intensity from 113.15 to 115.15. (See, Yoginder.K.Alagh, State of the Indian Farmer: An Overview, Delhi, Academic and Ministry of Agriculture, 2004, pp.40-42, for a description of the Seventies programme, the skepticism of Western scholars and aid agencies and the support of the then Prime Minister Indira Gandhi and pp.48-51 and 253 for the support of the then Prime Minister, Rajiv Gandhi for the Eighties programme.)

There has been very little progress since. These earlier programmes and the critical role they played have been described elsewhere' but the real issue is why did the AIBP fail? (See Table 6).We need a serious professional evaluation, but more important water management strategies are clearly called for.

7.

Table 6

Impact of Special Irrigation Programmes in the Seventies and Eighties

S.No	Year	Net Irrigated Area	Gross Irrigated Area	Irrigation Intensity
0	1	2	3	4
1	74/75	33.71	41.74	108.03
2	75/76	34.59	43.36	108.77
3.	76/77	35.15	43.55	108.40
4.	77/78	36.55	46.08	109.53
5.	78/79	38.06	48.31	110.25
6.	87/88	42.89	56.04	113.15
7.	88/89	46.15	61.13	114.98
8.	89/90	46.70	61.85	115.15

Source: *Government of India, Ministry of Agriculture, Nov.2005, Agricultural Statistics at A Glance:2005, Table 14.2, p.176.*

There are, however more basic factors at play. As compared to relief against rainfall failure, the farmer now wants yield enhancing water supplies for water stress periods of diverse crops grown with modern technology. Access to ground water gives them this facility, badly planned and inefficiently managed canals don't. farmers and their communities now want control on water deliveries. Water harvesting, ground water management and conjunctive use are important and successful models are at the crux of development.We have just started canal systems which employ for example hydraulic controls upto distributory levels and the successful examples are few and far between. In a recent critique of the Ken Betwa project put on web by the Interlinking of Rivers Project we have described how the soil scientists have shown that the area is unsuitable for paddy and irrigation would enhance yields from oilseeds, pulses and fodder crops, but the system is designed largely for flood irrigated paddy. We have also described the alternatives now possible, like the computer controlled delivery systems being constructed in the Sardar Sarovar Command.*

The implications of these trends are not being realized with the urgency they deserve, since at a basic level resource constraints of a more severe kind faced by certain East Asian economies are now being approached in India. Organizations, communities, households and individuals will have to grasp this fact and live with it. The severity of the blow will take time to sink in. But time India does not have. A few years ago I had warned that we are getting close to the kind of land and water shortage East Asian societies like China, Japan and Korea have grappled with, but have built up institutions through the centuries to cope. I had argued that we need to hasten. We would we hoped harvest water and improve irrigation deliveries.

*. *Yoginder.K.Alagh, Methodology of Irrigation Planning: The Ken-Betwa Case, in Yoginder.K.Alagh, Ganesh Pangare and Biksham Gujja, Ed., Interlinking of Rivers in India , Delhi, Academic, 2006, pp.81-102.*

During the same period, it was observed that area under forests, area for non-agricultural uses, fallow land and area not fit for cultivation had increased. On the other, wastelands (barren and unculturable lands, culturable wastelands, land under permanent pastures etc) were reduced (Table 7).

Table 7. Changes in Land Use Pattern

Land Use	Area (m.ha)		
	PE ending 1994	TE ending 2003	Change, %
Gross sown area	184.4	185.8	0.75
Net sown area	142.3	139.1	-2.20
Area sown more than once	42.2	46.7	10.69
Forest area	67.9	69.3	2.17
Not available for cultivation	41.0	42.3	3.11
Area under non-agricultural uses	21.6	23.7	9.85
Barren and unculturable land	19.4	18.5	-4.40
Other uncultivated land excl. fallow land	29.9	27.7	-7.14
Permanent pasture and grazing lands	11.3	10.8	-4.80
Miscellaneous	3.7	3.4	-8.78
Culturable waste land	14.8	13.6	-8.50
Fallow land	24.0	27.0	12.73
Current fallow	14.1	16.5	16.51
Other fallows	9.8	10.6	7.30

Source: CMIE database
PE Five years average ending with the year
TE Three years average ending with the year
Miscellaneous Land under misc. tree crops and groves not included in net area sown

Growth of Crop Production

The growth performance of different crop groups is summarized in the table below. The growth behavior is examined for the whole country and rainfed regions. Coarse grains (sorghum, bajra and maize), millets, pulses oilseeds and cotton are the major crops grown in the rainfed regions of the country. The growth performance of these crop groups is summarized here (Table 8).

Table 8. Growth performance of different crops and crop groups in India and rainfed regions, 1980-2003 (%)

	Growth rate %		
	1980-2003	1981-1990	1991-2003
Coarse grains			
Area (All India)	-1.49	-0.81	-1.62
Area (RF)	-1.95	0.18	-3.82
Production (India)	0.72	0.87	0.00
Production (RF)	0.23	2.17	-2.37
Productivity (India)	2.24	1.69	1.60
Productivity (RF)	2.23	1.91	1.47
Millets			
Area (India)	-3.97	-3.01	-3.72
Area (RF)	-1.67	-1.74	-2.17
Production (India)	-2.11	-1.13	-3.07
Production (RF)	0.85	1.33	-1.95
Productivity (India)	1.96	2.01	0.72
Productivity (RF)	2.49	3.31	0.29
Pulses			
Area (India)	-0.27	-0.14	-0.85
Area (RF)	2.68	4.78	2.74
Production (India)	3.93	5.11	3.14
Production (RF)	0.98	1.22	-0.23
Productivity (India)	1.22	1.36	0.62
Productivity (RF)	1.21	0.32	0.39
Oilseeds			
Area (India)	1.71	2.40	-1.02
Area (RF)	7.05	8.83	3.10

Production (India)	3.79	5.41	-0.56
Production (RF)	8.99	9.59	3.87
Productivity (India)	2.04	2.94	0.44
Productivity (RF)	1.84	0.70	0.75

The production of coarse grains did not show any significant trend during 1980-2003 in the country as well as in rainfed regions. The growth in production was found to be significant (2.17%) in rainfed regions during 1981-90. This growth was largely driven by increases in productivity (1.91%). During 1991-2003, the coarse grains continued to lose area at much faster rates (-1.61% in the country and –3.81% in the rainfed regions). The moderate growth in productivity levels could not neutralize the declining trend in production caused by the shrinking of area.

Similar is the situation with respect to millets. There was a reduction in the area sown to these crops throughout the period. Even the production showed significant declining trends. The production trends did not show any pattern over a long term (1980-2003). However, the significant growth observed during 1980s did not sustain in the nineties. At the national level, there was steep fall (-3.07%) in the production during 1991-2003.

During the period 1980-2003, the area sown to pulses declined marginally in the country though it increased at an annual rate of 2.7 per cent in the rainfed regions. The growth in productivity was however low at about 1.2 per cent in all India and rainfed regions. Compared to 1980s, growth in area and production slowed down considerably in the rainfed regions during the period after 1990. The growth in productivity was less than 1 per cent during this period.

The production of oilseeds increased in the rainfed regions at much faster rate compared to the all India growth during 1980-2003.

The growth was however more rapid during the 1980s largely because of the introduction of technology mission on oilseeds during this period. As a result, the oilseeds gained area at a rate of 8 per cent. This was however not accompanied by the yield gains. After 1990, the area expansion stopped, in fact there was a small loss of area to other crops in rainfed regions. The growth rate in productivity in rainfed regions never exceeded 1%.

There was reduction in area under cotton during 1980s in the country as a whole and in the rainfed regions. The productivity growth was much higher (4.04%) in the country compared to rainfed regions (1.94%). After 1990s, the production in the rainfed regions and in the country as a whole showed declining trend in spite of expansion of area under the crop.

To summarize, the slow down or negative trends in production and productivity of major rainfed crops after 1990's is a matter of concern. Declining profitability, continued weather related risks, lack of major technology break through are some of the generic causes. The specific factors however vary depending on the crop, region and other local factors that influence the farmers' decision on investments and crop choices (Table 9).

Table 9. Trends in acreage, production and productivity

Crop	Year	Area sown m.ha	Irrigated area m.ha	Rainfed Area m.ha	Total production m.t	Yield Kg/ha
Rice	1990-94	42.4	19.9	22.3	75.1	1774
	2000-05	43.2	23.4	19.9	85.2	1971
	Change, %	*2.0*	*16.8*	*-11.2*	*13.4*	*11.1*
Sorghum	1990-94	13.5	.8	12.6	11.3	844
	2000-05	9.6	.8	8.8	7.4	774
	Change, %	*-28.5*	*-1.2*	*-30.3*	*-34.5*	*-8.2*
Maize	1990-94	5.9	1.3	4.6	9.3	1561
	2000-05	6.9	1.4	5.5	12.8	1869
	Change, %	*15.7*	*10.1*	*17.2*	*38.7*	*19.7*
Redgram	1990-94	3.6	0	3.6	2.4	687
	2000-05	3.6	0	3.6	2.3	661

	Change, %	*-0.6*		*-0.6*	*-4.5*	*-3.8*
Soybean	1990-94	3.2	0	3.2	3.0	915
	2000-05	6.5	0	6.6	6.3	960
	Change, %	*102.6*		*102.6*	*108.9*	*4.9*
Groundnut	1990-94	8.4	1.6	6.9	7.8	928
	2000-05	6.4	1.2	5.3	6.3	981
	Change, %	*-23.7*	*-26.2*	*-23.2*	*-19.6*	*5.7*
Rapeseed & Mustard	1990-94	5.9	3.3	2.7	5.1	850
	2000-05	5.4	3.3	2.2	5.5	999
	Change, %	*-8.8*	*0.0*	*-19.4*	*7.9*	*17.5*
Sunflower	1990-94	1.9	0	1.9	1.1	541
	2000-05	1.6	0	1.6	0.8	518
	Change, %	*-16.1*		*-16.1*	*-20.1*	*-4.2*
Safflower	1990-94	0.7	0	0.7	0.4	501
	2000-05	0.4	0	0.4	0.2	489
	Change, %	*-46.4*		*-46.4*	*-48.2*	*-2.4*
Sesame	1990-94	2.4	0	2.4	0.7	305
	2000-05	1.7	0	1.7	0.6	346
	Change, %	*-27.0*		*-27.0*	*-17.0*	*13.4*
Cotton	1990-94	7.5	2.6	4.9	10.6	240
	2000-05	8.4	2.9	5.5	11.6	237
	Change, %	*11.5*	*11.5*	*11.5*	*9.6*	*-1.4*

Source: CMIE database

Rainfed area is reduced by about 4 m.ha and 1.6 m.ha under Sorghum and Groundnut respectively. About 4m.t of production is reduced in case of Sorghum.

Crop Diversification

In order to overcome the problems of soil fatigue due to intensive cultivation, saturation of high yielding varieties in terms of yield, vulnerabilities which arose through the spread of monoculture in which indigenous land races have been replaced, depletion of soil nutrients and water resources, creation of salinity and waterlogging, resurgence of pests and diseases, increased environmental pollution, factor productivity decline and last but not the least decline in farm profits.

Crop diversification is recommended as one option in agriculture, crop diversification essentially refers to a shift from one crop to another crop. But in real sense it is bringing out a discernible change in the existing cropping pattern towards more balanced cropping systems to meet ever increasing demand for cereal, pulses, oilseeds, fibre, fodder, fuel etc. and aims at improving soil health and agro-ecosystem.

Important cropping systems for 20 agro-regions covering the entire country is given Table. 10.

Table 10: Important Cropping systems for 20 agro-eco-zones

S. No	Eco-System and Name	Soil type	Growing period (days)	Important cropping systems*
Arid-Eco-system				
1	Western Himalayan	Shallow skeletal soil	<90	Maize-Wheat, pea/cabbage/potato/cauliflower-millet-red cloves
2	Western Plain	Saline soils	<90	Cotton-onion/napier, Pearlmillet hybrid/fodder sorghum/maize-wheat-cowpeas (f), Pearlmillet-potato-pearlmillet
3	Deccan plateau having hot arid climate	Red & black	<90	Maize-gram, hybrid Cotton-sunflower, Pearlmillet/groundnut-sorghum-gram
Semi-arid Eco-system				
4	Northern Plain and Central highlands	Alluvium derived soil	90-150	**For parts of Rajasthan** Bajra/maize-wheat, millet-wheat-mung bean, cluster bean-barlye
				For Punjab and Utter Pradesh Rice-wheat, rice-wheat-cowpea, sugarcane-wheat
				For part of Madhya Pradesh Jowar-wheat
5	Malwa highlands and Gujarat Plains	Medium to deep black soil	90-150	Groundnut-wheat-green gram, soybean-wheat-green gram soybean-wheat-fallow
6	Deccan plateau having semi-arid climate	Shallow and medium black soil	90-150	Sorghum-wheat, cotton-sorghum, green gram-rabi sorghum-wheat
7	Talengana plateau and Eastern ghats	Red & Black	90-150	Rice-rice, rice-groundnut, rice-black gram/green gram
8	Eastern ghats,	Red	90-150	Wet land: rice-rice-pulse

	Tamil Nadu uplands and Red loam soils Karnataka Plateau	loam soil		Garden lands: rice-groundnut-pulse
Sub-Humid Eco-system				
9	Northern Plains	Alluvium derived	150-180	Rice-wheat, rice-wheat-green gram/black gram/cowpeas, rice-sunflower/gobhi serson/sugarcane-wheat
10	Central highlands (Malwa, Bundelkhand and Saptura)	Black & Red	150-180	Cotton-wheat, soybean-wheat, sorghum-gram-fallow
11	Eastern Plateau	Red & Yellow	150-180	Rice-gram, rice-wheat/black gram/green gram
12	Chotanagpur plateau and Eastern ghats	Red lateritic	150-180	Rice-wheat, arhar + groundnut/black gram, rice-groundnut
13	Eastern Plain	Alluvium derived	180-210	Rice-wheat, rice-maize, rice-sugarcane + coriander/leafy vegetables, rice-potato/tobacco
14	Western himalaya with warm sub-humid climate	Brown forest & pod-zolic soils	180-210	Maize-wheat, rice-wheat, millets-potato/tomato/capsicum
Humid-per Humid Eco-system				
15	Bengal and Assam Plains	Alluvium derived	>210	Rice-rice, rice-mustard-rice In diara areas Potato/rajma-rice, sweet potato-rice, rice-buck wheat/niger
16	Eastern Himalayas	Brown & Red hill soil	>210	Rice-sugarcane, rice-potato/sweet potato/mustard/sesame, maize-rajma
17	Northern-eastern hills (Purvanchal)	Red & lateritic	>210	In Valley areas Rice-mustard/black gram/green gram/lentil, jute-pulse/oilseeds In hilly areas Maize-potato, millet-pulses
Coastal Eco-system				
18	Eastern Coastal Plains	Alluvium derived	90-120	Rice-groundnut, rice-rice-black gram, rice-vegetables (bhindi)/cowpeas/cauliflower
19	Western ghats and coastal plain	Lateritic & alluviam derived	>210	Rice (autumn)-rice (winter)-cowpeas/green gram/black gram/sesame/groundnut, rice-pulses
Island Eco-system				
20	Islands of Andaman &	Red loamy	>210	Rice-sasame/bhindi/cowpea, rice-rice-cowpea (f), rice-rice-black

	Nicobar and Lakshdweep	and sandy soils		gram/green gram, rice tomato/groundnut

- Gill and Ahlawat(2006)

- These potential/important cropping system were proposed by the Project Directorate for Cropping System Research, Modipuram on account of the information generated by the network of All India Coordinated Research Project on Cropping System at the country level.

About 30 promising diversified cropping systems identified by PDCSR for 20 agro-eco-regions of the country like rice-potato-sunflower (22.6 t wheat yield equivalent (WEY)/ha), rice-potato-wheat, rice-potato-groundnut, summer groundnut-potato-pearlmillet fodder, rice-chickpea, rice-berseem and rice-potato-onion (26.1 REY/ ha) in Punjab; rice-wheat-sorghum+cowpea (11.8 rice yield equivalent (REY)/ha) at R.S. Pura; Maize+Soyabean-wheat (21.4 t REY/ha) at Palampur; rice-vegetables pea-wheat-greeengram (16t REY/ha) at Modipuram, Meerut; rice-wheat-green gram (10.9 t REY/ha) at west coast of Navsari; rice-maize (cob) (26.4 t REY/ha) at north konkan coast; rice-tomato-lady's finger (48.8 t REY/ha) at east coast of Bhubaneshwar; rice-rice-soybean (16t REY/ha) at Cauveri Delta of TN; pearl millet-potato-groundnut/greengram at S.K.Nagar; rice-berseem (13 t WEY/ha) with maximum energy (18.6 x 10^6 Kcal/ha) and nutrient use productivity (45 kg grain/kg nutrient) and rice-tomato (11t WEY/ha) with maximum water use productivity (98.4 kg grain/ ha-m water) at Raipur; soybean-wheat/ chickpea/ lentil with the highest productivity, black gram-linseed with the highest net return and soybean-lentil with the highest net return and soybean-lentil with the highest nutrient use productivity (29.6 kg grain/kg nutrient) at Sehore; soybean-wheat (7.4 t WEY/ha) with the highest profitability and nutrient use productivity (23kg grain/kg nutrient applied) and pigeonpea-wheat with the highest water use productivity (105 kg grain/ha-cm water) at Indore. Oilseed based cropping systems with improved practice also showed 25-30% yield advantage with only 25% extra cost over the traditional practice in different regions. Thus region specific crop diversification is one of the potential options for sustainability and profitability of our agricultural production.

Minor Irrigation

During past 15 years, net rainfed area decreased by about 9.8% with corresponding increase in 12.1 % under net irrigation. Much of the increase in irrigation is through groundwater (Table 11, also see IWMMI graph above).

Table 11. Changes in rainfed and irrigated area

Area, m.ha	PE ending 1994	TE ending 2003	Change, %
Net rainfed area	93.0	83.9	-9.8
Net irrigated area	49.3	55.3	12.1

Source: CMIE database

The net area irrigated through canals and tanks has reduced over a period of time in spite of increasing in the potential created for irrigation through canals (Table 5).

Table 12. Changes in minor irrigation area

Area , m.ha	PE ending 1994	TE ending 2003	Change ,%
Net irrigated by canal	17.2	16.3	-5.1
Net irrigated by tanks	3.1	2.3	-24.1
Net irrigated by tubewells	15.1	25.1	66.0
Net irrigated area by wells	25.9	33.8	30.6

Source: CMIE database

Other salient observations include -

- Increase in rainfed area and increase in productivity in case of Maize and Soybean
- Increase in rainfed area and decrease in productivity in case of cotton
- Decrease in rainfed area with increase in case of Rice, Groundnut, Rapeseed mustard and sesame
- Decrease in area and decrease in productivity in case of Sorghum, Redgram, Sunflower, and Safflower.
- Decrease in rainfed (6.9 to 5.3 m.ha) and irrigated area(1.5 to 1.15m.ha) is observed in Groundnut
- Over 100% increase in area under Soybean cultivation during last 15 years (3.2 m.ha to 6.4 m.ha)
- About 4 m.ha and under 2 m.ha is reduced under total cultivated area of Sorghum and Groundnut.

As per the third census (2000-2001) of Minor Irrigation schemes conducted by Ministry of Water Resources, Govt. of India, about 70% (52 m ha) of potential area created through minor irrigation schemes (ground water & surface water schemes) is being utilized Table 12.

Table 12. Status of Minor Irrigation Schemes for States

S.No	Region	State	Ultimate pote-ntial (m.ha)	Poten-tial Created (m. ha)	Utili-sed potential (m. ha)	Potential created with reference to ultimate potential (%)	Utilisation with reference to ultimate potential (%)	Utilisation with reference to potential created (%)
Over exploited								
1	North	Uttar Pradesh	17.5	18.4	14.1	105	81	76

2	North	Punjab	3.0	6.3	5.8	213	194	91
3	West	Maharashtra	4.9	5.5	4.0	113	82	72
4	West	Rajasthan	2.4	6.1	3.9	255	165	*65*
5	West	Gujarat	3.1	4.9	2.8	157	89	*57*
6	South	Tamil Nadu	4.0	4.2	2.4	103	59	*57*
7	North	Haryana	1.5	2.4	2.3	161	150	94
Safe exploitation								
8	Central	Madhya Pradesh	11.4	5.9	3.5	52	31	*59*
9	South	Andhra Pradesh	6.3	5.3	3.4	84	54	*64*
10	North	Bihar	5.7	4.2	2.9	75	51	*68*
11	East	West Bengal	4.6	3.4	1.9	74	42	*57*
12	South	Karnataka	3.5	2.4	1.8	68	51	76
13	East	Orissa	5.2	1.4	0.6	27	12	*43*
		India	81.4	74.3	51.9	91	64	70

- ✓ States, where MI schemes play a significant role include Uttar Pradesh, Punjab, Maharastra, Madhya Pradesh, AP, Bihar &Gujarat.

- ✓ Dark (Alarming) states (percent of created and utilized potential is more than ultimate potential) include Rajasthan, Punjab and Haryana (14.8 m ha out of 74.3 m ha of potential created)

- ✓ Critical states (where potential created is more than ultimate potential but utilized potential is less than ultimate potential) include Gujarat, Uttarpradesh, Maharastra and Tamilnadu (33 m ha out of 74.3 m.ha).

- ✓ States, which can be categorized as safe, include Bihar, MP, AP and West Bengal.

- ✓ States with higher potential created than the ultimate potential include Gujarat, Maharastra, Punjab, Haryana, Tamilnadu, Uttar Pradesh and Rajasthan

- ✓ States with utilization is more than the ultimate potential include Punjab, Haryana and Rajasthan

- ✓ Major states in which the utilization is less than the national average include AP, Chattisgarh, Gujarat, MP, Rajasthan, Tamil Nadu, Orissa

Groundwater schemes: include dug wells, shallow tube wells and deep tube wells (Table 13).

Table 13. Status of Ground water Irrigation schemes

S.No	State	Ultimate (m.ha)	Created (m.ha)	Utilsed (m.ha)	Potential created with reference to ultimate potential (%)	Utilization with reference to ultimate potential (%)	Utilization with reference to potential created (%)
Over exploited							
1	Rajasthan	1.8	5.8	3.8	322.2	211.1	66
2	Punjab	2.9	6.3	5.7	217.2	196.6	90
3	Haryana	1.5	2.4	2.3	160.0	153.3	96
4	Gujarat	2.8	4.4	2.7	157.1	96.4	61
5	Maharashtra	3.7	4.6	3.3	124.3	89.2	72
6	Uttar Pradesh	16.3	18.3	14	112.3	85.9	77
7	Tamilnadu	2.8	3	1.7	107.1	60.7	57
Safe exploitation							
8	Bihar	4.1	3.6	2.5	87.8	61.0	69
9	Andhra Pradesh	4	3.3	2.3	82.5	57.5	70
10	West Bengal	3.3	2.4	1.4	72.7	42.4	58
11	Madhya Pradesh	9.3	4.7	2.8	50.5	30.1	60
	India	64	62.5	45	98	70	72

- ✓ Utilised area through GW schemes is about 44.5m.ha out of total utilized area of 52m. ha (combined utilization of GW and surface flow schemes). About 72.1% of potential created through GW is utilized

- ✓ Area covered by GW schemes across states is UP, Punjab, Rajasthan, Maharastra, MP, Bihar, Gujarat, AP, Haryana, Tamil Nadu.

- ✓ Dark (Alarming) states (percent of created and utilized potential is more than ultimate potential) include Rajasthan, Punjab and Haryana (14.5 m.ha out of 58.8 m.ha potential created)

- ✓ Critical states (where potential created is more than ultimate potential but utilized potential is less than ultimate potential) include Gujarat, Uttarpradesh, Maharastra and Tamilnadu (30.3 m.ha out of 58.8 ha).

- ✓ States which can be categorized as safe include Bihar, MP,AP and West Bengal.

- ✓ States, where utilization of GW is less than national average include AP, Chattisgarh, Gujarat, Madhya Pradesh, Orissa, Rajasthan & Tamil Nadu.

- ✓ In case of Punjab and Haryana, utilization is much higher than ultimate potential. However, the coefficient of variability for area irrigated through wells based on the data for the past 15 years is about 10.5 & 6.7% for Punjab & Haryana respectively. Further based on the groundwater level data in different villages (based on 3rd census of MI schemes by MOWR), about 78.4%(5551)& 93.6% (12459) villages in Haryana & Punjab respectively are having depth to water level at a level less than 30 m which indicates that canal flows are ensuring the recharge of ground water in a big way. But the situation in Haryana is slightly alarming as 10% of villages have >60m (Depth to water level).

- ✓ In case of Rajasthan, the higher utilization than the ultimate/created potential is associated with higher coefficient of variability indicating the pressure on groundwater resources & lack of opportunities for groundwater recharge through either rainfall / canal water.

- ✓ In case of other states where GW is major source for irrigation, the coefficient of variability along with percent of villages with different depth to groundwater levels is given below.

Percent of villages with water table < 30m	Coefficient of variability			
	<15	15-30	30-45	>45
<50				
50-75	AP	Rajasthan		
76-100	Maharastra, Bihar,	Gujarat, MP	UP,Tamilnadu	

Percent of villages with water table > 60m	Coefficient of variability			
	<15	15-30	30-45	>45

<10	Maharastra, Bihar,	MP	UP
10-20	AP	Rajasthan	Tamilnadu
>20		Gujarat,	,

- ❖ Priority may be given to states where coefficient of variability is high and percent of villages with deeper water table is high. The states, which are covered under this category, include Rajasthan, Gujarat, AP and Tamil Nadu.

- ❖ Priority in terms of better utilization of potential created through improved water management systems by reducing the losses through conveyance especially for surface lift schemes, adoption of improved irrigation systems, changing cropping pattern from high water consuming to ID crops / alternate land uses / dryland horticulture.

Reasons for under utilization of minor irrigation schemes

- Inadequate power
  - About 11% of under utilized MI schemes are due to inadequate power.
  - Out of this, UP, Punjab, Karnataka and Maharastra contribute about 22.5%, 18.8%, 14.4% and 8.5% respectively.
  - Majority of schemes which could not be energized include shallow tube wells (67%) and dugwells (23.7%) with UP, Punjab, Karnataka, Bihar and AP. dominating under shallow tube wells and Maharastra & Rajasthan dominating under dug wells. Hence, ensuring sufficient power supply would be able to bridge the gap between potential created and utilized.
- Mechanical breakdown of equipment
- Less water discharge

- About 43% of under utilized schemes are due to less available discharge.
- Maharastra, Tamil Nadu, MP and AP states got large share of under utilized schemes due to less available discharge. This indicates that sufficient recharge is not taking place even in states like MP and AP despite the fact that the potential created is less than ultimate potential.
- About 80% of under utilized schemes due to less available discharge are in the case of dugwells indicating the increase in depth to water table across these states.
- Under uitlised schemes in the category of shallow tube wells dominate in UP.

5. Impact of Irrigation

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In view of the high variability for the response to irrigation, an exercise is undertaken to delineate the effect of irrigation along with its association, production factors, from the secondary statistics. The effect of irrigation and no irrigation was studied for various crops in the 16 states covering arid, semi arid and dry sub humid climatic regions with a rainfall of less than 1500mm. The districts with same agro climatic conditions having both irrigation (more than 30% irrigation area for a crop in the district) and rainfed (less than 30% irrigated area under the crop) were identified for each crop. Quinquennial average production, area and irrigation (for the period ending 2000-01) and the agro eco sub region (AESR) (NBSSLUP 1996) were utilized for the data base preparation. No data on irrigation was available for the pulses. Other AESRs, which are having either exclusively irrigated or rainfed districts, were eliminated to avoid skew effect. Frequency classes are made for the selected districts with 5% class intervals for irrigation cutting across Agro Eco

Sub regions. The overall productivity of the class was calculated. A linear equation was derived for productivity as a function of irrigation intensity for each of the crops. Productivity estimates were made for 0% (Rainfed) and 100% irrigation. The standard error of mean for the intercept was given. This slope provided increase in productivity with increase in irrigation. The achievable yields are presented by the crop improvement projects (wide DARE Reports 1996-2004) are also included. Gross returns based on MSP (minimum support price of 2004-05) were also estimated for rainfed and irrigation conditions and are also given (Table.12).

Table 12. Effect of Irrigation on yields of selected crops from district database

Crop	Estimated Yield (kg/ha)		Percent Response	Minimum support price (Rs/ uintal)	Gross Returns (Rs)*		Estimated increase in yield, kg, per one percent increase in irrigation	Reported achievable potential yield t/ha
	With no irrigation	With irrigation			With no irrigation	With irrigation		
Rice, *Kharif*	1236	1630	32	560	6922	9128	3.94	4
Rice, *Rabi*	445	2907	552	570	2537	16570	24.61	-
Wheat	954	1554	63	640	6106	9946	6	6.5
Barley	1368	1658	21	540	7387	8953	2.89	3.7
Maize	1351	1690	25	525	7093	8873	3.39	10
Sorghum _*Kharif*	405	706	74	515	2086	3636	3.01	4.3
Sorghum _*rabi*	919	1299	41	525	4825	6820	3.8	3.4
Pearl millet	925	1164	26	515	4764	5995	2.38	3.2
Finger millet	1611	1868	16	515	8297	9620	2.57	4
Sesame	177	263	49	1500	2655	3945	0.13	1.1
Castor	346	532	54	1500	5190	7980	1.85	2.8

Linseed	400	429	7	1500	6000	6435	0.29	1.1
Rapeseed /Mustard	653	796	22	1700	11101	13532	1.43	1.7
Sunflower	704	1032	47	1340	9434	13829		2.5
Soya beans	603	605	0	900	5427	5445	0.01	4
Groundnut	955	1085	14	1500	14325	16275	1.3	2.2 (pods)
Cotton	254	306	21	1760	4470	5386	0.52	0.8
* Based on MSP for 2004-05. MSP of Sesame is considered for Linseed and Castor								

Salient observations based on above analysis are given below.

- Productivity increase due to irrigation varies between 7-74% except for Soya beans (0%) and Rice (*Rabi*) (550%).
- Achievable yields are much higher than productivity level from irrigation and full protection including complete fertilization.
- Productivity enhancement due to irrigation is less than 30% among oilseed crops except for castor (52%) and sunflower (47%).
- Among cereals, millets (pearl millet and Finger millet), maize and barley recorded less than 30% increase in productivity due to irrigation.

Difference between irrigated and rainfed areas are more pronounced when the crop is grown in divergent agro ecological regions. The difference is quite low when crop is restricted to few agro ecological regions (eg. Soybean) or when crop is predominantly rainfed (eg.Cotton). The difference between productivity from irrigated and rainfed areas is highest for *rabi* rice followed by wheat. The difference is lowest for Soybean followed by Sesame. It is to be noted that much of soybean cropped area lies in Central India with high seasonal rainfall. Possible reasons for low productivity where rainfall is of the order of 1000mm could be attributed to it's improper distribution with in the crop season and management practices. In order to address the issue of low productivity from high rainfall rainfed areas, it is necessary to understand the probable drought scenarios from the past climatic records. The improper distribution of rainfall with in season also leads to water logging and drought conditions with in the same season requiring greater attention on water management in terms of drainage/ water harvesting.

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Though the influence of irrigation on crop yields suggest very low for few crops, experimental results from on-station and evaluation reports of watershed projects (Annual Report of AICRP on Water Management, 2005, PK Joshi et al, YVR Reddy et al, Kulkarni et al 1999) suggest that the irrigation effect on crop yields is considerably higher. The contradictory results could be mainly due to non-availability of irrigation at critical stages (irrigation systems mainly concerned with supply management rather than demand management) and low efficiency of irrigation system and because of issues of scaling up. Therefore an assessment was made to identify opportunities for water harvesting and supplemental irrigation to overcome mid/terminal droughts so as to stabilize the production.

Returns from Canal/Ground water

- Districts were identified for greater than 30% irrigation (NIA/NCA*100)
- All districts except IGP were considered.
- Districts where canal + ground water irrigation is more than 85% of NIA were identified. Thus selected districts are 60 in number.
- For these districts, cropwise source of irrigation is not available.

- Total returns on weighted basis from different crops for which MSP is available were calculated and summed up. From these returns per ha were calculated. In the absence of clear-cut information on source of irrigation the contribution of canal + ground water was treated as 100% and an attempt was made to separate the effect of other by using simultaneous equation.

Returns form canal irrigation

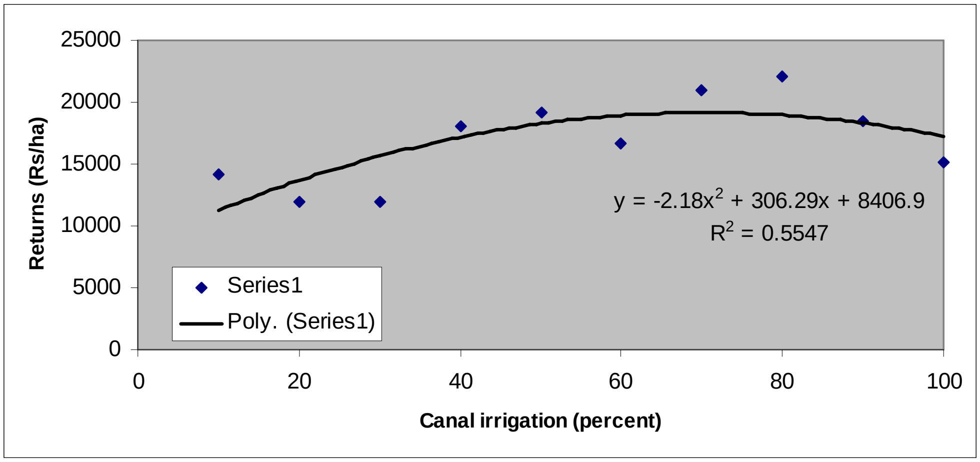

Fig. 2. Returns from canal irrigation

It is expected most of the ground water irrigation is used for cash crops like vegetables, flowers and fruits. In the absence of data on these items, the returns could not be accounted. The direct measurements of returns from source of irrigation on crop basis could not be attempted due to absence of data.

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Desertification

Desertification is not confined to the desert areas or to the arid region, but relates to land degradation in about two-thirds of our country's geographical area falling within the arid, semiarid and dry sub-humid regions. Land degradation has a direct impact on land and other natural resources which results in reduced in reduced agricultural productivity, loss of bio-diversity and vegetative cover, decline in groundwater and availability of water in the affected regions. All these lead to a decline in the quality of life, eventually affecting the socio-economic status of the region. A major part of our country is degraded in some form or other. In some regions, problems of land degradation have reached serious proportions threatening the very existence of the people.

About 12 per cent of India suffers from the threat of desertification in the arid northwest and in a broad semi-arid zone from the Punjab in the northwest to Tamil Nadu in the south. There is an estimated 1.7 million km^2 of arid land in India and Pakistan.

India's Rajasthan region is just one of a number of examples of the impact of population growth in the desertification process. Data from FAO show that while only 20 percent of the arid land in Rajasthan could be cultivated in the 1970s, 30 percent was being cultivated in 1951 and 60 percent was being cultivated in 1971, mainly at the expense of grazing lands and traditional long fallow periods (Grainger). By 1972, sand dunes had increased in height by as much as 5 meters and the water productivity of wells was declining.

Increased population and demand for animal products lead to overgrazing. Herd sizes increase and put pressure on grazing lands, which, at the same time, are decreasing because of over cultivation. For example, in northern Iraq, rangelands carry 11 million sheep, which, according to Grainger, is four times the land's sustainable capacity.

The area under water erosion, wind erosion, chemical degradation (acidic and salt affected) and physical degradation (Waterlogged) are 57.16, 10.46, 13.80 and 11.60 m.ha, respectively (MoA, GoI (1994) and NBSS&LUP (1994).

Soil erosion by water and wind account for 87% of the area affected by soil degradation. It has been estimated that between 1977 and 1997 the area critically affected by erosion has almost doubled.

Vast areas in the otherwise productive Indo-Gangetic plain cutting across the states of Haryana, Punjab, Uttar Pradesh and some coastal regions of Gujarat have lost their productivity due to soil salinity–alkalinity. Water logging is estimated to affect about 8.52 mha of the land surface. The problem is severe in the Indira Gandhi Canal Command Area in Rajasthan, where excess irrigation in the soils having gypsum-rich barriers at shallow depth and wrong drainage planning are the major causes for degradation in these canal command areas, leading to saline-sodic water and salt-rich hard pans. Some areas of Uttar Pradesh, Haryana and Punjab under agriculture also have this problem. According to a World Bank study, India loses 1.2-2.0 million tonnes of foodgrain production every year due to water logging (ICAR, 1999).

Sandy land forms in the western part of the desert (Agro-ecological Sub-Region (ASER): 2.1, 2.3) are more unstable and vulnerable than those in the east. This is especially due to the decreasing rainfall and increasing gradient in the wind velocity from east to west direction. The threshold velocity for initiating wind erosion has been estimated to be around 10 km/hr (Prasad & Biswas, 1999).

On an average, the area with good grass species in the < 300 mm average annual rainfall has declined by about 7% while in the >300 mm average annual rainfall zone the decline has been far greater from 8 % to 12%. This has a significant effect on the potential fodder production from these lands (Singh, et.al. 2000).

The reduction in the extent of availability of land for grazing has led to more and more forests being used as grazing grounds. The Livestock grazing on forestland are 35, 60 and 90 millions respectively in 1957-58, 1973-74 and 1995 (estimate) Source: NFAP, 1999

The availability of renewable freshwater resources per capita in India has fallen from 6000 cubic metres in 1947 to about 2300 cubic metres in 1997 (TERI report).

According to a World Bank study, India loses 1.2-6.0 million tonnes of food grain production every year due to water logging (Prasad & Biswas, 1999).

The States that currently overexploit groundwater the most are also the country's agriculturally important States, each with a net irrigated area of over 0.3 million hectares, groundwater is the predominant source of irrigation in eight States (TERI-GREEN, India 2047). During the past decade, ground water table has dropped at a rate of 0.5-0.8 m per year in Haryana and 0.2-1.0 m per year in Punjab. Major metros such as New Delhi, Chennai have over exploited their ground water and the levels have dropped drastically. The overexploitation of groundwater in some areas has made its extraction increasingly expensive and not viable. The effect of such high costs is likely to be particularly severe on small and marginal farmers. A falling water table requires greater expenditure on extraction, which the small and marginal farmers can ill afford. In Kutchh region of Gujarat, over extraction of ground water has led to saline water intrusion into coastal aquifers resulting in deterioration of water quality. Reclamation of saline ground water is one of the most difficult problems of reclamation of degraded lands.

India's Livestock Economy

At 485 million India has the World's largest livestock population – accounting for over 55 and 16% of the World's buffalo and cattle populations respectively (the World's largest bovine population). It ranks second in goats, third in sheep and camels, and seventh in poultry populations in the World. During the year 2004-05 we were globally the largest producer of milk with an annual production of 91 million tones. The same year, the country recorded a production of 45.2 billion eggs (seventh in the World), 44.5 million kgs of wool and 2.2 million tones of meat, which ranked us eight in the world in meat exports.

Taken together, the value of livestock output (2003-04) accounts for over six per cent of GDP, just a little under a third of the contribution of agriculture and allied sectors. By all accounts it appears that India has an extremely fast growing livestock economy, and there is much to be proud about.It is one of the great success stories in rural development and accounts for substantial productive employment, particularly of women. The Dudhwala, Verghese Kurien is the great Indian icon of the twetiwth century

It is estimated that almost 18 million people derive their livelihood from livestock (Government of India, Report of the Working Group on Animal Husbandry and Dairying, Tenth Five Year Plan (2002-2007), Planning Commission, New Delhi, 2002)

Women continue to play a key role in livestock production at the household level, with over 71% of the labour force being women.

However, it is a matter of growing concern that despite 70% of India's livestock being owned by landless, marginal and small farmers, recent studies across India indicate that over half of all these households are 'non-livestock owners' While total population and density of livestock has increased over time, the number per rural household has declined. There was a drastic decline of bullocks post the eighties, with the share of farm animals in power supply declining from 71% in 1961 to less than 23% in 1992. The 59th round of the NSSO reports that working cattle in rural areas declined by 25% between 1991-92 and 2002-03. There has been a corresponding shift in composition of the bovine population from cattle to buffalos.

A mere 56% of the households reported ownership of at least one livestock in 1998-99. Decline in livestock holding being sharpest amongst landless households. Only 15-20% of households own sheep and goat.

There has been an increasing dependence on irrigation for the livestock economy, leading to unsustainable use of ground water.

The X Plan argues that since close to 70% of milk is traded through traditional milk markets and in the unorganized sector, it can be tapped by private capital and investment through creating a favourable environment. The government withdrew the Milk and Milk Products Order (MMPO), which placed restrictions on the quantum of milk traded by a private dairy enterprise, to create 'level playing field for the private sector to complete with the government supported cooperatives', as recommended by the World Bank in 1996.

The first five decades of development investment clearly by passed the concerns of the vast majority of livestock rearers who live in the dryland regions of India in singularly advocating a dairy development program centered around extremely water-intensive

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technologies, which in the long run are completely unviable for water-scarce and resource poor farmers. The current ‘livestock revolution’ vision 2020, tends the divorce of livestock and agriculture. The recommendations may not be empowering the small-holder (1996 World bank Livestock Sector Review of India). The production and per capita availability of milk and eggs increased significantly throughout. However, the rates of growth were slower during 1990s compared to the 1980s (Table 13).

Table 14. Compound growth rates (%) in production of milk and eggs in India

Description	**1980-2004**	**1981-90**	**1991-00**
Milk	4.39	5.03	4.29
Per capita availability of milk	2.41	2.86	2.46
Eggs	5.88	7.97	4.90
Per capita availability of eggs	3.98	5.73	3.07

In 2003-04, the production of milk in the country was 88.1 million tones, of egg 34 billion nos. of wool 53 million kgs (Table 14).

Table 15. Changes in livestock population

Livestock population (000)			**% Increase / decrease**
	1997	**2003**	
Crossed cattle	20099	24686	22.82
Indigenous cattle	178782	160495	-10.23
Total cattle	198881	185181	-6.89

Buffaloes	89918	97922	8.90
Yaks	59	65	10.17
Mithuns	177	278	57.06
Total Bovines	289035	283446	-1.93
Sheep	57494	61469	6.91
Goats	122721	124358	1.33
Pigs	13291	13519	1.72
Horses & Ponies	827	751	-9.19
Mules	221	176	-20.36
Donkeys	882	650	-26.30
Camels	912	632	-30.70
Fowls	315428	457399	45.01
Ducks, etc.	32183	31613	-1.77
Total poultry	347611	489012	40.68
Total livestock	485385	485002	-0.08

NK. Chawla, MPG. Kurup and Vijay Paul Sharma State of the Indian Livestock Farmers and the Indian Livestock Sector: A Status Paper. Indian Institute of Management, Ahmedabad, 2002.

As per the 17th livestock census, crossbred cattle constitute 13.3% of the total cattle and 86.7% are indigenous cattle. Out of total livestock in the country, around 38.2% are cattle, 20.2% are buffaloes, 12.7% are sheep, 25.6% are goats and only 2.8% are pigs. All other animals are less than 0.50% of the total livestock.

There is a tremendous increase in the crossbred cattle in the country ie. 22.8% but the indigenous cattle declined by 10.2% during the inter-censal period from 1997 to 2003. The total cattle population has decreased by 6.9% during the period. The buffalo population has increased by 8.9%; sheep, goat and pig population has increased by 6.9%, 1.33% and 1.72% respectively. There is an increase of 10.2% and 57.1% in yaks and mithuns population in the country. There is small decrease in total bovines in the country by 1.9% between 1997 and 2003. Horses and ponies, mules, donkeys and camels have decreased between the two-census period by 9.2%, 20.4%, 26.3% and 30.7% respectively. The total livestock in the country has decreased from 485.385 million to 485.002 million between 1997 and 2003 showing a negligible decrease of 0.08%.

There is a decline in male cattle and buffaloes population used for work purposes in the country. During 1997 to 2003, there is a decline of 4.3% and 14.2% in the working cattle and buffaloes respectively.

The crossbred milch cattle have increased heavily during the period 1997 to 2003 (34.4%), as well as there is an increase of 10.5% in milch buffaloes. The indigenous milch cattle have decreased by 6.1% during the said period.

Many of the cooperative dairies are in serious financial crisis and also in areas where livestock development has been successful, suggesting a mid life crisis in organizational effectiveness.

Out of total poultry around 93.5% are fowls and the rest 6.5% are duck, drakes, ducklings, turkeys and other poultry birds in the country.

There is a sharp increase in the fowl population in the country during the period from 1997 to 2003. The fowl population has increased by more than 45.0% and the total poultry by 40.1% in the country. The population of duck drakes, etc., has decreased marginally by 1.8% during the same period.

Table 16. Changes in Livestock Population by Species Annual Growth Rate (%)

Species	1951-56	1956-61	1961-66	1966-72	1972-77	1977-82	1982-87	1987-92	1993-97	1997-03
Cattle	0.43	2.44	0.07	0.24	0.19	1.35	0.74	0.49	-0.56	-1.18
Adult Female cattle	-2.76	1.52	0.31	0.61	045	1.63	0.95	0.73	0.02	0.02
Buffalo	0.68	2.66	0.69	1.61	1.55	2.39	1.71	2.08	1.32	1.43
Adult Female Buffalo	0.66	2.29	0.89	2.40	1.82	0.76	3.78	2.29	1.32	1.44
Total Bovines	0.49	2.18	0.21	0.56	0.53	1.62	1.00	0.93	0.00	-0.33
Sheep	0.10	0.45	1.07	-1.16	0.50	3.53	-1.29	2.13	2.51	1.12
Goat	3.26	1.91	1.19	0.88	2.29	4.73	2.96	0.90	1.26	0.22
Horses and Ponies	0.00	-2.82	-3.29	-3.93	0.00	0.00	-2.33	0.50	0.24	-1.68
Camels	5.92	2.38	2.13	1.92	0.00	-0.37	-1.53	0.59	-2.45	-5.94
Pigs	2.18	1.20	-0.78	6.65	1.95	5.79	1.09	3.77	0.77	0.29
Mules	-7.79	4.56	9.86	0.00	2.38	7.63	5.51	2.25	2.98	-4.21
Donkeys	-3.29	0.00	0.00	-1.89	0.00	0.40	-1.21	0.21	-1.93	-4.92
Yak	NC	NC	8.45	5.92	26.58	0.00	21.00	8.45	0.00	0.00
Total Livestock	0.92	1.87	0.47	0.55	0.90	2.58	1.19	1.13	0.61	-0.01
Poultry	5.22	3.79	0.21	3.72	2.82	5.47	5.79	2.21	2.51	5.85
Dogs	NC	NC	NC	NC	NC	NC	-0.64	3.93	3.20	2.19

NC: Not collected; Source: Basic Animal Husbandry Statistics, 2004, GOI

Livestock interventions needs to be undertaken in watersheds

For regions with rainfall less than 500mm: Priority should be given for ensuring fodder and drinking water availability for livestock. Fodder banks can be created at Mandal/Panchyat level to meet fodder requirement of the livestock. Provision of community water trough at village level can be made for drinking of livestock under watershed development programmes. Silvopastoral model needs to be promoted on CPRs and waste lands. Provision for livestock health control measures can also be made under watersheds

Rainfall (500-700mm): Crop-livestock integrated farming system can be promoted. Emphasis should be given for better utilization of agricultural crop waste (caster/red gram stalks, sunflower heads, etc.). Hortipastoral model can be promoted for small ruminant production on a larger scale. Perennial grasses and fodder trees needs to promoted on CPRs. At least 10% of cultivated area needs to be devoted for fodder production with limited irrigation facility under watersheds. Provision for livestock health control measures can also be made under watersheds.

Rainfall (700-1100mm): Dairy based farming systems can be promoted. Fodder cultivation needs to be undertaken with assured irrigation to boost the productivity. Integrated farming system with fisheries, ducks, pigs can also be encouraged. Provision for livestock vaccination and augmentation of reproductive problems can be made under watersheds

Based on experiences from different watershed studies, the following technological interventions can be undertaken:

Emerging Issues:

- Improving the non-descript breeds with superior germplasm
- Enhancing the fodder availability by promoting superior grasses and fodder crops
- Developing silvopastoral and hortipastoral model for small ruminants
- Developing crop-livestock integrated farming systems for different agro-ecosystems

- Need for more effective interventions at the organizational levels, particularly reform of the Cooperative systems
- Creating awareness among stakeholders through training, exposure visits and demonstrations
- Increasing demand for water across rainfed areas
- Uncertainty in the available water resources for irrigation (ground water and tanks) due to climate variability
- Large scale dependence on groundwater across rainfall regions
- Upstream and downstream conflicts due to excessive watershed activity in low to medium rainfall activities
- Emphasis on livelihoods generation through watershed
- Limited potential for increasing canal irrigation

CHAPTER - III

LEARNINGS FROM INDIA'S WATERSHED PROGRAMME

Overview of the Programme

Even though watershed programmes in India are relatively new, work on soil and water conservation by the Ministry of Agriculture (MoA) had begun in the early sixties (Planning Commission, 2004). After independence, India relied on multi-purpose reservoirs for providing irrigation and generating hydro-electricity. To stabilize the catchments of reservoirs and to control siltation, a Centrally Sponsored Scheme of " Soil Conservation Work in the Catchments of River Valley Projects (RVP)" was launched in 1962-63. The MoA started a scheme of Integrated Watershed Management in the Catchments of Flood Prone Rivers (FPR) in 1980-81. During the 1980s, several successful experiences of fully treated watersheds, such as Sukhomajri in Haryana and Ralegaon Siddhi in Western Maharashtra, came to be reported. The MoA launched a scheme for propagation of water harvesting/conservation technology in rainfed areas in 19 identified locations in 1982-83. In October 1984, MoRD adopted this approach in 22 other locations in rainfed areas. In these 41 model watersheds ICAR was also involved to provide research and technology support. The purpose of these Operation Research Projects (ORPs) was to develop "model watersheds" in different agro-climatic zones of the country.

These schemes were reviewed in the Planning Commission and integrated into the Agro-Climatic Plan presented to Parliament in 1988.

The lessons learnt then were reported by the Planning Commission and are worth repeating, because the programme construct has not changed much and neither has the problems seen then. It is important now to move to a more reinvigorated programme.

It was said then that in "difficult" areas, the process of historical evolution had lead to a certain balance between social activity and resource endowments in different agro-climatic regimes. This was the phenomenon of traditional economic and cultural styles related to soils, climate and resource endowments. These are again being incorporated in watershed and other water and soil development projects. This traditional equilibrium was in many cases cruel , for specific groups such as women, for example. However, society had in a certain sense coped with the crisis of resource endowments. This fragile equilibrium was being disturbed, before the current emphasis on globalisation. Dimunishing mortality and subsequent population pressure and more generally, commercialisation and marketization were leading to breakdown of traditional community arrangements. Increasing desertification, soil erosion, flood proneness, forest clearing could be traced back to water harvesting or drainage breakdown and the impact of commercialisation, including on decline in labour contributions in kind.

These vicious circles coexisted with many positive experiences. There were examples of households and communities which have coped with the similar fragile land and water endowments and have met energy, food and at the basic level employment and income deficits in a sustainable manner. While in the early eighties these were being thought of as "experimental" in nature, they were by the end of the decade of a magnitude where they can be called as "alternative" organizational methods, rather than demonstration projects. In the late eighties, eight case studies were studied by independent research institutions in India, in which through community efforts combined with private ownership of land, food and energy gaps were met in a sustainable manner. These studies described the land and water development project implemented in a defined homogenous micro geographical area like a hill slope, a micro watershed, a tributory branch, an aquifer, or an irrigation distributory (Alagh,1991). They estimated the land and water development costs, The labour component, 'outside finance', the output in terms of food requirements met, energy requirements met and fodder supplies. There were estimates of 'economic rates of return on the investment', i.e. at accounting border prices, with a shadow wage rate 25% higher than the market rate. Financial rates of return at market prices were also estimated. These studies showed high economic rates of return, 18% plus , making them very productive investments. The programme with a component of a subsidy of Rs.4000/hectare and loan component of around Rs. 6000 was developed and in essential form continued.

These initial studies were flatteringly reproduced and replicated with many other examples (compare Alagh,1991 with K. Chopra and G. Kadekodi, 1993). There was no theory of such development, but there were preliminary pointers which were reviewed. The projects examined have varied considerably. Watershed development, for settled agriculture alternately tree crops, reclamation of saline lands, farmers run lower level irrigation systems, aquifer management in difficult situations, like coastal aquifers, tribal lift irrigation cooperatives, tank irrigation have all been reported and studied.

The success stories are community and leadership based, with leadership coming from diverse sources.- an NGO, a local army retired person, a 'concerned' civil servant, a scientist working in the field . The leaders either had a science background or new enough to adapt from a nearby science institution. The organisation structure was neither purely private ownership, nor fully community or social control. The leadership invariably argued for aggressively functioning markets and land ownership was private and agricultural operations at the household level. However there was for land or water management, limited and well defined cooperation. This could be drainage, soil shaping, contour management, improvement and management of lower level canals, controlled grazing and so on. They estimated the land and water development costs, The labour component, 'outside finance', the output in terms of food requirements met, energy requirements met and fodder supplies. There were estimates of 'economic rates of return on the investment', i.e. at accounting border prices, with a shadow wage rate 25% higher than the market rate. Financial rates of return at market prices were also estimated. These studies showed high economic rates of return, 18% plus , making them very productive investments.

Work is required on the regularities, if any and systemic features of such organizations. Established systems understand well-defined and linear models of organization. Their hierarchies and structures are understood. It is hybrid systems that are difficult to replicate. Rules of replication of systems, which combine limited forms of cooperation with private and market dominated systems are difficult to configure. A recent example of designing legislation for cooperatives to incorporate as public limited companies illustrates the difficulties (Alagh , 2000).

An interesting feature of these success stories has been that even though the economic rates of return were high, they incurred financial losses. These have at least been estimated in the initial stages of operation. The reasons for this are not fully understood. Some pointers are to the effect that invariably output prices are lower than border prices and input prices are higher. Markets are poorly developed in fragile regions and soil; amendments, pumpsets, seed prices and interest rates will be higher than in developed regions Another reason could be that input rates may in poor soils be high initially and may go down as the organic composition of the soil improves. In saline lands for example, initial irrigation requirements for leeching may be high, seed rates and soil amendments may cost substantially and low value crops may need to be grown in rotation to improve the organic composition of the soil. Financial support to such efforts also needs effort at institutional reform. Collateral becomes difficult to organize in partial cooperative forms of organizations and bankers generally find community collateral unacceptable. Many of these projects require lending through a weather cycle, for example a watershed development cycle. The fact that that some of the resource requirements of such projects emerge from labour contributions of the community makes it difficult to work out margin requirements. There is an interesting discussion of reform issues from a banker's perspective to refinance the loan component of such projects in an annual report of a national bank for agricultural and rural development (NABARD, 1991). From the available studies some of the systemic conclusions which follow in terms of rules for organisational and incentive/disincentive system reform need to be culled out in terms of systematic research. We attempt a first beginning below.

Local and Global Rules

The problem of imposing a hard budget constraint at the local level and helping those who help themselves, is a difficult one to address. Another way of setting the problem, is to harness the great vitality of decentralised markets in replicating widespread rural growth, with in the core areas of local and global concern? Some of the lessons, which follow, were as follows;

1. Financial institutions have to design structures such that community collateral is possible for viable projects. Self help financing groups are only one such group. Land and water development groups, local infrastructure projects, in road or communication sectors, (Alagh, 2000), productionising products developed in R&D institutions, training for production with improved techniques, market development schemes developed by local and community groups would be other examples (ADB, 2000) ;
2. Lending through a weather or project cycle would be necessary. NABARD started a scheme of this kind in 1991 as a part of an agro-economic regionalisation strategy started by the author, gave it up in 1993 and is again starting it now (See Reserve Bank of India, 2000 for details) ;
3. Developing policy “champions” for sorting out administrative, financial and procedural issues at local, regional and national levels, when problems arise with these kinds of development strategies. It is reasonably certain that problems are going to arise in development experiments, which are off the beaten track. The question then is, is there somebody in the policy decision-making structure who will sort out the problem. ADB reports in a detailed study of farmer managed irrigation systems, that the failure cases

were those where such support did not exist. Failure here is defined as performance levels in water delivery lower than by government agencies (ADB, 2000).

4. The kind of problems discussed in the last para, partly arise because the existing legal and administrative systems and financial rules are structured for formal organisations in the public or private corporate sector. So are global financial institutions. These newer kinds of institutions with strategic mixtures of organisational styles, coops and corporates, NGO's and government, NGO's and coops do not have a level playing field for them. For example a loss making subsidised electricity system can underprice a renewables group and drive it out of the market. The long-term problem is reform in the sense that subsidies and protection given to established groups have to be withdrawn. In the short run the protection given to each group must be the same.
5. The structure or incentive and disincentive systems for this kind of growth, should begin with a taxonomy of complimentarities of policy rules at different levels of policy making like no level can spend more resources than they have access to. But resources, which are short or binding constraints at national or global levels, are elastic at local levels. However their mobilisation requires policy changes at higher levels. For example, it is easy to buy a tax free bond of the New York civic bodies, but very little attention has been paid to markets for local bodies bond paper in developing countries and the fiscal reform that has to precede them (See Vaidya, 1998, for a description of an exceptional effort in Ahmedabad and the difficulties faced).

6. The last three problems essentially work out that the reform process has to be fairly deep rooted for widespread land and water based poverty reducing growth processes to take place.

The kind of growth discussed meshes well with higher output, income, employment and trade levels. Improved management of water leads to crop diversification. The typical sequence is a poor yielding mono inferier cereal economy, succeded by a high yield cereal and a commercial crop, or tree crops. In the Indian case, exchange rate reform led to higher growth of agricultural exports, before the East Asian crisis cut down demand in the fastest expanding markets (See Alagh, in UN, ESCAP, 1995, pp. 225-36), and recent evidence is that the districts sourcing non-traditional exports have gone through a phase of land and water development sequences. (Alagh, 1999)

With experience gained from all these, the concept of integrated watershed development was first institutionalised with the launching of the National Watershed Development Programme of Rainfed Agriculture (NWDPRA) in 1990, covering 99 districts in 16 states. Meanwhile, conservation work was ongoing in the Drought Prone Areas Programme (DPAP) launched by the Ministry of Rural Development (MoRD) in1972-73. The objective of this programme was to tackle the special problems of areas constantly affected by severe drought conditions. In 1977-78, the MoRD started a special programme for hot desert areas of Rajasthan, Gujarat and Haryana and cold desert areas of Jammu & Kashmir and Himachal Pradesh (which were earlier under DPAP) called Desert Development Programme (DDP).

In 1988, the National Committee on DPAP & DDP was set up under the Chairmanship of the Member, Planning Commission to appraise and review the DPAP and DDP. The committee was initially headed by Dr. Y.K. Alagh and later by Shri L.C. Jain who took over as Member, Planning Commission in charge of the subject. The committee submitted its report in August, 1990.

In 1994, a Technical Committee under the Chairmanship of Prof. C.H. Hanumantha Rao was appointed to appraise the impact of the work done under DPAP/DDP; identification of the weaknesses of the programme and to suggest improvements. The Hanumantha Rao Committee felt that "the programmes have been implemented in a fragmented manner by different departments through rigid guidelines without any well-designed plans prepared on watershed basis by involving the inhabitants. Except in a few places, in most of the programme areas the achievements have been dismal. Ecological degradation has been proceeding unabated in these areas with reduced forest cover, reducing water table and a shortage of drinking water, fuel and fodder." (Hanumantha Rao Committee, 1994, Preface). The Committee, therefore, decided to revamp the strategy of implementation of these programmes, drawing upon the "the outstanding successes" of some ongoing watershed projects. It recommended that sanctioning of works should be based on the action plans prepared on watershed basis instead of fixed amount being allocated per block as was the practice at that time. It called for introduction of participatory modes of implementation, through involvement of beneficiaries of the programme and NGOs. It recommended that "wherever voluntary organizations are forthcoming, the management of watershed development should be entrusted to them with the ultimate aim of handing over to them one-fourth of total number of watersheds for development". The Committee also called for a substantial augmentation of resources for watershed development by "pooling resources from other programmes being implemented by the Ministry of Rural Development e.g. Jawahar Rozgar Yojana, Employment Assurance Scheme etc., and by integrating them with DPAP and DDP". The Committee recommended suitable institutional mechanism for bringing about coordination between different departments at the central and state levels with a view to ensuring uniformity of approach in implementing similar programmes for the conservation of land and water resources.

On the basis of these recommendations, the Hanumantha Rao Committee formulated a set of "Common Guidelines", bringing five different programmes under the MoRD, namely, DPAP, DDP and IWDP, as also the Innovative-Jawahar Rozgar Yojana (I-JRY) and Employment Assurance Scheme (EAS), 50% of the funds of both of which were to be allocated for watershed works. The watershed projects taken up by MoRD from 1994 to 2001 followed these Common Guidelines of 1994. In 2000, the MoA revised its guidelines for NWDPRA, making them "more participatory, sustainable and equitable". These were called WARASA – JAN SAHABHAGITA Guidelines. The Common Guidelines of 1994 were revised by MoRD in 2001 and then again modified and reissued as “Guidelines for Hariyali” in April 2003. The watershed programme became the centerpiece of rural development in India. The Ministry of Environment and Forests (MoEF) as well as bilateral funding agencies are also involved in implementation of watershed projects in India. The ongoing watershed programmes are listed below:

1.1 Ministry of Agriculture (DAC - Department of Agriculture and Co-operation)

1. National Watershed Development Project for Rainfed Areas (NWDPRA): This project was launched in 1990. At present it covers all the 25 states and two Union Territories. The twin objectives of NWDPRA continue to be to improve production and productivity in the vast rainfed areas and to restore ecological balance. Till March 2005, 7.95 mha have been treated with a total expenditure of Rs. 2398.76 crores.

2. Soil Conservation in the Catchments of River Valley Projects (RVP) was launched by MoA in 1962-63. Subsequently another scheme of Integrated Watershed Management in the Catchments of Flood Prone Rivers (FPR) was launched in 1980-81. These schemes are primarily aimed at treating catchment areas, extending over more than one state, with appropriate soil and water conservation measures and to cover degraded arable and non-arable lands on watershed basis. In the Ninth Plan, both schemes were merged together into a new scheme called Soil Conservation for Enhancing Productivity of degraded lands in the catchments of River Valley Projects and Flood Prone Rivers (RVP & FPR). The Scheme is being implemented in 45 catchments spread over 20 states. 6.09 mha have been treated with an expenditure of Rs. 1894.12 crores till March 2005.

3. Shifting Cultivation: The Watershed Development Project in Shifting Cultivation Area (WDPSCA) was first launched during the Fifth Plan as a pilot project with 100% financial assistance from the Central Government, covering the whole of North Eastern Region along with A.P and Orissa and later on was transferred to the state plan sector. However, due to various reasons, the state

governments discontinued the scheme with effect from 1991-92. On pressing demand from N.E states, the Planning Commission and MoA relaunched the scheme on watershed basis from 1994-95 onwards in seven N.E. states. Till March 2005, 0.28 mha have been treated with a total expenditure of Rs. 236.35 crores.

4. Reclamation of Alkali Soils: The scheme for Reclamation of Alkali Soils was launched in 1974-75 in the states of Punjab, Haryana and Uttar Pradesh and extended to the states of Gujarat, M.P. and Rajasthan in the 8th Plan period. The main objective of the scheme is to reclaim land affected by alkalinity and improve land and crop productivity including development of horticulture, fuel wood and fodder species. 0.56 mha have been treated under this programme with an estimated expenditure of Rs. 82.54 crores till March 2005.

5. Watershed Development Fund (WDF): This fund has been established in 1990-2000 at the National Bank for Agriculture and Rural Development (NABARD), with the objective of integrated watershed development in 100 priority districts through participatory approach. The total corpus of the fund is Rs. 200 crore, which includes Rs. 100 crore by NABARD and a matching contribution of Rs. 100 crore by the DAC. The fund is to be utilized to create favourable conditions to replicate and consolidate the isolated successful initiatives under different watershed development programmes in the government, semi-government and NGO sectors.

6. Externally Aided Projects (EAPs): There are 17 EAPs on Watershed and Land Reclamation & Development in operation in 15 major states covering about 2.36 mha area with an estimated cost

of Rs. 4756.26 crores.[1]

1.2 Ministry of Rural Development (Department of Land Resources)

1. Drought Prone Areas Programme (DPAP): Drought Prone Areas Programme (DPAP) was launched in 1972-73 to tackle the special problems faced by areas constantly affected by severe drought conditions. The main objective of the programme is to minimize adverse effects of drought on the production of crops, livestock and productivity of land, to promote overall economic development and improve the socio-economic condition of the resource-poor and disadvantaged sections of inhabitants. The scheme covers 961 blocks of 180 districts in 16 States. Total area treated under DPAP is 15.13 mha with an investment of Rs. 2623.40 crores.
2. Desert Development Programme (DDP): The programme aims to mitigate the adverse effects of desertification and adverse climatic conditions on crops, human and livestock population, for combating desertification through shelter-belt plantation, pasture development, soil moisture conservation & water resources development and also to restore ecological balance. At present, this programme covers 232 blocks of 40 districts in hot desert areas of Rajasthan, Gujarat, AP, Karnataka and Haryana and cold desert areas of Jammu & Kashmir and Himachal Pradesh. Total area treated under DDP is 5.71 mha and investment is Rs. 1857.78 crores as on March 2005.
3. Integrated Wasteland Development Project: (IWDP) was started in 1988-89 by the MoEF with an objective of development

[1] *This figure for EAP investment appears a little on the high side to us but the MoRD vouches for its accuracy*

of wastelands based on village/micro-watershed plans. However, the scheme was transferred to the Department of Wastelands Development (DWD) now called DLR, during 1992-93. The projects under IWDP are being implemented in 216 districts of the country. Total area treated under DDP is 6.32 mha with a capital investment of Rs. 2161.81 crores as on March 2005.

4. Externally Assisted Projects (EAPs): The Department of Land Resources, MoRD is also implementing EAPs, assisted by the donor agencies like DFID, EEC, CIDA and SIDA, in the States of Orissa, Andhra Pradesh, Haryana, Kerala, etc. Total area treated is 0.36 mha and expenditure is Rs. 212.67 crores till March 2005.

5. Technology Development, Extension & Training (TDET): This scheme was launched during 1993-94 with a view to promoting the development of suitable technology for the reclamation of wastelands. Its main objective is to operationalise appropriate, cost effective and proven technologies for development of wastelands. Till March 2005, total area treated is 0.99 mha and expenditure is Rs. 80.16 crores.

6. Investment Promotional Scheme (IPS): This scheme was launched in 1994-95 in order to promote participation of the corporate sector and financial institutions etc. with a view to enhance the flow of funds for the development of non-forest wastelands. The scheme has been reconstructed in August 1998 with a major thrust for the development of degraded lands belonging to small & marginal farmers including SCs/STs. Since inception, 26 projects estimated to be covering an area of 893.08 ha have been sanctioned with an expenditure of Rs. 58.75 lakh.

7. Support to NGOs: The objective of the scheme is to create awareness, encourage the application of appropriate technologies

for the development of wastelands and provide training for increasing capability and capacity building. Extension & publicity are other components of the scheme. This scheme has now been transferred to the Council for Advancement of People' Action & Rural Technology (CAPART). Since inception of the scheme, 238 projects have been sanctioned with expenditure of Rs. 20.37 crore.[2]

8. The Wastelands Development Task Force (WDTF): The scheme was implemented using the services of ex-servicemen for development of 1200 ha of wastelands in ravines of Chambal in Morena district of M.P. The objective of the scheme was to develop wastelands through afforestation including soil & moisture conservation, plantation & protection. An area of 1200 ha ravine land is estimated to have been developed with an expenditure of Rs. 7.72 crores during till March 2005.

1.3 Ministry of Environment & Forests (MoEF)

1. Integrated Afforestation and Eco-development Projects Scheme (IAEPS): The schemes implemented by the MoEF have relevance to sustainable eco-system development in rainfed/degraded areas in the country. This scheme is implemented on watershed basis since 1989-90 with intention to promote afforestation and development of degraded forests by adopting an integrated watershed approach to development of land and other related natural resources through the micro-planning process. Total area treated is 0.82 mha and expenditure is Rs. 813.73 crores till March 2005.

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[2] *NGOs were also supported by NABARD under the Indo-German Watershed Development Programme*

Table 1 summarises area treated and total investment under various programmes till March 2005. Till date, a total of 45.58 mha has been treated through various programmes with an investment of Rs. 17,037 crores. Average expenditure per annum during 10th Plan is around Rs. 2300 crores.

Table 1

Area Treated (mha) and Investment Undertaken (Rs. crores), Watershed Programmes in India

No.	Programme	Upto end of 8th Plan		During 9th Plan		During 10th Plan till March 2005		Total (Till March 2005)	
		Area	Investment	Area	Investment	Area	Investment	Area	Investment
I	Ministry of Agriculture								
(a)	National Watershed Development Project for Rainfed Areas (NWDPRA)	4.22	967.93	2.77	911.01	0.96	519.82	7.95	2398.76
(b)	River Valley Project (RVP) and Flood Prone Regions (FPR)	3.89	819.95	1.60	696.26	0.60	377.91	6.09	1894.12
(c)	Watershed Development Project in Shifting Cultivation Areas (WSDSCA)	0.07	93.73	0.15	82.01	0.06	60.61	0.28	236.35
(d)	Alkali Soils	0.48	62.29			0.08	20.25	0.56	82.54
(e)	Externally Aided Project (EAP)	1.00	646.00	0.50	1425.01	0.86	2685.25	2.36	4756.26
	Sub-total MoA	9.66	2589.90	5.02	3114.29	2.56	3663.84	17.24	9368.03
II	Department of Land Resources (MoRD)								
(a)	Drought Prone Areas Programme (DPAP)	6.86	1109.95	4.49	668.26	3.78	845.19	15.13	2623.40
(b)	Desert Development Programme (DDP)	0.85	722.79	2.48	519.80	2.38	615.19	5.71	1857.78
(c)	Integrated Watershed Development Programme (IWDP)	0.28	216.16	3.58	943.88	2.46	1001.77	6.32	2161.81
(d)	EAP			0.14	18.39	0.22	194.28	0.36	212.67
	Sub-total DLR (MoRD)	7.99	2048.90	10.69	2150.33	8.84	2656.43	27.52	6855.66
III	Ministry of Environment & Forests (MoEF)								
	Integrated Afforestation & Eco-Development Projects Scheme (IAEPS)	0.30	203.12	0.12	141.54	0.40	469.07	0.82	813.73
	Grand Total	**17.95**	**4841.92**	**15.83**	**5406.16**	**11.80**	**6789.34**	**45.58**	**17037.42**

Source: MoRD (2006)

2. Potential of the Watershed Programme

A review of the performance of watershed projects during the last 20 years reveals their potential for drought-proofing, agricultural growth, environment protection and employment generation. The earliest studies have beeen reported earlier. More recently, Kerr and Chung (2001) provide an excellent summary of the operational indicators of impact of watershed programmes. It is true that there are not too many studies covering all these aspects. There is clear lack of rigorous methodology in most studies. The quality of the data is also highly variable across projects. However, there have been several studies and evaluations that do provide an indication of the potential of the watershed programme.

A study of 6 IWDP watersheds (Sharda, Samra and Dogra, 2005) showed that various mechanical and biological measures could reduce surface runoff by 58%. Soil losses form watersheds were reduced by 52%. The study reports that the water storage capacity created was on an average 47,400 cubic metres per watershed, which increased the recharge rate by 20 to 53%. The overall productivity of the watershed measured through a Crop Productivity Index rose by 12 to 45% in treated watersheds. A review of 120 selected households in four watershed projects in Gujarat (Amita Shah, 2000) found that after 4 years of implementation, irrigated area almost doubled in all the projects, reaching about 18% of the land held by the beneficiary households. Cropping intensity also showed a rise. The total net return from all crops increased by 63%. Around 87% of the households reported that their drinking water availability increased. 71% of the landless reported better availability of employment opportunities in the post-project period. The value of the stream of benefits from the project over a 15-year period is estimated at Rs. 10.48 lakhs with an initial investment of Rs. 2.57 lakhs, with an overall benefit-cost ratio (BCR) of 4.07.

An evaluation by the State Water Conservation Mission in Andhra Pradesh showed that out of nearly 2000 watersheds, water levels showed a rise in as many as 90%, despite a fall in the rainfall by about 28%. 1.7 lakh hectares of additional area has been brought under cultivation. The out-migration of labour from the project areas declined by 10 to 40%. There has been an improvement in the availability of drinking water as well. TARU's evaluation (TARU, 2001) of the Rajiv Gandhi Mission for Watershed Development in Madhya Pradesh showed that the cropped area in 46 out of 58 villages showed an increase. There has been an improvement in groundwater levels in all project villages. The study also reports an increase in irrigated area in 38 out of 58 villages. While the landless households have benefited from direct wage employment, impact on long-term employment is less clear. The TARU study also showed that one of the major direct impacts of watershed work has been in terms of equal wages for men and women. The study felt that reservation for women could have far-reaching impact on gender equality (TARU 2001).

A study of impacts in five watersheds in Andhra Pradesh by WASSAN (Reddy & Ravindra, 2004) found that the overall benefit cost ratio (BCR) of watershed investment in four watersheds varied between 1.10 and 3.78. Based on this estimate, they worked out that the investment payback period of a watershed project is 2 to 3 years. A cost benefit analysis of eight watersheds located in different parts of Gujarat has been conducted by DSC (Chaturvedi, 2005). The study comes out with rather high BCR figures in the range of 4.06 to 15.72. The study notes that benefits occur because of increase in cropped area, shifts in cropping pattern and improvements in crop productivity due to watershed treatment. Crispino Lobo (1996) presents a study of 3 watersheds under the Indo-German Watershed Development Programme (IGWDP) in Ahmednagar district of Maharashtra. An average rise of nearly 300% in the irrigated area and 50% in cropped area was recorded post-intervention.

An initial survey of 16 villages (8 watershed and 8 non-watershed) in drought-affected districts of Gujarat showed that the watershed villages were better placed compared to non-watershed villages in terms of water and biomass availability, employment opportunities and outmigration (Anil Shah, 2000). Only 1 out of the 8 watershed villages were dependent on water supply by tankers and 5 out of 8 watershed villages could take a rabi crop. 7 watershed villages had no shortage of fodder and there was no large-scale out-migration in 6 out of 8 villages. However, re-surveys of these villages in the second and third years of drought (Anil Shah, 2002, 2004) revealed that that this advantage of watershed villages almost vanished over successive years of drought. In the third year, half the watershed villages had to depend on tankers for water supply and almost all watershed villages witnessed massive out-migration. Similar conclusions are arrived at in a study of Surendranagar, Gujarat by the Aga Khan Rural Support Programme (AKRSP-I, 2004). The important policy implication of these studies is that more investment and intensification of effort is required to consolidate the gains from watershed development.

MoRD conducted a comprehensive evaluation of watershed programmes in 16 states covering 221 districts in 2001. A compilation of the results of this study (TERI, 2004) reports overall improvement in land use, increase in net sown and gross cropped area, expansion in irrigated area, greater fuelwood and fodder availability, higher incomes and employment opportunities from the majority of states. Perhaps the most comprehensive summary of the benefits of watershed programmes in India is provided by ICRISAT's 'meta-analysis' of the impact of watershed programmes (Joshi, *et al*, 2005). It is based on an exhaustive review of 311 case studies. The study found that in treated watersheds:

- soil loss (51 studies) reduced by 0.82 tonnes/ha/year;

- rate of runoff (36 studies) reduced by 13%;
- irrigated area (97 studies) increased by 34%;
- cropping intensity (115 studies) went up by 64%; and
- additional employment (39 studies) of 182 persondays/ha/year has been created. In some cases, the additional employment generated went upto 900 persondays/ha/year.

The BCR figure arrived at by the ICRISAT study is around 2.14. Only 15% of the watersheds studied had BCR >3. The mean internal rate of return (IRR) was estimated at 22%. The maximum IRR was 94% and 35% of the watersheds had IRR>30%. This result clearly shows that the investment in the programme is justified in these fragile and uncertain environments.[3]

3. Most Common Practices (Largely Unsuccessful) and Suggested Strategies (Including Case-Studies of Best Practices)

Our review of watershed programmes in India throws up a number of learnings that reveal a large number of areas where major improvements. The watershed programme is primarily expected to facilitate a participatory approach, actively involving all sections of the community at every stage; i.e. selection, planning, implementation, maintenance, monitoring and sharing of future benefits. It also envisages special attention to ensure the participation of women and other vulnerable groups in project activities. In recent years, there has been an increasing realisation that process followed in implementing activities during project cycle, determines effectiveness and extent of

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[3] *We treat the subsequent results of ICRISAT's linear regression analysis with greater caution, however, as these would have to be carefully checked out to ensure that they do not suffer from standard statistical problems created by auto-correlation, multi-collinearity and heteroscadasticity of the error term*

impact of the interventions. Accordingly, if processes are appropriate then wider impact is possible. This realisation has progressively increased focus on process-led watershed development approaches. The planning process is expected to prepare community for resource management, address specific needs of women and other poorer sections and enable sustainable income generation. It is expected that village level planning will have major impact on design and implementation of activities in watershed programmes.

This section is an attempt to understand prevailing processes of interventions at different stages of the watershed development project cycle. In other words, process gives an insight on the extent of participation of the community and operational strategies of watershed implementation. For each aspect studied, we first present the most commonly found practice and then goes on to outline the recommended practice expected to yield best results, illustrating this where possible with case-studies

3.1 Selection of Watershed Villages

Most Common Practice

There is widespread evidence of political pressure in selection of watershed villages. It is also found that selected villages are spread all over the district, in a piecemeal fashion.

Suggested Strategy

☑ District should have a perspective plan for the area being considered for Watershed development programme.

☑ The following criteria may broadly be used in selection of the villages/ watersheds:

1. Acute drinking water scarcity
2. Gross irrigated area not higher than a certain percentage of gross sown area (this percentage may be fixed by each state government

for each district, after taking into account the specific circumstances in each case – but a definite figure must be fixed in every district). The figure may be higher in case dependability of rainfall is low and if the main source of irrigation is rain-dependent groundwater

3. High incidence of poverty and backwardness in human development indicators;
4. Actual wages are significantly lower than the minimum wages.
5. Large population of scheduled castes/scheduled tribes
6. Willingness of village community to make voluntary contributions, enforce equitable social regulations on use of common property resources, equitable distribution of benefits, gender equality, as also create arrangements for the operation and maintenance of the assets created.
7. Positive history of women's agency and community action
8. A preponderance of non-forest wastelands/degraded lands.
9. A preponderance of common lands.
10. Watershed which is contiguous to another watershed that has already been developed/ treated.

☑ In order to have impact, the selection of watershed should be on contiguous basis. Rather than distributing 500 hectares or 1000 hectares randomly, 5000-12000 hectares of area should be allocated to one "competent" PIA, so that the PIA can depute full time quality staffs for the implementation.

In fact, the guideline (MoRD 1994, section 26; MoRD 2001, section 28;) itself suggests '...considering the workload and expenses, a PIA may be allocated watersheds for an area of 5000 – 12000 hectares'. This is also the suggestion of the recent report of the Parthasarathy Committee (MoRD, 2006)

☑ In case of ridgeline passing through the village, whole village should be taken under the WDP to facilitate the ownership and participation of all villagers.

3.2 Beyond Watershed Fundamentalism

Most Common Practice

Water resource development in India appears condemned to swing between the fundamentalism of the irrigation engineers on the one hand, and the orthodoxy of soil and water conservation engineers, on the other. While the former refused for years to see the importance of treating the catchment areas of the dams they were building, the latter appear to suggest that once ridge area treatment is done, there is no need to treat the major drainage lines at all! It is even suggested by some that building any kind of dam, big or small will, or rather, should become redundant, if the catchment is treated with the necessary intensity and rigour.[4] This has given rise to a quite unnecessary opposition between those advocating watershed programmes and those in favour of irrigation. The important thing is to see the essential complementarity between the two programmes. No irrigation project can be sustainable in the long-run, if catchment area treatment is not done either prior or at least simultaneously with its implementation. Indeed, advocates of the Green Revolution irrigation strategies of big dams or tubewells must realise that it is only watershed development that can help revive fallen water tables and prevent dams from prematurely silting up. Likewise, watershed

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[4] *Very senior technical advisors to government, for example, would argue that since rivers are nothing but enlarged gullies formed due to soil erosion, the aim of watershed projects should be essentially to so treat the catchments of rivers, that no drainage line treatment remains to be done, as there would be little run-off left to harvest! (Mihir Shah and Vijay Shankar, 2003).*

advocates must acknowledge that in many parts of the country (especially eastern and central India) there is a vast unutilised irrigation potential. Community-based micro-irrigation programmes can play a major role in drought-proofing these areas.

Within the watershed approach, problems are sometimes created by an excessively rigid insistence on what is termed the "ridge-to-valley principle". Simply stated this means that watersheds are to be treated in a sequence beginning with the ridge area and moving gradually down the slope of the watershed. Interventions specifically vary according to slope and "order" of stream[5] in the watershed. This, indeed, represents the strength of the watershed approach, reflecting its emphasis on location-specificity. It ensures that dams built in the lower reaches of the watershed are protected from excessive siltation, something that will tend to happen, were the upper catchment not to be treated first.

The problems begin when this principle, rather than being a guiding rule, starts to acquire the form of a rigid orthodoxy. For it often happens that village communities inhabit the lower reaches of the selected micro-watershed. Success or failure in watershed programmes depends on how closely the community is involved in it, right from the stage of action plan formulation. A rigid insistence on the ridge-to-valley sequence often alienates communities unwilling to understand the point of working so far from their fields and wells. From the very inception then, the implementing agency, in the

[5] *Streams or drainage lines in a watershed are classified, according to their catchment areas, into lower and higher "order" streams. Interventions vary according to the order of the drainage line.*

consciousness of the villagers, is relegated to an interloper status, destroying all chances of success of the programme.[6]

Suggested Strategy

A review of experience in the field suggests that it would be better to introduce a degree of flexibility in the way the ridge-to-valley principle is applied. We agree with the approach of demarcating the selected micro-watershed on a Survey of India toposheet and then plan various interventions within the watershed, in a ridge-to-valley sequence. However, the actual sequence of treatment may be kept a little flexible and responsive to local perceptions. It may at times be more useful to identify significant water harvesting sites within the selected watershed in a participatory fashion and then plan their construction, as also the treatment of their catchments, in a more or less co-terminus manner. This would simultaneously address the need to involve the village community, on the one hand, while ensuring that the catchments of the proposed structures are treated well in time, in anticipation of their storage. We would thereby achieve both -- strong community participation and adherence to the ridge-to-valley principle as well.

3.3 Overcoming Mechanical PRA

Most Common Practice

After the Hanumantha Rao Committee report of 1994, the Guidelines formulated for watershed development greatly emphasised participatory processes. However, a variety of studies show that

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[6] *In a rather naïve counter-reaction, even some fairly respected practitioners have started to speak of the need to adopt a "valley-to-ridge" approach. The real point is to apply the ridge-to-valley principle in a manner that gives primacy to social mobilisation, even while respecting the power of location-specificity and sequencing of works.*

participation, transparency and equity are some of the weakest aspects of the programme. Participatory Rural Appraisal (PRA) that was advocated as the tool for ensuring participation has perhaps turned into its own nemesis.[7] The spirit of PRA was demystification of the knowledge of experts and valorization of the knowledge of the people. The idea was that the programme would turn into a people's programme in which others (such as officials, NGOs and experts) will participate. Sadly, PRA has been turned into a "mechanical" tool wherein various prescribed exercises are ritually carried out without changing the overall tenor of the programme, as externally devised and implemented (Kolavalli and Kerr, 2002). Lip-service is routinely paid to the idea of participation without a genuine, organic practice of it. Moreover, it has also been recognised that PRA may be all right as a short-cut to getting quick, broad information. But in a programme as large as a watershed project, there is need for "hard" data for which a much more comprehensive base-line survey would be required.[8] (AFARM, 1998; Samaj Pragati Sahayog, 2005a).

Suggested Strategy

It is not difficult to understand why the resource-poor do not find a strong voice in decision-making in development programmes in an unequal society like rural India. It is no surprise, therefore, that this has generally not happened in watershed projects. So it may be unduly unfair to criticize watershed projects on this count. However, it is certainly possible and worthwhile to suggest specific steps that need

[7] *See Mosse (2005) and Samaj Pragati Sahayog (1999) for a scathing critique of the practice of PRA in watershed projects.*

[8] *In the section on research, we emphasise how poor quality of research on watershed programmes in India is, in part, a reflection of the fact that proper base-line data has generally not been collected, nor updated over the course of the project.*

to be taken that constitute a substantive attempt in this direction. Even after these steps, we may not achieve perfectly participatory processes or equitable outcomes, but the programme must still be judged by the extent and nature of effort it made in this direction.

Bina Aggarwal (2001) provides a very useful typology of modes of participation.

Table 2

TYPOLOGY OF MODES OF PARTICIPATION

Mode of Participation	Characteristics
Nominal	Membership of groups
Passive	Silent participation in meetings or getting information of decisions after meetings
Consultative	Being asked for opinions without necessarily being able to influence decisions
Activity-specific	Volunteering to undertake specific tasks
Active	Pro-actively expressing views, taking other initiatives
Interactive (empowering)	With voice and influence on decisions
Informed (empowered)	Being able to take into account information and opinions of external agents (“experts”) and make considered decisions

Note: *Adapted from Aggarwal (2001)*

To her table we have added a row – informed participation, which we see as the ideal that must be moved towards. Here participation is seen as a two-way process of intense dialogue between the local people and the outside agency, be it government, NGO or professionals. We see the watershed action plan as emerging out of this exchange of ideas. Neither a romanticisation of people’s knowledge nor a debunking of the expert. Rather a process of demystification of expertise in the process of valorising popular understanding, through a creative dialogue between the two. Such a dialogue has been rare. Most programmes have been either top-down impositions or a strangely hands-off acquiescence in whatever mistakes that may be taking place on the ground that “this is a people’s programme, people know best, so what can we say” (Mihir Shah, 1998). The challenge is to give enough time and space for differing viewpoints to be expressed, understood and acted upon so that a process of truly informed participation can be set into motion. The people must guide the plans (not necessarily determine them, because there are cases where the so-called "people" are the elite or simply misguided and plain wrong about certain ideas).

Deciding the activities to be included in the action plan and their sites must involve participatory methods such as transect of the entire watershed by groups of villagers, utilizing their deep knowledge of local conditions. This includes their understanding of the topography at a micro level, as also water flows and soil types. As also the socio-economic profiles of the families likely to benefit or be adversely affected by each proposed intervention. We get a picture of groups of villagers moving together, along with various professionals, across the watershed debating the merits and demerits of different proposals Only when the plan is arrived at through such a deeply consultative process can it be called genuinely participatory and only then will it stand the test of time and village debate.

An innovative methodology called “Participatory Net Planning” (PNP), which facilitates this process, has been developed by the Watershed Organization Trust (WOTR), Maharashtra. PNP brings together farmer couples as well as villagers in dialogue with experts "on site itself" in order to determine treatments as well as their sequencing thus resulting in enhanced stakeholder ownership as well as generation of data and information useful for planning, implementation and monitoring.

3.4 Incorporating Groundwater

Most Common Practice

India is a land of great social and natural diversity. One of the most important elements of the latter is the country's extremely variable hydrogeology. This varies not only across regions but also at times even within micro-watersheds. Groundwater is the single most important source of water in India, meeting 60% of our irrigation needs. But the availability of groundwater varies enormously across the length and breadth of India.

Perhaps the most critical weakness of watershed programmes in India is that they operate almost as if groundwater does not exist. It enters only as something to be recharged and replenished. But it appears to play almost no role at all in watershed planning. Watershed planners forget that just as there is a surface water catchment, there also exists a groundwater catchment. The issue is extremely complex, as the boundaries of the two catchments do not necessarily coincide. But we always define a watershed with reference to the surface water catchment alone. Even if we continue to do this, there is a need to recognise and study the contours of the groundwater catchment and variations in hydrogeology, at the earliest stages of planning a watershed project.

Suggested Strategy

1. <u>Location of structures</u>: Water harvesting structures can have broadly two purposes – either direct use of the water harvested or

recharge of water sources downstream. Knowledge of the hydrogeology at the site and in the intervening strata between the harvesting site and the water source could make a crucial difference to decisions on matching location with purpose. What matters are the storage and transmission characteristics of the aquifer at that point. If you want to store water for direct use the underlying strata should have low permeability and enough storage capacity to assimilate the artificially recharged water. On the other hand, if we want to recharge a water source downstream, the aquifer should have good transmission capability. For instance, if the water harvesting structure is underlain by "karstic" or highly permeable limestone, with regional connectivity, the very attempt to harvest rainwater may fail as the water will not stay within the intended local area. Again, the direction of groundwater flow may not mirror that of surface water flow. Thus, we must remember that we customarily deploy "upstream" and "downstream" as surface water flow terms and are not mindful of the fact that these may not apply in precisely the same sense to groundwater.

2. Sustainability: Even while our entire focus is on harvesting surface water run-off and converting it into usable groundwater, watershed programmes do not adequately factor in the impact of unsustainable groundwater use. All the effort in harvesting rainwater may come to nothing if we do not regulate use of groundwater. Watersheds selected for treatment might vary greatly in the base-level of groundwater development. This is fundamental base-line data that must be collected at the start of a programme. We may be interested in recharging fallen water tables following over-exploitation of groundwater. Or else it may be a situation where groundwater use is under-developed. In which case we need to study the aquifer

characteristics of different parts of the watershed and weave in a sustainable groundwater development and utilization plan into the overall watershed action plan. This is generally not done in most watershed projects implemented in India so far.

3. Danger of Groundwater Drought: Not doing so has meant that even when there is a normal rainfall year, the watershed could face a drought. This is because farmers made an over-drawal of groundwater in the previous year. This is what is termed a “groundwater drought”. The water balance calculation must include what the community is doing with its groundwater.

4. Equity[9]: The most important aspect of groundwater is that it is a common property resource, the means of access to which is privately owned. We generally access groundwater through private wells and tubewells. But drawal of water from our source can adversely affect the water in our neighbour’s water source. Depending on the hydrogeology of the watershed, the question “who is my neighbour?” gets answered. If the watershed is in an alluvial tract, for example, my deep draw of water can affect a farmer even hundreds of metres away. Thus, how farmers decide to collectively manage the groundwater resources of the village could have a deep bearing on how long groundwater survives. It could actually determine the entire efficacy of the watershed programme. Indeed, one could go as far as to say that sustainable and equitable management of groundwater could be the key area of rural governance in the 21st century.[10]

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[9] *This section draws heavily on Mihir Shah and Vijay Shankar (2003). Please also see Kulkarni* et al *(2004) for a more technical exposition*

[10] *In the present era of market fundamentalism, there are those who suggest that the best way to regulate groundwater and prevent its over-extraction is to develop groundwater markets. For them, the solution as always, lies in "getting prices right". They forget that we are dealing with a common property resource with significant externalities -- a classic*

The unique aspect of the situation is that water below my land is not "mine". Groundwater is a non-stationary, "fugitive" resource that merges into water under another's land in a fluid sort of way. By lowering the depth of his tubewell, my neighbour can squeeze all water out of my well. Without proper collective arrangements for groundwater use, there tends to be an infinite regress of competitive extraction, with farmers outbidding each other in depths of drilling. Competitive extraction of groundwater leads to disastrous outcomes, the worst of which are observable in coastal areas of Gujarat and Tamil Nadu, for example. Here, saline ingress of sea-water poses a virtually irreversible environmental hazard for farmers who have engaged in competitive pumping of groundwater.

What is required, therefore, is that we take a three-dimensional view of groundwater and see each aquifer as a common property resource. Wells and tubewells are to be viewed as the means used by farmers to extract water from this aquifer. Extraction of water from this aquifer needs to be carefully, collectively regulated. To place this regulation on a solid scientific basis, each aquifer needs to be mapped and its storage (s) and transmission (t) characteristics carefully studied.

Table 3

MODEL FOR OPTIMAL USE OF GROUNDWATER IN WELLS ACROSS THE SEASON

(To minimise interference and maximise productivity)

Well Characteristic	STORATIVITY (s)

market failure scenario. They fail to understand that as water becomes scarce, prices will tend to rise, gradually putting it beyond the means of the poorest farmers. And those users, such as large corporates, who can afford to pay and bid the highest, will enjoy a virtual monopoly over water, and could indulge in its unbridled exploitation.

		Low	High
	Low	Drinking Water	Last Use (3)
TRANSMISSIVITY (t)	High	Early Use (1)	Interim Use (2)

Such studies are best done with the close involvement of the farmers of the watershed. They would help the community decide the intensity and sequencing of use of water from different wells in the aquifer. To give a rough indication of a possible scenario -- wells tapping an aquifer or part of the aquifer with low storage and low transmissivity would be preserved for drinking water. Wells with a low storage of water and high rates of transmission out of it, would be used in the first part of the season, as water is not going to last for long in these wells. Where storage is high but so are the expected losses due to transmission, water would be used in the middle part of the season. The best wells, which have high storage of water and lose it also slowly (low t), would be used only at the fag end of the season, with a part of the water from such wells apportioned for drinking water during the summer.

5. Restriction on Tubewells: Considering the man-made crisis of water engendered in the country through deep drilling of tubewells (as described in Chapter 1), it may be useful to consider making it a condition of eligibility for a watershed project that

a) tubewells will be restricted only for drinking water
b) if at all tubewells are to be drilled for irrigation, they should only be if groups of farmers have a prior agreement on water-sharing and water-use with great care being given to sustainability of water extraction and use.

The celebrated Hivre Bazar watershed project in Maharashtra has banned borewells for non-domestic purposes. In the IGWDP, Maharashtra, a watershed project is undertaken only if the community agrees to ban the drilling of borewells for irrigation purposes and the cultivation of water intensive crops such as sugarcane, bananas, grapes etc.

6. Sustainable Groundwater Development Plan using Dugwells: While we are for restricting extraction of groundwater by tubewells in all watershed projects, we support the idea of integrating a sustainable groundwater development plan based on shallow dugwells into watershed projects. This has not been generally attempted so far. But some agencies such as Samaj Pragati Sahayog in Madhya Pradesh have developed such a plan and made it part of their watershed programme, based on a prior study and understanding of the groundwater catchment and hydrogeological features of the watershed.

3.5 Equity

Most Common Practice

One must not make the mistake of romanticising the notion of the village community. Indian rural society today (adivasi pockets no exception) is deeply fractured across social and economic lines. Discrimination against women, dalits, adivasis and the poor in resource-use and access is widespread. Any development programme based on local initiative needs to be necessarily accompanied by effective social mobilisation in favour of these socially and economically disadvantaged groups. Detailed agreements on sharing of water and other benefits need to be worked out well before any construction activity is started. The interests of the landless have to be specially borne in mind. Otherwise all the water you harvest will be cornered by the dominant elite. And this is what has happened in most watershed programmes in India. It must be recognised that the benefits of public investment on public land must be seen as a public good, to be shared with equity amongst all sections. For example, the fishing rights to a public pond may be reserved for the landless or dalits. The usufructs from protected/regenerated forests must extend to the dalits/landless/adivasis. Even the benefits from investments on private land should be shared as far as possible. For instance, if investments on private land exceed a certain threshold, there must be provision that its benefits will be shared by groups of farmers. They can, for example, share water from a well or pond constructed under the project. The bottom-line has to be that benefits from any resource created through the project must be equitably shared.

Suggested Strategy

Conflict Resolution: The entire range of activities to be included in the action plan must be discussed threadbare in a series of village meetings. There is bound to be some contention and conflict, but the attempt must be to allow this to be expressed and resolved in a democratic manner in the Gram Sabha. For example, detailed compensation packages need to be worked out for those who may lose a little of their land/assets due to dams to be constructed. Without a satisfactory resolution of all such conflicts, work cannot proceed

Beneficiary selection: This must be done in village meetings where detailed criteria are enlisted, reflecting considerations of equity. A hierarchy of preference must be created where the landless, poorest farmers, dalits, adivasis and women-headed households get highest ranking.

Benefit sharing: This involves complex questions of hours of pumping, sequence of irrigation, cropping patterns, share of cattle, ensuring share of landless etc. Before any structure is built, detailed agreements have to be thrashed out on all of these aspects. The outstanding example of water sharing, of course, is the late Vilasrao Salunke's Pani Panchayat in Maharashtra. Water is made available to each family at half an acre of irrigation per person, with a maximum of 2.5 acres per family (Pangare, 1996).

Who will be employed: Complex labour rationing has sometimes to be done to provide adequate representation to those in most need, different communities, hamlets, villages etc.

Special Provisions for Landless and Dalits: It is not surprising that a land-based programme like watershed has trended to neglect the interests of the landless. In many programmes a new mechanical *mantra* has developed – "User Groups for farmers, SHGs for the landless". Apart from the fact, that SHGs must be focused on all poor families, not just the landless, we must also realise that by merely forming SHGs for the landless nothing much is going to be achieved. There is a need to explicitly factor in participation of the landless in decision-making from the word go, recognise their rights to the commons and to include activities that would take care of their livelihood requirements. We also need to be careful that no provision in the watershed plan should militate against their interests. For instance, there are instances from projects in Maharashtra where over-zealous bans on grazing in the commons have deeply hurt livelihoods of small ruminant dependent landless families (Kerr *et al,* 1998). On the other hand, rights to fodder and fuelwood from the commons could be a major source of security for the landless and could help make them active stakeholders supporting watershed programmes. This is the reported experience of the Indo-Swiss watershed project in Karnataka (Joy and Paranjape, 2004). The use of Self-Help Groups to manage the commons in watershed projects in Karnataka is also most instructive in this regard (Mukherjee, 1998).

In many tribal-forest areas of Madhya Pradesh, the landless belong to various communities that have traditional artisanal skills of basket- and mat-weaving using bamboo and *Harsinghar* (*Nyctanthes arbortristis*). Today, a large number of bamboo products have been developed for furniture and building construction, the world-over. *Harsinghar* is a major medicinal herb. It should certainly be possible for watershed programmes to imaginatively weave in many such interventions into the action plans, that would develop this resource and provide livelihoods for sections such as the landless and the resource-deprived through value-addition.

The exclusion of the landless from watershed programmes finds a reflection in a similar exclusion of the Dalits and other backward communities. This is because Dalits are generally the ones who are resource-poor and often the landless. Little work has been done to study the specific concerns of Dalits but a recent initiative by WASSAN (2001) is worthy of mention. WASSAN reports cases in Andhra Pradesh where common lands developed by Dalits were handed over to non-Dalits. There are also instances from Maharashtra where Dalits have had to sell off their goats after their traditional access to commons was restricted following a watershed project (Joy and Paranjape, 2004). Every effort must be made to ensure effective representation of Dalit members in the Village Watershed Committee.

3.6 Focus on Gender

Most Common Practice

Perhaps the most "universal" equity issue, cutting across classes and communities, is the discrimination suffered by women. The challenge of women's empowerment has to be a thrust area in national reconstruction. We need to develop local institutions led by a cadre of local women who would become the transmitters of new development perspectives in their respective areas. Only with the growth of such local leadership can various development programmes initiated by the government be truly mainstreamed in these areas. Or else the massive public investment being made over the years will continue to largely go down the drain.

Over the last two decades, several attempts have been made to introduce gender sensitivity and gender orientation into development programmes. Sadly, however, much of this has remained restricted to mere lip-service and tokenism. The real challenge is to make stipulations and devise strategies to give a real chance for women's empowerment to occur. Nearly two decades of watershed development in India have shown that by simply putting the onus for change on a few women in committees and "users groups" here and there, has perhaps reinforced the ineffectiveness of women. The tight trap of patriarchy and consequently, women's reluctance to endanger their tenuous survival, call for guidelines that are firm, uncompromising and far reaching in commitment to gender equality.

The MoRD original guidelines (1994) restrict themselves to asking for the "willingness" of the community to share benefits with the weaker sections of society such as women. The CAPART guidelines speak of a "special emphasis" on disadvantaged sections such as women. The Indo-German Watershed Development Programme's (IGWDP, 1996) "guiding principles" on women take a step further to describe the effectiveness of "women-to-women" extension. The National Workshop on Watershed Approaches for Wastelands Development recommends "equal representation of women in gram sabhas and watershed committees" (Pangare and Farrington, 1998). As Pangare and Farrington (1998) put it "activities currently undertaken for women in watershed development projects do not empower them to be equal partners with men." They provide three main reasons for this weakness -- women's contribution to the rural economy is not recognized so they are treated as 'disadvantaged' rather than as 'farmers' like men; land titles do not belong to women which eliminates them from decision-making bodies where only landowners (men) are nominated; women's needs are overlooked, especially with regard to common property resources, from where women draw livelihood support.

Suggested Strategy

Over the years the understanding has moved forward - that for gender equality to happen an even handed approach will have to be dropped and women-specific interventions sharpened to overcome historical and social imbalances. This view is best expressed in a report prepared by the IFAD-UNIFEM Gender Mainstreaming Programme in Asia: "One common misunderstanding about gender mainstreaming is that it requires some sort of 'gender balance' in the project, a kind of 50:50 representation of women and men in various project components and not any women-specific projects or even women-specific components. Given that there is already a greater or lesser degree of gender imbalance in these groups, a pro-women or project imbalanced in favour of women, will only help to somewhat correct a historical imbalance. Thus, depending on the specific situation, attaining gender balance among the poor may require women-specific components or even women-specific projects (Kelkar and Nathan, 2004). The report goes on to ask: "Who will mainly work to change existing gender relations? Will it be men, who get some minor benefits from these relations? Or, will it be women, who are oppressed and confined by these relations? It is not unusual to expect that those who are oppressed by existing relations, will be most interested in changing it; or that those who get some benefits (even if they are relatively minor benefits, like more leisure, better food or social status) will be less interested in instituting changes. There may well be exceptional men, who conscious of the need to enhance the position of women in order to accomplish desirable social change, will take the lead in bringing about changes in gender relations. But these are not easy changes, and social experience shows that there is substantial masculine resistance to these changes. At the same time, all efforts need to be made to gain the support of men for desirable changes in gender relations. The recognition of enlightened self-interest will only make implementation easier. But gaining such support of men cannot be made a condition for initiating changes. What is desirable cannot become a condition (ibid.)"

With the odds stacked so heavily against women the lesson staring us in the face is that weak attempts to slide in gender concerns has led to 'policy evaporation' (Zuckerman, 2002) or a dilution of the effort to the extent that it has no effect. Partial representation in village-level institutions inhibits even vocal women, resulting in tokenism and reinforcing the pointlessness that women feel. Watershed development is an ideal opportunity to address gender intensively and in a multi-dimensional way. If ownership, control, decision-making, economic benefits, social security, knowledge and empowerment are to be the objectives then the guidelines should be a step-by-step visualization of how the process will make women's agency work. The aim should be to level the playing field and diffuse bias and to consciously use watershed development and the powerful potential it has to address some gender issues.

Some outstanding examples of this work already exist in India.

They are best summarised in a recent work by ANANDI (2003), a leading women's organisation in India. This study highlights the work of Agragamee, AKRSP (I), Deccan Development Society, Jan-Vikas Ecology Cell and Kutch Mahila Vikas Sangathan. We have studied this entire body of impressive work to distill lessons for next generation watershed programmes in India:

1. A Separate Women's Watershed Council: This distinct women's body will enable women to articulate their perspective, perceptions and interests in a relatively uninhibited manner. This will facilitate the formation of a watershed action plan that genuinely reflects the needs and aspirations of women. The body will also act as an effective watch-dog to ensure that the implementation of the watershed programme necessarily takes women's interests into account. The WWC will nominate their leaders who will represent women in the Village Watershed Committee. It will be mandatory for the WDT to mobilise WWCs in each village so that women are not only heard but play a decisive role in the formulation and execution of the watershed action plan. The WWC will provide the necessary back-up for the women members of the VWC so that their presence is not once again reduced to tokenism. The WWC would also play a big role in influencing the functioning of institutions such as the Gram Panchayat, ensuring greater and more effective participation of women in GPs and ensuring that they work in a accountable and gender-sensitive manner.

2. 50% reservation for women in membership of the Village Watershed Committee

3. Social Empowerment of Women: For women to take on the massive planning and implementation exercises required for watershed development the basic obstacles that prevent their participation will have to be addressed systematically. These are the overburden of

workload, health risks, child care, lack of information and socio-economic dependence. As entry point activities - drinking water, sanitation, alternative fuels, health facilities, crèches and improved shelter need to be provided for women to be free of drudgery and the struggle to survive.

4. Technical and Legal Empowerment of Women: Special efforts on arming women with information and technology on watershed development, natural resource management and procedures need to be introduced. This means making training accessible in relevant ways within the village. Again, most training efforts are designed and implemented in way that eliminates even the possibility of women participating in them. Low literacy levels and the inability to leave their household responsibilities for several days at a stretch prohibit women from investing in themselves. Therefore capacity building for women means, making it available at their doorstep, demystifying technology, learning-through-practice and interactive methods etc. Skill enhancement for women in relevant areas like masonry, alternative building technology will increase their options in finding employment both in the construction of the entry point activities as well as at watershed sites. An important aspect is legal information to women so that they know their rights within the law. The Indo-German Watershed Development Programme, Maharashtra, has developed an approach called the Gender-Oriented Participatory Operational Pedagogy (GO-POP) that while addressing the needs and priorities of women also systematically integrates them into the institutional and decision making processes of the village and builds up their capacities to be actively involved in these (D'Souza, 1998)

5. Changing the Schedule of Rates: Restructuring productivity norms in the Schedule of Rates to enable women to benefit from the direct

employment generated in watershed works is of critical importance. Preference in earthwork or masonry activities like mixing, carrying, brickwork and watering should be given to women.

6. Drudgery-reducing Appropriate Technology: To reduce drudgery, the nature of construction work in watershed development demands the provision of drudgery-reducing manually operated equipment like wheel barrows, small cranes, rollers, bullock cart mounted tankers for water. This is particularly relevant for reducing the arduous nature of manual labour for women given their biological differences and responsibilities.

7. Income Generation for Women: Building on the assets created in watershed development and the increased availability of water, skill enhancement opportunities for women must form part of the project. Improved agriculture, nursery management, livestock, fisheries, processing food and non-timber forest produce and other skills have to be imparted during the project implementation period to sustain the empowerment process afterwards.

8. Management of Common Property: The historical disinheritance of women from access to the primary means of production (land) make it an imperative that at least in common property (land, water, forests) management, women are given a primary role. The implementation of The Hindu Succession Act (Amendment) 2005, recognizing that women have equal rights over agricultural land, will have a powerful impact on gender equality. However, most married women in the village will be rightful owners of land in their maternal village. Common property must be therefore be used by women to strengthen their position in the village.

3.7 Entry Point Activities

Most Common Practice

Unfortunately, entry point activities (EPA) have been reduced to a farce in most watershed projects. There is much tokenism here. There is a notion based on text-bookish PRA that one needs to build mandir/masjid. Perhaps, this has to do with the Hindi translation of EPA as *aastha moolak* !

Suggested Strategy

In fact, the choice of EPA can have a critical bearing on the further course and success of a watershed project. It is very important to carefully assess what may be regarded as the most pressing need of the village. This should be based on a series of meetings involving a range of stakeholders. What is more, in the execution of the EPA there is a great opportunity to beta-test the principles and procedures for equity and transparency that are to be followed in the main project itself.

3.8 Voluntary Contributions

Most Common Practice

One of the distinguishing features of the watershed programme in India is that almost every project emphasises voluntary contributions by those who benefit from the work done. The idea is that such contributions will promote feeling of “ownership” of the programme among stakeholders. This will contribute to sustainable outcomes in the long-term. The voluntary contributions are saved in the Watershed Development Fund (WDF) that is to be used for repair, maintenance and use of assets created on common land. However, we also found many instances of so-called *shramdaan* (voluntary labour) working more as a “shram-tax”, where landless labourers’ wages were being deducted at a fixed rate to meet a set target of voluntary contribution. Resulting in effect in the poor subsidising the rich. This is a very serious shortcoming that needs to be addressed.

Suggested Strategy

The best way is to work out differential rates of contribution by beneficiaries – different rates applying to different classes of farmers as also to different activities. Whenever the activity is on private land and contributes directly to income-generation, the contribution expected should be higher. One of the best models of this system is reported from Gujarat in work done by the Aga Khan Rural Support Programme (Sen, 2004). Of course, in many tribal areas, since a number of those who work on watershed projects themselves own low-productivity land, *shramdaan* can occur on a reciprocal basis, reflecting their own traditional practices. We also find that land offered by farmers for constructing water-harvesting structures, for example, is not generally being taken into account as a contribution. This needs to be taken into account as a voluntary contribution.

At the same time, we are very wary of claims of very high contributions made by some NGOs. These are prevalent in villages inhabited by better-off farmers. It would be very wrong to perforce impose such high rates of contribution everywhere, when the whole idea is to promote voluntarism. Especially in the most backward regions inhabited by socially disadvantaged sections such as Dalits and Adivasis. The Hariyali Guidelines are exactly right when they state: “The contributions to WDF shall be a minimum 10% of the cost of works executed on individual lands. However, in case of SC/ST and persons identified below the poverty line, the minimum contribution shall be 5% of the cost of works executed on their lands. Contribution to the Fund in respect of community property may come from all the beneficiaries, which shall be a minimum of 5% of the development cost incurred. It should be ensured that the contribution comes from the beneficiary farmers and is not deducted from the wages paid to the labourers who are engaged to treat the private lands." As the Hariyali Guidelines state this is the minimum and beneficiaries may be encouraged to contribute more for income-generating works on private land such as farm bunding, land levelling, well construction and repairs etc. in accord with their capacity to do so.

Most of the money (running apparently into hundreds of crores) collected in the WDFs is lying unutilised. We would strongly urge various state governments to pass enabling orders that would allow VWCs (the authorised personnel in each case) to use the fund. Rules for operation of the fund should be prepared by the VWC and ratified by the Gram Sabha. The fund should be operated by 3 persons, one of whom must be a woman, one a member of the Gram Panchayat and one from a dalit/adivasi/landless family. These people should be selected in a meeting of the Gram Sabha. At least 50% of the funds should be set aside for the operation and maintenance of community assets created during the project. No part of the fund should be used for maintenance of works on private land. The remaining money may be used as a revolving fund to advance loans to the villagers of the project area who have contributed to the fund.

3.9 Transparency and Accountability

Most Common Practice

This has been one of the weakest elements in watershed programmes, especially those led by government departments. There is almost complete absence of social audit. There is need to ensure the accountability of management to the stakeholders. Quite often, the records of funds spent are not properly maintained. There should be answerability to the Gram Sabha at the Meetings held periodically for the purpose. There is absence of public knowledge of the relevant information among the villagers and inhabitants of watersheds.

Suggested Strategy

One of the most instructive studies on the issue of corruption in watershed works and systems required to prevent it is by Crispino Lobo of the Watershed Organisation Trust (WOTR), Maharashtra, Lobo (2005). has developed and extensively applied various IT systems to facilitate efficient and transparent project implementation and programme management. One of the best government articulations of social audit is to be found in the Guidelines of the MoRD for the NREGA.

There are many dimensions to this:

- Once the action plan is ready it must be presented for approval at the Gram Sabha meeting.
- ·A summary of the approved plan must be put up for display in a public place and the complete plan must be available to anyone who seeks access.
- All labour payments must be made in public.
- Regular *jan sunwayis* (public hearings) must be held where detailed accounts are presented to the people, including all documents – sanction and release letter, pass books, cheque books, muster rolls, vouchers etc.[11]
- Boards should be put up in public places and at each major site, which display details of work done, costs, volume of water harvested, employment generated etc.

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[11] *Institutions such as the Mazdoor Kisan Shakti Sangathan (MKSS) need to be requested to carry out large-scale training programmes on the methodology and rigour required in conducting social audits.*

- Wherever possible IT should be used to record, manage data and generate information on indicators to be monitored or measured

3.10 Clear Prioritisation of Objectives

Most Common Practice

Drinking water security has to be the paramount goal of a watershed programme. Chronic shortage of drinking water is one of the first criteria for selection of villages for the programme. However, the record of watershed projects on this count has been mixed. In most cases we would expect to corroborate the positive conclusion of the study by Reddy et al (2001), which finds both that drinking water use has gone up in all watershed villages and the time spent on fetching drinking water has also declined. However, many studies also show that the increased water made available by these projects gets diverted to irrigation, often at the cost of drinking water needs (Joy and Paranjape, 2004). As Kakade et al (2001) argue, since irrigation and drinking water needs are often met from the same aquifer, situations arise where after two crops have been taken, there is shortage of drinking water in summer.

Suggested Strategy

It is important that drinking water is re-asserted as the first charge on the water resources of the watershed and that protective irrigation for drought-proofing is accorded the next priority. Only in this way can the interests of the resource-poor and small and marginal farmers be protected. Crops requiring intensive irrigation need to be strongly discouraged.

3.11 Integrating Dryland Agriculture with Watershed Development

Most Common Practice

Unfortunately, watershed development in India has been one-sidedly preoccupied with supply augmentation. Little attention has been paid to the end-uses of harvested rainwater. In this respect it has failed to break with the dominant development paradigms of the 20^{th} century, all of which are characterised by supply-side solutions. These solutions are caught in the infinite regress of forever trying to catch up with ever-expanding demand. They are a major reason for straining the delicate fabric of the eco-system, within which economic processes necessarily unfold.

We need to recognise clearly that it is not merely enough to harvest rainwater. However much water we may conserve and collect, it will prove inadequate unless we take care to put it to sustainable uses. What is required is to find ways of not just increasing supply but much more critically reducing demand and regulating end-uses. So long as we do not question the emerging pattern of end-uses and pose the central question of efficiency of utilization of our resources, it will be absolutely impossible to endlessly augment supply. The fundamental binding constraint is really provided by the demand side. An integral element of the conservationist approach has, therefore, to be a quantitative and qualitative regulation of end-uses and demand.

The tragic spectacle of Maharashtra's drought-prone Ahmednagar district of the pioneering Ralegaon Siddhi experiment, growing vast acres of sugarcane, makes a mockery of the watershed approach, by engendering man-made scarcity of water. Unfortunately, watershed programmes in India's dryland areas have failed to break with the Green Revolution (GR) type agricultural package. The major flaw of this strategy was to try and indiscriminately apply the same package to all areas, quite irrespective of the agro-ecological specificities of each region, in a country with such immense diversity as India. The drylands of India have a delicate ecosystem, extremely vulnerable to external stress, be it that induced by the weather or the market. The GR package made farmers more vulnerable on both counts, by making them critically dependent on high quanta and precise timeliness of irrigation, as also by increasing their reliance on expensive market-procured inputs, such as hybrid seeds, chemical fertilisers and pesticides. The poorest were naturally the worst hit by a production plan that was unsustainable, both in economic and ecological terms. The unprecedented increase in suicides by farmers in recent times is the most dramatic and tragic expression of this vulnerability.

Suggested Strategy

It is necessary, therefore, to arrive at a package of agricultural practices finely tuned to the resource endowments of each watershed, which is both accessible to the poor (low-cost) and sustainable (low-risk). We need an approach that:

- Focuses on crops that form the nucleus of the livelihood security of poor and marginal, dryland farmers
- Reduces dependence on the market
- Reduces intensive use of water
- Respects the specific matrix of resource-availability of the particular agro-climatic region
- Builds upon the germplasm local to drylands, rather than imposing exotic varieties
- Respects the ecological balance while planning increases in productivity, building in strategies of resource rehabilitation, along with resource use

Often the critique of GR strategies tends to take on an excessively romantic “back-to-nature” kind of tone. We are not advocating such an approach. We believe that there is no going back, as we are faced with a continuously evolving environment, to whose specific challenges newer and more creative responses have to be evolved. There is also the increased pressure of population that demands a level of productivity, beyond the capabilities of traditional seeds. At the same time, however, great care must be taken that the improvements we attempt are based on the germplasm of the drylands, which has attuned itself to their environment, as it evolved over the centuries.

Added to this must be the attempt to minimise dependence on external inputs. This is sometimes described as LEISA (low external input sustainable agriculture). Reijntes et al (1992) contain a detailed exposition of this approach. The Prayog Parivar in Maharashtra provides a good example of such work. This means that all efforts should be made to increase self-sufficiency in seed production. Also organic manuring should be both intensified on each field and spread to as many farmers as possible, so that dependence on chemical fertilisers is reduced. Adoption of organic pesticides such as neem oil, which can be locally produced, would also help in reducing external market vulnerability, while contributing to environmental sustainability at the same time. Water-saving technologies such as drip irrigation must be promoted and made part of the project cost. The costs of such technologies can be regarded as partially recoverable.

A great deal of promising work in this direction has already been done at ICRISAT and centres belonging to the network of Agriculture Universities spread all over the hinterlands of India; also by field research stations of the ICAR and IARI. The ICAR initiated model watershed in Karnataka contain many an example of improved agronomic practices such as zingg terracing, broad bed furrow, contour sowing etc (Joy and Paranjape, 2004). The DFID-supported KAWAD projects (KAWAD, 1999) and Swiss-supported PIDOW projects in Karnataka (Karanth and Abbi, 2001) provide good examples of improved varieties being tried in watershed programmes. The problem is that these centres work in isolation from the farms for which their research is meant. As the National Advisory Council says: "at the moment there is little presence of agriculture department in the DPAP watersheds by way of promoting locally relevant research and extending suitable technologies, inputs and other necessary support to farmers" (NAC, 2005a). In our view, the crucial bottleneck has been the absence of an agency to effectively transmit the benefits of their research to farmers and also obtain detailed feedback from them. The packages developed by these scientists are in crying need of field-testing. Without this they remain ideal-types lacking the cutting edge of real-world trials. This role can be best performed by those NGOs who possess equal capability of building a dialogue with farmers and scientists alike. An example of such an agency is Samaj Pragati Sahayog (SPS) in Madhya Pradesh. SPS work on dryland agriculture focuses on 34 varieties of 9 crops -- jowar, maize, tuar, cotton, soyabean, gram, groundnut, bajra and wheat -- developed in the laboratories of agricultural scientists at Indore, Khandwa, Khargone and Chhindwara as also ICRISAT, Hyderabad. These are composite varieties based on indigenous seeds, which give good yields even with low external inputs. Multiplication of these seed varieties is carried out on farms of selected local farmers.

3.13 SHGs and Watersheds: Harnessing the Synergies

Most Common Practice

Both microfinance and watersheds are being developed as stand-alone activities. It must be realised, however, that sustaining the benefits of the watershed programme beyond the project period has two key requirements:

a. development of sustainable livelihoods on the basis of the augmentation of the natural resource-base through the programme
b. development of local people's institutions that would provide leadership to voicing the interests of the area and ensuring transparency, accountability and performance of state institutions

It is our considered view that for both these objectives to be realised needs a close interlinking of the watershed and SHG programmes. Indeed, there is a deep and largely unexplored complementarity between the two that must be developed in order to make each programme realise sustained benefits. The benefits of any development programme can only be sustained if incomes generated by them are transformed into savings and investment that sets the platform for the long-term economic transformation of the area. This means that a complete saturation of the area with SHGs, especially among the poor is an imperative. At the same time cadre-based organisations of local people have to be developed that can take over leadership of development initiatives in the long run.

Suggested Strategy

In this respect, two rural institutions appear to be critical and to hold the maximum promise for very different reasons – one, the SHGs and SHG Federations and two, the PRIs. SHG institutions have the unique merit of representing a happy marriage of social and individual interests. This gives them exceptional sustainability. Each member is a stakeholder, for her savings are what makes up the working capital of the institution. The interest of members is abiding. The SHG Federations are also financially powerful entities, growing in strength by the year. They, thus, possess the unique capacity of leveraging public funds from external institutions such as banks, NABARD, CAPART, and SIDBI etc. They can grow into community-based organisations (CBOs), which can be registered under the Societies Registration Act and can marshal grants and loans from a variety of agencies, depending on the relative bankability of the activities concerned. Over time, they would move rural development up the loan-subsidy scale, in a way no NGO can even begin to imagine. For unlike Micro-Finance Institutions (MFIs), which are condemned to remain external institutions like NGOs, these Federations are all grass-roots member-driven organisations.

A Federation of SHGs, with a membership of about 3000 women and savings of Rs. 60 to 70 lakhs, can become a powerful member-driven people's organisation, which takes up many activities including implementation of watershed projects. The SHGs can open up several non-agricultural livelihood options on the base of water security being created by watershed work. They can build up a strong grass-roots pressure to the development process a pro-poor orientation. Microfinance programmes, thus, help sustain watershed programmes beyond their specified project period and allow withdrawal of the promotional agency over time. However, it is important to remember that in a backward area with low levels of income, the upscaling of SHGs will soon encounter a limit. This limit is imposed by the problem of low credit absorption on account of low repayment capacity of members. Credit absorption is hampered by the low level of income and lack of diversified livelihood options to utilise the loan. In the initial years of SHG formation, when the average size of loan is still small, it is possible to visualise SHGs operating at 90% and above repayment levels. As the loan size increases the members would find it increasingly difficult to take loans and repay them with interest within a specified period of time. After a point, the average loan size of members will stagnate and the programme will never reach the scale required. Accidents and unforeseen contingencies might force the members to borrow large amounts from the market and this would destroy the members' faith in the SHG. Mobilisation of public investment is required to raise the levels of income and to diversify the livelihood options (livestock, fish farming, NTFP processing, marketing of agricultural produce and non-farm wage employment). In a backward area, public investment programmes such as watershed are an imperative for upscaling of SHGs. Neither watershed nor micro-finance can, therefore, be viewed as stand-alone programmes. But they are the perfect complements for each other. The work of MYRADA is especially instructive in this regard (Fernandez, 2002).

The PRIs, on the other hand, are constitutionally mandated institutions. These are the hope for a truly democratic India, where the voice of the weakest will be considered while taking decisions. It would be too romantic for us to visualize an anarchic, stateless society where people manage their affairs on their own. In an era of globalisation and growing interconnectivity, isolated self-serving institutions are somewhat of an anachronism. Every attempt has, therefore, to be made to ensure accountability of the officials to the people. To develop transparent systems of governance, where the officials truly serve the people. This is precisely the purpose of panchayat raj. So if we can create competent leaders running PRIs then the bureaucracy will perform.

3.14 The Unique Strength of NGOs

Most Common Practice

Watershed development is not merely a matter of harvesting rainwater. Its success crucially entails:

- working out collective protocols of equitable and sustainable use of surface and ground water
- bringing together of scientists and farmers to evolve a dryland agriculture package and a host of other livelihood options
- detailed land-use planning at the micro-watershed level and
- the mobilisation of rural communities in the direction of the disadvantaged

Many NGOs in India have set examples in one or more of these challenges. As the National Advisory Council (NAC) states: "The NGOs are, in general, better equipped to undertake the task of creation of awareness, social mobilization and capacity building. However, the revised Guidelines for Hariyali (introduced in April, 2003) have severely restricted the role of NGOs as PIAs in Watershed Development, notwithstanding the mounting evidence that the performance of watersheds, in the implementation of which NGOs have been involved, has been distinctly better than those which have been executed by the Government Agencies alone. . . . This process may be reversed at the earliest and mechanisms evolved at the national and regional levels, to involve bonafide and competent NGOs and empower Watershed Associations in the task of social mobilization and implementation at the watershed level." (NAC, 2005b).

We agree with the NAC.The voluntary sector is seeing a proliferation of agencies, many of which are of a dubious nature. It is not clear that a commitment to serve the poorest has brought them to this field. It appears that the larger cloud of corruption enveloping society in India has made its entry into the voluntary sector as well. Many NGOs are simply fly-by-night operators who obtain government grants and disappear without a trace. There are others who play a contractor-type role, thriving on huge government grants and resultant commissions.

Suggested Strategy

Grass-roots agencies have, therefore, to be very carefully identified, selecting only those with many special qualifications:

- solid field presence and deep commitment, so that the benefits can be sustained in the long-run
- requisite technical skills, with a capability of conducting meaningful interface with scientists, translating their inputs into specific field conditions, marrying the insights of scientists with those of the farmers and providing detailed feedback to scientists
- capacity to carry out empowerment programmes for representatives of Village Level Institutions (VLIs)
- capability of networking with other genuine grass-roots agencies, so that the benefits can be transmitted far and wide, with significant multiplier effects.

3.15 Overcoming the Oasis Syndrome

Most Common Practice

We do not want to create oases of excellence – rather the attempt must be to develop “living laboratories of learning”, from which more and more people benefit, far beyond the immediate location of the grass-roots agency. Most NGOs tend to be very localised in their operation. Many of them are excellent grass-roots mobilisers working as community-based organisations (CBOs). They can have a very important role to play in building capacities of PRIs for effective governance of rural areas. And those who try to work on a large scale suffer the problems of neo-governmental bureaucratisation. The trade-off between scale and quality appears irreconcilable.

Thus, while the role of NGOs can be very important it is clear that two problems need to be addressed:

- how to find genuine NGOs with quality
- how to ensure that NGOs do not end up becoming mere oases of excellence

Suggested Strategy

CAPART has sought to overcome the problem of quality of agency and operational scale through the concept of the Support Voluntary Organisation (SVO). CAPART has recognised seven SVOs for its watershed programme.[12] The role of SVOs is to search out and link up the thousands of disparate, small but sincere groups, working in far-flung corners of the country, and provide them the necessary wherewithal to both implement watershed programmes in their areas and mobilise rural communities for this purpose. The SVOs would provide them all logistical support from resource mobilisation to action plan implementation. The responsibilities of SVOs are to search for and screen prospective partners with a good track record, promote the watershed programme among them, by pro-actively seeking them out, orienting them into the programme and assisting them in preparing watershed action plans; to impart training on watershed development to agencies engaged in the programme; to provide technical and other required support through field visits to the watershed area at regular intervals; to act as institutional monitors for the watershed

[12] *The CAPART SVOs are Hind Swaraj Trust and AFARM (Pune), Development Support Centre (Ahmedabad), People's Science Institute (Dehradun), Agragamee (Orissa), Peermade Development Society (Kerala) and Samaj Pragati Sahayog (Madhya Pradesh). Organizations like WOTR which have developed a systematic and graduated approach called "Participatory Operational Pedagogy" (POP) as well as the "Mother NGO" concept and MYRADA, also have an outstanding record in capacity building for watershed development and could play a vital role as national SVOs.*

programme, evaluating the performance of agencies engaged in the programme or those wishing to join it; to conduct research on various aspects of watershed development; to disseminate widespread awareness by acting as ambassadors of the watershed approach. Each of the SVOs can be visualised as a nucleus, giving rise to many nuclei of empowerment all over the country. Through the SVO concept we can project how the watershed programme could be upscaled over, say the next 20 years, with carefully selected partners being in the forefront of implementation. Each SVO can conceivably support 200 partners over such a period, each of which could in turn cover 10 watersheds of 2500 hectares each. If we have 20 SVOs, this could add up to 100 million hectares of land being covered over the next twenty years. Also each SVO will not have to hand-hold each of its 200 NGO partners at the same time. There will be a typical phasing out period of 5-7 years, after which the NGO will be on its own, and will, in turn, empower other agencies in its area of work.[13] This would be no mean achievement. Apart from its direct impact, such work once it reaches a critical mass, could have a major demonstration effect on government-run programmes as well.[14]

3.16 Training and Support

Most Common Practice

Among the biggest weaknesses of the watershed programme has been the very scant attention that has been paid to capacity building. In this context, the reduction in allocation for training in the Hariyali

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[13] *To give an indication of what has already been achieved, it may be mentioned that over the last 8 years, one of the 7 national SVOs, Samaj Pragati Sahayog has identified and empowered 122 partners who have begun work on 1 million acres in their watersheds.*

[14] *This is how we must visualise the NGO effort -- not as a substitute for government initiative but as a stimulus for improving its quality.*

Guidelines was an extremely unfortunate step. The sad thing, however, is that even when the allocation was 5% of the total project cost, very rarely was this money utilised in a meaningful manner for capacity building. A review of training institutions all over India shows that the training input has suffered from the following deficiencies:

- Training is conducted at locations completely cut off from the context where it is to be applied ("at-a-distance/remote-control training/orientation courses" kind of approach). Training is provided in institutes based in locations far removed from the ground realities of the areas where its benefits are to be realised.
- These institutes are run by personnel who speak a language which is largely incomprehensible to the people and whose attitude is didactic rather than dialogic.
- A very serious lacuna has been the absence of any kind of follow-up to ensure that the benefits of training are materialised at the field-level for which it was meant.

Suggested Strategy

Training is a professional activity that must only be entrusted to institutions with a proved track record and qualified faculty. The Eswaran Committee Report (1997) provided a very useful list of criteria for selection of institutions for training in watershed development:

"i) Practical experiences in the implementation of watershed development project as a PIA

ii) Availability and access to faculty from relevant disciplines i.e., soil conservation water conservation and management, community organization, animal husbandry,
forestry, agriculture etc.,

iii) Capacity to use a mix of appropriate teaching and training technology and aids such as case studies, field visits, audio-visual aids, etc.,

iv) Reasonably good basic infrastructure including well equipped class rooms, furnished hostels, well-stocked library etc.,

v) Required to send faculty for updating the knowledge and skill at the National Level Institutions from time to time.

vi) Ability to provide post training follow up support to the trainees

vii) Linkages to with other Governmental and Non-Governmental organizations engaged in similar work, academic and research institutions

viii) To develop ability to handle gender issues involved in watershed development and management."

Institutions most effective in carrying out training in watershed programmes have the following features:

- Location at the grass-roots, where local communities have actively participated in implementing development programmes. This ensures hands-on, field-based training of partners by trainers who include local people who have themselves learnt by doing. This is probably the most effective context and method of teaching and learning
- A strenuous effort at demystification of expertise by a faculty which possesses the capability of communicating equally with scientists and the people, to harness and translate their respective insights into creative action in the field
- Continuous research and learning by the faculty itself to refresh its knowledge and understanding of the issues involved
- Development of a network of research institutions and

scientific laboratories that continuously services the training institute

- Beta-testing of these scientific inputs by the institute with communities in the field
- Providing feedback based on this testing to the scientific institutions
- Building a network of partners at the grassroots in the most backward and needy parts of country who learn and receive support from the training institute. This support is based on the protocols developed by the training institute through its own work and its interaction with local communities and the scientific institutions

The key elements here are

- the ability to demystify, communicate and empower. The biggest weakness of the watershed programme so far has been aspects such as participation, equity and transparency (as explained in earlier sections). None of these can be achieved without empowerment of a local cadre that can give leadership to the programme in the long-run. This has to be the basic mandate of training institutions.
- location at the grass-roots, where hands-on work has been done with local communities in watershed implementation
- continuous follow-up support being provided to those trained. Training is not to be seen as a one-off activity. A lot of training inputs in India have largely gone down the drain because there is no effective link to what follows in the field after training. There has to be regular field-support provided by the training institute to partners during the implementation phase. This support can gradually taper off as

the partner becomes capable of managing on its own.

- capacity to leverage partners, both to reinforce intellectual capacities and to build fruitful partnerships in the field with potential programme implementers at the grass-roots.

In a note on *Strengthening Training for Watershed Scheme of Ministry of Rural Development*, Anil Shah (1999) states "State Institutes of Rural Development are working for many years as state government's main instrument for imparting training to rural development functionaries. With some exceptions, most of them are weak in terms of infrastructure, leadership, faculty - number and quality as well continuity, relation with field activities and implementation, lack of focus and development of methodology for training and training material etc."

Among the existing training programmes, the one that comes closest to this ideal is the SVO programme (mentioned above) initiated by CAPART and now being adopted by a number of national and international agencies like the Ford Foundation, Sir Dorabji Tata Trust, Arghyam Trust and the American India Foundation..

The CAPART programme is, of course, a very small initiative. For it to be able cover the national watershed programme would need a major upscaling of the SVO concept. A major effort in this direction was initiated by the Ministry of Rural Development, GoI in 1999 through the formation of a *National Committee on Watershed Training*. The Committee was engaged in working out the precise modalities of extending CAPART's innovative SVO concept to the national watershed programme. The idea was that each state would have one or more (depending on training needs) SVOs who could help develop one or more Master Trainer Organisations (MTOs) at the district-level. MTOs would in turn take up the responsibility of training PIAs within the district. Each MTO could cater to the training and support requirements of about 5-10 new PIAs each year. These MTOs must have a proven record in terms of social mobilisation and technical competence. The intermediary rung of MTOs would ensure that training is achieved at the requisite scale without compromising on the uniform standards of performance within each state. In selection of master trainers, it was felt that preference should be given to NGOs. The selection of these NGOs would be based on an assessment of their capacities and capabilities. In cases where NGOs are not available, government personnel should be developed as master trainers.

These ideas must be carried forward so that a national initiative for training all levels/kinds of functionaries at different stages of the programme in specific subjects (already worked out in detail by the Eswaran Committee) can be carried out on a war-footing, so that the watershed programme can attain requisite quality within a reasonable time-frame.

3.17 Integrating tree crops and animal husbandry into rainfed farming systems

Most Common Practice

Ecological niches in rainfed areas tend to function at sub-optimal level because of many factors including the inability to sustain intensive management either agriculture, silviculture or animal husbandry or similar activities. Agro-forestry practices and utilisation are declining because they are often commercially unattractive, low productivity, low technology, finance not available, uncertainties and risks, poor market support (price, insurance, hedging, warehousing etc.).

There is need to synergise programmes and projects to build on forest/tree – livelihood linkage in rainfed, support existing village level institutions which link people and resources and develop new ones, build capacities across the board (implementing agencies, participating communities, social intermediaries), resource endowment based micro planning and developing forward linkages. Farmers can manage risks through multiple sources of income. In this context agro-forestry or forest-agriculture interface accommodates multiple combinations of crops and practices. Tree crops form appropriate land use choices, it is multi-disciplinary i.e. combine trees, agri crops, fruit trees, fisheries, live stock etc. These activities are traditional, socially acceptable, skills available and highly suitable for low input production. A combination of diverse products are supplied - food, fuel, forage, fruit, fibre, timber, NTFPs etc. and accommodate diverse patterns, practices and combinations (taungya, homegardens, shelter belt). Tree crops are critical for agriculture in rain fed areas – nutrient and moisture from forests to agri fields, soil protection, flood/run-off control, pest control, goods and services provided to dependent communities, provide livelihood options to the most deprived besides ecological benefits(local and global) etc.. Present policies seldom capture these intricate linkages tree crops have in rainfed systems.

Suggested Strategy

A preliminary mapping of species at the agro-climatic level is indicated in Annex 1.Rainfed areas can be both relatively high or low rainfall areas. The two need different approaches: in both the integration of agriculture with tree crops, animal husbandry and value adding market oriented activities is necessary. Such integration is integral to the emergence of sustainable incomes albeit in different ways.

A large part of rainfed or unirrigated agriculture is characterised by low and uncertain rainfall , low wages and high poverty. Strategies of watershed development are prompted by the need to protect inhabitants from acute distress caused by recurring drought. It is necessary to distinguish between

- interventions of a generic nature such as rainfall or weather insurance, input supply, value addition of crops, credit and market linkages etc. which protect vulnerable populations from weather related fluctuations in income,
- integration of 'on-farm' and 'non-farm' activities which increase these incomes, especially as increasing pressures develop on the natural resource base.
- 'Non-farm' activities can provide an outlet for surplus labour and contribute to the attainment of sustainable livelihoods. In many areas, particularly where agricultural activities are seasonal in nature, farmers have always recognized the complementarities between farm and non-farm activities, through emphasizing on the latter particularly during slack periods in the agricultural cycle Many of these jobs are in the non-formal sector and involve micro-enterprises which is also an area that needs much greater emphasis than it has to date. Thus, there is need for integrating on-farm with non-farm activities within the overall framework of poverty alleviation. Studies at the grassroots have confirmed that wage based employment avenues dovetailed with natural resource management strengthens both

While this has now been emphasised for some time, the essential steps forward in designing a strategy must outline:

1. The steps necessary **at the national level** to create mechanisms which ensure multiple pathways for ensuring such an integration
2. The steps in the planning mechanism **at the local and sub-regional levels** to help encourage value adding micro enterprises, linking to national markets, while at the same time creating appropriate mechanisms for more symetrical distribution of information and bargaining power.

Generic Interventions

Recording of Land use and rights(both ownership and user rights) to land and its output in rainfed areas As linkages between the farm and non-farm sector increase, transactions in land and its produce will become quantitatively larger and qualitatively important. A basic prerequisites for such transactions is the existence of records with respect to land, both ownership and user rights. This is all the more important in rainfed areas where large tracts of land are under informal traditional and community rights and can easily be looked at as not having any ownership rights at all. User Rights on land are incompletely recorded in India. The best records for all kinds of user rights are still from the 19^{th}-early twentieth century records. *Such recording of rights is a precondition for the setting up and evolution of new institutions linking farmers with the market economy which act as pathways out of poverty.* The government, under the aegis of the National Rainfed Areas Authority needs to take an initiative on this . Such a recording of rights is critical in determining who the stakeholders/actors in any integrated strategies for tree crops, animal husbandry and forest management and what policy will impact the decision making by them.

The above includes the securing of forest resource tenure and management rights for communities, while respecting historical tribal rights over forest resources.

***Weather Insurance** is an insurance cover against crop losses incurred due to unfavourable weather conditions such as deficit/excess/untimely rainfall, variations in temperature, etc.* Weather insurance product is designed on the basis of location's agricultural and climatic properties and productivity levels over the last several years. It also provides the background information on the extent of vulnerability of agriculture to weather, the measures taken to deal with it and hence the significant of non annual crop activities such as trees and animal husbandry in livelihoods.

It is different from crop insurance schemes which are of the multi-peril insurance type. Crop insurance provides coverage against most of the exogenous losses that occur during the production stage. However the scheme is marred by several shortcomings like its supply-driven nature, non-transparent loss assessments, long settlement periods, forced enrollments etc.Against this backdrop, weather insurance provides a good alternative to farmers for mitigating their production-related losses. A comparison of traditional crop insurance and weather insurance on some key aspects is illustrated in the following table.

Traditional Crop Insurance versus Weather Insurance

Traditional Crop Insurance	Weather Insurance
Coverage is effective largely for extreme loss situations – e.g. droughts and floods	Coverage for deviation in weather parameters from their optimum values
Claim settlement basis is non-transparent	Calculation of weather index is transparent and objective

Large delays in claim settlements	Claim settlements are quick and easy
High administration costs	Low administration costs

New formats for insurance which cover high risk rainfed areas shall need to be evolved. Weather insurance shall also have to be designed to take into account variations in rainfall in critical growth or other periods. This shall be possible since data on rainfall is easily available.

Assessment of Pilot Weather Insurance:
The weather insurance product was first piloted in Mahboobnagar and Anantapur districts of Andhra Pradesh in 2003 and again in 2004 with the help of BASIX. In 2003, the weather insurance was sold to 230 small, medium and large farmers (154 groundnut farmers and 76 castor farmers), mostly the members of borewell users associations and covering 450 acres of sown land. In 2003, farmers were still indemnified due to delay in rainfall that affected the time of sowing despite being normal rainfall levels in Mahboobnagar.In 2004, the insurance was sold to 427 farmers covering 670 acres of crop and insuring a total sum of around Rs. 4,020,000. In 2004, all 305 reported claims were settled with Rs. 4.5 lakhs. The claim settlement was done within 15 days of completion of the policy period in contrast to the long settlement period of 12-18 months for the conventional Crop Insurance.

Knowledge collation and dissemination *through use of IT through e-chaupals and the like.* The National Rainfed Areas Authority can play a stellar role in partnership with the private sector initiatives of ITC and others.Some benefits of the private sector e-chaupals have been that they

- reduce exploitation by mandi

- Introduce new technology in remote areas
- create access to updated information,
- encourage capacity building of village entrepreneurs

However, this is a limited experiment with limitations too, some of which are:

- Region selection based on crops relevant to the private sector
- The poor are often left out
- the information content and coverage is limited No monopolisation of purchase is envisaged. In fact, information dissemination will ensure that this does not happen.

Principles for Integration of Tree Crops

The cultivation of tree crops could be undertaken by individuals on their private land. This is farm forestry and has typically been undertaken by commercially oriented farmers when it is seen as a more profitable activity than agriculture. Studies undertaken illustrate that this option can be supported by appropriate policies such as:

- Removal of legal and procedural bottlenecks, for instance treating some kinds of species (such as subabul, casurina as ' agricultural produce') and abolishing sale and purchase tax in case of purchase of wood by paper mills from farmers through ' agricultural marketing committees' (as in Andhra Pradesh)
- Removing restrictive legal provisions such as the one that private land planted with trees can be declared a forest. This implies that the private owner stands the risk of losing control over his land if it is "notified" by the Forest department.
- India relaxed tariffs on the import of wood,pulp, and other intermediary products in the late 1980s. Further increase in domestic demand was then met largely through

imports.Thus,India allowed lower tariffs on forest products well before it began liberalizing its economy in the 1990s. this opportunity to turn to external sources was a disincentive for investment in trees. In the promotion of farm forestry, the paper and pulp industry was expected to be the major market for light timber produced from private lands. However, since industry had the option to import raw wood products, the price that it offered to farmers was extremely low.(India-Alleviating Poverty through Forest Development by Alagh et al,World Bank 2000)) Therefore,reduction or stoppage of raw material supplies to wood based industries from forests and cheap imports becomes necessary.

- Encouraging the formation of ‘ producer companies’ for growing trees as by the promulgation of the Producer Company Act.
  - Research and Development efforts by the private companies and by government in developing suitable clones of tree species
  - Ensuring a minimum price to the farmer
  - At the same time environmental externalities of some tree crops need to be taken account of.

Tree crops may also be grown by Joint Forest Management Committes and other groups as part of a scheme of management of common land, pooled private land or village panchayat land. In such cases, strategies to be integrated with rural livelihood needs. The following suggestions based on studies carried out in different agro-climatic zones provide clues, though finally, the decision shall have to be region specific:

- A three tier system of tree planting with different gestation periods to account for needs for short term and long term consumption and income needs is more likely to succeed (as in Chakriya Vikas Pranali in Jharkhand)

- A commonly agreed distribution mechanism for different stakeholders needs to be in place.The forest department is not envisaged to have a share in land
- Linkages with markets and opportunities for value addition through processing need to be developed as planning and implementation proceed

Principles for Diversification into Animal Husbandry

Livestock plays a crucial role in the farming system, particularly in the rainfed areas. It provides an important subsidiary occupation by diversifying the income source as well as provides drought proofing. Animal husbandry should be given a central place in rainfed areas. Elements of the strategy are given below:-

- ❖ Greater thrust is required on promotion of animal husbandry using ruminants. Ruminants help to covert non-human feed resources and roughage into products for human consumption.
- ❖ Thrust needs to be given both on large ruminants (dairy husbandry) as well as small ruminants particularly goat keeping). Typically in areas having rainfall greater than 600 mm, dairy husbandry through large ruminants should be promoted. *Typically, it is experienced that one cross-bred cow can generate self employment up to about 120 person-days per year*.
- ❖ In tracts having indigenous dairy / dual – purpose breeds, these may be promoted as a starting stock.
- ❖ Promotion of dairy husbandry should be carried out using artificial insemination through frozen semen technology. Quality

assurance to ensure use of pathogen-free semen from high quality bulls needs to be ensured.

- Farmers should have the choice of breeding with pure indigenous dairy breeds or through cross breeding. (in dryland areas cross breeding can have only limited applicability . Fodder and water requirements need to be kept in mind
- Poultry keeping being a high through-put activity, consuming primarily grain required for human consumption, should be taken up only as a backyard activity in rainfed areas.

The above strategies can be operationalized by introducing the following program components in rainfed areas :

- Livestock Breeding Centers for dairy animals to be promoted as a development infrastructure. To make them cost-effective, services should be mobile (home delivered) with each Centre covering 15-20 villages.
- Rainfed areas require a special 'fodder and feed augmentation program' covering plantation of fodder trees and grasses; promotion of dual-purpose crops (fodder + human food); and establishment of nurseries for making available the above planting material in adequate numbers.
- Special programs are required to promote silvipasture on common lands and Van-Panchayat lands, as well as dovetailing with JFM and watershed development.
- Infrastructure development program to be taken up in the form of Livestock Breeding Centers, establishment of Milk Routes and Milk Handling Facilities.

Goat Development Program to be introduced through 4-fold interventions (superior breeding bucks; improved management practices; primary health care through trained paravets; market awareness).

3.17 Forestry in Rainfed Areas

The Forest Scenario

The convergence of a variety of ecological, economic and social factors makes rainfed systems unique and rather sensitive. If one overlays the maps of drought prone districts, most backward districts and disturbed areas in the country they invariably coincide with the forest map of the country. Forests/tree crops therefore form an important element in the rainfed areas and need to be factored in. It is more so, given the critical issue of watershed protection in the ridges.

The mandate under the National Forest Policy, 1988 is to achieve one-third of the land area of the country under forest or tree cover overall, and two-thirds in the hills and mountainous regions for ensuring the enhanced availability of environmental services, including surface and ground water, soil conservation, biodiversity conservation, maintaining wildlife habitat, besides providing for the livelihoods to the forest dependant communities. In order to fulfil the above goal, the Planning Commission, in the Tenth Five Year Plan document, has set monitorable targets of achieving one-fourth forest and tree cover by 2007, and the one-third cover by 2012.The forests and tree cover (FTC) of the country as reported in the State of Forest Report, 2003 published by the Forest Survey of India was 23.68% of the geographical area of the country, comprising of 20.64% forest cover and 3.04% tree cover. Thus, in addition to maintaining the existing 23.68% forest and tree cover the principal task would be to raise additional 1.32% forest and tree cover by 2007, and another 8%

between 2007 and 2012. In terms of land area, these targets translate into increasing forest and tree cover by 4.36 million ha by 2007 and by another 27.10 million ha between 2007 and 2012. That is, a total of additional 31.46 million ha forest and tree cover is required to be raised by 2012

As per the State of Forest Report, 2003, the details of estimated Forest Cover and Recorded Forest Area (RFA) are as follows:

Sl. no.	**Particulars**	**Area in Million Ha**
1	Recorded Forest Area (RFA)	77.47
2	Total Forest Cover	67.83
3	Forest Cover (blocks of>1 ha) Outside RFA	11.26
4	Forest Cover Inside RFA (2-3)	56.57
5	Area Not Under Forest Cover Inside RFA (1-4)	20.90
6	Approximate area not available within RFA for planting (snow, wetlands, rocky areas, river & riverbeds, desert, scrub climax, etc.)	15.90
7	Approximate area in RFA for additional forestation (5-6)	5.00

Source: *State of Forest Report, 2003*

Of the total 31.46 million ha required for forestation by 2012, only about 5.0 million ha is expected to be available in the RFA. Accordingly 26.46 million ha, has to be raised on lands outside. The

Wastelands Atlas of India, 2003 prepared by the National Remote Sensing Agency, estimates about 55.27 million ha of wastelands in the country. Tree planting on wastelands is one of the most effective methods for restoration of land quality and ecological functions and realizing tangible economic benefits, including employment generation. Forestation on some acreage of agricultural lands by farmers may be a rational economic choice by them in order to diversify yield and price risks, to match income flows with episodic needs (e.g. education/marriage of children, house building, provision for old age), and for provision of fuelwood, fodder, fruits, and small timber for own use. The areas outside RFA that would need to be brought under tree cover will include both private as well as public lands. Accordingly, promotion of farm forestry and agro-forestry must be given high priority.

Suggested Strategy for Increasing Forest and Tree Cover

Rational choice of farmers is currently stymied by policy and regulatory measures, which result in disincentives. The current legal provisions impose restrictions on harvesting, storage, transport. and trade of forest and plantation products. The restrictions are imposed on the belief that there is a danger that illegal fellings from notified forests would be passed off as plantation products, leading to increase in illicit fellings. This requirement, however, imposes an unacceptable regulatory risk to the landowner and investor, and accordingly, the actual level of forestation is inefficient in economic terms. Over the years the indiscriminate enforcement of rigorous rules under these provisions, without consideration of whether the produce emanates from public forest lands, or other public lands, or private lands, and irrespective of the conservation status of the concerned forest species, has acted as a major disincentive to promoting forestry. The Ministry of Environment and Forests has, accordingly, issued Guidelines to the State Governments/Union Territories Administrations for rationalizing felling and transit regulations for tree species grown on non-forest private lands on 15 December 2004. Most of the states have not undertaken the desired rationalization. Further initiative in this regard lies with the respective State Governments.

With limited scope for increased direct funding by the Government, the Ministry of E&F has mooted an innovative proposal - *Multi-Stakeholder Partnership (MSP)* framework - to encourage private investment and community participation in forestation and tree planting on degraded forest lands, wastelands, and other public lands. Presently, there is no clear policy to enable anyone other than the Government, to undertake tree planting on such lands.The proposed MSP framework will enable forestation activities through a legally enforceable Memorandum of Understanding (MoU) between the partners (land owning agency, the local community [represented by the JFMC where they exist, in case of forest land, and the Village Panchayat(s) in case of other public lands], the forest department, and the investing entity setting forth the entitlements and obligations of each partner. The Sponsor may be a company, firm, user group, Trust, Society or organisation – public or private – competent to enter into a contract. The Sponsor will be selected through a transparent bidding process.

As noted by the National Advisory Council (NAC) the focus on farm forestry has been diluted since the early 1990s, notwithstanding its enormous potential, particularly in agriculturally backward areas like rainfed areas. There have been suggestions to assign the subject to a specific Ministry or Department of the GoI with measurable targets and designing and implementing special programmes for farm-forestry under MoEF.

The ecological services provided by forests and tree cover accrue as public goods to society, for which the land owners receive no compensation. In contrast, imported timbers/forest produce may receive such compensation in their countries of origin, through the application of WTO compatible “Green Box” subsidies by the respective Governments. Accordingly, the level of investment in forestry on private lands may be less than would be economically efficient. Enhanced import tariffs (within the WTO bound rates) may be levied for imported timbers/forest produce, to offset the “Green Box” subsidies that may be received by the foreign producers. Further, to resist demands for reduction in bound tariffs of timber and forest produce so long as “Green Box” subsidies are permitted in the relevant WTO agreements. The NAC in its note on Regeneration of Wastelands and the Planning Commission in its comments thereupon, have recommended the imposition of higher import tariff on pulp and other timber products, as well as relaxation of restrictions on export of forestry products, so that market access is available to the farmers to realise the best possible returns on their products, e.g. eucalypts and poplars in North and North-Western India and bamboos in the North-East. It also makes out a case for fiscal incentives to industries which promote trees on farm lands.

The price-risk faced by farm forestry is over a much longer duration than for seasonal agricultural crops, although the yield risk over the forestation cycle may be less than for single crop seasons. Direct and indirect price-supports reduce price-risk. While it could be difficult unrealistic to extend the price-support mechanism to farm forestry, a measure of reduction of price-risk may be realized through formation of Futures Markets in farm forestry products

Another major disincentive by way of yield risk faced by farm forestry is non-availability of insurance cover as applicable to agricultural crops. It is likely that forestry operations present less of an informational asymmetry between the farmer and the insurer than agricultural cropping, since loss of trees through adverse weather or other hazards is more easily verifiable, There is, thus, no reason to deny insurance cover to farm forestry. It is, accordingly necessary to ensure that farm forestry is eligible for insurance on the same basis as cropping.

Forestry R & D is still backward compared to the Agriculture. The current level of productivity of plantations is very low and there is enormous potential to increase it manifold drawing from the advances made in other sectors. Setting up of clonal nurseries, high input nurseries, focused tree improvement programmes and ensuring supply of high quality planting material for timber and non-timber species across the board will have tremendous impact on the wood balance scenario of the country.

There seems to be an urgent need to carry out of more research at the micro-level, so that suitable planting materials for different areas could be identified and extension services made available to the owners of private wastelands. Such research support may be provided by institutions such as Arid Forestry Research Institute (AFRI) and Central Arid Zone Research Institute (CAZRI) for development of silvicultural packages for different agro-climatic areas suitable for implementation by farmers. This need to be dovetailed with a well-structured extension programme for new technologies related to tree planting on farm lands based on the concepts of “Demonstration Centres” and “Farmer Field Schools” and implemented by the Indian Council of Forestry Research and Education (ICFRE) in collaboration with the State Forest Departments and the Indian Council for Agriculture Research (ICAR). In addition, the Krishi Vigyan Kendra (KVKs) managed by the State/UT Agriculture Departments may also provide extension services to farmers for Tree Planting on Farm Lands (TPFL). The ICFRE could be the national level nodal agency for collation of information on newly developed techniques and protocols and be responsible for forwarding the information to the State Forest and Agriculture Departments and KVKs.

"Forest Produce" may be notified as "Agricultural Crop" for priority sector lending by Banks and other Financial Institutions, classification of tariff category for electricity for irrigation,classification for purposes of Direct and Indirect taxes at Central, State, and Local levels,insurance cover under the National Agriculture Insurance Scheme or similar schemes

Lack of high quality planting material in the rural areas is a serious impediment to Tree Planting on Farm Lands (TPFL), as the returns are low, and uncertain, when common or sub-standard planting material is used. The Ministry of Environment & Forests launched a new scheme, "Grants-in-Aid for Greening India," during 2005-06 for supporting the establishment of High-Tech Nursery and Satellite Nurseries on a limited scale. While the High-Tech Nurseries may be managed by the State Forest Departments, the Satellite Nurseries, which directly cater to the demands of private and other tree growers, may be established and operated by private organizations, or individuals, or Eco-Task Forces comprising ex-servicemen, or local bodies, including Cantonment Boards, or committed and dedicated work force of organizations such as the National Social Service or National Cadet Corps, linked to the High-Tech Nurseries. In due course the private nurseries may operate on their own without linkage to Government nurseries, although a national system of accreditation/certification of such nurseries will have to be in place to ensure quality.

The decentralized forest management institutions, i.e. Forest Development Agencies (FDAs) at the Forest Division level are legal entities registered under the Societies Registration Act, and are allowed to receive grant funds from different sources and spend the same as per their own micro-plans at the village level (i.e. Joint Forest Management Committee, JFMC), the returns from management of JFMC forests being shared by the members. Exclusive dependence on grant funds has, however, resulted in the FDA/JFMC arrangements being unable to realize their full potential. They are also unable to access competent technical and managerial expertise, owing to their limited scale of operations. Both constraints may be significantly eased if FDAs are allowed to sponsor “for profit” entities to be registered under the Companies Act, with shareholding comprising the members of the constituent JFMCs. This would enable the FDAs to access institutional finance, and accordingly scale up their operations. The increased scale would also enable them to access competent technical and managerial expertise.

The challenging forestation and tree planting goals for 2012 cannot be achieved without mass mobilization. A mass awareness campaign, similar to those of Pulse Polio and *Sarva Shiksha Abhiyan*, would also be required in this case. Both the public mass media and private sector communications and media organisations should be involved to tap the expertise available in the country.

Certification of tree products that they are sustainably harvested, and in respect of their quality, would enable tree products to access and command a price premium, especially in export markets. They may also displace products of illegal felling, or otherwise unsustainable harvesting. The overall effect would be to enhance incentives for forestation and tree planting. The Ministry of Environment and Forests has constituted a National Working Group to frame guidelines on Forest Certification for timber and non-timber forest products (NTFPs) through the concept of certification criteria,

certification process, and accreditation criteria and processes. Once the guidelines are developed, a suitable scheme may be framed for its implementation in the country. Certification of forest products will also go hand-in-hand with development of Criteria and Indicators (CIs) for sustainable forest management (SFM) based on forest types, and incorporation of those CIs in the National Forest Working Plan Code.

New Integrated, Unified Approach

In light of the experiences that the area development programmes have had and the learnings that have been enunciated above, it is quite clear that a set of common guidelines needs to be formulated which will cut across departments and ministries and provide a holistic, integrated vision to the watershed-based approach to rural development. It will be recalled in this regard that the first set of guidelines was prepared in 1995 by the Hanumantha Rao Committee. Thereafter, a revised set of guidelines was issued by the Ministry of Rural Development in 2001 and finally the Hariyali Guidelines came into force from 1st April 2003.l

The Ministry of Agriculture had issued its own guidelines for watershed development projects “WARASA – JAN SAHBHAGITA” in 2000. The Ministry of Environment & Forests also has its own set of

Guidelines for regeneration and eco-developed and degraded forests and adjoining areas on a watershed basis. These guidelines were issued in May 2002. It would thus be seen that there are a multiplicity of guidelines and ministries have been working disjointedly with different parameters, different cost norms and diverse approach.

It is now desirable particularly after the setting up of the National Rainfed Area Authority to provide an integrated and unified approach that will ensure coordination between initiatives and will synergise the activities of the various departments and ministries of the Government of India.

For the Ministry of Rural Development, a new vision has been conceived of in order to bring about broad-based conceptualization and integration of the area development programmes. Such an integration among the programmes of the IWDP, DPAP and DDP will provide for strong synergy and convergence and will enable integrated planning, sustainable outcomes. The three programmes will now be coordinated into a single programme which will run on a national programme mode and will be implemented by dedicated agencies which will be operational at national, state and district levels. The new approach would have the following salient features.

Livelihood Orientation

- The livelihoods perspective is to be incorporated at the planning stage itself rather than as an add-on after the physical works have been completed. Resource development and usage will be planned to promote farming and allied activities to promote local livelihoods while ensuring resource conservation and regeneration. The new approach would systematically integrate livestock management as a central intervention and encourage dairying and marketing of dairy products. In the rain fed areas, the animal resources become a major source of income for the people. When effectively integrated with the IWMP, a comprehensive animal husbandry component would contribute significantly to ensuring a better and sustainable livelihood for the people of the rain fed areas.

Three Tier Approach

There would be a three-tier approach, which would be adopted towards the implementation of the Integrated Watershed Management Programme. The higher reaches or the forests are actually where the water sources start. Today, in our programme, we do not have a very focused approach to treating this area. Whatever we do at the intermediate or the lower level, if the forest area is not treated, surface soil runoff will be there and protecting the intermediate and the lower layers will be difficult. The approach, therefore, will be to identify an area, and first look at the forest and the hilly regions, which are in the upper reaches, and also where the source of the water exists. When suitable treatment is undertaken, with the support of the Ministry of Environment and Forest, or from the States' forest programmes and to a limited extent from the side of the MoRD, then the hardest part of the watershed is tackled. Under the forest laws, there is no difficulty in this approach since the forest department is managing structures such as check dams, contour-bunds etc. to arrest the erosion and degradation of the forests, which in turn, actually benefit the lower two-tiers. Thus, in the upper reaches, which are mostly hilly and forested, the onus of implementation would lie with the Forest Departments and the Joint Forest Management Committees (JFMC).

The second tier is the intermediate tier or the slopes, which are just above the agricultural lands. Some of these are being used for rain fed agriculture and for non-cereal crops and plantations and similar activities. In the intermediate slopes, the Integrated Watershed Management Programme would address all the necessary issues by looking at all the best possible options including treatment, cropping pattern, horticulture, agro-forestry etc.

As to the third level of the plains and the flat areas, where typically, the farmers are operating, there would be a large concentration of labour intensive works, The IWMP would be dovetailed with the employment generating programmes such as the National Rural Employment Guarantee Scheme (NREGS), Sampoorna Grameen Rojgar Yojana (SGRY) etc. thus providing strong convergence.

Cluster Approach

- At present, the conventional concept of geo-hydrological boundaries of a micro-watershed is being followed in watershed planning. The concept of developing a fixed area of 500 ha under a specific project excludes many important areas within the watershed from treatment. Particularly, the areas situated at the higher reaches and forestlands are ignored while prioritizing the treatment plan through participatory rural appraisal techniques. As a result, the task of full treatment of the watershed remains unaccomplished and whatever treatments are taken up, their sustainability remains threatened. The approach of 500-hectare projects is also not viable for agricultural production and market linkages and also not conducive for efficient management, planning etc. due to a multiplicity of small size projects. The new approach envisages a broader vision of natural hydro-geographical units of average size of 4,000 to 10,000 hectares comprising of clusters of micro-watersheds.

Scientific Planning

- Currently, the area development programmes suffer from the serious lacuna of the absence of detailed scientific planning. There has hardly been any attempt to harness available technologies or to coordinate with organizations such as National Remote Sensing Agency (NRSA). The new approach will look at the incorporation of scientific planning methodologies.
- GIS based data regarding watershed programmes would be consolidated at different levels and placed in the public domain.
- Remote sensing inputs with a judicious mix of Geographical Information System (GIS) and Global Positioning System (GPS) would help in resource characterization, prioritization of areas for treatment, detailed project and regional planning, preparation of DPRs, and monitoring of targets and outcomes.

- An MIS with GIS web based application for online monitoring as a part of National Database (National Programme for Comprehensive Land Resource Management, NPCLRM) would be used as a tool for planning and monitoring from National level down to district/micro-watershed level. The MIS will include GIS layers on disaggregated wasteland data along with demographic details including poverty mapping, tribal areas, drought prone areas, dark zones with acute drinking water scarcity and clearly defined bench marks indicating type of structures created, extent of land treatment, increase in water table and other parameters as outcomes of different schemes being implemented.

Convergence and Synergy

- Activities undertaken in the Watershed Development Programmes for soil and water conservation pertain to wage employment. Thus, implementation of these activities will be converged with NREGS and SGRY (so long as it is operational) for wage employment purposes for sustainable livelihood opportunities. Shelves of projects related to water conservation, plantation and afforestation, renovation of existing traditional structures of water sources, soil conservation and structures dealing with drought under NREGP at district level will be appropriately linked to Watershed Development Work Plans at Block level for convergence in planning. At the implementation level, Watershed Development Teams (WDT) would be properly trained for identification of resources and scientific analysis for implementation of Watershed Development Programmes in convergence with NREG activities. Community organisation at panchayat level through proper training modules will be ensured for true convergence in implementation. The creation of opportunities for sustainable livelihood in the villages in this manner will help in reducing out-migration.

- The IWMP will also be closely linked to the related initiatives of other Ministries and Departments such as the National Horticulture Mission, National Bamboo Mission etc.

Institutional Framework

- The lack of dedicated institutional structures and adequate professional support has been a major weakness in the implementation of the area development programmes. It is, therefore, proposed to bring in suitable institutional mechanisms, which will ensure both professional support and dedicated implementation agencies at the national, state and district level.
- At the national level, there will be a dedicated agency with a technical Secretariat which will be called the **National Watershed Management Agency** (NWMA). This will be a professional and output-oriented agency with autonomy and functional freedom which will be responsible for managing the watershed programme.
- At the State level there will be a State Watershed Management Agency with requisite professional support.
- At the District level, there will be a dedicated team which will be fully involved with the implementation of the programme from start to finish. They will provide technical as well as administrative inputs and will ensure high levels of quality with respect to the deliverables.

Delegation

- The State Level Agency would be empowered to scrutinize and sanction projects within the State. A representative of the MoRD will be a member of this Committee. The day-to-day management will be done by the State Level Agency with district level interaction.

Cost Norms

- In line with the considered suggestion of the Parthasarathy Committee, the Department would make a suitable recommendation for enhancement of the cost norms.

Capacity Building

- Capacity building has been identified as a key area of weakness of watershed programmes so far. Capacity building is a crucial component for achieving the desired result of livelihood enhancement through natural resource management. This is a continuous process that enables functionaries to enhance their knowledge, skills and attitudes, thereby becoming more effective in performing their roles and responsibilities. Each State will have an Annual Training Plan to be approved and monitored by the SWMA. Similarly, each DWMC will prepare a training plan for the district which will incorporate the training plan prepared by each PIA for capacity building of the various functionaries at the watershed level. These plans will be regularly monitored and reviewed at the state and district level.
- The IWMP functionaries and stake holders will be trained at all levels starting from State level, district level to the Project level.
- Capacity Building and training for all the stakeholders would be carried out on war footing for executing the watershed programmes with requisite professionalism and competence.

Evaluation

- There will be both a concurrent evaluation as well as a post project evaluation for every project.
- Each evaluation will include physical, financial and social audit of the work done.
- A separate set of Guidelines for Monitoring and Evaluation will be finalized and issued.

Role of PRIs

- A key role would be given to the Panchayati Raj Institutions (PRIs) at the Gram Panchayat, intermediate panchayat and Distt. Parishad levels. They would have full responsibility to oversee implementation of the programmes and they would provide all governance and administrative support.

Role of NGOs

- The role of NGOs would be recognized for creation of awareness, social mobilization and capacity building.

Common Guidelines

- In coordination with the Planning Commission and within the context of the Parthasarthy Committee Report, an initiative has been taken by the Ministry of Rural Development to formulate common guidelines to be applicable for all Ministries implementing the watershed programme for enabling different implementing agencies to have a **common unified perspective**.

This Working Group fully endorses this initiative of the Ministry of Rural Development and strongly recommends that the Common Guidelines be prepared as early as possible. Once the Guidelines have been formalized, they may be placed before the National Rainfed Area Authority so that they receive endorsement at a higher policy level and are then fully adopted by all implementing ministries/ departments and agencies.

Annex

Forest Class & Composition by Agro-Climatic Region

AC Region	Areas Covered	Forest Classes	Floristic Composition
1.Western Himalayan Region	J&K, HP, West UP	Mountain forest Monsoon temperate	Silver Fir, Deodhar, Blue Pine, Chir, Spruce, Indian Birch, Cyprus, Oak, Laurel, Mapels, Masnolia
2.Eastern Himalayan Region	Assam, Meghalaya, Sikkim, W. Bengal, Manipur, Nagaland, Tripura, Arunachal Pradesh, Mizoram	Mountain forest Tropical Evergreen Sub-tropical moist deciduous	Sal, Bamboo, Tall grass, Ebony, Teak, Mahoganj, Rosewood, Shishoo, Chaples, Bamboo, Anjan, Jarool
3.Lower Gangetic Plains	Bengal except Purulia, Darjeeling and Dinajpur	Sub-tropical moist deciduous Littoral & Swamp forest	Sal, Mangrove, Teak, Jarod, Khair, Mahua, Laurel Bamboo, Casaurina, Sundri, Pursur
4. Middle Gangetic Plains	Bihar plains & Eastern UP	Sub-tropical dry deciduous Sub-tropical moist deciduous	Babul, Tamarind, Bamboo, Mahua, Teak, Sal, Anjan, Jarod, Shishoo
5.Upper Gangetic Plains	Central UP, N. West UP plains & S. West UP plains	Sub-tropical dry deciduous	Sal, Teak, Shishoo, Chaplas, Babul, Tamarind
6. Trans Gangetic Plains	Punjab, Haryana, Delhi, Chandigarh, Ganganagar of Rajasthan	Sub-tropical dry deciduous	Accacia, Babul, Tamarind
7. Eastern Plateau & Hills	South Bihar, Interior Orissa, Eastern UP, E. Maharashtra and Purulia (WB	Sub-tropical moist deciduous	Bamboo, fodder, grasses, Timber, gum, lac
8.Central Plateau	Southern UP, MP, E. Rajasthan	Sub-tropical dry deciduous Tropical thorn	Tender, Mohua, gum, Teak, Lacquer, Chiranji, Aonla

9.Western Plateau	Interior Maharashtra, W.MP, one dist. of Rajasthan	Tropical thorn Sub-tropical dry deciduous Sub-tropical moist deciduous Tropical Evergreen	Teak, Shisham, Semal, Haldu, Babul, Salai, Shiwan
10.Southern Plateau	Interior Maharashtra, W.MP, one dist. Of Rajasthan	Tropical thorn Sub-tropical dry deciduous Sub-tropical moist deciduous Tropical Evergreen	Teak, Shisham, Semal, Haldu, Babul, Salai, Shiwan
11.East Coast Plains and Hills	Int. Karnataka TN, AP	Tropical thorn Sub-tropical dry deciduous	Timber, Eucalyptus, Sandalwood
12.West Coast Plains and Hills	Coastal Maharashtra Karnataka, Kerala & Goa	Sub-tropical moist deciduous Tropical Evergreen	Bamboo, Sandalwood, Neem, Teak, Sal, Shishoo Palms, Ebony, Mahoganj
13.Gujarat Region	Gujarat	Tropical thorn Littoral and Swamp forest Sub-tropical dry deciduous	Bamboo, Mahua, Neem, Babul, Accacia, Palms, Cactil, Tamrind
14.Western Dry lands	W. Rajasthan	Hot. Desert Tropical thorn forest	Gum, Anwal Grasses, Cactil

Source: Agro Climatic Regional Planning Unit**, Forestry in India**: Which Way Nov Ahmedabad, ARPU, 1991

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CHAPTER - IV

ROLE OF PANCHAYATI RAJ INSTITUTIONS IN RAINFED AREA DEVELOPMENT

TOR 1: An analysis of the major strengths of Panchayati Raj Institutions in Rainfed Areas Development.

1.1. The 73rd Constitutional Amendment Act 1993 gave constitutional status to Panchayats at the District, Intermediate and Village levels, through the insertion of Part IX in the Constitution. In the thirteen years following the enactment of the Amendment, in nearly all States and Union Territories to which Part IX of the Constitution applies except Jharkhand, two rounds of elections have been completed and in several of them, three. Today, more than 27 lakh representatives stand elected to the three levels of Panchayats, of whom more than 37.5 percent are women, 16 percent belong to Scheduled Castes and 11 percent to the Scheduled Tribes. The Panchayats today provide a diverse, widespread and strong political foundation for inclusive and participative growth.

1.2. Provisions of the Constitution relating to functional allocation to Panchayats:

Under Chapter IX of the Constitution of India, every State shall create elected Panchayats at the district, intermediate and village levels. Article 243G states that

"Subject to the provisions of this Constitution, the Legislature of a State may, by law, endow the Panchayats with such powers and authority as may be necessary to enable them to function as

institutions of self-government and such law may contain provisions for the devolution of powers and responsibilities upon Panchayats at the appropriate level, subject to such conditions as may be specified therein, with respect to-

> *(a) the preparation of plans for economic development and social justice;*
>
> *(b) the implementation of schemes for economic development and social justice as may be entrusted to them including those in relation to the matters listed in the Eleventh Schedule."*

The Eleventh Schedule of the Constitution, states out 29 functions that may be assigned to the Panchayats. Of the first 12 listed, 10 relate to the Primary sector of agricultural production or to downstream activities that are closely related. These relevant items are as follows.

1. Agriculture, including agricultural extension.
2. Land improvement, implementation of land reforms, land consolidation and soil conservation.
3. Minor irrigation, water management and watershed development.
4. Animal husbandry, dairying and poultry.
5. Fisheries.
6. Social forestry and farm forestry.
7. Minor forest produce.
8. Small scale industries, including food-processing industries.
9. Khadi, village and cottage industries.

12. Fuel and fodder.

All the above functions have great relevance to rainfed farming. .In several states, these functions have already been assigned through state legislations to the various levels of Panchayats. Such legislative assignment of functions to Panchayats will need to be respected by any planning strategy for rainfed areas.

1.3. The timing of the Eleventh Plan comes at a critical juncture – it coincides with the thrust on second-generation reforms in Panchayati Raj, aimed to close the gap between the constitutional mandate and effective functional transfer to Panchayats. Operationally, these reforms would focus on building mechanisms for increased people's participation in decision making, streamlining fiscal mechanisms fueling Panchayats functioning and strengthening administrative mechanisms to enhance Panchayat efficiency and capability. Both States and the Centre will need to work in concert to achieve these aims. In particular, the Central Government cannot be a bystander observing the growth of Panchayati Raj from afar, since it has the plenary responsibility for ensuring the implementation of Part IX of the Constitution and empowering Panchayats as institutions of local self-government, in true letter and spirit. The period of the Eleventh Plan could be when Panchayats finally are truly empowered in the letter and spirit of the constitutional provisions. This imperative would also need to guide the institutional mechanism proposed for rainfed areas development, during the Eleventh Plan.

1.4. Apart from the fact that the Panchayats are constitutionally mandated elected spheres of self-government assigned responsibilities under the law to undertake developmental tasks in the primary sector, there are several comparative advantages of Panchayats in leading a convergent plan for dealing with rainfed areas development, as follows:

(a) Village Panchayats know better the dimensions of poverty, which is often related to the uncertainties of agriculture and recurring drought, in their local areas. Their traditional and local knowledge on issues related with rainfed conditions and coping with drought help those immensely in planning and implementing programmes related with rainfed area development.

(b) Panchayats know better the kinds of bottlenecks to progress that must be removed, therefore their decisions are likely to be much more realistic and practical.

(c) Decisions taken at local level by Panchayats rather than being imposed by other layers of the government system such as line departments, create a local stake and sense of ownership and accountability among them.

(d) Fourth, Panchayats, particularly Gram Panchayats are directly accountable to the community through the Gram Sabhas, in a manner that line departments are not.

1.5. The comparative disadvantages of Panchayats in rainfed area development poverty could arguably be as follows:

(a) That they have a weak administrative capacity and even with the responsibility and inclination to spend for essential rainfed area development, they may not have the capacity to undertake these effectively;

(b) That there is the oft repeated fear of capture of Panchayat elected posts by the stronger economic class, who may not be willing to invest in rainfed area development,

(c) That generally there is no buy-in for rainfed area development programmes through a contributory element by way of local taxation or user charges, which is the best way to build downward accountability of Panchayats to the people,

1.6 Recommendations of the Sub-Group:

1.61 Several of these so-called comparative disadvantages can be addressed effectively through proper design of Panchayati Raj. For instance, a programme of strengthening the administrative capacity of Village Panchayats may yield far better dividends than pushing money through intermediaries, such as Block level officials to user and self help groups, The fear of elite capture can be handled by putting in place mechanisms for disclosure to, participation of, prior approval of and certification of utilization by Gram Sabhas. Regarding collection of local taxes and user charges, which is largely not an area of priority, the trigger is capacity building of Panchayats, These design features have already been arrived at by the Ministry of Panchayati Raj through a national consensus achieved through 7 Round Tables of State Ministers of Panchayati Raj and the same ought to guide design of Rained Area programmes.

1.62 Approaches to rainfed area development should be multidimensional and should address every aspect that could hinder or render the programme unsuccessful. This cannot be done without a greater focus on strengthening governance institutions, particularly Panchayats. A decentralized strategy towards rained area development would essentially be aimed at aiding PRIs to identify, implement, operate and maintain their own priority investments in the direction of improving delivery of services that benefit the poor, within a given budget. Initiatives in strengthening Panchayati Raj Institutions to implement rainfed area development strategies ought to be in the following seven areas:

(i) Enhancing the quality of people's participation in grassroots level institutions such as the *Gram Sabha* and *Gram Panchayats*

(ii) Delineating the roles, functions and responsibilities of each tier in the PR system so that there is greater clarity and thus lesser overlapping,

(iii) Strengthening mechanisms that ensure downward of PRIs accountability to the people that they serve,

(iv) Adopting appropriate measures of fiscal decentralisation so that PRIs are empowered to deliver what they have been entrusted to;

(v) Decentralising the planning process so that plans and programmes of PRIs reflect the aspirations of people;

(vi) Clarifying the relationship between elected representatives and staff working in PRIs so as to bring in greater managerial professionalism and accountability of the staff to elected bodies;

TOR 2: Functional demarcation between Zilla Panchayat, Block Panchayat, Gram Panchayats for rainfed areas development and strategies for collaboration between PRIs and non-Government organisations including strategies for capacity building of PRIs and other stake holders

2.1. Activity Mapping:

2.11. The key objective of Article 243 G of the Constitution is to ensure that Panchayats at all levels function as institutions of self-government. rather than as implementing agencies. This is to be done through devolutions of functions, funds and functionaries, which must eventually comprise the entire range of subjects in the Eleventh Schedule of the Constitution. Most States have already assigned responsibility for the most important of these services to rural governments and several States have devolved all 29 subjects through legislation, to the three levels of Panchayats. However, while the Constitutional provisions outline the broad contours of the Panchayati Raj pattern nationwide and concrete shape is given to it through State legislations, this tends has had little effect, for several reasons. First, there is often little rational thinking concerning which of the disaggregated activities ought to be devolved, based on considerations of economies of scale, efficiency, capacity, enforceability and proximity. This has led to most devolved subjects ending up in a kind of concurrent list, with different tiers of government sharing responsibility, which seriously undermines accountability. Second, though States may assign responsibilities to local governments, they leave the performance of key activities and sub-activities necessary to deliver such devolved services with state line agencies. A critical trigger for the effective transfer of funds and functionaries to the levels of Panchayats in accordance with the true letter and spirit of the Constitution is the process of Activity mapping relating to devolved functions, through which activities relating to the legislatively transferred functions are assigned to the appropriate level of Panchayat, keeping in mind the principle of subsidiarity. This will hopefully answer two specific questions, **first,** which level of government will be responsible for what and, **second**, which arrangements between governments are likely to work for better service delivery. These questions are very relevant for several sectors including the primary sector (agriculture, fishery, horticulture, forestry, sericulture, animal husbandry, watershed management and rainfed area development.

2.12. Activity Mapping can become a trigger for ensuring that Panchayats are on a sound footing. When Panchayats are assigned clear tasks, devolved funds and made accountable for their performance of these newly assigned responsibilities, they have a big incentive to demand the capacity required for effective performance. Thus role clarity catalyses capacity building from being supply driven to being demand driven, which is a huge benefit. Empowered Panchayats with clear roles assigned through activity mapping would begin to also demand the staff required for effective performance.

Therefore Activity Mapping can spur appropriate placement of functionaries for better service delivery.

2.13. The Ministry of Panchayati Raj, between June and December 2004, undertook a series of seven Round Tables of State Ministers of Panchayati Raj, aimed at arriving through consensus at a set of action points that touch upon different dimensions of Panchayati Raj. It was agreed during the First Round Table of State Ministers of Panchayati Raj in Kolkata that all States and UTs would undertake activity mapping by the end of 2004-05, using the activity mapping model as evolved in the Ministry of Rural Development in the Report of the Task Force on Devolution of Powers and Functions upon Panchayati Raj Institutions (August 2001). Though this target has not been achieved in all States, there has been considerable progress.

2.2. The special features of Activity Mapping for Watershed areas:

For several reasons, Activity Mapping assigning roles to the three levels of Panchayats in Watershed areas is a somewhat more complex exercise than for other functions. These reasons are as follows:

(a) A basic question that one must consider in the context of rainfed areas is whether land development through watershed development, building green cover and water conservation constitutes public or private goods – the general approach being that if it is a private good, then Government will have to adopt a relatively hands-off approach. On the contrary, if it is considered to be a public good with considerable government investment, then Panchayats will need to be assigned a more proactive role in implementation of programmes. The sub-Group felt that considering the ground situation, no clear demarcation on the above lines can be drawn in the context of rainfed areas development. Though at first sight the retention of rainwater on private agricultural land through the construction of rainwater harvesting structures might seem to constitute a private good, it might not really be so, because of the downstream effects such retention in the higher reaches might have. More obviously, the retention of rain water for common purposes in ponds, pools and larger catchments would ultimately be the responsibility of the Government, including Panchayats, even though the same can be out-sourced to technical agencies for execution. Therefore activity mapping would need to take into account the fact that rainfed farming straddles activities that fall in the domain of both public and private goods.

(b) Optimum implementation of rainfed farming strategies and plans may be at scales that are different from the political jurisdictions of Panchayats. This is particularly relevant for the assignment of activities to village Panchayats as quite frequently, watershed boundaries do not conform to Village Panchayat political boundaries.

(c) Considering the dispersed nature of investments in watershed areas, works and activities in rainfed area development are prone to leakage and inefficient implementation. There is sadly, a general lack of accountability for the implementation of watershed development programmes, particularly by line departments. One problem is that official estimates, prepared on the basis of government schedule of rates, have often generous cushions – permitting leakage of funds without necessarily compromising asset quality. Second, failures of watershed development are not readily apparent immediately after completion of the physical works. They are often discovered years after projects have closed, when alibis are aplenty. While strategies to counter such leakage revolve around greater community participation, institutions created for such participation, such as watershed committees etc. tend to be often dominated by officials and rarely fulfil the objective of local accountability. Therefore, there has been no discernible improvement in the quality of watershed development whether undertaken through stand-alone Committees or through Panchayats.

2.3. Recommendations of the Working Group:

2.31. While States have the responsibility of undertaking activity mapping for better functional demarcation, Ministries of the Government of India that deal with various facets of rainfed agriculture, such as the Ministry of Agriculture, Water Resources and Rural Development should undertake an Activity-Mapping exercise that clearly sets out, in accordance with the subsidiarity principle, what they need to do at their level and what can be done at the state level, and by the panchayats. Once Central Ministries undertake activity mapping (which can be through a consultative exercise), they will be better placed to modify individual scheme guidelines that deal with rainfed farming to be in tune with their Activity Mapping and those of the states.

2.32. In undertaking such Activity Mapping, the recommendations of the Task Force on Devolution of Powers and Functions upon Panchayati Raj Institutions (August 2001) set up by the Ministry of Rural Development may be followed.

2.33. The plan prepared for rainfed farming at the district level, by the District Panchayat ought to be consolidated into the District Plan in the manner as prescribed in the guidelines on district planning of the Planning Commission dated 25-8-06. Schematic guidelines of the Ministries concerned will need to state this out explicitly.

2.34. Financial devolution by placement of the funds pertaining to Watershed development should be placed directly with the level of the Panchayat concerned, which has been assigned the task of performing the function, in accordance with Activity Mapping. It is only when financial devolution follows activity mapping that the lines of accountability of Panchayats would be clear.

2.35 Activity mapping for the implementation of watershed programmes:

The Working Group suggests the following activity mapping in respect of Rainfed area and Watershed development. Table 1 gives pictorially, the broad assignment of functions to each level involved, including Panchayats. Table 2 gives a detailed list of roles that may be assigned not only to levels of government, but also management structures that may be created within it.

Table 1:

Broad category of function	Specific activity	Central Ministry	State Government	Panchayati Raj Institutions			Watershed Committees
				District Panchayat	Intermediate Panchayat	Village Panchayat	
Policies/Design Standards	National norms	■					
	Preparation of State Norms		■				
	Eligibility of NGOs & Voluntary orgns.		■		.		
	Indicative works	■	■				
Planning	Micro-watershed plan preparation						■
	Village Watershed plan (if required)					■	
	Block level aggregation of plans				■		
	District Watershed Plan and integration into overall district plan			■			
Facilitation and capacity building (see table 2 below)	Oversee the entire project and coordinate between all partners.		■				
	Train stakeholders in discharging their roles.		■				
Asset Creation	Micro-siting of rain water on harvesting structures						■
	Construction of Rainwater harvesting and watershed structures					■	■
	Release of Funds	■	■			■	■

Operation	Implementation/Choice/Supervision					■	■
	Reporting			■		■	■
	Display of Information					■	■
Monitoring and Evaluation	Social audit Gram Sabha						■
	Maintenance of programme parameters at the local level						■
	Overall quality of Watershed development		■				
	Studies		■	■			

Table 2:

Role of Partners	**Key Responsibilities**

Table 2 A: At Sub-Watershed and sub- Village Panchayat community levels

Village Watershed Committees (sub-Committees of Village Panchayats)	Work as Executive Committee for the execution of Watershed projects undertaking the conceptualisation, planning, preparation of action plans, implementation, operation, maintenance, and monitoring of watershed schemes in their areas of operation.
	To plan through local participation for project interventions on all lands coming within the micro-watershed
	To safeguard the interests of the vulnerable families in the watershed and prepare plans for their improvement.

	To mobilize community contributions for investment in and maintenance of assets created in the watershed, environment, and income generation sectors.
	To implement the activities planned and to take responsibility for post- management.
	Maintain its records and ensure systematic maintenance of books of accounts. Treasurer is responsible for the maintenance of accounts and book-keeping.
Field level NGOs	To build awareness about the project at the village level
	To assist in formation of CBOs at the village / micro-watershed level
	To assist CBOs in implementing their action plans.
	To build capacities of institutions to plan, implement and manage the program.

Table 2 B: At the Village Panchayat level:

Village Panchayat	Constitute a sub committee under the provisions of the State Panchayati Raj Legislation for each micro-watershed (please see duties of the sub-committee above), to look after the implementation of the programme
	Mediate and settle disputes if any, relating to the Watershed project and between villages/habitations that constitute the Gram Panchayat, during implementation of the project.
	Actively advise the Sub-Committee from time to time.
	Maintain asset registers under Watershed programmes, with a view to their protection after watershed treatment under the project is completed,

	Provide office accommodation and other requirements to the sub-committee.

Table 2 C: Intermediate Panchayat level:

Intermediate Panchayat	Constitute technical team for facilitation of Watershed development and rainfed farming
	Monitoring the progress against targets at taluka level.
	Provide support and facilitation for Technical team for watershed development at Intermediate Panchayat level.
Watershed development Team constituted by Intermediate Panchayat, consisting of representatives of line departments and NGOs	Monitoring and guiding proper maintenance of accounts by Village Panchayats and Watershed Committees.
	Collection, preparation and submitting progress reports of the project.
	Providing technical guidance to the team preparing the Action Plan.
	Providing necessary guidance in preparing estimates
	Providing technical guidance and supervising the works in order to maintain quality
	Conduction check measurements and providing guidance in preparation of bills

Table 2 D: At District Panchayat Level

District Panchayat	Constitute technical team for facilitation of Watershed development and rainfed farming
	Preparation of district plan and integration of the Watershed plan with the district plan.

	Provide support and facilitation for Technical team for watershed development at the district level.
	Constitute District level review committee, preferably as a sub-committee of the District Panchayat
Lead NGOs to support the District Panchayat & District Planning Committee	Create effective functional linkages between project partners at district level to implement the program.
	Assist District Panchayat in undertaking the development of watershed plans
	Assist District Planning Committee under Article 243ZD(3)(b) of the Constitution to consolidate their plans
District Level Review Committee (DLRC) preferably a sub committee of the District Panchayat.	Scrutinising of Watershed action plan
	Bringing better coordination among the project implementing line departments, NGOs and Lead Bank of the district
	Inspections of works and providing suggestions for improvement.
	Monitoring the project works and expenditure incurred by partner NGOs in executing the works.
	Implementing the directions and the decisions taken by state department on standards and norms.
District Resource Group (DRG) of technical experts	Report to the Standing Committee
	Imparting training related in the technical subjects to all partners at the district level.
	Monitoring the quality of technical training provided by the line department staff.
	Timely operation of training programs (specially technical trainings) for Watershed Committees and elected representatives of Panchayats and officials,

	Monitoring the implementation of administrative and technical guidelines issues by the project authorities at the field.
	To prepare micro-watershed wise treatment plans for sub-watersheds using remote sensing maps.
	To conduct training programs for stakeholders on technical aspects of watershed management.
	To develop reading material on comprehensive watershed development and public awareness materials to create awareness among the villagers about the project.

Table 2 E: State level:

State advisory committee, including NGOs	To advice and support the State Watershed Development Department in all matters related to implementation,
	To develop strategy papers on subjects relevant to the project.
	To produce, share and support training material development.
State level Monitoring & Evaluation Agency, working with the department	To develop data collection formats for impact monitoring input-out monitoring and process monitoring based on respective indicators.
	To develop decision support systems to prepare analytical reports and analyze the data collected and to share these reports with project partners.
	To build the capacities of the project partners to operate and maintain MIS for watershed development.

2.36: The suggested constitution of the community level watershed committee is as follows:

President	The president of the Sub-Committee may be elected by the members of the Sub-committee.
Secretary	One of the elected sub committee members shall be Secretary. If President is a man Secretary shall be woman.
Treasurer	Either one of the members represented from Self Help Groups / Area Groups
Members	5-6 from Area Groups. 5 from Self Help Groups. 2-3 Gram Panchayat members

As far as possible, while constituting the Sub Committee, 50% representation to women may be ensured. Of the members of Area Groups/Self Help Groups, representation may be provided to small and marginal farmers, at least one SC/ST, one progressive farmer, one landless and one rural artisan. The composition of the group may be kept flexible and more representatives may be accommodated as invitees if required.

In case the geographical area of operation of a Watershed Committee is spread over more than one Gram Panchayat, then members of the Gram Panchayats concerned may be co-opted onto the Sub Committee.

2.4. Interface between Panchayats and NGOs:

2.41. As functions of governance and implementation of programmes requiring different skills and knowledge, for optimum efficiency, Panchayats and NGOs need to collaborate to a much greater degree in the planning and execution of rainfed area development programmes. However, the reaction of the NGO community to the Panchayati Raj system has been mixed. While some have seized the opportunity to work with Panchayats on local development, others consider them as competitors. The Second Round Table Conference of Ministers in charge of Panchayati Raj held at Mysore in August 2004 agreed that parallel bodies, which are set up to plan and execute development projects in areas that are in the functional domain of local Governments, should be brought into an organic, symbiotic relationship with Panchayats at the appropriate level. Thus must (a) be set up if at all, in consultation and with the collaboration of Panchayats at the appropriate level, (b) report periodically to the Gram Sabha and (c) should not undermine the constitutional authority of Panchayats, but work together with them.

2.42. Role of NGOs in Panchayati Raj:

There are several roles that NGOs could play in supporting rainfed area development in collaboration with Panchayats, as follows:

(a) NGOs can directly give technical support to Panchayats in implementation of programmes.

(b) NGOs can assist District Planning Committees established under Article 243ZD and Panchayats in undertaking village planning, resource mapping and identification of development schemes.

(c) They can take up evaluation studies on panchayat performance and educate people periodically so that they can better hold their

Panchayats to account. As a continuation of this approach, NGOs have a big role to plan in mass movements and campaigns to ensure effective use of empowering legislations such as the Right to Information Act.

(d) NGOs could actively associate in the implementation of training programmes for elected Panchayat representatives and officials, in the technical aspects of rainfed development.

2.43. Role of Panchayats in promoting better NGO Panchayat interphase:

Panchayats, in turn can undertake several initiatives to ensure a good NGO movement:

(a) They can identify and nurture good local NGOs, and encourage them to directly disclose information to gram sabha meetings.

(b) Panchayats could also entrust implementation of rainfed development programmes and plans to NGOs.

(c) Panchayats can provide sustainability to NGOs initiatives, by being associated with project plans from the very beginning and taking over maintenance of the assets created.

(d) NGOs could operate technical resource centres, either independently or in collaboration with Panchayats and provide support staff and experts in agriculture and watershed development and rainfed farming that Panchayats could access, while implementing programmes entrusted to them.

2.5. Interface between Panchayats and other community based organizations:

2.51. Development strategies of the immediate past in rainfed area development, particularly Watershed Development have created and relied on watershed committees to implement them. However, there is a clear distinction between CBOs, SHGs and User Groups existing as autonomous social groups, augmenting social capital and deepening democracy and government-organised groups for implementation of specific programmes like watershed management. The former are entitled to absolute freedom of action and can even challenge Panchayats through public action. But the latter, organized for specific purposes around using public development funds, have to be considered differently. These groups cannot be considered as substitutes for Panchayats, which are local governments performing a range of governance and development functions accountable to the entire population of a Panchayat and not just responsible to a small circle of beneficiaries for project implementation.

2.52. The myth that these bodies are in some way more efficient than Panchayats also needs to be addressed. There is little hard evidence to show that such groups are free of all the evils that are supposed to bedevil PRIs, such as politics, sharing of spoils, corruption and elite capture. There are also serious questions about the sustainability of such groups. People may be very active when there is fund flow and capacity building support, but tend to lose interest when faced with the more mundane tasks of maintenance of assets and collection of user charges.

2.53. On the positive side, CBOs can realize all the stated objectives besides enriching social capital if they are seen as thematic or sectoral sub-systems of Panchayats. CBOs should draw their powers and resources from PRIs, not in a relationship of subordination or agency-function but in a spirit of social contact. Thus the autonomy of CBOs would be well protected even while being accountable to PRIs. Such an approach would strengthen both PRIs and CBOs and release synergies, paving the way for a symbiotic relationship.

2.6. Recommendations of the Working Group on linkages between NGOs and Panchayati Raj Institutions:

2.61. While there is no harm in developing multiple institutional options for improving delivery of programmes, it is necessary that they should be made accountable to the local community. These must, as a rule, be sub-committees of the local Panchayats so that they can draw up and implement need based local level plans. They should also be made accountable to the gram sabhas right from their inception. The following programme approaches therefore have to be strictly eschewed in the design of development strategies for rainfed areas:

(a) Central Guidelines that mandate the implementation of Watershed programmes through CBOS even after these functions have been devolved to Panchayats,

(vii) State Line agencies continuing to implement Watershed programmes through CBOs by-passing elected PRIs and directly dealing with CBOs,

(viii) CBOs utilizing funds and performing functions in the legitimate sphere of PRIs without their knowledge,

(ix) CBOs having not even symbolic accountability to elected PRIs even when they are using public funds or utilizing the natural resources of the locality.

(x) CBOs being nurtured as developmental substitutes of PRIs through generous infusion of funds even while starving the PRIs of resources.

2.62. Competent NGOs could assist PRIs in planning of various programmes, providing professional guidance and support to PRIs. However, the scope and ambit of the support that the NGOs provide should be clearly stated out in schematic guidelines dealing with implementation of these rainfed area schemes. It must be made clear that the ultimate decision makers will be the PRIs, and NGOs will be accountable to them.

2.63. Given the multi-jurisdictional nature of watersheds, the Panchayati Raj laws of States ought to provide flexibility for Panchayats to form collaboration with each other or with outside NGOs so as to ensure proper accountability and better scale efficiency in implementation. In this connection, it would be ideal if technical skills could be provided through autonomous bodies formed through collaborations between NGOs and PRIs, which can provide to PRIs inputs in respect of training, planning, implementation, documentation, evaluation, etc.

2.64. To supplement the above approach, the Government could empanel or accredit NGOs into a pool, which could be used to provide technical, training and handholding support to Panchayats for implementation of Rainfed Area programmes.

TOR 3: Suggest Modalities to enable Gram Panchayats to access funds under NREGA for development of rainfed agriculture.

3.1. NREGA has already mandated that 50% or more funds under shall be allocated to village Panchayats. In our view, this provides ample scope for Panchayats to dovetail the funds available under NREGA to undertake rainfed agriculture programmes. However, one added complexity could be that since NREGA is demand based, planning as to how much of available resources from NREGA could be utilized for implementation of programmes for rainfed areas would be initially based on broad estimations, which would take into account experience in this regard. This will necessitate Panchayats to undertake exercises in planning for convergence, after considering various scenarios of labour availability and determining as to how much funds are likely to be available from NREGA.

3.2. At the centre of NREGA lies the preparation of a village Panchayat level perspective plan for implementation, which would take into account the estimated demand for labour and the kind of works within the jurisdiction of the Panchayat that lend themselves well to labour creation. As a start-up process, the NREG Act mandates that the perspective planning exercise of the National Food for Work Programme could be used. It goes without saying that wherever such exercise and planning has been satisfactorily done, it should be strictly followed for implementing NREGA in respect of priority of villages, programmes and allocations.

3.3. Recommendations of the Working Group on optimizing NREGA for Rainfed Farming and Watershed Development:

3.31. The Working Group supports the selection of a professional agency or professional services by each District Panchayat to assist in participative planning processes at the Panchayat level. A panel of NGOs may also be created for the purpose to provide support to Panchayats at the Intermediate and Village levels.

3.32. While the creation of assets under NREGA for water retention and conservation lends itself to NREGA easily, it is equally important that NREGA be used for maintenance of assets created, while also providing rural employment. Special emphasis must therefore be given under NREGA plans at the village level to the repair and maintenance of assets.

CHAPTER - V

COVERAGE AND STRATEGIES IN THE PARADIGM OF AGRO-CLIMATIC REGIONAL POLICIES IN INDIA

Introduction

The Working Group first attempted an analysis of proposed coverage of rainfed development programmes in the light of the analysis of the somewhat distressing trends in land and water outcomes as highlighted in the Approach Paper and as amplified in this report in earlier chapters. It then outlines a strategy of a bifocal approach to future policies in the light of the somewhat uneven developments in the past in rainfed regions, with some growing faster and diversifying and others not having a good profile. The coverage of future programmes and policies for each segment are then outlined.

There have been several attempts at mapping India's land and water resources and identifying suitable cropping patterns and biomass production strategies for different regions. Such assessments are particularly important in understanding the constraints and opportunities in our rainfed areas. The range and diversity of the rainfed areas presents a qualitatively complex set of problems, which needs delicate handling. We must give up the one-size-fits-all approach and focus on fine-tuning and matching our interventions to the subtle variations in local contexts. Advances in science and technology provides us with useful tools for careful evaluation of the production potential of different land use categories to arrive at appropriate, location-specific strategies of intervention.

Coverage

The earlier analysis in the Statistical review section shows that all the programmes taken together covered 46 million hectares by now. According to the Planning Commission around 15 to 16 million hectares have been treated, it is presumed in the sense of successful treatment of area in terms of drought proofing.

1. The MORD has a definition of potential watershed areas of 55 million hectares, which compares with the Agro-Climatic Regional Planning Units (Agro-Climatic Regional Planning Unit ,1991, Agro-Climatic Regional Planning at the State Level, Working Paper No.5, Ahmedabad.) estimates built at the sub-regional level of 65 to 68 million hectares. The MORD's definition is in terms of irrigation coverage of 30% of area. ARPU's estimates were built up in terms of local knowledge of Agro-climatic Planning Teams of soil, land, rainfall, water and climatic characteristics at the sub-regional level of agro-climatic regions which were around three to five Districts each.

Mihir Shah has suggested, an argument given in earlier chapters, that rainfed regions area has gone down from 94 million hectares to 84 million hectares, on account of increased irrigation. The numbers now being advocated therefore would lie between the existing 55 million hectares to a possible 84 million hectares. The argument for not changing the existing definitions and sticking to the lower order range of 55 million hectares, are convincing. There is robust sense behind the existing definitions as also there is the more compelling fact that improved performance in the existing target area would give high rewards, particularly if the lessons of past experience, or 'learnings' as the Working Group calls them and as summarized in the Bopal Declaration of experienced and knowledgeable persons, are taken into account. Also there is the problem that in the era of coalition regimes there are always pressures to widen the scope of coverage, beyond the range presented by research or social priority based arguments.

The case for considering a revision of the existing coverage, emerges from some very distressing features of the country's land and water development, bordering on a 'crisis' situation, which can only be handled in the framework of holistic policies for rainfed regions. These features have been discussed earlier.

It is the view of the Working Group that the present situation can be described as an agrarian crises. In that context there is the need for a regenerated, focused and revitalized rainfed programme with stakeholder and local institutions and possible structures for them, spelt out. The word 'Crises' is sometimes loosely used in the country's democratic polity and is *de ja vue* anyway. The Working Group is using it for the following specific reasons:

1.Indian agricultural growth has fallen and so has investment and profitability of agriculture; rural employment trends are unacceptable;

2.India's net sown area under crops has fallen, drastically for the first time;

3.Area under canal irrigation has fallen again for the first time in history.

There are basic factors at play. As compared to relief against rainfall failure, the farmer now wants yield enhancing water supplies for water stress periods of diverse crops grown with modern technology. Access to ground water gives them this facility, badly planned and inefficiently managed canals don't. Farmers and their communities now want control on water deliveries. Hence there are difficulties in expanding irrigation, which are of a qualitatively level. Earlier analysis, in this report has listed the large number of Districts where in terms of ground water use, the coefficient of variability is high and percent of villages with deeper water table is high. The states, which are covered under this category, include Rajasthan, Gujarat, AP and Tamil Nadu.

There is available a listing of a hundred Districts where the problem of excessive groundwater use has led to major economic and sustainability problems. These districts are largely in the rainfed regions as suggested by Mihir Shah. The details are as follows;

There are 100 districts (list attached, Annex 1) which account for over 60% of India's 'critical' and over-exploited blocks. These also happen to have the highest concentration of dug-wells in the country; here is where falling water tables have the most disastrous impact on drying up wells and forcing farmers to revert to rainfed farming. Outside the Punjab, most recent farmer suicides are reported from these districts; and groundwater stress is an important source of agrarian distress in these regions.

Table 1

Groundwater-stressed Hard-rock States of India

	Annual Groundwater draft (billion m3[1]	Total number of irrigation dug wells in use and disuse ('000)[2]	% of India's critical and over-exploited blocks[3]	Area irrigated by groundwater (m ha)[4]	% of wells and tubewells with electric pumps[5]	Potential for increased recharge through well modification (b m^3)[6].
Andhra	14.90	1185	296	1.68	93.5	5.9

[1] Central Groundwater Board (2005) *Dynamic Ground Water Resources of India,* New Delhi: Ministry of Water Resources, Government of India.

[2] Government of India. 2005. *Minor Irrigation Census-2000-1,* New Delhi: Government of India.

[3] Central Groundwater Board (2005) *Dynamic Ground Water Resources of India,* New Delhi: Ministry of Water Resources, Government of India.

[4] Ministry of Agriculture, Government of India.

[5] Government of India. 2005. *Minor Irrigation Census-2000-1,* New Delhi: Government of India

[6] Estimated assuming that modifying an average dug-well for recharge enables it to put 5000 m3 of monsoon floodwaters into the aquifer over and above the natural recharge and recharge from other sources.

Pradesh						
Gujarat	11.50	936	43	2.39	54.5	4.7
Karnataka	10.71	328	68	0.86	96.1	1.64
Madhya Pradesh	17.12	1277	30	3.50	85.5	6.4
Maharashtra	15.09	1659	8	1.57	96.1	8.3
Rajasthan	12.99	1172	190	3.66	47.4	5.86
Tamilnadu	17.65	1656	175	1.41	82.5	8.28
Total for 7 states	99.96	8213	810	15.07	82.6	41.1
7 states as % of India total	43.3	85.4	70.9	48.9	65.2	
India	231	9617	1142	30.8	61.0	

Source: Tushar Shah

Much of this distress can be alleviated—and at a relatively low cost to the society—by mounting a well-designed program of groundwater recharge. It is sometimes suggested that small watershed development programs are an effective answer to groundwater depletion; however, according to Tushaar Shah, this is only partly so. In arid and semi-arid areas of India, tanks, small water harvesting structures with poor surface-area-to-depth ratio act as evaporation pans; they lose much more water to non-beneficial evaporation than is available for recharging the aquifers. In the old times, when groundwater withdrawal was a small fraction of today, irrigation tanks made sense; but today, they need to be reinvented. This is evident in the fact that on their own, farmer communities in many of these districts are converting their centuries-old irrigation tanks into percolation tanks to increase recharge to their wells. While Tushaar Shah does not mention this, this will require development in the framework of watershed development, in the sense that the aquifier characteristics will have to be the bedrock of the regeneration process and it will involve the interaction of the efforts of multiple stakeholders. Tushar Shah's point, however is that individual effort will be required and this then becomes a case of the point made early in the watershed project experience of aligning individual rights with limited and focused cooperation, as highlighted in the review sections.

By their very nature, hard-rock areas have a profusion of dug-wells and tanks while sandy-alluvial aquifer areas are dominated by tube-wells and have few tanks for irrigation. The groundwater recharge strategy in hard-rock areas should therefore focus on modifying dugwells and tanks for maximizing groundwater recharge.

To begin with the program can be confined to the 100 most groundwater-stressed districts of the hard-rock states; and can be expanded to cover other districts after reviewing the experience.

Program Components

The program can have five components as outlined below:

1. "***Bhujal-Mitra*** *Program*" for support to dug-well Recharge Shaft Component: Traditionally, farmers in many parts of India treat flood waters of monsoon as a nuisance and divert it away from their fields to downstream areas using cart roads as drains. The aim of this component should be to divert the floodwater of monsoon rains into dug-wells after reducing its silt load. This is done by [a] reworking the field drains so as to bring the floodwater towards the well; [b] constructing a desiltation chamber that allows the silt and dirt to settle to the bottom; and [c] convey clean floodwater into the well by a PVC pipe linking the chamber with the well. In Saurashtra region of Gujarat, the cost of well-recharge structure ranges from Rs 1500-5000. A Rs 1500-2000 subsidy per dugwell and a well-designed communication campaign can do the trick.

   The 100 most groundwater-stressed districts have over 7 million dug-wells, out of the country's 10 million dug-wells. In a normal monsoon, an average dug-well with a storage of 800 m^3, after modification, can put in 5000-6000 mn3 of groundwater into the aquifer creating a sizeable ‘recharge mound’ underneath each well. If all the 7 million wells are fitted with recharge shafts, they can augment groundwater resource by 35-40 km^3 and largely eliminate the groundwater stress in these districts. To be effective, this component has to be implemented on a large scale because of the common property nature of recharge benefits. In a village, if only 1 or 2 farmers install a recharge shaft in their dug-well, they will benefit little as other well owners will free-ride on their recharge. But if most or all wells in a village are fitted with recharge shaft, the entire village will benefit. The program is thus best implemented in a campaign mode, again highlighting the individual-communitty interface of the proposal.

Dug-well recharge shaft program is likely to be well –received for many reasons: [a] farmers in hard-rock areas will be able to intuitively visualize its benefit; [b] in the hard-rock formations, a farmer is able to recover some of the groundwater he recharges; in that sense, the recharge shaft works as a partial bank account; [c] the cost of the recharge shaft is modest; and it is easy to maintain.

2. **Additional Support to *Bhujal Mitra* Farmers**

Hard-rock area farmers will have a built in incentive for adoption of recharge shafts because they will get partial benefit of recharge in terms of improved well yields. However, this incentive can be much strengthened by supporting them to make other modifications that will augment their well yield but contribute much more to groundwater recharge. Two common items are: well deepening and making lateral bores within dug-wells. Both these improve yields of wells; but in dug-wells fitted with recharge shafts, these will also augment recharge capacity. The number of times a modified dug-well can be filled with floodwaters is determined by the speed with which it can dispatch its storage to the recharge mound. Lateral bores in dugwells can increase this speed, thereby quickly emptying the well to receive the next doze of floodwaters from a rainfall event. A scheme in which farmers contribute 40% and government offers a 60% subsidy on well-deepening as well as making lateral bores should give a strong fillip—and the much-needed scale-- to the *Bhujal Mitra* program.

3. **Tank Recharge Shaft Component:**
Hard-rock areas also have large number of tanks originally built for paddy irrigation. In many parts of AP, Karnataka and Tamil Nadu, farmers are sealing the sluice gates of tanks and converting irrigation tanks into percolation tanks because they find recharge of their wells more valuable than flow irrigation from tanks. Silt layer on tank beds however greatly impedes groundwater recharge. While desilting of tanks every year may be expensive, a simple tank water recharge shaft can increase the tank's recharge-effectiveness many-fold. The cost of a proper recharge shaft is around Rs 1-1.5 lakh. In this, a *pucca* desilting chamber (8*8*10 meters) is made to filter (through a gravel pit) the flood water 1.5-2 meters above the lowest point in the water spread area. A strainer pipe is introduced in to an 8 inch housing pipe (GI or PVC) through a bore drilled deep enough to pass through a water-bearing stratum. When the tank fills up during monsoon, water gets dispatched to the aquifer through the *pucca* filter system and pipe until the tank water level falls to 1.5-2 meters. The technology is simple; but involving local NGOs with some technical capacity may improve the quality of implementation.

4. **Water Harvesting Structures:** While dug-well recharge shafts and tank recharge shafts should be the key components of the suggested program, it is also critical to strengthen groundwater recharge effectiveness in watershed programs as well as water harvesting structures such as check dams, *johads, paals,* etc. This watershed projects which install recharge shafts in their water

harvesting structures should have access to additional funding to cover the cost in the 100 districts.

5. **Education, Information and Communication:** There is dire need for a strong and vibrant EIC program in hard-rock aquifer states in the criticality of groundwater recharge and the techniques of augmenting recharge. The Saurashtra region in Gujarat—which in early 1990's was under tremendous groundwater stress—mounted a massive hard-rock recharge program as a mass movement with government budgetary support. A major contributor to its success was a massive EIC campaign ran by the government and NGOs.

2. These Districts have been overlayed in maps with the ARPU units Districts, which classify Districts by existing programme coverage of Integrated Watershd Development Project and DDP and DAP Districts. As is well known many Districts have more than one scheme under operation. The detailed tabulation is given Annex 2. The summary tabulation is as follows;

Sl. No.	**Project coverage**	**No. of Districts.**
0	1	2
1 2 3 4	IWDP/DPAP IWDP/DPAP/DDP IWDP/DDP IWDP	102 02 20 192
2	IWDP/DPAP/Proposed Integrated Groundwater Development Project(PIGDP)	59
3 4	IWDP/DDP/DPAP/PIGDP IWDP/DDP/PIGDP	02 11
5	IWDP/PIGDP	26
TOTAL		414

The earlier analysis in the Statistical review section shows that all the programmes taken together covered 46 million hectares by now. According to the Planning Commission around 15 to 16 million hectares have been treated, it is presumed in the sense of successful treatment of area in terms of drought proofing.

If we take into account the areas which have assured irrigation and do not fall any more in the wasteland category, the area to be covered would be around 70 to 75 million hectares. It may be emphasized again that in the opinion of the Working Group districts which have surface irrigation, but in which ground water is in stress, watershed development and conservation in conjunctive use patterns and with emphasis on water efficiency enhancing strategies, will need a policy focus in the framework of the Rainfed regions strategy.

It may be noted that these estimates do not differ very radically from these worked out by a Planning Commission Committee on A Perspective Plan for the Development of rainfed Areas under the Chairmanship of S.R.Hashim.(Planning Commission ,1997, Report of the Committee on Twenty Five Years' Perspective Plan for the Development of Rainfed Areas, which updates the earlier literature of Agro-climatic planning, See Planning Commission 1989, Agro-Climatic Regional Planning - An Overview, New Delhi. And Wadia, F.K. ,1996, Agro Climatic Regional Planning at Zone Level in Basu et.al ,1996)

The distribution of such areas into different categories has been discussed above and in different taxonomies is discussed below. However at this stage it needs to be noted that in terms of growth records, the rainfed regions fall in both high and low growth categories. In many regions growth over a period has led to some regions achieving high levels of development and others are at low levels. As seen in earlier estimates, the growth of dryland crops was 0.87% annual in the decade of the Eighties for the country as a whole, but it was 2.17% in the rainfed regions. Since this is an average, it would be higher in some rainfed regions. Also the experience is that in some rainfed regions, growth of horticulture and dairying has been high.

In view of these differentiated growth strategies, the Working Group recommends that the strategy for rainfed regions should be of a bifocal kind. This would imply:

1. That in the existing Rainfed Regions of 55 million hectares, an improved Watershed Programme which takes into account the findings of the past experience and best practices as in the Learnings chapter, be targeted;
2. In the balance 20 million hectares, where a certain level of development has taken place already around water development strategies and programmes, selective strategies of rainfed region development be followed. These would provide selective and measured support for organizational innovation in soil and water conservation and distribution, programmes of ground water regeneration, conjunctive use, support to tree crops and high valued crops, support for non-crop agriculture like dairying, support for marketing, processing, information and training activities and other innovative programmes for drought proofing, particularly those which integrate drought proofing with existing programmes. These programmes would be supported to a maximum amount of 20% of the project costs in each District and the balance resources would have to be raised by the District authorities themselves, or from other project/plan programme sources.

It may be noted that these area coverage figures are approximate and need to be firmed up by official agencies since districts have been reclassified and need to be reclassified in terms of area figures. The above estimates are broad orders of magnitude.

As far as priority to area coverage is concerned, The Working Group would suggest that within each category the Moisture Index Approach Index described below be used for programme guidance.

The phasing of the programme for the Drought Proofing of India be done as follows:

Physical and Financial Targets of Perspective Plan for Watershed Development

Plan Period	Area to be covered by (Million hectare)		Cost per Hect.	Total at 1994-95 prices		
	Govt.	People's initiative	(Rs.)	Govt. (Rs. in crores)	People (Rs. in crores)	Total (Rs. in crores)
9th Plan	10	5	3000	3000	1500	4500
10th Plan	7	8	3000	2100	2400	4500
11th Plan	5	10	2800	1400	2800	4200
12th Plan	3	12	2600	780	3120	3900
13th Plan	2	13	2500	500	3250	3750
Total	27	48		7780	13070	20850

It is suggested that a sum of Rs. 1000 crores initially be placed at the disposal of the Planning Commission to be made available for the second category of programmes, by a special machinery to be set up for this purpose with the MORD. Once the National Authority for Rainfed Regions starts functioning, an Agency Approach could be designed to support and direct the watershed projects at the local level in the framework of Activity Mapping as described in the last chapter. This Agency Approach would setup lean mechanisms at the state and national levels to ensure outcomes. Separate Agencies could be set up for development programmes separately for Watershed Programmes and Ground water regeneration and conjunctive use. This approach has been recently advocated by Prof. Pradip Khandwala in work for the Administrative Reforms Commission, has described the structure extensively and we do not repeat that. He quotes a review of agencification in the UK, as follows:

“ the agency model has led to clarity and focus on specified tasks; a culture of service delivery; empowerment of frontline staff; greater accountability and openness; contextually appropriate structures and systems compared to the earlier standardized, monolithic government system; innovative thinking and action; development of brand for the services offered; better risk management; and greater tendency to expose problems rather than keeping them hidden (pp. 17-18). Some of its major recommendations were that the departments and agencies must work together to bridge the gulf between policy development and implementation, and fill high-level skills gaps in departments and agencies.”

Khandwala apart from giving examples of successful working elsewhere has recommended this structure for land and water development in India.

The implications of the negative trends, highlighted in this report are not being realized with the urgency they deserve, since at a basic level resource constraints of a more severe kind faced by certain East Asian economies are now being approached in India. Organizations, communities, households and individuals will have to grasp this fact and live with it. The severity of the blow will take time to sink in. But time India does not have. A few years ago it had been warned that we are getting close to the kind of land and water shortage East Asian societies like China, Japan and Korea have grappled with, but have built up institutions through the centuries to cope. It had been argued that we need to hasten.See, for example,

Y*.K.Alagh, Emerging Institutions in Rural Development, in Kanchana Chopra,C.H.Hanumantha Rao, and R.P.Sengupta, Ed.,Water Resources, Sustainable Livelihoods and Eco-Systems Services, Delhi, Concept, pp.403-431*

The Group discussed at some length recent developments in aid to programme support for rainfed region development, which are described below.

The Moisture Index Approach

The crop production potential of a region is limited by the availability of water for plant growth. Rainfall being the primary source of water for any region, the quantum of annual and seasonal rainfall is usually used as a key variable in delineation of agro-climatic zones. The **moisture index** approach uses the balance between annual rainfall (P) and the potential evapo-transpiration (PET) construct a Moisture Index (MI) to demarcate agro-climatic zones. Thornthwaite (1948) subtracted PET from the rainfall in each month to arrive at a moisture index (MI) for each region. Applying this approach, six broad climatic types ("bio-climates") are identified on the basis of this index. The dry regions are those in which the value of the moisture index is negative. The climatic types and their moisture index values are given in Table 2.

Table 2

Division of Regions based on Thornthwaite Moisture Index

Climate Class	Moisture Index
Per Humid	> 100
Humid	20 to 100
Moist Sub-humid	0 to 20
Dry Sub-Humid	-20 to 0
Semi-Arid	-40 to -20
Arid	-60 to -40

Source: Krishnan and Venkataraman (1992, p.462)

2 Modified Moisture Index and Soil-Climatic Zones

Water availability and crop production potential in areas with similar P and PET values can vary considerably depending on the composition of the soil of the area. Soils and their characteristics mediate the impact of climatic factors on crop production potential. Hence, agro-climates are best traced through changes in the **water balance** of the soil. In the initial formulation of the MI approach, all soils were uniformly assumed to be capable of holding water up to a given depth (100 mm/m), irrespective of the exact composition of the soil layer. This assumption has to be modified to account for the differences in the depth and structural properties of the soil that determine its water holding capacity. The water holding capacity varies between less than 50 mm/m depth in shallow sandy soils to more than 200 mm/m depth in deeper silty loams. Moreover, on account of these structural properties, soils exhibit diverging patterns of moisture loss while drying (Thornthwaite and Mather, 1955). Hence the MI needs to be modified, taking into account the properties of the soil. From the point of view of plant growth, change in the soil storage is the most critical variable determining moisture availability at the root zone. The modified moisture index (MI) is:

$$MI = (P - PET) / PET$$

This index has been adopted by Krishnan (1988) as the basis for grouping districts of India into **soil climatic zones**. Soil climatic zones are districts falling in the same climate and water balance class and having similar soil types. The district is chosen as the unit to facilitate comparisons with crop production data. Krishnan has computed PET for each district using Penman's equation (Penman, 1956). Annual rainfall data collected from the state rain gauge stations have been normalized to get long-term averages. The moisture index using these rates has been computed with the Thornthwaite-Mather formula given above. On the basis of this index, climatic classes ranging from extremely arid to per humid are distinguished. The semi-arid and sub-humid classes are further divided into wetter and drier halves and arid areas are grouped into extremely arid and arid regions. These 9 climatic classes are superimposed on the soil map with 13 prominent soil types to get 40 soil-climatic zones (Table 3).

Table 3

Soil Climatic Zones in India

Climate Class	*Water Balance Code*	*Number of Districts*	*% Land Area*	*Moisture Index*
Extremely Arid	A	7	9.3	< -80
Arid	B	24	6.3	-80 to -66
Semi-Arid (Drier Half)	C	97	21.9	-66 to -50
Semi-Arid (Wetter Half)	D	53	15.1	-50 to -33
Dry Sub Humid	E	107	21.1	-33 to 0
Total Negative MI Districts		**288**	**73.7**	
Moist Sub Humid	F	37	10.2	0 to + 20
Humid	G	35	7.8	+20 to +100
Per Humid	H	37	8.3	> + 100
Total Positive MI Districts	**109**	**26.3**		
All Districts		**397**	**100**	

Source: Krishnan (1988, p.16).

It may be seen from the table that 73 per cent of the land area of the country covering 70 per cent districts have negative moisture index. Districts with a positive MI are mainly located in the north-east, along the eastern and western coastline and in the foothills of the Himalayas. The rest of the country has moisture deficits for the year as a whole. This classification, thus, brings out the quantitative significance of rainfed drylands in India. A broad comparison of crop productivity in different soil-climatic zones clearly showed that the drylands represented a low productivity sector and a different strategy of agricultural growth and employment generation needs to be implemented here.

Agro-Climatic Zoning by Planning Commission and State Agricultural Universities

The soil-climatic classification did not, for many years, become the basis for any policy level intervention. The much needed shift in strategy was pioneered by the Planning Commission, at the end of 1980s, when it initiated a growth strategy based on the agro-climatic regional planning approach (Planning Commission, 1989). The purpose of this exercise was to identify broadly the crop mixes and types of land use that is best suited to the available resources of climate, soil, topography, water resources and irrigation facilities in each region. This implied a serious departure from the legacy of crop-centred research, which culminated in the Green Revolution. The package approach of the Green Revolution focused on yield maximisation of specific crops through provisioning of essential inputs and credit to already well-endowed areas. In contrast, the ACZ approach had three new, distinctive features. First, it began with an area-specific mapping of available resources and their potential, rather than an imposition of priorities from above. Second, its focus was on long term sustainability and efficiency of resource use, without compromising the short-term goals of higher output and employment. Third, this approach tried to strike a balance between national priorities like food security and regional concerns of protection of scarce resources and diversification of production structure. In its initial exercise, the Planning Commission identified fifteen Agro-climatic Zones (ACZ) on the basis of the commonality of variables like rainfall, soils, topography and crops grown.

The State Agricultural Universities were advised to divide each of the 15 ACZs into sub-zones under the National Agricultural Research Project (NARP). Accordingly, a 120 sub-zone map, based on rainfall, cropping pattern and administrative units, was prepared. This classification formed the basis of agricultural research and extension in the subsequent years and was used to arrive at detailed strategies of enhancing crop production and providing employment in each of the sub-zones in a sustainable manner.

The agro-climatic zoning approach attempted to identify commonalities among the relevant variables within an ACZ. However, in practice, this approach did not give adequate weight to soil considerations and soil water balance as key variables. It was also constrained by the use of state as the unit, which resulted in the creation of many sub-divisions with similar agro-climatic characteristics but which fell into different states. The Agro-climatic exercises were at the level of agro-climatic sub zones which were at the level of 3 to 5 districts but for administrative purposes the sub zones could straddle across States.

Agro-Ecological Sub-Regions Approach

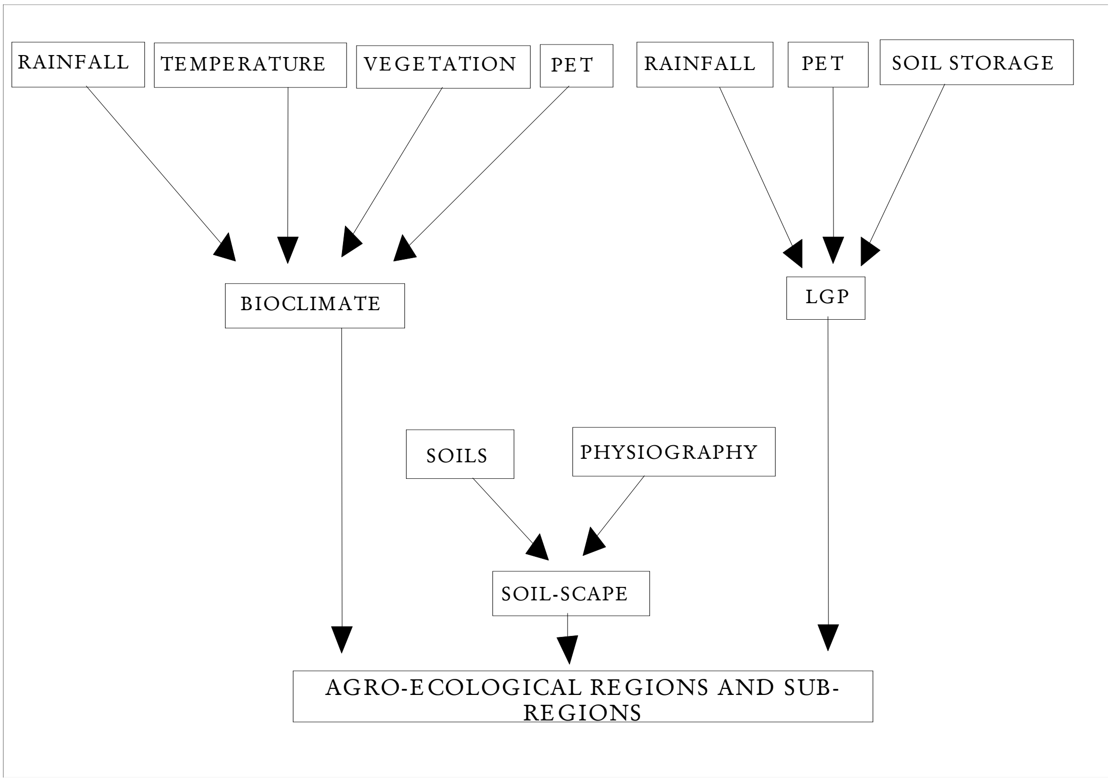
A more comprehensive attempt towards delineating agro-ecological regions in the country has been attempted by the National Bureau of Soil Survey and Land Use Planning (NBSS-LUP, 1992). This approach followed the FAO methodology (Higgins & Kassam, 1981) of a sequential layering of information on maps. Each contains areas of uniform physiography, climate, length of growing period and soils, and have similar hydrological and ecological responses. The major physiographic regions of the country such as the Himalayas, Indo-Gangetic plains, peninsular Deccan Plateau and coastal plains are subdivided to get 19 landform units. Information on the distribution of 16 broad soil units is superimposed on this landform map to get a map with 49 soil-scape units, out of which 24 are found to be significant. The combination of climatic elements, such as rainfall, temperature, vegetation and Potential evapo-transpiration (PET) together provides the bioclimate units. Five such units, viz., arid, semi-arid, sub-humid, humid and per humid, are identified (as in the MI approach discussed earlier). The water balance parameters rainfall, PET and soil storage together determines the soil moisture and soil temperature regimes. These variables together determine the period in which the moisture of the soil is adequate for supporting plant growth, called the length of the growing period (LGP). The growing period starts when rainfall exceeds 50 per cent of PET and ends with the utilization of the stored soil moisture after rainfall falls below PET. Five different ranges of LGP, counted in days from <90 to >210, are used. These LGP ranges together with 5 bioclimate units give 18 moisture availability regions of which 9 are found widely distributed. Finally, the layering of 9 LGP-Bioclimate units on the 24 soil-scape units gives rise to 20 generalized AERs.

On the basis of this classification, NBSS-LUP tried to identify the constraints on and potential of biomass production in each of these AERs. But the large size of AERs, often spanning several districts, rendered the average of climatic parameters used (rainfall, PET etc.) often too broad to inform any meaningful strategy of intervention. The smallest territorial AER (AER 3, Deccan Plateau) covered 4.9 million hectares or 1.5% of the land area of the country. The picture also gets much more complicated if one examines not just total rainfall but its pattern within the season. In some models of this approach, weekly or 10-day rainfall and PET figures have been used to characterise the growing period accurately. What is important for assessing crop potential is the correspondence between this distribution and the patterns of water requirement of different crops.

Subsequently, in 1999, the NBSS-LUP did another exercise to divide the AERs into 60 Agro-ecological Sub-regions (AESRs). This was done by narrowing down the LGP limits to 30 days instead of 60 and by including more soil criteria (NBSS-LUP, 1999). The methodology of delineation of AERS and AESRs is schematically shown in Figure 1.

Figure 1

Methodology for Agro-Ecological Regionalisation



Source: NBSS-LUP (1999)

A grouping of AERs into bio-climates and LGP ranges described above shows that about 83% of the country is located in sub-humid, semi-arid and arid bio-climates and has an LGP range of less than 210 days. In the absence of irrigation, dry farming will predominate in these areas. This again brings back the significance of rainfed drylands in Indian agriculture. Even at their low productivity levels, the quantitative significance of the dryland agriculture is by no means small. It accounts for 53% of total cropped area and 68% of that under non-food crops. In terms of production, drylands account for nearly 80% of the output of coarse cereals, 50% of maize, 65% of chickpea and pigeonpea, 81% of groundnut and 88% of soyabean. Half of the output of cotton in the country is from the dry districts (Mihir Shah, et.al. 1998; Kerr, 1996).

Table 4
Area under Agro-Ecological Regions in India

AER No.	Climate	LGP Range	Area (%)
1 - 3	Arid	0 - 90	15.9
4 - 8	Semi-Arid	90 - 150	35.7
9 - 14	Sub-Humid	150 - 210	31.0
15 - 17	Humid	> 210	9.9
18 - 19	Coastal	90 - 210	6.2
20	Island	> 210	0.3

Source: NBSS-LUP (1992).

The major weakness of the agro-ecological regions approach is that it focuses mainly on climatic, topographic and edaphic factors, without sufficiently emphasising the role of **irrigation** in modifying bio-climates and the LGP. While its use of LGP is an improvement over rainfall as an indicator of moisture availability, the model has no way of assessing crop performance across regions with similar LGP ranges. It also does not attempt to directly assess the extent of **vegetative cover** over land surface.

New Approach to Drought-prone Areas Proposed by the Parthasarathy Committee (2006)

Assessing Drought-Vulnerability

Taking the AESR classification as the basis, a new approach to agro-climatic planning has been suggested by the Parthasarathy Committee (PC). The mandate of the PC was to "assess and suitably modify the existing criteria for categorization of arid, semi-arid and dry sub-humid areas taking into account the changed climatic/biotic factors and identify the blocks for the implementation of DDP and DPAP". A similar exercise was done earlier by Hanumantha Rao Committee (1994), which used moisture index at district level as the basis of classification. The PC has suggested a method by which crop production potential and the extent of drought vulnerability could be assessed **at the block level** using **a composite drought index** combining bio-climates, rainfall, irrigation and extent of vegetation.

Drought is usually understood as a failure of rain. Hence, by the usual standards, the severity of the drought is measured by the extent of deviation of current year's rainfall from the long period average ("meteorological drought"). Since the quantum of rain varies between bio-climates, it is clear that we need to have different ranges to assess severity of meteorological drought in different bio-climates. The PC suggests the following ranges for calculating drought-proneness at the block level (Table 5).

Table 5

Weightage for Drought-proneness in Bio-climates

Type of drought	**Weigh-tage marks**	**Drought proneness (% departure of rainfall from mean)**		
		Dry sub-humid (MI 0 to –33.3)	Semi-arid (MI-33.3 to –66.6)	Arid (< -66.6)
Normal	0	< - 24	< - 19	< -14
Mild	10	-25 to 37.4	- 20 to 35.0	-15 to – 37.5
Moderate	20	-37.5 to 50.0	-35.1 to 50.0	-37.6 to 50.0
Severe	40	> 50.1	>50.1	> 50.1
Total	70			

Thus, a 15% deviation from average rainfall in a year will not be considered a drought in sub-humid and semi-arid bio-climates whereas it would qualify as "mild drought" in an arid bio-climate. Each category of meteorological drought is ascribed weights, which should be multiplied with the extent of the area suffering from rainfall deviation of the magnitude mentioned against it. Thus, we get a **weighted drought index**. Higher the value of the drought index, the more drought-prone the block will be.

Access to irrigation reduces drought vulnerability. Hence, the severity of the drought should be assessed together with the access to irrigation in a block. Moreover, sources of irrigation vary in their reliability and use efficiency. Hence, they are given different weights. Canal irrigation, which is considered most reliable, is given the least weightage. The PC gives maximum weight to a situation without irrigation ("rainfed"). Weightage factors given for different sources of irrigation are given below (Table 6).

Table 6

Weightage for Sources of Irrigation

Source of irrigation	**Weightage**
Canal	2
Lift	8
Rainfed	20
Total	30

The percentage of irrigated/rainfed area of the total block is multiplied with the weightage factor to get **weighted irrigation index**. This index is calculated for all blocks. Higher the value of irrigation index , the more drought-prone the block will be.

A further specification needs to be introduced to the notion of "irrigated area". The official reported data gives equal weightage to a unit area irrigated under sugarcane and, say, kharif maize. It is clear that sugarcane is an annual crop and has large irrigation requirement whereas kharif maize is a seasonal crop needing one or two protective irrigations only. Therefore, irrigated area under different crops should be ascribed different weights depending on *irrigation depth ("delta")* or *the sum of number of waterings per unit area irrigated*. The crucial gap here is the number of waterings per crop in each district or block. In the 1970s, ICAR had carried out detailed estimates of depth of irrigation for each crop in different agro-ecological regions (ICAR, 1977, ICAR 1987 and Prihar & Sandhu, 1994). Agricultural universities were expected to generate such data for subsequent years through detailed studies of various crops and types of soil. The Committee on Pricing of Irrigation Waters (GoI, 1992, Annexure 7.1) also has made some estimates of depth of irrigation cropwise for 6 states. The available evidence on depth of irrigation cropwise is summarised in Table 6. However, more detailed work is necessary to generate such information cropwise and areawise, taking into account all factors affecting crop growth and water use. This major gap in the existing database for this kind of data must be bridged by introducing this crucial distinction into the reporting schedules by asking questions about the number and source of each watering. Blocks with a higher depth of irrigation should be given lesser weight and considered less drought-prone.

Data is however available even at present on the number of waterings on a very large scale in the Crop Cutting Experiments which are used for preparing India's crop wise yield statistics on a District, State and National level. These statistics have been used for example for planning of irrigation projects as the following table shows, but could be used for identification of agro-economic characteristics. Thus the weightage given to Canal and ground water of 10 points in Table 6 , would be changed as follows:

Nos. of Waterings in a Crop Year	**Weightage in Drought Index**
=> 10	**1**
9	**2**
8	**3**
7	**4**

6 **5**

5 **6**

4 **7**

3 **8**

2 **9**

=< 1 **10**

Table 7
Net Irrigation Requirement of Crops (metres)

	Andhra Pradesh	*Bihar*	*Gujarat*	*Haryana*	*Karna-taka*	*Madhya-Pradesh*	*Maha-rashtra*	*Orissa*	*Punjab*	*Raja-sthan*	*Tamil Nadu*	*Uttar Pradesh*	*West Bengal*	
Rice	1.25	1.05	1.25	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.25	0.91	1.05	
Jowar	0.30	NI	0.10	0.25	0.14	NI	0.14	NI	NI	NS	0.30	NS	NI	
Bajra	0.15	NI	0.15	0.20	0.15	NI	0.15	NI	0.20	0.15	0.15	0.15	NI	
Maize	0.15	0.13	0.15	0.15	0.15	NS	0.15	NI	0.15	0.15	0.13	0.15	NI	
Ragi	0.35	NI	NI	NI	0.35	NI	NS	0.35	NI	NI	0.35	NI	NI	
Wheat	NI	0.50	0.60	0.50	0.38	0.60	0.60	0.55	0.50	0.50	NI	0.40	0.55	
Barley		NI	NI	NS	0.25	NI	0.20	NI	NI	0.08	0.30	NI	0.16	NI
Gram	NI	NI	0.15	0.06	0.44	0.20	0.15	NI	NS	0.20	NI	0.08	NI	
Tur	NI	NI	0.15	0.15	0.15	NS	NS	NI	0.15	NI	NI	0.15	NI	
Other Pulses	NS	0.14	NS	0.14	0.14	0.14	0.14	0.14	0.14	NI	0.14	0.14	NI	
Sugarcane	0.68	0.45	1.20	0.80	0.80	1.20	1.20	0.45	0.80	1.20	0.68	1.00	0.45	
Cond. & Spices	0.60	NI	0.60	0.60	0.60	0.60	0.60	0.60	NS	0.60	0.60	0.60	NI	
Fruits & Veg.	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
Groundnut	0.65	NI	0.55	NI	0.30	NS	0.55	0.60	NS	0.14	0.50	NS	NI	
Sesamum	NI	NI	NI	NI	NI	NI	NS	0.15	NI	NI	0.15	NI	0.15	
Rapeseed	NI	0.10	0.15	0.10	NI	0.15	NS	0.14	NI	0.08	NI	0.10	0.10	
Linseed		NI	NI	NI	NI	NI	NS	0.15	NS	NI	NI	NI	NI	NI
Cotton	0.40	NI	0.30	0.24	0.40	0.20	0.20	NS	0.30	0.20	0.40	0.30	NI	

Note: NS: Irrigated Area under the Crop is Not Significant. NI: Crop is Not Irrigated.
Source: Mihir Shah, *et al* (1998)

The **weighted drought index** and the **weighted irrigation index** are then combined to get a **composite drought index**. The weights given to the two indices are not the same. (Table 8).

Table 8

Weightage of Drought and Irrigation Indices

Indices	**Weightage**
Weighted Drought	70
Weighted Irrigation	30

Based on these weightage factors the composite drought index is estimated.

$$Y = 0.70X_1 + 0.30X_2$$

The higher the value of the composite drought index, the more drought-prone the block will be. Using this approach, drought vulnerability can be delineated at the block level and appropriate strategies could be visualised.

Generalising this approach by including other bio-climates and their respective weights and ranges for rainfall deviation and irrigated area, the AESR approach to agro-climatic planning could be considerably strengthened. This approach would enable us to identify highly vulnerable segments at a block level within an AESR for which suitable land use packages need to be implemented to reduce drought vulnerability.

Validation of Drought Vulnerability using High-resolution NDVI Data Sets

A major weakness of the AESR approach is that it does not assess vegetative cover directly. The PC suggests a new method of utilising remote sensing data from NRSA to develop a **Normalised Difference Vegetation Index (NDVI)** for each block, to validate the composite drought index. National Agricultural Drought Assessment and Monitoring System (NADAMS) is a remote sensing based agricultural drought monitoring mechanism in India and providing near real-time information on the prevalence, severity level and persistence of agricultural drought at national/state/district level. The project covers 14 states of India, which are predominantly agriculture based and prone to agricultural drought situation. Composition of NDVI for a period of 15 days to a month is being adapted that would also circumvent the problem of cloud cover, especially during the kharif season.

NDVI is a transformation of reflected radiation in the visible and near infrared bands of electromagnetic spectrum and is a function of crop growth, green leaf area and biomass in response to the prevailing agro-climate, availability of water and management conditions. NDV is defined as (NIR-Red) / (NIR+Red), where NIR and red are the reflected radiations in these two spectral bands. Among the various vegetation indices that are now available, NDVI is a most generally accepted index for operational drought assessment because of its simplicity in calculation, easy to interpret and its ability to partially compensate for the effects of atmosphere, illumination geometry etc. Stressed vegetation has lower NDVI compared to healthy vegetation.

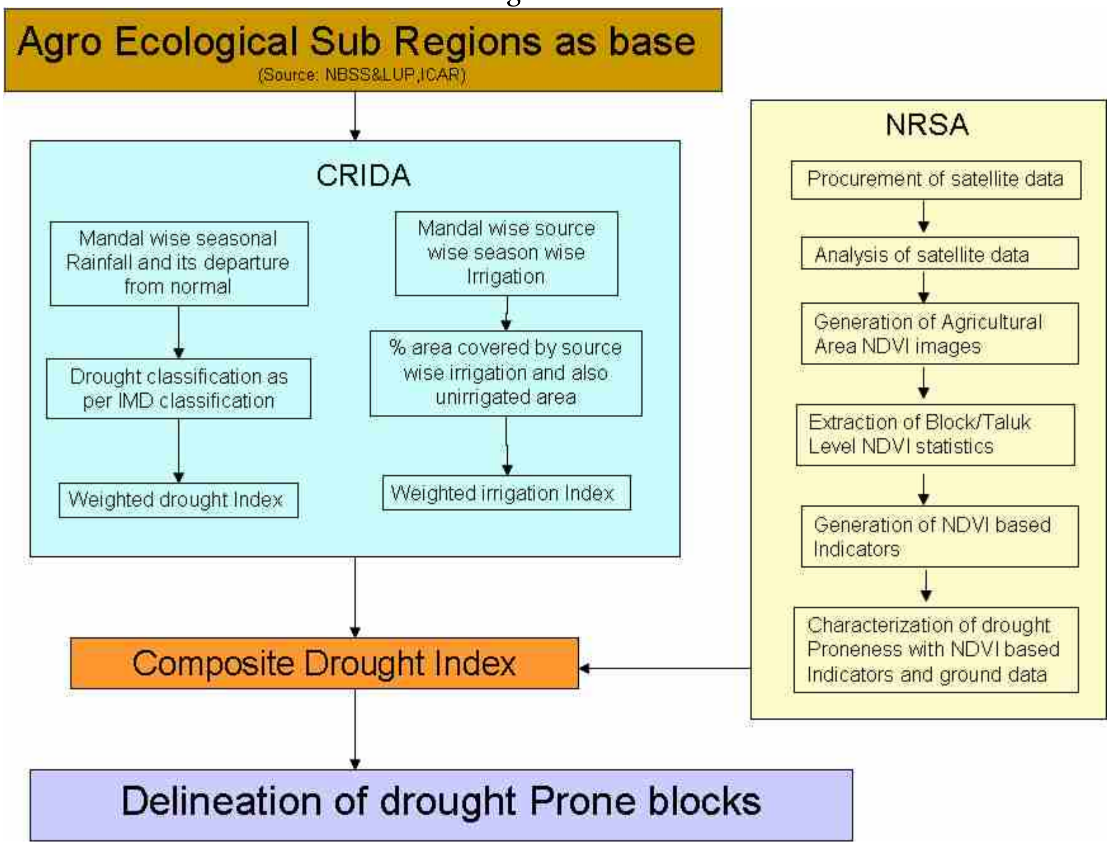
Fluctuations of crop condition as triggered by weather and water supply conditions determine the agricultural drought proneness in a given area. Assessment of agricultural drought situation in each district takes in to consideration the following factors:

- seasonal NDVI progression – i.e. transformation of NDVI from the beginning of the season;
- comparison of NDVI profile with previous normal years;
- weekly rainfall status compared to normal;
- weekly progression of sown area compared to normal.

The relative deviation of NDVI from that of normal and the rate of progression of NDVI within the season gives the indication about the agricultural situation in the district which is then complemented by ground situation as evident from rainfall and sown area. Long term NDVI database consisting of extreme drought events and normal season facilitates quantification of NDVI variability which directly indicates drought vulnerability.

Further, integration of NDVI and other parameters like rainfall, soil and irrigation support provide immense opportunities to characterize drought proneness and delineate drought prone areas. It therefore offers an opportunity to combine meteorological and agricultural drought situations and arrive at a comprehensive drought index. This is a significant improvement over simple climatic region approaches discussed above. The methodology of the PC is shown in the following figure (Figure 2)

Figure 2



However, the data requirements for construction of the NDVI are huge. Interpretation of the data requires collective effort of a large number of institutions and scientific expertise. A more serious problem is that this method cannot deal with vegetational heterogeneity. This method runs into great problems when, as in India, several types of land uses co-exist and often mix with each other. While NDVI can broadly indicate the presence or absence of vegetation, the information it provides can be quite misleading unless it is coupled with a lot of ground checks. NDVI should, therefore, be correlated with other secondary information about the blocks as well as primary surveys to verify the extent of actual vegetative cover on the ground. Since this method tries to incorporate remote sensing information into drought monitoring and crop planning, it should be made part of the existing models of agro-climatic regional planning in India.

In fact these techniques should not be used for identification of drought prone or rainfed regions, where the existing method suitably modified as discussed elsewhere in the report will be suitable,but should be used for planning of strategies and programme content of the rainfed regions plans. In fact using these kinds of indices for identification has a handicap in the sense tat an area which improves irrigation or vegetation would stand at a disadvantage for consolidation of strategies at a time when they need it most, given the emphasis on watershed plus kind of strategies discussed earler.But these techniques are now within the range of practical application for programme and policy planning and must be used accordingly. The use of biotechnology for species propogation, information technology for programme implementation and information support, including for marketing and of space products is now practically possible and must be vigourously pursued.

The use of space technology is well known and Sharma et.al., (Vaidyanathan and Dubey,2000), have listed all the possibilities comprehensively. A Seminar conducted by ISRO with the Indian Society of Agricultural Economics on Remote Sensing and Agricultural Statistics has shown the way ahead. A. Vaidyanathan, and Y.K.Alagh noted that strategies and programmes have been set from the last decade and a half and substantial progress is now possible if coordinated policies are followed.

The Vaidyanathan-Alagh proposals emphasized the relevance of National Natural Resources Management System (NNRMS). This included Crop Acreage and Production Estimation as a major project on generation of crop statistics using remote sensing data. Under the sponsorship of the Ministry of .Agriculture (MOA), Government of India, the joint MOA-ISRO formulation of forecasting Agricultural Output using Space, .Agro-meteorology and Land-based observations (FASAL) project aims at integration of land, space and weather data. A six-point programme for using satellite data to supplement traditional sources of agricultural statistics, included timely data on Land Use Statistics (LUS) where the traditional Crop and Season Reports were generally available with a time lag of three to five years. This is important in view of the acute land scarcity emerging from the constancy of net area sown. Second space data should be used for checking climates of errors of crop area and yield statistics. While at the national level Timely Reporting Scheme ('I'RS) and National Sample Survey Organisation (NSSO) sample checks gave low errors on production, at the state level, area and yield errors could be between 6 per cent and 12 per cent. Space data would be another check and would give timely results. Third, geographic mapping systems should be used not only for public sector projects as earlier in. watersheds, etc., but also for cooperative, NGO and private sector projects since around 40 per cent of foreign investment was in the agro-processing sector. The earlier drafts of the Space Policy enunciated provided marketing of space data by ISRO. It has been noted that the ISRO subsidiary Antrix was successful both at home and abroad. Fourth, two-way information systems would be developed with the help of space facilities. The farmer should not only be a source of data to the Patwari and for yield statistics, but should also be the recipient of technology and agro-economic data he needs for agriculture in a liberalizing economy. Finally, a small nucleus institute, centre with experts on deputation from ISRO, Central Statistical Organisation (('SO), NSSO, MOA, Indian Meteorological Department (IMD) to build up new systems of man and machine working together in a restructured agricultural information system, was necessary. Nowhere are these techniques more useful than the resource stressed regions of India.

Annex 1

100 Hard-rock Districts most at risk of Groundwater Depletion

(in nos.)

Sl. No.	Name of District	State	Total Dugwells	Semi critical	Critical	Over Exploited
1	KARIMNAGAR	A.P.	208000	7	13	22
2	TIRUVANNAMALAI	T.N.	169471	5	2	9
3	NASHIK	Maharashtra	168204	3		
4	WARANGAL	A.P.	160706	6	2	22
5	VILLUPPURAM	T.N.	156837	4	3	14
6	AHMEDNAGAR	Maharashtra	152524	5		
7	JUNAGADH	Gujarat	134112	8	2	1
8	SOLAPUR	Maharashtra	131361			
9	VELLORE	T.N.	127778	3	1	16
10	DHARMAPURI	T.N.	125394		1	7
11	ERODE	T.N.	124197	2	3	3
12	JAIPUR	Rajasthan	121275		2	11
13	BHAVNAGAR	Gujarat	118035	4	1	
14	PUNE	Maharashtra	116670	4		
15	CHITTOOR	A.P.	116623	11	9	18
16	JALGAON	Maharashtra	109468	2		2
17	NALGONDA	A.P.	109391	27	5	4
18	BHILWARA	Rajasthan	108486		3	8
19	COIMBATORE	T.N.	107441	1	4	11
20	RAJKOT	Gujarat	103684	8	1	
21	SALEM	T.N.	101726	3	1	14
22	MANDSAUR	M.P.	97909			3
23	DINDIGUL	T.N.	97327		2	10
24	CHITTORGARH	Rajasthan	91895	1		13

25	MAHABOOBNAGAR	A.P.	91809	23	7	13
26	SANGLI	Maharashtra	89591	2		1
27	TIRUNELVELI	T.N.	88952	1		4
28	AURANGABAD	Maharashtra	88291			
29	SABARKANTHA	Gujarat	84487	8	1	2
30	JAMNAGAR	Gujarat	83271	4		
31	AMRELI	Gujarat	80859	6		
32	CHHINDWARA	M.P.	77976	1		
33	TIRUCHIRAPPALLI	T.N.	77653		1	4
34	SATARA	Maharashtra	75483	1		
35	ALWAR	Rajasthan	74634		1	13
36	AMRAVATI	Maharashtra	73161		1	3
37	AJMER	Rajasthan	72525		2	6
38	RAJGARH	M.P.	70281			
39	Belgaum	Karnataka	65809			7
40	BULDANA	Maharashtra	64397	1		1
41	JHALAWAR	Rajasthan	63745		4	2
42	NAGPUR	Maharashtra	63578	2		
43	KHANDWA	M.P.	62938	1		
44	UDAIPUR	Rajasthan	62368		3	8
45	NAMAKKAL	T.N.	60864	3	2	8
46	TIKAMGARH	M.P.	59091			
47	BOLANGIR	Orissa	57782			
48	KHARGONE	M.P.	57430	2	1	
49	SURGUJA	Chhattisgarh	55806			
50	BETUL	M.P.	54006	1		
51	SHAJAPUR	M.P.	53911	2	1	5
52	CHHATARPUR	M.P.	53720	1		
53	MADURAI	T.N.	53674	3	1	3
54	ANANTHAPUR	A.P.	52937	9	12	28
55	SIKAR	Rajasthan	52852			7
56	JALORE	Rajasthan	52468			7
57	MEDAK	A.P.	52119	13	9	12
58	BANASKANTHA	Gujarat	50941	1	2	6

59	DHULE	Maharashtra	50806			
60	JALNA	Maharashtra	50361			
61	TONK	Rajasthan	48486		5	1
62	KANCHEEPURAM	T.N.	48103	3	2	2
63	KARUR	T.N.	47971	2		2
64	RAJSAMAND	Rajasthan	47878		2	5
65	NEEMUCH	M.P.	47536	1		1
66	PERAMBALUR	T.N.	47525			4
67	PALI	Rajasthan	45231		5	5
68	VIRUDHUNAGAR	T.N.	45166	2	1	1
69	RATLAM	M.P.	44723	1		2
70	SAGAR	M.P.	44663			
71	THRISSUR	Kerala	44475	4		1
72	PANCHMAHAL	Gujarat	44437	6		
73	WARDHA	Maharashtra	43978			
74	SHIVPURI	M.P.	43409			
75	PUDUKKOTTAI	T.N.	43372	1		
76	Bijapur	Karnataka	43111	2		2
77	OSMANABAD	Maharashtra	42702	1		
78	CUDDAPAH	A.P.	41783	18	4	17
79	DAUSA	Rajasthan	41500			5
80	KOLHAPUR	Maharashtra	41179			
81	UJJAIN	M.P.	40871	2		3
82	HAZARIBAGH	Jharkhand	39745			
83	RANCHI	Jharkhand	39393			
84	KHAMMAM	A.P.	38972	1		3
85	DHAR	M.P.	37404	1		5
86	SURENDRANAGAR	Gujarat	37115	3		
87	Dakshina Kannada	Karnataka	36925			
88	JHUNJHUNU	Rajasthan	36872			7
89	YAVATMAL	Maharashtra	36517			
90	SRIKAKULAM	A.P.	36389			
91	VIZIANAGARAM	A.P.	35796	3		
92	NELLORE	A.P.	35239	8	2	3

93	KURNOOL	A.P.	34742	4	1	12
94	DAHOD	Gujarat	34020	2		
95	DEWAS	M.P.	33494		2	
96	GANJAM	Orissa	32703			
97	SAWAI MADHOPUR	Rajasthan	32563		3	2
98	TUTICORIN DISTRICT	T.N.	31760	2	1	7
99	NAGAUR	Rajasthan	31686	1	2	7
100	BEED	Maharashtra	30914			
			7049438	257	133	425

Annex2

Overlay of IWDP, DPAP,DDP and proposed Integrated Groundwater Recharge Project

				Districts		
Sl. No.	Name of District	State	Groundwater Recharge	IWDP	DPAP	DDP
1	AJMER	Rajasthan	GrWater Recharge	IWDP	DPAP	DDP
2	UDAIPUR	Rajasthan	GrWater Recharge	IWDP	DPAP	DDP
3	CHITTOOR	A.P.	GrWater Recharge	IWDP	DPAP	
4	CUDDAPAH	A.P.	GrWater Recharge	IWDP	DPAP	
5	KHAMMAM	A.P.	GrWater Recharge	IWDP	DPAP	
6	KURNOOL	A.P.	GrWater Recharge	IWDP	DPAP	
7	MAHABOOBNAGAR	A.P.	GrWater Recharge	IWDP	DPAP	
8	MEDAK	A.P.	GrWater Recharge	IWDP	DPAP	
9	NALGONDA	A.P.	GrWater Recharge	IWDP	DPAP	
10	SRIKAKULAM	A.P.	GrWater Recharge	IWDP	DPAP	
11	AMRELI	Gujarat	GrWater Recharge	IWDP	DPAP	
12	BHAVNAGAR	Gujarat	GrWater Recharge	IWDP	DPAP	
13	DAHOD	Gujarat	GrWater Recharge	IWDP	DPAP	
14	JUNAGADH	Gujarat	GrWater Recharge	IWDP	DPAP	
15	PANCHMAHAL	Gujarat	GrWater Recharge	IWDP	DPAP	
16	SABARKANTHA	Gujarat	GrWater Recharge	IWDP	DPAP	
17	HAZARIBAGH	Jharkhand	GrWater Recharge	IWDP	DPAP	
18	Belgaum	Karnataka	GrWater Recharge	IWDP	DPAP	
19	BETUL	M.P.	GrWater Recharge	IWDP	DPAP	
20	CHHINDWARA	M.P.	GrWater Recharge	IWDP	DPAP	
21	DEWAS	M.P.	GrWater Recharge	IWDP	DPAP	
22	DHAR	M.P.	GrWater Recharge	IWDP	DPAP	
23	KHANDWA	M.P.	GrWater Recharge	IWDP	DPAP	

24	KHARGONE	M.P.	GrWater Recharge	IWDP	DPAP	
25	RAJGARH	M.P.	GrWater Recharge	IWDP	DPAP	
26	RATLAM	M.P.	GrWater Recharge	IWDP	DPAP	
27	SHAJAPUR	M.P.	GrWater Recharge	IWDP	DPAP	
28	SHIVPURI	M.P.	GrWater Recharge	IWDP	DPAP	
29	AHMEDNAGAR	Maharashtra	GrWater Recharge	IWDP	DPAP	
30	AMRAVATI	Maharashtra	GrWater Recharge	IWDP	DPAP	
31	BEED	Maharashtra	GrWater Recharge	IWDP	DPAP	
32	BULDANA	Maharashtra	GrWater Recharge	IWDP	DPAP	
33	DHULE	Maharashtra	GrWater Recharge	IWDP	DPAP	
34	JALGAON	Maharashtra	GrWater Recharge	IWDP	DPAP	
35	JALNA	Maharashtra	GrWater Recharge	IWDP	DPAP	
36	NAGPUR	Maharashtra	GrWater Recharge	IWDP	DPAP	
37	NASHIK	Maharashtra	GrWater Recharge	IWDP	DPAP	
38	OSMANABAD	Maharashtra	GrWater Recharge	IWDP	DPAP	
39	PUNE	Maharashtra	GrWater Recharge	IWDP	DPAP	
40	SANGLI	Maharashtra	GrWater Recharge	IWDP	DPAP	
41	SATARA	Maharashtra	GrWater Recharge	IWDP	DPAP	
42	SOLAPUR	Maharashtra	GrWater Recharge	IWDP	DPAP	
43	YAVATMAL	Maharashtra	GrWater Recharge	IWDP	DPAP	
44	BOLANGIR	Orissa	GrWater Recharge	IWDP	DPAP	
45	JHALAWAR	Rajasthan	GrWater Recharge	IWDP	DPAP	
46	SAWAI MADHOPUR	Rajasthan	GrWater Recharge	IWDP	DPAP	
47	TONK	Rajasthan	GrWater Recharge	IWDP	DPAP	
48	COIMBATORE	T.N.	GrWater Recharge	IWDP	DPAP	
49	DHARMAPURI	T.N.	GrWater Recharge	IWDP	DPAP	
50	DINDIGUL	T.N.	GrWater Recharge	IWDP	DPAP	
51	KARUR	T.N.	GrWater Recharge	IWDP	DPAP	

52	NAMAKKAL	T.N.	GrWater Recharge	IWDP	DPAP	
53	PERAMBALUR	T.N.	GrWater Recharge	IWDP	DPAP	
54	PUDUKKOTTAI	T.N.	GrWater Recharge	IWDP	DPAP	
55	SALEM	T.N.	GrWater Recharge	IWDP	DPAP	
56	TIRUCHIRAPPALLI	T.N.	GrWater Recharge	IWDP	DPAP	
57	TIRUNELVELI	T.N.	GrWater Recharge	IWDP	DPAP	
58	TIRUVANNAMALAI	T.N.	GrWater Recharge	IWDP	DPAP	
59	TUTICORIN DISTRICT	T.N.	GrWater Recharge	IWDP	DPAP	
60	VELLORE	T.N.	GrWater Recharge	IWDP	DPAP	
61	VIRUDHUNAGAR	T.N.	GrWater Recharge	IWDP	DPAP	
62	ANANTHAPUR	A.P.	GrWater Recharge	IWDP		DDP
63	BANASKANTHA	Gujarat	GrWater Recharge	IWDP		DDP
64	JAMNAGAR	Gujarat	GrWater Recharge	IWDP		DDP
65	RAJKOT	Gujarat	GrWater Recharge	IWDP		DDP
66	SURENDRANAGAR	Gujarat	GrWater Recharge	IWDP		DDP
67	JAIPUR	Rajasthan	GrWater Recharge	IWDP		DDP
68	JALORE	Rajasthan	GrWater Recharge	IWDP		DDP
69	JHUNJHUNU	Rajasthan	GrWater Recharge	IWDP		DDP
70	NAGAUR	Rajasthan	GrWater Recharge	IWDP		DDP
71	PALI	Rajasthan	GrWater Recharge	IWDP		DDP
72	RAJSAMAND	Rajasthan	GrWater Recharge	IWDP		DDP
73	SIKAR	Rajasthan	GrWater Recharge	IWDP		DDP
74	KARIMNAGAR	A.P.	GrWater Recharge	IWDP		
75	NELLORE	A.P.	GrWater Recharge	IWDP		
76	VIZIANAGARAM	A.P.	GrWater Recharge	IWDP		
77	WARANGAL	A.P.	GrWater Recharge	IWDP		
78	SURGUJA	Chhattisgarh	GrWater Recharge	IWDP		
79	RANCHI	Jharkhand	GrWater Recharge	IWDP		

80	Bijapur	Karnataka	GrWater Recharge	IWDP		
81	Dakshina Kannada	Karnataka	GrWater Recharge	IWDP		
82	THRISSUR	Kerala	GrWater Recharge	IWDP		
83	CHHATARPUR	M.P.	GrWater Recharge	IWDP		
84	MANDSAUR	M.P.	GrWater Recharge	IWDP		
85	NEEMUCH	M.P.	GrWater Recharge	IWDP		
86	SAGAR	M.P.	GrWater Recharge	IWDP		
87	TIKAMGARH	M.P.	GrWater Recharge	IWDP		
88	UJJAIN	M.P.	GrWater Recharge	IWDP		
89	AURANGABAD	Maharashtra	GrWater Recharge	IWDP		
90	KOLHAPUR	Maharashtra	GrWater Recharge	IWDP		
91	WARDHA	Maharashtra	GrWater Recharge	IWDP		
92	GANJAM	Orissa	GrWater Recharge	IWDP		
93	ALWAR	Rajasthan	GrWater Recharge	IWDP		
94	BHILWARA	Rajasthan	GrWater Recharge	IWDP		
95	CHITTORGARH	Rajasthan	GrWater Recharge	IWDP		
96	DAUSA	Rajasthan	GrWater Recharge	IWDP		
97	ERODE	T.N.	GrWater Recharge	IWDP		
98	KANCHEEPURAM	T.N.	GrWater Recharge	IWDP		
99	MADURAI	T.N.	GrWater Recharge	IWDP		
100	VILLUPPURAM	T.N.	GrWater Recharge	IWDP		
101	Davanagere	Karnataka		IWDP	DPAP	DDP
102	ADILABAD	A.P.		IWDP	DPAP	
103	PRAKASAM	A.P.		IWDP	DPAP	
104	RANGAREDDY	A.P.		IWDP	DPAP	
105	JAMUI	Bihar		IWDP	DPAP	
106	KAIMUR (BHABUA)	Bihar		IWDP	DPAP	
107	MADHUBANI	Bihar		IWDP	DPAP	
108	NAWADA	Bihar		IWDP	DPAP	
109	ROHTAS(SASARAM)	Bihar		IWDP	DPAP	
110	SITAMARHI	Bihar		IWDP	DPAP	
111	BASTER	Chhattisgarh		IWDP	DPAP	
112	BILASPUR	Chhattisgarh		IWDP	DPAP	

113	DANTEWADA	Chhattisgarh		IWDP	DPAP	
114	DURG	Chhattisgarh		IWDP	DPAP	
115	JANJGIR-CHAMPA	Chhattisgarh		IWDP	DPAP	
116	KORBA	Chhattisgarh		IWDP	DPAP	
117	KVARDHA	Chhattisgarh		IWDP	DPAP	
118	RAJNANDGAON	Chhattisgarh		IWDP	DPAP	
119	AHMEDABAD	Gujarat		IWDP	DPAP	
120	BHARUCH	Gujarat		IWDP	DPAP	
121	DANG	Gujarat		IWDP	DPAP	
122	NARMADA	Gujarat		IWDP	DPAP	
123	NAVSARI	Gujarat		IWDP	DPAP	
124	PORBANDAR	Gujarat		IWDP	DPAP	
125	VADODARA	Gujarat		IWDP	DPAP	
126	VALSAD	Gujarat		IWDP	DPAP	
127	Bilaspur	Himachal		IWDP	DPAP	
128	Solan	Himachal		IWDP	DPAP	
129	Una	Himachal		IWDP	DPAP	
130	DODA	J & K		IWDP	DPAP	
131	UDHAMPUR	J & K		IWDP	DPAP	
132	BOKARO	Jharkhand		IWDP	DPAP	
133	CHATRA	Jharkhand		IWDP	DPAP	
134	DEOGHAR	Jharkhand		IWDP	DPAP	
135	DHANBAD	Jharkhand		IWDP	DPAP	
136	DUMKA	Jharkhand		IWDP	DPAP	
137	GARHWA	Jharkhand		IWDP	DPAP	
138	GODDA	Jharkhand		IWDP	DPAP	
139	JAMTARA	Jharkhand		IWDP	DPAP	
140	KODERMA	Jharkhand		IWDP	DPAP	
141	LATEHAR	Jharkhand		IWDP	DPAP	
142	PAKUR	Jharkhand		IWDP	DPAP	
143	PALAMU	Jharkhand		IWDP	DPAP	
144	SAHEBGANJ	Jharkhand		IWDP	DPAP	
145	Bidar	Karnataka		IWDP	DPAP	
146	Chamaraja Nagara	Karnataka		IWDP	DPAP	
147	Chikmagalur	Karnataka		IWDP	DPAP	
148	Chitradurga	Karnataka		IWDP	DPAP	
149	Dharwar	Karnataka		IWDP	DPAP	
150	Gadag	Karnataka		IWDP	DPAP	
151	Gulbarga	Karnataka		IWDP	DPAP	
152	Hassan	Karnataka		IWDP	DPAP	
153	Haveri	Karnataka		IWDP	DPAP	
154	Kolar	Karnataka		IWDP	DPAP	
155	Mysore	Karnataka		IWDP	DPAP	
156	Tumkur	Karnataka		IWDP	DPAP	
157	BARWANI	M.P.		IWDP	DPAP	
158	BHIND	M.P.		IWDP	DPAP	
159	DAMOH	M.P.		IWDP	DPAP	
160	GUNA	M.P.		IWDP	DPAP	
161	JABALPUR	M.P.		IWDP	DPAP	

162	JHABUA	M.P.		IWDP	DPAP	
163	PANNA	M.P.		IWDP	DPAP	
164	RAISEN	M.P.		IWDP	DPAP	
165	REWA	M.P.		IWDP	DPAP	
166	SEONI	M.P.		IWDP	DPAP	
167	SHAHDOL	M.P.		IWDP	DPAP	
168	SIDHI	M.P.		IWDP	DPAP	
169	UMARIA	M.P.		IWDP	DPAP	
170	AKOLA	Maharashtra		IWDP	DPAP	
171	CHANDRAPUR	Maharashtra		IWDP	DPAP	
172	GADCHIROLI	Maharashtra		IWDP	DPAP	
173	HINGOLI	Maharashtra		IWDP	DPAP	
174	LATUR	Maharashtra		IWDP	DPAP	
175	NANDED	Maharashtra		IWDP	DPAP	
176	NANDURBAR	Maharashtra		IWDP	DPAP	
177	PARBHANI	Maharashtra		IWDP	DPAP	
178	WASHIM	Maharashtra		IWDP	DPAP	
179	BARGARH	Orissa		IWDP	DPAP	
180	BOUDH	Orissa		IWDP	DPAP	
181	DHENKANAL	Orissa		IWDP	DPAP	
182	KALAHANDI	Orissa		IWDP	DPAP	
183	NUAPADA	Orissa		IWDP	DPAP	
184	PHULBANI	Orissa		IWDP	DPAP	
185	SONEPUR	Orissa		IWDP	DPAP	
186	BANSWARA	Rajasthan		IWDP	DPAP	
187	BARAN	Rajasthan		IWDP	DPAP	
188	BHARATPUR	Rajasthan		IWDP	DPAP	
189	DUNGARPUR	Rajasthan		IWDP	DPAP	
190	KAROLI	Rajasthan		IWDP	DPAP	
191	KOTA	Rajasthan		IWDP	DPAP	
192	KRISHNAGIRI	T.N.		IWDP	DPAP	
193	RAMANATHAPURAM	T.N.		IWDP	DPAP	
194	SIVAGANGA	T.N.		IWDP	DPAP	
195	ALLAHABAD	U.P.		IWDP	DPAP	
196	BAHARAICH	U.P.		IWDP	DPAP	
197	BALRAMPUR	U.P.		IWDP	DPAP	
198	BANDA	U.P.		IWDP	DPAP	
199	CHITRAKOOT	U.P.		IWDP	DPAP	
200	HAMIRPUR	U.P.		IWDP	DPAP	
201	JALAUN	U.P.		IWDP	DPAP	
202	JHANSI	U.P.		IWDP	DPAP	
203	KHERI	U.P.		IWDP	DPAP	
204	LALITPUR	U.P.		IWDP	DPAP	
205	MAHOBA	U.P.		IWDP	DPAP	
206	MIRZAPUR	U.P.		IWDP	DPAP	
207	SHRAWASTI	U.P.		IWDP	DPAP	
208	SITAPUR	U.P.		IWDP	DPAP	
209	SONBHADRA	U.P.		IWDP	DPAP	
210	ALMORA	Uttaranchal		IWDP	DPAP	

211	BAGESHWAR	Uttaranchal		IWDP	DPAP	
212	CHAMOLI	Uttaranchal		IWDP	DPAP	
213	CHAMPAWAT	Uttaranchal		IWDP	DPAP	
214	PAURI	Uttaranchal		IWDP	DPAP	
215	PITHORAGARH	Uttaranchal		IWDP	DPAP	
216	TEHRI GARHWAL	Uttaranchal		IWDP	DPAP	
217	BANKURA	W.B		IWDP	DPAP	
218	BIRBHUM	W.B		IWDP	DPAP	
219	MIDNAPORE	W.B		IWDP	DPAP	
220	PURULIA	W.B		IWDP	DPAP	
221	KACHCHH	Gujarat		IWDP		DDP
222	PATAN	Gujarat		IWDP		DDP
223	AMBALA	Haryana		IWDP		DDP
224	FATEHABAD	Haryana		IWDP		DDP
225	HISSAR	Haryana		IWDP		DDP
226	JHAJJAR	Haryana		IWDP		DDP
227	NARNAUL	Haryana		IWDP		DDP
228	REWARI	Haryana		IWDP		DDP
229	SIRSA	Haryana		IWDP		DDP
230	Kinnaur	Himachal		IWDP		DDP
231	Lahail and Spiti	Himachal		IWDP		DDP
232	Bellary	Karnataka		IWDP		DDP
233	Koppal	Karnataka		IWDP		DDP
234	Raichur	Karnataka		IWDP		DDP
235	BARMER	Rajasthan		IWDP		DDP
236	BIKANER	Rajasthan		IWDP		DDP
237	CHURU	Rajasthan		IWDP		DDP
238	HANUMANGARH	Rajasthan		IWDP		DDP
239	JAISALMER	Rajasthan		IWDP		DDP
240	JODHPUR	Rajasthan		IWDP		DDP
241	SIROHI	Rajasthan		IWDP		DDP
242	EAST GODAVARI	A.P.		IWDP		
243	GUNTUR	A.P.		IWDP		
244	KRISHNA	A.P.		IWDP		
245	NIZAMABAD	A.P.		IWDP		
246	VISAKHAPATNAM	A.P.		IWDP		
247	WEST GODAVARI	A.P.		IWDP		
248	BARPETA	Assam		IWDP		
249	BONGAIGAON	Assam		IWDP		
250	CACHAR	Assam		IWDP		
251	DARRANG	Assam		IWDP		
252	DHEMAJI	Assam		IWDP		
253	DHUBRI	Assam		IWDP		
254	DHIBRUGARH	Assam		IWDP		
255	GOALPARA	Assam		IWDP		
256	GOLAGHAT	Assam		IWDP		
257	HAILAKANDI	Assam		IWDP		
258	JORHAT	Assam		IWDP		
259	KARBIANGLONG	Assam		IWDP		

260	KAMRUP	Assam		IWDP		
261	KARIMGANJ	Assam		IWDP		
262	KOKRAJHAR	Assam		IWDP		
263	LAKHIMPUR	Assam		IWDP		
264	MORIGAON	Assam		IWDP		
265	NAGOAN	Assam		IWDP		
266	NALBARI	Assam		IWDP		
267	NORTH CACHAR HILLS	Assam		IWDP		
268	SIBSAGAR	Assam		IWDP		
269	SONITPUR	Assam		IWDP		
270	TINSUKIA	Assam		IWDP		
271	ARARIA	Bihar		IWDP		
272	ARWAL	Bihar		IWDP		
273	AURANGABAD	Bihar		IWDP		
274	BANKA	Bihar		IWDP		
275	BEGUSARAI	Bihar		IWDP		
276	BHAGALPUR	Bihar		IWDP		
277	BHOJPUR	Bihar		IWDP		
278	BUXAR	Bihar		IWDP		
279	DARBANGA	Bihar		IWDP		
280	EAST CHAMPARAN	Bihar		IWDP		
281	GAYA	Bihar		IWDP		
282	GOPAALGANJ	Bihar		IWDP		
283	JEHANABAD	Bihar		IWDP		
284	KATIHAR	Bihar		IWDP		
285	KISHANGANJ	Bihar		IWDP		
286	LAKHISARAI	Bihar		IWDP		
287	MUNGER	Bihar		IWDP		
288	MUZAFFARPUR	Bihar		IWDP		
289	NALANDA	Bihar		IWDP		
290	PATNA	Bihar		IWDP		
291	PURNEA	Bihar		IWDP		
292	SARAN	Bihar		IWDP		
293	SHEKHPURA	Bihar		IWDP		
294	SIWAN	Bihar		IWDP		
295	VAISHALI	Bihar		IWDP		
296	WEST CHAMPARAN	Bihar		IWDP		
297	DHAMTARI	Chhattisgarh		IWDP		
298	JASHPUR	Chhattisgarh		IWDP		
299	KANKER	Chhattisgarh		IWDP		
300	KORIA	Chhattisgarh		IWDP		
301	MAHASAMUND	Chhattisgarh		IWDP		
302	RAIGARH	Chhattisgarh		IWDP		
303	RAIPUR	Chhattisgarh		IWDP		
304	NORTH GOA	Goa		IWDP		
305	SOUTH GOA	Goa		IWDP		
306	ANAND	Gujarat		IWDP		
307	GANDHINAGAR	Gujarat		IWDP		
308	KHEDA	Gujarat		IWDP		

309	MEHSANA	Gujarat		IWDP		
310	SURAT	Gujarat		IWDP		
311	BHIWANI	Haryana		IWDP		
312	FARIDABAD	Haryana		IWDP		
313	GURGAON	Haryana		IWDP		
314	JIND	Haryana		IWDP		
315	KAITHAL	Haryana		IWDP		
316	KARNAL	Haryana		IWDP		
317	MEWAT	Haryana		IWDP		
318	PANCHKULA	Haryana		IWDP		
319	PANIPAT	Haryana		IWDP		
320	ROHTAK	Haryana		IWDP		
321	SONEPAT	Haryana		IWDP		
322	YAMUNANAGAR	Haryana		IWDP		
323	CHAMBA	Himachal		IWDP		
324	Hamirpur	Himachal		IWDP		
325	Kangra	Himachal		IWDP		
326	Kullu	Himachal		IWDP		
327	Mandi	Himachal		IWDP		
328	SIMLA	Himachal		IWDP		
329	Sirmaur	Himachal		IWDP		
330	ANANTNAG	J & K		IWDP		
331	BARAMULLA	J & K		IWDP		
332	BUDGAM	J & K		IWDP		
333	JAMMU	J & K		IWDP		
334	KATHUA	J & K		IWDP		
335	KARGIL	J & K		IWDP		
336	KUPWARA	J & K		IWDP		
337	LEH	J & K		IWDP		
338	PHULWAMA	J & K		IWDP		
339	POONCH	J & K		IWDP		
340	RAJOURI	J & K		IWDP		
341	SRINAGAR	J & K		IWDP		
342	EAST SINGHBHUM	Jharkhand		IWDP		
343	GIRIDIH	Jharkhand		IWDP		
344	GUMLA	Jharkhand		IWDP		
345	LOHARDAGA	Jharkhand		IWDP		
346	SARAIKELA	Jharkhand		IWDP		
347	SIMDEGA	Jharkhand		IWDP		
348	WEST SINGHBHUM	Jharkhand		IWDP		
349	Bagalkote	Karnataka		IWDP		
350	Bangalore Rural	Karnataka		IWDP		
351	Kodagu	Karnataka		IWDP		
352	Mandya	Karnataka		IWDP		
353	Shimoga	Karnataka		IWDP		
354	Udupi	Karnataka		IWDP		
355	Uttara Kannada	Karnataka		IWDP		
356	ALAPPUZHA	Kerala		IWDP		
357	IDDUKKI	Kerala		IWDP		

358	KANNUR	Kerala		IWDP		
359	KASARAGODE	Kerala		IWDP		
360	KOLLAM	Kerala		IWDP		
361	KOTTAYAM	Kerala		IWDP		
362	KOZHIKODE	Kerala		IWDP		
363	MALAPPURAM	Kerala		IWDP		
364	PALAKKAD	Kerala		IWDP		
365	PATHANAMTHITTA	Kerala		IWDP		
366	THIRUVANANTHAPURAM	Kerala		IWDP		
367	ANOOPPUR	M.P.		IWDP		
368	ASHOKNAGAR	M.P.		IWDP		
369	BALAGHAT	M.P.		IWDP		
370	BHOPAL	M.P.		IWDP		
371	BURWANPUR	M.P.		IWDP		
372	DATIA	M.P.		IWDP		
373	DINDORI	M.P.		IWDP		
374	GWALIOR	M.P.		IWDP		
375	HOSHANGABAD	M.P.		IWDP		
376	INDORE	M.P.		IWDP		
377	KATNI	M.P.		IWDP		
378	MANDLA	M.P.		IWDP		
379	MORENA	M.P.		IWDP		
380	NARSINGHPUR	M.P.		IWDP		
381	SATNA	M.P.		IWDP		
382	SEHORE	M.P.		IWDP		
383	SHEOPUR	M.P.		IWDP		
384	VIDISHA	M.P.		IWDP		
385	BHANDARA	Maharashtra		IWDP		
386	GONDIYA	Maharashtra		IWDP		
387	RAIGHAR	Maharashtra		IWDP		
388	RATNAGIRI	Maharashtra		IWDP		
389	SINDHUDURGA	Maharashtra		IWDP		
390	THANE	Maharashtra		IWDP		
391	ANGUL	Orissa		IWDP		
392	BALASORE	Orissa		IWDP		
393	CUTTACK	Orissa		IWDP		
394	DEOGARH	Orissa		IWDP		
395	GAJAPATI	Orissa		IWDP		
396	JAJAPUR	Orissa		IWDP		
397	JHARSUGUDA	Orissa		IWDP		
398	KEONJHAR	Orissa		IWDP		
399	KHURDA	Orissa		IWDP		
400	KORAPUT	Orissa		IWDP		
401	MALKANAGIRI	Orissa		IWDP		
402	MAYURBHANJA	Orissa		IWDP		
403	NAWARANGAPUR	Orissa		IWDP		
404	NAYAGARH	Orissa		IWDP		
405	RAYAGADA	Orissa		IWDP		
406	SAMBALPUR	Orissa		IWDP		

407	SUNDARGARH	Orissa		IWDP		
408	AMRITSER	Punjab		IWDP		
409	FARIDKOT	Punjab		IWDP		
410	FEROZEPUR	Punjab		IWDP		
411	GURDASPUR	Punjab		IWDP		
412	HOSHIARPUR	Punjab		IWDP		
413	MANSA	Punjab		IWDP		
414	MUKTSAR	Punjab		IWDP		
415	NAWANSHEHAR	Punjab		IWDP		
416	PATIALA	Punjab		IWDP		
417	ROPAR	Punjab		IWDP		
418	SANGRUR	Punjab		IWDP		
419	BUNDI	Rajasthan		IWDP		
420	DHOLPUR	Rajasthan		IWDP		
421	CUDDALORE	T.N.		IWDP		
422	THENI	T.N.		IWDP		
423	THIRUVALLUR	T.N.		IWDP		
424	DHALAI	Tripura		IWDP		
425	NORTH TRIPURA	Tripura		IWDP		
426	SOUTH TRIPURA	Tripura		IWDP		
427	WEST TRIPURA	Tripura		IWDP		
428	AGRA	U.P.		IWDP		
429	ALIGARH	U.P.		IWDP		
430	AMBEDAKAR NAGAR	U.P.		IWDP		
431	AZAMGARH	U.P.		IWDP		
432	BADAUN	U.P.		IWDP		
433	BARABANKI	U.P.		IWDP		
434	BAREILLY	U.P.		IWDP		
435	BIJNOR	U.P.		IWDP		
436	BULANDSHER	U.P.		IWDP		
437	CHANDAULI	U.P.		IWDP		
438	ETAWAH	U.P.		IWDP		
439	ETAWAH (AURIYA)	U.P.		IWDP		
440	ETAH	U.P.		IWDP		
441	FAIZABAD	U.P.		IWDP		
442	FATEHPUR	U.P.		IWDP		
443	FIROZABAD	U.P.		IWDP		
444	GHAZIPUR	U.P.		IWDP		
445	GONDA	U.P.		IWDP		
446	GORAKHPUR	U.P.		IWDP		
447	HARDOI	U.P.		IWDP		
448	JAUNPUR	U.P.		IWDP		
449	KANNAUJ	U.P.		IWDP		
450	KANPUR DEHAT	U.P.		IWDP		
451	KANPUR NAGAR	U.P.		IWDP		
452	KAUSHAMBI	U.P.		IWDP		
453	LUCKNOW	U.P.		IWDP		
454	MAHARAJ GANJ	U.P.		IWDP		
455	MAINPURI	U.P.		IWDP		

456	MATHURA	U.P.		IWDP		
457	MAU	U.P.		IWDP		
458	MORADABAD	U.P.		IWDP		
459	MUZZAFARNAGAR	U.P.		IWDP		
460	PRATAPGARH	U.P.		IWDP		
461	PHILLIBIT	U.P.		IWDP		
462	RAEBARELI	U.P.		IWDP		
463	SAHARANPUR	U.P.		IWDP		
464	SANT RAVI DAS NAGAR	U.P.		IWDP		
465	SHAHJAHANPUR	U.P.		IWDP		
466	SULTANPUR	U.P.		IWDP		
467	UNNAO	U.P.		IWDP		
468	VARANASI	U.P.		IWDP		
469	DEHRA DUN	Uttaranchal		IWDP		
470	HARIDWAR	Uttaranchal		IWDP		
471	NAINITAL	Uttaranchal		IWDP		
472	RUDRAPRAYAG	Uttaranchal		IWDP		
473	UDHAM SINGH NAGAR	Uttaranchal		IWDP		
474	UTTARKASHI	Uttaranchal		IWDP		
475	BURDWAN	W.B		IWDP		
476	PASCHIM MEDINIPUR	W.B		IWDP		
477	WEST MEDINAPORE	W.B		IWDP		
478	CHANGLANG	Arunachal		IWDP		
479	DIBANG VALLEY	Arunachal		IWDP		
480	EAST KAMENG	Arunachal		IWDP		
481	EAST SIANG	Arunachal		IWDP		
482	KHONSA	Arunachal		IWDP		
483	KURUNG KAMEY	Arunachal		IWDP		
484	L/DIBANG VALLEY	Arunachal		IWDP		
485	LOHIT	Arunachal		IWDP		
486	LOWER SUBANSIRI	Arunachal		IWDP		
487	PAPUMPARE	Arunachal		IWDP		
488	TAWANG	Arunachal		IWDP		
489	TIRAP	Arunachal		IWDP		
490	UPPER DIBANG	Arunachal		IWDP		
491	UPPER SIANG	Arunachal		IWDP		
492	UPPER SUBANSIRI	Arunachal		IWDP		
493	WEST KAMENG	Arunachal		IWDP		
494	WEST SIANG	Arunachal		IWDP		
495	EAST GARO HILLS	Meghalaya		IWDP		
496	EAST KHASI HILLS	Meghalaya		IWDP		
497	JAINTIA HILLS	Meghalaya		IWDP		
498	RI BHOI	Meghalaya		IWDP		
499	SOUTH GARO HILLS	Meghalaya		IWDP		
500	WEST GARO HILLS	Meghalaya		IWDP		
501	WEST KHASI HILLS	Meghalaya		IWDP		
502	BISHNUPUR	Manipur		IWDP		
503	CHANDEL	Manipur		IWDP		
504	CHURACHANDPUR	Manipur		IWDP		

505	IMPHAL EAST	Manipur		IWDP		
506	IMPHAL WEST	Manipur		IWDP		
507	SENAPATI	Manipur		IWDP		
508	TAMENGLONG	Manipur		IWDP		
509	THOUBAL	Manipur		IWDP		
510	UKHRUL	Manipur		IWDP		
511	Bangalore	Karnataka			DPAP	
512	AIZAWL	Mizoram		IWDP		
513	CHAMPHAI	Mizoram		IWDP		
514	KOLASIB	Mizoram		IWDP		
515	LAWNGTLAI	Mizoram		IWDP		
516	LUNGLEI	Mizoram		IWDP		
517	MAMIT	Mizoram		IWDP		
518	SAIHA	Mizoram		IWDP		
519	SERCHHIP	Mizoram		IWDP		
520	DIMAPUR	Nagaland		IWDP		
521	KIPHIRE	Nagaland		IWDP		
522	KOHIMA	Nagaland		IWDP		
523	LONGLENG	Nagaland		IWDP		
524	MOKOKCHUNG	Nagaland		IWDP		
525	MON	Nagaland		IWDP		
526	PEREN	Nagaland		IWDP		
527	PHEK	Nagaland		IWDP		
528	TUENSANG	Nagaland		IWDP		
529	WOKHA	Nagaland		IWDP		
530	ZUNHEBOTO	Nagaland		IWDP		
531	EAST	Sikkim		IWDP		
532	NORTH	Sikkim		IWDP		
533	SOUTH	Sikkim		IWDP		
534	WEST	Sikkim		IWDP		
535	MADHEPURA	Bihar				
536	MAHENDRAGARH	Haryana				
537	BADGAM	J & K				
538	ERANAKULAM	Kerala				
539	WAYANAD	Kerala				
540	HARDA	M.P.				
541	BHADRAK	Orissa				
542	JAGATSINGHPUR	Orissa				
543	KANDHAMAL	Orissa				
544	KENDRAPARA	Orissa				
545	PURI	Orissa				
546	KARAIKAL	Pondicherry				
547	PONDICHERRY	Pondicherry				
548	BATHINDA	Punjab				
549	FATEHGARH SAHIB	Punjab				
550	LUDHIANA	Punjab				
551	MOGA	Punjab				
552	GANGANAGAR	Rajasthan				
553	KANYAKUMARI	T.N.				

554	NAGAPATTINAM	T.N.				
555	NILGIRIS	T.N.				
556	THANJAVUR	T.N.				
557	THIRUVARUR	T.N.				
558	BAGHPAT	U.P.				
559	BALLIA	U.P.				
560	BASTI	U.P.				
561	DEORIA	U.P.				
562	FARRUKHABAD	U.P.				
563	MEERUT	U.P.				
564	SANT KABIR NAGAR	U.P.				
565	SIDDHARTH NAGAR	U.P.				
566	COOCHBEHAR	W.B				
567	DAKSHIN DINAJPUR	W.B				
568	DARJEELING	W.B				
569	HOOGHLY	W.B				
570	JALPAIGURI	W.B				
571	MALDA	W.B				
572	MURSHIDABAD	W.B				
573	NADIA	W.B				
574	UTTAR DINAJPUR	W.B				
575	DHALAI	Tripura				
576	NORTH TRIPURA	Tripura				
577	SOUTH TRIPURA	Tripura				
578	WEST TRIPURA	Tripura				

CHAPTER -VI

ECONOMIC AND FINANCIAL INCENTIVES FOR RAINFED AREAS

The goal must be to make mandatory the presence of an assured water source in every village in the country. For this we need to have a system of financial and economic incentives provided to maximize the allocation of scare resources.
The issue was discussed at two levels:

A) Water Development
B) Land Development

There needs to be an integrated water resource management (IWRM) approach which needs to link water and land development together.

A) Water Development

Points of Discussion

In this context two sets of issues need to be discussed: those relating to creation of new models of water management and those relating to better use of the existing systems.

New models of water management

Three models of water management have been used in countries where there is a paucity of water. These three models are discussed below.

– ***Israeli Water Model***

In the Israeli model, which is a state-owned model for water management, water is owned by a monopoly State enterprise. All wells are networked and linked to study and monitor water usage. Utilization of water is measured using computerized networks. The water resources belong to the state and priorities are laid down on the allocation of these resources across uses. It is made clear that even though the land may be privately owned, the water resources would be owned by the community state.

However, it may not be feasible to adopt the Israeli model of state ownership of water rights & directed water supply in India for the following reasons. The cost for monitoring such a system would be exorbitant. All wells and water supply sources are networked and water utilization is measured electronically by heavy use of technology. Secondly, heavy computerization of available water sources which is possible in Israel because of access to few water sources. Further, the water sources in Israel are well defined therefore it is easy to monitor. The water sources in Israel are in a limited geographical span whereas in India they will be a huge number of such water sources spread over a large area which may make it difficult to monitor. The crop per drop (measured as the total value of the crop divided by the water utilization in cubic meters) value for Israel is around 3-4 USD while in India, it around Rs. 2-3. It is therefore viable for Israel to invest in a costly technology regime for monitoring the usage of water. More importantly, demand management techniques should not be used by India where a large number of farmers in such regions are subsistence. Withholding or rationing of resources from subsistence farming will negatively impact yield and therefore incomes.

– ***Californian Water Model***

The alternative Californian model is a private enterprise driven one where private companies are involved in storing ground water in huge underground reservoirs of capacity around 4000-6000 cubic meters. The water from recharge basins is then sold to high value crop farmers as required. This system is called Water Banking[1]. Such a system requires computerized monitoring and enforcement by physical checking (of around 10% of the wells in California).

The Committee discussed as to who would be the most appropriate authority to own these reservoirs in the Indian context i.e. whether ownership should rest in public or private hands (or through a public-private partnership) and who would invest in the creation of such capacity.

It was felt that the model could be propagated in India and private companies should be encouraged to either invest in such ideas however it was important to ensure that the process of seeking private returns did not lead to the outcome of adverse selection of the end users. In absence of private interest, public-private partnership should be considered or the state should take a responsibility to do the same.

India has huge ground water resources. Add to this the fact that every 5-6 years India receives excess rainfall during the monsoons, water conservation and recharge should be encouraged and propagated.

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[1] The concept of water credits is discussed in detail on page 44

Israeli and Californian Models: Common Issues

It was pointed out that in models like the Israeli or the Californian Model, monitoring was the key to success. Monitoring on such a large scale would be problematic in India and often would be mired in corruption and power mongering. In the situation that such monitoring is required; the best way to enforce the monitoring would be through end users.

One has to recognize the existing power systems might not accept radical plans. Transition through a slow gradual change may be more likely to have the desired results.

There appears to be no national authority which gave approval for constructing or digging water bodies like wells etc. However such authorities have come up in rain starved states like Gujarat & Andhra Pradesh where the permission and approval from the Groundwater Board is required to dig wells. Similar authorities may be replicated across other rain starved states.

Another model of water management that was considered by the Committee was Chinese model.

– ***Chinese Model***

Water scarcity is a problem in China. In many regions water demand exceeds available supplies. Surface water resources are insufficient to meet total demand and a rising reliance on ground water has resulted in falling ground water tables. The agricultural sector in particular is facing an increasing scarcity of water.

The establishment of a legal system of water management since 1980s was a direct response to the decrease in water acreage and deteriorating water supply. One of the key elements of water sector reform being undertaken by the Chinese Government to avoid a severe water crisis is water pricing. Along with the importance of water pricing mechanisms, the Water laws in China emphasize quota systems, with progressive penalty prices for consumption exceeding the quota.

China has begun to introduce incentives for water conservation and to create a potentially more effective pricing mechanism. Water charges have started to rise, and the area-based fees are being replaced by a two-part tariff. New laws and regulations have been issued, which set guidelines for water management and water pricing.

In the Chinese model, a private economic agent is provided the incentives to perform a role assigned to him/her within a boundary established and defended by the village committee. The phrase used to describe such an agent is 'bounded service provider'[2]. Typically, 'service providers' are found from the more entrepreneurial amongst the village's farmers, regardless of gender. The period of the management contract varies from five to 30 years.
The contractor's responsibility typically includes:

1. operation and maintenance of the system
2. orderly distribution of water to farmers
3. collection of irrigation fees and
4. The payment of electricity fees to the village electrician or township electricity bureau.

The irrigation fee is invariably determined by the village committee and/or the township water bureau, and this feature makes this

[2] (Shah, Giordano and Wang, 2004)

arrangement different from outright privatization. Generally, fees are fixed in terms of hours of pumping or kWh of electricity used.

It was observed that for the large scale irrigation projects, a Participatory Irrigation Programme (PIM) was followed. Bank funds were used to install meters at each WUA (Waters Users Association) so that farmers could save in water fees if they reduced water use. Maintaining the meter, distributing water and collecting the water fee and turning it over to the local water bureau was all that the WUA did. The maintenance of canals and other infrastructure is still the responsibility of the local government. But now this role is increasingly contracted out to private franchisees or WUAs often with strong financial incentives to save water and promote its efficient use.

Canal irrigation fees in many Chinese systems are levied in two parts: a basic water fee based on area irrigated and a volumetric water fee based on volume of water use. A part of the basic water fee collected is the contractor's fixed reward. However, the volumetric water fee offers the contractor opportunity to increase his income by saving water. Before each cropping season, Irrigation district officials determine a target water entitlement for each village based on historical use patterns and other criteria, and value these entitlements on a volumetric fee. The total cost is apportioned to the farm land in the village, and the contractor is authorized to collect the volumetric charge as an enhanced basic water fee from the farmers. However, he is required to pay to the water bureau only the volumetric rate on actual water use. By saving water, thus, the contractor can enhance his earnings.

Direct Regulation & Water Demand Management:

China has made quite some progress in controlling runaway groundwater over draft by using a combination of direct as well as indirect instruments of demand management such as promotion of water saving approaches and technologies, implementation of withdrawal permits, pricing of water resource as well as services, enforcement of water withdrawal quotas, crowding out urban tube wells by surface water imports and such like. Law has also institutionalized water rights at the legislative level and allows establishment of water markets and trade in water entitlements.

Different provinces have tried different combinations of instruments for direct demand management including:

1. tube well and permits,
2. differential and penal pricing,
3. sealing of wells and
4. Promotion of water saving technologies.

Like in many other countries, there is a trend towards an increased user participation in irrigation management. The results of management reform seem to be positive in most cases. Accountability under the new systems is clearer, the transparency of the charging system was greatly improved, and there is a stronger linkage between the water charge and the volume of water consumed. Water use efficiency as well as willingness to pay for the service has increased.

The Committee was of the opinion that we should strongly consider the pricing model adopted by China to address the situation of water scarcity in India. Water should be treated as an economic good and therefore its price should reflect the full cost of water supply as in the case of the Chinese model. The enforcement mechanism should be strengthened so as to facilitate efficient use of this scarce resource. ***However, any taxation policy should bear in mind the fact that most farmers in India are impoverished. We suggest that the taxation policy should be of a progressive nature. For instance it is the case that upstream farmers have better access to water than downstream farmers. Hence water taxation policies must take into consideration the economic condition of the farmer.***

Existing Sources of Water

The basic need is to focus on the retention and conservation of water resources. Due the fast decline of available irrigation potential and increasing demand for irrigation water, it becomes essential to increase the existing water use efficiency through various water conservation technologies. In order to conserve the available water resources, programmes/strategies such as watershed development programme, rain water harvesting and micro-irrigation methods such as drip and sprinkler irrigation systems must be encouraged.

Rainwater harvesting, water management and ground water recharge can help augment water availability in rainfed areas. Building structures for water management and managing them also provides employment generation in rural areas.

The Committee specifically discussed micro irrigation systems such as Drip and Sprinkler Irrigation systems which needed to be used in a more widespread manner for efficient use of water resources.

- Drip and Sprinkler Irrigation Systems

Some of the steps that can be taken to promote these technologies which not only conserve water but also improve the quality of agri-products are to provide these either on long-term repayment basis or on hiring basis. The latter can be taken care of by the panchayats/NGOs or even the banks. Suitable capital/interest subsidy needs to be given for the installation. Central Government has already initiated the programme to provide capital subsidy for micro irrigation systems wherein the Centre is providing 40% and State 10%. There could be structured schemes to promote drip irrigation. A special package scheme can be introduced where priority can be given in providing bank loans for farmers who are ready to adopt the technology.

Counter-argument

However, capital cost required to install drip irrigation is very high as a result most farmers are reluctant to adopt this technology. Measures can primarily be taken to reduce the fixed costs of irrigation by promoting research and development activities. There should be timely disbursal of subsidy, within one or two months to farmers to encourage farmers to adopt the technology. Manufacturers should be asked to actively promote the technology by introducing frequent demonstrations at farmers' fields

Role of Forests

The Committee also looked at the novel avenues of water management such as forests, which can play a key role in water conservation strategies.

Most forests are on the ridges of watershed area. Forests attract & store water and therefore help in water conservation.

It was agreed that as far as possible forest should not be tapped or piped for water. There were strong economic & ecological arguments against using forest land for water harvesting programmes.

- Taking stock of on going and unfinished irrigation projects:

Coverage area under micro irrigation so far is only 2.2 million hectares against the potential of 62.5 million hectares. Hence efforts must be made to increase the coverage of area under this system at an accelerated pace, which is possible with effective Public-Private partnership. The Steering Committee on irrigation for the 10^{th} Plan estimates that total spill over costs of previous costs to the 10^{th} Plan will be 1.77 lakh crores. The rate of bringing area under irrigation is slow due to high cost of investment (estimated at Rest. 100,000 /hectare) in major projects.

There must be time bound completion of major projects. Completion of 388 on going major and medium irrigation projects to potentially create 21.7 million hectares as irrigated area. Action plan for completion should be drawn based on the projects, which are nearest to completion. Land restoration through modernization of major, medium and minor projects and restoration of tanks must be undertaken. Focus on minor irrigation projects should include:

- Projects for revival of water bodies
- Water harvesting
- Water shed management
- Water saving technologies like drip and sprinkler irrigation

- Electricity & Water Supply management:

Currently due to the erratic nature of the electricity supply, farmers have installed automatic switches on their pumps which switch on as soon as the electricity flow starts. The pumps switch on and pump water into the field regardless of the necessity for moisture. Electricity boards supply electricity erratically for around 8-10 hours on a daily basis.

Electricity boards can rationalize the use of water and reduce their losses by a simple method of regulating electricity flow to the agricultural sector. Crops face water stress around 45-60 days in a year. During this time there is need for water to be pumped into the fields on a regular basis. Electricity boards should separate feeder lines to fields and those to homestead. Electricity to homesteads can be offered on a regular basis for 24 hours and electricity to fields should be regulated by the boards itself. On days when crops face maximum water stress, supply of electricity should be for longer periods of time. For days when water stress is low, electricity supply to fields should be for shorter periods of time.

The committee also recommended that electricity boards were best placed to service micro irrigation projects.

The Committee was however of the view that the bifurcation of the electricity supply to the field and to the villages might be difficult to implement.

C) Land Management

The Committee discussed three sets of issues for better management of land resources: the need to enhance the productivity of land, the need for reform of legal framework related to water use and the urgency of undertaking the registration of land records across all states in the country.

> *Since output prices are not rising, fast enough, agricultural profitability rates are going down. Profitability rates in Indian agriculture have fallen by 15% in the Nineties. In a market driven agriculture this would have serious consequences and drive away investment to other sectors. In the nineties, when the role of the private sector expands very considerably in supply of seeds, agrochemical and*

credit inputs, prices go up in a significant manner and in a relative sense. Of course, with this structure growth would go down. Agricultural growth has also gone down, because of a collapse of public investment. So we have both diminishing returns and cost push declines in profitability, in a period of substantial privatisation of agriculture. The rise in input prices and falling profitability can only be explained by inefficiency and the trend to low value added crops. (Table below)The case for reform in the state sponsored pricing system to encourage diversification of Indian agriculture is very clear. So is the need to remove bureaucratic controls on commodity movements in India and for exports. But the effectiveness of existing systems in supplying cheaper inputs in village markets of small size needs study. The existing private channels of distribution are not enough.(See Lele, Alagh, et. al., 2001)

The real policy options then are to build markets, develop information systems of the economic opportunities available, provide financial institutions which work and provide finances for communication, processing, standardization, quality upgradation and trade. Simultaneously, the harmonized tarrif, monetary, fiscal and trade policy package at individual crop levels will have to be prepared as the road map presentation argues. Improving Cereal Productivity and Diversification is not possible if the farmer does not have access to improved energy and water supplies and becomes much easier if the land development technologies are accessible. It is well known that he pays for such facilities when the service is good. A great initiative is required to release the Indian farmers energies by improving his access to inputs and services. This requires market driven input supplies. A number of organizations which cannot cover the last mile have to close down and this becomes difficult when they live on government subsidies and many others who succeed need organizational support and have access to bank finance. Newer organisational forms like Producer Associations need support. (Alagh, 2001)

Profitability is falling in Agriculture *Price Index (CACP Estimates)*

Year	***Input Items***	***Output Sold***
1989/90	*401.4*	*393.5*
1997/98	*920.1*	*785.4*
% Increase 97/98 over 89/90	*229*	*199*

Hybrids must get off the research success stage. States like Punjab, Harayana, and Western UP will show the way, but if price policy gives appropriate incentives for quality and transport differentials are introduced, the rice economy in MP, Chattisgarh and speciality cereals like the Durhams will revive. Shorter duration cereals will pave the way for diversification to oilseeds, pulses, fruits and vegetables. Markets and their development and processing are the key. Strategic alliances must be encouraged. The Companies Second Amendment Bill,2002, for coops must pass.

A bifocal policy initiative is required. Subsidies with adverse consequences on productivity of land must be phased out. Simultaneously profitability of alternate crops and activities must improve through market, economic and financial reform. This is again the road map for each crop. If this approach fails, the Sate must intervene in markets. The role of sponsoring policies for alternative distribution *channels so that there is genuine competition in input supplies is very necessary. Cooperatives, non-profit organisations and partnerships between private sector, Coops, NGOs or local governments are required. A Committee has presented a draft law for cooperatives to set up producer companies with corporate alliances. It saved the cooperative principle by providing the one share one vote basis. The Independent Cooperative Initiative supported this in the Anand Declaration in December 2000. The concerned legislation has been tabled in Parliament and has been approved by the Standing Committee. Producer* *cooperatives, working on a cooperative principle can be a very powerful instrument of growth and the required level of diversification. Producers groups should be encouraged to enter into strategic alliances, say with the Corporate sector for Contract Farming.*

Financial reform and Issues

The Rural Infrastructure Fund was meant to give loan finance for infrastructure. But it became a vehicle to finance the official irrigation plan. It has to revive or develop a new vehicle to power the Indian farmer and his organisations to diversify, trade and improve his income. All of that will now be WTO compatible. After Doha, the main challenge is at home. The road map abroad is no longer hazy.

There have to be well identified shelfs of a large number of small projects on land, water and other infrastructure projects available for financing. Financial institutions have to design structures such that community collateral is possible for viable projects. Self help financing groups are only one such group. Land and water development groups, local infrastructure projects, in road or communication sectors, productionising products developed in R&D institutions, training for production with improved techniques, market development schemes developed by local and community groups would be other examples. These could be drainage, soil shaping, contour management, improvement and management of lower level canals, desilting of tanks, raising embankments, fish culture, market development, controlled grazing and so on. Studies show high economic rates of return, making them very productive investments. They involve household labour, but also need outside finance.(For details, Alagh, 2003)

Some of the policy reform required for the replication on a required scale of such projects includes: lending through a weather or project cycle, NABARD had started a scheme of this kind as a part of the agro-economic regionalisation strategyof Rajiv Gandhi, gave it up in 1993 and is again starting it now (See Kapur Committee ,Reserve Bank of India, 2000 for details) ; Financial institutions have to design structures such that community collateral is possible for viable projects.

Points of Discussion

Enhancing the productivity of farmland

The last three decades have seen continuous fragmentation of land. The land holdings with majority of farmers have become so small that most of them are economically unviable. The problem is compounded by soil degradation.

A minimum economic size of land needs to be fixed by the Government. Fragmentation below this size should not be permitted and consolidation should be encouraged based on a minimum criteria.

There is an urgent need to enhance the health of the farmland. There could be Public-Private Partnership in this area. State Dept of Agriculture, Krishi Vigyan kendras and Corporate Sector can be involved in the exercise. As the process takes time and during the period, yield may actually go down, suitable livelihood subsidies must be provided for.

Reform of legal framework related to water use

In India the use, control and ownership of water is linked to the ownership of land. Laws relating to water are traced to the Indian Easement Act, 1882 which provides for unlimited right on groundwater to the owner of the overlying land and there was no provision for `prior appropriation' or `reasonable use'. Thus if you own land, you can drill or dig a well and capture as much groundwater as you are able for use on overlying lands. When land is sold, groundwater access rights pass with the land and cannot be legally separated from it.

There needs to be a change in the legal framework which currently permits landowners unrestricted right of extraction of groundwater from their plots.

Land Registration: Demat of Land Records

All land records in the country should become registered. Absence of land registration limits growth rates. A research report by the World Bank, which looked into the relation between land policy and poverty reduction, justified investment in land records and land access. World Bank and the Ministry of Rural Development, Government of India, agreed that improving land administration was a top priority in India.

The Committee accepted the fact that while land registration records were not systematically maintained, they did exist with fairly reasonable coverage. The focus hence had to be on creating systems for their maintenance.

Proper registration of land titles is the primary step to bring about further property and real estate activity and development which today contribute nearly 30-35% of GDP in developed countries. This figure in emerging countries is only 3-3.5%. Therefore this becomes an urgent and critical step when considering strategies for development of rainfed areas.

England Wales and Scotland provide excellent examples of successful implementation of electronic land registry.

In England and Wales the formal initiative of embracing e-conveyance started in 1998. It is currently run on a voluntary basis and is expected to become compulsory over time. England and Wales Land Registration

Office computerized almost 18 million titles by 2002. All registered titles are fully computerized and help in further improving customer service.

A case study on Land registration in Scotland looked at the merits of a title registration system over a deeds system. The advantages of the system were seen as:

- Unique and definitive title number, reference to map, a state guarantee
- Indemnity against damage or loss of a title deed
- Compact data provision, storage and archiving
- Security and simple conveyance
- Computerized registry allowed development of more comprehensive services including mapping element

India too can derive significant benefits from converting its paper based manual system of land record maintenance to a fully computerized demat system. The benefits that can be garnered from such a move are manifold and include: first less land disputes. Second, security for credit, business growth and investment third greater control over any illegal use of land and finally allows monitoring of land markets.

Issue

How to derive optimal cropping patterns and other economic activities in a liberalizing economy

The focus of better use of water resources can be directly linked finally to deriving optimum agricultural output. Therefore, it is important to examine ways in which this optimum level can be derived keeping in mind the facts that water is a scarce resource and that the national priorities are to be predefined.

Points of Discussion

The Committee discussed as to what should be the appropriate criteria that determines optimal cropping patterns in the country.

Cropping patterns are determined by prices of crop produced during the previous year, demand for the produce, multi market spread for the product, shelf life of the produce, financial returns etc.

Counter-argument

Cropping patterns should be linked to the climatic suitability of geographical areas for various land use based on agro-climatic zone mapping. *Natural comparative advantage should be the basis of planning.* Accordingly sustainable cropping systems can be developed for the farmer for different agro-climatic zones. This would mean that agricultural planning should entail region specific strategies. For this we would need to identify in which regions cropping should take place and where it should stop.

Agro-climatic zone mapping for sustainability

Cropping patterns shouldn’t be exclusively decided and dictated by market trends. Farmer should be encouraged to grow at least his own requirement or subsistence farming. This is especially true for small holdings. Moreover it will not reduce the productivity of farm holdings. Most subsistence farming will be in grain crops which will be shallow rooted and therefore complementary to deep rooted cash crops. In fact such diversity might actually help in increasing the fertility of fields.

The Committee felt there was no dearth of information on ideal cropping patterns. The agri-intelligence to zero down on crops to be grown and mapping of agro-climatic zones already exists in the country. Water requirements of all the crops are known and are usually dependent on local weather. The problem is not lack of agri-intelligence about water requirements or cropping patterns, but is the lack of awareness among farmers of such information.

Use of futures in choosing the crop pattern:

Futures prices can also be used by farmers as signaling devices for crop sowing pattern. Sowing decisions may be taken based on futures, rather than spot prices to enable better returns at the time of harvest. This will address the issue of the cobweb problem which besots Indian agriculture. Farmers tend to decide on their cropping pattern based on the price received on their previous harvest. When prices go up, there tends to be oversupply conditions in the next harvest as most farmers move to the crop which gives higher prices. This in turn leads to a fall in prices which affects the income of the farmers. A way out it to use futures prices a signal to decide on the cropping pattern which when simultaneously sold on the exchange will assure the farmer of his price.

For example, cotton & soybean require the same climatic & soil conditions. They also fall in the same cropping season (Kharif crops). They are therefore considered substitute crops since a farmer can grow either of the two.

Crop	**Spot Price 200x**	**Futures Prices (as on July 21st, 200x)** *Far month contract*	**Yield (quintal / hectare)**	**Realization on last year price (Rs)**	**Realization with Futures price (Rs)**
Cotton	6,430.99	6,870.00	3.09	19,868	21,228
Soybean	1,511.57	1,950.00	12.1	18,289	23,595

In the above table, the average price for cotton for a farmer in Gujarat is Rs 6,430.99 and that for soy bean was Rs 1,511.57 per quintal in 200x. Let us hypothetically consider a farmer who decides on cropping patterns after looking at futures prices of alternative crops. On July 21, when the contracts commenced, he would consider the alternatives that are available to him. Since cotton and soybean grow in similar agro-climatic conditions and assuming ceteris paribus conditions on factors such as cost of inputs, yield, ability to grow the crops etc, the farmer has a choice of the two crops – cotton or soybean. The futures price at the time of harvest Rs 6,870 per quintal for cotton and Rs 1,950 per quintal for soybean. A farmer typically knows that the yield per hectare of cotton is 3.09 quintals and 12.1 quintals for soybean. The relative value of production per hectare is Rs 21,228 for cotton while it is Rs 23,595 for soybean. A quick look at the yield per hectare for each of them suggests that higher realizations, to the tune of 11%, can be made by sowing soybean when compared to cotton. As total income from soy is higher than that on cotton, the farmer should have opted for soy.

However, if the farmer had used past prices to decide which crops to grow, he would have gone in for sowing cotton. On using 200x spot prices, cotton gives a higher realization than soybean. Income from growing cotton would be Rs 19,868 while that on soyabean would be Rs 18,289. Thus, based on past prices, cotton would be preferred to soyabean. If on the other hand, the farmer had based his sowing decisions on futures price, the farmer would have decided to go for sowing soybean. There is a clear 18% gain in realization (between cotton realization based on past prices & soybean realization based on futures prices). Thus, the entire decision making process itself can change to the benefit of farmers by the availability of futures prices and instruments to lock in the sale of the crop at those prices.

Farming Methods: Power of Scale to small farmers

Methods of providing the power of scale to small farmers will have to be developed and popularized on a win-win basis for all concerned. Such methods shall include the following:

-Co-operative farming

Co-operatives have tasted very little success except in the case of marketing. Dairy is a case in point. This is because members co-operate on the basis of enlightened self-interest. However, there appears to be scope for irrigation co-operatives. Co-operative farming is ideal for small farmers since coops can provide centralized services like tractors and other farm equipment to support small scale decentralized production. This will bring down the cost of production and enhance the quality of produce and thereby income. However, this is easier said than done. NABARD, for e.g., feels that this is not likely to meet with success. Convincing the farmers is a time consuming effort. All the same, this can be tried on a pilot basis with the intervention of serious like-minded NGOs as part of a multi-pronged approach.

-Company farming

Small farmers can become shareholders in companies producing bio-fertilizers, bio-pesticides and other forms of inputs as well as small agro-processing ventures. This could be integrated into an overall plan for the village or a cluster of villages in the rain fed areas.

Creating multiple livelihood opportunities will go a long way in improving the capacity of the farmer to experiment with cropping patterns.

Companies should be encouraged to source their raw material from such areas through producer companies only, not directly through individual farmers. Companies could get tax rebate for such action.

-Contract farming

There is need for a code of conduct to help the farmer get good quality input and a fair price with prompt payment on a continuous basis.

Positives of Contract farming:

- Farmers' income has gone up and levels of desperation have gone down.
- Increased incomes have allowed farmers to invest in better technologies e.g. drip irrigation
- Since pomegranate cultivation requires precision irrigation & regulated water use, water wastage has reduced drastically.

Negatives of Contract farming:

- Individual farmer does not have the same negotiating powers as the corporate. This should be borne in mind when propagating contract farming
- Contract farming will encourage mono cropping which has been proven to have negative effects in the long run.
- Externalities of contract farming will negatively impact those farmers who have not entered into contract farming and there should be a mechanism to address their rights.
- Contract farming should not be at the cost of subsistence farming which should be encouraged.

Programmes for marketing, infrastructure and policy support for income generation in post water harvesting phases

Issues:

The important issue here was to discuss modalities of providing support to the farmer consequent to the harvest of his crop in the post water harvest phase. Three broad areas were to be discussed in this context.

1. The need of the farmer for an assured market and risk management practices.
2. The need for good physical infrastructure which sustains agriculture.
3. The need for a well defined and clear legal infrastructure which effectively curbs over-drawl of groundwater. Fast depleting water resources necessitate establishment of a system of water rights to tackle the issue of withdrawal or entitlement of water.

Discussion Points:

Marketing issues:

It is important to realize that the key to success for a change in cropping patterns is the access to markets. Members of the Committee discussed the various marketing options available to the Indian farmer.

Farmers are often forced into distress sale because of the absence of adequate market opportunities and the need for income to tide over consumption requirements in particular. Direct marketing by farmers therefore has its disadvantages in that farmers are not able to get good price realization.

In contrast corporate farming and contract farming could assure the farmer a market for his produce. On the other hand, farmers can easily renege on contracts as there is very little political will to enforce contracts from the side of the farmer. At the same time, it must be realized that farmers do not have the same bargaining power as the corporates. Therefore it is important to build in proper safe guards for the rights of the farming community.

The Committee also discussed the need for developing electronic spot markets which are easily accessible to the rural community and which unite the country in one gigantic agricultural market. This would of course require amendments to the existing APMC act which puts the agricultural market or the *mandi's* under the purview of the state list rather than the national list. Electronic markets will improve efficiency of markets by bringing together buyers and sellers on an anonymous trading platform. More importantly, the process separated the actual sale from the delivery mechanism. Farmers will have access to price information at the press of a button.

With regard to the APMC Act, there was debate of the need for such an act. With boundaries between countries breaking down to allow for a common economic market, the time has perhaps come to join India into one big agricultural market. There should be no restriction on the movement of agricultural produce across states. In the event of emergency, the power to restrict movement or stockpiling should be under the discretion of the center. Cess which is an important source of revenue can be maintained by the State Government.

The Committee also considered the role of the futures market which sends price signals for the prices in the coming months. At the same time, the fledgling futures market must be encouraged so that market participants are confident of the price discovery mechanism in the future months. Financial solutions brought by commodity exchanges can have optimum benefits only when adequate steps are taken for creating greater awareness and understanding of such systems among farmers. Banks, NGOs, SHGs etc should be involved in seeking a way to aggregate farmers' produce so that farmers produce can be marketed without erosion of value to the farmer. Small and medium size farmers can thus partake of the benefits of financial solutions provided by commodity exchanges. The Committee noted that the system of exchange traded options can serve as a substitute for MSP. It can reduce the subsidy burden of the Government while maintaining all the objectives of the subsidy.

Risk Management Issues:

I. Option as an MSP

The MSP mechanism works in an open ended manner, where, the farmer can sell any amount of crop to the government. The MSP denotes a system where the farmer is not bound to sell his foodgrains to the government at the stated price. The farmer has the right but not the obligation to sell at the MSP. Hence, the MSP tantamounts to being an 'option', which can be traded on commodity exchanges. But the MSP programme has a few shortcomings. It covers 34 crops but is active for all practical purposes in case of wheat and rice. On the other hand options can be floated on any crop with very little cost. It is announced at the time of sowing when the government is not able to get a good idea of the market conditions. Though the MSP is some times revised upwards, it very rarely reflects market conditions.

Here we illustrate how an exchange traded option (ETO) is a superior tool to the MSP within the confines of the existing pre conditions. For deriving a cost comparison between the ETO and MSP, wheat has been taken as the referral commodity in this paper.

The acquisition cost of per quintal of wheat can be said to be around Rs 900 (MSP of 750 plus an acquisition cost of Rs 150). The distribution cost incurred is ~Rs 200 by the government over and above the procurement costs. The progressively rising MSP along with the higher incidental procurement and distribution costs was never passed on to consumer in the form of a higher issue price under PDS, where the wheat was sold at a much lower price.

This system of exchange traded options on commodities can not only provide the farmer with a floor price for his commodity with out the obligation to sell at the floor price (thus acting as an MSP) but also help him take the benefit of any rise in prices.

The role of an aggregator:

An aggregator (usually a producers' cooperative, a bank branch, an agri extension services provider or a financial intermediary) pools farmers' requirements and buys a put option on the exchange, by paying an option premium as the cost of this right to exercise the option. The option gives the aggregator a right to sell on a given date, a certain quantity of agreed commodity at a stated price; if on that maturity date the actual prevailing price is higher, the aggregator is not bound to sell at the agreed option price; he can sell in the spot market at the prevailing higher price and benefit from the upward movement of the price, beyond the contracted option price. On the other hand, if the prevailing price at maturity is lower than the contracted option price, the aggregator can exercise his option and sell at the higher contract option price.

A buyer of put option would typically abandon the option if on the settlement date the ruling spot price is higher than the strike price. If the spot price is lower than the strike price, the farmer would normally exercise his right to sell at that price. This is exactly what the MSP currently seeks to offer the farmer. Therefore, without diluting the existing protection afforded by MSP to the farmer, he can be migrated to buying a put option on the Exchange.

For the right to sell (but with no obligation to sell), the farmer pays a premium which is his cost. This ETO mechanism can be subsidized by the Government by covering the cost of the option premium. For example, a MSP of Rs 750/quintal involves a 12% tax/cess charge plus Rs 20 packing charges. The total cost works out to Rs 860/quintal. *For a contract maturing in April and a futures price of Rs 920, the option premium works out to just under Rs 7/quintal.* This would be the cost which can be borne by the government.

Therefore in this context, two alternatives can be suggested. Either the premium is paid by the aggregator who will collect it from individual farmers or it can also be paid by the government on behalf of the farmers.

II. Futures as a price risk mitigator:

The two major risk factors facing the farmers today in the pre-harvest stage are:

1. Price risk: The farmer is not sure at the point of sowing about the price to be received at the time of harvest and his income varies according to the vicissitudes of nature.
2. Volumetric risk: He is not sure of the harvest yield – the volume of production as the weather conditions can play truant and affect his crop output. We do have crop insurance and weather insurance schemes today but they are only gradually spreading and are not all-encompassing.(as has already been discussed)

The derivative markets model

Farmers can sell their produce forward on the exchanges after sowing their seeds. In this manner they will be in a position to hedge their price risk before the harvest. Futures provide the farmers well before harvesting, a firm price for the period when harvesting does take place. Futures assure farmers of a firm realization level. Thus they mitigate the price risk that the farmer runs.

Similarly during the post harvest phase of the crop cycle the farmer faces the problem of a fall in prices immediate on harvest. This is because of the glut in supply at this time of the crop cycle. In this situation if the farmer wants to sell in the futures markets he can take a position on the commodity exchange and simultaneously lodge the goods in the accredited warehouse of the exchange. The goods are accepted as being 'good' after being graded and certified by an assaying agency. The goods move in as an electronic commodity balance (demat balance), which is a substitute for the physical warehouse receipt practice today. Having deposited commodities in accredited warehouses, farmers, if they desire may not take a position on the futures platform. If the position on futures platform is not taken he may avail bank loan up to say 70% of the value of the commodity in the spot market against warehouse receipts. If farmer takes position on the future/spot exchange the farmers account can be credited after taking into account the interest burden for financing, margins, mark-to-market (M2M) provisions of the exchange and warehouse charges till the expiry date of the contract. If the regulator for this space viz. the Forward Markets Commission (FMC) permits, the physical deliveries made by the farmer can be considered as early pay-ins and margin and M2M requirement may be waived under special circumstances. This system assures full repayment of bank loan thus covers credit risk. In the process the quality of the asset also gets upgraded and the cost of credit comes down.

Basic Infrastructure:

Basic physical infrastructure in rural areas needs to be developed especially in the fields of transport, storage & distribution to link the producing areas to the consuming markets. Small multifunctional units like warehouses providing value added services for the farming community should be set up. Banks and other financial institutions in villages should provide the required finance to the entrepreneurs in this field. E.g. NABARD's initiative of setting up godowns & warehouses in rural areas has met with some success. Banks can be motivated to extend credit to the setting up of such units if they receive subsidy support from the Government as such activities would be capital intensive. The Committee also suggested setting up of agro-based processing units so that farmers get good value for their produce as well as ready markets. Private enterprise should be encouraged in the setting up of agro-based processing units. Easy loans should be made available to such enterprises especially if it acts as a ready market for less water intensive agri-produce.

The Committee also discussed the economics involved in building water resources. Farmers spend a lot of money in the digging wells to create new water sources. More often than not, in the absence of good information, the wells turn out to be dry. The Committee debated whether ground water resource management should be taken over by the government. The government should invest in investigation, digging of wells, establishment of pump stations etc. The transmission network which includes piping network can be invested through schemes like micro-irrigation. The distribution with in fields can be partially subsidized through micro-irrigation schemes for individual farmers. Thus the entire resource development, distribution can be with the government and the distribution can be with the water user associations. In this regard, it must be noted that small scale products would be more beneficial for easier management. The Committee considered an organization structure similar to that existing in the petroleum industry for groundwater management.

Financial infrastructure in the form of credit flows, insurance covers, negotiable instruments (warehouse receipts) etc should also be developed. The Committee noted that there has been a change in the source of credit. Where once the delivery mechanism was the Ministry of Agriculture, today it is through the banking system that the credit packages are channeled. The Committee also suggested that crop insurance packages must be made more comprehensive and pervasive.

Weather Derivatives - An innovative instrument that duplicate the purpose of weather insurance more efficiently

Agricultural production can vary widely from year to year due to unforeseen weather causing wide swings in yield and commodity price. These wide swings in yield and commodity price generate variability in farmer household income. The uncertainty in future income complicates both short-term production and long-term planning, that is whether to expand or reduce production, whether to invest in acquisition of fixed and moveable assets, whether to stay in farming or to exit. In the absence of effective risk management tools, when the swings significantly reduce income in the short-term there can be serious repercussions, especially when the swings are systemic shocks to the whole sector. The negative shocks can affect the farmer's ability to repay financial obligations and lead to a loan default.

The question to be posed is whether or not we can provide volumetric risk mitigation methods with greater efficiency, meaning thereby lower transaction costs, such that the farmer in rainfed areas receives a better cover for his marketable surplus. The answer lies in the use of commodity exchange platforms to offer weather derivatives.

New weather risk management instruments such as weather derivatives provide a viable alternative to traditional crop insurance schemes and offer real advantage to households, businesses and Governments in developing countries. Successful weather risk management in developing countries would offer potentially huge benefit not just to farmers but also agri-business and financial markets. Weather risk management products based on weather events avoid the problems faced by traditional crop insurance because they rely on objective measurement of specific weather events that are outside the control of either farmers or insurance companies. They are also less costly to administer because they do not require individual contracts and on-field inspection. While well suited to calamities and extreme weather events such as earthquakes and typhoons, insurance does not work well with the uncertainties in normal weather.

The importance of weather index derivatives is that it focuses on the covariate nature of the climatic risk faced by rural producers. Excess rains / droughts are among the many relatively cheaply and objectively verifiable weather events that have a direct and systemic impact on the economic activities of the rural sector in general and of the agricultural sector in particular. Thus, weather index derivatives not only help mitigate the high risk faced by vulnerable households and economic agents within the rural sector, but also reduce Government cost of natural disaster aid. Measures taken to reduce the impact of weather disasters provide an effective vehicle to make substantial advances in the fight against poverty.

Weather derivatives are based on the occurrence of a weather event rather than on actual losses such as crop failure. The underlying assumption is that certain weather events such as flood / drought are correlated with crop losses and are therefore income risks. All buyers pay the same premium and receive the same payment per futures / option. The key advantages to this kind of insurance are that the trigger events e.g. deficit rainfall can be independently verified and therefore not subject to the possibilities of manipulation which are present when insurance pay-outs are linked to actual farm losses. And, since the contracts and payments are the same for all buyers per unit of futures / options, the usual problems of moral hazard and adverse selection associated with traditional crop insurance are lessened.

Commodity exchanges can launch **weather derivatives** relevant to each meteorological zone so that farmers can use it as a buffer against yield deviations from normal weather. A weather index would be traded on the exchange and would be linked with a monetary value. Weather derivatives are easily adaptable for Indian climatic conditions. Agriculture in India is dependent on the monsoons. A failure in monsoon or a late arrival of monsoon can pose risk to the volume of crop harvested by the farmer. It is easy to create an index based on the monsoons in India. This index can be used to create a weather derivative.

For example, suppose on June 25, 2007 the index is at 980 and August futures (expiry on August 20, 2007) are trading at 900 (the market expects a bad monsoon). If by August 20, 2007, the farmer expects normal rainfall he will sell one futures contract at 900. Due to inadequate rainfall in July and August, on August 20, 2007 the index drops to 800; the farmer buys back his contract and closes his position. He thus gain Rs. 500/- (i.e. 100 * 5) The multiplier is set at Rs. 5/- (price per litre of water). As physical delivery is not possible, the trades will be cash settled using a multiplier of 5. Final settlement will be based on IMD rainfall data.

Weather derivatives are thus a superior alternative to both weather insurance and traditional crop insurance since it solves the problems of adverse selection, moral hazard, insurable interest and correlating rainfall with crop yield. Weather derivatives are relatively inexpensive to administer since there are no individual contracts to write, no on-farm inspections and no individual loss assessments. This makes derivatives affordable to a broad range of people, including agricultural traders, agro-processors, and every body else whose income is dependent on weather. Weather derivatives are relatively easy to market. Banks and rural finance institutions can also trade derivatives to protect their portfolios against defaults caused by severe weather events. Once financial institutions are able to off-set risk with weather derivatives, they are in a better position to expand credit at perhaps improved terms. This is a critical issue for many developing countries as credit availability to agriculture is constrained, partly because of weather risks. Finding solutions to protect borrowers against adverse weather events will contribute to improving credit markets in developing countries. Also, unlike insurance, a purchaser of a weather derivative does not have to submit a claim and demonstrate her loss to receive a payout. The payment is automatic upon exercise.

Farmers or rural local bodies should pool their resources so that they can benefit from economies of scale. It would also help them to provide a common credible risk identity so that they can access banks, capital markets etc. to finance their activities.

Legal infrastructure:

The Model Bill of 1992 which mandate compulsory installation of water meters need to be adopted & enforced by all states. State Groundwater Boards/ Departments should be empowered to check the depletion of groundwater.

At the moment, according to the law, the land owners has unlimited rights to extract groundwater within the property. The only regulations in place are those on spacing between wells and construction of new wells in over-exploited areas.

The development of a water rights regime becomes all the more important when understood in the context of inviting private participation in the building of ‘water banks’ as in the Californian model. Water banks or recharge reservoirs will be economically viable only if water rights regarding the recharge of wells in the vicinity of such reservoirs are well defined. Currently, water in wells on land owned by individuals (which are recharged by ponds or watershed development programmes) is treated as private property with the rights vested with the individual who owns the property.

The Committee agreed that in the absence of equitable sharing of water especially in water shed areas, reforms in water sector would alienate the landless. Hence treating water as a common property and ensuring a minimum supply of water to individuals is essential.

<u>Assessment of asset financing companies for re-financing activities</u>

Issues:

Farmers require credit funding for various activities. They require crop loans to finance the inputs (seeds, fertilizers, pesticides, etc…), capital requirement to finance purchase of tractors, installation of drip irrigation facilities, development loans to cover long term activities like soil regeneration activities. In spite of government intervention credit flow to the farming community is not adequate. There is hence still a considerable degree of dependence on the local moneylenders for credit requirements.

On the other side, given the indefinable nature of the uncertainties associated with agricultural produce, institutions like banks etc do perceive a greater amount of risk when dealing with farmers for providing credit. It is necessary to define these risks so that banks and other financial institutions can extend credit to the farming community with greater confidence.

Discussion points:

Currently the bulk of crop loans are facilitated by money lenders who charge exorbitant rates of interest. As farmers' indebtedness mounts they get trapped in a vicious cycle of poverty.

The Committee discussed various means by which credit financing to the farming Committee can be made viable. The credit system would become more efficient if the credit agencies *recognized the entire portfolio of income* (including animal husbandry, seasonal work etc…) for the rural households and then provided them loans. This would immediately widen the available credit resources with the farming community. Availability of credit should not be restricted to one source of income (agriculture) but acknowledge the multiplicity and scope of the entire spectrum. *At the same time, banks can attach weights to various activities based on their risk assessment.*

Banks and other credit institutions should consider 'portfolio funding' (entire spectrum of income sources of households in rural India) and funding at critical times for entire portfolio of enterprises of the household. They should move out of the traditional approach of financing and instead provide finance based on the complete needs of the farmer covering livelihood expenses as well as finance for subsidiary non farm activities (small scale industry).

In this context, it was also expressed by some members that banks were already in the process of using this criteria when sanctioning farm loans.

The farmers should be encouraged to not depend upon only agriculture for his income and subsidiary activities such as horticulture, animal husbandry should be adopted to a larger extent to insulate his income fluctuations partly from the vagaries of the weather.

Schemes such as NABARD's crop loan scheme linked to insurance ideally should be replicated by banks where the rates of interest charged to the farmer are low around 7-8%. Though attempts have been made in the past to link insurance to credit, an integrated approach whereby total support covering many aspects of the villager like crop, health, livestock, credit risk etc is still to evolve. There is an urgent need to bring out such hybrid products which reduce the cost of lending and provide for sustainable activity in times of adversity. NABARD refinancing activity can be linked to such a loan pattern of banks.

There is yet another way of looking at the problem of access to institutionalized sources of credit. It is generally seen that there are very few things of value that the farmer can offer as pledge to get a loan. Banks have come with innovative ideas on ‘acceptable collateral’ e.g. Trees in certain tribal belts are accepted as collateral. But there is an inherent danger in using collateral which does not have well defined property rights. The committee agreed on the importance of a security against which a credit line can be issued. The committee also debated on how the credit line could be extended against ‘social’ collateral as against ‘physical collateral’. Self-help groups could be targeted to advance this idea.

Funds for soil regeneration should be provided through banks to Panchayati Raj Institutions based on land mapping linked to the productivity of farms. At villages suffering from low soil productivity, a fund needs to be setup which can be managed by RRB/ other bank branches for a fee. There should be periodic review of the progress made carried out jointly by the banks and Panchayati Raj Institution representatives to undertake an assessment of the scheme and the utility of funds.

The Committee also debated the need for creating a new Rural Finance Agency which could provide refinance for the existing agri-financing institutions to farmers who were better insulated against risk i.e. taking insurance or deriving alternative income from related activities and so on. However, it was felt that we should not be creating new institutions and instead leverage the existing financial structures to deliver these results. The role of NABARD in particular was discussed at length in this context.

“Risk” is major issue in agricultural lending. Local bodies should pool resources and present a credible & viable risk so that risk bearing institutions can accept such risk. It was suggested that for such a purpose the size of a project will matter. When the projects are small and affect local communities, financial planning can be built in to the system.

Incentive and disincentive strategies for sustainable rainfed area development

Issues:

Specific measures were to be discussed to act as incentives or disincentives for better use of water resources in rainfed areas. The idea is to bring about better utilization of scarce resources through a system of financial incentives or disincentives so that ultimately the system can gravitate towards a cropping pattern which not only satisfies national priorities but also increases the returns on the use of water.

Points of discussion:

The Committee looked at both incentives and disincentives in considerable detail.

The committee was of the opinion that there are few fiscal instruments available for promoting private participation in rain fed areas.
The incentive structure can revolve around

- tax holidays
- tax rebates
- depreciation

These incentives can be extended to private participation in

- Manufacturing water saving devices
- Sourcing of raw materials from Producer Companies which have invested in water management techniques
- Invest in research and developmental activities in rain fed areas

The Committee debated on the viability of a tax system (or higher prices) to be introduced as a disincentive to excess use of water. There is an on-demand system of irrigation prevalent in France and Spain. The payment mode is based on water usage. The disincentive system ensures that extra charges are paid for non-preferred crops. But the Committee members agreed that introduction of a successful tax system might prove to be politically infeasible. Also until there is further clarity on the important crops at the national level, linking the two would be difficult. Further, given the land and water laws, we would need to change the ownership pattern first before dwelling on this issue.

With regard to incentives to promote sustainable development, the Committee studied the structure of a negative income tax. The negative income tax was a measure suggested by James Tobin. It involved the government providing assistance to those living below the poverty line in the USA. Instead of paying tax, at the time of filing returns, the wage earner were paid cash by the government for drawing income of less than a certain predetermined amount. This concept can be extended to those farmers who practice optimal use of land and water. An objective chart can be drawn up linking which crops should be grown on a piece of land based on existing related conditions: size, location, crop grown, income accruing to the farmers etc. Use of water will fall and farmers adopt conservation practices. This will act more as a kind of subsidy being given for optimal utilization of natural resources. At the same time, the income of the poor farmer directly increases.

The Committee debated on whether the negative Tobin tax could be used as an incentive for diversification of agriculture to help migration to other forms of sustainable livelihoods such as animal husbandry. Farmers in certain belts have taken to intensive cultivation of a plot of land for fodder cultivation, using water from bore wells. The remaining land is irrigated less intensively for growing various crops. Water consumption of pasture land is much less as compared to water consumption for irrigation of crop. This switch to an alternative livelihood partially reduces the strain on a scarce resource such as water. At the same time, animal husbandry provides farm yard manure for the cultivated land. Farmers can be encouraged in their efforts to undertake animal husbandry if they receive money transfers in the form of a negative Tobin Tax.

It was suggested that the Tobin tax be computed on the basis of the existing water rates. The tax could be computed as a reimbursement of a fixed percentage of the water tax rate to the farmers or communities involved in the water conservation process. The financial outlay for the scheme will have to be calculated estimating how many such projects can be undertaken in the rain fed areas *(see working of the proposed tax model in Annexure C)*

A study by International Food Policy Research Institute shows that Indian agriculture is diversifying rapidly especially in rain fed areas. Enterprises are widening to include live stock management and diverse crops. Farming is moving to high value crops. This is surprising since such changes should have been heralded by the irrigated belt rather than the rain fed areas. Has such diversification of enterprises been the result of state intervention? Surprisingly the answer was a ‘NO’. Diversification has solely been driven by farmer discretion. The shortage in water supply has in itself acted as a natural incentive for the change in cropping patterns and the change in enterprise structure. The state does give subsidy to tube and bore well construction and thus has also encouraged farmers in their efforts to diversify out of agriculture. The diversification can be strengthened by developing a good market for the new products. The best mechanism to strengthen this diversification is to connect farmers to the markets by improving strong market links. In this regard, contract farming has a new role and much potential.

The Committee also debated on whether government intervention or market mechanism would be more effective in bringing about an efficient water regime. It was agreed that market solutions are best in a case where active monitoring is required. Market solutions are also to be recommended when the area to be monitored is spread over a vast geographic area under different administrative units. In part of Tamil Nadu, Gujarat etc, informal water markets exist. Farmers with access to surplus supplies sell water to farmers with a water deficit. Such markets need to be regulated so that there is a proper & prompt system for redress in case of complaints. Such a water credits market would also be successful in developing water bodies.

The Committee noted that the use of bore and tube wells have been linked to drop in water table levels. *The Committee felt that all subsidies associated with ground water exploitation must be stopped forthwith especially in over-exploited areas or 'black zones'.* If any such need is felt, it must be allowed only at the community level. This negative effect of bore and tube wells should be reversed by large scale water recharge activities. This is apparently the role of the newly instituted Rain fed Authority. Funds should to be allocated to villages for collective effort to revive or create new water bodies like tanks which act like natural recharge basins. Private enterprise should be encouraged in the building of water banks and reservoirs to conserve rain water. Private enterprise in waste water management (collection, treatment and reclamation) should be encouraged too. The Committee also noted that the free availability of electricity has lead to the rampant use of bore wells. A disincentive can be applied by hiking the price of electricity so that its consumption is reduced which in turn would reduce the usage of water. But it was generally felt that hiking electricity rates would not help since electricity theft is wide spread in rural areas.

Another disincentive to curb over-usage of groundwater would be to cap the present usage of water (can be based on optimal cropping patterns) and installation of water meters to ensure that water is not pumped beyond the prescribed limits. In case of over-drawl, heavy penalties are to be imposed. The monitoring of such a system could be outsourced to a private enterprise with strict guidelines to reduce corrupt practices or adverse selection.

The incentive structure with regard to drip irrigation is geared towards the sale of irrigation units. There is no incentive to provide adequate guidance on better water management, maintenance of the installed system or investment in R&D to produce cheaper technology. Therefore all the above mentioned have suffered. The incentive structure for drip irrigation has to move away from incentives to produce group to direct incentive system where the subsidy is an immediate cash transfer to the farming community. Drip irrigation companies should be encouraged to use local enterprise for maintenance activity. Research & development in the field of micro-irrigation should be encouraged through grants and protection of IP rights of the researcher.

Current policies in respect of farm subsidies for urea-based fertilizers have led to distortions in land use and fertilizer consumption and promoted unsustainable exploitation of ground water. These policies need to be reviewed. Inversely, the government can also offer subsidies with regard to fertilizer, pesticide etc to promote crops which are less water intensive. At the same time, they can hike the MSP's offered for crops suitable to the agro-climatic and water situation. Crop varieties with high yields per liter of water consumed should be promoted. To discourage water intensive crops, the MSP offered on water intensive crops can be reduced. But the success of this plan would of course depend on a ready market for the less water intensive crop. In the event it is not the case, the farmer might find it more feasible to produce a water intensive crop.

The members deliberated on whether an authority like the NHAI needs to be created to own and manage water sources in India. This authority would be responsible for mapping water sources in India and ensuring that water from surplus areas is diverted to water in deficient areas. It was finally concluded that the need of the hour was not new institutions but clear areas of co-operation and co-ordination between the various existing agencies.

There was also debate on the role that various bodies played in exploitation of ground water. It was felt that the Rural Development Authority must have a greater say in ground water resources management. The dominant thought body in the CWC is bent towards canal irrigation while the focus should be on conservation and recharge.

The Committee finally discussed the issue of *water credits* which is a concept analogous to the carbon credits system. Tradable water rights give an economic value to a scarce resource. Price signals capture the scarcity and use value of water thus imparting efficiency to water allocation. Those farmers who move from water intensive crops to less water intensive crops will be given tradable credits or cash transfers on an annual basis. The NABARD experience with water credits show that the system of water credits had proved successful. Annual credits were proportioned out to households rather than individuals so that it ensured equity. But physical availability of water must be provided to farmers. Credits may not solve the physical water usage. The problem of water scarcity can be got around by subsidizing the distribution of water. It should be a one time activity supported by state. Also, the water rights must be distributed taking into account principles of justice, access and social equality.

Recommendations of the Sub Committee

Economic and Financial Incentives for sustainable land and water development Programmes

The Committee was of the opinion that we should strongly consider the pricing model adopted by China to address the situation of water scarcity in India. Water should be treated as an economic good and therefore its ***price should reflect the full cost of water supply*** as in the case of the Chinese model. The enforcement mechanism should be strengthened so as to facilitate efficient use of this scarce resource. However, any taxation policy should bear in mind the fact that most farmers in India are impoverished. We suggest that the taxation policy should be of a progressive nature. For instance it is the case that upstream farmers have better access to water than downstream farmers. Hence water taxation policies must take into consideration the economic condition of the farmer.

One of the recommendations was to allow third party investment in micro irrigation projects. Currently farmers take on loans and install the micro irrigation facilities (drip irrigation, sprinklers etc). Under the suggested scheme, third parties should be welcomed to undertake micro irrigation projects on farm holdings. Since land holdings are fragmented, the area could be demarcated like telecom circles (area wise) rather than on a per project basis. 3-5 enterprises could be allowed in each circle so that monopolies do not exist while at the same time, these enterprises could enjoy economies of scale. The projects could be seen as third party loans to farmers and relegated as land development projects. The enterprises could act as leasers of the infrastructure to farmers in contiguous farms and would be involved in maintaining the infrastructure. The projects could be put up for tendering by bidding process by interested parties (either public or private or in partnership). The enterprises could also access the capital markets through tax free bonds since the micro irrigation projects can be given the status of infrastructure. With regard to the water used for irrigation, the enterprises can invest in water banks / reservoirs to supply water to the farms.

For drip irrigation facilities which are spread over a large area, it becomes necessary to install systems and checks to ensure that water pressure all through out the network is at the same level. For small farms such checks and systems are not necessary and should be done away with. In fact, IIT engineers have come up with a less expensive drip irrigation system for small farms.
The specific recommendations with regard to the efficient promotion of Drip and Sprinkler irrigation in India can be found in *Appendix A*.

Models of water management
The NABARD experience of empowering user communities has been most productive & fruitful. We should avoid adding new institutions to solve old problems. It is better to empower existing institutions and communities (SHGs & Microfinance institution). Efforts should be focused on capacity building in local institutes. Financial weakness of single institutes can be got around by pooling resource of in contiguous areas.

Economic models for water management will work only in areas where people recognize it as a scarce resource with economic value. In fact people in certain villages have already put this fundamental idea into practice and sell water from their bore wells to the people willing to pay a price for the same.

Water literacy- NGOs and other organizations working in rural areas must be encouraged to disseminate water literacy among the farmers. Suitable extra allocations could be made in the Panchayat budget. To give an impetus to the projects on water and soil, agri-clinics must be established at least at the block level and be manned by Agricultural graduates. This could again be on a PPP-entrepreneurial model with finance from the banking system at low rates of interest. NABARD is already doing some work in this area. The canvas can be expanded with a capital subsidy mechanism built into it.

Incentives for irrigation

Incentives need to be given at different levels such as source, transportation, storage and utilization.

The Committee looked into the possibility of having a BOT (Bill Operate and Transfer) system in the case of water on similar lines as the power model and whether subsidies can be allocated for different stages such as the generation, operation and distribution of water.

Accountability of water bodies

There must be transparency in the water planning system where the water bodies are held accountable for the efficient allocation of the water resources.

B) Land Management

India too can derive significant benefits from converting its paper based manual system of land record maintenance to a fully computerized demat system. The benefits that can be garnered from such a move are manifold and include: first less land disputes. Second, security for credit, business growth and investment third greater control over any illegal use of land and finally allows monitoring of land markets.

The Government should therefore take advantage of technologies that facilitate the cataloguing of records and flagging and retrieval of information.
The Ministry for IT has given priority & incentive to develop an online system for land titles & deeds. According to the Committee it was a question of when rather than how. Electronic holding of land records and registration will make the credit process easier.

The committee recommended that all land should be registered by a cut-off date beyond which electronic registration is made compulsory. All states should have its separate depository like NSDL. Another suggestion was to allow private parties to assist in the land registration process (e.g. Birla Sun Life in pan card registration.

Successful cases of implementation of e-registration of land records by Indian states are:

- Maharashtra: *SARITA*- (*Stamp and registration with Information Technology Applications*). This is a case of a public private partnership. The private sector has been contracted to build operate and maintain SARITA across all SRD offices, five years after which it would be transferred back to the state.
- Andhra Pradesh: CARD (*Computer Aided Administration of Registration Department*) project: Land registration offices

throughout the state are equipped with computerized centres under *CARD*.

- Karnataka : public private initiative of e-governance called *KAVERI(Karnataka Valuation and E-registration Project)*
- Tamil Nadu is also another state where land ownership records have already been digitalized.

Such cases of successful electronic registration of land records must be extended to the remaining states in the country.

How to derive optimal cropping patterns and other economic activities in a liberalizing economy

It was agreed cropping pattern should be primarily decided by market and land, water resources.

Crop patterns should not be decided by National/State priority. The Committee considered the example of Kerala farmers who cannot grow anything other than rice. The Kerala Government supports labor intensive usage.

Efforts should be undertaken to collect and make available to the community agriculture related data. The importance of data warehousing can not be denied. Agri-intelligence units have an important role to play in this regard.

The Committee felt that futures prices can be used by farmers as signaling devices for crop sowing pattern. Sowing decisions may be taken based on futures, rather than spot prices to enable better returns at the time of harvest.

Private sector participation: Land Lease arrangement

Private sector participation can be encouraged in both the above models through land leasing arrangements to allow accelerated technology transfer and capital inflow and assured markets for crop production. Private investment in agriculture can be encouraged in areas like agricultural research, post harvest management and marketing.

In fact we should explore the export potential of crops which *can* grow in the rain fed areas. E.g. yellow peas which are grown as an export crop in Canada. Just like how industry is given the status of SEZ, zones targeting foreign markets should be given full benefits of infrastructure (electricity, transport etc), marketing and finance (access to credit). Enterprises which allow for forward linkages should also be encouraged. Industry should be welcomed to develop such regions without the farmer losing his right of land. The concept of commercialization of agriculture through Agri Export Zones should thus be given a thrust.

Linkages with User Industries

Cropping patterns under contract farming needs to be directly linked with user industries in the region or nearby areas. Such linkages are the only answer in the long run for sustaining crop prices and farmer interests.

Alternative Economic Activities

Also the creation of multiple livelihood opportunities will go a long way in improving the capacity of the farmer to experiment with cropping patterns.

Agri-Intelligence Units

Another important factor that contributes to the farmer's ability to decide the cropping pattern is his knowledge about the likely scenario in respect of a crop. The community service centers which have been planned by the Government have a major role to play here. There are differences in perception as regards the model to be used for these centers. These need to be resolved and a region-specific model with participation from the local community which it seeks to serve (an inclusive model) needs to be adopted.

The specific guidelines for changing cropping patterns can be found in Appendix B.

Programmes for marketing, infrastructure and policy support for income generation in post water harvesting phases

Access to markets is the key to viable farming. Any form of farming (co-operative, contract or corporate) should be encouraged with proper safe guards for the farmers rights.

This system of exchange traded options on commodities can not only provide the farmer with a floor price for his commodity with out the obligation to sell at the floor price (thus acting as an MSP) but also help him take the benefit of any rise in prices.

Futures help farmers mitigate their price risk during both pre and post harvest phases of their crop cycle. Futures assure farmers of a firm realization level.
Weather derivatives are a superior alternative to both weather insurance and traditional crop insurance since it solves the problems of adverse selection, moral hazard, insurable interest and correlating

rainfall with crop yield. It thus provided an efficient mechanism to cover the volumetric risk of the farmer.

The committee agreed on the importance of a security against which a credit line can be issued. The committee also debated on how the credit line could be extended against a ‘social’ collateral as against ‘physical collateral’. Self-help groups could be targeted to advance this idea.

With regard to policy support, the Committee had the following guidelines to offer. First, the role of the state needs to be redefined. The ‘state’ should have a sovereign right over a scarce necessity like water. People have well defined rights, which recognize the principles of justice, social equality and ecological security. The state acts as a facilitator and provides for a regulatory framework & mechanism. Second, incentives to conserve water must be linked to observable and measurable performance. Third, creation of new institutions should be avoided as far as possible. The role and scope of existing institutions can be redefined to meet objectives. It is generally the case that establishment costs will dispose off 80% of the total funds. Vested interests crop up which are unfavorable to the achievement of the targets. It would be better to strengthen existing Panchayati Raj institutions and its agencies. Fourth, the management and overseeing needs to be structured such that there is no overlap of jurisdictions or duplication of responsibilities. Also, structure should be decentralized and with minimum supervisory control. Fifth, incentive packages should be such that it is easily monitored. Therefore it would be better to rely on the market mechanism to reduce corrupt practices. Sixth, creation and maintenance of a comprehensive database in the public domain. The ideal database should cover institutions and their finances, land registration, cropping pattern, water consumption and usage patterns, etc. Seventh, water audit and budgeting should be practiced. This would, of course, require capacity building. Lastly food Security is the main driver of agri-policy & agri-produce pricing. It should be driven by market mechanism and optimal utilization of scarce resources like land and water.

Assessment of asset financing companies for re-financing activities

The Committee noted that households should be regarded as the key to the credit assessment scenario rather than the enterprise undertaken by the individual. We should remove the focus from agriculture to composite loans so that farmers can use his discretion to allot money to various enterprises that he wishes to take up.

The committee also recommended that the credit line could be extended against' social' collateral as against 'physical collateral'. Self-help groups could be targeted to advance this idea.

On the topic of the creation of Rural Financing Agency, the general consensus was that there was no need for the creation of new institutions. It would be better if we developed greater co-ordination and co-operation between the existing agencies. A new Rural Financing Agency institute may not solve the problem of increasing credit to the rural economy.

Incentive and disincentive strategies for sustainable rainfed area development

The committee was of the opinion that there are few fiscal instruments available for promoting private participation in rain fed areas.
The incentive structure can revolve around

1. tax holidays
2. tax rebates
3. depreciation

These incentives can be extended to private participation in

1. Manufacturing water saving devices
2. Sourcing of raw materials from Producer Companies which have invested in water management techniques
3. Invest in research and developmental activities in rain fed areas

The Committee agreed that the Tobin negative income tax appears to be a practical way to solve the problem of water efficiency. It would at the same time induce water conservation efforts and augment rural incomes.

It was suggested that the negative Tobin tax be computed on the basis of the existing water rates. The tax could be computed as a reimbursement of a fixed percentage of the water tax rate to the farmers or communities involved in the water conservation process. The financial outlay for the scheme will have to be calculated estimating how many such projects can be undertaken in the rain fed areas (see Annexure C).

The Committee recommended the development of a water credits market which will go a long way in providing incentives for better use of water.

Producer Companies: Rapid growth in the purchasing power of (urban) middle classes and globalisation of the economy is creating huge business opportunities in aggregation, processing and distribution of a variety of goods produced in rural areas, such as cereals, oilseeds, fruits, vegetables, milk, meat, fibres, etc. Modern Indian Corporate Sector has been quick to grasp this reality and several large Houses have already announced plans.

One prognosis is that the rain-fed regions and the poorer people engaged in rain-fed farming will get by-passed by this new “market revolution” just as they were by-passed by the green revolution. The present trends do indeed support this prognosis. After all, it is easier to produce fruits and vegetables in the irrigated plains and the purpose of aggregation and scale is better served by contracting with larger producers capable of taking risks, bringing investments and delivering larger quantities. Yet, public/social purpose would be better served if rain-fed regions were enabled to plug into these emerging market opportunities. For this to happen, farmers in rain-fed regions must be assisted to diversify their farming systems, ways must be found to create aggregates outside the cost structure of the Coprorates that are large enough to create viable business units, incentives similar to Section 35 (1) (ii) must be created for the Corporates to invest in “less endowed” regions and infrastructure must be developed. As aggregation is in any case essential for watershed development (watershed organizations are formed at various levels), the same may be done in ways most helpful to establish market linkages. For instance, the apex watershed organization may be incorporated as a Producer Company and project funds may be channelised through it. The Producer Company can also be a device for input supply besides aggregation of outputs.

Appendix A: PRODUCER COMPANIES

What is a Producer Company?

Producer Company is a business enterprise registered under the provisions of Part IX A of the Company Act, and is run on the basis of Mutual Assistance Principles (581G(2)).

Mutual Assistance Principles

581G(2)

- *Voluntary membership*
- *Voting right independent of share holding*
- *Elected board from amongst members*
- *Limited return on share capital*
- *Distribution of surplus on patronage base*

Examples Abroad

- ***Similar legal frameworks are in many countries, to quote a few:***
  - ***New Zealand***
  - ***United States***
  - ***Switzerland***
  - ***Italy***
  - ***Denmark***
  - ***Norway***

Who can form Producer Company

Having its objects as specified in the companies act the following may form a producer company

- *Any ten or more individual producers or*
- *Two or more producer institutions or*
- *A combination of both*

A producer company can also be formed by conversion of a co-operative eligible to become a producer company

A few key terms

Primary produce *– Produce of farmers, arising from agriculture (including animal husbandry, horticulture, …Pisciculture,…) or any other primary activity or service which promotes the interest of the farmers …;*

Definition of a Member

- *"Member" means a person or a Producer institution admitted as a member & who retains the qualifications necessary for continuance as such Sec.581A(d)*

- *"Active Member" means a member who fulfills the quantum and period of patronage as may be required by the articles Sec.581A(a)*

Members' Control

- *Company formed of individuals, member shall have single vote irrespective of share holding Sec.581D(1)a*

- *Where the company is formed exclusively by producer institutions, the voting right may be computed on the basis of participation in the business Sec.581D(1)b*

- *Company formed of individuals and institutions, there shall only be a single vote for every member Sec.581 D(1)c*

- *The articles may restrict the right of voting to only those members who patronize the company Sec.581 D(3)*

Other Salient Features

Producer Companies Legislation combines the institutional and philosophical strengths of cooperative like :

1. *Ownership limited to users;*

2. *Limited interest on shares;*

3. *No trading of shares,*

4. *Patronage based benefits*

with the flexibility and autonomy of company law.

Ensures active member participation in business and management

1. *Active members to participate in decision-making process, eligible to elect and to be elected as members on the Board.*
2. *Voting rights based on patronage*
3. *Special user rights to active members*
4. *Need for participation in business for continuance of membership*
5. *Regular audit by the CA appointed by the members*

Professional management – accountable to board

1. *Clearly defined role of Board and CEO/MD,*
2. *Freedom for appointment of professionals, compensation, organization structure,*
3. *Possibilities of availing experts' assistance in governance and management;*

4. *Employees of the company are accountable to MD/CEO and not to the board.*

Voluntary amalgamation and division in business interest
Election of the Board by the Producer Company without any government interference; and professional audit by chartered accountants;
Greater flexibility with regard to joint-ventures, alliances, mergers and acquisitions;

Insulation from bureaucratic and/or political interference.

1. *No political nomination possible by the government.*
2. *No govt. Equity.*
3. *No provision for supersession, providing exemption, issue of directive, compulsory amendments etc.*

Producer Companies vs Co-operatives

Features	***Producer Companies***	***Co-operatives***
Principles	*Mutual Assistance*	*Co-operative Principles*
Membership	*User-members*	*Non-user can be*
Voting rights	*One member one Vote / Patronage Voting*	*One member one vote*
Professional Management	*Provision for experts in Board*	*No such Provision*
Nominees on Board	*No such Provision*	*Provided*
Audit	*By CA*	*By Govt.*
Election Responsibility	*By Incumbent Board*	*By RCS*
Area of Operation	*Not restricted*	*Restricted*
Registration	*Central Act*	*State Act*
Restrictive Provisions	*No such provision*	*Provided*

Producer Company - Design Principles

- *Conformity to the law*

- *Locus of control – internal*
- *Building higher stakes of the members*
- *Accountability of the board to the owners*
- *Accountability of the CEO to the board*
- *Patronage driven governance*
- *Business orientation of the board and the CEO*
- *Lower structural overhead*
- *Easy to understand*
- *Ease of adoption*
- *Operationally feasible*
- *Lower political sensitivity*

Appendix B

According to the Committee the efficient promotion of Drip and Sprinkler irrigation in India can be based on the following:

1. *Micro Irrigation Board at the Central Government Level:*

Large amounts of funds are being earmarked for promotion of micro irrigation in the country. Considering the importance of these on farm irrigation technologies and considering the need for consistent efforts in achieving the benefits from these promising technologies in the hands of the farmers, it is necessary than an exclusive body is created at the Central Governmental level. The body shall be given suitable and legal status for promoting the concept efficiently and for interfacing with the central and state machinery for effective implementation.

The Constitution and functions of such a Board can be evolved through an elaborate process.

2. *Intensive Campaigns by Central and State Governments though all possible mediums:*

In order to improve the acceptability of the micro irrigation concept and in order to impart confidence among the farming community about the benefits from the concept as well as about the commercial viability of their investments on the micro irrigation systems, The Central and State Governments (irrespective of political and other affiliations) should launch large scale campaigns in various media such as Print, Radio, TV etc.

The concept should be promoted as a concept of efficient on-farm water management which can improve the yields and farm incomes.

All the political and administrative machinery dealing with agriculture and related portfolios in Central and State Governments should take up the cause with consistency and commitment.

3. *Single Implementing agency with district level infrastructure/manpower in the state, with farmer friendly image*

The promotion of micro irrigation should be assigned to single state level agency/department which has a farmer friendly image and reputation. Farmers need to derive confidence about the techno commercial feasibility of the micro irrigation systems, which is possible only if the implementing agency/department has wide acceptability, non-partisan, non-corrupt image among the farmers.

In the case if the concept is presently under departments/agencies which have little acceptance with the farmers and/or if such departments/agencies are already mired in corruption and red tape, there is an urgent need to reallocate the subject to another agency/department before the launch of large scale projects for promoting MIS.

4. *Stringent vendor selection for Quality Products and Services*

The State level agency/Department should evolve stringent vendor selection process consisting of:

- Firming up technical specifications of the components in MIS,
- Assessing capabilities of vendors in manufacturing of the system components as well as provision of services ranging from survey, design, installation, commissioning, training, agronomical support, and maintenance support.
- Firming of component pricing based on the product and service specifications.

5. *Efficient Credit Delivery Mechanisms*

Farmers need to invest the non-subsidy portion of the cost of micro-irrigation systems. Most often it has been found that the adoption rate of micro-irrigation systems is limited by the availability of credit to the farmers. In order to improve the adoption rate of micro irrigation, credit delivery to the farmers is important and hence the following needs to be considered:

- Each State Government should fix District/ Taluka level targets for Lead banks for extending credit to MIS
- The State and District level units of the implementing agency should monitor the progress of credit delivery against the set targets
- Banks should consider the Micro Irrigation Systems as collateral and should not seek mortgaging of additional assets
- Attractive interest rates and repayment periods

6. *Simplification of procedures and documentation for sanction of subsidy/credit*

Presently, the procedure for administering the schemes to promote micro irrigation is laborious. Also the intensity of documentation required to be fulfilled by the farmers is quite high. Though these procedures and documentation requirements are for avoiding misuse and misappropriation of funds there exist a large scope for red tape and consequent corruption. Such high intensity of procedure and documents deter the farmer from coming forward to adopt the concept.

7. Use of micro-irrigation systems shall be made mandatory, at least in the following situations:
    - In all dark and grey (groundwater) blocks
    - If farmers are offered subsidized electricity for irrigation
    - If farmers are water hungry crops like sugarcane etc

- In projects involving rain water harvesting and water shed management
- Water lifted from either rivers or canals for irrigating the farms (lift irrigation). It is already being practiced in Maharashtra and Andhra Pradesh and is called 'no lift without drip'.

8. Extensive Training and capacity building:

All the technical and agricultural staff of the implementing agency, agriculture/horticulture departments, banks, irrigation departments should be trained on subjects such as on-farm irrigation management, irrigation scheduling, micro irrigation system operation and maintenance, crop agronomy with micro-irrigation, techno-commercial feasibility of systems in various crops, etc

Appendix C

Some of the guidelines for changing cropping patterns:

- Do not introduce crops unsuitable for agro climatic zone even if it promises rich yields and income.
- Mono cropping is profitable but doesn't guarantee health of the soil and sustainability in long term.
- Provision of an incentive system for drip irrigation
- View different enterprises as source of income in rain fed areas. Life stock management should be actively encouraged as it makes the best utility of scarce water resources
- Subsidize use of natural farmyard manure. Move subsidies away from chemical fertilizers to natural manure. This will in turn increase the importance of keeping life stock.
- Common lands have fallen prey to government dictates on land allocation to landless laborers. Such commons were once open pastures for grazing cattle and also served as reserves and helped in land rejuvenation. Such reserves should be earmarked for its past uses. People who have been given such land must be relocated and offered alternate sources of income & compensation. Encroachment on such lands should be removed.
- Traditional methods of land and water conservation which had been fine tuned over years of experience should be brought back and strengthened using technology.

A nodal body needs to be setup which specifically lays down the grades and quality norms for both soil and water for different regions. A suitable enforcement mechanism has to also be put in place for ensuring that these norms are adhered to. A company/corporate body that undertakes contract farming has to bear the onus of complying with these norms.

Appendix D

The gross cropped area in India in 2002-03 is around 176,000 thousand hectares (CMIE). It is estimated that around 60 % of the gross cropped area (around 106,000 thousand hectares) falls under the rain fed areas (FICCI seminar on Public-Private Partnership for Water shed Development Areas). We propose that the entire rain fed areas region should be covered under the Negative Tobin Tax scheme to encourage migration to less water intensive cultivation. We propose that a sum of Rs. 10,000 crores be devoted to the scheme spread out over a period of 10 years. This would mean that the farmer would get monetary benefit of around Rs. 1000/- per hectare per annum. The scheme should apply for around 3 years to help each farmer to migrate to a new crop after which the scheme ceases to apply.

Negative Tobin Tax Model	
Gross Cropped Area(GCA) (in 000 hectares)	1,76,000
-Rain fed GCA (in 000 hectares)	1,06,000
Total allocation of 10,000 (in Rs. crores)	
Coverage period of 10 years	
Disbursal every year (in Rs. crores) Disbursal every year / hectare (in Rs.)	1,000 ~ 1000

The scheme could have a progressive policy with the small and marginal farmers earning a larger share of the tax benefits (as proposed below).

Progressive tax policy	
-Marginal and small	.5x
-Medium	.3x
-Large	.2x

CHAPTER - VII

CHALLENGES AND OPPORTUNITIES OF INTERNATIONAL TRADE IN DRYLAND AGRICULTURE

SECTION ONE: INDIAN AGRICULTURE AND WTO

A. Growth Performance of Indian Agriculture after WTO

The growth experience of Indian agriculture after mid 1990s was different than the experience before mid 1990s. GDP of agriculture sector showed annual growth rate of 3.16 percent during 1990-91 to 1995-96, after which it declined to 1.75 percent. Growth rate of fishery between the pre and post WTO periods declined from 7.49 percent to 2.72 percent. Growth rate in output of livestock sector decelerated from 4.25 percent to 3.47 percent. Likewise, growth rate in output of crop sector after 1996-97 plummeted to less than half of what it was during 1990-91 to 1995-96. As a result, crop sector, which forms largest segment of agriculture, showed poorest growth during post WTO period in the history of independent India.

Table 1

Growth Rates in Output of Economy and Agriculture (at 1993-94 Prices)

	Total	Non-Agricul-ture	Agriculture	Fishing	Livestock
1970-71 to 1979-80	3.45	4.72	1.94	2.90	3.92
1980-81 to 1989-90	5.38	6.78	3.13	5.82	4.99
1990-91 to 1999-00	6.19	7.40	3.28	5.46	3.82
1990-91 to 1995-96	5.56	6.63	3.16	7.49	4.25
1996-97 to 2001-02	5.53	6.85	1.75	2.72	3.47

Source: Chand, 2004

Within crop sector, growth rates of all commodities and crop groups except paddy and onions showed a declining trend after 1996-97. Thus, while initial years of reforms were somewhat favourable for growth of agriculture sector, in the period after 1995-96 the sector showed very poor growth rate (Chand, 2004). There is a continuous deceleration in the growth rate of livestock output after 1995-96. Growth rate in output of horticultural crops kept increasing till 1998-99 after which slowdown set in. Decline in growth rates is clearly visible in cereals, pulses, oilseeds, cotton, sugarcane, fishery, milk and eggs after 1995-96. The growth rate turned negative in oilseeds and cotton, which saw decline in their output along with pulses (Chand, 2004).

Table 2

Growth Rates of Selected Commodities, Pre and Post WTO

Commodity/Group	Before WTO	After WTO	Change
	1990-91 to 1995-96	1996-97 to 2001-02	
Foodgrains	1.51	1.17	Decline
Cereals	1.81	1.71	Decline
Pulses	(-) 0.66	(-) 2.56	Decline
Wheat	3.27	1.12	Decline
Paddy	1.53	2.25	Rise
Oilseeds	3.91	(-) 3.94	Decline
Sugarcane	2.92	1.74	Decline
Cotton	5.53	(-) 6.06	Decline
Onion	2.96	3.76	Rise
Milk	4.34	4.14	Decline
Egg	5.36	4.10	Decline
Fish	5.16	2.25	Decline

Source: Chand (2004)

The slowdown in agriculture growth rate after mid 1990s seems to have resulted from several factors. One of the major reasons often cited is the decline in public investment in agriculture, starting with the mid-1980s. It is also argued that output price intervention remained confined to already developed regions where crop yields have approached plateau and prices have little scope to improve supply response (Chand, 2004). Agriculturally underdeveloped regions which have potential for raising productivity and production did not have favourable output price environment. The slow growth in adoption of new and improved technology is also a major reason. To what extent WTO and opening up of the economy has contributed to this slowdown in agricultural growth needs to be investigated. Vaidyanathan (2006) argues that "overall, the volume of agricultural trade is still too small with respect to agricultural production to make a significant impact on domestic production and pattern of resource use". However, it is clear that large scale imports of some commodities in post WTO period caused adverse affect on their output. We now take up this issue for a detailed examination.

B. Agricultural Trade Before and After WTO

Implementation of UR AoA started from 1st January 1995 when India had already initiated liberalisation of its economy and trade with economic reforms in June 1991. As a part of these reforms, India adjusted its exchange rate to market rate and relaxed restrictions on agricultural exports. This created a favourable environment for agricultural exports. Export earnings doubled in three years between 1992-93 and 1995-96. Imports also increased at almost the same pace and net surplus generated by agriculture trade increased from $2012 million during 1992-93 to $4337 million during 1995-96. However, after 1996-97 earnings from agricultural exports started moving downward. This downturn continued till 2001-02 after which exports showed some recovery. However, the increase in exports seen during these years was neutralised by the sharp increase in imports in the same period.

Annual import of agricultural goods increased from $1190 million in the three years preceding WTO to $1996 million in the first triennium after WTO. Across the same period, exports increased from $ 3725 million to $ 6530 million and resulted in increase in net trade surplus from $ 2534 million to $ 4534 million. This led to increased trade orientation of Indian agriculture. Share of agricultural imports in GDP agriculture increased from 1.49 percent to 2.01 percent and share of agricultural exports in GDP agriculture increased from 4.76 percent to 6.60 percent. Surplus generated by agriculture trade increased from 0.32 percent of GDP agriculture to 0.46 percent. Despite sharp rise in imports with the implementation of WTO agreement, exports required to finance imports fell to 30.57 percent compared to 31.96 percent in the pre WTO period (Chand, 2005).

These favourable changes seen in the initial years of WTO did not last long. During 1998/99 to 2000/01, average agricultural export declined by 7 percent whereas agricultural imports increased by 64 percent as compared to initial years of WTO. Trade surplus generated by agriculture declined to 0.27 percent of GDP agriculture – lower than that recorded in the pre WTO period. The three years ending 2003/04 have seen some increase in agricultural exports but this is much smaller compared to the growth in imports. Consequently, exports needed to finance imports increased to more than 57 percent compared to around 30-32 percent in the pre WTO and initial WTO periods. Trade surplus generated in this period remained at 0.27 percent of GDP agriculture (more or less the same as in 1998/99 to 2000/01).

Table 3

Indicators of Agricultural Trade, Pre- and Post WTO

	1992/93 to 1994/95	1995/96 to 1997/98	1998/99 to 2000/01	2001/02 to 2003/04
Agricultural Imports	1190	1996	3272	4087
Agricultural Exports	3275	6530	6060	7141
Net Trade	2534	4534	2788	3055
Import as % of GDP	1.49	2.01	3.12	3.49
Export as % of GDP	4.76	6.60	5.79	6.36
Net Trade as % of GDP	0.32	0.46	0.27	0.27
Exports Needed to finance Imports %	31.9	30.6	54.0	57.2
Index of Global Agricultural Prices	91	102	81	80

Source: Chand, 2005

Sharp decline in ratio of trade surplus to GDP agriculture and much faster growth in import compared to export in post WTO years have raised serious questions about the view that increase in import should not be a cause of worry as exports would fetch much higher gain than what would be paid through imports.

We now look at the changes in the composition of India's agricultural trade to understand the trends with respect to important crops and crop groups.

C. Composition of India's Agricultural Exports and Imports

The disaggregated analysis of the commodity-wise and year-wise details indicate that exports from agriculture are spread over a larger number of commodities while imports are confined to a fewer commodities (Tables 4 and 5). Exports of wheat and rice have risen sharply. Share of foodgrains in total value of exports has more than doubled. Share of tea has collapsed from nearly 15% to a mere 5%. Oil meals share fell sharply between 1995-97 and 2002-04.

The period saw a massive jump in imports of edible oils (2000 percent). Their share in agri-imports rose from 15 to 51 percent. Edible oils, which account for almost two-thirds of the total agri-imports, are the single largest item of agri-imports in the country. The dominant share of this commodity continued to persist even in 2003-04. Imports of pulses nearly tripled and remained between 10-20 percent of agri-imports. Raw cotton imports rose dramatically.

Table 4

Export of major agricultural products during pre and post WTO periods

Commodity	**Value (Million US$)**			**Share in Agricultural Exports (%)**		
	1990-92	**1995-97**	**2002-04**	**1990-92**	**1995-97**	**2002-04**
Rice	291	881	1190	9.2	15.4	16.3
Wheat	24	107	401	0.8	1.9	5.5
Total Foodgrains	323	1032	1771	10.2	18.1	24.3
Marine Products	564	1089	1337	17.8	19.1	18.4
Oil Meals	410	753	572	12.9	13.2	7.9
Cashew nut	256	377	438	8.1	6.6	6.0
Tea	471	318	363	14.9	5.6	5.0
Spices	137	257	357	4.3	4.5	4.9
Meat & Preparations	86	172	346	2.7	3.0	4.8
Processed & Miscellaneous	90	229	351	2.8	4.0	4.8

Items						
Fresh Fruits & Vegetables	0	153	320	0.0	2.7	4.4
Coffee	133	396	221	4.2	6.9	3.0

Source: Agricultural Statistics at a Glance, Ministry of Agriculture, GoI

Table 5

Import of major agricultural products during pre and post WTO periods

Commodity	Value (Million US$)			Share in Agricultural Imports (%)		
	1990-92	1995-97	2002-04	1990-92	1995-97	2002-04
Edible oils	112	567	2240	15.2	30.8	51.1
Wood & Wood Products	119	247	650	16.1	13.4	14.8
Pulses	159	215	468	21.5	11.7	10.7
Cashew Nuts	102	214	313	13.8	11.6	7.1
Cotton Raw & Waste	24	109	280	3.3	5.9	6.4
Fruits & Nuts (Excl. Cashew Nuts)	54	109	180	7.3	5.9	4.1
Spices	0	22	123	0.0	1.2	2.8

Source: Agricultural Statistics at a Glance, Ministry of Agriculture, GoI

D. Falling International Prices and Rising Subsidies

The main reason for adverse impact on farm export and increase in import is sharp decline in international prices of almost all major agricultural products after 1997. This in turn is associated partly with cyclical nature of international prices and partly with increased global competition due to trade liberalization. International prices had slumped to their lowest levels during this period primarily because of the weight of the subsidies granted by the major players in the markets for agricultural commodities, in particular the United States and the members of the

European Union (Dhar and Murli, 2004). In the case of imports, liberalisation of trade in the initial years of implementation of WTO agreement did not cause much difficulty because international prices of bulk products were quite high in the first three post WTO years. Subsequently, as international prices started falling, India's imports started rising. Level of imports doubled in three years between 1996-97 and 1999-00. Domestic production of staples came under threat of disruption. International prices of cereals towards the year 2000 and 2001 turned out to be almost half of what they were in the beginning of WTO. This happened when India had a very large stock of rice and wheat. Tariffs were inadequate to keep a check on import of cereals and India had to resort to QRs on imports of foodgrains to keep a check on cheap imports. The important lesson from this experience is that India was not able to safeguard domestic production against imports with usual tariffs when international prices fell. In order to deal with this kind of situation, India needs either high bound tariff, so that applied tariffs can be raised appropriately, or special safeguards to regulate imports of sensitive products.

A feature of the subsidies being granted by the US and the EU has been the targeting of products that are of export interest to them. The members of the European Union have traditionally been using very high does of subsidies on specific products which include wheat, corn and sugar besides dairy products. In case of wheat, for instance, the production-related subsidies that producers received in 2002 were almost 84 per cent of the total value of output. The corresponding figures for sugar and milk were 51 and 50 per cent respectively. In addition to these subsidies, the EU members were also using export subsidies to gain control over the global markets. The United States, on the other hand, increased the subsidies it was granting to specific commodities, after the WTO was established in 1995. Wheat, rice, corn and soybeans were some of the commodities in which subsidies were increased quite considerably.

In case of rice, subsidies increased from close to US $ 12 million to more than US $ 700 million between 1995 and 2001, while for soybeans, the increase was from US $ 16 million to more than US $ 3.6 billion during the same period. These figures clearly show the extent to which countries controlling global agricultural markets are introducing distortions in these markets, leading to increased levels of uncertainties for farmers in developing countries.. It is not surprising therefore that the international prices for at least the major commodities are expected to remain sticky at relatively low levels for most of the present decade (Dhar and Murli, 2004). The following table gives an idea of the extent of producer support being provided by developed countries and how their magnitudes have moved during WTO period.

Table 6

Producer Support (PSE) to Agriculture in Selected Countries

Country	**Value (Million US$)**			**% of Value of Output**		
	1986-88	**1995-97**	**2002-2004**	**1986-88**	**1995-97**	**2002-2004**
Switzer-land	5457	5710	5343	78	68	71
Korea	12075	22845	18253	70	66	63
Japan	48976	59269	46924	61	57	58
EU	101672	117615	114274	41	34	34
Turkey	3162	5969	9365	16	17	25
Canada	6082	3621	5521	36	17	22
Mexico	8255	1533	7024	28	5	21
United States	36390	26304	40409	22	12	17

Source: Ali, J. (*Economic and Political Weekly*, forthcoming)

E. Changes in Tariff Policy

The ongoing agriculture negotiations in the WTO have brought to the fore the severe pressures on India to reduce its tariffs on account of India's bound tariffs (i.e. maximum tariffs allowed under the WTO regime) being high. It is, however, important for India to maintain tariffs on products that are critical from the point of view of maintaining food security and livelihoods, given that the international prices of many of these commodities have remained sticky at low levels in recent years (Dhar & Murli, 2004).

The actual performance on tariff front has been disappointing. The following table shows that a huge gap exists in the cases of several commodities between bound and applied tariff, even in a situation where the applied tariff has been raised over time. For instance, applied tariff has been raised significantly between 1997 and 2004 for commodities like grains, edible oils, plantation crops, dairy and meat. Even so, these continue to be well below the bound tariffs allowed by WTO. More importantly, in some cases (such as grain products and oilseeds) applied tariffs have been reduced, allowing more imports.

Table 7

Average Tariff Rate on selected agricultural commodities in India (%)

Commodity group	**1997**		**2004**	
	Applied Tariff	**Bound Tariff**	**Applied Tariff**	**Bound Tariff**
Grains	0	44	61	85
Grain products	33	133	30	117
Oilcake	40	109	15	100
Edible oils	31	222	79	218
Oilseeds	38	100	30	100
Fruits	54	110	30	84
Vegetables	22	103	36	113
Sugar	36	110	60	150
Coffee	25	134	100	100
Tea & tea extracts	18	142	100	150
Spices	30	124	50	113
Meat & meat preparation	15	105	53	109
Dairy	28	64	45	78
Eggs	30	150	30	100

Source: Agricultural Statistics at a Glance

SECTION TWO: IMPACT OF WTO AGREEMENTS ON SPECIFIC CROPS

We now take a close look at three rainfed crops, i.e., pulses, oilseeds and cotton. While pulses and oilseeds have been selected for detailed analysis as India imports significant quantities of these two products due to gap between domestic production and consumption, cotton is included as the important cash crop affecting the lives of millions of farmers and the main crop grown in areas with high incidence of farmer suicides.

A. Pulses

Applied tariff protection is nominal at 10% only for the commodities under open general license (OGL). The demand for pulses for the year 2004-05 is projected at 17.06 million tonnes as against the production estimated at 13.67 million tonnes (second advance estimate) during the corresponding period. Net production after discounting 12.5% for seed, feed and wastage, works out to 11.89 million tonnes. This leaves a gap of 5.17 million tonnes which is required to be bridged by imports.

Table 8: Ratio of Import to Availability of Pulses in India

('000 Tonnes,Percentage)

Year	Production	Import	Export	Availability *	% of Import to Availability	% of Import to Production
1990-91	14260	792	0	15052	5.26	5.55
1991-92	12020	313	0	12333	2.53	2.60
1992-93	12820	383	34	13168	2.91	2.98
1993-94	13300	628	44	13885	4.52	4.72
1994-95	14040	554	51	14544	3.81	3.95
1995-96	12310	491	61	12739	3.85	3.99
1996-97	14240	655	55	14840	4.41	4.60

1997-98	12980	1008	168	13820	7.29	7.77
1998-99	14910	564	104	15370	3.67	3.78
1999-00	13420	251	194	13477	1.86	1.87
2000-01	11080	350	244	11186	3.13	3.16
2001-02	13370	2218	162	15426	14.38	16.59
2002-03	11140	1993	148	12984	15.34	17.88
2003-04#	15240	1701	151	16790	10.13	11.16

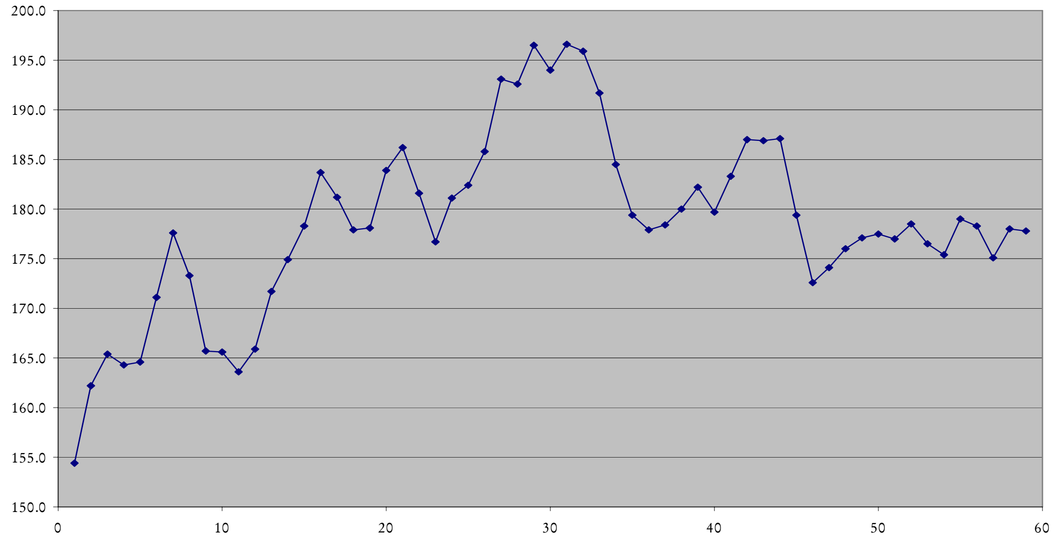
Provisional

Availability = Production + Import – Export

Source: YK Alagh

The large imports during the period from 2001-02 to 2003-04 influenced the wholesale prices of pulses as is evident from the chart. The price index rose sharply till August 2002 and thereafter declined to levels comparable to 1999.

Index Number of Wholesale Prices, Pulses



Months (1999-2004)

The present level of import duty on pulses is only 10% against the bound rate of 100%. The import of pulses in India has been in the range of 1.70 million tonnes to 2.20 million tonnes during the last three years. Pulses are very important for India's rural economy, particularly because they withstand dryland conditions. They also constitute a major component of the diet of the poorest of the poor, it is important to protect the domestic production of pulses and supplies have to be assured. **There is adequate cushion between the applied and bound rates. Import duty on pulses has to be fixed taking these factors into account.**

Therefore, concerted efforts should be made to attain technological breakthrough in substantially increasing yield rates from their current levels. However, greater emphasis will have to be put on the development of High Yielding Varieties (HYV) of seeds by the research institutions so as to attain a high degree of self-sufficiency in production of pulses.

B. Edible Oils

The production, imports and availability of edible oils are exhibited in Table 9.

Table 9

Ratio of Import to Availability of Edible Oils in India

('000 Tonnes, Percentage)

Year	Productio	Import	Expor	Availability	% of Impor to Availabilit	% of Impor to Productio
1990-91	4877	485	0.00	5362	9.04	9.94
1991-92	5022	226	0.00	5248	4.31	4.50
1992-93	5247	103	0.00	5350	1.92	1.96
1993-94	5397	114	0.00	5511	2.07	2.12
1994-95	5531	347	0.00	5878	5.90	6.27
1995-96	5641	1062	0.00	6703	15.84	18.83
1996-97	6171	1416	0.00	7587	18.66	22.94
1997-98	5041	1266	0.00	6307	20.07	25.11

1998-99	5880	2622	0.00	8502	30.84	44.59
1999-2000	4953	4196	0.00	9149	45.86	84.71
2000-01	4616	4177	0.00	8793	47.50	90.49
2001-02	5761	4322	0.00	10083	42.86	75.02
2002-03	4591	4365	0.00	8956	48.74	95.08

* Availability = Production + Import - Export

Source: YK Alagh

Import of edible oils to India has been progressively increasing, especially during post-1995 period. Its percentage to domestic production was as high as 95% during 2002-03. This shows the degree of import dependence of the country in this particular commodity group. The production of oilseeds attained a level of 24.75 million tonnes in the year 1998-99 from 10.83 million tonnes in 1985-86. However, during this time the Government liberalized import of edible oil by placing them under OGL and drastically reducing the import duty. Consequently, there had been sudden spurt in the import of edible oils after 1998-99. The large-scale import of oils especially of CPO/ RBD Palmolein adversely affected the domestic prices of oilseeds. It resulted in fall in the domestic prices of almost all oilseeds below MSP continuously for the next five years. This led the Government to undertake large scale price support operations. Imports and price support simultaneously shows the nature of policy in the recent past. Besides, drastic fall in the domestic prices of edible oils led to severe reduction in area under oilseeds in the subsequent years and the production fell as low as 15.06 million tonnes in the year 2002-03.

Spurt in imports of edible oils, especially low priced palm oil from countries like Malaysia and Indonesia in recent years, had a direct impact on demand for domestic oils including coconut oil as price elasticity within edible oil group is quite high. The low price of imported oils has substituted coconut oil. Since substantial increase in domestic production in short run is not technically feasible, the gap between demand and supply needed to be bridged by imports.

Dependence on imports of edible oils will have to be reduced in coming years in view of dwindling end stock of edible oil and rising landed costs. This is imperative not only from the point of view of conserving foreign exchange but also from the point of view of managing risk that arises from dependence on shallow international markets. Failure of crop in one or more countries would jeopardize the prospects of availability in international market. There is, thus, a need to increase production of oilseeds in the country through diversification and also through better farm practices, availability of credit, investment in infrastructure with emphasis on irrigation which in turn would increase the yield rate and thus production. Because of dwindling stocks in the international market, such imports cannot be sustained for a long period of time. Costs will have to be cut and yields improved. Low cost production strategy (specially in case of oilseeds) has been successfully adopted by some Asian countries such as Indonesia, Malaysia and Vietnam. The cost structure and also other relevant parameters attained by these countries should be studied by DES/CACP so that this could be replicated in India.

Table 10

Tariff Structure of Edible Oils

Name of items	Present applied Rate of Tariff	Bound Rate of Tariff
Soybean oil (crude)	45%	45%
Soybean oil (refined)	45%	45%
Crude Palm Oil	65%	300 %
RBD Palmolien and Refined Palm Oil	75%	300 %

Rapeseed / mustard oil (crude)	75%	75%
Rapeseed / mustard oil (refined)	75%	75%
Sunflower and safflower oil (crude)	75%	300 %
Sunflower and safflower oil (refined)	85%	300 %
Other edible oils including coconut oil (Crude)	75%	300 %
Other edible oils including coconut oil (refined)	85%	300 %
Oilseeds	30%	100 %

Source: YK Alagh

Import of edible oils has increased to 5.3 million tonnes in 2003-04 from 4.26 million tonnes in the previous year. This has happened due to reduction in the international market prices of edible oils. Government has recently announced 10% reduction in the tariff rate of imported edible oils. Import of cheaper edible oils like CPO/RBD palmolien is likely to increase, especially in view of the prevailing low international market prices. It is apprehended that large-scale import will have adverse impact on the domestic prices of oilseeds. This may affect in a big way the oilseeds production programme.

There is clearly a need to ensure remunerative prices for oilseeds, which cannot be achieved if cheaper imports are encouraged. Therefore, there is a need to raise import duty on edible oils. This would be possible in case of all edible oils other than soybean and mustard oils, for the applied and bound rates of duty are equal in case of soyabean and mustard oil.

All major oilseeds excluding copra currently attract a duty of 30% while copra carries a duty of 70%. Despite relatively low tariffs, very little import of oilseeds has actually taken place in recent years. However, duty levels on edible oils are more crucial than on oilseeds. Amongst edible oils, it is the duty on palm oil as well as soyabean oil that matter most. Palm oil, which is globally the cheapest oil and heavily imported in India currently attracts a basic duty of 75%. Soyabean oil, which is relatively expensive, carries a very low duty of 45%, which also happens to be the WTO bound level, as compared to 300% for other edible oils (75% for rapeseed/ mustard oil). According to World Bank data, world prices of palm oil varied in the range of $285 - $517 per ton. As compared to these prices, normative domestic cost of edible oils derived from the current MSP comes to about Rs. 38000 or $775 per ton for rapeseed/ soyabean/ sunflower oil and Rs. 52000 or $1060 per ton for groundnut oil. Similarly based on current MSP of milling copra, cost of coconut oil works out to about Rs. 54000 or $1100 per ton. It is clear from the above mentioned set of prices that MSP related domestic cost of edible oils are not adequately protected by the current levels of tariffs. Tariffs on edible oils should be revised upwards for sustaining the minimum level of price support to oilseed growers.

C. Cotton

The international trade of cotton, like that of sugarcane, has been fluctuating (Table 11). Cotton is one of India's largest commercial crops, affecting millions of farmers, has a high cash input and is risky to grow. Yet, it does not command as much attention of the Government as it deserves. This is evident from the fact that one of the most important documents such as "Economic Survey, 2004-05" has excluded raw cotton from agriculture imports in the main text despite the fact that its import is substantial.

Table 11

Ratio of Import to Availability of Cotton in India

('000 Tonnes, Percentage)

Year	Productio	Import	Export	Availability	% of Import to Availability	% of Import to Production
1990-91	1672.80	0.00	497.14	1175.66	0.00	0.00
1991-92	1650.70	0.00	160.34	1490.36	0.00	0.00
1992-93	1938.00	138.13	63.74	2012.39	6.86	7.13
1993-94	1825.80	3.82	312.56	1517.06	0.25	0.21
1994-95	2021.30	80.80	70.75	2031.35	3.98	4.00
1995-96	2186.20	69.62	33.28	2222.54	3.13	3.18
1996-97	2419.10	2.92	269.58	2152.44	0.14	0.12
1997-98	1844.50	9.97	157.53	1696.94	0.59	0.54
1998-99	2089.30	57.40	41.96	2104.74	2.73	2.75
1999-20(	1960.10	237.40	15.91	2181.59	10.88	12.11
2000-01	1618.40	212.36	29.7	1801.06	11.79	13.12
2001-02	1700.00	387.04	8.23	2078.81	18.62	22.77
2002-03	1482.40	233.85	10.8	1705.45	13.71	15.78

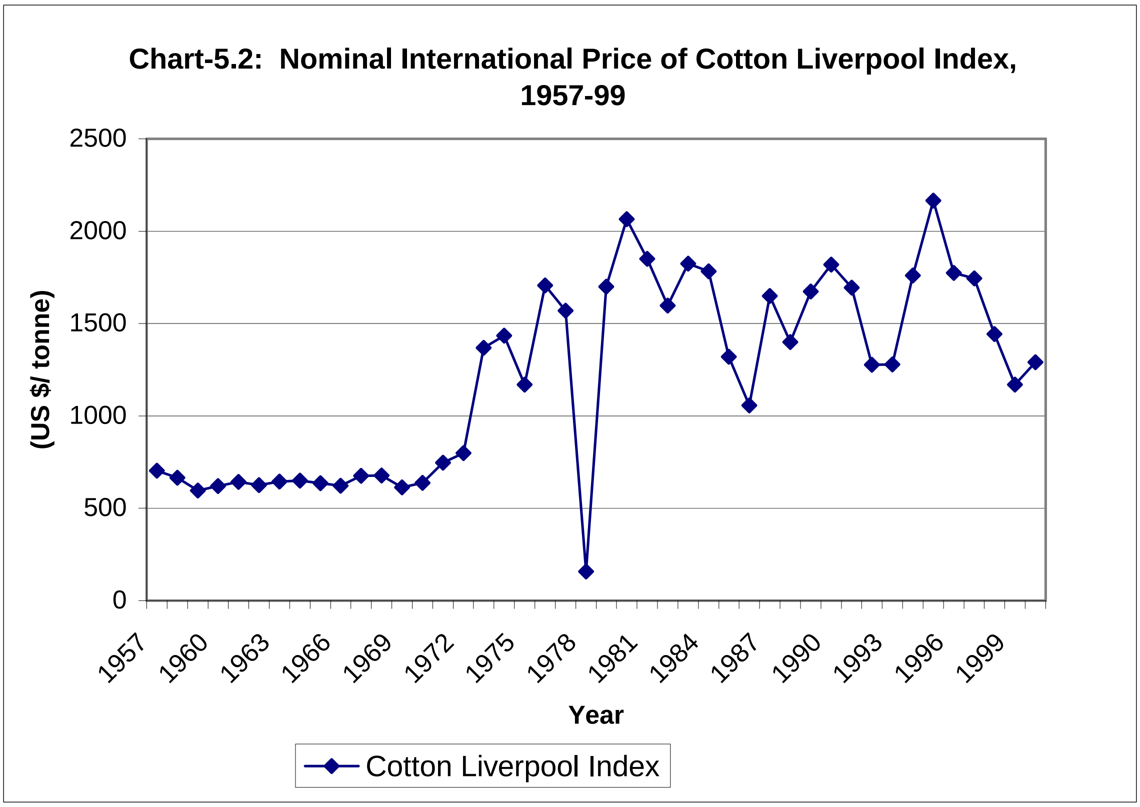
- Availability = Production + Import - Export

Source: YK Alagh

The production increased from 9.84 million bales (1 ton = 5.88 bales) in 1990-91 to 14.23 million bales in 1996-97, registering an annual growth rate at 2.8 per cent. However, it declined to 10.85 million bales in 1997-98 and further to 8.72 million bales in 2002-03 before attaining a level of 13.47 million bales in 2003-04. India exported both long and short staple varieties of cotton during late eighties and early nineties. The country imported 0.80 lakh tonnes of raw cotton in 1994-95 which increased to 2.37 lakh tonnes in 1999-2000. However, it declined to 2.12 lakh tonnes in 2000-01, increased to 3.87 lakh tonnes in 2001-02 before coming down to 2.33 lakh tonnes in 2002-03. Some of the highest imports, around 20% of domestic consumption have taken place during the last few years and consequently domestic stocks of unsold cotton increased. As the international prices of cotton have fluctuated, so has been the behaviour of quantity of Cotton imported.

Given the fact that subsidy on cotton exports in the World runs at US $320 billions, applied tariff rate at 5-10% on cotton in recent years has been low. Currently, some aspects of Indian cotton suffer from various shortcomings such as poor fiber attributes, high trash content, high levels of contamination and rampant mixing of varieties, causing inconsistency in quality. However, it is expected that following the launching of the Technology Mission on cotton, quality of Indian cotton would improve significantly in the next few years. Also, there are distortions in cotton trade. Additional protection in the form of reasonable levels of tariffs must be applied on cotton.

There are issues of supply of cotton to the textile industry in a phase in which quotas have been abolished. These are important. Policy can be designed to establish a level playing field between highly subsidized imported and domestic cotton for the Indian yarn manufacturer. This can consist of automatic setoffs for the producer.



Source: YK Alagh

Considering the fact that the MSP regime essentially reflects the cost of production of relatively low cost domestic producers, it is essential that levels of import tariffs be so fixed that these provide adequate protection to at least these producers. Here the role of CACP needs to be expanded to recommend levels of import tariffs. As cost of imports (c.i.f.) of some of agricultural commodities or the derived products of such commodities is not stable, often violent, due to fluctuation in world prices, import tariffs be varied with world prices. Based on the logic of minimum protection i.e. protection to relatively low cost producers necessary for sustainability of MSP regime as long as it is in the public policy domain, an automatic and transparent policy of variable tariffs on agricultural imports linked to the deviation of spot international prices from their long-run trends needs to be introduced. Such variable tariffs are imperative not only for stabilization of prices of all agricultural commodities in open market but also for sustaining the MSP.

Introduction of a system of variable tariffs would, however, require a new institutional arrangement under which world prices as well as import trends could be monitored on a real time basis and tariff calibrated accordingly. This would require review of tariffs more frequently than the current practice of doing this exercise annually on the eve of budget presentation or at the time of declaration of EXIM policy.

It is important that Government agencies appreciate the damage done to the Indian agrarian economy of the kind of import quantities shown above Many agencies show so called low imports by ignoring, for example, cotton imports, sugar imports and edible oil imports. Also the impact of an inadequate policy regime since the early Nineties need to be recognized.

SECTION THREE: RECOMMENDATIONS

- Pulses are very important for India's rural economy, particularly because they withstand dryland conditions. They also constitute a major component of the diet of the poorest of the poor. It is important to protect the domestic production of pulses and supplies have to be assured. There is adequate cushion between the applied and bound rates. Import duty on pulses has to be fixed taking these factors into account.
- For pulses, concerted efforts should be made to attain technological breakthrough in substantially increasing yield rates from their current levels.
- Greater emphasis will have to be put on the development of High Yielding Varieties (HYV) of seeds by the research institutions so as to attain a high degree of self-sufficiency in production of pulses.
- Low cost production strategy (specially in case of oilseeds) has been successfully adopted by some Asian countries such as Indonesia, Malaysia and Vietnam. The cost structure and also

other relevant parameters attained by these countries should be studied by DES/CACP so that this could be replicated in India.

- MSP related domestic cost of edible oils are not adequately protected by the current levels of tariffs. Tariffs on edible oils should be revised upwards for sustaining the minimum level of price support to oilseed growers.
- Policy can be designed to establish a level playing field between highly subsidized imported and domestic cotton for the Indian yarn manufacturer. This can consist of automatic setoffs for the producer.
- Considering the fact that the MSP regime essentially reflects the cost of production of relatively low cost domestic producers, it is essential that levels of import tariffs be so fixed that these provide adequate protection to at least these producers. Here the role of CACP needs to be expanded to recommend levels of import tariffs.
- Import tariffs must be varied with world prices. Based on the logic of minimum protection, an automatic and transparent policy of variable tariffs on agricultural imports linked to the deviation of spot international prices from their long-run trends needs to be introduced. Such variable tariffs are imperative not only for stabilization of prices of all agricultural commodities in open market but also for sustaining the MSP.
- Introduction of a system of variable tariffs requires a new institutional arrangement under which world prices as well as import trends could be monitored on a real time basis and tariff calibrated accordingly.
- Review of tariffs must be undertaken more frequently than the current practice of doing this exercise annually on the eve of budget presentation or at the time of declaration of EXIM policy.

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