

# **Report Works on Individual Land in MGNREGS**

**Prepared and Submitted to National Employment Guarantee Council  
Through  
Ministry of Rural Development, Government of India**

**Prepared by the Committee on Works on Individual Lands  
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## **I Mandate**

The terms of reference (TOR) of this committee as given are:

1. Examine the draft guidelines prepared on this and give suggestions.
2. Examine existing practice in major states.
3. Define public work/community asset.
4. Identify measures that aim to optimize the potential of NREGA for enhancing agricultural productivity and reducing economic vulnerability of the eligible groups.
5. Instituting broad norms for selection processes and per capita financial assistance.

Later and in addition, the committee was asked to examine

- a) Why capital formation in Indian agriculture is declining.
- b) Coverage, quality and support given to individual works be analyzed in detail at the Gram Panchayat and at individual and social group specific level, as many a work so far done are not complete nor fructuous.
- c) The impact of MGNREGS on agricultural productivity and sustainability need be ascertained and ensured.
- d) Address the impact of MGNREGS on the farmers under distress and on those of the tribes in the Left Wing Extremist affected areas.
- e) Feedback on the contribution of MGNREGS as in the farmer suicide districts and on the debt and credit impacts on the indebted farmers.

Based on TOR and upon review of current works, its orientation and thrust, the committee unanimously opined to consider its task as based in a context of complementary and symbiotic nature of landscapes, of productive natural resource base, multiple income sources of the poor and also as no other committee is looking it, to therefore adopt a wider view on works in MGNREGS that can improve productivity.

Although land size is the determinant to qualify for being a beneficiary in MGNREGS land development schemes, we must see them and define them as farmers. Here we have adopted the definition as given by the Farmers Commission as being most apt and includes landless agricultural laborers, share cropper, tenants small, marginal and sub marginal cultivators, fishers, livestock and poultry raisers, pastoralists, small plantation farmers as well as rural/tribal families engaged in farm related occupation such as collection of non timber forest products.

Upon MORD advice the committee furthered its task with focus on increasing productivity in the works taken up on individual lands and in conjunction with works permissible in MGNREGS. Following field visits, consultations with villagers and discussions with experts, we also outline the possible new works that increase productivity and serve the intent of the Act on works. Our

recommendations are based on the issues and opportunities from the aspects of land, natural resources and labor productivity of self employment or demand for labor services.

## **II Committee Membership**

The committee has thirteen persons - one scientist each from agriculture and fishery, a representative of the Ministry of Agriculture, six nominees of voluntary organizations, one Member of Lok Sabha and a management expert. In addition it had two state government nominees whose names never arrived. The process was facilitated by NIRD.

The members participated in field visits and state consultations and the committee received got cooperation and inputs from a large fraternity of experts, in farmers gathering and discussion with officials. While Mr. K. S. Gopal, Member of the national Employment Guarantee Council is the Chairperson the members of the committee are:

- |                           |   |
|---------------------------|---|
| 1. Dr Balasubramanyam     | Central Institute of Fisheries Technology, Cochin     |
| 2. Dr G.R. Desai          | MANAGE (Min of Agriculture Representative), Hyderabad |
| 3. Mr. Dibyendu Chaudhury | PRADAN, Kolkata                                       |
| 4. Dr Girish Sohani       | Bharatiya Agro Industries Foundation, Pune            |
| 5. Dr Hemnath Rao         | Administrative Staff College of India, Hyderabad      |
| 6. Mr. Malla Reddy        | Accion Fraterna, Anantapur                            |
| 7. Ms Neelima Khetan      | Seva Mandir, Udaipur                                  |
| 8. Mr. Sashi Kumar        | Yugantar, Hyderabad                                   |
| 9. Mr. Siricilla Rajaiah  | Member of the Lok Sabha, Warangal                     |
| 10. Dr J. Venkateswarlu   | Former Director, CZARI, Jodhpur                       |

The process and logistics was anchored at the National Institute of Rural Development by Dr Suresh Babu under the leadership of Dr Hanumantha Rao, Head of CWEPA at NIRD.

## **III Methodology**

The committee drew up its work plan and agreed to thematically and geographically address the task in the following manner.

### *Thematically*

1. Agriculture – irrigated, rain fed, dry land, protective and critical irrigation based farming.
2. Livestock – Ruminants (small and big), birds and others like rabbit, pigs etc with focus on measures to tackle feed and fodder as that is the biggest cost.
3. Horticulture – Fruits, vegetables and creeper based gourds (long shelf life) and greens (short shelf life).
4. Fisheries – Inland (both seasonal and perennial) including fresh and saltwater regimes.
5. Homestead – Trees, creepers, vegetables, birds etc.

*Geographical regions were clubbed as under:*

1. North East to represent the seven sister states, Sikkim, Chhattisgarh, Orissa and Jharkhand (all hilly terrains and market underdevelopment).
2. North West to mean Rajasthan, Gujarat, Haryana and MP.
3. Indo-Gangetic plains to mean Bihar, UP, Punjab and West Bengal.
4. Deccan to mean AP, Karnataka, Maharashtra, Tamil Nadu and Chhattisgarh.
5. North to mean J&K, Himachal Pradesh and Uttarakhand.

The committee held consultations and field visits in Andhra Pradesh, Tamil Nadu, Orissa, Rajasthan and Maharashtra wherein some of the members participated. Through these consultations we met over two hundred NGOs working on land development, a dozen scientists and five hundred poor farmers. In the consultations in Bhubaneswar and Udaipur, the State Ministers for Rural Development participated actively. The consultations were organized and hosted by some of the committee members and the members and some experts provided written inputs.

#### **IV Acknowledgements**

The Committee thanks all those who helped us in successfully undertaking this task especially the Central Employment Guarantee Council and the MORD for entrusting us with this task.

To the committee members this is also seen as a unique opportunity to further what has been dear to many of us and hence the acceptance of our report would mean immense satisfaction in making real what has been the pursuit for years by many of us.

We acknowledge the assistance, inputs, logistic support for field visits that we received from state governments and from rural development officials of Andhra Pradesh, Bihar, Maharashtra, Orissa, Rajasthan, Tamil Nadu and West Bengal.

We like to specifically mention and thank non-government organizations such as Accion Fraterna in Anantapur, AP, BAIF of Pune, Maharashtra, PRADHAN of West Bengal and Seva Mandir of Udaipur, Rajasthan. They helped organize consultations with stakeholders and we would like to place on record our appreciation to the ministers of rural development in the states of Orissa and Rajasthan for actively participating in the consultations along with officials of the state government.

We would also like to place our appreciation for the inputs received from experts and in deepening our understanding of the issues involved. Our gratitude is also to the staff of NIRD for giving cooperation always with a smile.

As, the chair, I K S Gopal, Member of the Central Employment Guarantee Council would like to place my grateful thanks to the members of the Committee for their hard work and full commitment to successfully undertaking this task. I do hope that I have been able to include all the ideas of the committee members and in case there are any mistakes, I am solely responsible.

## **V Field Observations**

**The works in MGNREGS continues legacy of thinking on the lines of old employment schemes and food for work schemes.** Works are ad hoc with limited types of physical infrastructure activities. Beneficiary involvement is missing as works on individual lands are decided elsewhere and dumped on gullible poor. Works are isolated as officials pursue their whims or act as directed. Works detailing is based on experience of rural development officials or their intuition, rather than technical knowledge. Single intervention or investment is deemed to qualify an “asset” and isolated infrastructure creation has not impacted increased productivity. “Success stories” are yet to demonstrate a framework to optimize productivity.

**Lack of interagency coordination and transparency on fund use on works is leading to anxiety of duplication of investments,** as similar work type schemes are found in Integrated Watershed Department project (IWDP), Backward Region Grant Fund (BRGF) and National Horticulture Mission or where new implementing agencies are emerging in then states.

**Approach to land development in MGNREGS assumes that a large latent resource is waiting to be tapped with one or two steps for being productive.** This narrow approach offers little to lands with poor endowments and thus has little to offer to SC/ST farmers, although statistics will show a large of coverage of them. And there is no involvement of agriculture department or research institution in any manner in the works planned or taken up.

The “Draft Guidelines” note of the MORD given to the committee titled “Implementation of Works on Individual Land” states “the primary objective of the Act is augmenting wage employment. Its auxiliary objective is strengthening natural resource management.” Hence the orientation to implementation and monitoring machinery has **little or no attention to works, save what serves the primary objective.**

There is no systematic understanding or review of why certain works are taken up in the basket of options or its value and relevance written down as outcomes don’t figure in the proposals. The perception of “assets” are limited to physical, measurable and verifiable and centered on labor component. This precludes investments that are ‘consumed’ in the process of building an asset. Water conservation is not linked to increasing soil moisture retention capability or its per capita use in production. Thus water productivity is not an issue. **There is a need to redesign and improve the works and its management along with its reporting and monitoring system.**

One observes good results in few districts of innovative thinking and integration with other schemes. But they remain isolated initiatives of individual officials and not absorbed into the thinking process or deliverance system. **The challenge is how to avoid large scale investment failures.**

One observes three types of investments – infrastructure such as roads and buildings used by the community, development of common or government lands predominantly used by the poor and thirdly improvement of SC/ST/MF individual lands. **But most investments are increasingly channeled to infrastructure.** For the second and third type, although much sought by the community, it has neither articulation nor acceptance as where villagers list their proposals and are included in the shelf of works, what is finally sanctioned and taken up are departmental decisions. Nor are the works suggested by people taken up later – they just ornate in the shelf.

While in several states no works on individuals land is being taken up, even among those few doing so, we find the investment on individual land development in MGNREGS on the decline as a percentage of the increasing total financial resources. Unless this distortion is checked, MGNREGS would soon have little to offer to the task given to our committee. This trend must be reversed as it is well recognized that on an average, better resource utilization is observed in works taken up on individual lands and on common resources, even though it is limited and ad hoc. **This falling use of MGNREGS on individual lands, in a country with massive rural poverty, is worrisome and must change.** A key reason why individual land development is not preferred by officials is because such works are scattered and difficult to supervise whereas large works are easy to roll out.

Interventions must be specific and based on land types, soil conditions and monsoon behavior. Lands belonging to the poor are poor in quality and enhancing it calls for substantial well planned measures and spiraling activities that are spread over time. Works taken on individual lands must address farmer needs and they must see value in it. If these are not addressed, plant mortality will be high or growth stunted, growth leading to low yield. **Without addressing the underlying productivity bottlenecks extension of mainstream treatment and plant growth practices is leading to high mortality and low returns.**

**MGNREGS must shift from physical land development to land husbandry.** Conserved soil and moisture would be productive only with microbial life and capacity to retain moisture for some time period. The problem of soils is alarming and serious even in irrigated areas but for different reasons. Without addressing them, physical water structures will not be much useful for the plant growth and to increase crop productivity. MGNREGS, being a public investment and intended to improve land productivity of poor farmers, must focus on production bottlenecks with investments to increase agricultural productivity that cannot be afforded by them but crucial for increasing incomes. This is important as no government schemes or lending of commercial banks is available for soil work as it takes much time to bring in the returns.

People do not know or are not told of the options available to them in the list of permissible activities in MGNREGS individual land development schemes. They receive what is given or thrust on them. The Act enshrines that works must be decided by Gram Sabha but its practice is observed in its breach. Even where the Gram Sabha meets and proposes some works, it is helpless as the works taken up is decided by departments. **Unless the gram sabha has a say in works and its implementation, investments will have little scope of being an asset.**

Information, exposure and knowledge on works for individual land beneficiaries are lacking. Technicalities in land husbandry and agriculture are complex and embedded in natural resources and its ecological principles and cycles. This is not commonplace knowledge but embedded through an interactive understanding of the scientific and natural processes at work in plant growth. But works in MGNREGS on individual lands are treated as similar to laying roads or constructing building or doing soil and moisture works or developing and renovating water bodies. Such cavalier attitude to land development must change and agriculture bodies such as district KVK and agriculture extension officers must play an active role in planning the activities to be taken up for land development and after examining each site. **The key in works on individual lands is to understand and plan on the basis of its specificities along with incorporating farmers ideas.**

Irrigated horticulture is gaining attention in individual land development activities. But only few with assured water supply can take it up. **Dry land horticulture is ignored even though they are best suited considering the soil type and location of lands owned by the poor people.** Also one should not be overwhelmed with providing irrigated horticulture on the entire land as it is important to for the poor to have some fodder and food crops as often are higher in the realized income. This is because among the factors of production costs, it places a value on physical labor, the only strength and competitive capability of the poor people owning such small patches of land.

**MGNREGS officials training must extend to literature and knowledge on the technical aspects of land development as otherwise they would continue to serve in the old ways.** The Prime Minister has repeatedly stressed on outcomes and MGNREGS must deliver on them – providing employment on demand along with judicious use of this money and manpower to develop our productive natural resource base. For Indian agriculture to grow, it is vital that investments on land development be grounded in knowledge and the changing nature of the demands on our soil and water resources. Climate change adaptation and mitigation steps need to be incorporated. Although expert advice on what is best suited to their land is necessary, it is important that the actual land development plan is prepared by farmers with their assistance. This can be done by training farmers and exposure to diverse successful farming methods and then assisting them to develop, cost and roll out an action plan along with defining their responsibilities and entitlements. This will make them seek what is appropriate to them from the available shelf of works for land development as the financial cap will compel making best choices from the menu.

An aspect that determines what must be grown on the land be it the type of plantations or crops is the backward and the forward linkages. For instance if a particular species is to be taken up, its backward linkages of quality supplies of seeds, seedlings and other inputs must be locally available while forward linkages calls for accessing markets especially when they are thin and with poor transport infrastructure, as found in backward areas. For instance ber was cultivated extensively in rain fed farm lands in Maharashtra with protective summer time water provisioning. In the beginning it failed as the seedlings were of poor quality. Later when this was improved through local nurseries, the yield was good but fetched little income to farmers as little could be supplied to the market. It was only when the plastic net was developed that farmers could pack them and sold to distant needy markets earning good incomes. Similarly where the infrastructure to reach wider markets are low then instead of growing vegetables with short shelf life and high perishable types, the effort must be on those with longer shelf life such as gourds. **By intimately linking MGNREGS productivity investment plans with platforms that provide and develop the necessary forward and backward linkages are crucial.**

**Shrinking land availability is leading to intense competition in its use. The worst affected are livestock.** Their feed areas, be it stall fed or grazing, is shrinking and degrading. In earlier days a part of the farm land lent itself for grazing or feed production but no longer so. Crops grown are not driven by considerations of fodder, although some crop residues serve as animal feed. Weeds that served as fodder are no longer available as deep plough has led to failure of seed germination of them. Forest land usufruct management is by select users as officials see grazing as an obstacle. Community lands, another grazing source, is now patta land or under tree plantation or given away to community purposes like graveyards etc. There are rising conflicts over CPRs and village pastures and the “commons”. These constraints call for community participation in its management and development. So livestock traverse longer distance and finding less quantity and quality feed, leading to poor productivity of milk and meat. Steps to increase the productivity of livestock must gain attention in MGNREGS.

One also needs **steps to reduce competitive pressure on scarce resource** especially living soil must be addressed through alternatives. For instance, as live soil is vital for productivity, apart from soil erosion, the biggest threat is coming from its use in brick kilns. It may be worthwhile exploring the use of dead rather than live soil in its manufacture. This will make available the live soil for application on lands apart from its conservation through building bunds. Undertaking such tasks must also be seen as developing convergence in natural resource use.

In certain areas works within the current permissible works framework is difficult especially states like Bihar. In such places we find water inundated areas, intensive land use and little common property resources. The ideas on permissible works are dominated by the needs of drought prone areas, as most hitherto employment schemes were in response to monsoon failure. **The needs of such areas must merit reconsidering permissible works to serve them.**

## **VI Approach:**

- 1) Our overall approach is to examine the status/problem/issue being addressed, followed by reasons for it and upon examining them to state our recommendations as measures or as strategy. Current works as discussed earlier are narrow and limited with its implementation being straight jacketed. We studied opportunities to harness low lying fruits and actions that trigger farmer social capital along with generating interest of potential investors, be it a government schemes or an institutional credit.
  
- 2) We examined validated and successful current non-MGNREGS practices with potential for adoption. Also we looked at “out of the box” ideas and experiments that are grounded in science and experience and examined its value for land development activities in MGNREGS. As farmers showed little or no enthusiasm for the current works being taken up save irrigation, we see the need for individual farmer to vet each land development proposal and activity and proper use of scarce resources to increase farm productivity. Our recommendations emerged after examining the following for each activity:
  - a) Is this step or measure of interest to the farmer?
  - b) Is this priority investment to the farmer especially women in the household?
  - c) Does it stabilize and enhance productivity?
  - d) List sequencing of measures, timeframe and check its usefulness to farmer.
  - e) List necessary conjunctional measures to optimize water harnessing, soil improvement as the steps to increasing productivity and income.
  - f) Examine from beneficiary perspective the yardsticks on investment impact and outcome.
  - g) How does it enhance the scope of farmer to access bank loans and related development measures and investments?

## **VII Moving Forward**

An appraisal of ground realities suggests three genres of works. The first brings unused land or fallow or low level of farming to cultivation with steps of land leveling, stone and boulder removal, bund building, plantation or digging farm ponds and open wells. They are generally single intervention based and dominant work types taken up for individual land development in MGNREGS. The second genre has a project approach, and adopted in Andhra Pradesh but on a small scale and goes more than genre one and involves steps for soil and water augmentation, trenches for water storage, application of tank silt, irrigated horticulture and growing green leaf plants on the bunds etc. The third genre which can seriously tackle underlying productivity bottlenecks of soils, both physical and biological properties and are innovative validated holistic ideas and “next practices” of farmers, voluntary agencies and research institutions. However its benefits take time to flow but enable investments being led to creating optimum productive assets.

MGNREGS must have both short and medium term measures but the focus must be clear –soil health correction including for enhanced soil moisture retention capacity, water harnessing optimization measures and its efficient use and production systems suiting local ecological cycles. Such an approach alone can serve the land types owned by the potential beneficiaries in MGNREGS as they are soil wise poor with low or no water potential. It will significantly increase and sustain productivity and to reduce crop risk. This approach is being sought by all sections - officials, scientists, farmers and volunteers in tackling land development of the targeted group of farmers. If these above is supplemented with steps for assured protective irrigation from external sources and as life saving measures for khariff crops to tackle long dry spells, then MGNREGS would address the key bottleneck facing rain fed poor farmers.

An important issue in the three genres of works is who should be benefit. Currently it is SC/ST followed by small and marginal farmer. This is valid but exceptions are needed in specific areas. Areas with mixed populations must be demarcated in advance and here the authority to include other beneficiaries be vested with a senior officer with clear technical criteria. Certain land development activities in areas with salinity or water logging can succeed only when the entire degraded portion is treated. In such cases one cannot restrict others but can impose criteria that at least fifty percent of those owning lands belong to the eligible categories to treat the entire area. In acidic soils this can be handled for a single farm and here the benefit need not be extended to beyond the current list of eligible beneficiaries of SC/ST and SF.

Here we need to make one important clarification on works that are physical infrastructure oriented covering the entire watershed. In the draft on note on works on individual lands of the MORD and asked to be examined by the committee, it is wrongly interpreted that (only) “para (iv) of schedule I permits work on individual lands”. Originally, permissibility of only irrigation facilities on individual lands was mentioned in the said para which is quite appropriate as irrigation is a different category of activity not normally covered under para (i) or (ii) and a special permission for this was given for the disadvantaged sections of the community. Similar is the case with horticulture, where externalities are limited and benefit of the development is primarily confined to the household which owns the plantation. On the other hand activities like land development, have strong water conservation and soil enhancement affect with large externality and should not be seen as an individual beneficiary oriented activity if taken up as part of an area development project.

In this context we must note that Schedule I of MGNREG Act lists permissible works in order of priority. Item (i) refers to water conservation and water harvesting and item (ii) refers to drought proofing. Outcomes here do not recognize ownership boundaries. Therefore, works under these two categories need to be taken up on public as well as private lands to be effective. The activities have to be area specific and watershed development illustrates the point where in the best results have been produced where lands have been treated from ridge to valley by planning for every survey number, irrespective of ownership and taking into

account only land capability and the socio-economic condition of the owner of each survey number to decide on the treatment.

In MGNREGS we favour choosing the disadvantaged sections in order of priority - SC/ST first followed by small and marginal farmers. But this should be taken up as a principle and as priority and not as a restrictive execution guideline, such as single rain fed crops or where the lands are contiguous and have some non-SC/ST farmers. In many regions large populace and livelihoods are dependent upon common lands and in ways more than one. For instance in Udaipur district, where the committee held a meeting with farmers, 72% of land is under commons. Though such lands are thoroughly degraded it is an important source of fuel wood, fodder and biomass for the tribal community who constitute 37% of the total population of the district. The extremely fragile natural resource base and little availability of alternatives locally to supplement household incomes merely reinforce the vicious cycle of degradation. **It is vital that MGNREGS builds in the steps to arrest degradation and improve productivity of such lands although they do not qualify as "individual lands".**

### **VIII Guiding Principles**

Much criticism of MGNREGS hinges on the assets being unproductive. It comes not only from external critiques but with questions that are posed to the committee - why it has not impacted on farmer suicides, left wing extremism or in capital formation. Accepting this reality and correcting this through considerable improvements in the planning and implementation package is vital for MGNREGS to stay and be sustainable. **The old notion of works emerging from food for work and other employment schemes must give way to a radical change and overhaul in planning, implementation, monitoring and investing on personnel to get the desired results and outcomes.**

Works on individual lands must be a part of a larger district development agenda and here the District Agriculture Plan, envisioned by Planning Commission, could be useful. The work plans for individual lands focus on the poor must and in its integration one caveat is that its thrust must be redirected to include the needs of resource poor lands. Otherwise it will serve better doing farmers or those with irrigation, leaving out the bulk of the poor who depend on rain fed or stored water for their farming operations. **This will involve agriculture institutions, enhance technical manpower capacities and provide the backward and forward linkages as they are primary for successful increase in yields and in enhancing incomes.**

While know-how and technologies for land development and enhancing productivity are available, **the real bottleneck is implementation especially for cascaded tasking work types as proposed by the committee as timely undertaking of works activities are crucial for outcomes through farmer confidence.** The National Council on Employment Guarantee sub group on Planning and Execution is addressing this matter but our report carries some recommendations, anxious as we are that the employment offer may dominate and its implementation framework may be extended to works.

Ideas and plans can deliver the desired outcomes when implementation is capable, creative and builds on social capital. We have given suggestive roadmaps to translate the recommendations into ground realities. This is high priority as the tasks in works are relegated by officials as being incidental and secondary, does not extend beyond physical civil works oriented check measurement, people have to take what is given to them and directing investments for intended asset building is low in importance. **It is crucial that justification of any works on its rationale and outcomes must form a component in planning and selection of works.**

Tradition in Indian agriculture philosophizes on the practice of one crop for farmer income and another for soil rejuvenation. Our soils are becoming sterile, is in poor health and soil organic matter has drastically decreased. Currently MGNREGS physical structures (e.g. contour bunds, terracing, loose boulder structures for soil and moisture conservation; check dams, percolation tanks, CCTs for water harvesting), must be accompanied with measures to improving soil productivity (fertility and soil tilth/structure) along with vegetation. One must seek for growing sustainable healthy crop by being integrated to livestock development and to tackle the vagaries of nature that will get worse with climate change. MGNREGS thrust must swiftly move from land development to land husbandry with investments that build such assets that enhance productivity and reduce risk.

Vegetation, neglected in physical works, plays a greater role in soil and water management plus its grasses offer several products used by the poor and consumed by their livestock. So while we start with physical infrastructure works in an area, it must follow with specific and tailored activities that address the needs in developing the land including soil quality and its health to sustain plant nutrient cycle needs. This will improve productivity of lands with healthy plant growth can tackle disease and moisture stress. It has another value as it helps farmers in the lower portions through increased harvests of ground water.

## **IX Committee Recommendations**

Our recommendations are in four categories - Approach, Scope, Modality and Others. In bold letters are the recommendations followed with a brief explanatory note. Explanations of some recommendations are detailed in subsequent pages.

### ***Approach***

#### **1. Works to receive equal and independent attention in personnel, planning, training, review and management time and financial provisions.**

The dominant impression of “task” at hand of officials in MGNREGS is that its primary objective is wage employment. This has unwittingly led to little or no attention to works, save in the context of serving the primary objective. This has a cascading negative effect in terms of deployment of human and technical resources, financial support and administrative interest

and attention to works. Most administrative expenses of the permissible six percent go to tasks related to employment generation with very little or nothing for the myriad tasks involved in developing productive assets. In the current situation of degraded lands it is crucial that specific attention be bestowed on works that improve productivity and not on par with civil works such as roads, buildings or cement mortar works. So specific manpower, management attention and monitoring of investments for land development by allocating necessary finances and administrative support is the first crucial step. These funds must be driven by then needs of specific works and earmarked to plan, develop and implement works that aim to increase productivity. If needed Administrative support must be increased to ensure adequate financing for works. To re-orient senior officials of the equal importance to works as assets, training must enlarge include inputs on works planning, social capital building, land husbandry, sustainable agriculture, convergence of services and market dynamics.

**2. Approach to shift from land development to land husbandry with implementation being a set of cascading activities spread and over a timeframe of two, three and four years.**

Tradition in Indian agriculture philosophizes on the practice of one crop for farmer income and the other for soil rejuvenation. Scientists have called for soil health cards to monitor soils as they are becoming sterile, are in poor health and soil organic matter has drastically fallen. Unless soil fertility is improved, productivity increase cannot occur or gains if any will be minimal and not sustainable. A first step forward in this direction under MGNREGS will be a leap for healthy crop growth, enhanced animal productivity and tackle the vagaries of nature. Land husbandry approach compels a shift from the current one time activity to a spiraling set of tasks that are spread over time. The plans must be region and land specific, integrated within the larger landscape contour and developed with participatory approaches using experts to assist beneficiaries by providing knowledge inputs. To tie-together various interventions for land husbandry, each project should be developed with a Farming Systems Approach, as seen in the BAIF Wadi programme funded by the Ministry of Tribal Affairs. Annexure I details adoption strategies of this approach in different agro-climatic zones.

**3. Land development cannot be treated like other civil works in MGNREGS and calls for specific and differently oriented personnel and practices.**

To begin and succeed with recommendation 2, the first step is of changing the orientation and responsibility of officials. Productivity increase cannot be the domain of civil engineers and RD officials as it calls for soil and agricultural scientists in planning and extension of the works. It involves managing diverse mutually reinforcing activities and has to be handled by competent agencies to function as Technology/Knowledge Partners. It calls for separate trained and skilled staff to plan, develop and oversee the works related to land and natural resources activities. Currently the MGNREGS technical assistant who is capable of giving markings and demarcation of work lay out, check measurement and wage calculation is entrusted with this task. Personnel

needed to work on land development will always be limited but their responsibilities can extend and cover several villages and a set number of farmers. They could be consultants with clear instructions including defining the number of visits to each farmer with time schedules, participatory planning, quality assurance and community mobilization. They must be provided with transport allowance with their cost being treated as skilled labor coming from the material/skilled labor component.

**4. Works must address the underlying causes for low productivity with choice of what must be done on the treated land wresting with the farmer.**

The current approach assumes that the land is ready for productive use or enhancement with marginal inputs whereas this is not the case with most lands belonging to SC and ST farmers and hence kept fallow or seed broadcasted for whatever may come in. Hence to correct the status of the inhibiting natural factors for deficient and unstable production calls for tackling the underlying bottlenecks. Works and investments towards them must be seen as the first step to improve productivity. Bulk of MGNREGS must focus on it rather than the current situation where the land quality is taken up as good and plantations are taken upon. We recommend that upon addressing underlying bottlenecks the choice of what the improved land must be used for must wrest with the farmer and not thrust upon them by officials or experts. For this the farmer must be assisted to get government schemes and institutional credit, and the capital leveraged must be seen as a key measure to judge the value of the MGNREGS investments on the individual lands.

**5. Farmer participation, community motivation in planning and choice making is the key to mobilizing social capital and its tapping must be invested upon.**

Providing a list of permissible activities on individual lands or elaborating its implementation through guidelines will not suffice as investments on it has not lead automatically productivity rise or income benefits to poor farmers. Currently no money is invested on planning and designing/prioritizing while works on individual lands or natural resources productivity increase needs both technical and social engineering expertise. Community land development involves working closely with the panchayats and the people.

Equally crucial is to eliminate faulty implementation while ensuring timely, efficient and accountable roll out of the agreed plan. This will bring farmer energy, vital for investments being productive. Such soft skills for community facilitation must be invested upon and built into work plans for individual and community land development. These must be set in a framework of “facilitation for outcome” that holds the program and ties up all the nitty-gritty’s.

Such tasks are labor and time intensive and hence the field personnel must be trained, oriented and tasked in undertaking them. The staff proposed in 3 must be entrusted with these tasks.

**6. To design productivity enhancement plans we recommend the following as the basis.**

- a) Information dissemination on options in land development activities followed by discussions on choices and options among the beneficiaries
- b) Exposure visit to successful farms by beneficiary leaders
- c) Help beneficiaries understand the linkages among various activities for soil health
- d) Vetting of development proposal and building in the ideas of the women in the household.

***Scope***

**1. The list of permissible works on individual lands must be expanded to include soil fertility enhancement and soil deficiency correction, tank soil and organic manure application and vegetation growth. In addition and as essential link, activities to enhance productivity of livestock, fisheries, homesteads and of humans must be included in permissible works.**

The works in individual lands are low on impact and farmer interest, as they are a limited set of ad hoc isolated physical activities, whereas the lands of poor farmers and assigned lands are highly degraded needing several mutually reinforcing corrective measures. So along with soil improvement measures, livestock development in terms of genetic improvement, feed availability, quality and storage, improving grazing lands, provision of water for livestock, upgrading cow shed, development of fingerlings, platforms for drying crops etc must be added to the list of permissible works. To increase household food and nutrition and incomes, homesteads infrastructure development offers good scope and opportunity and calls for inclusion. Such a widened listed of permissible works will help MGNREGS cater to the needs of the bulk of the poor especially women, while it can bring in quick productivity results and increases and done with relatively small investments. Reasons for each of what are being sought are specifically detailed in the next chapter.

**2. A committee to be constituted to develop norms, measurement yardsticks, outturn and for financial integrity.**

In case recommendation one is accepted, which we do expect as those aspects are basic and crucial needs for increasing productivity of MGNREGS investments, this genre calls for specific measurement centered detailing of inputs as they are not currently available while forming the basis of payments. They include standard schedule of rates for labor and materials, outturn including measurements, payment calculation, audits and verification needs of consumables

and steps to check, avoid and detect financial dishonesty and corruption. Towards this we recommend the forming of a committee to examine and come up with solutions. The committee must include currently available expertise such as banks that lend for long term land development, non-govt. organizations that have undertaken such works along with experts. They must be asked to submit their findings within three to four months. Members of our committee having expertise in this task are willing to volunteer to assist and associate if called upon.

### **3. MGNREGS land development investments must provide assured protective irrigation to khariff crop.**

Drought is a major and recurring issue facing poor farmers. Unless addressed crop productivity and unleashing the energies of the farmer will not happen. Several measures - water conservation, water harvesting structures and tank restoration are taken up in MGNREGS whose real benefits of enhanced water availability accrue only to a limited number of farmers and farming in the valley portion. The operational details are provided in following chapter.

As the poor have lands in ridge portion and drought is the biggest challenge we recommend MGNREGS invests in providing assured protective water supply to at least one acre to all SC, ST and SF farmers during kharif, in case of monsoons are not on time and crops begin to wither. This can be done by laying pipes from the improved tanks or water bodies to the lands of beneficiaries by pumping arrangements. *This single measure will make the biggest dent to increasing productivity, unleash the energies of poor landowners, reduce distress migration and make a significant contribution to the national food basket.*

### **4. Individual land development productivity success needs integration with natural resources development and management.**

Incomes, inputs and livelihoods of the poor come from own land, wages, CPRs and forests. Small peasant farming is dependent on livestock as timely operations is crucial and use of cattle as plough and manure for continued soil enrichment is the raison d'être for viable and successful farming by the small landowners. Hence while treating individual lands it is important that the productivity of CPRs and forests is increased, as they are degraded and need rejuvenation investments. Such tasks are avoided or neglected by officials as its impact is time consuming, slow on results at start and success here depends on community action and management and not the investments alone.

With panchayat raj agencies as the implementing agency in MGNREGS, we have a unique opportunity break this obstacle in developing community and government lands. In certain

areas such as Rajasthan it has the largest land mass and provides incomes for the poorest people. The Panchayats may overlook this need and priority for it as they offer value only to the poorest populations and hence calls for motivating the panchayat leadership with its planning and actions being incentivized. This can be done by assuring and providing the manpower needs for CPR development and management through provisioning MGNREGS employment person days. The government must enable a fast track approval from the departments that have a say on such land and its use. Details of what to be done for improving such lands are listed under livestock in the subsequent chapter.

**5. A Committee of the NAEC Council to list out works in areas where works options are limited and to submit a report within four months.**

There are many scattered areas where employment need and poverty are high, but the options of works seem limited. We see this in areas where land holding among SC/ST is meager and where every bit of land is under use or wherein lands are under water inundation for many months. The committee observed it in many parts of poverty ridden Bihar and also in some villages in Andhra Pradesh. One bottleneck for lack of ideas in such areas in providing productive employment lies in the historical fact that the type of works in MGNREGS itself has emerged from employment schemes, most of which were Food for Work schemes and taken up in drought prone areas where such a situation of high water availability is unthinkable.

In tackling such areas creative thinking is called for. For instance in Bihar one observed surfeit of grass in some areas, a precious product in dire demand in many other parts of the country. Employment here could mean making fodder enriched briquettes for easy transport to needy regions of the country. To address what works must be taken up in such areas that lie out of the drought framework and to help the communities we recommend constitution of a committee to creatively examine and propose the works to be taken up in such areas. Its proposals must come in four months and unless such parts of India that have the potential and need to improve the livelihoods of the poor it will continue to go unaddressed.

**6. Investment per acre or beneficiary must be activity based and with a cap while overall limit be brought down to realistic levels**

Currently 1.5 lakh rupees per land holder is the cap provided in MGNREGS, with most top end investments going on stone lining terraced dug wells. Ground water tapping opportunities through open wells have very limited prospects but can take away the bulk of the investments in just trying. The better option is conjunctive planning of water harvesting and drainage along with physical land development and soil husbandry. We recommend a cap of Rs 50000 for individual beneficiaries and no cap on investments for overall water resource development and

management. The beneficiaries must be given options from the menu with costs for each so that they exercise choice and limit to priority needs. It is crucial that MGNREGS investment addresses the underlying bottlenecks in productivity with the other aspects being covered through the farmer tapping institutional credit.

### **7. Need based personnel and administrative costs approach rather than uniform systems**

We have delineated three genres of works for land husbandry. In all the three the crucial element is an effective well conceived participatory on the sight develop plan followed by scrupulous adherence to its implementation both in quality and on time.

The first and the second genre can be done by having trained field assistants. They can be provided with templates on various land types and what needs to be look for and done. As illustration some additional items for inclusion in genre one is given in annexure II. The crucial aspect is overall planning for the area and specific planning for the particular land in terms of succeeding steps. In planning which must be participatory, one must involve local expertise of KVK, Agriculture Extension staff and NGOs while the implementation roll out steps can be managed by a field assistant. As already the District Agriculture Plan (DAP) must be the nodal framework on what is to be done for land and CPR development in MGNREGS with convergence departments also going through and working within this district development framework.

### ***Modalities***

#### **1. MGNREGS individual land and natural resource development must be an integral part of the District Agriculture Plan.**

The Planning Commission advises the preparation of District Agriculture Plans and ATMA is entrusted with the task. This is not done but could serve as a platform to embed and gain convergence for MGNREGS land and natural resource development initiatives. While doing so the unique issues facing lands with poor productivity must be adequately attended upon. Doing so will have better outcomes and success with works integrated and derived from such plan. This will help bring in backward and forward linkages in terms of inputs and market, provide the technical capacities to land husbandry and improve farm productivity and to bring convergence with available schemes etc leading to optimizing outcomes. By doing so the district KVK can be actively involved in various technical services needed in the processes for land husbandry.

#### **2. Begin with contiguous land patches of the poor and make the beneficiaries central.**

For ease, including the management, skill sets needs and benefit optimization, we must start with work on contiguous lands belonging to the eligible beneficiaries. This will provide wider learning making its adoption in individual land patches easy with the farmers being capable of

developing their detailed plan for enhancing land productivity. Plans for each beneficiary must be developed through consultation wherein the farmer is provided with options to choose among and has the benefit of expert/specialist advice. Hence budgetary allocations must build in the commitments made over the years. In such contiguous plots the scheme infrastructure work must be based on overall needs even if non SC/ST farmers are involved. While individual land activities must have a cap the overall landscape work for water conservation, drainage and vegetation enhancement the investment must be need based and without a limit. The implementation timeframe for each of the works must be clearly spelt out, written down and mutually agreed to between the official and the farmer.

**3. Strengthen community say in works envisaged in the Act through authenticated and verifiable registering of community choices.**

On who selects the works depends its benefit or use. The Act has rightly provides this responsibility to the gram sabha. In most places they are not held or the list of works that officials are read and taken as accepted or most people do not participate. Unless this issue is addressed the source of proposals will be contrary to the provisions of the act. Towards this it is important to have the community to list and cast their choice from among the shelf of works in an authenticated, transparent and well recorded process that uses low cost portable information technology tools. Doing this by itself would provide a reasonable basis for the works to be a community asset.

**4. ADD BIO (Agreed Development Design to Build Incubate Operate) approach for certain integrated work types pilots of one per district.**

As discussed earlier of the three genres of works, the first two can be delivered within existing personnel through enhanced training and tapping of locally available skills. Genre three must receive special attention and capabilities as they are innovative and promising next practices. We suggest having one such pilot must be taken in each district. This can serve as a learning centre for subsequent scaling up and wider adoption. The first batch of such districts must begin right away and be those districts where NREGS begun in its first year of implementation and then progressively increased to cover all districts within a two year framework.

Here the approach centers on as enunciated in land husbandry or integrated farming systems. It has been successfully demonstrated by organizations like BIAF, PRADHAN, Seva Mandir and Accion Fraternal and in different agro-climatic zones. Here the knowledge based service provider develops the detailed project design through a rigorous consultative process of interaction with the community that is followed by a peer review. They assist the stakeholders in undertaking the entire gamut of tasks beginning with planning and followed by building the

physical structures, then incubate a process of land husbandry for soil quality enhancement and finally provide operational assistance with cropping pattern and farm practices advice along with helping obtain financial institutional support for continuing productivity enhancement and sustainability. In addition to undertaking this task they will provide and benchmark the measurement needed to be made for various activities for land husbandry. An additional challenge worth tried is that such pilots must involve younger people as many of them are shying away from farming. Such pilots will need considerable budget and involves considerable skill sets and intensive work and at least fifteen percent of the budget of the project costs as incurred in MGNREGS must be provided for it. Some states have begun this process but much streamlining of the memorandum of agreement and stating of outcomes is needed.

#### **5. Farmer confidence on works deliverance and on time through written agreement**

In works on individual lands there must be written agreement given by the official or the service provider to the farmer listing the measures, transparency safeguards, timeframe, oversight arrangements and grievance resolution. A binding obligation in writing from the concerned implementing department is akin to giving of receipts upon application for work as provided in MGNREGS. We need such an arrangement will deliver works, make rights real, provide community confidence and ensure that officials deliver on what is planned and agreed upon. Also the TOR of the Ombudsman must include their overseeing that such agreement is complied with. This will improve beneficiary confidence in MGNREGS works and ensure that officials deliver on time. Such agreement must also be provided in case of CPR and forest development plans and with the panchayat with mutual tasks being defined.

#### **6. Fifty percent money for Land Development**

The money or increasing productivity and natural resources conservation and development are shrinking in MGNREGS. Bulk of the money is increasingly going for road, buildings and to certain departments. We recommend that at least fifty percent of investments of MGNREGS be earmarked for land development including individual beneficiaries and for overall area development based natural resource enhancements including CPRs and over time. Such commitment will provide assurance, adequate resources and full coverage to works to land development.

#### **7. Revision of schedule of rates to avoid conflict of interests between farmer and worker**

The standard schedule of rates (SSR) drives wage realization and is a source of conflict between workers and farmers. For instance in stone removal from the land, the worker collects and heaps them close by. The farmer wants it to be placed along boundaries. But in the SSR for stone removal no “lead” is provided. Where the farmer uses his or her own labor, for which they receive a wage, they hire additional hands of their choice defeating the fundamental tenet of MGNREGS – job card holder right to employment on demand. Some workers will not find suitors as caste forms the criteria in employment.

## **8. Improve work place facilities and provide lunch to people coming to work on land development activities.**

It is observed that lands of poor people that are far away from the habitation or for that matter to work on CPRs or works in hilly places is not finding labor. Unless such areas are worked upon and treated, many of the proposals placed here may not fructify. The ten percent increased wage for working in places beyond five kilometers is not seen on the ground. We suggest that when works are taken up in MGNREGS in such places the workers be provided with lunch, in addition to work place facilities as provided in the Act. A pilot on this idea found good response and hence placed for consideration by the Council. It also provided local rain fed cereals. The additional costs for this comes to twelve to fifteen rupees and can be paid in lieu of the compensation now offered works that are beyond five kilometers.

### ***Others***

In some areas support for fencing through live plants or material, land terracing in undulating areas, habitat sanitation and saturation approach to household toilets and drinking water are worth inclusion as they provide the infrastructure necessary for increasing productivity. All the ideas and suggestions given under exploratory notes are the committee recommendations.

## **X Explanatory Notes on Certain Recommendations**

### **1. Protective Irrigation**

Water is crucial to successful farming and unless its use builds the notion of distributive justice, bulk of the poor land owner's improvement in MGNREGS investments will not succeed. As a major breakthrough to motivate poor farmers and to reduce crop risk and assure incomes, we recommend that MGNREGS begin the building of a new approach to water equity. One must note that the lands of the poor people – scheduled castes and scheduled tribes are mostly rain fed and located in the ridge portion. Dug wells or bore well will remain their dream that can never fructify. Water storage options are limited and crop production and its yield depends on timely rains. Works of tank renovation and water harvesting structures taken up in MGNREGS is benefiting the valley portion land holding farmers.

This inequity can be reversed by assuring protective water supplies for at least a part of the land and during khariff, as that is what their lands are mostly used for and capable of. Here MGNREGS can create the infrastructure by digging and lay pipes followed by facilities for pumping water to these areas from nearby tanks and water bodies. This can also be extended, subject to water availability, to *rabi* crop provided the surface conditions are optimal for seeding. In case water is available in summer months, it can assure protective water supply to a

small portion of the land for horticulture, trees or fodder cultivation, as chosen by the individual.

Here the harvested water (surface or groundwater) has to be delivered to the field that is made into small plots. This may involve lifting the water from the source to the field and uniformly distributing it to the laid out small plots. A diesel pump to lift the water from surface water bodies or a bore well with a submersible pump along with high polythene density tubes from source to the field and lining of the channels in the small plots of the field are needed.

This step will have a very significant impact on productivity, contribute to beneficiary confidence, enthusiasm and livelihood and address the growing needs of cereals and legumes in the national food basket. Providing such water was not considered as the infrastructure costs were high and the return low returns as only one crop was seen as possible on such lands. It is now desirable as MGNREGS are public works investment aiming to address the livelihoods of the poor. It also serves the poor at marginal additional that makes effective and equitable the investments on watersheds and on water bodies.

## **2. Livestock**

There are two distinct categories of livestock with each calling for different interventions. One is stall fed and the other is grazing based. Both are a good portion of household income, especially women. In the stall fed varieties, productivity increase calls for improving the genetic stock along with feed quality, adequate availability and in some periods of its augmentation.

One sees a paradox in India with some places burning crop stubs that lead to global warming and harming our future while the same is desperately sought elsewhere as fodder for cattle. Steps to correct this must merit attention. In addition we need to provide fodder storage infrastructure of fodder and make it available to other places in periods of acute scarcity or seasonal shortages. This needs fodder chaffing, preparation of fodder blocks including some that are fortified with legume blocks.

Cattle provide substantial productive employment generation. Genetic improvement can be made possible by establishment of cattle/buffalo crossbreeding service centers with the developmental infrastructure service coming from MGNREGS. This must be augmented with the availability of feed and fodder resources to ensure that the livestock can produce to the full extent of their genetic potential. In order to augment the availability of feed and fodder resources, MGNREGS must consider the following in planning the works to be taken up for all land related activities.

- a. Fodder production by improved seed of fodder crops, grasses, planting multipurpose trees;
- b. Improving the productivity of barren lands through silvi-pasture development;
- c. Measures to improve practices such as fodder chaffing, preparation of fodder blocks, storage infrastructure for fodder, ensilation, etc.
- d. Support to improve cattle management through construction of better cowsheds, introduction of water troughs and managers.

The above three pronged approach covering breeding, feeding and management under the “Material Component” along with the wage payment support for the rearing of cattle during the gestation period can provide current-period employment generation along with production of valuable productive assets in the form of high producing livestock.

Meeting the green fodder need for milch bovine calls for supply of quality seed, irrigation and processing including the possible ensiling. One must redesign and improve cow sheds to serve various purposes – water trough, urine and dung collection and to tackle harsh climatic variations. Placing these in the district agriculture plan with complementary investment from MGNREGS will bring good results of increased incomes, avenues of self employment and support sustainable agriculture.

In the livelihood of the poor grazing based livestock is crucial and its income potential is well known. Small ruminants need pastures for grazing and which are in a very poor condition and calling for improvement. The large pastoral flocks – of camels, sheep, buffaloes and cattle, the semi-migrant systems in sheep and stationary or local grazing based systems depend heavily on non-cultivated fodder in terms of pastures, common lands, private fallows, water bodies etc. MGNREGS must invest in integrated development of the commons and govt. lands along with provisioning water. Otherwise degradation of common pasture lands and fodder resources will continue and further erode the natural resource base of the poor who depend on livestock.

Fodder availability can be increased by improving the productivity of common lands through multipurpose trees, shrubs and grasses based on local knowledge on the indigenous (mix of) species, climax vegetation and use them in regenerating fodder biomass. Water harvesting structures can provide drinking water to livestock but as the availability of water in many surface water bodies is unpredictable, there must be an assured ground based drinking water source for livestock through construction of water troughs that is appropriately designed and usable by small ruminants. The panchayat could supply assured water source from the village bore well with the infrastructure such as pipes being laid under MGNREGS.

The success of MGNREGS investments here will depend on the community. Its works must be designed and based on the agro-ecosystem, specific measures of biomass regeneration, evolving appropriate grazing systems and regulatory norms and management with the government helping to overcome the complexity in the legal rights regimes over such land and its usufructs as they involve of multiple-line departments in its management. The following measures are suggested for enhancing animal productivity and as part of individual land development because of the symbiosis between land, plant and livestock.

1. Water ponds with appropriate and slope channels from the watershed hills to provide drinking water to animals to reduce grazing stress incurred in walking long distances.
2. Silvi-pasture with improved genotypes of grasses and bio-fencing of pasture and range lands.

3. Pruning of trees and bushes and collection and storing of leaves and pods for animals during lean period.
4. Harvesting and storing livestock feed crop stem stock from farm lands as they are often left in the land in case the crop fails especially among poor farmers doing rain fed farming.
5. Regulating differed/rotational grazing and browsing on pasture lands to allow re-seed and regeneration. Fabrication of scientifically designed low cost thatched animal shelters with appropriate inter-spacing and around water ponds to provide cool environment and rest to the animals during peak sun hours in summer and thereby saving animals' energy for productivity.
6. Scientifically designed low cost thatched animals' pen to provide warmth to the animals during cold winters to curtail mortality of new born kids and lambs (kidding and lambing occurs generally in November) and saving animals' energy for productivity which otherwise would have spent for increasing body temperature.
7. Promoting ethno-veterinary plants to treat animal diseases of de-worming, cracked udders, gastric problems, wounds, arthritis, stomach disorders, fractured bones etc.

### 3. Homesteads

In places such as in tribal areas and in Eastern India, one observes poor people of having sizable homestead lands. Bringing it to use and enhancing its productivity will provide food security and give incomes for the households and hence it infrastructure development must be included in the MGNREGS. Food plants and creepers one can lay wooden poles and structure, improve cattle sheds and undertake linked activities such as compost or vermin-compost. A dug and lined water trough will provide adequate water to cattle, plants and other purposes.

In homesteads in high rainfall areas backyard ponds can be dug and being mostly lateritic soils lining is not be needed and this can serve for supplying fingerlings to improve fish productivity. In addition and especially for tribal habitations one must include activities such as flat paved floor for drying crops along with small storage structures. In undertaking such tasks, extension inputs must come from the agriculture and animal husbandry departments and by including this in the district agriculture plan, we can help build household food and nutrition security. Homestead farming is site specific could involve any of the following;

Sl. No.	Component	Infrastructure needed
1.	Milch animals including cow, buffalo, goat	Sheds
2.	Poultry / duckery	Baskets for poultry cover
3.	Vegetable growing	Poles for pandal for creepers
4.	Vermi composting / compost	Trenches and shed
5.	Fish / watering livestock	Pond / Trough
6.	Fodder storing	Shade with tree cover
7.	Sericulture	Rearing and reeling appliances
8.	Honey production	Bee hive

#### 4. Horticulture

In horticulture the focus has to be on dry land horticulture. Selection of suitable fruit trees and their varieties matching with the ecosystem is the first step. For establishing and stabilizing the seedlings to have normal growth a 2-3 year protective irrigation is important. This must be followed by pit diggings in a manner that it can hold as much rain water as possible. Mulching must be another step along with correcting soil deficiency. In case the farmer has a source of dependable irrigation, pressurized systems of irrigation may be extended provided the fruit crop chosen is of high value. Secondly depending on the quality of water, the choice of fruit tree may be made. Examples

Quality water	Fruit tree(s)
Good	Citrus
Satisfactory	Mango, Custard apple, Sapota, Guava
Salty	Ber, Aonla, Pomegranate

If the farmer chooses to provide flow irrigation as mentioned earlier high density polythene tubing may be provided to carry water from source to the basin. And forming the basin (size depending on the choice of the fruit tree and its possible canopy) with lining of the sides may also be taken up.

#### 5. Saturation Approach to Water and Sanitation

Though not listed as permissible works in MGNREGS its money is used in many states to meet certain costs for providing village water and sanitation schemes. But this is not serving its key objective - significant impact on health and hygiene - as open defecation continues. Gram Vikas in Orissa has a unique offer wherein no sanitation is taken up unless all households are covered. This approach is recommended for inclusion in MGNREGS along with sanitation schemes taken up by states, subject to undertaking the saturation approach. This will have a major impact on community health while bringing to people the values of impact enhancement through a whole habitation or village saturation approach and will trigger changes in the self image of women.

Two principles govern the Gram Vikas approach. One, it does not commence work unless the entire village chooses to have individual latrines. And next, the provision of toilet facilities ensures piped water supply to it. If water supply is not ensured or left as the problem of the individual household, no sanitation scheme can succeed. So we seek inclusion of the water supply infrastructure to toilets subject to acceptance and building of toilets by every household.

Gram Vikas works in hilly areas and amidst tribal settlements. In their scheme they excavate a dug well in a suitable area on the hills so that water can flow through gravity to the village overhead tank. Once the water yield is established, a trench is cut from the bottom of the well down to the village where a suitable spot is identified for construction of an overhead tank. A pipe line is laid along the trench and since water has to find its level, water flows from the bottom of the well down the pipe line and would rise by capillary action to the overhead tank

from where two outlets are provided. One outlet from the overhead tank leads to individual dwelling units in the village for supply of water to meet household consumption including use of water in toilets while the other outlet would direct the water available in excess of meeting household consumption, to the nearby kitchen gardens.

A related initiative is of excavation of water collection chambers normally of 20'x20'x15' dimension is found very useful in collecting water from the streams flowing across hilly areas. The water from the collection chamber can be pumped to village overhead tanks for sanitation. In times when the collection of water is sufficient enough to last beyond household consumption, the water is pumped to nearby farms. Such initiatives needs persons for masonry, plumbing, stone dressing and scaffolding and people can be trained by appropriate institutions. Such skills can potentially be deployed for creating quality assets under MGNREGA. As the absorptive capacity to undertake such works in MGNREGS would be large, this would create and trigger the initial demand for inculcating such skills as such services are needed in a growing market with the economy witnessing a good growth rate.

## **6. Convergence**

Convergence is much talked but its dynamics on the ground is overlooked. A key factor for convergence not taking off is because departments seek individual financial allotment. One must note that apart from MGNREGS there is virtually little or no money for development elsewhere and in their control. Nor is bringing them on board is being actively sought as the purse holder is happy with routine employment generation oriented work projects. Some change is now being witnessed as there is pressure on officials to spend more MGNREGS money. This has led to works being outsourced rather than emerging as convergence. Unless one aims a strength based convergence the situation on the ground in terms of work being outcomes will be low. With villagers or elected representatives having little say, "business as usual" dominates. Unless drastic steps of change and for accountability of asset creation are in place wherein productivity enhancement is driven, stressed and monitored, one will not see any drastic change in the situation.

The MORD has signed MOUs with the Ministry of Agriculture, Agricultural Research and Education, Ministry of Water Resources, Ministry of Environment and Forests etc. The MOUs spell out guidelines in detail for facilitating convergence of MGNREGA with schemes of the above ministries so as to widen the shelf of projects for meeting the wage employment demand, improve the quality of assets created under MGNREGA as well as leverage scarce resources to increase beneficiary coverage under various development schemes. For instance, the Ministry of Agriculture is implementing a suite of development programmes like the National Agriculture Development Programme/ Rashtriya Krishi Vikas Yojana (NADP/ RKVY); the National Food Security Mission (NFSM); National Horticulture Mission (NHM); Development of Inland Fisheries and Aquaculture (DIFA) and the Fodder and Feed Development Scheme (FFDS). But none of these are translated into ground reality.

Convergence is implicit in the design of RKVY that envisages “Each district will formulate a District Agriculture Plan (DAP) by including the resources available from other existing schemes- district, state or central schemes such as the BRGF (Backward Region Grant Fund), SGSY (Swarn Jayanti Gram Swarojgar Yojana), MGNREGS and the Bharat Nirman”. The process of planning under RKVY also involves the active participation of the Panchayat Raj Institutions (PRIs) and seeks a bottom-up planning approach as envisaged in MGNREGA.

The guidelines for convergence emphasize joint planning from the habitat/ village level up to the district. The District Rural Development Agency is expected to constitute small resource groups at the District and block levels with the active participation of representatives of the Krishi Vigyan Kendras (KVKs). Combined with the MGNREGA work plans approved by the Gram Sabha, the district and block level groups will scrutinize the activity plans and give professional advice for effective and co-ordinate implementation. The KVKs are to indicate appropriate technologies for each work. All such guidelines can begin to take shape only by ensuring the making of the DAP and then serve as the platform for convergence and field action.

Yet, convergence as observed on the field is not merely a function of implementing joint MOUs and guidelines but involves a change in mindset and commitment on the part of related Line Departments to work together in a spirit of partnership, which calls for intense capacity building, among other initiatives. One such initiative that this Working Group recommends is the appointment of an additional Field Assistant (Land and Farm Husbandry) to support the Gram Rozgar Sewak (GRS) in planning and implementing convergence projects on individual land holdings. While the GRS could continue to be the administrative face of the MGNREGA at the GP level, the Field Assistant (Land and Farm Husbandry) shall be the new technical face who should be trained to facilitate convergence and the ADD-BIO projects on individual lands.

The planning of activities through the development of District Agriculture Plan can serve as the platform for key department stakeholders and ADD-BIO partners to plan and have an understanding for assisting its implementation and in measuring its deliverance.

## **Annexure I**

### **Land Husbandry**

In MGNREGS physical structures (e.g. contour bunds, terracing, loose boulder structures for soil and moisture conservation; check dams, percolation tanks, CCTs for water harvesting), being one time tasks, are the dominant practice. It is crucial that the approach is shifted from soil conservation to land husbandry. So improving soil productivity (fertility as well as soil tilth/ structure) is crucial. Vegetation in any form, including a good crop, is a key technique in soil and moisture conservation. But this can happen only over a period and with well planned and sequenced investments along with active farmer participation.

For improved productivity through land husbandry, it is essential to improve and maintain the soil organic matter (SOM) as it drives several other chemical processes, physical properties, soil stability and resilience, vital for sustained food production. Enhanced SOM leads to better

aggregate stability through biologically more active soils, increased water retention capacity and mitigating the effects of drought. The opportunities for incorporating organics in some form or the other are many - FYM, compost, vermin-compost, incorporation of weeds, leaf litter from tree farming and crops, green leaf manure, integrated crop livestock farming etc. SOM involve activities spread over a period of 3 to 5 years by increasing the availability and application of bulky organics along with on-farm turnover of crop residues. Adequate biomass calls for multipurpose trees planting by bulk planting or row planting in cultivated land and on field boundaries along with its planting on farm roads, canals, fallows and on community lands. This must be complimented with in-village seed production and adoption of non chemical pesticide ways.

Large land tracts in Indian need reclamation. Soil is saline. Here salinity can be reversed by adding tank silt and cultivation of green manure crops, as part of the cropping system. In the Indo-Gangetic plains cultivation of rice is followed by wheat crops. This has led to soils being acidic that is temporarily managed by using chemical fertilizers. MGNREGS could promote here the growing of a green manure crop after the two harvests. Here a mixture of seeds or seed balls can be broadcasted and the crop ploughed into the soil after forty to fifty days.

This has two advantages – one is availability of green leaf in the soil and its cultivation helps the roots to emerge and with the moisture to serve as triggers for microbial diversity and activity. Here MGNREGS could cover the cost of the seed or seed balls and two wettings using ground water and coming from the material component. Such land treatment must be assured to the farmers for three years and upon seeing its benefits, the additional income earned could be used by the farmer to adopt the practice on his/her own. The key is that the manure crop must be short duration so that the farmer has enough time to prepare for the next sowing and undertaken during and in places with crop cultivation time gaps and having groundwater to irrigate the green manure crop.

A varied practice can be promoted in rain fed farming areas wherein bund plantation of green manure perennials is sown and harvested for application on the soil. Another rich source of green leaf is the forest areas. In MGNREGS, the forest department has support but its investments continue to be traditional – wood and pulp plantations centered. These are of value to the department but the productive capacity of such lands to provide green manure is not seen as an asset of value to farmers. Here one can grow green leaf manure plants that are harvested and supplied to farmers in the nearby areas. This would be similar in richness to taking soil from tanks and applying on farm lands.

India is a large country with diverse ground realities. For each agro-climatic zone prescriptions on the steps for land preparation and amelioration are available and given below are steps to be taken up in existing farming systems of farming improvements for arid, dry semiarid, wet semiarid and humid climatic ecosystems.

a) **Arid ecosystem**

Existing systems	Possible improvements	Action needed
<b>Hot arid Northwest India</b>		
<p>Pastures with bushes like <i>Ziziphus nummularia</i> (<i>Jhar ber</i>) in extreme arid and trees like <i>Prosopis cineraria</i> (<i>Khejri</i>) and <i>Acacia Senegal</i> (<i>Kumata</i>) in arid regions</p>	<ul style="list-style-type: none"> <li>• Improvement of pastures with HYV of grass seed of <i>sewan</i> (<i>Lasiurus scindicus</i>) and <i>Cenchrus ciliaris</i> (<i>Anjan</i>) linked to livestock production.</li> <li>• Inclusion of tree component (e.g. <i>Acacia tortilis</i> (<i>Israeli babool</i>), <i>Colophospermum mopane</i> (<i>mopane</i>), <i>Dicrostachys nutans</i> (<i>nutans</i>) and perennial legumes).</li> <li>• Contour furrowing for rainwater conservation</li> <li>• Provision of water bodies in the native pastures through rainwater harvesting.</li> <li>• In case of medium and large farmers, individual pastures can be developed as LEY farming</li> </ul>	<ul style="list-style-type: none"> <li>• Seed of <i>sewan</i> and <i>anjan</i> grasses need be produced / procured for subsidized sale to the farmers</li> <li>• The technologies available with CAZRI and the traditional systems in vogue in the region may be encouraged with 3:1 share of finances</li> </ul>
<ul style="list-style-type: none"> <li>• With biotic pressure, pastures degrade. Pearl millet is grown even in extreme arid regions. It is also a substitute feed for bovines and camels in particular</li> </ul>	<ul style="list-style-type: none"> <li>• Pearl millet as fodder needs separate breeding programme</li> </ul>	<ul style="list-style-type: none"> <li>• The AICRPPM located in Jodhpur under the aegis of RAU, Bikaner has already a programme in this direction. It needs more attention</li> </ul>
<ul style="list-style-type: none"> <li>• Cluster bean is taken up as a fodder for camel and draft/milch cattle.</li> <li>• With the entry of gum industry, large scale growing of clusterbean is taken up as it is the raw material for gum industry. The 'churi' (leftovers after gum extraction) is sold back by the industry to the farmers as cattle feed concentrate.</li> </ul>	<ul style="list-style-type: none"> <li>• Supply of HYV cluster beans as a joint programme between gum industry and NARS system on a no-loss no-profit basis</li> </ul>	<ul style="list-style-type: none"> <li>• The tie-up between industry and NARS (CAZRI; RAU) may be set in motion for supply of improved seed of <i>Gaur</i></li> </ul>
<ul style="list-style-type: none"> <li>• Short pulses are also taken up eg. mothbean, mungbean.</li> </ul>	<ul style="list-style-type: none"> <li>• Adoption of HYV of short duration pulses as evolved by the NARS system</li> </ul>	<ul style="list-style-type: none"> <li>• Seed multiplication is needed through seed villages</li> </ul>

Existing systems	Possible improvements	Action needed
<ul style="list-style-type: none"> <li>The interdunal plains in some locations are put to mustard (<i>taramira</i>) and sorghum (fodder)</li> </ul>	<ul style="list-style-type: none"> <li>Better varieties and improved <i>in situ</i> rainwater harvesting systems</li> </ul>	<ul style="list-style-type: none"> <li>Seed multiplication is needed through seed villages</li> </ul>
<ul style="list-style-type: none"> <li>Under irrigation commercial crops like <i>Jira</i> (<i>Cuminum cyminum</i>), mustard and <i>Isubgol</i> (<i>Plantago ovata</i>) and coriander taken</li> </ul>	<ul style="list-style-type: none"> <li>Improved varieties need to be introduced</li> </ul>	<ul style="list-style-type: none"> <li>Industry must be encouraged to be partners in this endeavour</li> </ul>
<ul style="list-style-type: none"> <li>MPTs like <i>Commiphora mukul</i> (<i>Guggal</i>) and <i>Salvadora</i> sp. (<i>Jhak, Pilu</i>) taken</li> </ul>	<ul style="list-style-type: none"> <li><i>Guggal, Jhak</i> and <i>Pilu</i> are fast vanishing and need improvement, agrotechniques, replantation</li> </ul>	<ul style="list-style-type: none"> <li>Under protection of biodiversity (POB), this programme may be considered</li> </ul>
<ul style="list-style-type: none"> <li>Traditional rainwater harvesting systems like <i>Khadin, Nadis, Relu</i> farming and <i>Ad-bandh</i> practiced</li> </ul>	<ul style="list-style-type: none"> <li><i>Khadin</i> and <i>Nadi</i> are slowly becoming extinct due to encroachment on catchment. <i>Relu</i> farming and <i>Ad-bandh</i> need fine-tuning and extended applications/use</li> </ul>	<ul style="list-style-type: none"> <li>Traditional systems need be encouraged through proper funding</li> </ul>
<ul style="list-style-type: none"> <li>Well/bore well water used for commercial crops like chillies. Wheat and barley shifted to mustard</li> </ul>	<ul style="list-style-type: none"> <li>Diversification to horticultural plants <i>Aonla</i> (<i>Embllica officinalis</i>) pomogranate etc. Drip irrigation has promise for water saving in such crops</li> </ul>	<ul style="list-style-type: none"> <li>Participatory hydrological monitoring with cropping practiced by the farmers after assessing the availability of water (rainfall, well, flow)</li> </ul>
<ul style="list-style-type: none"> <li>Native <i>ber</i> (both <i>Z. numularia</i> and <i>Z. rotundifolia</i>) in small pockets besides <i>Kair</i> (<i>Capparis decidua</i>) and <i>Phog</i> (<i>Calligonum polygonoides</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Improved varieties can be used</li> </ul>	<ul style="list-style-type: none"> <li>CAZRI may be involved along with the Centre for arid fruits of ICAR located at Bikaner</li> </ul>
<ul style="list-style-type: none"> <li>Overexploitation of ground water</li> </ul>	<ul style="list-style-type: none"> <li>Need interventions to recharge ground water and use of drip irrigation</li> </ul>	<ul style="list-style-type: none"> <li>Simpler systems of recharging groundwater at farm level are available and need be adopted</li> </ul>
<ul style="list-style-type: none"> <li>Small ruminants, bovines, camels</li> </ul>	<ul style="list-style-type: none"> <li>Health care and breed improvement (artificial insemination/introduction of pure-bred males)</li> </ul>	<ul style="list-style-type: none"> <li>NGOs like CASA are already involved in this endeavour. They need be widely involved</li> </ul>
<ul style="list-style-type: none"> <li>Pastorolists not able to adequately attend to health care of their small ruminants</li> </ul>	<ul style="list-style-type: none"> <li>Quality drugs need be made available to the pastorolists</li> </ul>	<ul style="list-style-type: none"> <li>Need support from Government to be provided</li> </ul>
<b>Cold desert region of Ladakh and Lahaul and Spiti</b>		

Existing systems	Possible improvements	Action needed
<ul style="list-style-type: none"> <li>Traditional water harvesting systems (e.g. <i>Kuhl / Gool</i>; artificial glaciers), use (e.g. gravity flow from spring channels and reservoirs) and management by people have been in existence</li> </ul>	<ul style="list-style-type: none"> <li>These systems can be improved. Limited water use through drips and micro-sprinklers and use of concepts like critical irrigation need be explored</li> </ul>	<ul style="list-style-type: none"> <li>PHM may be encouraged</li> <li>The State Agricultural University may be entrusted with the development of water use efficiency techniques</li> </ul>
<ul style="list-style-type: none"> <li>Vegetables under green houses is found useful by the Defence Ministry and the State Agricultural University</li> </ul>	<ul style="list-style-type: none"> <li>Needs replication</li> </ul>	<ul style="list-style-type: none"> <li>A suitable mechanism can be considered</li> </ul>
<ul style="list-style-type: none"> <li>Several important local plant species are available, but not properly attended to</li> </ul>	<ul style="list-style-type: none"> <li>Examples include seabuck thorn, a non-leguminous N-fixing plant</li> </ul>	<ul style="list-style-type: none"> <li>These need be looked into by the State Agricultural University and developed</li> </ul>
<b>Arid Deccan plateau</b>		
<b>1. Red soil regions</b>		
<ul style="list-style-type: none"> <li>Groundnut is the most important crop. Yields are static. Cost of production is increasing. Droughts are common. Often seed becomes a constraint</li> </ul>	<ul style="list-style-type: none"> <li>Overuse of phosphatic fertilizers (DAP) should be discouraged to avoid P-induced Zn deficiency</li> <li>Depreding on the feasible yield the external inputs should be used</li> <li>In-village seed production must be adopted</li> </ul>	<ul style="list-style-type: none"> <li>Awareness on these issues has to be created</li> <li>Intercropping of groundnut with pigeonpea must be encouraged</li> </ul>
<ul style="list-style-type: none"> <li>With any source of irrigation (canal, well) rice is commonly grown. Some fruit orchards are also taken up</li> </ul>	<ul style="list-style-type: none"> <li>Rice need be discouraged</li> <li>Drip irrigation may be provided for fruit orchards</li> <li>Critical irrigation concept may be considered</li> </ul>	<p>Adequate market mechanisms for alternate crops must be puit in place</p>
<b>2. Black soils</b>		
<ul style="list-style-type: none"> <li>Pearl millet, setaria, coriander safflower and <i>rabi</i> sorghum are common crops</li> </ul>	<ul style="list-style-type: none"> <li>Subsoil salinity is common in these areas. Salt tolerant crops (coriander, safflower) and shallow rooted cereals (local varieties of pearl millet, setaria and <i>rabi</i> sorghum) be taken up</li> <li>Drip irrigation may be considered for the fruit plantations</li> </ul>	<ul style="list-style-type: none"> <li>Suitable marketing facilities must follow</li> </ul>

## B) Dry semiarid ecosystems

Existing systems	Possible improvements	Action needed
<ul style="list-style-type: none"> <li>Village Commons are relatively less in area. Whatever available are poor/degraded. The common tree <i>Acacia nilotica</i> is vanishing at a fast rate for commercial usage. Vegetation on hilly areas is also depleting</li> </ul>	<ul style="list-style-type: none"> <li>The existing commons can easily be upgraded with <i>Sehima-Dicanthium</i> (<i>Sedwa - Marvel</i> grasses) – climax grasses/<i>Cenchrus ciliaris</i>. Introduction of fodder legume like <i>Stylosanthes hamata</i> has great promise. Neem also deserves attention.</li> <li>Besides <i>A. nilotica</i> (<i>Desi Babool</i>), <i>A. Senegal</i> and <i>Hardwickia binata</i> (<i>Anjan</i>) can be considered</li> </ul>	<ul style="list-style-type: none"> <li>Social fencing concept may be introduced</li> <li>Pro-poor and pro-shepherd bias is needed in the share of usufructs</li> </ul>
<p><b>Important crop systems</b></p> <p><b>South</b></p> <ul style="list-style-type: none"> <li>Deep and medium black soils: <i>Rabi</i> sorghum, safflower, chickpea, sunflower, groundnut, pigeonpea, cotton</li> <li>Shallow black soils: Pearl millet, short pulses, sunflower, groundnut, pigeonpea (sole or intercropped)</li> <li>Subsoil saline areas: Coriander, safflower</li> <li>Medium to shallow red soils: Groundnut, castor, sorghum, pearl millet</li> </ul> <p><b>North</b></p> <ul style="list-style-type: none"> <li>Medium black soils : Groundnut, castor, pigeon pea, soybean, sorghum, maize, sesame, sunflower</li> <li>Medium to shallow red soils: Pearl millet, mung bean, cluster bean, sunflower.</li> <li>Alluviums: Mustard, chickpea, wheat</li> </ul>	<ul style="list-style-type: none"> <li>Crop choice be made depending on the LGP (length of growing period), farmers priority and economic considerations</li> <li>One emerging point is that better crop husbandry with integrated use of on-farm and external inputs provide stability (case in point is groundnut in Rajkot). However mono-cropping of groundnut need be avoided. So is <i>rabi</i> sorghum.</li> </ul>	<ul style="list-style-type: none"> <li>In-village production of seed of groundnut and other crops must be taken up</li> <li>Proper training and capacity building facilities are needed</li> </ul>
<ul style="list-style-type: none"> <li>Irrigation: Heavy duty crops like sugarcane are taken up</li> </ul>	<ul style="list-style-type: none"> <li>Heavy duty crops need shift to commercial crops, mustard (above Vindhyan belt) and</li> </ul>	<ul style="list-style-type: none"> <li>Proper training and capacity building facilities are needed</li> </ul>

Existing systems	Possible improvements	Action needed
	sunflower (below the Vindhyan belt) with limited water use along with fruit trees, etc	
<ul style="list-style-type: none"> <li>Tanks, percolation tanks, check dams (medium to large) besides soil conservation through bunding is common</li> </ul>	<ul style="list-style-type: none"> <li>Many structures are dysfunctional and warrant rejuvenation through user groups involvement</li> </ul>	<ul style="list-style-type: none"> <li>Needed governmental support may be provided</li> <li>The user groups may have to maintain the structures</li> </ul>
<ul style="list-style-type: none"> <li>Saline water used to flocculate sodic black soils for growing crops</li> <li>Fruit trees: <i>Ber</i>, pomogranate, mango, <i>guava</i>, <i>aonla (Emblica officinalis)</i> with protective irrigation</li> <li>Tamarind, neem, <i>seethaphal (Annona squamosa)</i>, <i>Acacia catechu</i>, mulberry also grown</li> </ul>	<ul style="list-style-type: none"> <li>Drip irrigation should replace the existing systems for fruit trees and vegetables</li> <li>Clean cultivation and individual plant attention needed</li> <li>Besides grasses and fodder legumes, tree components (<i>A. nilotica</i>, <i>Prosopis juliflora (Vilayati babool)</i>) can be grown on degraded lands for fuel and bushes like agave can be considered. <i>Jamun (Syzygium cumini)</i>, <i>Hardwickia binata</i> can also be taken up</li> </ul>	<ul style="list-style-type: none"> <li>Improved genetic stock must be in place</li> </ul>
<ul style="list-style-type: none"> <li>Small ruminants, bovines</li> </ul>	<ul style="list-style-type: none"> <li>Health care and (artificial insemination / breed improvement) introduction of pedigree bulls/rams</li> </ul>	<ul style="list-style-type: none"> <li>Necessary support may be provided through existing programmes</li> </ul>

### C) Wet semiarid ecosystem

Existing systems	Possible improvements	Action needed
<ul style="list-style-type: none"> <li>Commons fast vanishing. Cases of even tank beds being usurped for arable farming. Vegetal cover on hilly areas also degraded</li> </ul>	<ul style="list-style-type: none"> <li>Re-vegetation to reduce erosivity of rainfall. <i>Leucaena leucocephala (Subabool)</i>, <i>Dalbergia sisso (Shisham)</i> along with <i>Sehima – Dicanthium</i> grasses and <i>Stylosanthes hamata</i> fodder legume be taken up</li> </ul>	<ul style="list-style-type: none"> <li>Social fencing concept with pro-poor bias in share of usufructs be developed</li> </ul>
<p><b>Important crop systems</b></p> <ul style="list-style-type: none"> <li>Medium to deep black soils: <i>Kharif</i> sorghum, cotton are traditional along with rice and pigeonpea. Sunflower, soybean are the new additions</li> </ul>	<ul style="list-style-type: none"> <li>Proper seed supply mechanism needed for sustained productivity. Wheat may be discouraged below Vidhyan belt. Safflower and chickpea</li> </ul>	<ul style="list-style-type: none"> <li>The needed HYV seed may be produced <i>in situ</i></li> <li>By encouraging custom-hiring of tractors, second crop in</li> </ul>

Existing systems	Possible improvements	Action needed
<p>supplanting <i>kharif</i> sorghum or taking up in <i>kharif</i> fallows. Double cropping is also practised with wheat, chickpea, safflower as second crops. Sometimes mungbean is taken as first crop</p>	<p>are better. HYB/HYV cotton in medium to deep black soils need specific attention. So is the case with rice. Frequently, the area is small, so neglected. Grown mostly by tribals. Variety needs improvement. Mixing rice and finger millet is a unique practice to cope with vagaries of weather and consequent fluctuations in the moisture regime. Should be fine-tuned. Diversification in the upland rice cropping system is urgently required</p>	<p>these regions is feasible, more so in deep black soils (e.g. Vidarbha, Malwa plateau and eastern part of Madhya Pradesh)</p> <ul style="list-style-type: none"> <li>• Fine tuning in management of temporary stagnation of rainwater in black soil region allows double cropping particularly in the Malwa plateau</li> </ul>
<ul style="list-style-type: none"> <li>• Shallow/medium black soils: <i>Kharif</i> sorghum, pearl millet, sunflower, soybean, pigeonpea, mungbean. Some intercropping taken up with sorghum and also with pigeonpea</li> <li>• Deep to medium red soils: <i>Kharif</i> sorghum, finger millet, groundnut, pigeonpea, maize, pearl millet, horse gram, cowpea. Intercropping also taken up</li> </ul>		
<ul style="list-style-type: none"> <li>• Fruit trees: Mango, citrus</li> <li>• MPTs: Bamboo, <i>Acacia catechu</i> (<i>Khair</i>), teak, <i>sal</i> (<i>Shorea robusta</i>), <i>Tendu</i> (<i>Diospyros melanorylon</i>), mulberry</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of perennials (trees, shrubs and grasses) desirable for control of erosion by runoff. FSR including livestock component should be the priority area of research to support the requirements of perennials</li> <li>• For packing citrus fruits, mango trees are felled. Alternates are available (e.g. <i>Dalbergia sisso</i>, <i>Albizia lebbek</i> (<i>Siris</i>)). Pest management on MPTs needs attention</li> </ul>	<ul style="list-style-type: none"> <li>• A crash programme on fast growing MPTs need be taken up</li> </ul>

Existing systems	Possible improvements	Action needed
<ul style="list-style-type: none"> <li>Water harvesting structures: Common ponds, tanks, sunken ponds in the streams and sunken stretches between fields are seen. High erosivity leads to considerable gully formation. <i>Bandh</i> cultivation practised in deep black soils for <i>rabi</i> crops</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater recharge is possible in black soils with the lentilar structure (Malwa region) as well as in red soil areas. For surface storage prismatic / blocky structure black soil areas (Deccan region) hold promise</li> <li>Gully control through gabions. On farm rainwater conservation with small cross-sectional bunds</li> </ul>	<ul style="list-style-type: none"> <li>Governmental support through existing programmes need be put in place</li> </ul>
<ul style="list-style-type: none"> <li>Bovines, small ruminants</li> </ul>	<ul style="list-style-type: none"> <li>Health care, artificial insemination and introduction of pure bred pedigree males</li> </ul>	<ul style="list-style-type: none"> <li>Governmental support through existing programmes need be put in place</li> </ul>

#### D) Humid (Dry humid, Humid and Per humid) ecosystem

Existing systems	Possible improvements	Action needed
<ul style="list-style-type: none"> <li>Substantial area still remains under forest, shrub jungles and village commons. However considerable degradation still occurring</li> </ul>	<ul style="list-style-type: none"> <li>Rejuvenation of these areas is possible with participatory forest management systems. <i>Alnus nepalensis</i> (Alder); <i>Grewia optiva</i> (Bhimal); <i>Sal</i>, <i>Tendu</i> can be considered</li> </ul>	<ul style="list-style-type: none"> <li>Elite trees be identified and propagated</li> </ul>
<ul style="list-style-type: none"> <li>Shifting cultivation is practised in slopy lands. Even fruit plants like pine apple are grown in high slopes</li> </ul>	<ul style="list-style-type: none"> <li>Shifting cultivation is gradually phasing out. Associated land degradation can be moderated through appropriate soil conservation measures</li> </ul>	<ul style="list-style-type: none"> <li>Encourage Alder or fruit trees in agricultural fields aiming at agroforestry so that shifting cultivation phases out at a faster rate</li> </ul>
<ul style="list-style-type: none"> <li>Slopes beyond 30% also cultivated</li> </ul>	<ul style="list-style-type: none"> <li>Encouraging the stakeholders to go for horticulture is a possible moderator</li> </ul>	<ul style="list-style-type: none"> <li>The needed saplings be obtained from NEH complex, Barapani (ICAR)</li> </ul>
<ul style="list-style-type: none"> <li>Rice is mostly grown as staple crop. Others include finger millet, niger, sweet potato, cassava, horse gram grown on the slopes. Sugarcane is also grown as rainfed, in the plains</li> </ul>	<ul style="list-style-type: none"> <li>Rice is life in this region. Grown in all locations-uplands, medium lands and lowlands. Uplands need special attention with diversification to more remunerative crops like groundnut. The medium and low lands and banded uplands require specific technological options. Sweet potato and cassava cultivation need improvement through</li> </ul>	<ul style="list-style-type: none"> <li>Production technologies need fine tuning depending on the slope of the land</li> </ul>

Existing systems	Possible improvements	Action needed
	introduction of better varieties	
<ul style="list-style-type: none"> <li>Second crop is taken through <i>paira</i> cultivation. In plains second crop of wheat, mustard or chickpea are taken</li> </ul>	<ul style="list-style-type: none"> <li>By early transplanting or seeding, second crop is certainty. Stand establishment of the second crop with minimum disturbance to the soil is a distinct possibility. If needed a come-up irrigation may be advantageous. Groundnut has a good potential and a specific programme be built up. Technologies are available</li> </ul>	<ul style="list-style-type: none"> <li>Come-up irrigation for the second crop and initial irrigation for growing paddy nurseries is feasible with shallow tube / open wells.</li> <li>A specific programme on groundnut can be mounted in the region</li> </ul>
<ul style="list-style-type: none"> <li>Growing vegetables along with arable crops is a common feature. Some farmers grow vegetables with protective irrigation through inverted pyramid wells dug in the fields</li> </ul>	<ul style="list-style-type: none"> <li>Should be encouraged for better nutrition. Better varieties be introduced</li> </ul>	<ul style="list-style-type: none"> <li>Improved vegetable seed is needed</li> </ul>
<ul style="list-style-type: none"> <li>Besides the oil seed crops like niger and groundnut, farmers also grow commercial crops like turmeric and ginger</li> </ul>	<ul style="list-style-type: none"> <li>Turmeric and ginger are locally accepted/grown crops. Varietal changes could be the first attempt</li> <li><i>Sal</i> leaves are used as mulch. Forest Department restricts use of them to protect <i>sal</i> trees. This clash needs a scientific solution through participatory management approach</li> </ul>	<ul style="list-style-type: none"> <li>Since turmeric and ginger are already grown locally its improvement in production is feasible</li> <li>The OUAT may look into the problem of <i>sal</i> leaves, besides supplying the improved varieties of turmeric and ginger</li> </ul>
<ul style="list-style-type: none"> <li><i>Diara</i> lands are put to short duration crops (<i>Satta</i> maize) in <i>kharif</i> followed by a poor second crop. <i>Tal</i> lands are put to post-monsoon crops which some-times fail for want of proper plant stands</li> </ul>	<ul style="list-style-type: none"> <li>A good crop establishment is difficult as the top soil dries up. A come-up irrigation helps. Shallow wells/tube wells are possible. They help in decongestion of the area</li> </ul>	<ul style="list-style-type: none"> <li>To provide come-up irrigation for <i>rabi</i> crop and to decongest the area during the later part of <i>kharif</i> season, shallow open / tube wells programmes must be taken up on an massive scale</li> </ul>
<ul style="list-style-type: none"> <li>Homesteads for meeting family needs</li> </ul>	<ul style="list-style-type: none"> <li>The plant material in use can be improved with better varieties of vegetables and fruit trees. The fish quality in the ponds also needs improvement</li> </ul>	<ul style="list-style-type: none"> <li>Necessary financial support may be provided</li> </ul>

Existing systems	Possible improvements	Action needed
<ul style="list-style-type: none"> <li>Traditional soil and water conservation system, among others, includes</li> </ul> <p><u>Soil conservation</u></p> <p>Terracing slope lands</p> <p>Bunding flat lands</p> <p>Providing levees</p> <p><u>Water conservation</u></p> <p><i>Pynes, Ahars and Talabs</i></p> <p>Shallow tube wells or wells</p> <p><i>Zabo</i> system</p> <p><i>Gool/Kuhl</i> system</p> <p>Farm ponds in homesteads</p>	<ul style="list-style-type: none"> <li>Existing systems are good and can be fine-tuned to properly provide surplussing without loss of added nutrients from field to field</li> <li>Energising the system of shallow tube wells provides great opportunities for early nurseries of rice and come-up irrigation to the second crop</li> </ul>	<ul style="list-style-type: none"> <li>Necessary financial support may be provided even to finance improvement / replication of traditional systems</li> </ul>
<ul style="list-style-type: none"> <li>MPTs and horticulture, among others, include</li> </ul> <p><u>MPTs like Alnus, Sal, Bamboo Bhima, Mulberry, and Horticulture</u></p> <p>Of Mango, Guava, Litchi, Jack etc</p> <p><b>Livestock: (Bovines, small ruminants and piggery)</b></p>	<ul style="list-style-type: none"> <li>Improvement through better genetic stock possible</li> </ul> <p>Health-care and breed upgradation of livestock. Better breed of pigs need attention</p>	<ul style="list-style-type: none"> <li><i>Kisan</i> nurseries in close association with RAU, BAU and other may be taken up for supplying state universities, the seedlings of fruit trees and MPTs</li> </ul> <p>Provide necessary facilities through existing programmes</p>

Given under are key considerations to be kept in mind in taking forward the above proposals.

- Develop and improved agricultural technologies adapted to local context – ecologically, culturally, locally developed biological and technical measures and build on and improved indigenous practices and species, whenever possible.
- Emphasize the maintenance of the land’s productivity, rather than limiting soil loss.
- Act to prevent of land degradation rather than the treatment of symptoms.
- Use biological (agronomic) technologies, e.g. agro forestry, and plant species that provide cover, organic matter, wood, fodder, food, soil nitrogen, etc.
- Emphasize productive diversity so as to minimize short-term risks both for farmer and land.
- Employ physical measures only when necessary and as supplements to biological measures.

- Promote techniques whose benefits can be captured by women and others secondary tenure rights holders (planting of grasses or bushes along contours).
- Promote techniques that accomplish more with less – i.e. economize on water/nutrients.
- In arid areas, for sustainability, ensure that plans to increase biological production are based on thorough understanding of the local water balance.
- Avoid ‘comprehensive’ land-use planning approach in which land capability is determined by elaborate physical surveys carried out by outsiders and imposed upon local land users.
- Encourage simple land-use planning by the land users themselves, with only complementary support from outside expertise and as locally requested and finalize the works plan through dialogue. The planning process is as important as the plan itself.
- When promoting land husbandry on a catchment basis, respect administrative boundaries as being more important than hydrological ones, as this reinforces the management capacity of existing institutions.

## **Annexure II**

### **Restructuring Current Physical Land Development Activities**

This follows recommendation 2 given in page 11. The current physical land development activities need improvements with the objective of ensuring the following - check erosion, diversify land-use to reduce vulnerabilities, incorporate fodder or grass plantation, check siltation of the water bodies in the downstream, finally enhance percolation to enrich soil moisture regime and finally augment ground water. Given are some examples that are suggestive and not comprehensive as several other validated approaches are found on the ground to serve the stated objectives.

#### **1. Staggered Trench**

A staggered trench helps in-situ water conservation wherein pits are excavated across the slope of the land that without bunds or terrace to collect runoff and allow gradual percolation into the soil mass. It is a low-cost soil and water conservation to substitute conventional measures such as contour bunds/trenching. Each trench is about one foot in depth and located directly below one another in alternate rows with the excavated soil serving as a bund for plantation or growing grasses that is planted in the space between the trench and the bund. The soil quality determines the type of vegetation that it can support.

The trench and the bund together act as a barrier to the runoff and check soil erosion. Again the accumulated water in the trench and behind the bund percolates down the soil to enhance soil moisture that increases biomass production from the otherwise unproductive lands. As often such soils are hard it is preferable to begin trench work when the soil is wet and labor is not engaged in agricultural operations. This is particularly useful in hilly regions where the slopes are high and where at least one foot deep soil can be excavated manually. This technique must be adopted on common land or government land with trench big enough to store expected runoff volume and bunds behind the trenches again provide for additional

storage in case the runoff exceeds the average. Land treatment with staggered trench should start from the ridgeline. A diversion channel has to be constructed, if for some reason the treatment cannot be started from the ridgeline, to prevent entry of runoff from above into the treated patch and dispose it off safely.

There is another approach to contour bunds and suited to high rainfall areas and easier for villagers to construct. Here a pit is dug at the lowest point of each such plot and the excavated earth from the pit is used to make two of its bunds. The steps here are:

- Divide and mark the selected area into 30 X 40 ft, starting from the ridgeline, with the help of measuring tape, rope, and lime. The size of the plots may be altered up to  $\pm 10\%$  to fit to the boundary and ownership.
- Identify the lowest point in each plot.
- Dig a 3 ft deep pit that is 7 X 7 ft at the top. The pit should have a sloping wall such that the bottom of the pit is 5 X 5ft.
- Bund the plot with the excavated soil from the pit. The bund across the slope should be 1 ft high with a top width of 1 ft and bottom width of 2 ft.
- Use the rest of the excavated earth to construct the field bund at the side, along the slope.

## **2. Field leveling and bunds**

Field leveling and bunds make a plot suitable for agriculture by

- uniform distribution of soil moisture
- retention of soil and manure
- better drainage and use of irrigation water where available

Field bunds are generally done in uplands, having less than 3% slope, to be used for intensive agriculture. The upstream side and mounds of the plot are cut to fill its downstream side, depressions and bunds to almost make a level field. Sloping fields are leveled and bunds constructed by using either earth or rocks. A bund is an earthen or rock embankment made around an agriculture plot to conserve soil and moisture. Rocks are used when they are easily available and there is a thin layer of topsoil.

They are employed on gentle slopes for the purpose of preparing level fields. Where the soils are clayey and rainfall is high, the fields are provided with a grade across the slope to drain away the excess runoff. Its purpose is to break long slopes into a series of level fields for cultivation, reduce run-off and soil erosion and increase infiltration. The people who have undulating land can adopt this technique, as it brings about efficient water application to the crops. Irregular, uneven lands do not hold soil moisture and so land leveling is necessary to level out sloping lands. This helps in increasing soil moisture as well as its uniform distribution across the plot.

The horizontal spacing of the bunds should be such that they are not close to make agricultural operation difficult. At the same time they should not be far away to make the leveling difficult. The

spacing of bunds must vary according to the slope. For instance, steeper slopes will result in narrower strips for cultivation. The steps in field leveling and constructing bunds are:

- After the selection of the patch for leveling and bunding, plan plot boundaries and drainage system considering the ownership and topsoil depth. The topsoil depth has to be kept in mind, for deciding the width of plots along the slope. After cutting the earth from upstream side of the plot for field bunds, at least 6" topsoil has to be ensured for crop cultivation. In case of thin topsoil, plots will be of smaller width.
- Mark the ground boundaries, along which bunds have to be laid, with a rope and lime powder. Make the bunds and fill up the depressions of each plot by removing a thin layer of topsoil from the adjacent upper slopes and mounds. While removing the topsoil care should be taken not to expose the hard strata that are not suitable for cultivation. In extreme cases the top soil may be kept separately and replaced once the final level of the plot is attained.
- Construct the bund as follows: The top width of the bund ranges from 0.5-1.5 ft depending on its height. The side slope is 1:1. The height of the bund will be such that the plot holds enough run off to maximize moisture conservation without causing inundation. It should at least be of 1' height. Usually the bund should be made 30% higher than the design height to provide for settlement.

To drain the excess run off from the field, construct a small surplus escape on the lower field bund with local stones. The top of the spillway should be at least 6" below the top of the bund. The small bunds should be protected by establishing grasses and the big ones by providing stone pitching with local material. The exact site of the spillway is to be fixed after discussion with the landowners of the surrounding plots.

### **3. Water Storage**

We need in-situ rainwater harvesting suitable for medium uplands, in which every plot has its own water body, the area of which equals 5% of the total area of the plot. It is able to hold rainwater that otherwise flows out of the plot as run off. The water held in the pits would irrigate the plots during water scarcity. The length is one-fifth of the length of the plot and the width is one-fourth of the width of the plot and constructed in the following way after measuring the length and width of each individual plot.

1. Demarcate 5% area of the plot in the following manner. Mark an area of one-fifth of the length and one-fourth of the width at the upper right corner of the plot to dig the pit. A simple illustration may be of help. Suppose a plot is 150 ft. long and 100 ft. wide, the pit area needs to be 30 ft X 25 ft or 750 square feet.
2. The pit dug to the following dimensions: depth: 8-10 ft depending upon the type of the soil and wall slope 1:1.
3. Use the excavated earth to fill the depressions and strengthen the field bunds.
4. Make a small 4" high bund around the pit to keep some standing water in the field.

The above not only saves the crop in the plot but also increases percolation to augment water availability in the downstream. Additionally, this treatment increases the farmer's access to

water as there is a storage structure in each of his plots. So the farmer can exercise individual choice to best utilize it. The 5% model has been successfully experimented in this agro-climatic zone for the above two purposes. The core idea of the 5% model of in-situ rain water harvesting is that every plot should have its own water-body to hold runoff that otherwise was flowing out of the plot.

This treatment is suitable for a patch of minimum 4 hectares with unidirectional slope where crop fails due to regular water stress. The patch should have good soil cover with moderate porosity. The norm for allocating 5% area is not sacrosanct. One needs to consider land qualities and farmers' preferences and other crop plans. A bigger pit is required to store more water. While laying out the pits in successive plots along the slope, one needs to make sure that pits are, not in a straight line, rather staggered.

#### **4. Loose boulder Checkdams:**

This is one of the temporary structural measures for gully control adopted where plenty of loose boulders are available locally. They are constructed in series across the gully bed to stop channel erosion. By reducing the original gradient of the gully channel, they diminish the velocity of water flow and the erosive power of run-off. They convey the peak run-off safely. They have a life-span of three to eight years and collect and hold soil and moisture in the bottom of the gully. Tree seedlings, as well as shrub and grass cuttings can be planted in gullies without being washed away by flowing water.

Thus, they facilitate establishment of a permanent vegetative cover afterwards. They are used in 100-1000m long gullies with a catchment area of 20 ha or less. To avoid falling and damage to the likely vegetation, their heights are kept low. They are not necessary on those gully portions that are not affected by channel and lateral erosion due to continuous rock outcrops along their gully beds. They may also be combined with retaining walls parallel to the gully axis in order to prevent the scouring and undermining of the gully banks. They continue functioning if the gully catchment is well vegetated.

The check dams are advised to be placed along the gully in such a way that the top level of the lower one nearly matches with the bottom level of the upper check dam. However, they can be placed along the gully at a gradient up to 3%, called compensation gradient. The lowest check dam in a gully at the junction point of the gully to the main stream or river, lake or reservoir should preferably be constructed on a stable point such as a rock outcrop. If there is no such stable point, enough precaution has to be taken to make it stronger. The points where the other check dams are to be built are determined according to the compensation gradient and the effective height of the check dams. The height of these check dams above the gully bed is normally kept within 1m and its foundation depth at least 0.5 m.

This means that the top of the check dam, in the middle of the stream, is 1m above the bed level. They are preferably placed on the narrowest parts of the gully in order to reduce

construction costs. The thickness of the dam at spillway level is 0.5m. As the material used in the check dam has a high angle of repose, the upstream slope of the check dam should be fixed at 1:1 in general, to be varied only in exceptional cases where the structure has to handle very high volume of runoff of high velocity. The downstream slope of the boulder check can vary from 2:1 to 4:1 depending on the volume and velocity of runoff. The higher the volume and velocity of runoff, the flatter is the slope. The downstream slope is given for two reasons - absorb the impact of water that enters the structure at a high velocity; and drain out water from the structure and make it trickle-through at a non-scouring velocity. Boulder check dams are made in a series along the drainage line, with each structure dividing the total catchment of the drainage line into smaller sections.

1. Boulder checks should not be made at a point where the bed slope of the drainage line is above 20%. This reduces its capacity to hold water and trap silt. The flatter the bed slope, the more would be the storage per unit height of the structure.
2. A boulder check dam should be made where the embankments are strong and stable, and high enough to accommodate the peak flow.
3. No checks should be constructed where boulders are not adequately available within a radius of 50m.
4. Maintenance of these must be continued for at least two years after the treatment year. Treated areas must be inspected at least once a year.

#### **5. Diversion channel or Grassed water way**

Waterways are constructed to carry runoff from the upper catchments at a safe velocity to a natural drainage line without forming a gully. Waterways are vulnerable to erosion caused by water flow. Many farmers make the waterways too narrow to avoid wasting land that leads to erosion within them. So they should be carefully designed, constructed and maintained to reduce its risk of failure by erosion. When waterways are constructed to intercept and divert runoff away from agricultural land or habitations into natural drainage or water storages, they are called diversion channels. The typical uses for diversion channels are:

- above the patches treated with 30-40 or contour/graded bunds to intercept runoff from areas above cropping land and direct it to a waterway
- in strategic locations within cultivated patches where it is required to divert runoff from entering the low lands and take it through uplands and medium lands before joining a waterway and collect runoff from cross road drainage points and direct it to a waterway

#### **6. Earthen tank or Water Harvesting Tank**

Earthen structures constructed mostly across the drainage lines to store water for irrigation, fishery, domestic use or livestock. Its size is usually dictated by the availability of adequate land. In rare cases one gets to design and build a tank of a desired size to meet the water requirements of the community. The step is to determine the catchment area, above the tank site, from where the run off would be collected to fill the pond. Thereafter the location, alignment and height of the earthen bund are decided, as also the location and size of the spillway to evacuate the surplus monsoon discharge.

## **Annexure III**

### **Select Field Examples of Next Practices**

Shashwat, a NGO in Ambegaon Tehsil of Pune district has carried out terracing on private lands in the upper reaches of the Dimbhe dam. As a result, lands which produced minor millets have started producing paddy. Food availability which previously lasted for 4 to 6 months for the families involved went up to 8 to 10 months post terracing. A bonus benefit is the prevention of silt transport into the Dimbhe dam significantly adding to the design life of the dam. Here traditional system of community mutual aid (Padkai) helped convert the uplands into terraces. Village youth were trained for the measurement work which was then only cross checked and certified by the departmental staff. Community mobilization has led to making this happen.

SERP in AP with the help of self help groups has pioneered an innovation in MGNREGS which is promising. Here on individual lands, continuous counter trenches on the top field and stand alone trenches are dug at various places within the field so that water is harvested to flow through them into the farm pond. Diversion drain is also dug to allow excess to flow out. Then each farmer has a compost pit and green manure crops will be planted and this along with the crop waste will be used for composting. In addition conservation furrows are dug in the field for each four meter gap with a depth of fifty centimeters. The furrow bunds are planted with perennials variety of red gram. In addition to these and at the start silt application is taken up on the individual land along with pits for horticulture. This approach has enabled the land to absorb and store rain water in various places or sink into the soil and be available for plant growth. Cropping is also advised and done across the slope so that the runoff is smooth and as much as possible water is absorbed in the soil or available on the land. This explains the value of rigorous and integrated planning.

Tree Based Farming Systems is the approach of BAIF wherein activities are planned in compact blocks of 100 hectares of farmer's lands. The support on individual farmers land can range from one acre to one hectare. The project is 5 to 6 years of which material/input support activity is of 3 years, and last 2-3 years is wage support until the productivity starts. During first three years major material support is also needed and for this location specific 60- 40 norm details are worked out. Some material is sourced from the area itself, seedlings, while neem cake, seedlings, seeds, etc are be sourced from outside. In the first three years land productivity enhancement through water and soil conservation measures along with standard watershed treatment with intensive thrust on landscape greening. Here technology and size integration are seen as the basis for its effective outcome.

The summary table given below is the approach of WASSAN, an organization well experienced on watershed being evolved under AP Drought Adaptation Initiative for asset improvement.

<b>A. Enhancement of soil fertility:</b> Fertility and productivity of the soils improvement by rectification of soil problems, establishing mechanisms for regular application of organic matter and bringing about appropriate changes in crop patterns/ rotations.			
1)	The status of soil organic matter during the crop season improved through changes in the crop systems, appropriate agronomic measures, application of compost and tank silt application.	<ul style="list-style-type: none"> <li>• Tank silt application,</li> <li>• Promoting composting (aerobic and vermi), green manure &amp; mulching and other practices.</li> </ul>	Improve soil physical and biological and chemical properties. Reduce soil nutrient deficiencies including micronutrient deficiencies
2)	Rectification of the problem soils (salinity, alkalinity, acidity, water logging, stone clearance etc.)	Warping, gypsum application, addition of green manures, stone / bush clearance etc.	The soil productivity is improved. Problem soils will be brought under cultivation.
<b>B. Biomass development:</b> in both private and common lands provides critical support for soil fertility enhancement, increasing fodder base (tree and grass) for large and small ruminants, fuel, fruits and income diversification.			
3)	Development of tree biomass within the farms – on bunds and allocated areas – particularly fodder trees and biomass for soil productivity.	<ul style="list-style-type: none"> <li>• Multi-species nursery raising,</li> <li>• plantation, protection and watering – in private lands (bulk / on bunds)</li> </ul>	<ul style="list-style-type: none"> <li>• 50 fodder, 5 fruit and 100 other trees to improve soils.</li> <li>• Biomass compost and green leaf manure along with fodder.</li> </ul>
4)	Rain fed horticulture integrated into the farming systems	Purchase /nursery raising, plantation, protection and watering	<ul style="list-style-type: none"> <li>• At least 10% area in dry land horticulture species as part or bulk plantations.</li> </ul>
<b>C. Diversification of crop systems and promoting sustainable agriculture:</b> Establishing support systems, especially in the supply of seed material of diverse crops, integrating millets/ pulses into mono-crop systems and promoting diversified crop systems and crop rotations will enhance the adaptive capacity.			
5)	Crop systems are diversified to include intercrops that provide fodder and improve soil fertility.	<ul style="list-style-type: none"> <li>• Infrastructure for seed banks – fodder and food</li> <li>• Harvest green manure and crop residues.</li> </ul>	Enable multiple crop cultivation.
<b>D. Regeneration of commons:</b> Patches of common lands or water bodies will be conserved and biomass in such lands is enhanced.			
6)	The common lands (including water	Conservation and	Location specific with

	bodies) and private fallows within the block will be developed into quality pastures/ fodder plots.	development of resources, plantation (if required) and pasture development as per the local needs.	focus on vegetative and measures
<b>E. Extending Protective Irrigation</b>			
7)	<ul style="list-style-type: none"> <li>• Protective irrigation expanded to most of the 100 ha block depending on the local opportunities/ negotiations</li> <li>• Restoring the irrigation potential of water bodies by</li> </ul>	<ul style="list-style-type: none"> <li>• Protective irrigation to rain fed lands from water bodies.</li> <li>• Support trenching and laying of pipelines for extension of critical irrigation</li> <li>• Repair/maintenance of irrigation canals, water bodies/feeder channels.</li> </ul>	Location specific & based on opportunities of availability of water.