
UNIT 1 DROUGHT PRONE AREAS PROGRAMMES & DESERT DEVELOPMENT PROGRAMME (DPAP & DDP)

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1.0 OBJECTIVES

On completing this unit, you should be able to:

- state the main objectives of the Drought Prone Areas programme (DPAP) and the Desert Development Programme (DDP);
- describe the importance of watershed approach in DDP and DPAP;
- analyse the strengths and weaknesses of these programmes; and
- explain the ways and means of improving people's participation in these programmes.

1.1 INTRODUCTION

Sizable proportion of the total land area of the country falls under arid, semi-arid or/and dry sub-humid categories and is either subject to desertification or identified as drought prone dependent on dry land agriculture. A *drought* is a long period of dry weather caused by a shortfall in the usual rainfall in a given time period of more than

a certain percentage, usually 50% in the sowing season. A drought prone area is characterized by continuous degradation of land, depleting water resources, decreasing productivity of crops, livestock and human resources, hunger and malnutrition and out-migration of both human and cattle populations in times of distress. Most of our arid land mass falls in the desert category and due to very low rainfall, low productivity and extreme climatic conditions is also subject to frequent droughts.

For the overall development of land, water and other natural resources, there are many programmes under implementation in our country. In this unit, we are going to discuss two of these important area development programmes, namely the Drought Prone Areas Programme (DPAP) and the Desert Development Programme (DDP).

1.2 AIMS AND OBJECTIVES OF DPAP AND DDP

The DPAP and the DDP aim at restoring the ecological balance through soil and moisture conservation measures on watershed basis. In the present framework, these 'area development programmes' aim at involving village communities more meaningfully in planning, implementation and the management of the economic development activities within watershed projects in rural areas through the Panchayati Raj Institutions (PRIs). The objectives of DPAP and DDP are:

- i) Developing wastelands/degraded lands, drought-prone and desert areas on watershed basis, keeping in view the capability of land, site-conditions and local needs.
- ii) Promoting the overall economic development and improving the socio-economic conditions of the resource poor and disadvantaged sections of the society.
- iii) Mitigating the adverse effects of extreme climatic conditions such as drought and desertification on crops and human and livestock populations for the overall improvement.
- iv) Restoring ecological balance by harnessing, conserving and developing natural resource base, i.e. land, water and vegetative cover.
- v) Encouraging village the community for active participation in the planning and implementation of developmental projects and the sustainable maintenance of the assets created through their collective wisdom and indigenous technology.

1.3 NEED FOR DPAP

The first systematic effort to tackle the problem of drought and desertification started during the Second and the Third Five Year Plans. The problem of drought-affected areas was mainly addressed through Dry Farming projects, spread over a few areas, with emphasis on moisture and water conservation measures.

The origin of DPAP may be traced to the Rural Works Programme (RWP) that was launched in 1970-71 to create assets designed to reduce the severity of drought in the affected areas. For this, the programme entailed long-term strategy in the context of conditions and the potential of the drought prone districts. RWP identified 54 districts, along with parts of another 18 districts contiguous thereto, as drought prone for its purposes. The programme initiated labour-intensive schemes, viz. medium and minor irrigation, road construction, soil conservation, and afforestation measures, which then covered 12% of the country's population and about 20% of geographical area.

The mid-term appraisal of the Fourth Five Year Plan re-designated the RWP as the Drought Prone Areas Programme (DPAP) launched in 1973-74 to tackle the special problems faced by those areas that were constantly affected by severe drought conditions.

1.4 EVOLUTION OF DPAP AND DDP

1.4.1 DPAP

Over the years, the increase in human and livestock populations in the drought prone and desert areas had reduced the natural resources of certain very arid areas under relatively greater stress. The major problems included continuous depletion of vegetative cover, increase in soil erosion and fall in ground water table. All these factors amounted to spirally diminishing productivity of land and loss of natural resources. The situation would have been worse had some highly focused area-specific development programmes not been started in these regions.

During the Fifth Plan (1974-75 to 1978-79), DPAP followed the strategy and approach of 'integrated area development' as envisaged by the Task Force constituted by the Planning Commission in 1971 under the Chairmanship of Dr. B. S. Minhas, then Member Planning Commission. The Task Force had recommended that the programme should aim at:

- integrated development of agriculture with focus on conservation, development and utilization of land, water, livestock and human resources in the optimum manner, and
- providing more stable income and employment to the weaker sections of the rural society.

1.4.2 DDP

On the recommendations of the National Commission on Agriculture, in its Interim Report (1974), the *hot desert areas* were identified for the implementation of a programme comprising afforestation and livestock development. As for the *cold desert areas* of Jammu & Kashmir and Himachal Pradesh, the National Commission (in its Final Report, 1976) recommended that their specific problems should be studied in depth.

The above recommendations lead to the Desert Development Programme (DDP) in the year 1977-78. DDP programme was implemented on sectoral basis to develop poor areas in the long-term. It was launched in both the hot-desert areas of Rajasthan, Gujarat and Haryana, and the cold-desert areas of Jammu & Kashmir and Himachal Pradesh.

Till 1994-95, DPAP and DDP were implemented in the *programme states* in a segmented and isolated manner and watershed as a unit of *area development* was completely lost sight of. The sectoral autonomy leading to over-centralization of the process of making decisions, giving sanctions and administrative control completely diluted the Integrated Watershed Development as the key to the restoration of ecological balance. Investments under these programmes as well as those for other drought-desert mitigation measures were liberally used for sectoral activities, such as soil conservation, minor irrigation, ground water exploitation, social forestry, sericulture, horticulture, etc. without paying any attention to the integration and comprehensive development of land and water resources. Within each sector, separate allocations were made for each activity to be undertaken in the programme area. Isolated implementation of wide ranging sectoral activities over widely disjointed areas of very small sizes failed to bring about any noticeable impact and the programme objectives were remained unfulfilled.

1.5 REVISION OF DPAP AND DDP

The implementation of DPAP and DDP, effected in a fragmented manner by different line departments through rigid guidelines and without well designed plans, did not bring about the desired achievements. The programmes could not attend to people's concerns, as the participation and involvement of the local inhabitants was missing. Despite a substantial expenditure of over Rs.1700 crores under DPAP and about Rs.550 crores under DDP, since the inception of these programmes till 1993-94, the appraisal of the impact of the activities undertaken revealed discouraging outcomes at the macro level, as no significant improvement in vegetative cover, ground water table, supply of drinking water, fuel and fodder was observed to be registered in the *programme areas*. The 5.7 million hectares of area treated during the period, under DPAP constituted only 10% of the total area to be covered. The area treated under DDP was 0.51 million hectares that accounted merely 1% of the total programme coverage. This necessitated revamping of the strategy for the implementation of these programmes.

Accordingly, a *High Level Technical Committee* was constituted under the Chairmanship of Prof. C.H. Hanumantharao, then Member Planning Commission. The Committee reviewed the programmes comprehensively and subscribed to its approach on all aspects, viz. Programmes Strategy, Planning and Implementation, People's Participation, Programme Contents, Monitoring & Evaluation, Integration with related Programmes, Research & Training and Administrative Setup. The Committee, however, re-identified the blocks for treatment under DPAP and DDP by adopting more methodical and scientific criteria.

The Technical Committee identified the following as the major causes for the unsatisfactory performance of DPAP and DDP under Sectoral approach:

- Diffused focus on the efforts (because of a multitude of activities over widely dispersed areas of very small sizes) for achieving the core objectives of the programmes.
- Ad hoc planning without integrating the approaches to land and water management.
- Planning was done without people's involvement.
- Non-viable work plans in the absence of multi-disciplinary agencies at the watershed, block and district level.
- Plans not oriented to the local needs and indigenous and/or vetted technologies not used for the programme activities.
- No appropriate mechanism for the maintenance of the assets created.

The Technical Review Committee visited a large number of areas to take stock of the ground realities and held discussions with the government, the beneficiary communities, public representatives, Voluntary Organizations, etc. and underlined a strategic approach for the implementation of DPAP and DDP, envisaging the following major **tenets**:

- Treatment and development of degraded lands in drought prone and desert areas to be taken up compulsorily on watershed basis, covering contiguous micro-watersheds of 500 hectares that have primarily community lands and may encompass private and revenue lands and tracts of degraded forests.
- Implementation of DPAP & DDP with the total participation of the beneficiaries, with adequate representation to women, SCs/STs and other weaker sections, in planning and decision making activities.

- Development of areas through people's own work plans prepared with the assistance of Multidisciplinary Technical Teams using low cost indigenous and labour oriented technologies facilitating employment of the local people.
- Positive role of Voluntary Organisations for bringing about coordination between people's organisations and District Funding Agencies for purposes of project implementation and for extending public awareness and imparting training to the stakeholders.
- Transfer of programme assets to the community for maintenance and usufructs sharing among the beneficiaries.
- Creation of exclusive Nodal Watershed Departments in the States for administrative revamping in the government, and provision of assistance by a Multi-disciplinary Team of senior officers from Departments of Forests, Agriculture, Soil Conservation, Animal Husbandry, Horticulture, Minor Irrigation, etc. at the district level.
- Unified approach and convergence of all the rural development programmes with various departments/ministries to ensure a multiplier effect in area resource development and economic development of the resource poor.
- Effectively monitor and evaluate the programmes to ensure their implementation in accordance with the watershed approach and strategy.

In addition to suggesting the criteria for watershed development to the Government, the Hanumantha Rao Committee also worked to identify coverage under DPAP and DDP.

Accordingly, the Department of Land Resources in the Ministry of Rural Development, that *inter alia* administers DPAP and DDP, formulated the *Guidelines for Watershed Development* for implementing these programmes in the project mode with effect from 1995-96. The Guidelines were reviewed in the year 2001 to develop a contemporary outlook and a more practicable approach; an objective realized six years after the original Guidelines were framed. The role of Panchayati Raj Institutions (PRIs) in watershed development programmes got specified to a limited extent in the *Revised Guidelines-2001*. Since the Ministry of Rural Development has been committed to strengthen Panchayati Raj, its policy of devolution of powers to PRIs by the States in consonance with the 73rd constitutional amendment, motivated the framing of *Hariyali Guidelines* to further the active role of PRIs in the watershed programmes. The revised Hariyali Guidelines were applicable to DPAP and DDP with effect from April 1, 2003. The basic framework in all these Guidelines, however, is based on the recommendations of the High Level Technical Committee and the current objectives and strategy of DPAP and DDP owe much to them.

Check Your Progress I

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) What are the objectives of DPAP and DDP?

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- 2) Identify four major recommendations made by the High Level Technical Committee that reviewed DPAP and DDP.

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Box A

Total Water Management New Lease of Life

Watershed project under DPAP was taken up in 1995-96 in village Dantha of district Khandwa, M.P. in 823 hectares of micro-watershed. The village was facing persistent droughts, half of the land lied fallow, 22 of the 46 wells remained dry through out the year, cattle died of hunger, bunches of villagers migrated out every year for livelihood.

Total Water Management for prosperity:

Villagers were organized, training imparted, Participatory Rural Appraisal (PRA) exercises done and the work plan prepared. Works started in 1996, total water management approach was adopted for ridge to valley treatment, series of drain line earthen check dams and continuous contour trenches were built, field bunds and kundis were made not to allow the water to flow more than 10 metres for very effective recharge, so much so that if it rained 20 cms. a day, not even a drop would go down the drain.

The water requirement of the village was 97.3 hect. mt. against which only 12.5 hect. mt. were available. Beginning 2001, villagers got a new lease of life, as after the treatment, the village had the resource of 305 hect. mt. and did not face the pinch of scarcity even during the severe droughts in 2001 and 2002. All the 46 wells not only have water through out the year, 102 new wells have been sunk and the ground water level has jumped as much as 40-60 feet providing enough water for rabi crop.

Total agricultural area went up from 300 hectares to 421 hectares, the productivity from 16-19 quintals to 30-35 quintals and the area which could hardly grow jowar, now grows soyabean, moong, potato and vegetables.

The village has emerged triumphant by effecting total drought proofing and has marched on to prosperity.

Source: Watershed Mission, M.P.

1.6 COVERAGE UNDER DPAP AND DDP

As identified by the Technical Committee, DPAP has a coverage of 74.6 million hectares spread over 182 Blocks in 16 States namely, Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Rajasthan, Uttaranchal, Uttar Pradesh and West Bengal. DDP is being implemented in 235 Blocks across 7 States

with the treatment coverage of 45.8 million hectares. These included Andhra Pradesh, Gujarat, Haryana, Karnataka, Rajasthan (all hot-desert areas), and Himachal Pradesh and Jammu and Kashmir (cold-desert areas). Three biggest States under DPAP coverage are Maharashtra, Andhra Pradesh and Karnataka with an area of 19.4 million hectares, 9.9 million hectares and 8.4 million hectares respectively. Under DDP, Rajasthan is the biggest recipient of the central funds for having the maximum coverage of 19.8 million hectares. Jammu & Kashmir and Gujarat follow with DDP coverage of 9.6 million hectares and 5.5 million hectares respectively.

Criteria for Identifying the Areas to be covered under the Programmes

The Committee adopted scientific criteria based on parameters of precipitation, percentage of irrigated area, evapo-transpiration, etc. to estimate the Moisture Index for a block that forms the basic unit of DPAP & DDP coverage. The Moisture Index is the function of Precipitation and Potential Evapo-transpiration and is defined as follows:

$$MI = \frac{(P - PE)}{PE} \times 100$$

where P = Precipitation

PE = Potential Evapo-transpiration

While the Committee considered rainfall and percentage irrigation as only the broad indicators, the Moisture Index actually determined the dryness or aridity of the blocks and categorized them under different Climatic Zones to qualify them for treatment either under DPAP or DDP as shown below:

Moisture Index (M1)	Climatic Zone	% Irrigated Area	Permissible Programme.
<-66.7	Arid	< 30%	DDP
-66.6 to - 33.3	Semi-arid	< 20%	DPAP
-32.3 to 0	Dry Sub-humid	< 1%	DPAP

The Committee classified the desert and drought-prone areas into three eco-systems, viz. arid, semi-arid and dry sub-humid and recommended DDP for blocks under arid and DPAP for blocks under semi-arid and dry sub-humid zones. It also prescribed that the arid and semi-arid blocks having respectively more than 30% and 20% of their net cultivated area under irrigation are not to be included in DDP/DPAP. In the dry sub-humid ecosystem, the blocks having up to 5% of cultivated area under irrigation is to be included in DPAP coverage.

In addition, the Committee recommended the inclusion of such non semi-arid and dry sub-humid blocks where the percentage of irrigated area was <10% of the total cultivated area and/or resource degradation was due to high slopes. Accordingly, some blocks of Bastar (Chhattisgarh), Srikakulam (A.P.) and Almora, Pithoragarh, Tehri Garwal and Pauri Garwal (Uttanchal) also fell under DPAP coverage.

The Committee also included some fringe blocks adjoining DDP blocks for preventive treatment to protect them from desertification.

Later on cold desert areas of Himachal Pradesh and Jammu & Kashmir also were brought into the fold of DDP coverage.

Check Your Progress II

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) List three important characteristics of a good Work Plan.

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2) Define the terms: Drought, Watershed and Moisture Index.

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1.7 ACTIVITIES UNDER DPAP AND DDP

The DDP emphasizes on activities based on the methodology of low-cost and locally accessible technology. Accordingly, *Land Development* including *in-situ* soil and moisture conservation measures, *Water Resource Development* to increase land productivity, *Afforestation* for biomass production and *Sand Dune Stabilization* and *Pasture Development* to support livestock population are the broad categories of activities taken under the programme.

1.8 WATERSHED APPROACH

A watershed is defined as *a geo-hydrological unit draining into a common point*. The *in-situ* soil-moisture conservation, water harvesting, afforestation, etc. are thus ensured by the treatment of degraded watershed with ridge to valley approach. DPAP and DDP are Project based, where the unit of development/treatment is a watershed area of about 500 hectares. Watershed Development under these Guidelines can be considered to have two components, namely a) Resource Inventorisation and b) Action Plan.

1.8.1 Preparation of Resource Inventories

Preparation of *resource inventories* is a key to the identification of area specific problems and also to the application of viable solutions.

Participatory Rural Appraisal (PRA) does this exercise at a micro-watershed level. This method helps the local inhabitants in knowing about the qualitative aspects of the resource situation in the village/watershed and also in identifying the hot spot situations. The thematic maps for different resource themes, such as land cover, soil, land use,

water regime, etc. on their superimposition, give a complete profile of the watershed and a strategy for its treatment is set out. Some states have codified watersheds/micro-watersheds, based on the satellite generated thematic maps, for proper utilization.

1.8.2 Work Plan

The basic tenets with which the participatory watershed development programme is taken up are:

- i) sustainable resource,
- ii) use of traditional/indigenous technologies as the starting point,
- iii) use of doable technologies,
- iv) creation of assets that are small and can benefit larger number of people,
- v) provision for post-operation maintenance of such assets by the beneficiaries,
- vi) sharing of the usufructs from commons by all, particularly the poorer participants and
- vii) convergence with activities of other programmes.

For sustainability, the work plan has to be holistic and should ensure people's participation using eco-friendly technologies that have to be simple, easily implementable, cost effective and replicable. Evidently the techniques have to be endogenous. And the best way to acquire them is to take the existing traditional/indigenous system as the starting point. We have to identify the most critical gaps in the various production systems necessarily and then encourage the beneficiaries to adopt/adapt solutions for them through various alternatives.

1.8.3 Criteria for the Selection of Watersheds

The following criteria are adopted in the process of selecting watersheds for treatment:

- The 500 hectares of a watershed area can be in one patch or else can comprise contiguous watersheds of smaller areas. A watershed should preferably coincide a village.
- Watersheds with a preponderance of community lands. They may, however, encompass private lands and degraded forests as well to some extent.
- Watersheds having acute shortage of drinking water.
- Watersheds inhabited by large populations of scheduled castes/tribes who depend on its natural resources.
- Watersheds where actual wages are sizably lower than the minimum wages.
- Watersheds/Villages where people's participation is assured in planning, implementation and maintenance of assets.
- A watershed contiguous to an already treated watershed.

1.9 STRATEGIC METHODOLOGY

The first Guidelines for Watershed Development were framed in 1995, and they were revised in the year 2001 to accommodate suitable provisions for addressing the real field situations and thereby making the implementation of programmes more objective and effective. Later, the Guidelines were further revised on April 1, 2003 under *Hariyali Guidelines* with the intention of devolving more powers and assigning key roles to Panchayati Raj Institutions (PRIs) in Watershed Development Programmes.

The strategy for *Planning and Implementation* adopted in the Guidelines for Watershed Development issued by the Ministry of Rural Development for various programmes of the Ministry, such as DPAP, DDP, IWDP, EAS, etc. is considered to be the most balanced approach addressing the productivity, equity and environmental concerns while achieving integration, convergence and participation. It makes radical departure from the erstwhile departmental procedures through a process of intensive *delivery mechanisms of Community Participation, Community Empowerment and capacity building. The new implementation methodology adopts well-defined and effective mechanisms of Monitoring and Evaluating the watershed projects.* The main features of planning and implementation as envisaged in the Guidelines are as follows:

- The Department of Land Resources, the Ministry of Rural Development, taking Block as a unit, sanctions the watershed projects. The project period is 5 years.
- DPAP and DDP are administered in the district through Zilla Parishads (ZPs) or District Rural Development Agencies (DRDAs) which receive the instalments of the Central share of funding directly.
- The cost of a watershed project of 500 hectares is Rs. 30 Lakhs @ Rs. 6000.00 per hectare. The cost is shared in the ratio of 75:25 between the Central and the State Governments. While 80-85% of the project cost is incurred on watershed development activities, 5% each on training and community organization and the remaining 10% on administrative overheads of DRDA /ZP, WC/Gram Sabha, PIA, etc.
- A Project Implementing Agency (PIA) working through a Watershed Development Committee (WDC), elected by the Watershed Development Association (WDA), implements the projects. PIA can be a Gram Panchayat, a Line Department or a Non-Governmental Organisation. It is instrumental in Community Organisation for people's participation by constituting Self-Help Groups and User Groups and imparting training to the beneficiaries and the members of Watershed Development Team (WDT) and WC.
- The Work Plans are prepared by WDC with the assistance of a Watershed Development Team (WDT) appointed by the PIA. The WDT comprises experts on Forestry, Agriculture, Soil & water Conservation, Horticulture, etc. The District Watershed Development Committee for implementation approves the detailed action plan.

People's Participation: Village Institutions

The essence of watershed programmes is to facilitate involvement of the local community and to organise it to participate in the process of planning and implementation, maintenance of assets and usufruct sharing in order to institutionalise these programmes to ensure self sustained effort by the community for economic development.

Watershed Association/Watershed Committee

According to the Guidelines, the legal holder of watershed funds and activities is the general body of the members within a watershed community called the Watershed Association (WA). It is the WA which is supposed to be registered formally, meet "as frequently as necessary but not less than twice a year", formulate its own working procedures (including those connected with the working of the Committee and its Secretary), approve/improve the watershed development plans, resolve differences, approve the activities/works, monitor and review the progress, approve receipt and disbursement of funds (statement of accounts), lay down procedures for the work of Watershed Committee (WC) and its office bearers, supervise and control its activities, take disciplinary action, remove members or Secretary, etc. The Committee assists the President of WA and on behalf of WA looks after the day-to-day work of the watershed project. The WC is the executive body of Watershed Association and not independent of it

Self-Help Groups

These are homogenous groups of non-landholders who are dependent on the watershed ecology and economy such as agriculture labourers, shepherds, women, SCs/STs, etc. These groups are encouraged to adopt alternative resources of livelihood with the cash loans provided from the revolving fund created under the projects. Separate Self-Help Groups are organized for women, SCs and STs.

User Groups

The role of User Groups is critical to the watershed development programme because the user groups are the backbone of participatory planning and participatory implementation. These are homogenous groups who may be the most influenced, benefited or otherwise by the watershed activities and include the landholders.

1.10 REVIEW AND CO-ORDINATION

The implementation of projects is reviewed and coordinated under a three-tier system at the District, State and Central Levels.

District Watershed Development Committee headed by the Chairman, ZP/DRDA, with officials of various line departments associated with the implementation of projects, and some non officials as members including women, ensures coordination at the district level. The Committee advises and assists the ZPs/DRDAs on the selection of PIAs, constitution of Watershed Development Teams, training, formation of SHGs and UGs, promotion of public awareness, etc. The Committee also approves the detailed work plans for watershed projects in the district. The policy issues, if any, are referred by it to the State/Union Government.

At the State level, co-ordination among various Government Departments, Institutions and Non-Governmental Organisations is effected by a *State Watershed Development Committee* constituted under the Chairmanship of the Additional Chief Secretary/ Agriculture Production Commissioner/Development Commissioner, with the Heads of related Line Departments, two women representatives, two reputed NGOs and one representative of the State Institute of Rural Development as its members. The State Committee monitors, reviews and evaluates the implementation of DPAP and DDP.

At the Central level, the programmes are coordinated through periodical review meetings under the Chairmanship of the Union Secretary, the Ministry of Rural Development, involving the administrative heads of State Departments of Rural Development. In these meetings, the progress of programme implementation is reviewed and also the decisions on policy issues are taken.

1.11 TRAINING

Watershed Development Programmes have adopted the approach of people's involvement and community empowerment in participation with the Government Departments, NGOs, etc. At the functional level, SHGs, UGs, Members of WCs, WDTs, Officials of ZPs/DRDAs and now under ***Hariyali*** arrangement, the Gram Sabhas/Gram Panchayats/Block & Zila Panchayats are the stakeholders and the main interest groups in these programmes. To ensure successful and sustainable implementation of watershed programmes, capacity building of different groups and functionaries through relevant training programmes is a key factor.

SHGs and UGs

PIA and WDT ensure imparting of training to SHG and UG members with the assistance of Institutions, NGOs with expertise, technical departments, etc. This

training must include demonstrations by way of visits to successful watersheds, Research Stations, Kisan Vikas Kendras, etc., so as to expose the group members to viable technologies and practices successfully implemented elsewhere. Use of audio-visual media should be an effective instrument in facilitating training inputs. The training modules need to include:

- as components on upgrading skills and orientation regarding the technical and organisational issues;
- basic skills on financial management to handle the revolving fund, etc.;
- various aspects of PRA and
- introductory know-how regarding Remote Sensing Technology and its application in the preparation of databases for watershed development.

Nodal Government Agencies

Since, the programmes are administered by ZPs/DRDAs, the relevant *orientation* and *sensitization* of the dealing functionaries in these organizations, including Project Directors and Chief Executive Officers, is an integral part of the training programme. The curriculum is required to include:

- Familiarisation with Remote Sensing and GIS Techniques (see sub-section 4.3.1)
- Training on watershed approach and the related aspects of technology
- Community organisation and empowerment

The State Rural Development Institutes organise such training programmes on their own and in collaboration with other institutions.

1.12 MONITORING AND EVALUATION

The implementation of watershed projects is monitored by periodically assessing the physical and financial progress. The Project Implementing Agency (PIA) submits such progress report to ZP/DRDA once in every three months. Similarly, each Watershed Committee/Gram Panchayat is required to furnish Quarterly Progress Reports (QPRs) to PIA after the Watershed Development Team has scrutinised and vetted it properly. DRDAs/ZPs and the State Governments are responsible for continuous monitoring of the projects and submit the QPRs of the districts and states to the Department of Land Resources, the Government of India.

The programmes are also monitored at the Central level under the Area Officers Scheme in which teams of senior officers of the Ministry of Rural Development interact with the State Officials and undertake field visits regularly to assess the implementation.

Under an earlier arrangement, Vigilance & Monitoring Committees at the State, the District and the Block levels were constituted by the States, as per the direction of the Union Ministry of Rural Development, for monitoring the programmes they were sponsoring. In December 2002, however, the Ministry directed the States to abolish these committees and in order to revitalize the monitoring instruments, reconstitute Vigilance & Monitoring Committees at the State and the District levels under the Chairmanship of the Minister, Rural Development and the local Member of Parliament respectively. Some of these committees have come up in some States and Districts. These Committees are to watch closely the implementation of the programmes as per the Guidelines and procedures and ensure quality expenditure in view of the fact that large public funds are being spent under all the schemes of rural development.

The watershed projects under DPAP and DDP are also subject to an *elaborate evaluation mechanism*. The States are responsible to carry out a Mid-term and a Final Evaluation of the projects. This evaluation is done through independent expert evaluators who may be either individuals or institutions. The satisfactory Mid-term Evaluation Reports are in fact a pre-requisite for the States to become eligible to obtain further Central funding for the projects. The Ministry of Rural Development also conducts concurrent/post-project evaluations and Impact Assessment Studies.

The Evaluation Reports detail the assessment of the implementation of watershed projects broadly in four categories, viz. assessment of social, physical, financial and impact aspects.

1.13 ROLE OF NON-GOVERNMENT ORGANISATIONS

The High Level Technical Committee of Prof. C.H. Hanumantha Rao underlined an active role for NGOs in the Watershed Development Programmes in order to implement them in *the participatory mode*. Accordingly, the Guidelines for Watershed Development envisaged the role of the Project Implementing Agency (PIA) (i.e. supervision and the overall implementation of projects) for NGOs besides the Panchayati Raj Institutions and the Line Departments.

Criteria for the selection of NGOs

The NGOs are selected for participation in the programme on the basis of the following major considerations amongst others.

- 1) Perspective on watershed development,
- 2) Nature of projects handled in the past,
- 3) Technical and managerial capability,

The NGO should have been active in the area for a significant period before proposing a watershed project for the area.

Functions of an NGO as PIA are central to the programme implementation and encompass:

- monitoring and review of the overall project implementation,
- community organisation and constitution of SHGs and UGs,
- organising trainings for the village community,
- conducting PRA exercises, Preparation of Work Plans and the supervision of watershed activities,
- providing technical guidance through WD and
- inspecting and authenticating project accounts.

The performance of NGOs during the last 8 years of watershed development has been rather contentious. There are success stories where NGOs have shown exemplary work and on the contrary some NGOs faced serious allegations on account of their incompetence, sub-quality works, irregularities, misutilisation of funds, etc. Unfortunately, of late, the overall impression of NGOs in watershed development programmes has received a set back and also an opinion against them has emerged. This has certainly affected the activities of the committed and performing NGOs.

1.14 PANCHAYATI RAJ INSTITUTIONS IN WATERSHED PROGRAMMES

The roles of Panchayati Raj Institutions (PRIs), especially Gram Sabhas/Gram Panchayats, were subdued and poorly defined in the *Guidelines of Watershed Development-1995* as these institutions had not much to do in the developmental activities. However, following the 73rd and the 74th Amendments to the Constitution of India, PRIs have become the primary and key actors in the implementation of developmental programmes at the grass roots levels. Accordingly, the *Revised Guidelines for Watershed Development-2001* envisage an enlarged and more active role for PRIs as their mandate includes the following:

- First option of serving as a PIA to PRIs;
- Authority to monitor and review the implementation of Watershed Programmes and make interventions to ensure their convergence with other programme;
- Full involvement of Gram Panchayats in community organisation and training;
- Approval of Work Plan by the Gram Sabha and
- Inspection of the accounts of the Watershed Committee

The institutional arrangement of Watershed Associations and Watershed Committees provided in the earlier Guidelines was observed to be lacking in the desired co-ordination with Gram Panchayats/Gram Sabhas.

Since, it is the commitment of the Ministry of Rural Development to ensure devolution of the prescribed 29 subjects to PRIs and their empowerment, a step in this direction has been taken by further consolidating the role of these institutions in Watershed Development Programmes under the recently framed *Hariyali Guidelines*.

The watershed projects sanctioned since 2003-04 under the *Hariyali Guidelines* are to be executed by the Gram Panchayats, instead of Watershed Committees, in consultation with the Gram Sabhas. Consequently, the first discharge of PIA's role now is with Block Panchayats and thereafter with the Zila Panchayats.

With the devolution of financial and administrative powers to PRIs, it is expected that they would perform better as they: a) have the potential to integrate watershed development into the larger canvas of development activities in the area, b) are capable of mustering more support from Government Departments, c) are well equipped to maintain the created assets and levy user charges in usufruct sharing.

Box B

Success Story of Three Villages

Watershed projects under DPAP were started in 1995-96 with an area of 1999 hectares in villages Shyamdihi, Badkhera and Kumarseja of Sohagpur Block in District Shahdol, M.P. The villages were affected by acute soil erosion of lands caused by Son river, shortage of drinking water in summers as wells dried up and the water of Son was not potable due to the presence of pollutants poured by the nearby paper mill, the sloppy terrain devoid of vegetative cover that could hardly facilitate water discharge, no water for crop irrigation, fodder scarcity and the absence of means of self-employment.

Watershed treatment for self-reliance:

The villagers united together and took up need-based activities under a DPAP project. Four years of dedicated involvement did wonders and changed the face of the villages:

Soil-moisture Conservation: 424 works of gully plugging and nalla bunding taken up through 550 villagers organized in 27 UGs. 339 hectares of affected land was treated benefiting 66 farmer families.

Water Conservation Measures: 134 works of check dams, percolation tanks and harvesting tanks taken up involving 26 UGs of 380 beneficiaries, 381 hectares of land was treated, additional irrigation was created for 30 hectares, 20 hectares changed from single crop to double crops routines and 5 hectares of fallow land was brought under cultivation.

Afforestation and Pasture Development: 58 hectares brought under tree cover, pasture development completed in 22 hectares. Now producing 1150 quintals of grass annually to cater the needs of the village cattle; milk production enhanced by 37%.

Self-employment: 19 SHGs of women formed, each given Rs. 20-25 thousand from the revolving fund, net average earning Rs. 7-8 thousand by means of collecting mahua seeds and selling them to tribal/forest departments.

Source: Watershed Mission, M.P.

1.15 PERFORMANCE OF DPAP AND DDP

DPAP

DPAP is being currently implemented in 972 blocks of 182 districts in 16 States and covers an area of 745914 Sq. Kms. (*see details in Annexure I*)

Since the adoption of watershed approach, from 1995-96 to August 2003, 18,803 projects (500 hectares each), including 2535 new projects sanctioned in 2003-04 under *Hariyali*, were taken up for treating an area of about 94.10 Lakh hectares. The total cost of these projects is Rs. 4804.20 crores, of which Rs. 3298.70 crores is the share of the Central Government. Till 31.3.2004, the central share of Rs. 1431.03 crores was released to the *programme states*. Of the 18,803 projects, 4449 are deemed completed, as the corresponding Central share has been released in full.

On comparison, it is apparent that after the adoption of watershed approach, since 1995-96, the implementation has definitely accelerated as during the last 8 years of implementation, about 50 Lakh hectares of area is estimated to have been treated under DPAP, while prior to that 20 years of implementation registered treatment of about 57 Lakh hectares (*see details in Annexure II*)

DDP

DDP programme is being implemented in 235 blocks of 40 districts, covering an area of 457949 sq. kms in 7 States, viz. Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka and Rajasthan. (*see details in Annexure I*)

Since the adoption of watershed approach, from 1995-96 to 2003-04, 9,876 DDP projects, including 1551 new projects of 2003-04 under *Hariyali*, have been taken up for treating an area of about 49.32 lakh hectares. This includes 1,895 special projects sanctioned for sand dune stabilization, shelter belt plantations and afforestation sanctioned to the state of Rajasthan. The total cost of these projects is Rs. 2755.71 crores, of which the share of the Central Government is Rs. 2156.20 crores. Till 31.3.2004, about Rs. 1050 crores of Central funding has been disbursed to the programme States. Of the 9876 projects, 1,861 are deemed completed as the corresponding Central share has been released in full.

DDP has also gathered definite momentum over the years beginning 1995-96, as more than 19 Lakh hectares are estimated to have been treated till 2002-03 against only 5.15 Lakh hectares treated under the sectoral management of 15 years (*see details in Annexure-III*). The Central investment under DDP has also more than doubled since 1995-96.

Yet there is a very long way to traverse at the current pace of implementation and the quantum of investment under these two programmes. DPAP has so far addressed only about 12-13% of its total targeted coverage while DDP merely about 5%. There are some issues to be addressed to make the programmes more meaningful and objective oriented:

- The pace of the implementation of watershed projects needs gearing up considerably in some states.
- The selection of watersheds for treatment needs to be systematized and streamlined as per the NRSA's list of identified watersheds in the states on priority basis.
- People's participation needs to be strengthened to institutionalize the Programmes and the formation of SHGs and UGs under every project should really be the fulcrum of implementation.
- It is necessary to build inventories of the created assets, put in place mechanisms for post project maintenance and evolve a mechanism of equity sharing of the productive resources based on livelihood surveys before the formulation of work plans.
- Convergence of watershed development activities with other rural development programmes in the area is necessary.
- There is need to improve the inputs in relation to the *capacity building* of PRIs and other stakeholders' groups. And training needs to be relevant and related to the roles of various active players and it has to be dynamic to effect improvements.
- There is need to substantially increase investments under the programmes through linkages with financial institutions, donor agencies, etc.

Nevertheless, the efforts made so far have shown encouraging results. As for the DPAP and DDP projects sanctioned during 1995-96 to 1997-98, which have either been completed or are nearing completion, the Ministry had commissioned *Impact Assessment Studies* through independent organizations. Some of these studies have since been completed. The results indicate that with the implementation of watershed projects under DPAP and DDP programmes, the overall productivity of land and water table have increased, and there has been a positive and significant impact on the overall economic development in the project areas. Further, the studies reveal that green vegetative cover has improved in desert areas and that is going to have a positive role in checking soil erosion caused by water and wind. (*See Success Stories in Boxes A & B.*) The studies also indicate that the availability of fodder and fuel wood has improved in the programme areas.

Check Your Progress III

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

- 1) List three criteria used for the selection of watersheds for treatment under DPAP/DDP.

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2) Describe the role of Panchayati Raj Institutions (PRIs) under *Hariyali Guidelines*.

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3) Enumerate three important areas of improvement in the implementation DPAP/DDP.

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1.16 LET US SUM UP

A sizable population of rural India inhabiting arid, semi-arid and sub-humid regions of the country is subject to abject poverty. These areas are characterised by frequent drought conditions and desertification. The means of traditional livelihood for the people in these areas are based on natural area resources, which due to adverse climatic conditions and degradation are severely depleted. DPAP and DDP were launched in 1973-74 and 1977-78 as long-term measures for poverty alleviation of such populations by aiming at *drought proofing* and *controlling of desertification* through the replenishment of natural area resource base, improved agricultural practices and wider livelihood options for the population. Initially, the two area development programmes were implemented on sectoral basis involving soil-moisture and water conservation activities, afforestation, pasture development, horticulture, animal husbandry, etc. The programmes, however, did not yield many benefits as the sectoral activities were taken up in isolation over disjointed areas of very small sizes without any involvement of the targeted population.

In 1994, a High Level Technical Committee reviewed the programmes and a watershed approach focusing on integrated implementation of various activities was adopted. The philosophy of community participation and empowerment underlines the implementation of these programmes since then. The role of NGOs as the main facilitators has also recognized and the coverage under the two programmes has been identified by adopting scientific criteria, viz. moisture index, rainfall, evapo-transpiration, etc.

The programmes are being implemented through people's bodies, i.e. Watershed Committees and Watershed Associations. The two vital stakeholders under the programmes are Self-Help Groups for alternative livelihood avenues and User Groups for drawing benefits from the created assets. Training to various categories of stakeholders for capacity building is an important component under the programmes, but needs to be strengthened. The programmes are monitored and evaluated at the district, the state and the Central levels.

Following the 73rd and the 74th Amendments to the Constitution and the commitment of the Rural Development Ministry to give the central role to PRIs in watershed development, a new set of guidelines called *Hariyali Guidelines* has been formulated and made effective from April 1, 2003.

The watershed projects sanctioned under *Hariyali Guidelines* are to be executed by the Gram Panchayats, instead of Watershed Committees, in consultation with the Gram Sabhas. Consequently, the PIA's role is now to be with Block Panchayat. In case a Block Panchayat is not capable of taking up this responsibility for whatever reasons, the Zila Panchayat is to act as the PIA.

In order to be more *objective oriented* and meaningful, these programmes need a) to address issues like convergence with other programmes of rural development, b) to give greater importance to people's participation, c) more intensive training, d) better arrangements for the maintenance of assets and e) to pay greater attention to equity concerns.

The impact of these programmes so far has been encouraging as revealed by the studies. The overall productivity of land and water table has increased, and there has been a positive and significant impact on economic development in the project areas. The studies also indicate that the green vegetative cover has improved in desert areas and it is going to play a positive role in checking soil erosion caused by water and wind. The studies also indicate that the availability of fodder and fuel wood has also improved in the programme areas.

1.17 KEY WORDS

Desertification	: The process of desert formation.
Endogenous	: Originated from within; internally
Evapo-transpiration	: Process by which water moves from the soil into atmosphere by evaporation from the soil and water surface besides transpiration from plants.
Shelter Belt	: Block plantations to protect crop fields, water bodies etc. from shifting sand dunes
Usufructs	: user rights over an asset or produce

1.18 REFERENCES AND SUGGESTED READINGS

Guidelines for Watershed Development 1995, 2001 and (Hariyali) 2003, The Department of Land Resources, The Ministry of Rural Development, The Government of India, New Delhi.

Report of the High Level Technical Committee (1994) under Prof C.H. Hanumantha Rao, The Department of Land Resources, The Ministry of Rural Development, The Government of India, New Delhi.

Report of the Kidwai Committee (1964) on Integrated Desert Development, The Ministry of Rural Development, The Government of India, New Delhi.

Report of the National Committee on DPAP & DDP (1988), The Planning Commission, New Delhi.

Report of the Task Force (1982) commissioned to review DPAP and DDP under the Chairmanship of Dr. Swaminathan, The Ministry of Rural Development, The Government of India, New Delhi.

The Ninth and the Tenth Five Year Plans, The Planning Commission, New Delhi.

1.19 CHECK YOUR PROGRESS – POSSIBLE ANSWERS

Check Your Progress I

1) **The main objectives of DPAP and DDP are:**

- Mitigating the adverse effects of extreme climatic conditions such as drought and desertification on crops, human and livestock populations in order to enhance the overall improvement.
- Promoting the overall economic development and improving the socio-economic condition of the resource poor and disadvantaged sections of the society.
- Restoring ecological balance by harnessing, conserving and developing natural resource base, i.e. land, water and vegetative cover.
- Encouraging village the community for active participation in planning, implementation and sustainable maintenance of the assets created through their collective wisdom and indigenous technology.
- Employment generation, poverty alleviation, community empowerment and the development of human and other economic resources of the village.

2) **The major recommendations of the High Level Technical Committee are:**

- Treatment and development of degraded lands in drought prone and desert areas compulsorily on watershed basis covering contiguous micro-watersheds of 500 hectares that have primarily community lands and may encompass private and revenue lands and tracts of degraded forests.
- Implementation of DPAP and DDP with total participation of the beneficiary with adequate representation to women, SCs/STs, and the other weaker sections in planning and decision making.
- Transfer of programme assets to the community for maintenance and usufructs sharing among the beneficiaries.
- Unified approach and convergence of all rural development programmes with various departments/ministries to ensure a multiplier effect in area resource development and the economic development of the resource poor.

Check Your Progress II

1) The important characteristics of a good work plan are:

- creation of need based assets that are small but benefit larger number of people,
- provision of the post-operational maintenance of such assets by the PRIs/beneficiaries and
- sharing of the usufructs from commons by all, particularly the poorer participants.

2) The definitions are:

- **Drought** can be defined as a meteorological event characterized by a shortfall of rainfall in a given time period of more than a certain percentage, usually 50% of the average for the area in the sowing season.

- A **watershed** is defined as a geo-hydrological unit that drains into a common point.
- **Moisture Index** is a function of precipitation and potential evapo-transpiration and is defined by the following equation:

$$MI = [(P-PE)/PE] \times 100$$

where, MI = Moisture Index, P = Precipitation and PE = Potential Evapo-transpiration.

Check Your Progress III

- 1) The three criteria for the selection of a watershed for treatment under DPAP/DDP are:
 - Watersheds having acute shortage of drinking water.
 - Watersheds inhabited by large populations of scheduled castes/tribes who depend on its natural resources.
 - Watersheds/Villages where people's participation is assured in planning, implementation and maintenance of assets.
- 2) The role of Panchayati Raj Institutions (PRIs) under *Hariyali Guidelines*.

Following the 73rd and the 74th Amendments to the Constitution and the commitment of the Rural Development Ministry to give the central role to PRIs in watershed development, the new Guidelines called *Hariyali Guidelines* have been formulated.

The watershed projects sanctioned since 2003-04 under *Hariyali Guidelines* are to be executed by the Gram Panchayats, instead of Watershed Committees, in consultation with the Gram Sabhas. Consequently, the PIA's role is now to be taken up by the Block Panchayat. In case this panchayat is not capable of taking the responsibility then the Zila Panchayat is to act as PIA.

- 3) The three important areas of improvement in the implementation of DPAP/DDP are:
 - Convergence of watershed development activities with other Rural Development Programmes in the area.
 - Need a) to make inventories of the created assets, b) to put in place the mechanism for post-project maintenance and c) to evolve a mechanism for equity sharing of productive resources based on livelihood surveys before the formulation of work plans
 - Need a) to increase efforts for the capacity building of PRIs and other stakeholders' groups and b) to make training consistent with and relevant for the roles of various active players and also make it dynamic to effect improvements.
 - People's participation needs to be geared up to institutionalize the programmes and the formation of SHGs and UGs under every project should really be vital for the success of implementation.

**States, Districts and Blocks Covered Under Drought Prone Areas
Programme (DPAP) and Desert Development Programme (DDP)**

Sl. No.	State	Number of Districts		Number of Blocks		Area in Sq. Kms.	
		DPAP	DDP	DPAP	DDP	DPAP	DDP
1.	Andhra Pradesh	11	1	94	16	99218	19136
2.	Bihar	6	-	30	-	9533	-
3.	Chhattisgarh	8	-	29	-	21801	-
4.	Gujarat	14	6	67	52	43938	55424
5.	Haryana	-	7	-	45	-	20542
6.	Himachal Pradesh	3	2	10	3	3319	35107
7.	Jammu & Kashmir	2	2	22	12	14705	96701
8.	Jharkhand	14	-	100	-	34843	-
9.	Karnataka	15	6	81	22	84332	32295
10.	Madhya Pradesh	23	-	105	-	89101	-
11.	Maharashtra	25	-	149	-	194473	-
12.	Orissa	8	-	47	-	26178	-
13.	Rajasthan	11	16	32	85	31969	198744
14.	Tamil Nadu	16	-	80	-	29416	-
15.	Uttar Pradesh	15	-	60	-	35698	-
16.	Uttaranchal	7	-	30	-	15796	-
17.	West Bengal	4	-	36	-	11594	-
	Total	182	40	972	235	745914	457949

Source: Reports of Dept. of Land Resources, Ministry of Rural Development, Govt. of India

DPAP

Physical and Financial Achievements

Year	Area treated (In lakh hactares)	Corresponding release of funds (Rupees in Crores)		
		Centre	State	Total
1973-74 to 1994-95	57.14	881.00	881.02	1762.02
1995-96	5.95	118.95	118.95	237.90
1996-97	5.50	109.98	109.98	219.96
Total (from inception of DPAP up to the end of 8 th Plan)	68.59	1109.93	1109.95	2219.88
1997-98	4.54	90.75	90.75	181.50
1998-99	3.65	73.00	73.00	146.00
1999-2000	3.66	94.99	50.61	145.60
2000-2001	7.50	189.58	109.58	299.16
2001-2002	5.44	208.99	83.62	292.61
Cumulative figures from inception up to the end of 9 th Plan	93.38	1767.24	1517.51	3284.75
2002-2003	6.56	249.99	90.84	340.83
2003-2004	7.35	294.80	102.64	397.44
Grand total	107.29	2312.03	1710.99	4023.02

Source: Reports of the Department of Land Resources, Ministry of Rural Development, Govt. of India

DDP

Physical and Financial Achievements

Year	Area treated (In lakh hactares)	Corresponding release of funds (Rupees in Crores)		
		Centre	State	Total
1977-78 to 1994-95	5.15	555.42	0.00	555.42
1995-96	2.02	101.00	7.27	108.27
1996-97	1.31	65.37	7.01	72.38
Total (from inception of DDP up to the end of the 8 th Plan)	8.48	721.79	14.28	736.07
1997-98	1.40	70.01	8.02	78.03
1998-99	1.60	79.80	5.93	85.73
1999-2000	2.00	84.99	18.13	103.12
2000-2001	3.41	134.99	22.66	157.65
2001-2002	3.56	149.88	42.32	192.20
2002-2003	4.39	185.00	51.13	236.13
2003-2004	4.72	214.80	68.60	283.40
Cumulative figures from inception up to 31.3.2004	29.56	1641.26	231.07	1872.33

Source: Reports of the Department of Land Resources, Ministry of Rural Development, Govt. of India

UNIT 2 INTEGRATED WASTELAND DEVELOPMENT PROGRAMME (IWDP)

Structure

- 2.0 Objectives
- 2.1 Introduction
- 2.2 Historical Background/Evolution of the Programme
- 2.3 Objectives of IWDP
- 2.4 Wastelands: Definition, Categories, Area Estimates, Wastelands Atlas
- 2.5 Programme Guidelines and Guiding Principles
 - 2.5.1 Revision of Guidelines
 - 2.5.2 Salient Features of the Guidelines
- 2.6 What is a Watershed?
- 2.7 Components of Watershed Development
- 2.8 Salient Features of the Programme
 - 2.8.1 Coverage of the Programme
 - 2.8.2 Project Mode
 - 2.8.3 Criteria for the Selection of a Watershed Project
 - 2.8.4 Major Activities of a Watershed Project
 - 2.8.5 Funding Pattern
 - 2.8.6 Allocation of Funds within a Project
- 2.9 Institutional Framework for Implementation
 - 2.9.1 Procedure for Sanctioning Projects
 - 2.9.2 Flow of Funds
 - 2.9.3 Convergence of the Related Development Programmes and Activities
 - 2.9.4 Size of the Problem Area and the Extent of Coverage Under the Programme
- 2.10 Funds: Requirement and Availability
- 2.11 Monitoring the Performance
- 2.12 Impact Evaluation
- 2.13 Future Strategy
- 2.14 Let Us Sum Up
- 2.15 Key Words
- 2.16 References and Suggested Readings
- 2.17 Check Your Progress- Possible Answers

2.0 OBJECTIVES

After completing this unit, you should be able to:

- trace the evolution of Integrated Waste Land Development Programme;
- define what a wasteland is;
- describe the problems caused by wastelands;
- explain the salient features of the programme;
- outline the institutional framework for its implementation; and
- explain the ways of monitoring the performance of the programme.

2.1 INTRODUCTION

The most important natural resource, on which all human activity is based, is land. Man's inexorable progressive development has, however, damaged our land resource base considerably. Further, land also suffers from various kinds of soil erosion, degradation and deforestation. The estimates of the extent of area suffering from land degradation vary from 38.40 million hectares to 187 million hectares. The National Remote Sensing Agency (NRSA) of the Department of Space, Hyderabad, has estimated the extent of wastelands to be 63.85 million hectares, which is about 20% of the total geographical area of the country. To harness the full potential of the available land resources and prevent their further degradation, the development of wastelands is of great significance. The problem of degraded land and its management is complex and multi-dimensional and its development requires a scientific, holistic and innovative approach. The question is whether such land is really *a waste* or if it can be made suitable for farming again. This unit is an attempt to explain the guiding principles, the basic features and the institutional framework for the implementation of Integrated Wasteland Development Programme.

2.2 HISTORICAL BACKGROUND/EVOLUTION OF THE PROGRAMME

Unprecedented population pressure and demands of society on scarce land, water and biological resources and the increasing degradation of these resources are affecting the stability and resilience of our ecosystems and the environment as a whole. Globally, the expansion of human settlements and infrastructure, intensification of agriculture and expansion of farming into marginal areas and fragile ecosystems, emphasizes the need for integrated planning and management of land resources.

These trends are also exacerbating conflicts over access and rights to land, water and biological resources; and also increasing competition between agriculture and other sectors for declining per capita land resources. They affect food security in many developing countries, global environmental balance and the well being of present and future generations. The challenge is to develop and promote sustainable and productive land use systems and to protect critical resources and ecosystems through balancing land, water and other resource uses, providing a basis for negotiation, participatory decision-making and conflict resolution among stakeholders, as well as providing an enabling political, social and economic environment.

To accelerate the pace of the development of wastelands and degraded lands and to give focused attention to the issues concerned, the Government set up a National Wastelands Development Board (NWDB) in 1985 under the Ministry of Environment and Forests. Later, a separate Department of Wastelands Development was created in the Ministry of Rural Development in 1992 by transferring the National Wastelands Development Board from the Ministry of Environment and Forests. With this, all non-forest wastelands have come under the purview of the Department of Wastelands Development for purposes of development. In April 1999, the nomenclature of the Department of Wastelands Development was modified to the Department of Land Resources (DoLR) to act as the Nodal Agency at the national level in the field of Land Resources Management. All land based Programmes/schemes, which were earlier being implemented by different Departments in the Ministry of Rural Development, have been brought within the purview of this new Department of Land Resources.

The Integrated Wastelands Development Programme (IWDP) had been under implementation since 1989-90 by the NWDB in the Ministry of Environment and

Forests, and was transferred to the Ministry of Rural Development in July 1992. The IWDP envisages development of all the non-forest wastelands in the country. The basic approach in implementation of this programme was modified in April 1995 when the Guidelines for Watershed Development for the development of problem lands through watershed approach came into force.

2.3 OBJECTIVES OF IWDP

The basic purpose of the programme is to develop wastelands/degraded lands in the country in an integrated manner based on village/micro watershed treatment plans. Specifically, the programme aims at fulfilling the following objectives:

- 1) Developing wastelands/degraded lands on watershed basis, keeping in view the capability of land, site-conditions and local needs.
- 2) Promoting the overall economic development and improving the socio-economic condition of the resource poor and disadvantaged sections inhabiting the programme areas.
- 3) Restoring ecological balance by harnessing, conserving and developing natural resources, i.e. land, water, vegetative cover.
- 4) Encouraging village community:
 - a) to undertake sustained community action for the operation and maintenance of assets created and to further the development of the potential of the natural resources in the watershed; and
 - b) to adopt simple, easy and affordable technological solutions and institutional arrangements that make use of, and build upon, local technical knowledge and available materials.
- 5) Employment generation, poverty alleviation, community empowerment and development of human and other economic resources of the village.

2.4 WASTELANDS: DEFINITION, CATEGORIES, AREA ESTIMATES AND WASTELANDS ATLAS

Definition: As per the Report of the Technical Task Group constituted by the Planning Commission (1987), wastelands are “degraded lands which can be brought under vegetative cover with reasonable efforts and which are currently under-utilized and land which is deteriorating for lack of appropriate water and soil management or on account of natural causes.”

Broadly, the following are the causes of degradation.

- i) Increasing biotic pressure on the fragile ecosystem.
- ii) Population pressure, unplanned urbanization and rural poverty.
- iii) Breakdown of traditional institutions that manage the Common Property Resources.
- iv) Lack of appropriate management practices.

There are various estimates on the extent of wastelands/degraded lands in the country. These estimates are presented in the table below.

Sl. No.	Source	Estimated area of wastelands (m. ha.)
1	National Commission on Agriculture (1976)	175.00
2	Directorate of Economics & Statistics, Dept. of Agriculture & Cooperation (1978-79)	38.40
3	Dept. of Environment & Forests (1980)	175.00
4	National Wastelands Development Board (1985)	123.00
5	National Bureau of Soil Survey & Land Use Planning, ICAR (1994)	187.00
6	Indian Agriculture in Brief, Dept. of Economics & Statistics (1994)	174.97
7	National Remote Sensing Agency (NRSA) (2000)	63.85

The variation in the area estimates by these agencies is due to the type and nature of secondary data used and the methodology of estimation. While all the above estimates, except that of NRSA, were made using secondary sources of information, the NRSA estimate is based on remote sensing technology using satellite imageries. The Department of Land Resources, which sponsored the NRSA study, follows the NRSA estimates in planning for its land development programmes.

During 2000, the National Remote Sensing Agency, Hyderabad, under the sponsorship of the Department of Land Resources, the Ministry of Rural Development brought out the “Wastelands Atlas of India” which contains maps on a 1:50000 scale and provides district-wise estimates of various types of wastelands in the country. The boundaries of micro-watersheds have also been incorporated in the maps. As a result an authoritative figure on the extent of wastelands in the country has emerged for the first time on a highly scientific basis. According to these estimates, out of 329 million hectares of total geographical area, 63.85 million hectares (20.17%) are wastelands comprising 14.06 million hectares of forest wastelands and 49.79 million hectares of non-forest wastelands. The details of category-wise wastelands in India are given below.

Sl. No.	Category	Total Wastelands (in m. ha.)	% to total Geographical Area
1	Gullied and/or Ravenous land	2.06	0.65
2	Land with or without scrub	19.40	6.13
3	Waterlogged and Marshy land	1.66	0.52
4	Land affected by salinity/alkalinity-coastal/inland	2.05	0.65
5	Shifting Cultivation Area	3.51	1.11
6	Under utilized/degraded notified forest land	14.06	4.44
7	Degraded pastures/grazing land	2.60	0.82
8	Degraded land under plantation crops	0.58	0.18
9	Sands— Inland/Coastal	5.00	1.58
10	Mining/Industrial wastelands	0.13	0.04
11	Barren rocky/stony waste/sheet rock area	6.45	2.04
12	Steep sloping area	0.77	0.24
13	Snow covered and/or glacial area	5.58	1.76
	Total Wasteland Area	63.85	20.17

2.5 PROGRAMME GUIDELINES AND GUIDING PRINCIPLES

In April 1993, the Ministry of Rural Development constituted a high-level Technical Committee under the chairmanship of Prof. C.H. Hanumantha Rao, who was earlier a Member (Agriculture) of the Planning Commission, to thoroughly review and recommend suitable means of implementing the Central Sector Area Development Programmes (being administered by the Ministry, namely the Drought Prone Areas Programme and the Desert Development Programme) more effectively so as to bring about visible and perceptible impact in drought proofing and the control of desertification in the problem areas covered by these programmes. After a critical examination of the mode of implementing and the performance of the programmes, field visits and interaction with all the stakeholders, the Technical Committee brought out its Report in April 1994, which *inter alia* recommended that:

- 1) All the Area Development Programmes being administered by the Ministry of Rural Development, including the Integrated Wastelands Development Programme (IWDP), should have a watershed as the basic unit of development.
- 2) Small watersheds, each of a size of about 500 hectares, which may cover one village as far as possible, be identified for development.
- 3) The small watershed, so identified at the village level, should be managed in terms of its planning, implementation and maintenance by the local people themselves with the Government and the non-Government Organizations providing the necessary technical and financial support services.

On the basis of the recommendations of the Hanumantha Rao Committee (1994), the Ministry of Rural Development issued “Guidelines for Watershed Development” and brought the three Area Development Programmes of the Ministry, viz. DPAP, DDP and IWDP under the purview of these Guidelines. These Guidelines became operational with effect from April 1, 1995.

Since then, *watershed development approach* for area development and *people’s participation* in all aspects of the implementation of the area development programmes of the Ministry have become the Guiding Principles in the administration of these programmes.

2.5.1 Revision of Guidelines

After implementing the programme for over 5 years, a need was felt by both the State Governments as well as the Department of Land Resources for fine-tuning certain provisions of the Guidelines to make them more suitable to the local requirements. Accordingly, the Guidelines for Watershed Development were revised in August 2001 to make them more focused, transparent and easy to follow.

Role of Panchayati Raj Institutions: In order to ensure people’s participation in the implementation of watershed projects under the three Programmes, the Guidelines for Watershed Development provided for a detailed institutional framework at all levels of implementation, particularly people’s organisations called the Watershed Associations, the Watershed Committees, the Self Help Groups, the User Groups, etc. at the village level. In this institutional framework, the Gram Panchayats and other PRIs were not given the pivotal role, since the PRI framework was not strong enough at the time of framing the Guidelines for Watershed Development in 1994-1995. The revision of Guidelines in 2001 did envisage a role for PRIs in the implementation of watershed projects. However, the concept of Watershed Association and Watershed Committee at the village level was retained for implementing the projects.

Following the 73rd and the 74th Amendments to the Constitution of India, the Panchayati Raj Institutions (PRIs) have been mandated with an enlarged role in the implementation of developmental programmes at the grass-roots level. The Ministry of Rural Development is committed to empower PRIs and have been impressing upon the State Governments to devolve the necessary financial and administrative powers to the PRIs for self-governance, particularly in planning, implementation and the management of economic development activities in rural areas. Watershed Development has been included in the list of subjects to be devolved to the PRIs. The institutional framework of Watershed Associations and Watershed Committees depicted them as parallel bodies at the village level as far as the implementation of Watershed Programmes was concerned, and there was very little coordination between them and the Gram Panchayats/Gram Sabhas. On devolution of the necessary powers, the PRIs are expected to perform far better than the Watershed Associations/Committees, as they are:

- equipped with the statutory rights and a mandate for natural resource planning,
- in a position to plan according to people's wishes and integrate watershed management into wider development activities,
- in a position to draw the services of line departments in an integrated way and press for political pressure on line departments at higher levels,
- potentially equipped with the powers to impose local taxes or user charges and
- committed to making "reservations" for the representatives of women and the weaker sections as per the Constitutional provisions.

Thus, for the Ministry of Rural Development to fulfill their constitutional obligation of empowering PRIs, it was felt necessary to bring in suitable modifications in and amendments to the existing institutional framework for the implementation of Watershed Development Programmes. With this objective, the Prime Minister of India launched a new initiative called *Hariyali* on 27th January 2003. It seeks to empower the PRIs, both administratively and financially, for the implementation of the Watershed Development Programmes of the Ministry of Rural Development. Accordingly, the Ministry have modified the existing provisions and incorporated the new initiative in the Guidelines. The guidelines so modified are now called the *Guidelines for Hariyali*, which are commonly applicable to IWDP, DPAP and DDP. These Guidelines became operational with effect from April 1, 2003.

2.5.2 Salient Features of the Guidelines

- 1) The Guidelines are designed in such a way that the user communities have to take the center stage in the implementation and management of area development programmes in which the Government participates.
- 2) Since degradation usually occurs and gets aggravated through over exploitation of lands under public/common ownership, emphasis is on the development of common/community lands and not on the privately owned lands.
- 3) The watershed community comprises landed as well as landless people, agricultural and non-agricultural labour, village artisans, weaker sections like the scheduled castes and scheduled tribes, women, etc. Though watershed development benefits primarily the landed people, emphasis is given to equitable distribution of benefits resulting from the development of the watershed area among all the sections of people inhabiting this area.
- 4) An exclusive institutional framework has been prescribed for bringing about active community participation in all the aspects of watershed project management, viz. watershed planning, execution of development works and post-project maintenance.

- 5) Emphasis is placed on sustainable rural livelihood support systems through Self-Help Groups from the landless and the weaker sections of the watershed community and the User Groups built around each of the community assets created under the project, thus securing the participation of women as well as the landless also in watershed development.
- 6) In order to enable the village community and all other stakeholders participate actively in the watershed development activities, specific provisions have been made for their capacity building and skill development which is a vital component of the programmes and is a pre-requisite to initiate actual development works on the ground.
- 7) Decentralisation of the processes of planning and decision-making is achieved through delegation of necessary powers to various levels of programme administration and management, i.e. the State, the District and the village/watershed levels.
- 8) Community participation and the feeling of owning the assets created under the programme are brought about through insistence on public contributions to the project cost, either in cash or kind or voluntary labour. The beneficiaries of various development works/assets of the project are required to contribute at least 10% of the project cost by these means.
- 9) For watershed development, emphasis is placed on the adoption of low-cost technologies that use local materials and are easily operable and maintainable by the local people. Use of indigenous technical knowledge is encouraged in all aspects of watershed development.
- 10) Post-project management and sustainability of the project is ensured by maintaining a Watershed Development Fund created out of public contributions. It is placed at the disposal of the village level managing body for purposes of maintaining the public assets after the project gets completed and whenever such necessity arises.

Check Your Progress I

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) What is the basic purpose of Integrated Wasteland Development Programme?

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2) What is a Wasteland and what are the causes of the formation of Wastelands?

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2.6 WHAT IS A WATERSHED?

Simply stated, a watershed is a geo-hydrological unit of landmass, from where rainwater drains through a common drainage point. The ridges of the watershed form its boundaries, which slope down to the valley and flat land and the rainwater falling in this catchment area runs off from the uplands downwards through small streams and gullies into the main natural drainage system of the watershed, usually a river. If the land surface of the watershed area is not adequately covered with vegetation, surface soil gets carried away by the rainwater run off causing severe soil erosion problems, widening of gullies and silting of streams and water bodies downstream.

Watershed development, therefore, involves scientific treatment of the watershed area from the ridges to the flat lands, in that order of priority. To control water run off, suitable vegetative cover in the form of plantations, horticulture, agro-forestry, pastures and agricultural crops, as demanded by the land capability, are required to be taken up along with soil conservation measures, like contour bunds, gully plugs, contour trenches, rock fill dams, etc. These measures, besides aiding in soil retention and arresting erosion, will also help in improving the *in situ* soil-moisture conservation. For water resource conservation, its optimal utilization and for recharging of ground water aquifers, water-harvesting structures like check dams, farm ponds, percolation tanks, etc. are usually taken up.

2.7 COMPONENTS OF WATERSHED DEVELOPMENT

The various steps and components involved in watershed development comprise:

- i) Identification and demarcation of the watershed area on scientific basis.
- ii) Prioritisation of watershed areas on the basis of pre-determined criteria and prioritisation index prepared for the execution of developmental works in the worst affected watersheds first.
- iii) Conducting a benchmark survey of the watershed to assess the extent of the problem and pre-project socio-economic situation of the local community. This provides the base to assess project benefits through a post-project impact evaluation.
- iv) Land use capability studies and land use planning aspects: these are necessary to reorient the present production systems to the desirable cropping patterns and activities that are in consonance with what various soils in the watershed are capable of supporting on a sustainable basis.
- v) Identification of suitable technologies, local as well as improved, for the development of agriculture, horticulture, forestry, pastures, etc. on the one hand and soil and water conservation on the other.
- vi) Building of a suitable institutional framework for effective participatory approach in all the aspects of watershed management (planning, execution and maintenance) at the State, the District, the Block and the Village/watershed levels.
- vii) Mobilisation and organisation of the watershed community involving massive contact programmes to inform, educate and familiarize the local population about the importance of watershed development in resource conservation, economic development, for improving people's quality of life and their environment.

- viii) Training of project functionaries at the various levels of government. This involves two distinct components. One is concerned with reorientation and changing the general mindset of the government personnel from that of providers to that of facilitators in a people-led programme. The other is concerned with the technical training of both the government functionaries at various levels and the village leaders vested with the responsibility of project management at the local level.
- ix) Preparation of the watershed development plan for each selected watershed by people's organisations with the technical support of subject matter specialists from the government/non-government organisations acting as the project implementers. This plan must consist of a perspective treatment map and the treatment plan for the watershed, time phasing of physical works and the financial requirements over the project period, details of the post-project management arrangements, etc.
- x) Project execution and release of funds in suitable instalments in accordance with the project performance in terms of progress achieved in physical works and financial expenditure.
- xi) Project monitoring, concurrent evaluation and mid-course corrections.
- xii) Project completion, approval of Completion Report and withdrawal of external agencies from the project after the post-project management arrangements are made and the project and its assets are transferred to the peoples' organizations/ village panchayat concerned for maintenance.
- xiii) Post-project impact evaluation.

Check Your Progress II

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) Define *watershed*?

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2.8 SALIENT FEATURES OF THE PROGRAMME

2.8.1 Coverage of the Programme

The programme is implemented in all those districts and blocks that are not covered under either DPAP or DDP. To avoid duplicity, it is ensured that no other development work of similar nature was taken up or is under way in the area identified for the IWDP watershed project.

2.8.2 Project Mode

The programme is implemented exclusively on watershed development project basis. A Watershed Development project has to be implemented over a period of 5 years during which period financial assistance is provided to the implementing agencies.

2.8.3 Criteria for the Selection of a Watershed Project

- a) The watershed area selected for development should have a preponderance of wastelands.
- b) The area identified for treatment should include a preponderance of common lands and lands belonging to SCs/STs, small and marginal farmers and other weaker and poor sections of the project area.
- c) The watershed selected for development should have a large population of SCs/STs dependent on it.
- d) Watersheds should be selected for development in such a way that they are contiguous to one another to derive the maximum benefit out of the development works.
- e) Preference should be given to those areas that have not received attention previously for comprehensive development.

2.8.4 Major Activities of a Watershed Project

These can be broken down into three categories: (a) pre-project activities like building of the relevant village level organizations, community mobilization, capacity building/training of the watershed functionaries, survey and preparation of the watershed treatment plan and its approval, (b) development works for soil-moisture conservation, water resources development and development and/or regeneration of green cover on the reclaimed lands and (c) post-project activities like adoption of suitable production technologies, maintenance of public assets created under the project, etc.

It is important that development works indicated in (b) above are taken up following the ridge-to-valley principle of watershed development. That is, the uplands or the ridge region of a watershed should be treated first, followed by the development of slopes and drainage lines and finally the development of the low lands or the valley region. This will ensure control of the water run-off and the resulting soil erosion and silt flow from the upper ridges to the valleys and river systems downstream. An indicative list of these development works is given below.

- i) Development of small water harvesting structures such as low-cost farm ponds, *nalla* bunds, check-dams, percolation tanks and other ground water recharge measures.
- ii) Renovation and augmentation of water sources, desilting of village tanks for drinking water/irrigation/fisheries development.
- iii) Fisheries development in village ponds/tanks, farm ponds, etc.
- iv) Afforestation including block plantations, agro-forestry and horticultural development, shelterbelt plantations, sand dune stabilization, etc.
- v) Pasture development either by itself or in conjunction with plantations.
- vi) Land Development including *in situ* soil and moisture conservation measures like contour and graded bunds fortified by plantation, bench terracing in hilly terrains, nursery raising for fodder, timber, fuel wood, horticulture and non-timber forest products.
- vii) Drainage line treatment with a combination of vegetative and engineering structures.
- viii) Repair, restoration and upgrading of the existing common property assets and the structures in the watershed to obtain the optimum and sustained benefits from the previous public investments.

- ix) Crop demonstrations for popularizing new crops/varieties or innovative management practices.
- x) Promotion and propagation of non-conventional energy saving devices, energy conservation measures, bio-fuel plantations, etc.

2.8.5 Funding Pattern

IWDP is a Central sector scheme and watershed development projects under the programme are sanctioned at a cost norm of Rs. 6,000 per hectare of the area identified for treatment. This project cost is required to be shared between the Central and State Governments in the ratio of Rs. 5,500 : Rs. 500 per hectare respectively.

2.8.6 Allocation of Funds within a Project

Broadly, funds earmarked for a watershed project must be spent on the following components in accordance with the percentage indicated against each head.

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| 1) Community mobilization and capacity building | : 5% |
| 2) Works component | : 85% |
| 3) Administrative overheads | : 10% |

2.9 INSTITUTIONAL FRAMEWORK FOR IMPLEMENTATION

For the implementation of projects under IWDP, there is an elaborate and well-defined institutional structure covering various levels. This structure is described below.

National level: The Department of Land Resources, the Ministry of Rural Development, the Government of India, New Delhi, is the nodal agency at the national level responsible for getting the programme implemented. The Department is responsible for evolving policies for smooth implementation of the programme, its funding, monitoring its progress and evaluating the overall impact of the programme in relation to its objectives. The Department also plays an advisory role in so far as assisting the State governments and District administrations in the smooth implementation of the programme.

State level: Normally, the Department of Rural Development is the nodal agency responsible for the implementation of IWDP at the State level also. However, the State Government may designate any other related department like Agriculture to be the State nodal agency. The State level nodal department acts as an intermediary between the Central Government and the Districts in so far as the implementation of IWDP is concerned. It is responsible for programme policy implementation, advising, assisting and guiding the districts and for monitoring, reviewing and evaluating the progress of implementation in the State. It is also responsible for assessing the training requirements of all the state/district functionaries involved in the implementation of the programme and then for coordinating the organization of the required training activities.

District level: The Zilla Parishad (ZP) or the District Rural Development Agency (DRDA), as the case may be, is the nodal agency at the district level for the implementation of the programme. In the states where the ZPs have yet to come into operation with adequate powers and resources as envisaged under the Panchayati Raj Legislation and so have yet to acquire adequate technical capacity in watershed

development, DRDAs have been designated to supervise the implementation of IWDP. The district nodal agency works under the supervision and guidance of the State and Central Governments and is responsible for the selection of watersheds for the implementation of IWDP projects; identification and appointment of suitable implementing organizations; approval of the action plans/watershed treatment plans in the district and for reviewing, monitoring and evaluating the progress of the implementation of the IWDP projects. The agency is also responsible for arranging the requisite training programmes for the functionaries involved in watershed development in the district including district officials, Project Implementing Agencies and Watershed Development Team members.

The IWDP projects sanctioned to a district are, generally, implemented by the ZP/DRDA through Project Implementation Agencies (PIAs) specifically identified for the purpose. Preferably, an Intermediate Panchayat/Panchayat Samiti may be the PIA for all projects sanctioned to that particular Block/Taluka. In cases where these Panchayats are not adequately empowered or technically equipped, the ZP concerned can act as the PIA itself or may appoint a suitable district level line department like Agriculture, Forestry/Social Forestry, Soil Conservation, etc. or an agency of the State Government or the local university or any other suitable institute or a reputed Non-Governmental Organization as PIA. Nonetheless, the State Governments should make efforts to empower the Panchayats and build their capacities so that they may ultimately be in a position to take up the responsibility of implementing the projects independently.

The PIA carries out its responsibility through a multi-disciplinary team called the Watershed Development Team (WDT) which has at least four subject matter specialists from the disciplines of forestry/plant sciences, animal sciences, civil/agricultural engineering and social sciences. The PIA may utilize the services of its own staff for this purpose or may hire outside experts wherever necessary. The PIA, through this WDT, is responsible to create awareness about the importance and the advantages of area development on watershed basis and mobilize the requisite public participation in the project areas allocated to it. Arranging for training of all functionaries at the village and watershed level in different aspects of watershed project management is also its responsibility.

Watershed/Village level: At the field level, IWDP projects are implemented by the Gram Panchayats concerned, under the overall supervision and guidance of the WDT. All works executed by the Gram Panchayats should have the final approval of the Gram Sabha, which exercises overall control of the functioning of the Gram Panchayat. If necessary, the Gram Panchayat may get specific project works, involving a higher degree of technical competence, executed by outside agencies like the government technical departments, non-governmental organizations, etc.

2.9.1 Procedure for Sanctioning Projects

Procedure for the sanction of projects under IWDP in a financial year: The Department of Land Resources, in consultation with the State Governments, first prioritises the districts for the purpose. In doing so, the following factors are considered.

- 1) Preference is given to the districts that (i) have a large area of wastelands, and (ii) have not been sanctioned any watershed projects earlier or do not have any ongoing projects.
- 2) Those districts, which reflect a high degree of backwardness and incidence of poverty are considered on priority basis.

2.9.2 Flow of Funds

For sanctioned projects, the Central share of funds is released directly to the districts (ZPs/DRDAs), where the projects are under implementation, in 5 instalments over a period of 5 years. The State Governments concerned are also required to release their share of the project cost to the districts soon after the Central releases. Funds so received by the ZP/DRDA are further released to the PIA (administrative and training components) and the Gram Panchayats (administrative and works component) within 15 days.

2.9.3 Convergence of the Related Development Programmes and Activities

Successful implementation of a watershed project is expected to considerably enhance the economic condition of the project area in terms of the productivity of land and overall availability of agricultural, horticultural, forest and other related products. This improved situation requires that efficient backward and forward linkages for the provision of inputs for the production, storage and sale of the final products are in place. It also requires that suitable production and post-harvest technology in the project area is made available, the requisite infrastructural facilities are provided and other social inputs like health, sanitation, education, etc. are easily accessible to the local people. With these requirements in view, emphasis is placed on the convergence of all the relevant developmental schemes and activities in IWDP project areas. These should form part of the district development plan along with the watershed development plan.

2.9.4 Size of the Problem Area and the Extent of Coverage under the Programme

According to NRSA estimates, out of the 329 million hectares of total geographical area of the country, 63.85 million hectares are wastelands. Of this, approximately 51 million hectares, including 14 million hectares of degraded forest area, are treatable. In addition, 89 million hectares of cultivated area is rainfed, most of which is subject to severe erosion problems, needing comprehensive treatment under one or the other watershed development programme. Thus, the extent of the area that requires to be treated under various programmes is as follows.

	<u>In m. ha.</u>
1. Rainfed areas	89.00 (approx.)
2. Treatable non-forest Wastelands	37.00
3. Degraded Forest areas	14.00
Total	<u>140.00</u>

Against this *problem area* requiring treatment, projects under various watershed development programmes of the Department of Land Resources (IWDP, DPAP and DDP) sanctioned since April 1995 cover an area of about 19 million hectares, including about 5 million hectares under IWDP.

2.10 FUNDS: REQUIREMENT AND AVAILABILITY

Out of the estimated 37 million hectares of treatable non-forest wastelands, about 32 million hectares need development assistance as on date. At the present cost norm of Rs. 6,000 per hectare of treatment, the funds required to treat this area under IWDP may be estimated at Rs.19,200 crores. For the implementation of IWDP during the Tenth Five Year Plan (2002-07), the Planning Commission has approved

an allocation of Rs.1,800 crores, which translates into an average of Rs.360 crores that would be available annually.

2.11 MONITORING THE PERFORMANCE

During its implementation, the programme is monitored at frequent intervals by all the relevant implementing agencies comprising the Central and the State Governments, the ZPs and the DRDAs. Independent evaluators from reputed government and non-government organisations, universities, research and training institutes and professional consultants are also engaged for mid-term evaluation of the programme to obtain feedback on the progress of implementation and to check whether it is being implemented as per the guidelines and approved action plans. The mid-term evaluation is conducted after 45% of the project cost is released to the districts and the outcome of the evaluation is utilised by the Department of Land Resources for mid-course corrections wherever necessary.

From these monitoring and evaluation exercises, certain drawbacks in programme implementation have been observed. These are briefly listed below.

- i) Sometimes the watershed treatment plans do not reflect the local people's aspirations and requirements adequately as they are prepared on the basis of the perceptions of the PIA. This also indicates a low level of people's involvement in the project.
- ii) Community mobilisation and training activities, which are more crucial for ensuring people's participation, have not been given due importance.
- iii) In some cases, there have been undue delays at the level of ZPs/DRDAs in approving the watershed treatment plans and also in releasing funds received from the Central and the State Governments to the grass-roots implementing agencies. These delays lead to ad hoc execution of unapproved works as well as extension of project period much beyond the prescribed limit.
- iv) Sometimes, development of private lands was taken up extensively at the cost of planning for and development of degraded community land in the project area.
- v) In some cases people have not been adequately sensitised on the importance of public contributions to the Watershed Development, which is crucial to inculcate a sense of ownership of the project among the watershed community.
- vi) In some cases, due importance has not been given to a) the formation of Self-Help Groups from amongst the landless and weaker sections of the village community and b) the provision of the necessary training and financial assistance to start suitable income generating activities.
- vii) Plantation works that are necessary to improve the green cover of the degraded lands, particularly on those owned by the community, have been given the lowest priority in some cases.
- viii) Even where plantation works were taken up, the arrangements for their proper upkeep, maintenance and management for the benefit of the village community have either been absent or weak.
- ix) Arrangements made by the PIA for post-project maintenance of the assets created under the project and ensure their sustainability are not clear.
- x) In some cases, the project action plan did not reflect any formal arrangements made for the equitable distribution of benefits from the project amongst various sections of the village community.

- xi) Suitable production technologies for judicious utilisation of resources developed under the project, like water and land, have more or less been ignored resulting in improper and wasteful utilisation of these valuable resources.
- xii) Convergence of the related development schemes in the watershed area has either been absent or weak.

In spite of these infirmities, the overall impact of the programme in the problem areas has been very positive and encouraging. The Department of Land Resources has taken suitable corrective measures by way of more stringent monitoring and financial control to eliminate the above weaknesses in programme execution, which should result in enhanced benefits and a more positive impact.

Check Your Progress III

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) How are wastelands identified for treatment under IWDP?

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2) What monitoring mechanism is followed in IWDP?

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2.12 IMPACT EVALUATION

During the past few years, to assess the impact created by the programme in terms of both the physical and social benefits and the weaknesses in the implementation of the programme that might be diluting or hampering its full potential, the Ministry of Rural Development commissioned several evaluation studies in most of the states where IWDP is being implemented. As for the benefits that have accrued in the project areas, the evaluation studies reveal that:

- 1) overall productivity of land has improved, water table has increased, vegetative cover has improved and irrigation/drinking water wells have been recharged, suggesting a better position in terms of the availability of water and the improved natural resource base in the project areas as compared to non-project areas;
- 2) overall economic condition of the project areas has improved significantly;
- 3) the impact of drought was of a much lower intensity in the drought affected areas where watershed projects have been successfully executed;

- 4) public demand for watershed projects has increased significantly indicating improved social awareness about the programme; and
- 5) out migration of non-agricultural labour has reduced.

2.13 FUTURE STRATEGY

As has been seen earlier, due to financial constraints at the national level, annual allocations to the programme are not commensurate with the actual requirements and the problem at hand. Obviously, the Government alone cannot tackle the problem on its own and therefore, there is an urgent need to bring in other important players into picture for speedy and effective development of wastelands. Important among these other players, who are also interested in involving themselves in wasteland development, are the corporate sector, financial institutions and external donors. The roles of these actors whose support could be integrated into wastelands development strategies in future are indicated below.

Corporate Sector: It is worthwhile to consider giving the government land on lease to those corporate bodies that can improve its productivity and utilise it for commercial purposes. The private sector can come in a big way in this venture through a viable programme of contract farming.

Financial Institutions: With improved natural resource base of the project areas the village community would be requiring credit facilities for purchasing improved seeds, fertilizers and other such inputs for judicious utilisation of these developed resources. Further, to sustain the enhanced productivity and increased production levels of the project areas, it is necessary that suitable credit facilities are available to the local community to develop necessary forward linkages like godowns, safe storage of surplus produce and food-processing facilities, etc. Necessary infrastructure and marketing network also need to be developed. With the improving economic status of the people, demand for consumer goods from outside would increase progressively, for which local commercial ventures need to be encouraged. For all these requirements, NABARD and other commercial banks can contribute in a big way.

The Ministry of Rural Development has constituted a Task Force to examine the areas of support that can be obtained from corporate bodies, banks and other financial institutions for wastelands development.

External Donors: Traditionally, external assistance is available to several organisations in the country for the provision of social inputs like education, health, sanitation, livelihood activities, etc., particularly for the underprivileged. It is important that such assistance is channeled properly for comprehensive development of watershed areas.

2.14 LET US SUM UP

In this unit, you have read about the efforts made by the Government of India for the development of vast areas of wastelands, which can be improved to productive use. You have seen that the Integrated Wastelands Development Programme under implementation aims to develop the wastelands in an integrated manner so that the natural resource base of the degraded areas is regenerated and brought back to productive use resulting in the overall economic development of the rural communities depending on these areas for their livelihood.

You read that IWDP is implemented exclusively on watershed basis and by the people themselves inhabiting the project areas. This is a people's programme where the Government participates. We learnt about the Guidelines that govern the implementation of the programme, the institutional framework specified at various

levels for the purpose and the salient features of the programme. Further, we learnt about some drawbacks in the process of implementing the programme and the corresponding efforts made to overcome them. Despite these weaknesses, we have seen that the programme has generated significant impact—land quality has improved, more water is available and more areas are under the green-cover now.

We have learnt that the problem of wastelands development is so large that the finances available for the programme annually are not adequate to tackle the problem speedily and in a time-bound manner. Obviously, we require active participation of other players like the corporate sector, financial institutions and external donors in order to comprehensively develop our wasteland areas.

2.15 KEY WORDS

Culturable Waste : Land which by upgradation can be put to cultivation
Aquifers : Sub-soil water sources

2.16 REFERENCES AND SUGGESTED READINGS

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2.17 CHECK YOUR PROGRESS – POSSIBLE ANSWERS

Check Your Progress I

- 1) The main purpose of the integrated wasteland development programme is to develop wasteland as well as degraded lands in an integrated fashion, with a clear understanding of the capability of the land, site conditions and local needs. This is also expected to help in restoring ecological balance and promoting overall economic development of the people residing in these areas.
- 2) Wastelands are ‘degraded lands which are either completely or partially unfit for agriculture and also include such land as is deteriorating for lack of appropriate water and soil management or on account of natural causes’. The causes for the formation of wasteland are deforestation, unscientific cultivation, overgrazing and wrong methods of irrigation.

Check Your Progress II

- 1) A watershed is a land area from where rainwater flows down to a common drainage point. The ridges of the Watershed form its boundaries. The flow of

water takes place on the surface of the land in the watershed area. If the land surface of the watershed area is not adequately covered with vegetation, surface soil gets carried away by the rain water run off, causing severe soil erosion problems and silting of streams and water bodies down stream. The watershed development, therefore, involves scientific treatment of the watershed area from the ridges to the flat lands, in that order of priority.

Check Your Progress III

- 1) Under IWDP, wastelands for treatment are identified using the following considerations:
 - i) The districts are prioritised.
 - ii) Preference is given to those districts that have large areas of wastelands and have not taken up any watershed project earlier.
 - iii) The selected district should reflect a high degree of backwardness.
- 2) The programme implementation is monitored at frequent intervals at various levels by the Central and the State Governments as well as Zilla Parishads and DRDAs. Further, a mid-term evaluation is conducted after 45% of the project cost is released to the districts. The results of this mid-term evaluation are utilised by the department concerned for taking mid-course corrective action wherever necessary.

UNIT 3 SOCIAL FORESTRY AND JOINT FOREST MANAGEMENT

Structure

- 3.0 Objectives
- 3.1 Introduction
- 3.2 Social Forestry: Perspective
- 3.3 Types of Social Forestry
 - 3.3.1 Farm Forestry
 - 3.3.2 Agro-Forestry
 - 3.3.3 Community Forestry
- 3.4 Assessment of Social Forestry Programmes
- 3.5 The Social Forestry Programme: Some Lessons
- 3.6 Joint Forest Management: Concept and Objectives
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- 3.9 The Impact of Joint Forest Management
- 3.10 Participation of Communities in Conservation of Biodiversity
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- 3.11 Let Us Sum Up
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- 3.14 Check Your Progress – Possible Answers

3.0 OBJECTIVES

After studying this unit, you should be able to:

- critically analyse the role and extent of inter-dependence between the communities and forest resources in sustainability and conservation;
- explain the concepts of social forestry, Joint Forest Management and Village Eco-development;
- describe the programmes of the Government for the promotion of people's participation in forest management; and
- outline the performance of these programmes and the factors associated with them.

3.1 INTRODUCTION

Forests form the life support system for a population of nearly 147 million people living in about 1,73,000 villages of India inside and along the fringes of forests. The state of forests has been intrinsically related to the economic well being of the rural poor in these villages. Increasing population, development programmes and accordingly the invasive use of forests has caused shrinking of forest areas and therefore increase in the pressure for forest products and services. Naturally the rural poor in the vicinity have been the worst affected lot.

According to a study of Forest Survey of India (FSI), the total requirement of fuel wood, probably the most important forest produce for villages, in the country was about 201 million tons in 1996. Projected demands of fuel wood for 2001 and 2006 were/are 223 and 247 million tons respectively (Planning Commission, 2001). The present availability on a sustainable basis from the existing forests has been estimated at only 17 million tons. It is believed that about 51% of the total demand, much more than is available, is met from forests. Similar pressures exist for timber, fodder and other forest products. Productivity of our forests as estimated is 1.3 cubic meters per ha per year compared to the global average of 2.10 cubic meters per ha per year in terms of timber and firewood. The diversion of forests for various development needs also has contributed to the depletion of these resources.

Conventional rural development programmes have seldom taken into consideration this situation and there have not been any specially designed rural development models for the rural areas with populations wholly dependent on the forest resources for subsistence. As a result, various programmes formulated with good intentions have often resulted in conflicting situations, especially in the context of the conservation status of natural resources like forests and wildlife. This has caused further impoverishment of the people. The maintenance of forest resource base has always been a critical factor in the life of forest fringe communities, but it has seldom been seen as a means of rural development.

Concepts of social forestry and participatory forest management have emerged as a response to these circumstances. This unit aims at providing you an understanding of the concepts and programmes associated with *the forestry aspect* of natural resource management in a rural development environment. Also, the recent trends in the management of forest resources as applied in the social and legal framework of the empowerment scenario of rural life are introduced.

3.2 SOCIAL FORESTRY: PERSPECTIVE

The National Commission on Agriculture, considering the need to expand the tree resource base of the country, suggested the adoption of *social forestry* in rural areas in 1976. The Sixth Five Year Plan period (1980-85) gave a boost to the afforestation activities with the Centrally Sponsored “Social Forestry including Rural Fuel Wood Plantations” scheme. A series of social forestry projects followed with the support of international agencies including the World Bank, SIDA, DANIDA, US AID and others.

Social forestry projects aimed at taking the pressure away from the forests by afforestation of all the unused and fallow lands including village common lands, the Government wasteland and Panchayat lands. Tree planting in and around agricultural fields, along railway lines, roadsides, river and canal banks were carried out to meet the growing demand for timber, fuel wood, fodder, etc., thereby reducing the pressure on the traditional forest area.

It was also considered as a means of putting to the optimum use the fallow and degraded lands. Community Development schemes like NREP and RLEGP too had the components of social forestry, but the implementation through the Government establishment was aimed at planting trees as mentioned above. People’s participation was envisaged through awareness creating campaigns and extension services.

3.3 TYPES OF SOCIAL FORESTRY

Social forestry activities may be categorized into three groups: farm forestry, agro-forestry and community and extension forestry.

3.3.1 Farm Forestry

Individual farmers are encouraged to plant trees in their own farmlands to meet the market requirements of wood products. Forest departments as well as industries promoted forestry as a diversification option to conventional agriculture in suitable farmlands. In the initial stages, planting material was made available by the state forest departments. Subsequently, industries established buy-back agreements with *tree growers* and financial institutions also facilitated investments. These systems developed in the states like Punjab, Haryana, Gujarat, Karnataka, Uttar Pradesh, parts of Himachal Pradesh, etc. Now industries have their own nursery development programmes and quality seedlings are provided to the farmers with whom they have buy-back arrangements. WIMCO, Mysore Paper Mills, some units of Hindustan Paper Corporation and ITC Bhadrachalam are some of the pioneers in this field. The programme experienced a setback in the wake of smaller holdings coming to the fore and difficulties of the industries to organise these arrangements with smaller farmers and also the relaxed import of pulp. Relatively longer gestation period, demand driven market and emphasis on exotics and monoculture also contributed to the slow progress of the programme. However, economic considerations ensured that the system survived in the private sector and is still prevalent in many parts of the country.

3.3.2 Agro-Forestry

Agro-forestry is the system of land use that combines growing of forest trees along with agricultural crops. The farmlands are used for agricultural crops and trees are grown along the margins for various needs of the farmers. In fact, most farmers in India grow agricultural crops, rear animals, and plant certain trees on their land, often on the boundary areas. Growing of trees helps in conserving soil, enhancing soil fertility, and providing shelterbelts for crops and fruit trees, apart from wood and other produce.

Agro-forestry reduces farmers' dependence on forests even as it provides them economic benefits resulting in a healthy and sustainable land-use system. There have been several traditional agro-forestry systems in vogue in different regions of the country. Usually multipurpose trees are grown along the farmlands. Different versions of shifting agriculture are also termed as agro-forestry systems, which are now considered unsustainable because of their short cycles and high frequency.

The agro-forestry programmes in India were started in the late 1970s as a component of social forestry programmes. The Government promoted agro-forestry systems included fast growing species like eucalyptus, poplar, subabul, siris, etc. These systems though still prevalent in some areas, have not become very popular because of the market situation, which led to the slump in farm forestry systems. In the Tenth Five Year Plan, it is proposed to popularize agro-forestry as a strategy to increase the green cover of the country in areas outside the government forests.

3.3.3 Community Forestry

Another scheme taken up under the social forestry programme is the raising of trees on community land and not on private land as in farm forestry. All these programmes aim at creating tree resources for the entire community and not for any individual. The government takes the responsibility of providing seedlings, fertilizers, etc., but the community has to take the responsibility of protecting the trees. Some communities have managed the plantations sensibly and in a sustainable manner and the public continues to benefit.

Planting of trees on the sides of roads, canals and railways, along with planting on wastelands came to be known as 'extension forestry', as it increases the domain of forests. Planting of trees in vacant lands in urban areas, mainly along roadsides for

beautification and for reducing noise and dust levels, came to be known as ‘urban forestry’. Developing beautiful landscapes for recreation like picnics, jogging, relaxation, education, etc. has been named as ‘recreation forestry’. Under this system wood lots have been created in village common lands, government wastelands, panchayat lands and urban areas.

Check Your Progress I

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) Enumerate the main causes of the depletion of forests and its impact on rural population.

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2) What are the main types of social forestry?

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3.4 ASSESSMENT OF SOCIAL FORESTRY PROGRAMMES

Social forestry was originally conceived by the government as a response to the forestry crisis and to the accelerating deforestation in India. The original objectives of social forestry projects were to assist rural communities and the landless people to meet their needs for fodder, fuel wood, small timber, fruits, and minor forest produce through tree plantations planned and managed by the community.

Most social forestry projects, however, came under increasing criticism because they failed to adequately involve the local communities and the rural poor, the main beneficiaries. Instead, these projects catered mainly to urban and commercial interests through the widespread promotion of fast growing tree species for pulp and paper manufacture, rayon production, urban fuel wood supply and other commercial uses. Private farmlands, wastelands and community lands were converted for these uses, and in a number of cases the access of the poorer rural population to fodder, fuel wood and other forest products actually reduced. The only benefit was the availability of seasonal employment to the rural people in tree planting operations, which actually reduced in net terms in the case of farm forestry.

On the management front, the main drawbacks included greater emphasis on silviculture, lack of the required extension work, involvement of people and Panchayati

Raj Institutions, commensurate modifications in the forest regulations to motivate people to grow trees and that of orientation for the grass roots functionaries towards the needs of social forestry. Focus on economic benefits gave greater emphasis to fast growing species, which could not cater to the subsistence needs of the poor. Although eucalyptus trees grow more quickly, and remained at the focus of the projects, they could not provide the community with basic subsistence items.

A 1988 midterm review of social forestry cited the lack of the participation of local communities in project design and implementation and over reliance on industry-biased management as the main causes of the shortcomings of the project.

3.5 THE SOCIAL FORESTRY PROGRAMME: SOME LESSONS

In the social forestry programmes, emphasis on planting trees without appreciating the requirements of the communities impacted its sustainability negatively.

Planting of tree is still taken as a good option for degraded soils and wastelands instead of a diversification crop. Farm forestry became popular more for its long gestation period, for low labour requirement and absentee landlordism, rather than its remunerative aspects. Agro-forestry seems to be acceptable when a balance is struck between agriculture and the planting of tree. However, it works only for farmers with bigger holdings, because for marginal farmers and the landless, livelihood issues compel the use of land mainly for conventional agriculture.

Some aspects of agro- and farm forestry, namely private enterprises in tree planting, have suffered not only from the indifferent forest related regulations but also from the fiscal policies related to them.

The control on harvest and the movement of forest produce as provided in forest laws works as a disincentive for the farmer to grow trees. Permissions are required from the forest department for felling trees as well as transporting the forest produce in almost all the states of the country. Even where these regulations are relaxed, adequate evidence is required to prove (during transportation) that the produce has been collected from private lands and not government forests.

In the initial stage of agricultural development, expansion of agriculture took place at the expense of forests. These sectors competed for space in the private sector and plantation of trees lagged because of the lack of incentives, policy back up and the resultant economic considerations. The concessionary supply of the forest raw material from state governments and the relaxed conditions for the import of pulp have acted as additional disincentives for *growing of trees* because of the availability of cheaper raw material to industries. Thus, social forestry in its initial form was faced with the problems of low viability.

Today, the social forestry establishments within the state governments continue with the work of extension and awareness campaigns, afforestation on non-forest lands, urban forestry and the related activities. Community participation in social forestry is pursued through government interventions in the preservation of sacred groves, planting of institutional areas, other vacant lands and urban areas with resident associations, etc.

Though by law social forestry is a Panchayat subject, Panchayats have seldom played any active role in the process of afforestation in the case of common lands. It is necessary that the establishment of social forestry operates in collaboration with Panchayati Raj Institutions, as these institutions have adequate allocation of resources for afforestation and the management of existing *tree lands* as common property resources.

Check Your Progress II

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) What are the factors that affected the realisation of the objectives of the social forestry programme?

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2) Elaborate the factors that have affected the popularity of farm forestry and agro-forestry systems.

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3.6 JOINT FOREST MANAGEMENT: CONCEPT AND OBJECTIVES

Degradation of forest resources resulting from more than a century of its overexploitation and increasing human and livestock pressures has been of great concern to the nation. The degradation of forests affects most the poor rural masses that depend on forest resources for livelihood. The management of the government forests till recent past was aimed at the production of goods and services like timber, other forest produce and maintenance of soil and water regime. Access of communities to these resources was limited to Rights and Concessions granted for pathways, dry wood for fuel wood to a limited extent and grass and fodder as regulated by the government. In some states, traditional rights for structural timber were also recognized and granted on a periodic basis.

Through the social forestry scheme, the government aimed at community participation, as part of a drive towards afforestation, and rehabilitation of the degraded common lands. A similar programme has been identified for the rehabilitation and conservation of the government forests. Through Joint Forest Management, degraded government forests in the vicinity of villages are being revitalized by the collective efforts of the government and the villagers.

In 1988 the Government of India introduced a new forest policy that radically altered the aims of forest management, shifting it from a commercial and industrial focus to one that stresses environmental functions and meets the basic needs of the people living in or near the forests. For the first time, the rights of people living in and around the forests were recognized as a part of the management of forests, and the demand of the people has been recognized as the first charge on the forest produce.

In support of this new policy, in 1990 the Government of India issued a directive to the states to develop a participatory approach in their efforts to restore nation's degraded forests. This approach has been named Joint Forest Management and is also called Participatory Forest Management. So far 28 states have issued resolutions for Joint Forest Management. By 2003, 17.33 million ha of forestlands were being managed and protected by about 84600 village-level JFM Committees. The aim is to universalize JFM to involve all the 1.73 lakh villages in the vicinity of forests. Based on the experiences gained in the implementation of this programme since 1990, the Government of India modified the related guidelines in 2000 and 2002 and State Governments have been framing their respective rules within the framework of the said guidelines of the Government of India.

The National Afforestation and Eco-development Board (NAEB) was established in 1992 for promoting afforestation and ecological restoration activities in the country. It is the successor of the erstwhile National Wasteland Development Board (NWDB) and is responsible for providing impetus to the rehabilitation of degraded forests in the states. Under the National Afforestation Programme, the Government of India assists the states in their afforestation efforts. Also, this programme is being used by the Government of India to expand and promote the Joint Forest Management in the states.

3.7 DESIGN OF THE PROGRAMME

Basically, Joint Forest Management empowers the communities to assess, plan and manage the forest resources, which constitute their main life support system. An adequate extent of Government forest area is earmarked for handing over to the village unit of communities for management. Villagers are organised as *Joint Forest Management Committees* (JFMCs) for this purpose. These committees are given various names like *Vana Samrakshana Samiti* (VSS), *Forest Protection Committee* (FPC), *Village Forest Committee* (VFC), etc. The State Forest Department organises and provides motivational, technical and administrative support to the JFMCs, which attract the support of the villagers on the fringes of the degraded forests as its willing members. Generally, two people from each household become members, one of them a woman. The general body of 75 to 150 members, 50 per cent of whom are women, elect a JFM Executive Committee, which in turn elects a chairperson to oversee and manage the affairs of the JFMC. It is prescribed that at least 33% of the seats in the JFM Executive Committee be filled by women members. For a general body meeting, presence of at least 50% of the women members is taken as a prerequisite. Adequate representation is ensured to all the sections of the society. The Forest Department representative acts as the secretary. Interested social and non-governmental organisations are also involved in building up confidence among the communities.

A memorandum of understanding between the JFMC and the Forest Department formally details the duties, functions, and entitlements of everyone involved. The primary purpose of the JFMC is to protect the forest from encroachment, grazing, theft, fire and to improve the forest in accordance with an approved joint forest management plan, known as a micro-plan. Micro-plans are designed to ensure protection of forests and at the same time they aim at restoring their productive capacity as quickly as possible.

As an incentive for managing a particular forest, a JFMC is entitled for a share from the forest produce grown and available in the area. The income generated from the disposal of forest produce, after meeting the requirement of communities, is distributed equally among the members of the JFMC. At the outset, to help motivate people and to address some of their most pressing social needs, the State Forest Department provides some financial support for the development of the village(s) concerned. The

project supports some of these “entry point” activities, with the assistance of other government departments or NGOs to facilitate this broader rural development activity. This enables successful integration of conservation with development aims of the government. It is also prescribed that an appropriate percentage of the income generated from the forest resources be apportioned for activities that are important for ensuring sustainability of the forest(s) managed by the JFMC.

The works and funds of the JFMC are handled in a transparent manner jointly by the chairperson of the JFMC and the forester who acts as the secretary. This transparency helps to ensure the quality and cost-effectiveness of all activities. All the decisions related to the implementation of the micro-plan and appropriation of the funds accrued to the JFMC are taken collectively by the JFMC.

Check Your Progress III

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) How is Joint Forest Management different from social forestry in concept and objectives?

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2) What are the responsibilities of the JFM institutions in the management of forests?

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3.8 ROLE OF PANCHAYATI RAJ INSTITUTIONS IN JFM

One of the basic purposes of Panchayati Raj is to enable people to understand their socio-economic interests and take decisions at their level for their own good. With the notification of the 73rd amendment Act 1992 and its implementation in 1996, Panchayati Raj Institutions have been provided at the village, the intermediate and the district levels. Among the 29 duties entrusted to the PRIs as per the Act, *social forestry, farm forestry, minor forest produce, fuel and fodder* are some, which are related to the forestry sector. Thus, it empowers the PRIs to take decisions regarding the management of the natural resource at their disposal. However, the management of state forests has been the responsibility of the state government institutions and, therefore, JFM institutions, participating in the management of the government forests are considered to be outside the purview of local self-governments.

This is the reason that the JFM Committees are to be registered under the Societies Registration Act 1860 and function independently. Nevertheless, any activity, including afforestation and management of forests outside state forests, like community lands, etc. do come within the purview of Panchayats, and JFMC in such case would be associated with the Panchayats concerned.

In this context, the Government of India has suggested formation of a Committee at the district level under the chairmanship of President, Zila Parishad or the Collector, where Zila Parishad is non-functional, with Divisional Forest Officer as the convener and other district level officers as its members. However, it has been advocated that separate non-political identity of the JFM Committees as 'guardians of forests' should be maintained.

Panchayats (Extension to the Scheduled Areas) Act 1996 extends panchayats to the tribal areas of Andhra Pradesh, Bihar, Jharkhand, Gujarat, Himachal Pradesh, Maharashtra, Madhya Pradesh, Chhattisgarh, Orissa and Rajasthan with the objective of enabling tribal societies to assume control over their own destiny to preserve and conserve their traditional rights over natural resources.

In this context, as the management of government forests has been retained with state governments, the right over *Minor Forest Produce* (MFP) in both the Acts has attracted conflicting interpretations of MFP leading to a situation where definite clarifications on this aspect are not forthcoming. Ownership of MFP with PRIs has been accepted only to the extent of making only the residual profits of state forest corporations/federations of co-operatives available to them (i.e. PRIs). This is seen going against the provision of vesting the ownership of MFP with these institutions (Planning Commission: 2000, the Ministry of Rural Development: 2003). However, keeping in view the fact that the state forests are kept beyond the domain of PRIs, options of appropriation of MFP by the communities in JFMCs is available under the JFM regime for the state forests while MFP from the community forests and such other forest areas will be at the disposal of PRIs.

In the guidelines issued by the Government of India on JFM, it is suggested that the benefits accrued from *Non-Timber Forest Produce* (NTFP) sales should be shared with all the members of the Gram Sabha including the JFM Committees. Panchayats and State Forest Corporations have been advised to assist the JFMCs for developing skills for handling the NTFP collection, storage and marketing. These guidelines are very general and do not offer a resolution mechanism for conflicts arising out of the following situations, particularly in the case of major NTFP items involving significant yields.

- In several states, MFP is managed and marketed by State Forest Development Corporations as commercial activities on payment of royalty to the state governments and communities have access for the use of MFP for *bona fide* purpose only.
- In many states, tribal or other co-operative societies are entrusted with the collection of MFP on payment of royalty or free of cost and the state level federations of these co-operative institutions manage marketing. In many cases MFP is the only activity dealt by these institutions.
- Under the Panchayati Raj Act, MFP has been brought under the mandate of Panchayati Raj Institutions, though the state forests have been kept out of their purview.
- Under JFM arrangements, the JFMC members have a natural right to appropriate the yield, including that of MFP, from the forest area managed by them.

In some states, like MP, the representative of Gram Sabha has been made a member of the executive committee of the JFMC as a measure of conflict resolution. As the micro-planning and major decisions are generally taken in the general meetings, there are few chances of conflicts. However, the relations between JFMCs and PRIs vary from state to state and it is essential to bring harmony between these institutions to avoid any conflicting situations.

3.9 THE IMPACT OF JOINT FOREST MANAGEMENT

The participatory management of forests enables the communities to understand the capability of the forests in catering to their need and thus prompts them to have a realistic resource management plan, based on their requirements and priorities, for the forests entrusted with them. The empowerment of communities in planning and managing the common property resources in their vicinity evolves a sense of ownership of the forests and thus the responsibility of maintaining sustainability becomes a voluntary commitment. As all the villagers are involved in this process, unity and consensus for taking conscious decisions about collective (common property) resources along with wholehearted co-operation are evolved. These, as we know, are the crucial attributes for an ideal village society. Participatory management also ensures willing inputs from the communities in optimizing/maximizing the productivity of forests. The process of micro planning enables the villagers to understand and appreciate the resource related issues and the importance efforts required for conservation of natural resources.

Most of the states have adopted the JFM concept for the management of degraded forests in the vicinity of villages. States like Madhya Pradesh have entrusted the management of forests within 5 kms of villages to the village communities, irrespective of the degradation status of such forests. Kerala too has adopted the JFM concept for the management of Non-wood Forest products/resources making it possible for the forest and fringe dwellers to take up activities for conserving the resources and appropriate the NWFP on the principles of sustainability. The Government of India has made JFM an integral part of the National Afforestation Scheme in which the Central Government provides funds for afforestation of degraded forests through Forest Development Agencies (FDAs), which are the consortia of JFM Committees with representation from Panchayats, Forest and other line Departments of the State Governments concerned.

Check Your Progress IV

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

- 1) Explain how JFM institutions are different from Panchayati Raj Institutions in terms of their mandates and responsibilities.

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2) What is the expected outcome of the JFM programme?

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3.10 PARTICIPATION OF COMMUNITIES IN CONSERVATION OF BIODIVERSITY

3.10.1 Village Eco-development

We have learnt about the forestry management models with participatory approaches adopted for the management of degraded forests for sustainable use, growing of trees as an economic activity and rehabilitation of private and community lands for community use. The typical JFM model is not applicable in situations where the villages are situated in the vicinity of protected areas, i.e. Sanctuaries and National Parks. Protected Areas or PAs, as these conservation area units of forest management are called, are basically the forest areas set apart for the preservation of biodiversity and representative or unique natural habitats in which human interference is sought to be avoided. These areas showcase the wildlife (uncultivated flora and undomesticated faunal diversity) of the country and the objective of management in this case is to preserve the gene pool by preserving the natural habitats. Forestry operations are avoided and so the removal of forest produce.

In India, at present an area of approximately 1.56 lakh square kms is covered and managed as 500 Sanctuaries and 89 National Parks. Human habitations are situated near these areas also and in many cases within the PAs and there are populations, especially tribal communities, which have lived there for ages. Relocation of human settlements out of the PAs has been one of the operational components of the Protected Area Management, but it is resolved that such relocation should be absolutely voluntary (National Wild Life Action Plan, 2002). However, human interference in PAs is preferred to be avoided. In such cases, therefore, the village population is deprived of the life support system and perhaps the most important natural resource at its disposal. Besides, these communities face hardships due to loss of employment based on forestry operations, damage of crops and elimination of life by wild animals, etc. This often results in a conflicting situation between the objectives of management and the needs of the society, breaking the bond between the nature and the human inhabitants.

In these situations, instilling the realization of the positive impact of conservation in ecological and economical terms in the communities concerned would be possible by designing rural development programmes which could divert the livelihood pressures from the forests (in terms of their invasive use), and provide improved quality of life to the neighborhood communities by positive ecological impact of the conserved PAs on the village ecosystem. This strategy is known as *Village Eco-development*.

3.10.2 Concept and Design

Village Eco-development aims at the all round development of the village as planned by the villagers themselves for sustainable use of all the resources available at their disposal. Dependence of villagers on the forests of a PA is diverted by creating

livelihood opportunities outside the PA by optimizing the use of available resources, increasing productivity and value addition based rural enterprises. Non-invasive services generated in the PAs are made available to the deserving members of the community and they are empowered with knowledge and techniques in achieving the objectives of the management and protection of the PA. Children, for example, are involved in *nature education* and the *appreciation of natural phenomena*.

As in Joint Forest Management, Eco-development Committees (EDCs) are formed in villages and they work with NGOs and the PA managers for planning and implementing the appropriate eco-development plans for the village as well as conservation of biodiversity. Development of community resources and generation of gainful employment outside the PA, avoiding invasive and destructive use of PA habitats are the prime considerations in micro planning. Opportunities of seasonal and regular employment in the PA are made available to the villagers recommended by the EDC. Alternatives to the forest based employment are explored and pursued. Modalities of regulating access to the resources (like water and biomass products) in conformity with the prescriptions of the management plan of the PA are also decided by the EDC.

The micro-plan thus prepared takes the shape of an integrated rural development plan that may require investment. There have been instances where such investments have been ensured by various line departments on requests from the PA management, ensuring implementation of site-specific plans beyond the realm of conventional government schemes. In most of the cases so far, investment has been made under the government schemes for the management of PAs.

3.10.3 Village Eco-development as a Government Programme

Village eco-development was adopted as a government effort for the management of PAs during the Ninth Five Year Plan. A pilot project on *park management* based on participatory Village Eco-development was started during the plan period in seven Project Tiger Areas under the aegis of the Global Environment Facility (GEF) through the World Bank. The Project is in its final stage and has been slated to be one of the successful experiments in winning the co-operation of communities in the conservation of biodiversity. The final results are yet to be compiled in order to develop a universally applicable model of Eco-development Approach. Now the Government of India has prescribed that the village eco-development activities be taken up as a regular *PA management* activity in all the wildlife park management schemes supported by the Central funds.

Check Your Progress V

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) Who benefits from the Village Eco-development programme and how?

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3.11 LET US SUM UP

We have seen that the pressures of population, development and the resultant invasive use of forests caused degradation and depletion. At the local level the worst sufferers have been the rural people living in the vicinity of forests. Social Forestry Programmes designed for afforestation of forest areas as well as non-forest areas dealt mainly with biomass production for relieving the pressures of wood products from forests. Popularity of these tree-planting programmes promoted in private, community and other degraded lands varied depending upon the requirement of user populations, demand situation of industries and policy and laws related interventions. Social forestry programme has been recognized as a programme for planting trees, wherein community participation could not be ensured satisfactorily.

For rehabilitation of degraded forests in the vicinity of inhabited areas, people's institutions have been created to manage government forests in recognition of their first claim on the natural resources as provided in the National Forest Policy 1988. The guidelines of the Government of India for this participatory approach, named the Joint Forest Management, issued in 1990 and improved in 2000 and 2002, provided for the transfer of the responsibility of managing these forests to the communities in terms of planning, management, protection and sharing of benefits. These Guidelines provide for adequate representation of women in decision-making and clarify that the institutions are independent of the purview of Panchayati Raj Institutions for the management of State Forests. However, a clear definition of roles and responsibilities is needed for conflict resolution.

Similar institutional arrangements are evolving for the conservation of biodiversity and the concept of Village Eco-development is emerging as a viable means of ensuring peoples participation in Protected Area Management. It also helps in mitigating conflicts arising out of the denial of forest based subsistence related activities within the Protected Areas.

Thus, community participation in the management of natural resources in the rural development scenario has taken place in the field of forest management. It is expected that the related community institutions would perform this task to bring productivity to the optimum level and the resource character in conformity with their requirements. The ecological functions of the forests can be fulfilled only when the communities ensure optimum productivity in terms of biomass and sustainability in use of forest products.

3.12 KEY WORDS

Exotics	: Plants which are not native to Indian Habitats and have been imported such as eucalyptus
Monoculture	: Cultivation of single / similar species of trees.
Silviculture	: Art and science of growing trees.
Preservation of sacred grows	: Natural and small patches of forests surrounding religion shrines and preserved by the community based on their religious beliefs

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3.14 CHECK YOUR PROGRESS – POSSIBLE ANSWERS

Check Your Progress I

- 1) The main causes of the depletion of forests and its impact on rural population include:
 - Invasive use of forests for developmental activities depleting forestlands.
 - Population growth resulting in higher pressure for removal of forest produce.
 - Increased deprivation of communities due to shrinking forest resources.
 - Lack of consideration for the needs of communities in forest management planning and rural development.

Thus, depletion of forest resources causes denial of the life support system that the forests provide to the fringe dwelling communities. Development of forests is an integral part of village development for the communities that live in over 1.70 lakh villages dependent on forests for their daily subsistence.

- 2) Social Forestry dealt mainly with the plantation of trees, generally economically important species, in private and community/common lands. Tree cultivation in and along farmlands came to be called *farm forestry* and *agro-forestry*. Planting

trees in community lands is termed *community forestry*. Plantation along roadsides, railway lines, ponds and river embankments, and such other places is known as *extension forestry*. The terms *recreation forestry* and *urban forestry* refer respectively to the plantation activities for beautifying landscapes and development of green cover in urban areas.

Check Your Progress II

- 1) The positive impact of social forestry programmes was the expansion of tree cover in many areas and increased availability of wood products such as fuel wood and raw material for industries. This was the outcome of the focus of social forestry programmes on the plantation of trees. This programme also provided seasonal employment to the rural people.

The factors that affected the programme badly are as follows:

- Excessive emphasis on wood production overlooking the needs of communities.
 - Communities could not be involved in the planning process.
 - Fast growing species chosen for quick success catered to industries but could not meet the demands of the people.
 - Cultivation of trees without the involvement of people rendered these plantations inaccessible to communities; this added to the levels of their alienation.
 - Subsidies available to forest based industries on the raw material supplied by forests.
 - A demand-driven programme not facilitated through market support.
 - Forest regulations regarding felling of trees and their transportation acted as disincentives.
 - Fall in the price of pulp due to relaxed imports affected the viability of plantation programmes.
- 2) The factors which have affected the popularity of farm forestry and agro-forestry systems are:
 - Subsidies available to forest based industries on the raw material supplied by forests.
 - A demand-driven programme not facilitated through market support.
 - Forest regulations on felling and transportation acted as disincentives.
 - Fall in the price of pulp due to relaxed imports affected the viability of plantation programmes.

Check Your Progress III

- 1) The JFM is different from social forestry because:
 - JFM is the means of managing forests by communities while social forestry dealt with building up forest resources beyond forest areas.
 - JFM empowers community institutions to plan and practice forest management.
 - JFM is practiced in government forests by fringe dwelling communities while social forestry is practiced everywhere.

- 2) The responsibility of the JFM institutions is outlined as follows:

JFM institutions assess the forest resource and its capability of catering to the requirements of communities, formulate a micro-plan for its management and implement the plan with the help of the government. The plan includes protection of forests, augmentation of the vegetative cover and sustainable utilization of the products available from the forest. Income generated from the forest is also appropriated as decided by the JFM institutions including that for forest management.

Check Your Progress IV

- 1) JFM mechanism is adopted for the management of state forests, which is a state subject. Thus JFM institutions are considered independent of the purview of PRIs. However, as the communities, which are the basis of PRIs, form the basis of JFM institutions also, these are not expected to act in conflict with each other. While PRIs are the elected local self-governments at the village level, JFMCs are societies of villagers directly engaged in conserving forests.
- 2) The participatory management of forests enables the communities to understand the capability of the forests for catering to their needs and thus prompts them to have a realistic resource management plan, based on their requirements and priorities, for the forests entrusted with them. As all the villagers themselves are involved in this process, they make inputs for maximizing the productivity of forests willingly. This involvement ensures equitable distribution of benefits from the forests among all the villagers.

Check Your Progress V

- 1) The Village Eco-development Programme helps the populations living in or near Protected Areas as follows:
 - its focus is on diverting the pressure of subsistence away from PAs;
 - other resources at the disposal of community are augmented for optimum utilization;
 - the involvement of communities in the protection and conservation of PAs is attempted by providing *nature education* and *awareness of natural phenomena* to them and
 - employment opportunities emerging from the management of PAs are made available to the communities concerned for livelihood.

UNIT 4 SCIENCE AND TECHNOLOGY FOR RURAL DEVELOPMENT

Structure

- 4.0 Objectives
- 4.1 Introduction
- 4.2 S&T Inputs for Rural Development
 - 4.2.1 Significance of S&T
 - 4.2.2 S&T Schemes and Programmes
- 4.3 Spatial Technologies and Rural Development
 - 4.3.1 Geographic Information System (GIS)
 - 4.3.2 Global Positioning System (GPS)
 - 4.3.3 Remote Sensing (RS)
- 4.4 Factors Associated with the Utilization S&T
- 4.5 Strategy for the Application of S&T for Rural Development
- 4.6 Let Us Sum Up
- 4.7 Key Words
- 4.8 References and Suggested Readings
- 4.9 Check Your Progress – Possible Answers

4.0 OBJECTIVES

After reading this unit, you should be able to:

- explain the significance of S&T for rural development and illustrate the experiences of those working on S&T applications in rural development;
- describe the nature of interaction among the generators, the carriers and the users of technology, particularly in the rural areas;
- identify the areas requiring technological interventions and the related mechanisms for the generation and diffusion of S&T;
- describe some of the major programmes of rural development launched after independence which involved significant S&T inputs.
- critically analyse some of the major factors associated with the utilization of S&T and explain the role of spatial technologies and their applications in rural development.

4.1 INTRODUCTION

The importance of science and technology (S&T) to rural societies has been recognised since long. Though enormous strides have been made in the area of S&T in India since 1947, there is an urgent need to deliver them to the most needy so that they are able to meet the challenges of a technologically sophisticated world. Advances in technology continue to create newer methods of communication and information management, which have produced profound impact on the society at large. They have offered unprecedented opportunities and challenges for scientific endeavours. Though science has a universal character, it is supported or constrained by practices, which are influenced by local customs and values. In rural areas, behaviour patterns and practices are deeply rooted in traditional beliefs and superstitions that are not easily displaced by science or modern approaches based on new knowledge. The

S&T policies for rural development need to take into account the nature of the local environment to effectively deliver the benefits of S&T to the rural society. Herein lies the challenge for the management of rural natural resources and environment.

Rural areas need to explore the socio-economic implications of new technologies, especially to predict their impact on society, identify emerging opportunities, and serve as an early-warning system for natural disasters. The rapid growth and unprecedented influence of new technologies, especially the information and communication technologies, including the Internet, are raising global awareness about the power of technology as a whole.

There is also a need to bridge the 'digital divide' between the urban and the rural areas by making these technologies more and more accessible by improving connectivity, computerisation and content areas. Similarly, in the context of pollution, environmental degradation and the need for sustainable development, harnessing the potential of S&T for systematic and coordinated use of local resources is a matter of paramount importance.

This unit covers the broad aspects of the use of S&T for rural development. Firstly, the significance, role and contribution of scientific and technological inputs [including that of spatial technologies, like Geographic Information System (GIS), Global Positioning System (GPS) and Remote Sensing (RS)], in the various aspects of rural development planning and management are discussed in brief. This is followed by a description of the factors related to the application of S&T. In the concluding section, an attempt has been made to explain how S&T may be integrated effectively in the strategies related to rural development programmes.

4.2 S&T INPUTS FOR RURAL DEVELOPMENT

4.2.1 Significance of S&T

There are several reasons why focusing S&T for the benefit of the rural poor in India is both appropriate and timely. S&T is the most important means for empowering the poor. The rural areas, which have not addressed the issue of acquiring scientific and technological knowledge so far, must now redouble their efforts with a strategy that begins with popularising science and its application to rural development in concrete terms. It is now an imperative for the governments to invest in these technologies or risk widening of the gap between the urban and the rural areas. It is this realisation that should make S&T work for development, and take the country's rural development agenda to the top.

In order to appreciate the role of S&T in the process of development, it is necessary to understand that *S&T is the means of enhancing productivity and the physical and mental capabilities of human beings. It is the instrument for transforming natural resources into useful goods. It is also the means for effecting social change.* S&T has made major contributions to many fields, including agriculture, industry, utilization of resources (like physical, biological, financial and infrastructure), medicine and health, transport, environment, and the quality of life in general.

The scarce resources can be put to rational use through S&T. Those who own or use precious natural resources, particularly land and water, can increase their efficiency levels through judicious use of S&T. New technologies facilitate the processing of raw materials, by-products and waste materials. The application of S&T can help in making improvements in land and water resources and also in starting agro-industries, and thus create additional jobs for the unemployed and underemployed persons.

Many of our achievements in agricultural and rural development can be traced to the application of S&T. The diffusion and adoption of innovations in rural areas have generated changes in almost all aspects of rural life. Farm mechanisation has enhanced productivity and due to modern technology farming got commercialised and moving away from the traditional farming techniques farmers are fast adopting entrepreneurial production systems. The use of electricity has revolutionized farming. Better means of transportation and communication have shown deep impact on the socio-economic life of the rural people.

As you know, women have been a disadvantaged group in many ways. Amongst the rural masses, the brunt of hardships is borne by women. The situation is further complicated by the fact that women are heading an increasing number of households in the villages due to the migration of men to cities. It is therefore essential to strive for introducing and applying technology in spheres directly affecting the well-being of rural women.

Removal of poverty and generation of employment are major objectives of our development plans. The achievement of these objectives is possible by drawing up scientific strategies for rural development based on a comprehensive survey of resources, their planned utilization and management based on technological appropriateness to the local environment and mass mobilization of people through education, and equitable sharing of the benefits of development.

Several instruments are now available to educate the general public about the scientific and technical aspects of the related issues such as agro-techniques, community healthcare and other matters concerning daily life. The instruments we are talking about are formal, open distance and on-line education; media presentations by experts and practitioners; broadcasts of relevant S&T messages; and exhibitions, fairs, and science competitions. All of them offer opportunities to the public to visualize how S&T can and does contribute to development, seek information and get their queries clarified and learn more and more about various new products and processes.

These initiatives provide answers to such questions as: How should technology be used to facilitate development? What role should the private sector and the non-governmental sector play? What technologies should be promoted? And what type of educational structure and curricula would facilitate the achievement of development objectives? The strategies of delivery would include a) restructuring of science education with a focus on the utility of scientific culture, b) use of familiar materials and processes, and c) teaching through and about indigenous S&T practices using local languages.

4.2.2 S&T Schemes and Programmes

Rural development is determined by the efficient, scientific and optimum assessment, conservation, utilization and distribution of rural resources. Science & technology and rural development are thus inter-related and inter-dependent.

Let us now have a look at some of the developmental areas in the context of S&T inputs.

In the field of agriculture, advances in agricultural technology have revolutionized agricultural production. These include the use of high yielding and disease resistant seeds, fertilizers, pesticides, improved implements, irrigation and drainage, crop rotation and cropping patterns, storage, processing and marketing.

Various programmes linking S&T and rural development have been launched in recent times. The major ones are as follows:

- Science and Society Programme of the Department of Science and Technology (DST), the Government of India. It includes S&T Application for Rural Development (STARD).
- S&T Application for Weaker Sections (STAWS).
- S&T for Women.
- S&T for Practical and Strategic Needs of SC Population
- Empowering Tribal Groups through S&T
- Scheme for Young Scientists.

Several other programmes are also available for the development of animal husbandry and fisheries, which are integral parts of agriculture in rural India. These include:

- Dairy Development Programme (DDP),
- Fodder Development Programme (FDP),
- Intensive Cattle Development Programme (ICDP) and
- Special Livestock Production Programme (SLPP).

Awareness regarding S&T inputs arising from the researches being done in genetics and breeding, botany, microbiology and biochemistry are made available to one and all under these programmes. Setting up of poultry, piggery, fisheries and sheep production units and rearing of cross-heifers by small and marginal farmers and agricultural labourers are encouraged through these programmes.

Special programmes have been launched for the development of hill areas, tribal areas, drought-prone and desert areas, command areas, etc. by adopting area-specific approaches. Notable among these are:

- Hill Area Development Programme (HADP),
- Tribal Development Programme (TDP),
- Intensive Agricultural District Programme (IADP),
- Drought Prone Area Programme (DPAP),
- Desert Development Programme (DDP),
- Command Area Development Programme (CADP) and
- Whole Village Development Programme (WVDP).

In the field of rural housing, suitable indigenous building materials and improved cost-effective construction techniques are being developed and made available to the rural masses. Indira Awaas Yojana (IAY) was launched in May 1985 as a sub-scheme of Jawahar Rozgar Yojana (JRY). It is being implemented as an independent scheme since January 1, 1996. The other two important schemes in this field are: Pradhan Mantri Gramodaya Yojana (Gramin Awaas) and Samagra Awaas Yojana, which came into effect from April 1, 1999. The National Mission for Rural Housing and Habitat was also set up on the same date to facilitate the induction of S&T inputs on a continuous basis in the rural housing sector.

Health and sanitation continue to remain an important component of rural development. Preventive, curative and rehabilitative services are being extended all over the country through different health care programmes. For the improvement of environmental sanitation in rural areas, improved low cost sanitation techniques have been developed for disposal and/or recycling of human and animal wastes.

Poor quality of curriculum in the formal education system is one of the key issues. There are weaknesses and deficiencies in the curricula for science education and the

techniques of their delivery in the education system. First, the school enrolment is low in rural areas, particularly that of girls. A significant percentage of youths thus does not access even the feeble S&T programmes that exist in the curricula. Secondly, there are few incentives to draw the youth into careers in S&T. The teaching of S&T needs a special form of instructional material and skills. Science teachers, particularly those working in rural areas, are not adequately trained in such skills. For example, they are seldom able to show any relation between science and everyday living. In addition, teachers in rural areas are often poorly paid. Consequently, the rural masses do not become enlightened citizens or “intelligent users” of their natural resources.

Improper delivery of non-formal education is an equally important issue. The major weakness here lies in the sources of knowledge and information. The non-formal approaches often miss the underlying principles of science, as they tend to concentrate on a shallow interpretation of scientific applications without touching the requisite knowledge base.

Among the rural masses, the explanatory theories that shape their environmental understanding stem from the cultural beliefs and traditions, as well as from the age-old superstitions. These influences are not easily displaced by general science or the programmes that aim at popularising it.

Some missions related to the major socio-economic sectors were launched during the Seventh Five Year Plan. They have a large S&T component and may provide a higher visibility when accomplished. As a result of this strategy, the technology missions that came into being relate to the areas of: (i) drinking water, (ii) immunization of vulnerable populations, especially children, (iii) eradication of illiteracy, (iv) self-sufficiency in edible oils, (v) better communications, and (vi) wastelands development. Besides, several S&T projects (in the mission mode) have been initiated to cover areas like immunological approaches to fertility control; integrated vector-control of malaria, filaria and other vector-borne diseases; control of iodine-deficiency disorders; development of immuno-diagnostics and cattle herd improvement using embryo transfer; together with the operationalisation of the National Natural Resource Management System (NNRMS), the Natural Resource Data Management System (NRDMS), National Centre for Medium Range Weather Forecasting (NCMRWF) and the development of agro-meteorological services. The significance, implementation and impact of these technology missions and S&T projects in mission mode for rural development constitute major efforts of the government in the process of rural development.

The Technology Mission for Drinking Water in Villages and the Related Water Management: It aims at providing safe drinking water, and locating and developing new sources of water using high technology inputs. It also aims at eradicating guinea worm, controlling fluorosis, controlling brackishness and reducing excessive iron in water to tolerable limits. Conservation of water and recharging of aquifers are given priority. Remote sensing techniques are being used extensively in hydrological and geophysical surveys being conducted all over the country. The problem villages, affected by bacteriological and chemical contamination, have been identified and the quality of water available to them too has been tested. Work on the installation and operation of tube wells, desalination plants, defluoridation plants and excess iron removal plants has been undertaken. A computerised information system on drinking water has also been developed. In this way scientific inputs are being utilized on a large scale for locating water sources, hydrological and groundwater mapping and for constructing water conservation structures.

The immunization Mission: It aims at: a) reducing morbidity and mortality due to diphtheria, whooping cough, tetanus, polio, measles and tuberculosis among children, b) reducing mortality due to tetanus among pregnant women, and c) achieving

self-sufficiency in vaccine production. Efforts have been made under this mission to establish systems for disease surveillance and epidemiological monitoring, create linkages with other programmes like the Integrated Child Development Services (ICDS) programme, modernize existing vaccine production units, strengthen the cold chain maintenance system, establish vaccine testing facility, promote the use of indigenous systems of medicine in specific areas, and arrange for field testing the new kinds of polio and quadruple vaccines. The strategy for the introduction and development of BCG vaccine with fewer doses was also developed by the same mission.

The National Literacy Mission: It aims at imparting functional literacy to adults in the age group of 15-35 years. The strategy adopted by the mission includes improvement in the learning environment, motivating instructors and learners, institutionalization of post-literacy activities, ensuring the availability of standard learning material and the adoption of an area approach. Use of improved technology inputs such as better blackboards, modern mobile audio-visual aids and innovative mobilization techniques are being encouraged. Under this mission, stress is laid on the dissemination of information and the creation of awareness about rural development programmes.

The Oilseeds Mission: It aims at accelerating the process of reaching self-sufficiency in edible oils within a specified period. It was, in fact, an import substitution effort. It also had a strong equity angle as a large number of small and marginal farmers cultivate oilseed crops on rain-fed land with poor soil in some of the most backward areas. The aims of the mission include use of crop technology and new varieties, modern post-harvest and processing technology and identification and adoption of new sources of oil.

The Telecom Mission: It was meant to increase connectivity and accessibility. The main emphasis was on improving the quality of services, improving delivery of telegrams, provision of telex on demand, improvement in communication and building up of a national digital network. Under this mission, the key contribution was the introduction of modern digital technology and communication techniques, including setting up of rural automatic telephone exchanges. The large number of ISD/STD/PCO booths that you see spread throughout the country is a visible aspect of this contribution.

As you must have noticed from the above details, S&T inputs are important in all the sectors of rural development. However, unless appropriate technologies are developed, diffused and adopted, the contribution of S&T to rural development in particular, and national development in general, will be only marginal.

Check Your Progress I

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) Explain the importance of S&T in rural development with reference to agriculture. (Hint: Refer to Section 4.3)

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4.3 SPATIAL TECHNOLOGIES AND RURAL DEVELOPMENT

4.3.1 Geographic Information System (GIS)

The Geographic Information System (GIS) is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information, i.e. data identified according to a location that can be used for scientific investigations, resource management, and development planning. It can be used purposefully for rural development planning and monitoring.

A GIS is a powerful tool to relate different pieces of information in a spatial context and to reach a conclusion about this relationship. The spatial context of any place on the globe is outlined with the help of a *location reference system* comprising longitude, latitude, elevation, etc. Using this system, GIS enables us to relate any geographical information to any point on the globe. For example, to know about the possible changes in the weather of our village/town at a given point in time, we may collect general information about rainfall around that time, and then use the location reference of our village/town to forecast what may be expected there in the immediate future.. Further, comparing the information on rainfall with other information, such as the location of crops across the landscape, may show that certain crops are likely to receive little rainfall and thus likely to dry up. This inference can help us make the most appropriate decisions about how this situation may be handled, and in general how humans should interact with the crops. A GIS, therefore, can bring forth significant insights that should lead to better decision-making in the rural areas.

Some questions that may be asked about GIS are: What about information retrieval? What do you know about the swampy area at the end of our street? With a GIS you can “point” at a location, object, or area on the screen and retrieve recorded information about it from off-screen files. Using scanned aerial photographs as a visual guide, you can ask and get information from a GIS about the geology or hydrology of the area or even about how close a swamp is to the end of a street. This type of analysis allows you to draw conclusions about the swamp’s environmental sensitivity. Have there ever been gas stations or factories that operated next to the swamp? Were any of these within 1 or 2 kilometres of the swamp? A GIS can recognize and analyse the spatial relationships among mapped phenomena. Conditions of adjacency (what is next to what), containment (what is enclosed by what), and proximity (how close something is to something else) can be determined with a GIS quite easily.

A critical component of a GIS is its ability to produce graphics on the screen or paper to convey the results of analyses to the people who can make decisions about resources. Wall maps, Internet-ready maps, interactive maps, and other graphics can be generated, allowing the decision makers to visualize and understand the results of analyses or simulations of potential events.

The early records followed the two-element structure of modern geographic information systems (GIS)— a graphic file linked to an attribute database. Maps are generally easy to make using a GIS and they are often the most effective means of communicating the results of the GIS process. The users of a GIS must be concerned with the quality of the maps produced, because the GIS normally does not regulate the common cartographic principles. One of these principles is the concept of generalisation, which deals with the content and details of information at various scales. Map makers have long recognized that content and detail need to change as the scale of the map changes. For example, states can be mapped at various scales, from the small scale of 1: 500,000 to the larger scale of 1: 250,000 and the yet larger scale of 1: 100,000, but each scale requires an appropriate level of generalisation.

Traditional maps are abstractions of the real world; each map is a sampling of important elements portrayed on a sheet of paper with symbols to represent physical objects. People who use maps must interpret these symbols. Topographic maps show the shape of the land surface with contour lines. Maps have traditionally been used to explore the Earth. GIS technology has enhanced the efficiency and analytical power of traditional cartography. As the scientific community recognizes the environmental consequences of human activity, GIS technology is becoming an essential tool in the effort to understand the process of global change. Maps and satellite information sources can be combined in models that simulate interactions of complex natural systems.

Through a process known as visualization, a GIS can be used to produce images not just maps, but drawings, animations, and other cartographic products. These images allow researchers to view their subjects in ways that they never could imagine before. The images often are helpful in conveying the technical concepts of a GIS even to non-scientists. Through Internet map server technology, spatial data can be accessed and analyzed over the Internet. For example, current wildfire perimeters are displayed with a standard web browser, allowing fire managers to better respond to fires while in the field and helping homeowners to take precautionary measures.

The future of GIS in the context of rural development is very bright. Environmental studies, geography, geology, planning, business, marketing and other disciplines have benefited from GIS tools and methods. Together with cartography, remote sensing, global positioning systems, photogrammetry, and geography, the GIS has evolved into a discipline with its own research base, known as *geographic information sciences*. An active GIS market has resulted in lower costs of and continual improvements in GIS hardware, software, and data. These developments will certainly lead to a wider application of the technology in government, business, and industrial sectors.

4.3.2 Global Positioning System (GPS)

Global Positioning System (GPS) is a Satellite Navigation System. It was designed for and is being operated by the US military. It is funded by and controlled by the US Department of Defense (DOD), though today there are many civil users of GPS worldwide.

Four GPS satellite signals are used to compute positions in three dimensions and the time offset in the receiver clock. The Space Segment of the system consists of the GPS satellites. These space vehicles (SVs) send radio signals from space. The GPS provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity and time.

The nominal GPS Operational Constellation consists of 24 satellites that orbit the earth in 24 hours. The satellite orbits repeat almost the same ground track once each day. The orbit altitude is such that the satellites repeat the same track and configuration over any point approximately every 24 hours. There are six orbital planes (with nominally four SVs in each), equally spaced (60 degrees apart), and inclined at about fifty-five degrees with respect to the equatorial plane. This constellation provides the user with five to eight SVs visible from any point on the earth. GPS data can directly be uploaded into a GIS database and can be put to use in various applications of rural development.

4.3.3 Remote Sensing (RS)

Remote Sensing (RS) is the science and art of obtaining information about a phenomenon without being in contact with it. RS deals with the detection and measurement of phenomena with devices sensitive to electromagnetic energy such as light (cameras and scanners), heat (thermal scanners) and radio waves (radar).

RS is very useful in many ways, e.g. it provides a unique perspective from which to observe large regions, sensors can measure energy at wavelengths that are beyond the range of human vision (ultra-violet, infrared, microwave) and global monitoring is possible from nearly any site on earth. Today RS data are used independently or in conjunction with other data sets for different rural development applications.

Check Your Progress II

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) Explain GIS and comment on the current status of its development.

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2) Describe Global Positioning System briefly.

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3) Explain what you understand by the *science of remote sensing*.

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4.4 FACTORS ASSOCIATED WITH THE UTILISATION OF S&T

You are aware of the beneficial effects of S&T, and also of the fact that the rural masses have by and large shown resistance to the adoption and utilization of S&T inputs. Why does this state of apparent contradiction prevail?

Studies have indicated that the major reasons for non-adoption of improved technologies by the rural people are:

- The complexity of the technologies.
- Socio-cultural and economic incompatibility.
- Non-accessibility of the technologies.

- Very rapid changes in technologies and the resultant digital transformation leading to e-governance, e-commerce, e-health, e-education, e-crime, etc.
- Capital-intensive nature of technologies.
- Low income, scarce capital/credit (financial limitations) of the rural people.
- Social inequalities.
- Lack of information about technologies.
- Lack of infrastructural facilities.
- Lack of easy, timely and adequate availability of S&T inputs.
- Lack of marketing facilities.
- Risk and uncertainty involved in the use of the new technologies.
- Uncertain profitability or benefits of new technologies. ;
- Sponsoring the innovations as independent entities rather than as parts in an integrated package.
- Illiteracy, i.e. low level of education in the rural sector.

Jaiswal and Arya (1981) in their paper, “*Transfer of farm Technology in India: An overview*” have made an attempt to classify the factors, which influence the adoption of new technologies. Some of the items listed above may be classified, in the following way:

Client-centred factors: Caste, class, age, education, knowledge, attitudes, value-orientation, social status, etc.

Client-environmental factors: Infrastructure, farm size, availability of resources, etc.

Technology factors: Cost, profitability, compatibility, etc.

Communication factors: Physical accessibility, media exposure, contact with extension agencies, etc.

Other variables: Pricing policies related to inputs and outputs, etc.

These factors do not act independently or in isolation. They rather interact with each other and produce a *barrier-complex*. This barrier of resistance comes in the way of adopting new technologies and varies in intensity with regard to different innovations, different farming communities, and different categories of peasantry.

A lot of research has been done with regard to the diffusion and adoption of new technologies and the factors influencing the rate of their adoption, i.e. the relative speed with which members of a social system adopt an innovation. The rate of adoption is generally expressed as the percentage of receivers who adopt a new idea out of the total number who receive the idea, in a specified time period.

Rogers (1971), in his book entitled *Communication of Innovations*, described that the *relative advantage*, *compatibility*, ‘*trial ability*’, and *observability* of an innovation, as perceived by the members of a social system, are positively related to its rate of adoption. On the other hand, *complexity* of the innovation has been found to be negatively correlated to the rate of adoption. In this context, you must bear in mind that it is the way the target population perceives the attributes of innovations that influences their rate of adoption, rather than the perception of experts and change agents.

The transfer of technology from academic institutions and national laboratories to industry has been limited. In spite of several governmental initiatives, the participation of private industry in promoting S&T has been extremely restricted. Our institutional

structures and ambience have also limited the growth of intensely collaborative research, an almost essential ingredient for success in today's world.

Check Your Progress III

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

- 1) What is your understanding of the significance of S&T for Rural Development? Please illustrate your experiences.

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- 2) With biogas as an example, outline the factors that influence the adoption or otherwise of S&T.

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- 3) Classify the factors that influence the adoption of a new technology.

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Activity 1

Visit a village and talk to the villagers and field level workers about any technology that is being propagated and try to identify the factors that are contributing to its adoption or non-adoption/rejection.

4.5 STRATEGY FOR THE APPLICATION OF S&T FOR RURAL DEVELOPMENT

The benefits of the achievements in scientific and technological fields have, by and large, accrued only to limited groups, especially the urban-centred groups. Their trickle-down effect to the rural masses has been grossly inadequate. This disconcerting dualism does not exist only between the urban and the rural sectors, but is also

perceptible even within the rural sector, e.g. in the case of 'Green Revolution', the benefits of new technologies are being reaped primarily by the land owners and the rich farmers in rural areas. The gravity of the situation has been brought out by a number of studies, which suggest that in a society marked by inequalities, technological changes often enlarge these inequalities. What may be beneficial for the members in one society, need not be so in another. The potential of technology in improving the quality of life of the masses remains largely untapped. The task of effecting technological change in the rural areas is extremely complex. It requires a multi-disciplinary approach, which is sensitive to the actual needs of the rural community and attends to the reality of the rural scene. Also, development and transfer of scientific and technological solutions should be based on an objective assessment of the actual needs of the people. For the successful diffusion and adoption of a technology, active participation of the target population is not only necessary but also crucial.

While formulating the S&T Policy-2001, the Government of India has been conscious that a concerted plan of action is necessary to infuse a new sense of dynamism into our S&T institutions. There is also a clear felt-need for restructuring the administrative and management structures controlling the government science departments, agencies and S&T institutions. While the Government can make necessary budgetary commitments (may enhance to at least 2% of the GDP in the next five years) for higher education and the S&T sector, it is essential to enhance the participation of the private sector, in order to ensure that the maximum benefit may be derived from the new S&T Policy.

Various programmes and schemes are being implemented for popularizing sciences and their applications. Initiatives in the public understanding of sciences would consist largely of finding the means to deliver scientific information to lay people, and training the scientists on how to get their messages across. Instruments that capture the interest and imagination of the general public are usually effective in popularising sciences and the simple application of technology. Such programmes should seek to:

- 1) Encourage creativity and innovation in everyday scientific and technological activities, and provide incentives for participation in them.
- 2) Provide opportunities to general public, especially the youth and women, to appreciate S&T and participate in their development.
- 3) Demonstrate the linkages between the basic and applied sciences and show their role in rural development.
- 4) Increase the visibility of successful projects that have an impact on society's progress and rural development.
- 5) Honour and recognize scientists and technologists who make significant contributions in their fields.

During the decades of development endeavour, a large number of schemes and projects have been, and are being, tried out in rural areas. Almost all of them suffer from the defect of being 'imposed from above' and hence do not have sustained impact. To promote the acceptance and application of S&T inputs, it is important to fully mobilize public participation at the grass roots level. In such a case, the members of the target population would take greater interest in the improved technology. They would appreciate that their previous knowledge and experience are not going to be wasted and what is being offered to them is based on their choices and decisions and is for the betterment of their skills and economy.

A programme for popularising science needs to be started by an institution that has a clear mandate for this purpose. Such a focused institution has to be both regulatory and advisory, under the direct control of the government. The institution needs to be invested with enough authority to be able to command the respect and cooperation of other institutions and organizations, both public and private that are associated with the task of popularizing science. The government should demonstrate its political will towards such a programme through appropriate funding and political patronage.

Mobilization of people's participation is not possible only through the official machinery like the District Rural Development Agency (DRDA), for instance. The revitalization and involvement of local democratic institutions, specifically the three tier system (particularly that came into existence after the 73rd Constitutional Amendment), viz *Zilla Parishads*, *Panchayats Samitis*, and *Gram Panchayats*, and also the various voluntary, non-governmental and civil society organizations based in rural areas, is a must. These institutions would help in identifying areas for new research and innovation. Feedback from them would help in evaluating technologies that need to be extended.

While talking about voluntary contributions, it is worth mentioning the name of CAPART (Council for Advancement of People's Action and Rural Technology), which is an autonomous body under the Ministry of Agriculture, the Government of India. The objectives of CAPART include (i) strengthening and promoting voluntary efforts in rural development with focus on injecting new technological inputs, and (ii) to act as a catalyst for the development of technology appropriate for rural areas, by identifying and funding research and development efforts and pilot projects by different agencies and institutions, particularly voluntary organizations. Though this agency has made some efforts but a lot more is required from it and the way it should be revitalized its working.

A close link between research training and extension is necessary. Research scientists should be made aware of the problems at the field level through feedback received either directly from the rural people or indirectly via the extension agencies. In practice, the researchers get little feedback and as a result, the research work often goes on without being in harmony with the conditions and requirements of the target population. It is important that the new technology is extensively field tested before being introduced to avoid any operational field-level problems. For instance, in agricultural sector, studies indicate that many high-yielding varieties of seeds that were introduced could not establish themselves in different agro-climatic environments and soil conditions in the various regions of our country.

The need of the hour is to develop '*appropriate technologies*'. Though there is no consensus, on the meaning of this term, it is generally agreed that appropriate technology should be labour intensive (capital saving), involve maximum utilization of local resources, use renewable sources of energy and materials which can be recycled, have minimum destructive impact on the environment, be adaptable to local socio-economic and cultural conditions and be comprehensible, accessible and easy to maintain.

In today's world of rapidly developing sophisticated technology, the term '*appropriate technology*' is sometimes misunderstood to mean some kind of second-rate technology. This certainly is not so. As was clearly stated in the Sixth Five Year Plan document (and this continues to be generally accepted), "Rural technology would not be taken to mean primitive technology or technology of yesterday. A determined effort is needed to take modern S&T to the rural areas so that it is brought well within the material, financial and skill resources of the rural people".

Check Your Progress IV

Note: a) Use the space provided for your answers.

b) Check your answers with the possible answers provided at the end of this unit.

1) Why is it important to have a close link between research and extension?

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2) Describe the role of S&T in Rural Development with reference to spatial technologies.

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4.6 LET US SUM UP

The use of S&T is a crucial determinant for the realisation of the objectives of rural development. Thus, S&T must be integrated effectively into our strategies related to rural development programmes. Unless appropriate indigenous technologies are developed, diffused and adopted, the contribution of S&T towards rural development cannot be significant.

Although the beneficial effects of S&T are many, the rural masses in our country have by and large, shown resistance to the adoption and utilization of S&T inputs. This has been due to many reasons—complexity, cultural incompatibility and capital-intensive nature of the innovations coupled with the lack of information, low income and the risks involved, among others. There are other factors too that influence the adoption of innovations, such as the relative advantage, compatibility, trial ability and observability of the innovation, as perceived by the members of the target group.

This unit covered the broad aspects of the use of S&T for rural development. First, the significance, role and contribution of scientific and technological inputs, including those of spatial technologies like Geographic Information System (GIS), Global Positioning System (GPS) and Remote Sensing (RS), in the various facets of rural development planning and management were discussed in brief. It was followed by a description of the factors related to the application of S&T. In the concluding section, an attempt was made to understand how S&T can be integrated effectively in the strategies related to rural development programmes.

4.7 KEY WORDS

Area Approach	:	Area approach is concentration of activities in a selected geographical region.
Aquifers	:	Sub-soil water sources
Client-centred factors	:	are those factors which are related to users, e.g. Caste, class, age, education, knowledge, attitudes, value-orientation, social status, etc.
Client-environmental factors	:	are those factors which are related to user's environment such as infrastructure, farm size, resource availability, etc.
Cold Chain	:	A process required to maintain, store and transport the vaccines at required cold temperature.
Communication factors	:	are those factors which are related to communication, e.g. physical accessibility, media exposure, contact with extension agencies, etc.
GIS Applications	:	are used to study and analyse the spatial variations in various fields such as agriculture, industry, health, environment, resource analysis, decision making, etc
GPS Applications	:	are used to compute positions in three dimensions and the time offset in the receiver clock.
Immuno-diagnostics	:	The use of the antibody or antigen reaction is testing for the presence of or the body's response to diseases organisms is called immunodiagnostics.
Immunological Approach	:	Adopting immune based approach to reduce the infant, child and maternal morbidity and mortality by protecting against six major vaccine preventable diseases viz. tuberculosis, diphtheria, pertussis, tetanus, polio and measles is known as Immunological Approach.
Other variables	:	include factors such as pricing policies related to the inputs and outputs, etc.
Photogrammetry	:	Photogrammetry is an important part on Remote Sensing which consists of three Greek words i.e. (i) Photo – meaning light (ii) Grama meaning graphy or drawing (iii) Metry meaning measurement. Thus, Photogrammetry may be defined as the art, science of obtaining reliable information through the process of recording and taking measurements from photographs
RS Applications	:	are used to detect and measure phenomena with devices sensitive to electromagnetic energy such as light (cameras and scanners), heat (thermal scanners) and radio waves (radar).
Spatial Technologies	:	are those technologies which are applied to objects that exist in space and differ from one another in two or three dimensions The GIS, GPS, RS are the main spatial technologies

Rural Development Planning	:	is the process by which the strategy of developing rural areas is analyzed and designed.
Technology factors	:	are those factors which are related to technology and its cost, such as cost, profitability, compatibility, etc.

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4.9 CHECK YOUR PROGRESS – POSSIBLE ANSWERS

Check Your Progress I

- 1) S&T have made major contributions in rural development and also in agriculture. Many achievements in agriculture can be traced to the application of S&T, such as farm mechanization that has enhanced productivity. Modern technology

applications have made agriculture a commercial activity. Advances like high yielding and disease resistant seeds, fertilizers, pesticides, improved implements, irrigation and drainage have revolutionized agricultural production. S&T have contributed significantly to programmes such as Intensive Agricultural District Programme (IADP), missions like 'self-sufficiency in edible oils' and 'wastelands development' and the 'Oilseeds Mission' which was also an import substitution effort with a strong equity angle. Thus application of S&T has played an important role in our development programmes including those meant for agriculture.

Check Your Progress II

- 1) GIS, a computer system capable of capturing, storing, analyzing and displaying geographically referenced information, is a powerful tool to relate different pieces of information in a spatial context, e.g. information about climate, by collecting data about rainfall, its location, direction of winds, etc. GIS can reveal/give important insights that may lead to better informed decisions and therefore better plans of action. Map and satellite data can be combined in models. Further, GIS can be used to produce images, not just maps but also drawings, animations and other cartographic products that help visualization. Also, using Internet, spatial data can be accessed world wide and analyzed for local use/purposes. The future of GIS, in the context of rural development, is bright as it has a prominent role to play in fields like environmental studies, geography, geology or planning. Together with other spatial technologies, it has evolved into a discipline with its own research base, known as *geographic information sciences*.
- 2) GPS, a Satellite Navigation System, was designed for and is being operated, funded and controlled by the US military. Currently, it has many civil users worldwide. Four GPS satellite signals are used to compute positions in three dimensions and the time offset in the receiver clock. The space segment and space vehicles are its important components, which provide specially coded satellite signals that are processed in a GPS receiver, enabling the receiver to compute position, velocity and time. The nominal GPS Operational Constellation consists of 24 satellites that orbit the earth in 24 hours. The orbit altitude is such that the satellites repeat the same track and configuration over any point approximately every 24 hours. There are six orbital planes, equally spaced 60 degrees apart, and inclined at about fifty-five degrees with respect to the equatorial plane. GPS data can directly be uploaded into a GIS database and can be put to use in various applications for purposes of rural development.
- 3) RS is the science and art of obtaining information about a phenomenon without being in contact with it. This deals with the detection and measurement of phenomena with devices sensitive to electromagnetic energy such as light, heat and radio waves—cameras or scanners for light, thermal scanners for heat and radar for radio waves. It provides a unique perspective for observing large regions. Its sensors can measure energy at wavelengths which are beyond the range of human vision (ultra-violet, infrared, microwave) and global monitoring is possible from nearly any site on earth. Today, RS data are used independently or in conjunction with other data sets for different applications in the process of rural development.

Check Your Progress III

- 1) There are several ways in which the significance of S&T for rural development can be demonstrated. S&T is the most important means of empowering the poor. The rural areas, which have not acquired S&T or the related applications sufficiently so far, must now redouble their efforts with a strategy that begins with popularizing those applications for purposes of development. There is a

realization now that S&T should be used extensively for rural development. Removal of poverty and the generation of employment are the major objectives of development plans. To achieve these, it is necessary to draw scientific strategies for rural development based on comprehensive surveys of resources, their planned utilization and management based on S&T applications, mass mobilization, people's education, and equitable sharing of developmental benefits. General public needs to be educated through formal and informal education, mass media presentations, broadcasts of relevant S&T messages, exhibitions, fairs, and science competitions, regarding the issues such as agro-techniques, community healthcare and those concerning daily life. This way the public can visualize the developments in S&T, seek information, get their queries clarified and thus move closer to appreciating the utility of S&T and adopt the related applications willingly.

- 2) There are various factors which influence the adoption of S&T. Studies have shown that the major factors that cause resistance to improved technologies include their complexity, capital-intensiveness, non-accessibility, socio-cultural and economic incompatibility, people's low income and scarce capital/credit facilities. In case of biogas, the major factors that influenced its non-adoption include: socio-cultural incompatibility like caste, class, age, education, knowledge, attitudes, value-orientation, social status, etc; economic and technological incompatibility such as cost, profitability, compatibility, etc; infrastructural incompatibility such as farm size, resource availability, etc. and communication factors like physical accessibility, media exposure, contact with extension agencies, etc. Further, these factors did not act independently or in isolation, rather they interacted with each other and resulted in a barrier-complex, which caused resistance to biogas technology. Most of the researches, which have been done with regard to the diffusion and adoption of biogas technology, demonstrate more or less the same factors.
- 3) The factors that influence adoption of a new technology may be classified in many ways. However, Jaiswal and Arya (1981) have classified the factors as follows:
 - a) **Client-centred factors:** Caste, class, age, education, knowledge, attitudes, value-orientation, social status, etc.
 - b) **Client-environmental factors:** Infrastructure, farm size, resource availability, etc.
 - b) **Technology factors:** Cost, profitability, compatibility, etc.
 - c) **Communication factors:** Physical accessibility, media exposure, contact with extension agencies, etc.
 - d) **Other variables:** Pricing policies related to inputs and outputs, etc.

These resistance factors do not act in isolation, rather they interact with each other and produce a **barrier-complex**.

Check Your Progress IV

- 1) The importance of a close link between research and extension (R&E) need not be over emphasized. This close link is necessary to encourage creativity and innovation in everyday S&T activities and thereby provide incentives for people's participation and opportunities particularly to general public, the youth and women. It is also necessary to demonstrate the links between basic and applied sciences. These relationships should be brought to the notice of the public giving greater visibility to successful projects which have positive impact on society's progress and rural development. In the process of building purposeful links between *research* and *extension*, research scientists should be made aware of the problems

at the field level through feedback received either directly from the rural people or indirectly via the extension agencies. In practice, researchers get little feedback and as a result, the research work often goes on without being in harmony with the conditions and requirements of the target population. It is therefore necessary that before new technologies are introduced, they should be field tested extensively to avoid any operational field-level problems. Therefore, such close links are not only important but essential too.

- 2) Spatial technologies play an important role in rural development. One spatial technology, i.e. GIS, is a computer system used in scientific investigations, resource management and development planning. It reveals new information that leads to better decision-making. It recognizes and analyses spatial relationships among mapped phenomena and conditions of adjacency, containment and proximity. Early records followed the two element structure of modern GIS—a graphic file linked to an attribute database. Map and satellite information sources are combined in models that simulate the interaction of complex natural systems. Similarly, GPS, another spatial technology, is a Satellite Navigation System which provides specially coded satellite signals that are processed in a GPS receiver, enabling the receiver to compute position, velocity and time. Its data is directly uploaded into a GIS and put to use in various applications. Yet another spatial technology, i.e. Remote Sensing, obtains information about various phenomena without being in contact with them and then provides useful and up-to-date data which can be used independently or in conjunction with other data sets for different rural development applications.