

Integrated Land Resources Management: A Case Study of Temghar Lake Catchment

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Introduction:

Land is comprehensive natural resource which is the core element of the biosphere and responsible to survive all living things. It is an important natural resource, supports all living organisms including plants as well as every primary production system such as roads, industries, communication, storage for surface and grounds water, amongst others. Land is as non-renewable resource, which reserve energy itself related to a host of other element. Rapid urban development and increasing land use changes due to the increasing population and economical growth in selected landscapes is being witness of late in India and other developing countries. Land have been the basic factor of life support system on our planet since dawn of civilization .In recent year, the land resources has been subjected to a variety of pressures. Still it is surviving and sustaining mankind's these difficulties merit emphasis from the outset. Land surface, depending on the definition of what should be considered as land, can be measured accurately in units of area. They also can be classified fairly readily in broad terms by geographical or soil features or by climatologically and related ecological-vegetative grouping.

Study Area:

The area selected for the present study is a catchments area of the Temghar Lake Catchments from western Maharashtra. The main purpose of the Temghar irrigation project is to supply water for Pune city as well as for irrigation in Haveli, Daund, Indapur and Baramati tahsils in Pune district. The dam is located near village Temghar across river Mutha, which located between at 18° 38' 00"N to 18° 47' 00" N. latitude and 73° 27'00" to 73° 32' 00" E longitude, and is about 50 Km. to the west of Pune city. The project was undertaken in May 1989 and completed in February 1993. The full reservoir levels have been fixed at 706.5m and an area of 499 ha. is thus under submergence. Temghar, Lavarde, Vegre and Vede are the affected villages due to this irrigation project. The geology of the entire study area is covered by basaltic lava flow known as "Deccan Trap". The climate is tropical monsoon type; the annual average temperature is 24.6 C and annual average rainfall is 1395.14 mm. physiographical the area exhibits extremely rough terrain and high variation in slopes. The area is well drained with perennial streams. There is a considerable variation in soil properties. The Temghar lake catchments have mixed deciduous type of vegetation.

Objectives:

1. To find out the need of integrated land resource management.
2. To suggest planning strategy for land resource management

Importance of land resources

As per quantitative and qualitative development of human being has been closely related to the various natural resources. These resources can be classified such as mineral resources, forestry resources, human resources, energy resources, water resources etc. A Land resource is being the important among them. It is most important in the socio- economic development and resources management. Land resources management is the actual practice of the use of land by the local human population, which should be sustainable/appropriate techniques. In a broader sense it includes land-use planning, administrative and institutional execution, inspection and control of adherence to the decisions, solving of concession for plant and animal extraction. Improved land management that ensures better resource use and promotes long term sustainability is basic to future food production and to the economic welfare of communities. Because of the dynamic aspect of land management, a flexible and adaptive process, approach for monitoring the quality and quantity of the land resources such as soil, water, and natural vegetation etc. and for determining how human activities affects their resources is essential.

A more comprehensive and useful definition is of legal derivation. It can be stated in different ways, but a good short definition is "Any part of the earth's surface which can as owned as property, and everything annexed to it, whether by nature or by hand of man."

Need of Land Resource Management:

There is growing consensus that an effective way to control land degradation and enhance the long term sustainability of agricultural and rural communities is through locally based planning and management at the watershed scale. Coordinated resource management of a watershed requires the simultaneous of

physical and socio-economic interrelationship and impact. In order to address these considerations, it is necessary to integrate a large amount of spatial information and knowledge from several disciplines. To be useful, information and knowledge must be made available to maker in a rational framework.

Advances in remote sensing, geographical information system GIS, multiple objective decision making, and physical simulation make it possible to develop user-friendly, interactive, decision support systems for watershed planning and management.

Study of land resources for economic development has been recognized as an essential component of development planning. It has assumed much greater importance in India now with acceptance of multi level regional development planning. Drainage basin or watersheds from the most convenient as well as most appropriate spatial units for the study of natural resources like land, forest and water.

Appraisal of resources and diagnosis of problems involved in management of the availability of these resources is particularly important in areas of scarce resources. Another striking problem arises in developmental planning especially in dam side areas that is submergence of land under water and resultant rehabilitation problems of the villagers. The problem this kind seems to be severe from point of view of the project affected people.

Increasing population ultimately exerts a pressure on natural resources, obviously, land resources are severely exploited due to increasing human interferences in natural ecosystems, therefore it is a urgent need to assess such kind of resources and create awareness in the society. Deradation or depletion of such kind of resources may lead to adverse effects on naturally balanced ecosystems.

Land assessment is concerned to a better balance between land potential and land practices. Proper management of natural resources is essential for sustainable development. Now it is realized fact that the optimum utilization of any resources should be a pre-requisite goal of management of natural resources. Management of natural resources calls for delicate balance between competing demands and protection of fragile environment.

It is realized fact that comprehensive integrated information on natural resources is an essential prerequisite for integrated land use planning of an area. Land use bears a close correspondence with terrain characteristics especially in the tropical countries, where farming is much kin to the natural ecosystems. There is a direct impact of relief, geology, soil fertility status and micro climatic conditions in laying out the land use pattern. Recently, terrain evaluation has become a very important technique for the development planning purposes. Terrain analysis of an provides the data base for the classification purposes.

Priority levels for conservation planning:

The present study attempted for priority levels for conservation planning and also made to perform analysis for computation of sub-basin wise soil loss which is classified as follows.

The study area composed of total ninety sub basins where, fifty first order sub basins, twenty are second order basins, third order basins are three, fourth order basins have two and fifth order basins have only one.

Integrated Land Resources Management for Temghar lake catchment.

Catchments area treatment plan.

Watershed is a natural hydrological entity from which surface run-off flows to a define drain, channel, stream or river at a particular point. Watershed management is the optimal use of soil and water resources within a given geographical area so as to enable sustainable production. It implies changes in land use, vegetation cover, and other structural and non- structural action that are taken in watershed management objectives. Watershed deterioration is a common phenomenon in most part of the world. Amongst several causes, the major ones are improper and unwise utilization of watershed resources without any proper vision. Sustainable development is no doubt the appropriate policy strategy. Drainage basin, catchments and sub- catchments are the fundamental units of the management of land and water. The watershed management concept recognizes the inter relationships among the linkage between uplands and low lands. Soil and water conservation is the key issue in watershed management while demarcating watersheds. While considering watershed conservation work.

The Temghar lake catchment treatment plan is based on priority levels and related landforms. Table No.7.2 Various conservative measures are introduced in the plan to land resource management.

The overall objectives of Watershed Management programme are to;

- Increase infiltration into soil.
- Control excessive runoff.
- Manage and utilize runoff for useful purpose.

Following Engineering and Biological measures have been suggested for the catchment area treatment.

Engineering measures:

- Step drain
- Angle iron barbed wire fencing.
- Stone masonry.
- Check dams.

Biological measures;

- Development of nurseries.
- Plantation/afforestation.
- Pastures development.
- Social forestry.

Proposed scheme for integrated land resource management**Integrated management of****Scheme for agricultural development –Horticulture**

Horticultural products play a unique role in economy by improving the incomes of the farming community. Cultivation of crops, trees and pastures is labour intensive and as such they generate a lot of employment opportunities for the affected people. In the study area selection of the species are depends on previous status of various fruit trees available.

Regarding the qualitative aspect especially methods of plantings, spacing, advice on maintenance for increased and survival growth pattern has been most disappointing with survival rates ranging around 10-20 per cent.

Focus is on horticultural crops as they are less water consuming and give more income.. There is high scope for area expansion of horticultural crops in the study area, specially Jackfruits, Jamun and mango. The feedback is that by considering investments on afforestation without built in mechanism for still more effective watering and continuous watch and ward for a few years, the efforts are not compensated with required development. Similarly, incurring huge expenditure in respect of soil and water conservation structures without provisions for their maintenance from time to time and in the horticultural sector by distribution of plant grafts, seedlings and saplings of high economic value crops involving huge cost to be incurred by the farmer beneficiaries without committed viable operational mechanism for their monitoring and supervision may not result in value addition to the community.

Scheme for waste land development - waste land regeneration

Wasteland is any piece of land which has been damaged and suffered degradation due to its overuse, wrong use and uncared, which has resulted in eroded soil, salinity and alkalinity, water logging, ravines and gully erosion, degraded forest land including fallow land.

Dudly Stamp defines wasteland as “That land which has been previously used but which has been abandoned and for which no further use has been found.

The objective being optional utilization of basic resources like soil, water and Natural vegetation through integrated approach on scientific basis for maximizing the production and productivity per unit area. It is also includes stabilization of hill slopes, rejuvenation of vegetative cover and improvement in productivity of fuel, food, fodder, crops and horticultural products, through the introduction of simple, cheap, replicable and innovative technologies of soil and moisture conservation. There are three areas of development they are, a) Command area development, b) Watershed area development and c) Sustainable farming system.

In the process of waste land development the activities can be listed as a) Micro level study b) Preparing perspective study c) Locating models to utilized land d) Awareness in the land management e) Inflow of scientific study.

Structure of waste land regeneration: - Integrated management of different category of wastelands needs to be achieved by suitably integrating the scientific technology inputs.

Technique for gullied and ravenous land: - In the Temghar lake catchment, some area surrounding area has gullied land. The technology for development of these lands are soil and water conservation, the gullies need to be plugged, soil working and moisture conservation measures such as contour bunding check damming, gully plugging etc, have been found effectively. Rigging of the gully slopes by continuous trench to divert the runoff water from active gully is important to assert their extension the important species of plants that can be grown in these lands are eucalyptus, bombax, ceibe etc.

Technique for upland: - The technology required for these lands will be soil, water conservation and selection of proper species such as Agave sisolona(ghypat), pernisetum, andropogan, lequmes such as olitoria, dolichor etc.

Technique for degraded forest area: - A cause by daily requirement of fuel wood in the study area, some area has remained degraded forest area. The technology for development of these lands depends on the degree of degradation of locality factors, rising of nurseries, gap filling has to make. Species like acacia nilotica, catechu, procera, eucalyptus and tectona grandies can be grown.

Technique for steep slopping area:- In the Temghar lake catchment, the steep slopping nature have been found in between 600 m to 800m elevation. The technology for development of these lands depends on site factors. The selection of species will depend upon the degree of slope and altitude. The important species suitable for steep slopping like Accacia (Khair), lerminala chebula (Hirada), terminalla balerica (Behada),Tectona grandis (Teak),Chir, Bamboo, Anjan, Haldu, Arjun etc.

Technique for degraded pastures and grazing lands:- Technique for both these lands include providing protection, seeding the area with suitable species, application of mature and fertilizers and replacement of grazing by stall feeding, effective fencing is required to stop further degradation.

Scheme for forest development –Afforestation

The term is being concern with the development of forest by raising plantation. The work of compensatory afforestation in the catchment of forest area diverted for non- forestry purpose as per the provisions of the govt. but for the improvement/ balance of bio-diversity there should be exact plans of afforestation. Accordingly, the Temghar lake catchments having the appropriate geomorphic as well as climatic condition. Thus the following steps to be taken in to consideration; traditionally, the study area has huge bio-diversity so the species of plants may be suggested in to two groups i.e., Horticultural plants and tree plat. In Horticultural plants, Mango, Jamun, Jackfruits, local Berry (karvande) etc.species of plant and in the tree plantation, Bamboo, teak, kair, and Haldu etc. There should be a massive programme of afforestation and tree plantation. The forest should have an adequate share of land for productive, protective and aesthetic functions. There is also proper implementation of social forestry will provide fuel wood, small timber and employment opportunities to the project affected peoples. Rural fuel wood plantation schemes should be introduced. After planting care is important in the wasteland afforestation programmes. It is very important to go in for a mixed plantation, no single species should cover more than 10% of the area, along with other species, fodder grasses and legumes can also introduced, pioneer trees can be pruned for mulching the other species. The number of weeding, replacement of causalities, application of insecticides and fungicides need to be worked out. A number of species are being raised in afforestation of wasteland, but wasteland investigations are necessary with regard to their optimum use, chemistry of forest products for extraction of number of useful commercial chemicals needs to be investigated.

Scheme for ecotourism development – identification of spots

Western ghat region has intensive potentials for tourism. Various tourist attractions are available in terms of natural, religious spots. In such manners, Temghar lake catchment has natural attractions such as dense forests, water falls, dam sites, tribal traditions and recently developed planned urban town that is Lavasa. Due to the Lavasa, accessibility has been increased, roads, hotels, motels are constructed. All infrastructural facilities are responsible in sudden growth of tourism activity in and around the study area. Impact of this situation has associated with the surrounding villages. Socio- Economical development has been take place. So the influence of the tourist activity directly related to the study area.

In the study area, lake catchment and surroundings, dense forest are the main recreation spots, which can be a part of economical activity to increased the employment opportunities to the project affected peoples. In terms of availability of tourist spots in the study area, surroundings of the water body which has 13.24% (4.99 km²) of area. 24.88 % (9.38 km²) area occupied by natural vegetation which is helpful to attracts the tourists.

Potential outcome of land resources management plan Conservation measures:

Land conservation means reducing the amount of soil erosion and maintaining soil fertility. It relies on increasing the amount of water seeping into the soil, reducing the speed. Table no7.3 depict the treatment plan of the Temghar lake catchments suggested various conservation measures for protect the land in the study area. All the conservation measures are elaborate as follows:-

1) First priority level;-

The first priority level conservation plan suggested for hilly summit zone is as follows:

a) Terracing: - A terrace is an embankment of ridge of earth constructed across the slope to control runoff and to minimize soil erosion. A terrace reduces the length of the hill side slope, thereby reducing sheets and rill erosion and prevents formation of gullies. There are different types of terraces as follows:-

i) Bench terracing: - It consists of transforming relatively steep land into a series of level or nearly level strips or steps running across the slope. The soil materials that are excavated from the upper part of the terrace are used in filling the lower part and a small bund is also raised along the outer edge of the terrace to check the downward flow of rainwater and also soil erosion.

ii) Channel terrace: - It consists of making of wide but shallow channels across the slope of the land either exactly on contour line. In this process, the excavated soil is placed along the lower edge of the channel in the form of low ridge.

iii) Narrow based terrace: - It consists of making a number of narrow based ridges or bunds at a distance of 1m to 2m across the slope of the land at suitable intervals in high rainfall areas.

iv) Broad based ridge terrace: - It consists of making wide but low bunds on the contour lines by excavating soils from both sides of terrace. This is practiced in areas where the rainfall is relatively low.

b) Contour trenching: - It consists of making a series of deep pits (i.e. 2ft wide and 1ft deep) or trenches across the slope at convenient distance. The soil excavated from the trenches is deposited on the lower edge of the trenches where forest trees are planted.

c) Gully reclamation: - Gullies can rapidly erode valuable topsoil and expose the sub soil or bedrock and making the land very fertile. It is important to halt the process of gully formation early, before they have had a chance to erode a large area. It reduces the amount of soil erosion down slope.

d) Water retaining pits: - Water retaining pits trap runoff and allow it to seep into the soil. A series of pits are dug into the ground where runoff normally occurs.

2) Second priority level:-

The following plan is suggested for hilly fringe in Second priority level.

Contour bunding: - Contour bunding consists of building earthen embankment at interval across the slope and the contour line of the field. A series of such bund divide the area into strips and as barrier to the flow of water. As a result, the amount and velocity of runoff are reduced, resulting in reducing the soil erosion. Contour bunding is made on land where the slope is not very steep and the soil is fairly permeable. Contour bunds are also called level terraces, absorption type terraces or ridge type terraces.

b) Retention ditches: - These ditches are dug along the contour. They catch and retain incoming runoff and hold it until it seeps into the ground.

c) Afforestation: - Afforestation means growing of forests where there were no forests before owing to lack of seed trees or due to adverse factor such as unstable soil, aridity. Along with afforestation, reforestation should be undertaken which means replanting of forests at places where they have been destroyed by uncontrolled forest fire, excessive felling and lopping. Afforestation is the best means to check the soil erosion.

d) Mulching: - Mulches of different kinds such as leaves, straws, paper, stubbles etc. minimize evaporation and increase the absorption of moisture and protect the surface of the land against the beating action of rain drops. Later on they decay to form humus which improves the physical condition of soil. Natural mulching also helps in the infiltration of water and the reduction of evaporation.

e) Organic manure: - Organic manure improves the soil structure. The crumb and granular structure increases the infiltration permeability in the soil and conserve the soil water. Consequently soil erosion decreases.

f) Control of grazing: - Grazing increases the soil erosion. But the grazing cannot be completely stopped in all areas. So the restricted and rotational grazing may be helpful in checking soil erosion to some extent. The area open to grazing for sometimes should be closed for the following year to facilitate regeneration of forests and to maintain thick ground vegetation.

g) Field strip cropping and Buffer strip cropping: - Strips of crop are parallel to the general slope of the land. In buffer strip, the severely eroded portion of land is permanently kept under grass and contour strip cropping is practiced in the rest of the area.

2) Third priority level:-

For third priority level which shows rolling pediments landform following main conservation measures are suggested.

a) Plantation of Medicinal Aromatic plants: - Plantation of Medicinal Aromatic plants vegetation provides organic matter to the soil. As a result, the fertility of soil increases and the physical condition of soil is improved. It also provides ecological and economic benefits to the region.

b) Horticulture development: - Rolling pediments in the study area are suitable for horticulture development. Trees cover the ground surface well and have extensive root system reduce soil erosion.

- c) **Cultivation of dense plant and grasses:-** Crop such as Clover, ground nut, grass etc. cover the surface of the land and their roots bind the soil particles to form the soil aggregates, thus preventing soil erosion.
- d) **Cultivation of proper crops: -** Cultivation of row crops in sloppy lands permits soil erosion. In this field, the crops particularly cereals, fodder crop etc. should be broadcasted and the plants remain haphazardly in field. As a result, the movement of water gets obstacle and more water is absorbed in the soil, thus reducing soil erosion. Mixed and intercropping practice checks the soil erosion and avoids the risks of the crop failure.
- e) **The land should not be kept without crop: -** There is very scope of soil erosion if there are no crops in the land. The soil erosion decreases in different way of cropped land.

4) Fourth priority level;- This is last priority level which indicates plain surface landform in the region for conservation planning and following measures are introduced for that:-

a) Crop rotation: - Crop rotation is planned sequence of cropping. Rotation of crop is an important method for checking erosion and maintaining productivity of soil. A good rotation should include densely planted crops, spreading legume crop etc. This may check soil erosion.

b) Give the preferences for cultivation of vegetables, flowers, perishable fruits etc.

This region suitable for vegetables, flowers, perishable fruit cultivation not only climatic condition is suitable for that but also this region is accessible to nearest Pune urban area due to this the nearest nest of urban region create lot of demand for fresh vegetables, flowers, fruits. These crops maintain the fertility of soil.

c) Agroforestry: - Agroforestry involves planting trees or shrubs in the farm, or keeping those that are already there. Trees can conserve the soil erosion in many ways. They cushion the impact of raindrop on the soil, so reducing the amount of rain-splash erosion. Their roots bind the soil. They can interrupt the flow of water running of the surface. They shade the soil, reducing the soil temperature and cutting the amount of water that evaporates into the air. They break the wind, reducing the amount of wind erosion. They recycle nutrients from deep in the soil, and leguminous trees fix nitrogen that can benefit for crops.

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