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WATER MANAGEMENT IN RAINFED AGRICULTURE: WATERSHED AND GEO-INFORMATICS APPROACH.

Ashok D. Medpalliwar¹, Dr. Kalpana Deshmukh² and S. V. Balamwar¹

¹Scientist, Maharashtra Remote Sensing Applications Centre, Nagpur.

²Head, Geography Deptt., Dhanwate National College, Nagpur.

ABSTRACT

Water is important for every one and crucial inputs in agriculture. The cropping intensity and yield mainly depends upon the availability of irrigation sources. The unpredictable rainy season, decreasing amount of rainfall creates new challenges for Indian agriculture and rain fed in particular. The people's participatory watershed management programs help to combat the ever increasing demand of domestic as well as irrigation water. The various land and drainage line treatments within watershed boundary restore and protect the available natural resources in sustainable manner. The water balance awareness among the local governance aid for cautious use of available water. The advanced Geo-informatics system viz. Remote Sensing, Geographic Information System (GIS) and Global Positioning System (GPS) emerge as powerful tools



to identify, monitor and evaluate the vulnerable areas. It also support for multidisciplinary planning and managements of watershed, agriculture and related problems. The availability of high resolution remote sensing data, free public domain of GPS facilitate user to explore the remote areas for better utility of available natural resources.

KEYWORDS: Geographic Information System (GIS) and Global Positioning System (GPS), Water management.

INTRODUCTION:

Water is important for every one and crucial inputs in agriculture. The cropping intensity and yield mainly depends

upon the availability of irrigation sources. The unpredictable rainy season, decreasing amount of rainfall creates new challenges for Indian agriculture and rain fed in particular. The rainy season which is exist for short period of year is only a source of water in rain fed areas.

Rain fed area shows high range of diversities from resource-rich areas with good agricultural potential to resource-poor areas with much more restricted potential. These areas have great potential for productivity which fails to explore due to flawed management of available resources and lack of information. In drier parts, agriculture growth has lagged behind, and there is widespread poverty and

degradation of natural resources. The traditional approach of farming and low risk cover of crops failure is another disaster which leads to low or zero production.

India's total cultivable land account 142 million hectares. Of this, 40 percent is irrigated and share for 55 percent of production. The remainder 85 million hectares are rain fed and contribute 45 percent to total output. Rain fed agriculture is complex, diverse and risk prone and is characterized by low levels of productivity and low input usage. Vagaries of the monsoon result in wide variation and instability in yields. Rain fed areas therefore need to contribute substantially to incremental output by producing marketable surpluses more reliably. The development of agriculture and allied sector in this areas helps to combat the ever increasing problems of poverty, unemployment and environmental problems.

WATERSHED APPROACH

Watershed is a geo-hydrological unit which drains from common points. The every location on the globe is part of watershed. It shares, village, district, state or international boundary. The size of watershed range from few acres of fields to millions hectares river basin, which support every kind of biotic and abiotic forms of life. On the basis of location, watershed divided into upper, middle and lower catchments. The network of drainage line further divide into left and right catchments, watershed having only one drain line without tributaries term as first order watershed and drain as first order drain. The two drain lines with common outlets and tributaries term as second order watershed and so on. Generally, fourth order drain founds perennial source. The widespread problems emerges during the recent years are shrinking water source, soil erosion, loss of vegetative cover etc. which leads to social problems like poverty, unemployment and migration particularly in remote areas of rural India.

The people participatory watershed development programs based on the following objectives-

- The Regeneration, conservation, and development of natural resources by sustainable manner.
- Development of agriculture and allied sector to generate round the year employments opportunity and boost the production with introduction of cost effective methods of crop cultivation.
- Restoration of ecological balance in the degraded and fragile rainfed eco-system by greening these areas through appropriate mix of trees, shrubs and grasses.

LOCAL PARTICIPATION

Local governing institutes play important role to achieve the pre-decided goals of watershed developments. It includes the participation of all beneficiary of respective watershed. The new mode of peoples' participation, i.e., formation of watershed community including representative from all division of society and active participation of women's, along with sharing all activities, responsibilities and their part in decision making process help to run the development programs effectively and efficiently. The wide areas of activities promote by local watershed community includes identification of problems related to agriculture, health, water etc. Awareness and exposure for present problem of locality, building guide line for easy run of programs, scrutiny of all financial task and specially set up various levels of watershed committee's for all levels of watershed management including initial planning and design of harvesting and recharging structures, as well as construction, supervision, decision making, operation and maintenance, monitoring and evaluation of systems designed and constructed.

WATER BALANCE

The water balance is an accounting of the inputs and outputs of water. The water balance of a place, whether it is an agricultural field, watershed, or continent, can be determined by calculating the input, output, and storage changes of water at the surface. The major input of water is from precipitation and output is evapotranspiration. The simple calculation of water balance from precipitation after possible losses from watershed area gives the fair idea about available water. The main losses of water include evapotranspiration, runoff, deep percolation etc. The awareness among local community helps for judicious management of domestic and agriculture water requirements. The controlled water use in agriculture includes the promotion of crops or varieties of low water requirements and restriction or complete avoidance of high water consuming crops like sugarcane and banana. It also promotes the use of modern irrigation tools like sprinkler and drip irrigation systems. The main focus on equal distribution of available water to all beneficiary of society, provision made to secure one or two source for domestic purposes which fulfill the need during critical period of season.

USE OF GEO-INFORMATICS

The advanced Geo-informatics system viz. Remote Sensing, Geographic Information System (GIS) and Global Positioning System (GPS) emerge as powerful tools to identify, monitor and evaluate the vulnerable areas. It also support for multidisciplinary planning and managements of watershed, agriculture and related problems. The availability of high resolution remote sensing data, free public domain of GPS facilitate user to explore the remote areas for better utility of available natural resources.

DATA-BASE GENERATION

Watershed database comprises of topographic data, drainage network, available infrastructure details and primary social records of villages. The data related to agriculture fields includes cropping pattern of study area, varietal information of different crops, soil types and land use capability classification of fields, available inputs, irrigation source, slopes etc. were collect by survey or from concern agriculture departments which help to generate detail cadastral map of village. The knowledge of geo-hydrology of watershed support for better utilities of available resource. All these dataset is important for watershed delineation based on the type of watershed and social issue.

TOPOGRAPHIC DATA

The digital topographic data of respective areas were generated by means of digitization of Survey of India's Toposheet either 1:50,000 or 1:25,000. The 1:25,000 toposheet is preferable for watershed area range between 500-1000 hectares. Now a day's digital data of Survey of India's toposheet in various formats is available for user with affordable price. Digital Elevation Data will be generated by digitization of contour of region or extracted from Shuttle Radar Topography Mission (SRTM) data.

DRAINAGE LINE DATA

The data generated by means of digitization of toposheet or high resolution remote sensing satellite imagery, recent trend of survey with hand-held GPS (Global Position System) and mapping tool aid splendor to field, drain-line survey and database generation. The identification code is allotted to each drain line as per pre define classification scheme. This information is further use for delineation of watershed and drainage analysis.

DATA LINKING

All the developed data viz. Point, line or polygon were linked with attribute information for analysis and thematic map generation of pre and post watershed development activities.

DRAINAGE ANALYSIS AND TREATMENTS

Drainage system analysis carried out for building of various treatments and structures along the drainage line, which includes gully plug, check dam, recharging structure, percolation tank. All these treatments are based on the accounts of geo-hydrologic data, soil data, soil erosion characteristics, aspects and slope within the watershed boundary.

FIELD ANALYSIS AND TREATMENTS

The detail land capability classification of cadastral map of watershed with help of various input layer in GIS help to identify and suggest specific field treatments. The continuous contour trenches (CCT), gully plug, stone bunding, vegetative bunds etc. recommended as per the class of fields. The crop cultivation, horti-postoral and other agro-based supportive business activities were recommended. About five to ten per cent fields allotted for community grazing land and social forestry.

GROUND WATER DETECTION

The detection of ground water sites is challenging for every personnel of geology. The geo-informatics helps to make a decision about hidden impression of geological sites with ground water aspects. The high resolution satellite data present synoptic view for better understanding of geological formation that of GPS technology assist to locate sites in remote areas.

MONITORING WITH REMOTE SENSING.

Every part of globe is in the coverage of satellite eye, recurring visit properties permit user to visualize study areas after specific interval with different sensor data. Generally, pre, middle and post watershed development data results better progress of study area. Pixel to pixel change detection with digital image processing depicts the unit area change over development period.

CHANGE DETECTION.

The over all changes occur during participatory watershed development project evaluated on following basis-

- The rise in ground water levels caused by changes in surface, ground water storages and period of availability within year and extremes events such as drought.
- The change in cropping pattern, yield, input available and utilize by individual, cropping intensity and adoption technology of rural farmers.
- The employment opportunity generated over development period and numbers of beneficiary benefited from project along with change in living standard of each house hold.
- Area treated and vegetation cover develops, alteration in soil losses due to erosion and positive transformation of fields in terms of land capability classes.
- Awareness among the rural for sustainable development and approach to pass on the develop technique to next generation.

CONCLUSION

The changing environmental scenario leads to critical problems of ecological imbalances which force to disastrous events frequently. The participatory watershed development programs planning with geo-informatics technique gives better solution for management and recreation of natural world by sustainable approaches which facilitate over all development of remote areas.

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Ashok D. Medpalliwar

Scientist, Maharashtra Remote Sensing Applications Centre, Nagpur.

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