

Prioritization of soil and water conservation using geospatial technology

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In recent times, when summer hits India, most of the areas face shortage of rainfall, stipulation of drinking water and face drought. In some places there is an enormous amount of downpour which leads to flood. Conservation practises must be carried out during excess to overcome the drought in the remaining period. To analyse these types of major parameters with respect to time period, factors and renovation, remote sensing and GIS tool can be used.

Key words: Geospatial technology, Soil conservation, Water conservation

REMOTE sensing is the science of obtaining the information about the earth features from a distance either by satellites or aircrafts. Geographic Information System is a technology designed to capture, store, manipulate, analyse and manage the spatial or geographic data. With the help of these geospatial tools the conservation of soil and water is initiated to preserve the resources for the future.

Application of Remote Sensing and GIS in Soil and Water Conservation measures

Soil erosion: Erosion is a process of detachment, transportation and deposition of soil due to the action of water or wind. The quantity of erosion has turned into a rigorous problem in vegetation, climate, topography and soil characteristics. The factor which causes most damage and lowers soil productivity is soil erosion. Every now and then due to the anthropogenic and other activity, there is the initiation of soil erosion. In a large area, if the amount of erosion changes in phases, monitoring can be made for the particular or previous stage using Remote Sensing and GIS. Considering the factors of Universal

Soil Loss Equation (USLE) for an area per year per unit of time the threats of soil erosion can be calculated. The annual soil loss can be estimated by the equation $A = R \times K \times L \times S \times C \times P$. The equation parameters such as rainfall erosivity (R), soil erodability (K), topography (LS), crop management (C) and conservation practise (P) of USLE can be evaluated using remote sensing data by using either visual or digital interpretation. In GIS, every parameter is ordered as thematic layers which provide spatial distribution. Spatial distribution in every grid cell represents the product of the equation which when summed up for the whole area; annual average soil loss can be estimated.

Site suitability for construction of water harvesting structure: 'Catch the rain where it falls'. The next major part for present circumstances is conservation of water which is primarily used for agricultural, industrial, household and recreational purpose. National Water Policy and National Agricultural Policy of India have already stressed the importance of water harvesting structures. A large quantity of rainwater can be harvested in reservoir, farm ponds, tanks and percolation ponds. The water can be

collected in the form of runoff from the remotest point of the watershed which can be stored for future use. To control the excessive runoff, water harvesting structures such as check dams, earthen dams, gully control structures, percolation tanks and farm ponds should be constructed at the appropriate location. Drainage line treatment can be provided in the large catchment area from which the water is diverted to the open wells or tube wells which retain water even in the post monsoon period in a watershed. Using Remote Sensing and GIS, suitable sites for construction of water harvesting structure can be identified. Decision rules for site selection should be prepared according to the site and the watershed area should be delineated and visual interpretation can be done for preparing base map and the remaining digital analysis can be done using GIS software. The potential sites for water harvesting structure can be identified to reduce over exploitation and managing the soil and water resources.

Groundwater monitoring: For past decades, groundwater is being exploited in large quantity as it does not meet up the supply demand ratio which is majorly due to climate variability and uneven distribution of

rainfall. Because of very little assess of surface water like lakes, ponds and rivers, people use groundwater as its alternative either from dug wells or bore holes. The possible way to recharge groundwater must be studied in detail to improve the water table level. Geological, structural, lineament and geomorphology are considered major in Remote Sensing and GIS for groundwater studies. It allows manipulation and analysis of spatial data and helps to identify the groundwater potential zones as well as in preparation of thematic maps. The discharge of water for the different time periods can be identified by the analysis and this risk area which is monitored regularly or the artificial recharge structures can be provided at the over exploited zones. Ground-water pollution can also be mapped using this modern tools either its point source or non-point source.

Irrigation management: Controlled amount of water must be applied to the crops at the required intervals. Water availability in the reservoir or source of irrigation can be identified for optimal management of water to meet irrigation demand. The data of irrigation canal and its network is available in the remote sensed satellite images. Design of irrigation network can be done with the help of GIS. GIS has capability to integrate database, statistical analysis and preparation of maps. Spatial database of soil, rainfall, geology, land use, topography, and socio-economics can be applied for irrigation planning and management. To monitor the irrigation system, parameters such as soil moisture, water availability, evapotranspiration and salt content should be considered. Crop response after the irrigation applied can be monitored using these modern tools, and irrigation interval and type of irrigation to be carried out for the particular environment can be established. Water logging and salinity problem can also be identified using satellite data and analysis can be made using GIS software.

Drainage: Agriculture field is affected by drainage due to excess rainfall, over-irrigation, poor

infiltration and salinity. For the healthy crop production, the excess water should be removed from the field. Monitoring of the field is necessary and the remote sensing provides the data of area affected by drainage problem. Looking over it, using proper techniques, the land can be converted into a cultivable one. The analysis can be done through GIS for estimating slope, area and flow direction. Based on the accuracy of the analysis, further improved studies can be made in different spatial scales. If the surface and sub-surface drainage is controlled sometimes the groundwater quality can be maintained. If the water table depth is shallow there is a chance of drainage water along with fertilizers reaching out. It is better if the groundwater quality is checked once the agricultural field is flooded. In this instance, using GIS and remote sensing tools mapping can be done to identify the risky areas and suitable recommendation for practise can be provided.

Crop suitability analysis: The optimum production of crops is possible depending upon the soil, climate and water. Among these the primary consideration is soil suitability and it should meet the crop requirements. The major features which must be taken into consideration are climatic, topographic, soil, natural vegetation and management factor. By the integration of the land quality parameters such as soil texture, rainfall, temperature, soil depth, erosion and slope in a logical operation using GIS, the crop suitability map can be derived. The weightage must be provided for each parameter based on the types of crop grown. The cropping pattern can be classified from satellite image under NDVI (Normalised Difference Vegetative Index).

Crop monitoring: Regular monitoring, weather prediction and improving yields are the major factors that increase profitability. With geospatial analysis and analytical modelling, farmers are now able to visualize their land, crops and management practices for precise

management of their businesses. Remote sensing along with GIS technology can be used to accurately conclude the control inputs and reducing the quantity of harm to the soil. Remote sensing data has the ability to provide timely and accurate crop growth and its yield. Crop modelling can be developed using these advanced technology.

Conclusion

Conservation of natural resources is the responsibility of every human since the resources are being degraded continuously. For effective and rapid study, modern tools become the improved option. Collection of data in the large area and analysing is possible through this advanced technique. Effective conservation practises can be carried out using the study. Therefore, it can be concluded that both the RS and GIS technologies have great prospective to develop the monitoring and management of vital soil and water resources in the future, though there were some challenges. Furthermore, the application of GIS will enhance the quality and neutrality of soil and water conservation studies.

Remote Sensing and Geographic Information System has become one of the principal tools in the arena of agricultural and environmental sectors in conserving natural resources. These techniques have primarily improved our opinions and conducts to manage wide ranging natural resources and water resources in particular. Agricultural practices are denied due to the uneven climatic change, droughts, floods and poor farming techniques which may endure individuals and communities. Regular monitoring of crop, conservation of soil and water resources along with the shift over a period of time can overcome the undulating scenario which may be analysed precisely using Remote Sensing and GIS tools.

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