Runoff potential indices of watersheds a case study of Tilaiya catchment by using Remote Sensing and GIS techniques

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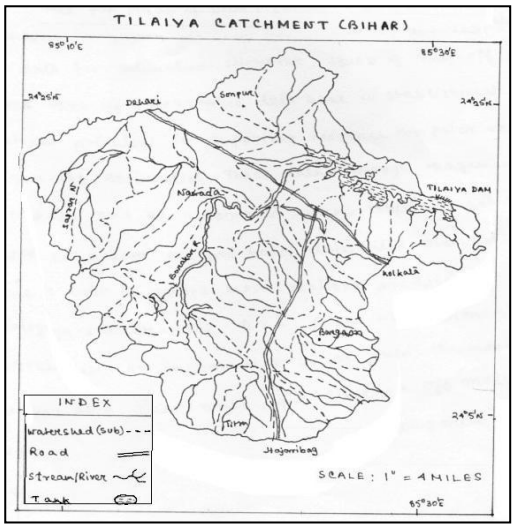
ABSTRACT: Runoff is an index of watershed development. It is the flow of all sources of precipitation. Tilaiya catchment has been taken for runoff potential identification by using modern technology i.e remote sensing and gis. During the rainy season runoff increases, this is why accumulation of water takes place at various places depending upon the elevation of surface. In this work an effort has been made to find out the runoff ranking by runoff index for water resources management.

INTRODUCTION: Flood is one of the environmental problems which have been of global concern since the very ancient bays. In the wake of recurring loss of agricultural lands and human suffering, the problem of foods has attracted the attention off all concern in India .hits the country every year and causes damage to an average area of 6.7 million hectares resulting in a climate annual loss of 1260 million rupees. Optimal management of flood prone areas necessitates flood control measures in recipient areas as well as the catchment areas.

Several empirical models are in use for predicting the total quantum of runoff generated from a specific hydrologic (unit) entity.Infomation on the climate parameters, terrain configuration soil and land cover forms the basic inputs to a runoff prediction model.

STUDY AREA: Encompassing a total area of nearly 0.1 million hectares, Tilliya catchment is located between $24^0$05'-$24^0$28'N latitude and $85^0$09'-$85^0$23'E longitude.

Geologically the area is quite complex,



having rocks of varying composition.Archaean gneisses and micaceous schist's constitute the Mein lithology of the region, this is the part of chotonagpur plateau, the area is characterized by hill gently undulating platau,intermontone valleys and alluvial land form monaduocks & rocks hills provide evidence of the degradation processes active also in this study area.

CLIMATE: Sub-humid, sub-tropical monsoonal type of climate, characterized by hot summer and mild winters, is prevalent in the area. The total annual precipitation of 1157 mm is distributed mainly between Junes to September. The average storm intensity by considering

storm of more than 30 minutes duration works out to 37 mm.

MATERIALS AND METHODS:

The fallowing data were deployed for the study:

- Land sat MSS computer compatible tapes pertaining to path 151/ row -3.
- Survey of India (SOI) topographic map Nos. 72H/7 and 72H/11 or 1 inch to 1 mile scale.
- Report on priority demarcation of sub watersheds in Tilaiya catchment, Bihar published by all India soil & land use survey.

A false colour composite (FCC) using land sat B & S, 4, 5, and 7 has generated and enlarged to the scale of 1"= 1 mile. This FCC has used as base map for obtaining different in out parameters to the model.

The steps involved in the preparation of data base are discussed below:

- Framc work of watersheds: The delineation of watershed on the basis of SOI topo map were numerically ceded following the hierarchy of stream orders.
- Gradient of watershed: The gradient of watershed can be determined on the basis of closeness of contours on the topographycal map and after computing the average slope.
- Soil Map: In can be determined by consulting the soil map and a will be further modified through visual interpretation of land sat MSS image.
- Land use/ Land cover Map: Land use and land cover map was generated through visual interpretation of SFCC image. The different clauses of cultivated lands based on the conservation practice adopted, were not easily discernible on the lands at data covering to the carse resolution.
- Digitization of data layers: The watershed frame, soil map and land cover map must be digitized.
- Vegetation Index: The vegetation index can be prepare by making the NOVI or band rationing to detect the vegetal growth of this Tilaiya catchment area.
- Computation of run- off curve number: The soil classes were arranged into four hydrologic soil groups and these classes together with the land cover types were used to derive CN numbers using storage capability of soil look up tables.
- Compilation of 'Q' value: The value of run- off can be (in inch) calculated considering pixel by pixel method.

SOURCE OF DATA: Remote sensing data acquired from space- borne platform, owing to its wide synopticity and multispectral acquision, offer unique opportunities for study of soils, land use/land cover and other parameters required for run- off modelling. The capability of these data for estimating relative value of run- off palatial indices of sub watersheds, however, the establishment and maintenance of geographic data base in computer readable from has great potential for supplying resource management information for run-off estimation. These data, though the use of a suitable GIS package and an automated system, could be use for run-off volume estimation on grid basis distributed over the entire hydrologic unit to arrive more realistic predictions. A case study in Tilaiya sub catchment, D.V.C, Bihar was the main objective of the project. An improvement in the run- off

model by introducing vegetation index and slope component was also envisaged.

MODEL USED: The model for estimating quantum of run- off generated from various hydrologic units is based on the average precipitation/ storm and storage capacity of the soil. The empirical relationship can be expressed as:

$$Q = \frac{(P-0.2s)^2}{p + 0.8s}$$

Where, Q= Run- off in inches.

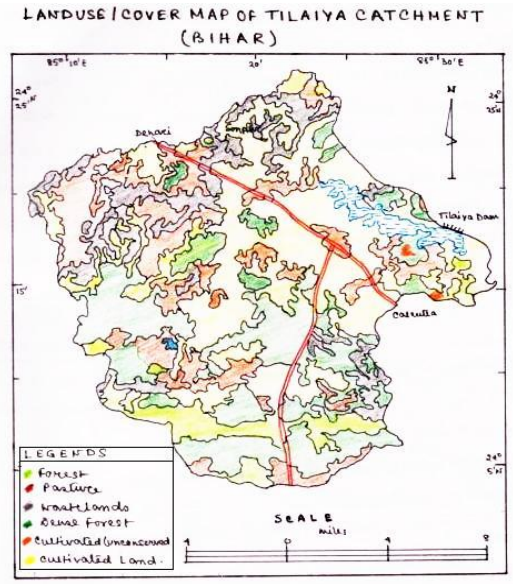
P= Average precipitation/ storm in inches.

S= storage capacity of the soil in inches expressed as (100/CN) - 10.

The CN value (run- off curve number) is arrived at by using standard SCS (storage capability of soil) look up table which are based on hydrologic soil groups and land use/ land cover.

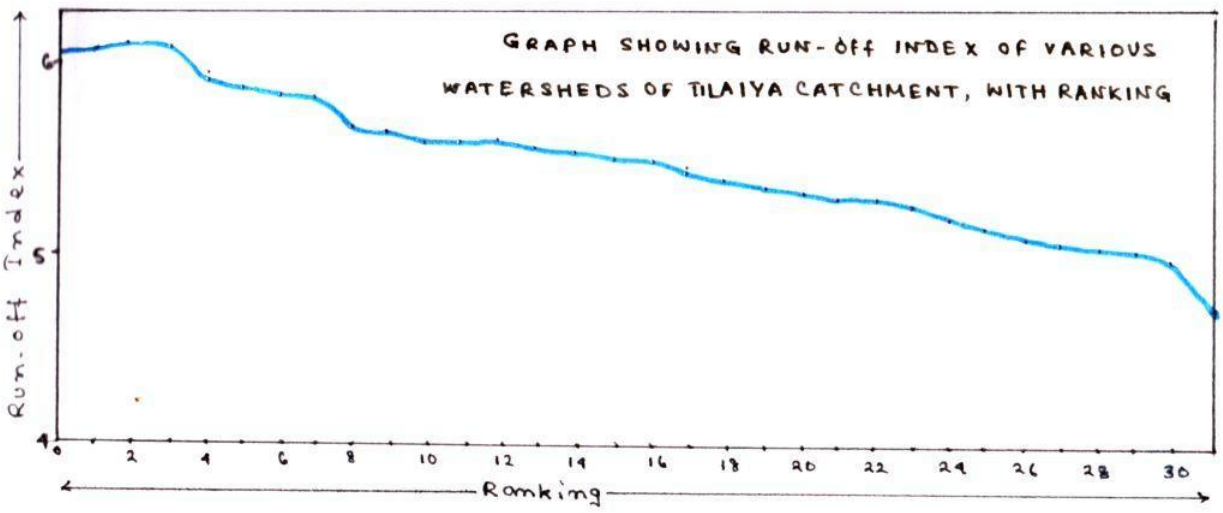
RESULTS:

The frame work of watersheds in Tilaiya catchment is clear. In all, 36 polygons were demarcated fallowing the stream orders. In interbasiual areas of lower order stream were grouped with the basis of the higher order for demarcating the watersheds. Fertile soils associated with this flood plain. Major land use of this area is low to medium density forecast, grazing lands, cultivated lands and barren areas. The predicted value of run- off for 36 watersheds computed through the use of different model.



CONCLUSION:

Watershed prioritization is an important aspect of planning for implementation of the watershed management programme. The implementation of the hydrological model at the watershed scale to generates the estimates of water and sediment yield at sub- watershed. There are such application- one for finding the interaction between the admieaistratire and watershed boundaries and the other to locate the water harvesting structure. Here the spatial tools also helps in estimating the related parameter like the water spread areas and available water storage capacity at that location. This application is also useful to help the watershed



managers in objectively priorities the

watershed with respect to the stipulated norms. The application can also use for monitoring and evolutions of the watershed programmes which is important component, but invariably missing.

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