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Title: Watershed Management for Soil Conservation: A Case Study of Nun Nadi Watershed

ABSTRACT

The Nun Nadi Watershed is a part of Yamuna river catchments. It is located in the north eastern part of Doon Valley between 30º 20' 08" to 30º 28' 18" N latitude and 77º 58' 36" to 78º 06' 21" E longitude in the state of Uttrakhand, India and encompasses a total area of 8697.33 hectares. The area falls under high prone to erosion. The complex topography, with elevations ranging from 600 meter to 2000 meters (Above MSL), results in steep gradients of rainfall. The land use land cover mapping and the change matrix have been done to analyze the changes from 2000 to 2009. According to that, it was observed that about 4653.18 hectare (53.50 per cent) of area experienced change in land use category of varied nature and extent. The changes have been recorded through out the study area and don't follow any specific pattern. The remaining 46.50 per cent area has been noticed no change (unchanged) during the same time period. Such areas are generally observed in the inner part of dense forest. It is found that highest positive changes are recorded in agricultural land (9.92) and built-up (8.39) category followed by water bodies and scrub land (<2.50). The vegetation (Dense, Sparse and Scrub land) reported insignificant decline in area (about -2.5 per cent) whereas, fallow land (-6.20 per cent) and barren land (-10.37 per cent) recorded very high negative changes in per cent during the study period. Google images and some pictures which have been captured during the field survey were used to rectify the errors while selecting the signature sites at the time of classification. Generally 75 per cent accuracy level of supervised classification considers the satisfactory for the hilly areas and study show the 79.83 and 83.43 per cent of accuracy level for the year 2000 and 2009, respectively. Soil loss estimation has been done the same time periods and RUSLE model was utilized for it. The estimated mean soil loss for the year 2000 and 2009 is 3283.11 and 1419.39 Mg ha^{-1} yr^{-1}, respectively. Nearly 1554.27 hectare (17.87 per cent) is prone to very high rate of soil loss and 1359.57 hectare (15.63 per cent) of land is prone to high rate of erosion in 2000. The study finds that about 80 per cent area has low or least risk of erosion and about 7.53 per cent is exposed to

high or very high prone to erosion which indicates the improvement in terms of soil loss if we compare the data of both the time periods. All factors contributing their role in soil loss but the findings show that the rainfall, LULC change and elevation are the main responsible factors for the soil loss in Nun Nadi watershed. Mainly, the rainfall quantity and quality really determines the soil loss rate. Some pictures during the field survey have been captured which are responsible for soil loss. The micro watershed prioritization has been done using SYI and RUSLE model. The weightage values were assigned for the calculation of SYI equation. The manual calculation and computer generated raster (pixel by pixel) calculation has been performed to check that how much the results appear close using these two different approaches. In this study RUSLE model consider the best for prioritization and management perspective that gives the satisfactory results and the 50 per cent area under different micro watersheds fall under the same priority zones in 2000 and 2009. On the other hand only 30 per cent micro watersheds fall under the same category if we compare the SYI and RUSLE model. SYI calculation is based on weightage values that can be changed person to person and RUSLE gives pixel to pixel information and all the input layers gives the same information. As result the SYI calculations will be different if calculates by different person and the outcomes using RUSLE model will be the same at some extent from different persons. The mean soil loss value of each micro watersheds have been taken and further they were classified into very high, high, medium and low priority zones for both the time period in RUSLE model. According to that it has been found that micro watersheds named SW4a and SW5a fall under the very high priority zone in both the time period. Near about 50 per cent of micro watersheds fall under the same priority zones if we compare the data. Generally prioritization and management for soil conservation implement on the basis of recent information. So the data of year 2009 consider here the best for prioritization and management and according to that near about 37 per cent area fall under high or very high priority zones and needs immediate attention. For that, soil loss values using RUSLE model, drainage and slope layers were overlaid and identified the suitable sites of check dams that will work efficiently for minimizing the soil loss rate at some extent. The located check dam's and contours farming, up and down cultivation, channel terraces with contour farming and plantation of grasses that can not be grazed easily are some proposed conservation techniques for better watershed management that will be helpful for the soil loss protection were suggested for the protection of soil.