



Studies on Watershed Management in Shivaji University, Kolhapur, India

Ingavale R.R., Jadhav V.V. and Raut P.D.

Department of Environmental Science, Shivaji University, Kolhapur, MS, INDIA

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Abstract

Indeed water as a biological need of all living things it is needed to be used wisely due to over exploitation of such valuable natural resource. Hence, watershed management plan has proved to be very beneficial for water conservation. Analysis and assessment tools like GIS along with remote sensing have proved to be very efficient and effective and hence useful for management of such a useful resource. The present study is carried out in Shivaji University, Kolhapur situated at 16°40'31.81"N and 74°15'12.10"E, in the outskirts of Kolhapur city and is at altitude of 607 m above mean sea level. The obtained land cover map easily shows that majority of the land is under vegetation. It is due to availability of the water through small tributaries. This work is concerned with various maps of Shivaji University, Kolhapur. These maps are prepared by using toposheets of Kolhapur city and the software's like Erdas 9.1 and Arc GIS 9.1. The prepared maps include the drainage pattern, contour map, elevation map and land use/ land cover map. Depending upon these maps, three suitable sites for watershed management plan are proposed in Shivaji University, Kolhapur.

Keywords: Watershed management, Shivaji University, Kolhapur, Erdas 9.1, Arc GIS 9.1.

Introduction

In the fragile Indian hot arid ecosystem, the degradation of environment and its natural resources is basically due to low and erratic rainfall, hostile climatic conditions and increasing biotic pressure due to population growth¹. The other reasons also include lack of adequate investment and proper management practices to conserve the natural resources. Even tremendous increase in population, industrialization, agricultural run off is adding to the pollution of available water resources². India is expected to become water stressed country by the years 2020-2025 with per capita water availability falling to 1341 m³/person/year by 2025³. Therefore careful implementation of resource management on watershed is essential. Hence application of technology of the watershed management is necessary to solve its supply conflicts and annual problems of droughts. Adequate supply of water for our land can be obtained by proper and permanent practice of watershed management⁴. Topographs can be used conveniently to identify and mark the stream channels at respective places⁵.

In this case a watershed has been taken as a unit of planning as this is the logical smallest unit for the pilot. Also the soil and vegetation can also be conveniently and efficiently managed in this unit, the watershed is considered as the ideal unit for managing these three vital resources of soil, water and vegetation⁴. The appropriate information regarding the biological and ecological entities is of immense importance for improving the integrated management of corresponding reserves of nature.

The recent technologies like Remote Sensing and GIS helps us by giving a quicker and cost effective analysis for various

applications with accuracy for Planning. It also gives a better perspective for understanding the problems and therefore helps Planners to evolve a better solution for sustainable development⁶. Geographic information system is set of technical and programmatic tools for storing, processing and using geographic information's in two forms - graphic and database, mutually linked and topologically ordered⁷.

The present study is conducted in Shivaji University, Kolhapur (SUK) situated at South-West of Maharashtra at 16°40'31.81"N and 74°15'12.10"E, in the outskirts of historic Kolhapur city and is at altitude of 607 m above mean sea level. It covers an area of about 853 ha. The major portion is covered with vegetation due to abundant supply of water from natural water sources. Hence due to this factor the programmes for water conservation are carried at various levels in University area. The demand and need for water conservation is increasing day by day as many students are pursuing their higher education in University. Hence some of the actions taken for this are like, a mini irrigation tank is constructed behind the language department of capacity 8.52 million cubic feet. When this tank fills about 50% of its capacity, it results in recharging of well located down the tank. From 2005, the university instead of purchasing water from Municipal Corporation is using the water from this recharged well and thus has become self reliant in water. An earthen dam is constructed near music department and its capacity is about 1.5 cubic feet. The water from this dam is supplied to Girls hostel, few departments, teachers quarters and garden. Continuous contour trenches (CCT), Check dam and nullah bunding have been constructed on about 51 hectares of area. This prevents excess water runoff in rainy season and thus helps in restoring the available water.

The study was carried out considering various objectives. Preparation of various maps and thus obtaining the distribution of water channels was important. Hence with the help of this all factors, to find suitable and potential sites for development of watershed area was the main objective.

Material and Methods

The respective project is carried in the area of Shivaji University, Kolhapur (SUK). To complete the entire project work, material required was as follows: i. MAPS - a. KMC maps (Kolhapur Municipal Corporation Maps), b. Toposheet of Shivaji University, Kolhapur (No. 47L/6, Scale- 1: 50000), c. Google image of Shivaji University, Kolhapur. ii. SOFTWARE - a. Erdas 9.1, b. Arc GIS 9.1.

The available KMC maps, toposheets and google images were used to prepare the base maps. The obtained base maps were subjected to GIS analysis where Erdas 9.1 and Arc GIS 9.1 were used. Erdas 9.1 is used for the classification of satellite data into supervised and unsupervised classifier. Supervised classifier is used to code the pixels manually which is done by field work. Land use cover or land use pattern maps were obtained by using Erdas 9.1.

Available satellite data was digitized, geo-coded and geo-referenced. Further analysis was made by using Arc GIS 9.1. This was used to obtain all other maps like drainage pattern map, contour map and elevation map.

The obtained maps were then imposed and site selection analysis was done on the basis of slope, elevation and drainage pattern⁸.

Results and Discussion

In the present study various maps of Shivaji University, Kolhapur (SUK) were prepared by using toposheet of Kolhapur city, google images and also the software's like Erdas 9.1 and arc GIS 9.1. It includes land use or land cover map, contour map, elevation map and a map of drainage pattern⁸. On the basis of these maps, three suitable sites for implementation of watershed management plan were identified. The map of Land use/ Land cover (figure 1) shows the greenery at maximum area. This indicates the abundant water supply in the university campus.

Study also revealed that the existing water management plan had helped Shivaji University to become self reliant on water usage and thus had saved many lakhs of rupees. Field study carried out in University campus area also noticed that biodiversity has also been restored. Various endemic plant species have been recognized as well the birds census carried in 2010 also showed that migratory waterbirds like Grey Francolin, Painted Francolin, Indian grey hornbill etc. has increased in their number.

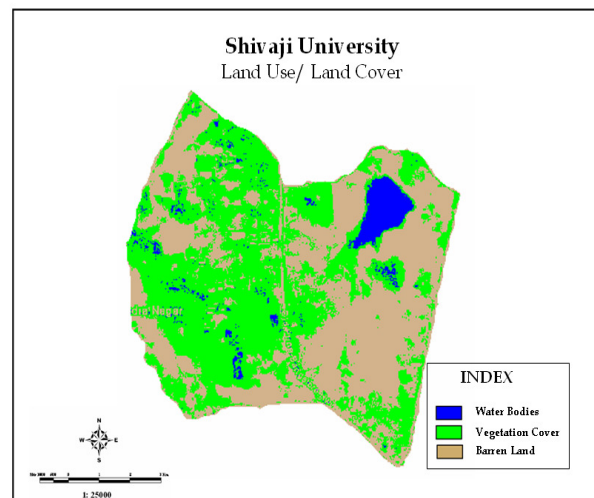


Figure-1
Land use/ Land Cover map of SUK

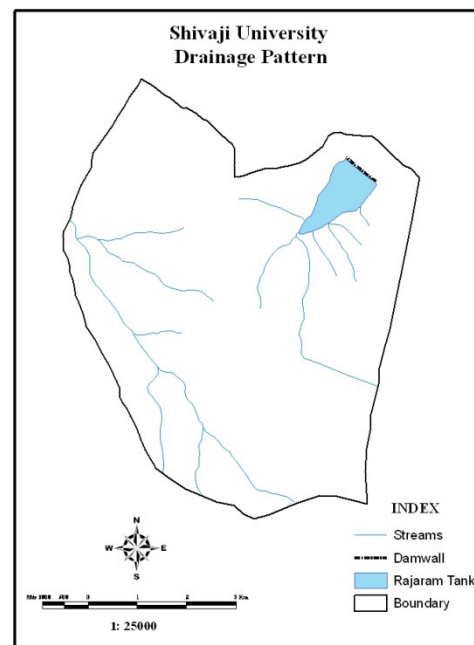


Figure-2
Drainage pattern map of SUK

During the entire study it was observed that Shivaji University covers about 853 ha area and is located at higher altitudes. The areas with higher altitudes and slope were revealed with the help of contour map (figure 3) and elevation map (figure 4). These maps show that the Southern part of Shivaji University has higher contour lines and the slope is at North-East and North-West region of Shivaji University.

The maps of drainage pattern (figure 2) shows that streams in these areas are of second order. They flow from higher altitude to lower altitude i.e. from South to North-East and North-West.

The elevation maps helps to mark the areas with higher and lower elevations. Hence with the help of elevation map and map of drainage pattern the flowing stream can be trapped at lower elevation and thus water can be conserved efficiently.

One of such practices involves existing Rajaram Lake at North-East side of Shivaji University. Even the present lakes near Music Department and language department are also considered as potential watershed areas. Other suitable sites are suggested on the basis of contour maps, elevation map and drainage pattern map 6.

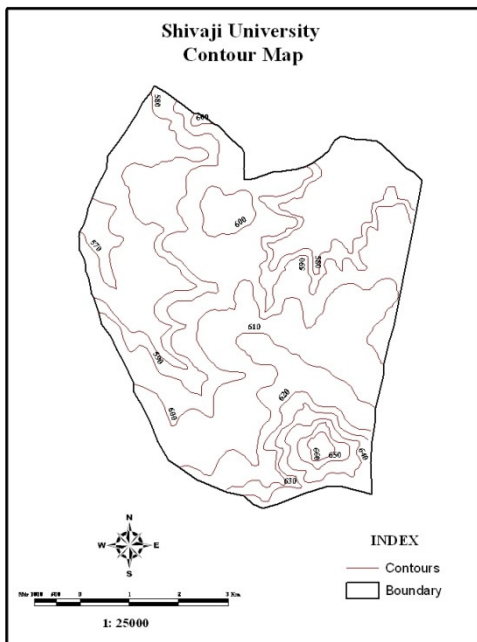


Figure-3
 Contour map of SUK

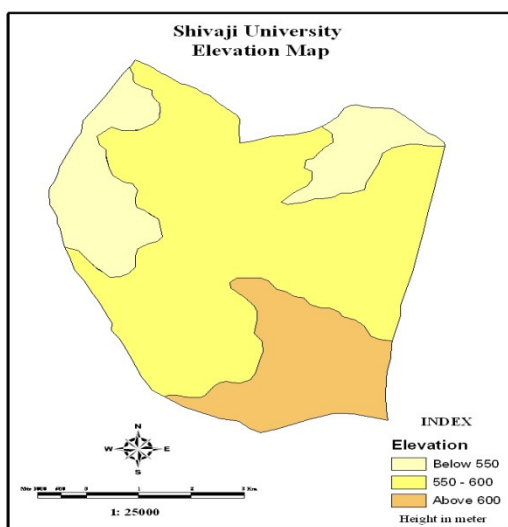


Figure-4
 Elevation Map of SUK

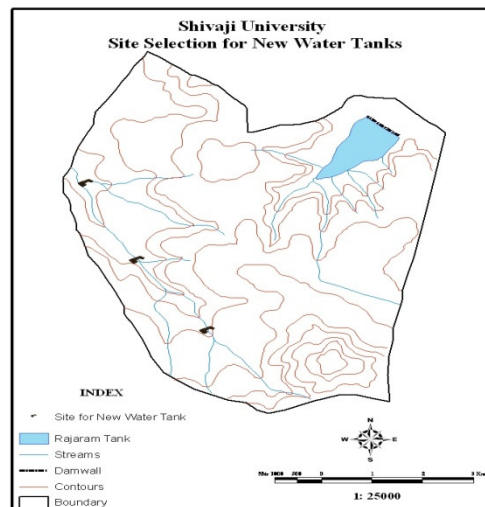


Figure-5
 Site selection for new water tanks at SUK

The location of newly identified sites (figure 5) can be broadly given as – i. $16^{\circ}40'31''$ N and $74^{\circ}14'50''$ E, ii. $16^{\circ}40'21''$ N and $74^{\circ}14'54''$ E, iii. $16^{\circ}40'10''$ N and $74^{\circ}14'63''$ E.

By implementing proper management plan these sites can be developed into potential watershed areas. Hence it requires proper measures such as contour trenching, checkdams etc. Even there should be minimum disturbance to the natural flow of the tributaries. Construction activities are likely to cause the blockage of natural drainage. Hence, the construction with the lack of proper management should be avoided. Stress should be given on plantation around the watershed area so as to avoid the problem of soil erosion which can lead to deterioration of watershed area⁶.

Conclusion

The concerned project helped to mark the three suitable sites for watershed management with the help of obtained various maps. Provisions should be made to develop the newly identified sites as a watershed area. Technology in terms of Engineering and Environment should be well blended in proper proportion so as to develop the new sites into potential watershed areas. The existing management practices had made Shivaji University campus independent for water availability.

Activities like construction that are less concerned about flow of natural drainage system should be avoided in such areas to be developed. Even the existing lakes near Music Department and Rajaram lake should be managed properly. Thus emphasis should be given on plantation around the watershed areas. Cutting of trees near such watershed areas should be prohibited completely so as to avoid soil erosion which is a major cause of deterioration of watershed area.

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