UTILIZATION OF NATURAL RESOURCE ON WATER RESOURCE MAPPING ACTION PLAN FOR HAMPAPATNAM MICROWATERSHED USING REMOTE SENSING AND GIS TECHNIQUES

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ABSTRACT
Remote Sensing and GIS, a potential tool for facilitating the generation and use of thematic information has been applied to water resources of the Hampatapatum Microwatershed. The role of various parameters namely, drainage, lineament, lithology, slope and landuse have been emphasized for water resources. The resultant map indicates a high groundwater potentiality in the river terraces and river channels in the vicinity of the area. Other site of high potentiality includes places showing break in slopes and criss-crossing of lineaments.

Keywords: Microwatershed, Groundwater Potentiality, River Terraces, Slopes

INTRODUCTION
Karnataka being predominantly a dry forming state, irrigation development in the state as compare to other states and the country as a whole is low. Drought is a serious problem in the state. To combat the drought on a sustainable basis development of the watershed area adopting integrated approach is the only key answer and is on more secret (Sukumar and Sankar, 2010). Hampapatum sub-watershed comes under Merur watershed (4D4B1) which lies in Bay of Bengal region, Krishna basin, Upper Tungabhadra catchment and Chikkahagari sub-catchment in Bellary district. The sub-watershed was divided into mini-watersheds (Mugamavinahalli and Hampapatum) and further in to seven micro-watersheds (4D4B1C1a, 4D4B1C1b, 4D4B1C2a, 4D4B1C2b, 4D4B1C2c, 4D4B1C2d and 4D4B1C2e).

Study Area
The total area of the Hampatapatum sub-watershed is 4639.10 hectares which again has two mini-watersheds of 1255 ha (Mugamavinahalli) and 3384 ha (Hampatapatum). Among the micro-watersheds, the largest in Hampatapatum (857 ha) and the smallest is Katteval Tanda (547 ha). The geographical location of the study area falls between 15° 5’ 31” to 15° 15’ 31”N Latitude and 76° 20’ 29” to 76° 20’ 57”E longitude (Figure 1 and 2).

The Hampatapatum sub-watershed falls under Northern Dry Zone of Karnataka in Region-II and average rainfall of the area ranges between 475 to 550 mm per annum. Average ground water level of the area is 8.5 mbgl (May 2003). Water is the most important and scarce natural resource in this region which needs to be used efficiently and judiciously.

In addition to that erratic distribution with high intensity of rainfall results in runoff leading to soil erosion which, demands proper water resource action plan for the region based on watershed principles and check the runoff/ soil erosion and improve the overall resources, its productivity and livelihood standards of the area (Taheri and Zare, 2011).

MATERIALS AND METHODS
Methodology and Database
1. Preparing water resource action plan leading up to treatment of drainage lines, checking runoff and soil Erosion,
2. Improving the storage capacity of tanks for human and agriculture purposes,
3. Recharge of ground water, overall development of agriculture productivity and employment generation.

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RESULTS AND DISCUSSION

The area of interest lie in the watershed 4D4B1 as codified by the National Institute for Soil Survey and Land Use Planning (NISS&LUP) and further classified as sub, mini and micro watersheds using classification made by KSRSAC. Digitization of Drainage Layers: The drainage layers were digitized (Auto CAAD2000, ERDAS 8.5 and ARC Map 8.12) using SOI toposheets (1976) and were updated/corrected using LISS III + PAN merged imagery of 1:12,500 scale (Dec.2000).

Watershed Delineation

The Hampapatnam sub-watershed into mini (4D4B1C1 and 4D4B1C2) and micro watersheds (4D4B1C1a, 4D4B1C1b, 4D4B1C2a, 4D4B1C2b, 4D4B1C2c, 4D4B1C2d and 4D4B1C2e) based on the origin and flow direction of water drains / streams (Ramasamy and Anbazhagan, 1996) (Figure 3, 4, 5 and 6 and Table 1 and 2).

Water Harvesting Structures & Drainage Line Treatment

Water harvesting and drainage line treatment structures were located based on the analysis of both toposheet and imagery of the area and taking other factors in to consideration (Soil slope and type, land use / cover, waste lands, hydro-morphology, population (argil, labors / SC & ST), forest cover, command area, etc. (Figures 1 to 8) (Krishnamurthy et al., 1996).

Structure Recommended

a) Vegetative Checks: The VC are located for the 1st order drains running through agriculture lands having gentle to moderate slopes to check velocity of runoff and further erosion of soil (Table 1 and 2).

b) Boulder Checks: The BC are located to 1st order drains running through lands having little or no top soil to check runoff velocity and prevent the damage to drains downstream (Saravi et al., 2006).

c) Vegetative Boulder Checks: To check the velocity of runoff and conserve soil, VBC are recommended to streams running through lands having soil with low infiltration rate and high runoff.

d) Drainage Line Stabilization / Nala Revetment: The DLSs and NRs were recommended to 2nd and 3rd order drains at the point of sharp curves to prevent damage to stream bunds. Stony masonry work / vegetation cover is given to prevent bank erosion.
Field photographs

Figure 3: Drainage order classification of HAMPAPATNAM SUB WATERSHED

Figure 4: Resource themes of HAMPAPATNAM SUB WATERSHED-SLOPE MAP
Research Article

Figure 5: Resource themes of HAMPAPATNAM SUB WATERSHED geomorphology map

Figure 6: Isohyetes of total rainfall for HAMPAPATNAM SUB WATERSHED

Table 1: Water harvesting structures recommended for hampapatnam sub-watershed

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>NAME OF THE MICROWATERSHED</th>
<th>MWSD CODE</th>
<th>V</th>
<th>C</th>
<th>B</th>
<th>D</th>
<th>S</th>
<th>V</th>
<th>VB</th>
<th>RF</th>
<th>C</th>
<th>D</th>
<th>DS</th>
<th>T</th>
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<th>R</th>
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<th>S</th>
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Legend
VC  VEGETATIVE CHECKS
BC  BOULDER CHECK
DS  DROP STRUCTURES
VD  VENTED DAMS
VBC  VEGETATIVE BOULDER CHECKS
RFD  ROCK FILLED DAM
CD  CHECK DAM
DST  DESILTATION OF TANK
NR  NALA REVETMENT
DLS  DRAINAGE LINE STABILAZATION
ES  EXISTING STRUCTURE

Table 2: Priority table for hampapatnam sub watershed area

<table>
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<tr>
<th>S L. NO</th>
<th>MWSD_NAME</th>
<th>MWS_CODE</th>
<th>AREA(HA)</th>
<th>R F</th>
<th>S L</th>
<th>W L</th>
<th>F C</th>
<th>I L</th>
<th>SO IL</th>
<th>GE OM</th>
<th>SC/ST</th>
<th>WT G</th>
<th>PRIO RITY</th>
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<td>5</td>
<td>28</td>
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</table>
e) **Check Dam:** The CDs are located for 2nd and 3rd order drains to check runoff velocity and provide more time for water to infiltrate and reduce soil movement further down.

f) **Vented Check:** The VCs are recommended to streams which are originating from and running through large forest catchment area at the point of joining plains / agriculture lands to slow down the running water force.

g) **De-siltation of Tank:** De-siltation of tanks is recommended to those tanks which are losing their carrying capacity due to encroachment by scrubs but, have more number of water feeding streams to rejuvenate the tank life and productivity and improve ground water potential (Pedro *et al.*., 2011).

**Conclusion**

Prioritization of micro-watershed plays key role in identifying the micro-watershed, which need immediate attention those can be taken of development with available resources. An attempt was made for the prioritization of micro-watershed based on several criteria like rainfall, slope, wasteland, forest cover, irrigated area, soil type, SC / ST population and geo-morphology of the area and the total weightage of marks given was 100. Remote sensing and GIS and other resource generated data pertaining to these criteria. Based on this analysis, we found the scores ranging between 28 to 71 out of 100 marks. Hence, Rayarahalu Tanda 2 scored 71 marks followed by Hampapatnam Obalapura with 60 marks while, the
lowest score of 28 and 31 scored by Hampapatnam Obalapura (60), katteval Tanda (59), Rayarahalu Tanda l(53), Guladahalu (45) , Muguvinahalli (31) and the last one should be Hampapatnam (28). Thus, the study also proves that remote sensing and GIS when synergistically used provide ample scope for the integration of spatial and non-spatial data and can be successfully adopted to prioritize the micro-watershed in more scientific and un biased manner.

REFERENCES


