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Delineation of Areas for Water Conservation in Peruvamba River basin, Kannur district, Kerala, Using Remote Sensing and GIS.

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ABSTRACT

The concept of Watershed prioritization is the basis of effective planning and optimum development of the natural resources. Selection of priority watershed area includes the location and determination of vulnerable watersheds, the treatment of which can be possible on priority basis with adaptation of frontier technologies like Satellite Remote Sensing, Geographic Information Systems (GIS). The present study is an attempt to locate and assess the priority areas of Peruvamba river basin, Kannur district, Kerala to take action plan for development, by interpretation of space borne Satellite data and overlaying different factors in the GIS platform. Peruvamba River is one of the 20 rivers in Kannur district situated in the northern part of it originating from the Western Ghats and flows in to the Lakshadweep Sea constituting a total catchment area of 269 Km2.The catchment boundary and drainage network have been delineated using topographic map on 1:50,000 scale and watershed boundary are demarcated with attention to stream ordering. From the existing collateral data, different aspects like geology, soil, relief, drainage, landform, slope, aspect, relative relief and landuse maps were prepared using Arc GIS software. Land use and land cover map is prepared from IRS LISS-III FCC by supervised classification in Erdas Imagine software. Normalized Difference Vegetation Index (NDVI) is used to get vegetation and period of growth. Weightage are assigned for different factors and a composite map is prepared by overlaying in IDRISI platform and reclassified to bring out the result and final output. Appropriate suggestions are made for future development.

By overlaying the Panchayat boundary on the Watershed map, it is derived that watersheds of Kankole-Allappandamba, Peringome-Vayakara, Eramam-Kuttur and Periyaram Panchayats should be prioritized. This will be useful for developmental planning by the Administrators and Agriculture Dept.

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1 Introduction

The rapid growth of population has put a severe strain on soil and water resources in developing countries. Thus in this water competition arena, water is very much essential for agriculture, industrial, domestic and other needs. Traditionally it has been very difficult to attract attention and interest to develop, manage, use and preserve natural resources under an integrated watershed approach. Effective planning and optimum development of the natural resources of the earth can be successfully done by taking hydrological units like watershed as a planning unit.

The Remote Sensing and Geographical Information System (GIS) has opened new era in inventorying and monitoring of natural resources especially soil, water and vegetation because of the unique characteristics of satellite data such as repetitive coverage, spectral, spatial resolution, ability to provide the near real time cost and time effectiveness.

2 Study area

The river basin in the northern part of Kannur district is situated in between North-Karingote basin & South-Kuppam and Ramapuram river basin, East- Western Ghats & West – Lakshadweep Sea. The study area lies between 12° 3′ N to 12° 15′ N and 75° 12′ E to 75° 24′E .The length of the river and basin area of 269 km^2 .The main tributaries are Macharuthodu ,Mathamangalam, Challachal,Mukkutenkarachal,Nitaringapuzha & Panappuzha. The pre-monsoon occurs from June till the end of September contributing about 82% rainfall which is followed by post- monsoon until November. Although there is maximum rainfall occurs in this area because of sloppy terrain and impervious nature of the soil most of the precipitation is lost as run off in to the sea. . The winter season from December to February is characterized by general dryness.

3 Materials used:

Topographic map 1:50,000 scale (48P/4 and 48P/8), pre existing maps and IRS 1-C LISS-III. Arc GIS 9.2 is used for different GIS processing works like preparation of thematic maps by digitization, spatial data base creation, overlaying, analysis and for producing output. Extensions of ArcGIS – spatial analyst, geostatistical analyst and 3D analyst are used for different analysis purpose., Erdas imagine 8.7 has been used for subsetting, supervised

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classification and IDRISI 2.0 is used for the reclassification and overlaying of different thematic maps based on the weightage parameters.

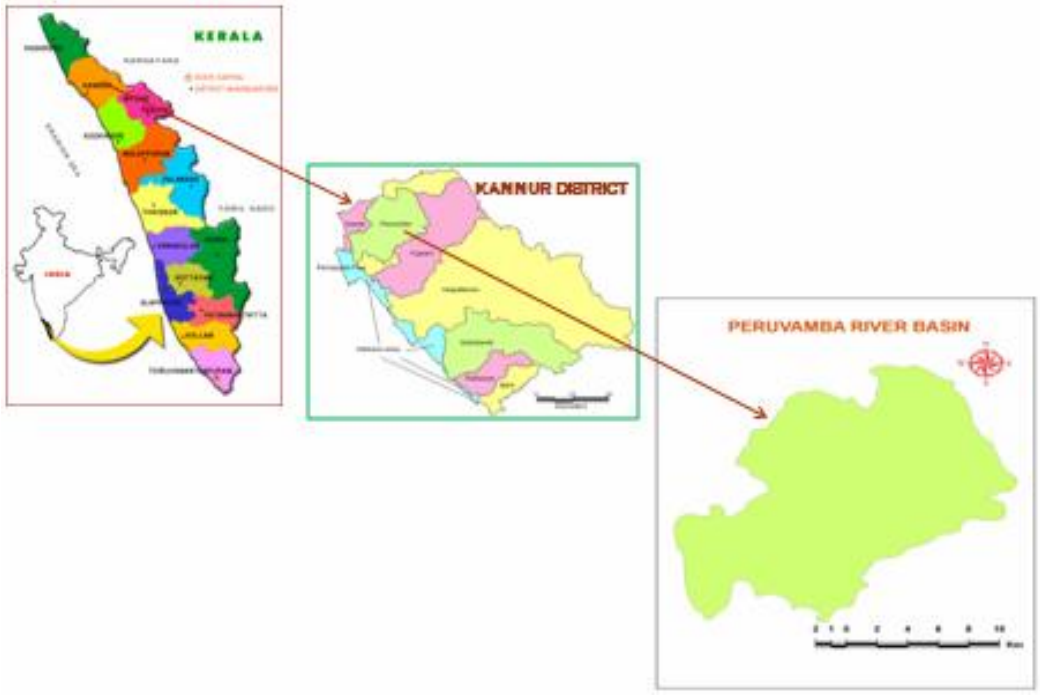
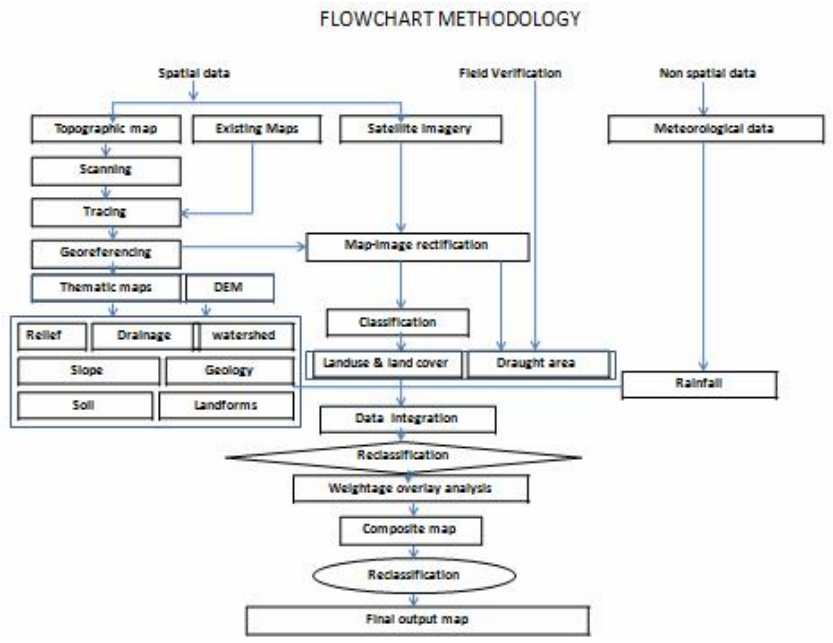


Fig-1 Location Map of Peruvamba river basin, Kannur district, Kerala

4 Methodology



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4.1 Relief

Relief directly reflects the terrain ruggedness, which is characterized by steeper topographic gradient as the relief increases. The low relief area with elevation 0 to 60m is covering 25 percentage of the study area having softer lithology. High relief areas with elevation >300 m comprising of only 20 percentage area. As the relief increases the water level decreases because of sudden run off movement from high relief area to downwards.

4.2 Drainage

The drainage pattern is of dendritic type. Stream ordering is done for delineation of watersheds from the study area. The drainage density (in terms of km/km2) indicates the closeness of spacing of channels. More the drainage density, higher would be the run-off, less percolation and infiltration.

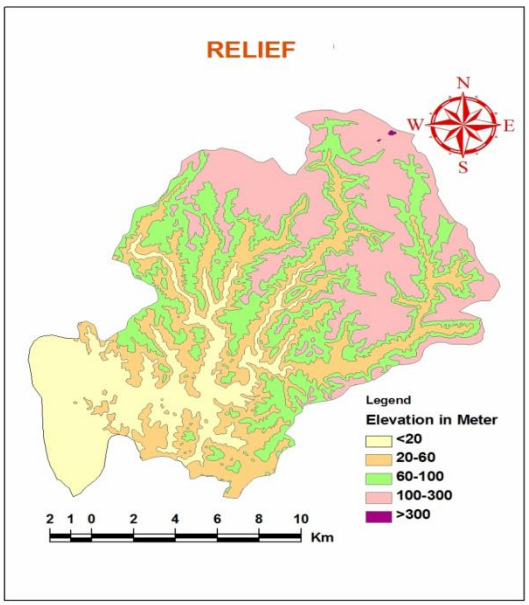

Fig.2

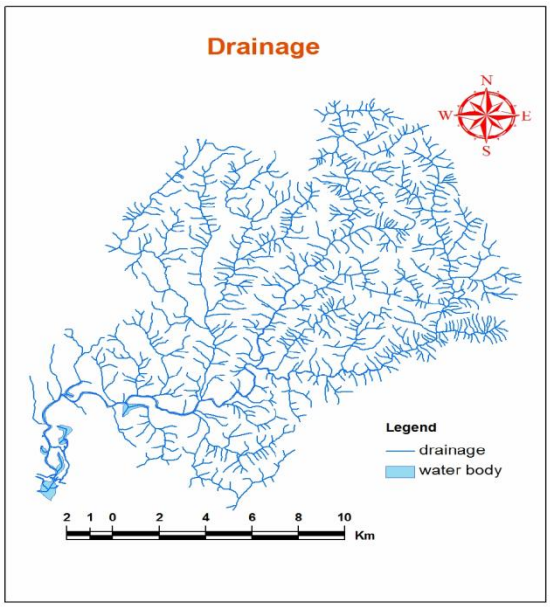

Fig.3

4.3 Watershed

The whole catchment is divided into 5 sub catchments using drainage order and contour lines. Since watershed forms a basic unit of agriculture development, the watershed boundaries have been delineated. Total 25 watersheds have been delineated form the catchment area.

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4.4 Slope

Slope is prominent factor for assessing the runoff and water conservation. Normally, the higher the slope, the greater will be the run off speed with least percolation. Contours are digitized from tracing sheets drawn on topographic map and a DEM created. The elevation in the catchment ranges from 20 m to 340 m above mean sea level. Slope map has been generated from the DEM.

4.5 Geology and Landform

Geologically the area is underlined by crystalline rocks of Archean group consisting of Charnockites in most part of it. The coastal area consists of coastal sand and alluvium and sand stone and clay with intercalation. The other areas consist of pyroxene granulites, anthracite and Biotite Hornblende Gneiss.

The Landform map is prepared from the contour and relief map showing five types of landforms of which Undulated Denudational Upland characterized by steeply sloping, highly weathered hills and covers about 45% of the area. The low relief areas contain coastal plain and valley fill and the higher areas consist of low dissected plateau/pediments and the top most high mountain regions.

4.6 Soil

The coastal plain area contains coastal alluvium and the river valley area consists of riverine alluvium. The upland nearer to valley fill contains soft laterite and in the high hilly areas and mountain areas mostly hard laterite (duricrust-ferricric) type.

4.7 Land use and land cover

The land use and cover was prepared from the satellite imagery by supervised classification. The In the slope above the valley fill mixed crop like pepper and in the high hilly area rubber ,cashew nut, mango plantation are there. In the coastal region there are vast areas of coconut plantation. The valley fill is having paddy field. The land cover shows the present topographic condition of the area.

4.8 Draught prone area

The draught prone areas are the areas which have been suffering shortage of water loss are delineated from the satellite imagery by digital image interpretation technique. These areas are characterized by continuous depletion of vegetative cover due to fall in ground water levels, erosion.

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5 Data integration:

IDRISI, a raster based, GIS was employed to combine the different layer parameters producing a composite map. The Weighted overlay method is used which grouped the layers and graded them according to their perceive importance .Finally, the RECLASS function was used to select only those areas with high need of establishment of water conservation.

Sl No.	parameter	categories	weightage
1	Land form	High Mountain	5
		Low Dissected plateau/Pediments	4
		Undulated Denudational Upland	3
		Valley fill	2
		Coastal plain	1
2	Relief	>300	5
		100-300	4
		60-100	3
		20-60	2
		<20	1
3	Soil	Hard Laterite	4
		Soft Laterite	3
		Riverine Alluvium	2
		Coastal alluvium	1
4	Slope	>18°	5
		12°-18°	4
		6°-12°	3
		3°-6°	2
		0-3°	1
6	Drainage density	4.36-7.41	5
		3.23-4.36	4
		2.27-3.23	3
		1.28-2.27	2
		0-1.28	1
7	Geology	Anthrosite	5
		Pyroxine granulite	4
		Charnockite	4
		Horneblende biotite Gneiss	3
		Sand stone and clay with intercalation	2
		Coastal sand and alluvium	1
8	landuse	Barren area	5
		Rubber plantation	4
		Mixed tree	3
		Mixed Crop	2
		Paddy Field	1
		Coconut plantation	1
9	Draught area	Draught prone area	1
		No draught prone area	0

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6 Results and discussion

From the study carried out it has been found that most of the areas of the watershed in the middle and eastern part are having surface as well as ground water deficiency. About 118 km^2 (as shown in table below) of the basin falling in seven panchayats and the only one Payyannur municipality falling in the zones of dryness need water conservation.

Sl.No.	Panchayat/municipality name	Water conservation area in Km^2
1	Payyannur	3.02
2	Peringome-Vayakkara	47.24
3	Kankole-Alappanadamba	15.33
5	Eramam Kuttur	80.41
6	Kadanappally-Panappuzha	26.67
8	Cheruthazham	0.5
14	Alakode	6.33
16	Chapparapadavu	1.55
Total area of water conservation		118.15

7 Conclusion& Recommendation

In the Weighted overlay technique, its flexibility in assigning factors gave more allowance and effectiveness in the suitability analysis of areas delineation for water conservation. Location of such areas by considering the various parameters is a heavy task, however GIS as a decision making tool overcomes such difficulties. Action should be taken on these areas by the local administrators on priority basis, so that a sustainable environment can be achieved.

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