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Land suitability analysis for agriculture, a case study of Kannur district, Kerala

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Abstract

Land suitability is the fitness of a given type of land for a defined use. The land may be considered in its present condition or after improvements. There are several methods used for land suitability analysis. In the paper, an attempt is made to derive land suitability classes by considering relief, landforms, slope, aspect, topographic wetness index (TWI), soils, soil texture, and erosion-prone areas. The relief map is prepared by digitizing contours from the Survey of India's topographic maps in 1:50,000 scale. SRTM data also used to derive contours, slope, aspect, and topographic wetness index. The study area is chosen in Kannur district in Kerala State. It is situated in the northern part of Kerala. All these eight parameters were digitized using ArcGIS software. Weighted overlay analysis was done for identifying land suitability for agriculture, and derived into different classes based on values and labeled as most suitable (S1), moderately suitable (S2), marginally suitable (S3), not suitable (NS1), and not suitable (NS2). This analysis will be useful for identifying the main limiting factors for agricultural production and enables decision-makers to develop crop management able to increase land productivity.

Keywords: Land suitability; topographic wetness index; Weighted overlay analysis

Introduction

The land is the base for all human activities in the world. Land suitability is the fitness of a given type of land for a defined use. The land may be considered in its present condition or after improvements. Land suitability analysis can be made for various purposes. It started mainly for agriculture and many methods have been followed for agricultural production and sustainable agriculture. FAO (1975, 1976, 1996) has suggested methods based on physical and soil parameters of various countries in the world. Young et al. (1977), shah et al. (1988), and Jyothirmayi et al. (2019) have also suggested land suitability and land evaluation methods in their studies. There are several methods used for land suitability analysis. In this paper, an attempt is made to derive land suitability classes by considering relief, landforms, slope, aspect, topographic wetness index (TWI), soils, soil texture, and erosion-prone areas. The relief map is prepared by digitizing contours from the Survey of India's topographic maps in 1:50,000 scale. SRTM data also used to derive contours, slope, aspect, and topographic wetness index.

Study area

Kannur district is located between latitudes 110 40’ North to 120 48’ North latitudes and 740 52’East to 750 56’East longitudes (Map.1). The district is bound on the north by Hosdurg Taluk of Kasargode district and the south by Mananthavady Taluk of Wayanad district and Vatakara Taluk of Kozhikode district and Mahe of Pondichery. The eastern boundary of the district shares with the Coorg district of Karnataka State. The Lakshadweep sea lies on the Western side of the district. The landform of the Kannur district undulates from east to west with a series of hillocks and valleys dissected by the streams and rivers. The general gradient of the slope is steeper in the eastern part and gentler towards the western side of the district. Based on physiography the district is divided into three broad physical units., namely, the high land, the mid land, and the coastal plains and low lands. The district experiences a humid climate with a severe hot season from March to the end of May followed by South West Monsoon season which continued till the end of September. Retreating Monsoon is from October to November. December to April, the district has a dry season. The average annual rainfall recorded in the district during the year 2018-19 was 3418 mm., of which 70% of rainfall received during the period from June to September. With seven major rivers and about twenty minor streams, the Kannur district is endowed with a well-developed drainage system. Most of the rivers in the district originate from the Western ghat in the east and drains into Lakshadweep Sea in the west.

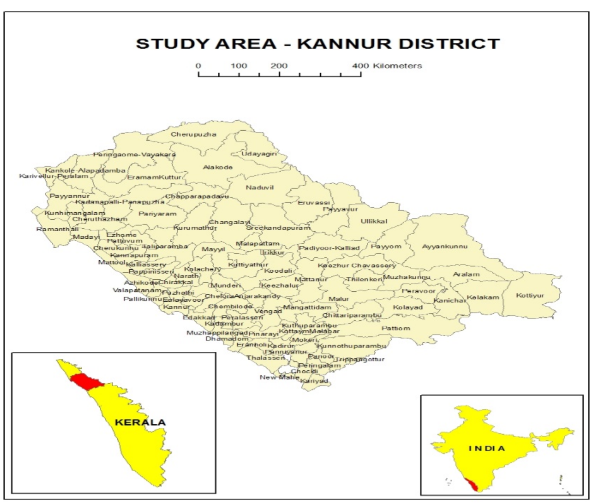

Fig. 1. Study Area

Aim and objectives

The aim of the study is to analyse the land suitability for agriculture based on physical parameters. To prepare Land Suitability Map for Kannur district using GIS platform.

Methodology

To achieve the objectives, an attempt is made to derive land suitability classes by considering relief, landforms, slope, aspect, topographic wetness index (TWI), soils, soil texture, and erosion-prone areas. The relief map is prepared by digitizing contours from the Survey of India’s topographic maps in 1:50,000 scale. SRTM data also used to derive contours, slope, aspect, and topographic wetness index. Landform map is derived from relief and slope maps. Soils and soil texture map is prepared based on Soil Survey Department publications, satellite imagery, and field work. Erosion prone area map is prepared by using relief, slope, and drainage density. Water bodies and settlement areas were classified using satellite imagery.

Results and discussions

Relief is an important aspect of the consideration of agriculture and productivity. Crops like paddy, coconut, banana, and vegetables will grow better in the low land and productivity will be higher. Rubber would grow up to 600 meters and give better yield. It also needs a drainage facility. It prefers land with a slope to plain. Coffee can grow from 600 to 1000 meters and give a better yield. Tea needs cool and higher elevation than coffee.

Landforms also play important role in agriculture. It is a combination of geology, relief, and slope. Some crops prefer plain regions and others prefer land with different degrees of slopes. The flat duricrust (hard laterite) low plateau region above 40 to 60 meters is a unique landform feature of this district. It is an indurated hard laterite surface. Because of the hard and flat nature of this landform, it is barren and promotes surface runoff.

Slope plays a very important in agriculture. Certain crops like rubber, pepper, and coffee need land with slope and drainage. Very steep slope lands are not suitable for agriculture as it triggers soil erosion and landslides.

Aspect i.e., slope direction is also important to get water. Since this district gets rainfall mostly from the southwest monsoon, slopes facing south, southwest, and west are more favorable get water and stream formation and water flow.

Topographic Wetness Index (TWI) is a terrain index. It is a combination of degree of slope and slope area. Higher the TWI values higher the availability of water. Lower the index value lowers the availability of water. Availability of water can be assessed with the help of this index which is very important for agriculture, crops, and yield.

Soil types: Different types of soils also play an important role in agriculture. Alluvial soil is a transported soil mixed with humus and other soil nutrients. It is found generally in the river valleys and plain region. Forest loam is covered in the higher elevations of the eastern part of the district. Hard and soft laterite covers the midland region of the district. Crop combination and cropping patterns vary according to the soil types of the district.

Table 1. Parameters , classes and weightages

Parameter	Classes	Weightage
Relief	0-20m	7
	20-60m	6
	60-100m	5
	100-200m	4
	200-300m	3
	300-600m	2
	600-1200m	2
	Above 1200m	1
Landforms	Coastal Plain	6
	Valley Fill	5
	Undulating denudation Upland	4
	Low Dissected Plateau/Pediment	1
	High Mountain	2
	Hill/Ridges	3
Slope	0-3 degrees	10
	3-6 degrees	9
	6-9degees	8
	9-12degrees	7
	12-15degrees	6
	15-18degrees	5
	18-21degrees	4
	21-13degrees	3
	23-25degrees	2
	25-27degrees	1
	More than 27 degrees	1
Aspect	North	1
	North East	2
	East	3
	South East	4
	South	7
	South West	8
	West	6
	North West	5
Topographic Wetness Index	0	1
	1	2
	2	3
	3	4
	4	5
	5	6
	6	7
Soil Texture	Sandy	2
	Sandy loam	4
	Clay loam	6
	Laterite	3
	Duricrust	1
	Forest loam	5
Soils	1	4
	2	4
	5	4
	7	1
	8	3
	9	2
	10	3
	13	1
	20	1
	21	2
	22	2
	23	3
	24	2
Erosion Prone areas	3-6	1
	6-9	2
	9-12	3
	12-16	4
	16-24	5

Source: Compiled by the author

Soil texture is another important factor for the growth of the crops and root system of the plants. It plays an important role in the percolation of surface water to the groundwater and maintains soil moisture for the growth of crops and trees.

Erosion prone area is prepared by using relief, slope, and drainage density.

All these eight parameter maps were digitized using ArcGIS software. They were converted into raster file and reclassified them according to the suitability for agriculture. Overlays were made with reclassified values of the layers and summed up the weightage using the spatial analyst tool in ArcGIS. Sum weightage map was reclassified into five classes from the lower value to higher values. The first three ranks of higher values are considered suitable for cultivation. The last two values were considered as not suitable for cultivation. They were labeled as most suitable (S1), moderately suitable (S2), marginally suitable (S3), not suitable (NS1), and not suitable (NS2).

When all the 8 reclassed weightages maps were overlaid using the weighted Sum sub-tool from the Spatial analyst tool in ArcGIS, got a map with weights ranging from 15 to 50. This was reclassed into 5 classes as mentioned earlier. In NS2, water bodies and urban and settlement areas are included as they cannot be used for agriculture. This map was converted into vector format and area calculated for each class. The area under each class of suitability and the percentage to the total area of the district is given in the following table.

Table 2. Kannur district– Land suitability and areas

Land suitability class	Area in sq.km	Percentage to the total area of the district
Most Suitable (S1)	213.48	7.20
Moderately Suitable (S2)	1106.98	37.66
Marginally Suitable (S3)	602.35	20.31
Not Suitable (NS1)	380.48	12.83
Not at all Suitable (NS2)	662.71	22.01
Total	2966.00	100.00

Source: Compiled by the author

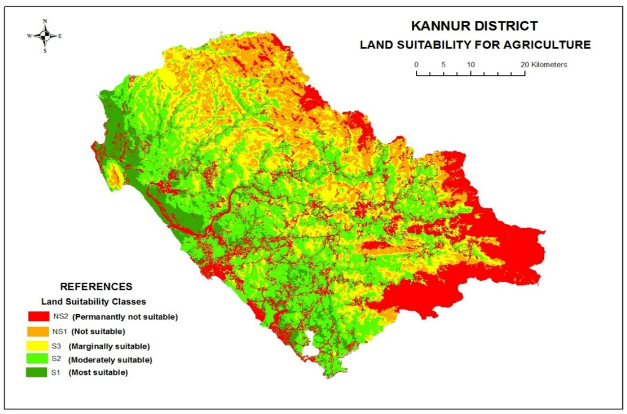

Fig. 2. Land suitability for agriculture

Conclusion

The application of the GIS technique in land suitability classification has the greatest potential and capabilities in analyzing and preparing maps for the Kannur district. This study derived land suitability classes by considering relief, landforms, slope, aspect, topographic wetness index (TWI), soils, soil texture, and erosion-prone areas and prepared a land suitability map, which is much closer to the field reality. The present investigation can be useful for identifying the main limiting factors for agricultural production and enables decision-makers to develop crop managements able to increase the land productivity of Kannur district.

References

1) Jyothirmayi P, Sukumar B. Role of Relief and Slope in Agricultural Land Use: A Case Study in Valapattanam River Basin in Kannur District, Kerala Using GIS and Remote Sensing. *Journal of Geography, Environment and Earth Science International*. 2019;21(2):1–11. Available from: https://dx.doi.org/10.9734/jgeesi/2019/v21i230123.
2) Shah PB, Schreier H. Agricultural Land Evaluation for National Land-Use Planning in Nepal: A Case Study in the Kailali District. *Mountain Research and Development*. 1985;5(2):137–137. Available from: https://dx.doi.org/10.2307/3673251.
3) FAO. Report on the Ad hoc, Expert Consultation on Land Evaluation Rome, Italy, 6-8. Jan.1975. world Soil Resources Report. 45. 1975.
4) Priya S. GIS Aided Land Evaluation for Crop Suitability, A Case Study of Panchana Watershed. Geographic Information System (GIS) and Economic Development. 1997.
5) Jyothirmayi P. Land evaluation for sustainable agriculture in Valapattatanam River Basin, Kannur district, Kerala. Kannur. 2012.
6) Young A, Goldsmith PF. Soil Survey and Land Evaluation in Developing Countries a Case Study in Malaŵi. *The Geographical Journal*. 1977;143(3). Available from: https://dx.doi.org/10.2307/634710.
7) Fao. FAO. A Framework for Land Evaluation, FAO soils Bulletin, and 32, Rome. 1976.
8) FAO. Background Document. Expert Consultation on Land Evaluation for Rural Purposes. AGL. LERP 72/1, OCT.1972. FAO. Rome. 1972.
9) FAO. Agro-Ecological Zoning; Guidelines. FAO Soils Bulletin 73. Rome. 1996.