

# SITE SUITABILITY ANALYSIS FOR HORTICULTURE PLANTATION ON CULTURABLE WASTELAND IN BANDA DISTRICT USING REMOTE SENSING AND GIS TECHNOLOGY

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**Abstract** - Land suitability evaluation for horticulture plantation on the Culturable wasteland is carried out in Banda District of Uttar Pradesh, India. In the previous study the total Wasteland area in Banda district for the year 2021-22 was calculated as 104 sq km, which is 2.5% of the total geographical area of the district in which the culturable wasteland was calculated as 98 sq km approx. There are many factors which affect the land suitability assessment like soil, slope, land use, geomorphology and groundwater. The Wasteland evaluation results of the present study area were classified into different categories of Land suitability as per Food and Agriculture Organization (FAO). These categories were arrived at by integrating the various layers with corresponding weights in Geographical Information System (GIS) environment. The aim of this study was to determine the present wastelands in Banda District that will be suitable for Horticulture Plantation using GIS overlaying method. In the assessment, it was estimated that all culturable wasteland having an area of 96 sq. km. of the study area is suitable. Finally, based on the land suitability assessment, action plan map was developed for Horticulture Plantation of Banda District.

**Key Words:** Wasteland; Action Plan; FAO; Integrating; GIS Overlaying; Land suitability; Horticulture

## 1. INTRODUCTION

The state of Uttar Pradesh has diverse Agro-Climatic conditions, with its vast agricultural and natural resources. It's facilitating production of varied food crops like fruits, vegetables, spices, medicinal and aromatic plants etc The state is fourth in country with a cultivable area of 15.91 lakhs hectare under vegetables. The state of Uttar Pradesh accounts for 16% of India's total population and produces 15% of the country's vegetables i.e. 266.06 lakhs tonnes. Uttar Pradesh also ranks the second largest producer of vegetables among all states; moreover it ranks 3<sup>rd</sup> in production of fruits among all states in country. Major

fruits grown in the states are Mango (leading state in India in terms of Production), Guava (ranked 4<sup>th</sup> in India), Banana and Litchi. The overall Productivity of fruits in the state is 10.79 tons/ha against national average of 11.9 tonnes per hectares. To increase the production the culturable wasteland can also be used for the Horticulture Plantation. Wasteland in general called as Degraded Land or unculturable Lands. They have been utilized in recent past to bridge the gap between demand and supply of Food, Fodder, Timber and also for resource conservation.

In view of above the present study is carried out in Banda District of Uttar Pradesh to find the suitable culturable wasteland for Horticulture Plantation.

## Objective

The principal objective of this study is to provide inputs for effective Planning for Horticulture Development activities on the culturable wasteland of the district with respect to the natural and climatic variability in the Banda District of Uttar Pradesh using a Geospatial technology approach.

## 2. STUDY AREA

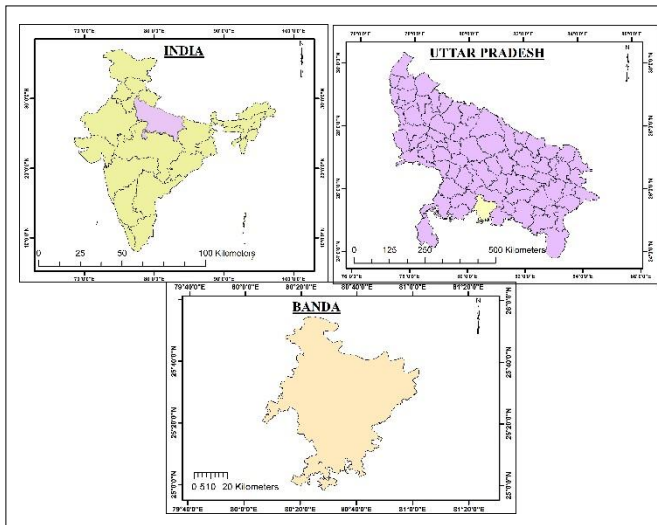
### Location and Area

The total geographical area is about 4460 sq km. The district forms part of Northern Periphery of peninsular India coming in contact with Gangetic alluvium. Northern side of Banda District is bounded by Fatehpur District, western by Mahoba and Hamirpur, eastern side by Chitrakoot and southern side by Madhya Pradesh.

District falls under Chitrakoot division and Banda town is that the district Headquarters. There are 5 Tehsils namely Banda, Baberu, Attarra, Pailani and Naraini in the district. Banda District has 8 blocks in 5 tehsils namely Badokhar Khurd, Mahuva, Baberu, Bisanda, Kamasin, Jaspura, Naraini, Tindwari. Banda District is drained by Yamuna, Ken, Baghain and Ranj Rivers. Yamuna River splits the District Banda from Fatehpur in north and flows from West to East in the complete District. River Ken is the tributary of River Yamuna at Gilla ghat in Banda district.

### Geography and Physical Features

The district Banda is located in geographical extends between 24 deg 53 min to 24 deg 55 min N latitude and 80 deg 07 min to 81 deg 34 min E longitude.



**FIGURE -1: STUDY AREA MAP OF BANDA DISTRICT**

### 3. MATERIAL AND DATA USED:

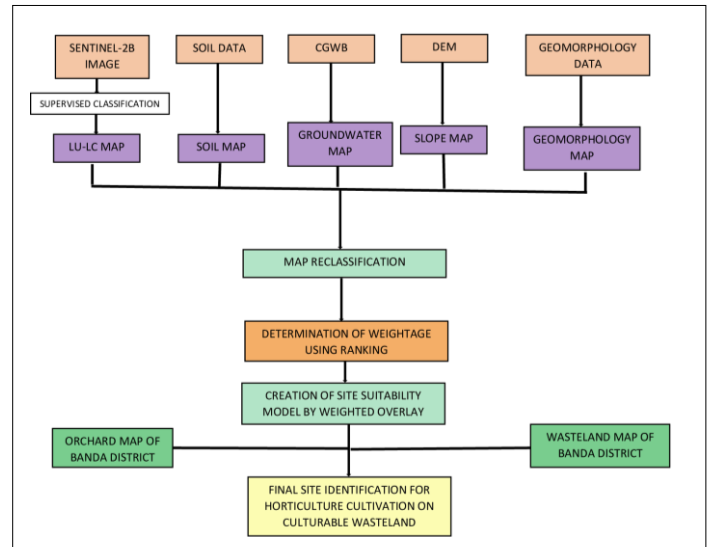
#### 3.1. DATA USED:

- Survey of India Topographical Maps.
- DEM data downloaded from bhuvan.
- Soil Map of Banda District.
- Sentinel-2B Image of Banda District to create LULC Map.
- Groundwater Data collected from CGWB of Banda District.

#### 3.2. SOFTWARE USED:

- ▶ ArcGIS 10.8
- ▶ Google Earth Pro

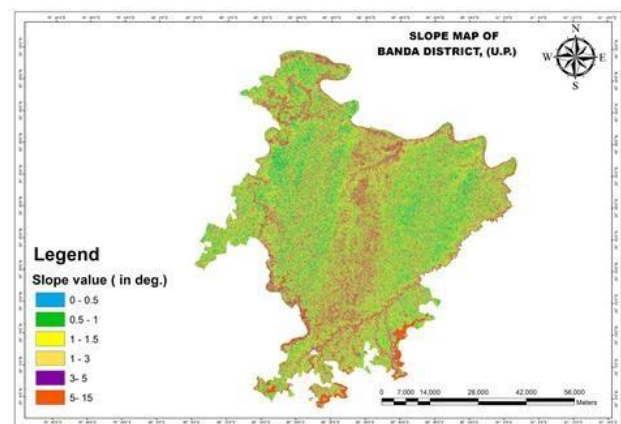
### 4. METHODOLOGY



**FIGURE -2: FLOW CHART OF METHODOLOGY**

#### 1. SLOPE

The slope map of Banda district is created from DEM image of Banda district. The DEM image was downloaded from bhuvan, Indian Geo-Platform of ISRO. Slope has been classified into different categories which are shown in the map. Slope of 0-3 degrees is of flatland and mainly they are in the district. They are mostly suitable for Horticulture plantation on the Wastelands which falls in Flat lands. Slope greater than 5 degrees are not highly suitable for Horticulture plantation because Barren rocky type of Wastelands are found there.



**FIGURE -3: SLOPE MAP OF BANDA DISTRICT**

#### 2. LAND USE/ LAND COVER

Sentinel-2B image of resolution 10\*10 m is used to create LULCmap of the Banda District. The Supervised Classification for twelve different classes with the help of their signatures was done to make LU LC map. The Twelveclasses present in

this study area are identified in the given Map. Mainly the District is covered by crop land and Built up area as shown in the map but some wastelands i.e. Fallow Land, Land with Scrub, Land without Scrub and Salt affected Land are also marked in the map which are suitable for Horticultural Plantation.

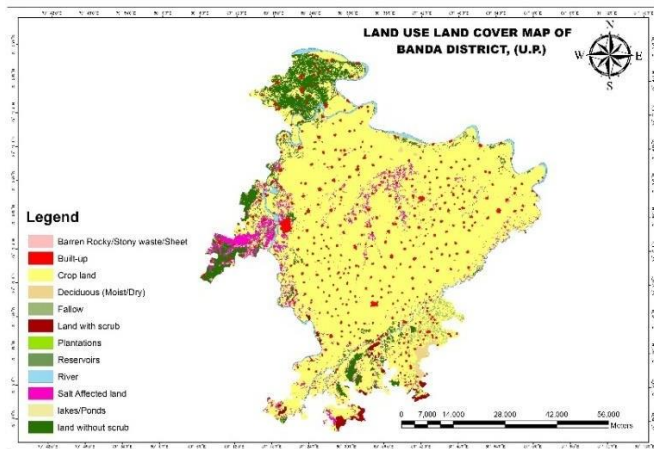


FIGURE -3: LU-LC MAP OF BANDA DISTRICT

LULC TYPE	AREA (HECTARES)
AGRICULTURE LAND	3,63,928.74
FOREST	13,647.33
WATERBODIES	22,745.55
WASTELAND	18,196.44
BUILTUP	36,392.87

TABLE-1: TABULAR REPRESENTATION OF VARIOUS CLASSES OF LU LC MAP

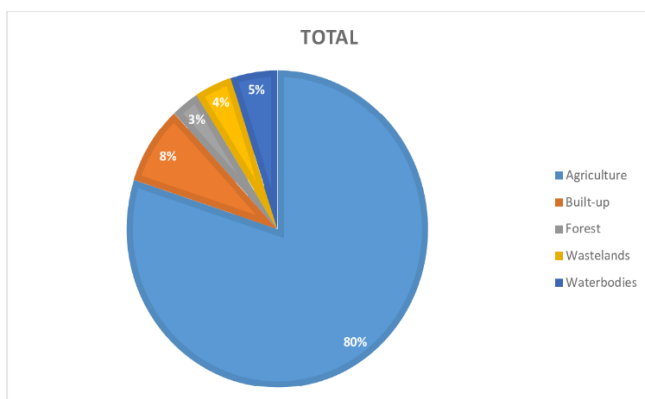


FIGURE-4: WEGHTAGE OF VARIOUS CLASSES OF LULC MAP

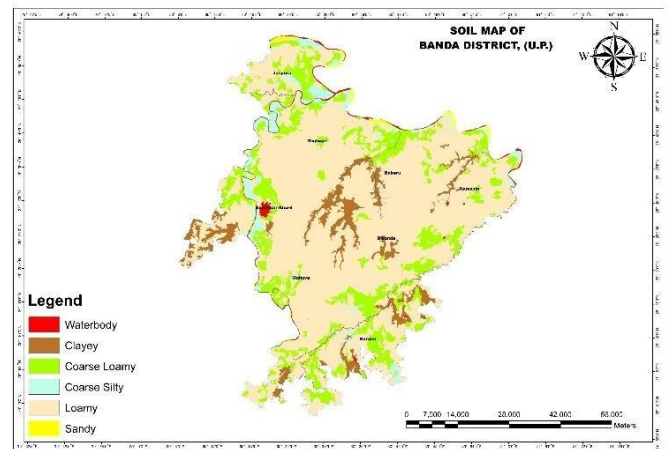


FIGURE-5: SOIL MAP OF BANDA DISTRICT

[3.] SOIL TEXTURE:

District is characterized by loose sediments as well as black cotton soil. Loose sediments constitute clay, silt and sand. Black cotton soil is quite prominent in central part of the Banda district. On the basis of local name of soils and its coverage in different blocks, these are four types of soils as below:-

[a] RAKAR: It is characterised by silt, clay and subordinate amount of sand. Badokhar Khurd, Tindwari, and Jaspura block are all affected.

[b] MAR: It is also characterised by silt, clay and sub-ordinate amount of sand. It has coarse texture than Rakar. It is spread over Badokhar Khurd, Tindwari and Bansi blocks. It is fertile and absorb more water.

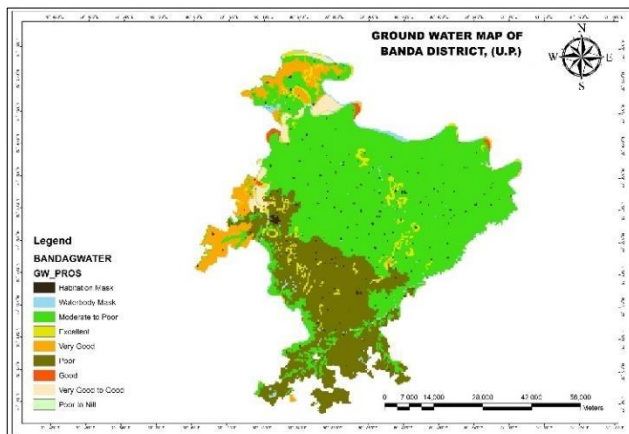
[c] KABAR: It is characterized by black cotton soil and is fertile. Rabi crops are more grown and yielded from this type of soil. Baberu and Kamasin blocks have this type of soil.

[d] PADUA: It is characterized by silty loam type of soil which is less fertile and water retention capacity is poor. This type of soil is found in mainly Mahua, Bansi and Bisanda blocks. After above all types of soil, it is important to note that soil is deciding factor for cropping pattern in the district.

[4.] GROUNDWATER:

Groundwater in the district is of 7 categories ranging from excellent to poor quality of Groundwater. Since the district is characterized by alluvium, marginal alluvium and hard rock terrain, the ground water occurs in porous formation like sand, gravel and fractures/joints (secondary porosity). Major portion of the district has moderate to poor quality of Groundwater. Water level ranges from 1.99 to 12.95 mbgl in year 2020. Post-Monsoon water level varied from 1.15 to 13.8 mbgl during post-monsoon in year-2020. In year 2020, most of the values range from 0-5m. It is observed that in central and northern portion of district Banda, the water level fluctuation has minimized over the years.

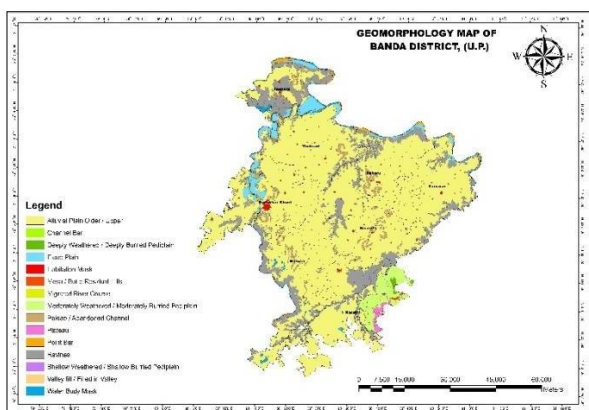




**FIGURE -7: GROUNDWATER MAP OF BANDA DISTRICT**

**[5.] GEOMORPHOLOGY:**

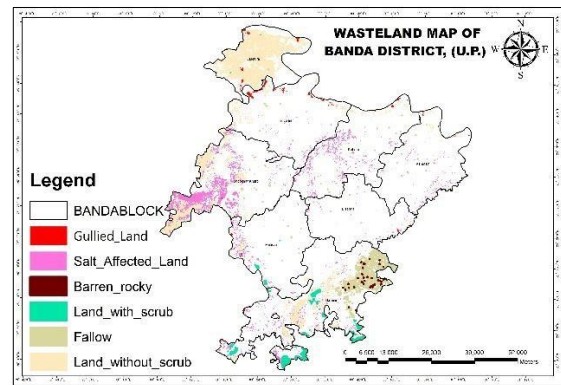
The district is characterized by alluvial, hard rock as well as marginal alluvium. The district can be broadly classified into three physiographic units. i.e. (i) The alluvial Plain, (ii) Marginal Alluvial, and (iii) High Land Area.



**FIGURE-8: GEOMORPHOLOGY MAP OF BANDA DISTRICT**

**[6] WASTELANDS:**

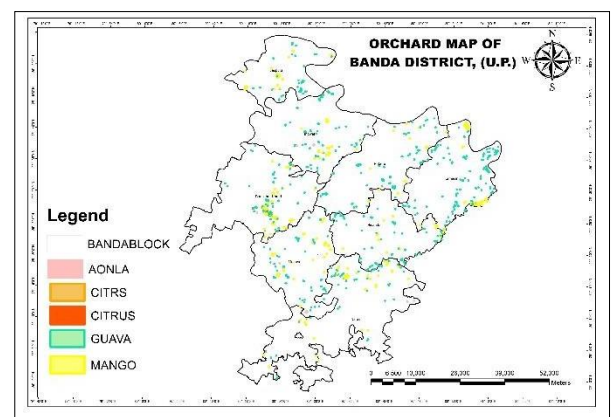
The degraded lands or Wastelands found in Banda District is around 4% of the Geographical area of the District. Mainly six types of degraded land are there i.e. Ravinous Land, Barren Rocky, Marshy Lands, Salt Affected land, Land with Scrub, Land Without Scrub. Out of the 8 blocks of Banda major Portion of the wastelands are found in Baberu Block.



**FIGURE-9: WASTELAND MAP OF BANDA DISTRICT**

**[7] ORCHARDS:**

Orchards Map of Banda District is shown below. Banda District is mainly covered by Mango, Guava and in some parts citrus and aonla are also found.



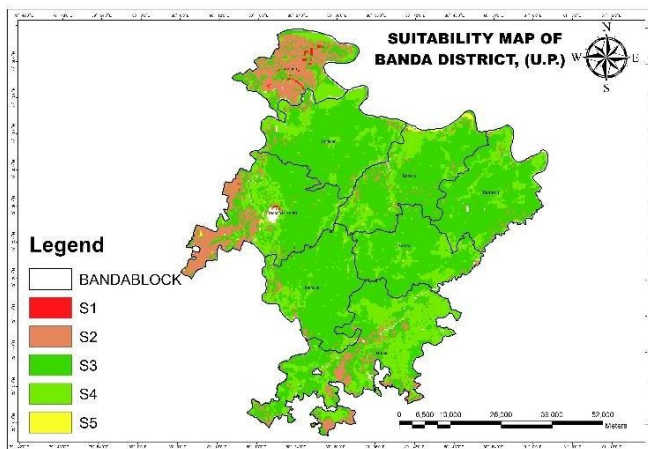
**FIGURE-10: ORCHARD MAP OF BANDA DISTRICT**

**5. RESULTS AND CONCLUSIONS**

Soil suitability map of Banda District is divided into five classes, Class S1; S2; S3; S4; S5. Classes S1;S2;S3;S4 is suitable for Horticulture cultivation and covers major Portion of the District. Class S1 Mainly Consists of Sandy soil with Alluvial plains and has land with Scrub type of wasteland so The suggestions will be given for Aonla or citrus types of Horticulture Plantation. Class S2 consists of Land without scrub type of Wasteland with Loamy Soil predominant in the area. Classes S3,S4,S5 has Salt effected, Ravinous and marshy types of wasteland and the soil type in this Categories is of mainly clayey, Coarse Silty and Coarse Loamy so there will be difficulty in some region to do the horticulture cultivation.

CATEGORY	SUITABILITY	AREA (HECTARES)
S1	EXCELLENT	1084.379
S2	VERY GOOD	48374.466
S3	GOOD	287895.235
S4	AVERAGE	109026.162
S5	BAD	1374.574

**TABLE -2: SUITABILITY OF AREA IN TABULAR FORM FOR BANDADISTRICT**



**FIGURE-10:SOIL SUITABILITY MAP OF HORTICULTURE PLANTATION ON CULTURABLE WASTELAND FOR BANDA DISTRICT**

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