# Determination Potential habitat of *pinus brutia* with using RS and GIS techniques for rehabilitation of Deforested area occasional study (watershed of Armand, Chaharmahal Bakhtiyari Province- Iran)

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**Abstract**

The growth of plants in a region is affected by environmental and biological factors of the region. It is necessary to do researches in fields of the ecological needs of species and also environmental characteristics of the studied region in order to determine the potential habitat of a plant growth. In this research, the potential habitat of a tree species *pinus brutia* was determined in the watershed of Armand in the Chahar Chaharmahal Bakhtiyari province by the technology of GIS and RS. In order to do this research, first, the different maps of this region such as topography, geological and thematic maps were collected from different organizations. After digitizing these maps, information layers such as hypsometric and aspect of topography maps, geological information layers of geological map, and different climatic layers of gradients existing in reports and raster topography map were prepared. Also, information layers related to soil were prepared from soil maps and existing reports and standardizing information related to sample profiles. Information layers such as forest, agricultural irrigation lands, dry farming, rangeland, outcrop rock and shaded area were prepared from TM satellite data. Refer to different scientific sources the ecological needs of *pinus brutia* were determined. And different information layers were prepared based on these needs. Finally, it was determined that about 3309 hectares of the studied area is suitable to grow this species, combining these layers together.

**Key words**: ecological needs, Information layer, RS, GIS, Armand, Chahar Mahal Bakhtiyari.

## introduction

The increase in the population and rising the needs of the human's life have caused on increasing pressure in the limited natural resources existing on the earth. Committing destructive acts such as deforestation, over grazing of rangelands, farming in the unsuitable lands caused many problems to appear. The average annual destruction of the forests in Iran has been 130000 hectares during the last three decades and the average destruction of the rangelands has been more than one million hectares during this time. One of the suitable ways to rehabilitation this forest is to know the potential of this region in order to present suitable tree species. Today, it seems to be necessary

to use new techniques such as RS and GIS considering to increasing destruction of the natural resources in order to speed rehabilitation of these regions.

To perform reforestation with the purpose of preventing erosion in Africa, Mckendry and colleagues use GIS techniques to prepare the potential rehabilitate map of *Eucalyptus grandis* species. In this study, they only used climatic information layer. With the purpose of reforestation of Molin forest in Taiwan, Wang and Co., used RS and GIS techniques to determine potential rehabilitate of Taiwania cryptomerioides tree species. In this study, they used physiographic and soil information layers.

## Study area

Armand Watershed with the area of 30111 hectares is located between 50^ 42` 43" to 50^ 54` 30" E of longitude and 31^ 32` 18" to 31^ 45` 18" N of latitude within 10 kilometers from north of Lordagan city in the Chaharmahal Bakhtiyari province.

### Methodology

This research was done in three stages as follows:

1- To prepare information layers, 2- To prepare ecological needs of the species *Pinus brutia,* 3- To combine information layers together in order to determine the potential habitat of the *pinus brutia.*

1- To prepare information layers: a needed information layer in this research was prepared from two resources:

1-1: The thematic maps of the region which were prepared from the different institution and organizations. In this part, first topography map was digitized in the 1:50000 scale and information layers such as hypsometric, aspect were prepared in ILWIS software. The geological map of the region was prepared and digitazed from Iran's geology organization and also geological information layers were prepared. The average annual rain, the average annual temperature was prepared by using of raster topography map and gradient existing in weather reports and climatology of the study area. Information layer of the soil texture, the deep of the soil, soil pH were prepared by digitizing maps related to soil studies of the region. Figure1 briefly shows the steps of the study.

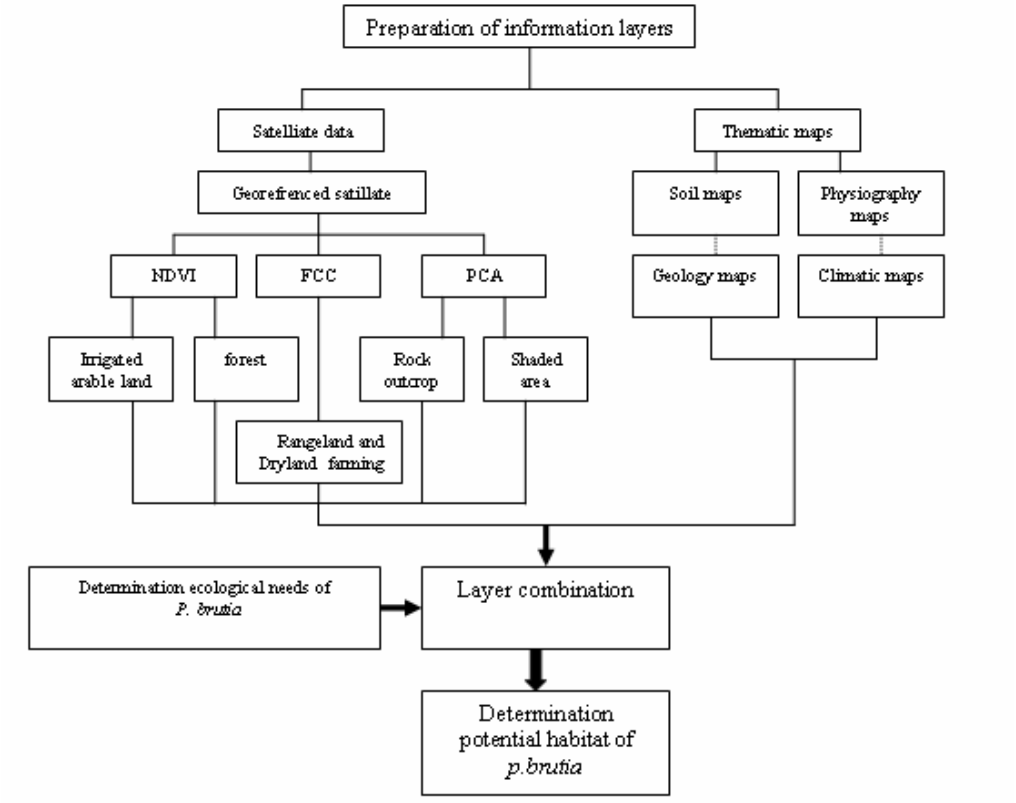


Figure1: Methodology of the study

1-2- Preparation of information layers from satellite data: in this study the Thematic Map per data (TM) of Land sat satellite of year 1998 were used. These data were geometrically corrected using topographic map of 1:50000 with Root Mean Square (RMS) 11.5 meters. After geometric correction of data in order to recognize different land covers as the satellite images, false color composite (FCC) were prepared on which, land cover such as rock outcrop, forest area, shaded area, irrigated land farms, rangeland and dry land farms become clearly separated. By principle component analysis (PCA), it was found out that on PCA3, rock outcrops and on PCA1, shaded area are well recognizable. Therefore separated training sites were chosen over them and by using maximum likelihood classifier method, the information layer of rock outcrop and shaded area were prepared. To separate irrigated land farms and forest cover the normalized vegetation index (NDVI) was used. Since the satellite data of month September was used, rangelands and dry land farms had the same reflection. Therefore, by using FCC image and maximum likelihood classifier method, information layers of rangelands and dry land farms were prepared. Table 1 shows the area of various land covers in the study area. Figure 2 shows the information layers obtained from satellite data.

| Land cover | Area (hec) |
|---|---|
| Forest | 16667.46 |
| Shaded area | 72.1 |
| Irrigated land | 147.5 |
| Rock outcrop | 2314.38 |
| Rangeland & Dry land farming | 10909.29 |

Table 1: Area of various land cover in Armand watershed

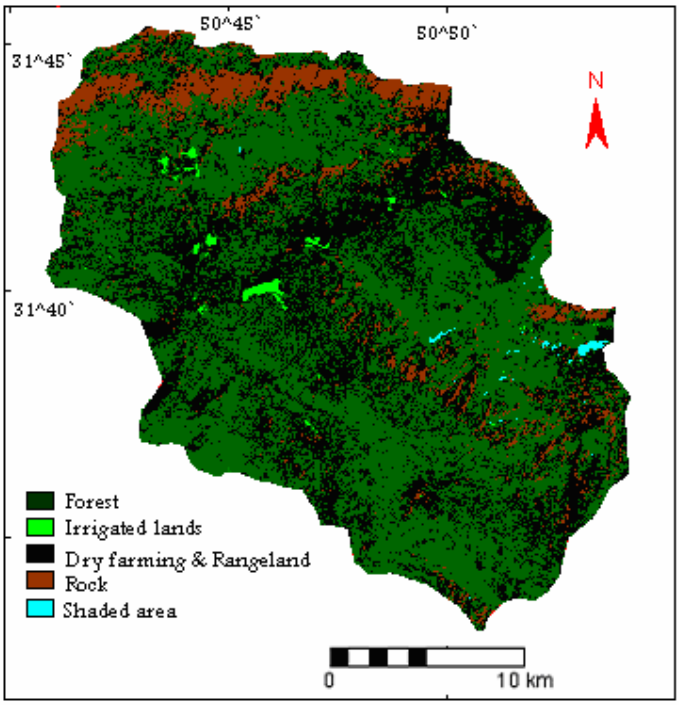


Fig 2: land use map of the study area

**2- Determination of ecological needs of *p.brutia*:**

*P.brutia* is a member of pinacea family and is one of the important Mediterranean species. The height of this species reaches up to 20 to 25 meters and its diameter to 60 centimeters and is distributed from sea level to the height of 1500 meters in the northern and eastern slops. It is a resistible to coldness and dryness and grows in region with 300 to 1000 mm 0f annual precipitation and average annual temperature of 10-20 C^ and minimum temperature of -14 C^. *P.brutia* grows soils that vary widely. But it best grows in sand soil and deep and semi-deep, lime soils with a pH of 6 to 7.5. This Pine is a fast-growing species and grows rapidly during its young.

**3- To combine layers**

After preparing different environmental information layers and determining ecological needs of *pinus brutia*, they started to do combination of these layers based

on degree of the growth and placement of these species. So first, each one of environmental layers were classified in the form of Boolean file based on ecological needs of the *pinus brutia*, then all of the prepared information layers were combined together and finally, suitable region were determined to grow that species.

**Results and Discussion**

In this research, information layers of the rock outcrop due to lack of soil and shaded area for being unclear the kind of its land cover and also information layers of agricultural irrigated lands due to economic-social problems were considered as unsuitable region. Region with salty formations in the study area were separated by using of geological map and were considered as unsuitable region. Information layers of forest, rangelands, and also dry land farming were combined with that after preparing the potential habitat map of *pinus brutia* and it was determined that from total part of map, how much are as forest area and how much are as rangelands and dry farming. After combining the layers together, it was determined that about 3309 hectare of the region are as potential habitat of the *pinus brutia* which from this amount, about 1667 hectares as forest area and 1642 hectares are rangeland and dry farming.

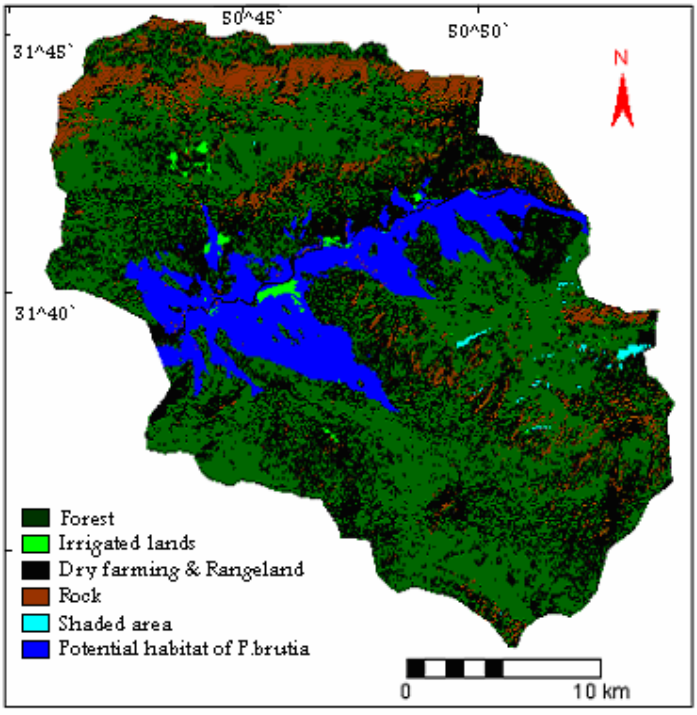


Fig3: Potential habitat map of *p.brutia*

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