# Geographic study of mountain area



## CHAPTER – II

### STUDY AREA PROFILE

#### 2. 0General:

The study area (13858. 83 ha) is a mountain range between River Pravara and River Mula Basin. The range started from western boarder at Ghatghar village and end eastern border at village Washere in the Akole tahsil, district Ahmendagar of Maharashtra state. The extent of study area is 19° 35′ 06. 86″ to 19° 30′ 13. 08″ N latitude and 73° 37′ 00. 03″ to 74° 04′ 24. 65″ E longitude. It covers parts of the Survey of India topographic sheet numbers 47 E/ 10, 11, 14, 15 and 47 I/ 2, 3. The depth and water-holding capacity of the soils are varied even if there is slightly change in slopes which is the one of the reason in the variation of forest land. The slope of the area is decreasing from NW to SE respectively and the height varies from 560 m to 1646 meters above mean sea level.

Study area is distributed in the Sahyadri mountains (Western ghat) region of the Maharashtra state. Geologically this area formed from basaltic lava. Basalt rock prevent percolation of rainy, reservoir water in to underground zone. Due to rock type the soil cover is very shallow at the top of the mountain and increasing its deepness at foothill zones near water reservoirs. Basic Intrusive (Dykes) mainly found nearby this area. This are the approximate reasons of the shallow soil cover. Very shallow loamy, shallow clayey soil found on the moderate (1°- 3°) and stiff (3°- 6°) slope. Soil moisture impact on the amount of the vegetation cover with respect to soil type and slope. Therefore, North West and South zone have maximum

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vegetation cover compare to other land of the study area. It receives annual rainfall about 440. 4 mm. The mean annual maximum and minimum temperatures are 39. 80 C and 8. 70 C respectively. Local tribal people engages with the agricultural activities at reclaimed land from forest area. Forestry is the second occupation after agriculture.

### 2.1 Geology:

Study area is a part of Sahyadri Mountain Range (Western Ghat). Also called as Deccan Trap formed by basaltic rocks; amygdaloidal basalts form the bedrock.

This area has shallow soil like loam, clayey; again divided in to sub types based on depth and slope classes. Overlying weathered and fractured rocks, resting on hard massive basalt. The basalts are nearly horizontal, separated by thin layers of ancient soil and volcanic ash (red bole). The basalt flows are nearly flat-lying (the sequence has a regional southerly dip of 0. 5-1°) and mainly belong to the Thakurvadi Formation (Fm) of the Kalsubai Subgroup (Khadri *et al*. 1988; Subbarao and Hooper 1988).

The lithology of the area indicating that around 77. 17 % area covered by 12-14 compound pahoehoe flows and some Aa flows (max 206m). Around 4. 53 % by 2 compound pahoehoe flows (40-50m) and Megacryst compound pahoehoe basaltic flow M3 (50-60m) up to 3. 26 %. Remaing 0. 89% covered by 5 Aa and 1 compound pahoehoe basaltic lava flows (Max. 160m); 4-5 compound pahoehoe basaltic lava flows (Max. 150m), Basik Sill/Lava channels respectively. The regional stratigraphy of the Deccan basalts has been described by Beane et al. (1989), Khadri et al (1988), and Subbarao https://assignbuster.com/geographic-study-of-mountain-area/

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and Hooper (1988). Structural indices indicate the part of basic intrusive (dykes) in the part of noer-west and south-east. One fault line cross at the middle part of the study area.

## 2. 2Relief:

Study situated at the middle of the tehsil Akole. It has horizontal shape and act like a natural water divider. Relief turn and fix the surface geographical landforms. The altitude of this area is varies from less than 640 meter (minimum) to 1646 meter (maximum). The formation of soil, natural vegetation cover and soil moisture conditions are totally controlled by the status of the relief. Contour lines demarcate the height of the study area above mean sea level. The Kalasubai (1646m) highest peak of the Maharashtra state located in the Akole tehsil. In the tehsil second highest peak Harishchandragarh (1422m) located in the south-west part of the study area. Relief decreasing toward to the Washere village of this mountain range. Drainage network flow depends on relief is explained in next point.

# 2. 3 Slope:

Slope of the study area calculated in degree (0° to 90°) on the basis of contours. This slope of the area divided in to 7 classes. Gentle slope has up to 1° slope where water reserve and collected in dam. Soil depth, cover and types also depends on the nature of slope. Hill top and cliff sides has precipitous to very steep slope (12° to 90°).

At foothill slope moderate to steep (1° to 12°) zone has maximum forest cover in north-west and south-west direction. Eroded material on the top hill concentrating on the foothill slopes and favourable for soil formation. That is why the in this area soil moisture, soil depth and vegetation cover found more than other zone. Soil types and different characteristics has been elaborated in the next point.

## 2. 4 Drainage:

Network of drainage is developing continually and it's responsible for the different landform creation. Relief controlled the drainage flow and streams erode land surface in to different geographical landform features. Relief and streams has strong correlation. Study area has an origin point of the main river Pravara. River flows from north-west to north-east direction. This river has main and minor dam. Bhandardara is main dam situated on river Pravara, which is an important land-cover feature in study area. At the time of robust forest change analysis this water body play an important role.

Soil moisture depend on drainage network and water reservoirs after rainy season.

It made difference in the type of vegetation cover from dense forest to open scrub land.

Drainage pattern related to slope and slope related to forest growth has been explained in detailed in the next point.

## 2. 5 Soil:

The growth and reproduction of forest cannot be understood without the knowledge of soil. The soil and vegetation have a complex interrelation

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because they develop together over a long period of time. The vegetation influences the chemical properties of soil to a great extent. The selective absorption of nutrient elements by different tree species and their capacity to return them to the soil brings about changes in soil properties (Singh et al. 1986). Soil element is one of the most important biophysical matter. Concentration of elements in the soils is a good indicator of their availability to plants. Their presence in soil would give good information towards the knowledge of nutrient cycling and bio-chemical cycle in the soil-plant ecosystem (Pandit and Thampan 1988). Generation of soil is depend on geology, topography, time span, climatic conditions, organic and inorganic factors, etc. Forests in general have a greater influence on soil conditions than most other plant ecosystem types, due to a well-developed " O" horizon, moderating temperature, and humidity at the soil surface, input of litter with high lignin content, high total net primary production, and high water and nutrient demand (Binkley and Giardina 1998).

Study area is a hilly zone, soil is very shallow at the top-hills while excessively drained loamy soil (a rich soil consisting of a mixture of sand and clay and decaying organic materials) found at steep slopes north-west direction. Shallow well drained clayey soil and slightly deep excessively drained loamy soil found over moderate to gentle slope respectively. Clay soils, are made up of very fine, microscopic particles. These tiny particles fit together tightly, resulting in tiny pore spaces between them. The tiny pore spaces allow water to move through them, but at a much slower pace than in sandy soils. Clay soils drain quite slowly and hold more water than sandy soils. Loams soil capacity of maximum water holding (MWHC) approximately 0. 18 inches of water per inch of soil depth, and clays hold up to 0. 17 inches of water per inch of soil depth. However, soil types, soil elements, soil depth depends on the geology of the study area, explained in next point.

2. 6Population and economic activities:

Humans being living surrounding this area most are the tribal population. Primary economical activities including shifting cultivation, fishery,

2. 7Spectral properties of plants in the forest: (1 st ch)

Interaction of radiation with plant leaves is extremely complex. General features of this interaction have been studied but many spectral features are yet unexplained. Gates et al., (1965) are considered pioneers, who have studied spectral characteristics of leaf reflection, transmission and absorption. Optical properties of plants have been further studied to understand the mechanisms involved by Gausman and Allen (1973), Wooley (1971) and Allen et al., (1970).

It is the synthesis of the parameters like reflection of plant parts, reflection of plant canopies, nature and state of plant canopies and Structure and texture of plant canopies, which will be required to fully understand the remote sensing data collected from space borne and aerial platforms. They have been attempted for crop canopies through the development of models but not yet fully achieved. It will be initially required to discuss the electromagnetic spectrum and its interaction with vegetation canopies. Subsequent factors affecting the spectral reflectance of plant canopies with its possible applications in remote sensing technology would be discussed. The vegetation reflectance is influenced by the reflectance characteristics of individual plant organs, canopy organization and type, growth stage of plants, structure and texture of the canopies. The synthesis of the above four aspects provides true reflectance characteristic. However, various authors without fully achieving models to determine vegetation reflectance characteristics have studied effect of individual parameters.

2. 6. 1Nature of the Plant:

Numerous measurements have been performed to evaluate the spectral response of various categories of plants with a spectrophotometer (Fig. \*\*\*).

For a plant in its normal state i. e., typical and healthy the spectral reflectance is specific of the group, the species and even of the variety at a given stage in its phenological evolution. The general aspects of spectral reflectance of healthy plant in the range from 0. 4 to 2. 6 µm is shown in figure \*\*\*\*.

The very abrupt increase in reflectance near 0. 7  $\mu$ m and the fairly abrupt decrease near 1. 5  $\mu$ m are present for all mature, healthy green leaves. Very high; further in the far infrared > 3. 0  $\mu$ m. Thus, the typical spectral curve of plant is divided into three prominent zones correlated with morphological characteristics of the leaves (Gates, 1971).

2. 6. 2ï€Pigment Absorption Zone:

The important pigments, *viz*. chlorophyll, xanthophylls and carotenoids absorb energy strongly in ultraviolet blue and red regions of the EMR. The

reflectance and transmittance are weak. The absorbed energy of this part of this spectrum is utilized for the photosynthetic activity (Allen et al. 1970).

2. 6. 3Multidioptric Reflectance Zone:

In this zone, the reflectance is high, while the absorbptance remains weak. All the unabsorbed energy (30 to 70% according to the type of plant) is transmitted. They reflectance is essentially due to the internal structure of the leaf and the radiation is able to penetrate. The reflectance from internal structure is of physical more than chemical nature. Apart front the contribution of the waxy cuticle, the magnitude of the reflectance depends primarily upon the amount of spongy mesophyll.

2. 6. 4ï€Hydric Zone:

Amount of water inside the leaf affect the pattern of spectral reflectance with water specific absorption bands at 1. 45  $\mu$ m, 1. 95  $\mu$ m and 2. 6  $\mu$ m. Liquid water in a leaf causes strong absorption throughout middle infrared region. Beyond 2. 5  $\mu$ m the reflectance becomes less than 5% due to atmospheric absorption and beyond 3  $\mu$ m the vegetation starts acting as quasi blackbody (Gates *et al.*, 1965).

There are numerous factors either internal of the plant or external coming from the environmental conditions have an influence on the specific spectral reflectance. The above descriptions are true only for a normal, mature and healthy vegetation. The factors which affect the spectral reflectance of leaves are leaf structure, maturity, pigmentation, sun exposition, phyllotaxis, pubescene, turgidity (water content) nutritional status and, disease etc. Important factors are pigmentation, nutritional status, anatomy of leaves and water content. While, sun exposition and phyllotaxy affects the canopy reflectance, phenological state and disease are linked to the primary factors affecting the spectral reflectance (Wooley, 1971).

2. 7Spectral vegetation indices:

Radiant energy intercepted by a vegetative canopy is primarily scattered by leaves either away from the leaf surface or to the leaf interior. The scattered radiation is reflected, transmitted or absorbed by leaves. The partitioning of radiation a reflected, transmitted or absorbed energy depends on a number of factor including leaf cellular structures (Gates et al. 1965; Kfipling, 1970; Woolley, 1971), leaf pubescence and roughness (Gausman, 1977), leaf morphology and physiology (Gausman et al., 1969 a, b; Gausman and Allen, 1973; Gausman et al., 1971) and leaf surface characteristics (Breece and Hommes, 1971; Grant, 1985).

Leaves are not perfectly diffuse reflectors but have diffuse and specular characteristics. Leaf transmittance tends to have a non Lambertian distribution, while leaf reflectance is dependent on illumination and view angles. Knowledge of soils radiation interaction with individual leaves is necessary for several reasons like special to interpret and process remotely sensed data. Typical reflectance and transmittance spectrum of a individual plant leaf indicate three distinct wavelength regions in interaction: visible (0. 4-0. 7  $\mu$ m), near infrared (NIR) (0. 7-1. 35  $\mu$ m) and mid infrared (mid IR) (1. 35-2. 7  $\mu$ m). Thus the typical spectral curve of plant is divided into three prominent zones correlated with morphological/anatomical/physiological characteristics of the leaves and these are Pigment Absorption Zone, Multi-Dioptric Reflectance Zone and Hydric Zone, etc.

The analysis of all remotely sensed data involves models of many processes wherein the EM radiation is transformed (the scene, atmosphere and sensor) and whereby inference is made about the scene from the image data. The most common strategy for relating remote sensing data to vegetation canopies has been via the correlation of vegetation indices with vegetation structure and functional variables. This simple empirical approach has yielded substantial understanding of the structure and dynamics of vegetation at all scales. These indices are capable of handling variation introduced in a scene due to atmosphere or sensor and vegetation background influence in low vegetation cover areas.

The capacity to assess and monitor the structure of terrestrial vegetation using spectral properties recorded by remote sensing is important because structure can be related to functioning, that is to ecosystem processes that are ultimately aggregated up to the functioning of the local-regional-global level of ecosystem. The categorization of the various spectral indices in to approximately five types. Such as Ratio Indices, Vegetation Indices, Orthogonal based Indices, Perpendicular Vegetation Indices and Tasseled Cap Transformation, etc.

Remote sensing of cropland, forest and grassland involves the measurement of reflected energy of component in the presence of each other. The development and usefulness of vegetation indices are dependent upon the degree to which the spectral contribution of non-vegetation component can

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be isolated from the measured canopy response. Although vegetation indices have been widely recognized a valuable tools in the measurement and interpretation of ' vegetation condition' several limitation have also been identified. They are related to soil brightness effect and secondary soil spectral deviations. The use of site specific soil lines reduces soil background influence. In this context SAVI, GRABS and PVI holds greater promise in low vegetated areas.

The vegetation indices are simplified method to extract information about vegetation parameter from multispectral data however, their use in spectral modeling needs to be studied in context of spectral dynamics of earth surface components.

## 2. 8Resume`:

Forest cover is an important natural resource for the environment and socioeco on the surface of the earth. It can bridge the gap between nature and human beings conflicts. Changes in the forest land increase the imbalance in the ecosystem, climatic conditions, temperature, land degradation, drought prone zones, soil erosion, depending manmade activities, etc. The living tribes in the mountain hill as well as foot hill area utilized forest material for their domestic usages. Therefore, the objectives of detection and delineation of the forest land by using ordinary classification methods have been outlined in the present study. The methodology has been outlined in this chapter. The Landsat-5 TM and Landsat-7 ETM+ dataset has been suggested as a source of information to achieve the objectives of the study. The basic knowledge regarding spectral properties of the forest and physiographic elements as well as spectral vegetation indices area has been proposed for the second chapter to make information base study for image analysis, classification and interpretation in the next chapters.

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