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**DEPARTMENT OF AGRICULTURAL ENGINEERING**

# AI3701 – REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYATEM

## UNIT 2 DATA PRODUCTS AND IMAGE ANALYSIS

## 2.2 ELEMENTS OF IMAGE INTERPRETATION

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## 2.2 Basic elements of image interpretation

A systematic study .of aerial photographs and satellite imageries usually involves several characteristics of features shown on an image. The following characteristics (elements) are called fundamental picture elements. These elements aid visual interpretation process of aerial photos and/or satellite imagery.

### (i) Tone

Ground objects of different colour reflect the incident radiation differently depending upon the incident wave length, physical and chemical constituents of the objects. The imagery as recorded in remote sensing is in different shades or tones. For example, ploughed and cultivated lands record differently from fallow fields. Tone is expressed qualitatively as light, medium and dark. In SLAR imagery, for example, the shadows cast by non-return of the microwaves appear darker than those parts where greater reflection takes place. These parts appear of lighter tone. Similarly in thermal imagery objects at higher temperature are recorded of lighter tone compared to objects at lower temperature, which appear of medium to darker tone. Similarly top soil appears as of dark tone compared to soil containing quartz sand. The coniferous trees appear in lighter tone compared to broad leave tree clumps.

Tone, therefore, refers to the colour or reflective brightness. Tone along with texture and shadow (as described below) help in Interpretation and hence is a very important key. Differences in moisture content of the soil or rock result in differences in tone. In a black and white photograph dark tone indicates dark bodies, namely, greater moisture contents and grey or white tone reflect the dry soil.

The aerial photos with good contrast bring out tonal differences and hence help in better interpretation. Tonal contrast can be enhanced by use of high contrast film, high contrast paper or by specialized image processing techniques such as 'Dodging' or 'Digital Enhancement'. Sometimes Infrared film can give better contrast but it can also reduce resolution and loss of detail in shadows.

### (ii) Texture

Texture is an expression of roughness or smoothness as exhibited by the imagery. It is the rate of change of tonal values. Mathematically it is given as dD/dx where D is the Density and 'x' the distance measured from one arbitrary starting point, and can be measured numerically by the use of microdensitometer. Changes of density 'D' from point 'A' of the imagery to point 'B'

as measured by the micro-densitometer divided by the distance gives the texture values numerically. Texture is dependent upon

(a) photographic tone

(b) shape,

(c) size,

(d) pattern and scale of the imagery.

Any slight variation of these can change the texture. Texture can qualitatively be expressed as course, medium and fine. The texture is a combination of several image characteristics such as tone, shadow, size, shape and pattern etc., and is produced by a mixture of features too small to be seen individually because the texture by definition is the frequency of tonal changes. As an example, leaves of a tree are too small to be seen on an aerial photo collectively along with shadow they give what is called texture, which in turn helps to differentiate between shrubs and trees. Texture sometimes can be very important factor in determining the slope stability. In the case of a humid ground, the blockage of water or bad drainage a characteristic texture results. Even spring and seepage of water from the base of clay give a kind of 'turbulant' texture So is the case with mud flows. The term texture is also, sometimes, used to denote drainage density and the degree of dissection of land surface.

**(iii) Association**

The relation of a particular feature to its surroundings is an important key to interpretation. Sometimes a single feature by itself may not be distinctive enough to permit its identification. For example, Sink holes appears as dark spots on an imagery where the surface or immediate subsurface soil consists of lime stones, Thus the appearance of sink holes is always associated with surface lime stone formation. An example is that of kettle holes which appear as depressions on photos due to terminal moraine and glacial terrain. An another example is that of dark-toned features associated with a flood plain of a river, which can be interpreted as Infilled oxbow lakes.

**(iv) Shape**

Some ground features have typical shapes due to the structure or topography. For example air fields and football stadium easily can be interpreted because of their finite ground shapes and geometry whereas volcanic covers, sand, river terraces, cliffs, gullies can be identified because of their characteristics shape controlled by geology and topography.

**(v) Size**

The size of an image also helps for its identification whether it is relative or absolute. Sometimes the measurements of height (as by using parallax bar) also gives clues to the nature of the object. For example, measurement of height of different clumps of trees gives an idea of

the different species, similarly the measurement of dip and strike of rock formation help in identifying sedimentary formation. Similarly the measurements of width of roads help in discriminating roads of different categories I e. national, state, local etc. Size of course, is dependent upon the scale of imagery.

**(vi) Shadows**

Shadows cast by objects are sometimes important clues to their identification and Interpretation. For example, shadow of a suspension bridge can easily be discriminated from that of cantilever bridge. Similarly circular shadows are indicative of coniferous trees. Tall buildings and chimneys, and towers etc., can easily be identified for their characteristic shadows. Shadows on the other hand can sometimes render interpretation difficult i.e. dark slope shadows covering important detail.

**(vii) Site factor or Topographic Location**

Relative elevation or specific location of objects can be helpful to identify certain features. For example, sudden appearance or disappearance of vegetation is a good clue to the underlying soil type or drainage conditions.

**(viii) Pattern**

Pattern is the orderly spatial arrangement of geological topographic or vegetation features. This spatial arrangement may be two-dimensional (plan view) or 3-dimensional (space). Geological pattern may be linear or curved. Linear pattern are formed of a very large number of continuous or discontinuous short ticks which when viewed by eye appear to be continuous lines. Examples of linear geological pattern are faults, fractures, joints, dykes, bedding planes, anticlines etc.,

Examples of curved features are plunging anticlines and folds. Lineaments or lineations may be short, medium or long running for several hundred kilometers. These are very important expressions of the lithologic characters of the underlying rocks and the attitude of the rock bodies, spacing of planes of bedding and other structural weaknesses and the control extended by them over the surface features. Vegetation pattern may be of the 'Block' type or 'Alignment' type.

The 'Alignment' type may be further subdivided into the Linear, Parallel and curved type. Alignments are due to narrow rockbands or faults. Since faults retain moisture, vegetation is aligned along the fault lines. Example of topographic pattern is the typical drainage patterns (controlled and uncontrolled type). The uncontrolled types are those, which are purely governed by topography, i.e., the slops whereas the controlled type are those, which are governed by the underlying geological formations.

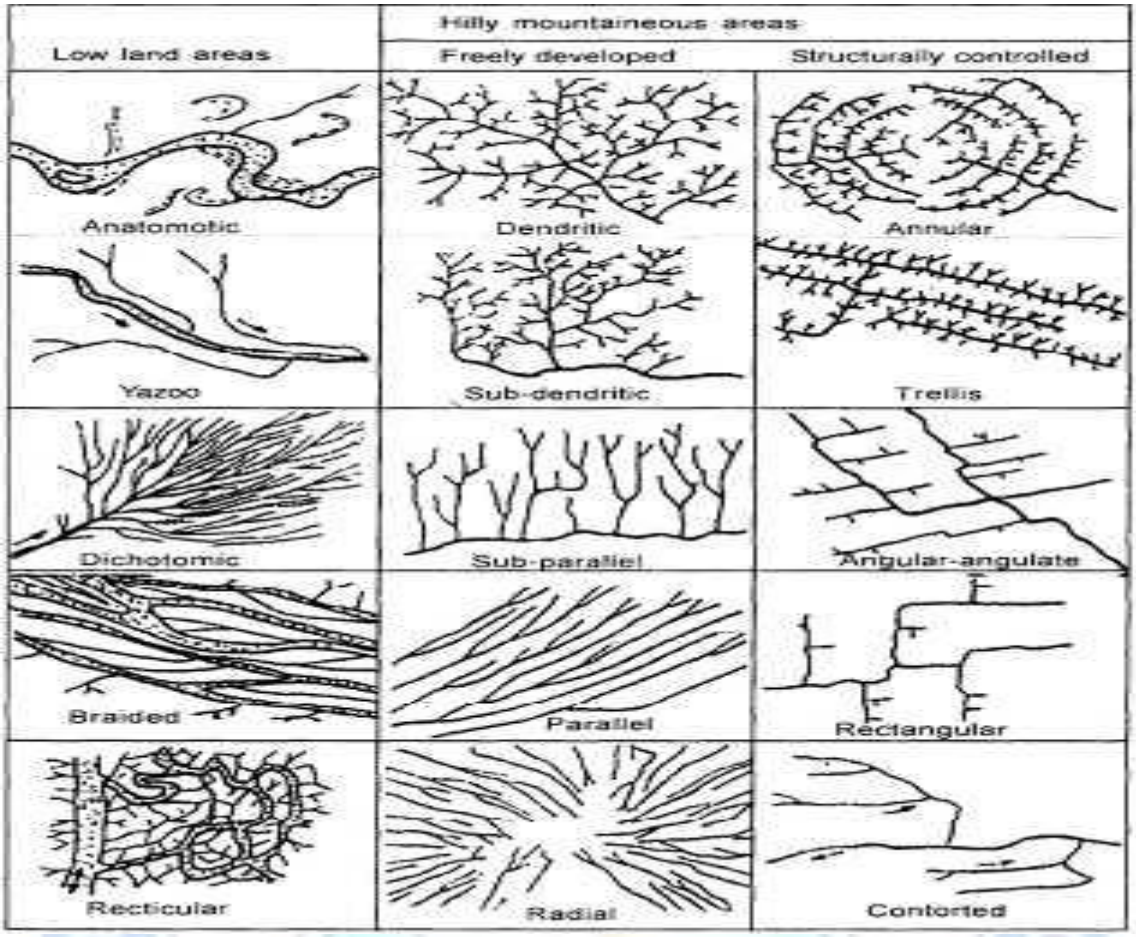


**Figure Main drainage patterns**

The well-known drainage patterns are:

(i) Dendritic

(ii) Trellis

(iii)Annular

(iv)Radial

(v) Rectangular

(vi) Parallel Type

(vii) Braided

(viii) Anastomotic

(xi) Asymmetrical

(x) Collinear

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