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SURVEY OF NATURAL RESOURCES BY REMOTE SENSING TECHNIQUE

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ABSTRACT

Aerial Remote Sensing Photography has been defined as the science of taking a photograph from a point from the satellite for the purpose of making some type of the study of the surface of the earth. In the field of Physical & Geological features, the use of remote sensing aerial photographs has been proved to be of immense help. This paper reveals that remote sensing by Radar is a type of active sensor which depends upon man made source of electromagnetic radiation. A beam of radiation is directed towards the object. The Radar imagery is obtained by collecting and measuring the reflection of pulses sent out from air-craft or satellite. The cost determination will depend on the number of aerial photographs required to cover the area. This estimation is rather simple but one should understand clearly an aerial coverage of different scales.

Key Words: -1. Reconnaissance 2.Aerial Remote Sensing Photography 3.Mineral 4. Airborne 5. Microwave 6.Electromagnetic radiation.

Sub-Area: Remote Sensing Technology
Broad–Area: Applied Geology Engineering.

Introduction:

Remote sensing is broadly defined as science and art of collecting information about objects, area or phenomena from distance without being in physical contact them. Remote sensing data basically consists of wave length intensity information by collecting the electro magnetic radiation leaving the object as specific wavelength and measuring its intensity with the help of color combination. Photo interpretation can at best be considered as the positive form of Remote Sensing. In the muddy area this technique is so useful and importance of this technique is very large in the field of survey like- Mineral Deposit.

Remote Sensing became possible with the invention of camera in the nineteenth century. Astronomy was on of the first fields of science to explore this technique. Although it was during the first world War that free flying aircrafts were used in a remote sensing role, but the use of remote sensing for environmental assessment & survey specially for, minerals really became establish after the 2^{nd} world war. It not only proved the value of aerial photography in land reconnaissance and mapping, but had also driven technological advances in air borne camera design, film characteristics and photogrammetric analysis. From about 1960, Remote sensing underwent a major development when it extended to space and sensors began to be placed in space. From 1970's started the new era of remote sensing.

A single 9 inches by 9inches aerial remote sensing photo will cover areas as follows:

A) 1 : 20,000 (or 3 inches = 1mile approx.) will cover about 9 Square Miles.

B) 1 : 30,000 (or 2 inches = 1mile approx.) will cover about 20 Square Miles.

C) 1 : 60,000 (or 1 inch = 1mile approx.) will cover about 81 Square Miles

Photographs from a variety of NASA programs provide project-specific coverage over the United States, Grand Bahama, Jamaica, and Central America at base scales ranging from 1:16,000 scale to 1:450,000 scale. Film types, scales, acquisition schedules, flight altitudes, and end products differ, according to project requirements.

Idealized Remote Sensing system:-

An idealized remote sensing system consists of the following stages:-

1. Energy source
2. Propagation of energy through atmosphere
3. Energy interaction with earth's surface features
4. Airborne/ space borne sensors receiving the reflected and emitted energy
5. Transmission of Data to earth station and generation of data produce
6. Multiple-data, users.

Basic principles of Remote Sensing

Remote sensing employs electromagnetic energy and to a great extent relies on the interaction of electromagnetic energy wit the matter (object). It refers to the sensing of EM (Electromagnetic radiation, which is reflected, scattered or emitted from the object.

Until space imagery,aerial photos were the principal means by which maps are made of features and spatial relationships on the surface. Cartography, the technology of mapping, depends largely on aerial/satellite photos/images to produce maps in two dimensions or three (see next Section). Aerial photos are obtained using mapping cameras that are usually mounted in the nose or underbelly of an aircraft that then flies in discrete patterns or swathes across the area to be surveyed. These two figures show a camera and a cutaway indicating its operation: These elements can be ranked in relative importance:

Among the most obvious features in a photograph are tones and tonal variations (as grays or colors) and patterns made by these. These, in turn, depend on the physical nature and distribution of the **elements** that make up a picture. These "basic elements" can aid in identifying objects on aerial photographs.

Tone (closely related to Hue or Color) -- Tone refers to the relative brightness or color of elements on a photograph. It is, perhaps, the most basic of the interpretive elements because without tonal differences none of the other elements could be discerned.

Size -- The size of objects must be considered in the context of the scale of a photograph. The scale will help you determine if an object is a stock pond or Lake Minnetonka.

Shape -- refers to the general outline of objects. Regular geometric shapes are usually indicators of human presence and use. Some objects can be identified almost solely on the basis of their shapes: for example - the Pentagon Building, (American) football fields, cloverleaf highway interchanges

Texture -- The impression of "smoothness" or "roughness" of image features is caused by the frequency of change of tone in photographs. It is produced by a set of features too small to identify individually. Grass, cement, and water generally appear "smooth", while a forest canopy may appear "rough".

Pattern (spatial arrangement) -- The patterns formed by objects in a photo can be diagnostic. Consider the difference between (1) the random pattern formed by an unmanaged area of trees and (2) the evenly spaced rows formed by an orchard.
Shadow -- Shadows aid interpreters in determining the height of objects in aerial photographs. However, they also obscure objects lying within them.
Site -- refers to topographic or geographic location. This characteristic of photographs is especially important in identifying vegetation types and landforms. For example, large circular depressions in the ground are readily identified as sinkholes in central Florida, where the bedrock consists of limestone. This identification would make little sense, however, if the site were underlain by granite.
Association -- Some objects are always found in association with other objects. The context of an object can provide insight into what it is. For instance, a nuclear power plant is not (generally) going to be found in the midst of single-family housing.
These elements can be ranked in relative importance:

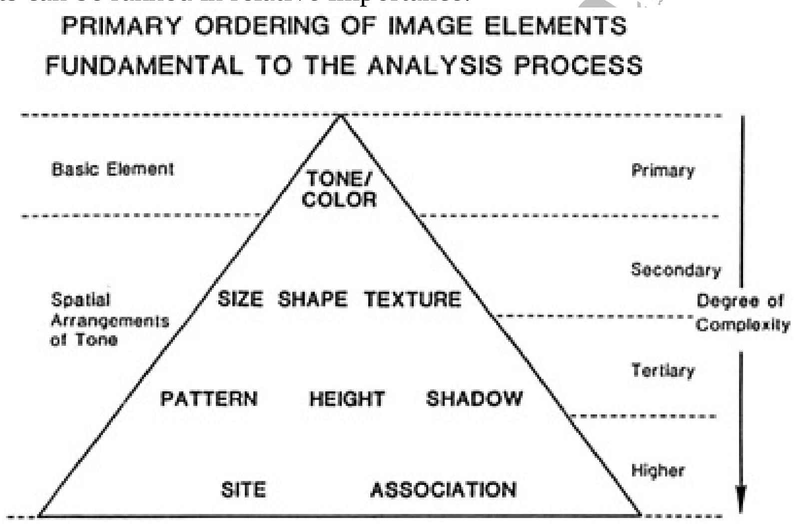

FIG-1

Since aerial photography is dependent on photographs, we need, at this juncture, some basic insight into how a photo is made.

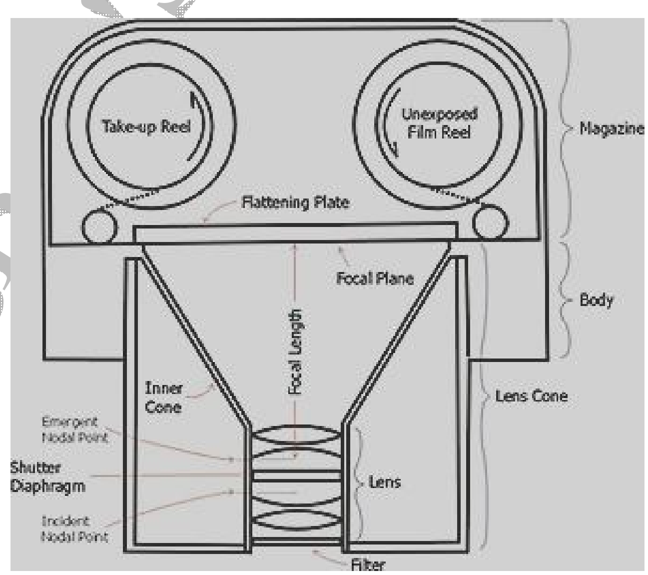

FIG-2

For most flight surveys, the camera film is advanced automatically and wound onto reel spindles at a rate which is tied to the aircraft's speed.
A variant of this camera system is the multispectral camera. This type uses separate lenses, each with its own narrow band color filter, that are opened simultaneously to expose a part of the film inside the camera. Here is one such camera developed for use in the Skylab space station program:

Earths atmosphere absorbs energy in Gamma ray, X-ray and most of the ultra-violet region. Therefore, these regions are not used for remote sensing. Remote sensing deals with energy invisible, infrared, thermal and microwave regions. These regions further sub divided into bands such as blue, green, red (invisible region) near infrared, mid-infrared, thermal and microwave etc. It is important to realize that significant amount of remote sensing performed within infrared wavelength is not related too heat. It is photographic infrared at a slightly longer wavelength (invisible to human eye) than red. Thermal infrared remote sensing is carried out at longer wave lengths.

Wave length regions and their applications in Remote Sensing
Following figures shows the EM spectrum which is divided in to discrete regions on the basis of wave length. Remote sensing mostly deals with energy in visible (blue, green, red) infrared regions.

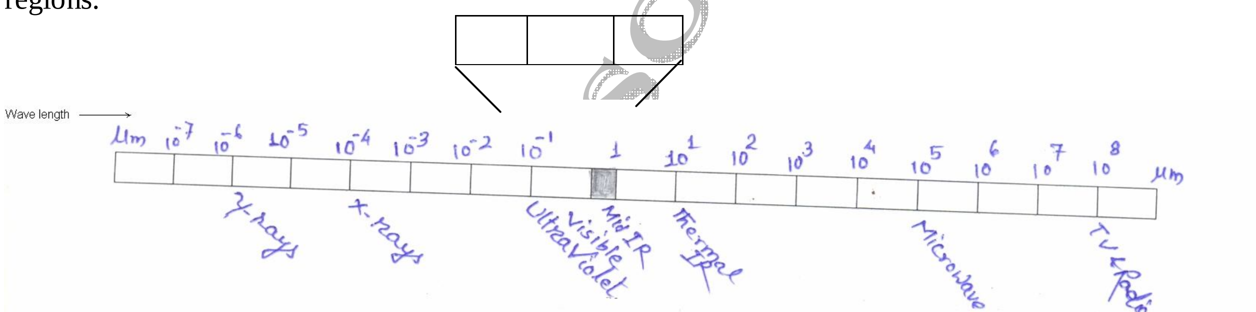

Fig.A

FIG-3

Fig-3 describes for the moment we shall define resolution in a photograph as the size of the smallest object whose tonal appearance is notably different from its surroundings or background; technically there is a more precise definition, given in terms as the minimum spacing between two dark lines embedded in a light background that can be visually separated.

In general, the wave lengths and frequencies vary from shorter wavelength high frequency cosmic wave to long wave length low frequency radio waves Fig .A & Table .1

Electromagnetic Spectral Regions-

Table No.1

Sno.	Region	Wavelength	Remarks
1	Gamma Ray	0.03mm	Incoming radiation is completely absorbed by the upper atmosphere and is not available for Remote Sensing
2	X-ray	0.03 to 3.0mm	Completely absorbed by atmosphere. Not employed in Remote sensing
3	Ultraviolet	0.3 to 0.4 µm	Incoming wavelengths less than 0.3µm are completely absorbed by ozone in the upper atmosphere
4	Photographic UV band	0.3 to 0.4 µm	Transmitted through atmosphere. Detectable with film and photo detectors, but atmospheric scattering is severe
5	Visible	0.4 to 0.7 µm	Images with film and photo detectors.
6	Infrared	0.7 to 1.00 µm	Interaction with matter varies with wave length atmosphere transmission windows are separated
7	Reflected IR band	0.7 to 3.0 µm	Reflected solar radiation that contains information about thermal properties of materials. The bands from 0.7 to 0.9 µm is detectable with film and is called the photographic IR band.
8	Thermal IR	3 to5 µm	Images at this wavelength are acquired by optical Mechanical scanners and special Vidicon systems but not by film. Microwave 0.1 to 30cm longer wave length can penetrate clouds, fog and rain. Images may be acquired in the active or passive mode.
9	Radio	>30cm	Largest wavelength this proportion of electromagnetic spectrum. Some classified radars with very long wavelength operate in this region.

Table-2 gives the wave length region along with the principal applications in Remote Sensing. Energy reflected from earth during daytime may be recorded as a function of wave length. The maximum amount of energy is reflected at 0.5µm, called the reflected energy peak. Earth also radiates energy both during day and night time with maximum energy radiated at 9.7 µm called radiant energy peak.

Wave length Region and their applications in Remote Sensing Table No.-2

S No.	Region	Wave length µm	Remarks
(a) Visible Region			
1	Blue	045-0.52	Coastal morphology and sedimentation study, soil and vegetation differentiation, coniferous and deciduous vegetation discrimination
2	Green	0.52-0.60	Vigor assessment, rock and soil discrimination, turbidity and bathymetry studies
3	Red	0.63-0.69	Plant species differentiation
(b) Infrared Region			
4	Near Infrared	0.76-0.90	Vegetation- vigour, Biomass, declination of water features, land forms/ geomorphic studies
5	Mid Infrared	1.55—1.75	Vegetation moisture content, soil/ moisture content snow and colored differentiation
6	Mid Infrared	2.08-2.35	Differentiation of geological materials and soils
7	Thermal IR	3.0-5.0	For hot forgets i.e. fires and volcanoes
8	Thermal IR	10.4-12.5	Thermal sensing, vegetation, discrimination, volcanic Studies

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