REMOTE SENSING

Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object, in contrast to in situ or on-site observation. The term is applied especially to acquiring information about the Earth and other planets. Remote sensing is used in numerous fields, including geography, land surveying, and most Earth science disciplines (for example, hydrology, ecology, meteorology, geology, oceanography, glaciology); it also has military, intelligence, commercial, economic, planning and humanitarian applications, among others.

In current usage, the term "remote sensing" generally refers to the use of satellite or aircraft based sensor technologies to select, detect and classify objects on Earth. It includes the surface and the atmosphere and oceans, based on propagated signals (e.g. electromagnetic radiation). It may be split into "active" remote sensing (when a signal is emitted by a satellite or aircraft to the object and its reflection detected by the sensor) and "passive" remote sensing (when the reflection of sunlight is detected by the sensor).

STAGES IN REMOTE SENSING :-

The basic processes that help in the collection of information about the properties of the objects and phenomena of the earth surface are as follows:

(a) Source of Energy (Sun / Self-emission);
(b) Transmission of energy from the source to the surface of the earth;
(c) Interaction of energy with the earth's surface.
(d) Propagation of reflected / emitted energy through atmosphere;
(e) Detection of the reflected / emitted energy by the sensor;
(f) Conversion of energy (reflected / emitted energy by the sensor) received into photographic / digital form of data;
(g) Extraction of the information contents from the data products; and
(h) Conversion of information into Map / Tabular forms.

a. SOURCE OF ENERGY: Sun is the most important source of energy used in remote sensing. The energy may also be artificially generated and used to collect information about the objects and phenomena such as flash guns or energy beams used in radar (radio detection and ranging). Artificial energy sources are also used in remote sensing. Whether the energy is radiated from an external (natural or artificial) source or emitted from the object itself, it is in form of EMR.

b. TRANSMISSION OF ENERGY FROM THE SOURCE TO THE SURFACE OF THE EARTH : The energy that emanates from a source propagates between the source and the object surface in the form of the waves of energy at a speed of light (3,00,000 Km pa second). Such energy propagation is called the Electromagnetic Radiation (EMR). The energy waves vary in size and frequency. The plotting of such variations is known as the Electromagnetic Spectrum. (figure given below). On the basis of the size of the waves and frequency, the energy waves are grouped into Gamma, X-rays, Ultraviolet rays. Visible rays, Infrared rays, Microwaves and Radio waves. Each one of these broad regions of spectrum is used in different applications. However, the visible, infrared and microwave regions of energy are used in remote sensing.

c. INTERACTION OF ENERGY WITH THE EARTH'S SURFACE : The propagating energy finally interacts with the objects of the surface of the earth. This leads to absorption, transmission, reflection or emission of energy from the objects. We all know that all the objects vary in their composition, appearance forms and other properties. Hence, the objects responses to the energy they receive are also not uniform. Besides, one particular object also responds differently to the energy it receives in different regions of the spectrum. For example, a fresh water

body absorbs more energy in the red and infrared regions of the spectrum and appears dark/black in a satellite image whereas turbid water body reflects more in blue and green regions of spectrum and appears in light tone.

d. PROPAGATION OF REFLECTED / EMITTED ENERGY THROUGH ATMOSPHERE: When energy is reflected from objects of the earth's surface, it re-enters into the atmosphere. You may be aware of the fact that atmosphere comprises of gases, water molecules and dust particles. The energy reflected from the objects comes in contact with the atmospheric constituents and the properties of the original energy get modified. Whereas the carbon dioxide (CO_2), the hydrogen (H), and the water molecules absorb energy in the middle infrared region, the dust particles scatter the blue energy. Hence, the energy that is either absorbed or scattered by the atmospheric constituents never reaches to sensor placed onboard a satellite and the properties of the objects carried by such energy waves are left unrecorded.

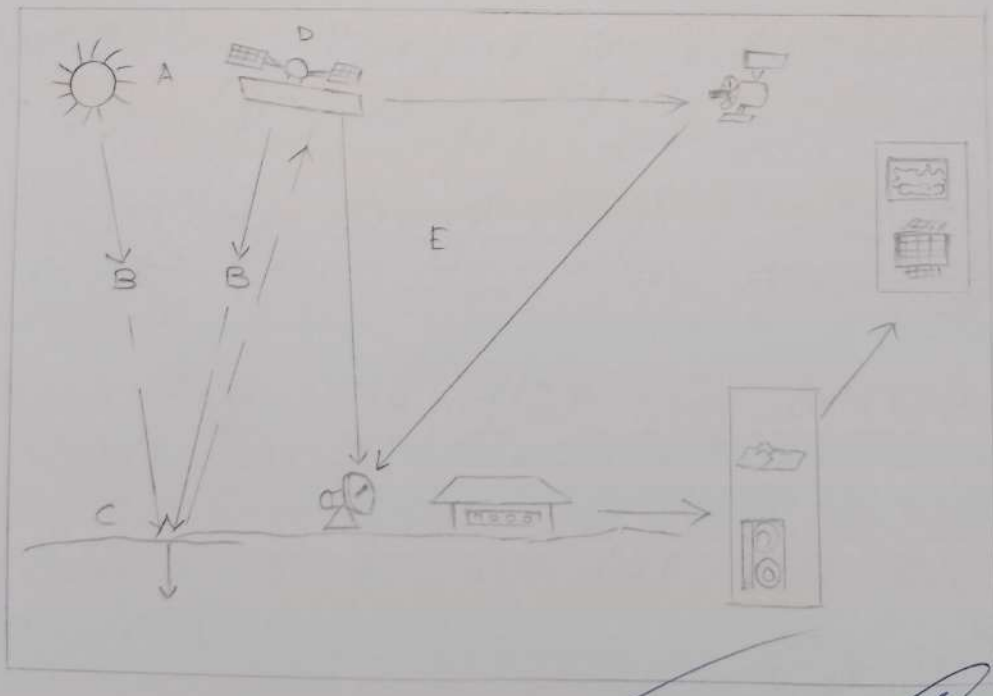
e. DETECTION OF REFLECTED / EMITTED ENERGY BY THE SENSOR: The sensors recording the energy that they receive are placed in a near-polar sun synchronous orbit at an altitude of 700-900 km. These satellites are known as remote sensing satellites (e.g. Indian Remote Sensing Series). As against these satellites,

the weather monitoring and telecommunication satellites are placed in a geo stationary position (the satellite is always positioned over its orbit that synchronises with the direction of the rotation of the earth) and revolves around the earth (coinciding with the direction of the movement of the earth over its axis) at an altitude of nearly 36,000 km (e.g. INSAT series of satellites). Remote sensing satellites are deployed with sensors which are capable of collecting the EMR reflected by the objects. However, the sensors used in remote sensing satellites possess a mechanism that is different from photographic camera in collecting and recording the information. The images so acquired by space-borne sensors are in digital forms / format as against the photographic format obtained through a camera-based system.

5. CONVERSION OF ENERGY RECEIVED INTO PHOTOGRAPHIC / DIGITAL FORM OF DATA: The radiations received by the sensor are electronically converted into a digital image. It comprises digital numbers that are arranged in rows and columns. These numbers may also be converted into an analogue (picture) form of data product. The sensor onboard an earth-orbiting satellite electronically transmits the collected image data to an Earth Receiving Station located in different parts of the world. In India, Shadnagar, near Hyderabad, is one such station.

g. EXTRACTION OF INFORMATION CONTENTS FROM DATA PRODUCTS: After the image data is received at the earth station, it is processed for elimination of errors caused during image data collection. Once the image is corrected, information extraction is carried out from digital images using digital image processing techniques and from analogue form of data products by applying visual interpretation methods.

h. CONVERSION OF INFORMATION INTO MAP/TABULAR FORMS: The interpreted information is finally delineated and converted into different layers of thematic maps. Besides, quantitative measures are also taken to generate a tabular data.



04/06/2022

IMPORTANCE OF REMOTE SENSING :-

1. Determining soil moisture content using active and passive sensors from space.

2. Comparing climatic factors from past to present.

3. Monitoring active volcanoes using thermal remote sensing.

4. Quantifying the damage after an earthquake.

5. Fighting wildfires by planning fire fighter dispatch.

6. Locating groundwater activity for wells.

7. Revealing illegal rainforest cutting in Brazil.

8. Detecting land cover / use types of land for decision making.

9. Observing the flow of ocean currents and circulation.

10. Keeping a watchful eye on biodiversity.

Anupam 01/06/2021

EMS

Electromagnetic Spectrum (EMS) represent the continuum of electromagnetic radiation (EMR), arranged on the basis of wavelengths or frequency. Electromagnetic spectrum ranges from shorter wavelengths (gamma rays to x rays) to the longer wavelengths (microwave and radio waves). Most common remote sensing systems operate in one or several of the visible, infrared and microwave portions of the electromagnetic spectrum. Within the infrared portion of the spectrum it should be noted that only thermal infrared energy is directly related to, the sensation of heat; not the near and mid infrared ones. Before discussing about EMS with reference to remote sensing it is important to understand it fully.

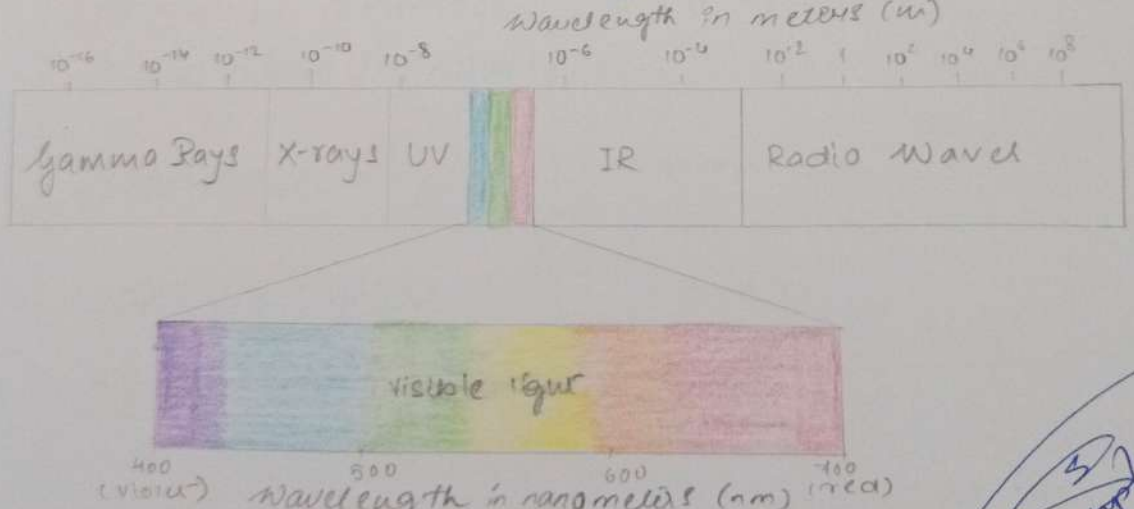


Fig :- Electromagnetic Spectrum

04/06/2021

TABLE 1 · ELECTROMAGNETIC SPECTRUM

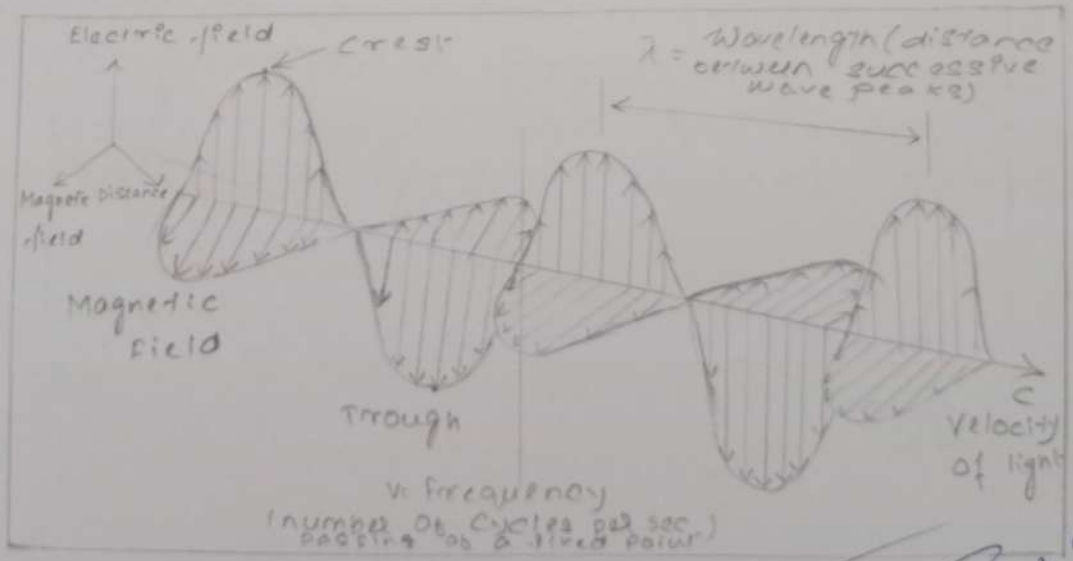
REGIONS	WAVE LENGTH
Gamma Rays (γ)	$< 10^{-10}$ μm
x Rays	0.001 – 0.03 μm
Ultra Violet Region	0.03 – 0.40 μm
Visible Region	0.40 – 0.70 μm
Near Infrared Region	0.70 – 1.3 μm
Short Wave Infrared	1.30 – 3.00 μm
Middle Infrared	3.00 – 8.00 μm
Thermal Infrared (Long Wave Infrared)	8.00 – 14.00 μm
Microwave Region	1mm – 1m
Radio Wave	> 1m

Gupta 21/06/20

EMR

The first requirement for remote sensing is to have an energy source to illuminate the target (unless the sensed energy is being emitted by the target). This energy is in the form of electro-magnetic radiation.

Electromagnetic radiation consists of an electrical field (E) which varies in magnitude in a direction perpendicular to the direction in which the radiation is travelling, and a magnetic field (M) oriented at right angles to the electrical field. Both these fields travel at the speed of light (c). Two characteristics of electro-magnetic radiation are particularly important for understanding remote sensing. These are the wavelength and frequency.



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The wavelength is the length of one wave cycle, which can be measured as the distance between successive wave crests. Wavelength is usually represented by the Greek letter lambda (λ). Wavelength is measured in metres (m) or some factor of metres such as nanometres (nm, 10^{-9} metres), micrometres (μm, 10^{-6} metres) (μm, 10^{-6} metres) or centimetres (cm, 10^{-2} metres). Frequency refers to the number of cycles of a wave passing a fixed point per unit of time. Frequency is normally measured in hertz (Hz), equivalent to one cycle per second and various multiples of hertz. Wavelength and frequency are related by the following formula:

$$c = \lambda \nu$$

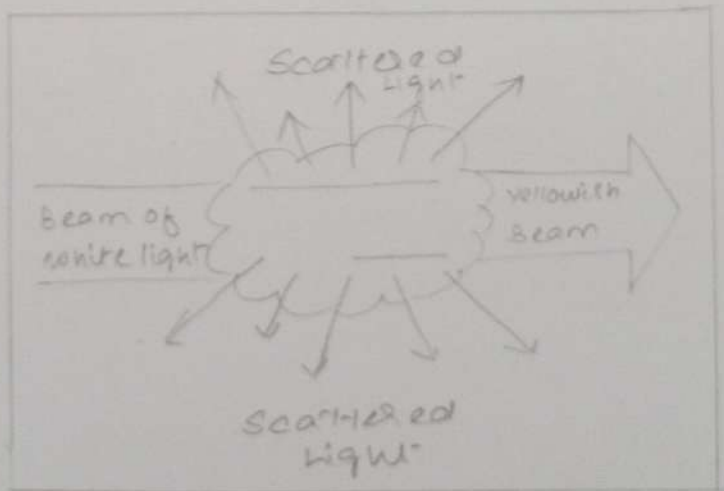
where, λ = wavelength (m), ν = frequency (cycles per second Hz), c = speed of light (3×10^8 m/s)

Therefore, the two are inversely related to each other. The shorter the wavelength, the higher the frequency. The longer the, lower frequency will be lower wavelength. Understanding the characteristics of electromagnetic radiation in terms of their wavelength and frequency is crucial to understand the information to be extracted from remote sensing data.

INTERACTION OF EMR WITH ATMOSPHERE :-

Once EMR is generated, first it is propagated through the vacuum almost at the speed of light in a vacuum and then through the earth's atmosphere. Unlike a vacuum in which nothing happens, however, the atmosphere may affect not only the speed of radiation but also its wavelength, its intensity and its spectral distribution. These effects are caused by the two main mechanisms, scattering and absorption. The EMR may also be diverted from its original path due to refraction.

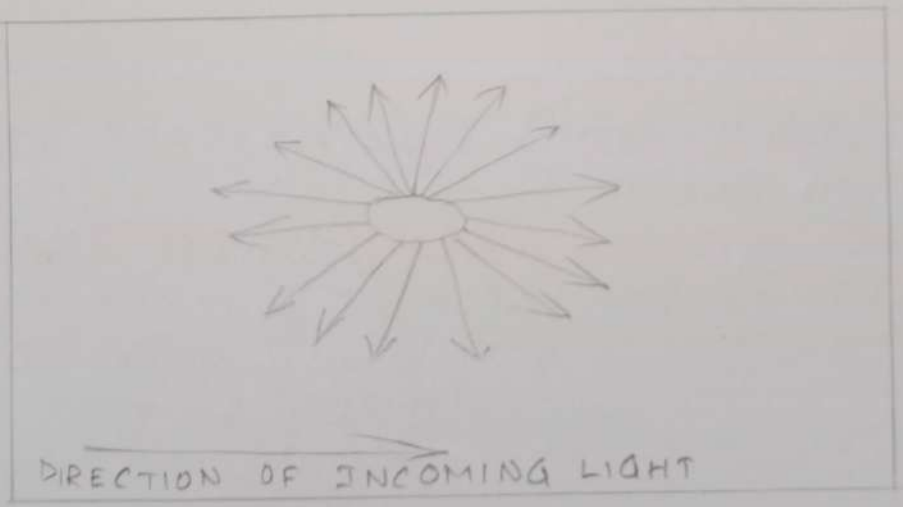
(A) SCATTERING : Atmospheric scattering is unpredictable diffusion of radiation by particles in the atmosphere. Scattering is the process where an atom, molecule or particle redirects energy.



Sengupta 04/06/2020

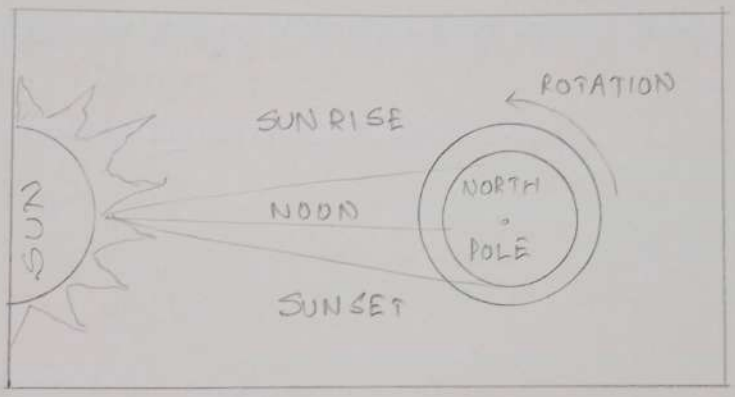
TYPES OF SCATTERING: There are two classes of scattering - selective and non-selective. Three different types of selective scattering are Rayleigh scattering, Mie scattering and Raman scattering.

1. RAYLEIGH SCATTERING: Atmospheric gas or small molecule scatters radiation by a process known as Rayleigh scattering. Rayleigh scatter is common when radiation interacts with atmospheric molecules and other tiny particles that are much smaller in diameter than the wavelength of the interacting radiation. The effect of Rayleigh scatter is inversely proportional to the fourth power of wavelength.

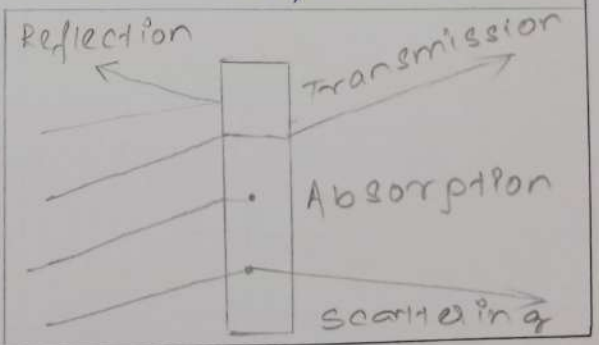


Rayleigh scattering redirects the radiation about equal in all directions. It is responsible for blue skies & red sunsets.

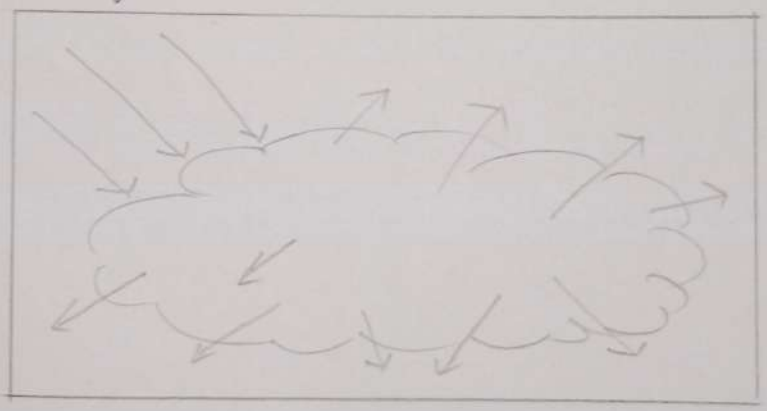
2. MIE SCATTERING: Mie scatter exists when atmospheric particles diameters essentially equal the energy wavelengths being sensed. Water vapour and dust are major causes of Mie scatter. This type of scatter tends to influences longer wavelengths compared to Rayleigh scatter. Mie scatter is significant in slightly overcast ones. For example, water vapour, smoke particles, fine dust.



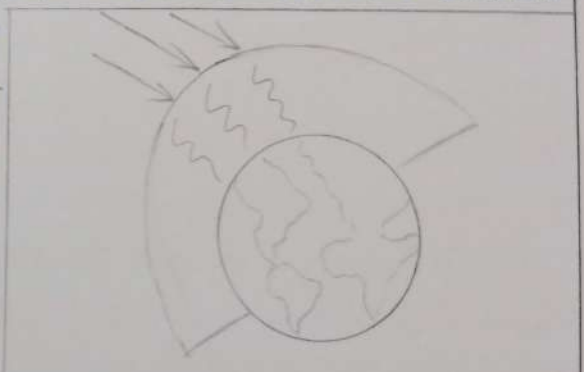
3. RAMAN SCATTERING: Raman scattering is caused by atmospheric particles, which are larger, smaller or equal to that of the wavelength of the radiation being sensed. The atmospheric particles may be gaseous molecules, water droplets, fumes or dust particles.



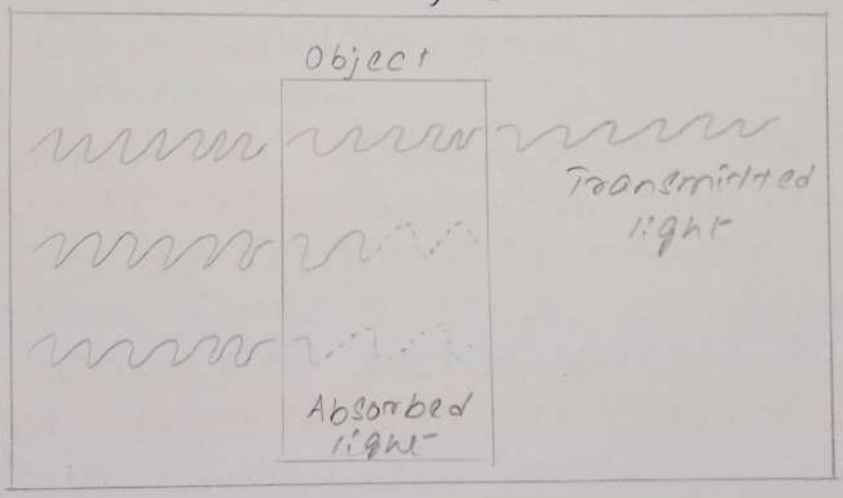
3. NON-SELECTIVE SCATTERING: Non-selective scatter, which comes about the time, when the diameters of the particles causing scatter, much larger than the energy wavelengths being sensed. Water droplets causes such scatter. Non-selective scattering get its name from the fact that all wavelengths are scattered about equally. This type of scattering causes fogs and clouds to appear white to our eyes because blue, green and red lights are all scattered in approximately equal quantities; (blue + green + red light = white light).



(B) ABSORPTION: Absorption is the other main mechanism at work when electro-magnetic radiation interacts with atmosphere. This phenomenon causes molecules in the atmosphere to absorb energy at various wavelengths. Ozone, carbon-dioxide, & oxygen are the main atmospheric constituents which absorb radiation.



(c) TRANSMISSION: A material transmits light when it allows the light to pass through it. Transparent materials allow all the light to pass through them so that things on the other side can be seen easily. Examples of transparent materials are glass, water, and air. Translucent materials scatter the light that passes through them. Examples of translucent materials are wax paper, frosted glass, and also some kind of plastic.



If the object is transparent, then the vibrations of the of the electrons are passed on to neighbouring atoms through the bulk of the materials and reemitted on the opposite side of the object. Such frequencies of light waves are said to be transmitted. If the object is opaque then vibrations are not passed from atom to atom, through the bulk of the materials. Rather the electrons of atoms on the material's surface vibrate for short periods of time & then reemit the energy as a reflected light wave. Such frequencies is reflected

INTERACTION'S WITH EARTH SURFACE FEATURES : Electromagnetic radiation that passes through the earth's atmosphere without being absorbed or scattered reaches the earth's surface to interact in different ways with different materials constituting the surface.

There are three ways in which the total incident energy will interact with earth's surface materials. These are

- Absorption
- Transmission, and
- Reflection

Absorption (A) occurs when the radiation (energy) is absorbed into the target while transmission (T) occurs when radiation pass through a target. Reflection (R) occurs when radiation 'bounces' off the target and is redirected.

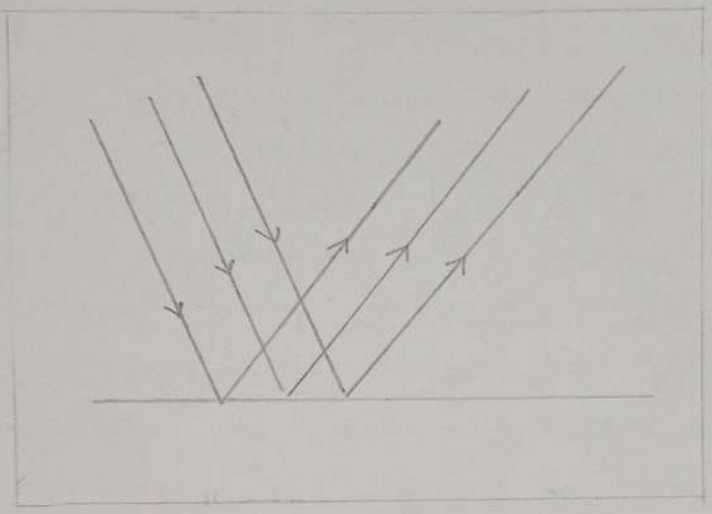
How much of the energy is absorbed, transmitted or reflected by a material will depend upon :

- Wavelength of the energy
- Material constituting the surface &
- Condition of the feature.

REFLECTION FROM SURFACES OCCURS FROM TWO WAYS :

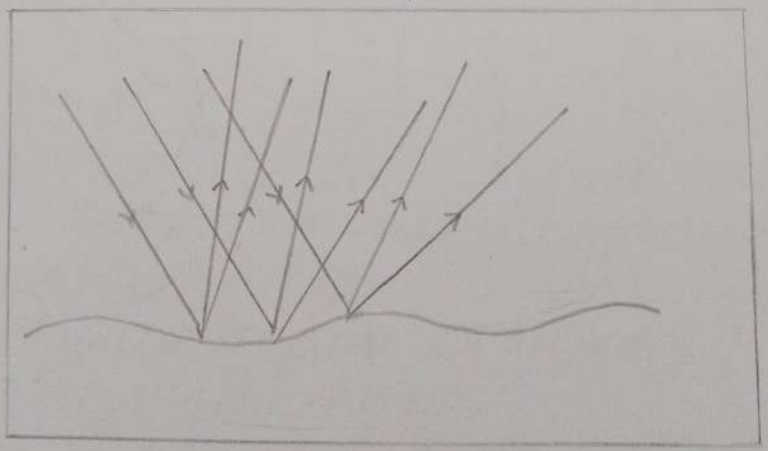
1. When the surface is smooth, we get a

mirror-like or smooth reflection where all (or almost of all) of the incident energy is reflected in one direction. This is called Specular Reflection and give rises no images.



Specular Reflection

2. When the surface is rough, the energy is reflected uniformly in almost all directions. This is called Diffuse Reflection and does not give rise no images.



Diffuse Reflection

04/06/2022

VEGETATION: A chemical compound in leaves called chlorophyll strongly absorbs radiation in the red and blue wavelengths but reflects green wavelengths.

- Leaves appear "greenest" during summer, when chlorophyll content is at its maximum. In autumn, there is less chlorophyll, so less absorption is there & proportionately more reflection of red wavelengths, making the leaves appear red or yellow (a combination of red & green wavelengths.

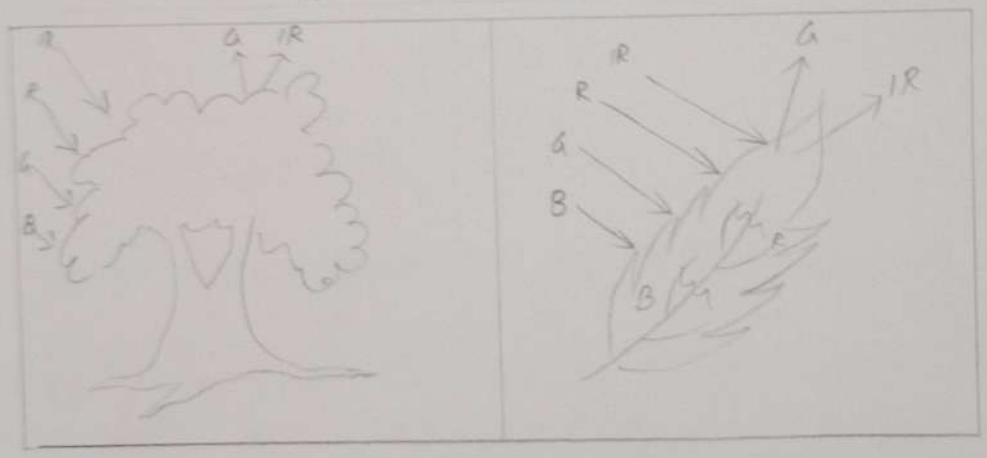
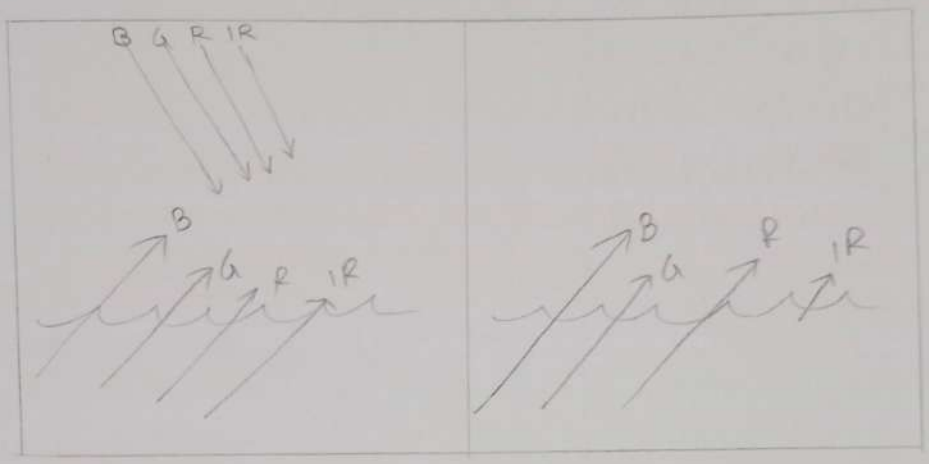


Fig 1: Vegetation

- The internal structure of healthy leaves act as excellent diffuse reflectors of near-infrared wavelengths. If our eyes, were sensitive to near-infrared, trees would appear extremely bright to us at these wavelengths.

WATER: Longer wavelength visible and near infrared radiation is absorbed more by water than shorter visible wavelengths. Thus water typically looks blue or blue-green due to stronger reflectance at these shorter wavelengths, and darker if viewed at red or near infrared wavelengths.



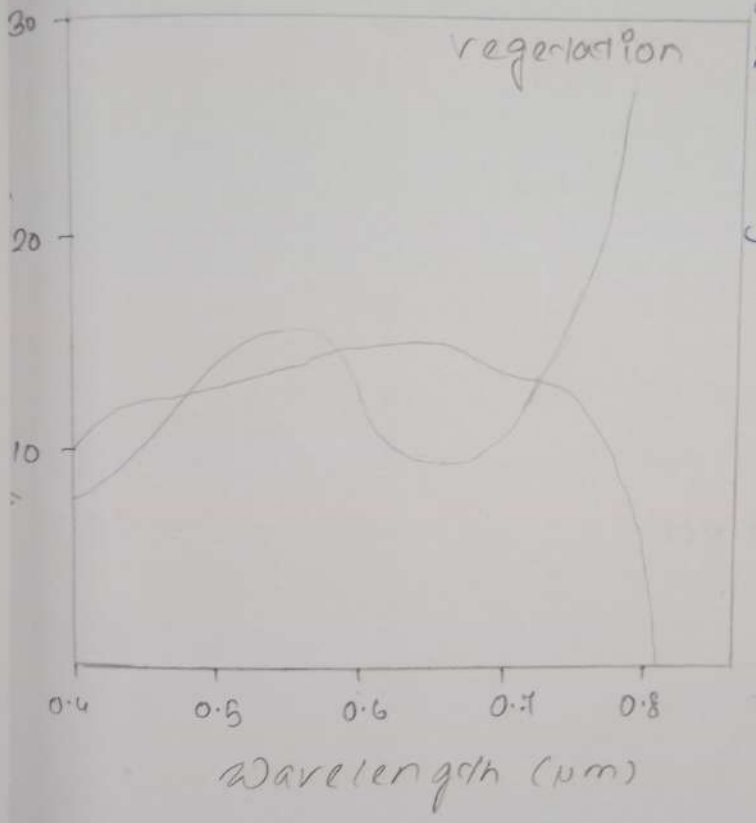
Clear water Suspended Sediment

SPECTRAL RESPONSE OF MATERIALS: By measuring the energy that is reflected (or emitted) by targets on the Earth's surface over a variety of different wavelengths, we can build up a spectral response for that object. The spectral response of a material to different wavelengths of EMR can be represented graphically as a Spectral Reflectance Curve.

It may be possible to distinguish between different materials if we were to compare their response at one wavelengths.

01/06/2020

But by comparing the response patterns of those materials over a range of wavelengths, (in other words, comparing their spectral reflectance curves), we may be able to distinguish between them. For example, water and vegetation may reflect somewhat similarly in the visible wavelengths but are almost always separable in the infrared.



Spectral Response Materials

URBAN STUDIES

Urban studies is based on the study of the uban development of cities. This includes studying the history of city development from an architectural point of view, to the impact of uban design or community development efforts. The core theoretical and methodological concerns of the uban studies field come from the social science, disciplines of history, economics, sociology, geography, political science, anthro-pology, and the professional fields of uban planning, architecture landscape architecture, and uban design. Uban studies helps with the understanding of human values, development, and the interactions, they have with their physical environment.

Remote sensing application may lead to innovation in Urban Planning in various types / ways :-

1. Thematic Map generation using visual interpretations techniques.

2. GIS techniques for the integration of thematic maps for urban sprawl analysis and urban land use change analysis.

3. Spatial Framework in GIS for perspective and development plans.

4. Urban land suitability analysis.

5. Land records calculation for urban development for capacity building of a region.

Image processing software such as ERDAS, ENVI, PCI Geomatica, ILWIS made correction side for various layers of information about a future in the satellite imagery. Beside this remote sensing is a useful technology for application such as base mapping, land use, land cover, mapping, urban chage detection, and mapping, urban management etc.

Remote Sensing Application for Urban Population

• Land Use and Land Cover Mapping :

The land is one of the prime resource. Land cover refers to the surface cover on the ground, whether vegetation, urban structure, water, urban infrastructure, bare soil or other. Identifying, delineating and mapping land cover is important for global monitoring studies, resource management and planning resources activities. Land use refers to the purpose the land serves, for example recreation, wildlife habitat, or agriculture. This knowledge will help develop strategies to balance conservation conflicting uses & developmental pressures.

• Effective Traffic Management :

The transportation network is the most basic and important infrastructure which connects urban centres and allows movement of people, and goods. Transportation planners often use remote sensor data to update transformation network map, evaluated existing road & rail condition study urban traffic patterns at choke point such as tunnels, bridges, malls and airports & conduct parking studies.

• Urban Land use Suitability analysis :-

One of the classic problem in decision making or multi parameter analysis (Urban land use survey hand book 1987) is the determination of the relative importance of each parameter with respect to the other. This problem requires human judgement supplemented by mathematical tools. Since all the land parameter are not equal and they have a different role to play they have been given weight as per their relative importance with respective to suitability assessment.

• Urban Growth / Urban Sprawl Analysis :-

Urban Sprawl is defined as the spreading of urban development (such as houses and shopping centers) on undeveloped land near a city. Urban Sprawl has been described as the unrestricted growth in many urban areas of housing, commercial development, & roads over large expanses of land, with little concern for urban planning. It can directly influences the land use and land cover changes. It also suggest the further, directions and patterns of sprawing growth.

Solid Waste Management :-

The term solid waste management mainly refers to the complete process of collecting, treating and disposing of solid wastes. In the waste management process, the wastes are collected from different sources and are disposed of. This process includes collection, transportation, treatment, analysis and disposal of wastes. It needs to be monitored so that strict regulations and guidelines are followed for its disposal. Here a geospatial database is generated using remote sensing and GIS techniques on satellite data can be used.

Cadastral Mapping :-

Cadastral Mapping data depicts the location of survey plans and shows the boundaries of surveyed parcels which include ; roads, railways, subdivisions. In developing countries, being slow and expensive process cadastral mapping and cadastral surveys are considered as one of the major limitations of economic development. Yet most of the authorities agree that they are essential for economical development of the country.

Estimating Population :-

Knowing the number of people live within a specific geographical extent are administrative unit is very powerful information. Estimation of population can be performed at the local regional & national level based:

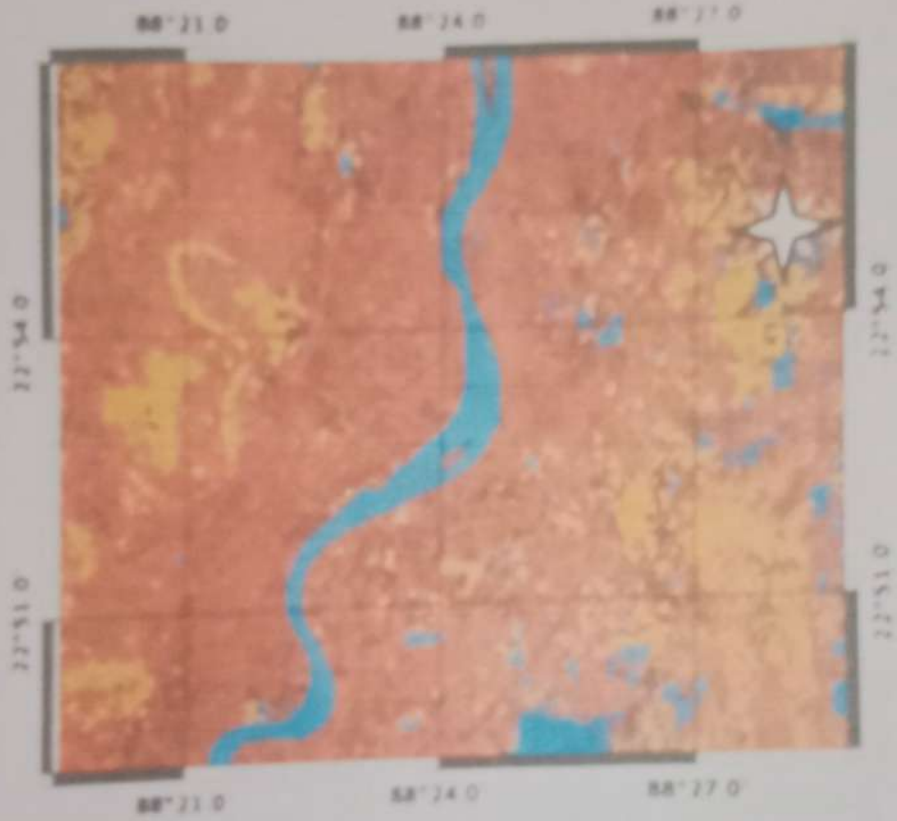
1. Dwelling unit of individual counts which requires nominal spatial resolution of 0.25-5m.

2. Urbanized land area management and its measurement often referred to as size of settlement (Taken at all 2004).

3. Estimate of land use / land cover classification with the availability of sufficiently accurate in situ data for the calibration of remote sensing models, Remote sensing techniques may provide population estimates that approach the accuracy of traditional census methods.

M. Das
09/07/22

SHOWING THE BUILD UP AREA OF HOOGHLY RIVER SURROUNDINGS (2019) BY UNSUPERVISED IMAGE CLASSIFICATION



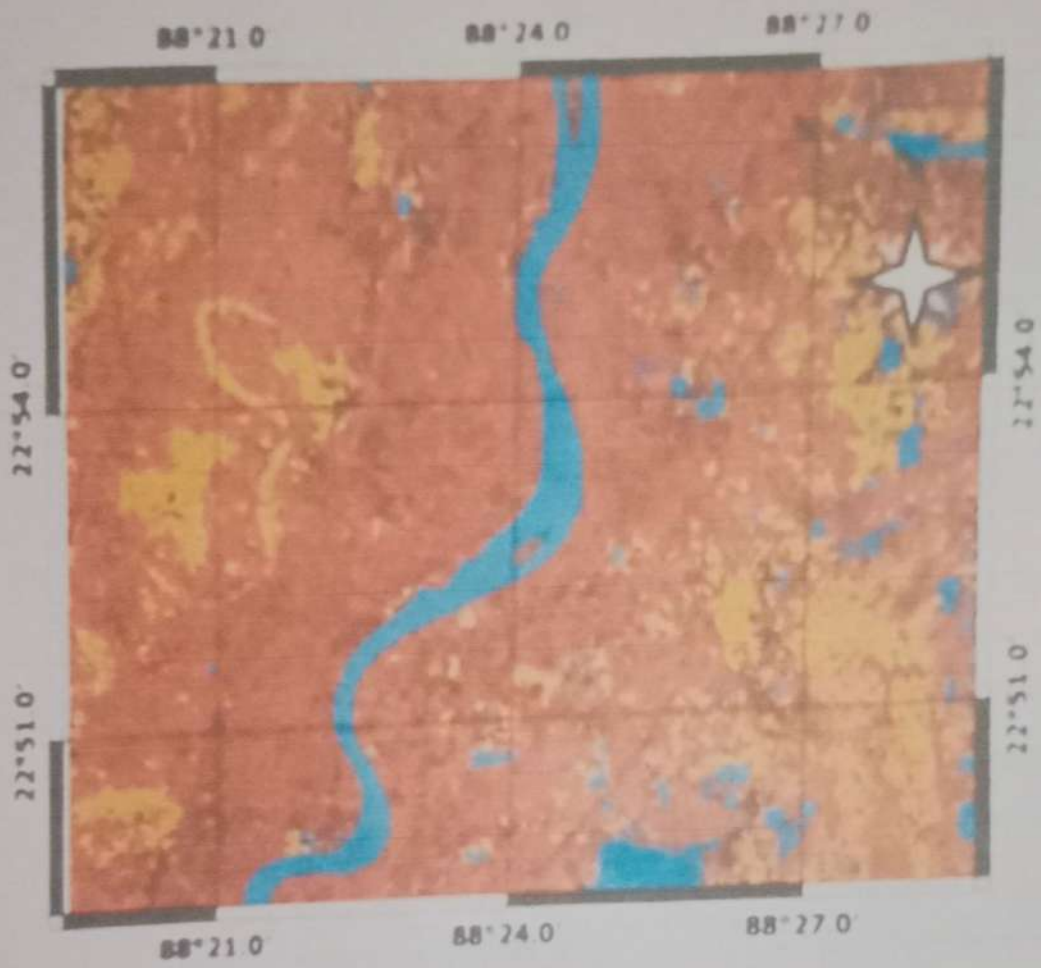
SCALE

LEGEND

WATER BODY
BUILD UP AREA
AGRICULTURAL AREA
UNCLASSIFIED

M. Das
04/07/22

SHOWING THE BUILD UP AREA OF HOOGHLY RIVER SURROUNDINGS (2019) BY UNSUPERVISED IMAGE CLASSIFICATION



SCALE

2 0 2 4 6 km

LEGEND

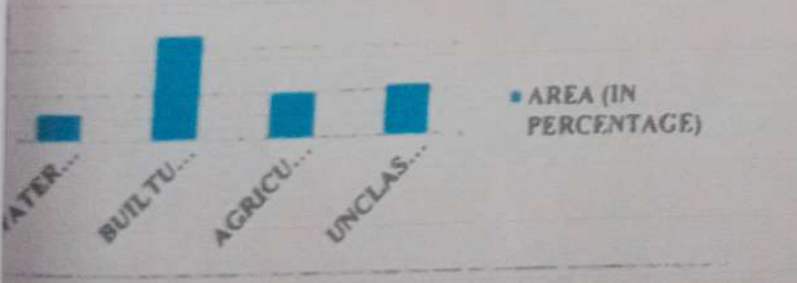
- WATER BODY
- BUILD UP AREA
- AGRICULTURAL AREA
- UNCLASSIFIED

M. Das
04/07/22

SHOWING THE AREA OF HOOGHLY RIVER SURROUNDINGS
2009

TURES	AREA (IN PERCENTAGE)
ERBODY	9.91
LTUP AREA	34.06
CULTURAL LAND	15.51
ASSIFIED	40.52

SHOWING THE AREA OF HOOGHLY RIVER SURROUNDINGS
2019



ATURES	AREA (IN PERCENTAGE)
ATERBODY	11.71
ILTUP AREA	46.38
RICULTURAL LAND	19.52
CLASSIFIED	22.39

INTERPRETATION

From the classified image of 2009-2019 (LI35-III Image). Various features area are calculated by GIS software and it is seen that major change on build up area in last 10 years. The calculated values are 46.30% on 2019. The calculated values of various features of the image shows that rapid change on agricultural land in it is converted to build up area main causes of growth are given below.

1. Population growth
2. Various standard Urban accomodation
3. Various type of service like- Health, Education facility etc, available.

It's good for development but also one thing that agricultural lands are rapidly to settlement areas.

IMAGE CLASSIFICATION

Image classification is one of the most important tasks in image processing and analysis. It is used to analyze land use and land cover classes. With the help of remote sensing, we get satellite images such as landsat satellite images. But these images are not enough to analyze, we need to do some processing on them. So to used these images for analysis we need image classification.

Qgis (Quantum gis) is very powerful and useful open source software for image classification.

There are mainly two types of image classification methods :-

1. Supervised classification.
2. Unsupervised classification.

STEPS OF SUPERVISED CLASSIFICATION:-

At first open QGIS → Layer → View → Panel → Layer → Add Layer → Add Raster Layer → Click on three dot and Select input image → Open → Add → SCP → Band Set → Click on Refresh list → Select all → Add Band no Band Set → Run (Select location) → View → Panels → SCP dock → check the base → Training input → Create a new training input → Click on polygon Select MCID and CID → draw a polygon on physical features → Signature → Merge two or more CID → SCP → Band Processing → Classification → Check MCID Box → Run.

M. Das
04/07/22

LAND USE AND LAND COVER MAP

LEGENDS

Class_temp_group

20220712_012531777113221_temp

Band 1

- 0 - Unclassified
- 1 - river
- 2 - sand bar
- 3 - agriculture land
- 4 - vegetation
- 5 - fellow land
- 6 - settlement
- 7 - waste land
- 8 - grassy field
- 9 - water body

SCALE

0 5 10 km

M. Das
04/07/22

UNSUPERVISED CLASSIFICATION

In unsupervised classification, pixels are grouped into 'clusters' on the basis of their properties. K-means and ISODATA are among the popular image clustering algorithms used by GIS data analysis for creating land cover maps in this basic technique of image classification. Once a clustering algorithm is selected, the number of groups to be generated has to be identified. In the next step, every individual unclassified cluster identified with land cover classes. As samples are not necessary for unsupervised classification, this technique serves as an easy means of segmenting and understanding images. The two major popular image clustering are :-

1. K-means.
2. ISODATA.

1. K-means :- K-means is one of the simplest unsupervised learning algorithms that solve the well known clustering problem. The procedure follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed a priori. K-means clustering is rather easy to apply even large data sets. It has been successfully used in market segmentation, computer vision, and astronomy among many other domains.

2. ISODATA :- The Iterative Self-Organizing Data Analysis Technique (ISODATA) represents a comprehensive set of heuristic procedures that have been incorporated into an iterative classification algorithm. ISODATA is a method of unsupervised classification and it don't need to know the number of clusters. Computer runs algorithm through many iterations until threshold is reached.

STEPS OF UNSUPERVISED CLASSIFICATION:-

At first open QGIS → SCP → View → Panels → Layers → Add Rusted layer → Rusted datasource → Downloaded → Select → Open → Image open / Add image → SCP → Band set → Open a file → On the image we will work → Band Processing → Clustering → K-means → Number of classes → Run → Processing → File Name (Unsupervised classification) → Save as type (.tif) → Save → Processing → Run → Sound → Picture whose colour will be different → Click the unsupervised classification → Properties → Colour ramp → Run.

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UNSUPERVISED CLASSIFICATION

LENGEND

unsupervise classification.PDF.png
Band 1 (Gray)

- 0 - Unclassified
- 1 - RIVER
- 2 - VEGETATION
- 3 - FELLOW LAND
- 4 - SETTLEMENT
- 5- AGRICULTURE
- 6- WATER BODY
- 7 - SAND BAR
- 8 - MINING AREA

SCALE

0 5 10 km

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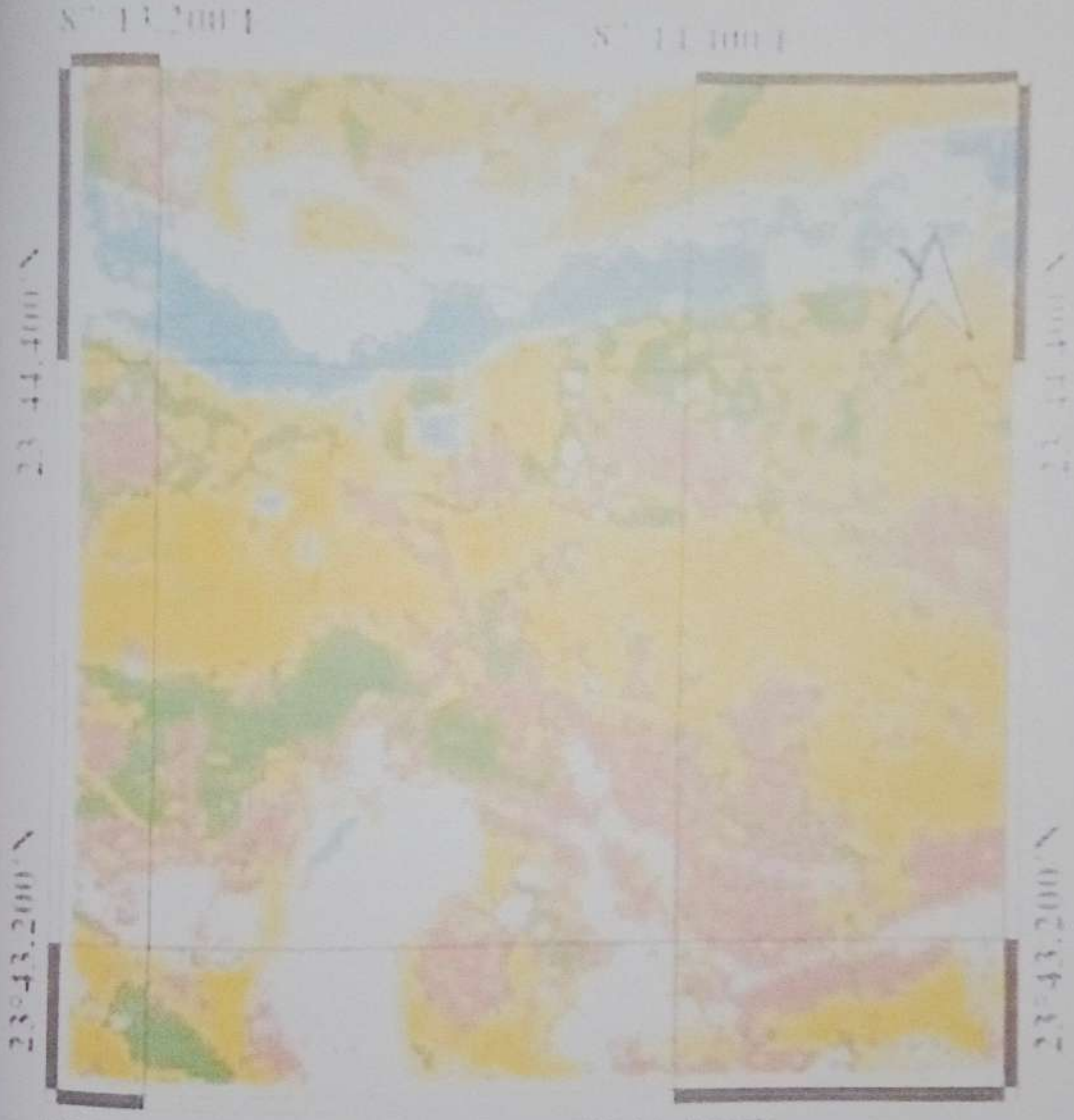
INTERPRETATION :-

From the classified image of the area surrounding (liss-III) we see that, the clear highlight of settlement, vegetation cover, water body, mining area, basically this area is old mining based also sand mining activity seen here. From the point of view agriculture activity is moderate open cast old mining activity see some parts of Birbhum and west Burdwan district coal mining activity seen from this classified image.

LANDSAT LAND COVER MAP OF AJAY RIVER AT SURROUNDING
(SUPERVISED IMAGE CLASSIFICATION)



SCALE

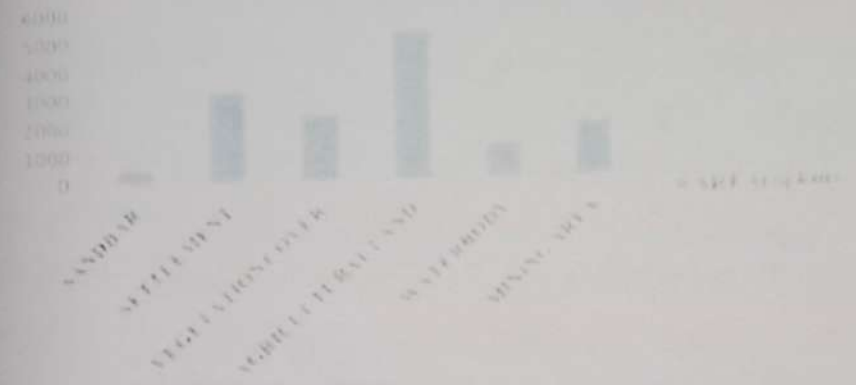
250 0 250 500 750 m

LEGEND

1 - SANDBAR
2 - SETTLEMENT
3 - VEGETATION COVER
4 - AGRICULTURAL LAND
5 - WATER BODY
6 - MINING AREA

CLASS	AREA (IN Sq. KM)
SANDBAR	863.68
SETTLEMENT	3173.76
VEGETATION COVER	2332.592
AGRICULTURAL LAND	5264.64
WATERBODY	1233.792
MINING FIELD	1891.584

SHOWING THE AREA (IN SQ. KM) CLASSIFIED INTO 6 BY BAR DIAGRAM



FLOODS

A flood is an overflow of water that submerges land that is usually dry Human changes to the environment often increases the intensity and frequency of flooding, for example land use changes such as deforestation and removal of wetlands, but in particular 'climate change' increases rainfall and extreme weather events that increase the severity of other causes for flooding, which results in more intense floods & increased flood risk.

EFFECTS OF FLOODS :-

- Heavy rains lead to rise in the water, level of rivers, seas and oceans.
- The floods causes extensive damage to crops, domestic animals, property and human life.
- During floods many animals get carried away by the force of water and eventually die.

REMOTE SENSING AND GIS APPLICATION IN FLOOD MANAGEMENT :-

VIEWING THE AFFECTED AREA - When there's a flood the remote sensors monitor the flooded area. The images take by the satellite are analyzed and can show the area affected by the floods.

FLOOD FORECASTING :- Heavy rainfall is the main cause of flooding. Remote sensors can detect the changes in weather, and send the data to weather station, who uses it to prepare people for floods.

LOCATING PEOPLE IN FLOODED AREAS :- When floods occur many people get stuck and it becomes difficult to rescue them. The rescue team employs remote sensing techniques to locate them.

UPDATING FLOODS ANALYZES AND INVENTORIES: For future reference, the information about flood can be recorded. Flood analyzes and inventories greatly depend on the remote sensor as their main data source.

DETECTING RIVER STAGE AND DISCHARGE- Rivers and and other water bodies also causes floods, remote sensing helps in monitoring river's stage & discharge.

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TROPICAL CYCLONE

A tropical cyclone is a rapidly rotating storm system characterized by a low-pressure centre, a closed low-level atmospheric circulation, strong winds, and a spiral arrangement of thunder-storms that produce heavy rain and squalls. Depending on its location and strength, a tropical cyclone is refered to by different names including hurricane, typhoon, cyclonic storm, or tropical depression.

EFFECTS OF TROPICAL CYCLONES

- Losses of life and material damage are significant due to strong winds, heavy rains, large swells, and storm surges.
- Hazardous phenomena are not only located on islands and coasts.
- Even mitigated, cyclones often causes damages inland, through floods, and landslides, sometimes hundreds of kilometres from the ocean.

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REMOTE SENSING AND GIS APPLICATION IN TROPICAL CYCLONE :-

During cyclone Remote sensing data provide timely and detailed information that are required by the authorities to locate and identify the affected areas and to implement corresponding damage mitigation.

Remote Sensing technique can be useful to detect the 'eye' of the cyclone.

When there's a tropical cyclone the remote sensors, who have a wide view monitor the cyclone and the affected areas.

Remote sensing helps in managing the coastal ecosystem, as tropical cyclones often have devastating impacts in many coastal areas across the world.

Remote sensors gives the data about the early signs of tropical cyclones in the form of information to weather radio and television for updated information, so that the people can themselves prepare for cruel natural calamities.

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