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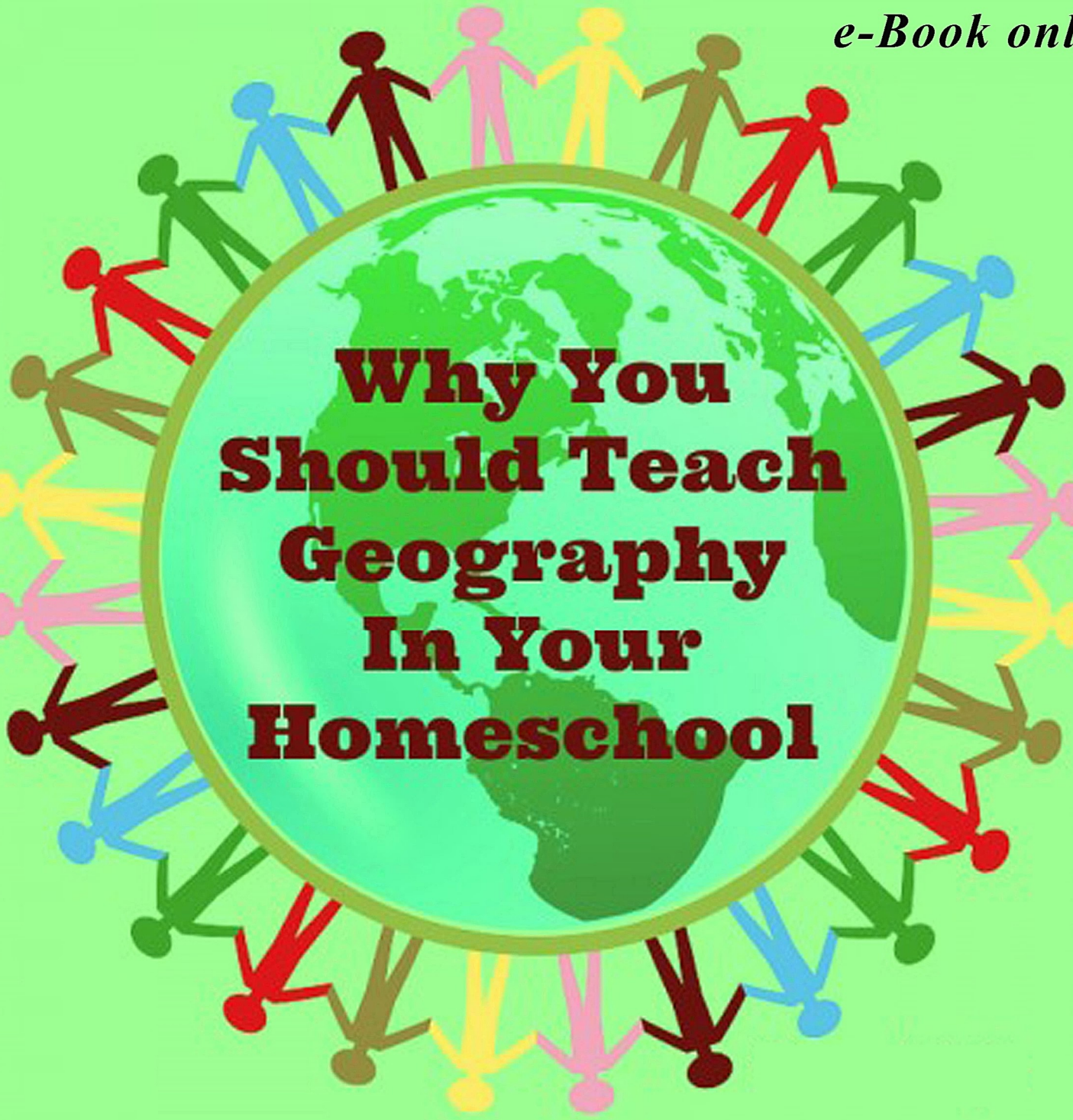

Why You Should Teach Geography In Your Homeschool

Edited by
SANJIT KUNDU
SRIMANTA SATPATI

Vol. 1 ۞ Issue 1 ۞ March 2018

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Preface

"Is not a Gimmick, not a Guarantee of Success,
this page will have your Desired Success!!
What is Geography? As is, how? Needs of Geography
and the Future, Research, Employment Fields and
the other, everything. After all, when Geography distant."

Education is human culture and development of Science, Geography is the part of this Science. So in Geography, well-planned human development, and, requirements of modern curriculums are added. That is why Physico-Environmental Science likes as Geography; we think that as our midwife. The sum of all things Geography became shining him to a unique entity. Geography is being discussed dynamic and changing with time to time. It is very funny for the infinite scope of Geography is bounded into a magazine. But in the meantime, some parts of the vast scope of Geography have been discussed into our small effort **"ভূগোল শিক্ষা @bhugolsiksha"** Magazine. Like other magazine highlights the full issues of this magazine may not guarantee success, but you will find some of the knowledge we hope that the desired success. Despite the fact of the expectations of the readers is disappointed we take the smallest effort, so that we can learn about your expectations. Geography Lovers will like which part of this paper/s contributed to our knowledge, full credit goes to our Torchbearer Teachers and for defective component/s is responsible to our immaturity of knowledge. For the overall development of this Magazine, a better presentation of the composition of the subject and constructive criticism and expectation for valuable advice kept an eye.

March 30, 2018,
Bankura

Sincerely,
ভূগোল শিক্ষা @bhugolsiksha

মুখবন্ধ

"বিজ্ঞাপনের চমক নয়, সাফল্যের নিশ্চয়তাও নয়,
হয়ত আপনার ইপ্সিত সাফল্য এই পেজটিতে!!
ভূগোল কি? বিষয় হিসাবে কেমন? ভূগোলের চাহিদা
ও ভবিষ্যৎ, উচ্চতর গবেষণা, চাকরীর ক্ষেত্র এবং
অন্যান্য, সবকিছুই। সর্বোপরি ভূগোল যখন ভাবায়।"

শিক্ষা মানব সংস্কৃতি ও উন্নয়নের বিজ্ঞান, ভূগোল সেই বিজ্ঞানের অংশ। তাই ভূগোলে মানব উন্নয়নের সুচিন্তিত, প্রয়োজনীয় আধুনিক পাঠ্যক্রম যুক্ত থাকে। তাই ভৌগোলিক পরিবেশের বিজ্ঞান ভূগোলকে আমাদের ধাত্রী হিসাবে ভাবতে হবে। ভূগোল সকল বিষয়ের সমষ্টি হয়েও তার নিজস্ব অনন্য সত্বায় দ্যুতিমান। সময়ের সাথে সাথে ভূগোলের আলোচনা হচ্ছে গতিময় ও পরিবর্তনশীল। ভূগোলের এই অসীম পরিধিকে একটি পত্রিকাতে সীমায়তকরন করা খুবই হাস্যকর। তবুও এরই মধ্যে ভূগোলের এই বিশাল পরিধির কিছু অংশ আলোচিত হয়েছে আমাদের ক্ষুদ্র প্রয়াস **"ভূগোল শিক্ষা"** পত্রিকায়। অন্যান্য পত্রিকার মতো সম্পূর্ণ বিষয় তুলে ধরে সাফল্যের নিশ্চয়তা হয়তো এই পত্রিকায় নেই, কিন্তু আপনার জ্ঞানের ইপ্সিত সাফল্য হয়তো খুঁজে পাবেন বলে আশা রাখি। পাঠকদের প্রত্যাশাতে নিশ্চিত হতাশ জেনেও এই ক্ষুদ্রতম প্রয়াস আমরা নিয়েছি, যাতে আপনাদের প্রত্যাশার কথা আমরা জানতে পারি। এই পত্রিকাটির যেটুকু অংশ ভূগোল প্রেমীদের ভালো লাগবে তার কৃতিত্ব সম্পূর্ণ আমাদের জ্ঞানের দিশারী শিক্ষক-শিক্ষিকা মহাশয়গনের এবং ত্রুটিপূর্ণ অংশগুলির জন্য দায়ী আমাদের জ্ঞানের অপরিপক্কতা। পত্রিকার সর্বাঙ্গীন উন্নতির জন্য আরো ভালো বিষয় সংযোজন ও উপস্থাপনের গঠনমূলক সমালোচনা এবং পরামর্শের প্রত্যাশায় রইলাম।

৩০ শে মার্চ, ২০১৮,
বাঁকুড়া

ধন্যবাদান্তে,
ভূগোল শিক্ষা

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Contents

Present Member's Panel (ভূগোল শিক্ষা @bhugolsiksha)

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Srimanta Satpati (Admin)

Aparupa Biswas (Moderator)

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Sahadat Ansary (Moderator)

Sukhamay Mallick (Moderator)

Identification of Backward Areas

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The study attempts to assess the spread effects of development process in Bihar with a view to identify the regions of iniquitous distribution of development. Identification of forces adversely affecting the process of development requires to be made for evolving criteria for identification of backward areas in the country. Studies by various Committees constituted by Planning Commission, Government of India have been made in this connection.

These Committees are:

a) Study Group Constituted in the context of the formulation of the Draft Fourth Five Year Plan (1966-71) to identify areas with high density of population, low level of income, employment and living conditions etc. in the country through a set of indicators of regional development.
b) The Pande Committee with the intention to ultimately suggest a strategy whereby regionally imbalances could be minimized or even eliminated by arranging establishment of industries of all sizes in selected backward areas or regions through financial and fiscal incentives.
c) The Wanchoo Committee was the second working Group appointed by the National Development Council in 1986 to make a careful study of the issue of regional imbalance.
d) Committee on Backward Areas under the Chairmanship of Prof. Sukhamoy Chakravorty in October 1972.
e) National Committee on the Development of Backward Areas (N.C.D.B.A.) under the chairmanship of Shri B. Shivaraman was appointed by planning commission in November, 1978.
f) Planning Commission appointed another committee on 6.2.1997 to evolve criteria for identification of 100 most backward poorest districts in the country. This committee was headed by Dr. E.A.S. Sarma.

The criteria recommended by these committees for identification of backward areas can be summarized as follows:

i. Density of population per sq.km. of area.
ii. Percentage of agricultural workers to total workers.
iii. Percentage of literate population.
iv. Percentage of school going children.
v. Total per-capita income.
vi. Per capita income from agriculture.
vii. Sex ratio, industry and mining.
viii. Availability of infrastructural facilities.
ix. Per capita consumption of electricity
x. Chronically drought prone areas.
xi. Chronically flood prone areas.
xii. Length of surfaced roads per 100 sq. km. of area.
xiii. Public health care system.
xiv. Safe drinking water facility.
xv. Poverty rates.

Different Measures of Migration

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DIFFERENT MEASURES OF MIGRATION

Human migration is the movement by people from one place to another with the intentions of settling temporarily or permanently in the new location. The movement is often over long distances and from one country to another, but internal migration is also possible; indeed, this is the dominant form globally.

Measures of Migration:

- **In-migration Rate (IR):** The number of in-migrants to a physical/administrative area in a given year.

$$\text{IR} = \frac{\textit{The number of in-migrants to an area in given year} \times 1{,}000}{\textit{Mid year population}}$$

- **Out-migration Rate (OR):** The number of out-migrants departing an area of origin, per 1,000 populations at that area of origin in a given year.

$$\text{OR} = \frac{\textit{The number of out-migrants in a given year} \times 1{,}000}{\textit{Mid year population}}$$

- **Net Migration Rate (NMR):** The net effect of in-migration and out-migration on an area's population, expressed as increase or decrease per 1,000 population of the area in a given year.

$$\text{NMR} = \frac{\textit{Number of inmigrants} - \textit{outmigrants}}{\textit{Mid year population}} \times 1{,}000$$

or, **NMR = IR – OR**

- **Gross Migration Rate:** The total number of in-migrants and out-migrants per 1,000 population of the area in a given year.

GMR = IR + OR

Human Migration

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Migration (human) is the movement of people from one place in the world to another for the purpose of taking up permanent or semi-permanent residence, usually across a political boundary. An example of "semi-permanent residence" would be the seasonal movements of migrant farm labourers. People can either choose to move ("voluntary migration") or be forced to move ("involuntary migration").

Migration occurs at a variety of **scales**: **intercontinental** (between continents), **intracontinental** (between countries on a given continent), and **interregional** (within countries). One of the most significant migration patterns has been **rural to urban migration**—the movement of people from the countryside to cities in search of opportunities.

Types of Migration:

- **Internal Migration:** Moving to a new home within a state, country, or continent.
- **External Migration:** Moving to a new home in a different state, country, or continent.
- **Emigration:** Leaving one country to move to another (e.g., the Pilgrims emigrated *from* England).
- **Immigration:** Moving into a new country (e.g., the Pilgrims immigrated *to* America).
- **Population Transfer:** When a government forces a large group of people out of a region, usually based on ethnicity or religion. This is also known as an **involuntary** or **forced migration.**
- **Impelled Migration (also called "reluctant" or "imposed" migration):** Individuals are not forced out of their country, but leave because of unfavourable situations such as warfare, political problems, or religious persecution.
- **Step Migration:** A series of shorter, less extreme migrations from a person's place of origin to final destination—such as moving from a farm, to a village, to a town, and finally to a city.
- **Chain Migration:** A series of migrations within a family or defined group of people. A chain migration often begins with one family member who sends money to bring other family members to the new location. Chain migration results in **migration fields**—the clustering of people from a specific region into certain neighbourhoods or small towns.
- **Return Migration:** The voluntary movements of immigrants back to their place of origin. This is also known as **circular migration**.
- **Seasonal Migration:** The process of moving for a period of time in response to labor or climate conditions (e.g., farm workers following crop harvests or working in cities off-season; "snowbirds" moving to the southern and south-western United States during winter).

People Who Migrate:

- **Emigrant:** A person who is leaving a country to reside in another.
- **Immigrant:** A person who is entering a country from another to take up new residence.
- **Refugee:** A person who is residing outside the country of his or her origin due to fear of persecution for reasons of race, religion, nationality, membership in a particular social group, or political opinion.
- **Internally Displaced Person (IDP):** A person who is forced to leave his or her home region because of unfavourable conditions (political, social, environmental, etc.) but does not cross any boundaries.
- **Migration Stream:** A group migration from a particular country, region, or city to a certain destination.

Why Do People Migrate?

People move for a variety of reasons. They consider the advantages and disadvantages of staying versus moving, as well as factors such as distance, travel costs, travel time, modes of transportation, terrain, and cultural barriers.

- ✓ **Push Factors:** Reasons for emigrating (leaving a place) because of a difficulty (such as a food shortage, war, flood, etc.).
- ✓ **Pull Factors:** Reasons for immigrating (moving into a place) because of something desirable (such as a nicer climate, better food supply, freedom, etc.).

Several types of push and pull factors may influence people in their movements (sometimes at the same time), including:

1. **Environmental** (e.g., climate, natural disasters),
2. **Political** (e.g., war),
3. **Economic** (e.g., work),
4. **Cultural** (e.g., religious freedom, education).

- ✓ **Place Utility:** The desirability of a place based on its social, economic, or environmental situation, often used to compare the value of living in different locations. An individual's idea of place utility may or may not reflect the actual conditions of that location.
- ✓ **Intervening Opportunities:** Opportunities nearby are usually considered more attractive than equal or slightly better opportunities farther away, so migrants tend to settle in a location closer to their point of origin if other factors are equal.
- ✓ **Distance Decay:** As distance from a given location increases, understanding of that location decreases. People are more likely to settle in a (closer) place about which they have more knowledge than in a (farther) place about which they know and understand little.

Laws of Migration:

Geographer E.G. Ravenstein developed a series of migration 'laws' in the 1880s that form the basis for modern migration theory. In simple language, these principles state:

- Most migrants travel only a short distance.
- Migrants travelling long distances usually settle in urban areas.
- Most migration occurs in steps.
- Most migration is rural to urban.
- Each migration flow produces a movement in the opposite direction ("counter flow").
- Most migrants are adults.
- Most international migrants are young males, while more internal migrants are female.

Impacts of Migration:

Human migration affects population patterns and characteristics, social and cultural patterns and processes, economies, and physical environments. As people move, their cultural traits and ideas **diffuse** along with them, creating and modifying **cultural landscapes**.

- ❖ **Diffusion**: The process through which certain characteristics (e.g., cultural traits, ideas, disease) spread over space and through time.
- ❖ **Relocation Diffusion:** Ideas, cultural traits, etc. that move with people from one place to another and do not remain in the point of origin.
- ❖ **Expansion Diffusion**: Ideas, cultural traits, etc., that move with people from one place to another but are not lost at the point of origin, such as language.
- ❖ **Cultural markers:** Structures or artifacts (e.g., buildings, spiritual places, architectural styles, signs, etc.) that reflect the cultures and histories of those who constructed or occupy them.

Site & Situation of Settlements

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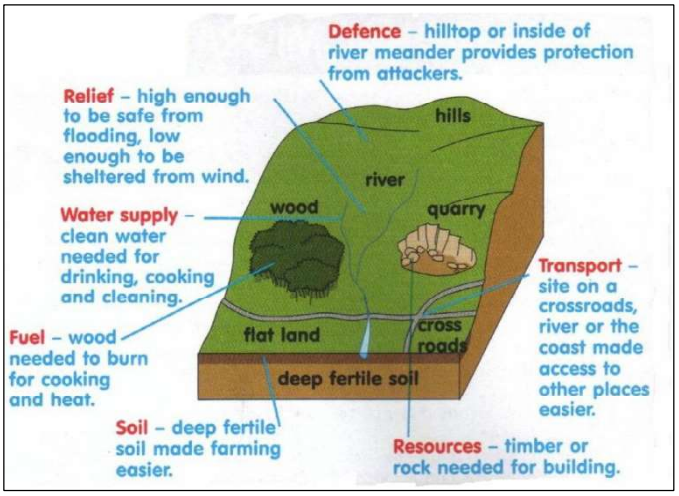
SITE & SITUATION OF SETTLEMENTS

Two key factors are important for where a Settlement will be located:

- **SITE** is the physical landscape a settlement is built on.
- **SITUATION** is the settlement location relative to the surrounding area.

1. *SITE*

- **WET POINT SITES** water supply is a key factor; many settlements grew up near a river or spring. Early villages located at springs at base of escarpments (e.g. Salisbury Plain) or where simple wells could be constructed (e.g. Desert Oasis).
- **DRY POINT SITES** are found on areas of higher land away from marshy areas or areas prone to flooding (e.g. Ely –Cambridgeshire).
- **DEFENCE** originated on higher land which gave a good view in case of attack (e.g. Edinburgh). These sites also found on meanders in rivers – which form a natural barrier (e.g. Durham).
- **BUILDING MATERIALS / FUEL SUPPLY** were heavy and bulky to transport so villages grew up where wood or stone available. Wood also important for fuel (e.g. Forest of Dean).
- **GOOD FARMING LAND** was essential to produce food (although ideal location would be suitable for growing food and rearing animals). Many villages grew up on fertile lowlands (e.g. Vale of Evesham).
- **ACCESSIBILITY & COMMUNICATION** were essential – villages grew up at bridging points (e.g. Oxford) crossroads/route centres (e.g. Paris) and gaps between hills (e.g. Dorking).



- **SHELTER & ASPECT** in GB a south-facing slope is protected from cold northerly winds and gains max. benefit from sun's warmth (e.g. Torquay).

2. *SITUATION*

A settlement with good access to natural resources and to other settlements will grow in size. Settlements with the best situations grow into cities.

Settlement Patterns & Settlement Hierarchy

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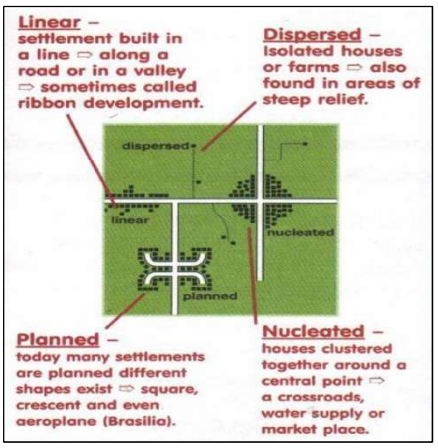
SETTLEMENT PATTERNS

As Settlements grow they develop distinctive shapes and patterns. Settlements may contain a mixture of these patterns.

- ✓ **Linear** buildings along a communication line; river, road.
- ✓ **Nucleated** buildings grouped together, initially for defence, later for social and economic reasons.
- ✓ **Dispersed** buildings are spread apart from communication link and each other.
- ✓ **Planned** e.g. Milton Keynes – settlements on newly reclaimed or developed land.



SETTLEMENT HIERAECHY

Hierarchy of Settlements according to Services:

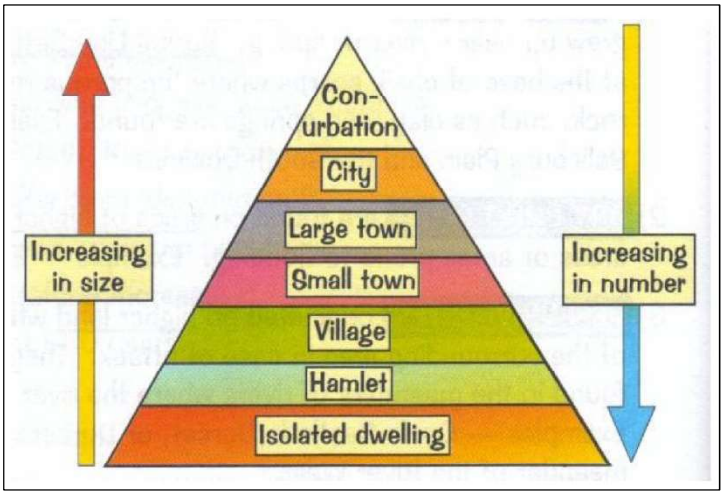
Isolated dwelling: Scattered house/s.

Hamlet: Perhaps none, or public telephone.

Village: Church, Post Office, Public House, Shops for Daily goods, Small Junior School, Village Hall.

Small Town: Town Hall, Doctor, Several Churches / Chapels, Cafes and Restaurants, Small Secondary School, Railway Station, Several Shops.

Large Town: Several shopping areas / arcades, Hypermarket, Railway Station, Bus Station, Hotels, Banks, Small Hospital, Small Football Team.



City: Large Railway Station, Large Shopping Complex, Cathedral, Opticians and Jewellers, Large Hospital, Large Football Team, University, Theatre, County Hall, Airport.

Conurbation / Capital: Cathedrals, Government Buildings, Banking HQ, Railway Termini, Museums and Art Galleries, Large Theatre, Shopping Centre, Several Universities, International Airport.

*Large places provide HIGH and LOW order goods and services e.g. Furniture stores, Theatres which a high number of people will use.

*Small places provide LOW order goods and services e.g. A local newsagents which a lower number of people will use.

Sphere of Influence
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SPHERE OF INFLUENCE

SPHERE OF INFLUENCE

(Also Urban Field, Catchment Area, Market Area and Hinterland). It is the area served by the goods, services, administration and employment of a settlement.

Range : is the maximum distance people are prepared to travel to use a service.

* Goods bought frequently are called convenience goods → weekly shopping → people only travel short distances.

* Goods bought infrequently are called comparison goods → furniture → people travel greater distances.

Threshold : is minimum number of people needed to support a service.

* Shops selling convenience goods have low threshold populations.

* Shops selling comparison goods have high threshold populations.

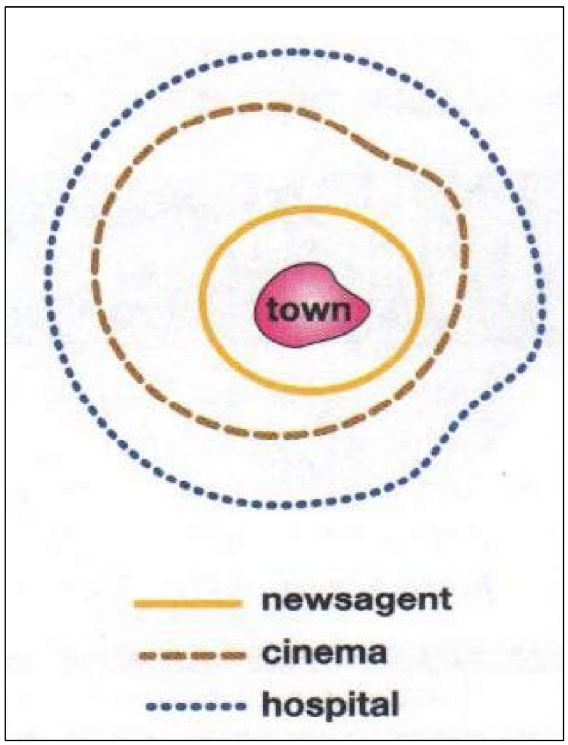

Fig. - A Sphere of Influence Model

Urban Renewal

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URBAN RENEWAL

URBAN RENEWAL SCHEMES: Aim to attract industry back into older areas and encourage investment in new housing, amenities and employment (e.g. London Docklands).

- **Gentrification** old terraced houses and industrial buildings are converted to high-quality housing (e.g. London Docklands).
- **Urban Regeneration** derelict factories and wasteland redeveloped with office blocks, shops and leisure facilities (e.g. Millennium Dome, Greenwich, London).
- **Urban Redevelopment** old terraced housing replaced with tower blocks (e.g. Tower Hamlets, London).
- **Integrated Transport** Systems new ring roads, light railways and trams relieve congestion (e.g. Docklands Light Railway).

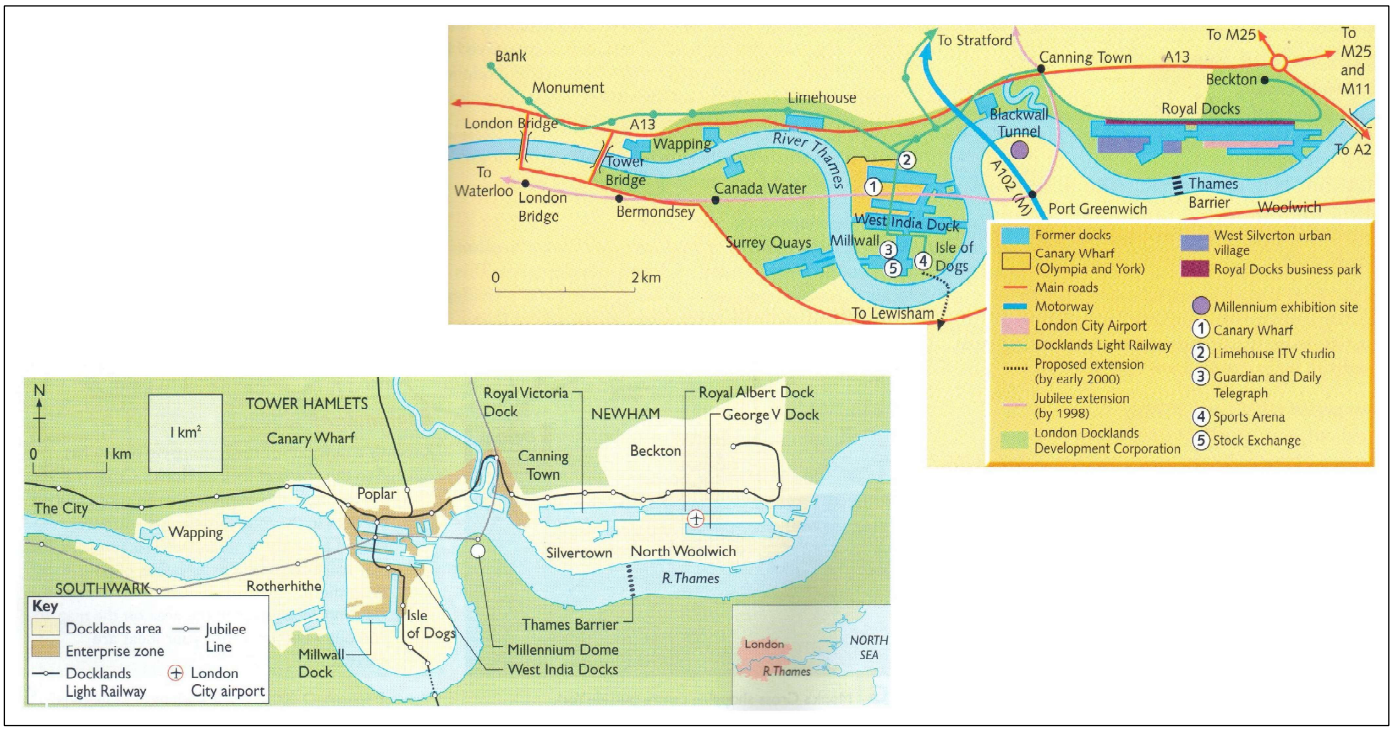

Fig. - Enterprise Zone

Counter-Urbanisation / Suburbanisation

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COUNTER-URBANISATION / SUBURBANISATION

COUNTER-URBANISATION : is the movement out of cities to surrounding areas.

SUBURBANISATION : is where the rural areas on the outskirts of towns increasingly develop the characteristics of Urban areas. Also known as Commuter/Dormitory towns. (Also - outward growth (OG) of urban areas, groups of people moving to surrounding villages).

Reasons for Counter-Urbanisation

1) Growth in transport and communication means people no longer need to live close to where they work. Increase in commuting. IT means people can work from home.
2) Govt. policies can encourage movement out of cities by setting up fast transport links in 'satellite towns'.
3) New business parks on out of town 'Greenfield Sites' mean people don't need to travel to city centre – so live close to work on outskirts.
4) Pollution and traffic congestion in cities encourage people to rural areas.
5) More people move house when they retire.
6) Cities are so popular that house prices have become too high.

Counter-Urbanisation Effects on Village Character & Function

1) Movement into village.
2) More affluent population and higher car ownership – people use city, not local services.
3) Increase in house prices – young cannot afford homes and move away.
4) Village is largely empty during the day – dormitory village. Decline in community spirit.
5) Local shops and services close as few people use them. Rural transport reduced as it is non-economical.
6) Local people without transport have access to fewer amenities – young/old become isolated.

Introducing Physical Geography

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I. **Introducing Geography:** Geography is the study of the evolving character and organization of the Earth's surface. It is about how, why, and where human and natural activities occur and how these activities are interconnected. The two sides of geography include:

1. ***Regional geography*** is concerned with how the Earth's surface is differentiated into unique places.
2. ***Systematic geography*** is concerned with the processes that differentiate places in time and space.

II. **Realms of Geography:** Systematic geography can be divided into human geography and physical geography.

1. ***Human geography*** deals with social, economic, and behavioural processes that differentiate places.
2. ***Physical geography*** examines the natural processes occurring at the Earth's surface that provide the physical setting for human activities. The five fields of physical geography are climatology, geomorphology, coastal and marine geography, geography of soils, and biogeography.

Climatology is the science that describes and explains the variability in space and time of the heat and moisture states of the Earth's surface, especially its land surfaces. We can think of climate as a description of average weather and its variation at places around the world. Climatology is also concerned with climate change, both past and future. Global climate modelling is one of the most rapidly expanding and challenging areas of climatology. This field attempts to predict how human activities will change global climate.

Geomorphology is the science of the Earth's surface processes and landforms. The Earth is constantly being altered under the combined influence of human and natural factors. The work of gravity as well as flowing water, blowing wind, breaking waves, and moving ice act to remove and transport soil and rock and to sculpt a surface that is constantly being renewed through volcanic and tectonic activity.

Physical geography includes climatology, geomorphology, coastal and marine geography, geography of soils and biogeography. Hazard assessment and water resources bring together both human and physical geography by studying how humans affect and are affected by the natural world.

III. **Tools in Geography:** Geographers use unique tools including maps, geographical information systems (GIS), remote sensing, mathematical modelling and statistics to represent spatial information.

IV. **Systems in Physical Geography:** A systems approach helps in understanding the interconnections in natural processes.

V. **Understanding Physical Geography:** Physical geography is also concerned with the natural world around us – the human environment.

VI. **Physical Geography, Environment and Global Change:** Environmental change is produced by both natural processes and human activity. Some important topics of global change that physical geographers are studying are:

1) Global climate change,
2) The carbon cycle,
3) Biodiversity,
4) Pollution,
5) Extreme events.

Spheres, Scales, Systems, & Cycles in Physical Geography

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SPHERES, SCALES, SYSTEMS, AND CYCLES IN PHYSICAL GEOGRAPHY

I. **The Four Great Realms in Physical Geography:** The natural systems encountered in physical geography operate within the four great realms, or spheres, of the Earth. These are the atmosphere; the lithosphere, the hydrosphere, and the biosphere.

a) ***Atmosphere*** **-** The gaseous layer that surrounds the Earth. It receives heat and moisture from the surface and redistributes them, returning some heat and all of the moisture to the surface. It supplies vital elements needed to sustain life forms.

b) ***Lithosphere*** **-** This outermost solid layer of the Earth provides a platform for most lifeforms. The solid bedrock bears a shallow layer of soil in which nutrient elements become available to organisms. The surface of the lithosphere is sculpted into landforms which provide varied habitats for plants, animals, and humans.

c) ***Hydrosphere*** **-** The liquid realm of the Earth is principally the mass of water in the world's oceans. It also includes solid ice in mountain and continental glaciers. Water occurs as a gaseous vapour, liquid droplets, and solid ice crystals. In the lithosphere, water is found in the uppermost layers in soils and in ground water reservoirs.

d) ***Biosphere*** **-** Most of the biosphere is contained in the shallow surface zone called the life layer. It includes the surface of the lands and the upper 100 meters of the ocean. On land, the life layer is the zone of interactions among the biosphere, lithosphere, and atmosphere.

II. **Scales in Physical Geography:** The processes of the life layer and the four great realms operate on various scales. These scales range from global to individual scales.

a) ***Global scale*** **-** The sun is the power source that powers most of the phenomena that occurs within the life layer. At this scale, Earth-sun relationships are very important.

b) ***Continental scale*** **-** The sun's energy is not evenly absorbed by the Earth's land and water surface. Unequal solar heating produces currents of air and water and constitute the global atmospheric and oceanic circulation system.

c) ***Regional scale*** **-** This smaller scale observes the cloud patterns of weather systems, and their regular movements over time. These movements, along with solar control of surface temperature, form the basis of the climates of the world.

d) ***Local scale*** **-** Factors at this scale are important in determining the exact patterns of vegetation and soils.

e) ***Individual scale*** **-** Individual landforms and their associated plant and animal communities are produced by unique activities of wind or water, and develop distinctive biological communities and soil properties.

III. **Systems in Physical Geography:** A helpful way to understand the relationships among the four realms and the life-layer is to study them as systems.

a) ***Flow systems*** **-** This is a system in which matter, energy, or both, move from one location to another.

i. **Pathways:** The structure of a flow system that allows for movement.

ii. **Structure:** The pattern of pathways and their interconnections.

iii. **Inputs and outputs:** Flow systems may have matter, energy, or both entering and leaving the system.

iv. **Power source:** Each flow system needs some type of power source. Natural systems are powered largely or completely by natural power sources.

*Examples of flow systems in physical geography are river systems, a food chain in an ecosystem, and the global energy balance system.

b) ***Open and Closed Flow Systems***

i. **Open Flow System -** This is a flow system where there are inputs and outputs of matter and energy.

ii. **Closed Flow System -** This is a flow system with no input or output flows of matter. The flow of materials in the system moves endlessly in a series of interconnected paths or loops. This is also known as a cycle, or a material cycle. Any global material flow system must be closed, since only a minute amount of matter flows from Earth to space or from space to the Earth. The global carbon, nitrogen, and oxygen cycles are all closed matter flow systems. Energy flow systems are always open. All objects that are warmer than the depths of space emit radiant energy, and some fraction of that energy ultimately leaves the Earth.

c) Feedback and Equilibrium in Flow Systems

i. **Feedback -** Occurs when the flow in one pathway acts to either reduce or to increase the flow in another pathway.

a. ***Positive feedback-*** Where the feedback reinforces the flow of matter or energy in the system.

b. ***Negative feedback*** **-** Where the feedback reduces the flow of matter or energy in the system.

ii. **Equilibrium-** This is a steady state in which the flow rates in the various pathways of a system remain about the same.

IV. Cycles in Physical Geography:

➢ ***Time Cycles*** **-** Any system can undergo a change in the rates of flow energy or matter within its pathways. Flow rates may grow faster or may slow down. These changes in activity can be reversed at intervals of time – that is, a rate can alternately speed up and slow down during a time cycle. In many natural systems, there is a rhythm of increasing and decreasing flow. The annual revolution of the Earth around the Sun generates a time cycle of energy flow in many natural systems.

Vernal Equinox (21st March) in Northern Hemisphere

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As Earth revolves around the Sun, there are two moments each year when the Sun is exactly above the equator. These moments — called equinoxes — occur around March 20 or 21 and September 22 or 23. Equinox literally means “equal night," since the length of day and night is nearly equal in all parts of the world during the equinoxes.

The March equinox marks when the Northern Hemisphere starts to tilt toward the sun, which means longer, sunnier days. In the Northern Hemisphere, the March equinox is called the vernal equinox, because it signals the beginning of spring (vernal means fresh or new like the spring). The September equinox is called the autumnal equinox, because it marks the first day of fall (autumn).

When the Northern Hemisphere starts to tilt toward the sun in spring, the Southern Hemisphere starts to tilt away from the sun, signalling the start of fall. Thus, in the Southern Hemisphere, the March equinox is called the autumnal equinox, and the September equinox is called the vernal equinox.

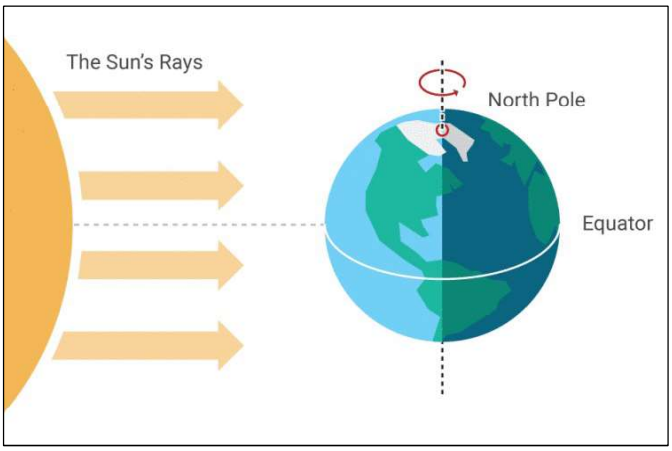

Fig. - On the equinox the Earth's axis is perpendicular to the Sun's rays.

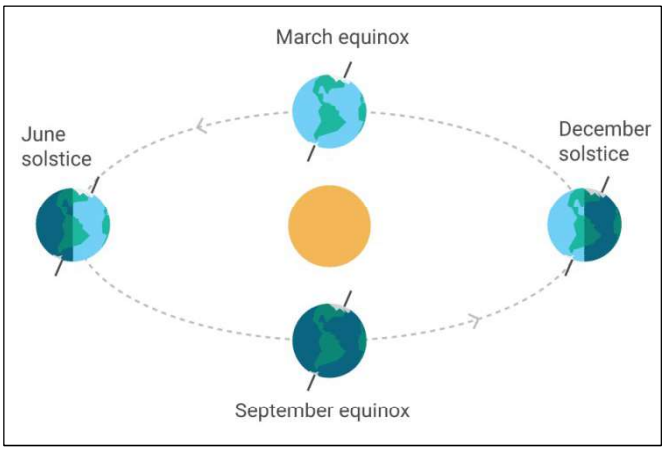

Fig. - Equinoxes and Solstices are opposite on either side of the equator.

People have celebrated the vernal equinox for centuries. For ancient cultures, the vernal equinox signalled that their food supplies would soon return. Early Egyptians even built the Great Sphinx so that it points directly toward the rising Sun on the day of the vernal equinox. In Christianity, the vernal equinox is significant, because Easter always falls on the first Sunday after the first full moon after the vernal equinox.

If you keep your eyes and ears open around the time of the vernal equinox, you're likely to hear or see people talking about a magical phenomenon that only occurs on that day. According to legend, the special astronomical properties of the vernal equinox make it possible to balance eggs on end.

So is there any truth to this popular legend? Nope! It's actually possible to balance eggs on end on any day of the year. It just takes a lot of patience and determination. There's nothing magical about the vernal equinox that makes it any easier to balance an egg on end.

You might be wondering how such an interesting and widespread legend got started. No one knows for sure, but some believe the Chinese may have started the practice of balancing eggs on end during the vernal equinox. Given that day and night are balanced at the time of the vernal equinox, it's possible that the Chinese chose a balanced egg as a symbolic representation of this astronomical phenomenon.

Plate Tectonics: An Introduction

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I. Introduction:-

A. *General:*

1. The theory of plate tectonics is a recent development in the geological sciences, really accepted by scientific community since the early 1960's.

2. Earlier in the century geologic paradigm was dominated by the belief that ocean basins and continental land masses were permanent and fixed on the surface of the earth.

3. The theory of Plate Tectonics now recognizes that the positions of land masses are not fixed and that they have moved about the earth's surface over geologic history.

- *Ocean basins/oceanic crust are continually being created and destroyed through tectonic processes.*

B. *Terminology:*

1. "Tectonics" - is a term that refers to the deformation of the earth's crust.

2. "Plate" - refers to the subdivision of the earth's crust and lithosphere into a number of tectonically coherent blocks.

3. "Plate Tectonics" - refers to the formation and migration of these lithospheric plates.

- *Problem: Time spans of plate motion on order of 10' of to 100's of million's of years, theory has beed deduced from evidence recorded in earth's rocks, often difficult to interpret and sometimes inconclusive.*

II. Overview of Earth Interior:-

A. *Crust- a relatively thin outer layer:*

1. Oceanic crust - Thin on order of several km's thick - Volcanic / basalt in composition.

2. Continental crust - Thicker on orde of 10's of kms thick - Plutonic/sedimentary / "granitic" in composition.

B. *Mantle- rocky layer located below the crust and having a thickness of 2885 km:*

1. Mantle - Dense, iron-magnesium silicate rocks.

2. "Moho":

a. *Mohorovicic discontinuity or Moho-seismic discontinuity in which velocity of earthquake waves increases abruptly below a depth of 50 km.*

b. *Now known to be boundary between crust and upper mantle.*

3. Asthenosphere - Soft zone of partially melted rock.

C. *Lithosphere- outer solid portion of the earth which includes the upper mantle above the aesthenosphere and the crust.*

D. *Outer core - 2270 km thick, possesses characteristics of mobile liquid:* Liquid, iron-rich.

E. *Inner core- 1216 km thick, solid metallic sphere:*

- **Core -** Thought to be composed of iron and nickel, very speculative, based on study of meteorites and speculation that they represent the interior composition of earth.

III. Historical Perspective on the Evolution of Plate Tectonic Theory: Continental Drift a Precursor to Tectonic Theory:-

- ***Continental Drift - Alfred Wegner (German earth Scientist) proposed a hypothesis in early 1900's that the world continents have been drifting about on the earth's surface:***

1. Supercontinent of "Pangaea" existed 200 M.Y. ago in which all of major worlds continents were once amalgamated together, and have since broken apart and migrated or drifted to their present positions/configurations.

2. Evidence for Wegner's hypothesis of Continental Drift:

a. Jig-saw puzzle fit of the Continents.

b. Fossil Evidence:

i. Mesosaurus which is only found on east coast of South America and west coast of Africa.

ii. How did these critters migrate across the ocean basins?

c. Similar Rock Types and Structural Rock Deformation across ocean basin.

d. Paleoclimatic Evidence: Evidence for glacial conditions 250 m.y. ago are found in similar aged rocks from southern Africa, South America, India and Australia.

3. Problem with Wegner's ideas:

a. Not widely accepted.

b. Suggested on the continents were "drifting" not ocean basins.

c. Did not have a viable mechanical explanation as to how continents would "drift".

IV. Modern Plate Tectonic Theory:-

- ***Basic Model - Based on early work by Wegner, more recent mapping of seafloor, magnetic surveys of earth's magnetic field, and observation of earth's seismic activity or earthquake activity:***

1. Plates- Plate tectonics model suggests that the outer, rigid lithosphere of the earth consists of about twenty rigid segments known as "plates".

- ***Plate Mobility*** *- It is recognized that each moves as a distinct rigid unit in relation to other plates. These plates move on top of a semi-plastic asthenosphere, and interact with one another along their boundaries.*

2. Plate Boundaries and Nature of Interaction between Plates

a. 3 types of plate boundary interaction: *Divergent, Convergent, or Transform fault boundaries.*

b. Divergent Boundaries: *Boundary condition in which tectonic plates move apart, resulting in upwelling of magma and volcanic material to create new seafloor: i.e. creation of new crust.*

i. Located at crests of mid-oceanic ridges, where plates move apart and molten rock is injected and cooled to form new seafloor.

ii. Seafloor spreading- process of plate divergence and injection of magma.

a) *E.g.Atlantic ocean basin, has undergone seafloor spreading over last 165 m.y. at avg. rate of 6 cm/year.*

b) *E.g. Red Sea in Middle East is an example of a very young ocean basin that is just beginning the process of seafloor spreading.*

iii. Continental Rifting.

a) *Pulling apart of continental crust by faulting.*

b) *Incipient seafloor spreading centre.*

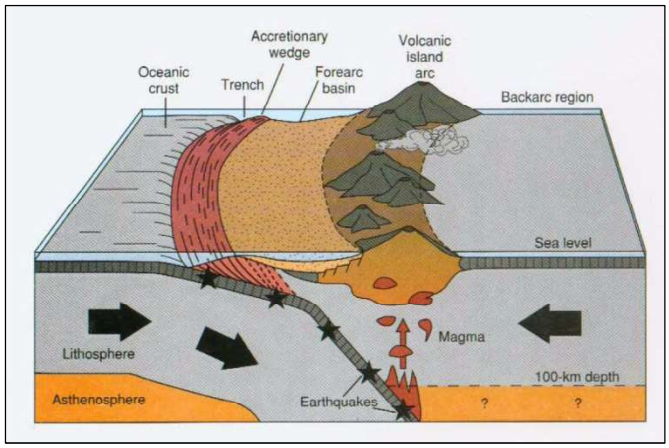

Fig. - Oceanic-Oceanic Subduction Zone

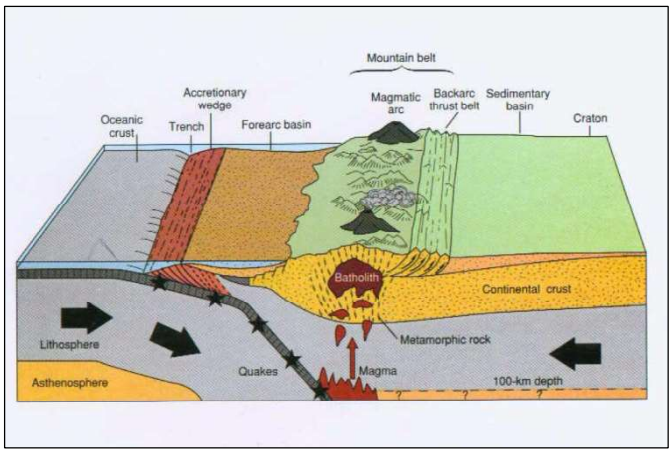

Fig. - Oceanic-Continental Subduction Zone

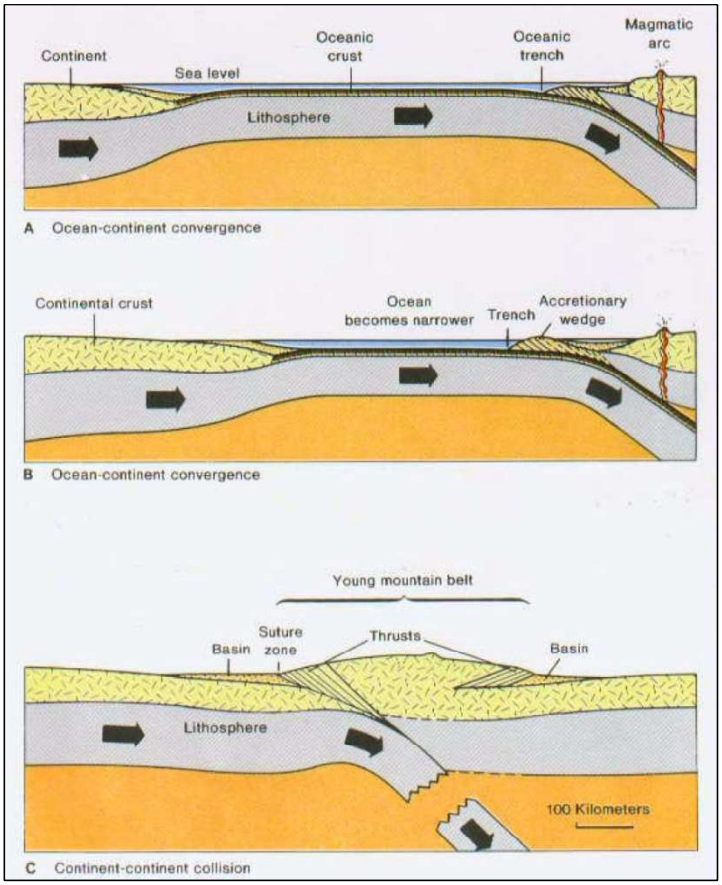

Fig. - Continent-Continent Collision

c. ***Convergent Boundaries:*** Plate boundaries in which two plates move toward one another or collide.

i. Collision of one plate into another results in downbending of one plate and descent of that plate beneath the other.

ii. Subduction zone - a zone of plate convergence in which where an oceanic plate descends into the upper mantle beneath the overriding plate.

iii. Trenches - zone where subducting slab dives beneath over-riding plate.

iv. Volcanic arc - an arcuate chain of volcanoes on continental crust that result from subduction of oceanic crust beneath continental crust.

a) *Cascade mountains in U.S., Andes in SAM, Sierra Mtns in CA are eroded core of volcanic arc.*

b) *Forearc region - zone in front of arc, towards trench e.g. Willamette Valley, west of Cascades.*

c) Backarc region - zone behind the arc, away from trench e.g. central Oregon, east of Cascades.

v. Types of convergent boundaries:

a) Oceanic-Continental Plate Convergence e.g. W. Coast of North America.

b) Oceanic-Oceanic Plate convergence e.g. Japan.

c) Continent-Continent Plate Convergence e.g. India / Asia / Himalayas.

d. **Transform Fault Boundaries:** Condition where plates slide horizontally past one another along a fault (or fracture along which there is movement).

i. Crust is neither consumed nor destroyed.

ii. Transform faults connect convergent and divergent boundaries into a worldwide network of interconnected plate boundaries e.g. San Andreas Fault in Ca.

V. Evidence to Support Modern Plate Tectonic Theory:-

A. Magnetism and Paleomagnetism (result of search for German submarines in WWII):

1. Earth has a magnetic field about it with a magnetic north pole and south pole similar to a bar magnet with lines of magnetic force flowing from North to south.

2. Paleomagnetism - Iron-rich minerals such as magnetite (Fe3O4) act as tiny magnets, when these minerals cool from a magma there is a temperature at which they align with the magnetic field of the earth (curie point),

a. Polar Wandering.

b. Polar Reversals -

i. **Normal Polarity -** So rocks have been found with paleomagnetism similar to todays polar arrangement termed "normal" polarity.

ii. **Reversed Polarity -** Rocks which indicate magnetic north pole at current position of south magnetic pole.

c. Seafloor Stripes.

B. Evidence from Seismic Records of Earthquakes: The distribution of earthquake focii or origination points of earthquakes was examined around the world and at convergent plate boundaries or subduction zones.

C. Evidence from Ocean Drilling.

D. Hot spots: Hawaiian Islands.

VI. Driving Mechanism for Plate Tectonics: what force causes the plates to move about the earth's surface?:-

A. Heat Transfer/Convection within Mantle:

- **Model:** the lower or inner portion of the mantle, near the core, is hotter than the upper mantle, this unequal distribution of heat results in circulation of heated, semiplastic mantle material...warm, less dense material of lower mantle rises very slowly in regions of spreading centres, spreads laterally, cools, and slowly sinks back into the mantle and reheating process repeats, these mantle convection currents result in shear force being applied to overriding crustal plate and drive plate tectonic motion.

B. Other Ideas:

1. **Active subduction pull -** Cold, dense subducting slab pulls plate into interior of Earth.
2. **Ridge push -** Active spreading centres push slab into interior of Earth.

Submarine Canyon

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Under the ocean there is a different world compared to the land we humans are living. The landscape underwater is spectacular meanwhile explorable. One of the features cannot be found on solid ground is submarine canyon. Submarine canyon is steep-sided, V-shaped valley that is formed at outer edge of continental shelf and continue across the slope. Meanwhile at its lower end usually leads to an abyssal fan (submarine fan), a fan-shaped, big pile of sediment lying on the sea floor.

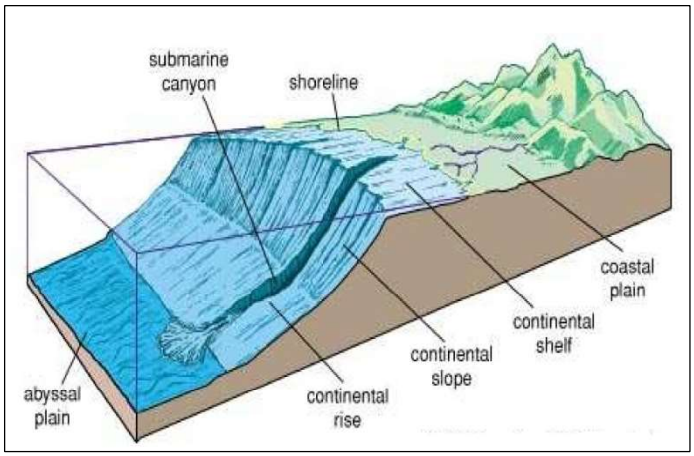

Fig. - Continental margin: elements of the continental margin.

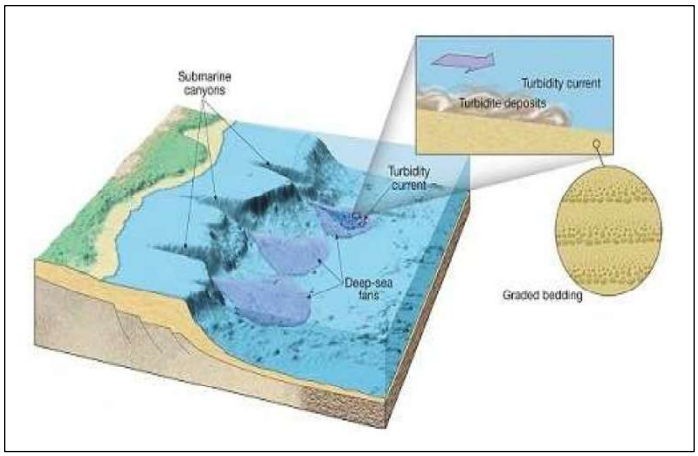

Fig. - Turbidity Current Deposits.

Formation:

When submarine canyons are first discovered, geologists proposed they were eroded by rivers during the Pleistocene Epoch, when glaciers started accumulated on land and lowered the sea level around 150 meters. However, this hypothesis cannot explain the deeper portions of submarine canyons that cut into lower continental slopes at depths of a kilometre or more. Therefore, submarine canyons must be formed underwater and associated with a submarine mechanism.

Geologists subsequently realized that turbidity currents are those who did the work. Turbidity currents are created when loose, wet sediment tumbles down the slope resembles a submarine landslide. The movement can be caused by an earthquake or simply by gravity on the slope when sediment overloads. Mixture of water and sediment is denser than water, it flows down the shelf and slope like a turbulent. A turbidity current can reach a speed greater than 100 kilometres per hour and a distance up to 700 kilometres. With this speed and range turbidity current has tremendous erosive power. Once a turbidity current cut a crack into the shelf and slope, the following currents could take up the chance and deepen the crack. Over time, the currents erode a submarine canyon on the shelf and slope. Turbidity currents slow down once they reach the sea floor and the sediment starts to accumulate to form the abyssal fan.

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Theme (2018): "Nature for Water" – To the Water Challenges we face in the 21st Century.

জল যেমন আমাদের প্রানধারণের পক্ষে অপরিহার্য তেমনি বিভিন্ন অর্থনৈতিক চাহিদাও মিটিয়ে থাকে। পৃথিবীর মোট জলসম্ভারের পরিমান ১৩৮৬ মিলিয়ন ঘনকিমি, যার ৯৭.৫% সমুদ্রভাগের লবনাক্ত জল এবং ২.৫% স্বাদু জল। এই স্বাদু জলের ৬৮.৭% বরফরূপে, ২৯% ভূগর্ভস্থ জল,এবং ২.৬% ভূপৃষ্টস্থ জল হিসেবে রয়েছে। পৃথিবীর মোট ব্যাবহারযোগ্য স্বাদুজলের ৬৯% কৃষি,২৩% শিল্প এবং ৮% গৃহস্থালীর কাজে ব্যাবহার করা হয়।আফ্রিকা,এশিয়া ও দক্ষিন আমেরিকায় ব্যাবহৃত জলের ৮৬% জল কৃষির জন্য,উত্তর আমেরিকায় ব্যাবহার্য জলের ৪২% জল শিল্পের জন্য এবং ইউরোপে ব্যাবহৃত জলের ৫৪% শিল্পের জন্য ব্যাবহার করা হয়।

জনপ্রতি বার্ষিক জলের পরিমান ২০০০ ঘনমিটার হওয়া দরকার।মাথাপিছু বার্ষিক জলের পরিমান ১৭০০ ঘনমিটার কম হলে বলা হয় জলের অভাব আছে এবং ১০০০ ঘনমিটার নিচে হলে বলা হয় জলের চরম সংকট। এই তথ্য অনুসারে পৃথিবীর সামগ্রিক জনসংখ্যার ১/৬ অংশ আজ জলাভাবের সন্মুখীন। শুধুমাত্র চিন দেশের প্রায় ৫৮ কোটি মানুষ দৈনন্দিন জীবনে ব্যাবহারের পর্যাপ্ত জল পায় না। খরা প্রবন সাহারা মরুভূমি সন্নিহিত আফ্রিকার দেশ গুলিতে এই সমস্যা প্রকট। United Nations এর সমীক্ষা অনুসারে বর্তমান পৃথিবীর ৭৩৫ কোটি মানুষের ব্যাবহারে উপযোগী জলের পরিমান এই সময় মাত্র ২ লক্ষ ঘনকিমি। বর্তমান পৃথিবীর প্রায় ২০ কোটি মানুষ বিশুদ্ধ পানীয় জল থেকে বঞ্চিত।

পৃথিবীর মোট ১৭% মানুষ আমাদের দেশে বাস করে। কিন্তু পৃথিবীর মোট জলসম্পদের ৪% অধিকারী হচ্ছে ভারত। রাষ্ট্রসংঘের একটি সমীক্ষা অনুযায়ী ১৮০ টি দেশের মধ্যে মাথাপিছু জল ব্যাবহারে ভারতের অবস্থান ১৩৩ তম। ভারতের প্রায় ১৭ কোটি মানুষ বিশুদ্ধ পানীয় জল থেকে বঞ্চিত। ভারতের দ্রুত জনসংখ্যা বৃদ্ধির সংগে সংগে জলের চাহিদা বৃদ্ধি পাচ্ছে। ১৯৯৭ সালে যেখানে বার্ষিক জলের চাহিদা ছিল ৫৫২ ঘনকিমি, সেখানে ২০২৫ সালে বার্ষিক জলের চাহিদা দাড়াবে আনুমানিক ১০৫০ ঘনকিমি। তাই ভারতের মতো নদীমাতৃক দেশে অদূর ভবিষ্যতে চরম জল সংকটের মুখে পড়তে পারে বলে আশঙ্কা করা হচ্ছে। তাই ভারতে ছোট ছোট জলবিভাজিকা নির্মান ও জল সংরক্ষন উপর জোর দিতে হবে।

জল সম্পদ সংরক্ষন জন্য ১৯৯২ সালে ব্রাজিলের রিও ডি জেনিরোতে United Nations Conference on Environment & Development এ প্রথম বিশ্ব জলদিবস পালনের প্রস্তাব উত্থাপিত হয় ; এবং ১৯৯৩ সাল থেকে প্রতিবছর ২২ শে মার্চ বিশ্ব জল দিবস পালিত হচ্ছে। সারা বিশ্বে পরিশ্রুত জলের গুরুত্ব,তার যোগান ও ভান্ডার কে সুরক্ষিত রাখা নিয়ে সচেতন করতে এই দিনটির বিশেষ গুরুত্ব রয়েছে।

The Mahabharata and the Sindhu-Sarasvati Tradition

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The Mahabharata as an encyclopaedia of early Indian culture and history may be expected to shed light on the Sindhu-Sarasvati (SS), or Indus, Tradition. For example, the Mahabharata and the Puranas call Visnu and Siva by the name Ekasrnga, the "one-horned one," or the unicorn, which is one of the most striking images from the mature phase of the SS Tradition.

The Santi-Parva (chapter 343) of the Mahabharata speaks of the one-tusked boar (Varaha) who saves the earth as Visnu's incarnation. Here Varaha is described as being triple-humped, a figure that we see in the Harappan iconography. There is other continuity of motif and style between the SS Tradition and the classical Indian culture.

The change in the focus of the civilization from the Sarasvati river to the Ganga is not only implicit in the Puranic story of the descent of Ganga but also in the statement in the Mahabharata (Vana Parva, chapter 85) that in the Treta Puskara was the holiest tirtha, in Dvapara it was Kurukshetra, and in the Kaliyuga it is Prayaga.

The Mahabharata telescopes early genealogical history. The Puranic king-lists provide useful clues to the sequence of events. Some of the main events are: Generation 45, Bhagiratha, Ganga changes course; Generation 65, Rama Dasarathi, Dvapara begins; Generation 94, Mahabharata War. Given that the Mahabharata War took place several centuries before the Buddha, it is clear that even if we allocate only 20 years to each generation, the Puranic king-lists reach back into the early phases of the SS Tradition.

The Greek historians inform us that the Indians during the time of the Mauryas remembered more than 150 generations of kings spanning over 6,000 years. (We assume that these lists remember the prominent kings only.) The earliest calendar in India was centennial, with a cycle of 2,700 years. Called the Saptarsi calendar, it is still in use in several parts of India. Its current beginning is taken to be 3076 BC. Notices by the Greek historians Pliny and Arrian suggest that, during the Mauryan times, the calendar used in India began in 6676 BC. It is very likely that this was the Saptarsi calendar with a beginning of 6676 BC.

The SS Tradition has been traced to about 7000 or 8000 BC in Mehrgarh in northwest India. It is seen to have evolved in four distinct stages as follows:

Table. Phases of the SS Tradition

1. Early Agriculture Economy Era **8000 BC – 5500 BC**	Mehrgarh, Period I Aceramic, Neolithic, 8000 – 5500 BC
2. Regional Growth Era **5500 BC – 2600 BC**	Mehrgarh, Period II, 5500 – 4800 BC Mehrgarh, Period III, 4800 – 3500 BC Harappa, Period I, 3500 –2800 BC Harappa, Period II, 2800 – 2600 BC
3. Integration Era **2600 BC – 1900 BC**	Harappan Phase Harappan Period, 3C, Final, 2200 – 1900 BC
4. Localization Era **1900 BC – 1300 BC**	Late Harappan Phase, 1900 – 1300 BC Harappa, Periods 4 and 5, 1900 – 1700 BC Beginnings of the Ganga Phase

♦ The Date of the Mahabharata:

Let's consider the epoch for the Mahabharata War. By popular tradition, the Kali Age started with the death of Krishna, 35 years after the War. The Kali calendar has a beginning of 3102 BC, therefore it is thought that the Mahabharata War took place in 3137 BC. The Kali age is supposed to have begun with a grand planetary conjunction.

The first mention of the Kali calendar is by the astronomer Aryabhata in his treatise on astronomy with an internal date of 500 AD. The earliest epigraphical reference is in the 5th century inscription of King Devasena where it is alluded to indirectly, and in the Aihole inscription of 3735 Kali (634 AD). Because of these late references, some scholars have suggested that the Kali calendar was started at a late period with an assumed conjunction at the beginning of the era for convenience of calculations, and, therefore, the Aihole inscription cannot be taken as proof of the date of the War. The most prominent competing theories may be gathered into the following four classes:

1. The date of around 1000 BC. This is the date popularized by Western Indologists as being most "reasonable" based on archaeological data. Repeated in numerous school texts, it has achieved a certain kind of canonicity. This date was first proposed within the framework of the Aryan invasion theory. Although that theory has been discredited, this date has taken independent life of its own.
2. The date of 1924 BC. Based on Puranic genealogies that see a gap of 1000 years or so between the War and the rule of the Nandas (424 BC) we get the date of 1424 BC. But Pargiter, while editing these accounts from the various Puranas,4 suggested that the original number was 1,500 which was wrongly copied in various texts as 1000, 1015, or 1050. I accept the arguments of Pargiter and, therefore, consider the Puranic tradition to support the date of 1924 BC. Furthermore, the date of 1424 BC sits in the middle of an obscure period, and it is hard to see how the events of that age would not have left markers in the archaeological record.
3. The date of 2449 BC. This is based on a statement by Varahamihira in 505 AD in chapter 13 of the Brihat Samhita, where it is claimed that the commencement of the Saka era took place 2,526 years after the rule of the king Yudhisthira. If the Saka era meant here is the Salivahana era (78 AD), then the date follows. Some scholars have suggested that this Saka era refers to the one started by an earlier Saka king in Central Asia and that this date is not at variance with the Kali date of Aryabhata.
4. The date of 3137 BC. The traditional value, mentioned by Aryabhata and in the Aihole inscription of 634 AD.

♦ The Puranic Tradition:

The king-list for Magadha has the following dynasties in the post-Bharata War period:

1. Brhadrathas (32 kings) 967 years;
2. Pradyotas of Avanti (5 kings) 173 years;
3. Sisunagas (10 kings) 360 years;
4. Nandas (Mahapadma + sons) 100 years;
5. Mauryas (9 kings) 137 years;
6. Sungas (10 kings) 112 years;
7. Kanvas (4 kings) 45 years;
8. Andhras (30 kings) 460 years.

We know that Candragupta Maurya started his reign in 324 BC. Therefore, if we were to accept these periods, the dynastic eras for the post-Bharata age will be:

1. Brhadrathas 1924-957 BC,
2. Pradyotas 957-784 BC,
3. Shishunagas 784-424 BC,
4. Nandas 424-324 BC,
5. Mauryas 324-187 BC and so on.

Basic Concepts of Geomorphology

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The basic or fundamental concepts of geomorphology are as follows:

1. **The same physical processes and laws that operate today operated throughout geologic time, although not necessarily with the same intensity as now.**

   This is the important principle of geology and is known as the *principle of uniformitarianism.* It was first enunciated by Hutton in 1785. According to Hutton " the present is the key to the past ". According to him geologic processes operated throughout geologic time with the same intensity as now. We know that it is not true. Glaciers were much more significant during the Pliestocene and during other periods of geologic time than now; world climates have not always been distributed as they now are, and, thus, regions that are now humid have been desert and areas now desert have been humid. There are numerous examples which shows that the intensity of various geologic processes has varied through geologic time.

2. **Geologic structure is a dominant control factor in the evolution of landforms and is reflected in them.**

   The major controlling factor in land form development is structure and process. Here the term structure includes not only the folds, faults etc. but all those ways in which the earth materials out of which land forms are carved differ from one another in their physical and chemical attributes. It includes such as rock attitudes; presence or absence of joints, bedding planes, faults, and folds; rock massiveness; hardness of constituent minerals; the susceptibility of the mineral constituents to chemical alteration; permeability and impermeability of rocks; and various other ways by which the rocks of the earth crust differ from one another. The term structure also has stratigraphic implications, and knowledge of the structure of a region implies as appreciation of rock sequence, both in outcrop and in subsurface, as wel as regional relationship of the rock strata.

   In general the structures are much older than the geomorphic forms developed upon them. Such major structural features as folds and faults may go back to far distant periods of diastrophism.

3. **To a large degree the earth's surface possesses relief because the geomorphic processes operate at different rates.**

   The rocks of the earth's crust vary in their lithology and structure and hence offer varying degrees of resistance to the gradational processes. Differences in rock composition and structures are reflected not only in regional geomorphic variability but in the local topography as well. The local intensity of particular processes may change notably in response to differences in such factors as temperature, moisture, altitude, exposure, topographic configuration, and the amount and type of vegetal cover. The microclimatic conditions may vary markedly between a valley floor and a hilltop, between a northern and a southern exposure, and between bare ground and that with a heavy vegetal cover. The rate of all weathering, all mass-wasting, all erosion, and all deposition varies appreciably within rather narrow limits in relation to the influence of local conditioning factors.

4. **Geomorphci processes leave their distinctive imprint upon land forms, and each geomorphic process develops its own characteristic assemblage of land forms.**

The term process applies to the many physical and chemical ways by which the earth's surface undergoes modification. In general endogenetic processes (originate from forces within the earth crust such as diastrophism and volcanism) tend to build up or restore areas which have been worn down by the exogenetic processes (results from external forces like weathering, masswasting, erosion); otherwise the earth's surface would finally become largely featureless. Just like plants and animals land forms have their individual distinguishing features depending upon the geomorphic process responsible for their development.

A proper appreciation of the significance of process in land form evolution not only gives a better picture of how individual land forms develop but also emphasizes the genetic relationships of landform assemblages. Land forms are not haphazardly developed with respect to one another but certain forms may be expected to associated with each other. Thus the concept of certain types of terrain becomes basic in thinking of geomorphologist. Most landscape are the products of a group of processes. The complex of geomorphic processes and agents which operates under a particular set of climatic conditions has been termed a *morphogenetic system.*

5. As the different erosional agents act upon the earth's surface there is produced an orderly sequence of land forms.

The land forms possess distinctive characteristics depending upon the stage of their development. This idea was most stressed by W. M. Davis and out of this idea grew his concept of *geomorphic cycle* and its concomitant stages of youtj, maturity, and old age culminating in a topographic surface of low relief called *peneplain*. Use of the term geomorphi cycle will carry with it implication of orderly and sequential development but there will be no implication that designation of the topography to a certain area as youthful, mature or old means that the topography of another region in the same stage of development has fully comparable characteristics. Under varying conditions of geology, structure, and climate land form characteristics may vary greatly even though the geomorphic processes may have been acting for comparable periods of time. Partial cycles are more likely to occur than completed ones , for much of the earth's crust is restive and subject to intermittent and differential uplifts.

6. Complexity of geomorphic evolution is more common than simplicity.

Usually most of the topographic details have been produced during the current cycle of erosion, but there may exist within as area remnants of features produced during prior cycles. Commonly we are able to recognise the dominance of one cycle. Horberg (1952) divided the landscapes into five major categories: (1) simple, (2) compound, (3) monocyclic, (4) multi-cyclic and (5) exhumed.

Simple landscapes are those which are the product of a single dominant geomorphic process, compound landscapes are those in which more than one geomorphic processes have plays major role in the development of existing topography. Monocyclic landscapes are those that bear the imprint of only one cycle of erosion; multicyclic landscapes have been produced during more than one cycle of erosion. Much of the earth's topography bears the imprints of more than one period of erosion. Exhumed or resurrected landscapes are those which were formed during some past period of geological time, then buried beneath a cover mass of igneous or sedimentary origin, then still later exposed through removal of the cover. Topographic features now being exhumed may date back as far as the Precambrian or they may be as recent as Pleistocene.

7. Little of the earth's topography is older than tertiary and most of it no older than Pleistocene.

Most of the details of our present topography probably do not date back of the Pleistocene, and certainly little of it existed as surface topography back of the tertiary. The Himalayas were probably first folded in the Cretaceous and later in the Eocene and Miocene but their present elevation was not attained until the Pleistocene and most of the topographic details in Pleistocene or later in age.

8. Proper interpretation of present-day landscape is impossible without a full appreciation of the manifold influences of the geologic and climatic changes during the Pleistocene.

Pleistocene have had far-reaching effects upon present-day topography. Glaciation directly affected many million square miles, perheps as much as 10,000,000 square miles, but its effects extended far beyond the areas actually glaciated. Glacial outwash and windblown materials of glacial origin extended into areas not glaciated, and climatic effects were probably worldwide in extent. In the middle latitude regions the climatic effects were profound. There is indisputable areas evidence that many regions that are today arid or semiarid had humid climates during the glacial ages. Although glaciation was probably the most significant event of the Pleistocene, we should not loose sight of the fact that in many areas the diastrophism which started during the Pliocene continued into the Pleistocene and even into the Recent. Around the Pacific ocean, Pleistocene diastrophism has played a most significant role in shaping of present-day landscapes.

9. **An appreciation of world climate is necessary to a proper understanding of the varying importance of the different geomorphic processes.**

Climatic variations may affect the operation of geomorphic processes either indirectly or directly. The indirect influences are largely related to how climate affects the amount, kind, and distribution of the vegetal cover. The direct controls are such as the amount and kind of precipitation, its intensity, the relation between precipitation and evaporation and daily range of temperature, whether and how frequently the temperature falls below. There are, however, other climatic factors whose effects are less obvious, such as how long the ground is frozen, exceptionally heavy rainfalls and their frequency, seasons of maximum rainfall, frequency of freeze and thaw days, differences in climatic conditions as related to slopes facing the sun and those not so exposed, the differences between conditions on the windward and leeward sides of topographic features transverse to the moisture-bearing winds, and the rapid changes in climatic conditions with increase in altitude.

10. **Geomorphology, although concerned primarily with present day landscapes, attains its maximum usefulness by historical extension.**

Geomorphology concerns itself primarily with the origins of the present landscape but in most landscapes there are present forms that date back to previous geological epochs or periods. A geomorphologist is thus forced to adopt an historical approach if he is to interpret properly the geomorphic history of a region. The palogeomorphology covers the identification of ancient erosion surfaces and study of ancient topographies.

Field Survey Procedures for Characterization of River Morphology

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FIELD SURVEY PROCEDURES FOR CHARACTERIZATION OF RIVER MORPHOLOGY:

By DAVE ROSGEN

- Locate a reach for a minimum of 20 channel widths (Two Meander Wavelengths).
- This reach should characterize or represent the dimension, Pattern, Profile, and materials of the stream type you select.
- Select the reach starting point for the survey at the upstream location. Locate reach on aerial photo and map.

A. DIMENSION:

1) Establish a cross-section at the start of the survey reach. Establish a Permanent Benchmark to tie Both Cross-Section and longitudinal profile to an elevational control for future comparison. The Benchmark should be located a sufficient distance from the edge of the bank to prevent loss of the reference elevation by lateral erosion. The benchmark should be of a permanent installation using Sackrete with Stove Bolt into a "cone hole". Another alternative is to drive 5/8" rebar 4' into the ground and place a cap over the rebar, flush with the ground surface.

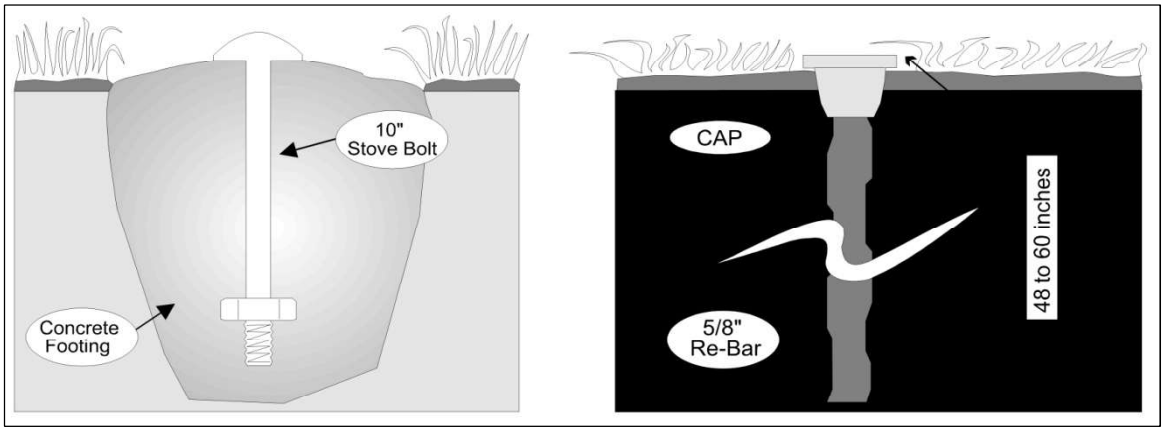

Fig. - Benchmark Examples.

2) The cross-section needs to show:

- Benchmark elevation and location,
- Terraces and floodplain,
- Flood prone area width and depth,
- Bankfull stage (Both left and right banks),
- Existing left and right edge of water,
- Variability in shape of cross-section,
- Thalweg.

3) Start Cross-Section with the zero end of tape on left bank (looking downstream).

4) The following information is obtained from the cross-section:

a. Bankfull width (W_{bkf}),

b. Mean Bankfull depth (d_{bkf}) (cross sectional area (A_{bkf})/(W_{bkf}),

c. Width/depth ratio W_{bkf} /d $_{bkf}$,

d. Entrenchment ratio = W_{FPA}/ W_{bkf} [Flood prone Area width (W_{FPA}) = (width at an elevation2 × maximum bankfull depth)],

e. Cross-sectional area at the bankfull stage (A_{bkf}). Cross-sectional area is obtained by computing the sum of the products of the intervals of width times depth across the section. Wetted perimeter @ the bankfull stage.

f. Wetted perimeter @ the bankfull stage (WP):

i. measure from from plotted cross section, or,

ii. approximate by computation:

$$WP = \left(2d_{bkf}\right) + \overline{W}_{bkf}$$

$$Where: \overline{W} = \frac{\left(W_{top} + W_{bottom}\right)}{2}$$

OR:

$$WP = W_{bottom} + 2\sqrt{\overline{d}^{2}_{bkf} + \left(\overline{W}_{bkf} - W_{bottom}\right)^{2}}$$

$$Where: \overline{W} = \frac{\left(W_{top} + W_{bottom}\right)}{2}$$

g. Compute bankfull hydraulic radius (R_{bkf} = mean hydraulic depth):

$$R_{bkf} = \frac{A_{bkf}}{WP}$$

h. Estimate mean bankfull velocity (U_{bkf}) in ft/sec.

i. Estimate bankfull discharge (Q_{bkf}) = A_{bkf} x U_{bkf}.

j. Obtain drainage area (mi^2) from topographic map. Compare regional curves at the bankfull stage for; cross-sectional area, width, depth, velocity and discharge by drainage area.

B. PROFILE:

1) Start the longitudinal profile from first cross-section and tie-into a permanent elevation control for replicate measurements.

2) Obtain the following elevations on the longitudinal profile:

- Bed surface,
- water surface,
- Bankfull stage,
- Bank height (note left and /or right bank) (Optional).

3) Measure Thalweg elevation, i.e. maximum depth. Make sure to measure changes in elevation that indicate the shape, depth, and length of pools and other features to accurately define the bed features along the profile.

4) Locate other cross-sections with longitudinal stationing as reach identifiers i.e. crosssection 3+50 is located 350 feet down from start of profile.

5) The number of points (elevations) obtained along the profile should be sufficient to describe the show the length and depth of pools and well as other bed features such as runs and glides.

6) The following data is obtained from the longitudinal profile:

- Average slope (S) (using water surface),
- Bankfull slope (S_{bkf}) (for certain hydraulic and sediment computations),
- Maximum riffle depth,
- Ratio of maximum riffle depth/average depth (d_{maxrif} / d_{bkf}),
- Riffle slope,
- Ratio of riffle slope to average water surface slope (S_{riff} /S),
- Pool slope,
- Ratio of pool slope to average water surface slope (S_{pool} / S),
- Maximum pool depth (d_{pool}),
- Ratio pool depth to average bankfull depth (d_{pool} / d_{bkf}),
- Riffle/pool spacing or pool to pool distance (r-p / W_{bkf}).

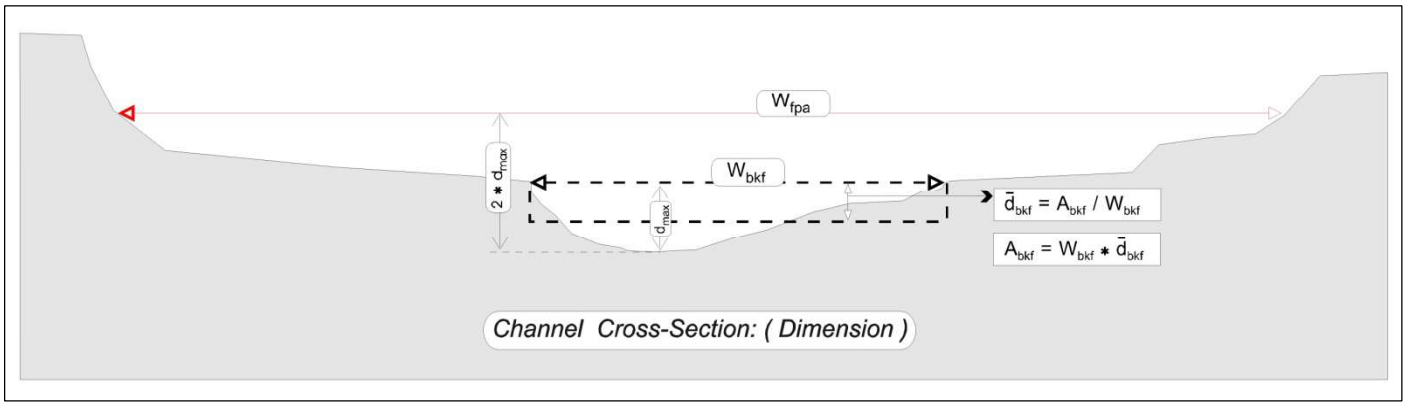

Fig. - Channel Cross Section.

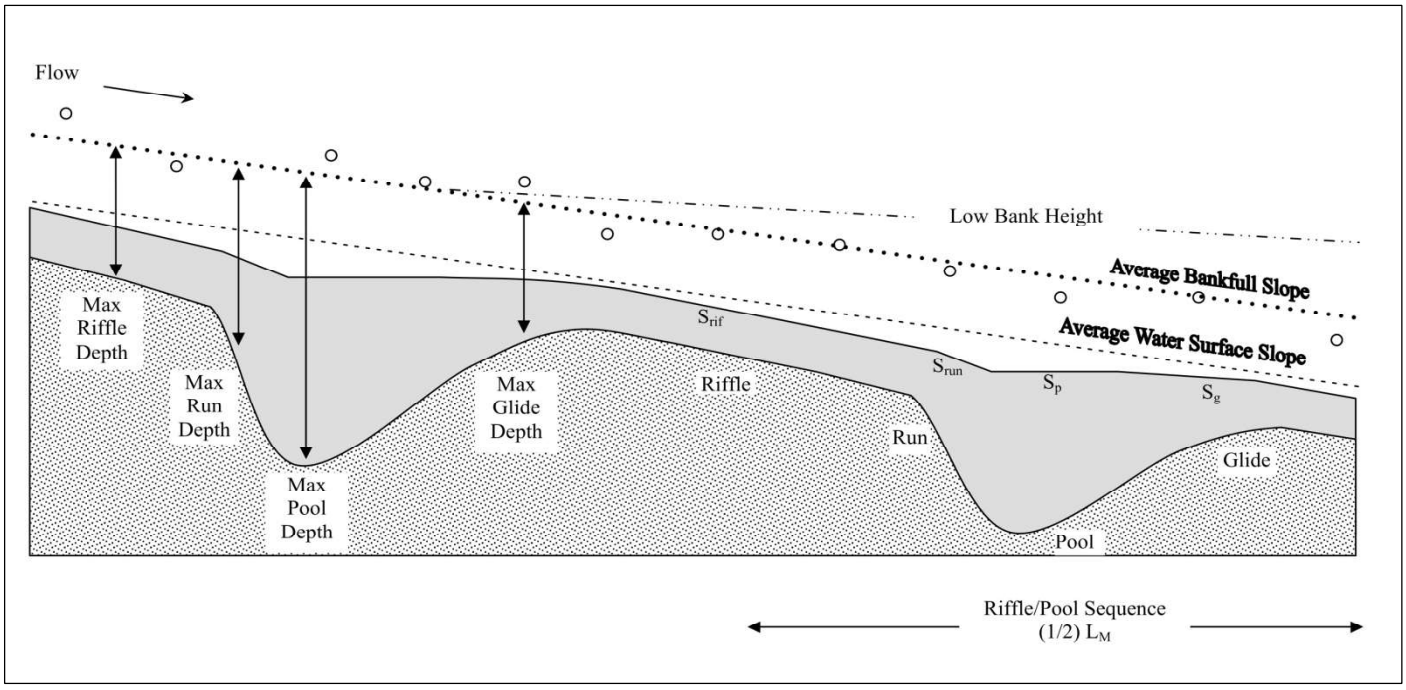

Fig. - Longitudinal Profile.

C. PATTERN:

From aerial photos or from field survey obtain the following information:

1) Radius of curvature (R_c) Obtain for minimum, maximum and average values. Besides measuring on aerial photo or in field, another technique for field measurement is the Chord length/mid-ordinate method where $R_c=C^2/8M+M/2$.

2) Meander wavelength (Lm) Obtain minimum maximum and average values.

3) Ratio of meander wavelength to bankfull width (L_m / W_{bkf}).

4) Meander width ratio (belt width/ bankfull width, or lateral containment) (W_{BLT}/W_{bkf}) Measure minimum, maximum and average meander width ratios.

5) Arc length (L_{arc}).

6) Sinuosity (Stream length/ Valley distance, or valley slope/ channel slope).

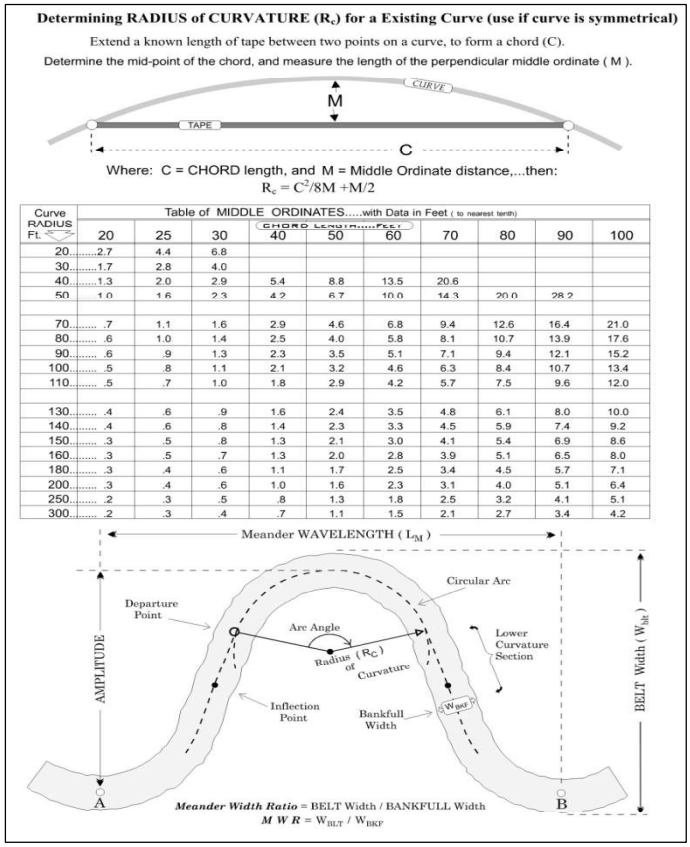

Fig. - Pattern.

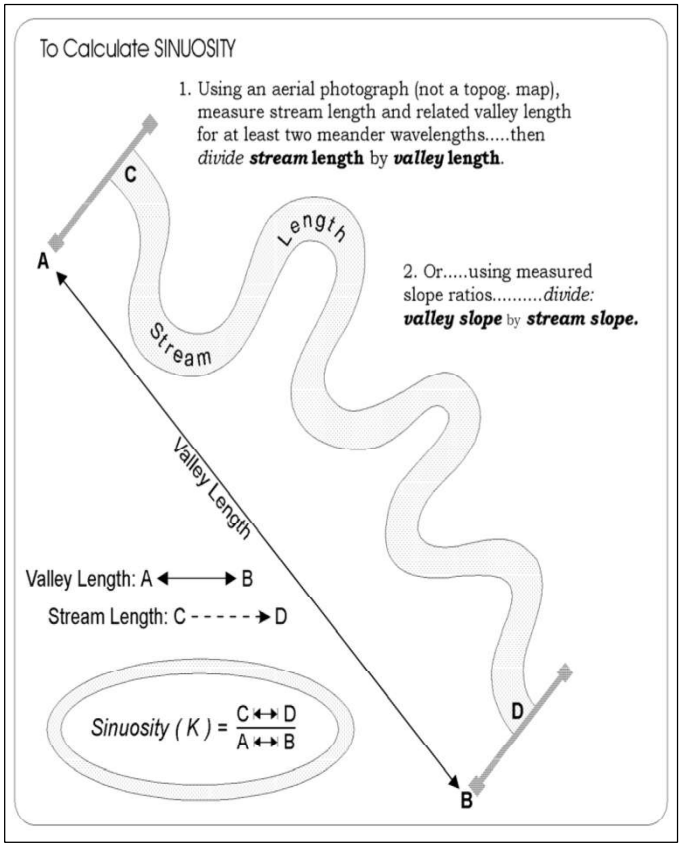

Fig. - Sinuosity.

D. GENERAL INFORMATION:

- The location, elevation, and type of each cross section is tied to the longitudinal profile.

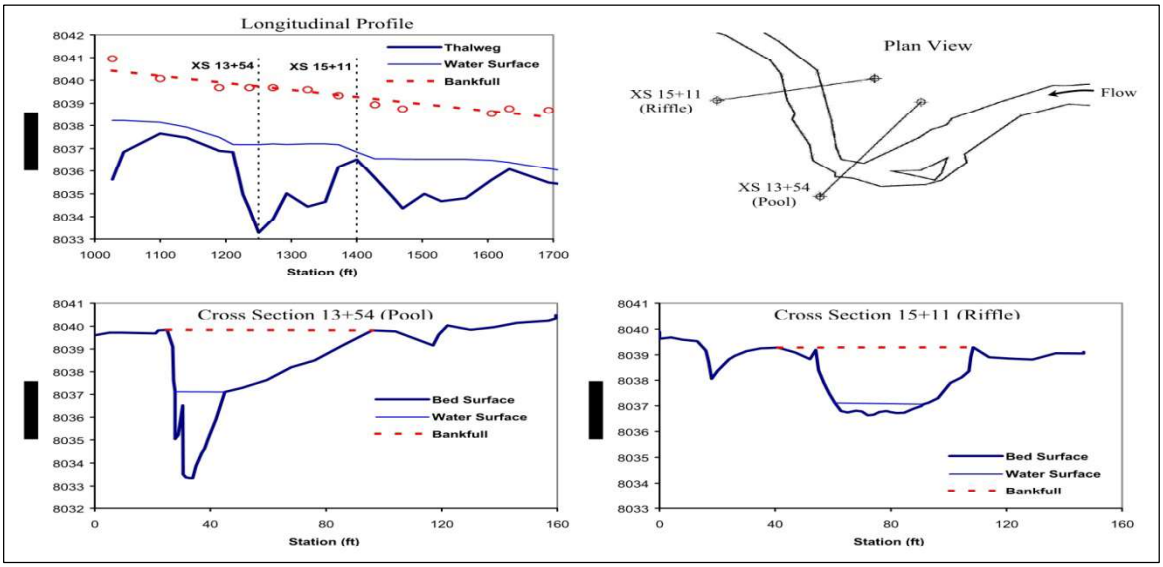

Fig. - Profile, Cross Section, and Plan View.

GIS Data Types: Vector vs. Raster

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GIS Data Types: Vector vs. Raster

VECTOR

Basic Elements:

- Location (x,y) or (x,y,z)
- Explicit, i.e. pegged to a coordinate system
- Different coordinate system (and precision) require different values
  - e.g. UTM as integer (but large)
  - Lat, long as two floating point numbers +/-
- Points are used to build more complex features

Advantages of Vector Data Structures:

- Good representation of phenomenonology
- Compact
- Topology can be completely described
- Accurate graphics
- Retrieval, updating and generalization of graphics and attributes possible

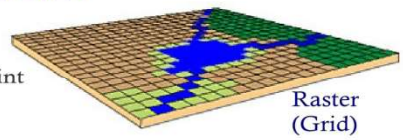
Disadvantages of Vector Data Structures:

- Complex Data Structures
- Combination of several vector polygon maps through overlay creates difficulties
- Simulation is difficult because each unit has a different topological form
- Display and plotting can be expensive, particularly for high quality color
- The technology is expensive, particularly for the more sophisticated software and hardware
- Spatial analysis and filtering within polygons are impossible

VECTOR FORMATS

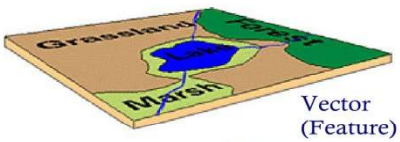
1. Shapefile

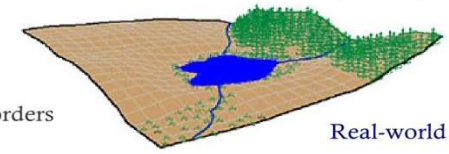
Contains:
- Point, or multi-point
- Line, or polyline
- Polygon



2. Coverage

Contains:
- Point, or node
- Arc, or line
- Polygon
- Label





EXAMPLES

- Administrative borders
- Linear features
- Roads
- Rivers
- Discrete habitat boundaries

RASTER

Basic Elements:

- Extent
  - # Rows
  - # Columns
- Origin
- Orientation
- Resolution: pixel = grain = grid cell

Advantages of Raster Data Structures:

- Simple data structures
- Overlay and combination of maps and remote sensed images easy
- Some spatial analysis methods simple to perform
- Simulation easy, because cells have the same size and shape
- Technology is cheap

Disadvantages of Raster Data Structures:

- The use of large cells to reduce data volumes means that phenomenonologically recognizable structures can be lost and there can be a serious loss of information
- Crude raster maps are considerably less beautiful than line maps
- Network linkages are difficult to establish
- Projection transformations are time consuming unless special algorithms or hardware is used.

EXAMPLES

- Temperature (air, water)
- Air pressure
- Ecotones
- Soil ph
- Precipitation
- Salinity
- Elevation & its derivatives
- Flow
- Direction, distance
- Reflectance (photography/imagery)

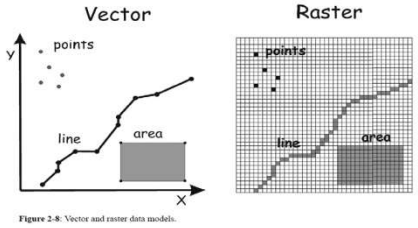


Figure 2-8: Vector and raster data models.

আর্থ আওয়ার: ২৪ শে মার্চ, ২০১৮

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বিশ্বব্রহ্মান্ডের মধ্যে আমাদের পৃথিবী একটি ক্ষুদ্র গ্রহ। বিশ্বব্রহ্মান্ডের অন্যান্য গ্রহের মতো পৃথিবীর জলবায়ুও ক্রমশ পরিবর্তিত হচ্ছে। বিজ্ঞানীরা নিরন্তর গবেষনার পর দেখেছেন, ৪৬০ কোটি বছর আগের উষ্ণ পৃথিবী আজকের ১৫ ডিগ্রি সেন্টিগ্রেড গড় তাপমাত্রায় নামতে বহু উত্থানপতনের সম্মুখীন হয়েছে। বিভিন্ন যুগে পৃথিবীর তাপমাত্রা বহুবার হ্রাসবৃদ্ধি হয়েছে। কোন যুগে পৃথিবীর তাপমাত্রা কমে বরফে আচ্ছাদিত হয়েছে, যা হিমযুগ; আবার কালক্রমে উষ্ণতা বেড়ে সেই বরফের স্তর গলে গিয়ে পৃথিবীতে অন্তবর্তি হিমযুগ এসেছে।

জলবায়ু বিজ্ঞানীদের মতে ২০ শতকে পৃথিবীর তাপমাত্রা ০.৫-০.৭ ডিগ্রি সেন্ড্রিগ্রেড বৃদ্ধি পেয়েছে। ২০ শতকের শেষ দুই দশক ও একুশ শতকের প্রথম ছয় বছরে (২০০১-২০০৬) পৃথিবীর গড় তাপমাত্রা ১৮৭৮ সাল থেকে সবচেয়ে বেশী বৃদ্ধি পেয়েছে। পৃথিবীর এই উত্তোরোত্তর তাপমাত্রা বৃদ্ধির ফলে ২০৫০ সালে পৃথিবীর গড় তাপমাত্রা বৃদ্ধি পাবে ৩.৫ ডিগ্রি সেন্টিগ্রেড।

বিশ্ব উষ্ণায়ন তথা জলবায়ু পরিবর্তন নিয়ে সচেতনতা বাড়াতে ২০০৭ সালে অষ্ট্রেলিয়ার সিডনি অপেরা হাউসে একটি নিদৃষ্ট সময় (বিশেষত রাত্রে) নিষ্প্রদীপ রাখা হয়। মার্কিন উপরাষ্ট্রপতি ও পরিবেশ প্রেমী অ্যালগোরের ভাবনার ফসল এই আর্থ আওয়ার। আজ শনিবার, প্রায় দেড়শোর বেশী দেশের প্রায় সাত হাজার শহরে, বিভিন্ন দেশের স্থানীয় সময় রাত্রি ৮:৩০-৯:৩০ পর্যন্ত WWF উদ্যোগে আর্থ আওয়ার পালিত হচ্ছে।

ভারতের রাষ্ট্রপতি ভবন, ইন্ডিয়া গেটে, মহারাষ্ট্রের ছত্রপতি শিবাজি টার্মিনাসে, মালয়েশিয়ার কুয়ালালামপুরের পেট্রোনাস বিল্ডিং এ, প্যারিসের আইফেল টাওয়ার, বার্লিনের ব্র্যানডেনবার্গ গেটে, মস্কোর স্টেট ডিপার্টমেন্ট স্টোর (GUM), রাশিয়ার সেন্ট বাসিলস ক্যাথিড্রাল ও ক্রেমলিনে, রোমের কলোজেল, জলবায়ু পরিবর্তন এবং প্রকৃতি রক্ষায় সচেতনতা সৃষ্টির প্রয়াসে বরাবরের মতো এবারও বিশ্বের বিভিন্ন দেশে পালিত হল আর্থ আওয়ার।

Catchment

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What is a Catchment?

The amount of water carried by a stream, the shape of the channel, the chemical composition of its water, and its ability to support life are determined by its catchment and what is happening there. A stream is only as healthy as its surrounding catchment.

This section will help you to look beyond the stream, and learn about the land that surrounds it.

Everybody lives in a catchment.

A **catchment** is a basin shaped area of land, bounded by natural features such as hills or mountains from which surface and sub surface water flows into streams, rivers and wetlands. Water flows into, and collects in, the lowest areas in the landscape. The system of streams which transport water, sediment and other material from a catchment is called a **drainage network**.

A catchment catches water which falls to earth as precipitation (rainfall), and the drainage network channels the water from throughout the catchment to a common outlet. The outlet of a catchment is the mouth of the main stream or river. The mouth may be where it flows into another river or stream, or the place where it empties into a lake, estuary, wetland or ocean.

Catchments vary in size from large ones such as the Waikato, which begins in Tongariro National Park, includes most of Waikato Region (see map on the next page) and extends to the ocean just south of Auckland, to the myriad of small catchments that drain Mt. Taranaki.

Tributaries are small feeder streams that empty into larger streams or rivers. The catchments of tributaries are referred to as sub-catchments. Large catchments are often made up of a number of smaller sub-catchments. For example, the catchment of the Buller River contains eleven major sub-catchments.

Whatever happens in each of the smaller streams affects the overall wellbeing of the main waterway.

What does your catchment look like?

It is quite a simple task to trace your catchment boundaries and drainage network from a topographical ('topo') map onto tracing paper, and to examine the pattern of streams and rivers that cover the reaches of your catchment.

No catchment is exactly like another. Each has a different size, shape, drainage pattern and features that are determined by natural processes, particularly geology and climate.

The geology of your catchment will influence many of its characteristics, from the stability of the stream banks and streambed to the natural pH of the water.

Climatic processes and flowing water erode and shape the land. As rocks are broken down into smaller pieces they can be transported in the flow. Fine materials are transported as sediment throughout the catchment. Weathered rock and organic matter make up the soils that blanket the landscape.

Soils have different textures, mineral content, structure, and drainage properties. The nature of the soils in your catchment will have a key role in deciding how much water runs off the land and how likely the land is to erode.

Upper Catchment - The Headwaters:

Streams begin their journey to the sea in the upper reaches of the catchment. Some may appear briefly, flowing only during periods of intense rainfall. Some are intermittent, flowing during the wet seasons of the year. Others are more permanent, having year-round flow.

If the stream is steep it will be fast-flowing and energetic. This means that it has the energy to carry large amounts and large-sized pieces of rock and gravel which have been eroded from stream beds and banks.

Streams tend to be narrower here and riparian vegetation almost completely covers the stream with its canopy. Very little sun reaches these streams, so the water temperature remains cool throughout the year.

Low light levels restrict algal growth, and upstream plant eaters (herbivores) rely mostly on food material from outside the stream, leaves, fruits, seeds, twigs and bark. This coarse material is made finer by physical abrasion and microbial activity.

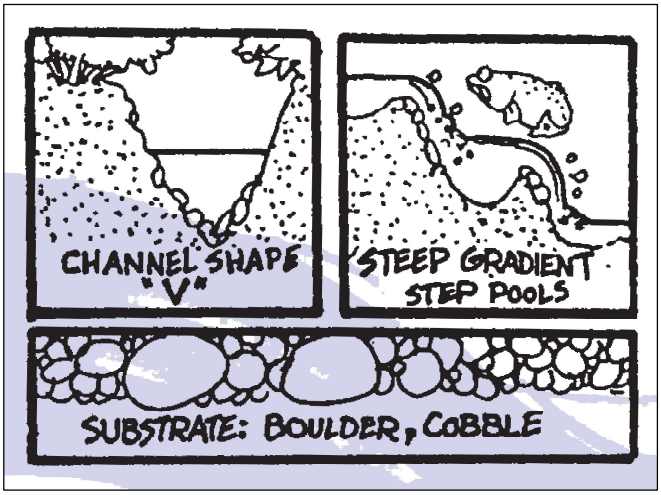

Fig. - Upper River Reach: Relatively Straight Channel.

Some more processing is done by macro invertebrate 'shredders', but there are not many in New Zealand streams. Collector-browsers tend to dominate in these sections (see Glossary). Coarse organic debris, especially larger woody debris, also provides habitat for stream life.

In headwater streams that are not shaded by stream bank vegetation, attached algae and rooted aquatic plants produce most of the available food.

Headwater streams in unforested areas tend to show greater seasonal and daily changes in water temperature. In these streams, sunlight and air temperature have greater effects on water temperature.

Rocks, pebbles and bedrock are characteristic of fast-flowing headwater streams, and these substrates are usually well sorted. Rocks, pebbles and the mosses etc growing on provide many habitats for aquatic macro invertebrates.

The headwaters of a river system can be very important to the health of the entire river.

Macro invertebrates and fish species are provided with lots of varied habitat, making these areas important for restocking depleted downstream sites. These areas also provide much of the food carried downstream.

Dams and weirs restrict the distribution of food and the movement of aquatic animals.

Middle Catchment:

In the middle reaches of the catchment some tributaries have entered the stream and added to the flow. The land is generally flatter, and the flow of the stream is slower. There are frequent shallow areas of faster moving water called riffles, where rocks break the surface and deeper areas of water called pools. The bottom substrate is composed of mostly gravel and cobble.

The channel has widened into a .U. shape and you can usually detect a flood plain - a flat area beside the stream bank. The stream regularly overflows onto this area, slows, and dumps its load of sediment.

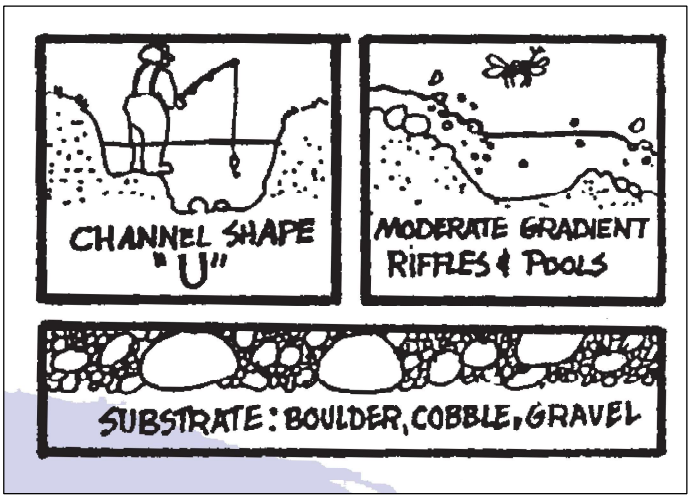

Fig. - Middle River Reach: Meandering or Braided Channel.

The stream often flows across the flood plain in curves or meanders. Usually there is a combination of erosion on the outside edge of bends, where the water flow is more rapid, and sediment in areas where the water flow is slower.

In these middle reaches the canopy no longer reaches across the stream to shade the entire water surface. Here the sun is able to warm the water, raising water temperature over the day. Slower flows, together with murkier water in these reaches may increase the heat. Seasonal changes in water temperature are usually greatest in this section.

Organic debris still falls into the stream from the riparian zone but the amount of light increases algae become an important part of the food base. As the nature of the food base changes there is a shift in the kind of life. Grazer and collector macro invertebrates dominate this section of the stream.

Lower Catchment:

Moving downstream towards the streams mouth, more tributaries have entered and added more flow. The wider, deeper channel meanders through a flat flood plain and broad valley. The stream travels very slowly and deposits the large quantities of sediment it has been carrying from further upstream.

Although the water is unshaded, the murky water limits sunlight penetration, but some attached algae may grow in the shallows if stones or other suitable substrate are available. Fine particles replace organic debris and algae as the food source.

The community of small aquatic organisms is changed again. Collector-filterer macro invertebrates are more common in this stretch of the stream, filtering out accumulated minute particles suspended in the water and gathering fine particles that have settled to the river bottom.

In slower stream reaches, there is less spread of atmospheric oxygen into the surface water. This causes even lower dissolved oxygen levels in the streambed sediments. The breakdown of organic matter often decreases the dissolved oxygen level in the sediments even more. Organisms that tolerate lower oxygen levels and that prefer slower flowing water are more common in this section of the stream.

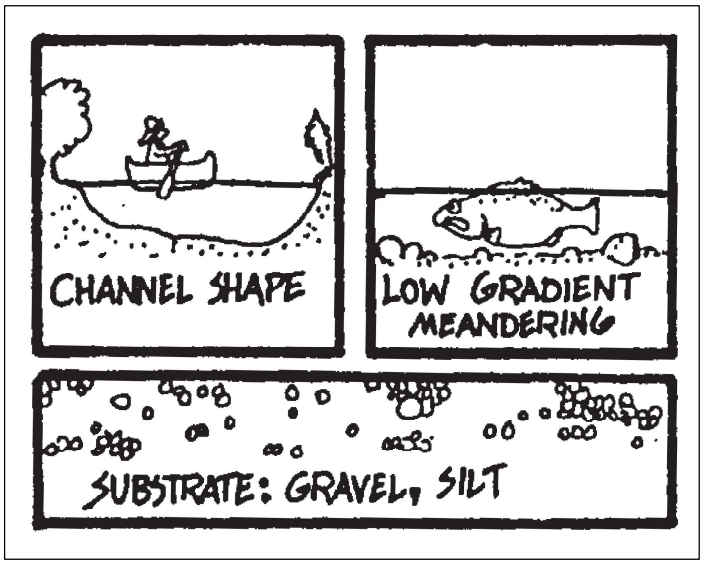

Fig. Lower River Reach: Wide Arching Loops and Meandering Channel.

At its mouth, the stream or river empties into another body of water and carries its remaining load of sediment, debris and other substances. Lakes and estuaries gather these, which can damage them. Estuaries are particularly sensitive environments and their role as a nursery for fish is easily disturbed.

Stream Order

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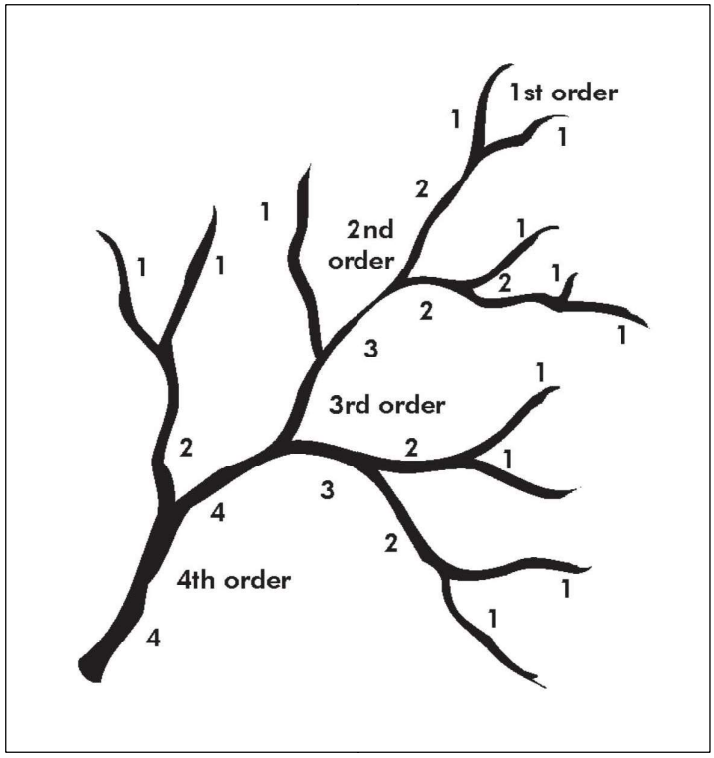
Stream order only changes when two streams with the same classification meet. For example, when a first order stream meets a second order stream the resulting stream remains a second order stream.

Strahler's Stream Order:

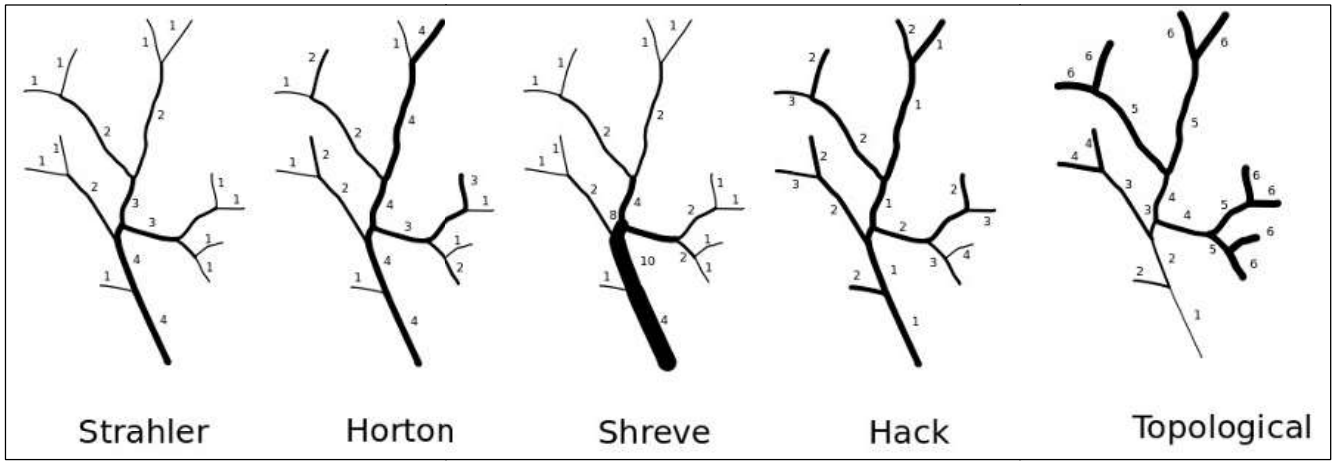


Strahler's stream order is a modification of Horton's stream order which fixes the ambiguity of Horton's ordering. In Strahler's ordering the main channel is not determined; instead the ordering is based on the hierarchy of tributaries. Streams are often classified by size. Within any catchment the smallest streams that have year round flow and no tributaries are called **first order** streams. When two first order streams meet they form a **second order** stream. A **third order** stream is formed when two second order streams join, and so on.

Advantages and Disadvantages of Strahler's Ordering:

Strahler's stream order has a good mathematical background. All catchments with streams in this context are directed graphs, oriented from the root towards the leaves. The equivalent definition of the Strahler number of a tree is that it is the height of the largest complete binary tree that can be homeomorphically embedded into the given tree; the Strahler number of a node in a tree is equivalent to the height of the largest complete binary tree that can be embedded below that node. The disadvantage of that methods is the lack of distinguishing a main channel which may interfere with the analytical process in highly elongated catchments

Source:- *Strahler, A. N. (1952), "Hypsometric (area-altitude) analysis of erosional topology", Geological Society of America Bulletin 63 (11): 1117–1142.*



Managing Bank Erosion

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Erosion of your riverbanks by natural processes or livestock can reduce the capital value of your farm. Not all erosion is a problem, but management of damaged or vulnerable areas can help you to reduce costs by:

* limiting the loss of land and maximising crop production,
* protecting wildlife habitats, e.g. for fisheries and game,
* improving livestock health,
* reducing the risk of water pollution.

Steps to success:

1. ***Review the current situation*** by examining the stability of the riverbanks on your farm and the potential for bank erosion. In your review, consider the availability and timing of stock access, stocking densities, vegetation cover and management of woody debris.
2. ***Identify potential opportunities*** for the improved management of bank erosion on your farm. Identify where banks are eroding and identify the causes of erosion. Look out for damaged and vulnerable areas, e.g. overgrazing, poaching and degradation by livestock, undercutting and slumping, baying between trees, woody debris concentrating flow, lack of bankside vegetation and bare soil.
3. ***Calculate the cost-benefit of these opportunities*** by considering the potential savings such as reduced loss of land, improved stock welfare and potential income from fishing versus the cost of remedial measures including fencing and the provision of an alternative water supply.
4. ***Prioritise*** the most vulnerable or damaged locations, e.g. where flood flows are concentrated, erosion and loss of land is severe and/or vegetation is absent.
5. ***Develop an action plan*** to manage bank erosion on your farm:
    - Reduce stocking densities to avoid overgrazing and bank-side erosion, particularly during winter and spring months and drought conditions.
    - Provide an alternative water supply away from the river to reduce livestock pressure on riverbanks.
    - Use temporary or permanent fencing to exclude livestock from damaged or vulnerable areas, and allow vegetation to regenerate. Allow bank-side access for drinking water at specific points only, or provide an alternative water supply. Reduce stocking densities after removal of temporary fencing to avoid future erosion damage.
    - Consider establishing riparian buffer strips to encourage natural regeneration of riparian vegetation, including trees.
    - Plant native tree species, including willow stakes and whips, to protect riverbanks and benefit fisheries. Aim to create dappled shade with some open sections to allow sunlight in, and to maintain the growth of ground cover. Manage existing and newly planted trees regularly by selective coppicing and pollarding.
    - Manage bankside footpaths to avoid damage to riverbanks and protect footpaths from bank erosion. Consider re-routing footpaths where erosion is severe.
    - Always consult the Environment Agency (EA) for advice and permission before planning any work on your riverbanks. Remember that if bank erosion is severe an engineering solution may be required.
6. ***Monitor*** your riverbanks as part of routine farm walks to help identify erosion problems early.

Geomorphic Hazards

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Hazards have attracted increasing interest over recent decades and the concept of geomorphic hazards embraces all those natural and technological hazards that impact on the Earth's surface, often inducing changes of morphology. Investigations have focused on individual hazards but it is also possible to envisage the way in which a combination of hazards can contribute to the hazardousness of a place. Geomorphic contributions have mapped and modelled hazards, analysed vulnerability, hazard and risk, and suggested management options including those for the prevention of natural disasters. Particular studies have been made in dry lands including desertification, as well as in urban areas. Future potential includes improvement in understanding of geomorphic hazards by research into the characteristics of hazard events and predicting their occurrence especially as affected by global climate change.

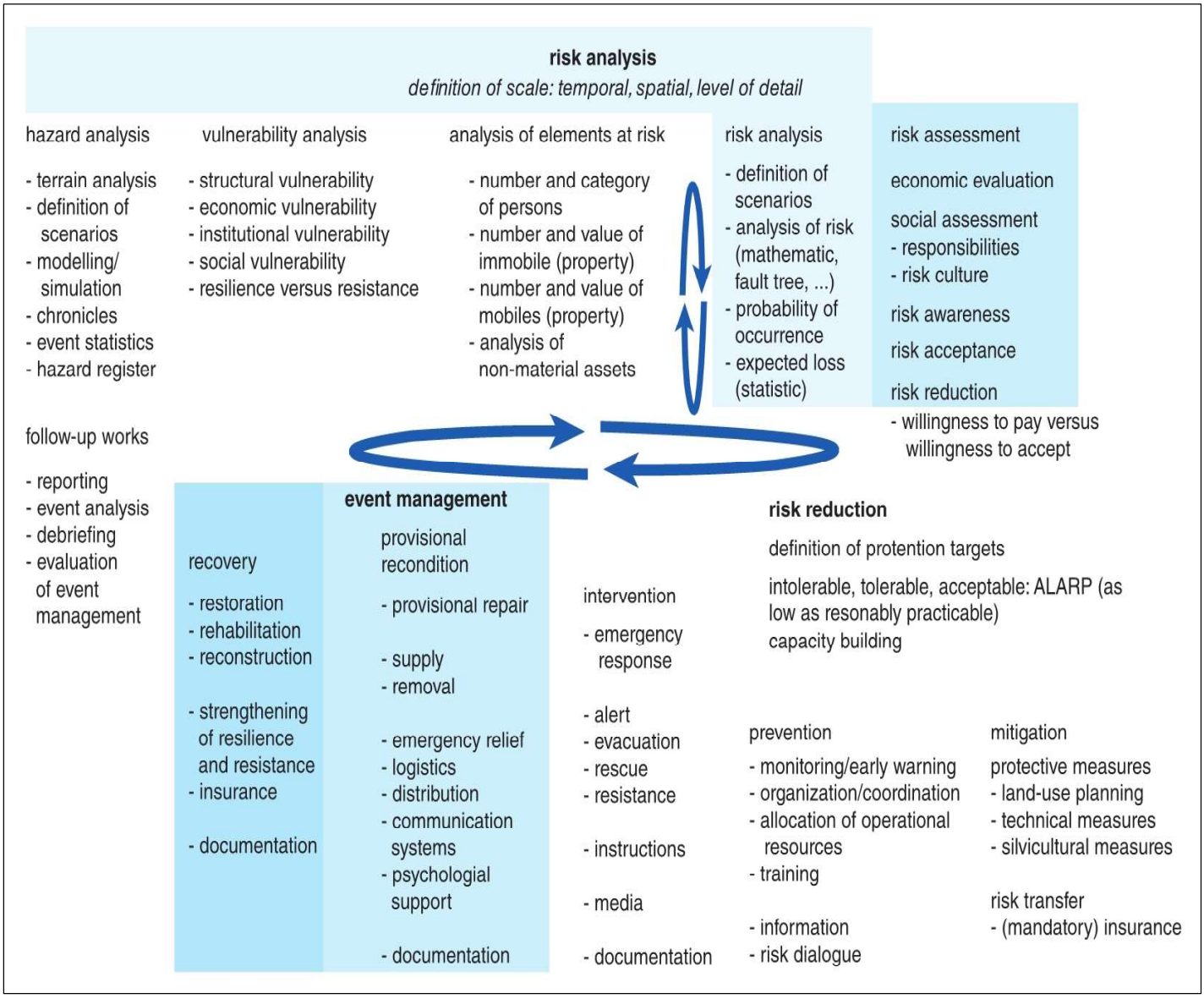

Fig. - A 'risk-cycle' model of integrated risk management (adapted from Carter, 1991; Alexander, 2000; Kienholz et al., 2004) From Jasper Knight et al.

Table: Definitions of hazards and related concepts

Term	Definition	Source
Hazard	A natural hazard is a threat of a *naturally* occurring event that will have a negative effect on people or the environment.	Wikipedia
Natural hazard	An interaction of people and nature governed by the coexistent state of adjustment in the human-use system and the state of nature in the natural event system.	White, 1974
Natural hazard	A naturally occurring condition that threatens life or property.	American Geological Institute, 1984
Natural hazards	Naturally occurring physical phenomena caused either by rapid or slow onset events which can be geophysical (earthquakes, landslides, tsunamis and volcanic activity), hydrological (avalanches and floods), climatological (extreme temperatures, drought and wildfires), meteorological (cyclones and storms/wave surges), or biological (disease epidemics and insect/animal plagues).	
Technological or man-made hazards	Such hazards (complex emergencies/conflicts, famine, displaced populations, industrial accidents and transport accidents) are events that are caused by humans and occur in or close to human settlements. This can include environmental degradation, pollution and accidents.	
Geohazards	Geological conditions capable of causing damage, or loss of property and life, are geological hazards, commonly referred to as geohazards.	PanGeo www.pangeoproject.eu/eng/what_are_geohazards_the_basics
Extreme event	An event in a geophysical system displaying relatively high variance from the mean. Inherent in hazard because they exceed the normal capacity of the human system to reflect, absorb, or buffer them.	White, 1974: 4
Geological hazard	A geological condition, process or potential event that poses a threat to the health, safety, or welfare of a group of citizens or the functions or economy of a community or larger governmental entity.	USGS, 1977: 19, 292
	Sudden event geologic hazards (events on time scales of seconds to hours); gradual change geologic hazards (time scales of tens of years or longer); geologic condition hazards.	Lundgren, 1999 (in Encyc)
Geomorphic hazard	Results from any landform change that adversely affects the geomorphic stability of a site and that intersects the human use system with adverse socioeconomic impacts.	Slaymaker, 1994
Disaster	A natural or man-made (or technological) hazard resulting in an event of substantial extent causing significant physical damage or destruction, loss of life, or a drastic change to the environment. An event that results from interaction between humans and natural processes resulting in injuries or loss of life accompanied by significant damage to property.	Wikipedia
	An environmental disaster is a disaster to the natural environment due to human activity, which distinguishes it from the concept of a natural disaster.	
	The interaction between extreme physical or natural phenomena.	Westgate and O'Keefe, 1976, cited by Scheidegger, 1994
	A serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using only its own resources.	IDNDR, 1992
	Some rapid, instantaneous or profound impact of the natural environment upon the socio-economic system.	Alexander, 1993
	A sudden disequilibrium of the balance between the forces released by the natural system and the counteracting forces of the social system.	Scheidegger, 1994

Vulnerability	A characteristic of individuals and groups of people who inhabit a given natural, social and economic space, within which they are differentiated according to their varying position in society into more or less vulnerable individuals and groups. It is a complex characteristic produced by a combination of factors derived especially (but not entirely) from class, gender, or ethnicity. Involves three parts: (1) livelihood resilience – the degree of resilience of the particular livelihood system of an individual or group, and their capacity for resisting the impact of hazard; (2) health – including both the robustness of individuals, and the operation of various social measures; (3) preparedness – determined by the protection available for a given hazard, something that depends on people acting on their own behalf, and social factors.	Blaikie et al., 1994, Irasema Alcántara-Ayala, 2002
Catastrophe	Disaster that is massive in extent and requires significant expenditure in time and money for recovery to take place. May be termed cataclysm.	*
Risk	Is present in a situation if the outcome of a choice, a decision or an action cannot be anticipated with certainty.	*Encyclopedia Britannica;* Zappellini, 1999
	Risk is a measure of the probability of a loss, life, property, productive capacity.	Peterson and Tilling, 1999

Table: The context of geomorphic hazards

Sphere	Sub-Sphere	Hazard Group	Hazards
Atmosphere			Near Earth Objects (NEOs): Comets and asteroids, nudged by the gravitational attraction of nearby planets into orbits allowing them to enter the Earth's spheres. Composed mostly of water ice with embedded dust particles; see http://neo.jpl.nasa.gov/
		Climatic and meteorological	Drought, hurricanes, tornadoes, lightning and severe thunderstorms, hailstorms, snow storms, frost hazards.
	Noosphere Anthroposphere	Technological or man-made hazards	Including environmental degradation, pollution and accidents, associated with complex emergencies/conflicts, famine, displaced populations, industrial accidents and transport accidents.
Hydrosphere		Hydrological	Extreme events associated with water occurrence, movement, and distribution, tsunamis, storm surges, floods and flash floods, droughts.
	Geosphere	Geomorphic	Earth surface dynamics including landform change and process extremes that can adversely affect the site stability and produce adverse socio-economic impacts.
			Endogenetic – volcanism, neotectonics.
			Exogenetic – mass movement (snow avalanche), fluvial (floods, channel erosion, sedimentation), karst (collapse), coastal (erosion, tsunamis).
			Other spheres with consequences for the Earth's surface systems.
Biosphere		Biological	Exposure of living organisms to germs and toxic substances, epidemics, insect infestation, locusts,animal stampede, fungal diseases, poisonous plants, viral diseases.

Lithosphere		Geohazards, geological, geophysical	1. Deep ground motions (earthquakes, tectonic movements, salt tectonics, volcanic inflation/deflation); 2. Natural ground instability (landslide, soil creep, ground dissolution, collapsible ground, running sand/ liquefaction); 3. Natural ground movement (shrink-swell clays, compressible ground); 4. Man-made ground instability (ground water management – shallow compaction, ground water management – peat oxidation, groundwater abstraction, mining, underground construction, made ground, oil and gas production.

Table: Urban channel hazards in relation to effects of urbanizatio (developed from Gregory and Chin, 2002; Chin et al., 2013)

Urbanization: Channel effects and responses	**Urban Channel Hazards**
URBANIZATION EFFECTS	
Discharge increase, peak flows higher, overbank flows more frequent	***Channel system*** – compartmented by road and rail network
Sediment yield – increase during building construction, decrease with greater impervious area	***Flood frequency*** – increase
	Drainage – temporary floods
CHANNEL RESPONSE	
Channel enlargement, widening, deepening, bank erosion, gullying	***Bank erosion*** ***Scour*** – along channels, downstream from crossings, below culverts, behind revetment, at bridge piers
Headcut/knickpoint recession upstream	
Channel pattern adjustment, single thread to multithread	***Aggradation*** – along channel, above crossings, buried structures, contracted bridge openings, urban debris accumulation
Siltation from high sediment loads	
Decrease in channel capacity, narrowing, shallowing	
Riparian vegetation, increase or decrease	
MANAGEMENT RESPONSE	
Channel clearing, snagging, total vegetation clearance or removal of exotic species	***Blockage*** – due to culvert size or slope or bridge opening
Resectioned channels to accommodate larger discharges	***Change of aquatic communities*** – reduced species diversity, reduced productivity
Bank protection to control erosion	***Vegetation*** – fire hazard increase, invasion of exotic species
Channelization	
Detention basins and ponds	***Quarrying of channel sediments*** – removal of gravel, sand
Culverting of streams	
Infilling and grading sections and crossings	***Dredging***

Natural Hazards and Disasters: Causes, Consequences and Management

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NATURAL HAZARDS AND DISASTERS

DISASTERS:

Disaster is an undesirable occurrence resulting from forces that are largely outside human control, strikes quickly with little or no warning, which causes or threatens serious disruption of life and property including death and injury to a large number of people, and requires therefore, mobilisation of efforts in excess of that which are normally provided by statutory emergency services.

Types of Disasters:

A. NATURAL DISASTERS:

1. Earth Quakes,
2. Volcanic Eruptions,
3. Landslides,
4. Forest Fires,
5. Floods
6. Tsunamies,
7. Diseases.

B. MAN-MADE DISASTERS:

1. Nuclear Explosions,
2. Earth Quakes caused by Dam Construction,
3. HIV Aids,
4. Mining,
5. Environmental Pollution,
6. Leakage of Nuclear Material.

Table: Some Natural Disasters Since 1948

Year	Location	Type
1948	The Soviet Union (now Russia)	Earthquakes
1949	China	Floods
1954	China	Floods
1965	East Pakistan (now Bangladesh)	Tropical Cyclones
1968	Iran	Earthquakes
1970	Peru	Earthquakes
1970	East Pakistan (now Bangladesh)	Tropical Cyclones
1971	India	Tropical Cyclones
1976	China	Earthquakes
1990	Iran	Earthquakes
2004	Indonesia, Sri Lanka, India, etc.	Tsunamies
2005	Pakistan, India	Earthquakes
2011	Japan	Tsunami

Consequences:

1. Firstly, the magnitude, intensity, frequency and damages caused by natural disasters have increased over the years.
2. Secondly, there is a growing concern among people the world over to deal with the menace created by these so that the loss of human life and property can be minimized.
3. Finally, significant changes have taken place in the pattern of natural disasters over the years.

HAZARDS:

Natural Hazards are elements of circumstances in the Natural environment that have the potential to cause harm to people or property or both.

Mitigation and Preparedness:

There are three stages involved in disaster mitigation and management:

i. Pre-disaster management involves -

a. Generating data and information about the disasters.
b. Preparing vulnerability zoning maps.
c. Spreading awareness among the people about these.
d. Disaster planning.
e. Preparedness and preventive measures are other steps that need to be taken in the vulnerable areas.

ii. During disasters -

Rescue and relief operations such as -

a. Evacuation,
b. Construction of shelters,
c. Relief camps,
d. Supplying of water, food, clothing and medical aids etc. should be done on an emergency basis.

iii. Post-disaster operations should involve -

a. Rehabilitation.
b. Recovery of victims.
c. Concentrate on capacity building in order to cope up with future disasters, if any.

Flood Vulnerability Index

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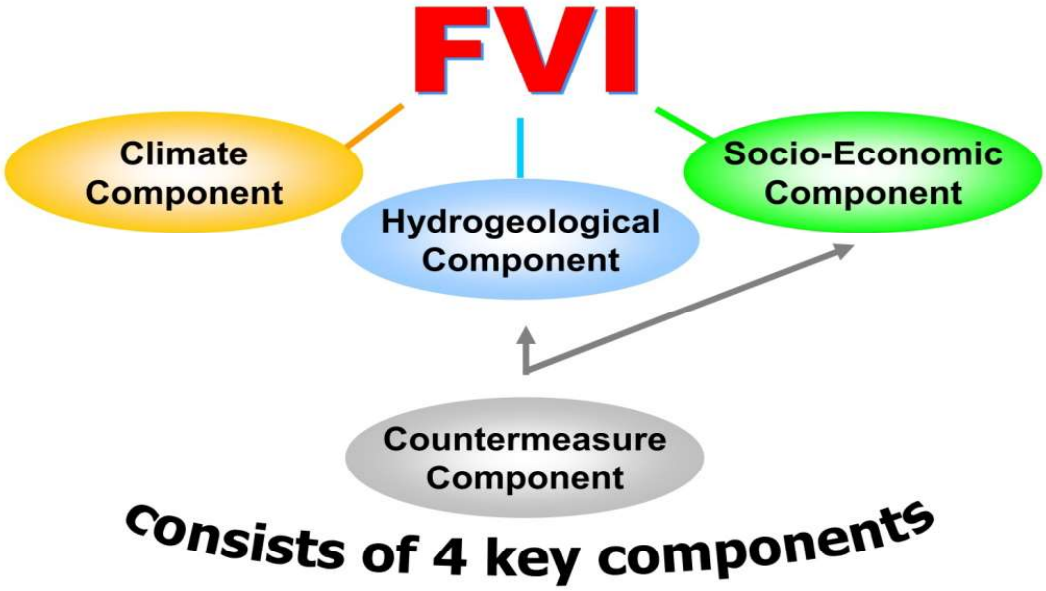
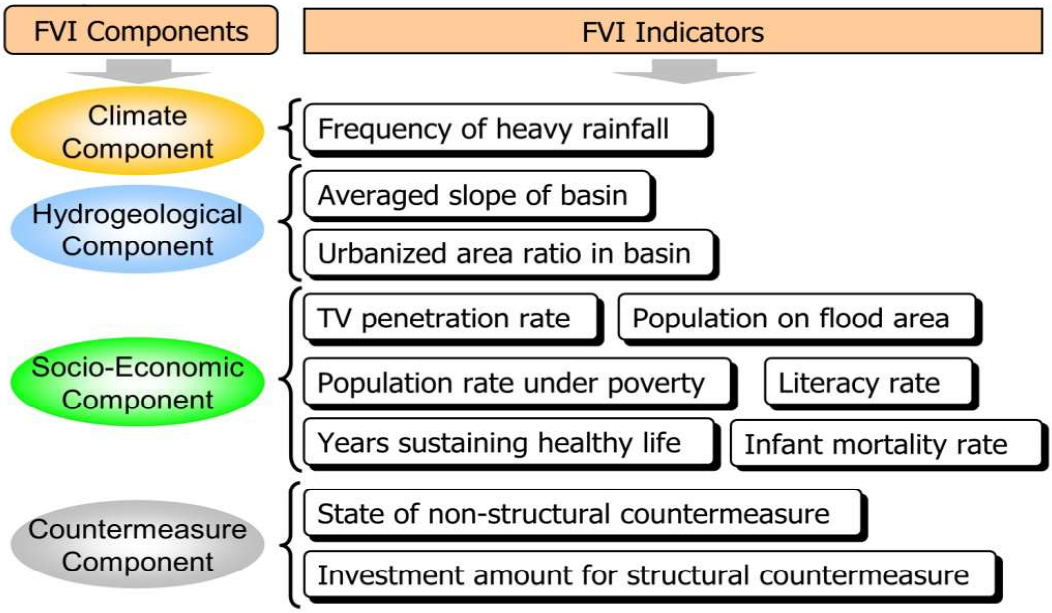
Flood Vulnerability Index (FVI) can be an important policy-making tool for

1) Raising public awareness,
2) Assisting governments in priority setting and
3) Guiding the international organizations in directions of involvement.

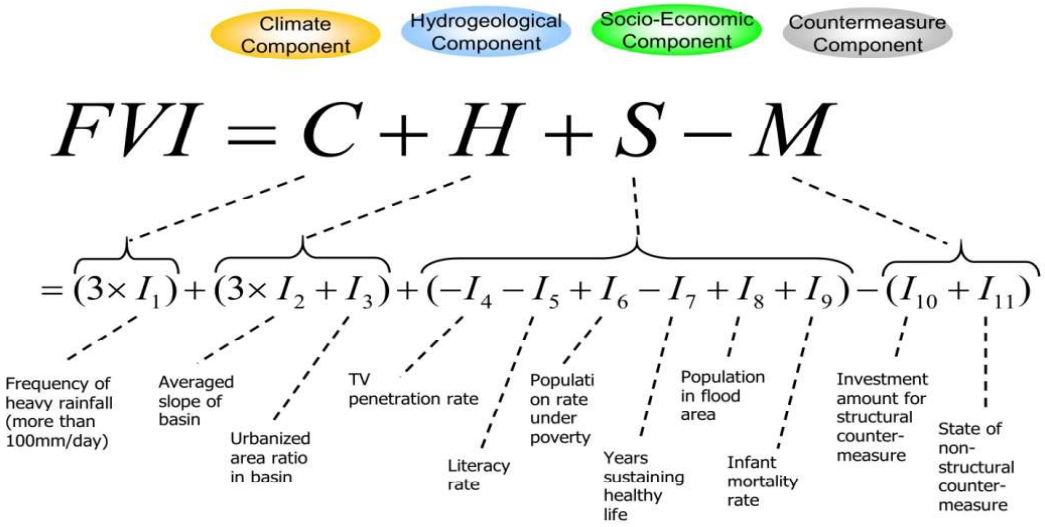
The Four Key Components:



These components might be categorized as below:

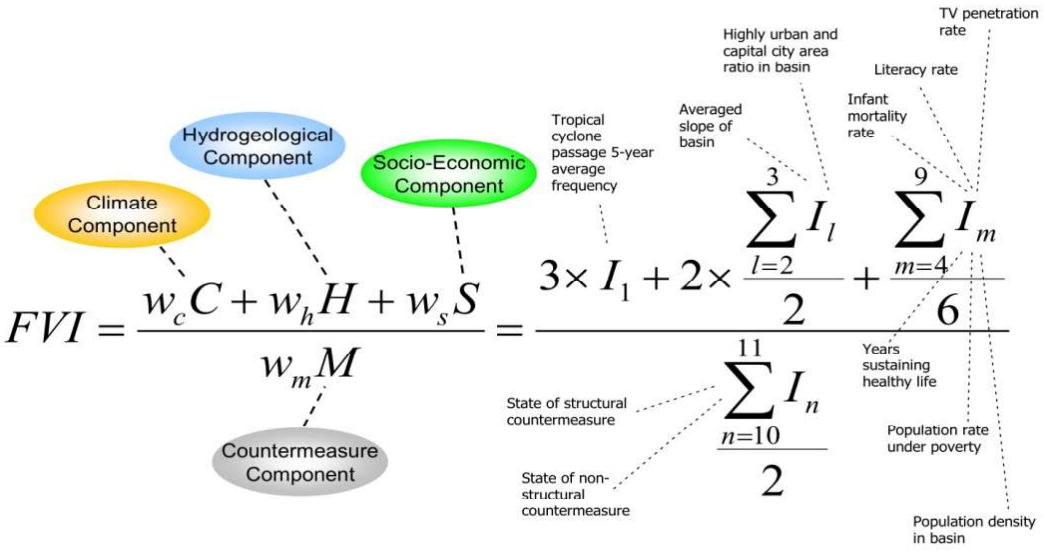


FVI equation for the river basins (major international):

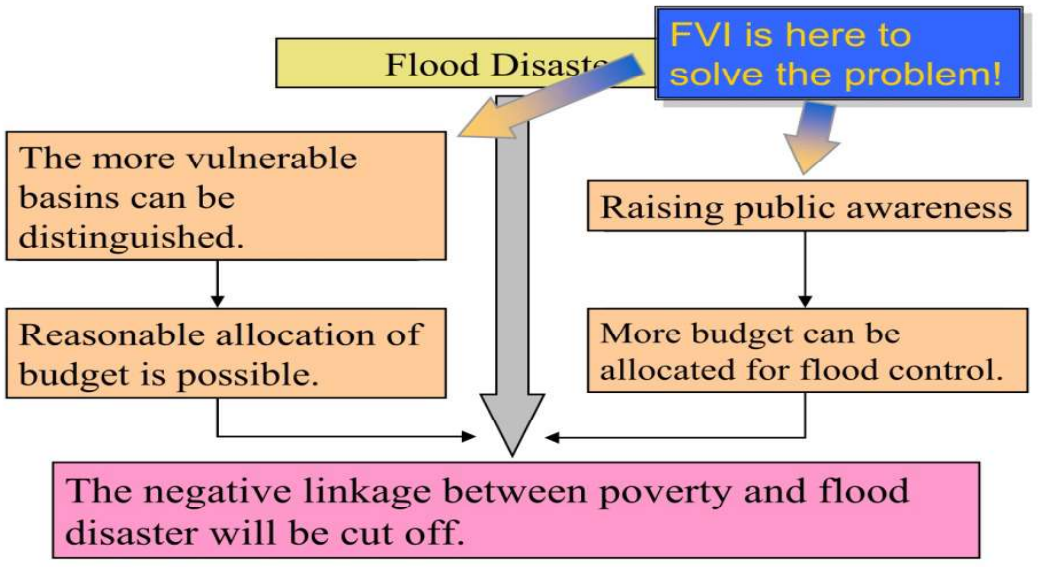


or,

FVI equation for the river basins (special case):



Problems to be solved in the field of flood control:



Different Types of Winds

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Local winds occur on a small spatial scale, their horizontal dimensions typically several tens to a few hundreds of kilometres. They also tend to be short-lived lasting typically several hours to a day. There are many such winds around the world, some of them cold, some warm, some wet, some dry. There are many hazards associated with the wind.

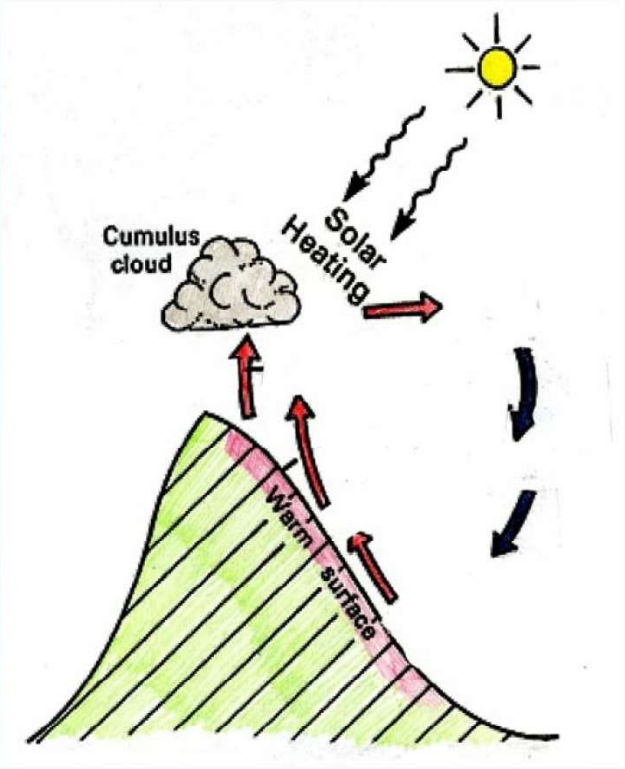
The main local winds are:

1. Sea breezes and land breezes
2. Anabatic and katabatic winds
3. The bora and mistral
4. The Főhn

Cumulus clouds

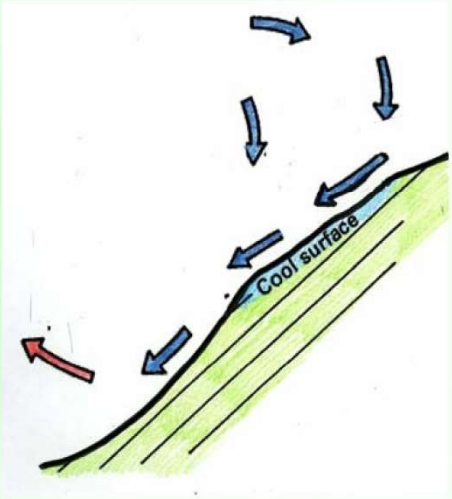
Anabatic winds

This wind is again caused by thermal (heat) processes. Anabatic (upslope) winds occur over slopes which are heated by the sun. Air which is in contact with slopes that are warmed expands upward and cool and sinks over neighbouring valleys (see diagram). Anabatic winds are usually slow, at only 1-2m/s and are rarely importance expect near coasts where they can increase the strength of sea breezes.



Katabatic winds

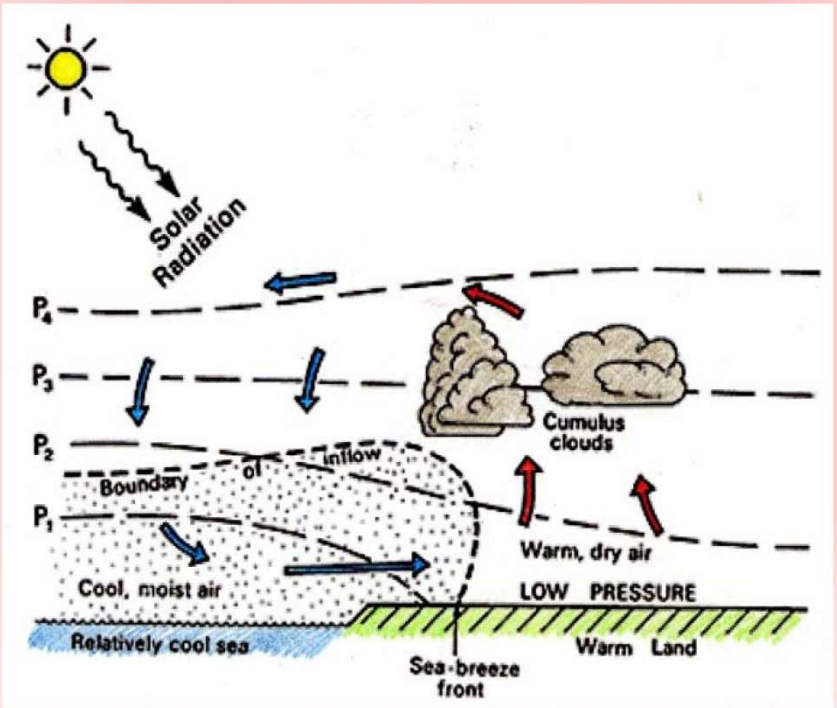
Katabatic (downslope) winds occur over slopes which are cooled. Katabatic winds occur where air in contact with sloping ground is colder than air at the same level away from the hillside over the valley (see diagram below).



Katabatic winds are nocturnal phenomena in most parts of the world (i.e. they tend to happen at night) as there is surface cooling, especially when there is little cloud and due to lack of heating by the sun. Katabatic wind speeds do not typically not exceed 3 or 4 m/s. However, where the ground is covered with snow or ice, katabatic winds can occur at any time of day or night with speeds often reaching 10 m/s, or even more if funnelling through narrow valleys occurs. Katabatic winds may lead to the formation of frost, mist and fog in valleys.

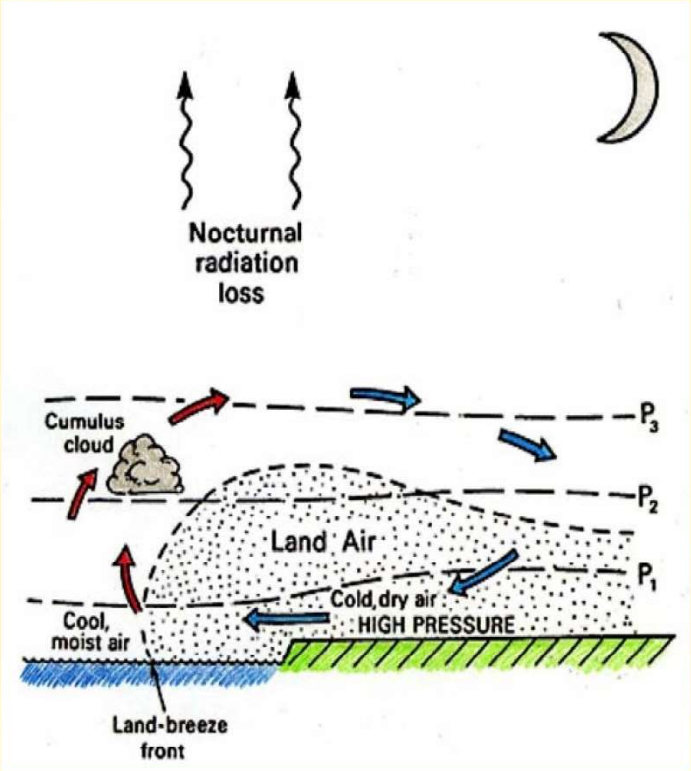
Sea breezes

Sea breezes are the result of differential heating of the land and the sea. Sea breezes occur by day, when the land becomes warmer than the sea. Warm air from the land cannot expand into the sea as the air is cooler and more dense, so it expands up into the atmosphere. Cumulus clouds tend to form as the warm air rises over the land to about 500-1500m. The diagram below shows the whole sea breeze process.



Land breezes

Land breezes occur at night and in the early morning, when the land is cooler than the sea. This is because as the air cools in the night time (as there is less heating from the sun) it contracts. Pressure is higher over the land than the sea. This causes the air to flow from the land to the sea which is known as a land breeze. The circulation is completed by air rising and moving towards the land at 100-300m. This is shown on the diagram below.



Cumulus clouds from where there is rising air. Land sea breeze fronts tend to only affect a small area of 10-15km out to sea, in comparison to the much larger effect of sea breezes. Wind speeds are also lower at 2-3m/s.

The mistral

The **mistral** is also a strong and often violent wind. It blows from the north or north-west down the Rhône Valley of southern France and across the Rhône Delta to the Golfe du Lion and sometimes beyond. Though strongest and most frequent in winter, it may blow at any time of year and develops when stable air is forced through the Rhône Valley. It occurs when a depression is centred over north-west Italy and the Ligurian Sea and a ridge of high pressure extends north-eastward across the Bay of Biscay. It may blow continuously for a day or two and attain speeds of 100 km/h, causing considerable damage to crops and making driving conditions difficult in the Rhône Valley.

The Föhn (or foehn)

The Föhn is a warm, dry, gusty wind which occurs over the lower slopes on the lee side (the side which is not directly exposed to wind and weather) of a mountain barrier. It is a result of forcing stable air over a mountain barrier. The onset of a Föhn is generally sudden. For example, the temperature may rise more than 10°C in five minutes and the wind strength increase from almost calm to gale force just as quickly. Föhn winds occur quite often in the Alps (where the name *föhn* originated) and in the Rockies (where the name *chinook* is used). They also occur in the Moray Firth and over eastern parts of New Zealand's South Island. In addition, they occur over eastern Sri Lanka during the south-west monsoon.

The danger of a Föhn where there are steep snow-covered slopes is that avalanches may result from the sudden warming and blustery conditions. In Föhn conditions, relative humidity may fall to less than 30%, causing vegetation and wooden buildings to dry out. This is a long-standing problem in Switzerland, where so many fire disasters have occurred during Föhn conditions that fire-watching is obligatory when a Föhn is blowing.

The Bora

The bora is a strong, cold and gusty north-easterly wind which descends to the Adriatic Sea from the Dinaric Alps, the mountains behind the Dalmatian coast (the coast of Croatia). It is a winter phenomenon that develops when a slow-moving depression is centred over the Plain of Hungary and western Balkans so that winds are blowing from the east towards the Dinaric Alps. These mountains form a barrier which trap the cold air to the east of them whilst the Adriatic coast remains comparatively mild. Gradually, though, the depth of the cold air increases until the air flows over passes and through valleys to reach the Adriatic Sea. The bora begins suddenly and without warning and the cold air typically descends to the coast so rapidly that it has little time to warm up. The bora can reach speeds of more than 100 km/h and has been known to overturn vehicles and blow people off their feet.

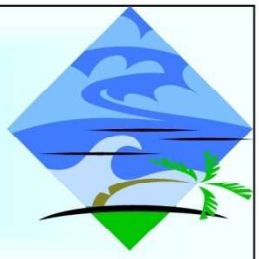
Sumatra

These are characteristically squally local winds which occur over the Malacca Strait several times a month during the period April to November. They are always accompanied by heavy rain from cumulonimbus clouds and are almost always accompanied by lightning and thunder. They are initiated by katabatic winds and therefore tend to occur at night.

Tehuantepecer

A violent squally wind from the north or north-east in the Gulf of Tehuantepec in winter. It originates in the Gulf of Mexico as a norther and blows across the Isthmus of Tehuantepec.

Shamal



Strictly, the shamal is any north-westerly wind over the Persian Gulf and Gulf of Oman, but the term usually refers not to the normal prevailing winds but to the squally gale-force winds accompanied by rain and thunder which occur in winter.

Tramontana

A cold, dry, northerly or north-westerly wind over the coast of Catolina and a cold, dry northerly or north-easterly wind over the west coast of Italy and the north coast of Corsica. It is typically a strong wind but does not often reach gale force.

The Norther

This name for a wind is used in more than one place. In Chile, a Norther is a northerly gale with rain. It usually occurs in winter but occasionally occurs at other times of year. Typically, it can be identified by falling air pressure, a cloudy or overcast sky, good visibility and water levels below normal along the coast. Over the Gulf of Mexico and western parts of the Caribbean Sea, Northers are strong, cool, northerly winds which blow mainly in winter. Over the Gulf of Mexico, they are sometimes humid and accompanied by precipitation, but over the Gulf of Tehuantepec they are dry winds.

The Bise

A cold dry wind which blows from the north-east, north or north-west in the mountainous regions of south-eastern France and western Switzerland in winter months. The bise is accompanied by heavy cloud.

The Leste

A hot, dry, southerly wind which occurs in winter and spring between Madeira and Gibraltar and along the coast of North Africa ahead of an advancing depression.

The Levenche

A hot, dry, southerly wind which blows on the south-east coast of Spain ahead of an advancing depression. It is typically laden with sand and dust, and its approach is often heralded by a belt of brownish cloud on the southern horizon.

The Maestro

The name given to north-westerly winds over the Adriatic Sea, the Ionian Sea and coastal regions of Sardinia and Corsica.

The Libeccio

A strong, squally, south-westerly wind which occurs over central parts of the Mediterranean Sea, most common in winter.

The Marin

A strong south-easterly wind over the Golfe du Lion. It is usually accompanied by warm, cloudy weather with rain.

Willy-Willy

A willy-willy is a dust storm over north-west Australia.

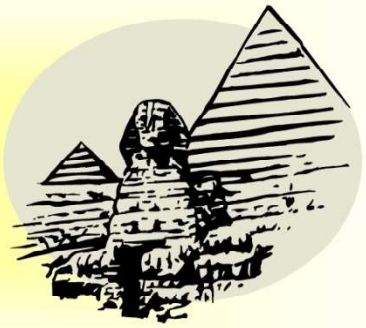
Pampero

The name given to severe line squalls in Argentina and Uruguay, particularly in the Rio de la Plata area. They are associated with marked cold fronts and are usually accompanied by rain, thunder and lightning, a sharp drop in temperature and a sudden change of wind direction from northerly or north-westerly to southerly or south-westerly. They are most likely to occur during the period June to September.

Southerly-buster

The name given to the violent squalls which are associated with well-defined active cold fronts over coastal regions of southern and south-eastern Australia. They are accompanied by lightning, thunder and gale-force winds and are similar to pamperos. They are most frequent in summer but may also occur in spring and autumn.

The Khamsin



A hot, dry, dust-laden, southerly wind over Egypt, the Red Sea and eastern parts of the Mediterranean Sea ahead of eastward-moving depressions. It occurs during the period February to June, being most frequent in March and April.

The Kharif

A strong south-westerly wind which blows daily over the Gulf of Aden from about 22:00 hours until about noon the following day. It occurs in June, July and August (during the south-west monsoon) and frequently reaches gale force.

The Scirocco

The name given to southerly winds over the Mediterranean Sea. When over the African coast, the winds are hot, dry and oppressive. As they pass over the sea, however, they are moistened. Accordingly, they reach the coasts of Europe as warm, humid winds, often with fog or low stratus cloud.

The Levanter

A moist wind which blows from the east over the Strait of Gibraltar. It is frequently accompanied by haze or fog and may occur at any time of year, though it is most common in the period June to October. A feature is the occurrence of a 'banner cloud' extending a kilometre or more downwind from the summit of the Rock of Gibraltar. The strength of the Levanter does not normally exceed Beaufort Force 5. When it is strong, however, complex and vigorous atmospheric eddies form in the lee of the Rock, causing difficult conditions for yachtsmen and the pilots of aircraft. The levanter can also cause persistently foggy weather on the coast of Spain.

The Crachin

The name given to the drizzly weather with low stratus, mist or fog which occurs from time to time during the period January to April over the China Sea and in coastal areas between Shanghai and Cape Cambodia. It occurs when cool, moist air from the north encounters warm, moist air, and it is intensified by orographic lifting and/or by coastal convergence.

The Etesians/meltemi

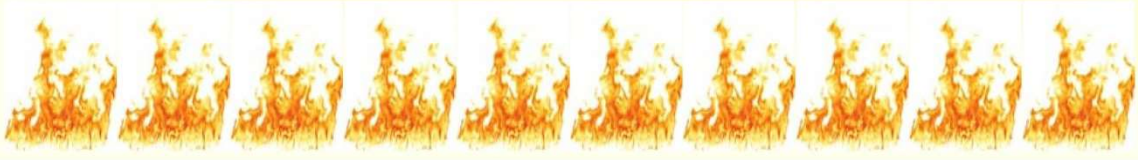
The strong northerly winds which blow at times over the Aegean Sea and eastern parts of the Mediterranean Sea during the period May to October. The winds are known as *meltemi* in Turkey.

The Kaus/Suahili

The name given to the south-easterly winds which prevail in winter (December to April) in the Persian Gulf. They are accompanied by gloomy weather, rain and squalls and are sometimes followed by very strong south-westerly winds called *suahili.*

The Santa Ana

A hot, dry, strong, blustery, föhn-type wind which blows from the north-east or east over southern California and carries with it large quantities of dust. It is most frequent in winter but may also occur in spring or autumn. It may get its name from the Santa Ana Mountains or the Santa Ana Canyon but other possibilities are that it derives from santanas, meaning 'devil winds', or the Spanish Satanás, meaning Satan. These winds can cause a great deal of damage. As they are hot and dry, they cause vegetation to dry out, so increasing the risk of wildfires; and once fires start the winds fan the flames and hasten the spread of the fires. In spring, Santa Ana winds can cause considerable damage to fruit trees.



The Gregale (or grigale)/ euroclydon/ euraquilo

A notorious wind of the western Mediterranean which also blows across central parts of the Mediterranean Sea. It is a strong and cold wind from the north-east and occurs mainly in winter. It is most pronounced on the island of Malta, where it sometimes reaches hurricane force and endangers shipping.

The Harmattan

A dry and comparatively cool wind which blows from the east or north-east on the coast of North Africa between Cabo Verde and the Gulf of Guinea during the dry season (November to March). It brings dust and sand from the Sahara Desert, often in sufficient quantity to form a thick haze which hinders navigation on rivers. Dust and sand are sometimes carried many hundreds of kilometres out to sea.

The Zonda/Sondo

This term applies to two different phenomena. It usually refers to a dry and often dusty föhn wind that occurs over the eastern slopes of the Andes in central Argentina in winter months. It is also the name (or sondo) given to a hot, humid, northerly wind over the Pampas region of South America in advance of an eastward-moving depression and preceding a pampero occurrence.

The Vendavales

Strong, squally, south-westerly winds off the east coast of Spain and in the Strait of Gibraltar. They occur mainly during the period September to March and are often accompanied by violent squalls, heavy rain and thunderstorms.

The Solano

An easterly or south-easterly wind, with rain, which occurs in the Strait of Gibraltar and over south-eastern coasts of Spain

Feminist Geography

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Feminism exists to critically and self-reflexively examine regimes of power at work in everyday life. Through attention to social differences, such as gender, race, class, ethnicity, age, ability, and sexuality, feminist geography highlights the significance of difference in shaping experiences of space and place. Feminist geography emerged in the 1980s as a move within geography that took two primary directions. First, to open the discipline up to more female geographers, through more equitable hiring processes and attempts to shift oppressive departmental cultures. Second, feminist geography encouraged geographers to develop scholarship that was mindful of gender and that included studies of women and women's concerns. Since feminism's early forays into geography, attention to gender has evolved into an emphasis on social difference more broadly construed. Feminist geographers have emphasized the significance of embodiment, emotion, and spaces of intimacy through geographic research. Today the term "feminist" within geography means different things. First, that one simply does geography with a feminist lens, approaching subject matter that falls under the headings of any of the more traditional sub-disciplines, including geographies of the political, economic, social, or environmental. Second, feminist geographical approaches often involve more participatory and inclusive methods in both research and publication. Third, feminist geographies are often rooted in social justice concerns, mindful of the capacity for scholarship to call attention to the ways affected communities are negatively impacted by oppressive forces at work in the world. Lastly, feminist geographers are concerned with how greater regimes of power, such as governmental and corporate entities, and problematic social norms, are experienced and negotiated in people's everyday lives.

Three Phases in the development of focus in Feminist Geography:

1) ***1st phase (mid 1970s to late 1970s)geography of women***

- Tropical focus: on the description of the effects of gender inequalities.
- Theoretical influences: by welfare geography and liberal feminism.
- Geographical focus: spatial separation.

2) ***2nd phase (1980s) socialist feminist geography***

- Tropical focus: explanation of gender inequality & relation between capitalism and patriarchy.
- Theoretical influence by marxism and socialist feminism.
- Geographical focus: spatial separation, place and location.

3) ***3rd phase (end to 1980 onwards) postcolonial feminist geography***

- Tropical focus: gender identities, difference among women, gender & women.
- Theoretical influence by cultural, post-structural and postcolonial theories, and women from developing countries.
- Geographical focus: micro-geographies of the body, distance, separation, place, space and environment.

Impact of Economic Liberalisation

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Pre Liberalization & Globalization:

From independence till the later part of the 1980s, India economic approach was mainly based on government control and a centrally operated market. The country did not have a proper consumer oriented market and foreign investments were also not coming in. This did not do anything good to the economic condition of the country and as such the standard of living did not go up. In the 1980s, stress has given on globalization and liberalization of the market by the Congress government under Rajiv Gandhi. In his government tenure, plenty of restrictions were abolished on a number of sectors and the regulations on pricing were also put off. Effort was also put to increase the condition of the GDP of the country and to increase exports.

Even if the economic liberalization policies were undertaken, it did not find much support and the country remained in its backward economic state. The imports started exceeding the exports and the India suffered huge balance of payment problems. The International Monetary Fund (IMF) asked the country for the bailout loan. The fall of the Soviet Union, a main overseas business market of India, also aggravated the problem. The country at this stage was in need of an immediate economic reform.

Liberalization in 1990s:

It was in the 1990s, that the first initiation towards globalization and economic liberalization was undertaken by Dr. Manmohan Singh, who was the Finance Minister of India under the Congress government headed by P.V. Narasimha Rao. This is perhaps the milestone in the economic growth if India and it aimed towards welcoming globalization. Since, the liberalization plan, the economic condition gradually started improving and today India is one of the fastest growing economies in the world with an average yearly growth rate of around 6-7 per cent.

Impact of Economic Liberalisation:

Globalization and liberalization has greatly influenced the Indian economy and made it a huge consumer market. Today, most of the economic changes in the country are based on the demand supply cycle and other economic factors. Today, India is the world's 12th largest economy in terms of market exchange rate and 4th largest in terms of the Purchasing Power Parity. According to a report by the World Bank, the Indian market is expected to grow at around 8 per cent in the year 2010.

Globalization and liberalization has also made a positive impact on various important economic segments. Today, the service sectors, industrial sectors and the agriculture sector have really grown to a great extent. Around 54 per cent of the annual Gross Domestic Product (GDP) of India comes from the service industry while the industrial and agriculture sector contributes around 29 per cent and 17 per cent respectively. With the improvement of the market, more and more new sectors are coming up and reaping profits such as IT services, chemical, textiles, cement industry and so on. With the increase in the supply level, the rate of employment is also increasing considerably.

There has been an improvement in the manufacturing sector as well which grew from 8.98 per cent in 2005 to around 12 per cent. The communication segment has grown up to around 16.64 per cent. The condition is expected to improve further with more demand and increase in customer base. The yearly growth of the industrial sector has been around 6.8 per cent which will rise more in the future. India is one of the well known industrial markets in the Asia-Pacific region.

Foreign Direct Investment (FDI):

One of the main aspects of globalization is foreign investment. India today has emerged as one of the perfect markets for foreign investors due to its vast market base. More and more foreign companies are investing in the Indian market to get more returns. The foreign institutional investments (FII) amounts to around US$ 10 billion in FY 2008-09, while the rate of Foreign direct investments (FDI) has grown around 85.1 per cent in 2009 to US$ 46.5 billion from US$ 25.1 billion (2008).

The information regarding the growth of foreign direct investments in India both the international practices by the Reserve Bank of India and FDI equity inflows as per the Department of industrial Policy and Promotion, Ministry of Commerce and Industry is presented in Table 1.

Table 1: Growth in FDI Inflows

(US $ Billions)

No.	Years	As per International Practices*	% Growth	FDI Equity Inflows#	% Growth
1	2003-04	4.32	14.00	2.23	18.00
2	2004-05	6.05	40.00	3.78	69.00
3	2005-06	8.96	48.00	5.97	58.00
4	2006-07	22.83	155.00	16.48	176.00
5	2007-08	34.84	53.00	26.86	63.00
6	2008-09	35.18	1.00	27.99	4.00
7	2009-10	37.18	6.00	27.15	3.00

Source: - Economic Survey, 2010-11.
Note* means RBI Estimates
 # As per Department of Industrial Policy and Promotion Estimates

It may be observed from Table 1 that the growth of FDI inflows as per international practices adopted by Reserve Bank of India showed an increasing trend from $ 4.32 US Billion in 2003-04 to $ 37.18 US Billion in 2009-10. While during the same period FDI equity inflows in India increased from $ 2.23 US Billion to $ 27.15 US Billion as per DIPP estimates. The highest growth in the FDI inflows during the period covered under the study was observed in 2006-07 at 155 per cent by RBI estimates and 176 per cent by DIPP estimates.

In India, highest FDI inflows showed in service sector, computer software and hardware, telecommunication, housing and real estate, construction activities respectively. The information regarding highest FDI inflows in selected sectors of Indian Economy is published in Economic Survey 2010-11 and the same is presented in Table 2.

Table 2: Sectors Attracting Highest FDI Equity Inflows.

(Rs. Crore)

No.	Sectors	2008-09	2009-10
1.	Services Sectors	28516 (6138)	20776 (4353)
2.	Computer Software & Hardware	7329 (1677)	4351 (919)
3.	Telecommunications	11727 (2558)	12338 (2554)
4.	Housing and Real Estate	12621 (2801)	13586 (2844)
5.	Construction Activities	8792 (2028)	13516 (2862)

Source: - Economic Survey 2010-11.
Note: Figures in parenthesis are US$ million.

It may be observed from Table 2 that the highest FDI equity inflow in India during 2009-10 was observed in service sector. Second, third and fourth position observed in construction, housing and real estate and telecommunications respectively. The highest sector-wise FDI inflows in India during 2008-09 & 2009-10.

সুস্থায়ী উন্নয়ন

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জঙ্গল সাফ করে জঙ্গলের মতো গজিয়ে ওঠা অজস্র বাড়ি, জমি অধিগ্রহন দ্বারা কলকারখানা বৃদ্ধি, পিচরাস্তার ঘনত্ব বৃদ্ধি, জৈব রাসায়নিক পদ্ধতি প্রয়োগ করে ফসলের উৎপাদন বৃদ্ধি, জলাভূমি ভরাট করে বহুতল বাড়ি নির্মান, সেজ (S.E.Z.) এর জন্য জমি অধিগ্রহন, আরাম ও বিনোদন পূর্ণ জীবনজাপন, রাষ্ট্রীয় আয় বৃদ্ধির যে কোন উপায় কে উন্নয়ন বলা যায় না; পরিবেশের স্বাভাবিক স্বত্বা কে অস্বীকার করে প্রচুর এনক্লেভ, শিল্প তালুক, গার্ডেন্স ই যদি উন্নয়ন হয়, তাহলে বসুন্ধরা সম্মেলন, কোপেনহেগেন, ডারবান সম্মেলন এর দরকার হয় কেন?

উন্নয়নকে আমরা নিজের মতো করে ভাবি, কলকারখানার মালিক ভাবে মুনাফা, কর্মীরা ভাবে উপার্জন সম্ভাবনা, সরকার ভাবে জাতীয় আয় বৃদ্ধির উপায়, আর পরিবেশ কে নিয়ে ভাবার কেউ নেই। সে নিজেও প্রতিবাদহীন অক্ষম, তবে তার নিঃশব্দ প্রতিবাদের ছোবল উপলব্ধি করতে শুরু করে মানুষ। মানুষের অপরিমেয় লোভ, ভোগ-লালসা, পরিবেশ কে বিপদগ্রস্ত ও সংকুচিত করে তুলেছে। উন্নয়নের ধ্বজায় পরিবেশ সুরক্ষার মোড়কে লাভের কড়ি গুনতে ব্যস্ত মানুষের যতই উন্নয়নের চাকা সামনে অগ্রসর হচ্ছে, ততই ধ্বংসের অভিমুখে আমাদের যাত্রাও হচ্ছে অপ্রতিহত। একদিকে একদল শৌখিন সমাজের কর্পোরেট মানুষের বস্তুবাদী উন্নয়ন, অন্যদিকে গরীবের বাঁচার লড়াই ক্রমশ জটিল হয়ে পড়েছে ভারত তথা বিশ্বময়। তাই প্রকৃত উন্নয়ন করতে হলে পরিবেশের সহযোগে পরিবেশ কে সংরক্ষন করে তার সম্ভাবনা গুলির ইতিবাচক সদ্ব্যবহার করে শিক্ষা, স্বাস্থ্য, সংস্কৃতি, পরিবেশ সচেতনতা গড়ে তোলাই হল উন্নয়ন, আমাদের সেই উন্নয়নের কথা ভাবতে হবে।

⟰ সুস্থায়ী উন্নয়ন :-

মানবজাতি বা সমাজের এক অর্থনৈতিক উন্নয়ন যা পরিবেশের সাথে সামঞ্জস্য ভাবে এক দীর্ঘমেয়াদী স্থায়ী মানব উন্নয়নই হল সুস্থায়ী উন্নয়ন। এর দ্বারা কেবল মানুষের অর্থনৈতিক উন্নয়নই ঘটে না, তার পাশাপাশি সামাজিক, মানবিক, সাংস্কৃতিক উন্নয়ন, জীবকূল ও পরিবেশের প্রতি নৈতিকতা গড়ে ওঠে। মানুষের সুস্থ ও স্বাভাবিক ভাবে বেঁচে থাকার এ এক চাবিকাঠি। এই উন্নয়নের মাধ্যমে দীর্ঘকাল যাবৎ প্রাকৃতিক সম্পদের গুনমান ও কার্যকারিতা বজায় রেখেও সর্বোচ্চ উন্নয়ন করা যায়।

১৯৮৩ সালে রাষ্ট্রপুঞ্জের World Commission on Environment and Development নামে একটি সংস্থা গঠন করা হয়। নরওয়ের প্রধানমন্ত্রী গ্রো হারলেম ব্রান্টল্যান্ড ছিলেন সভাপতি। তারই সভাপতিত্বে গঠিত হয়েছিল ব্রান্টল্যান্ড কমিশন। এই কমিশন ১৯৮৭ সালে যে রিপোর্ট পেশ করেছিল তার নাম "Our Common Future"। এই রিপোর্টে দুটি বিষয়ের প্রতি গুরুত্ব দেওয়া হয়েছে -

১. পরিবেশ ও বাস্তুতান্ত্রিক ভারসাম্য কে অক্ষুন্ন রাখতে হবে।
২. পরিবেশের গুনাগত মান কে সুরক্ষিত রেখে মানুষের জীবনযাত্রার স্থায়ী উন্নয়নের দিকে গুরুত্ব দিতে হবে।

International Institute of Environment and Development এর প্রতিষ্ঠাতা Eva Balfour ১৯৮০ সালে প্রথম সুস্থায়ী উন্নয়ন কথাটি প্রথম ব্যাবহার করেন।

⟰ সুস্থায়ী উন্নয়নের পরিবেশগত গুরুত্ব :-

মানুষের সুখ ও স্বাভাবিকভাবে বেঁচে থাকার জন্য দরকার সুস্থ ও নির্মল পরিবেশ। তাই সুস্থায়ী উন্নয়নের মূল কথা হল পরিবেশত উন্নয়ন। তাই কয়েকটি বিষয় আলোকপাত করা হয়েছে -

১. উদ্ভিদ, পশুপাখি সহ মানুষ যাতে পারস্পারিক সামঞ্জস্য বজায় রেখে চলতে পারে সেই দিকে লক্ষ্য রাখা।
২. সম্পদের সুষ্ঠু ও বিজ্ঞানসম্মতভাবে ব্যাবহার ও সংরক্ষন।

৩. পরিবেশের বৈশিষ্ট্য অনুসারে উন্নয়ন পরিকল্পনা।

৪. দূষন কে সর্বতোভাবে দূর করে পরিবেশত মান অক্ষুন্ন রাখা।

৫. জনসংখ্যা যেন উন্নয়নের বাধা না হয়ে দাঁড়ায়।

৬. জীববৈচিত্র্য সংরক্ষনের জন্য সংরক্ষিত জীবমন্ডলের সুস্থায়ী উন্নয়ন।

⟰ সুস্থায়ী উন্নয়নের নীতি ও গৃহীত পদক্ষেপ :-

স্থিতিশীল উন্নয়ন কে কার্যকর করার জন্য ব্রাজিলের রিও-ডি জেনিরো শহরে অনুষ্ঠিত আন্তর্জাতিক পরিবেশ বিষয়ক আলোচনা বা বসুন্ধরা সম্মেলনে কয়েকটি নীতি ও পদক্ষেপ নেওয়া হয়েছে -

১. সুস্থায়ী উন্নয়নের জন্য জনসংখ্যার স্থিতাবস্থা প্রয়োজন, তাই বিজ্ঞানসম্মত উপায়ে জনসংখ্যা নিয়ন্ত্রনের মধ্যদিয়ে সুস্থায়ী উন্নয়ন ঘটাতে হবে।

২. শক্তিসম্পদ ব্যাবহারের কয়েকটি পদ্ধতি গ্রহন করতে হবে -

* সম্পদ ব্যাবহারে দক্ষতা বৃদ্ধি করতে হবে, তাহলে কম সম্পদ ব্যাবহারে অধিক উপযোগিতা পাওয়া যাবে।
* সম্পদের অপচয় রোধ করে চাহিদা মতো ব্যাবহার।
* আবর্তনীয় সম্পদ ব্যাবহারে গুরুত্ব এবং সম্পদের পুনর্ব্যাবহার।

৩. দক্ষ মানবশক্তির বিকাশ ঘটাতে হবে।

৪. পৃথিবীর সকল দেশের মধ্যে রাজনৈতিক সুসম্পর্ক স্থাপন ও আন্তর্জাতিক সৌভাতৃত্ব করতে হবে, ফলে আন্তর্জাতিক স্তরে সম্পদ ব্যাবহারে নিয়ন্ত্রন আসবে এবং পরিবেশ সুরক্ষায় আন্তর্জাতিক নীতি ও পদক্ষেপ গ্রহন সফল হবে।

৫. ভূমির বিজ্ঞানসম্মত ব্যাবহারের মাধ্যমে সুস্থায়ী উন্নয়ন সুনিশ্চিত করতে হবে। এর জন্য সুসংহত ভূমি ব্যাবহার পরিকল্পনা, ভূমিক্ষয় রোধ, ভূমিকে দূষন ও অবনমনের হাত থেকে রক্ষা, সুসংগত কৃষি ব্যাবস্থাপনা দ্বারা ভূমির স্বাভাবিক উর্বরতা ও গুনগত মান বজায় রাখতে হবে।

৬. বনসৃজন ও সবুজায়নের দিকে জোর দিতে হবে, ফলে বাস্তুতন্ত্র ও জীববৈচিত্র্য সুরক্ষিত থাকবে, তাহলেই সুস্থায়ী উন্নয়ন সম্ভব।

৭. নিরস্ত্রীকরণ ও বিশ্বশান্তিতে জোর দিতে হবে, কেননা যুদ্ধবিগ্রহ প্রচুর পরিবেশ ও সম্পদের ক্ষতি করে।

⟰ সুস্থায়ী উন্নয়নে উন্নয়নশীল দেশের পদক্ষেপ :-

দক্ষিন ও দক্ষিন-পূর্ব এশিয়া, মধ্যপ্রাচ্য, লাতিন আমেরিকার অনুন্নত ও উন্নয়ন শীল দেশগুলিতে স্থিতিশীল উন্নয়ন বাধা হয়ে দাঁড়িয়েছে। ফলস্বরুপ জনবৃদ্ধি, সচেতনতার অভাব, স্বল্পশিক্ষার হার, অনুন্নত প্রযুক্তি, অবৈজ্ঞানিক ভাবে সম্পদ ব্যাবহার স্থিতিশীল উন্নয়নের পক্ষে অন্তরায়।

এই সকল কারনে জনস্বাস্থেও ক্ষতিকর প্রভাব পড়ে। যেমন পৃথিবীর ৭৩০ কোটি মানুষের মধ্যে প্রায় ৫০০ কোটি তৃতীয় বিশ্বের এই দুর্বল অর্থনীতির দেশ গুলিতে বসবাস করে। এখানকার ১৬০ কোটি মানুষ দারিদ্রসীমার নিচে বাস করে, যাদের দৈনিক মাথাপিছু আয় ২৫ টাকারও কম। প্রতি তিনজন শিশুর মধ্যে একজন অপুষ্টির শিকার, দশ জন মধ্যে একজন শিশু পাঁচ বছর পৌছানোর আগে মারা যায়, প্রায় ৯০ কোটি মানুষ এখনও নিরক্ষর, ১০০ কোটি মানুষ রাতে না খেয়ে ঘুমোতে যায়, প্রত্যহ গড়ে ৩৫০ জন মানুষ অনাহারে মৃত্যুবরন করে।

তাই উন্নয়নশীল ও অনুন্নত দেশগুলিতে স্থিতিশীল উন্নয়নের কয়েকটি পদক্ষেপ গ্রহন করা দরকার -

১. জনসংখ্যার দ্রুত বৃদ্ধি কে নিয়ন্ত্রন করতে হবে। অধিক জনবৃদ্ধির দরুন দ্রুত ও অধিক প্রাকৃতিক সম্পদের ব্যাবহার হওয়ায় সম্পদ নিঃশেষীকরণ, পরিবেশ দূষন ও অবনমনের সম্ভবনা বৃদ্ধি পাচ্ছে।

২. নারী-পুরুষ সমান অধিকারের সুযোগ বৃদ্ধি দ্বারা নারী উন্নয়ন ঘটাতে হবে। নারী উন্নয়নের ফলে জনসংখ্যা নিয়ন্ত্রন, শিক্ষার উন্নয়ন, সামাজিক উন্নয়নের পথ প্রশস্ত করলে পরিবেশ সুরক্ষা, সচেতনতা ও স্থিতিশীল উন্নয়ন সম্ভব।

৩. নীরোগ, স্বাস্থ্যবান, দীর্ঘায়ু, দক্ষ মানব সম্পদই স্থিতিশীল উন্নয়ন ও পরিবেশ সুরক্ষার জন্য কাম্য। তাই রোগ, মহামারী, জন্ম ও মৃত্যু হার হ্রাসের জন্য স্বাস্থ্য সচেতনতা ও পরিচ্ছন্নতায় গুরুত্ব দিতে হবে।

৪. দেশগুলিতে শ্রমনিবিড় অর্থনৈতিক কার্যক্রম চালু করতে হবে, ফলে অধিক কর্মসংস্থান দারিদ্রতা কমাবে।

স্থিতিশীল উন্নয়নে উন্নত দেশগুলির ভূমিকা :-

বিশ্বের উন্নত দেশগুলির (কানাডা, রাশিয়া, জাপান, অষ্ট্রেলিয়া, উত্তর-পশ্চিম ইউরোপের দেশ, যুক্তরাষ্ট্র, যুক্তরাজ্য) প্রভূত অর্থনৈতিক উন্নয়ন ঘটেছে। ফলে উন্নত জীবনযাপন প্রনালী, উচ্চ আয় জনস্বাস্থ্যের উন্নয়নের কারন; কিন্তু অত্যাধিক সম্পদ ভোগ, শিল্পায়ন, নগরায়ন, পরিবহনের উন্নয়ন, প্রযুক্তি ব্যাবহার, রাসায়নিক পদার্থের ব্যাবহার পরিবেশের ক্ষেত্রে ক্ষতিকর প্রভাব নিয়ে এসেছে। পৃথিবীর ২০৪ টি দেশের মধ্যে উন্নত দেশের ২২টি দেশ পৃথিবীর মোট সম্পদ উৎপাদনের বেশীরভাগ ভোগ করে। যেমন সমগ্র বিশ্বের ২০% উন্নত দেশের জনগন পৃথিবীর ৮২% বিদ্যুত শক্তি, ৯০% তেল, ৮৫% কাঠ, ৭১% খনিজ সম্পদ ভোগ করে। ফলে উন্নত দেশের ২০% লোকেই জল, বায়ু, মৃত্তিকা, তেজস্ক্রিয় ও রাসায়নিক দূষন দ্বারা পরিবেশের সর্বাধিক ক্ষতিসাধন করে। উন্নত দেশগুলির ভোগসর্বস্ব জীবনে পশু, মাংস, মাছ, ডিম, দুগ্ধ, ফল এবং অর্থকরী চাষে গুরুত্ব বৃদ্ধির ফলে পরিবেশের স্বাভাবিক ভারসাম্য ক্ষতিগ্রস্ত হচ্ছে। উন্নত দেশগুলির অত্যাধিক অর্থনৈতিক উন্নয়নের ফলে ওজন স্তর অবক্ষয়, ভূপৃষ্টের উষ্ণায়ন, অম্লবৃষ্টির মতো মারাত্মক পরিবেশগত সমস্যা প্রকট হচ্ছে।

তাই স্থিতিশীল উন্নয়নে উন্নত দেশগুলির দায়িত্ব অধিক। দেশগুলির গৃহিত পদক্ষেপ নেওয়া দরকার –

১. সম্পদ ভোগের পরিমান হ্রাস করে ভোগপূর্ণ জীবন অভ্যাস কিছুটা হ্রাস করা।
২. উন্নয়নশীল দেশগুলিকে পরিবেশ সুরক্ষা ও মানব উন্নয়নে অর্থ সাহায্য করা।
৩. পৃথিবীর সকল দেশকে সম্পদ ভোগ ও সম্পদের ওপর অধিকারকে স্বীকৃতি দিতে হবে।
৪. অনুন্নত দেশগুলির সম্পদ আহরন, আগ্রাসন ও বাজার দখল থেকে বিরত থাকতে হবে।
৫. উন্নয়নশীল দেশগুলিকে শিল্পায়ন ত্বরান্বিত করার জন্য শুল্কছাড় দিতে হবে, ফলে উৎপাদন ব্যায় কম হলে বাজারে উন্নত দেশগুলির সাথে সম-প্রতিযোগিতায় টিকে থাকা সম্ভব হবে।
৬. উন্নয়নশীল দেশগুলিকে ঋনের বোঝা হ্রাস, সুদ প্রত্যাহার, বিমা প্রকল্প গ্রহন দ্বারা আর্থ-সামাজিক উন্নয়নের জন্য পদক্ষেপ গ্রহন করাতে হবে।

রাষ্ট্রসংঘে গৃহীত উদ্দেশ্য:-

২০১৫ সালের ২৫শে সেপ্টেম্বর সারা পৃথিবীর দারিদ্র ও অর্থনৈতিক অসাম্য দূরীকরন ও জলবায়ুর পরিবর্তন রোধে আগামী ১৫ বছর ধরে রূপায়ন করার জন্য রাষ্ট্রসংঘ এক আন্তর্জাতিক কর্মসূচি ঘোষনা করেছে। "Transforming Our World: The 2030 Agenda for Sustainable Development" - শীর্ষক ঘোষনাপত্রে রাষ্ট্রসংঘ মোট ১৭ টি উদ্দেশ্য (Goal) এবং তাকে অর্জন করার জন্য ১৬৯ টি লক্ষ্য (Target) রেখেছে। এগুলি একসাথে Sustainable Development Goals (SDGs) নামে পরিচিত, যা ২০১৬ সালের ১৫ই জানুয়ারী থেকে ১৫ বছর ধরে অর্জন করার চেষ্টা করা হবে।

SDG 1: পৃথিবীর সকল রকমের দারিদ্র্যতার অবসান ঘটানো।
SDG 2: পৃথিবীর সকল মানুষের ক্ষুধার্থতা দূর করে খাদ্য নিরাপত্তা দেওয়া ও তাদের পুষ্টির উন্নতি এবং কৃষিতে সুস্থায়ী উন্নয়ন নিয়ে আসা।
SDG 3: মানুষের জীবনযাত্রাকে আরো স্বাস্থ্যকর করা ও সমস্ত বয়সের মানুষের মানব কল্যান করা।
SDG 4: উন্নত ও সমমানের শিক্ষা সকলের নাগালের মধ্যে নিয়ে আসা ও সারাজীবন ধরে জ্ঞান অর্জনের উপযোগী পরিবেশ গড়ে তোলা।
SDG 5: লিঙ্গ বৈষম্য দূর করা ও মহিলা ও কন্যা শিশুদের ক্ষমতায়ন ঘটানো।
SDG 6: সকলের জন্য পরিশুদ্ধ পানীয় জলের ব্যাবস্থা ও জল ব্যাবস্থাপনা গ্রহন এবং সকলের জন্য শৌচালয়ের বন্দোবস্ত করা।
SDG 7: সকলের জন্য সুলভে, সহজে সুস্থায়ী ও আধুনিক শক্তি সরবরাহ করা।
SDG 8: সকলের জন্য লাভজনক কর্মসংস্থানের বন্দোবস্ত করা ও এর মাধ্যমে স্থিতিশীল উন্নয়নের পথ প্রশস্ত করে সকলকে তার শরিক করা।
SGD 9: শিল্পায়নের দ্রুত প্রসার, উন্নত পরিকাঠামোর বিস্তার ও উদ্ভাবনী ক্ষমতার প্রসার করা।
SDG 10: বিভিন্ন রাষ্ট্রের মধ্যে এবং একই রাষ্ট্রের ভিতর বিভিন্ন শ্রেনীর মানুষের অসাম্য দূর করা।

SDG 11: শহর ও জনপদগুলিকে নিরাপদ ও প্রাকৃতিক দূর্যোগ প্রতিরোধের উপযোগী করা।

SDG 12: জনসাধারনের ভোগমাত্রা কে স্থিতিশীল ভাবে উন্নত করা এবং উৎপাদন ব্যাবস্থা কে একই ভাবে স্থিতিশীল করা।

SGD 13: জলবায়ু পরিবর্তন ও তার প্রভাব রোধে খুব দ্রুত ব্যাবস্থা নিতে হবে।

SDG 14: সমুদ্র, সাগর, মহাসাগরে সমুদ্র সম্পদের সংরক্ষন ও সুস্থায়ী উন্নয়ন।

SDG 15: পার্থিব বাস্তুতন্ত্রের সংরক্ষন, অরন্যের স্থিতিশীল ব্যাবস্থাপনা, মরুকরণ প্রতিরোধ, ভূমিক্ষয় রোধ এবং জীববৈচিত্র্য হ্রাস রোধ করা।

SDG 16: সারা বিশ্বজুড়ে স্থিতিশীল উন্নয়নের প্রচেষ্টাকে সফল করে তুলতে একটি আন্তর্জাতিক সমঝোতা গড়ে তোলা।

SDG 17: সমাজ ব্যাবস্থাকে সকলের জন্য অনুকূল, শান্তিপূর্ণ ও উন্নয়নমুখী করে তোলা এবং সকলের জন্য ন্যায় ও সুবিচার সুনিশ্চিত করা।

চিত্র: Sustainable Development Goals (SDGs).

সুস্থায়ী উন্নয়ন ও রাজনীতি :-

বিশ্বের উন্নত দেশগুলি পরিবেশ সুরক্ষায় উন্নয়নশীল দেশগুলির উপর বিভিন্ন বিধিনিষেধ আরোপ করে চলেছে, অথচ উন্নত বিশ্বই অধিকাংশ প্রাকৃতিক সম্পদ ব্যাবহার দ্বারা বাস্তুতন্ত্র ও সুস্থায়ী উন্নয়নের পথে বাধা হয়ে দাড়াচ্ছে। এইভাবে আপাত পরিবেশ সুরক্ষার নামে উন্নত দেশগুলি অনুন্নত দেশগুলির বাজার দখল ও প্রাকৃতিক সম্পদের উপর কায়েম করে চলেছে, যা 'সবুজ সাম্রাজ্যবাদ' নামে পরিচিত।

আসলে পরিবেশ সুরক্ষার ব্যাপারে উন্নত দেশগুলি তাদের নিজ স্বার্থে অপেক্ষাকৃত দরিদ্র দেশগুলিকে রাজনৈতিক ও সাংস্কৃতিক নিয়ন্ত্রন করে চলেছে, অর্থাৎ বিশ্ব পরিবেশ ও উন্নয়নের নামে উন্নতদেশগুলির প্রভুত্ববাদ। সুস্থায়ী উন্নয়নের নাম করে উন্নত দেশগুলি অনুন্নত দেশগুলির প্রাকৃতিক সম্পদ নিয়ন্ত্রন দ্বারা নিজেদের জাতীয় অর্থনীতির সাফল্যকে চূড়ান্ত জায়গায় নিয়ে যাচ্ছে, আর অনুন্নত দেশগুলির অর্থনৈতিক উন্নয়ন থমকে যাচ্ছে।

পরিবেশ নিয়ে রাজনীতি করছে উন্নত দেশগুলি আর পরিবেশ নিয়ে বিতর্ক সৃষ্টি করছে উন্নয়নশীল দেশ গুলি। পৃথিবীর উন্নত দেশগুলির জনসংখ্যা ২০% হওয়া সত্ত্বেও প্রাকৃতিক সম্পদের ৮০% ভোগ করে উন্নত দেশগুলি। তারা তাদের অর্থ ও সমাজব্যাবস্থাকে উন্নত করে নিয়েছে, এখন আবার তা সুরক্ষিত করে নিজেদের নির্মল পরিবেশে ভোগপূর্ণ জীবনের নিশ্চয়তার জন্য পরিবেশ সুরক্ষার বিভিন্ন পন্থা উদ্ভাবন করছে। অন্যদিকে উন্নয়নশীল দেশগুলি এই সবেমাত্র আর্থ-সামাজিক উন্নয়নের দিকে যাত্রা শুরু করেছে (১৯৮০ র দশকের পর থেকে)। এই অবস্থায় পরিবেশ সুরক্ষার নীতিগুলি সর্বোতোভাবে কার্যকরী করতে গেলে জাতীয় উন্নয়ন, শিক্ষা, স্বাস্থ্য বিপর্যস্ত হয়ে পড়বে। এই মুহূর্তে পরিবেশ সুরক্ষার সব নিয়ম মানা সম্ভব নয়। আসলে উন্নত দেশগুলির সাথে একমত হয়ে পরিবেশ নিয়ে মাতামাতি করলে উন্নয়নশীল দেশগুলির মূলসমস্যা (দারিদ্রতা, অশিক্ষা, অপুষ্টি, ক্ষুধা, নিম্ন আয়, জনসংখ্যা বৃদ্ধি) চাপা পড়ে যাবে, তাই দেশগুলি কখনোই আর্থ–সামাজিক দিক থেকে উন্নত হতে পারবে না, আর অর্থনৈতিক উন্নয়ন না ঘটলে সুস্থায়ী উন্নয়ন সম্ভব নয়। পরিবেশ সুরক্ষা তথা সুস্থায়ী উন্নয়নই যদি উন্নত দেশগুলির সত্যিকারের উদ্দেশ্য হয় তবে গরীব দেশগুলির পরিবেশের মান বজায় রাখা ও দূষন নিয়ন্ত্রনে যে ব্যায়ভার তা বহন করুক উন্নত দেশগুলি - এই অভিমত পোষন করে উন্নয়নশীল দেশগুলি। উন্নত দেশগুলি তা অস্বীকার করলে পরিবেশগত বিতর্কের উদ্ভব হয়।

উন্নত ও উন্নয়নশীল দেশের পরিবেশ সম্পর্কিত বিতর্কের অবসান ঘটিয়ে সুস্থায়ী উন্নয়নের বিকল্প পন্থা উদ্ভাবন করা সব দেশেরই কর্তব্য হওয়া দরকার। পৃথিবীর সকল দেশের পরিবেশ সম্পর্কিত এক সমন্বয়, নীতি, সহমত গঠন করা প্রয়োজন। উন্নত ও ভোগপূর্ণ জীবন-যাপন যেন অন্যের ক্ষতি ও বিরক্তের কারন না হয়, অথবা প্রয়োজনে জীবনভোগের মান সরল ও অনাড়ম্বর অভ্যাসের প্রতি গুরুত্ব প্রদান করতে হবে। সর্বোপরি উন্নতদেশগুলির বিশ্বমানবতা বোধের উন্মেষের দ্বারা গরীব দেশগুলির উপর অজগরবৃত্তি পরিত্যাগ করে সাহায্যের হাত বাড়িয়ে দিলেই পৃথিবীজুড়ে দূষনমুক্ত ও নির্মল পরিবেশ বজায় থাকবে।

Introduction to Remote Sensing

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Remote sensing is the art and science of recording, measuring, and analyzing information about a phenomenon from a distance. Humans with the aid of their eyes, noses, and ears are constantly seeing, smelling, and hearing things from a distance as they move through an environment. Thus, humans are naturally designed to be remote sensors. In order to study large areas of the Earth's surface geographers use devices known as remote sensors. These sensors are mounted on platforms such as helicopters, planes, and satellites that make it possible for the sensors to observe the Earth from above.

Passive and Active Sensor Systems

Two types of sensors exist, namely passive and active. A passive sensor system needs an external energy source (Fig. 1). In most cases this source is the sun. These sensors generally detect reflective and emitted energy wave lengths from a phenomenon. An active sensor system provides its own energy source. As an example, a radar sensor sends out sound waves and records the reflected waves coming back from the surface. Passive systems are much more common than active systems.

Most sensors record information about the Earth's surface by measuring the transmission of energy from the surface in different portions of the electromagnetic (EM) spectrum (Fig. 2). Because the Earth's surface varies in nature, the transmitted energy also varies. This variation in energy allows images of the surface to be created. Human eyes see this variation in energy in the visible portion of the EM spectrum. Sensors detect variations in energy in both the visible and non-visible areas of the spectrum.

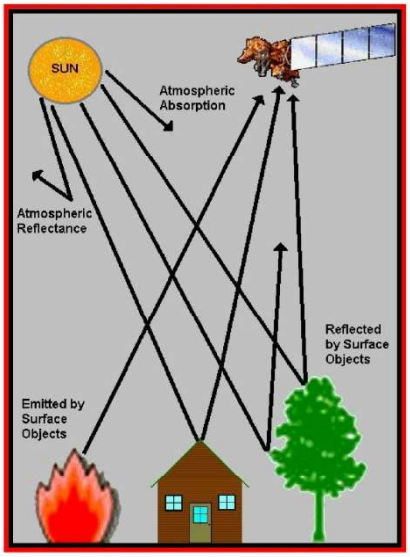

Fig. 1: Passive System.

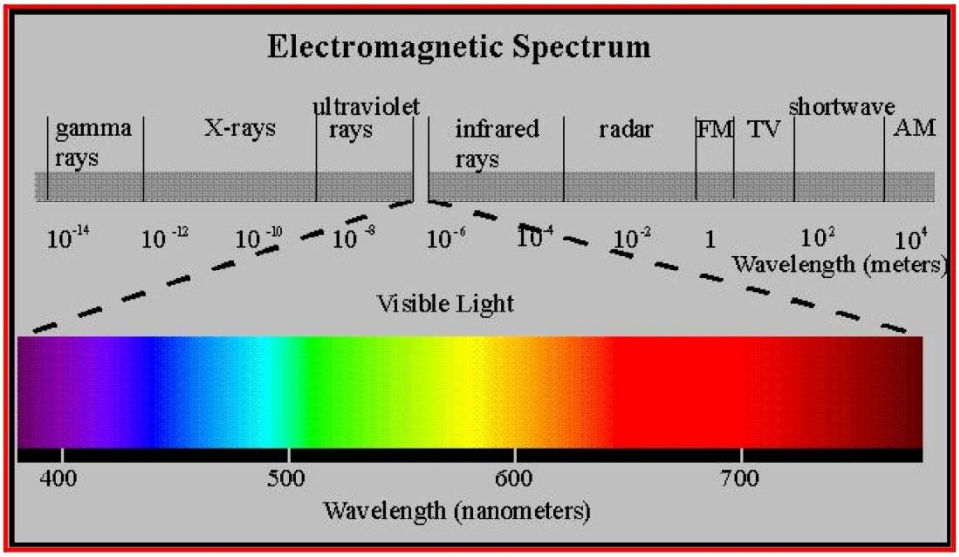

Fig. 2: Electromagnetic (EM) Spectrum.

Energy waves in certain sections of the EM spectrum easily pass through the atmosphere, while other types do not. The ability of the atmosphere to allow energy to pass through it is referred to as its transmissivity, and varies with the wavelength/type of the radiation. The gases that comprise our atmosphere absorb energy in certain wavelengths while allowing energy with differing wavelengths to pass through.

The areas of the EM spectrum that are absorbed by atmospheric gases such as water vapour, carbon dioxide, and ozone are known as absorption bands. In Fig. 3, absorption bands (shown in brown) are represented by a low transmission value that is associated with a specific range of wavelengths. Trying to obtain remotely sensed imagery

in the absorption bands is nearly impossible; thus, sensors are generally designed not to record information in these portions of the spectrum.

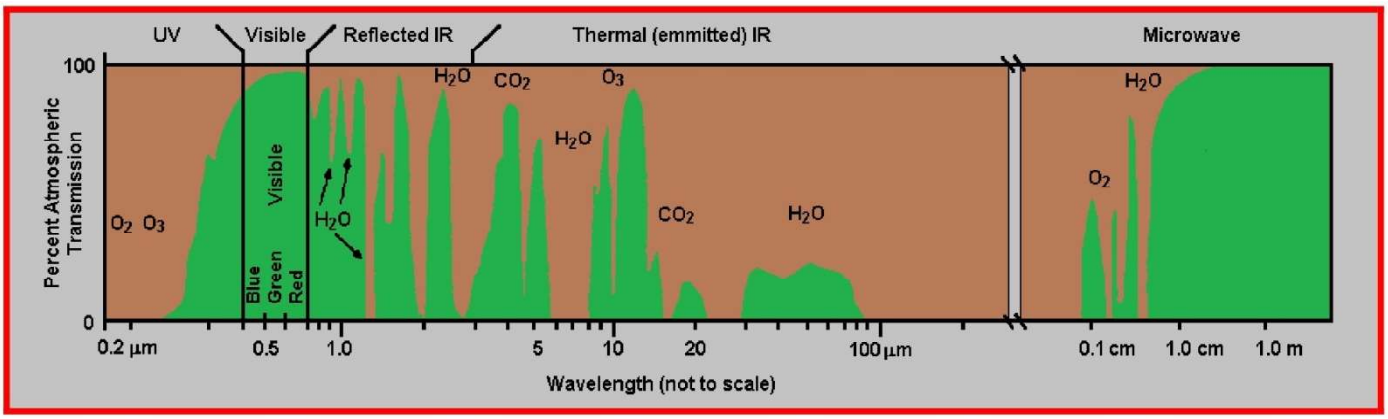

Fig. 3: Atmospheric Windows.

In contrast to the absorption bands, there are areas of the EM spectrum (shown in green in Fig. 3 and described in Table 1) where the atmosphere is transparent (little or no absorption of energy) to specific wavelengths. These wavelength bands are known as atmospheric "windows" since they allow the energy to easily pass through the atmosphere to Earth's surface. It is in these windows that sensors are used to gather information about Earth phenomena.

Table 1: Major regions of the electromagnetic spectrum

Region Name	Wavelength	Comments
Gamma Ray	< 0.03 nanometres	Entirely absorbed by the Earth's atmosphere and not available for remote sensing.
X-ray	0.03 to 30 nanometres	Entirely absorbed by the Earth's atmosphere and not available for remote sensing.
Ultraviolet	0.03 to 0.4 micrometres	Wavelengths from 0.03 to 0.3 micrometers absorbed by ozone in the Earth's atmosphere.
Photographic Ultraviolet	0.3 to 0.4 micrometres	Available for remote sensing the Earth. Can be imaged with cameras and sensors.
Visible	0.4 to 0.7 micrometres	Available for remote sensing the Earth. Can be imaged with cameras and sensors.
Near and Mid Infrared	0.7 to 3.0 micrometres	Available for remote sensing the Earth. Can be imaged with cameras and sensors.
Thermal Infrared	3.0 to 14 micrometres	Available for remote sensing the Earth. This wavelength cannot be captured by film cameras. Sensors are used to image this wavelength band.
Microwave or Radar	0.1 to 100 centimetres	Longer wavelengths of this band can pass through clouds, fog, and rain. Images using this band can be made with sensors that actively emit microwaves.
Radio	> 100 centimetres	Not normally used for remote sensing the Earth.

Most remote sensing instruments on aircraft or space-based platforms operate in one or more of these windows by making their measurements with detectors tuned to specific frequencies (wavelengths) that pass through the atmosphere. When a remote sensing instrument has a line-of-sight with an object that is reflecting sunlight or emitting heat, the instrument collects and records the radiant energy. While most remote sensing systems are designed to collect reflected energy, some sensors, especially those on meteorological satellites, directly measure absorption phenomena, such as those associated with carbon dioxide (CO_2) and other gases. The atmosphere is nearly opaque to EM energy in part of the mid-IR and all of the far-IR regions. In the microwave region, by contrast, most of this

radiation moves through unimpeded, so radar waves reach the surface (although weather radars are able to detect clouds and precipitation because they are tuned to observe backscattered radiation from liquid and ice particles).

Traditional aerial photographs were black and white pictures based on camera and film technology. Such photographs related to one region of the EM spectrum. Satellite images are generally captured using sensors and digital technology. A sensor often records simultaneously in several different regions of the spectrum creating multi-images taken at the same time. The regions of the spectrum scanned are called “bands”. A band is identified in nanometres (nm). For example, an image or band scanned in the visible light region of the spectrum would be identified as 400-700 nm. With multi-bands various colour composite images can be created. Also, bands of various widths on the spectral scale can be recorded.

A single band image shows features in various grey tones but if several images are combined, they can form a colour composite. Fig. 4 B is a true colour composite image of Charleston, South Carolina. A true colour composite is based on using the red, green, and blue portions of the visible region of the EM spectrum. This type of composite relates to what the human eye would see if a person was on a satellite or aircraft looking down at the Earth. Other band combinations form false colour composites. Fig. 4 A, C, and D represent two different false colour composites. A false colour composite generally enhances certain features on an image, features that might not be as apparent on a true colour composite. Using different colour composites is one way that a remote sensing specialist detects features on the Earth.

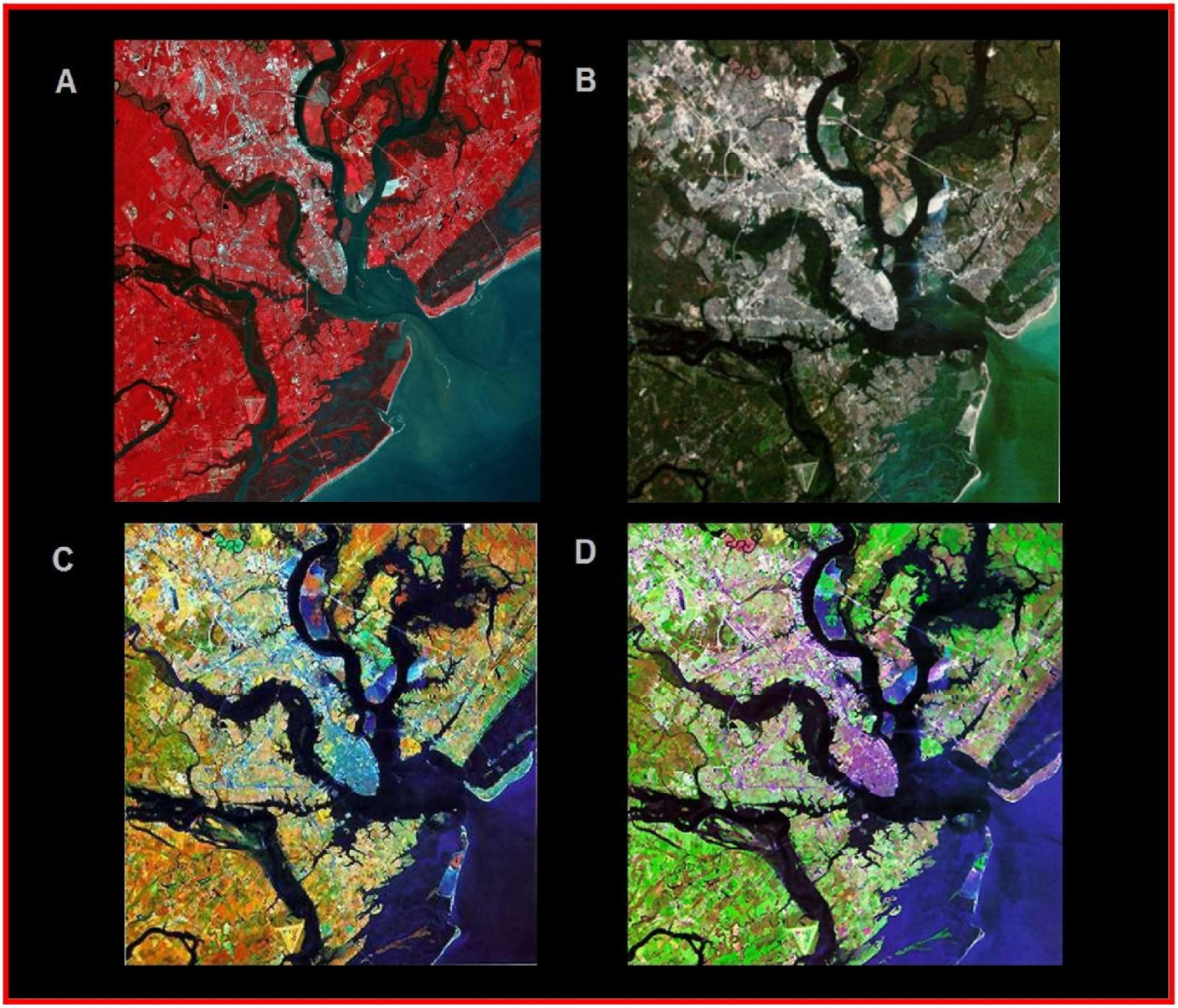

Fig. 4: Colour Composite.

Radiometric and Geometric Resolutions

Digital remote sensing deals with two types of resolutions: radiometric (spectral) and geometric (spatial). Radiometric resolution is the number of levels that a sensor can record spectral information. Such information generally ranges from 0-255 to 0-65,535. The most common range is 0-255, which relates to the storage capacity of an 8-bit computer byte. These numbers are integer values (whole numbers). A single byte can hold one distinct integer value ranging from 0-255. This value represents the degree of reflective or emitted energy recorded by a sensor for a particular ground spot on the Earth's surface. Although geographers take into consideration radiometric resolution when selecting imagery to study an environmental issue, they relate more toward geometric resolution due to its spatial nature.

Geometric resolution refers to the smallest amount of area on the Earth's surface for which a sensor can record radiometric (spectral) information. Generally this resolution is expressed in terms of a pixel (picture element). The pixel size of the Enhanced Thematic Mapper sensor on Landsat 7 is 30m, which relates to an area of 30m x 30m on the Earth's surface. In comparison, a sensor entitled AVHRR has a pixel of 1.1 km^2 while the panchromatic sensor on the QuickBird satellite possesses a 61 cm^2 pixel size.

Geometric resolutions vary greatly and are defined loosely as being low, moderate, and high. The parameters associated with these designations change as finer resolutions in imagery become available. Imagery identified as being of moderate resolution at one point in time might now be low resolution. Fig. 5 shows the size of a one kilometre pixel as it compares to an American football field. Two hundred football fields could be located in a single kilometre pixel. An image with a one kilometre pixel size is viewed as being a low resolution image. Such an image provides a synoptic coverage of the Earth's surface. An example of a low resolution image is Fig. 6, which shows a massive dust storm blowing off the northwest African desert and blanketing hundreds of thousands of square miles of the eastern Atlantic Ocean with a dense dust.

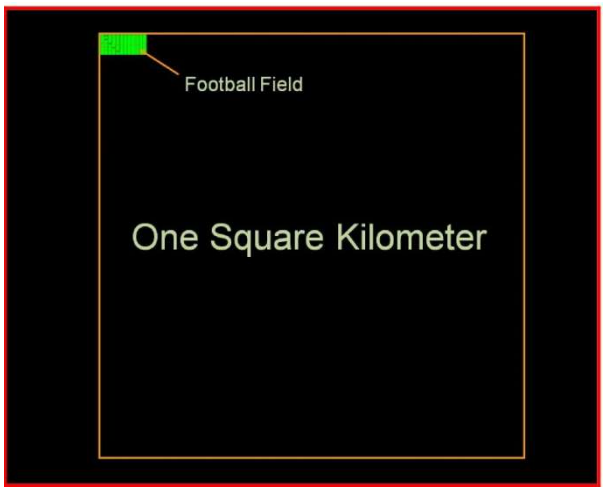

Fig. 5: One Kilometre Pixel.

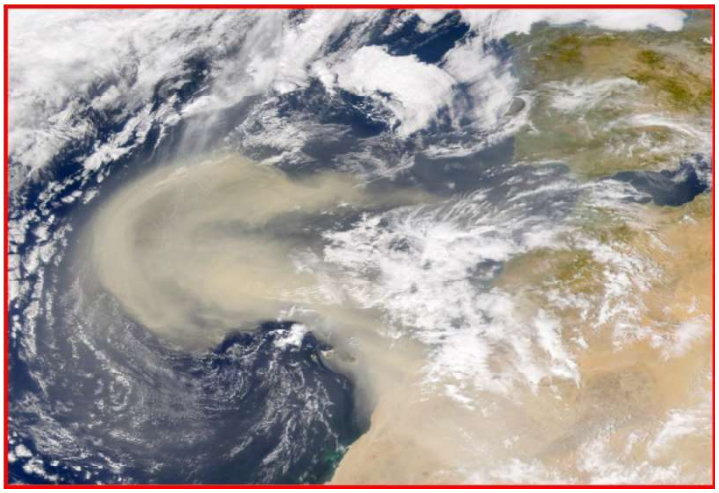

Fig. 6: African Dust Storm (Low Resolution).

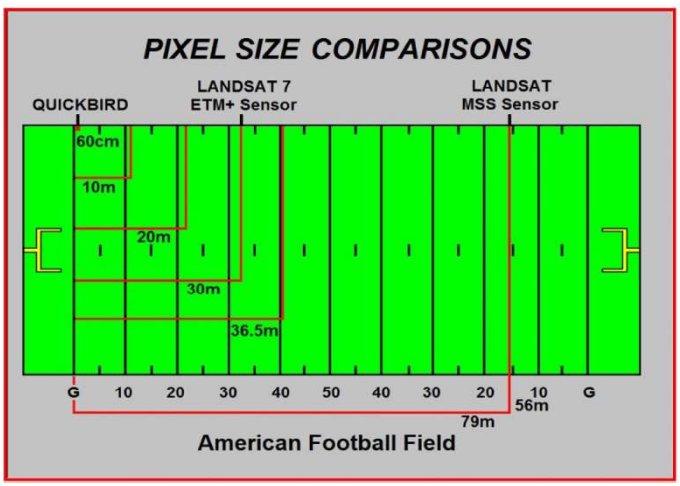

Fig. 7: Pixel Size Comparison

Fig. 7 is a representation of an American football field that has superimposed on it several different pixel sizes. The Landsat 7 ETM^{+} sensor records images at a 30m resolution, which is a moderate resolution size. It would take 5.5 Landsat 7 pixels to cover the area of a football field. One would not be able to differentiate much about the field with only 5.5 pixels. The four images shown in Fig. 4 are Landsat images. They provide more detailed information than the low resolution image of the desert dust storm in Fig. 6 but do not cover as much area. Situated in the upper left portion of the field is a QuickBird pixel. An image with a 60cm resolution would be a high resolution image. It would take 8,361 such pixels to cover a football field. With this number of pixels one would be able to see a great amount of detail about the field. Fig. 8 is a high resolution image of an actual football field. This image was acquired by a digital aerial camera and the pixel resolution is 30cm.

Fig. 8: American Football Field (High Resolution).

Remote sensing imagery has many applications in cartography, land use and cover, agriculture, soils mapping, forestry, city planning, grassland management, archaeology, military observations, meteorology, and geomorphology, among other uses. In order to use such imagery, one must have considerable knowledge about the Earth's surface and a strong background in remote sensing data acquisition and analysis techniques. Since the Earth's surface consists of a mosaic of environmental conditions, geographers through their unique training in both the sciences and social sciences are well qualified to undertake various remote sensing applications.

Geography Puzzle

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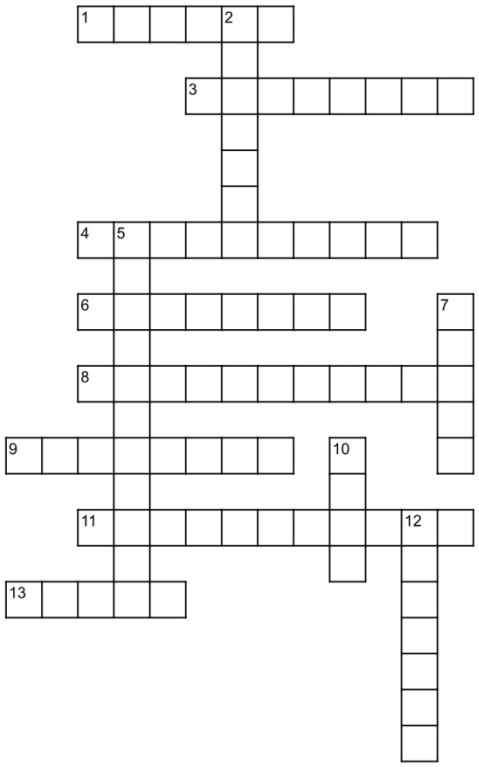
Vol. 1, Issue 1 No. - 2018/01

Mountains and Their Origins



Across

1 Mountains that are made by intense compressional forces
3 The only volcano in Europe to erupt in the last century. It also destroyed Pompeii.
4 Mountains that resulted from geological tensional stress.
6 Mountains that resulted from broad arching of the Earth's crust.
8 A big, deep canyon in Gunnison
9 A mountain with molten stuff, or magma, inside of it.
11 A fun-sounding name for a deadly mountain located in Tanzania, Africa.
13 The closest Rocky Mountain to Denver, Colorado.

Down

2 The tallest mountain in the world which is located in the Himalayas.
5 A mountain chain located in the eastern part of the US.
7 Jews and others believe that Moses got the 10 Commandments on this mountain.
10 A beautifully symmetrically shaped mountain in Japan.
12 A mountain chain located in the northwestern part of the US.

- Send the Answer of Puzzle to bhugolsiksha@gmail.com on and before 20/05/2018. Name of person/s who gives Correct Answer, will be informed in Vol. 1, Issue 2 and same time Puzzle Answer Key will be given.
- Puzzle -এর উত্তর ২০/০৫/২০১৮ -র মধ্যে bhugolsiksha@gmail.com তে পাঠিয়ে দিন। সঠিক উত্তরদাতার/দের নাম Vol. 1, Issue 2 তে জানিয়ে দেওয়া হবে এবং Puzzle -এর উত্তর ও দিয়ে দেওয়া হবে।

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@bhugolsiksha

Vol. 1 ۞ Issue 2 ۞ May 2018

Sub-Theme:

1. Development Issues in Geography.
2. Social Problem.
3. Fluvial Geomorphology.

Rules:

1. Send your text to *bhugolsiksha@gmail.com* with your Name, Title of Topics and your E-mail ID.
2. For English, Font Size: 11, Font: Times New Roman, Align Text: Justify and type it in MS Word having with extension .doc / .docx. Do not accept any other format.
3. There have no limits of page/s for your text.
4. You also send separately figures/ pictures (if any) with this article.
5. You will receive a confirmation E-mail for acceptance.

☻ Last date of submission is 20/05/2018.

☻ Vol.1, Issue 2 will be published on 01/06/2018 (only e-Book). That day e-Book will be uploaded to Facebook Page (*www.facebook.com/bhugolsiksha/*) and Group (*www.facebook.com/groups/bhugolsiksha/*).

বিষয়:

১. ভূগোলের যেকোনো উন্নয়ন প্রসঙ্গে।
২. সামাজিক সমস্যা।
৩. নদী সংক্রান্ত ভূমিরূপবিদ্যা।

নিয়মাবলী:

১. আপনার লেখা নিজের নাম, শিরোনাম এবং নিজের E-mail ID সহ *bhugolsiksha@gmail.com* তে পাঠিয়ে দিন।
২. বাংলা লেখার জন্য, ফন্টের মাপ: ১১, ফন্ট: যেকোনো, পংক্তিবিন্যাস: (প্রান্তিককরণ /Justify)-এর সাথে MS Word –এ টাইপ করুন .doc / .docx -এ । অন্য কোনো Format গ্রহণ করা হবে না।
৩. আপনার লেখার জন্য কোনো পৃষ্ঠার সীমা নেই।
৪. আপনি এই লেখার সাথে আলাদা করে ছবি পাঠান (যদি থাকে)।
৫. আপনার লেখা স্বীকৃতির জন্য একটি নিশ্চিতকরণ E-mail গ্রহণ করবেন।

☻ লেখা পাঠানোর শেষ তারিখ ২০/০৫/২০১৮।

☻ Vol.1, Issue 2 প্রকাশিত হবে ০১/০৬/২০১৮ (কেবলমাত্র e-Book)। ঐ দিন ফেসবুক পেজ (*www.facebook.com/bhugolsiksha/*) এবং গ্রুপ (*www.facebook.com/groups/bhugolsiksha/*) এ দিয়ে দেওয়া হবে।