(3)

# Geography
# By
# Neetu Singh

## Vol-3

## 2014

1. Biogeography
2. Physical Geography of India
3. Indian Geography (Human, Settlement etc.)
4. Climate, Soil Geography of India

PART III

# INDIAN CLIMATE

→ DRY WINTERS

→ DRY SUMMERS

→ ADVANCING MONSOONS

→ RETREATING MONSOONS

# INDIAN CLIMATE

Tropical monsoonal climate prevailing in the country involves the combined effect of relief and latitudinal location. It is however that India represents very well defined rhythmic sequence of seasons in the annual cycle. Demarcated by IMD these seasons includes

(i) Dry winters (15th Dec. – 15th Mar)

(ii) Dry summers (15th Mar. – 15th June)

(iii) Advancing monsoonal season (15th June – 15th Sep.)

(iv) Retreating monsoonal season (15th Sep. – 15th Dec)

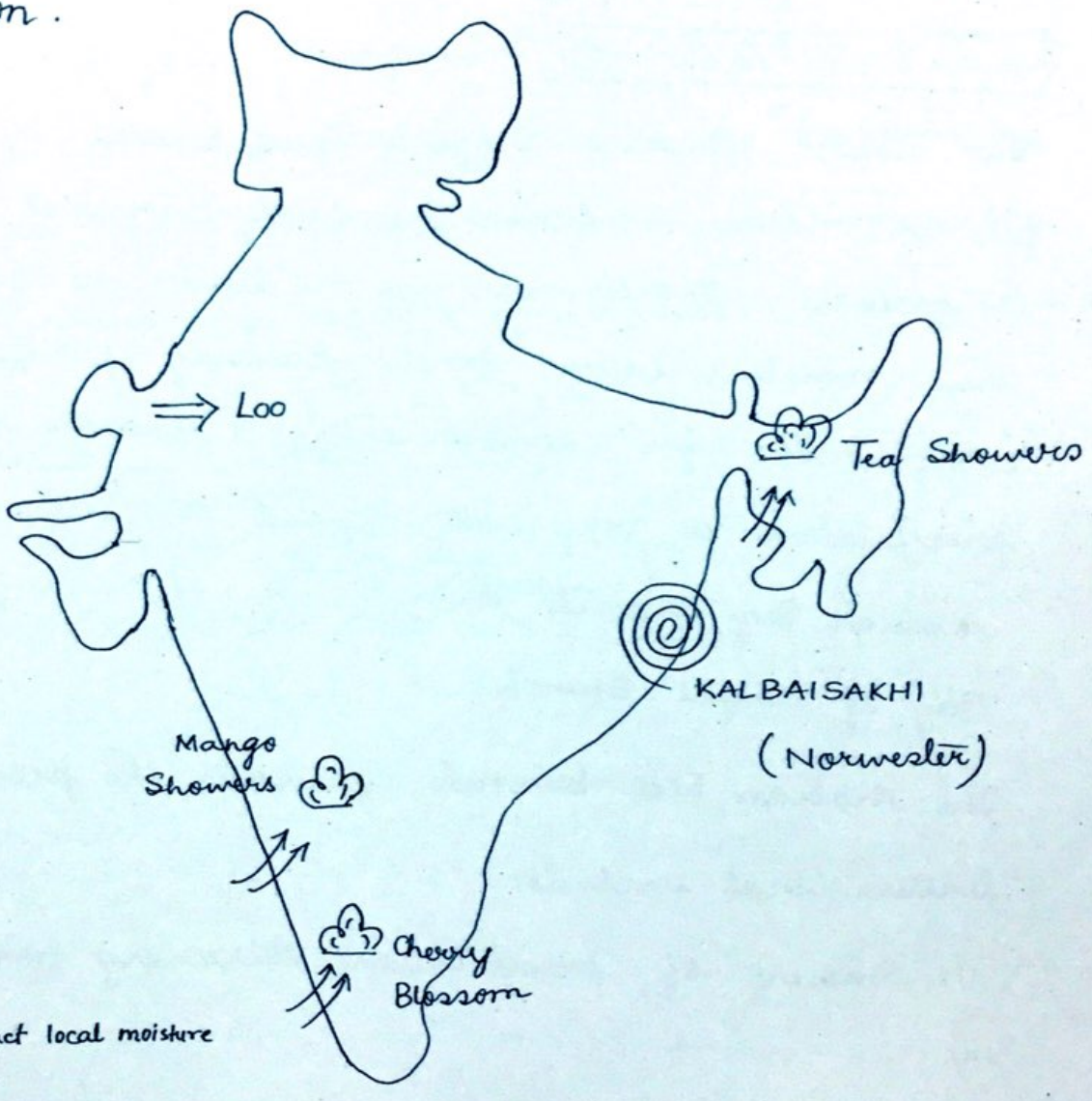
## (i) DRY WINTERS

The typical low sun seasons with prevailing atmospheric stability offshore winds thus dry conditions. The HP over India corresponding to the presence of STHP depicting the effect of maritime and continental locations involves the range between 1014 – 1019 mb. Though entire country for this entire season remains dry it is in the effect of sub-tropical westerly jet that NW part of the country bounded bf. within the gratitude network of 22°N & 82°E experiences western disturbances precipitation.

## DRY SUMMERS

Apparent shift of sun towards north with thermal equator shifting north of geographical equator high T conditions values in the country with the shift of high T isotherm (42°C) from south to north. It is by month of June therefore that entire India experiences high T-conditions. However in the influence of maritime and continental characteristics, peninsula & extra peninsula represents the temperature contrast of more than 10°C. The dry summer season correlates with the development of weak pressure gradient attracting local moisture laden winds that causes precipitation in the confined coastal areas. Tea Showers of sub-Himalayan W.B. and Assam, Mango showers of Maharashtra, Cherry Blossom of Karnataka forms the welcome precipitation watering the standing plants. In this season, natural hazards as heat wave conditions and tropical cyclones are also experienced in local scale. The pressure contrast b/w the Great Indian Desert and neighbouring alluvial low-lands forms the cause of loo, the hot dry local wind creating heat-stroke like health hazards upto Rohilkhand Plains.

In the Hooghly Plains, developed low pressure with favourable supply of moisture marks the generation of tropical cyclones called KALBAISHAKHI. These destructive winds combined with heavy precipitation and sea surges are known to create significant amount of destruction.




- High T
- Low P to attract local moisture laden winds
- Kalbaisakhi
- Loo

Occasionally northern plains of India during this season experiences hailstorm due to the encroachment of moisture laden winds. Similarly in the case of strong 'loo' capable of transporting erg particles in the northern plains of India, increased scattering facilitates respite from excessively heated conditions.

## ADVANCING MONSOON

This season represent sufficiently generated pressure contrast between Indian landmass and neighbouring water bodies to generate attractiveness for SE trades as SW Monsoons. These moisture-laden winds causing precipitation in entire India for almost entire 3 months yields precipitation in very well defined two sub-branches:

Arabian Sea Branch &

Bay of Bengal Branch.

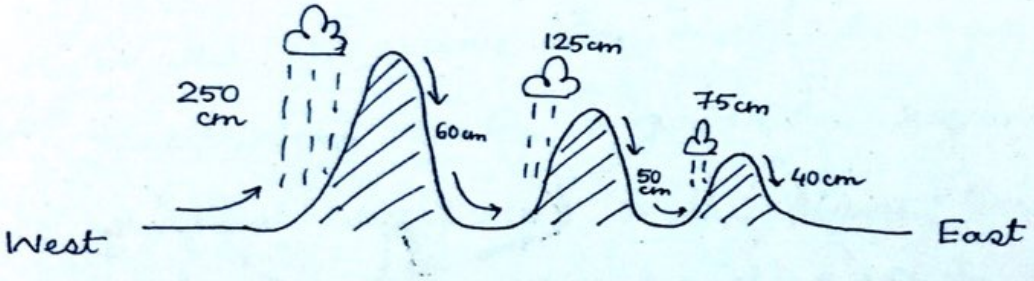
The Arabian Sea branch generates the precipitation pattern that includes:

(i) Amount of precipitation decreasing from S to N &

(ii) " " " " W to E in peninsula.

The movement of Arabian Sea branch taking long term data tables is distinguished as Western Ghats branch, Central Indian branch & Kathiawar Branch.

The Western Ghat Branch, correlating to continuous orographic barrier yields annual amount of ppt. of >250 cms. Even on the windward side, Malabar Coast with taller orography generates more wetter conditions than the Konkan Coast. The W.G. Branch travelling from W to E in almost entire peninsula causes decrease in the amount of ppt. towards east with Telangana & Dandakaranya forming drought-prone interiors. This decrease of precipitation however is not continuous as peninsular orography generates alternating sequence of windward & leeward sides.



# Lecture 47

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04/2014

## The Central Indian Branch

Encroaching in India from the Narmada - Tapi mouths correlates to annual amount of precipitation of only upto 125 cms primarily because orographic barrier encountered is not continuous. In the similar sequence, the Kathiawar branch encroaching in the land from Gujarat coastal plains causes only 75 cms of rain as there is complete absence of orographic barrier. All these branches marks up their merger in the Sutlej - Yamuna plains where lowest pressure of monsoonal trough is correlated to.

A. Sea

Ws Ghats >250

Cn Indian 125

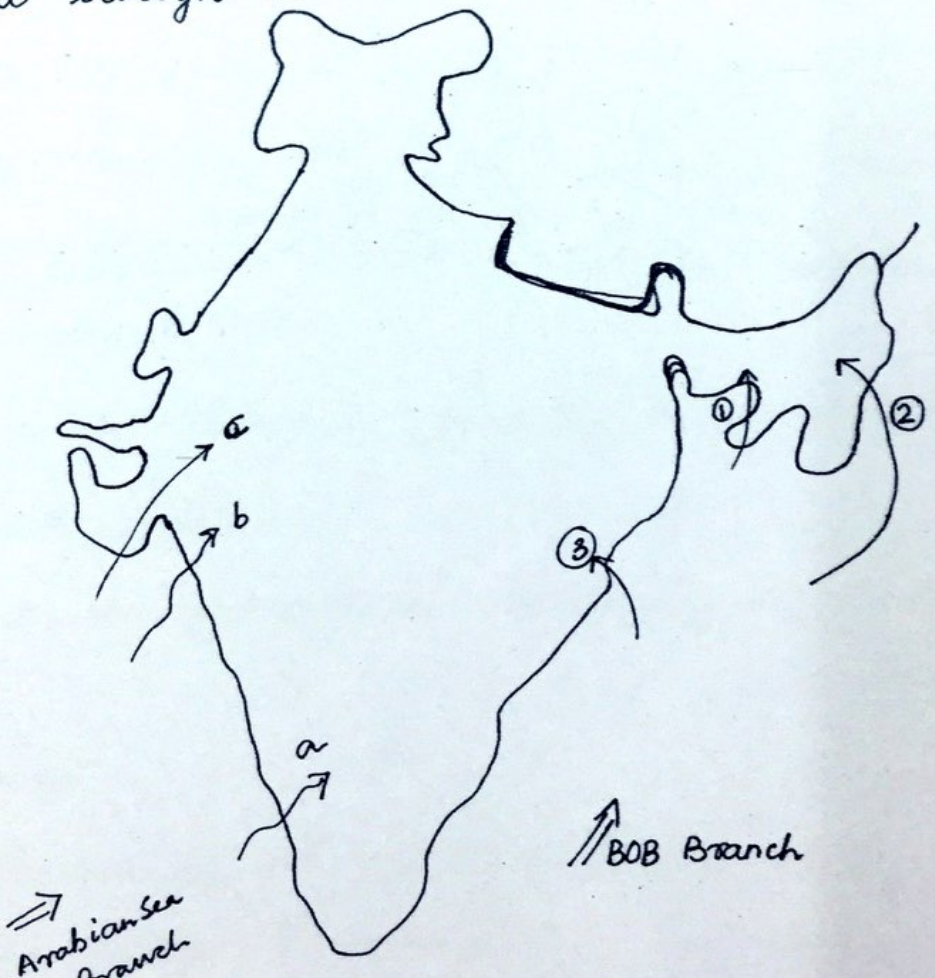
Kathiawar 75

OB

Meghalayan >1000 cm

NEn Branch 7250 cm

Utkal 125 cm



⇒ The Bay of Bengal Branch

It correlates to wettest advancing monsoonal branch called Meghalayan Branch which yields >1000 cms of annual precipitation due to its higher magnitude of moisture attainment. travelling via warmer BoB, this wettest branch therefore generates par humid rain-shadow interiors (150 cms) as well. At near Brahmputra valley Meghalayan Branch marks its merger with NE$^{n}$ Branch that enters India encroaching via Myanmar yielding annual amount of precipitation of >250 cms Both these combined branches travelling from E to W causes continuous decrease in the amount of precipitate in the extra-peninsular region. The rate of decrease of precipitation in the mountainous regions however is gradual compared to the plains. The third branch of BoB called Utkal Branch regulates advancing monsoonal precipitation of Utkal Coast generating Cholanagpur Plateau as a drought prone tableland with eventually merging with the other branches in the northern plains of India. The advancing monsoonal season forms the major precipitation bearing season of the country with >70% of annual precipitation received in entire country barring the exceptions of Coromandal Coast (parallel

movement of moisture-laden winds) along with Lahul-Spiti (H.P.) and Leh-Ladakh (J & K) [continentality + orography]

15 Sep - 15 Dec : Rebreating Monsoons (NE Trades)

15 Dec - 15 March : Dry Winters (NE Trades)

## RETREATING MONSOONAL

Also referred as NE Monsoonal Season, it covelates to precipitation bearing season of the country. Fundamental mechanism leading to precipitation in this season are re-established NE Trades and Tropical Cyclonic Surges. With apparent position of sun towards south, reestablishment of HP over Indian landmass reestablishes NE Trade Winds attaining moisture from significantly warm BoB. These reestablished NE Trades causes precipitation of upto 200 cms in Coromandal Coast.

Though NE Trade remains valid even during DRY WINTERS, they ceases to act as rebreating monsoons as per sufficient "cooled down BoB."

The tropical cyclones forms the second major precipitation bearing mechanism applicable to this season. Sufficiently warm BoB & Arabian Sea

generates strong tropical cyclones. More continentality makes BoB more prone to frequent and intense circulations compared to Arabian Sea. Within BoB lower Gangetic Plain & Utkal Coast are more prone to cyclone than the coromandal coast. In Arabian Sea, presence of Sahyadris minimises cyclone-risk in Konkan Plains. It is Malabar Plain & Gujarat Plain that thus are referred to be more cyclone prone. From among them Gujarat Coastal Plain along G. of Khambat forms most cyclone-prone regions due to its most continental location. General absence of cyclonic surges in G. of Kuchcha is due to less heating of the salt marshes and thus absence of development of LP reqd. for this circulation The rebreading monsoonal season in the continental interiors correlates to unique weather mechanism called OCTOBER HEAT. It represents warm & humid oppresive weather conditions near similar the month of June-July, caused due to water-logged condition facilitating by successful monsoons in the preceding season.

# CLIMATIC REGIONS OF INDIA

Indian climatic categories are primarily distinguished on the basis of annual amount of precipitation. Among the utilised classification schemes KENDREW's classification, KOPEN's classification, STAMP's classification & THORNTHWAITE's classification are included.

## KENDREW's CLASSIFICATION

It is genetic classification scheme absolutely based on precipitation classifying the country into 3 climatic regions :

(a) Par-moist (>200 cms)

(b) Semi-arid (< 100 cms)

(c) Sub-humid (100 - 200 cms)

The par moist region includes Malabar Coast, NE States, and island groups of the country with only 3 winter season months remaining dry.

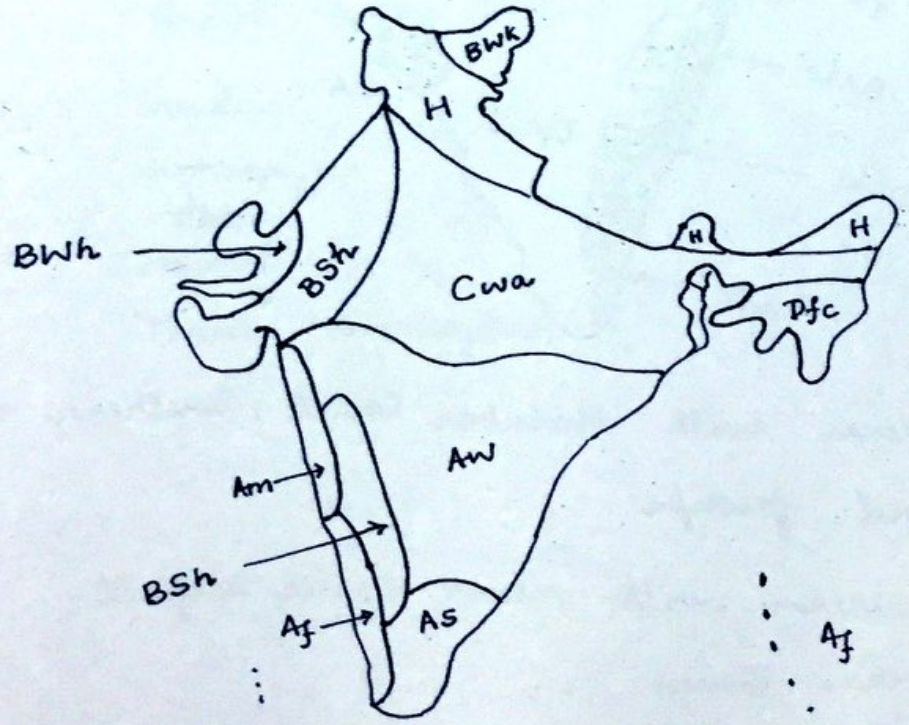
The semi-arid region is sub-divided as true deserts distinguished from other dry areas. The true deserts with <50 cms of rain includes Great Indian Desert, Rann of Kutch and Leh-Ladakh region. Among the areas included in true semi-arid i.e. ppt. b/w 50 to 100 cms - rainshadow interiors of Sahyadris, Telangana, Dandakaryana, CN Plateau, NE Himalayas

and semi-arid belt of western India (Punjab to Gujarat) are included.

Sub-humid region i.e. 100-200 cms of rain includes rest of India with Gangetic Plains, Utkal Coast, Konkan Coast, Coromandal Coast & remaining plateau interiors are included.

## KOPPEN'S CLASSIFICATION:

Empirical climatic classification scheme incorporating both temperature and precipitation in dividing the country into climatic regions. All the climate types barring the exception of polar climate is identified with India. The demarcated climatic regions include :=



# THORNTHWAITE'S CLASSIFICATION (APPLIED)

Applied category of classification involving potential evapotranspiration calculated on the basis of humidity provinces, seasonal variations of it, thermal efficiency regions, seasonal variations of it. With elimination of lab-calculated values Thornthwaite classification scheme is favourably applied to demarcate Indian climatic regions. The distinguished climatic regions include =

AA'r

BA'w

BB'w

CA'w

CB'w

DA'w

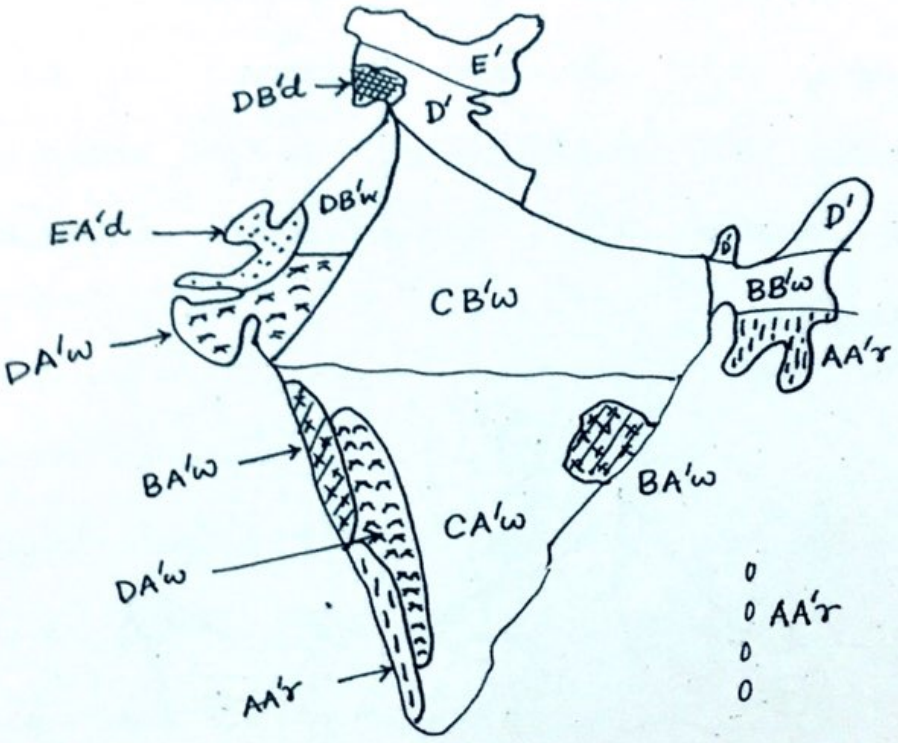
DB'w

DB'd

EA'd

D'

E'




Par moist megatherm with Malabar Coast, Southern NE states and island groups.

BA'w : Moist megatherm with minor winter deficit. Konkan Coast, Utkal Plains.

BB'w : Moist mesotherm with minor winter deficit.

Brahmputra Plains forms example.

CA'w : Sub-moist megatherm with minor winter defical.
Ex. Maxm of peninsula.

CB'w : Sub-moist mesotherm with minor winter defical.
Ex. - Maxm. of Gangetic Plains.

DA'w : Semi-arid megatherm with minor summer surplus
eg. - Rainshadow of Shahyadris & Southern part of western semi-arid belt.

DB'w : Semi-arid mesotherm with minor summer surplus
eg. Northern part of semi-arid western belt

DB'd : Semi-arid mesotherm with no surplus
"Drier Montane climate"
eg. South West J&K.

EA'd : Arid megatherm with no surplus
Great Indian Desert & Rann of Kutch.

D' : Tundra
Himalayas

E' : Frosted
Trans - Himalayas

## STAMP'S CLASSIFICATION :

The climatic classification scheme presented by Stamp forms the most utilised classification scheme of the country. For every purpose of climatic analysis required for planning this classification scheme, belonging to empirical category, includes — temperature and precipitation values, is taken into account to demarcate climatic regions. It is 18°C January-map isotherm that has been taken into account to demarcate :

1) Extra-tropical continental climatic regions
2) True-tropical maritime climatic regions

Demarcated sub-divisions of the climate includes :

Extra-tropical
- i) Himalayan Region
- ii) Nominal Rainfall
- iii) Arid Region
- iv) Moderate Rainfall
- v) Transitional Region

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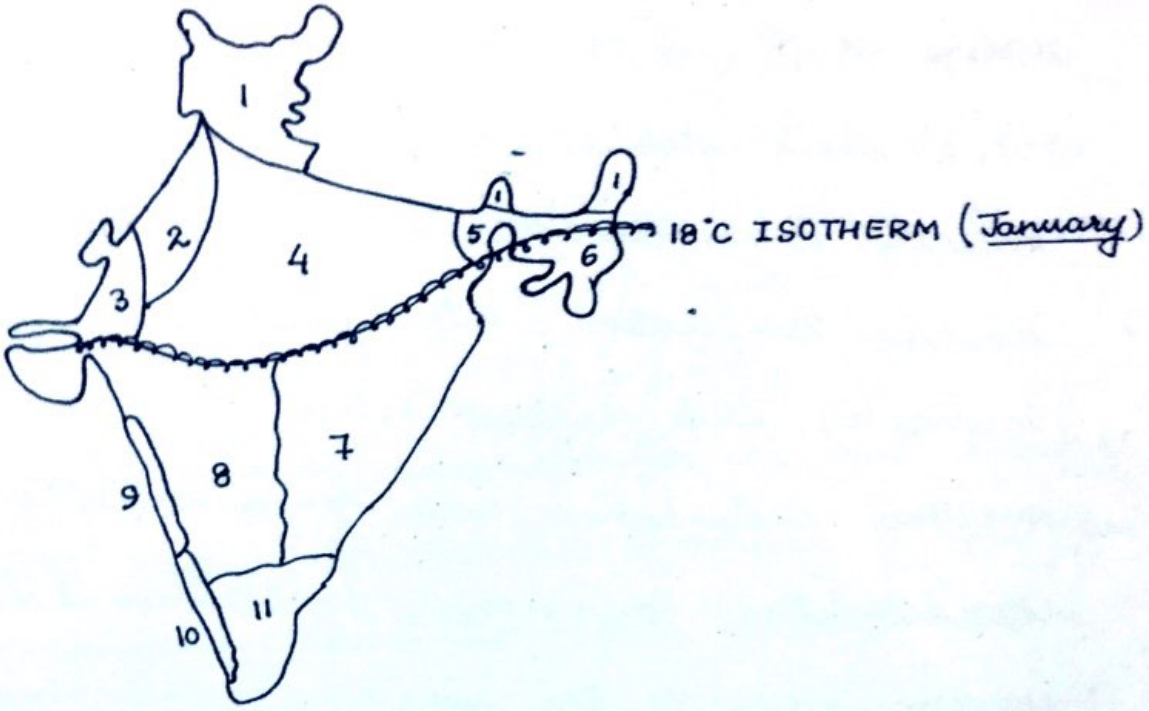
- vi) Excessive Rainfall
- vii) Humid Region
- viii) Nominal Rainfall
- ix) Konkan Coast
- (x) Malabar Coast
- (xi) Coromandal Coast




## (A). EXTRA-TROPICAL CONTINENTAL

Confined north of 18°C January map isotherm, the region collectively includes well-defined low-sun seasons. In terms of relief as well as relative location distinctive sub-climatic regions however are outlined.

Region 1 called Himalayan Region is extensive from J&K to Arunachal Pradesh. Absolute example of montane climate, the region depicts variations in temperature with every increase of height. Among the specific characteristics is more continental NW Himalayas receiving western disturbances rain and more maritime Sikkim & Arunachal Himalayas receiving advancing monsoonal rains.

Region 2

The nominal rainfall region with amount in the range of 50 - 100 cms is confined in Sutlej - Yamuna Plains which depicts most continental climate of the country. It is therefore that maximum range of annual temperature, latest encroachment of advancing monsoons with earliest retreat & most favourable western disturbances rain form defining climatic characteristics. Occasional hailstorms during dry season adds to the weather mechanism applied to the region.

# Lecture 48

Date 8/04/2014

## Region 3

This region is arid region confined in western Rajasthan & northern Gujarat depicting true desert of the country. Its climatic characteristics of less than 50 cms of annual rain correlates to the permanent prevalence of high pressure.

## Region 4

Moderate rainfall region accounts for largest part of extrapeninsular region. It includes Chambal Valley, Upper and mid-Gangetic plains. The region incosporates moderate effectivities of both advancing monsoons & western disturbances. It is with this region that the effectivities of loo and hailstorm during dry summers are also associated. Range of annual precipitation is between 100-200 cms.

## Region 5

It is the transitional region incosporating Sub-Himalaya WB and neighbouring Brahmputra plains. The transitional characteristics denotes the combination of location transition b/w peninsula and estra-peninsula as well as precipitation transition b/w moderate and excessive rainfall regions. This climatic region is completely deprived of western disturbances effectivities and

xperiences 150–200 cms of rain justifying its characteristics.

TROPICAL MARITIME REGIONS:

Demarcated south of 18°C January-map isotherm, entire region is identified with less intense winters. It incorporates six different climatic regions.

Region 6

Excessive rainfall region confined in NE India

Region 10

Malabar Coast including islands.

The above two regions represents similarity with annual amount of precipitation >250 cms, very well distributed thro'out the year, with only 3 low-sun season months representing true dry conditions. However apart from location & actual amount of rain, the 2 climatic regions are distinguished from each other as Malabar Coast includes the cyclonic effectivity and excessive rainfall region have well defined winters.

Region 9 i.e. Konkan Coast & Region 11 i.e. Coromandal Coast also denotes similarity in reference to the season specific precipitation with annual amount in b/w 100 to 200 cms. They are distinguished

not just on the grounds of location but also season of precipitation which makes Konkan Coast (region 9) more wetter than Coromandal Coast (region 11) inspite of similar amount of precipitation. Added to these, Coromandal coast involves cyclonic surges which is near completely absent in Konkan Coast. Maximum part of Indian peninsula is included in region 7 i.e. humid and region 8 i.e. moderate/nominal.

Climatic region 7 incorporating maximum of the coastal belt of BoB qualifies to be humid as it involves pre- and post-monsoon tropical cyclonic surges combined with direct encroachment of moisture-laden Utkal branch. However the region also including drought-prone tablelands of the country do not represent as wet conditions as correlated to the other coastal areas.

For region 8 which is majorly comprised of drought prone interiors of Sahyadris along with coastal plains of Gujarat that marks the effect of driest sub-branch of advancing monsoons represents nominal rainfall region.

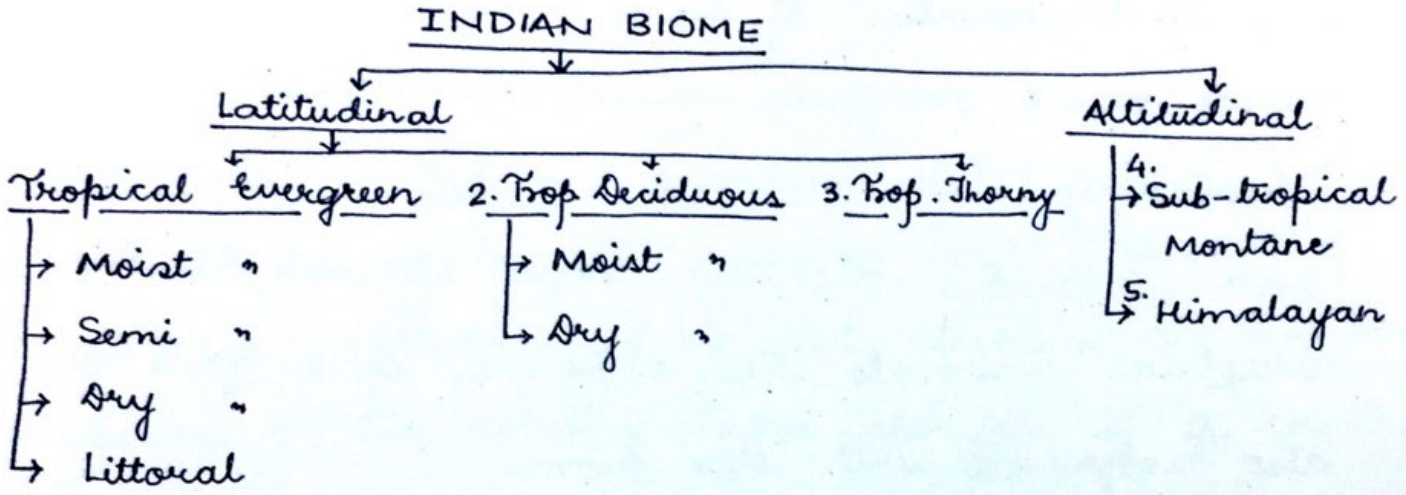
verall, Stamp's Classification utilised for all the practical purposes of study of climate & climate-based planning forms the best climatic classification scheme among all the other categories.

## PART IV

# INDIAN BIOMES

# The INDIAN BIOME

Ministry of Environment & Forests identifies Indian bio-diversity to be dominantly tropical. Maximum variations in the characteristics of biomes is due to the prevailing nature of precipitation. Taking these facts into account 5 distinctive categories of Indian biomes are distinguished. These includes :




## . TROPICAL EVERGREEN

It is the terrestrial biome that is identified with the densest vegetation stand due to the prevailing wetter conditions. It is in the range of amount & season of precipitation that this biome is sub-categorised into 4 categories :=

i) The moist evergreen
ii) The Semi evergreen
iii) The Dry evergreen
iv) The Littoral

The MOIST Evergreen

The moist evergreen biome depicting densest undergrowth is primarily confined in regions with 7200 cms of rain including malabar coast, island groups and southern parts of NE states. The nature of standing phototrophs involves diversity of deciduous plants with TOON, DHUP, AGAR & GURJAN as important varieties of trees. Dense undergrowth marks moist evergreen correlate to arboreal adaptability with MALABAR HORNBILL, NILGIRI TAHR and LANGOORS depicting unique heterotrophs. Big terrestrial animals like elephants and tigers are also recognised with this biome.

The SEMI Evergreen

Depicting sparse undergrowth as it is primarily confined in regions of upto 200 cms of rain. Konkan Coast and Brahmputra Valley represents the location. MANAS, BETLA, GORUMARA & INDIAN CHESTNUT forms important varieties of trees. Arboreal adaptability is largely missing in this biome with big terrestrial animals elephants, tigers, rhinos and aquatic heterotrophs as GANGETIC DOLPHIN

and GHARIAL represents the heterotrophs.

iii) The DRY evergreen

Confined to Coromandal Coast, dry evergreen biome represents the effectivity of dry summers. Lower canopy of vegetation with trees like Indian Chestnut and MUDUMALAI involves sparser varieties of heterotrophs with dominating animals as NILGAI and CHAWSINGA.

iv) The LITTORAL

Considered to be the part of OPEN FOREST, the littoral vegetation is formally treated as terrestrial biome in the country. Entire shoreline of the country (7516 kms) correlates to both on- and off- shore littorals. Among the prominent locations, however, sunderbans, Chilka Lake, Pulicat Lake, Vembanad Lake, G. of Khambat & G. of Kutch are included. Important varieties of trees includes SUNDARI, NIPA, BHENDI and KEORA. The heterobioph population involves ROYAL BENGAL TIGER, SWAMP DEER, HUMP BACK DOLPHIN, OLIVE RIDLEY TURTLE, ASIATIC BOX TURTLE with nectonic varieties — CRABS and PRAWNS and range of waterbirds.

# TROPICAL DECIDUOUS BIOME

This biome correlates to maximum expanse of the country corresponding to the dominating-most climate i.e. tropical monsoonal climate. This biome is sub-divided into 2 sub-categories :

- Moist Deciduous
- Dry Deciduous

## The MOIST Deciduous

This biome correlating to the regions with 150 to 200 cms of rain includes Gangetic plains, Utkal Coast, Narmada- Tapi basins, Bangalore Mysore tableland and Chos Belt of Sutlej- yamuna plains. This biome includes SAL, TEAK, SANDALWOOD as important varieties of trees.

## The DRY Deciduous

This biome in comparision is confined to the locations with 150 cms of rain. It includes Semi-arid semi-circular belt of western India from Punjab to Gujarat & plateau interiors as its prominent locations. Among the important varieties of trees TEAK, SAL, PALAS, KENDU are included.

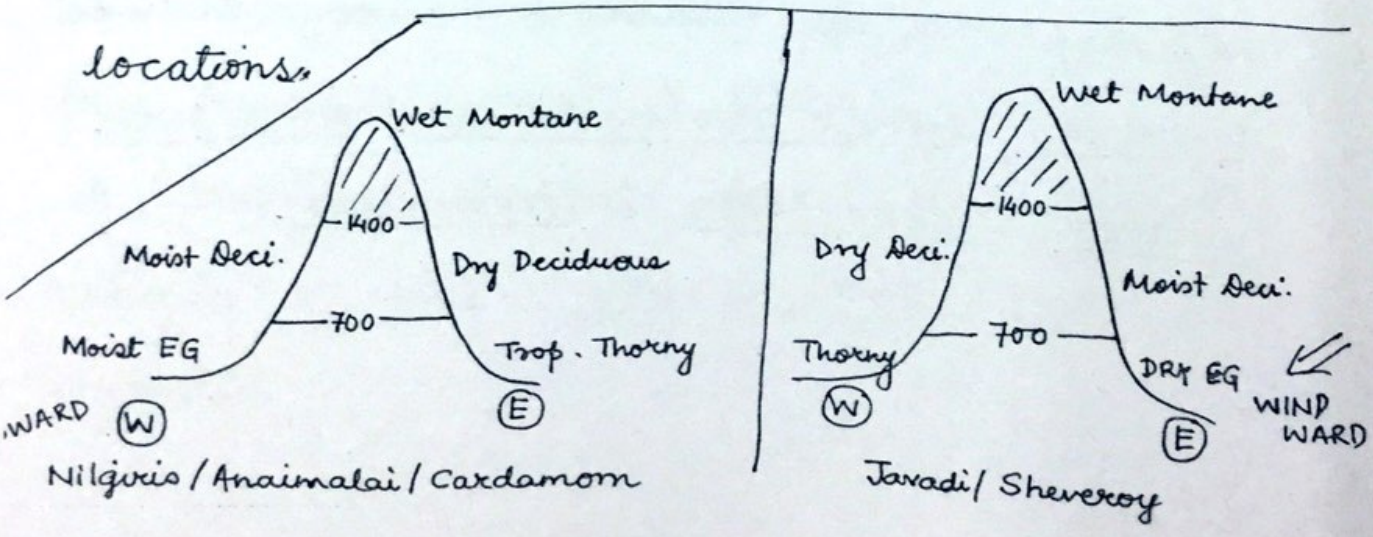
The tropical deciduous biome represent entire range of heterotroph population of the country with generalised ELEPHANTS, TIGERS along with specialised LION (Gir Forests), CHITAL (Moist Valleys), SAMBHAR (wooded regions), entire range of BUSTARDS with BENGAL FLORICAN, LESSER FLORICAN & MAC QUEEN*; FLAMINGOES, GHARIALS & DOLPHINS as important examples.

3. TROPICAL THORNY

This biome is confined in true deserts and drought prone interiors of the country representing western Rajasthan, northern Gujarat, rainshadow interiors of Sahyadris, Telangana, Dandakaranya and CN Plateau. The phototrophs includes xerophytic adaptability with BABUL, SENEGAL, SABAI GRASSES & halophytic adaptability of KABULI KIKAR. The heterotrophs in the specialised category includes CHINKARA, GREAT INDIAN BUSTARD, BLACK BUCK, VULTURE, DESERT FOXES & FLAMINGOES.

## 2. SUB-TROPICAL MONTANE

This altitudinal biome is correlated to <u>southern hills</u> where the latitudinal location, altitude and sun-bearing characteristics are identified to be similar with the variations generated primarily due to maritime influence. For Nilgiris, Anaimalai and Cardamom - western slopes forms the windward slopes whereas for Javadi and Sheveroy it is eastern slope that is windward slope. Moreover, for Nilgiris, influence of advancing monsoons and for Javadi, influence of retreating monsoons adds to the distinction in developed biomes. Climatologically, amount of precipitation on the windward side goes on decreasing with increasing height whereas on lee-interiors it decreases with decrease in height making maximum difference applicable to Piedmont locations.



## E. HIMALAYAN BIOME

This altitudinal biome correlates with maximum biotic diversities generated due to height. Unlike sub-tropical montane, this biome incorporate only southern slope as sun-bearing. In accordance, the biotic characteristics remain confined to only one slope. In terms of location, Himalayan biome is sub-classified into

(a) NE$^n$ Himalayan
(b) Trans Himalayan
(c) NW$^n$ Himalayan

(a). The NE$^n$ Himalayan biome confined to Sikkim & Arunachal Pradesh represents stronger maritime influence and thus includes moist evergreen and moist deciduous biomes as major categories. In accordance, arboreal adaptability with RED PANDA, LESSER CATS justifies unique heterotrophs, along with common elephant & rhino population In terms of height, it is in Sikkim that temperate variety of animals - SIKKIM STAG are also included.

(b) The Trans-Himalayan biome confined in J&K lies to the lee-side of Himadri and thus,

xeric represent lesser production / productivity restricting the biotic community to the grazing levels (herbivores) GAZELLE, IBEX, YAK represents the specialised heterotrophs. The Brackish water lakes avail the habitat for water birds as BLACK NECKED CRANE.

Most diverse biome, however, correlates to the NW$^{n}$ Himalayas. It incorporates entire sun-bearing slope with the range of height upto the treeline of this latitude. Distinctive altitudinal biomes includes - tropical hardwood deciduous biome, temperate hardwood deciduous, coniferous biome and tundra biome. The treeline for NW$^{n}$ Himalayas is identified to the height of 4500 mts, which paves way to seasonal ALPINE tundra biome till the height of 6000 m.

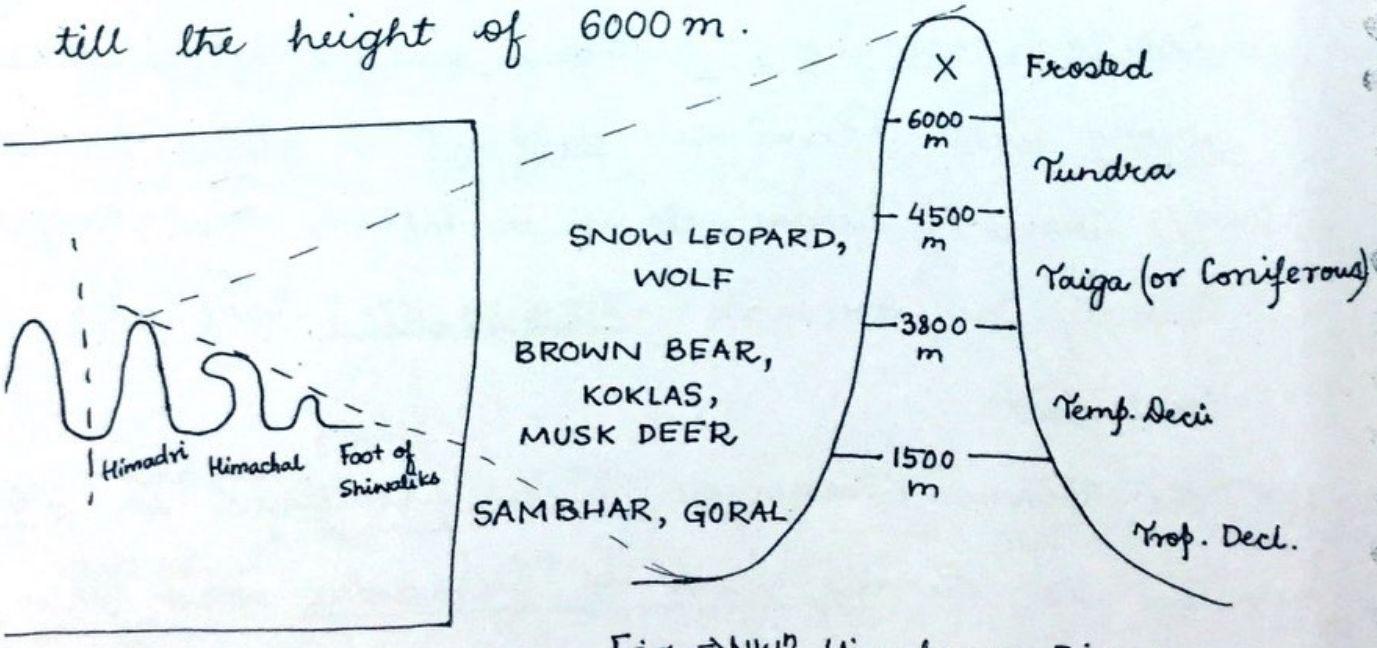



Fig. ⇒ NW$^{n}$ Himalayan Biome

= ZOOGEOGRAPHICAL ZONES - INDIA

→ Demarcated by Wildlife Research Institute, contributed by Rogers and Panwar (1986)

→ Ten Zones:

① Trans-Himalayas
② Himalayan
③ Desert
④ Semi-arid
⑤ Western Ghats (including Southern hills)
⑥ Deccan Interiors
⑦ Coastal Plains
⑧ Gangetic Plains
⑨ NE States
⑩ Islands (Nicobar Islands ⇒ Equatorial Biome)

# Animals ⇒ Zoogeography

# Biodiversity ⇒ T & Ppt.
Warm & Wet
Diverse

≠ Assingment Question

→ Write Short Notes on Zoogeographical Zone - Deccan Interio

Location
Climate
Pholobroph
Helerobroph

09/04/2014 Lecture # 49 Contemporary

① FCA – 1980

Indian Forest Act – 1927 : Prior to FCA (1980)

→ CAMPAs (2010)

) NFP (1988)

↳ Joint Forest Mgmt. Guidelines

↳ Social Forestary (2011)

↳ Integrated with MGNREGA

→ Environment Policy (2006)

↳ Forests Rights Act (2006)

↳ REDD + (2009)

3) NEP (2006)
(National Environment Policy)

{ →MFF
→Coral Reef Protection

IUCN – International Union

PART V

INDIAN

# ENVIRONMENT PROTECTION & CLIMATE CHANGE MITIGATION

MoEF forms the nodal ministry planning, implementing & monitoring environment protection programs in the country. This nodal ministry functions in accordance to the provisions of 3 flagship laws:-

① FCA (1980)

② Wildlife Protection Act (1972)

③ Environment Protection Act (1986)

## FOREST CONSERVATION

The forest status report in accordance to 2014 environment report maintains Indian rank as 10th most forested country of the world accounting for ~1.8% of the global forest area. However, unlike the top 9 countries, Indian forest status reveals stability inspite of heavy population load and absence of fulfillment of the fundamental physical needs. It is approx. 23% of the total geographical stretch of the country which is forested and is distinguished as forest area (20%) and tree-cover (3%). The forest area in turn incorporates moderate dense, open (including Mangroves) and very dense categories in decreasing order of share. In regional perspective it is mountainous regions that accounts for maximum 39% of the total

geographical stretch as forested. In the political sub-divisions, all the NE states except Assam accounts or > 75% of their respective geographical stretch as forested. In comparision, Punjab-Haryana accounts for less than 10% of their total geographical stretch as forested.

The Forest Conservation approaches in the country is traced back to 1927 as Indian Forest Act. It formed the first comprehensive forest conservation act which primarily focussed on regulatory provisions with absolute absence of participatory clauses. Chronologically, important milestones in the forest conservation includes:

i) Forest Conservation Act (1980) – FCA

ii) National Forest Policy (1988) – NFP

iii) National Environment Policy (2006) – NEP

) The FOREST CONSERVATION ACT (1980):

This makes one of the flagship laws regulating the functioning of MoEF & forms the first comprehensive law oriented absolutely towards minimising the diversion of forested areas for non-forestary purposes. It, therefore, established the

norm of compensatory afforestation making user-agency compensate in cash or kind for the diverted forest land.

* In the present perspective, mechanism of compensatory afforestation with the Supreme Court intervention have become much more applicable and result-oriented. Under the present mechanism, the user agency has to pay for not just the diverted land but also for the destructed forest-resource base. In case of protected areas, user agency is required to pay 5 to 10 times net-worth of land and forest resource along with the attainment of Supreme Court approval. The generated revenue remains in the control of national CAMPA advisory council, kept outside consolidated fund of India in the name of the concerned state CAMPA (Compensatory Afforestation Management and Planning Authorities). The collected fund is provided to the state CAMPAs as annual plan fund with national advisory council involving the responsibility of monitoring & evaluating the

progress. For this purpose, maximum of 5% of the generated revenue is utilised which since 11th plan period have paved way to E-GREENWATCH currently implemented in AP, Karnataka, MP, Sikkim and Tripura and is likely to be implemented in the entire country by the end of current plan period.

The NATIONAL FOREST POLICY (1988):

The forest policy primarily incorporated the clauses of realisation that in the absence of well-defined mechanism compensatory afforestation is failing to generate desired returns. This policy therefore advocated transition from regulatory to participatory and from revenue-oriented to conservation-oriented.

Following this approach, in 1990, the Joint Forest Management Guidelines was notified. Orientation of these guidelines was to enhance local community participation in the management of forest and forest resources. Under these guidelines social forestory programmes was integrated in

Forest conservation multiplying the common participation. At present, social forestary integrated with Mahatma Gandhi NREGA justifies well-defined grass-root participation in the forest conservation. The mould of forest policy as forest rights Act (FRA-2006) correlates to the significant mention of historical injustice in the National Environment Policy (2006). In the reference of FRA-2006, STs and all traditional forest dwellers are provided with significantly delayed rights on their forest and resource. It is in accordance that the benefits arising from comprehensive reduction of emissions from deforestation and forest degradation (REDD+), ratified by India in 2009, will also involve traditional forest dwellers. REDD+ argues for compensating countries/regions not only for reducing deforestation but also for conservation, sustainable management & increase of forest cover.

## The NATIONAL ENVIRONMENT POLICY (2006)

It involves the provisions of protection of mangrooves which are considered to be part of open forest in the country. Mangroove prolection integrated with coral reef prolection involves the provisions of IUCN's regional initiated called Mangrooves for Future (MFF) along with coastal regulation zones (CRZs) notifications - 2011. In reference to MFF, approx. 5% of the quality mangrooves is targetted to be protected involving protection of coral reefs that provides substantive habitat. WB, Gujarat & AN Islands make the priority zones. In the CRZ- notifications, Sudarbans, Navi Mumbai, Greater Mumbai, Goa, Kerela and A-N Islands are been provided with priority of planning.

# BLOCK 2: WILDLIFE CONSERVATION/PROTECTION

Wildlife Protection Act

This second flagship law regulating the functioning of MoEF involves the provisions of INTEGRATED DEVELOPMENT of wildlife habitat. It is under this flagship law that 3-fold objectives of protecting wildlife is correlated with

i) Support to the protected areas
ii) Biodiversity protection
iii) Recovery programs

The protected areas in the country are notified in accordance to this flagship law involving 2003 amendment protected areas in the country includes wildlife refuge (completely natural), national parks (semi-natural), conservation reserves and community reserves in decreasing order of numbers. It is in the provision of WPA (1972) that critically endangered animals are distinguished as category I animals provided with highest priority of protection which involves wildlife crime control bureau with the provisions of

monetary fine and imprisonment for illegal hunting of the notified categories of the animals as tigers, lions, elephants, gharials, antelopes, rhinos.

The support to protected areas provided under this act includes cent percent Central assistance for all the non-recurring items and for the protected areas in mountainous, deserts, coastal areas; and the protected areas involving endangered species. For rest of the locations and for re-occuring items it is equal resource sharing between the union and concerned state governments

The protected area network in the country involve global recognition as Man and Biosphere (MAB) Reserve and world Heritage Convention Sites In India out of 18 biospheric reserves, 8 are included in the MAB list of UNESCO. Moreover, from among the entire list of protected areas, there are 6 that are notified as World Heritage Convention Sites. Among the latest examples, W. Ghats incorporating Radhanagari & Chandoli National Parks was integrated in World Heritage Convention list in 2012 and Amarkantak

Biospheric Reserve have been integrated in MAB site in 2013.

(11) BIODIVERSITY PROTECTION

At par with the provisions of CBD, India incorporated biodiversity protection act in year 2002, generating multi-hierarchial administrative support for regulating the use sharing the benefits & conserving the biodiversity. It is under this Act that National Biodiversity Authority was established as an autonomous body working under MoEF involving the network of state biodiversity boards and biodiversity management committees at PRIs levels. (Panchayati Raj Institution Levels). Under BDA national biodiversity strategies were formally initialed in 2008 involving:

(a) G-SHE

(b) GANGES

(c) TEEB

G-SHE represents Governance for Sustaining Himalayan Ecosystem which is depicted to be one of the most diverse and fragile ecosystem of

the country.

GANGES is Global Advisory Network Group on Environmental Sciences which involves participation of NRIs & PIOs on the priority basis to induce monetary or technical support in mobilising sustainable use of biodiversity.

TEEB is The Economics of Ecology and Biodiversity rolled by group of like-minded megadiversity countries (LMMCs) involves the conservation of biodiversity in its every form and dimension. This group involves 17 countries of the world which collectively accounts for 70% of the global biodiversity.

RECOVERY PROGRAMMES:

The recovery plan under WPA (1972) involves the provisions of artificially generated the conditions to revive depleting population of animals. It involves:

(a) Flagship Category

(b) Non-flagship

The Flagship Category involving the priority programme called Project Tiger (1972) & Project Elephant (1992) involves the provisions of functioning of separate national conservation authority under MoEF to regulate recovery programs. Both the flagship programs — — involves the support of World Wildlife Fund (WWF). These programs justifies the priority with the facts that tiger population left-out in only 7% of its original geographical range involves India as one of the remnant destinations. For elephants India incorporates more than 50% of asiatic elephant population. For Project Elephant additional dimension of programme called MIKE (Monitoring of Illegal Killing of Elephants) in the support of CITES justifies its importance. as both these animals correlates to near complete geographical expanse of the country involves well-diffused notified reserves wherein SRISAILAM, NAGARJUNASAGAR is largest tiger reserve and BANDIPUR (Karnataka) have highest density of

-

lephant population in the country.

Among the non-flagship programmes, project Vulture, Project Gharial includes common elements of CAPTIVE BREEDING ; Project Hungar (sub-species of Red Deer) and Project Snow Leopard represent absolute specific-locational projects; and Project Cheetah represents the category where the attempt to revive population of the animal that is extinct in wild is correlated.

BLOCK 3 : ENVIRONMENT PROTECTION ACT (1986)

This flagship law incorporate prominent aspect of climate change mitigation and control measures. Involving active participation of Central Pollution Control Board under this flagship law, there are 2 prominent activities that are mobilised by the Ministry

1 Indian Network for Climate Change Assessment (INCCA)

1 National Action Plan on Climate Change (NAPCC)

# INCCA

The INCCA apart from being involved in the development of four by four (4×4) assessment report on climate change in India projected for 2030 which involves four regions —

i) Himalayas

ii) NE States

iii) W^n Ghats

iv) Coasts

and four areas:

i) Agriculture

ii) Water Resource

iii) Forest Resource

iv) Health

It is also engaged in :=

(a) National Carbonaceous Aerosol Programme

(b) Montreal Protocol Compliance

(c) Environment Impact Assessment (EIA)

The National Carbonaceous Aerosol Programme is the priority initiative of INCCA oriented towards analysis of chemical properties of aerosols & their temporal heterogeneity.

The orientation is to analyse its spectral characteristics to conclude the actual nature of effect it induces on incoming / outgoing radiation and thus change in the heat budget.

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Date 10/04/2014

6. Montreal Protocol Compliance (* INCCA EPA - 1986)

The protocol oriented towards controlling ODS# as the outcome of Vienna Convention involves India as one of the most consistent and successful developing country. India is recognised to be producing 9 out of 96 ODS recognised as per the protocol. Benefitting from multi-lateral fund, India marked the notification of ODSs regulation and control order in year 2000. Under the provisions of these orders, production and consumption of CFCs, CTC≠ were demarcated to be freezed by 2010. India has successfully implemented the prohibition orders barring minor exceptions as utilisation of CFCs in pharmaceutical sector. Moreover in the continuation, the freezing year of HCFCs≠ has been ascertained at 2030 as it is utilised as an interim substitute for the CFCs, specifically in the pharmaceutical sector.

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# ODS = Ozone Depleting Substances

≠ CTC = Carbon Tetra Chloride

≠ HCFC = Hydro CFC

## Environment Impact Assessment (EIA) (Under EPA 1986) INCCA

The EIA notifications traced back to year 2006 is identified to be the major tool to minimise adverse effect of developmental projects on the environment. As per EIA notifications, attainment of GREEN CERTIFICATE is being made mandatory for almost all the large-scale developmental programme which involve massive replacement of natural habitat or is planned in dense-forested areas. Encouraging the cleaner source of energy in the modern infrastructure and industrial growth, EIA amendment in year 2009 completely exempted biomass- or biogas-based power plants from the compulsion of attaining green certificate. As per these amendments de-centralised state-level EIA authorities have also been established, in order to avail favourable data network for planning, implementing & monitoring purposes.

The progress attained so-far involves :=

(a) Charter on Corporate Responsibility for Environmental Protection (**CREP**)

(b) Comprehensive Environment Pollution Index (**CEPI**)

≠ Under CREP, 15 highly polluting industries have been demarcated so far where under EIA notification green certificate is granted under the norms of strict environmental protection agreements. Among the major industries included – metallurgical industries, petrochemicals, paper-pulp, pharmaceutical and fertiliser plants – make examples. # Under the norms of CEPI, with the support of CPCB (Central Pollution Control Board), MoEF have developed this index which analyses levels of pollution in the scale of 0–100. As per this index, polluted areas are being recognised with >70 points on the recognised scale depicting critically polluted areas are completely denied with green certificate for further industrialisation. At present, 43 such clusters have been notified.

≠ NAPCC

The nodal plan that marked its initiation in year 2009 correlates to 9 different missions implemented in the country through different ministries / organisations to make India comply

with Kyoto Mechanism or Flexible Mechanism.

These missions include :=

Jawaharlal Nehru National Solar Mission.

National Mission on Energy Efficiency.

National Mission on Strategic Knowledge.

National Mission on sustaining Himalayan Ecosystem.

Green India Mission.

National Water Mission.

National Mission on Sustainable Habitat.

Sustainable Agriculture Mission.

Clean Coal Mission.

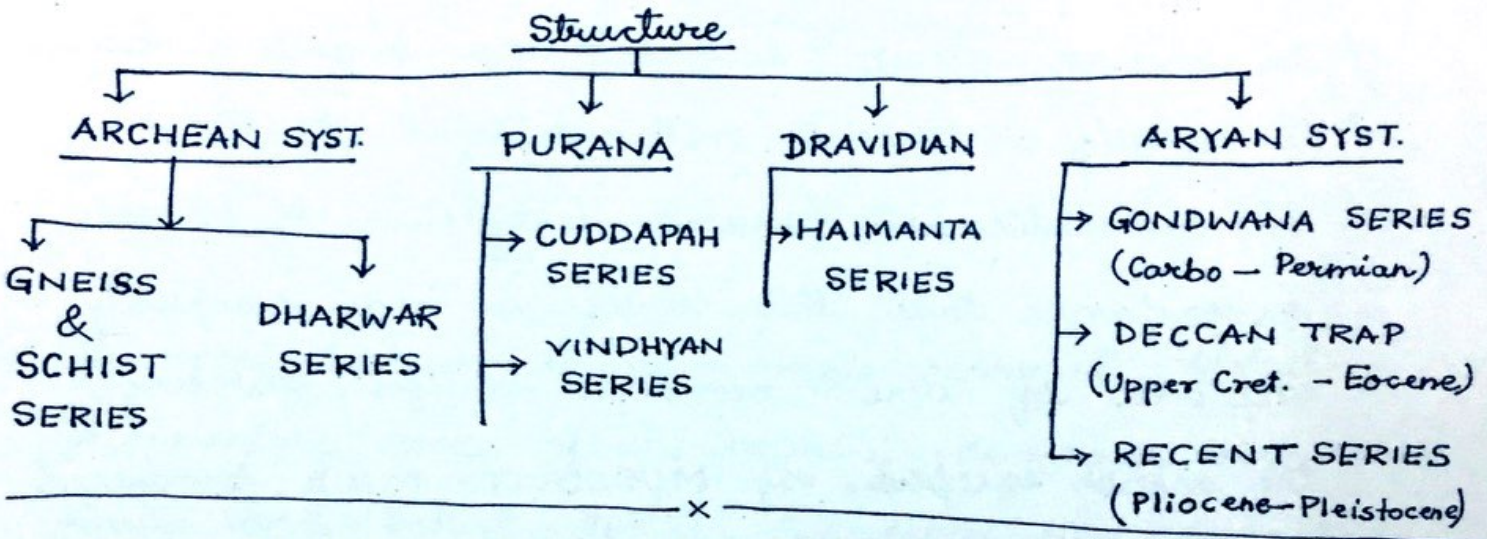
## PART VI

## INDIAN

# GEOLOGICAL STRUCTURE

## INDIAN STRUCTURE :=

Geological Survey of India identifies Indian geological structure to be incorporating all the major imprints of stratā-formations outlined in the chronology of development of surface of earth. Such long chronological development is well demarcated into 4 geological systems :

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Archean System ⇒ Lower Pre-Cambrian

Gneiss & Schist Series → Older 'Lower Pre-Cambrian'

Dharwar Series → Younger "Archean/Lower P-Cambrian"

(Purana System + Archean System) ⇒ AZOIC

Oldest Sedimentary Stratā = Dharwar Series
↳ Adobe of metalliferous minerals

- Cuddapah = Lower Purana ; Like Dharwar
  ↳ Metallic + Non-metallic (due to transgression effect of sea).

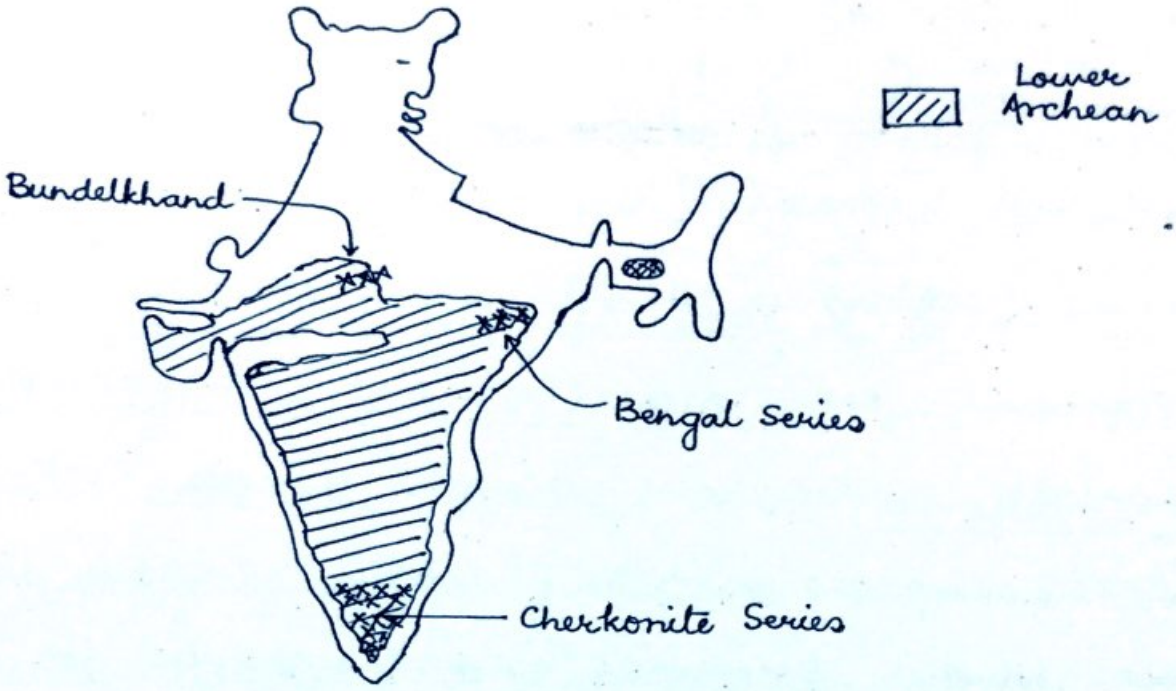
# Vindhyan = Like Cuddapah & Dharwar
  ↳ Only non-metalliferous
  ↳ Limestone

## ARCHEAN SYSTEM

The oldest geological system of the country that corresponds to lower pre-Cambrian (4000 Myear to 1400 M year ago). This system incorporate well-defined sub-divided series called Gneiss and Schist Series & Dharwar Series.

‡ The Gneiss and Schist series represents Indian Shield developed due to original cooling & solidification of Indian crust. Developed as granite & basalt, it largely represents metamorphised plutonic characteristics in present perspective. It is in accordance that this series is near completely deprived of direct economic benefit, barring the minor exception of MUSCOVITE MICA produced in Koderma (another variety called BIOTITE MICA is produced in Nellore). Structurally Gneiss and Schist series forms the fundamental complex or basement rock of India which facilitated subsequent geological and geomorphological developments. Recognised as backbone of Himalayas, this lower Archean Series though covers more than 2/3rd of the peninsula have surface projections as

Bengal Series (CN Plateau), Bundelkhand Series and Cherkonite Series (Southern Hills).




* The Upper Archean <u>Dharwar Series</u> represents <u>oldest</u> sedimentary rocks of the country developed over Gneiss and Schist. It is this series that corresponds to metalliferous mineral resources of the country Deriving its building material from the shield of the country, Dharwar Series represent Karnataka with largest expanse of this geological construct. Within this state, KUDREMUKH, SHIMOGA denotes rich iron-ore producing areas; CHITRADURG, BELLARY- manganese production areas; KOLAR & RAICHUR (HUTTI)-gold producing areas. The Dharwar Series also

correlates to DANDAKARANYA tableland including BILA DILA, JAGDALPUR, DANTEWADA = iron-ore production and extension of Dandakaranya in Odisha have KORAPUT = the bauxite producing area. CN Plateau incorporate NAOMUNDI (iron-ore), LOHARDAGA (bauxite), GHATSILA (copper) in Jharkhand ; KENDUJHARGARH (manganese), BADAMPAHAR (iron-ore), JHARSUGUDA (uranium) in Odisha ; Aravalli ranges with KHETRI, ALWAR, JHUNJHUNUN- copper ; Udaipur (ZAWAR MINES silver), BANSWARA and DUNGARPUR for ~~lead~~ lead and zinc as important Dharwar Constructs of the country.

Karnataka

- Dandakaranya (Chattisgarh + Odisha)
- CN Plateau (Jharkhand + Odisha)
- Aravalli (Rajasthan)

} Largest Belt = Dharwar

## B. PURANA SYSTEM

This geological system correlates to upper pre-Cambrian (1400 M years to 600 M years ago). This geological structure is completely comprised of sedimentary stratas. It is sub-divided into Cuddapah Series and Vindhyan Series.

# The Cuddapah Series representing lower Purana Series are sedimentary stratas developed over Archean Gneis and Schist combined with TRANSGRESSION effectivity of sea. It is therefore that Cuddapah series correlates to both metallic and non-metallic mineral resources. Largest recognised area of this geological formation is identified in the state of A.P. from where it attains its name. Kurnool, Cuddapah and Anantpur (Ramagiri Gold) are the prominent locations producing manganese, dolomite and gold in the state. Beyond A.P., Cuddapah Series is known for country's largest manganese node including Nagpur & Bhandara (Maharashtra); Bhilai & Durg (Chattisgarh); and Balaghat (M.P.). Other important resource base of Cuddapah Series

ncludes copper in Balaghat, dolomite in Seoni and Jabalpur (all in M.P.); dolomite in Raipur, Bilaspur and iron-ore in Dalli - Rajahara (all in Chhattisgarh). Limestone deposits in Bundi, Sawai Madhopur and Kota in Rajasthan — also represent this series. Compared to Cuddapah Series, upper Purana called VINDHYAN SERIES correlates mainly to non-metallic resources. The Vindhyan Series is believed to be as extensive as Archean Gneiss and Schist extending from peninsula below the northern plains buckling up with Himalayas. However in major peninsular part, it is trapped under basaltic magma & in extra-peninsula it is either buried under alluvial deposits or forms innermost fold of Himalayas which makes Vindhyan Series projected on surface only as Vindhyan Range. This series mainly includes limestone deposits confined in M.P. at Satna, Rewa and Katni. This series also includes diamond-bearing horizons of the country with Panna (Geosynclinal) in M.P. and Golkonda

(Lacustarine) in A.P.

# Dravidian ⇒ Paleozoic Beginning

## C. DRAVIDIAN SYSTEM

Correlating to the Paleozoic era (600 M years to 300 M yrs) depicts the extra-peninsular system that is Himalaya mountain building material sourced from Indian peninsula. This is the least deciphered system known only for well recognised Haimanta Series belonging to Cambrian, wherein rock salt (Pir Panjal Range) and anthracite coal deposits in KALAKOT (in Kashmir Valley) form recognised resource base.

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## ARYAN SYSTEM

The youngest geological system of the country that correlates to temporal stretch of 300 M year ago till date. It therefore includes upper paleozoic to pleistocene constructs as important structure. This geological system involves 3 well-defined series called :=

(i) Gondwana Series

(ii) Deccan Trap Series

(iii) Recent Series

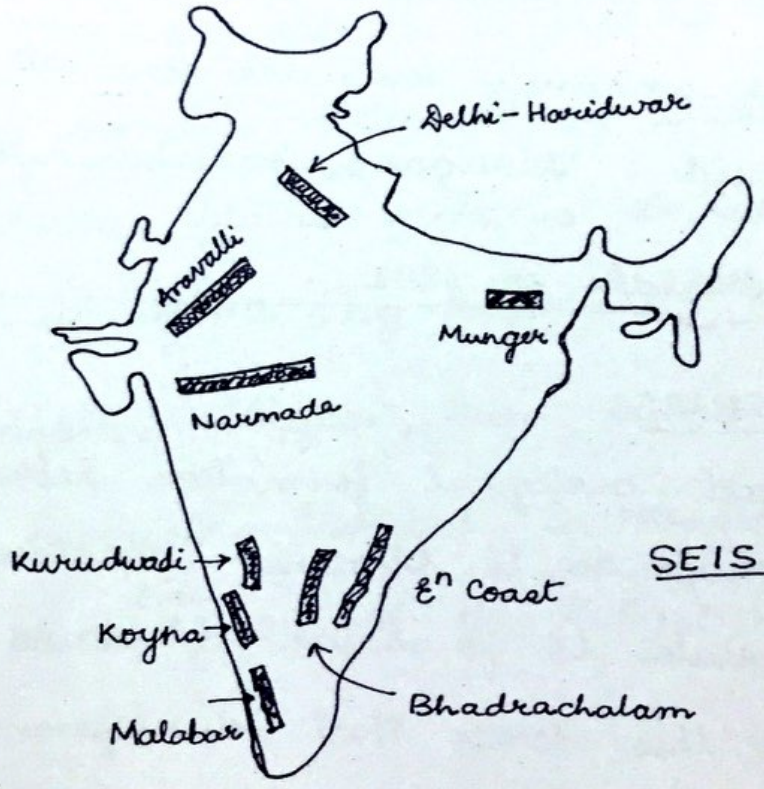
The Gondwana Series corresponding to upper carboniferous and permian forms the coal bearing horizons of the country. Being slightly younger than global coal deposits, Indian coal is prominently bituminous variety. The entire range of Indian Coal of the Gondwana Series correlates to peninsular drainage basins barring only major exception of Brahmputra Basin which includes Sibsagar as the major coal producing location.

Among the peninsular examples, Damodar Valley (in Jharkhand) with Jharia, Bokaro, Giridih, Dhanbad, and Raniganj (WB); Son River Valley – with Singrauli and Umaria (MP); Hasdo R. Valley with Chirmiri and Korba (Chattisgarh); Brahmani R. Valley with Talcher (Odisha); Wardha R. Valley with Pench, Umred, Kamthi and Wardha (Maharashtra) and Godavari R. Valley with Ramagundam, Kottagudem and Singrani* (AP) makes prominent examples. Entire Gondwana series justifies its commercial significance with the fact that >50% of the commercial energy supplies in the country is sourced from coal-deposits. Almost entire Gondwana coal falls in the domain of CIL (Coal India Limited) barring the minor exception of Singrani coal (Singrani Co Corporation Limited) involving minority stake of Union Government, Ministry of Coal.

## DECCAN TRAP SERIES :=

Movement of Indian plate towards Eurasia inducing the compressional stress & marking the beginning of orogenesis of northern mountain wall was near simultaneous to development of extensive transform fault on Indian plate resulting in the ejection of basic magma precisely in between upper cretaceous to eocene. The ejected mobile magma travelled great distances following the available gradient, trapping almost all the earlier geological formations in Indian peninsula. The developed giant steps covering all the original geological constructs of the country is recognised to be deccan trap. With > 1800 m of original height, deccan trap ha paved way to structural soil regur, representing its denudation. Formation of deccan trap involves Maharashtra & Gujarat as the major areas; Karnataka, MP as transitional areas along with CN, Meghalaya & parts of TN as minor areas. Economically, the Deccan Trap

series not just identifies the development of regur soil but also avails the information of general absence of commercially exploitable mineral resource base in the state of Maharashtra. Tectonically, these transform faults correspond to seismic highways denoting earthquake-prone zone '3' i.e. moderate risk zone as well as zone '2' i.e. low risk zone of the country.




SEISMIC HIGHWAYS

Earthquake Risk in India:

GSI, IMD and National Geophysics lab divides India into 5 earthquake prone zones.

Zone 5 is extremely high-risk zone at the plate boundary includes Shivalike, 7 NE States, Kuchchh peninsula and A&N Islands.

Zone 4 is high-risk zone near the plate boundary including Sikkim, NW Himalayas, Kathiawar peninsula.

Zone 3 is moderate-risk zone at seismic-highways i.e. transform faults.

Zone 2 is low-risk zone near seismic highways.

Zone 1 is extremely low-risk zone at absolute stable shield: Telangana, Dandakaranya, CN Plateau.

Latur Earthquake in 1991.

RECENT SERIES

The youngest geological formation representing recent series corresponds to pliocene-pleistocene epochs which correlates to formation of plains of the country. It is with this series that development of erg horizon of Rajasthan is correlated. This sedimentary strata correlates to rich proven deposits of crude oil - Barmer, Kishangarh; & Natural Gas - Barmer

, Tanot. Lignite coal deposits correlating to Jaiselmer, Marpalana and Palana also represents this series. Development of Rann of Kuchchh also correlates to this series not just involving rich source of salt but also lignite coal deposits at Umarsar. Among the other major formations on land, the sedimentary horizon of Malabar plains extensive between Kollam - Kottayam called Monozoite Sand forms world's richest thorium deposits. Sedimentary stratas in TN corresponds to richest lignite coal in Neyvelli. The similar sedimentary stratas with Gujarat alluvial plains includes Ankaleshwar, Kalol as crude-oil producing regions. In Brahmputra Valley in Assam - Digboi, Sum-Duma & Naharkatia are crude oil producing regions & Krishna-Godavari Basin in AP has one of the richest natural gas deposits.

In the offshore category, Hazira (Gujarat), Rawa (AP) - forms commercially mobilised natural gas producing regions & Mumbai High (ONGC) - crude oil & natural gas production site.

'hysiographically, recent series is also known for Karewas of Kashmir Valley that are the glacial deposits considered to be the most fertile location for cultivation of saffron.

Nellore (A.P.) — Biotite Mica (Belongs to recent series)

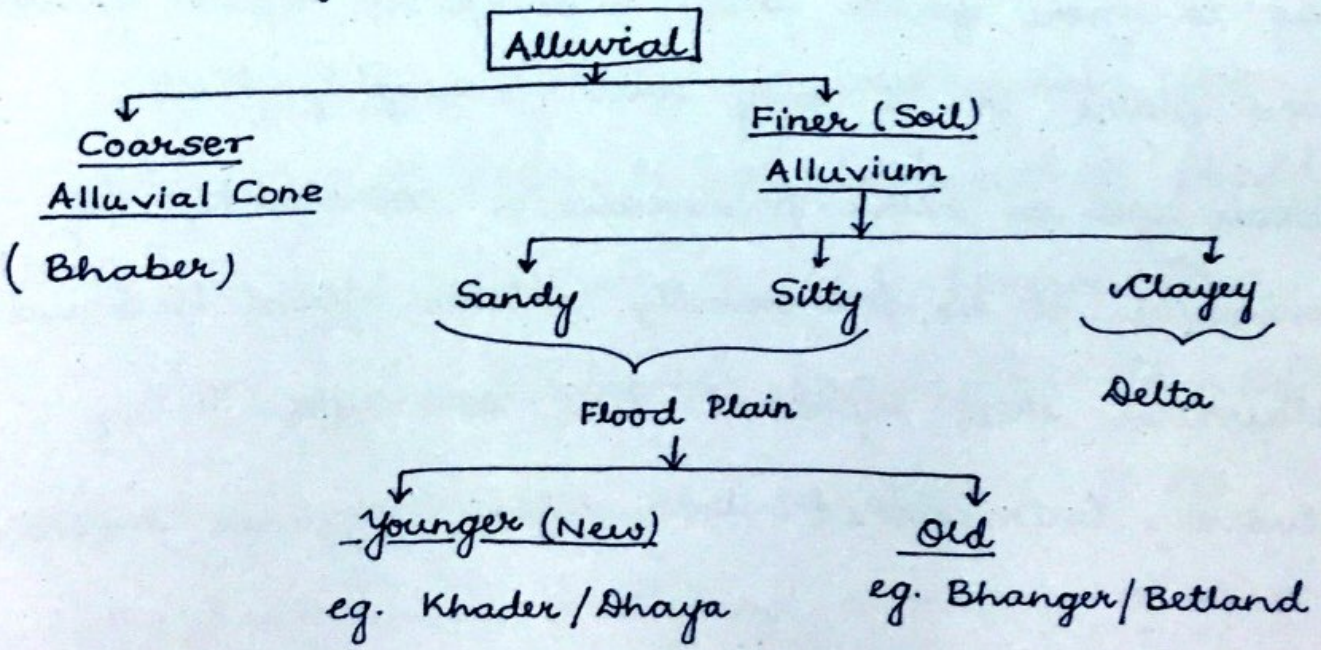
## Part VII
## INDIAN
# SOILS

ICAR = Indian Council of Agricultural Research

# INDIAN SOILS

Diversity of physiography, climate, vegetation and structure forms the base of diversity of Indian soil. From among range of classification developed to study Indian soil, it is ICAR's classification that is applied for all geographic purposes. The recognised categories of soil includes:=

i) Alluvial Soil
ii) Black Soil
iii) Red Soil
iv) Forested Soil
v) Desert Soil
vi) Laterite Soil
vii) Saline Alkaline Soil
viii) Piet Bog Soil



: Alluvial Soil Type

Occupying largest geographical expanse alluvial soil corresponds to entire physiographic unit of the country. This soil is rich in $N_2$., humus and potash and marks up deficiency of phosphorous. This fertile soil type is structurally classified as Bhaber i.e. coarsest alluvial cone, bhanger or bet land i.e. old alluvium and khader or dhaya i.e. new alluvium.

In northern plains similar textured flood plain soil dominates. Inspite of this similarity, major distinction in the soil fertility is outlined due to the involved processes.

The Satluj-Yamuna plains represent pedcal flood plain, thus is more fertile than Brahmputra basins pedalfer flood plains. It is only with R. Hooghly that deltaic soil in extra-peninsula is correlated. In peninsula, it is prominently deltaic finest textured alluvium that represent this soil type. It is, however, distinguished as slightly coarser western

plain deltaic soil and finer textured eastern plain deltaic soil. In addition, the peninsular alluvial soil in the middle courses of the channels represents variable fertility due to variable composition. Godavari, Krishna basins with black alluvial marks more fertile flood plain soil than Kaveri, Mahanadi – red alluvial flood plain soil. It is with Narmada & Tapi that in the absence of deposition recognisable alluvial soil is missing.

ii) BLACK SOIL

Forms the most fertile structural soil of the country, developed over basaltic tableland. This soil type is rich in lime, magnesium, iron, potash and have minor amount of phosphorous. It, however, lacks in $N_2$ and humus. This soil type is primarily known for its water retention capacity and is devoted to the cultivation of matching diversity of crops

to that of alluvial soil. Both structurally and geographically, this soil incorporate three defined sub-categories :

(i) Dark Black Soil
(ii) Medium Black Soil
(iii) Light Black Soil

The Dark Black Soil confined in Maharashtra & Gujarat is the most developed black soil of the country and thus most fertile.
The Medium Black Soil confined in Karnataka & MP is developed over less genrated Deccan Trap and have moderate fertility.
The Light Black Soil not just forms least fertile black soil but also corresponds to scattered locations like Shillong Plateau, E$^{n}$ part of CN plateau, and plateau interiors in TN.

## RED SOIL

It is the structural soil developed over Archean base and thus covers maximum part of Indian peninsular plateau. Involving the

combination of silica, aluminium, iron – technically the soil forms infertile type. Practically, however, it is elaborately devoted to cultivation of nutri cereals, pulses, oilseeds as it readily responds to agriculture infrastructural inputs. Geologically this soil type is sub-classified as :

(i) Red-yellow &

(ii) Red-Brown.

- The Red-Yellow Soil commonly corresponds to tropical thorny biome with Aravallis, rainshadow Sahyadris, Telangana, Dandakaranya & CN Plateau representing it.
- The Red-Brown soil correlates to tropical deciduous biome with Wn Ghats, Bangalore-Mysore Tableland, En Ghats representing it.

## 4. LATERITE SOILS

It is structural soil developed over Archean base However, it is typical to par-moist climatic regions which makes it incorporate the processes of leeching and laterisation, which in accordance results in acidic characteristics of soil.

This soil type is confined in Malabar coast, windward slopes of Meghalayan Upland as major areas. Technically infertile, even this soil type is devoted to elaborate cultivation of traditional plantation crops with rubber, spices, coffee — making it refered as commercially fertile soil.

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DESERT SOIL

It is the soil type of the country that is absolutely regulated by prevailing climate. It forms coarse-textured mineral-rich humus-less fertile soil type that is confined only in W. Rajasthan including Jaisalmer, Jodhpur, Nagour, Barmer and Bikaner districts. This soil type have been put to elaborate range of cultivation with the support of Indira Gandhi Canal. Moreover, with National Dairy Development Board (NDDB) formally recognising this soil as most conducive soil for fodder crop cultivation, it makes sound commercial significance at par with other fertile soils.

6. FORESTED SOIL

It is montane soil that is humus and $N_2$- rich, well drained fertile soil with fertility restricted only due to limited depth of the soil. Confined to the northern mountain wall, this soil includes not just the diversities relating to the standing vegetation (podzolic, podzol, chestnut) but also the effectivity of geadational agents (Karewas, Doons, Duars). In all the combination, the montane forested soil are been applied not just for cultivation of basic food-crops but also biggest range of horticultural produce in the country.

7. SALINE ALKALINE SOIL

It is halomorphic infertile soil confined in salt marshes of Rann of Kuchchh. Even this soil has been put to the cultivation of salt-resistant varieties of fodder crops as per the support of NDDB.

## PIET BOG SOIL

It is mineralised infertile soil, Representing to be the only example that is devoid of any commercial utilisation. Prominent locations of this soil are tarai and littoral biomes.

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## HUMAN GEOGRAPHY

Demography *– Population Geography

Theories – Malthusian / Marxtian / Demo-transition

Growth & Distribution of Global population

Demographic Variations:

- Fertility
- Mortality
- Migration
- Population Composition

Population Policies / Problems / Optimum Population

1 Global migration

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er-2

) Growth & Distribution of Indian Population

f) Other demographic variables:
Effective literacy, Sex Ratio

3) Intra-national migration