

Floristic Diversity of India

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Floristic Diversity of India

To be different or unlike.

Variety of life forms in a given region, the ecological roles they perform and the genetic diversity they contain (Wilcox, 1984).

Groups or classes of plants to be varied.

The Indian Region

Position: $6^{\circ} 45'$ to $37^{\circ} 6'$ N. Latitude and $68^{\circ} 7'$ to $97^{\circ} 25'$ E. Longitude

Area: 3029 million hectares. **Land frontiers:** 15,200 km. **Coast line:** 5,400 km.

Boundaries: North = Tibet, Nepal and Bhutan. North-West = Pakistan

East = Bangladesh.

North-East = Myanmar.

South = Indian Ocean. S-E = Bay of Bengal. S-W = Arabian Sea.

The Indian Region

Climate and Soils: It determines the distribution of ecological groups of plants.

Climate:

1. Highest mountain peaks covered by perpetual snow **X**
Hottest places on Earth.
2. World's highest rainfall areas (N-E) **X**
Almost zero rainfall areas (W).
3. Northernmost part: **Montane** climate,
4. Deccan Peninsula and N-E part: **Tropical** climate,
5. Central and Southern part: **Subtropical and Seasonal**.



Soils:

Oxylophytes : Plants growing in acidic soils

Halophytes : Plants growing in saline soils

Psammophytes : Plants growing in sands

Lithophytes : Plants growing on rock surface

Chasmophytes : Plants growing in rock crevices

Extreme variation in climate and soil has resulted in an enormous floristic diversity.

Floristic Diversity of India

- ❖ **Hooker (1904): The Indian flora is more varied than that of any other country of equal area.**
- ❖ **Vavilov (1926): Hindusthan Centre of diversity and centre of origin of cultivated plants.**
- ❖ **17,000 species of flowering plants: Confluence of floras from Malaya, Tibet, China, Japan and Europe.**
- ❖ **5,000 species are endemic to this region.**
- ❖ **Champion and Seth (1968): 16 major and 221 minor forest types.**
- ❖ **Tropical moist deciduous forest = 37%, Tropical dry deciduous forest = 28.6%**

Floristic Diversity of India

Division	Approximate No. of species
Angiosperms	15,000
Gymnosperms	64
Pteridophytes	1,022
Bryophytes	2,584
Lichens	1,600
Fungi	23,000
Algae	2,500
Bacteria	850

Represents 11% of known plant species of the world



Floristic Diversity of India

Sr. No.	Family	No. of Genera	No. of species
1	Poaceae	255	1225
2	Orchidaceae	140	1300
3	Fabaceae	123	775
4	Asteraceae	161	1000
5	Rubiaceae	90	495
6	Cyperaceae	24	449
7	Euphorbiaceae	74	419
8	Lamiaceae	68	393
9	Acanthaceae	84	379
10	Scrophulariaceae	66	356



Floristic Diversity of India

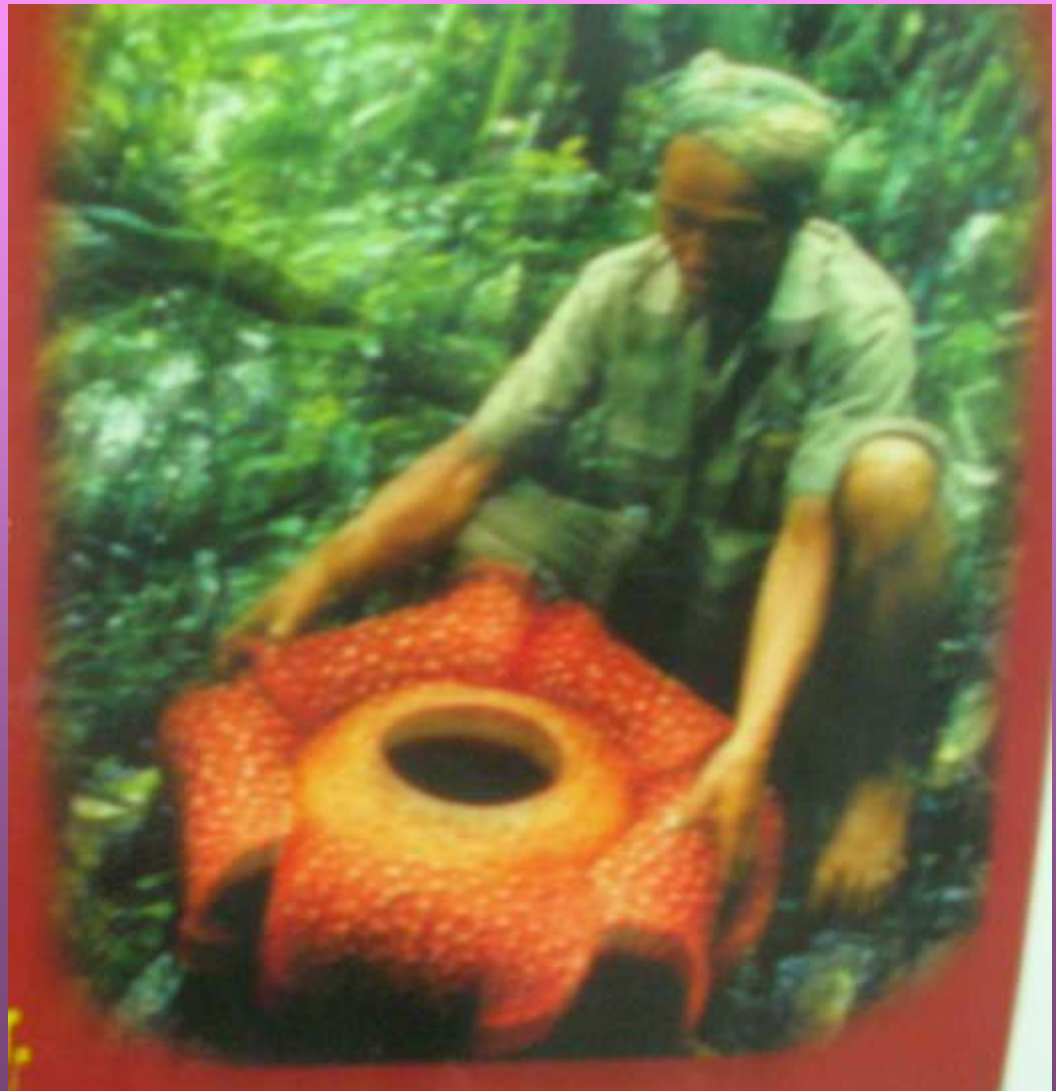
- 315 families of flowering plants.
- 60 monotypic families: e.g. Turneraceae, Ruppiaceae, Hydatilaceae.
- 2560 (17%) are tree species includes highly valued timber species
- Has worlds half of the aquatic plants: Alismataceae, Butamaceae, Nymphaeaceae, Typhaceae, Podostemaceae, Najadaceae, etc.

Floristic Diversity of India

- Insectivorous species: Droceraceae, Nepenthaceae, Lentibulariaceae.



➤ Parasitic species: **Loranthaceae**, **Santalaceae**, **Balanophoraceae**, **Rafflesiaceae**, **Cuscutaceae**, **Orobanchaceae**.



Metal tolerant species: Caryophyllaceae,
Ceratophyllaceae, Portulacaceae.

➤ Salt tolerant species: Chenopodiaceae,
Basellaceae, Amaranthaceae.

➤ Medicinal plant species: *Atropa acuminata*,
Chlorophytum borivalianum, etc.

Floristic Diversity of India

Takhtajan (1969): The presence of large number of primitive flowering plants in India renders the region 'a cradle of flowering plants'.

➤ 131 primitive species.

Sr.	Family	Genera
1	Magnoliaceae	<i>Magnolia, Manglietia, Michelia</i>
2	Tetracentraceae	<i>Tetracentron</i>
3	Annonaceae	<i>Alphonsea, Annona, Artabotrys, Miliusa</i>
4	Myristicaceae	<i>Horsfieldia, Knema, Myristica</i>
5	Lauraceae	<i>Actinodaphne, Alseodaphne, Litsea</i>
6	Schisandraceae	<i>Kadsura</i>
7	Chloranthaceae	<i>Chloranthus</i>

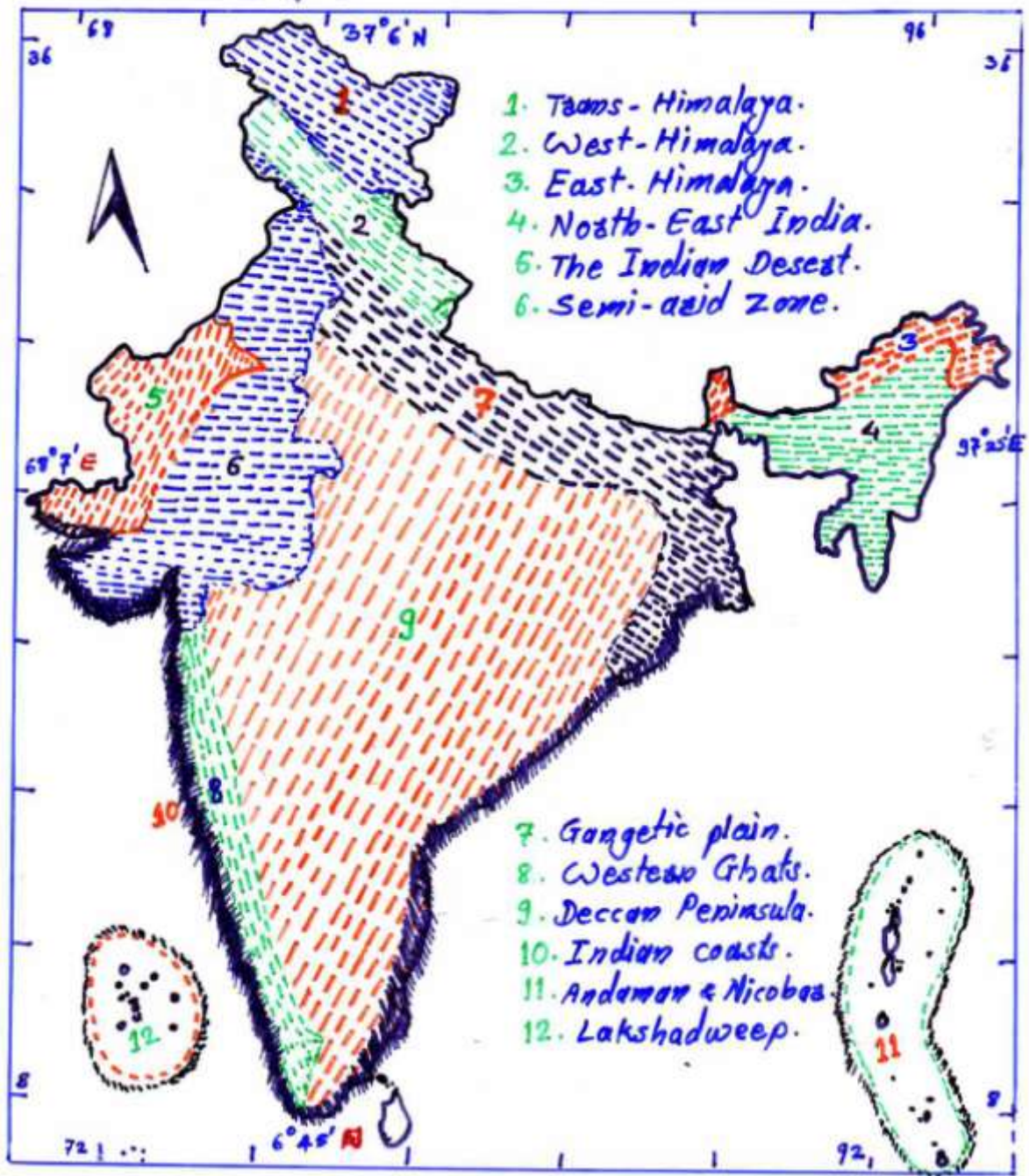
Phytogeographic zones of India

On the basis of floristic composition, the naturalness of the flora and the local climate, the Indian region is divided in several phytogeographical provinces (Hooker, 1854, 1904; Clarke, 1898; Chatterjee, 1940, 1962; Rao, 1974).

Rodgers and Panwar (1988) proposed the biogeographic classification of Indian region on the basis of vegetation types and floristic diversity.

1. Trans Himalaya
2. West Himalaya
3. East Himalaya
4. North-East India
5. The Indian desert
6. Semi-arid zone
7. Gangetic Plain
8. Western Ghats
9. Deccan Peninsula
10. Indian Coasts
11. Andaman and Nicobar Islands
12. Lakshadweep Islands

Biogeographic Zones of India 1. Trans Himalaya



1. Trans Himalaya

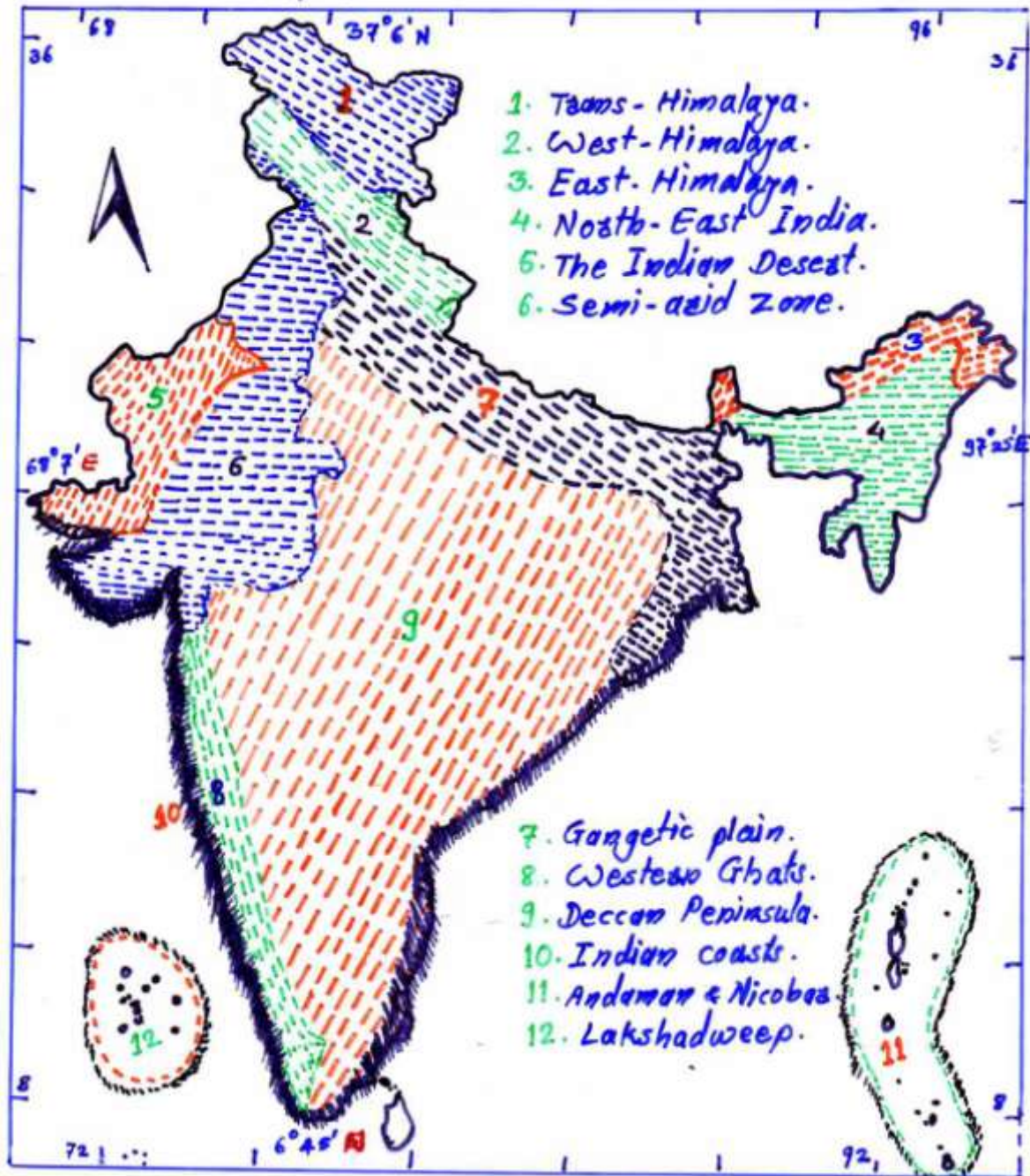
Cold desert of India: Ladakh district of Jammu and Kashmir
Lahul- Spiti districts of Himachal Pradesh

- Extremes of Heat and Cold coupled with extreme dryness.
- Mountains get cracked and crumbled.
- Scanty rainfall and snow fall.
- Drass: second coldest place of the world: winter temp. – 75°C.
- Most elevated zone of Earth (2900 to 5900 m).
- Topography is rough, rugged, rocky with a number of mountain peaks, sandy, extremely barren valleys.

Floristic Diversity:

- Alpine flora: *Podophyllum hexandrum*, *Lotus corniculatus*, *Juniperus wallichiana*.
- Cold Desert flora: *Nepeta tibetica*, *Saussurea subulata*, *Cicer microphyllum*.
- Oasitic flora: *Hordium turkestanicum*, *Rosa eglanteria*.

Biogeographic Zones of India 2. The Western Himalaya



2. The Western Himalaya

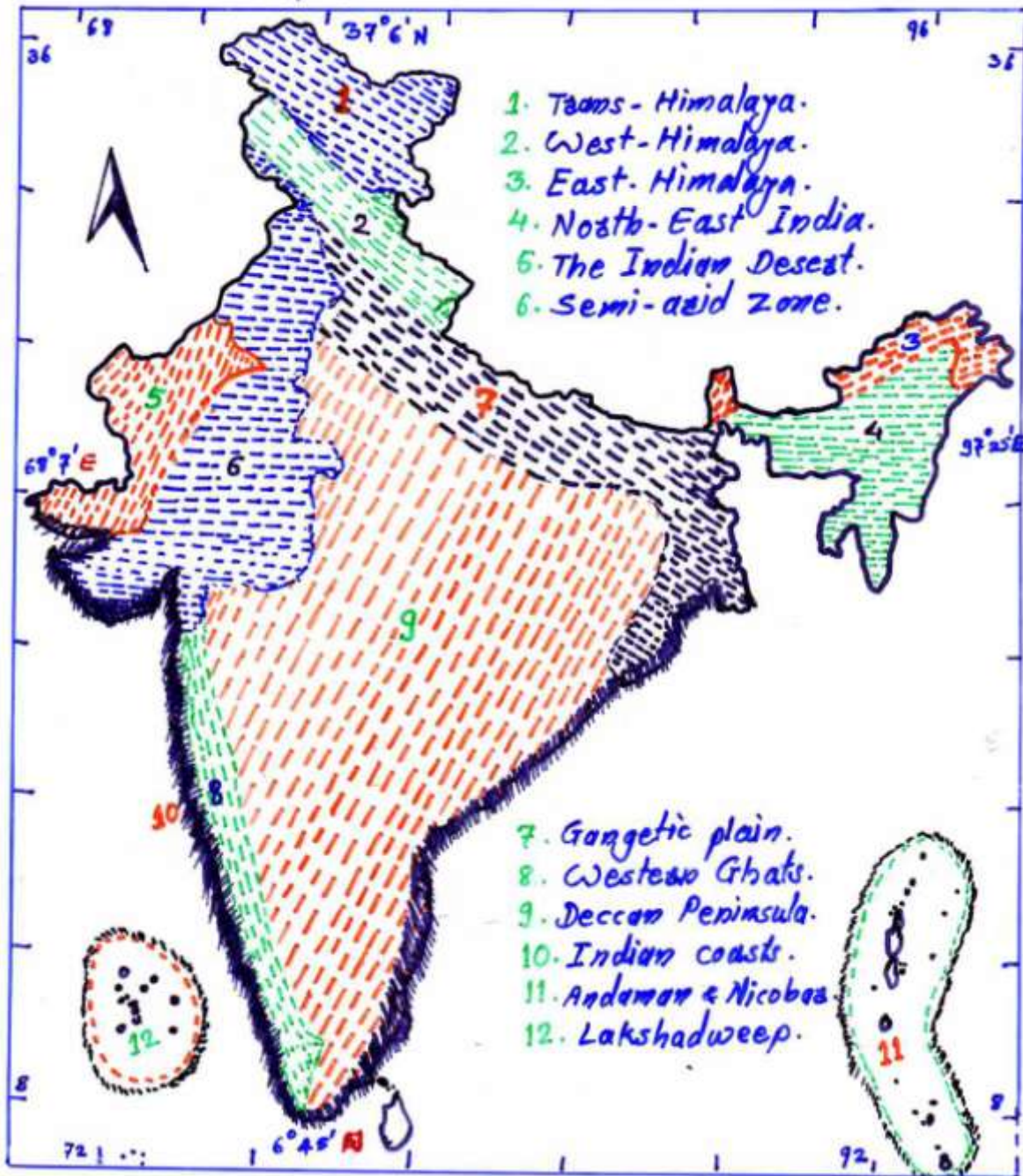
Covers Garhwal and Kumaon of Uttaranchal; part of H.P. and part of J & K.

- Exhibit wide range of altitude, climate, topography and edaphic conditions.
- Admixture of floras of Mediterranean region, Central Asia, Europe and S-W China.
- Drought resistant/ cold loving plants, Chir pine, Blue pine, Deodar and Fir.

Floristic Diversity:

- a) Tropical and subtropical vegetation: *Terminalia alata*, *Litsea monopetala*, *Tropidia pedunculata*, *Toona cilliata*, *Bauhinia vahlii*, *Rhododendron arboreum*, *Pinus roxburghii*.
- a) Temperate vegetation: *Quercus lanata*, *Abies pindrow*, *Aesculus indica*, *Ulmus villosa*, *Picea smithiana*, *Tsuga dumosa*, *Berberis kumaonensis*, *Saxifraga sp.*

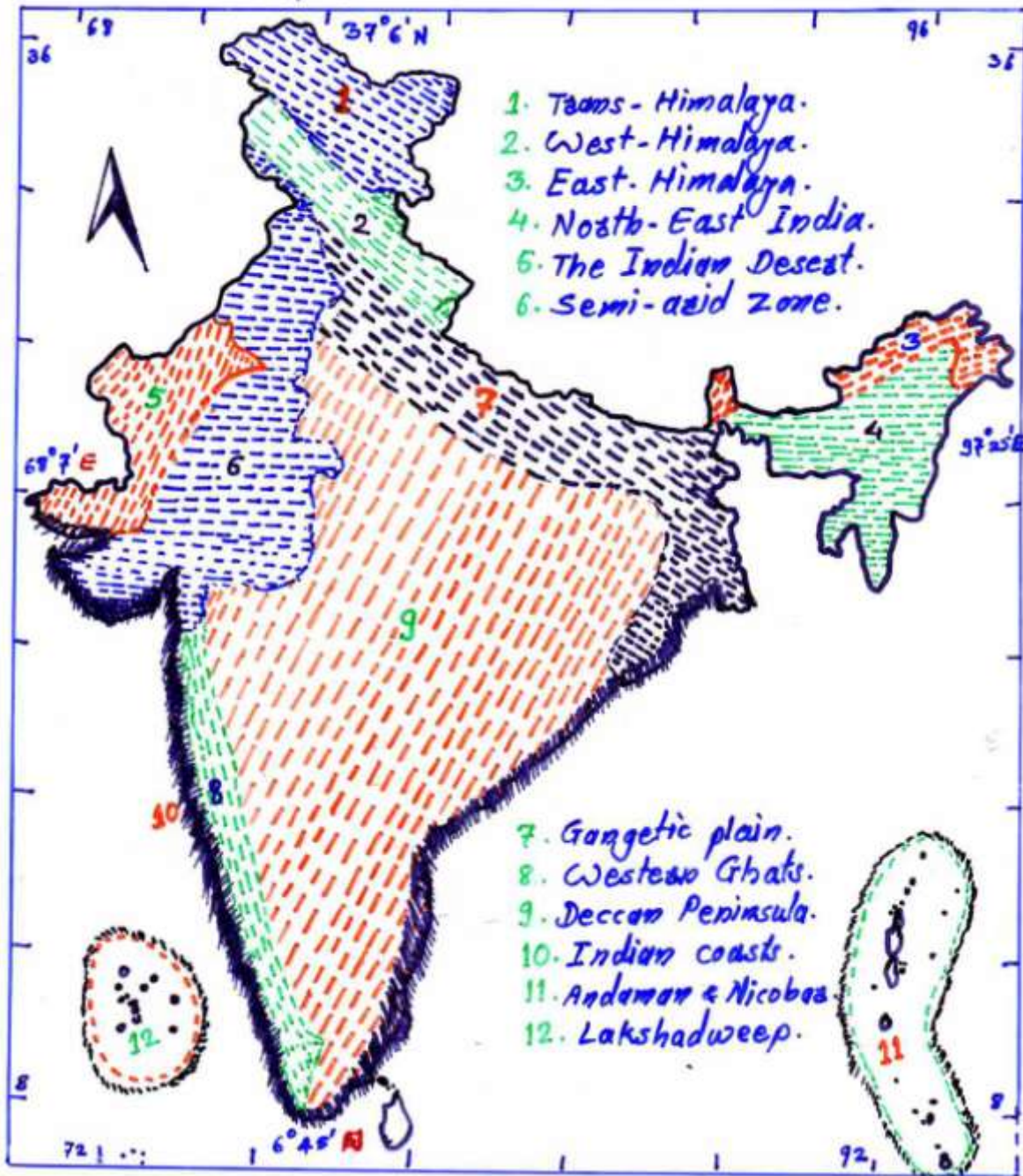
Biogeographic Zones of India 3. Eastern Himalaya



3. Eastern Himalaya

- Sikkim and Darjeeling districts of W. Bengal and Arunachal Pradesh.
- The altitude ranges from 1500m. to the ice chapped mountains of Kanchanganga (8598m.).
- One of the major features of world relief with the tallest peaks, deep river gorges and rare flora.
- Sanctuary of ancient flora. Cradle of flowering plants (Takhtajan, 1969).
- Gateway for migration of flora from Burma, China, Japan, Bhutan, etc.
- Floristic Diversity
 - *Paphiopedilum fairieanum* (Lost orchid)
 - *Galeola falconeri* (Tallest orchid in India- 3m.)
 - *Sapria himalayana* (close relative of *Rafflesia arnoldii*)
 - Tallest trees in India, Tree ferns, Primulas, Blue poppies, Orchids.

Biogeographic Zones of India 4. North-East India



4. North-East India

Covers N-E states except Arunachal Pradesh: Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura.

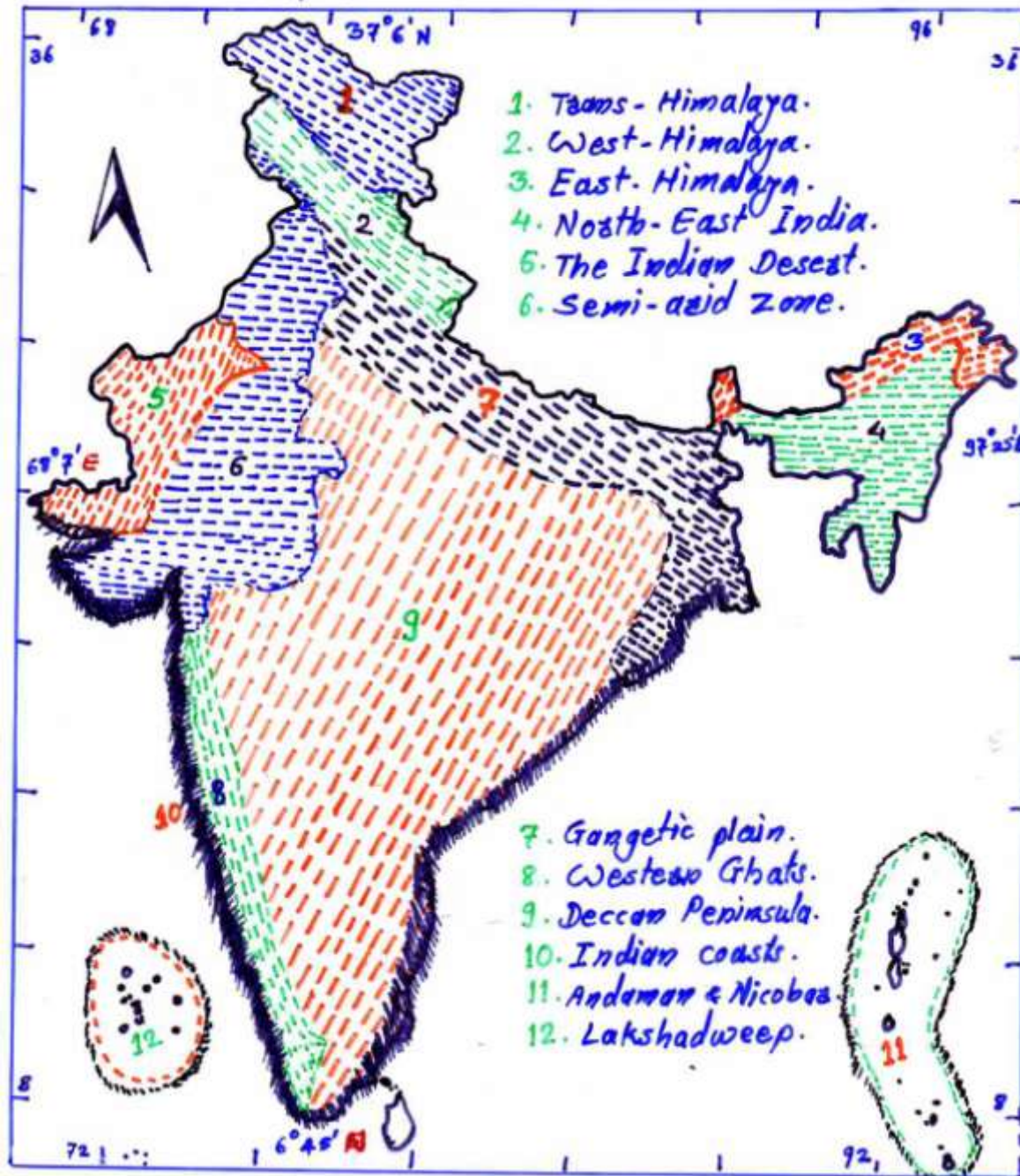
- Most significant and transition zone between Indian, Indo-Malayan and Indo-Chinese Biogeographic regions.
- Meeting place of Himalaya and Peninsular India.
- Khasi and Jaintia hills in Meghalaya are the richest botanical habitats in entire Asia.
- Cherapunji and Mawsynram: Worlds rainiest spots (11,000 mm/year).





Floristic Diversity:

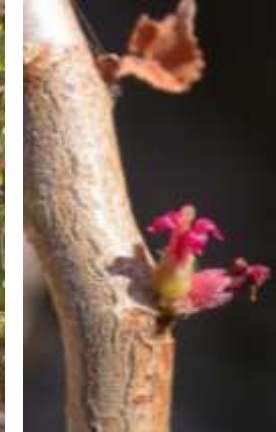
- 8000 species (200 families): about 50 % of Indian flora.
- Monotypic families: Coriariaceae, Nepanthaceae, Turneraceae, Ruppiaceae, etc.
- Rare species: *Cycas pectinata*, *Gnetum gnemon*.
- Endemic species: *Uvaria lurida*, *Magnolia gustavi*.
- Orchids: 125 genera and 800 species (For India 1300 sp.) Pradhan, 1976.
- Great diversity in *Rhododendrons*, *Hedychium*, *Bamboos*, Medicinal plants, non-flowering plants and wild relatives of cultivated plants.



5. Indian Desert

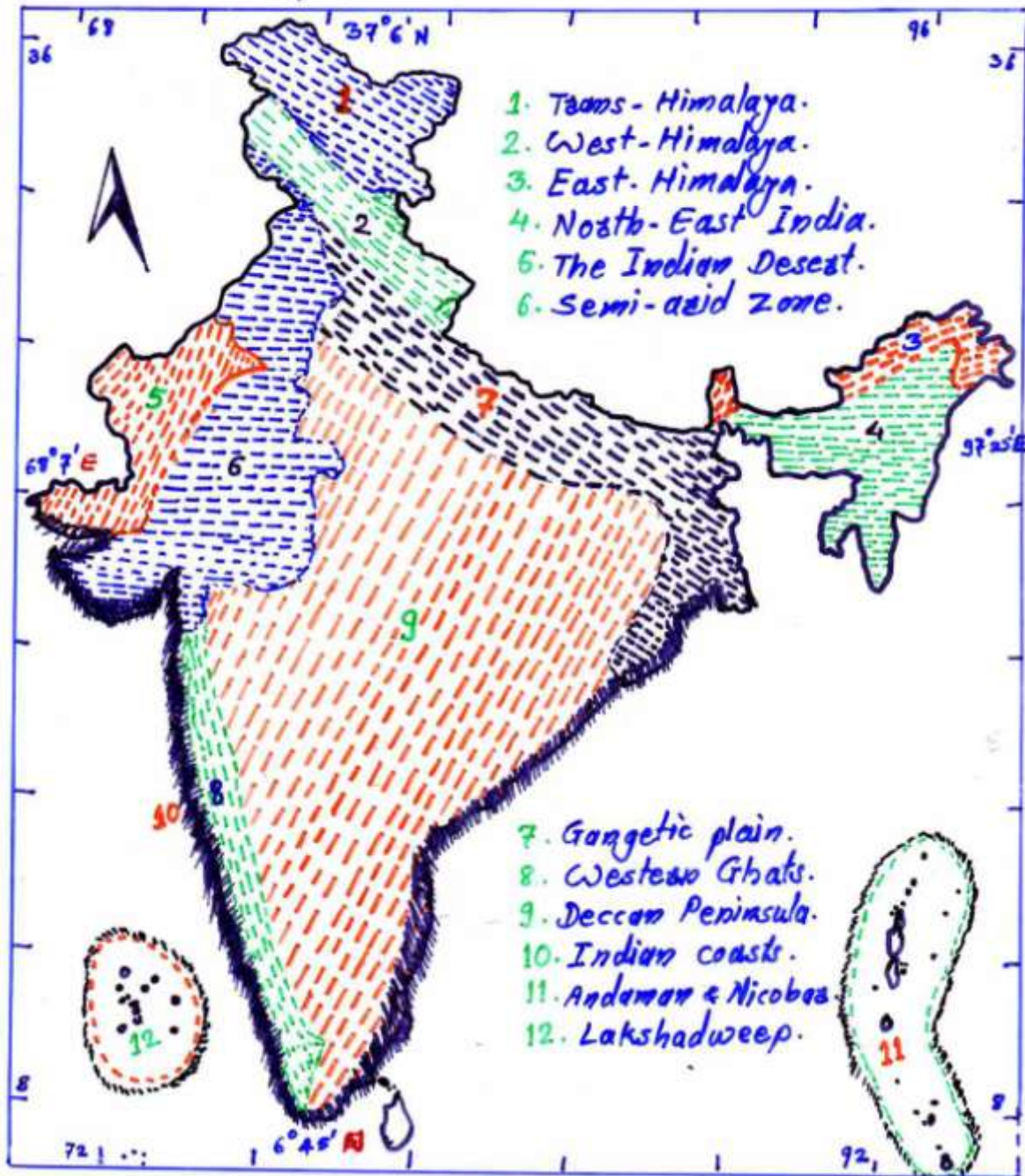
- **The Great Indian Desert**
- It covers most part of Rajasthan, Kutch of Gujarat, some part of Haryana and Panjab
- Extremely arid conditions, high atmospheric temperature, low erratic rainfall, high wind velocity, low relative humidity, high evaporation rate, non-existence of perennial water source and scanty vegetation.
- **Only 2% forests of the total geographic area.**
 - a. Habitat of sand dunes and interdunal areas
 - b. Vegetation of sandy and hammocky plains
 - c. Gravelly and rocky plains and isolated hills
 - d. Vegetation of saline tracts
- **Floristic diversity:** Genetic resources of many life support species typically of arid and semi-arid zone.
- **Vegetables:** *Amaranthus viridis*, *A. spinosa*. **Grains:** *Panicum sp.*, *Eleusine sp.* **Fruits:** *Zizipus nummularis*, *Grewia tenax*, *cucumis callosus*, *Momordica sp.* **Roots** of *Chlorophytum*, *Asparagus sp.*, **tubers** of *Ceropegia sp.* are eaten during scarcity.







Biogeographic Zones of India 6. Semi-arid Zone



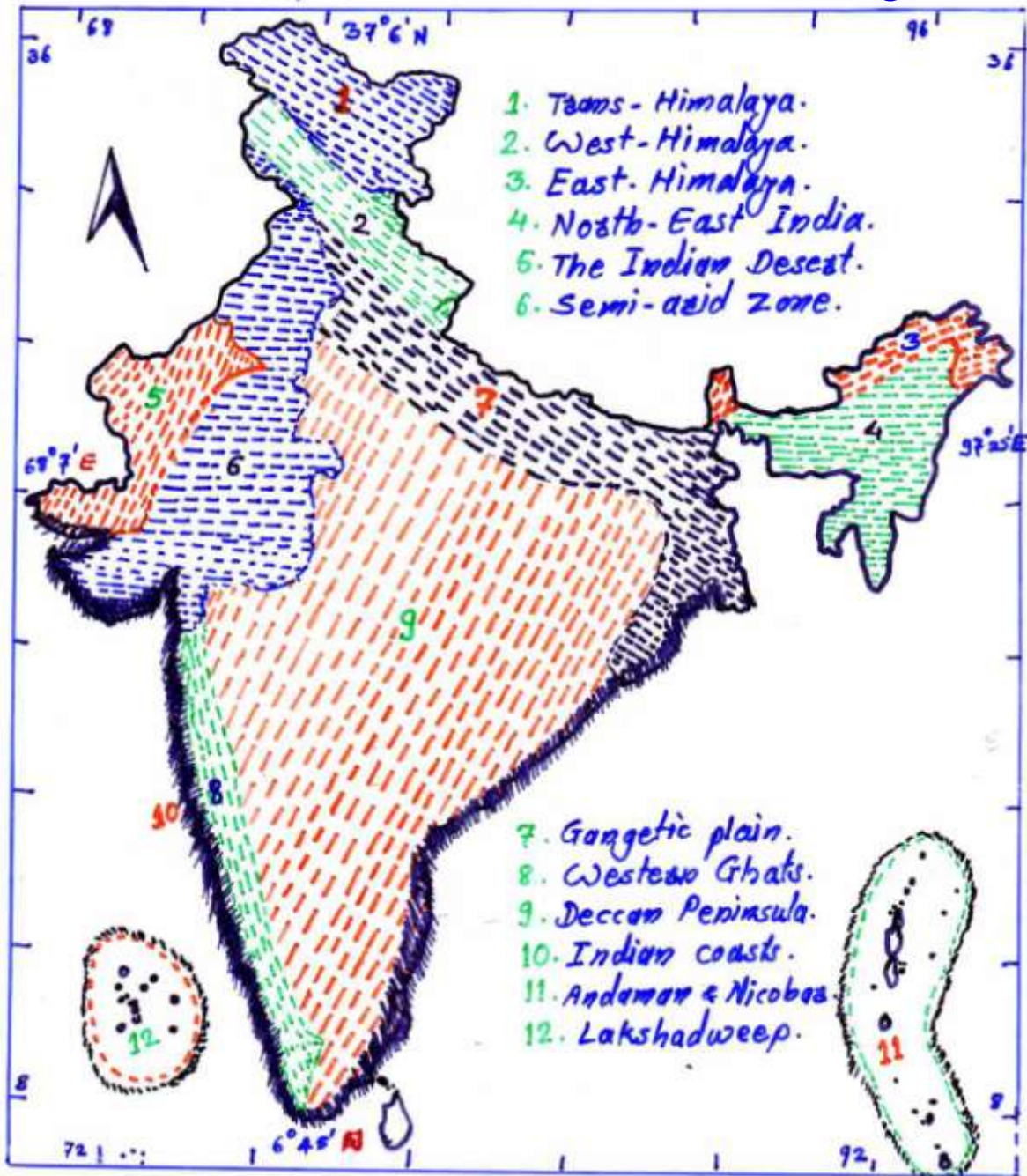
6. Semi-arid Zone

- Region of transition between true desert and Deccan Peninsula
- Covers parts of Gujarat, Rajasthan, Panjab plains, Delhi, Haryana, Jammu and Kashmir, H.P., U.P. and M.P.
- Climate: very hot in summer and markedly cold in winter. Low rainfall and frequent dust storms.

Deciduous Forests: *Tectona grandis*, *Acacia chundra*, *butea monosperma*, *Diospyros melanoxylon*, *Boswellia serrata*(Arawali ranges, Mount Abu).

Open Scrub Jungles: Predominant in entire semi-arid tracts; draught resistant species: *Acacia senegal*, *Belanitis aegyptiaca*, *Capparis decidua*, *Zizipus nummularia*.

Hydrophytic and marshy flora.

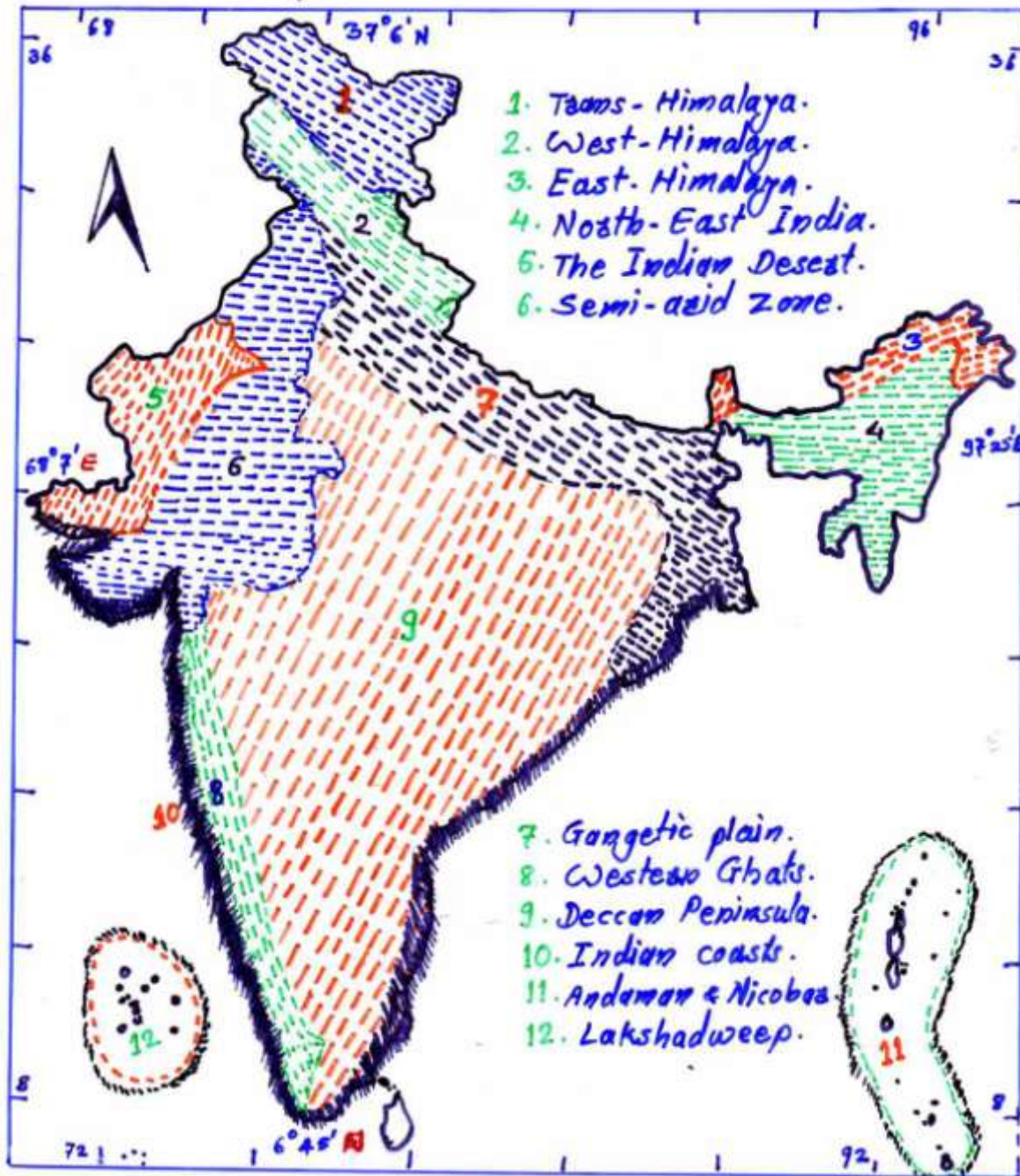


7. Gangetic Plains

- It is stretching from eastern Rajasthan through U.P. to Bihar and W. Bengal.
- The Northern limit is Siwalik hills and Southern boundary is Vindhyan escarpment.
- The entire region is a flat alluvial region.
- Being the most populated region of India and having been under continuous and intensive cultivation, the area has lost its original flora, except *Shorea* forest in Terai region.
- The vegetation is chiefly tropical moist and dry deciduous type.
- It is characterized by tall grasses: *Themeda*, *Saccharum*, *Vetiveria*, etc.
- Tree species: (in cultivated lands) *Butea monosperma*, *Bombax ceiba*, *Sterculia urens*, *Terminalia alata*, *Mangifera indica*, etc.

Biogeographic Zones of India

8. Western Ghats



8. Western Ghats

- ↗ W. G. Biogeographic zone forms the Malbar province.
- ↗ It is a narrow stretch of 1600 km. running from the hill south of Tapti river in the North to Kanyakumari in the south, along with West coast of India. (except a palghat gap of about 20 km.)
- ↗ Highest point is Dodabetta (2920 m.) in the Nilgiris.
- ↗ Broad range of altitudinal variation, rainfall pattern and climate resulted in a variety of forest types.
- ↗ 4000 species of flowering plants are recorded for Western Ghats of which 50% are endemic to this region.
- ↗ Based on floristic composition WGs is divided in 4 units:
 - From river Tapti to Goa.
 - From river Kalinadi to Coorg.
 - Nilgiris and
 - Anamalai, Palni and Cardamon hills.



8. Western Ghats

➤ Mainly seven forest types occur in the Western Ghats:

1. The dry scrub vegetation

2. Dry deciduous forests

3. Moist deciduous forests

4. Semi-evergreen forests

5. Evergreen forests

6. The sholas

7. Grasslands

➤ W.G. is a major genetic estate with enormous diversity of ancient lineage.

➤ Dominant families are:

Poaceae (120 G. & 400 Sp.)

Orchidaceae (60 G. & 267 Sp.)

Cyperaceae (21 G. & 160 Sp.)

Leguminosae (85 G. & 220 Sp.)

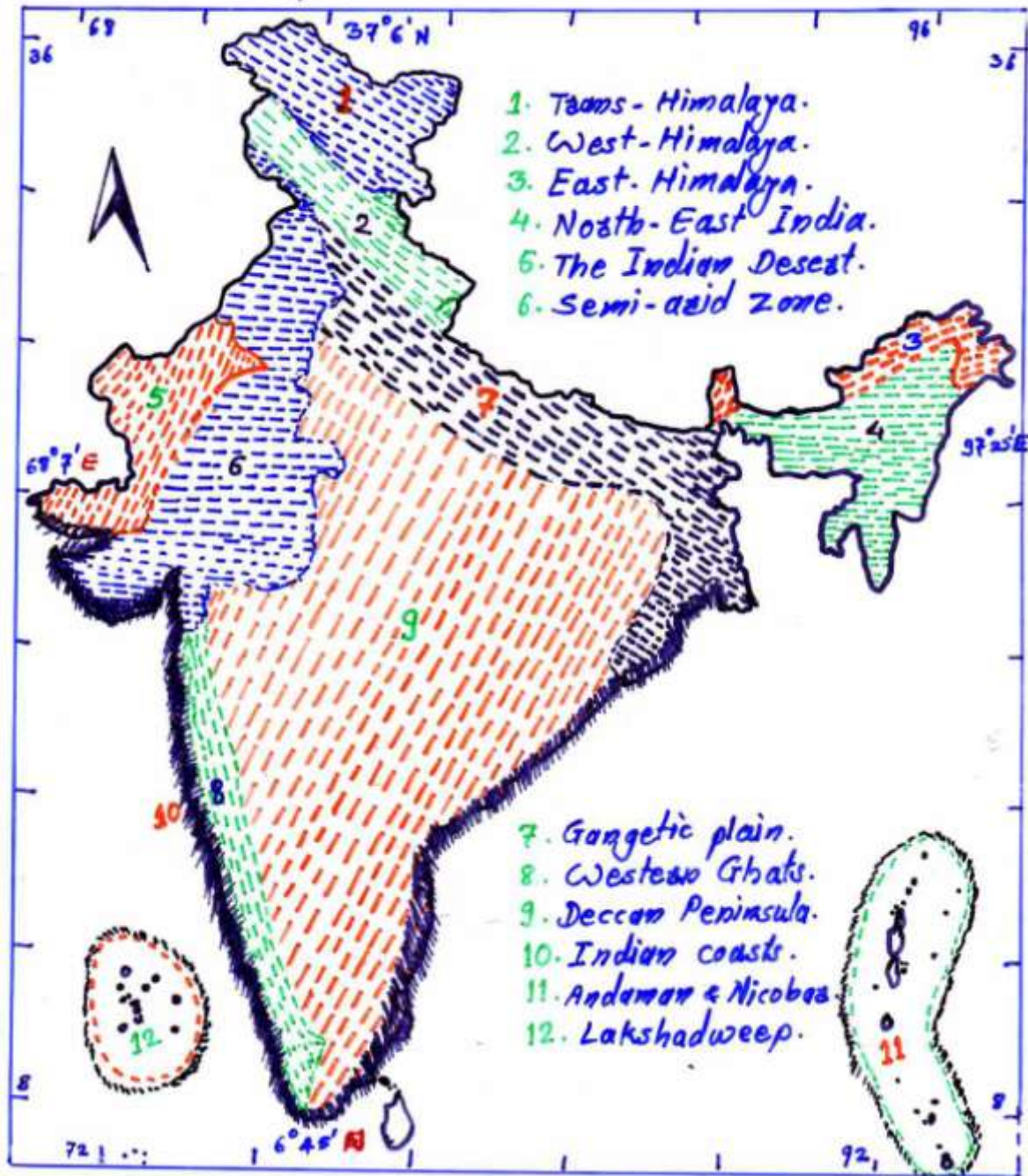
Acanthaceae (55 G. & 165 Sp.)

Euphorbiaceae (55 G. & 220 Sp.)

➤ It is rich germplasm centre for wild relatives of economically important species of cereals and millets, legumes, fruits, vegetables, condiments, etc.

➤ Medicinal plant diversity is also too high.

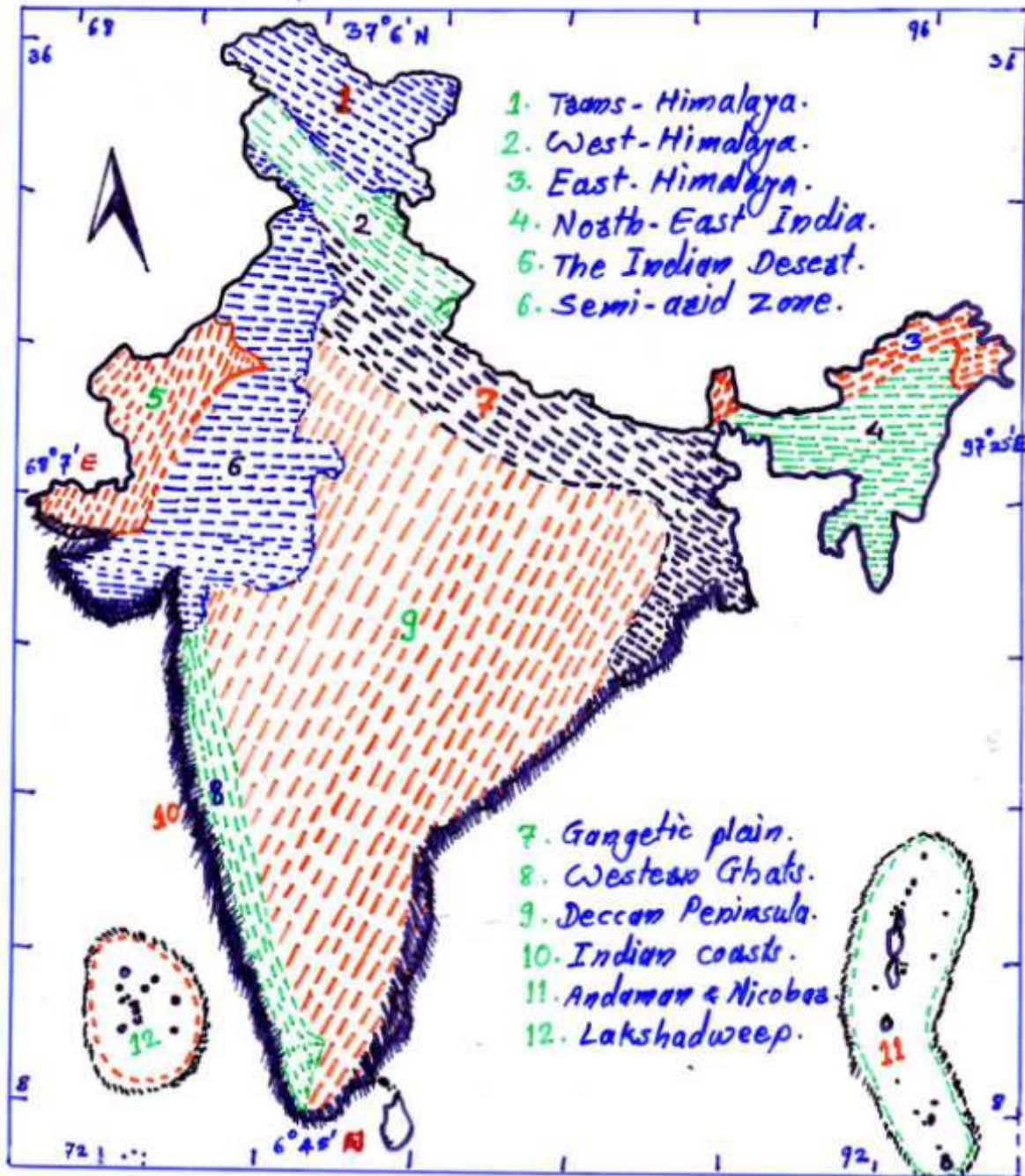
Biogeographic Zones of India 9. Deccan Peninsula



9. Deccan Peninsula

- This zone covers major portion of Maharashtra, M.P., Karnataka, T.N., A.P., Orissa and Bihar.
- It is covered by deciduous forests, thorn forests and scrublands.
- Evergreen forests are confined to certain pockets in Eastern Ghats.
- Deciduous forests are dominated by Sal and Teak.
- Thorn forests are dominated by *Acacia* and *Albizia*.
- 2500 species of vascular plants of which 4% are endemic.
- Wild relatives of cultivated plants: *Oryza sp.*, *Musa bulbisiana*.
- Numerous medicinal plants and wild food plants.
- Shifting cultivation, excessive grazing and over exploitation of forests for fuel wood resulting in depletion of forest cover rendering number of endangered plant species.

Biogeographic Zones of India 10. Indian Coasts

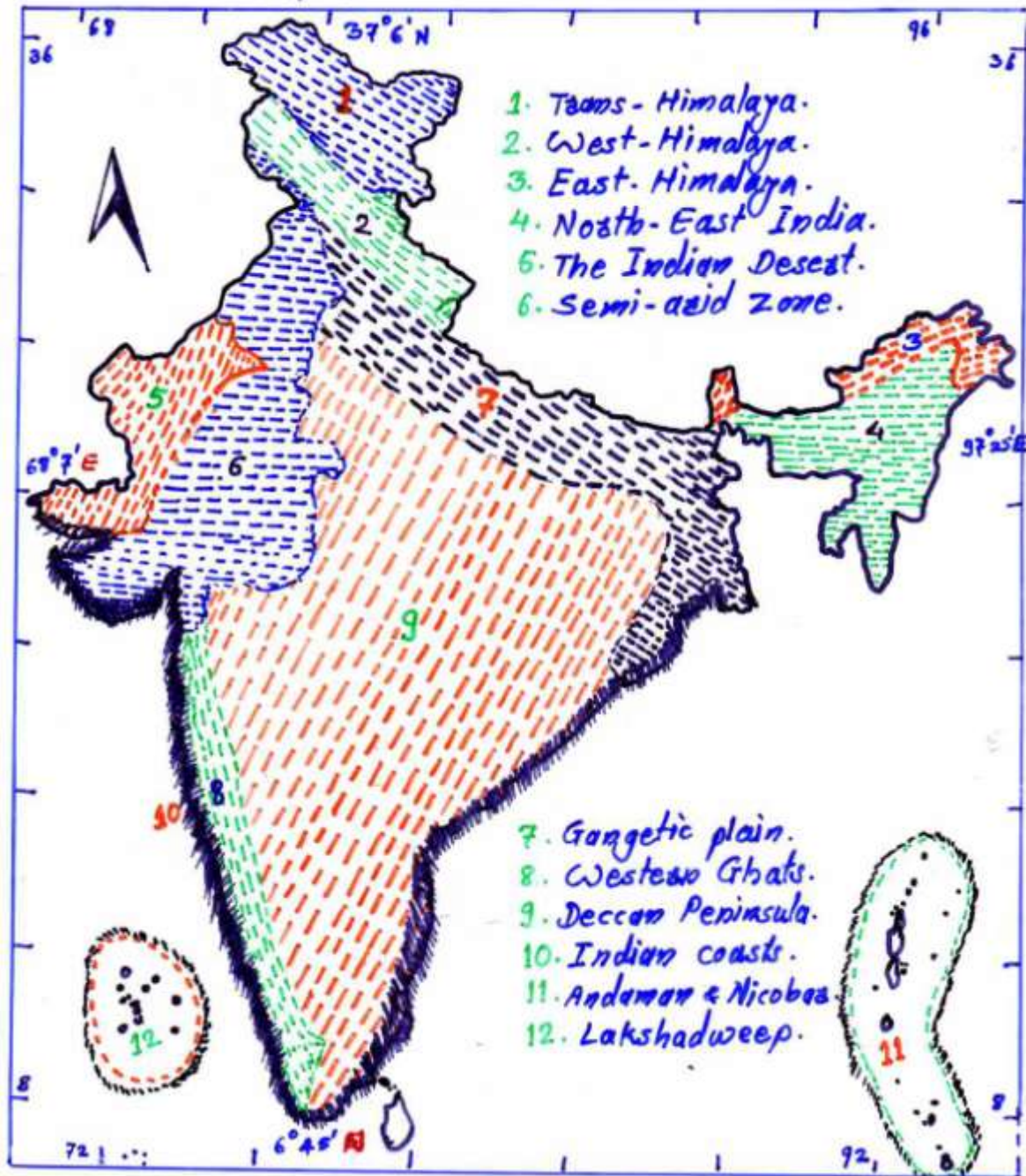


10. Indian Coasts

- The coast line of India stretches from Gujarat to Kanyakumari in the West and from Sundarbans to Kanyakumari in the East (5400 km.). It also includes coasts of Andaman and Nicobar islands.
- Coast line has very diverse set of biotic communities.
- The coastal ecosystem of India include : 1) submerged vegetation, 2) mangroove forests, 3) strand vegetation, 4) tidal or swamp forests (beach vegetation).
- The coastal vegetation at several places being replaced by palms like *Coccus nucifera*, *Borassus flabellifer* and *Casurina equisetifolia* as wind screen.
- In Andaman islands the oil palm *Elaeis guyanensis* is extensively planted and has now almost naturalized.



Biogeographic Zones of India



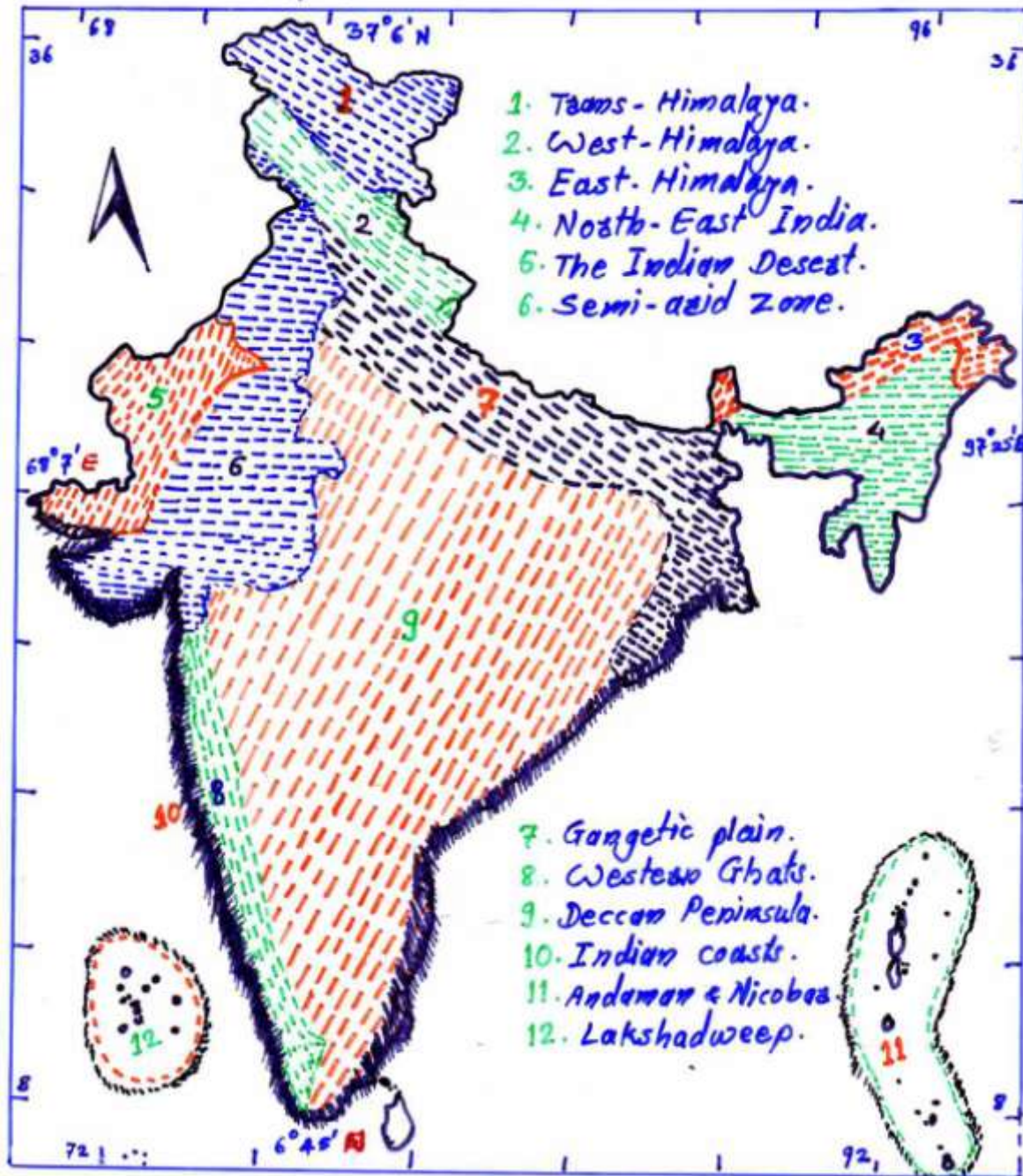
11.
Andaman
and
Nicobar
Islands

11. Andaman and Nicobar Islands

- It is an elongated north-south oriented group of 348 islands in the Bay of Bengal stretching for 590 km.
- Northern (Car Nicobar), Central, and southern (Great Nicobar).
- Climate is hot and humid; High rainfall; no marked winter season.
- Evergreen forests, semi-evergreen forests, deciduous forests and grasslands.
- The zone is a major genetic emporium of several plant resources of great economic potential.
- Wild relatives of tropical crops like *Mangifera camptosperma*, *Piper betle*, *Musa species*, *Areca catachu*, *Myristica elliptica*, etc.
- Multipurpose species like *Calamus andaminicus*, *Rhizophora apiculata*, *Vanilala andaminica*, *Nypha fruticans*, etc.
- Medicinal plant diversity is also too numerous.

Biogeographic Zones of India

12. Lakshadweep Islands



12. Lakshadweep Islands

- It is an archipelago of 27 small islands in the Arabian sea.
- They are 320 km. away from Kerala coast.
- Rivers and streams are absent.
- Virtually no natural vegetation. Heavy coconut tree plantation invariably associated with *Acacia catachu* and *Piper betle* which are the commercial crops of the islands.
- Majority of taxa are naturalized exotics perhaps brought by water currents, wind and migratory birds.
- The shrubby *Scaevola* and *Argusia* are only remnants of the original vegetation.



Thank you

Endemism

Hot spot: The specified region where various factors are responsible for creation of biodiversity, but change in even single factor causes greater disturbance.

Endemism: It encompasses taxonomic units of any rank or taxa which occur in a biogeographic area usually isolated by geographical, ecological and temporal barriers. The area of endemism may be small or large.

Hot spot of endemism: The major concentration of endemic plants occurring in a particular geographical zone or ecological niche.

Genetic diversity of a species: A species with a large number of inter-population differences, where each population gets genetically adapted to specific environmental conditions is said to be genetic diversity of a species. OR

The variability among different genotypes of a species.

Young seedlings of *Hubbardia* in its natural habitat (Tilari Ghat) in June



Keystone species: the species whose absence from a system cause the disappearance of dependent plants or animals.
e.g. *Ficus glomerata*.

Flagship species: The dominant species of the community which serves as markers.

Extinct: A taxon is extinct when there is no reasonable doubt that its last individual has died.

Endangered: A taxon is endangered when it is not critical, but is facing a very high risk of extinction in the wild in a near future.

Endemism in Western Ghats

(Western Ghats: Mega Endemic Area)

1. W.G. straddle the states of Kerala, Tamil Nadu, Karnataka, Maharashtra and Southern Gujarat.
2. The latitudinal positional and altitudinal gradients with its rainfall patterns of South-West and North-East monsoons, changes of climatic shifts, due to variations in dry months on the leeward side of mountains, the Deccan plateau, the presence of mosaic of soil types, soil nutrients have resulted in a mosaic of ecological islands, niches, and refugia which favour high degree of endemism, vicariants, and relict species.
3. Based on the floristic composition and other natural factors, the Western Ghats have been divided in to 4 phytogeographical units viz.
 - i) From the River Tapti to Goa;
 - ii) From the River Kalindi to Coorg;
 - iii) Nilgiris and iv) Annamalai, Pulney and Cardamom hills.





Plant diversity of Western Ghats



Plant diversity of Western Ghats



Biodiversity
of Western
Ghats







Endemic Centers

1. Southern western Ghats Mega Endemic Centre and
2. Northern Western Ghats Mega endemic center

Nayar (1996) described following eight centers of endemism in mega center Western Ghats:

Sr. No	Location	Area km ²	Altitude	No. of endemic species
1	Agasthyimalai Hills	2,450	500-1868 m	189
2	Anamalai High Ranges	8,000	500-2695 m	94
3	Pulney Hills	2,068	300-2068 m	43
4	Nilgiri-Silent Valley, Wynad- Kodagu	12,800	500-2677 m	150
5	Shimoga- Kanara	12000	300-1375 m	58
6	Mahabaleshwar – Khandala	11,000	300-1375 m	63
7	Konkan- Raigad	20,000	300-1000 m	50
8	Marathwada- Satpura	1,00,000	200-1500 m	27



1. Southern Western Ghats Mega Endemic Centre

- It extends from the Kalinadi river in the north to the Agasthyamalai in the south.
- Includes highest peak of Anamudi (2695 m) of the Anamalais and Dodabetta (2920 m) of the Nilgiris
- 1286 species of flowering plants are endemic to this center.
- Mineral deposits like lime stone, quartzite, gold (Kolar, Gulbarga), Copper (Gulbarga, Chickmanglur, Hassan), uranium (N. Kanara, Chickmanglur), etc.
- The genera *Hubbardia* and *Paracautelya* are exclusively endemic region.

- ❖ Commonly distributed genera like *Carvia*, *Danthonidium*, *Erinocarpus*, *Moullava* and *Polyzygus*.
- ❖ Other endemic genera: *Ascopholis*, *Blepharistemma*, *Phlebophyllum* and *Poeciloneuron*.
- ❖ Extremely threatened/ endangered species: *Caralluma truncatao-coronata*, *Cynoglossum ritchiei*, *Hubbardia heptaneuron*, *Leea talbotii*, *Leucas agustissima*, *Neanotis ritchiei*, and *Viscum mysorense*.

2. Northern Western Ghats Mega endemic center

(From River Tapti to Goa)

- Scrub and Semideciduous type of vegetation
- Windward side: Moist deciduous forests with evergreen pockets.
- Leeward side: Dry deciduous hill forests.
- Monotypic genera: *Frerea*, *Helicanthes*, *Pogonachne*, *Seshagiria*.
- Endemics: *Abutilon ranadei*, *Achyranthus coynei*, *Barleria sepalosa*, *Cessus arenosus*, *Glyphocloa santapau*, *Bidaria khandalensis*, *Salacia brunoniana*, etc.
- Endemic trees: *Erinocarpus nimmonii* (Tiliaceae)
Cordia domestica (Boraginaceae)
Rhamnus purandharensis (Rhamnaceae)

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THANK YOU