

BIOGEOGRAPHY - MUDIT JAIN

- Soil:
- ① Not just accumulated dirt
 - ② organic mixture of sediments, airspace, moisture, lifeforms
 - ③ living system of biotic + abiotic factors.

Genesis < Factors
Processes

Factors

- ① Parent Material → PH (↑ exchangeable ions → ↑ base capacity)
• Porosity, permeability (clay) by controlling texture [decided by hardness]
coarse (granite rock), fine (sedimentary). [↑ permeable → ↓ saline (sandy)]
• soil colour (red soil), nutrients (type + capacity ex limestone → Ca rich soil).
- ② Structure
Rock hardness, cracks, crystal str → control weathering.
- ③ Relief
slope, elevation → depos'n / erosion → thick / thin soil profile.
- ④ Climate (Most imp)
Rain, wind, temp → rate of weathering → Type of weathering
[warm humid → chemical → fine soil]
[cold → physical → coarse], [tropics → Laterisaⁿ],
[temperates → Podzolisⁿ], [capillary action → saline / Alkaline],
(~~Podzolisⁿ~~) (Podocals)
- ⑤ Biota
- ⑥ Time [for horizon, profile]

Processes

- ① Weathering: In situ, gradual disintegration of rocks.
Chemical (Hydrolysis (Feldspar $\xrightarrow{H_2O}$ Kaolin), (oxidation / decaying $Fe \rightarrow Fe_2O_3$ (red))
& Carbonation (corrosion $CO_2 + H_2O \rightarrow$ acid))
Mech (block, frost, exfoliation)
(angular)
- ② Leaching: (mechanical)
Translocⁿ of nutrients within soil → do not leave it. Insoluble, finer
nutrients move in suspension if soil holds water [slow movement]
• Warm condⁿ → Laterites, cold → Podzols.

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Warm $\rightarrow$ Si $>$ mobile $\rightarrow$ Al/Fe on surface $\rightarrow$ reddish soil. (Bauxites)
cold $\rightarrow$ opp $\rightarrow$ grey soil. [Podzolization]

Laterites [acidic, fragile, erosion vulnerability]
Podsol formⁿ [Fe/Al form sesquioxides on moving down. chelating agents in coniferous leaves fasten acidic podzol formⁿ. Hard, impervious Si layer formed. $\uparrow$ Humus due to $\downarrow$ bacterial action.]

③ Capillary action:- opp of leaching. in arid areas $\rightarrow$ H₂O move up.
 $\rightarrow$ evaporates $\rightarrow$ salts left [$\uparrow$ Ca $\rightarrow$ alkaline, $\uparrow$ Na/K $\rightarrow$ saline].

④ Gleification:- waterlogged swamps, mangroves $\rightarrow$ anaerobic oxidⁿ
 $\rightarrow$ $\uparrow$ K (blue, green (glaucanites of china, Japan) or, Kaori ($\uparrow$ organic due to swampy condⁿ).
 $\hookrightarrow$ arctic/antarctic.

To find pattern, fertility, agri potential, $\hookrightarrow$ improving needs etc.

Classification $\leftarrow$ Genetic (Process/Factor based Marbut)
Morphological (Property based USDA)

Genetic

- ① By Russians (Dokuchaev, Winkler, Marbut)
- ② Imp factor is climatic effectivity in deciding relief, type of process etc.
- ③ Focus on soil usage r/t content.
- ④ Openⁿ $\rightarrow$ desert focus on problems.
- ⑤ Arid, semi arid $\rightarrow$ capillary action $\rightarrow$ Pedocals.
- ⑥ Humid $\rightarrow$ leaching $\rightarrow$ Ped allers. [Podzols or Latosols]
- ⑦ Each divided into zonal/Azonal. Reflect LCT.
- ⑧ Pedocals [chernozem (black earth, $\uparrow$ humus, $\uparrow$ Ca, $\uparrow$ fertile $\rightarrow$ steppes)
chestnut [tropical chernozem $\rightarrow$ prairies (less Ca)
serozem [desert soil, $\uparrow$ arid, salty [sahara, colorado] $\rightarrow$ $\downarrow$ agri.
[diff from India's desert soil].
- ⑨ Zonal/ Intrazonal/ Azonal [older classificⁿ. links distribⁿ of soil types to climate/vegⁿ].
- ⑩ Zonal [dominant influence of climate $\rightarrow$ prolonged climatic influence $\rightarrow$ develop in denudⁿ process] agent becomes imp ex lithosol, podzol, serozem etc]
- ⑪ Intra [local factors [moisture/parent rock] is dominant factor. develop in poor drainage conditions $\rightarrow$ Hydromorphic (gleificaⁿ), Calcimorphic (rendzina, solonchak)
Halomorphie (solonetz ($\uparrow$ Na)).

Azonal [youthful due to sedimentation/renewal/erosion, Parent material is continuously eroded & deposited (alluvial) → ↓ horizons [↓ T, loose sands, slopes]

Morphological scheme :-

- ① Entisol [new, ↓ horizon] [flood plains, deltas, slopes] [N. Africa, Iran, Pak etc]
- ② Inceptisol [some horizon → layers] [top of flood plains, delta] [N. plains, Russia, N/E US]
- ③ Histosol [↑ organic, ↓ bacteria] [tundra-tropics] [Canada, Europe]
- ④ Aridisol [↓ org, arid, light, ↓ agri, calcification, salinization] [deserts] / shifting sands
- ⑤ Andisol [volcanic ash in parent material, ↑ veg] [Ring of fire] [Chile, Mexico, Japan]
- ⑥ Vertisol [black soil, ↑ clay, inverted profile] [steppe/wet-dry tropics] [Deccan, Ethiopian highlands]
- ⑦ Mollisol [↑ ca, ↑ fertile, ↑ org, ↑ moisture retain] [humid] [C. Asia, Russia, C. America]
- ⑧ Spodosol [temperate cool, moist] [Canada, Scandinavians]
- ⑨ Alfisol [sub-surface clay argillic layer, humid mid-lats / cont / sub-trop, fertile, ↑ agri, in glacial regions]
- ⑩ Ultisol [red/yellow, humid ST, extra layer w/ oxisols] [S/E A, Wghats, Odisha]
- ⑪ Oxisol [evergreen, warm, rainy → chem weathering] [↑ decomposition → ↓ agri] [Sahel]

Soil horizon

- 1) Study of soil's vertical cross section → its properties.
- 2) Depends on soil's age → Thick/Thin, climate.
- 3) Differentiated into layers ∴ is heterogeneous.
- 4) Soft rock → thick profile.
- 5) D & O are not soil but superficial layers.
- 6) A & B are soil proper & root zones (deeper in B).
- 7) A leaches → B accumulates (enriched) (illuviated). A (depleted) / (illuviated)
- 8) O A ⊕ B C D.
- 9) ex: Latrites
- 10) ex: Spodosol

Weathering process	
A	top soil
B	sub soil
C	weathered rock
D	rock proper / R layer

O (↓ humus), A (Fe, Al), E (silica poor), B (silica rich / grey).
 O (↑ humus), A (↓ Fe, ↓ Al, ↑ Si / grey), B (Al sesquioxides).

Soil erosion

Reasons :- overgrazing, deforestation, top soil removal, following, compact → round
 CC → ↑ rain intensity → splash / sheet erosion.

Affects :- 20 mn tonne productivity loss / yr, land loss (7-10 MHa).
Soln :- Engg / str [plugging dam, detention wall / basins, check dams, bunds, tripods, stone pitching, wire nets, groynes (etc)]

Preventive [agri modification, organic farming, ↓ grazing, ↑ trees, soil mulching, N, land use pattern, ↓ fallow, ↑ modern irrigation, terrace farming, watershed, Relay cropping, mud-it-jam]

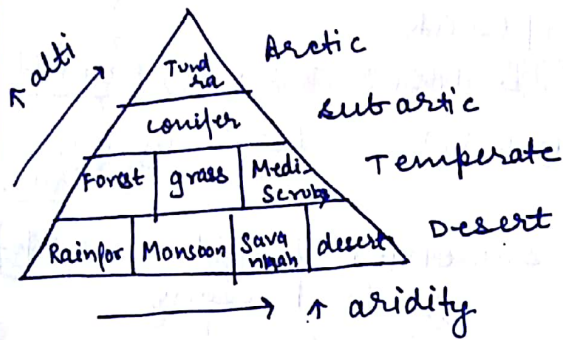
Salinization

Reasons [drainage, capillary, canal seepages, ↑ salt] .

Sol :- soil washing, ↑ drainage, gypsum use, canal lining. But all the work is by salinization.

better sol :- preven :- agri practice, ↓ h₂O use, ↓ H₂O intensive, agro-climate planning, lay farming (cynodon), agro-stological solutions.

Factors affecting distribⁿ of plants



- ① Trop climate - vertical sunrays.
- ② Trop rainforest [tall, dense, broad leaf hardwood, teak, Mahogany]

oxisols → x cultivated plants.

- ② savannah parkland, campos, llanos. ultisols & vertisols.

- ③ Deserts [sahara, Arabian, Aus, Kalahari], w. coast, aridisols.

④ Mid lats

Medi [winter rain → scrubs oak]
Marine west coast etc etc.

Origin & evolunⁿ of animals

- (1) fossils of sedimentary rocks are evidences.
- (2) Microscopic org : Pre-cambrian, ≥ 4600 mn yr ago.
- (3) Clemmay : outlines that oldest fossils are in Zambia.
- (4) Invertebrates : 680-580 mn yr old Africa, EU, N. America
- (5) Cambrian T > Pre cambrian T : evolunⁿ of protozoa, sponges, molluscs etc.
- (6) vertebrates : ordovician, bony animals snails, corals etc.
- (7) Silurian T cooler → Algae evolved, 1st land plant CLUBMOSS.
→ land invertebrates [snail, jellyfish etc].
- (8) Devonian dev of primitive life. insects, flies, fishes etc.
- (9) Carboniferous → glaciⁿ → ↑ insects, Amphibians, reptiles
- (10) Early Permian → retreat of ice → only robust species survived
→ reptiles were greatly modified.
- (11) Triassic → CDT → ↑ invertebrates, arthropods
- (12) Jurassic → warm, humid → ↑ insects, reptiles, dinosaurs.
- (13) Cretaceous → more CDT → inland swamps → flower plants, forests decreased, ↑↑ dino, evolunⁿ of mammals, bony fishes.

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- ⑭ Eocene: CDT, SFS → climatic zones developed → mammals evolved, placental animals.
- ⑮ Oligocene: warm, S. American unique animals due to isolation.
- ⑯ Miocene: cool → grasses → Elephants.
- ⑰ Pliocene: Polar / temp climate developed → Herbs, Hominids.
- ⑱ Quaternary: extinct, dispersal, redistribution → fast running animals.

Animal Dispersal [gradual, rapid, seasonal, forced, Anthropo] for breeding.

" " Factors [Phyenv, innate ability]

Factors of animal distribution

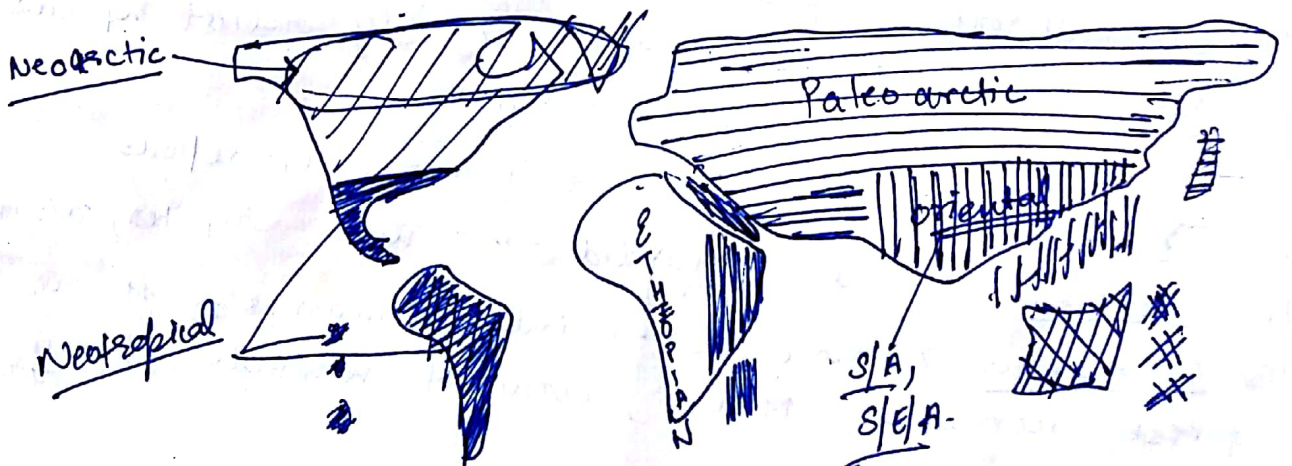
- Physical [LF, climate [T, H₂O, sunlight, P], gravity, salinity, soil]
- Biological [mobility, dispersal, mutual interaction, popⁿ size etc].

world distribution of animals

by Wallace into zoo-geographic zones.

- ① Paleoarctic: Europe, E. Asia, W. Asia
- ② Ethiopian: Africa, Arab, Madagascar [endemics African flying squirrel, mole rats etc]
- ③ Oriental: Tropical Asia [Ind, SL, S. China, Indo Malaysia] SR = sub-region
- ④ Australian: Aus, NZ, PNG, islands
- ⑤ Neotropical: Mexico, C. America, S. America, W.I., Galapagos marine,
- ⑥ Neoarctic: Greenland, N. America.

Wallace's
Zoo-geographic
zones.



Gene pool centres

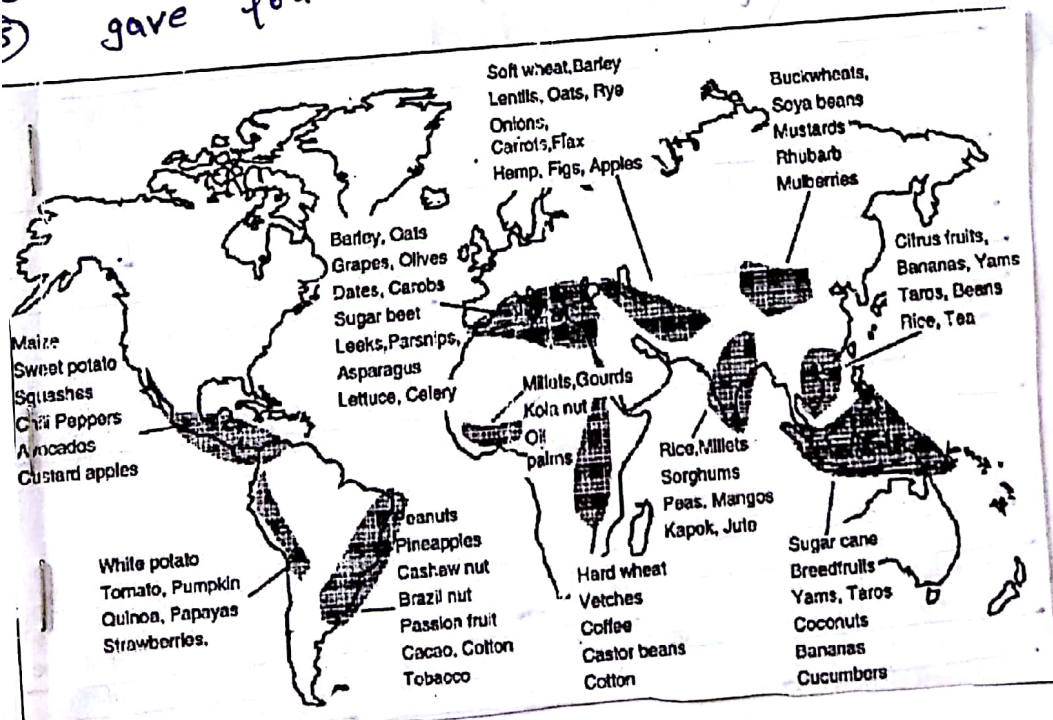
Large gene pool indicates ↑ genetic diversity. → robust pop.
 ↓ " " " " ↓ biological fitness & ↑ chance of extincⁿ

• centre of origin is a geog area where group of organisms either domesticated or wild, 1st developed. Acc to scientists, it is very tough to assemble info on origin / evolution as evidences are getting dim with time. candolle was 1st to pose ques of geog origin of cultivated plants. Based on Darwin's evolution concepts & candolle's observanⁿ, N I Vavilov gave hypothesis on gene pool centres of plants in 1920s.

- Assumpⁿ :
- ① main species used b traced back to 1 p/r region called centre of origin.
 - ② These centre would b common for a range of crops.
 - ③ These are areas of origin or evolution genetic diversifican.

Findings :

- ① distinguished b/w primary & secondary crops.
- Primary = basic ancient cultivated plants.
- Secondary = derived from weeds that infested primary crop fields.
- ② Region of max varian, usually including endemic species, and the centre of origin.
- ③ found foci of type formation / hearts of centres.
- ④ members & borders of GPCs changed continuously.
- ⑤ gave four GPCs :-



Prim vs sec
 Fou
 Δ accepted
 endemic → C.O.

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VAVILOV'S CENTRES OF ORIGIN OF CULTIVATED PLANTS

Centres of origin:	Foci of type formation:	Some important crops:
1. <u>The South-Asiatic tropical centre</u> (most of South and Southeast Asia)	<u>The Indian focus</u> <u>The Indo-Chinese focus</u> <u>The Island focus</u> , comprising islands in South-east-Asia	<u>Rice</u> , <u>sugar cane</u> , and a large number of <u>tropical fruits</u> and <u>vegetable crops</u>
2. <u>The East-Asiatic centre</u> (comprising East China, Taiwan, Korea and Japan)		<u>Soybeans</u> , different species of <u>millet</u> , the majority of <u>vegetable crops</u> and very many <u>fruits</u>
3. <u>South-western-Asiatic centre</u> (from Turkey to Kashmir)	<u>The Caucasian focus</u> <u>The Asia Minor focus</u> <u>The North-western-Indian focus</u>	Majority of endemic species of <u>wheat</u> , <u>rye</u> and <u>fruits</u> , <u>pea</u> , <u>chickpea</u> and <u>lentil</u> .
4. <u>Mediterranean centre</u> (Mediterranean countries)		<u>Olives</u> , <u>carob tree</u> , a multitude of <u>vegetable</u> and <u>forage plants</u>
5. <u>Abyssinian centre</u> (Highlands of Ethiopia, Eritrea, south-western parts of Arabia/Yemen)		<u>Teff</u> , <u>Arabica coffee</u> , <u>sorghum</u> , endemic species of <u>wheat</u> , <u>barley</u> and the <u>enset banana</u>
6. <u>Central American centre</u> (the northern parts and islands of Central America)	<u>The mountainous South-Mexican focus</u> <u>The Central American focus</u> <u>The West Indian focus</u>	<u>Maize</u> , several species of <u>cotton</u> , <u>beans</u> , <u>gourds</u> , <u>cocoa</u> , and probably <u>sweet potatoes</u> , <u>yams</u> , <u>peppers</u> and <u>fruits</u>
7. <u>Andean centre</u> (surroundings of the three foci in South America)	<u>Andean focus proper</u> <u>Chilcan focus</u> (southern parts) <u>Bogotan focus</u> (eastern Colombia)	<u>Potatoes</u> and other tuber-producing species, the <u>quinine-tree</u> , the <u>coca bush</u>

Rice, fruits, sugar cane

soya, fruit, millet, veg

Pea, chick, wheat, rye

olives, grapes

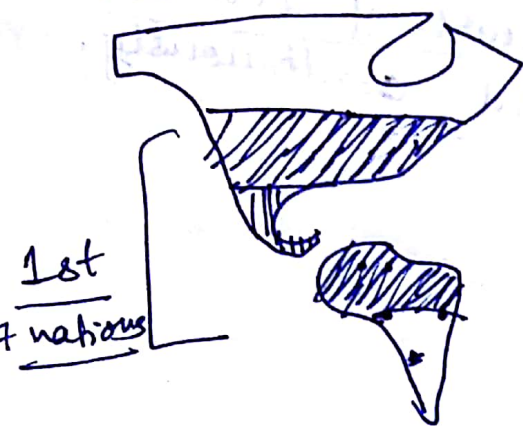
coffee, wheat, sorghum, Barley

Maize, yam, cotton, sweet potatoes, beans etc.

Potatoes, other tubers

Megadiversity countries

- ① Some regions have ↑, sm ↓ biodiversity.
- ② Tropical RF = ↑ ex Amazon forest.
- ③ Identified by Unep's world conservⁿ monitoring centre
- ④ 17. [those which highest endemism [> 5000 endemic plants]



USA
mexico
Peru
Brazil
Ecuador
Venezuela
Colombia

7

Africa (3rd)
3 { Madagascar
Congo
SA.

Asia: 2nd. (5)
Phil
Indo
Malaysia
India
China } 5

Oceania 4th

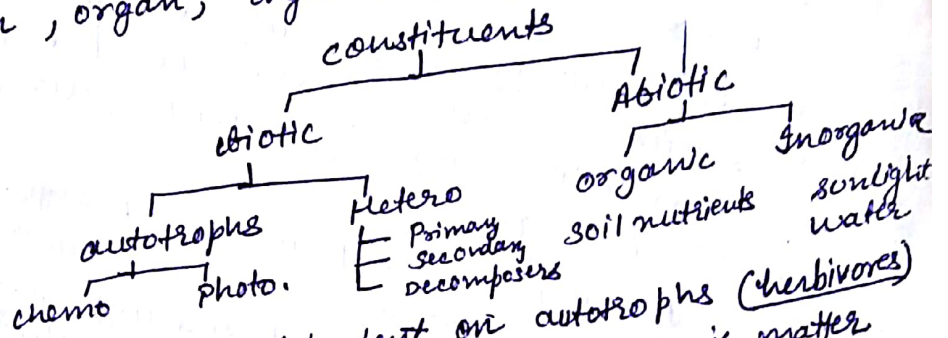
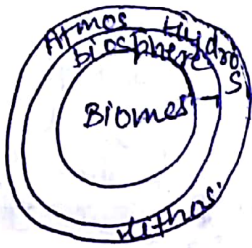
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Principles of Ecology

life bearing sphere of our env is biosphere. the realm of narrow zone of contact of other 3 realms that sustain life.

It is a complicated biotic system where interactive relation b/w various components generates & sustains life bearing capacity. There are 6 hierarchies of interactive relation, where every level represents well developed system by itself and also interprets relation with other levels. study of these relation by ODUM who identified biotic & abiotic constituent's interactions w/d each other. 6 hierarchies are gene system, cell system, organ, organism, popⁿ, ecological.



primary heterotrophs are directly dependent on autotrophs (herbivores) secondary (carni). decomposers decompose dead organic matter or organic excreta

linkages: Abiotic - Biotic (Production), biotic - biotic (Feeding), biotic - abiotic (Decomposition)

biotic producers utilize abiotic constituents to generate food. production amount varies from Locⁿ to Locⁿ. these variations are determined by 4 factors. Major factors include sunlight & capacity of phototrophs in converting solar energy $\rightarrow$ food regulated by water.

$\therefore$ producⁿ $\downarrow$ with $\uparrow$ in latitude. Minor Factors include

season cycle, age of vegⁿ

* Productivity is stored amount of energy / time / area. Avg global productivity is 323 dry gram / m² / year

biotic - biotic feeding relation is outlined w/d respirational loss applicable at every level of relatⁿ b/w biotic community. These levels of biotic community are called trophic levels. with $\uparrow$ TL $\rightarrow$ $\uparrow$ respirational loss $\rightarrow$ $\downarrow$ feeding / ecological capacity. This justifies food pyramids having 4-5 levels. Primary producers occupy level 1 & have largest abundance & biomass in a given location [wt of living matter / area / time]

* also with $\uparrow$ LAT $\rightarrow$ $\downarrow$ producⁿ $\rightarrow$ $\downarrow$ feeding capacity. $\therefore$ biodiversity $\downarrow$.

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abiotic - abiotic represents decomposition and related to decomposers which convert abiotic into abiotic. Decomposition has 2 phases Humification & Mineralization.

Biomes are regional divide of ecosystem that inc both terrestrial & aquatic subcategories.
Terrestrial inc Tundra, Desert, Forest, grassland, savannah.

Tundra terrestrial biome | terrestrial ecosystem
Highest latitudinal biome of world. Confined to sub-polar location. Long cold winters w/ brief summers. Summer season causes ablation of surface with subsurface permanent frozen → water logging → condⁿ for autotrophs / heterotrophs. Plants have floating adaptability due to no soil. Common ex: mosses, lichens, few flowering plants. Heterotrophs inc insect, big terrestrial animals (caribou), polar bear, water birds.
Has least productivity

Desert ↓ water. In tropical west margins & subtropical contiⁿ. Interior: evaporational loss > precipitⁿ loss. Photo^otoph^s adapted as xerophytes due to prevailing aridity. Deep roots (Phreatophytes) & succulent features. Cactus, thorny bushes & region specific plants (Aloevera etc). Date palms in oasis regions. Heterotrophs adapted to thick coating, nocturnal adaptability (rodents). In subtropics higher tablelands feature yak, Antelope. Collectively this biome exhibit less biotic diversity in more habitat diversity → NICHE diversity