# Koppen's scheme Of Classification Of Climate

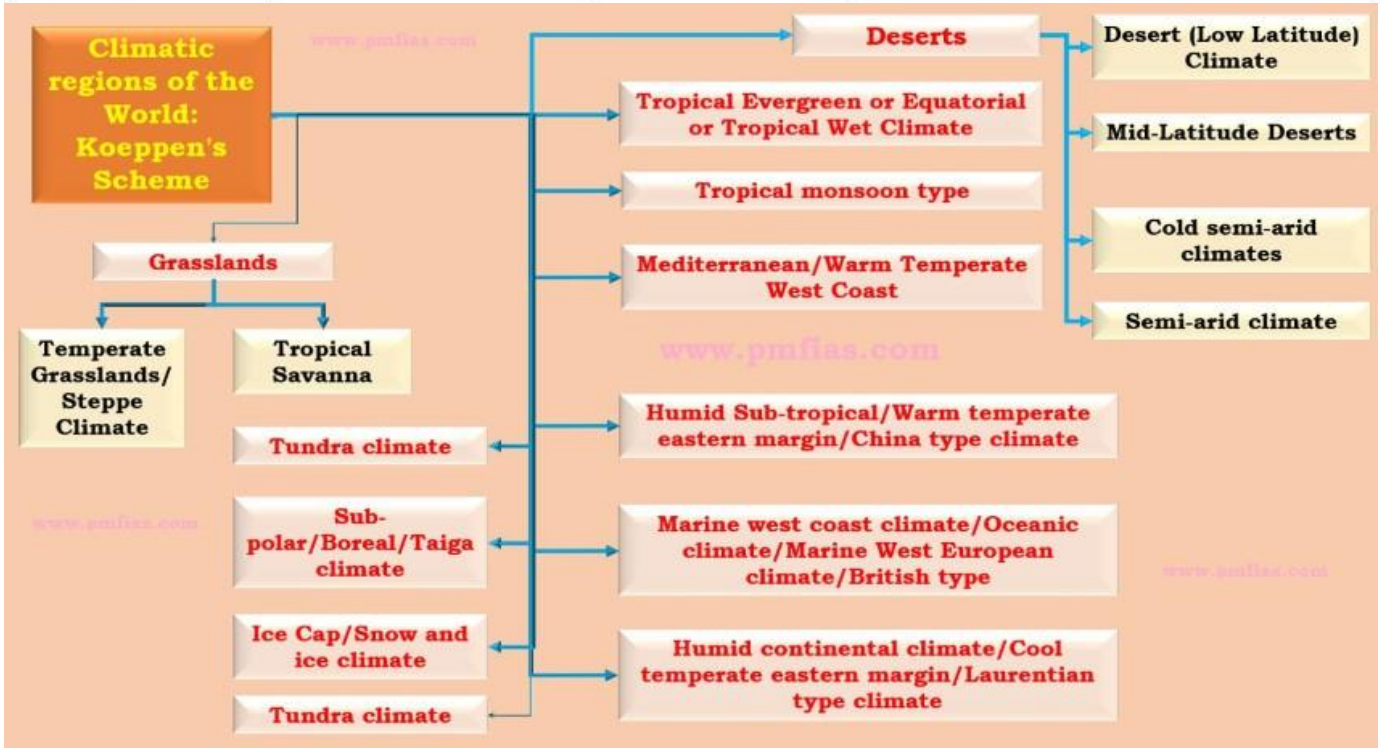
- The most widely used classification of climate is the empirical climate classification scheme developed by V. Koeppen. [**empirical**: verifiable by observation or experience rather than theory or pure logic][when dropped, stone falls to the ground – logic. Drop a stone to confirm that it falls to the ground – empirical]
- Koeppen identified a close relationship between the **distribution of vegetation** and **climate.** He selected certain values of **temperature** and **precipitation** and related them to the **distribution of vegetation** and used these values for classifying the climates.
- Koeppen recognized five major climatic groups, four of them are based on temperature and one on precipitation.
- The capital letters : **A, C, D and E delineate humid climates** and **B dry climates**.
- The climatic groups are subdivided into types, designated by small letters, based on seasonality of precipitation and temperature characteristics.
- The seasons of dryness are indicated by the small letters : f, m, w and s, where **f corresponds to no dry season, m – monsoon climate, w – winter dry season and s – summer dry season.**
- The small letters a, b, c and d refer to the degree of severity of temperature.
- The B – Dry Climates are subdivided using the capital letters S for steppe or semi-arid and **W for deserts**

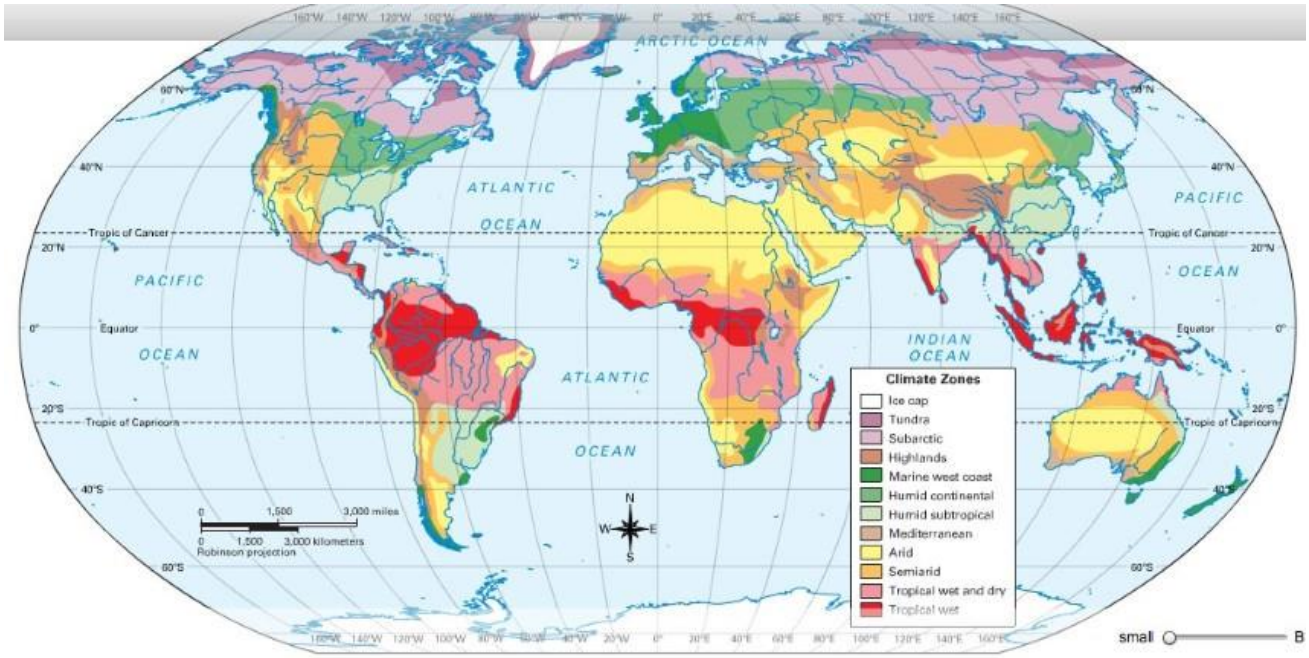
**Table 12.1 : Climatic Groups According to Koeppen**

| *Group* | *Characteristics* |
|---|---|
| A - Tropical | Average temperature of the coldest month is 18° C or higher |
| B - Dry Climates | Potential evaporation exceeds precipitation |
| C - Warm Temperate | The average temperature of the coldest month of the (Mid-latitude) climates years is higher than minus 3°C but below 18°C |
| D - Cold Snow Forest Climates | The average temperature of the coldest month is minus 3° C or below |
| E - Cold Climates | Average temperature for all months is below 10° C |
| H - High Land | Cold due to elevation |

**Table 12.2 : Climatic Types According to Koeppen**

| *Group* | *Type* | *Letter Code* | *Characteristics* |
|---|---|---|---|
| A-Tropical Humid Climate | Tropical wet | Af | No dry season |
| | Tropical monsoon | Am | Monsoonal, short dry season |
| | Tropical wet and dry | Aw | Winter dry season |
| B-Dry Climate | Subtropical steppe | BSh | Low-latitude semi arid or dry |
| | Subtropical desert | BWh | Low-latitude arid or dry |
| | Mid-latitude steppe | BSk | Mid-latitude semi arid or dry |
| | Mid-latitude desert | BWk | Mid-latitude arid or dry |
| C-Warm temperate (Mid-latitude) Climates | Humid subtropical | Cfa | No dry season, warm summer |
| | Mediterranean | Cs | Dry hot summer |
| | Marine west coast | Cfb | No dry season, warm and cool summer |
| D-Cold Snow-forest Climates | Humid continental | Df | No dry season, severe winter |
| | Subarctic | Dw | Winter dry and very severe |
| E-Cold Climates | Tundra | ET | No true summer |
| | Polar ice cap | EF | Perennial ice |
| H-Highland | Highland | H | Highland with snow cover |

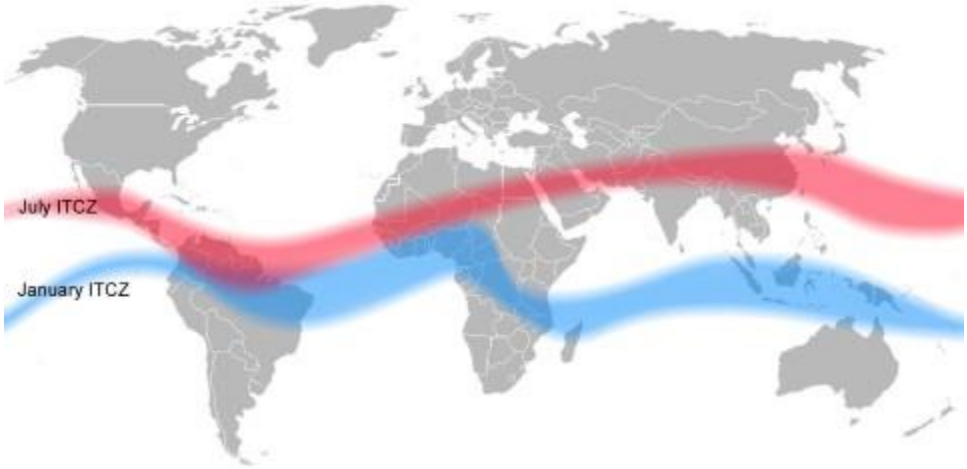





## Group A : Tropical Humid Climates

- Tropical humid climates exist **between** Tropic of Cancer and Tropic of Capricorn.
- The sun being overhead throughout the year and the presence of **Inter Tropical Convergence Zone (INTCZ)** make the climate hot and humid.
- **Annual range of temperature is very low** and **annual rainfall is high**.
- The tropical group is divided into three types, namely

1. **Af – Tropical wet climate;**
2. **Am – Tropical monsoon climate;**
3. **Aw – Tropical wet and dry climate.**

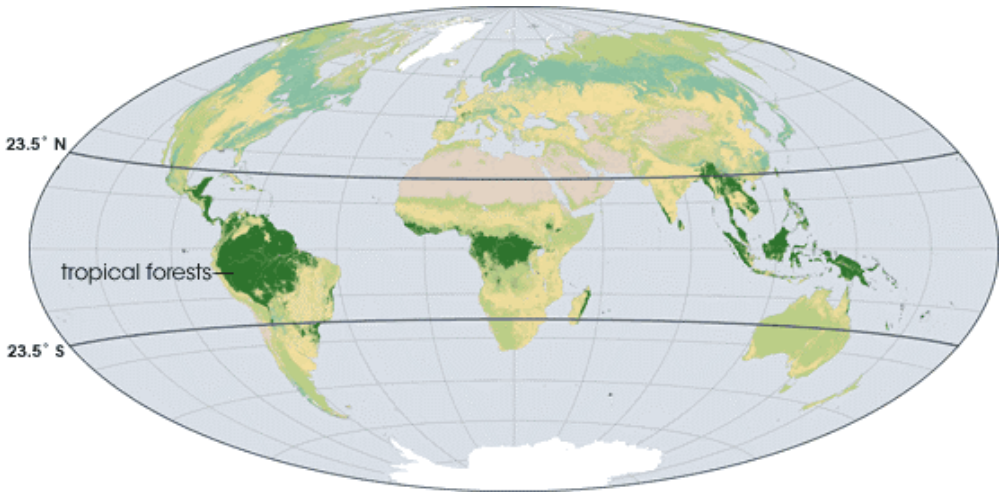



## Tropical Wet Climate (Af)

- Also known as '**The Hot, Wet Equatorial Climate**', '**Equatorial Rainforest Climate**'.
- The regions are generally referred as **'Equatorial Rainforests', 'Equatorial Evergreen Forests', 'Tropical Moist Broadleaf Forest', 'Lowland Equatorial Evergreen Rainforest'.**

## Distribution

- Mostly between **5° N and S of Equator**. [little or no Coriolis Force == no tropical cyclones]
- Its greatest extent is found in the **lowlands of the Amazon, the Congo, Malaysia and the East Indies.**




## Equatorial Climate

- Dominated by **Maritime Tropical air masses**.

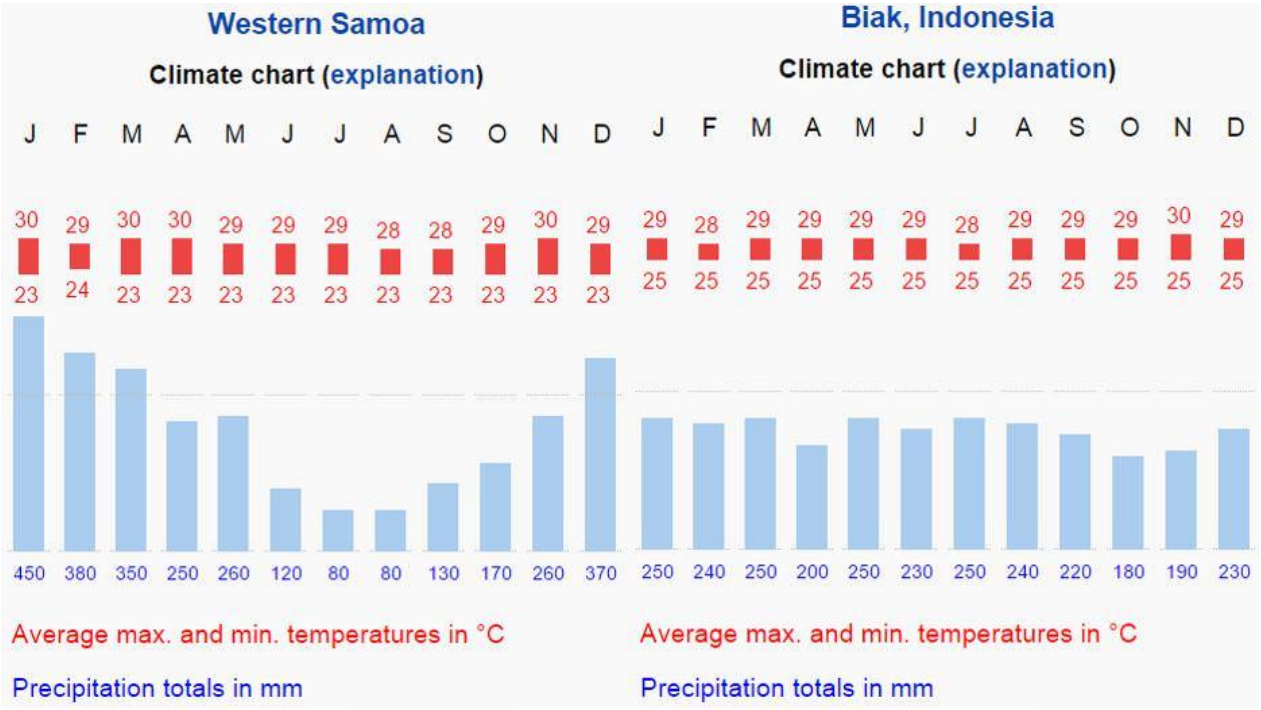
## Temperature

- Temperature is **uniform** throughout the year.
- The mean monthly temperatures are always around **27° C** with very little variation.
- **There is no winter**. [Typical to Equatorial Rainforest Climate]
- Cloudiness and **heavy precipitation** moderate the daily temperature.
- Regular land and sea breezes assist in maintaining a truly equable climate.
- The diurnal range of temperature is **small**, and so is the annual range.

## Precipitation

- Precipitation is heavy and **well distributed throughout the year**.
- Annual average is always above **150 cm**. In some regions the annual average may be as high as 250 – 300 cm.
- There is **no month without rain (distinct dry season is absent)**. The monthly average is above **6 cm** most of the times.
- There are two periods of maximum rainfall, **April** and **October**. [shortly after the equinox]. Least rain fall occurs in June and December [**solstice]**.
- The ***double rainfall peaks coinciding with the equinoxes*** are a characteristic feature of equatorial climates not found in any other type of climate.
- There is much evaporation and convectional air currents are set up, followed by **heavy thunderstorms in the afternoons**.

## Climate Graphs




## Equatorial Vegetation

- High temperature and abundant rainfall support a luxuriant **tropical rain forest**.
- In the Amazon lowlands, the forest is so dense that it is called **'selvas'**. [selvas: A dense tropical rainforest usually having a cloud cover (**dense canopy**)]
- Unlike the temperate regions, the **growing season here is all the year round**- seeding, flowering, fruiting and decaying do not take place in a seasonal pattern.
- The equatorial vegetation comprises a multitude of evergreen trees that yield ***tropical hardwood, e.g. mahogany, ebony, dyewoods etc.***
- Many parts of the tropical rain forests have been cleared either for **lumbering or shifting cultivation.**
- In the coastal areas and brackish swamps, **mangrove forests** thrive.

## Canopy

- From the air, the tropical rain forest appears like a thick canopy of foliage, broken only where it is crossed by large rivers or cleared for cultivation.

- All plants struggle upwards (most **ephiphytes**) for sunlight resulting in a peculiar layer arrangement.

**Epiphyte:** An epiphyte is a plant that grows harmlessly upon another plant (such as a tree) and derives its moisture and nutrients from the air, rain, and sometimes from debris accumulating around it.

- The tallest trees attain a height close to **50 m**.
- The smaller trees beneath form the next layer.
- The ground is rooted with ferns and herbaceous plants which can tolerate shade.
- Because the trees cut out most of the sunlight the **undergrowth is not dense**.

## Multiple species

***In spite of dense forests, countries in equatorial regions are net importers of timber.***

- Though the tropics have great potential in timber resources, commercial extraction is **difficult.**
- **Multiple species** of trees occur in a particular area (trees do not occur in homogenous stands or pure stands) making commercial exploitation a difficult task.
- Many of the tropical hardwoods (very heavy) **do not float** readily on water and this makes transportation an expensive matter.
- It is therefore not surprising that many tropical countries are **net timber importers**.

## Life and Economy

## Agriculture

- The forests are sparsely populated.
- In the forests most primitive people live as **hunter gatherers** and the more advanced ones practice **shifting cultivation.**
- Food is abundantly available. People generally don't stock food for the next day.

Commercial

1. In the **Amazon basin** the **Indian tribes** collect wild **rubber**,
2. in the Congo Basin the **Pygmies** gather nuts and
3. in the jungles of Malaysia the **Orang Asli** make all sorts of cane products and sell them to people in villages and towns. *[The names of the tribes come under Social Geography – Prelims]*

## Shifting Cultivation or Slash and Burn Cultivation.

- This type of cultivation is followed in many parts of the world where dense forests are common [In India, North-East is known for this type of cultivation].
- Tribes cut the trees in a plot, burn them and cultivate the plot till the fertility is exhausted.
- Once the fertility is exhausted, the clearing is abandoned and they move on to a new plot. Such farming practices are becoming more and more widespread even among backward tribes.

- In the clearings for shifting cultivation, crops like manioc (tapioca), maize, bananas and groundnuts are grown.

## Plantation Boom in Rainforests

- With the coming of the Europeans, many large plantations have been established, especially in **Java, Sumatra, Malaysia, West Africa and Central America**.
- The climate is very Favourable for the cultivation of certain crops that are highly valued in the industrial West. The most important is **natural rubber.**
- **Malaysia and Indonesia** are the leading producers. The home country, **Brazil** exports practically no natural rubber.
- **Cocoa** is another important crop which is cultivated in **West Africa**, bordering the **Gulf of Guinea**. The two most important producers are **Ghana and Nigeria**. All the cocoa here goes into American and European **chocolate industry**.
- From the same area another crop, **oil palm**, has done equally well and many countries like Indonesia have now taken to its cultivation.
- Other important crops include coconuts, sugar, coffee (Brazil), tea, tobacco, spices, etc.
- The plantations resulted in the destruction of nearly half of equatorial forests.

| Plantations | Regions |
|---|---|
| Palm | Malaysia, Indonesia |
| Sugarcane | Brazil |
| Coffee | Brazil |

| | |
|---|---|
| Rubber | Malaysia, Indonesia |
| Cocoa | Ghana, Nigeria |

## Factors Affecting the Development of Equatorial Regions

## Equatorial climate and health

- Excessive heat (sun-stroke) and high humidity creates serious physical and mental handicaps.
- High humidity feeds many tropical diseases such as malaria and yellow-fever.
- Communicable diseases are rampant as germs and bacteria are transmitted through moist air.
- Insects and pests not only spread diseases but are injurious to crops.

## Jungle hinders development

- The construction of roads and railways is a risky business as workers are exposed to wild animals, poisonous snakes, insects and most importantly tropical diseases.
- Once completed, they have to be maintained at a high cost.

## Rapid deterioration of tropical soil

Why does restoration of lost forests take decades in equatorial regions?

- The fertility of top soil in rainforest regions is very poor. Torrential downpours wash out most of the top soil nutrients **[leaching** == percolation and draining way of nutrients due to rain water action**].**
- The soil deteriorates rapidly with subsequent soil erosion and soil impoverishment.
- It takes **decades** to replenish the soil of lost nutrients.
- So a seed doesn't usually germinate and even if it does, its development is hindered due to little availability of sunlight.
- ***Lalang (tall grass)*** and thick undergrowth spring up as soon as the trees are cut. They choke the restoration of forests.
- Indonesian island of Java is an exception because of its rich volcanic ashes.

## Difficulties in livestock farming

- Livestock farming is greatly handicapped by an **absence of meadow grass**. The grass is so **tall and coarse** that it is not nutritious.
- The few animals like buffaloes are kept mainly for domestic use. Their yield in milk or beef is well below those of the cattle in the temperate grasslands.
- In Africa, domesticated animals are attacked by **tsetse flies** that cause ngana, a deadly disease.

## Mineral resources

- Gold, copper, diamonds, and other precious metals and gemstones are important resources that are found in rainforests around the world.
- Extracting these natural resources is a destructive activity that damages the rainforest ecosystem.
- Examples are **gold mining in the Brazilian and Peruvian Amazon**, **rare earth mining in the Congo**, and **gold and copper mining in Indonesia and Papua New Guinea.**
- Some of the world's most promising oil and gas deposits lie deep in tropical rainforests. **Oil and gas development** often takes a heavy toll on the environment and local people (This happens in Ecuador).
- More than 70 percent of the Peruvian Amazon is now under concession for oil and gas.

## Group A : Tropical Humid Climates

- Tropical humid climates exist between Tropic of Cancer and Tropic of Capricorn.
- The sun being overhead throughout the year and the presence of Inter Tropical Convergence Zone (ITCZ) make the climate hot and humid.
- Annual **range of temperature is very low** and **annual rainfall is high**.
- The tropical group is divided into three types, namely

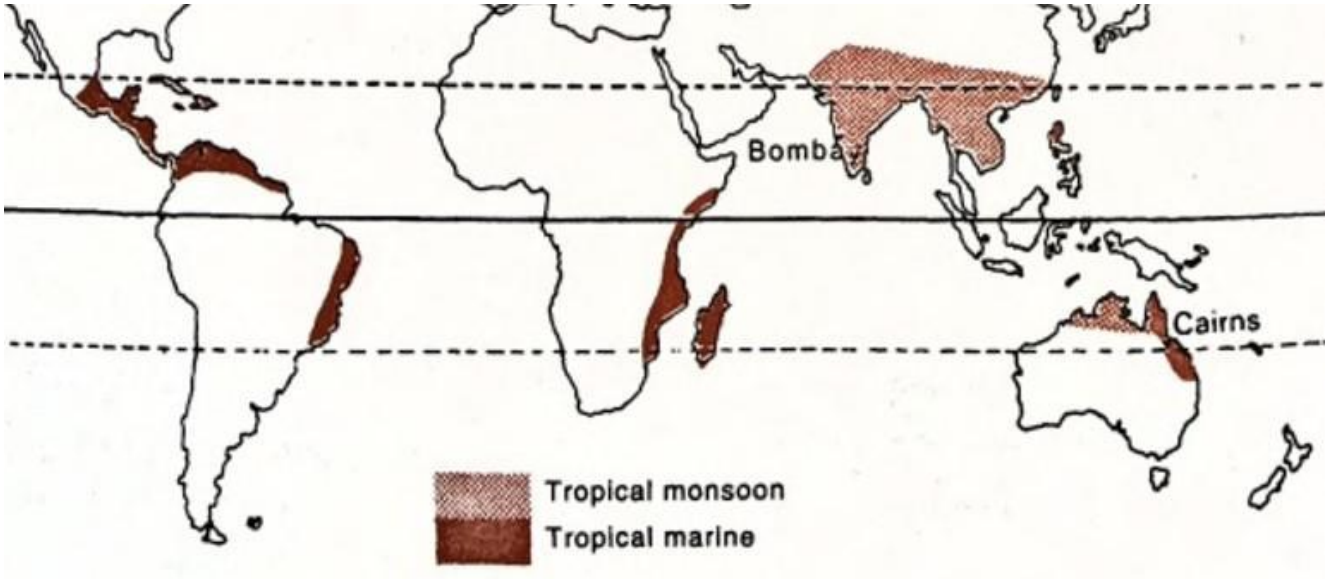
1. **Af- Tropical wet climate [Done in previous post];**
2. **Am – Tropical monsoon climate [This post];**
3. **Aw- Tropical wet and dry climate [Next Post].**

## Tropical Monsoon Climate

- Monsoons are **land and sea breezes** on a much larger scale.
- Unlike equatorial wet climate, monsoon climate is characterized by **distinct wet and dry seasons** associated with **seasonal reversal of winds**.
- **Floods** in wet season and **droughts** in dry season are common.
- Usually there are three seasons namely **summer, winter and rainy** season.

## Distribution of Tropical Monsoon Climate

- Occur within **5° to 30°** N and S of the equator.
- On-shore [sea to land] tropical monsoons occur in the summer and off-shore [land to sea] dry monsoons in the winter.
- They are best developed in the **Indian sub-continent, Burma, Thailand, Laos, Cambodia, parts of Vietnam and south China and northern Australia**.




## Climate

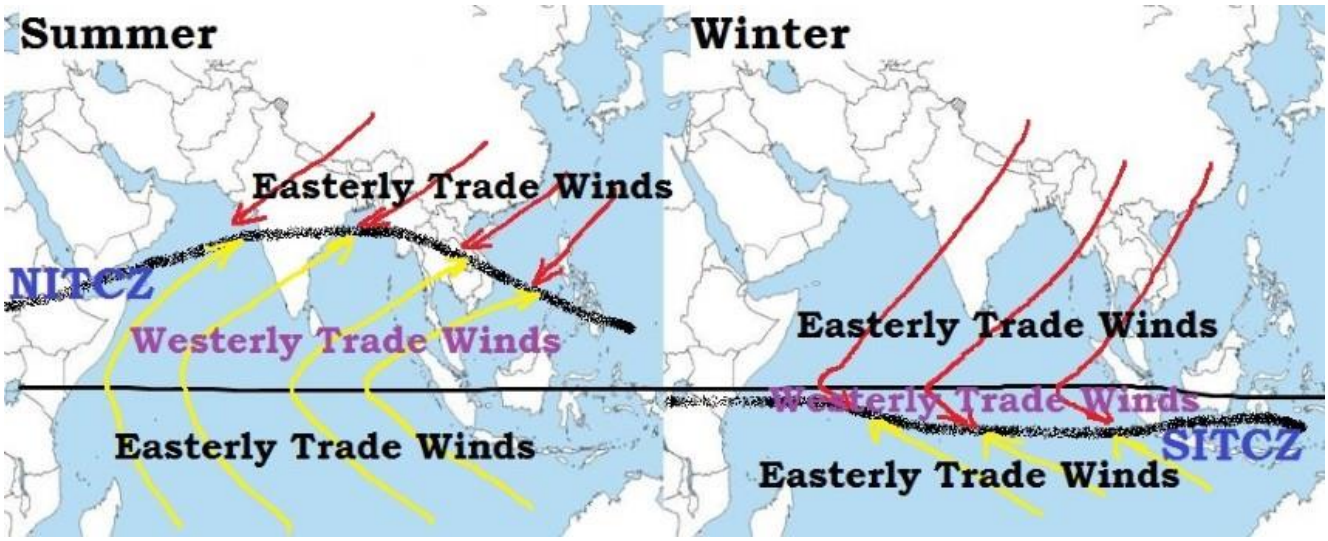
- The basic cause of monsoon climates is the difference in the **rate of heating** and cooling of land and sea (This is old theory. New theory will be explained while studying Indian Climate).
- In the summer, when the sun is overhead at the Tropic of Cancer, a low pressure is created in Central Asia.
- The seas, which warm up much slower, remain comparatively at high pressure. At the same time, the southern hemisphere experiences winter, and a region of high pressure is set up in the continental interior of Australia.
- Winds blow outwards as the South-East Monsoon, to Java, and after crossing the equator are drawn towards the continental low pressure area reaching the Indian sub-continent as the South-West Monsoon (Coriolis force).
- In the winter, conditions are reversed.

## Temperature

- Monthly mean temperatures **above 18 °C.**
- Temperatures range from 30-45° C in summer. Mean summer temperature is about 30°C.
- In winters, temperature range is 15-30° C with mean temperature around 20-25° C.

## Precipitation

- Annual mean rainfall ranges from 200-250 cm. In some regions it is around 350 cm.
- Places like **Cherrapunji & Mawsynram** receive an annual rainfall of about **1000 cm.** [They lie on the windward side of the Meghalaya hills, so the resulting **orographic lift (orographic rainfall)** enhances precipitation. Also, they are located between mountains which enhances cloud concentration due to **funneling effect**]




## Seasons

- Seasons are chief characteristics of monsoon climate.

## The cool, dry season (October to February)

- Out blowing dry winds, the North-East Monsoon, bring little or no rain to the Indian sub-continent.
- However, a small amount of rain falls in Punjab from cyclonic sources (Western Disturbances: Frontal precipitation brought by jet streams) and this is vital for the survival of winter cereals.
- North-East Monsoons blowing over the Bay of Bengal acquires moisture and bring rains to the south-eastern tip of the peninsula at this time of the year (Nov-Dec).

## The hot dry season (March to mid-June)

- The temperature rises sharply with the sun's northward shift to the Tropic of Cancer.
- Day temperatures of 35° C are usual in central India and the mean temperature in Sind and south India may be as high as 44° C.
- Coastal districts are a little relieved by sea breezes. There is practically little rain. [Hailstorms (thunderstorms with hail) occurs here and there]

## The rainy season (mid-June to September)

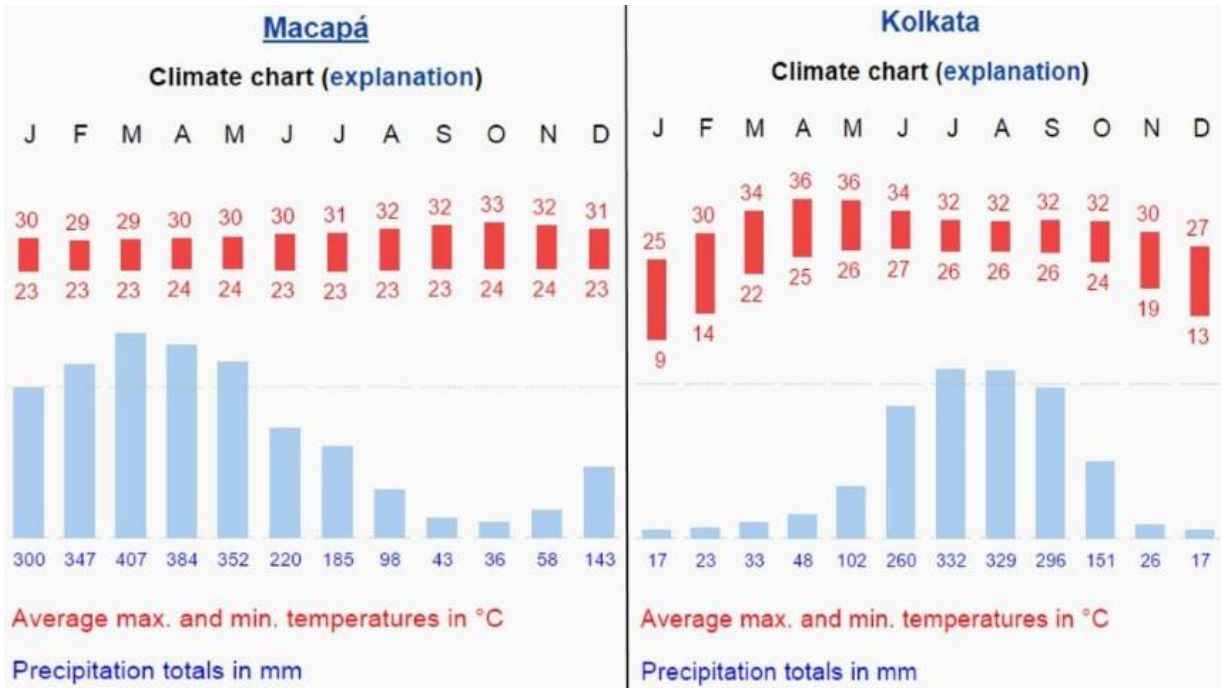
- With the ‘burst’ of the South-West Monsoon in mid-June, torrential downpours sweep across the country. Almost all the rain for the year falls within this rainy season.
- This pattern of **concentrated heavy rainfall** in summer is a characteristic feature of the Tropical Monsoon Climate.

## The Retreating Monsoon

- The amount and frequency of rain decreases towards the end of the rainy season. It retreats gradually southwards after mid-September until it leaves the continent altogether.
- The skies are clear again and the cool, dry season returns in October, with the out blowing North-East Monsoon.

The role of monsoons in India is vital for its economy.

## Climate Graph




## Tropical Marine Climate

- Outside the monsoon zone, the climate is modified by the influence of the on-shore Trade Winds **all the year round**. This type of climate is called Tropical Marine Climate. Such a climate has a more **evenly distributed rainfall**.

- Such a climate is experienced in Central America, West Indies, north-eastern Australia, the Philippines, parts of East Africa, Madagascar, the Guinea Coast and eastern Brazil.
- The rainfall is both **orographic** where the moist trades meet upland masses as in eastern Brazil, and **convectional** due to intense heating during the day and in summer.
- Its tendency is towards a summer maximum without any distinct dry period.
- Due to the steady influence of the trades, the Tropical Marine Climate is **more Favourable for habitation**, but it is **prone to severe tropical cyclones, hurricanes or typhoons.**

## Tropical Monsoon Forests

**Drought-deciduous forest; dry forest; dry-deciduous forest; tropical deciduous forest.**

- **Broad-leaved hardwood trees**. Well developed in **southeast Asia.**
- Trees are normally deciduous, because of the marked dry period, during which they shed their leaves to withstand the drought [They shed their leaves to prevent loss water through **transpiration**].
- The forests are more open and **less luxuriant** than the equatorial jungle and there are far **fewer species.**
- Where the rainfall is heavy, e.g. in southern Burma, peninsular India, northern Australia and coastal regions with a tropical marine climate, the resultant vegetation is luxuriant.
- With a decrease in rainfall in summer, the forests thin out into **thorny scrubland or savanna** with scattered trees and tall grass.
- In parts of the Indian sub-continent, rainfall is so deficient that semi-desert conditions are found in summer. Monsoonal vegetation is thus most varied, ranging from forests to thickets, and from savanna to scrubland.

## Population and Economy in Monsoon Climate

- Monsoon climatic regions support high population density.
- Income levels are low as most of these regions are underdeveloped or developing.
- Subsistence farming is the main occupation. (crops grown with an intention to secure food for the season. The crops are not sold as the production is very low).
- Intensive cultivation is common in regions with irrigational facilities.

- Shifting cultivation is followed in North-East India and South-East countries.
- Major crops include rice, sugar, cotton, jute, spices, etc..
- Cattle and sheep rearing is carried out for domestic and commercial purposes. Livestock industry is not as profitable as in temperate regions.

## Agricultural Development in the Monsoon Lands

- Much of the monsoon forest has been cleared for agriculture to support the very dense population. Subsistence agriculture is the major occupation.
- Farms are small and the people are forever **'land hungry.'** Industrialization make things worse.
- Tropical agriculture dependent on natural rainfall and a large labour force, reaches its greatest magnitude in the monsoon lands.
- Farming is the dominant occupation of the Indian sub-continent, China, South-East Asia, eastern Brazil and the West Indies. The following types of agriculture are recognizable.

## Crops

- Rice is the most important staple crop.
- Irrigation water from rivers, canals, dams or wells is extensively used in the major rice producing countries.
- Other food crops like maize, millet, sorghum, wheat, gram and beans are of subsidiary importance. They are cultivated in the drier or cooler areas where rice cannot be grown.

## Lowland cash crops

- The most important crop in this category is **cane sugar**.
- As much as two-thirds of world's sugar production comes from tropical countries.
- Some of the major producers include **India, Java, Formosa, Cuba, Jamaica, Trinidad and Barbados.**
- **Jute** is confined almost entirely to the Ganges – Brahmaputra delta, in India and Bangladesh.
- Other crops include cotton, a major commercial crop of the Indian sub-continent.

## Highland plantation crops

- The colonization of tropical lands by Europeans gave rise to a new form of cultivated landscape in the cooler monsoonal highlands.
- Thousands of acres of tropical upland forests were cleared to make way for plantation agriculture in which tea and coffee are the most important crops.

## Coffee

- Coffee originated in Ethiopia and Arabia.
- But **Brazil** accounts for almost half the world's production of coffee.
- It is mainly grown on the eastern slopes of the Brazilian plateau.
- The crop is also cultivated on the highland slopes in the Central American states, India and eastern Java.

## Tea

- Tea originated in China and is still an important crop there.
- It requires **moderate temperatures** (about 15° C), **heavy rainfall** (over 150 cm) and **well drained highland slopes.**
- It thrives well in the tropical monsoon zone (highlands).
- The best regions are thus the Himalayan foothills of India and Bangladesh, the central highlands of Sri Lanka and western Java, from all of which it is exported.
- In China tea is grown mostly for local consumption.

## Lumbering

- Most of the forests yield valuable timber, and are prized for their **durable hardwood.**
- Lumbering is undertaken in the more accessible areas. This is particularly important in continental South-East Asia.
- Of the tropical deciduous trees, **teak,** of which **Burma** is the leading producer, is perhaps the most sought after. It is valuable on account of its **great durability, strength, immunity to shrinkage, fungus attack and insects.**
- Teak logs are so heavy that they will not float readily on water. It is therefore necessary to 'poison' the tree several years before actual felling, so that it is dry and light enough to be floated down the **Chindwin** and the **Irrawaddy** to reach the saw mills at **Rangoon.**
- Other kinds of timber include **Neem, Banyan, Mango, Teak, Sal, Acacia, Eucalyptus**

- Together with the forests are bamboo thickets, which often grow to great heights.

## Teak

- Burma alone accounts for as much as three – quarters of the world's production.
- It is such a durable timber that it is extensively used for **ship building**, furniture and other constructional purposes.

## Shifting Cultivation

- This most primitive form of farming is widely practiced.
- Instead of rotating the crops in the same field to preserve fertility, the tribesmen move to a new clearing when their first field is exhausted.
- Maize, dry padi, sweet potatoes and some beans are the most common crops.
- Farming is entirely for **subsistence**, i.e. everything is consumed by the farmer's family, it is not traded or sold.
- As tropical soils are **rapidly leached and easily exhausted, the first crop may be bountiful but the subsequent harvests deteriorate.**
- Shifting cultivation is so widely practiced amongst indigenous peoples that different local names are used in different countries.

| **Region** | **Name of Shifting Cultivation** |
|---|---|
| Malaysia | Lacking |
| Burma | Taungya |
| Thailand | Tamrai |
| Philippines | Caingin |
| Java | Humah |
| Sri Lanka | Chena |
| Africa and Central America | Milpa |
| North-east India | **Jhum** |

## Savanna Climate or Tropical Wet and Dry Climate or Sudan Climate

- This type of climate has **alternate wet and dry seasons** similar to monsoon climate but has **considerably less annual rainfall**.
- Also, there is **no distinct rainy season** like in monsoon climate.

[Only two seasons – winter and summer. **Rains occur in summer**].

- Floods and droughts are common.
- Vegetation, wildlife and human life are quite different from monsoon climate regions.


## Distribution of Savanna Climate

- It is confined within the tropics and is best developed in **Sudan**, hence its name the **Sudan Climate**.
- It is a **transitional type** of climate found between the **equatorial rainforests** and **hot deserts.**

## African Savanna

- The belt includes **West African Sudan**, and then curves southwards into East Africa and southern Africa north of the Tropic of Capricorn.

## South American Savanna

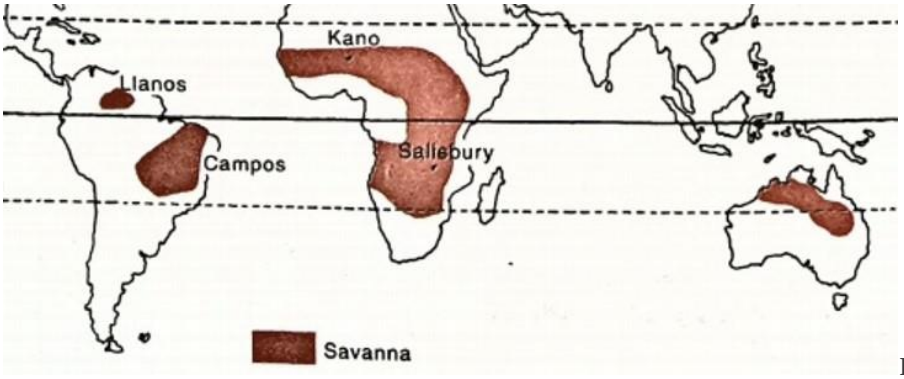
- There are two distinct regions namely the **llanos** of the Orinoco basin [north of equator] and the **compos** of the Brazilian Highlands [South of equator].

## Australian savanna

- The Australian savanna is located south of the monsoon strip (northern Australia) running from west to east north of the Tropic of Capricorn.

## Indian Savanna

- Certain parts across Northern Karnataka, Southern Maharashtra and Telangana exhibit characteristics of both semi-arid and savanna climate.
- Due to irrigation and cultivation, this region is different from other savanna region



ns.

## Savanna Climate

## Rainfall

- Mean annual rainfall ranges from **80 – 160 cm** [Rainfall decreases with distance from equator].
- In the northern hemisphere, the rainy season begins in May and lasts till September.
- In the southern hemisphere, the rainy season is from October to March.

## Temperature

- Mean annual temperature is **greater than 18° C.**
- The monthly temperature hovers between 20° C and 32° C for lowland stations.
- **Highest temperatures do not coincide with the period of the highest sun** (e.g. June in the northern hemisphere) but occur just before the onset of the rainy season, i.e. April in Northern Hemisphere and October in Southern Hemisphere.
- **Days are hot and nights are cold**. This **extreme diurnal range** of temperature is another characteristic feature of the Sudan type of climate.

## Winds

- The prevailing winds of the region are the Trade Winds, which bring rain to the coastal districts.
- They are strongest in the summer [favorable position of ITCZ] but are relatively dry by the time they reach the continental interiors or the western coasts [Trade winds are easterlies – flow from east to west. So rainfall decreases from east to west here].
- In West Africa, the North-East Trades, in fact, blow off-shore [continent to sea] from the Sahara Desert and reach the Guinea coast as a dry, dust-laden winds.

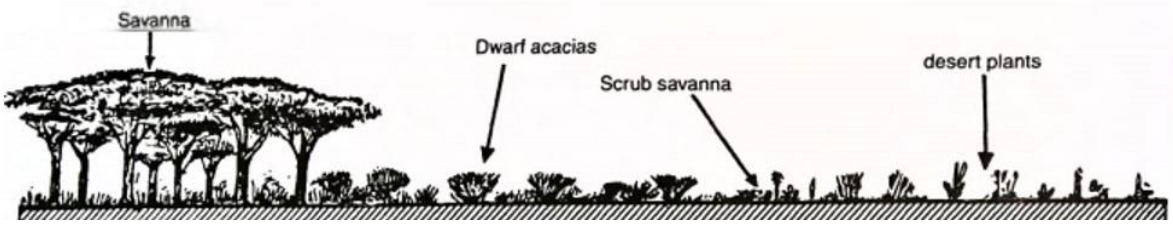
**What is the reason for alternating wet and dry seasons in Savanna type climate?**

- On shore winds is summer bring rains.
- Off-shore winds in winter keep the climate dry.

## Natural Vegetation of Savanna Climate

- The savanna landscape is typified by **tall grass and short trees**.
- The grasslands are also called as ***'bush-veld'.***
- The trees are **deciduous**, shedding their leaves in the cool, dry season to prevent excessive loss of water through transpiration, e.g. acacias.
- Trees usually have **broad trunks**, with water-storing devices to survive through the prolonged drought.
- Many trees are umbrella shaped, exposing only a narrow edge to the strong winds.

- In true savanna lands, the grass is **tall and coarse**, growing 6 to 12 feet high. The **elephant grass** may attain a height of even 15 feet.
- Grasses appear greenish and well-nourished in the rainy season but turns yellow and dies down in the dry season that follows.
- As the rainfall diminishes towards the deserts the savanna merges into thorny scrub.




## Animal Life of the Savanna

- The savanna is known as the **'big game country'** as thousands of animals are trapped or killed each year by people from all over the world.
- There are two main groups of animals in the savanna, the grass-eating herbivorous animals and the fleshing-eating carnivorous animals.
- The herbivorous include the zebra, antelope, giraffe, deer, gazelle, elephant etc. [most of the National geographic and Animal Planet documentaries on wild animals are shot in savanna regions] and carnivorous animals include the lion, tiger, leopard, hyena, panther, jaguar, jackal etc..
- Species of reptiles and mammals including crocodiles, alligators, giant lizards live together with the larger rhinoceros and hippopotamus in rivers and marshy lakes.

## Life and Economy in the Savanna

- Many tribes live in savanna region. Tribes like the **Masai** tribes of the East African plateau are pastoralists whereas **Hausa** of northern Nigeria are settled cultivators.
- The old grazing grounds of Masai tribes in the **Kenyan Highlands** were taken over by the immigrant white settlers for plantation agriculture (coffee, tea, cotton) and dairy farming.
- The cattle kept by the Masai are kept entirely for the supply of milk. They don't slaughter cattle for meat. **Agriculture is barely practiced**.
- The Hausa are a tribe of settled cultivators who inhabit the savanna lands of the Nigeria. They are more advanced in their civilization.

- They do not practice shifting cultivation. Instead, they clear a piece of land and use it for several years.

## Crops in Savanna

- Settlements in central Africa, northern Australia and eastern Brazil have shown that the savannas have immense agricultural potential for **plantation agriculture** of cotton, cane sugar, coffee, oil palm, groundnuts and even tropical fruits.
- Tropical Queensland, despite its scarcity of labour force has been very successful in developing its huge empty land.
- Kenya, Uganda, Tanzania and Malawi have already taken to large-scale production of cotton.
- In West Africa, the commercial cultivation of groundnuts, oil palm and cocoa have been gradually extended into the savanna lands.
- In the cooler highlands, temperate crops have been successfully raised.

## Farming

- Droughts are long due to unreliable rainfall.
- Political instability hinders the development of agricultural infrastructure.
- The Sudan Climate, with **distinct wet-and-dry periods** is also responsible for the **rapid deterioration of soil fertility**.
- During the rainy season, torrential downpours of heavy rain cause leaching of nitrates, phosphates and potash.
- During the dry season, intense heating and evaporation dry up most of the water.
- Many savanna areas therefore have **poor lateritic soils** which are incapable of supporting good crops.

## Cattle rearing

- The savanna is said to be the **natural cattle country** and many of the native people are pastoralists.
- But the **quality of grass doesn’t support large scale ranching**.
- Grasses here are no match to nutritious and soft grasses of temperate grasslands.
- The cattle varieties are also poor and yield little meat or milk.

- The export of either beef or milk from the tropical grasslands is so far not important.
- Few regions progressed with the adaptation of science and technology. **Queensland** has become Australia's largest cattle producing state. Both meat and milk are exported.

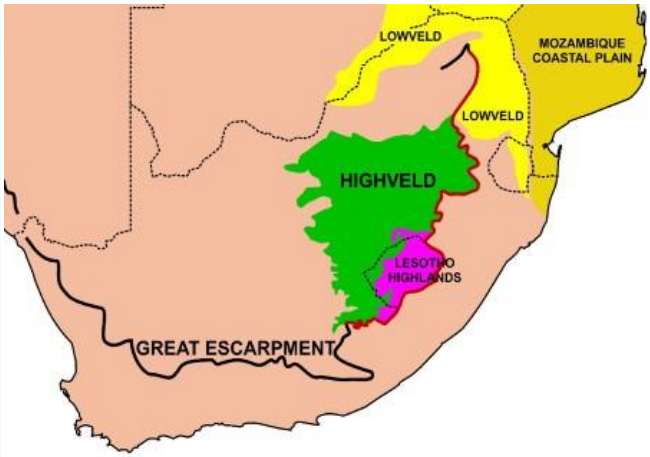
## Steppe Climate or Temperate Continental Climate or Temperate Grassland Climate

### Distribution

- They lie in the **interiors of the continents**.
- Lie in the **Westerly wind belt [mid-latitudes or temperate region]**.
- Grasslands are practically treeless due to continentiality [deep within the interiors of the continents where rain bearing winds don't reach].
- In Eurasia, they are called the **Steppes**, and stretch eastwards from the shores of the Black Sea to the foothills of the Altai Mountains. [2,000 miles long belt].

| Name of the Temperate Grassland | Region |
|---|---|
| Pustaz | Hungary and surrounding regions |
| Prairies | North America [between the foothills of the Rockies and the Great Lakes] |
| Pampas | Argentina and Uruguay [Rain-shadow effect] |
| Bush-veld (more tropical) | Northern South Africa |
| High Veld (more temperate) | Southern South Africa |
| Downs | Australia: Murray-Darling basin of southern Australia |
| Canterbury | New Zealand |


Major Grasslands of the World
Savanna
1. Llanos of the Orinoco in Venezuela and Colombia
2. Campos of Brazil
3. Sudan in Africa
4. South African veld
5. Australia
Prairie
1. Midwestern United States and Canada
2. Pampa of Argentina, Uruguay, and southeastern Brazil
3. Plains of Hungary, Romania, and historic Yugoslavia
4. Black Earth Belt of Russia
5. Manchurian Plain
Steppe
1. Great Plains of North America
2. Kyrgyz Steppe
ARCTIC OCEAN
NORTH AMERICA
EUROPE
ASIA
ATLANTIC OCEAN
Tropic of Cancer
AFRICA
PACIFIC OCEAN
Equator
SOUTH AMERICA
INDIAN OCEAN
Tropic of Capricorn
AUSTRALIA
SWEDEN
SIBERIA
Moscow
Western Steppe
Eastern Steppe
UKRAINE
KAZAKHSTAN
MONGOLIA
HUNGARY
ROMANIA
TURKEY
SYRIA
IRAN
AFGHANISTAN
CHINA
TIBET
INDIA
MYANMAR
VIETNAM
JAPAN
ARABIA
AFRICA
Ancient site
Steppes
© 2012 Encyclopaedia Britannica, Inc.


## Steppe Climate

## Temperature

- Climate is continental with **extremes of temperature**.
- Temperatures vary greatly between summer and winter.
- The summers are hot and the winters are cold.
- Summers are very warm, over 18 – 20° C.
- The steppe type of climate in the southern hemisphere is never severe.

## Precipitation

- The average rainfall may be taken as about 45 cm, but this varies according to location from 25 cm to 75 cm.
- The heaviest rain comes in June and July (late spring and early summer).
- Most of the winter months have about an 2.5 cm of precipitation, brought by the occasional depressions of the Westerlies and coming in the form of snow.
- The maritime influence in the southern hemisphere causes more rainfall.

## Chinook: Local winds in Steppe regions

- On the eastern slopes of the Rockies in Canada and U.S.A. a local wind, similar to the Fohn in Switzerland, called the Chinook, comes in a south-

westerly direction to the Prairies and has a considerable effect on the local pastures.
- It actually comes with the depressions in winter or early spring from the Pacific coast ascending the Rockies and then descending to the Prairies [katabatic wind].
- It is a hot wind and may raise the temperature by 5° C within a matter of 20 minutes.
- It melts the snow-covered pastures and animals can be driven out of doors to graze in the open fields. The agricultural year is thus accelerated.
- Local farmers welcome the Chinook for frequent. Chinooks [**Snow eaters**] mean mild winters.

[Other important Local Winds in different regions: Loo, Mistral, Sirocco, Foehn etc.]

## Natural Vegetation of Steppe Climate

Grasses

- Greatest difference from the tropical savanna is that steppes are practically **treeless** and the **grasses are much shorter**.
- Grasses are tall, fresh and **nutritious**. This is typical of the grass of the wheat-lands in North America, the **rich black earth or chernozem areas of Russian Ukraine** and the better watered areas of the Asiatic Steppes.
- Where the rainfall is light or unreliable, or the soil is poor, as in the continental interiors of Asia the short steppe type of grass prevails.
- The grasses are not only shorter but also **wiry [**lean, tough**] and sparse [**thinly dispersed or scattered**]**.
- These areas are **less suitable for arable farming** and are used for some form of **ranching** as in the High Plains of U.S.A.
- The growth of grasses is not abruptly checked by summer droughts or winter cold.

Trees

- Polewards, an increase in precipitation gives rise to a transitional zone of wooded steppes where some **conifers** gradually appear.
- In the cultivated regions, such as the wheat farms of the Prairies, double rows of trees are planted around the house to shield the occupants from the strong wind.

Animals

- Does not have much animal diversity.
- **Horses** are common in Asian Steppes.

## Economic Development of Steppes

## Wheat and Maize Cultivation

- Cultivation was unknown just before a century and the region was one of the most sparsely populated parts of the world.
- In recent years, the grasslands have been ploughed up for extensive, mechanized wheat cultivation and are now the **'granaries of the world' [Prairies].**
- Besides wheat, maize is increasingly cultivated in the warmer and wetter areas.

## Ranching

- The tufted grasses have been replaced by the more **nutritious Lucerne or alfalfa grass** for cattle and sheep rearing.
- These temperate grasslands are now the **leading ranching regions** of the globe.

## Nomadic herding in Asian Steppes

- This type of migratory animal grazing has almost disappeared from the major grasslands. The herders were wandering tribes e.g. the **Kirghiz**, and the **Kazakhs.**
- The harsh environment of the nomads, with long droughts and unreliable showers made the Kirghiz a tough and fearless people, and they long resisted subjugation by the Russians.
- Now, however, under the Communist regime they are being forced to settle down.
- The steppes have been made into huge **collective farms** and state farms for ranching or producing cereals.

## Extensive mechanized wheat cultivation

- The **temperate grasslands** are ideal for extensive wheat cultivation.

- The **level ness** of the Steppes and other temperate grasslands all over the world makes ploughing and harvesting a comparatively easy job.
- In the **Prairies, the Argentinian Pampas, the Ukrainian Steppes** and the **Downs of Australia**, agriculture is completely mechanized.

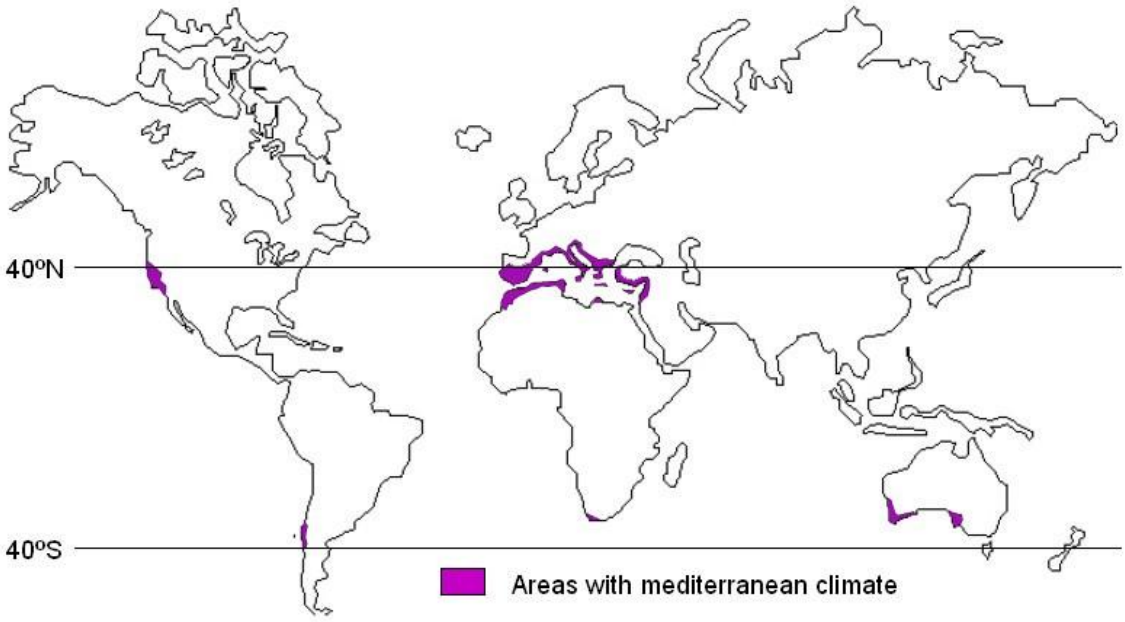
## Pastoral farming

- The natural conditions suit animal farming.
- With the development of refrigerated ships in the late nineteenth century, the temperate grasslands became major pastoral regions, exporting large quantities of beef, mutton, wool, hides.
- Milk, butter, cheese and other dairy products are also important in some parts of the North American grasslands.

| **Grassland** | **Major Economic Activity** |
|---|---|
| Prairies | Wheat Granaries<br><br>Extensive Ranching |
| Pustaz | Rich black soil<br><br>Abundant wheat production<br><br>Sugar from Sugar beet [Beta vulgaris, is a plant whose root contains a high concentration of sucrose]<br><br>Countries like Hungary, Ukraine, Romania etc. |
| Pampas | Alfalfa: nutrient rich grass.<br><br>Ranching, cattle rearing; Dairy products<br><br>Extensive wheat producing region<br><br>Economy depends on wheat and beef export |
| Downs and Canterbury | Sheep and Cattle rearing, |

| | |
|---|---|
| | Merino sheep: wool production |
| Veldts | Maize farms<br>Sheep and Cattle rearing |

## Mediterranean Climate or Warm Temperate Western Margin Climate or Warm Temperate West Coast Climate




## Distribution

- Entirely confined to the western portion of continental masses, between **30° and 45°** north and south of the equator.
- The basic cause of this type of climate is the **shifting of the wind belts**.
- Mediterranean Sea has the greatest extent of this type of ***'winter rain climate'***, and gives rise to the name Mediterranean Climate.
- The best developed form of this climatic type is found in **central Chile.**
- Other Mediterranean regions include

1. **California (around San Francisco),**
2. **the south-western tip of Africa (around Cape Town),**
3. **southern Australia, and south-west Australia (Swanland).**

## Mediterranean Climate

**Clear skies and high temperatures; hot, dry summers and *cool, wet winters.***

- Mean annual precipitation ranges from **35 – 90 cm.**
- Temperature of warmest month greater than or equal to 10º C.

- Temperature of coldest month is less than 18º C but greater than –3º C
- Climate is **not extreme** because of cooling from water bodies.

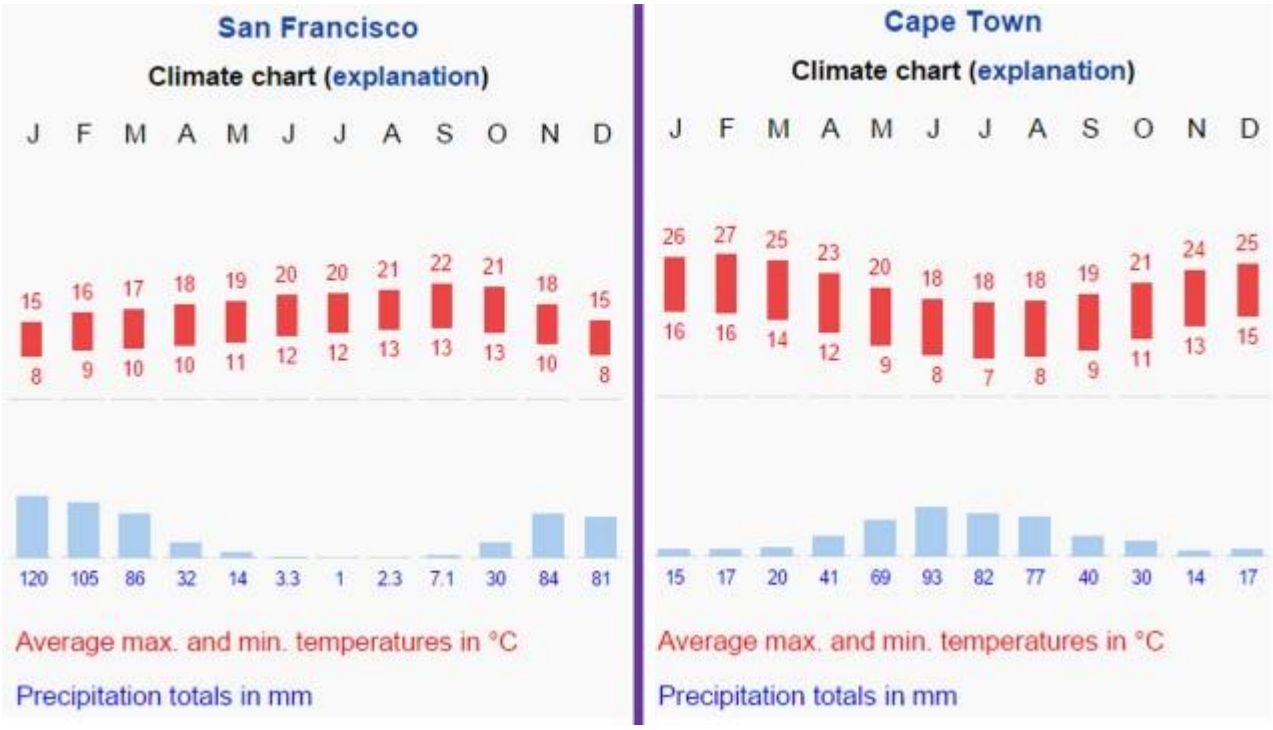
## A dry, warm summer with off-shore trades

- In summer when the sun is overhead at the Tropic of Cancer, the belt of influence of the **Westerlies is shifted a little pole wards**. Rain bearing winds are therefore not likely to reach the Mediterranean lands.
- The **prevailing Trade Winds [tropical easterlies] are off-shore** and there is practically no rain.
- Strong winds from inland desert regions pose the risk of wildfires.

## Rainfall in winter with on-shore Westerlies

- The Mediterranean lands receive most of their precipitation in **winter** when the Westerlies shift equator wards.
- In the northern hemisphere, the prevailing on-shore Westerlies bring much cyclonic rain from the Atlantic (Typical to Mediterranean Climate).
- The **rain comes in heavy showers and only on a few days with bright sunny periods between them**. This is another characteristic feature of the Mediterranean winter rain.
- Though the downpours are infrequent they are often very torrential and in mountainous districts, **destructive floods** occur.

## Climate Graphs




## Local winds of the Mediterranean Climate

- Many local winds, some hot, others cold are common around the Mediterranean Sea.

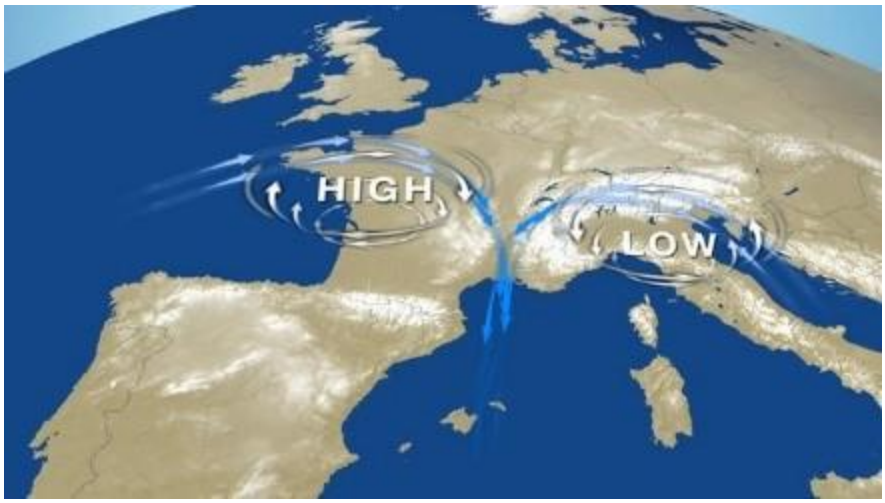
## Sirocco

- This is a hot, dry dusty wind which originates in the **Sahara Desert**.
- It is most frequent in **spring** and normally lasts for only a few days.
- The Sirocco blows outwards in a southerly direction (south to north) from the desert interiors into the cooler Mediterranean Sea.
- After crossing the Mediterranean Sea, the Sirocco is slightly cooled by the absorption of the water vapour.
- Its scorching heat withers [To dry up or shrivel from loss of moisture] vegetation and crops.
- This may be **'blood rain'** because the wind is carrying the red dust of the Sahara Desert.

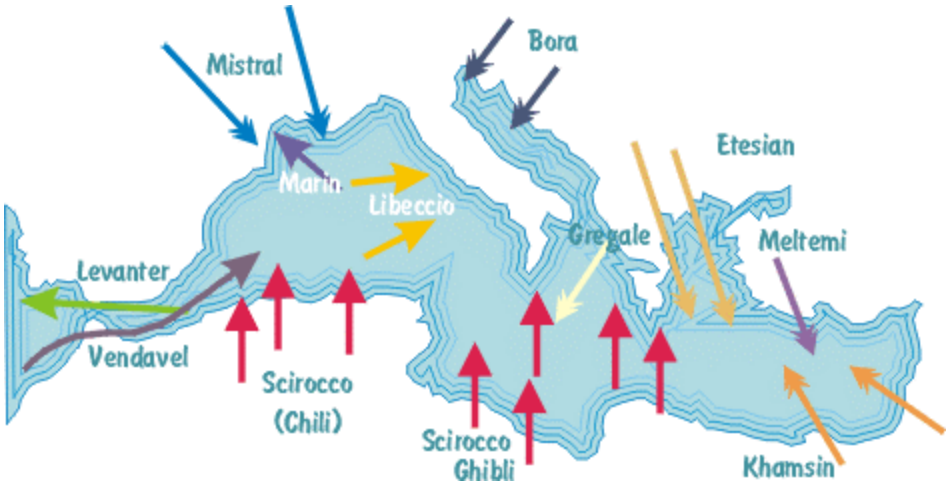
## Mistral

- Mistral is a **cold wind** from the north, rushing down the **Rhone valley** in violent gusts between 40 and 80 miles per hour.

- The velocity of the Mistral is intensified by the **funneling effect** in the valley between the **Alps** and the **Central Massif [Plateau in France]**.




- A similar type of cold north-easterly wind experienced along the **Adriatic coast** is called the **Bora.**
- **Tramontane** and **Gregale** are similar **cold winds** of the Mediterranean Sea.




## Natural Vegetation in the Mediterranean Climate

- Trees with **small broad leaves** are widely spaced and **never very tall**.
- The **absence of shade** is a distinct feature of Mediterranean lands.
- Plants are in a continuous struggle against heat, dry air, excessive evaporation and prolonged droughts. They are, in short **xerophytic [drought tolerant]**, a word used to describe the drought-resistant plants in an environment deficient in moisture.

## Mediterranean evergreen forests

- These are open woodlands with **evergreen oaks**.
- They are found only in the climatically most favored regions.
- The trees are normally low, even stunted, with massive trunks, small leathery leaves and a wide-spreading root system in search of water.
- The **cork oaks** are specially valued for their thick barks, used for making **wine-bottle corks** and for export around the world.
- In Australia, the **eucalyptus** forests replace the evergreen oak.
- The giant **redwood** is typical of the **Californian** trees.

## Evergreen coniferous trees

- These include the various kinds of **pines, firs, cedars** and cypresses which have evergreen, needle-shaped leaves and tall, straight trunks.

## Mediterranean bushes and shrubs

- This is perhaps the most predominant type of Mediterranean vegetation.

## Grass

- Conditions in the Mediterranean **do not suit grass**, because most of the rain comes in the cool season when growth is slow.
- Even if grasses do survive, they are so **wiry [**lean, tough**] and bunchy** that they are **not suitable for animal farming.**
- Cattle rearing is thus unimportant in the Mediterranean.

## Agriculture in the Mediterranean Climate

## Orchard farming

- The Mediterranean lands are also known as the **world's orchard lands.**
- A wide range of ***citrus fruits*** such as oranges, lemons, limes, citrons and grapefruit are grown.
- The fruit trees have long roots to draw water from considerable depths during the long summer drought.
- The thick, leathery skin of the citrus fruits prevents excessive transpiration.
- The long, sunny summer enables the fruits to be ripened and harvested.
- The Mediterranean lands account for 70 per cent of the world's exports of citrus fruits.
- The **olive tree** is probably the most typical of all Mediterranean cultivated vegetation.
- Olive oil extracted is a valuable source of cooking oil in a region deficient in animal fat.
- Besides olives, many nut trees like chestnuts, walnuts, hazelnuts and almonds are grown and the nuts picked as fruits or for the chocolate industry.

## Crop cultivation and sheep rearing

- **Wheat** is the leading food crop. **Barley** is the next most popular cereal.
- The mountain pastures, with their cooler climate, support a few sheep, goats and sometimes cattle.
- **Transhumance** is widely practiced (moving up and down the hills in search of pastures according to seasons).

## Wine production

- **Viticulture** is by tradition a Mediterranean occupation.
- Regions bordering the Mediterranean Sea account for three-quarters of the world's production of wine.

- Some 85 per cent of grapes produced, go into wine.
- The long, sunny summer allows the grapes to ripen.

## Economy

**Net exporter of citric fruits and net importer of dairy products.**

- Clear skies in summer and good landscapes **encourage tourism [Lot of Indian Songs are shot here].**
- European Mediterranean has many ancient cities and are famous for their health and pleasure resorts, frequented by millions all-round the year.

## Warm Temperate Eastern Margin Climate

Different variants of Warm Temperate Eastern Margin Climate include the

1. **Temperate monsoon Climate or China Type Climate,**
2. **Gulf Type Climate and**
3. **Natal Type Climate.**

- Found between **20° and 35° N and S latitude** (warm temperate latitudes just outside the tropics); on the **east coast** in both hemispheres.

### China Type Climate

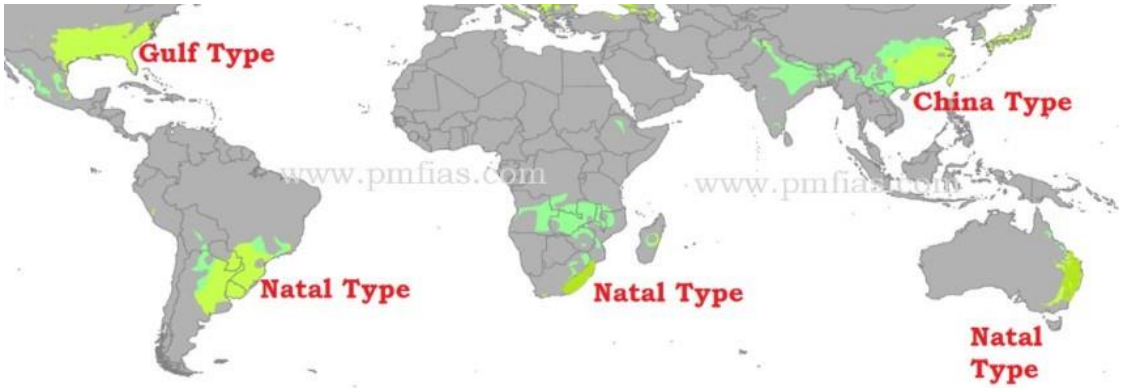
- Temperate Monsoon or China Type climate is observed in most parts of China. The climate is also observed in **southern parts of Japan**.

### Gulf Type Climate

- Found in **south-eastern U.S.A**., bordering the Gulf of Mexico where continental heating in summer induces an inflow of air from the cooler Atlantic Ocean.

### Natal Type Climate

- Found in in **New South Wales (Australia), Natal (South Africa), Parana-Paraguay-Uruguay basin (South America).**
- Natal type is different from temperate monsoon or China type as it **receives rainfall from on-shore Trade Winds all the year round**.




### Climate

- Characterized by a **warm moist summer** and a **cool, dry winter** (one exception: winters are also moist in Natal Type).

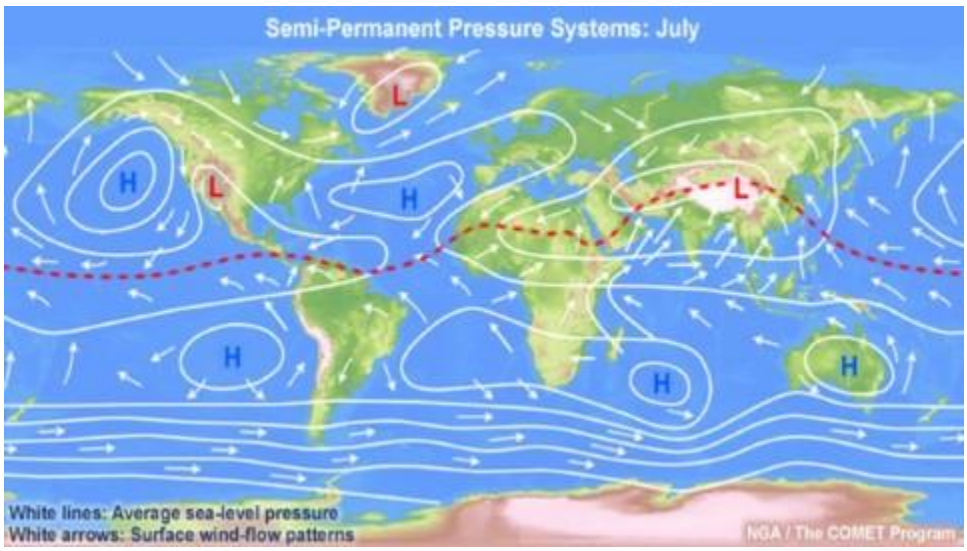
## Temperature

- The mean monthly temperature varies between 4° C and 25° C and is strongly modified by **maritime influence.**
- Occasionally, the penetration of **cold air (Polar Vortex)** from the continental interiors may bring down the temperature to freezing point.
- Though frosts are rare they occasionally occur in the colder interiors.

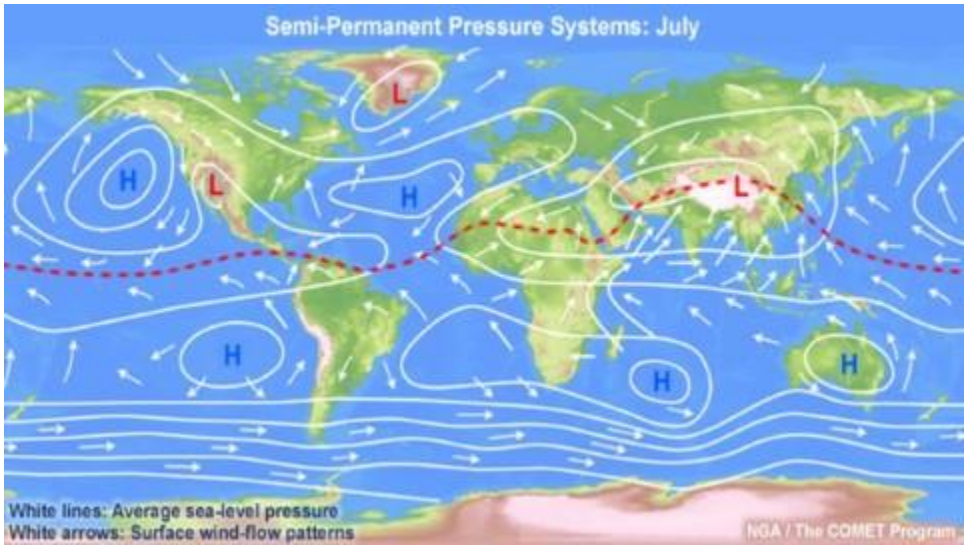
## Precipitation

- Rainfall is more than moderate, anything from **60 cm to 150 cm**.
- This is adequate for all agricultural purposes and hence supports a wide range of crops.
- Areas which experience this climate are **very densely populated**.
- There is the **fairly uniform distribution of rainfall throughout the year**.
- Rain comes either from convectional sources or as orographic rain in summer, or from depressions in prolonged showers in winter.
- **In summer, the regions are under the influence of moist, maritime airflow from the subtropical anticyclonic cells.**
- Local storms, e.g. **typhoons (tropical cyclones)**, and **hurricanes**, also occur.

## Summer in Northern Hemisphere



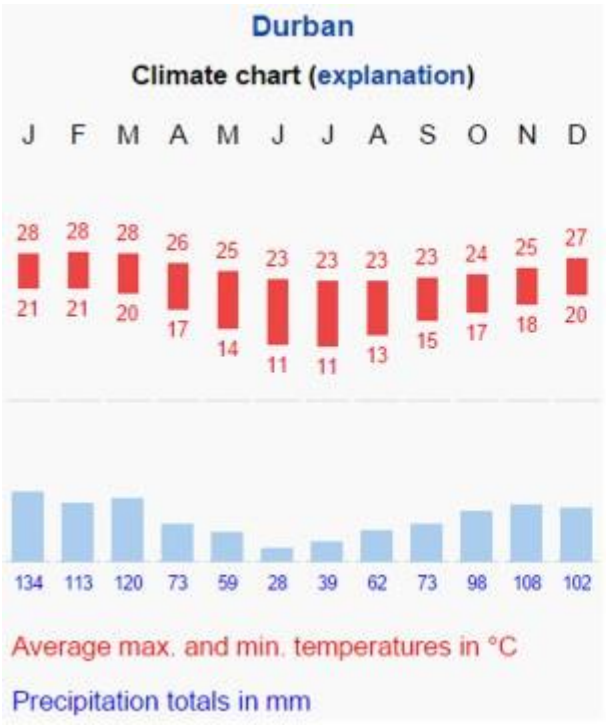
## Summer in Southern Hemisphere

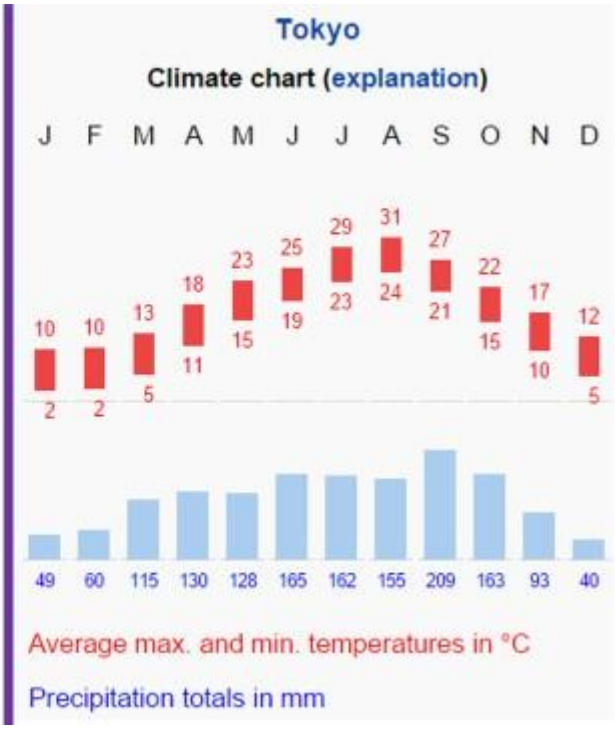



## Variations of Warm Temperate Eastern Margin Climate

| Climate type | Feature |
|---|---|
| China type | Temperate monsoonal |
| Gulf type | Slight-monsoonal |
| Natal type | Non-monsoonal |

## Climate Graphs




## China type climate

### Summer

- Intense heating within interiors (Tibet, desert region) sets up a region of low pressure in summer attracting tropical Pacific air stream (South-East Monsoon).
- Monsoon does not ‘burst’ as suddenly, nor ‘pour’ as heavily as in India.
- Typhoons form mostly in late summer, from July to September.

### Winter

- In winter, there is **intense pressure over Siberia** and the continental polar air stream flows outwards as the North-West Monsoon, bitterly cold and very dry.
- There is little rain but considerable snow on the windward slopes.
- Another climatic feature associated with the China type of climate in southern China is the occurrence of typhoons.

## Gulf type climate

- Monsoonal characteristics are **less intense** compared to China type.
- There is **no complete seasonal wind reversal**.

- Hurricanes occur in September and October.

## Natal type climate

- The narrowness of the continents and the dominance of maritime influence **eliminate the monsoonal elements.**
- The South-East Trade Winds bring about a more even distribution of rainfall throughout the year

## Natural Vegetation

- Supports a luxuriant vegetation.
- The lowlands carry both evergreen broad-leaved forests and deciduous trees [**hardwood**].
- On the highlands, are various species of conifers such as pines and cypresses which are important **softwoods.**
- Perennial plant growth is not checked by either a dry season or a cold season.

## Timber

- The forests of China and southern Japan also have considerable economic value and include oak, camphor, etc..
- South-eastern Brazil, eastern Paraguay, north-eastern Argentina have Parana pine, and the **quebracho** (axe-breaker, an extremely hard wood used for tanning).
- Eastern Australia have Eucalyptus forests.
- In Natal palm trees thrive.
- The Gulf states of U.S.A. have lowland deciduous forests.

## Economic Development

| **Region** | **Major Cropping Patterns** |
|---|---|
| South-Eastern China | -Rice, tea and mulberries (sericulture)<br>-Sericulture is declining |
| South-Eastern | -Widespread cultivation of maize and cotton in the Corn and |

| | |
|---|---|
| USA | Cotton Belts of U.S.A<br><br>-Fruit and tobacco are also grown |
| Natal, South Africa | Sugarcane |
| South America | Coffee and maize and dairying |

## Farming in monsoon China

- A third of the world's rice is grown in China, though the huge population leaves very little for export.
- Monsoon China has all the ideal conditions for padi cultivation; a warm climate, moderately wet throughout the year, and extensive lowlands with fertile moisture-retentive alluvial soil, which if necessary, can be easily irrigated.
- As the flat lands are insufficient for rice cultivation, farmers move up the hill-slopes and grow padi on terraced uplands.

## Agriculture in the Gulf states

- Lack of population pressure and the urge to export gave rise to **corn, cotton and tobacco.**

## Corn

- The humid air, the sunny summer and the heavy showers suit the crop well.
- It is grown right from the Gulf coast to the Mid-west south of the Great Lakes, with the greatest concentration in the Corn Belt of Nebraska, Iowa, Indiana and Ohio.
- The region accounts for more than half the world's production of corn, but only 3 per cent of the world's export.
- This is because most of the corn is used for **fattening animals**, mostly **cattle and pigs. [Thriving beef and pork industry]**
- The fattened animals are then sold to the meat plants in Chicago and Cincinnati to be processed into **'corned beef'.** [From here the beef is exported through **Great Lakes** and **St Lawrence** water way]

- Apart from its ease of cultivation, corn's most outstanding feature is its prolific yield.
- It gives almost twice as much food (mainly starch) per acre as wheat or other cereals.
- This explains why it is so widely cultivated in both the warm temperate and the tropical latitudes.

## Cotton

- Of the cash crops grown in the Gulf states, none is comparable with cotton.
- The Gulf type of climate is undoubtedly the **best for cotton growing**.
- Its long, hot growing season with 200 days frost free and a moderately high temperature permits the crop to grow slowly and mature within six months.
- In the very south, in the Gulf-lands, the heavy rainfall damages the lint. This area is therefore less suitable for cotton and is devoted to **citrus fruits**, **cane sugar** and **market gardening**, as in Florida.
- The commercial cultivation of cotton is now concentrated only in the most favorable areas which are the **Mississippi flood plains** and **Atlantic coastlands**.
- The most dreaded enemy of the Cotton Belt is the **boll-weevil**. The pest multiplies rapidly. The pest is responsible for the **westward migration of the Cotton Belt**.

## Tobacco

- Native crop of America.
- Virginia tobacco is famous.
- The humid atmosphere, the warmth and the well-drained soils of the Gulf states, enable tobacco to be successfully cultivated in many of the eastern states of U.S.A.
- No less than half the tobacco that enters international trade comes from these states.

## Crop in Southern Hemisphere

- In the coastlands of Natal, **cane sugar** is the dominant crop, followed by **cotton** and **tobacco** in the interior.
- Maize is extensively cultivated for use both as food and animal fodder for cattle rearing.

- In South America where rainfall is less than 120 cm, there is much grassland on which many cattle and sheep are kept for meat, wool and hides.
- The extensive natural pastures provide valuable forage for both cattle and sheep.
- Further north in southern Brazil, the rainfall increases to more than 120 cm and forest gradually replaces grass.
- Here the important occupations are the cultivation of yerba mate (Paraguay tea) and the lumbering of araucaria or Parana pine. Cattle and sheep are reared, and maize and cane sugar are grown.
- In eastern Australia, Giant eucalyptus trees rise one above the other right up the Eastern Highlands.
- But with the influx of European immigrants, much of the forest has been cleared for settlement and dairying.
- The eastern margin of New South Wales is now the chief source of Australia's milk, butter and cheese, besides cotton, cane sugar and maize which are increasingly grown in the north.

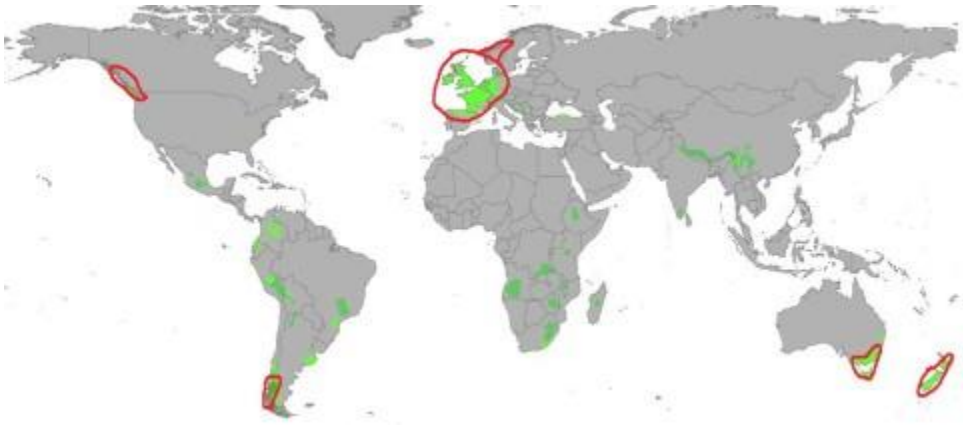
## British Type Climate

- Westerlies come all the year round.
- There is a tendency towards an autumn or winter maximum of rainfall.
- Light snow falls in winter.
- Ports are never frozen but frosts do occur on cold nights.
- The seasons are very distinct .
- And the climate is very favorable for maximum human output.

## British Type Climate or Cool Temperate Western Margin Climate or North-West European Maritime Climate.

- The cool temperate western margins are **under the influence of the Westerlies all-round the year.**
- They are the regions of **frontal cyclonic activity [Temperate Cyclones]**.
- This type of climate is typical to Britain, hence the name 'British Type'.
- Also called as North-West European Maritime Climate due to **greater oceanic influence.**

## Distribution of British Type Climate



## Europe

- Most pronounced in and around Britain.
- In Europe the climate extends inland some 2,000 km.
- Climatic belt stretches far inland into the lowlands of North-West Europe (northern and western France, Belgium, the Netherlands, Denmark, western Norway and also north-western Iberia).

## North America

- Confined mainly to the coastlands of British Columbia. [high Rockies prevent the on-shore Westerlies from penetrating far inland]

## Southern Hemisphere

- The climate is experienced in southern **Chile, Southern Australia, Tasmania** and most parts of **New Zealand.**

## British Type Climate

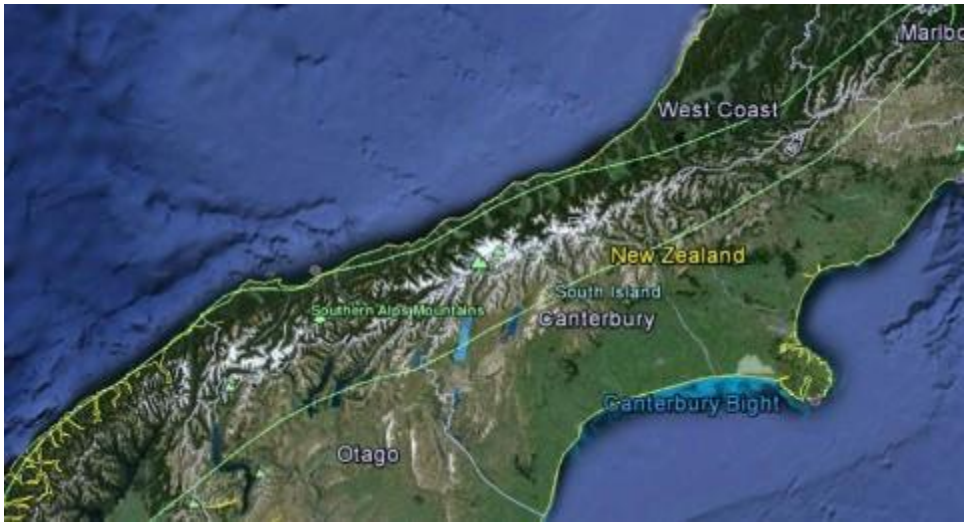
- Moderately warm summers and fairly mild winters.
- **Rainfall occurs throughout the year with winter maxima**.

## Temperature

- The mean annual temperatures are usually between 5° C and 15° C.
- Winters are **abnormally mild**. This is because of the warming effect brought by **warm North Atlantic Drift.**
- Sometimes, unusual cold spells are caused by the invasion of **cold polar continental air (Polar Vortex)** from the interiors.

## Precipitation

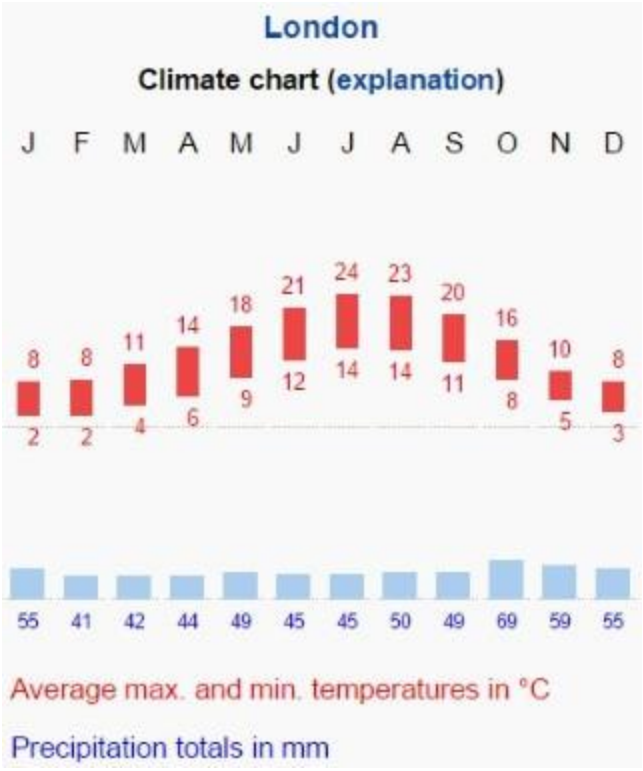
- The British type of climate has **adequate rainfall throughout the year** with a tendency towards a slight **winter maximum (due to frontal cyclones).**
- Western margins have the heaviest rainfall due to westerlies.
- Relief can make great differences in the annual amount. This is particularly significant in New Zealand where the western margins are subjected to heavy orographic rainfall whereas the eastern **Canterbury plains** receive comparatively less rainfall due to **rain-shadow effect.**




## The seasons

- As in other temperate regions there are **four distinct seasons**.
- Winter is the season of cloudy skies, foggy and misty mornings, and many rainy days from the passing depressions.
- Spring is the driest and the most refreshing season when people emerge from the depressing winter to see everything becoming green again.
- This is followed by the long, sunny summer.
- Next is the autumn with the roar of gusty winds; and the cycle repeats itself.
- This type of climate with its four distinct seasons is something that is **conspicuously absent in the tropics.** [Rainforest == Only Rainy season, Tropical Monsoon == Summer, Winter and Rainy, Tropical Savanna == Summer (rains) and Winter]

## Climate Graph British Type Climate




## Natural Vegetation in British Type Climate

- The natural vegetation of this climatic type is **deciduous forest.**
- The trees shed their leaves in the **cold season.**
- This is an adaptation for protecting themselves against the winter snow and frost.
- Shedding begins in **autumn, the 'fall' season**.
- Some of the common species include oak, elm, ash, birch, beech, and poplar.
- In the wetter areas grow willows (Light weight cricket bats are made from willows. In India willows are found in Kashmir).
- Higher up the mountains in the Scandinavian highlands, the Rockies, southern Andes and the Southern Alps of New Zealand, the deciduous trees are generally replaced by the **conifers** which can survive a higher altitude, a lower temperature and poorer soils.

## Economy in British Type Climate

## Lumbering is quite profitable

- Unlike the equatorial forests, the **deciduous trees** occur in **pure stands** and have greater lumbering value.
- The open nature of the forests with **sparse undergrowth** is useful in logging operations.
- **Easy penetration** means much cost can be saved in the movement of the logs.
- The **deciduous hardwoods** are excellent for both fuel and industrial purposes.
- In Tasmania, the **temperate eucalypts** are also extensively felled for the lumbering industry.
- Higher up the mountains, **conifers (softwood)** are felled and transported to **paper and pulp industry**. They are extensively used in cardboard making.

## Industrialization

- The regions are highly industrialized with high standard of living.
- The countries are concerned in the production of machinery, chemicals, textiles and other manufactured articles rather than agriculture, fishing or lumbering, though these activities are well represented in some of the countries.
- Fishing is particularly important in Britain, Norway and British Columbia.
- Britain, France and Germany have significant mineral resources and are heavily industrialized.
- **Ruhr region in Germany, Yorkshire, Manchester and Liverpool** regions in Britain are significant for wide ranging manufacturing industries.
- Automobile industry is the most significant. (BMW, Volkswagen, Audi, Mercedes-Benz and many other world leading car manufacturers have their headquarters in Germany).
- Industries based on dairy products thrive in **Denmark, Netherlands and New Zealand.**
- Tasmania is important for **merino wool production**. Wool produced here is exported to textile factories in England, Japan, China etc..

## Agriculture

- A large range of cereals, fruits and root crops are raised, mainly for home consumption rather than for export.
- North-West Europe, which includes some of the most crowded parts of the globe, has little surplus for export. It is, in fact, a **net importer of food crops, especially wheat**.

## Market gardening

- All the north-western European countries are highly industrialized and have high population densities. There will normally be great demand for fresh vegetables, eggs, meat, milk and fruits.
- As the crops are perishable, a good network of transport is indispensable. The produce are shipped by high speed trucks (truck farming, which is commonly used in the United States)
- In Australia, high-speed boats ply across the Bass Strait daily from Tasmania to rush vegetables, tomatoes, apples and beans to most of the large cities in mainland Australia. It is no wonder the Australians nicknamed Tasmania the **'garden state'.**

## Mixed farming

- With the rise of industry, more arable farms are being devoured by factories and **wheat is now a net import item in Europe**.
- Throughout north-western Europe, farmers practice both arable farming (cultivation of crops on ploughed land) and pastoral farming (keeping animals on grass meadows).
- Amongst the cereals, wheat is the most extensively grown, almost entirely for home consumption.
- The next most important cereal raised in the mixed farm is **barley**. The better quality barley is sold to the breweries for **beer-making or whisky distilling**.
- The most important animals kept in the mixed farm are cattle.
- The countries bordering the North Sea (Britain, Denmark, the Netherlands) are some of the most advanced dairying countries where cattle are kept on a **scientific and intensive basis.**

## Dairying

- The temperate western margin type of climate is almost ideal for **intensive dairying.**
- Cheese is a specialized product of the Netherlands.
- From Denmark and New Zealand comes high-quality butter.
- Milk is converted to cream, which is **less perishable than fresh milk** and is exported to all regions across the globe.

- Fresh milk is converted into various forms of **condensed or evaporated milk**, and exported around the world for baby-feeding, confectionery, ice-cream and chocolate making.

## Beef cattle

- Besides dairying, some cattle are kept as beef cattle.
- In Argentina or Australia, meat production is the primary concern.
- The high rate of beef consumption in Europe necessitates large imports of **frozen and chilled beef.**
- The **pigs and poultry** act as **scavengers** that *feed on the left-overs from root-crops and dairy processes.* In this way, Denmark is able to export large quantities of bacon [cured meat from the back or sides of a pig] from pigs that are fed on the **skimmed milk, a by-product of butter-making.**

## Sheep rearing

- Sheep are kept both for wool and mutton.
- Britain is the home of some of the best known sheep breeds.
- With the greater pressure exerted on land by increased urbanization, industrialization and agriculture, sheep rearing is being pushed further and further into the less favored areas.
- Britain was once an exporter of wool (But now it imports from Australia). But today exports only British pedigree animals to the **newer sheep lands of the world (Australia).**
- In the southern hemisphere, sheep rearing is the **chief occupation of New Zealand**, with its greatest concentration in the **Canterbury Plain [The rain shadow region]**. It has been estimated that for every New Zealander there are 20 sheep.
- Favourable conditions include extensive meadows, a mild temperate climate, well-drained level ground, scientific animal breeding, the development of refrigeration –enables chilled Canterbury lamb and Corriedale mutton to reach every corner of the globe.
- Though New Zealand has only 4 per cent of the world's sheep population, it accounts for two-thirds of the world's mutton exports, and one sixth of world wool exports.
- In Tasmania and southern Chile, sheep rearing has always been a predominant occupation with surplus sheep products for the international trade.

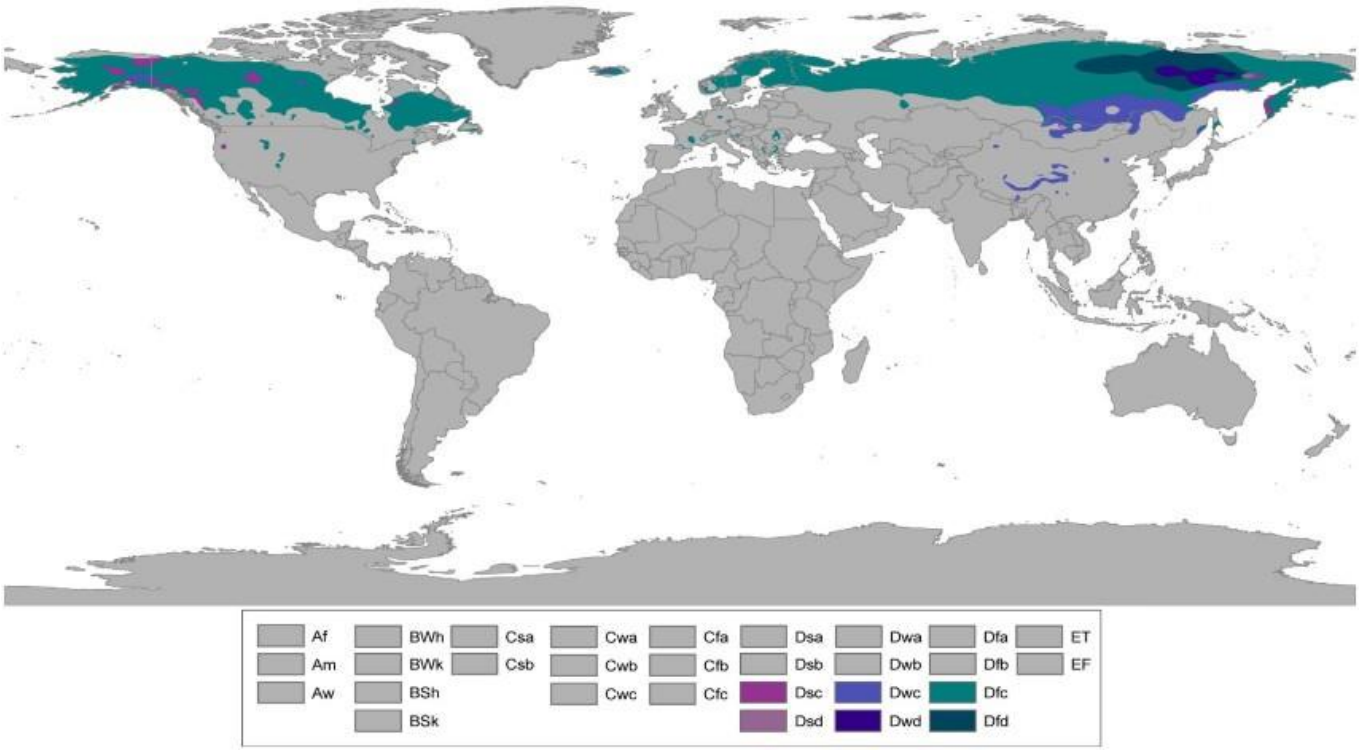
## Other agricultural activities

- Amongst the food crops, **potatoes** feature prominently in the domestic economy of the cool temperate regions.
- It is the staple food in supplementing wheat or bread for millions of people.
- In terms of starch, potato yields far more food than any cereals and can be cultivated over a wide range of climatic and soil types.
- Today almost two-thirds of the world's annual production of potatoes comes from Europe, of which Poland, Germany, France and UK are the major producers.

## Beet Sugar

- Found almost exclusively in north-western Europe (including European Russia) and parts of U.S.A.
- The need for such a crop was greatly felt during the Napoleonic Wars around 1800 when military blockades caused a scarcity of sugar.
- The beet is crushed for sugar and the green tops are used as animal fodder.
- The crop thrives best in the warmer and drier east of Britain and in mainland Europe. The highest sugar yield is obtained when the autumn is both dry and sunny.

## Taiga Climate or Boreal Climate




**Boreal Climate OR Taiga Climate OR Siberian Climate OR Cool Temperate Continental Climate OR Continental Sub-Polar Climate.**

- Found **only** in the northern hemisphere [due to great east-west extent. Absent in the southern hemisphere because of the narrowness in the high latitudes].
- Experienced in the regions **just below Arctic circle.**
- On its poleward side, it merges into the **Arctic tundra**.
- The climate fades into the temperate **Steppe climate.**

## Distribution

- It stretches along a continuous belt across **central Canada**, some parts of **Scandinavian Europe** and most of **central and southern Russian**. **[50° to 70° N]**

## Absent in Southern Hemisphere

- Narrowness of the southern continents in the high latitudes is the main reason.
- The **strong oceanic influence** reduces the severity of the winter.
- Coniferous forests are found only on the mountainous uplands of southern Chile, New Zealand, Tasmania and south-east Australia.

## Taiga Climate

## Temperature

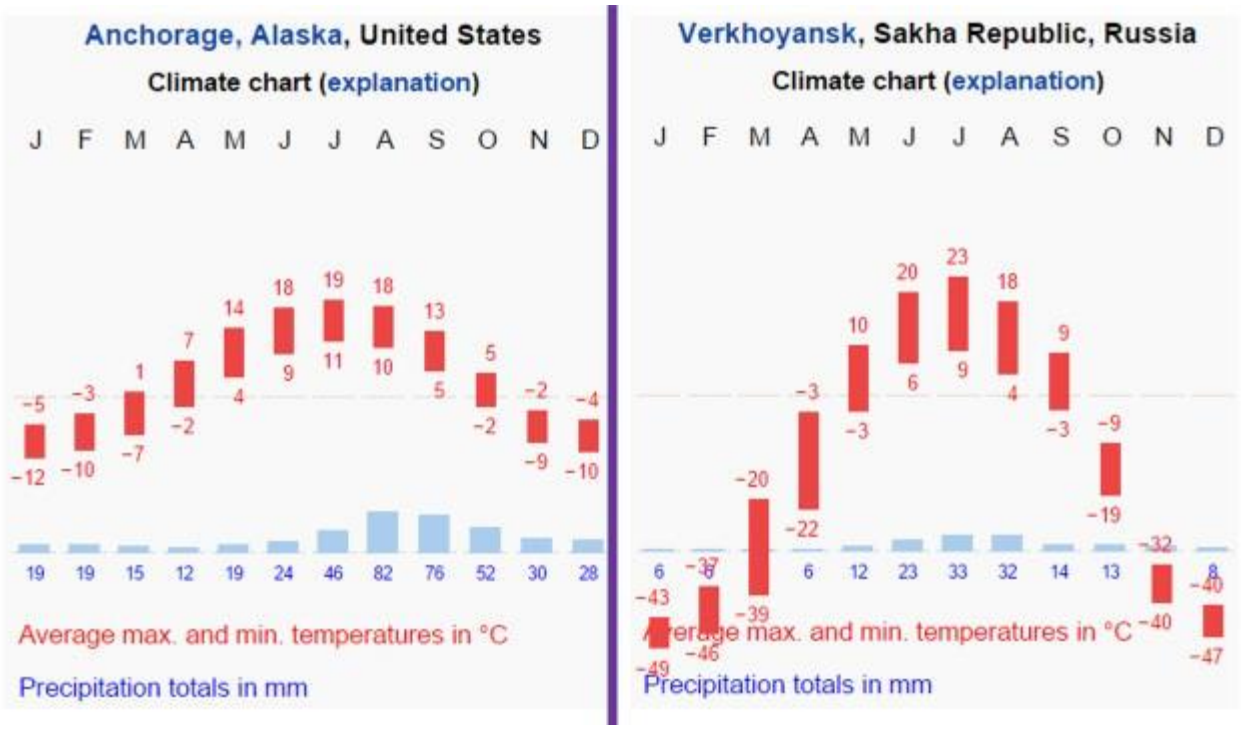
- Summers are brief and warm reaching 20-25 °C whereas winters are long and brutually cold – always 30-40 °C below freezing.
- Annual temperature range of the Siberian Climate is the ***greatest [Almost 50-60 °C in Siberia].***
- Some of the lowest temperatures in the world are recorded in **Verkhoyansk** (68°N. 113°E) where -67 °C was once recorded.
- In North America, the extremes are less severe, because of the continent's lesser east-west stretch.
- All over Russia, nearly all the rivers are **frozen**. In normal years, the Volga is ice-covered for about 150 days.
- Occasionally cold, northerly polar local winds such as the **blizzards of Canada** and **buran of Eurasia** blow violently.
- Permafrosts [a thick subsurface layer of soil that remains below freezing point throughout the year] are generally absent as **snow is a poor conductor of heat** and protects the ground from the severe cold above.

## Precipitation

- Maritime influence in the interiors is absent.

- Frontal disturbances might occur in winter.
- Typical annual precipitation ranges from 38 cm to 63 cm.
- It is quite **well distributed throughout the year**, with a **summer maxima** [convectional rain in mid-summer – 15 °C to 24 °C]
- In winter the precipitation is in the form of snow, as mean temperatures are well below freezing all the time.

## Climate Graph of Taiga Climate




## Natural Vegetation of Taiga Climate

- The predominant vegetation is **evergreen coniferous forest**.
- The conifers, which require little moisture are best suited to this type of sub-Arctic climate.
- The greatest single band of the coniferous forest is the **taiga** (a Russian word for coniferous forest) in Siberia.
- In Europe the countries that have a similar type of climate and forests are **Sweden** and **Finland**.
- There are small amounts of natural coniferous forest in Germany, Poland, Switzerland, Austria and other parts of Europe.
- In North America, the belt stretches from **Alaska** across **Canada** into **Labrador**.

## Softwood trees

- The coniferous forest belts of Eurasia and North America are the **richest sources of softwood.**
- Softwood is used in building construction, furniture, matches, **paper and pulp, rayon** and other branches of the chemical industry.
- The world's greatest softwood producers are Russia, U.S.A., Canada and the **Fenoscandian countries (Finland, Norway and Sweden).**
- In the production of **wood pulp** (by both chemical and mechanical methods), the U.S.A. is the leader.
- But in the field of newsprint, **Canada** accounts for almost half of the world's total annual production.
- There are four major species in the coniferous forests – Pine, Fir, e.g. Douglas fir and balsam fir; Spruce and Larch.
- Their presence in **pure stands** and the existence of only a few species are a great advantage in commercial forest exploitation.
- Relatively inaccessible taiga of Siberia will remain the richest reserve of temperate softwood.

## Characteristics of Coniferous forests

- Unlike the equatorial rain forests, Coniferous forests are of **moderate density** and are more uniform. The trees in coniferous forests grow straight and tall.
- Almost all conifers are **evergreen**. There is no annual replacement of new leaves as in deciduous trees.
- The same leaf remains on the tree for as long as five years. Food is stored in the trunks, and the bark is thick to protect the trunk from excessive cold.
- Conifers are conical in shape. Their conical shape and sloping branches prevent snow accumulation. It also offers little grip to the winds.
- Transpiration can be quite rapid in the warm summer. So, leaves are small, thick, **leathery** and needle-shaped **to check excessive transpiration.**
- The soils of the coniferous forests are **poor.** They are excessively **leached** and very **acidic**. Humus content is also low as the evergreen leaves barely fall and the rate of decomposition is slow. Under-growth is negligible because of the poor soil conditions.
- Absence of direct sunlight and the short duration of summer are other contributory factors.
- Coniferous forests are also found in regions with high elevation [Example: The forests just below the snowline in Himalayas].

- But on very steep slopes where soils are immature or non-existent, even the conifer cannot survive [Example: Southern slopes of Greater Himalayas].

## Economic Development of Taiga Region

- Lot of coniferous forests in the northern hemisphere are still untouched due to **remoteness.**
- Only a small fraction of coniferous forests in Canada, Russia etc. are exploited leaving a huge potential for the future.
- More accessible forests are cleared for lumbering on a large scale.
- Agriculture is most unlikely as few crops can survive in the sub-Arctic climates.

## Trapping

- Many fur-bearing animals are trapped in northerly lands of Canada and Eurasia.
- Wherever the cold is severe, the quality and thickness of the fur increases.
- The most severe winters produce the finest furs.
- In Canada trappers and hunters, armed with automatic rifles, reside in log cabins in the midst of the coniferous forests to track down these animals.
- Muskrat, ermine, mink, and silver fox are the most important fur-bearing animals.
- To ensure a more regular supply of furs many fur farms have been established in Canada and Siberia.

## Lumbering

- This is the **most important occupation** of the Siberian type of climate.
- The vast reserves of coniferous forests provide the basis for the lumbering industry.
- **Lumberjacks:** Contract laborers called lumber jacks used to temporarily move to the forest regions to fell the trees. Now felling is done by machines.
- **Rivers for transportation:** The soft wood logs easily float on rivers. Hence rivers are used to transport logs to the sawmills located down the stream.
- **Sawmilling:** Logs are processed in saw mills into timber, plywood, and other constructional woods.

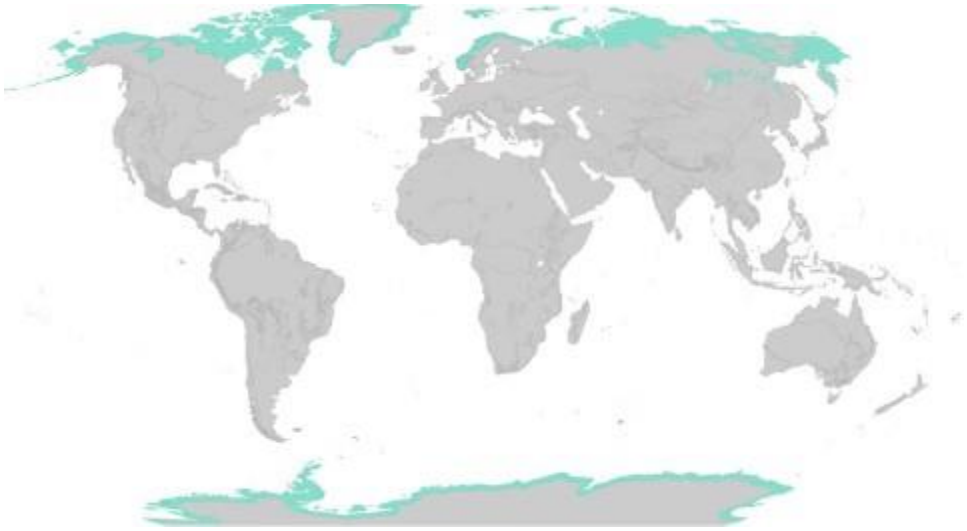
- **Paper and pulp industry:** Timber is pulped by both chemical and mechanical means to make wood pulp. Wood pulp is the raw material for paper-making and newsprint.
- **Canada and U.S.A**. are leading suppliers of **newsprint** and **wood pulp** respectively.
- **As a fuel:** Very little softwood is burnt as fuel as its industrial uses are far more significant.
- **As an industrial raw material:** In Sweden, matches form a major export item.
- From other temperate countries, timber is used for making furniture, wood-carvings, toys, packing cases etc..
- From the by-products of the timber, many chemically processed articles are derived such as rayon turpentine, varnishes, paints, dyes, liquid resins, wood-alcohols, disinfectants and cosmetics.

## Factors that favor lumbering

Coniferous forests is characterized by the following favorable features for Lumbering.

- The conifers are **limited in species**. Pine, spruce and fir in the northern forests and larch in the warmer south are the most important.
- Unlike rainforests, they occur in **homogeneous groups [Pure stands]**. This saves time, costs and enhances the commercial value of the felled timber.
- Lumbering is normally carried out in the winter when the sap ceases to flow. This makes felling much simpler.
- The snow-covered ground makes logging and haulage [commercial transport of goods] a relatively easy job.
- The logs are dragged to the rivers and float to the saw-mills downstream when the rivers thaw [unfreeze] in spring. This has greatly assisted the lumbering industry in eastern Canada and Sweden.
- Lumbering is quite easy in Canada, Norway and Sweden as the rivers are not frozen for a greater part of the year. But in Russian taiga most of Siberian rivers drain poleward into the Arctic Ocean which is frozen for three-quarters of the year, and there are few saw-mills there.
- With the use of the Northern Sea Route, which links Murmansk and Vladivostok via the Arctic Ocean, development is increasing.
- Cheap hydro-electricity for driving the saw-mills is harnessed in the mountainous uplands of North America and Europe and has greatly assisted the lumbering industry.

## Tundra Climate or Polar Climate or Arctic Climate



## Distribution

- Found in regions **north of the Arctic Circle and south of Antarctic Circle**.
- The ice-caps are confined to highlands and high latitude regions of Greenland and Antarctica.
- In the southern hemisphere, Antarctica is the greatest single stretch of ice-cap (10,000 feet thick).
- The lowlands – coastal strip of Greenland, the barren grounds of northern Canada and Alaska and the Arctic seaboard of Eurasia, have tundra climate.

## Tundra Climate

## Temperature

- The tundra climate is characterized by a very **low mean annual temperature**.
- In mid-winter temperatures are as low as 40 – 50 °C below freezing.
- Summers are relatively warmer.
- Normally not more than four months have temperatures above freezing-point.
- Within the Arctic and Antarctic Circles, there are weeks of continuous darkness (Rotation and Revolution).
- The ground remains solidly frozen and is inaccessible to plants.
- Frost occurs at any time and blizzards, reaching a velocity of 130 miles an hour are not infrequent.

## Precipitation

- Precipitation is mainly in the form of snow and sleet.
- Convectional rainfall is generally absent.

## Natural Vegetation – Tundra Climate

- There are **no trees** in the tundra.
- Lowest form of vegetation like mosses, lichens etc. are found here and there.
- Climatic conditions along the coastal lowlands are a little favorable.
- Coastal lowlands support hardy grasses and the reindeer moss which provide the only pasturage for reindeers.
- In the brief summer, berry-bearing bushes and Arctic flowers bloom.
- In the summer, birds migrate north to prey on the numerous insects which emerge when the snow thaws.
- Mammals like the wolves, foxes, musk-ox, Arctic hare and lemmings also live in tundra regions.
- Penguins live only in Antarctic regions.

## Human Activities

- Human activities of the tundra are largely confined to the coast.
- People live a semi-nomadic life.
- In Greenland, northern Canada and Alaska live the **Eskimos.**
- During winter they live in compact **igloos.**
- Their food is derived from fish, seals, walruses and polar bears.
- Now a days rifles instead of traditional harpoons are used to track down animals.

## Recent Development of the Arctic Region

- New settlements have sprung up because of the discovery of minerals.
- Gold is mined in Alaska, petroleum in the Kenai Peninsula, Alaska; and copper at the Rankin Inlet, Canada.
- With the declining reserves of iron ore around the Great Lakes, iron ore deposits in Labrador are gaining importance. New railway lines have been constructed to bring the ores to the St. Lawrence River.
- Rich deposits of iron ores at Kiruna and Gallivare helped Sweden enjoy a prosperous export trade in iron and steel and other metallurgical products.

- New ports on the Arctic seaboard of Eurasia has made it possible to ship timber and fur from Siberia. Modern ice-breakers makes the frozen seas navigable.

Climatic Classifications

| Code | Description | Group | Precipitation Type | Level of Heat |
|---|---|---|---|---|
| Af | Tropical rainforest climate | Tropical | Rainforest | |
| Am | Tropical monsoon climate | Tropical | Monsoon | |
| As | Tropical dry savanna climate | Tropical | Savanna, Dry | |
| Aw | Tropical savanna, wet | Tropical | Savanna, Wet | |
| BSh | Hot semi-arid (steppe) climate | Arid | Steppe | Hot |
| BSk | Cold semi-arid (steppe) climate | Arid | Steppe | Cold |
| BWh | Hot deserts climate | Arid | Desert | Hot |
| BWk | Cold desert climate | Arid | Desert | Cold |
| Cfa | Humid subtropical climate | Temperate | Without dry season | Hot summer |
| Cfb | Temperate oceanic climate | Temperate | Without dry season | Warm summer |
| Cfc | Subpolar oceanic climate | Temperate | Without dry season | Cold summer |
| Csa | Hot-summer Mediterranean climate | Temperate | Dry summer | Hot summer |
| Csb | Warm-summer Mediterranean climate | Temperate | Dry summer | Warm summer |
| Csc | Cool-summer Mediterranean climate | Temperate | Dry summer | Cold summer |
| Cwa | Monsoon-influenced humid subtropical climate | Temperate | Dry winter | Hot summer |
| Cwb | Subtropical highland climate or | Temperate | Dry winter | Warm |

| | | | | |
|---|---|---|---|---|
| | temperate oceanic climate with dry winters | | | summer |
| Cwc | Cold subtropical highland climate or subpolar oceanic climate with dry winters | Temperate | Dry winter | Cold summer |
| Dfa | Hot-summer humid continental climate | Cold (continental) | Without dry season | Hot summer |
| Dfb | Warm-summer humid continental climate | Cold (continental) | Without dry season | Warm summer |
| Dfc | Subarctic climate | Cold (continental) | Without dry season | Cold summer |
| Dfd | Extremely cold subarctic climate | Cold (continental) | Without dry season | Very cold winter |
| Dsa | Hot, dry-summer continental climate | Cold (continental) | Dry summer | Hot summer |
| Dsb | Warm, dry-summer continental climate | Cold (continental) | Dry summer | Warm summer |
| Dsc | Dry-summer subarctic climate | Cold (continental) | Dry summer | Cold summer |
| Dwa | Monsoon-influenced hot-summer humid continental climate | Cold (continental) | Dry winter | Hot summer |
| Dwb | Monsoon-influenced warm-summer humid continental climate | Cold (continental) | Dry winter | Warm summer |
| Dwc | Monsoon-influenced subarctic climate | Cold (continental) | Dry winter | Cold summer |
| Dwd | Monsoon-influenced extremely cold subarctic climate | Cold (continental) | Dry winter | Very cold winter |
| EF | Ice cap climate | Polar | Ice cap | |
| ET | Tundra | Polar | Tundra | |