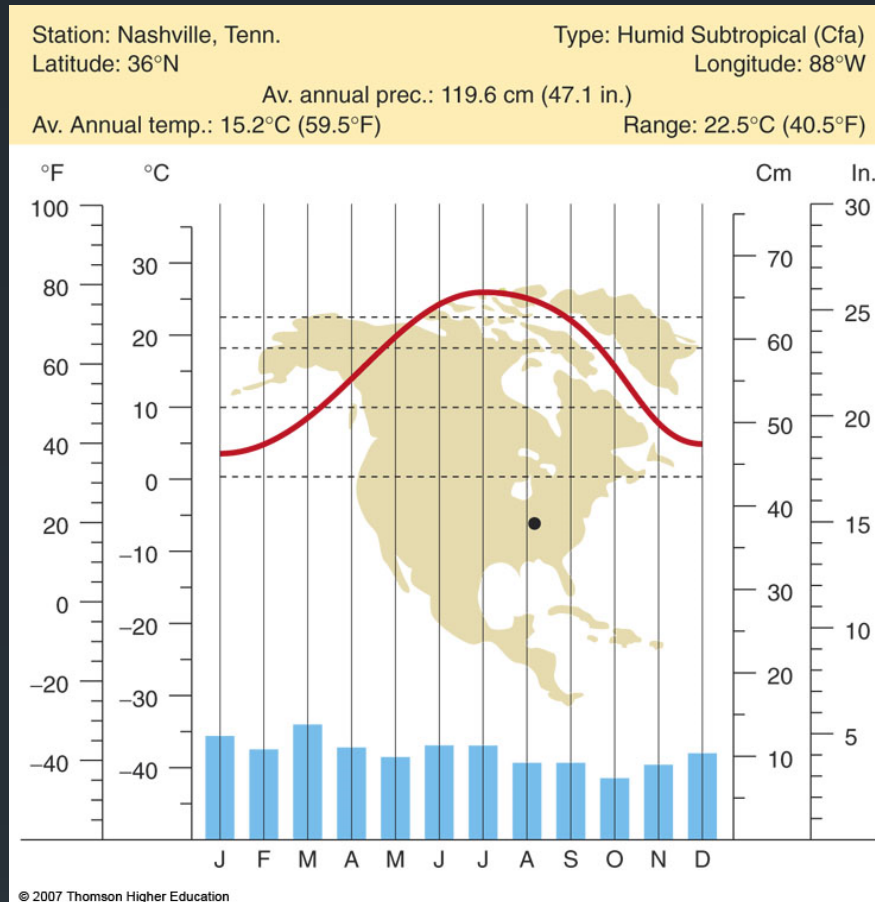


# Chapter 15: World Climates



- **Climate** is more than just a generalization of weather, it includes extreme events and probabilities, it is the sum of all statistical weather information describing a place or region.
- **Climatology** is the study of climate regions that have evolved in response to different moisture and temperature regimes.
- Typical Climatological time scale is **30+ years**.



**Climatologists** employ many different tools to organize the wealth of information about earth's climates: **graphs**, **classification systems**, and **maps** are among the most common

**Temperature & Precipitation** have been used in **Climographs** and in climate classification schemes.



## ❑ HOW DOES CLIMATE INFLUENCE OTHER ASPECTS OF THE ENVIRONMENT?

- **Animal life** adapts to both climate and vegetation
- **Soils** develop in response to climate and vegetation
- **Landforms** are constantly modified by climate-related processes
- **Water** availability is related to humid vs. arid climates

## ❑ HOW DOES CLIMATE RELATE TO ECOSYSTEMS?

- The interaction of climate, vegetation, animal life, soils, and landforms creates an **environmental complex** or **ecosystem**
- Unique **ecosystems** evolve as a result of differing climate conditions

## ❑ WHAT IS THE IMPACT OF CLIMATE UPON PEOPLE'S LIVES?

- Regions of extreme climatic conditions have fewer people
  - Deserts, rainforests, polar regions
- Climate influences agriculture
  - Choice of crops grown and animals raised
- Tourism and recreation patterns are shaped by climatic conditions
- Water resources availability and utilization also affected by climate
- Climate and disease – relationships have persisted despite technological advancement

❖ ***Climatologists and geographers*** study and compare climate regions that have evolved in response to different moisture and temperature conditions, in order to enhance our understanding of these and other relationships.

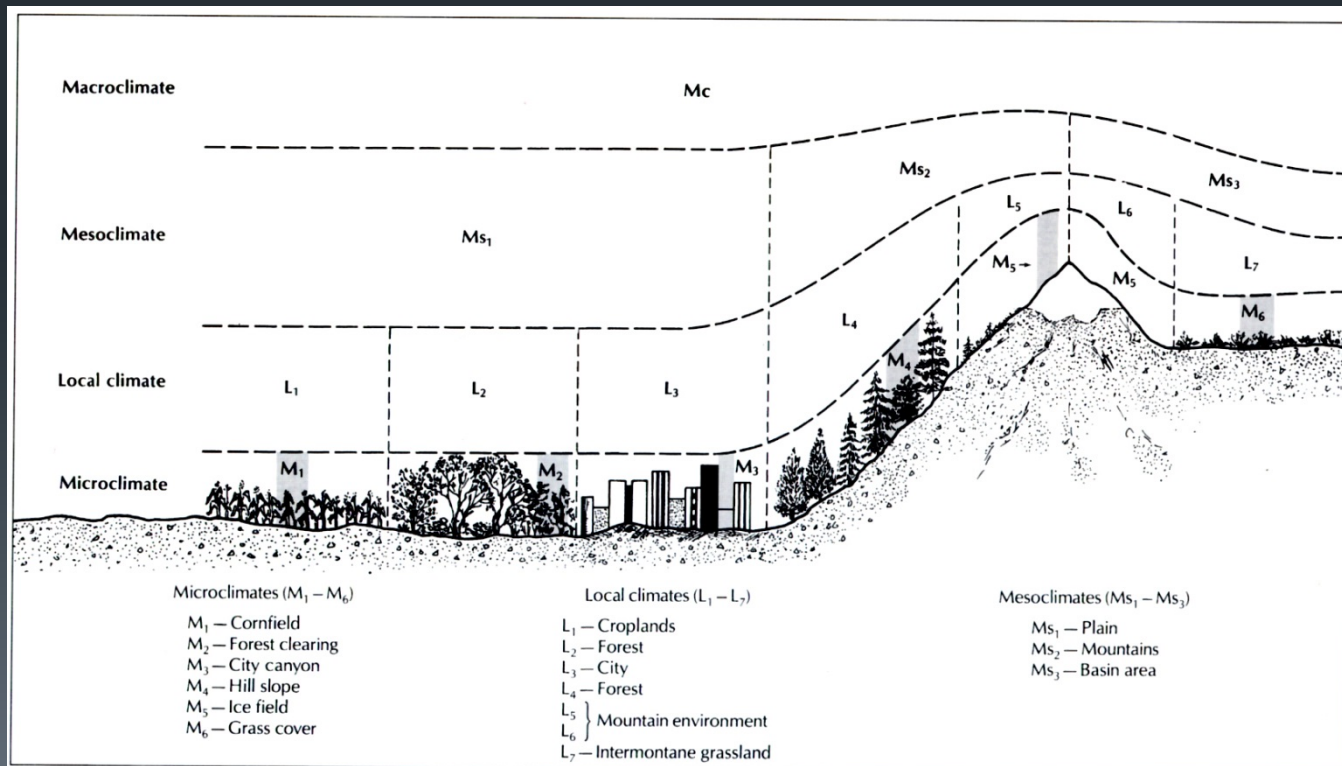
# SCALE

**Macroclimate:** continental in scale, area =  $4 \times 10^8 \text{ m}^2$

**Mesoclimate:** subcontinental, area =  $10^3 \text{ m}^2$  up to  $4 \times 10^8 \text{ m}^2$

**Local climate:** a group of microclimates that characterize a specific region,  $10^3$  to  $10^8 \text{ m}^2$  in size

**Microclimate:** an individual field or park, 1 to  $10^4 \text{ m}^2$  in area



## Factors Influencing the World Climatic Regions



Climate of a particular place is the function of:

- 1) Latitude and its influence on solar radiation received
- 2) Air mass influences
- 3) Location of global high and low pressure zones/belts
- 4) Pattern of prevailing winds (includes migrating cyclones)
- 5) Location of mountain barriers
- 6) Heat exchange from ocean currents
- 7) Distribution of land and water
- 8) Altitude or elevation

# The Simplified Köppen Classification System



- One of the most widely used classification schemes because it is easy to apply and data requirements are minimal.
- Each climate is defined according to set values of **mean monthly precipitation**, **mean monthly temperature** and **seasonal extremes**.
- Strong correlation between vegetation boundaries and climate regions.

# The Simplified Köppen Classification System



Recognizes 6 major climatic types, designated by capital letters

- A = Tropical Rainy Climates
- B = Arid (Dry) Climates
- C = Humid Mesothermal (Mild Winter) Climates
- D = Humid Microthermal (Severe Winter) Climates
- E = Polar Climates
- H = Highland Climates

Analysis: E – C – A – B – D, H: elevation based



# Modified Köppen Classification of World Climates

Köppen system							
First division	Description	Second division	Description	Third division	Description		
A	<b>Tropical</b> Coolest month's average temperature >64°F/18°C	m	A period of less precipitation in an otherwise very moist climate				
		w	Dry winters, wet summers				
		f	Constantly wet (no less than 2.4 in./60 mm of rain, in the driest month)				
B	<b>Dry</b> Potential evaporation and transpiration exceed precipitation	S	More precipitation than deserts, but under 20 in./500 mm per year (semiarid/steppe)	h	Mean annual temperature >64°F/18°C (tropical)		
				k	Mean annual temperature <64°F/18°C (temperate)		
		W	Less than 10 in./250 mm of precipitation per year (arid/desert)	h	Mean annual temperature >64°F/18°C (tropical)		
				k	Mean annual temperature <64°F/18°C (temperate)		
		C	Midlatitude with mild winters	s	Mild with dry summer (mediterranean)	a	Hot summer season
						b	Warm summer season
f	Mild with no dry season (humid subtropical)			a	Hot summer season		
				b	Warm summer season		
D	Midlatitude with severe winters	w	Mild with dry winter	c	Cool summer season		
				a	Hot summer season		
		f	Humid with severe winters; no dry season (humid-continental)	a	Hot summer season		
				b	Warm summer season		
w	Severe dry winters (subarctic)	c	Cool summer season				
		d	Cool summers and very cold winters				
E	<b>Polar</b> Average temperature of the warmest month <50°F/10°C	T	Warmest month's average temperature between 32°F/0°C and 50°F/10°C	a	Hot summer season		
				b	Warm summer season		
		F	Warmest month's average temperature <32°F/0°C	c	Cool summer season		
				d	Cool summers and very cold winters		

## Main Categories

**A**, Tropical - All months above 18°C, a critical cutoff for many tropical plants.

**B**, Arid and semiarid - Less precipitation than evaporation.

**C**, Temperate - All months above -3°C. Long growing seasons favor deciduous trees.

**D**, Cold winter - 1+ months below -3°C. Short growing seasons favor evergreen trees.

**E**, Tundra and icecap - All months below 10°C and 0°C, too cold for trees, good for ice.

**H**, Highland - Mountainous regions where temperature varies sharply with altitude.

## Secondary Categories

**f**, wet all year

**w**, dry winter or low sun

**s**, dry summer or high sun

[https://en.wikipedia.org/wiki/K%C3%B6ppen\\_climate\\_classification](https://en.wikipedia.org/wiki/K%C3%B6ppen_climate_classification)

## What is Your Climate Classification? Data Sheet

Location: \_\_\_\_\_

Lat/Long: \_\_\_\_\_ N or S \_\_\_\_\_ E or W

**Table A: 30 Year Data**

Month	Mean Air Temp (°C)	Monthly Accumulated Precipitation (mm)
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

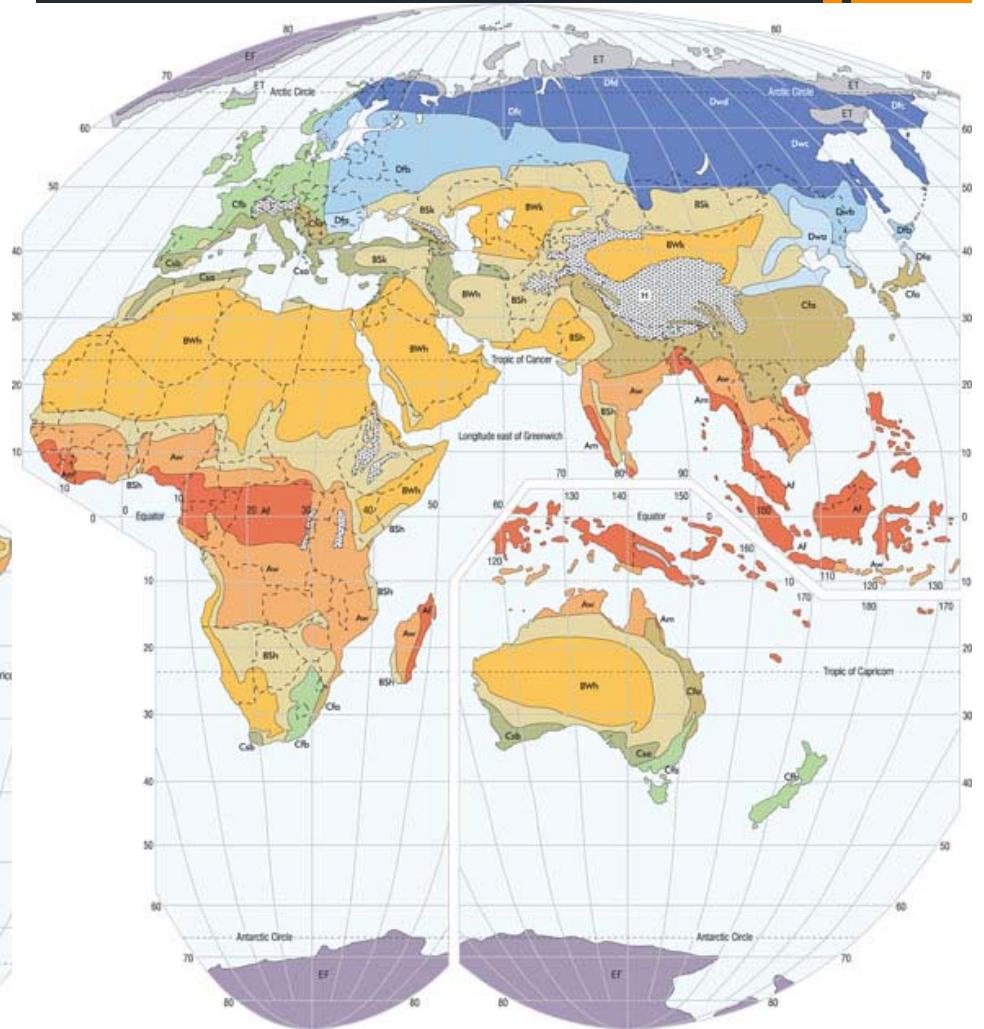
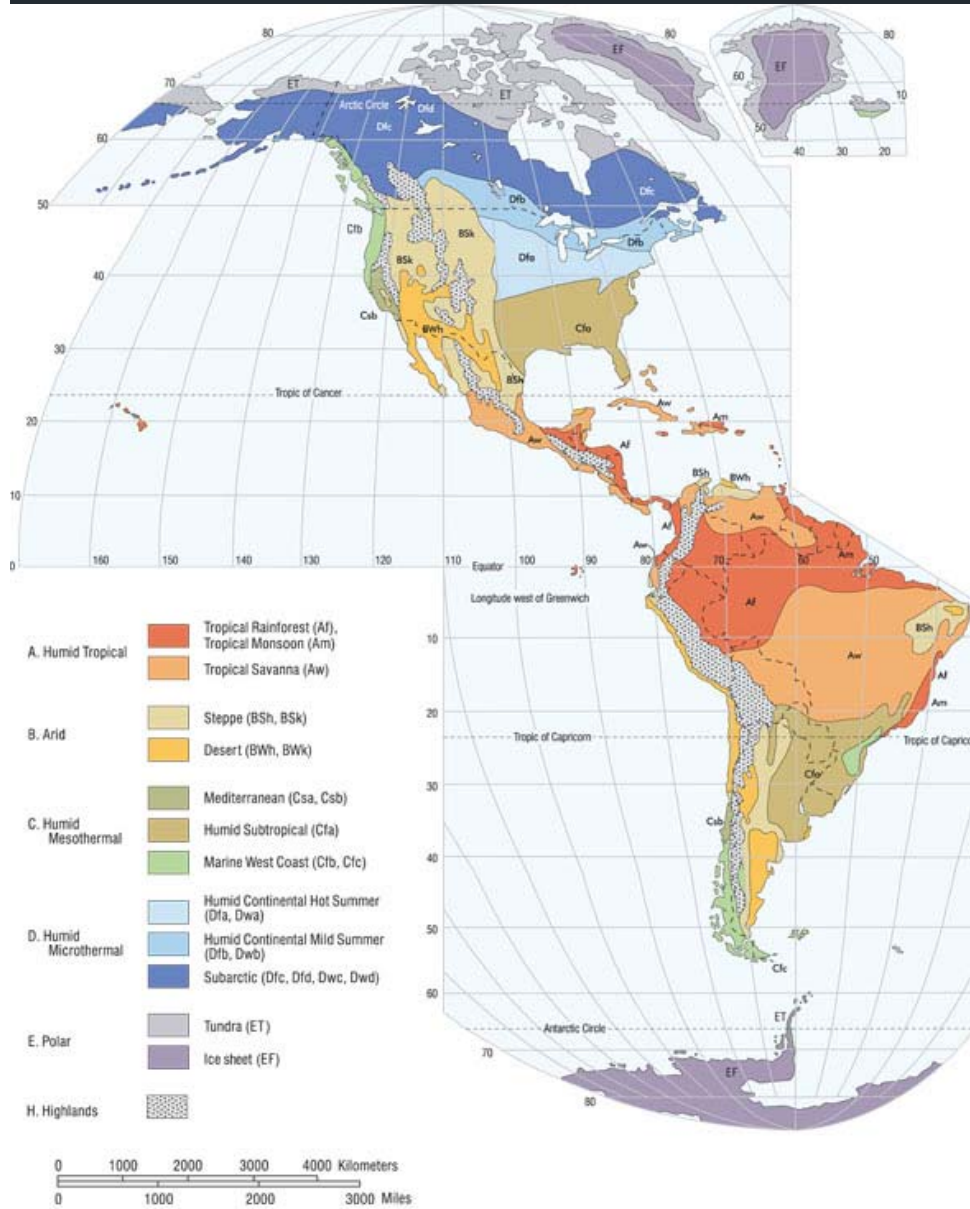
**Additional Pth information needed:**

Does 70% or more of the precipitation fall in the summer?  
In the winter? Or neither?  
April-Sept. are summer northern hemisphere/winter southern  
October-March are winter northern hemisphere/summer southern

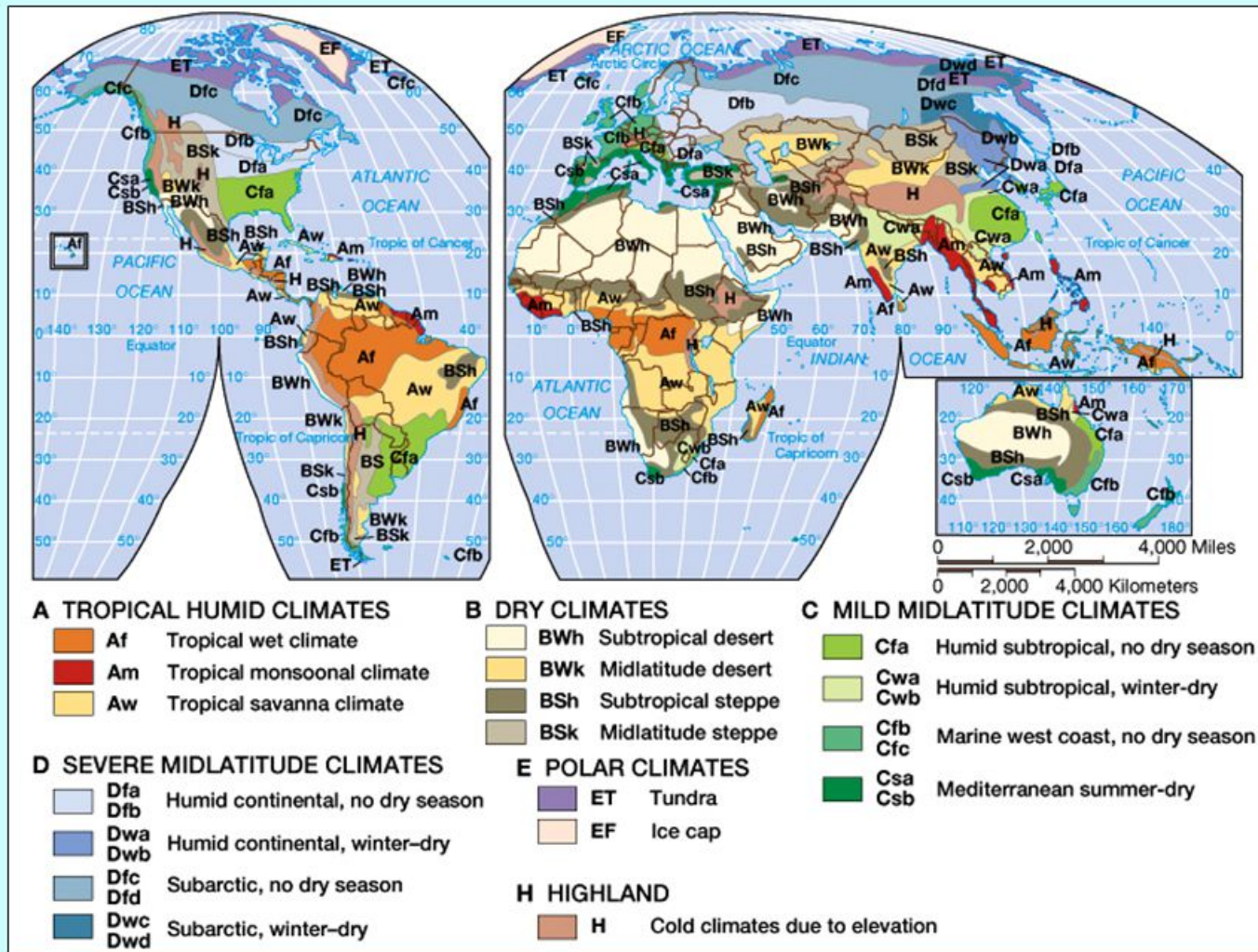
**Table B: Calculations**

Abbreviation	Description	Value
Tann	Annual Air Temperature (°C) <i>[Add all 12 Mean Air Temperatures and divide by 12]</i>	
Tmin	Air Temperature of the Coldest Month (°C) <i>[The lowest value in the Mean Air Temp column]</i>	
Tmax	Air Temperature of the Warmest Month (°C) <i>[The highest value in the Mean Air Temp column]</i>	
Pann	Accumulated Annual Precipitation (mm) <i>[Add all 12 Monthly Accumulated Precipitation Values]</i>	
Pth	Precipitation Threshold (mm) <i>[If 70% or more precip. falls in summer then <math>Pth = (Tann \times 2 + 28)</math> if 70% or more falls in winter then <math>Pth = Tann \times 2</math> if neither of the above, then <math>Pth = (Tann \times 2 + 14)</math></i>	
Pmin	Amount of Precipitation in the driest month (mm) <i>[The lowest value for Monthly Accumulated Precipitation]</i>	
Psmax	Amount of Precipitation in the wettest summer month (mm) <i>[Identify summer, the highest Monthly Accumulated Precipitation in these months]</i>	
Psmin	Amount of Precipitation in the driest summer month (mm) <i>[Identify summer, the lowest Monthly Accumulated Precipitation in these months]</i>	
Pwmax	Amount of Precipitation in the wettest winter month (mm) <i>[Identify winter, the highest Monthly Accumulated Precipitation in these months]</i>	
Pwmin	Amount of Precipitation in the driest winter month (mm) <i>[Identify winter, the lowest Monthly Accumulated Precipitation in these months]</i>	

# Modified Koppen Classification of World Climates

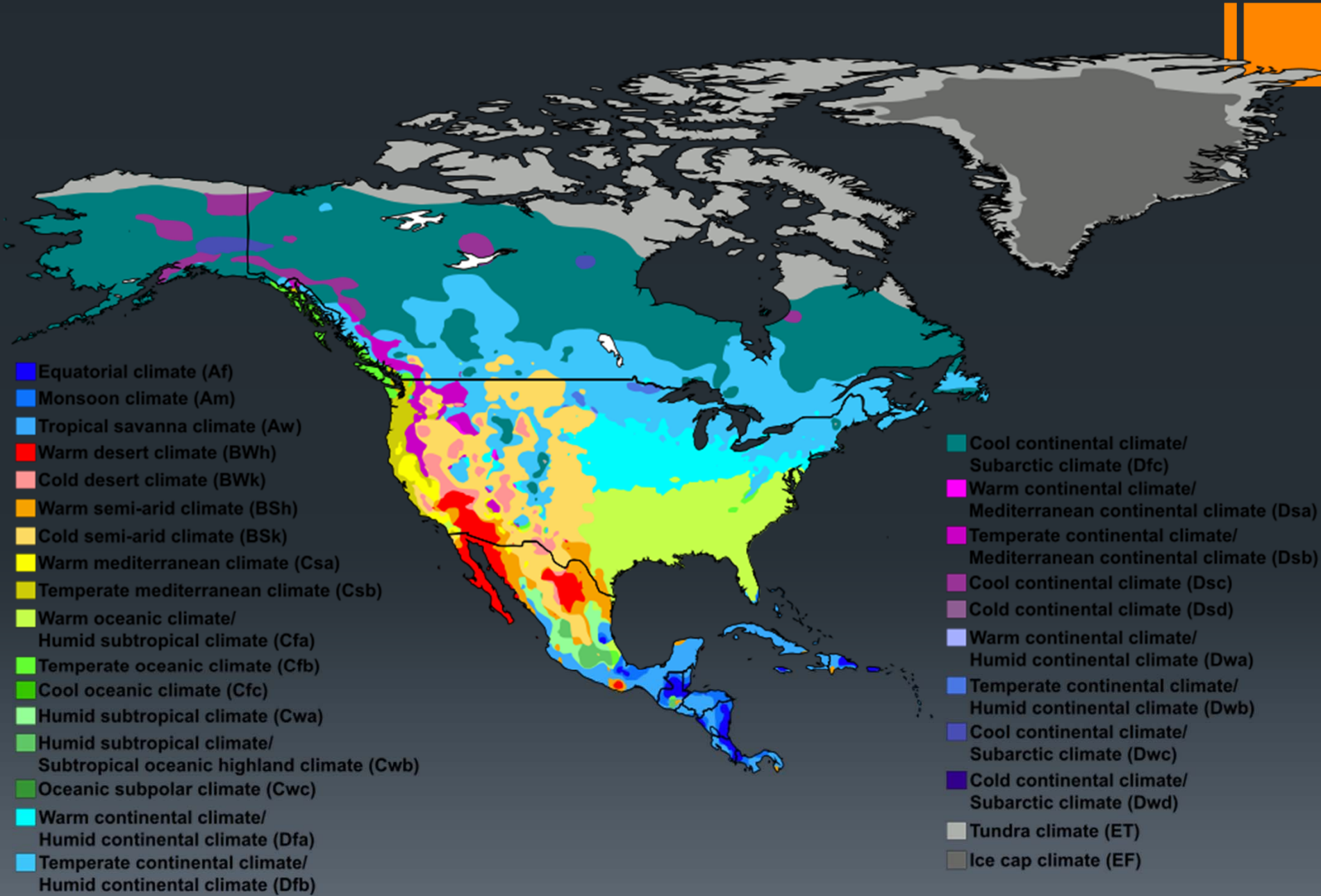


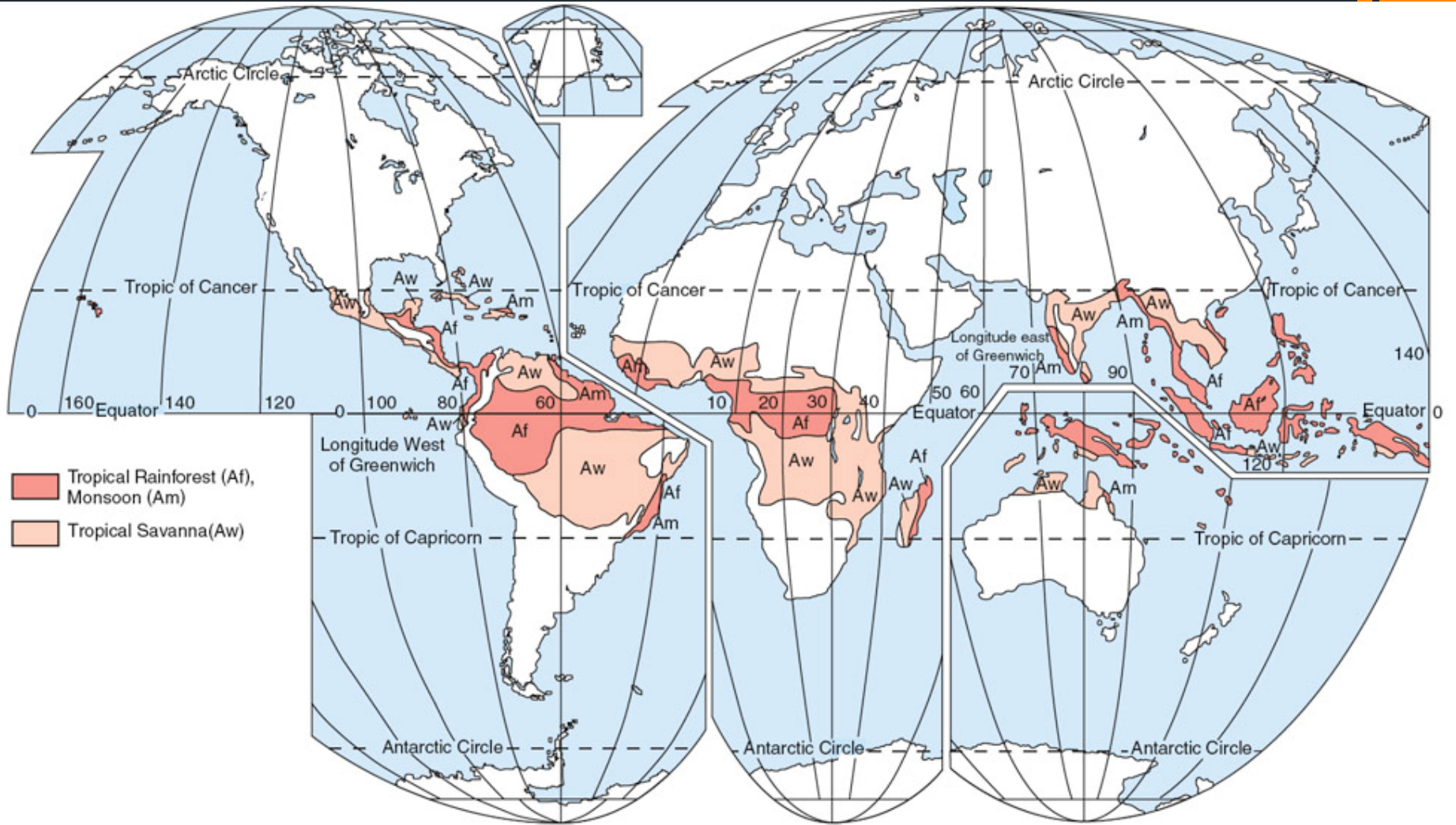
# Modified Koppen Classification of World Climates



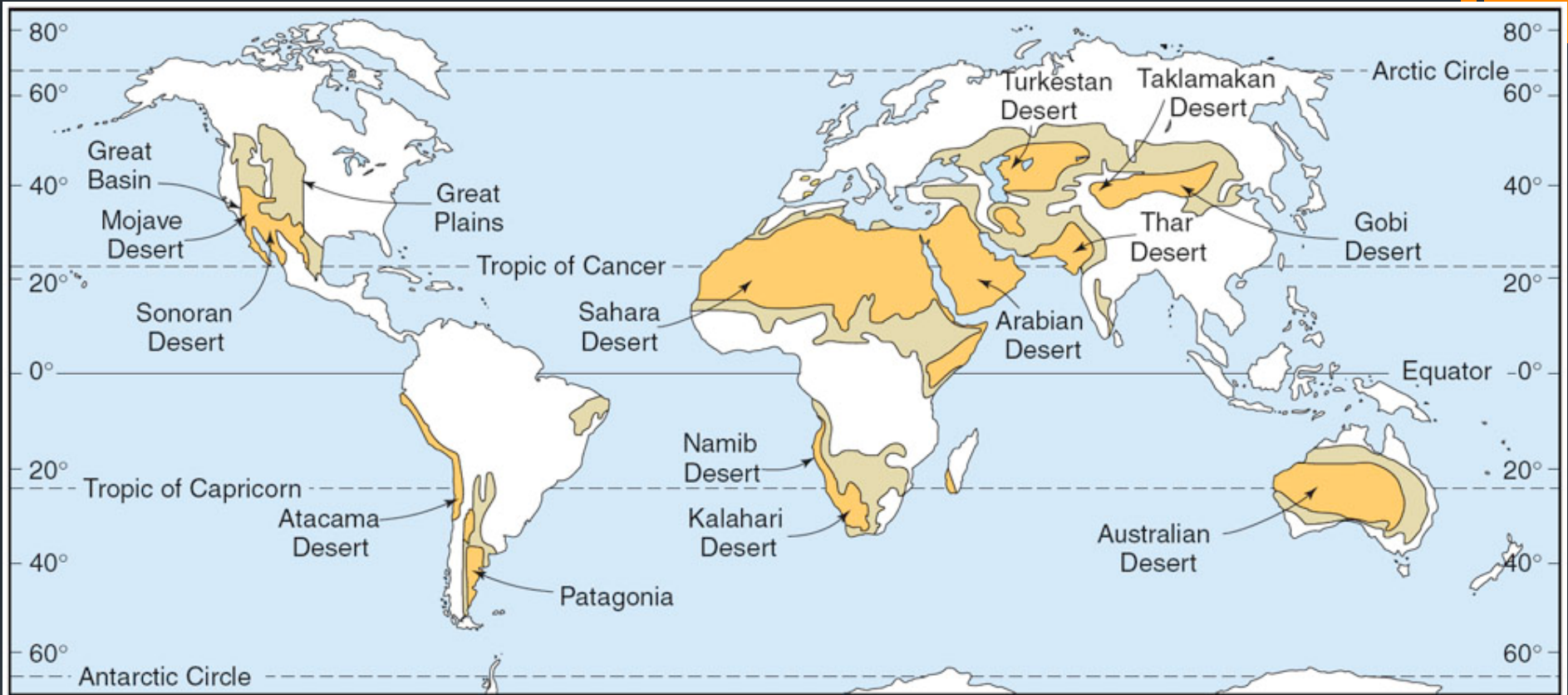
World map of Koeppen climates.

# North America map of Köppen climate classification



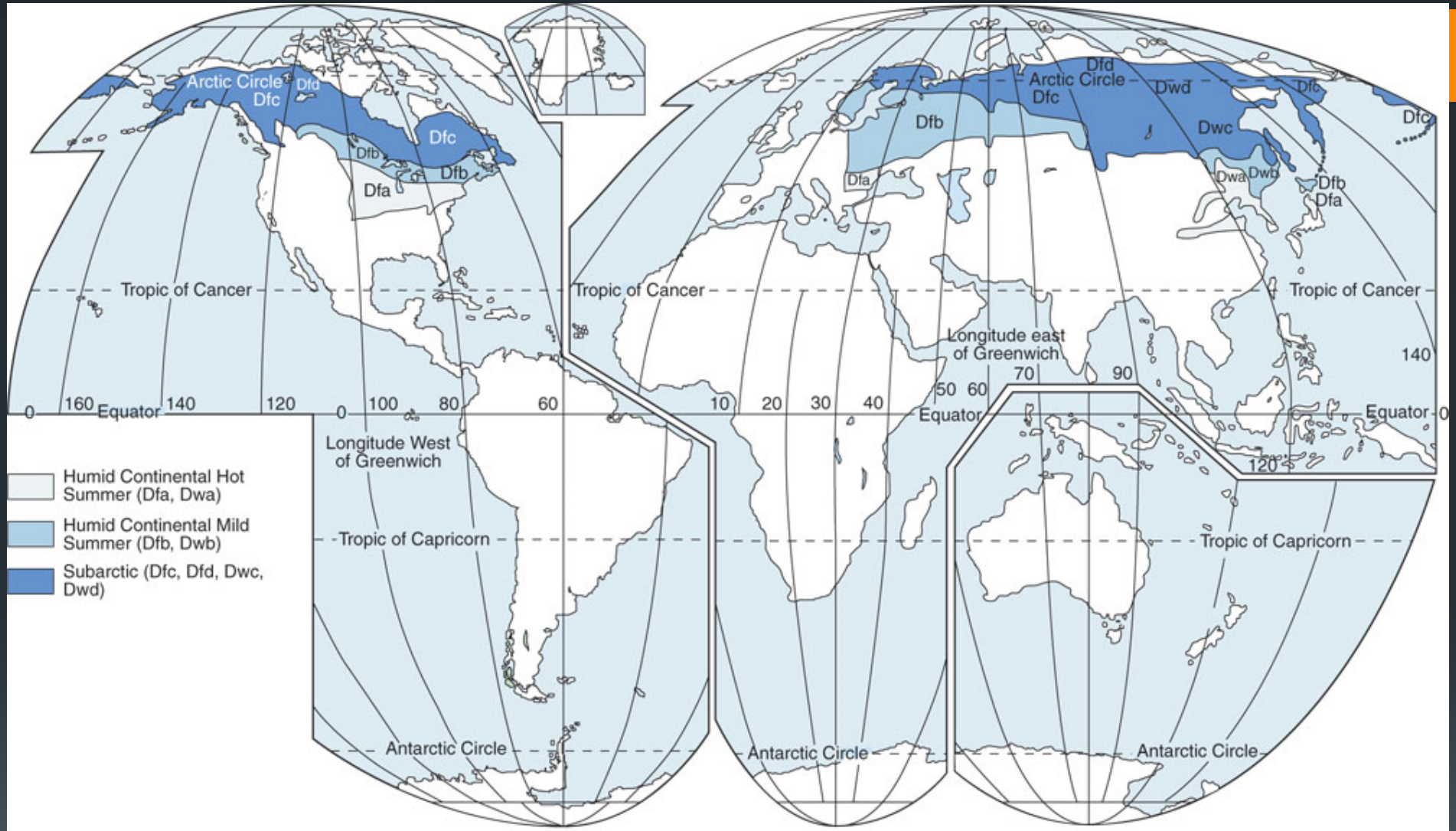


Humid Tropical Climates



 Low-latitude and middle-latitude deserts (BWh, BWk)

 Low-latitude and middle-latitude steppes (BSh, BSk)



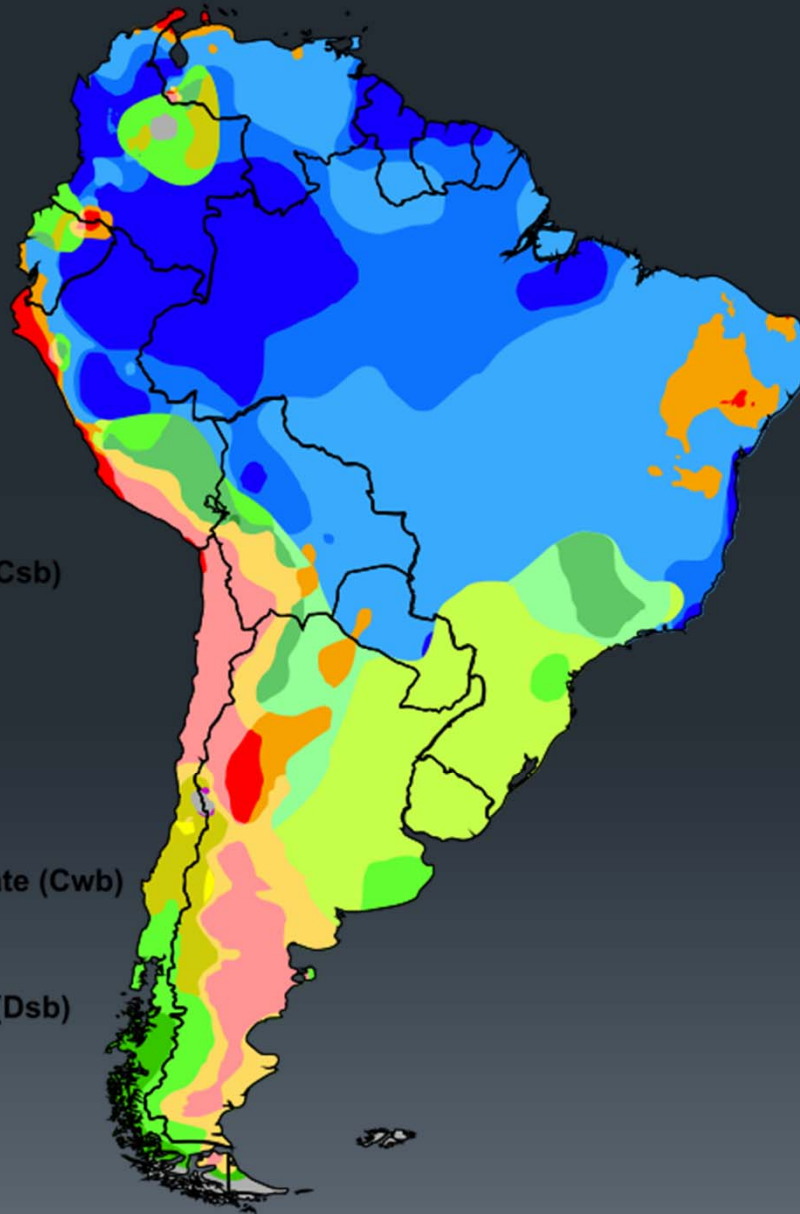
**Humid Microthermal Climates**



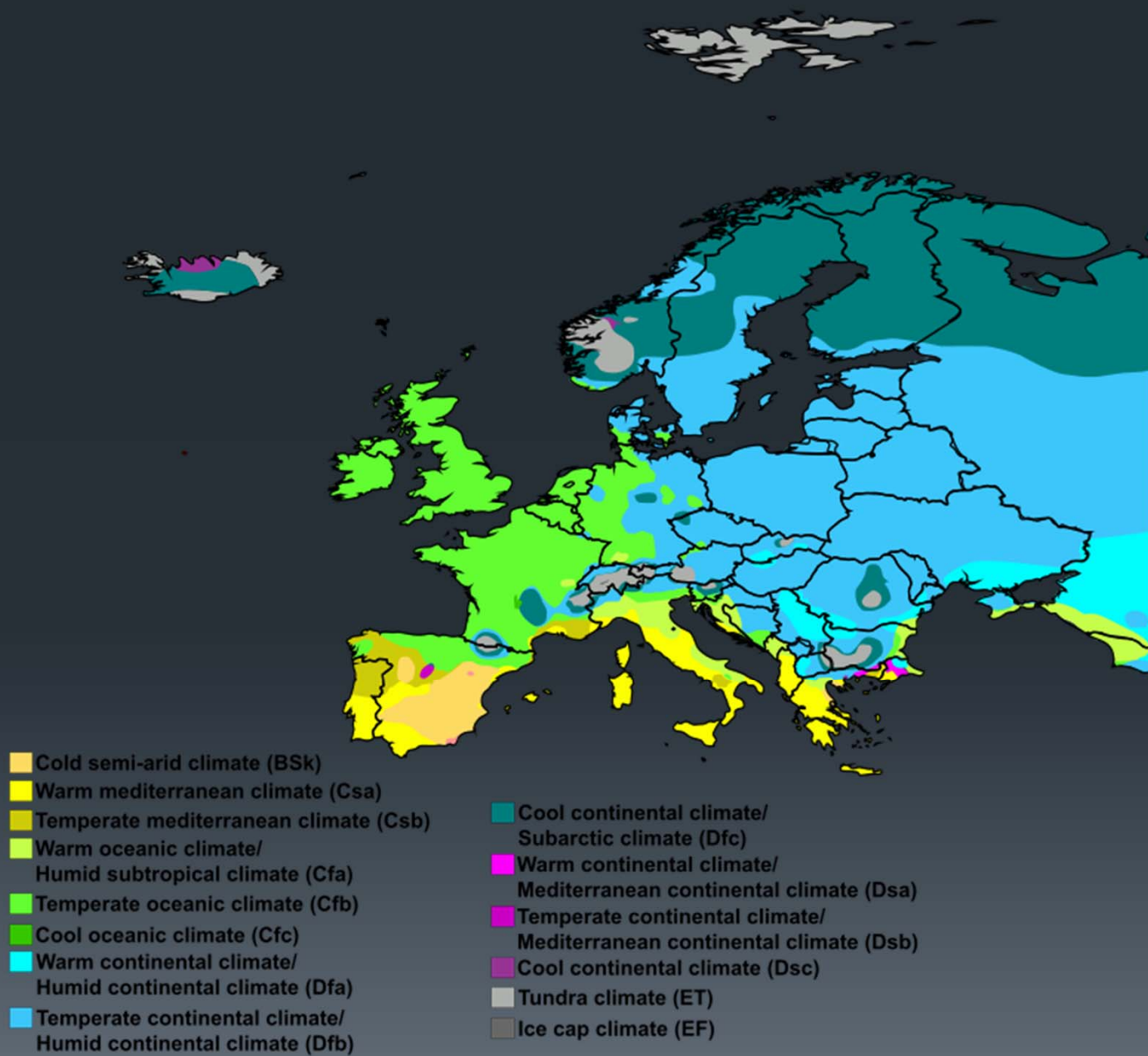
# South America map of Köppen climate classification



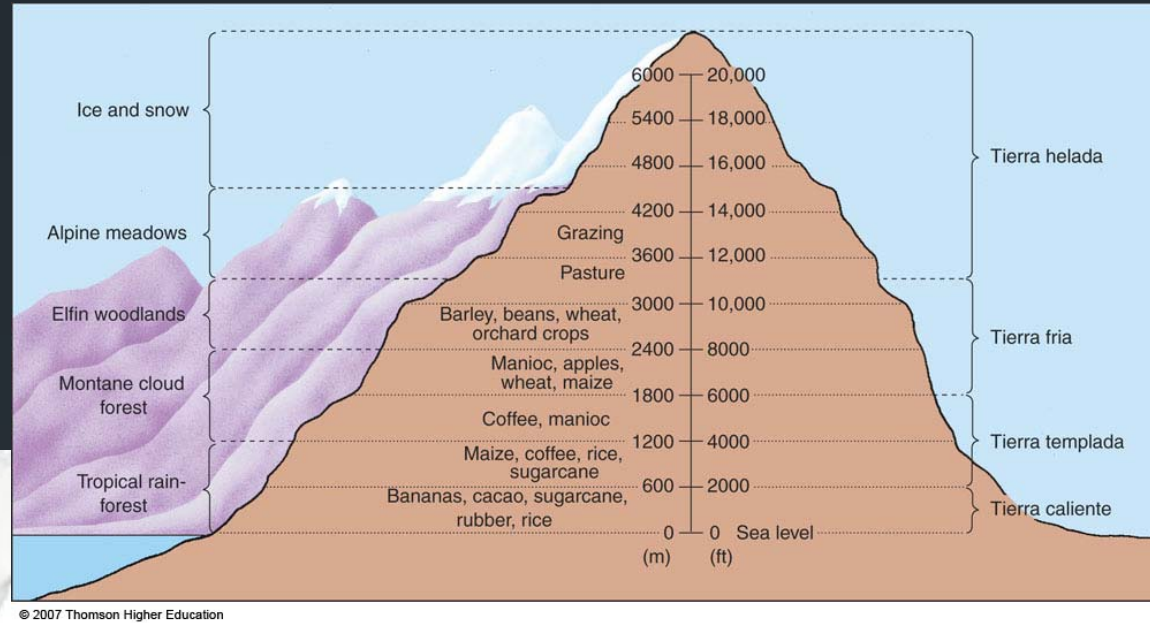
- Equatorial climate (Af)
- Monsoon climate (Am)
- Tropical savanna climate (Aw)
- Warm desert climate (BWh)
- Cold desert climate (BWk)
- Warm semi-arid climate (BSH)
- Cold semi-arid climate (BSk)
- Warm mediterranean climate (Csa)
- Temperate mediterranean climate (Csb)
- Warm oceanic climate/  
Humid subtropical climate (Cfa)
- Temperate oceanic climate (Cfb)
- Cool oceanic climate (Cfc)
- Humid subtropical climate (Cwa)
- Humid subtropical climate/  
Subtropical oceanic highland climate (Cwb)
- Oceanic subpolar climate (Cwc)
- Temperate continental climate/  
Mediterranean continental climate (Dsb)
- Tundra climate (ET)



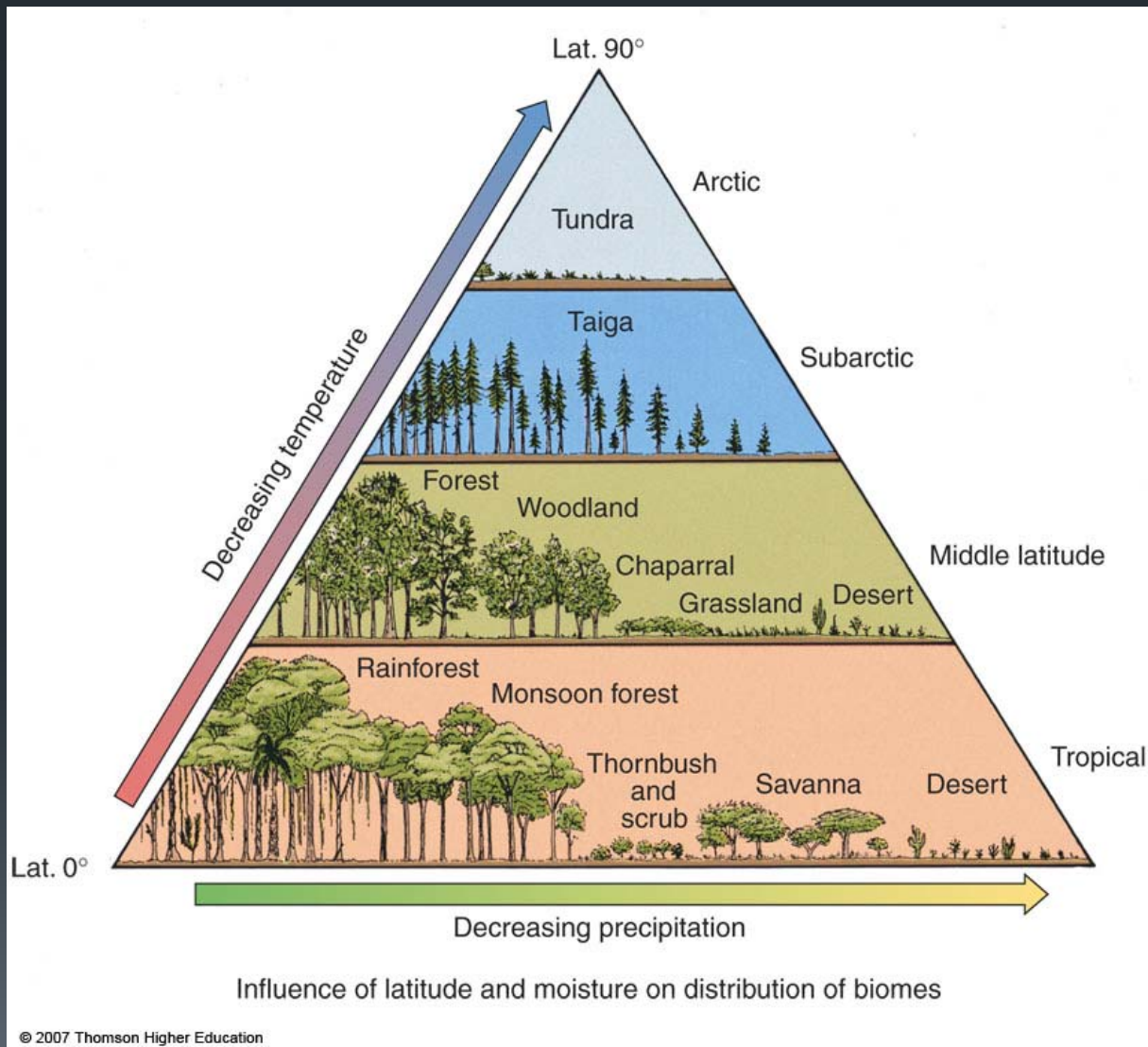
# Europe map of Köppen climate classification



# H = Highland Climates

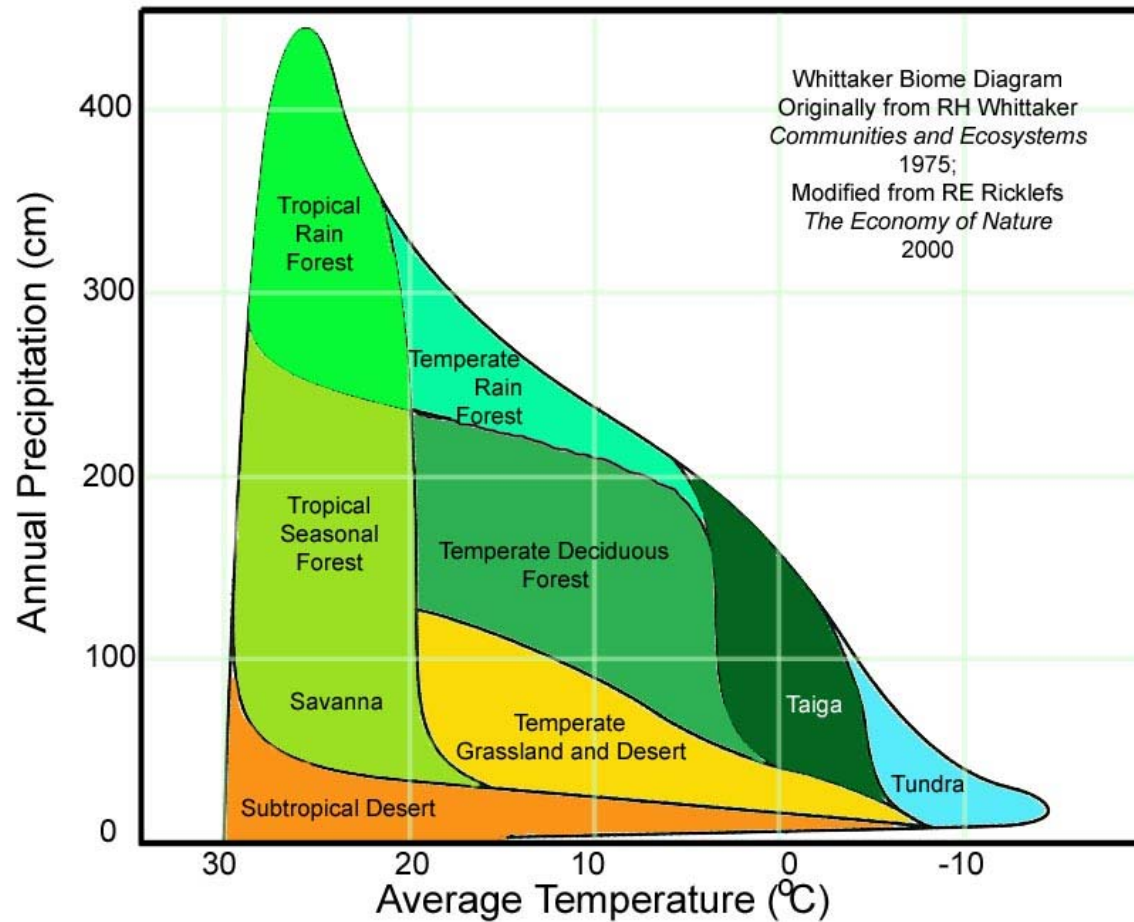


# Climate and Natural Vegetation



**Vegetation** is the most visible expression of climate

# Climate and Natural Vegetation



**Vegetation** is the most visible expression of climate

# Classification of Global Natural Vegetation

