Global Regional Climates

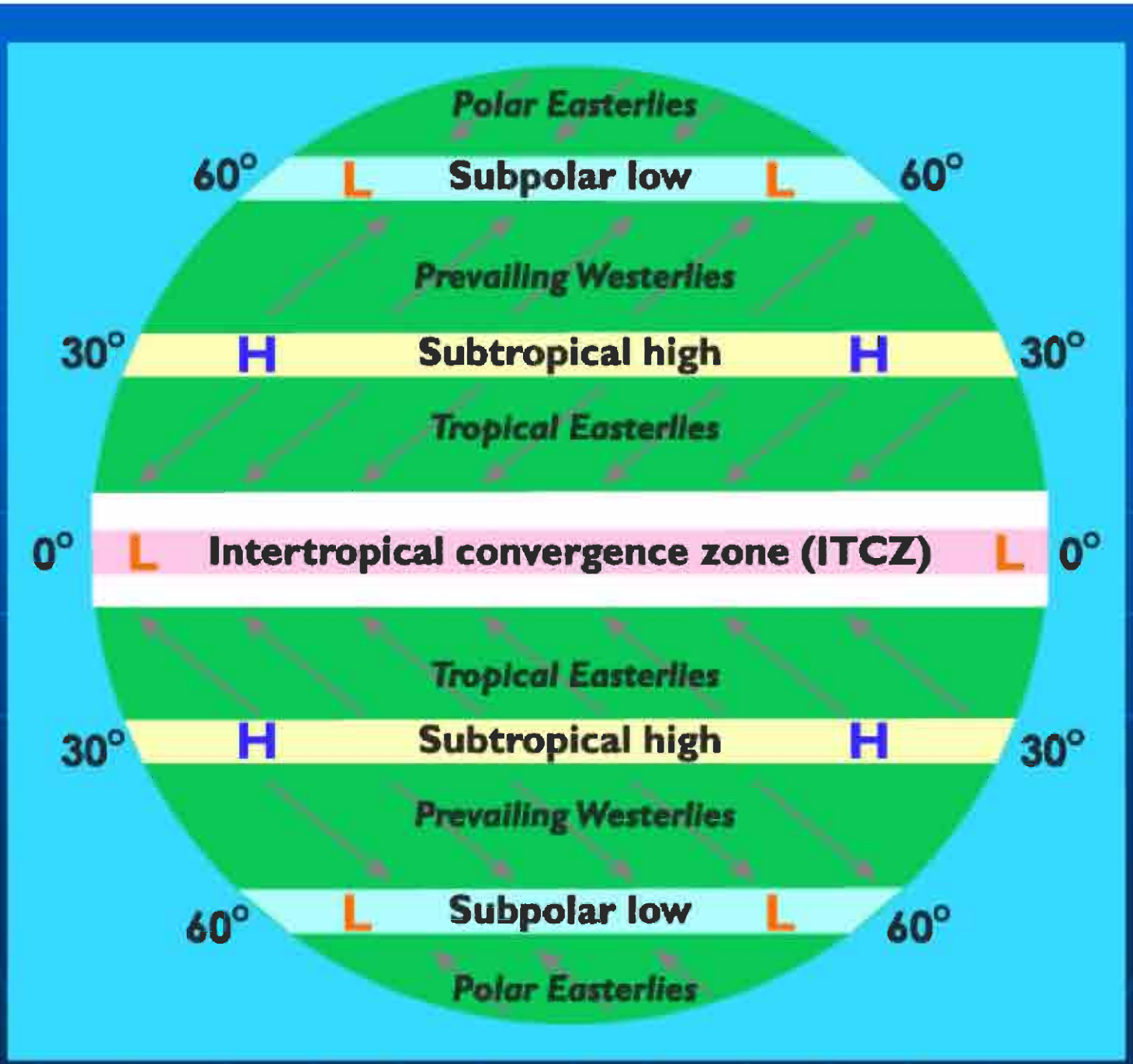
- OLLI
- Loudoun Campus
- January 28 - February 18 2010
- Barry Haack
- GMU Geography

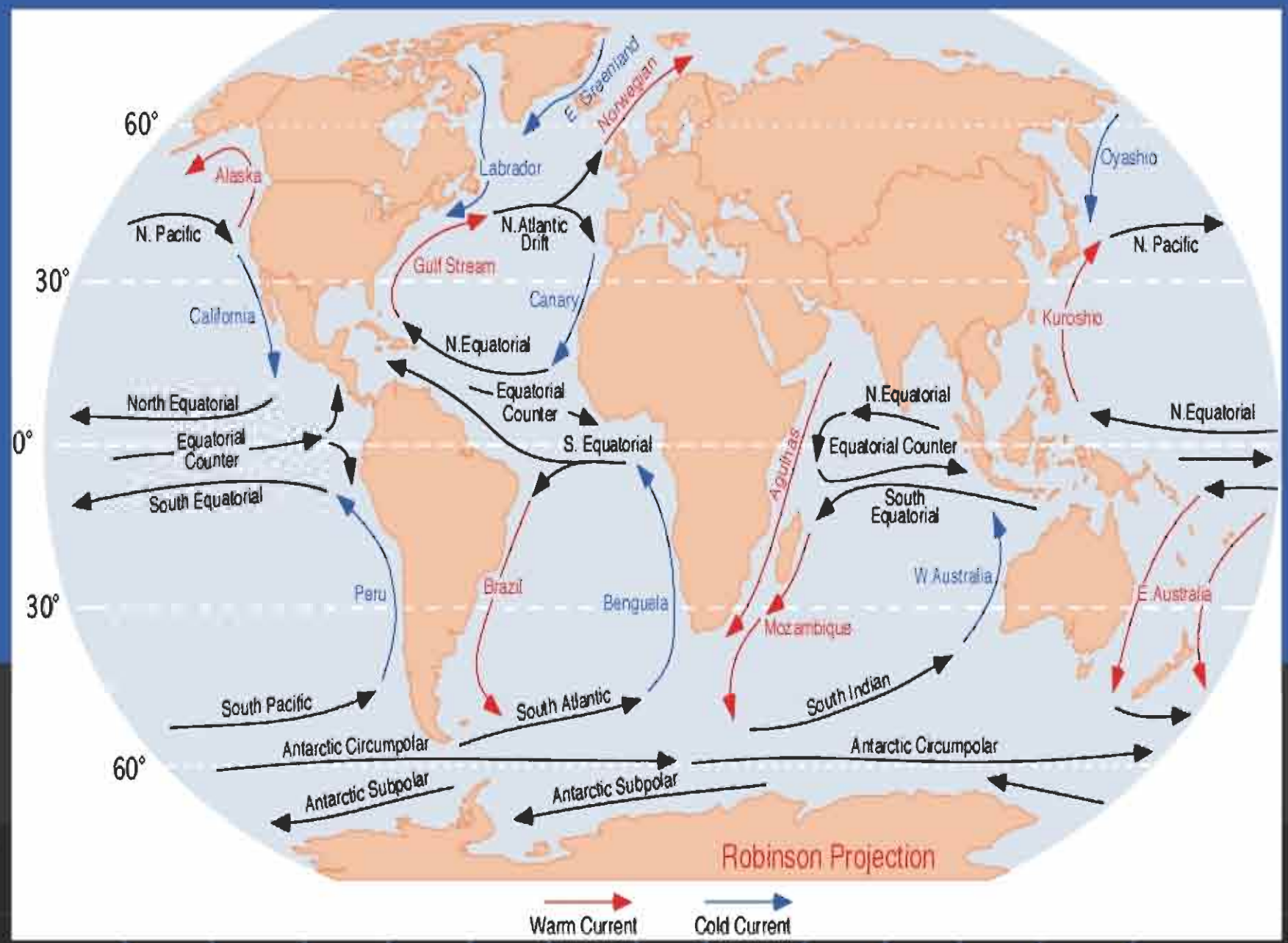
Regional Climatology

- Average weather conditions
- Variation over space rather than time
- Informs on environmental and economic conditions and opportunities
- Many classification systems
- Originally based on natural vegetation
- Statistically based today

Climate Controls

- Latitude
- Global wind and pressure belts
- Distribution of land and water
- Altitude
- Mountain/topographic barriers
- Ocean currents
- Man?


Polar Easterlies
60°
L
Subpolar low
L
60°
Prevailing Westerlies
30°
H
Subtropical high
H
30°
Tropical Easterlies
0°
L
Intertropical convergence zone (ITCZ)
L
0°
Tropical Easterlies
30°
H
Subtropical high
H
30°
Prevailing Westerlies
60°
L
Subpolar low
L
60°
Polar Easterlies


60°
30°
0°
30°
60°
E. Greenland
Norwegian
Labrador
Alaska
N. Pacific
N.Atlantic Drift
Gulf Stream
Canary
California
N.Equatorial
North Equatorial
Equatorial Counter
S. Equatorial
South Equatorial
Peru
Brazil
Benguela
South Pacific
South Atlantic
Antarctic Circumpolar
Antarctic Subpolar
Oyashio
N. Pacific
Kuroshio
N.Equatorial
Equatorial Counter
South Equatorial
Agulhas
Mozambique
W.Australia
E.Australia
South Indian
Antarctic Circumpolar
Antarctic Subpolar
Robinson Projection
Warm Current
Cold Current

Climate Class Parameters

- Koppen symbols and name
- Causes and controls
- Temp characteristics
- Precipitation characteristics
- Soils
- Natural vegetation
- Man's utilization
- Location

Soil Physical and Chemical Properties

- Texture
- Structure
- Consistency
- Porosity
- Permeability
- Color
- Chemical composition

Soil Change Factors

- Parent material
- Climate
- Topography
- Time
- Biosphere

Comprehensive Soil Classification System

- Global
- Hierarchical
- 11 Orders
- 47 suborders
- 230 Great Soil Groups
- Three lower levels

- (Fairfax Co. 1955, ~75 soil classes)

Soil Forming Processes

- Laterization
- Podsolization
- Calcification
- Salinization
- Gleization

Natural Vegetation Biomes

- Forests
- Grasslands
- Savanna
- Tundra
- Desert

Physical Descriptors of Vegetation

- Life form
- Plant size and stratification
- Percent cover
- Periodicity
- Leaf size and shape
- Leaf Texture

Vegetation Change Factors

- Climate
- Topography
- Soil
- Biotic
- Time

World Climate Classification
Modified Köppen System

A. Tropical Humid
- Tropical wet
- Tropical savanna
- Tropical monsoon

B. Dry
- Desert
  - warm and cool
- Steppe
  - warm and cool

C. Mild Midlatitude
- Humid subtropical
- Marine west coast
- Mediterranean

D. Severe Midlatitude
- Humid continental
- Subarctic

E. Polar
- Tundra
- Ice cap

H. Highland

Climate Zones and Types

A. Tropical Humid

Tropical rainforest Af

Tropical monsoon Am

Tropical savanna Aw

Tropical Rainforest Af

Low Latitude Equatorial Low

Hot, low annual range, high diurnal

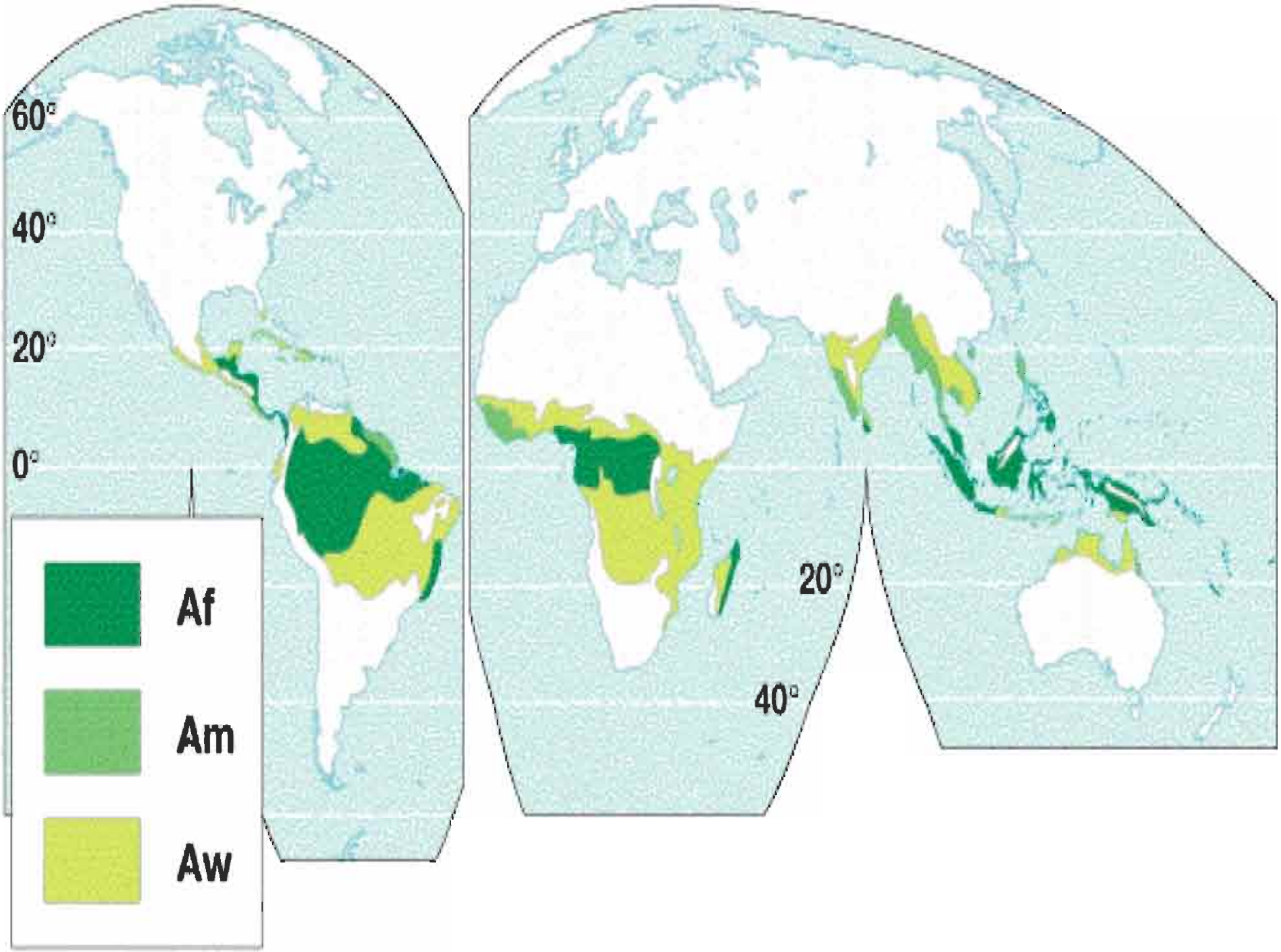
Wet 80-100 inches

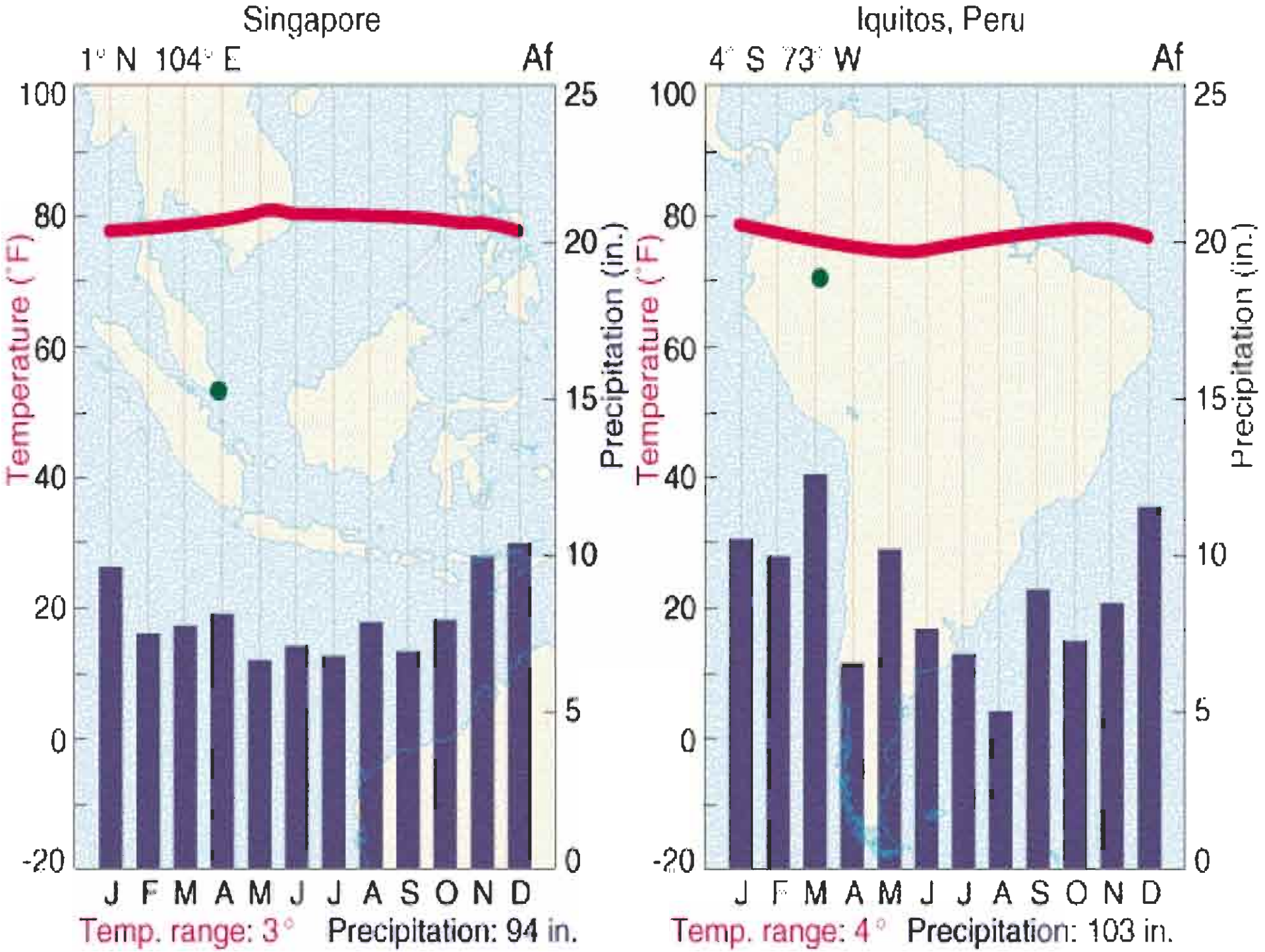
Laterization, Oxisols

Broadleaf evergreen forest, epiphytes, lianas

Low population, slash and burn, forestry

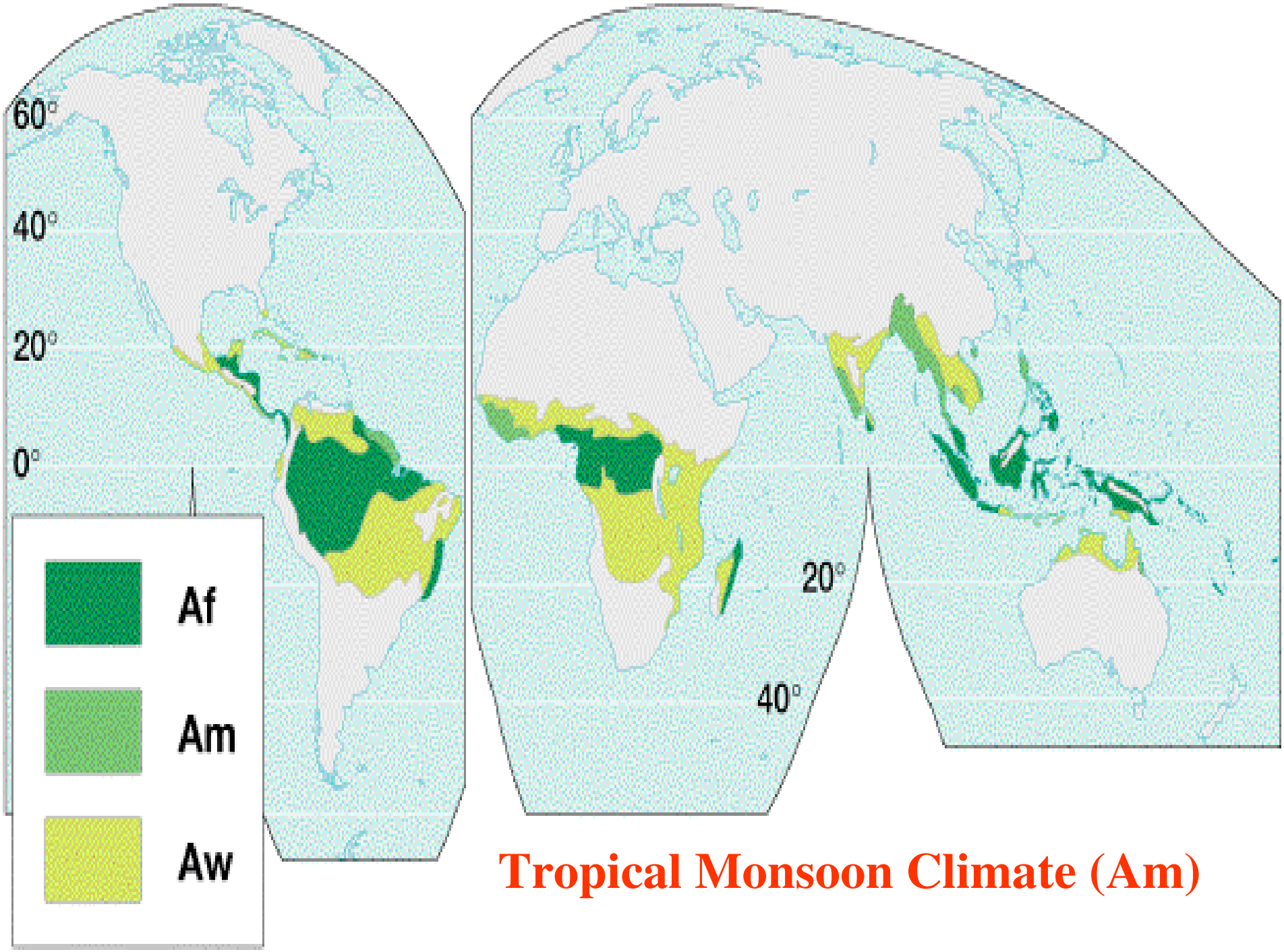
Amazon Basin, Zaire Basin, Indonesia


60°
40°
20°
0°
20°
40°
Af
Am
Aw

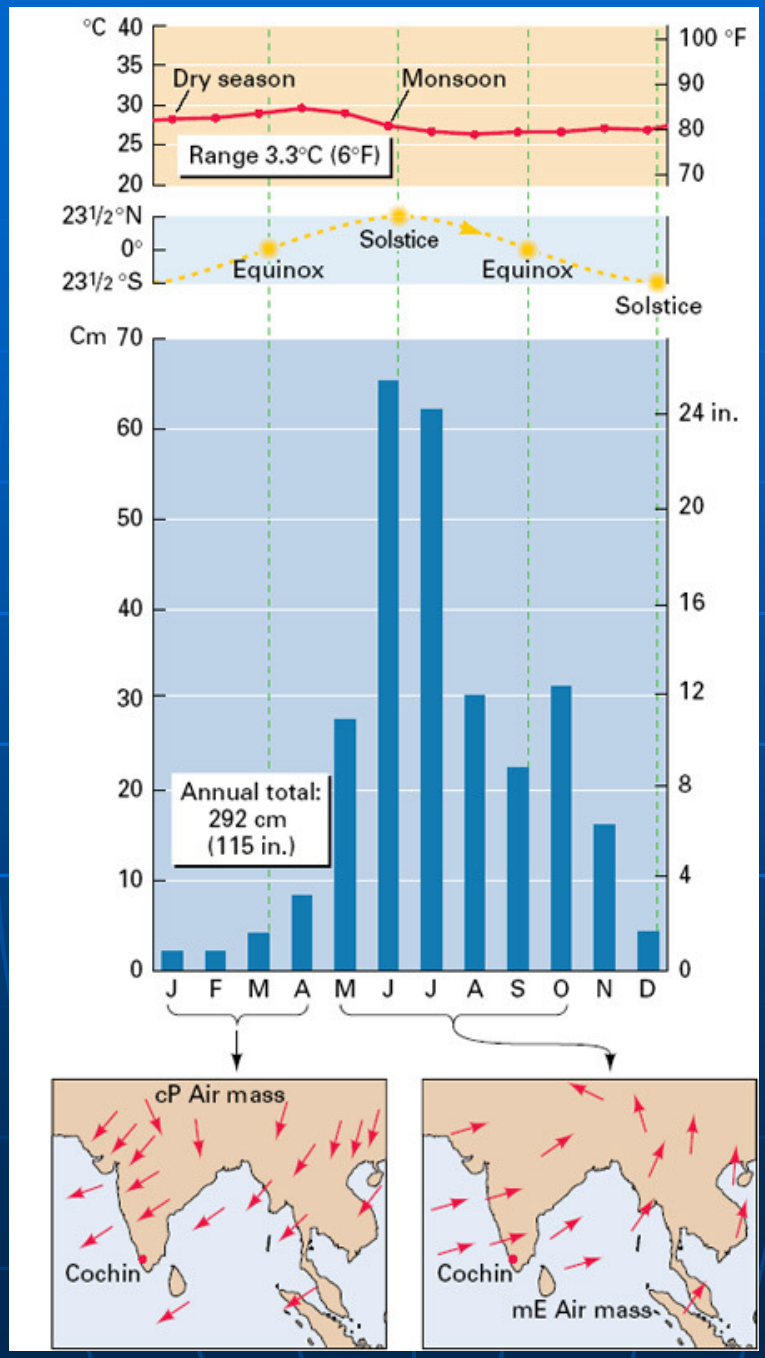

Singapore
1° N 104° E
Af
Temperature (°F)
Precipitation (in.)
100
80
60
40
20
0
-20
25
20
15
10
5
0
J F M A M J J A S O N D
Temp. range: 3°
Precipitation: 94 in.
Iquitos, Peru
4° S 73° W
Af
Temperature (°F)
Precipitation (in.)
100
80
60
40
20
0
-20
25
20
15
10
5
0
J F M A M J J A S O N D
Temp. range: 4°
Precipitation: 103 in.

Tropical Monsoon Am

Monsoon Circulation System
Hot, low annual range, high diurnal
Wet and dry, very wet 100-500 inches
Laterization, inceptisols on floodplains
Broadleaf evergreen, some deciduous
Slash and burn, timber, rice*, dense populations along rivers
South Asia Coasts, Philipines, West Africa, Amazon Coast,



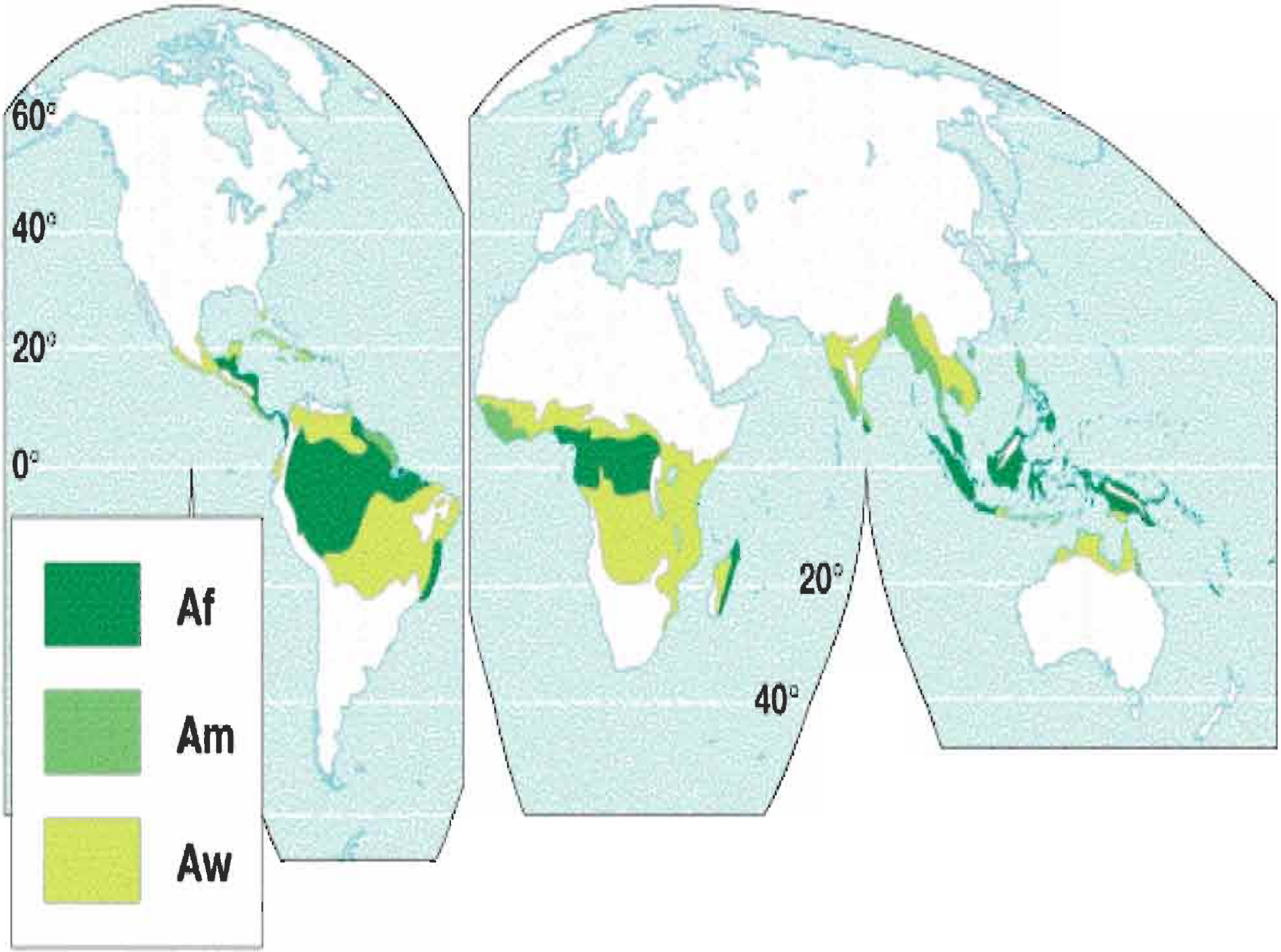
Tropical Monsoon Climate (Am)

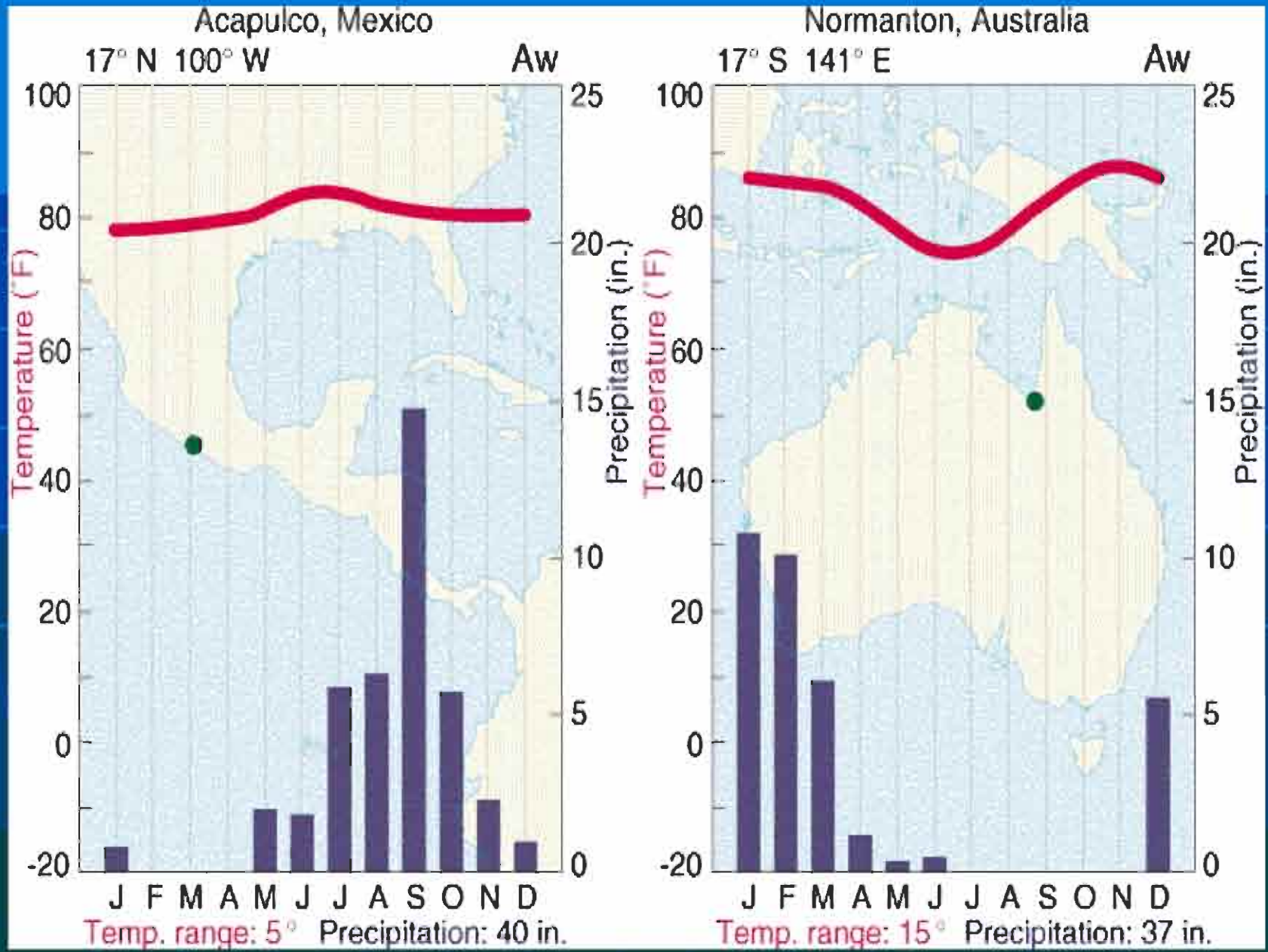

°C 40
35
30
25
20
100 °F
90
80
70
Dry season
Monsoon
Range 3.3°C (6°F)
23½°N
0°
23½ °S
Solstice
Equinox
Equinox
Solstice
Cm 70
60
50
40
30
20
10
0
24 in.
20
16
12
8
4
0
Annual total:
292 cm
(115 in.)
J F M A M J J A S O N D
cP Air mass
Cochin
Cochin
mE Air mass

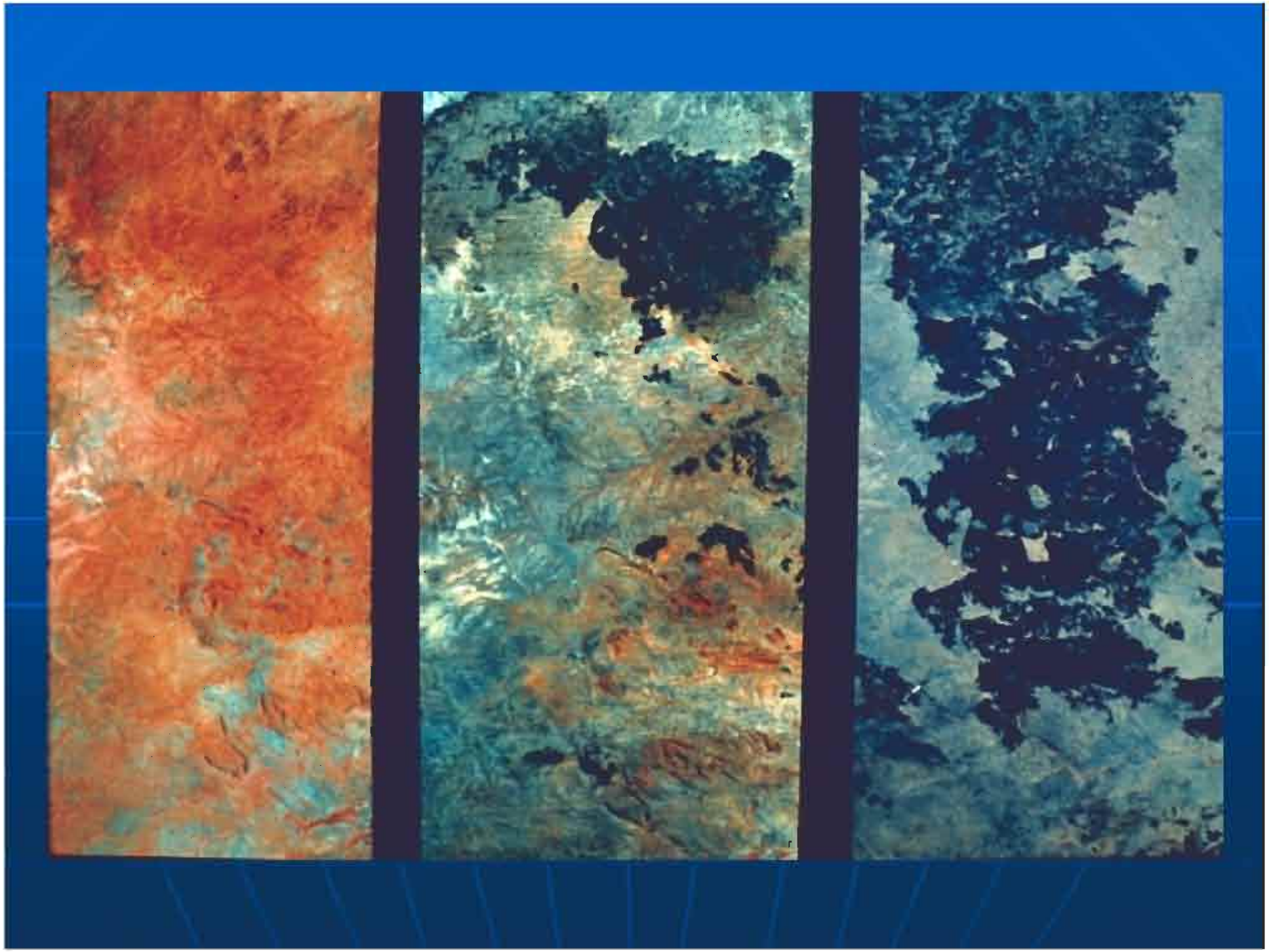
IG4e_07_11

Tropical Savanna Aw

Transition climate
Subtropical high, winter
Equatorial low, summer
Wet and dry, 30-50 inches
Oxisols and vertisols
Savanna
Low population, grazing, agriculture
Africa, No. Australia, Llanos, Campos
India, extensive


60°
40°
20°
0°
20°
40°
Af
Am
Aw


Acapulco, Mexico
17° N 100° W
Aw
Temperature (°F)
Precipitation (in.)
100
80
60
40
20
0
-20
25
20
15
10
5
0
J F M A M J J A S O N D
Temp. range: 5°
Precipitation: 40 in.
Normanton, Australia
17° S 141° E
Aw
Temperature (°F)
Precipitation (in.)
100
80
60
40
20
0
-20
25
20
15
10
5
0
J F M A M J J A S O N D
Temp. range: 15°
Precipitation: 37 in.



Mid Latitude C Climates

Humid subtropical Cfa

Mediterranean Csa (b)

Marine west coast Cfb

Humid Subtropical Cfa

Mid Lat, 25-40 degrees, extensive

Poleward side of marine subtropical high

Mild winter, hot summer

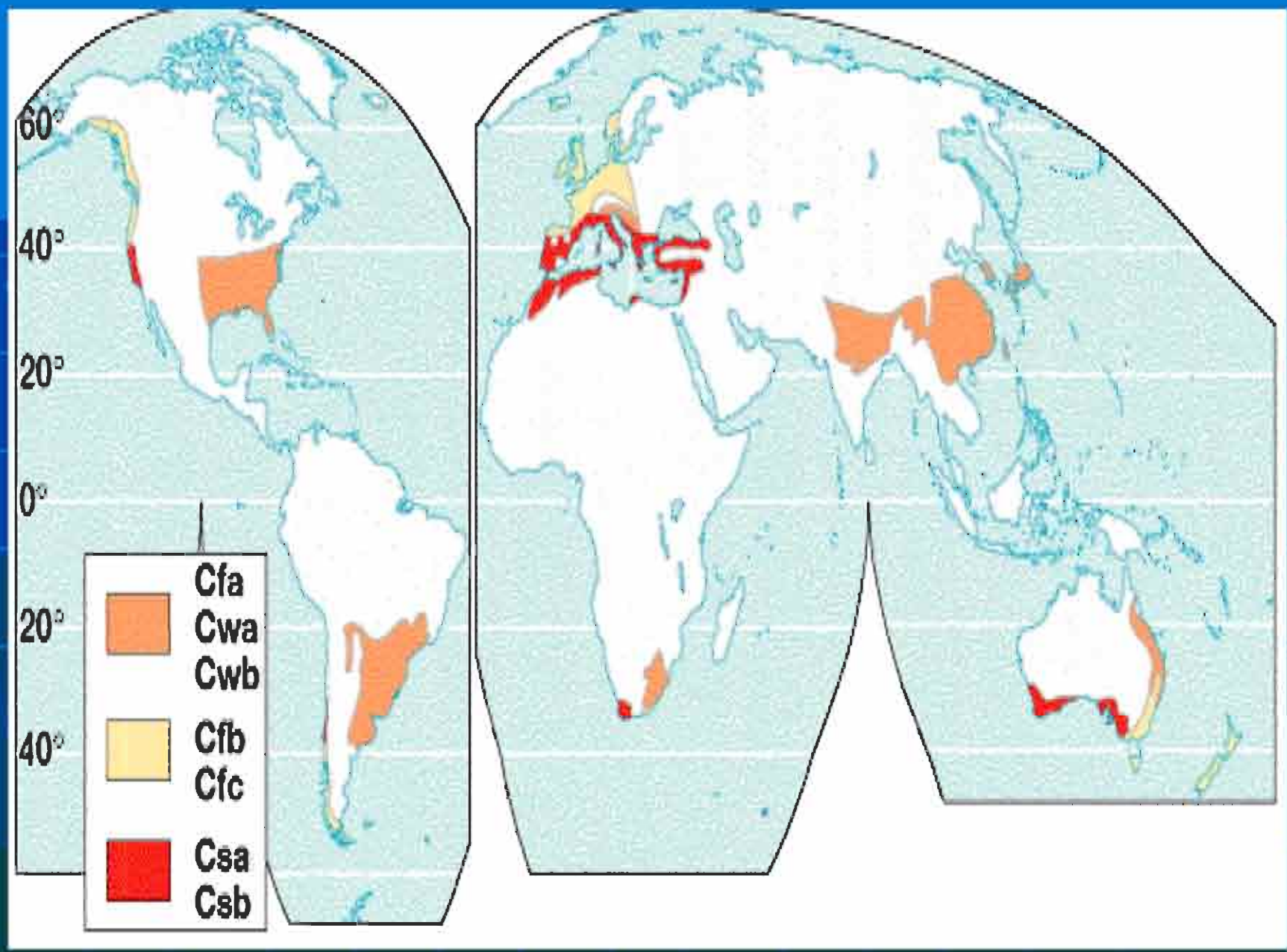
30-100 in, convective and cyclonic

Oxisols and alfisols

Mixed vegetation

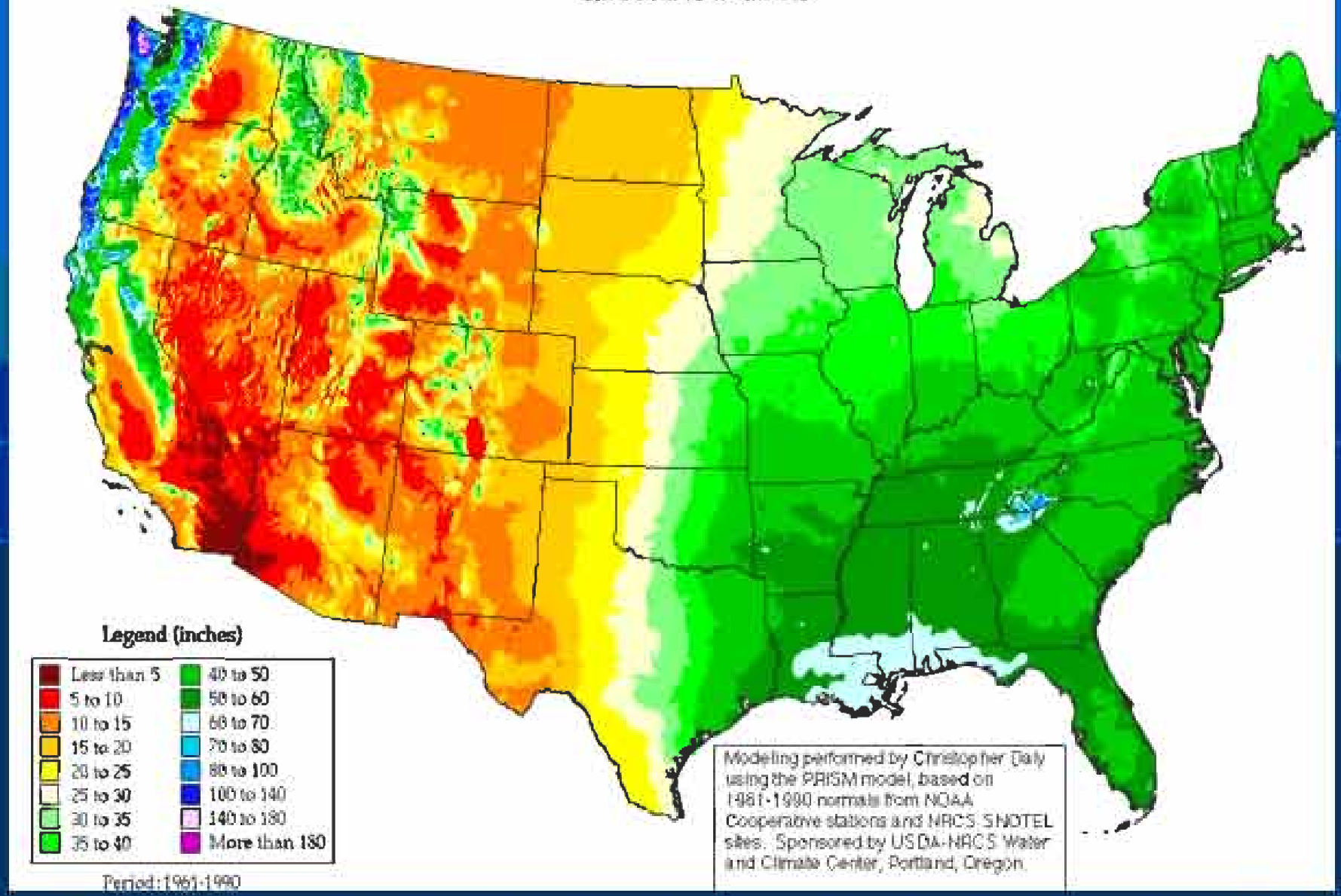
High pop, forestry, agriculture

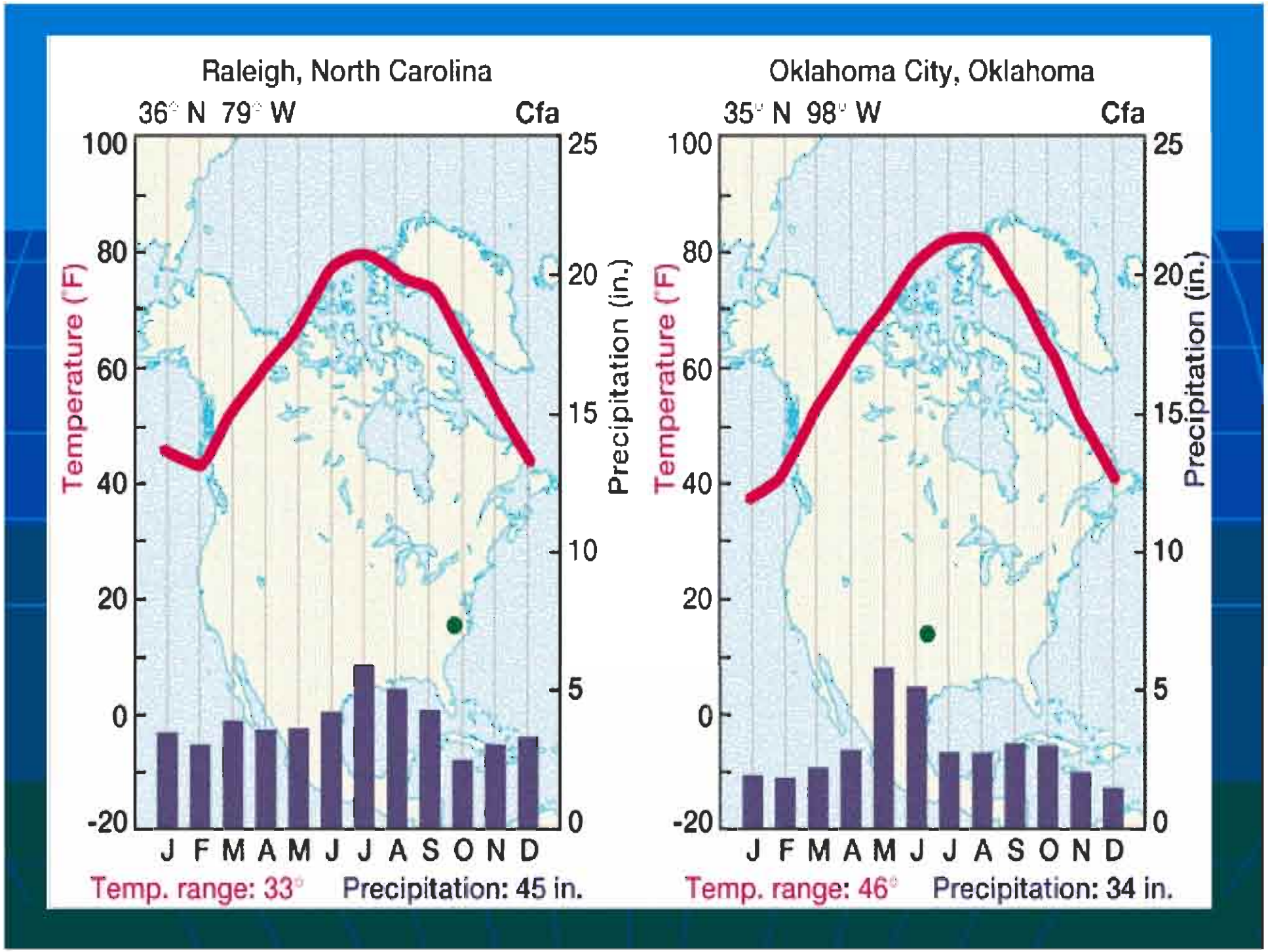
SEUS, Pampas, China, Japan, SE Australia


60°
40°
20°
0°
20°
40°
Cfa
Cwa
Cwb
Cfb
Cfc
Csa
Csb

Annual Average Precipitation

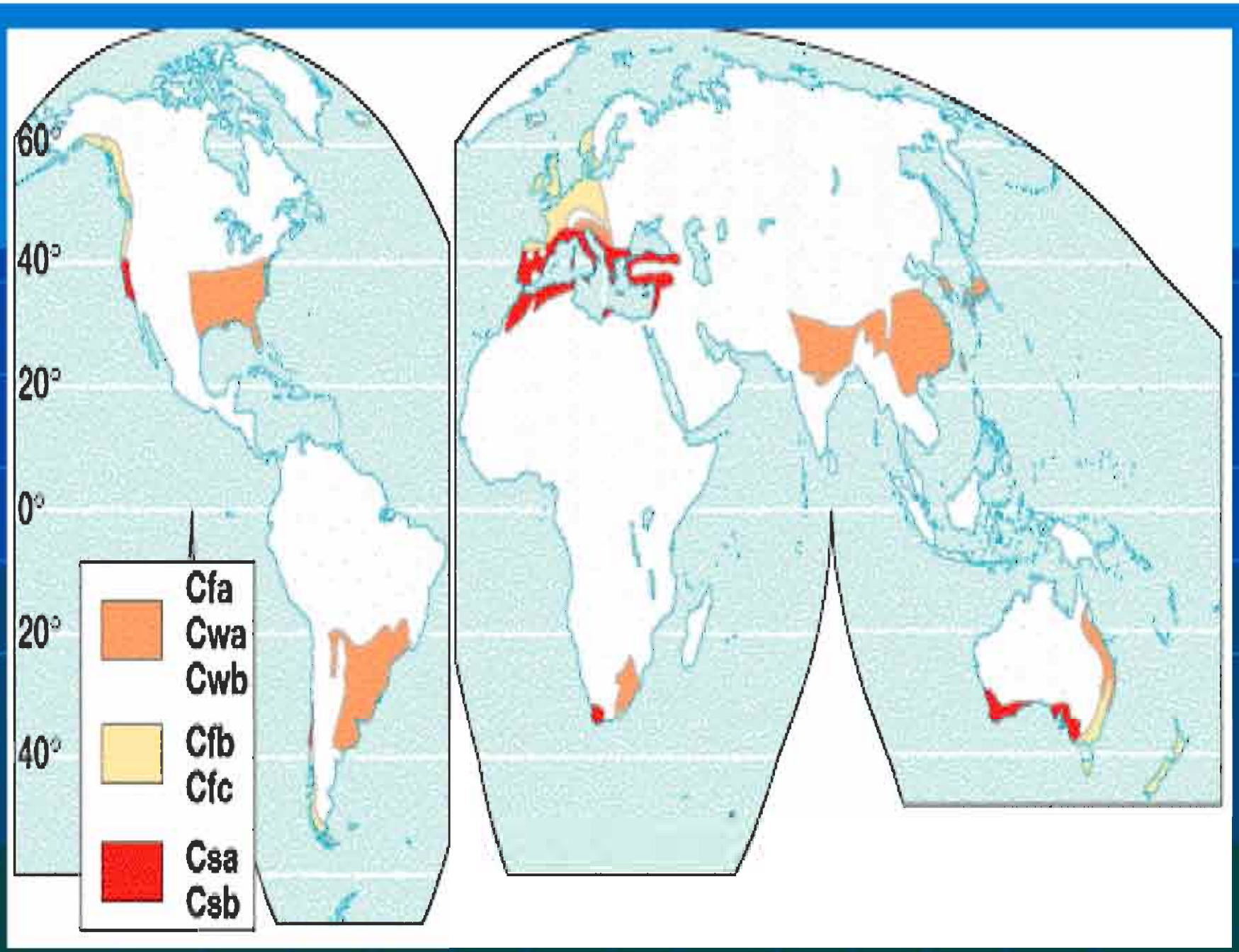
United States of America

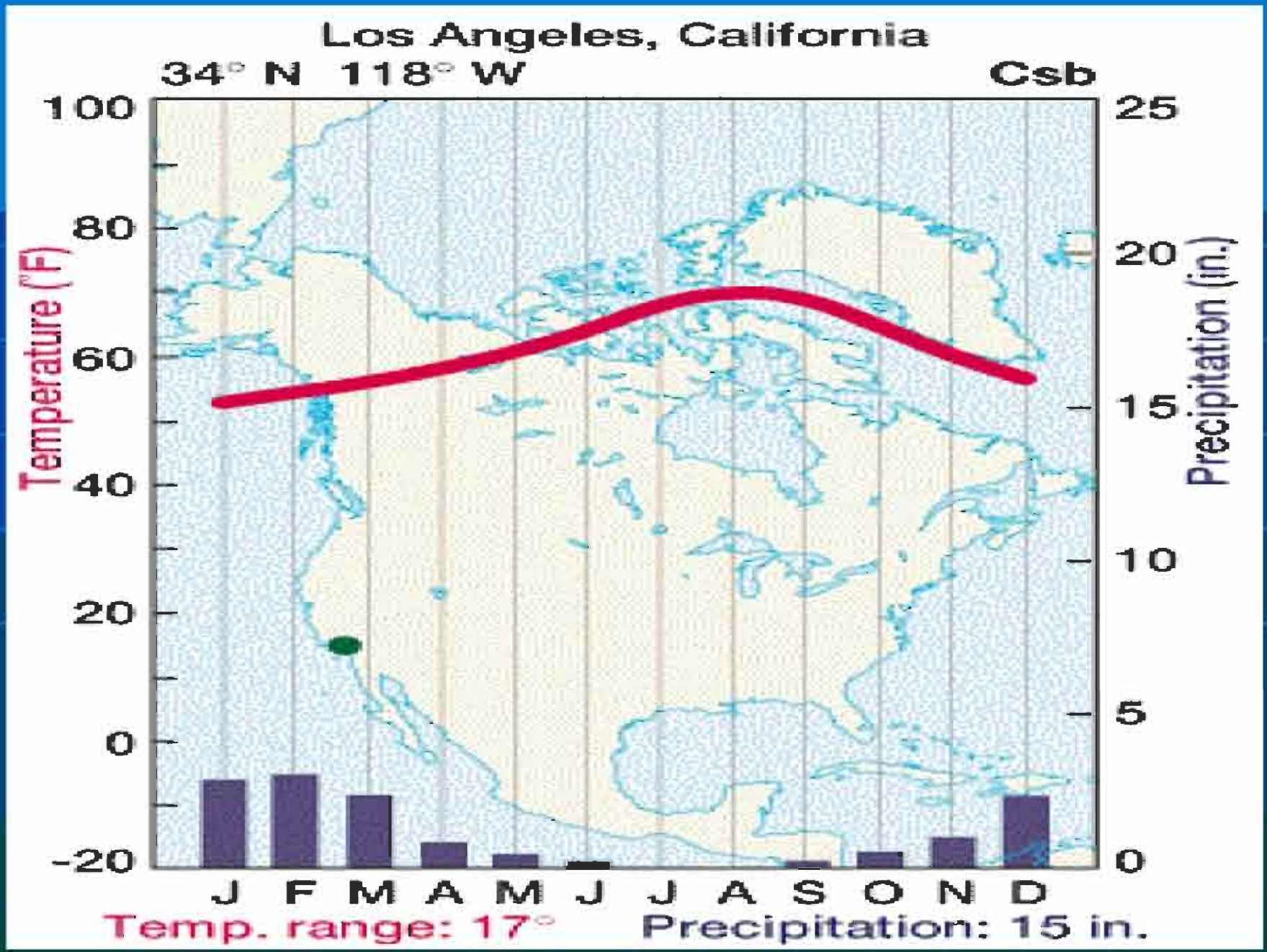


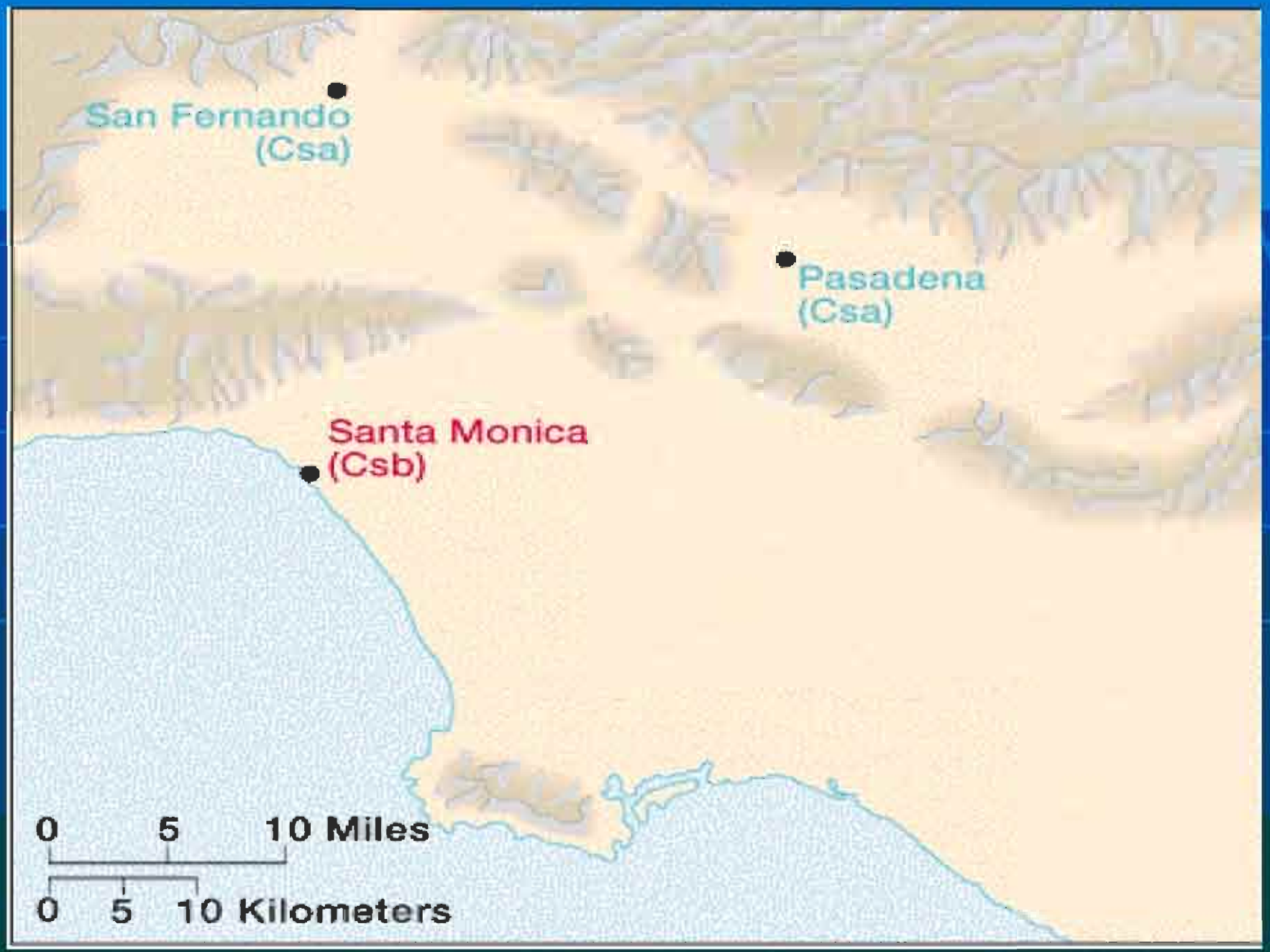

Raleigh, North Carolina
36° N 79° W
Cfa
Temperature (°F)
Precipitation (in.)
100
80
60
40
20
0
-20
25
20
15
10
5
0
J F M A M J J A S O N D
Temp. range: 33°
Precipitation: 45 in.
Oklahoma City, Oklahoma
35° N 98° W
Cfa
Temperature (°F)
Precipitation (in.)
J F M A M J J A S O N D
Temp. range: 46°
Precipitation: 34 in.

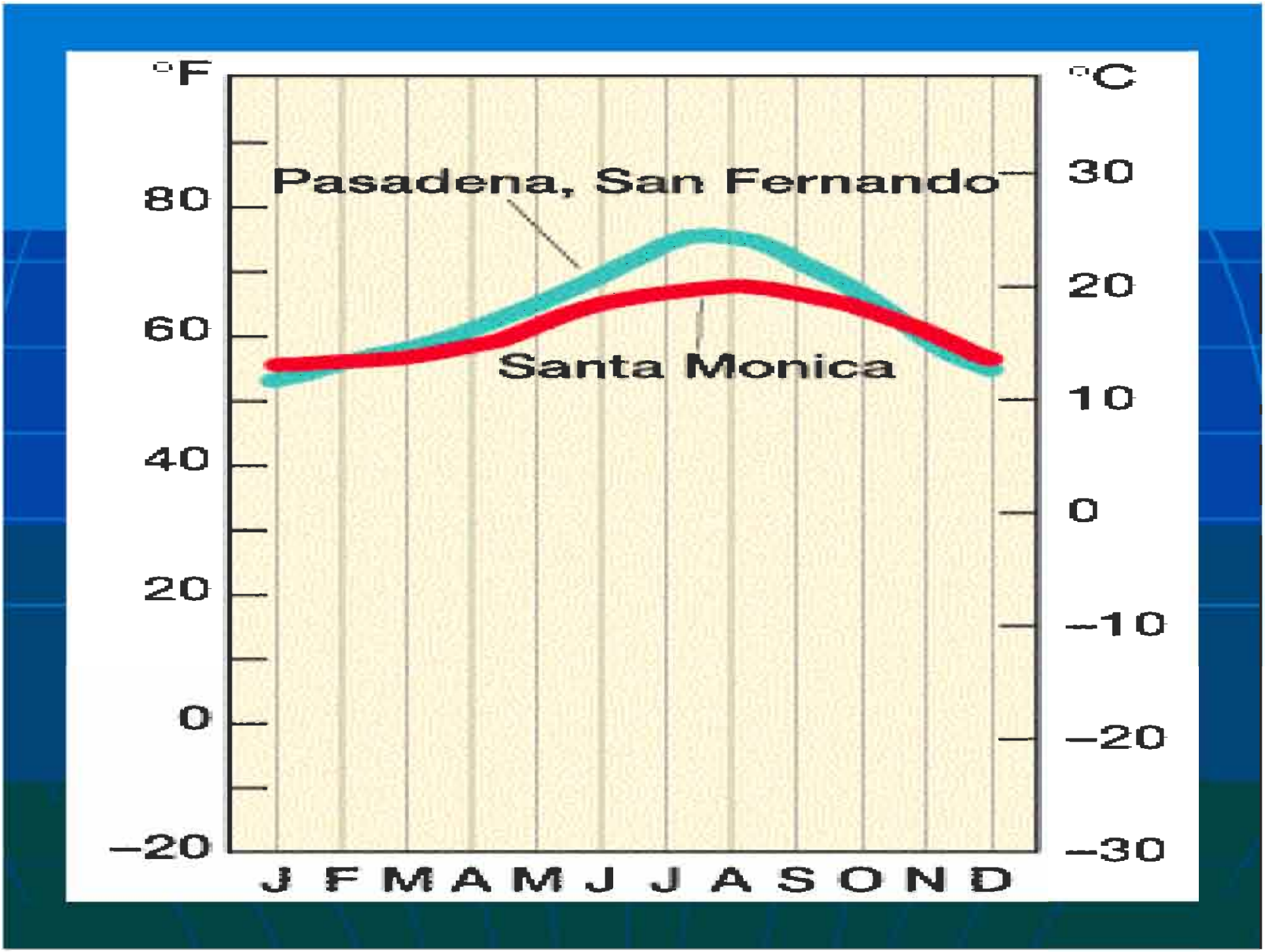
Mediterranean Csa (b)

Mid Lat, 30-40 degrees, limited
Equatorial side of marine subtropical high
  Westerlies, cool ocean current
Mild winter, warm summer
Seasonal (s), 15-30 inches
Oxisols and alfisols
Chapparal, schlerophylous
High pop, agriculture, tourism
West side of continents, California, Central Chile, Mediterranean Basin


60°
40°
20°
0°
20°
40°
Cfa
Cwa
Cwb
Cfb
Cfc
Csa
Csb

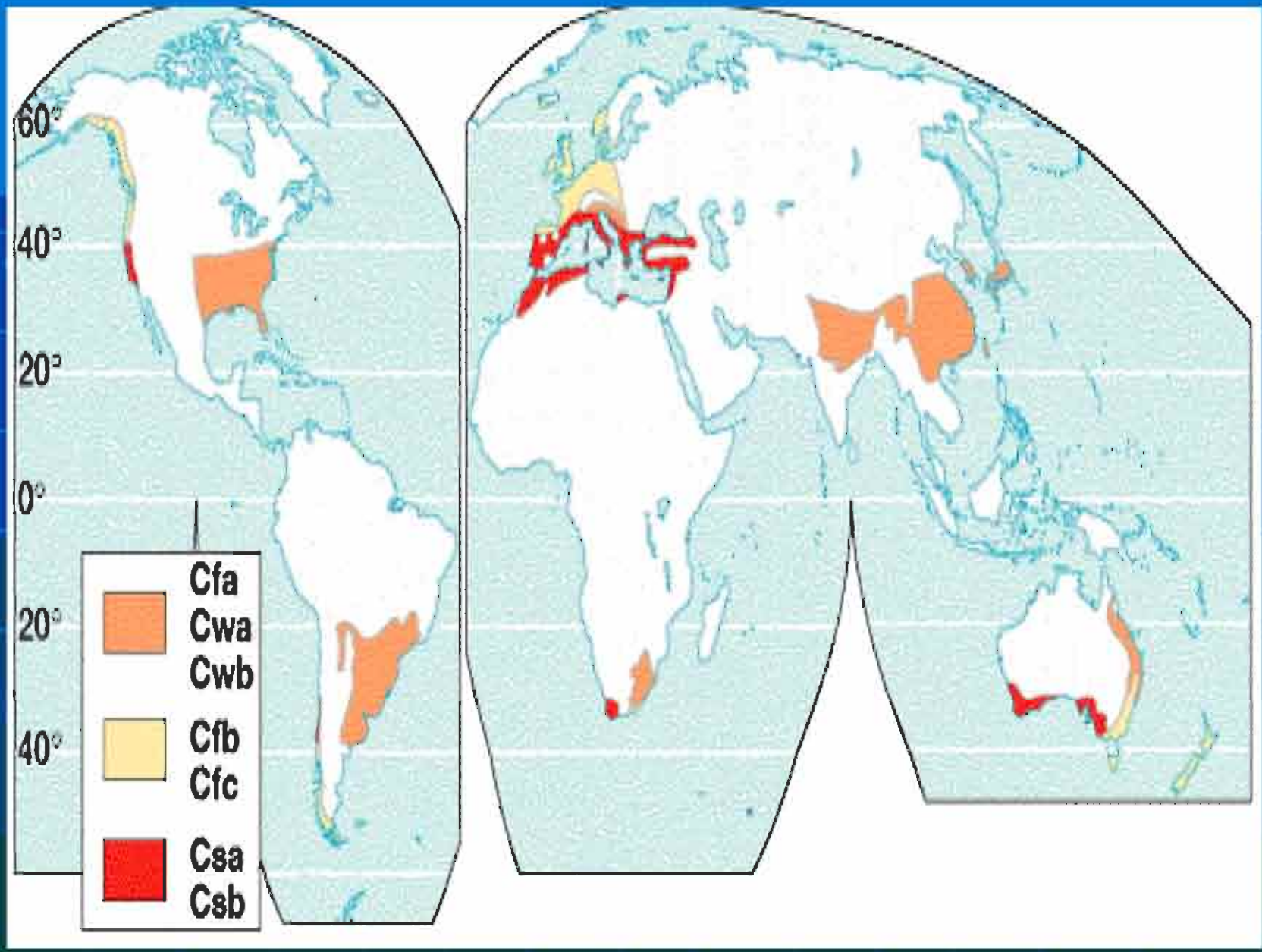

Los Angeles, California
34° N 118° W
Csb
100
80
60
40
20
0
-20
Temperature (°F)
25
20
15
10
5
0
Precipitation (in.)
J F M A M J J A S O N D
Temp. range: 17°
Precipitation: 15 in.

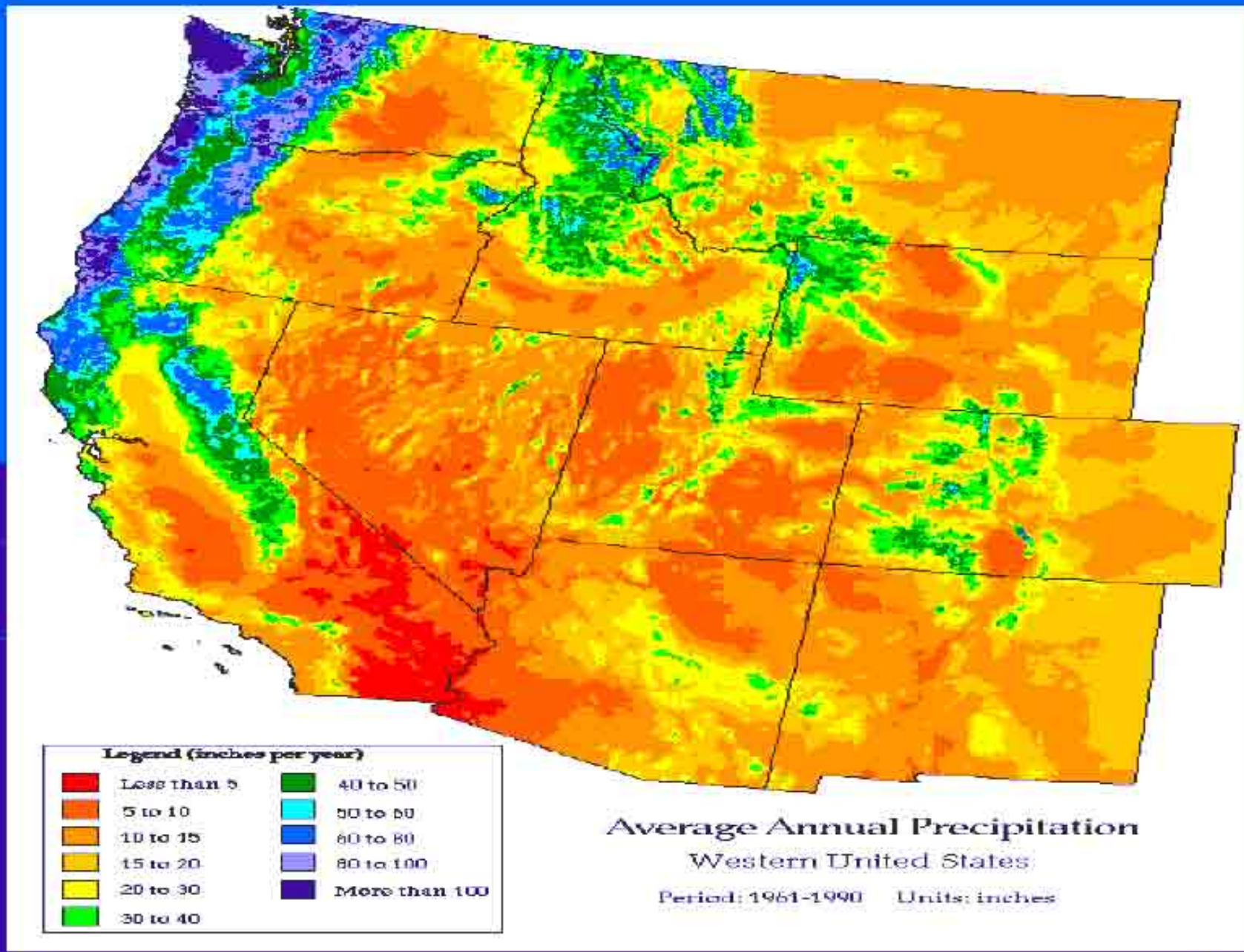

San Fernando
(Csa)
Pasadena
(Csa)
Santa Monica
(Csb)
0 5 10 Miles
0 5 10 Kilometers

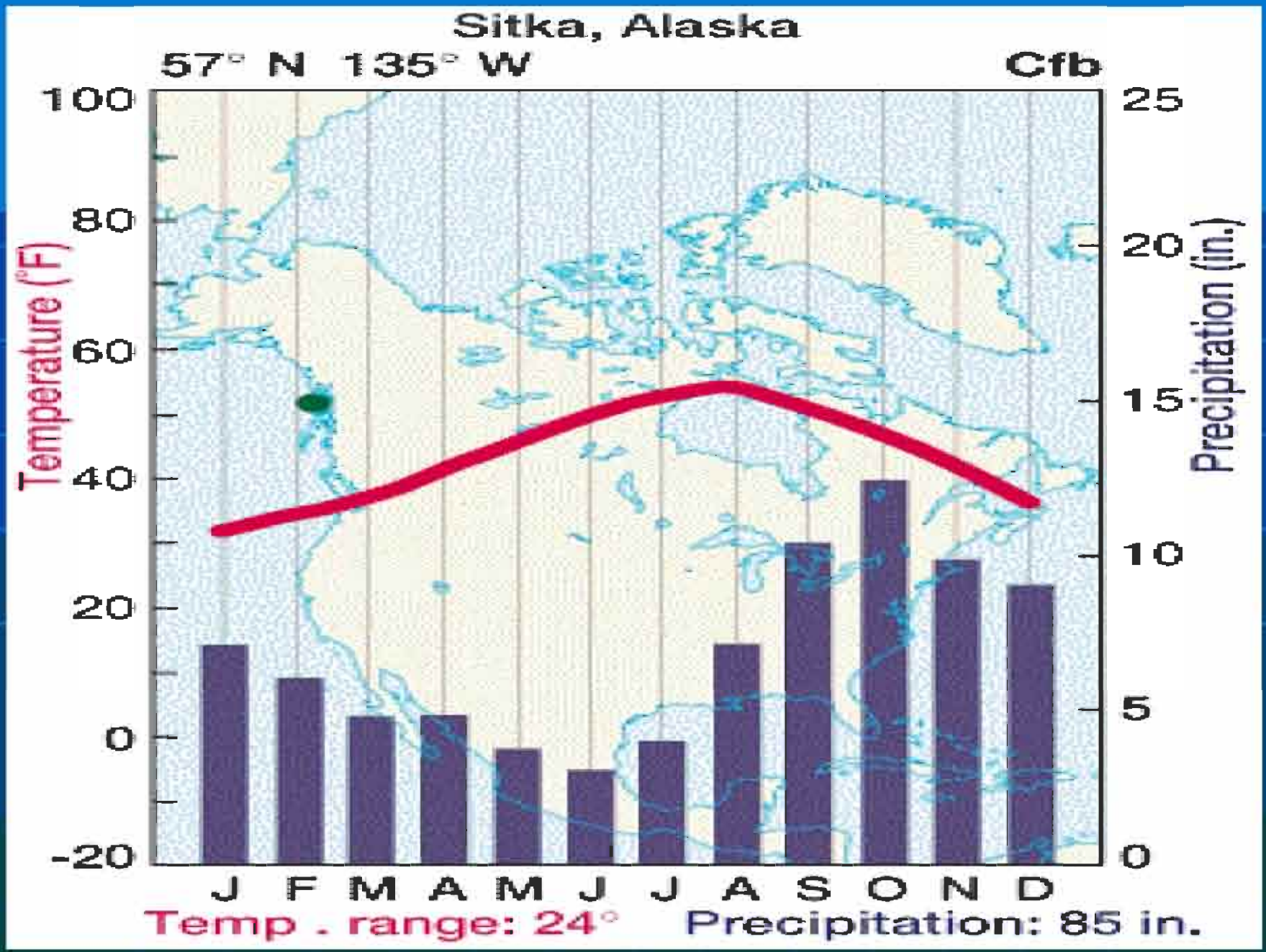

°F
°C
Pasadena, San Fernando
Santa Monica
80
60
40
20
0
−20
30
20
10
0
−10
−20
−30
J F M A M J J A S O N D

Marine West Coast Cfb

Mid Lat, 40-65 degrees, west side continents
Westerlies, warm ocean current
Mild winters and summers for latitude
20-35 in. Europe, 100-200 in NWUS, fog
Spodosols US, Alfisols Europe
Forests, Needleleaf US, Broadleaf Europe
Lumbering, agriculture
Poleward Csa, NWUS, Europe, So. Chile
So. Australia, New Zealand

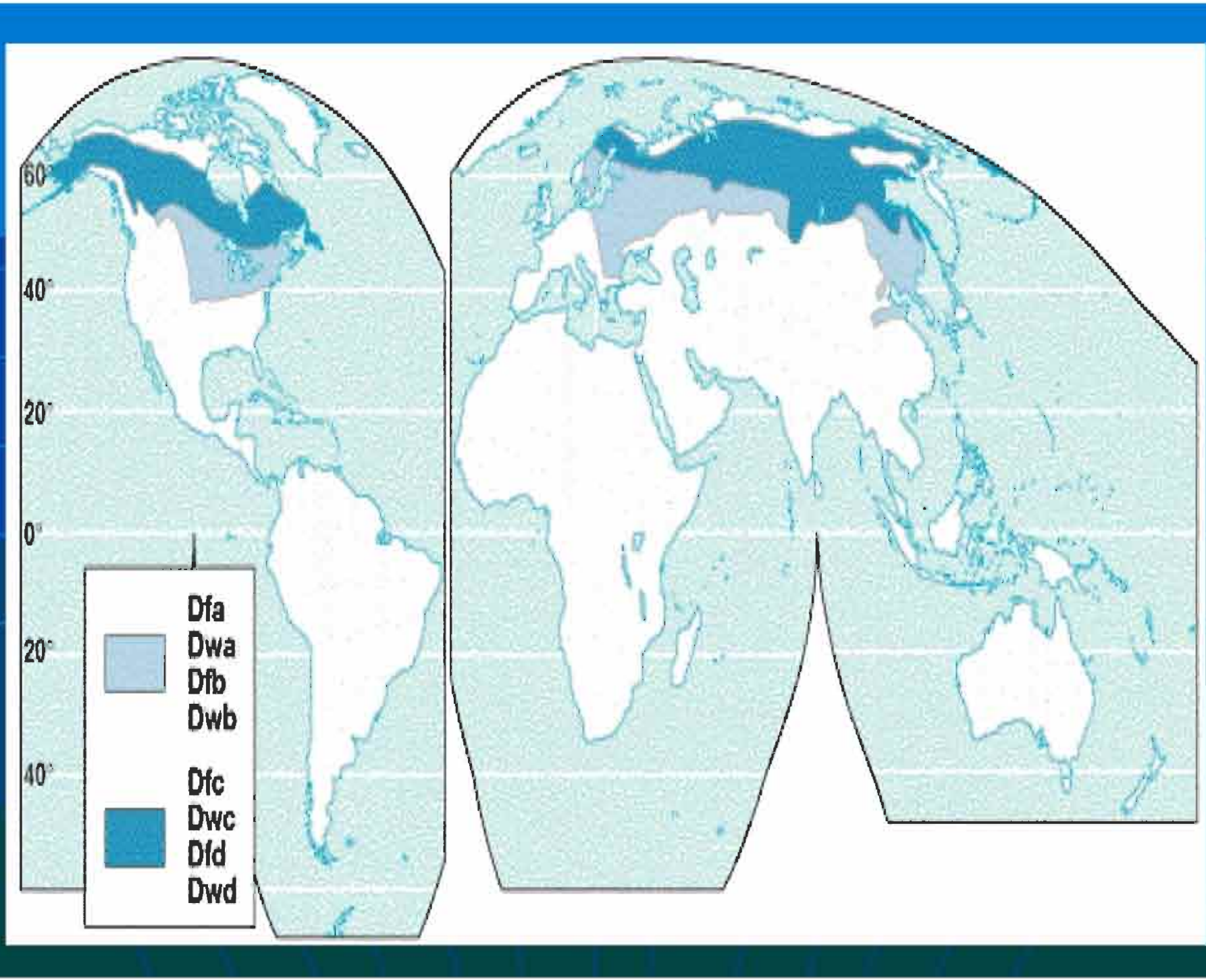

60°
40°
20°
0°
20°
40°
Cfa
Cwa
Cwb
Cfb
Cfc
Csa
Csb

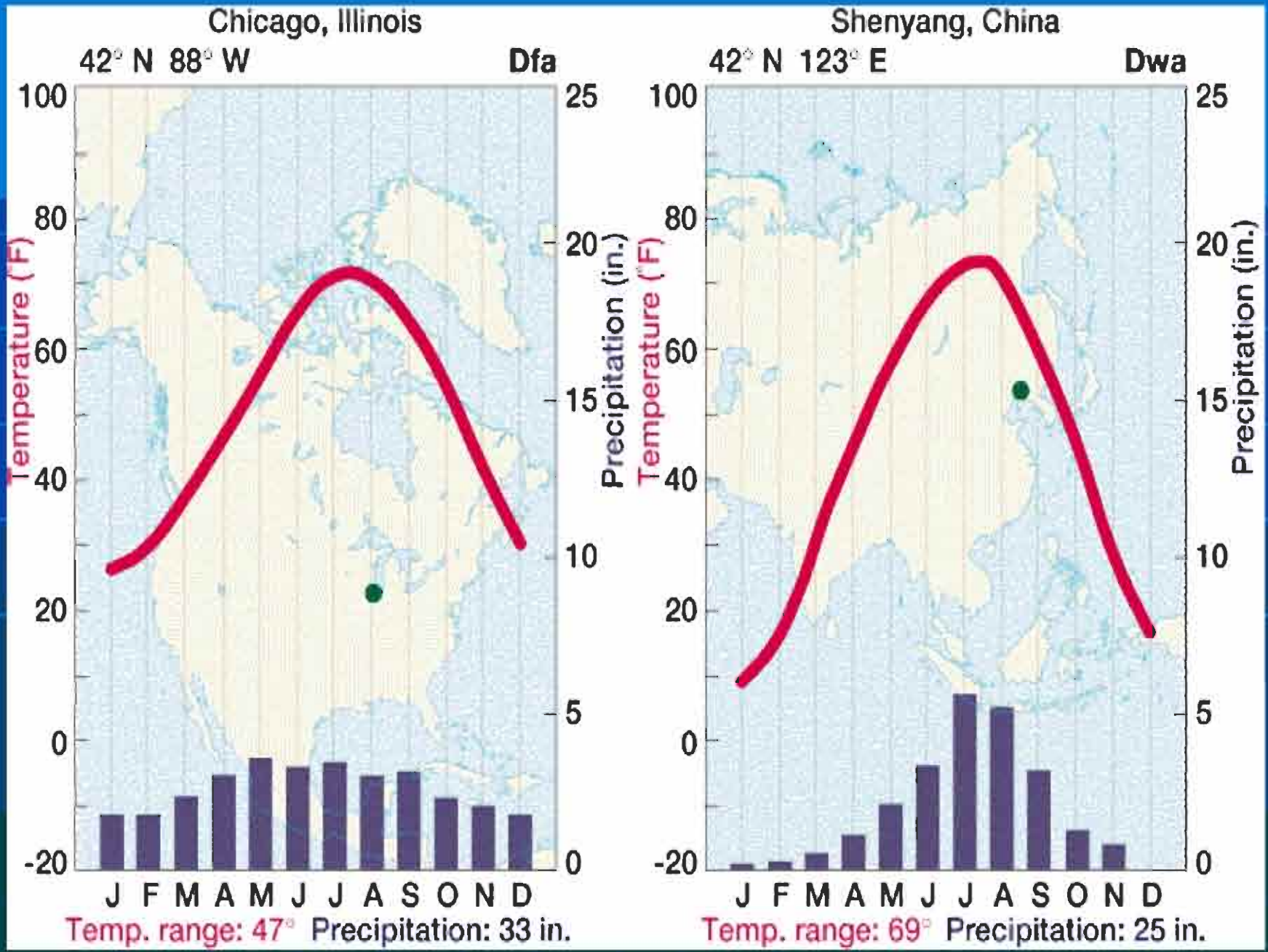

Legend (inches per year)
Less than 5
5 to 10
10 to 15
15 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 80
80 to 100
More than 100
Average Annual Precipitation
Western United States
Period: 1961-1990 Units: inches


Sitka, Alaska
57° N 135° W
Cfb
100
80
60
40
20
0
-20
Temperature (°F)
25
20
15
10
5
0
Precipitation (in.)
J F M A M J J A S O N D
Temp . range: 24°
Precipitation: 85 in.

Humid Continental Dfa (b)

High middle latitude, land controlled
Severe winters, hot summer days
25-35 inches, f, convective and cyclonic
Broadleaf deciduous forest
Alfisols
High population, agriculture, forestry
industrial
No. Hemisphere, Great lakes, Russia


60°
40°
20°
0°
20°
40°
Dfa
Dwa
Dfb
Dwb
Dfc
Dwc
Dfd
Dwd


Chicago, Illinois
42° N 88° W
Dfa
Temperature (°F)
Precipitation (in.)
100
80
60
40
20
0
-20
25
20
15
10
5
0
J F M A M J J A S O N D
Temp. range: 47°
Precipitation: 33 in.
Shenyang, China
42° N 123° E
Dwa
Temperature (°F)
Precipitation (in.)
J F M A M J J A S O N D
Temp. range: 69°
Precipitation: 25 in.

Subarctic Dfc (d)

High latitude, polar air mass, continental

Severe winter, hot summer days, greatest annual range >100 degrees

15-25 in, f, cyclonic, effective

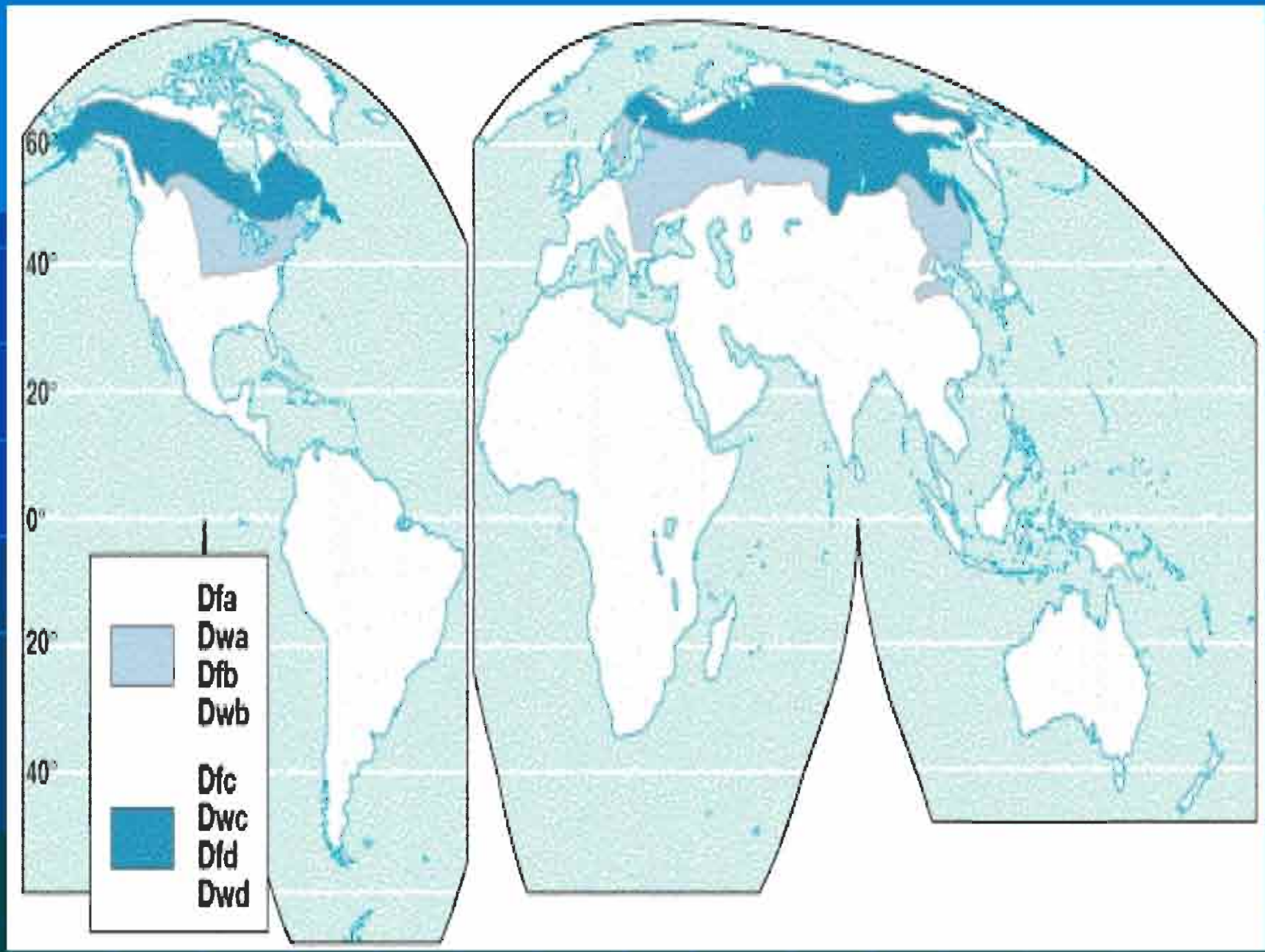
Needleleaf evergreen forest

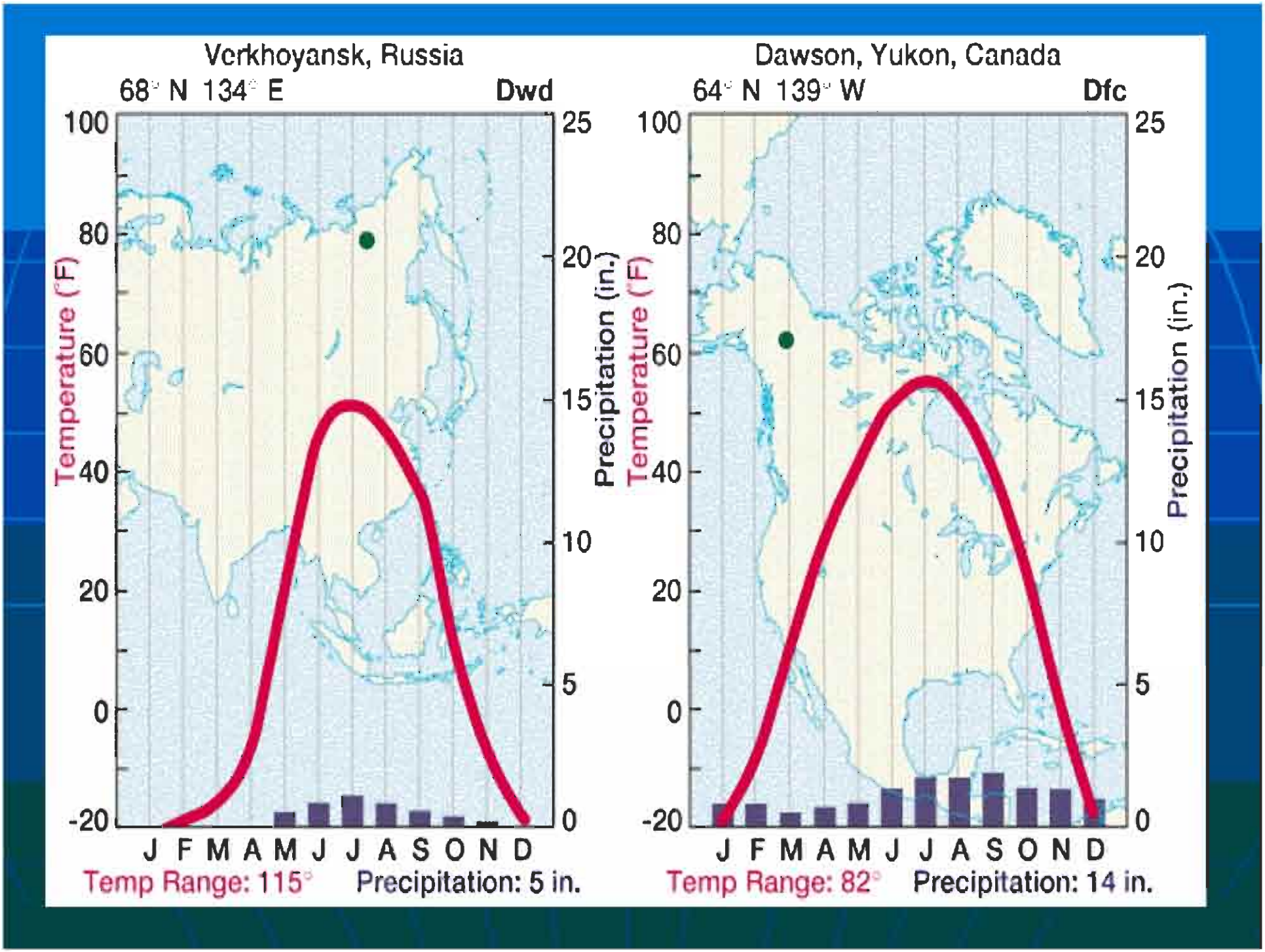
Spodosols, podsolization

inceptisols on permafrost

Low pop, hunting, fishing, lumber, mines

No. Hemi, Canada, No. Eurasia


60°
40°
20°
0°
20°
40°
Dfa
Dwa
Dfb
Dwb
Dfc
Dwc
Dfd
Dwd


Verkhoyansk, Russia
68° N 134° E
Dwd
Temperature (°F)
Precipitation (in.)
100
80
60
40
20
0
-20
25
20
15
10
5
0
J F M A M J J A S O N D
Temp Range: 115°
Precipitation: 5 in.
Dawson, Yukon, Canada
64° N 139° W
Dfc
Temperature (°F)
Precipitation (in.)
J F M A M J J A S O N D
Temp Range: 82°
Precipitation: 14 in.

Tundra ET

High latitude, polar air masses

Cold winter, short summer, near ocean

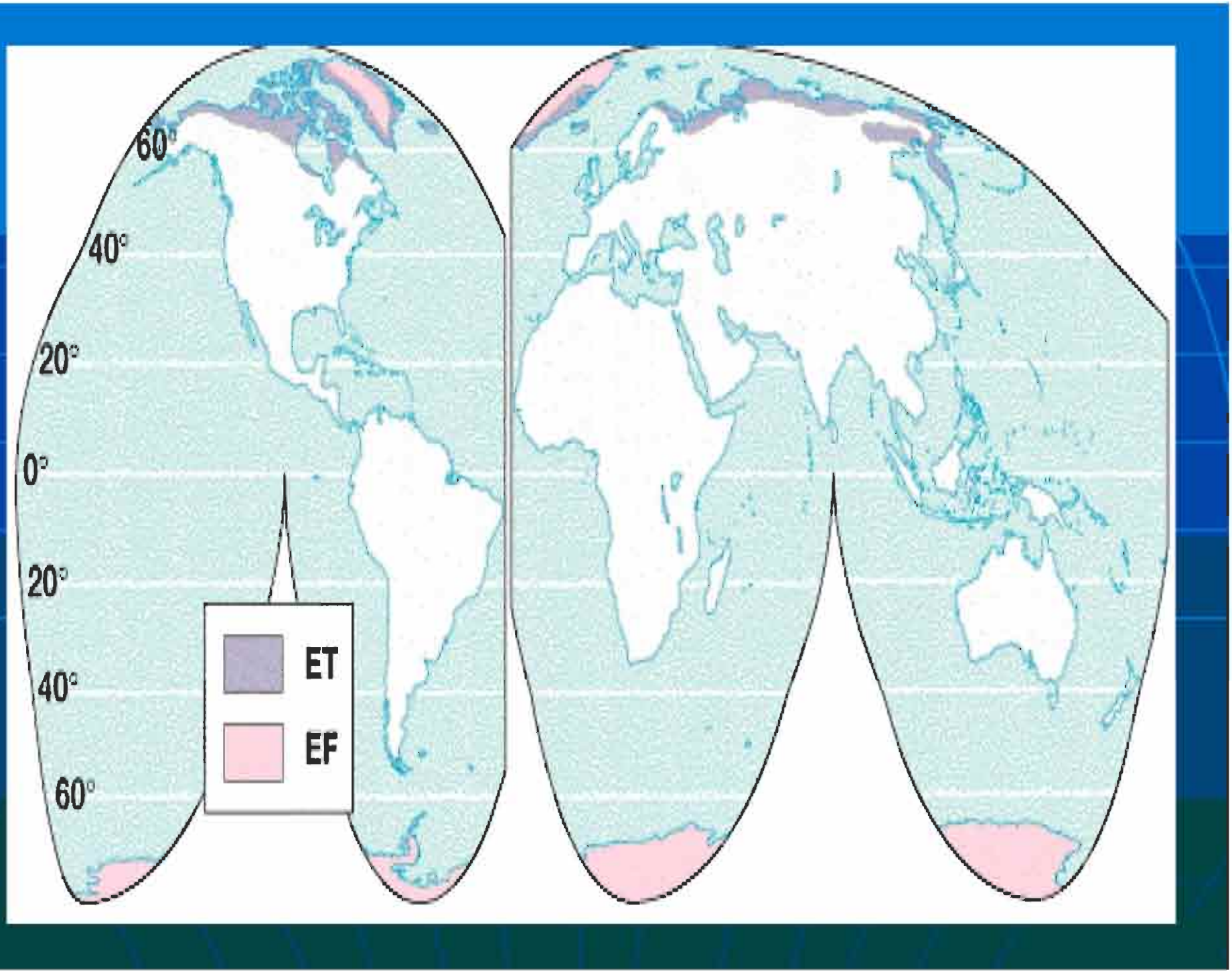
10-12 in, cyclonic, summer

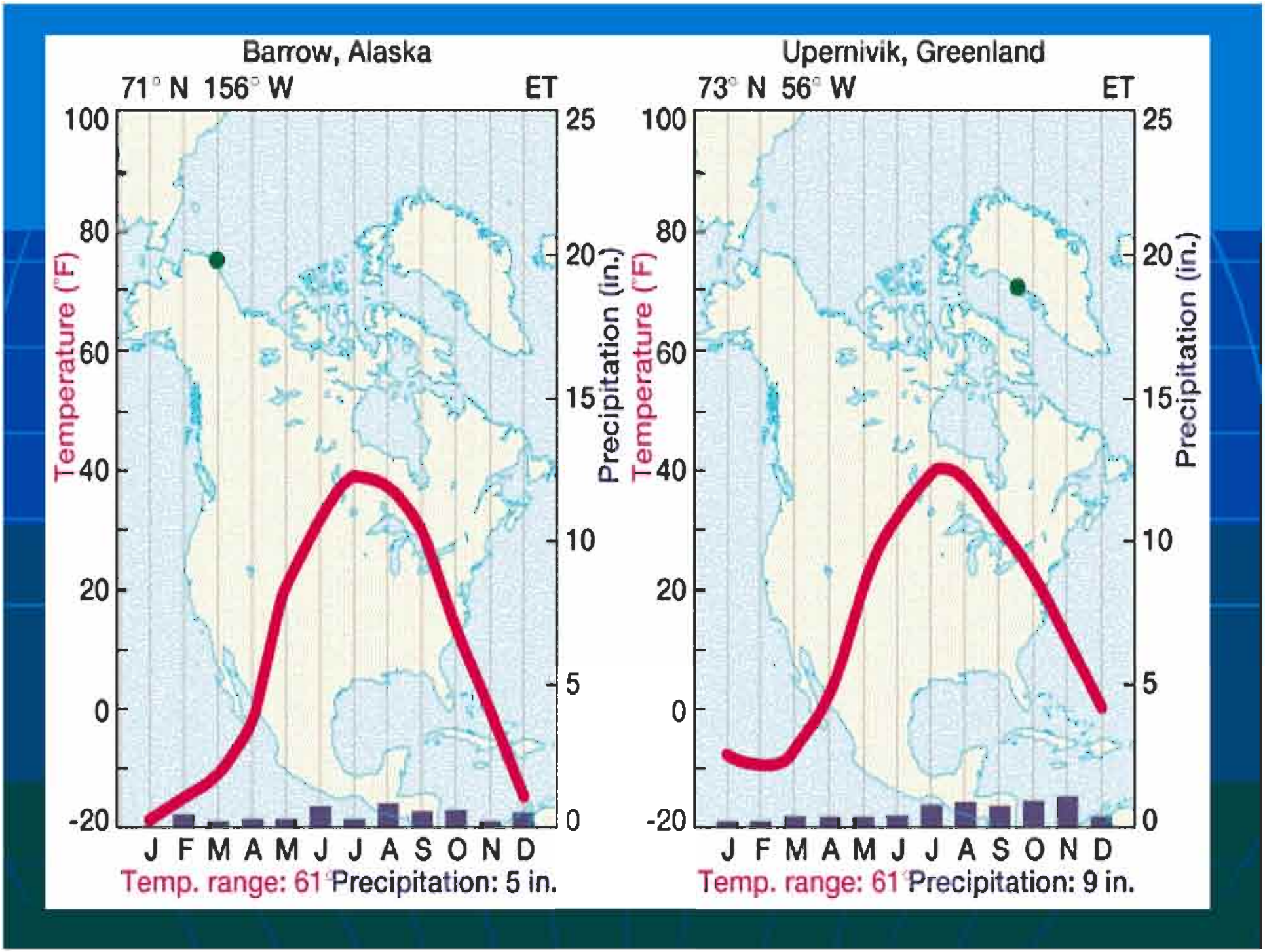
Tundra vegetation

Inceptisols, permafrost, gleization

Low pop. Eskimos, Inuit, mining

No. Canada, No. Eurasia, Antarctic fringe


60°
40°
20°
0°
20°
40°
60°
ET
EF


Barrow, Alaska
71° N 156° W
ET
Temperature (°F)
Precipitation (in.)
100
80
60
40
20
0
-20
25
20
15
10
5
0
J F M A M J J A S O N D
Temp. range: 61°
Precipitation: 5 in.
Upernivik, Greenland
73° N 56° W
ET
Temperature (°F)
Precipitation (in.)
J F M A M J J A S O N D
Temp. range: 61°
Precipitation: 9 in.

Icecap EF

High latitude, polar air mass

Cold, all mean mo temp <32 degrees

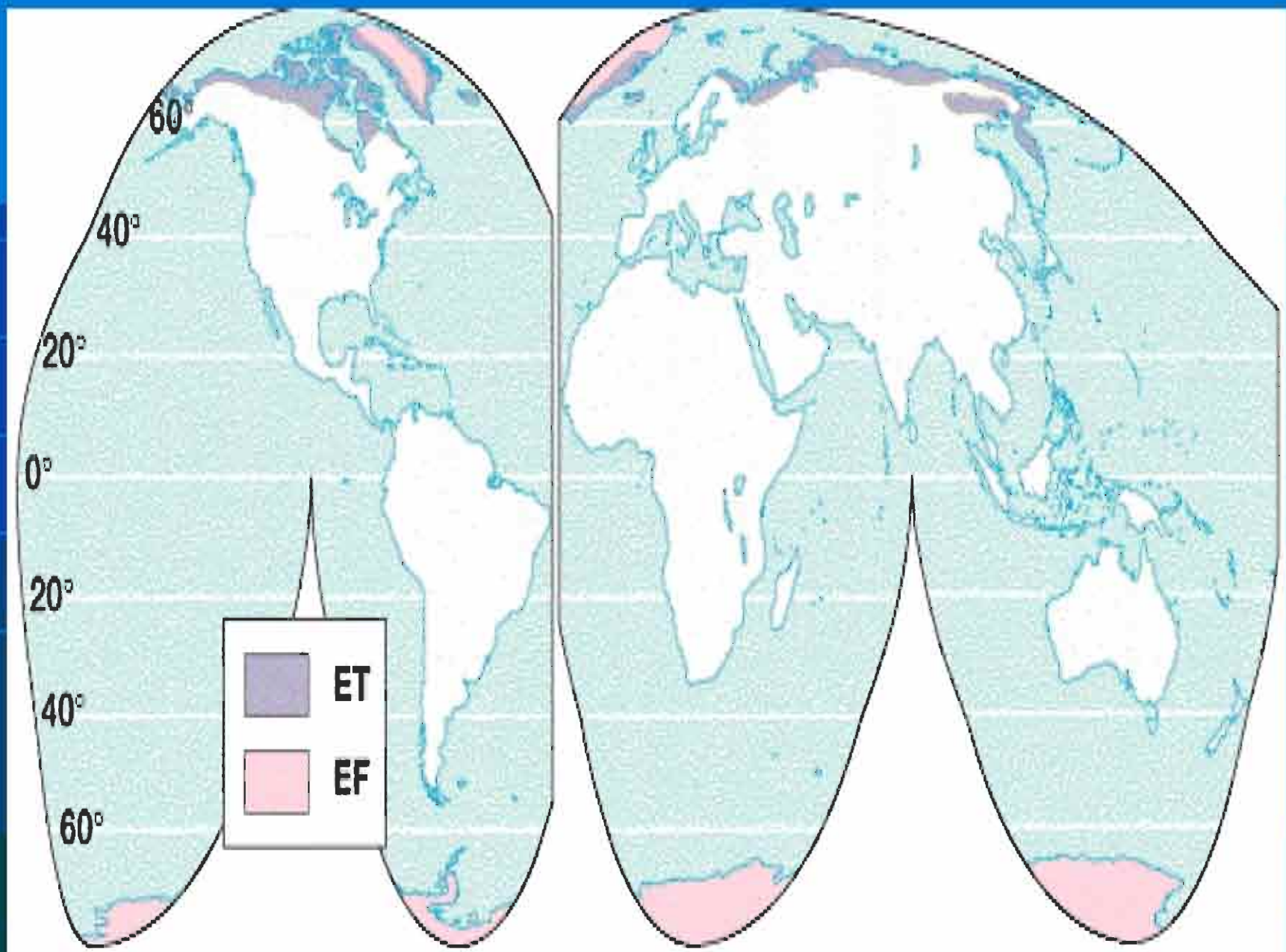
Low percipitation, snow

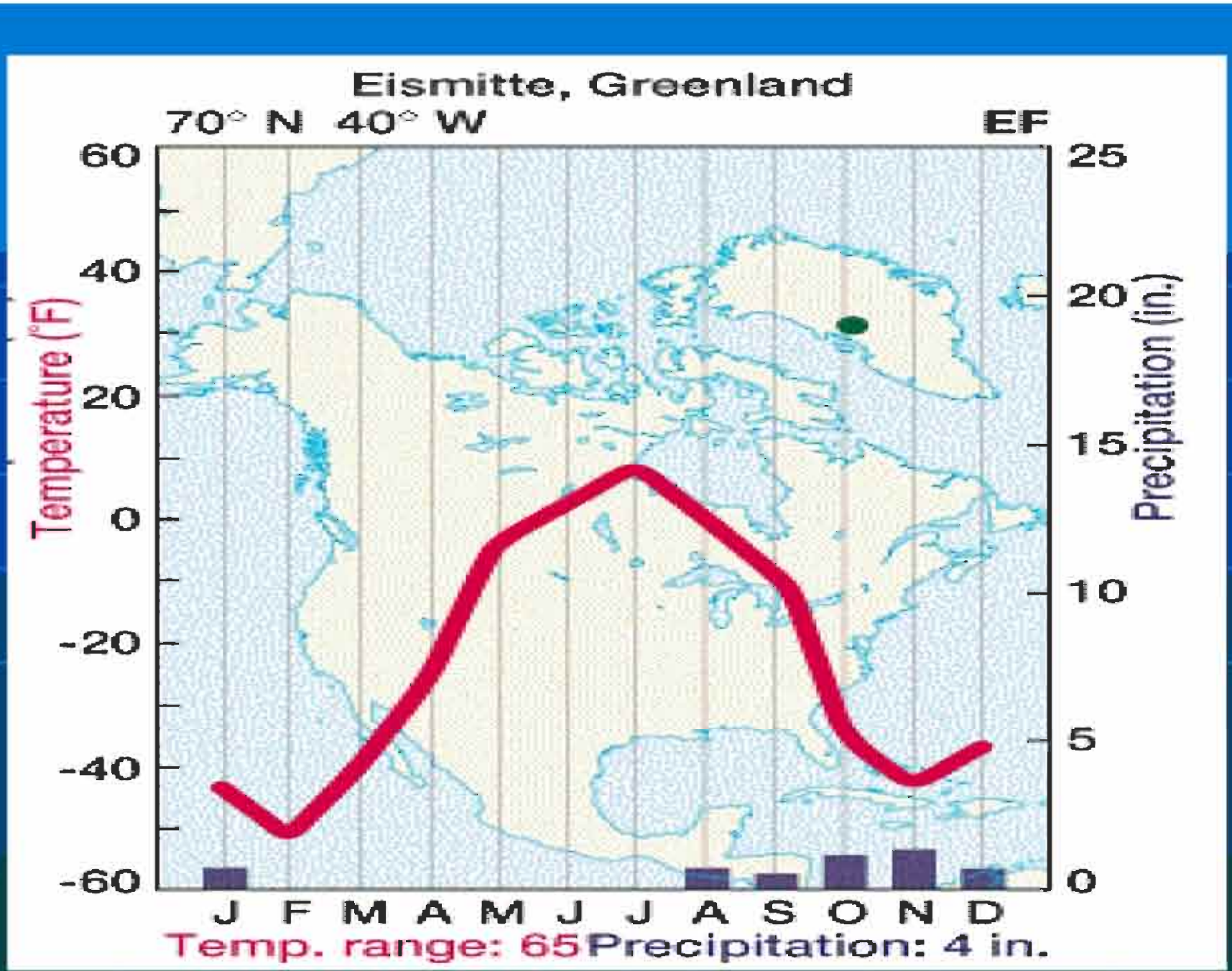
No soil

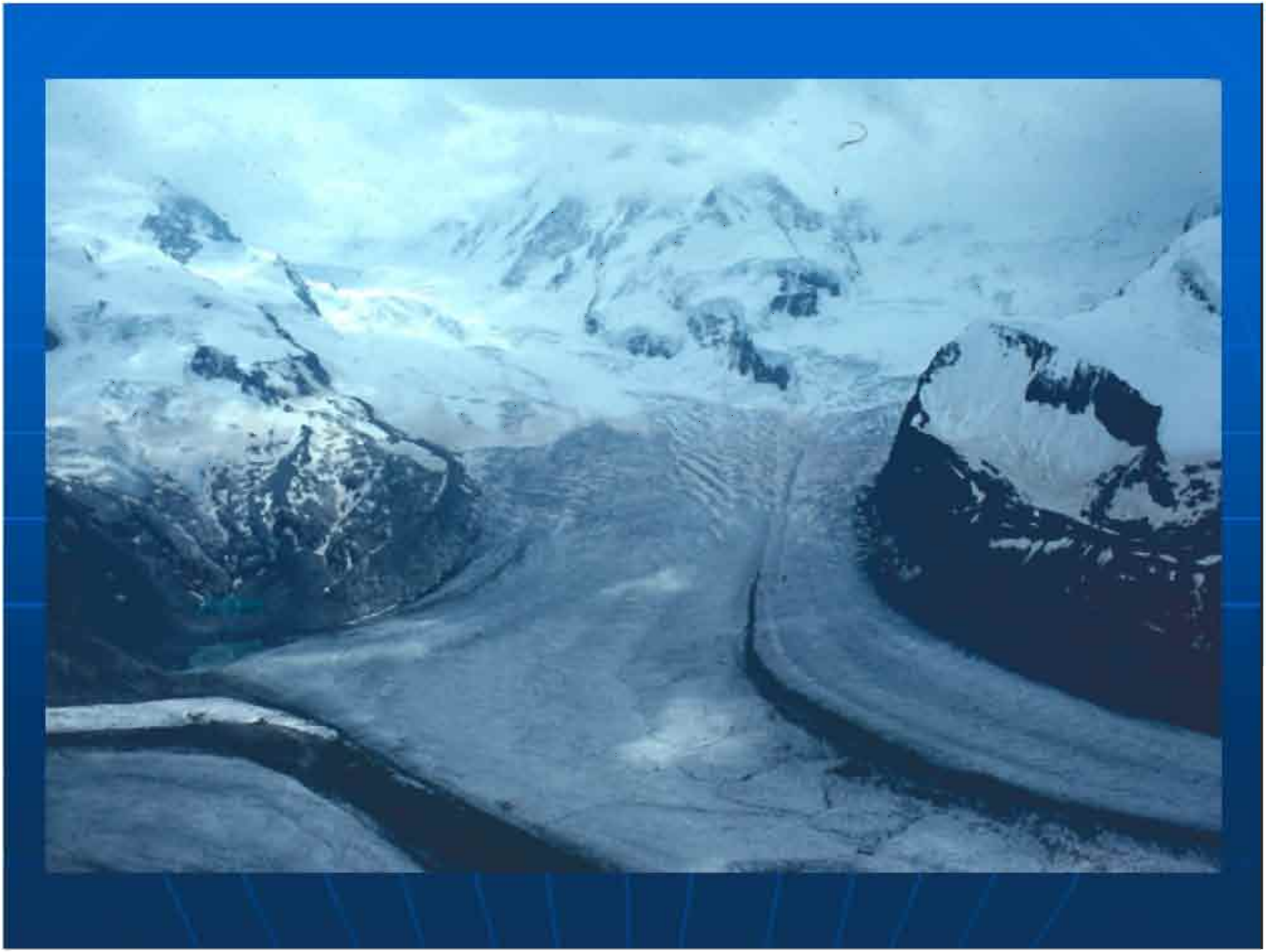
No veg

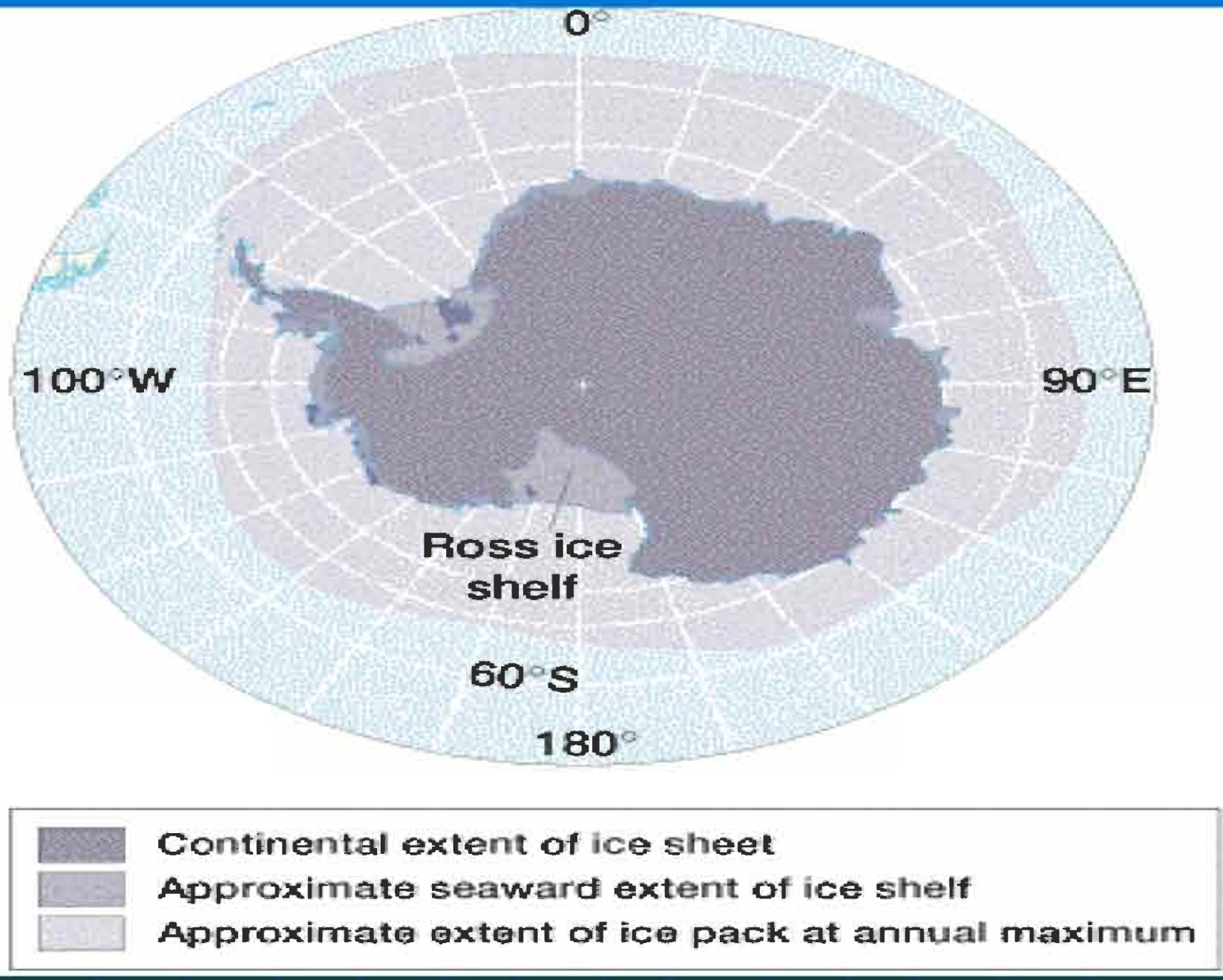
No utilization, exploration

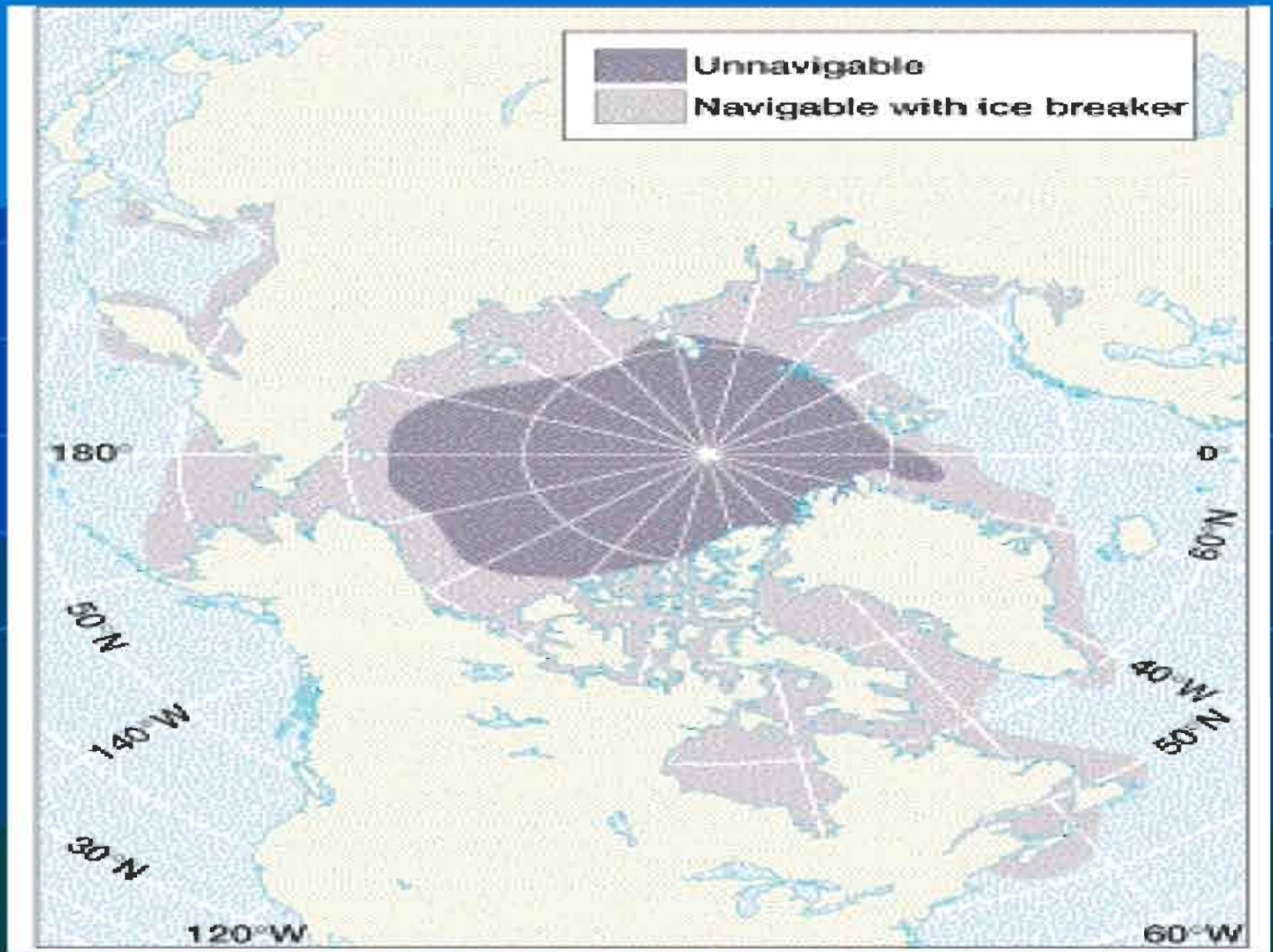
Greenland, interior Antarctica


60°
40°
20°
0°
20°
40°
60°
ET
EF


Eismitte, Greenland
70° N 40° W
EF
60
40
20
0
-20
-40
-60
Temperature (°F)
25
20
15
10
5
0
Precipitation (in.)
J F M A M J J A S O N D
Temp. range: 65
Precipitation: 4 in.




0°
100°W
90°E
Ross ice shelf
60°S
180°
Continental extent of ice sheet
Approximate seaward extent of ice shelf
Approximate extent of ice pack at annual maximum

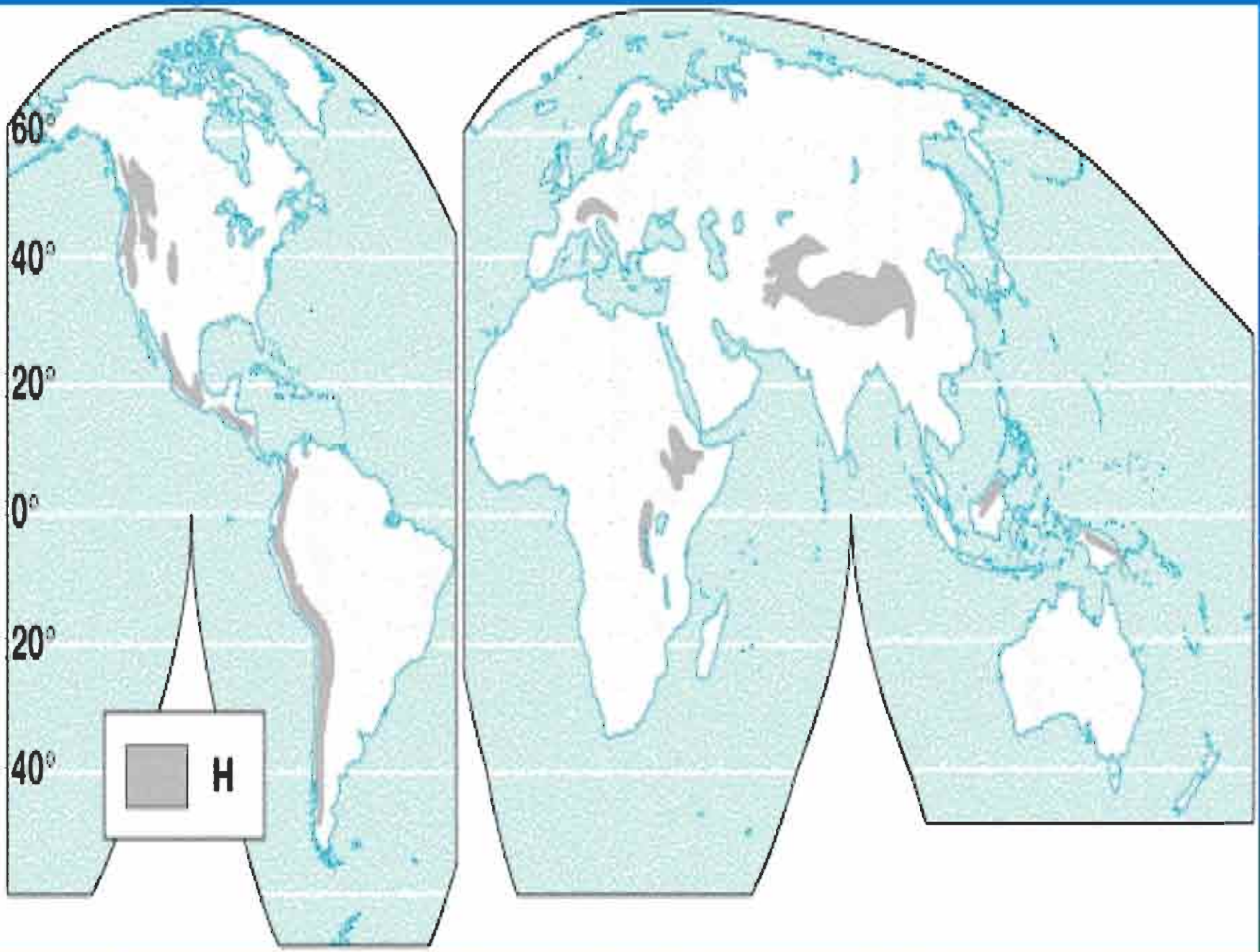

Unnavigable
Navigable with ice breaker
180°
0
60°W
40°W
60°N
120°W
60°W
60°N
140°W
30°N

Highland H

Same as ET or EF

Elevated

Major mountain areas, Rockies, Andes, Alps, Tibetian plateau


60°
40°
20°
0°
20°
40°
H

Steppe BSh (k)

Transition climate

Varied temp, function of latitude

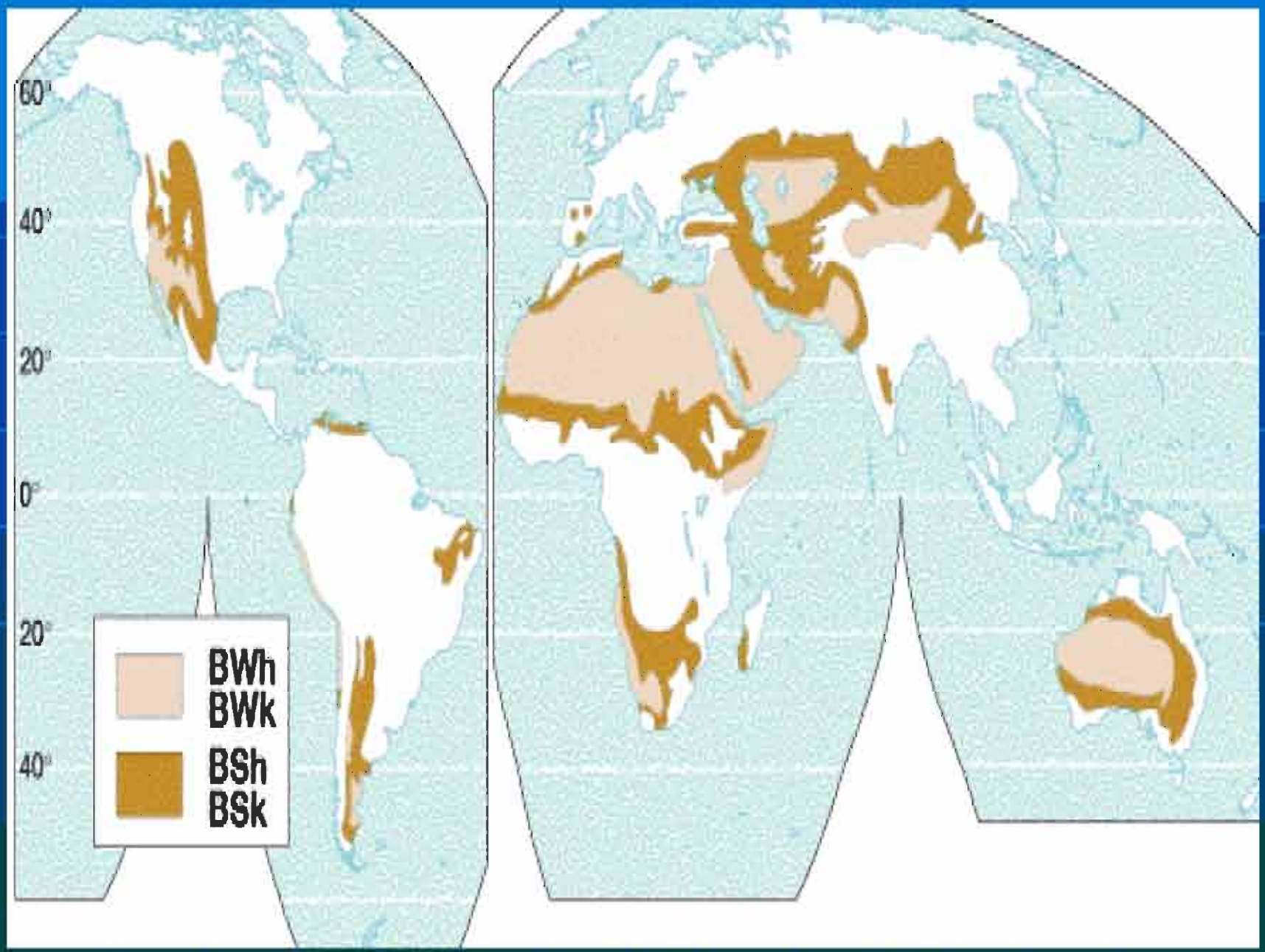
Under 20 inches, erratic

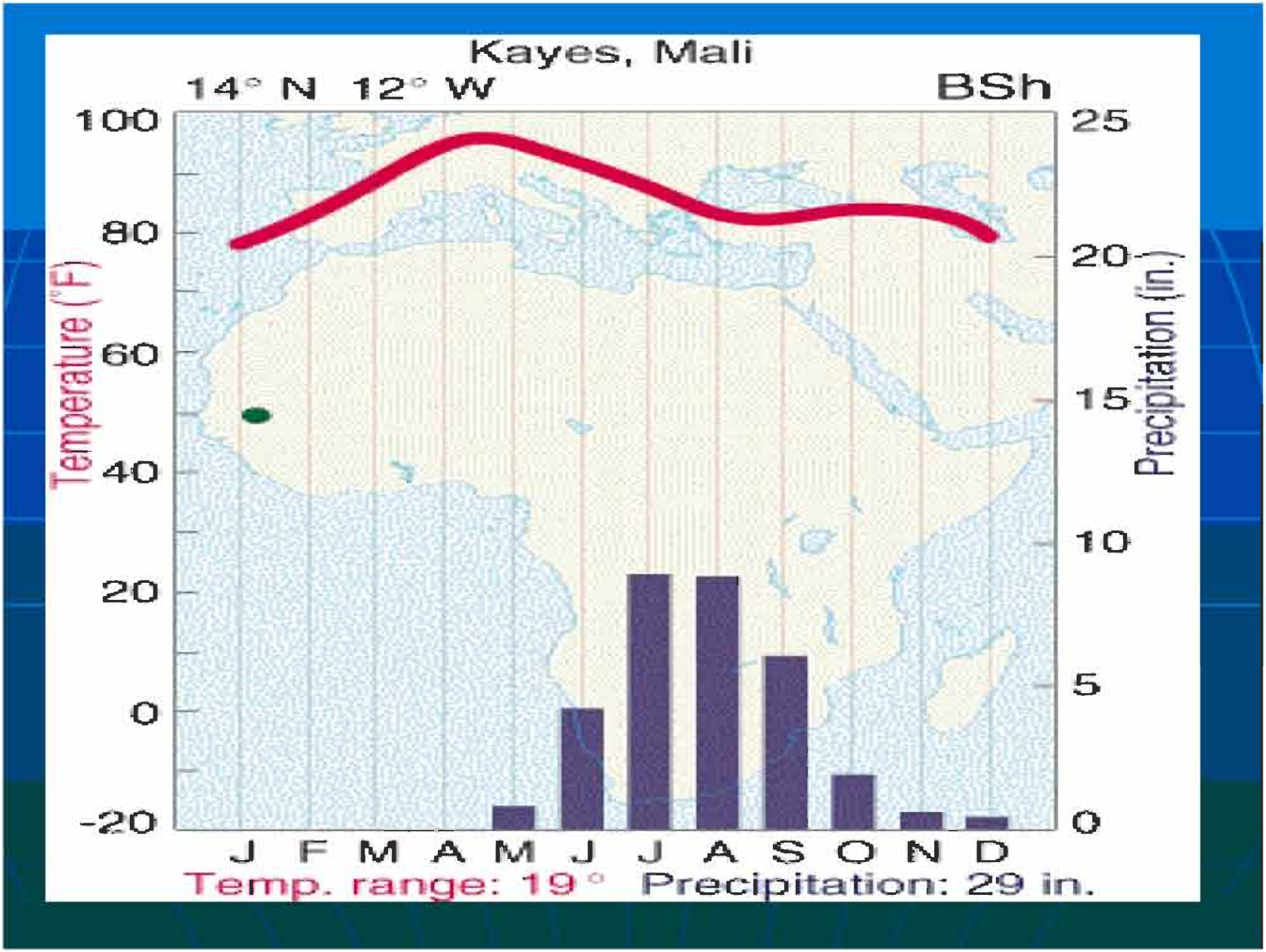
Short grasses

Mollisols, calcification

Low population, agriculture, livestock

Extensive, near all deserts


60°
40°
20°
0°
20°
40°
BWh
BWk
BSh
BSk


Kayes, Mali
14° N 12° W
BSh
100
80
60
40
20
0
-20
Temperature (°F)
25
20
15
10
5
0
Precipitation (in.)
J F M A M J J A S O N D
Temp. range: 19°
Precipitation: 29 in.

Desert BWh (k)

Three types, low lat, west coast, interior

Temp function of latitude, high diurnal

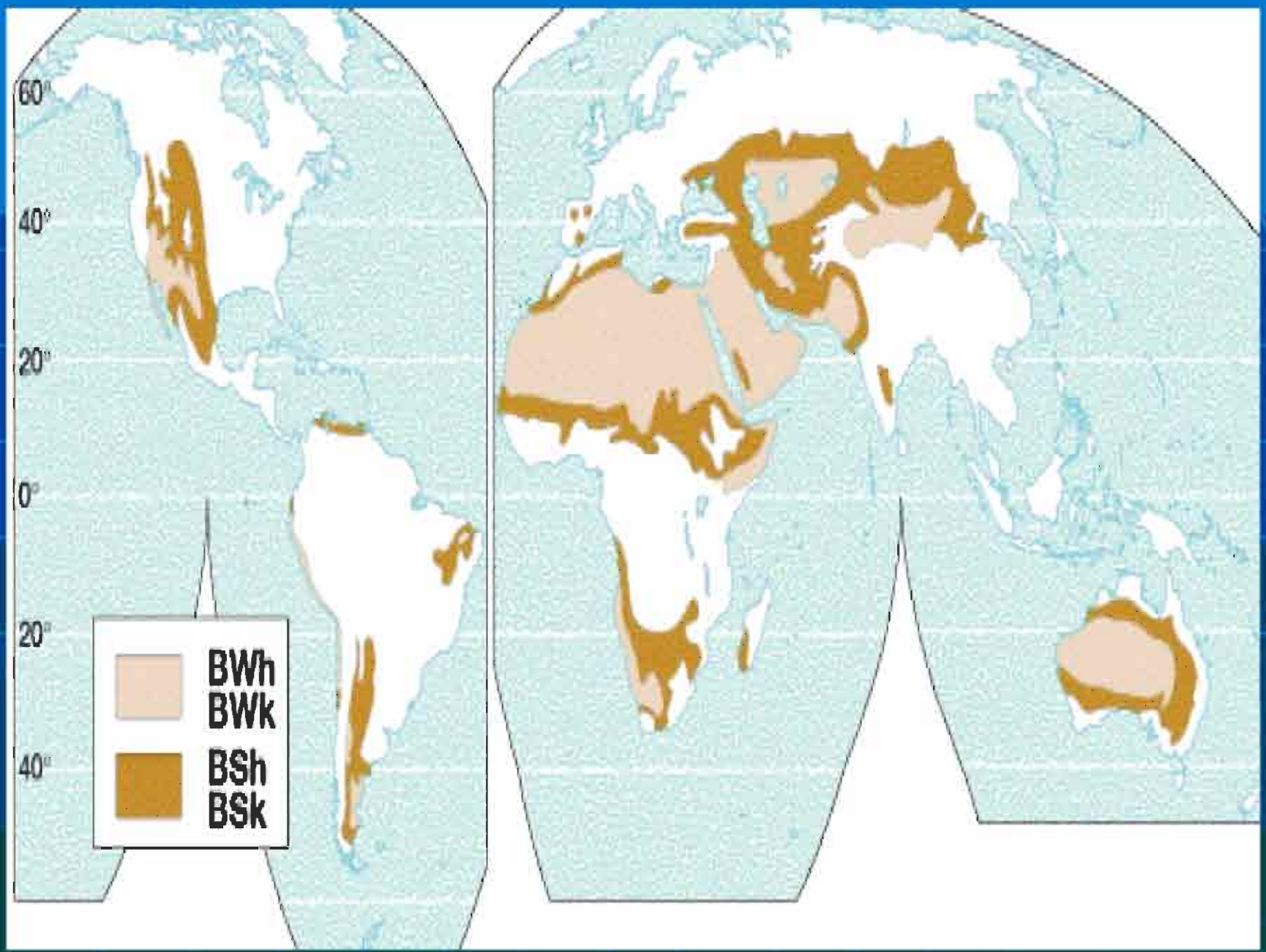
Dry, <10 inches, erratic

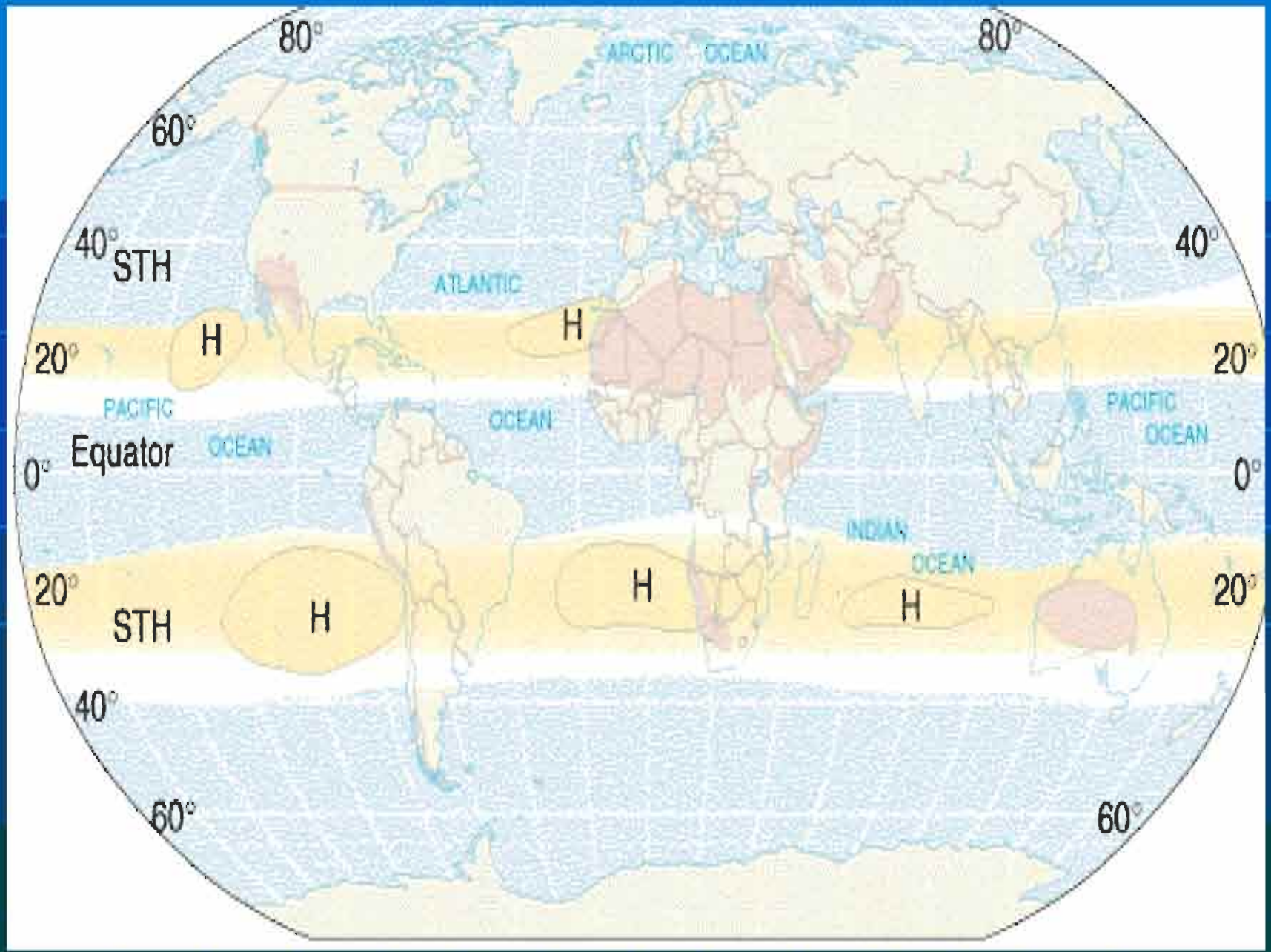
Desert shrub

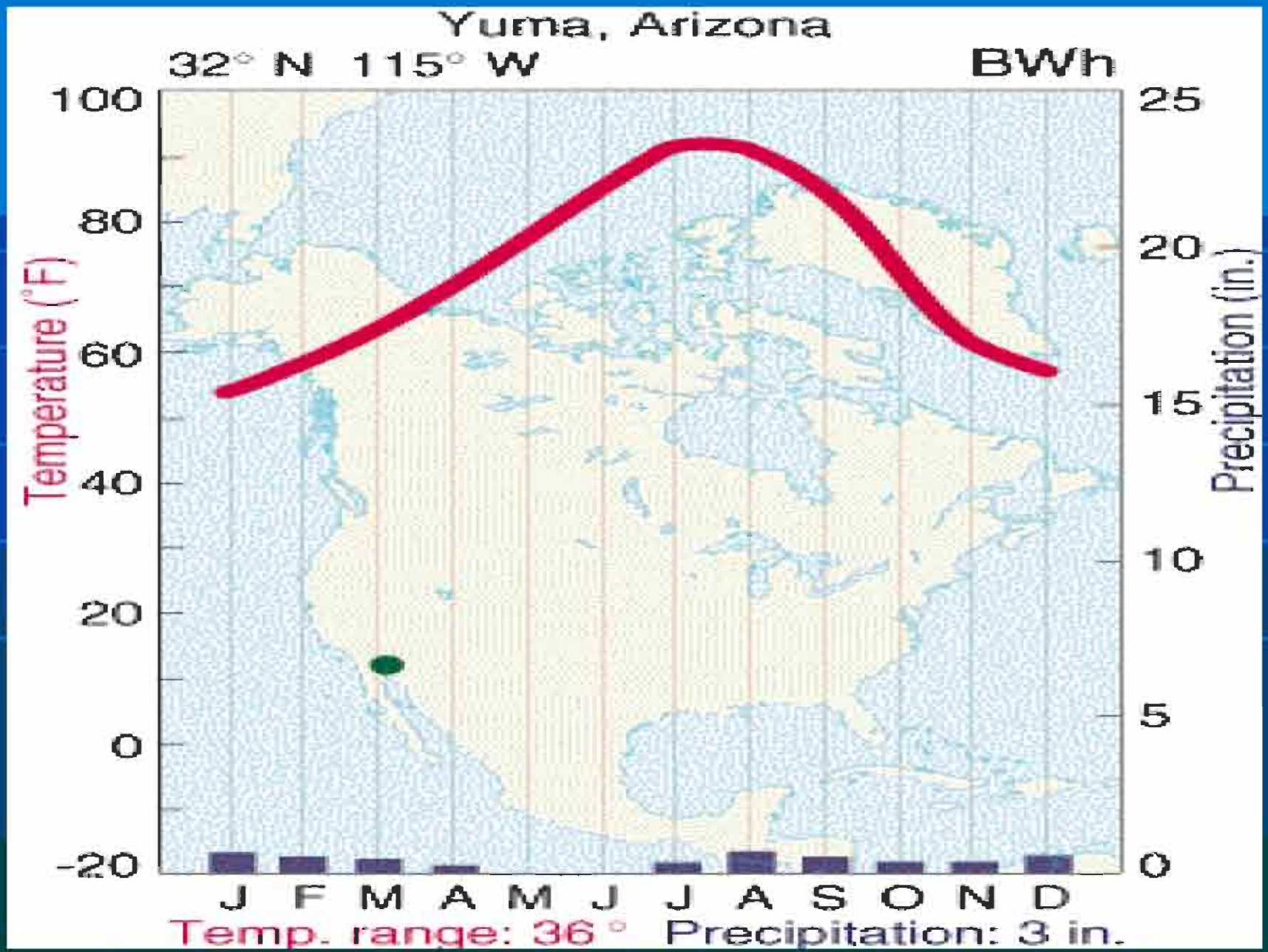
Aridisols, desertification

Low pop., nomatic herding, retirement

25 % land surface, many locations


60°
40°
20°
0°
20°
40°
BWh
BWk
BSh
BSk


80°
ARCTIC OCEAN
80°
60°
40°
STH
ATLANTIC
40°
H
H
20°
20°
PACIFIC
OCEAN
PACIFIC
OCEAN
Equator
OCEAN
0°
0°
INDIAN
OCEAN
20°
H
H
H
20°
STH
40°
60°
60°


Yuma, Arizona
32° N 115° W
BWh
100
80
60
40
20
0
-20
Temperature (°F)
25
20
15
10
5
0
Precipitation (in.)
J F M A M J J A S O N D
Temp. range: 36°
Precipitation: 3 in.

Thank you!