

# 1 ☐ Physical Environment: Climate and Biomes

## EVPP 110 Lecture

Instructor: Dr. Largen Fall 2003

## 2 ☐ Climate and Biomes

### ✓ Ecosystem

- concept
  - physical and biological components of environment are considered as single, interactive system
- defined as
  - group of interacting species along with their physical environment

## 3 ☐ Climate and Biomes

- ✓ similar physical environments lead to
  - evolution of organisms similar in form and function
  - similar **ecosystems**
  - known as “rule of climatic similarity”
    - basis of concept of **biome**
      - type of ecosystem
        - » plant and animal community that covers large geographic areas

## 4 ☐ Climate and Biomes

### ✓ Biomes

- major communities of organisms that
  - have characteristic appearance
  - distributed over wide geographic area
    - defined largely by regional variations in **climate**

## 5 ☐ Climate and Biomes

- ✓ strong relationship between climate and life suggests that
  - if we know climate of an area
    - we can predict what **biome** will be there
      - knowing biome means knowing
        - » approximate biomass
        - » approximate productivity
        - » dominant types of organisms

## 6 ☐ Climate and Biomes

- ✓ distribution of biomes
  - is dependant on **climate**

## 7 ☐ Climate and Biomes

### ✓Climate

- a region's average atmospheric or weather conditions over a long period of time
- results from interaction of
  - physical features of earth
    - two key physical factors
      - » amount of solar heat
      - » global atmospheric circulation

## 8 ☐ Climate and Biomes

### ✓Climate

- determined by
  - two main climatic factors
    - precipitation
    - temperature

## 9 ☐ Climate and Biomes

### ✓why are there variations in earth's climate?

- different parts of earth receive different amounts of energy from sun
  - uneven heating of earth's surface due
    - spherical shape
    - seasonal variations because of earth's tilt on axis

10 ☐ Figure: Solar radiation and latitude

11 ☐ Figure: What causes the seasons?

## 12 ☐ Climate and Biomes

### ✓why are there variations in earth's climate?

- variations in amount of energy received from sun
  - responsible for
    - major climatic differences on earth
    - diversity in earth's biomes

## 13 ☐ Climate and Biomes

### ✓why are tropics warmer?

- earth is sphere
  - mid portions receive more energy (more direct rays) from sun than others on a per unit area basis
  - tropics are warmest
    - receive more sun energy per unit area
  - poles are coldest

- receive less sun energy per unit area

#### 14 ☐ Climate and Biomes

✓ Two main climatic factors

- **precipitation**
- **temperature**

#### 15 ☐ Climate and Biomes

✓ **precipitation**

- plays vital role because
  - all organisms require water
  - on land, water is often scarce
- important aspects
  - total amount per year
  - form in which it arrives
  - seasonal distribution
- affects ecosystem productivity
  - $\uparrow$  precipitation =  $\uparrow$  productivity

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#### 17 ☐ Climate and Biomes

✓ **precipitation**

- generally low
  - near 30° N & S latitude
    - dry, descending air masses produce deserts
      - » all great deserts of world lie near 30° N or S latitude
  - in interiors of large continents
    - due to great distance from sea (ultimate source of most moisture)
      - » other deserts lie at continental interiors

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19 ☐

#### 20 ☐ Climate and Biomes

✓ **precipitation**

- generally higher
  - where air is rising & cooling
    - releasing moisture it contains
      - » ability to hold moisture  $\downarrow$  as temperature  $\downarrow$
    - near equator, most significantly
      - » produces tropical rainforests
    - at 60° N & S latitude, to lesser extent
      - » produces temperate deciduous, northern coniferous, temperate rain, coastal coniferous forests

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27  Figure 6.8: Influence of precipitation and temperature on vegetation

## 28 Climate and Biomes

### ✓ precipitation

#### – rain shadow effect

- reduction in rainfall on side of mountains facing away from prevailing winds

## 29 Climate and Biomes

### ✓ rain shadow effect

#### – occurs most significantly in context of coastal mountain ranges

- warm, moist air in prevailing onshore winds encounter mountains
- air is forced to rise
- as air rises, ability to hold moisture ↓
- moisture leaves air as precipitation (rain, snow)
  - ↑ precipitation on windward slope

## 30 Climate and Biomes

### ✓ rain shadow effect

#### – air descends leeward slope

##### – starts out as dry mass

- » having lost moisture on windward slope

##### – is warmed as it descended

- » moisture-holding capacity increases
- » inhibits precipitation

## 31 Climate and Biomes

### ✓ rain shadow effect

#### – examples

- Sierra Nevada Mountains of CA
  - eastern sides much drier than western sides
  - vegetation very different


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## 33 Climate and Biomes

✓ **temperature**


- plays vital role because
  - most organisms adapted to live within relatively narrow range of temperatures
    - won't survive if temperatures are significantly warmer or colder
      - » example, growing season of plants influenced by temperature
- affects ecosystem productivity
  - ↑ temperature = ↑ productivity

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35  **Climate shapes the character of ecosystems**


✓ **Temperature**

- affected by
  - **latitude**
    - tropical latitudes
    - temperate latitudes
  - **elevation**

36  **Climate shapes the character of ecosystems**

✓ **Temperature**

- affected by **latitude**
  - **tropical latitudes**
    - temperatures higher
      - » receives more sunlight per unit area
      - » highest mean global temperatures occur near equator
    - no seasons in tropics
      - » little variation in mean monthly temperature in tropical ecosystems

37  **Climate shapes the character of ecosystems**

✓ **Temperature**

- affected by **latitude**
  - **temperate latitudes**
    - temperatures decrease
      - » as you move from equator toward temperate latitudes
      - » receives less sunlight per unit area
    - seasons occur
      - » producing significant seasonal variations in temperature


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39  **Figure: Temperature and latitude**

40  **Climate shapes the character of ecosystems**

✓ **temperature**


- affected by **elevation**
  - decreases with increases in elevation
  - at a given latitude
    - normally, air temperature decreases ~6.5°C/1000m increase in elevation

41  Climate shapes the character of ecosystems

✓ **temperature**

- decreases with increases in elevation and latitude
  - higher elevations and latitudes become progressively colder

42  Figure 6.8: Influence of precipitation and temperature on vegetation

43  Climate shapes the character of ecosystems

✓ **Temperature ~ with - elevation and - latitude**

- ecological consequences
  - ↑ in elevation produce similar changes in ecosystems as do ↑ in latitude
  - in North America, 1000m ↑ in elevation results in temperature ↓ ~ to that of an 800 km ↑ in latitude
    - this is why “timberline” (elevation above which trees don’t grow) occurs at progressively lower elevations as one moves farther from equator

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45  Figure: Vegetation, Latitude, Altitude

46  Biomes

✓ **Biomes**

- terrestrial climax communities with wide geographic distribution
- concept is useful for describing in broad terms
  - general structure of the ecosystem
  - types of niches present
- of same type from different areas will exhibit variations in exact species present
- affected by two nonbiological factors
  - temperature
  - precipitation

47  Biomes

✓ major **biomes** of the world

- **desert**
- **grassland**
- **savanna**
- **Mediterranean shrublands**
- **tropical dry forest**
- **tropical rainforest**
- **temperate deciduous forest**
- **northern coniferous forest (taiga or boreal forest)**
- **tundra**

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50  The End