

Mr. Ulrich  
AP Biology

# Ecology Packet I

## Biomes

Components of an Ecosystem

Physical Factors and Gradients

Physical Factors in a Forest

Stratification in a Forest

Physical Factors in a Small Lake

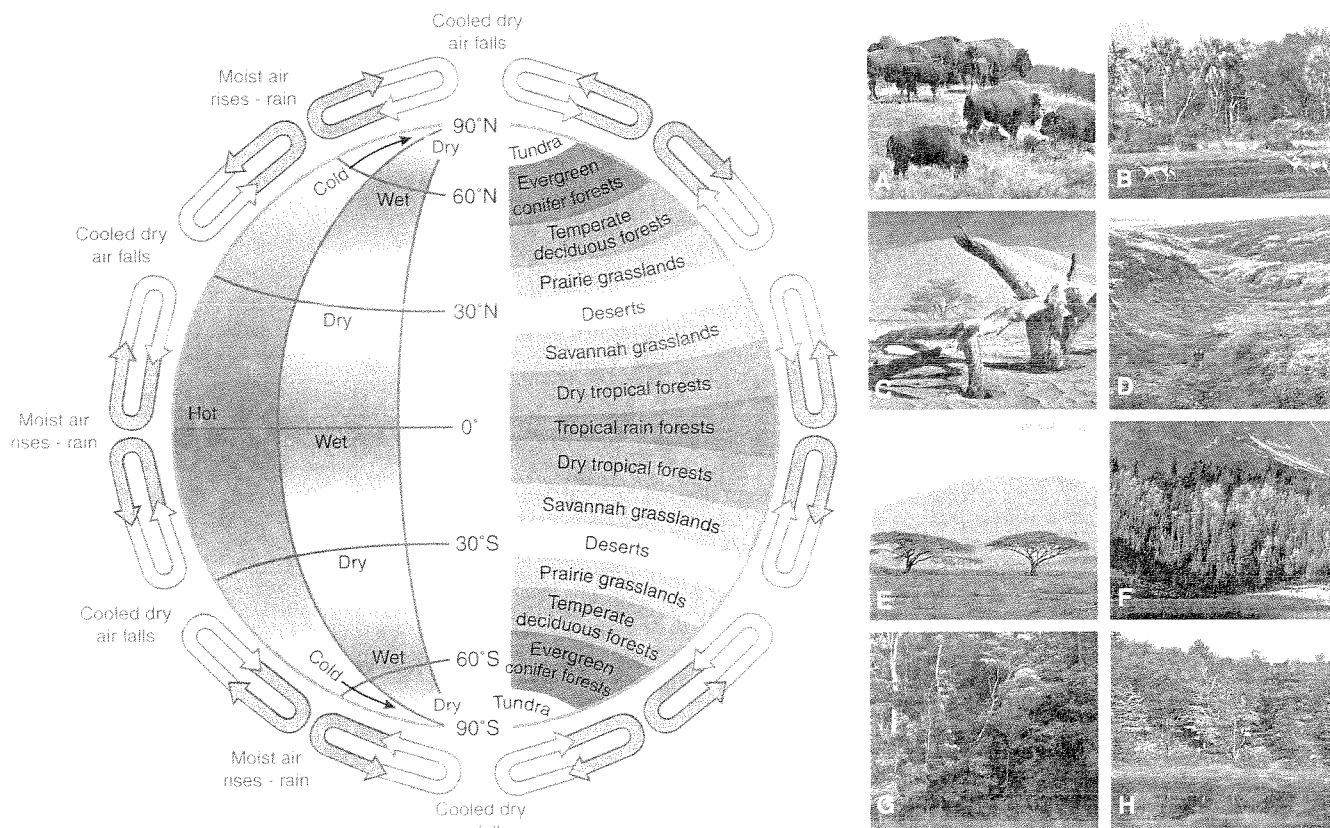
# Biomes

The Earth's **biomes** are the largest geographically based biotic communities that can be conveniently recognized. These are large areas where the vegetation type shares a particular suite of physical requirements. Biomes have characteristic features, but the boundaries between them are not distinct. The same biome

may occur in widely separated regions of the world wherever the climatic and soil conditions are similar. Terrestrial biomes are recognized for all the major climatic regions of the world. They are classified by their predominant vegetation type.

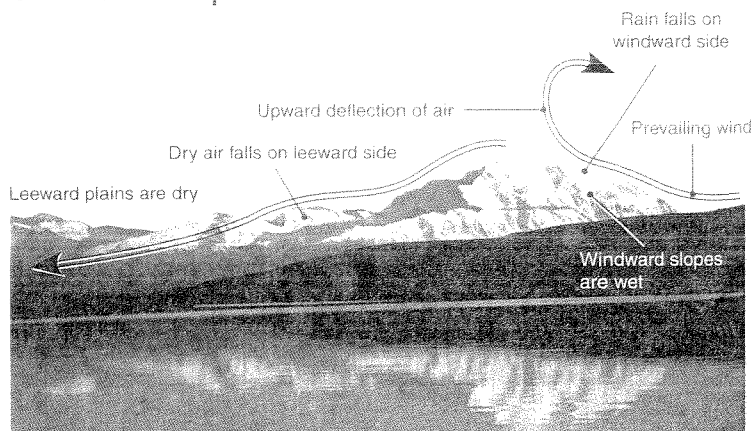
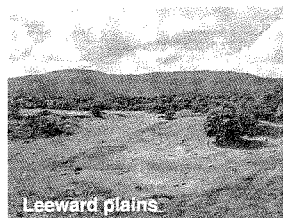
## Earth's Climate and Biomes

Biomes are closely related to the major air cells that circle the Earth and are reflected in the Northern and Southern Hemispheres.



## Biomes and Landscapes

Climate is heavily modified by the landscape. Where there are large mountain ranges, wind is deflected upwards causing rain on the windward side and a **rain shadow** on the leeward side. The biome that results from this is considerably different from the one that may have appeared with no wind deflection. Large expanses of ocean and flat land also change the climate by modifying air temperatures and the amount of rainfall.



1. Match the lettered biome images (above, right) with the appropriate biome name:

(a) Tundra: \_\_\_\_\_ (e) Evergreen conifer forest: \_\_\_\_\_

(b) Temperate deciduous forest: \_\_\_\_\_ (f) Prairie grasslands: \_\_\_\_\_

(c) Deserts: \_\_\_\_\_ (g) Savannah grasslands: \_\_\_\_\_

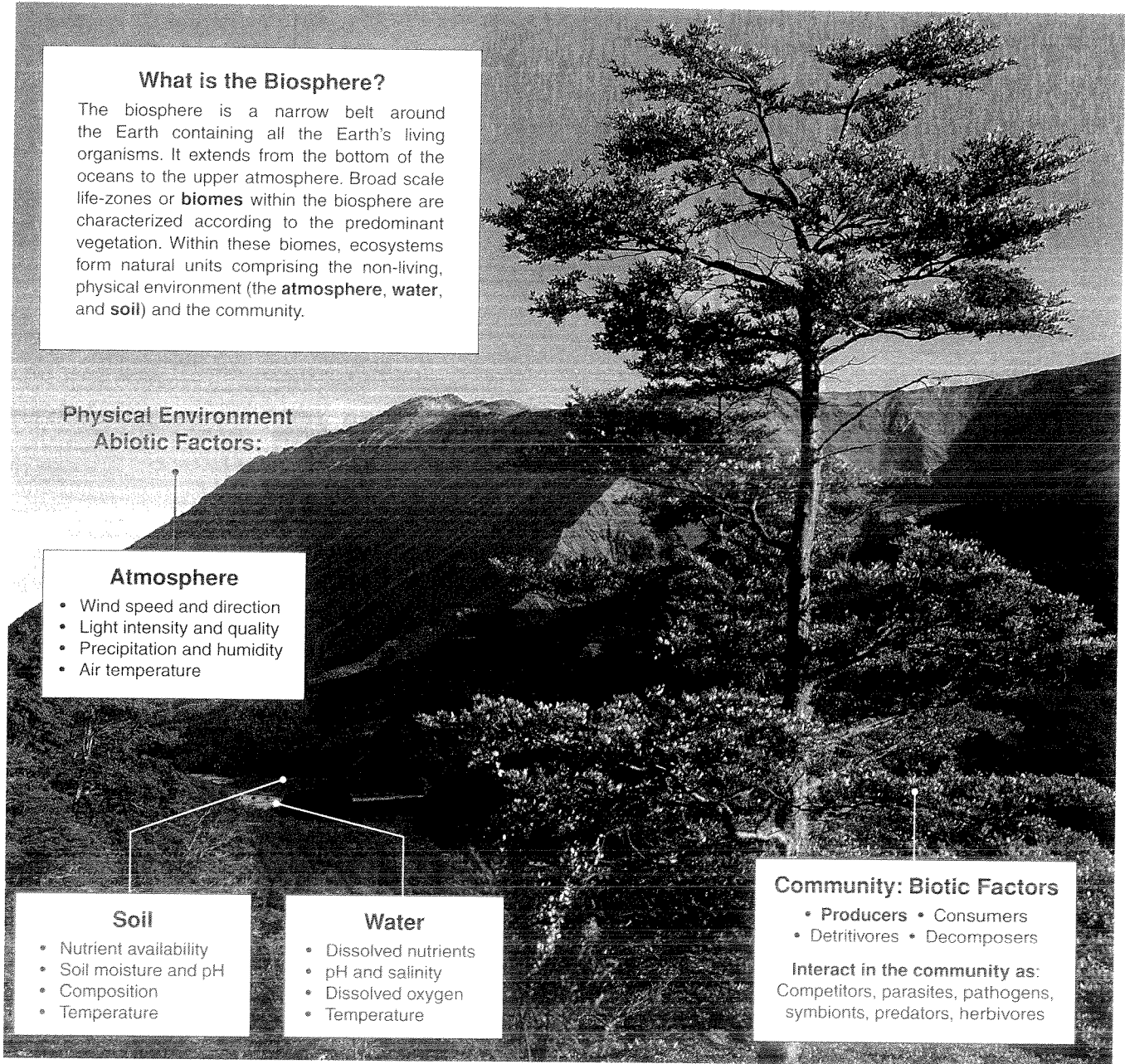
(d) Dry tropical forests: \_\_\_\_\_ (h) Tropical rain forests: \_\_\_\_\_

2. Identify which abiotic factor(s) limit the extent of temperate deciduous forests: \_\_\_\_\_

# COMPONENTS OF AN ECOSYSTEM

The concept of the ecosystem was developed to describe the way groups of organisms are predictably found together in their physical environment. A community comprises all the organisms

within an ecosystem. The structure and function of a community is determined by the physical (abiotic) and biotic factors, which determine species distribution and survival.



1. Distinguish clearly between a community and an ecosystem: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Distinguish between biotic and abiotic factors: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Use one or more of the following terms to describe each of the features of a beech community listed below:  
**Terms:** *population, community, ecosystem, physical factor.*

(a) All the beech trees present: \_\_\_\_\_ (c) All the organisms present: \_\_\_\_\_

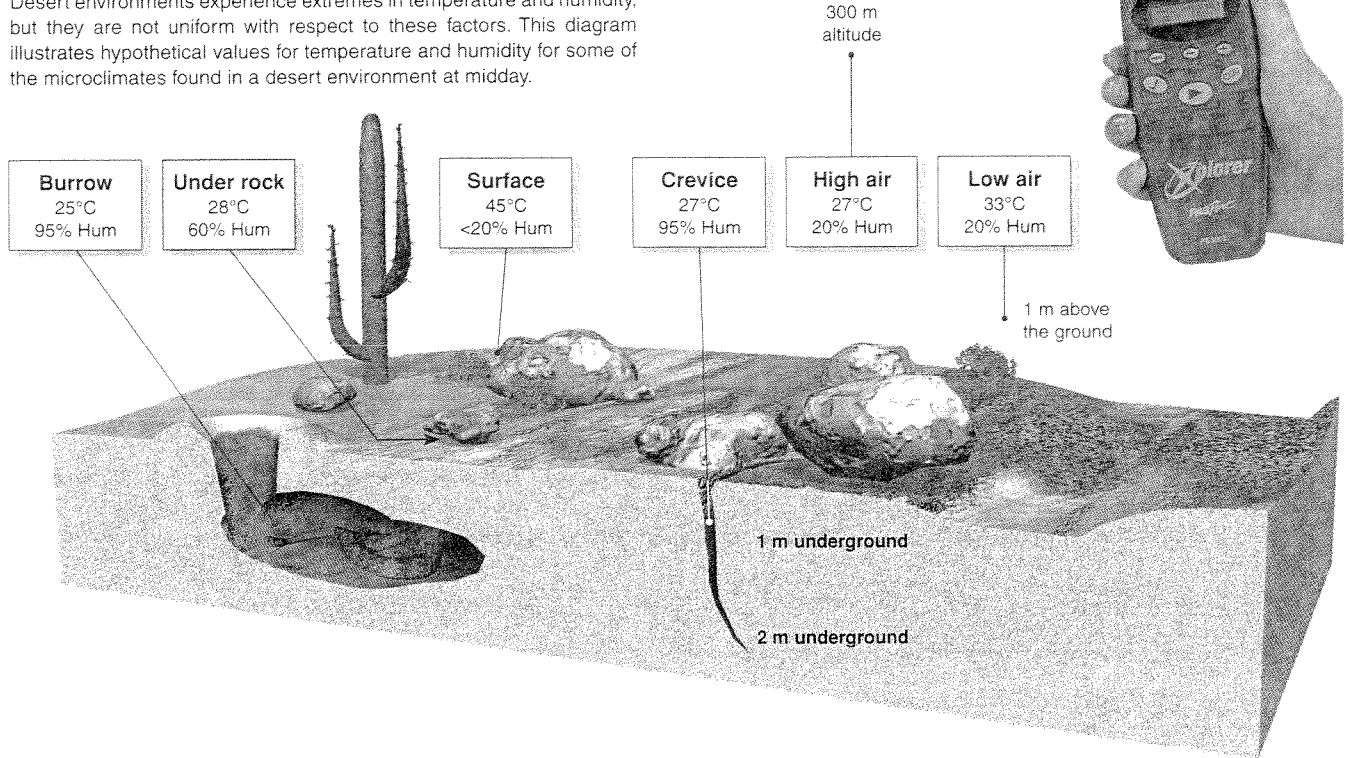
(b) The entire forest: \_\_\_\_\_ (d) The humidity: \_\_\_\_\_

# Physical Factors and Gradients

Gradients in abiotic factors are found in almost every environment; they influence habitats and **microclimates**, and determine patterns of species distribution. This activity, covering the next four pages, examines the physical gradients and microclimates that might typically be found in four very different environments. Note that **dataloggers** (pictured right), are being increasingly used to gather such data.

## A Desert Environment

Desert environments experience extremes in temperature and humidity, but they are not uniform with respect to these factors. This diagram illustrates hypothetical values for temperature and humidity for some of the microclimates found in a desert environment at midday.

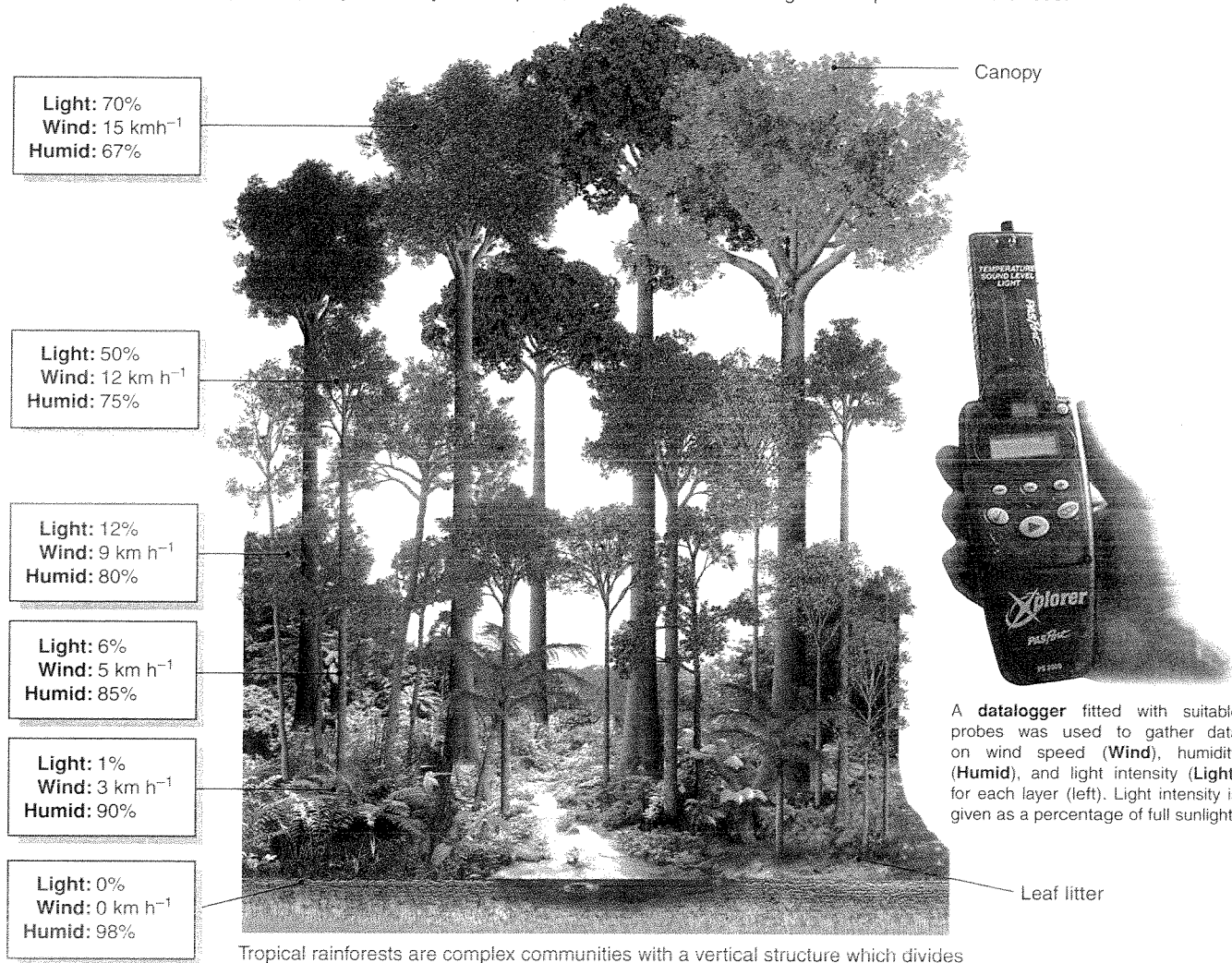


1. Distinguish between **climate** and **microclimate**: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
2. Study the diagram above and describe the general conditions where high humidity is found: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
3. Identify the three microclimates that a land animal might exploit to avoid the extreme high temperatures of midday:  
 \_\_\_\_\_  
 \_\_\_\_\_
4. Describe the likely consequences for an animal that was unable to find a suitable microclimate to escape midday sun:  
 \_\_\_\_\_  
 \_\_\_\_\_
5. Describe the advantage of high humidity to the survival of most land animals: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Describe the likely changes to the temperature and relative humidity that occur during the night: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# Physical Factors in a Forest

We have seen how environmental gradients can occur with altitude and with horizontal distance along a shore, but they can also arise as a result of vertical distance from the ground. In a forest, the light quantity and quality, humidity, wind speed, and

temperature change gradually from the canopy to the forest floor. These changes give rise to a layered or stratified community in which different species occupy different vertical positions in the forest according to their particular tolerances.



Tropical rainforests are complex communities with a vertical structure which divides the vegetation into layers. This pattern of vertical layering is called **stratification**.

1. Describe the general trend from the canopy to the leaf litter for each of the following:

- (a) Light intensity: \_\_\_\_\_
- (b) Wind speed: \_\_\_\_\_
- (c) Humidity: \_\_\_\_\_

2. Explain why each of these factors changes as the distance from the canopy increases:

- (a) Light intensity: \_\_\_\_\_  
\_\_\_\_\_
- (b) Wind speed: \_\_\_\_\_  
\_\_\_\_\_
- (c) Humidity: \_\_\_\_\_  
\_\_\_\_\_

3. What other feature of light, other than intensity, will also change with distance from the canopy and why?

\_\_\_\_\_

\_\_\_\_\_





# Stratification in a Forest

Forest communities throughout the world show a pattern of vertical layering called **stratification**. Stratification produces a heterogeneous environment, providing greater habitat diversity and opportunity for a greater number of niches. Fallen logs

and cavities in trees also add to vertical structure and enhance biodiversity. The forest composition itself (the actual species present) depends on many factors including altitude, light levels, soil type, drainage, and the past history of the area.

### Canopy

The canopy intercepts most of the direct sunlight. Canopy trees that grow taller than the canopy layer are called emergents.

### Subcanopy

Sometimes called the understory. This lower level of smaller trees is not always present.

### Epiphytes and lianes

Epiphytes are plants that have no contact with the soil but grow in crevices in the branches and trunks of larger trees. Lianes are rooted in the ground, but clamber into the canopy. This layer includes ferns and orchids.

### Shrub layer

A layer of plants 1-3 m tall. Includes seedlings less than 1 m tall and shade adapted, low growing plants such as ferns.

### Ground layer

Includes mosses, fungi, lichens, dead leaves, and debris. This layer may also incorporate some of the plants from the shrub layer (ferns and shrubs).



1. Using examples, explain why a forest with a strong pattern of stratification might provide a greater diversity of habitats than a forest without such a vertical structure:

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2. Predict the impact of deliberate removal (logging) of emergents and large canopy trees on the community composition. Consider how logging alters the physical environment and how existing and colonizing species might respond to this:

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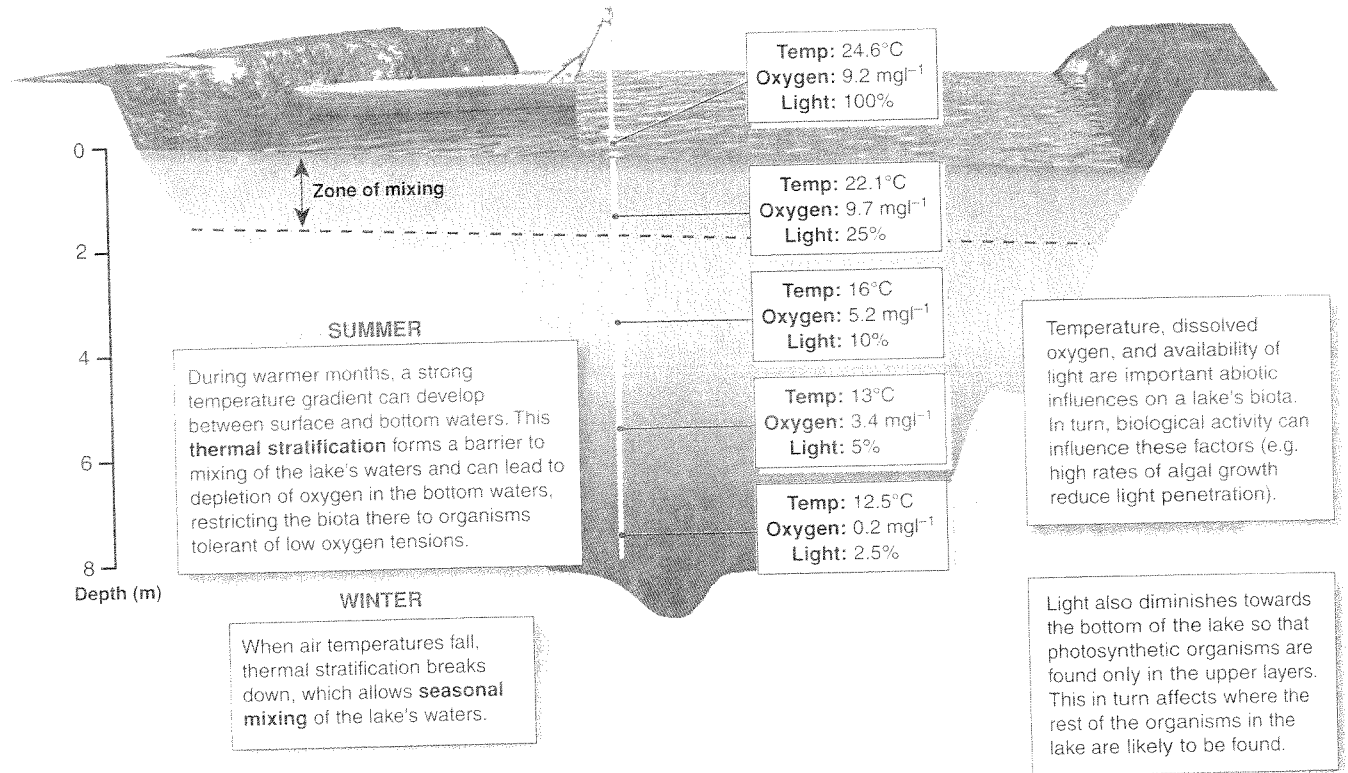


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# Physical Factors in a Small Lake

**Oxbow lakes** are formed from old river meanders which have been cut off and become isolated from the main channel following a change of the river's course. They are shallow (about 2-9 m deep) but often deep enough to develop temporary, but relatively stable, temperature gradients from top to bottom (below). Oxbows are commonly very

productive and this can influence values for abiotic factors such as dissolved oxygen and light penetration, which can vary widely both with depth and proximity to the shore. Typical values for water temperature (**Temp**), dissolved oxygen (**Oxygen**), and light penetration as a percentage of the light striking the surface (**Light**) are indicated below.



- With respect to the diagram above, describe the environmental gradient (general trend) from surface to lake bottom for:
  - Water temperature: \_\_\_\_\_
  - Dissolved oxygen: \_\_\_\_\_
  - Light penetration: \_\_\_\_\_
- During the summer months, the warm surface waters are mixed by wind action. Deeper cool waters are isolated from this surface water. This sudden change in the temperature profile is called a **thermocline** which itself is a further barrier to the mixing of shallow and deeper water.
  - What is the effect of the thermocline on the dissolved oxygen at the bottom of the lake? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
  - What causes the oxygen level to drop to very low levels near the lake bottom? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- Many of these shallow lakes can undergo great changes in their salinity (sodium, magnesium, and calcium chlorides):
  - What event could reduce the salinity of a small lake relatively quickly? \_\_\_\_\_
  - What process would gradually increase the salinity of a small lake? \_\_\_\_\_
- What is the general effect of physical gradients on the distribution of organisms in habitats? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_