

## Lesson 4: Changes in Ecosystems

- Terrestrial and Aquatic ecosystems can change gradually or, in some cases, suddenly. These changes can affect the species found in the ecosystems.

- Think of some things which would cause a gradual change in an ecosystem
  
- Think of some things which would cause a sudden change in an ecosystem

### **Human Impacts on Terrestrial Ecosystem**

- **Deforestation** is a very common way that humans change ecosystems

- Deforestation falls under three categories

- Slash and burn
  - Occurs mainly in tropical areas
  - Trees are cut down to clear area for farming
  - Trees are piled and burned to provide nutrients for crops

<http://earthobservatory.nasa.gov/Features/WorldOfChange/deforestation.php>

- Clear cutting
  - All the trees in an area are removed for timber or pulp (paper)
  - The dominant tree species is replanted

**Table 1** Effects of Clear-Cutting

Positive effects	Negative effects
<ul style="list-style-type: none"><li>• Clear-cutting is less expensive than selective cutting. This provides timber or pulp at more competitive prices.</li><li>• If a site is teeming with pests, clear-cutting can eliminate the hazard without infecting surrounding areas.</li><li>• Clear-cutting permits the replacement of less valuable trees with ones that are more valuable.</li><li>• Some wildlife, such as moose, benefit from clear-cuts. Low vegetation, such as fruit-bearing shrubs, provide a stable food source.</li></ul>	<ul style="list-style-type: none"><li>• Soil erosion and runoff into the streams increase.</li><li>• Nitrates and other nutrients are carried into streams and ponds, increasing algal growth.</li><li>• Sediment is carried into streams, affecting fish spawning areas.</li><li>• The removal of vegetation on the ground exposes dark soils and increases the warming of the area. In turn, this increases water loss from the soils.</li><li>• Replanting with a monoculture decreases biodiversity in the ecosystem.</li><li>• Some wildlife, such as owls, are negatively affected by clear-cuts. Nesting sites are destroyed in mature forest areas.</li></ul>

- Selective cutting
  - Only certain trees are removed
  - Others are left to regenerate the area

## Effects of Fire

- Fire is an important and often helpful cause of change in ecosystems
  - creates and maintains a mosaic of different vegetation types, such as grassland, wetland, shrub area, and aspen parkland
  - recycles nutrients stored in dead material faster
  
- humans have suppressed fire in many places over the last 100 years
  - this upsets the ecological integrity of an area that is used to regular fires
  
- ecologists have more recently started doing **prescribed burns**
  - a controlled fire set intentionally in a designated area

## Types of Lakes

- **Oligotrophic** lakes are typically deep and cold
  - Nutrient levels are low in such lakes, limiting the size of producer populations
  - Because there are limited numbers of only a few kinds of organisms, the water is usually very clear
- **Eutrophic** lakes are generally shallow and warmer, and have an excellent supply of nutrients.
  - Many species of photosynthetic organisms find these abiotic conditions very favorable.
  - As a result, the water of eutrophic lakes is often highly turbid (murky)

## Changes in Lake Ecosystems

- In general, oligotrophic lakes gradually become eutrophic over time.
- Eutrophic lakes become increasingly shallow, eventually filling in and becoming **dry land**.
- This evolution from oligotrophic to eutrophic to land is called **eutrophication** and may take hundreds or even thousands of years
- Humans sometimes accelerate eutrophication by adding to lakes nutrient-rich substances such as
  - human wastes
  - fertilizers in the runoff from agricultural land
  - other household and industrial products
  - thermal energy (raising the temperature)
- These extra nutrients cause excess plant growth
  - Plants die and decompose (uses oxygen)
  - Dead material fills bottom of lake
  - Lake gets shallower and warmer (less oxygen)
  - More plant growth (b/c lots of nutrients)
  - Lake gets shallower



Lesson 4 Review Questions

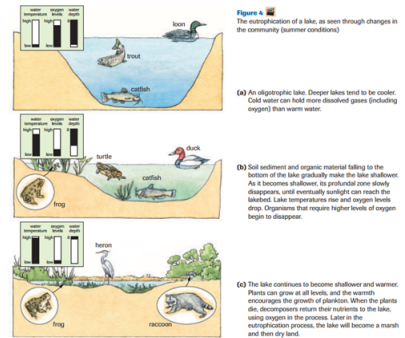
Read pages 113-122

1. Why are forests important?
2. What are three methods used for deforestation?
3. What problems could be created by clear-cutting an old-growth forest?
4. List types of pollution that cause reduced levels of dissolved oxygen in aquatic ecosystems. For each type of pollution, explain in your own words how dissolved oxygen is affected.
5. Which would show a higher biological oxygen demand: a sample of water from a cold lake or a sample of water from a warm lake? Explain your answer.
6. Describe two ways in which phosphates can get into surface water.
7. Indicate some factors that would cause a dramatic change in the shoreline of a lake.
8. How could the removal of plants from along the shoreline have a negative impact upon a lake?
9. Drilling companies pump water into oil wells to increase oil extraction. Because the oil is less dense than fresh water, the oil is pushed closer to the surface, making extraction less expensive. Indicate both positive and potentially negative impacts of this practice.
10. Alberta's lakes are a valuable recreational resource. Should the number of cottages built along the shoreline be restricted?

Use Figure 4, on page 116, to answer the following questions.

1.

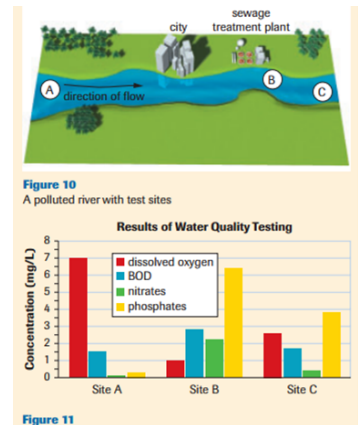
- What happens to the depth of a lake over time? Why?
- Explain how the mean water temperature is related to the depth of the lake.
- How would a change in lake temperature affect the types and numbers of plants found in the area?
- Describe the changes in the species and populations of fish you would expect to find in a lake that progresses through the three stages of eutrophication.



- Explain why turtles might be found in the second stage but not the first.

2. Aer complaints were received from fishers on a river (Figure 10), the data in Figure 11 were collected from three sites.

- What is the source of nitrates and phosphates?
- In which area of the river would you find the highest level of eutrophication? Explain your answer.
- Why does the BOD increase from site A to site B?
- Why does the BOD decrease from site B to site C?
- Sewage treatment plants are supposed to remove organic waste. Is the plant doing a good job?



3. Design and conduct an investigation to determine how water temperature affects algal growth. Based on your results, how would you expect surface thermal pollution to affect dissolved oxygen levels in the epilimnion and hypolimnion of a lake? Draw diagrams illustrating your hypothesis.