

## 3.0 Changes can be observed and monitored in ecosystems

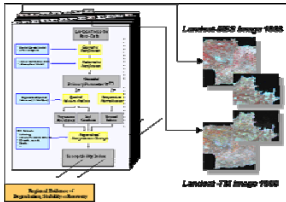
### 3.1 Investigating the Distribution of Living things in an Ecosystem

- *Distribution of Living Things*

Ecosystem monitoring (also called - *environmental monitoring*) is a way to check the condition - health - of an ecosystem by comparing results of investigations done at different times. Monitoring helps scientists understand impacts of disturbances and changes - sudden and gradual - in order to try to reverse or reduce the impact. Biotic and abiotic factors are monitored.

#### Ecosystem Monitoring Types

**Physical**, uses satellites to track changes in the landscape over time.



**Environmental** tracks changes in climate, temperature and weather patterns.



**Chemical**, assesses the quality of air, soil and water



**Biological**, tracks the changes in organisms or populations of organisms



**Environmental monitoring** usually begins after a disturbance has taken place. It can also begin before a disturbance occurs. A key part of the monitoring program is to provide the evidence on which environmental decisions can be made to maintain the balance between human needs and the needs of other organisms in the environment. **Continuous monitoring** gives us the scientific data we need to make informed decisions about how we affect the environment over time.

#### Long-Term Monitoring Programs

Amphibians are very sensitive to environmental change, which makes them an indicator species. By using this indicator species, scientists all over the world can study the effects of pesticides, acid rain, loss of habitat and introduction of non-native species on these amphibians.

[http://www.biology-online.org/4/6\\_monitoring\\_populations\\_2.htm](http://www.biology-online.org/4/6_monitoring_populations_2.htm)

<http://www.earth.nasa.gov/outreach/biodiversity/paper1.html>

Monitoring programs may be **qualitative**, **semi-quantitative**, or **quantitative**. Monitoring involves the use of **indicators**, **indicator species** or **indicator communities**. The presence or absence of the indicator or of an indicator species or indicator community reflects environmental conditions.

**Dichotomous Key (Identification Key for Alberta Amphibians)**

<http://www3.gov.ab.ca/srd/fw/amphib/identify.html>

**Baseline Data** gives scientists a starting point to compare changes in the environment. Scientists to monitor change use permanent plots, or study areas. The report that provides the data that has been collected - identifying how a certain activity will affect the environment - is called an **Environmental Impact Assessment**.

**Quadrant Sampling** is a technique used to study a large area. The quadrant is selected and the species is counted in the quadrant. The number of quadrants in the area provides the multiplier to estimate the **Quadrant sampling** is one way that ecologists estimate the distribution of different populations of species in an **ecosystem**. Studying the sample is called **quadrant analysis**.

### 3.2 Interactions and Changes Occur in Ecosystems

In any ecosystem a balance between living populations must exist if these populations are to be maintained. Setting a forest on fire (*a controlled burn*) is often necessary to maintain a balance in the ecosystem. These fires get rid of small trees, leaves, needles and other debris that settles on the forest floor. The new growth after a fire becomes food for elk, deer and other animals that need these nutrients from the forest floor.

A **wetland** ecosystem is also important. Drainage of wetlands to provide land for farming and housing put the populations that used these ecosystems, as their habitat, were at risk of extinction. Pollution also destroyed many wetland areas. The importance these wetlands to the overall diversity of living things has meant that many wetlands are now protected by law.

- **All Things Change**

#### Bioinvasion

When species that are not native to a particular area are introduced they tend to take over and multiply quickly – taking necessary food or nutrients away from the native species. The native species suffer as a result and many have been **extirpated** (extinct in a specific area). The species that is introduced may have no natural predators and will overtake the area (using up the food supply) so that other organisms cannot survive.

Introducing a species not natural to a particular area can cause more problems than what it solves.

This happened when **zebra mussels**



were introduced into the Great Lakes. It has become a major problem.



**Purple loosestrife** – sometimes called the “*beautiful killer*” – was introduced into North America has taken over valuable wetland habitat, pushing out native species.

#### Competition

All living things compete for food, water and habitat. Because there is only so much to go around many species cannot survive because they are fewer in numbers and have more predators than other species.

Examples of birds that have multiplied very quickly and compete for food with many native birds.

House sparrows

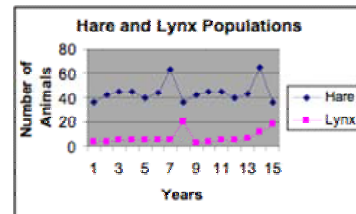


European Starlings



#### Predation

Predation occurs when one animal hunts other animals for food. The organisms that are hunted are called **prey**. The hunters are called **predators**. The predator and prey populations increase and decrease as they numbers change. When prey population increases, the predator population will also increase. When the prey population decreases, the predator population also decreases.



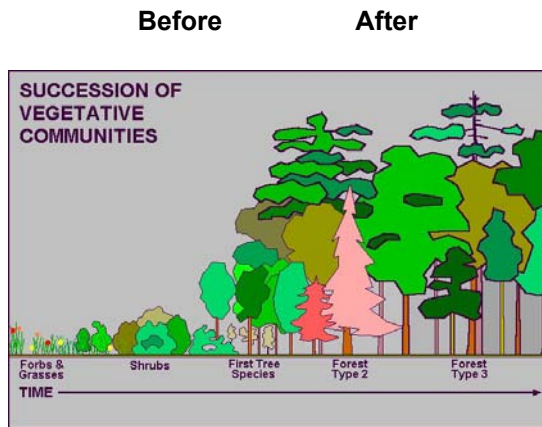
#### Weather

Weather can also affect ecosystems. Temperature, and the amount of precipitation will affect the growth of plants (the producers) positively or negatively. Natural disasters can also impact the populations of producers.

### 3.3 Succession: How Ecosystems Change over Time

The gradual process by which some species within an ecosystem replaces other species is called **succession**.

**Primary succession** is the gradual growth of organisms in an area that was previously bare – like a rocky slope. Organisms to first appear (called **primary species**) are those that can cling to the rock and grow, such as mosses and lichens. These organisms break down the rock and died. Other organisms use the nutrients to begin to grow.

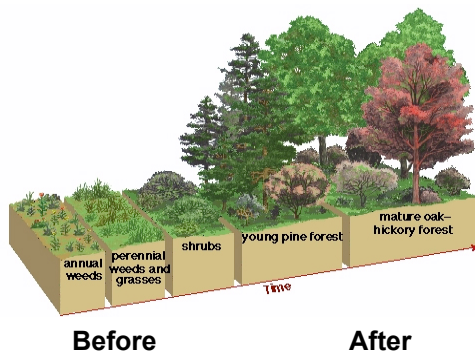


Examples of areas in which a community has never lived before would be:

- new lava or rock from a volcano that makes a new island or a new landscape
- a sand bar that arises from shifting sands in the ocean
- exposure of igneous rock surfaces by a land slide
- a meteor makes a depression that fills with rainwater or fresh water from underground streams.

A **climax community** is a stable community with a lot of diversity and is not easily replaced by other communities.

**Secondary Succession** The gradual growth of organisms in an area after a disturbance, such as a fire, or when a large tree falls, is known as **secondary succession**.



Examples of secondary succession include:

- A farmer's field
- a vacant city lot
- a newly forested area
- a strip mine.