

### 3.2 ECOSYSTEM CHANGES

- An ecosystem is a large community of living organisms (plants, animals and microbes) in a particular area. The living and physical components are linked together through nutrient cycles and energy flows.
- Whether just starting out or full of life, ecosystems are constantly changing. The process in which they are changing is called succession.

#### Succession comes in two forms:

- Primary
- Secondary.

#### 1. Primary succession

It is “the series of community changes which occur on an entirely new habitat which has never been colonized before”. These changes occur in places like area of cooled down lava, sandy areas and chiseled out rock faces.

#### 2. Secondary succession

It is “the series of community changes which take place on a previously colonized, but disturbed or damaged habitat.” These places involve areas damaged by

- Fires,
- Floods

These disturbances have not taken away all forms of life and nutrients from the area. If succession is done in a proper way, the ecosystem can become a climax community in which the ecosystem stabilizes. The process in becoming a climax community can take either a short or long time which differs from area to area. There can also be times which it is set back a few stages, like when trees are cut down. This sets the area back some, but it can still grow back and still become a climax community. The climax is stabilized by a small community of prominent species.

The web of biotic interaction that a climax community creates is so intimate that an introduction of a new species could disrupt the stabilization. If a new species were to be introduced, it could cause one species to become too dominant. However, this ecosystem would be more diverse. This loss of stabilization could easily be called a disturbance.

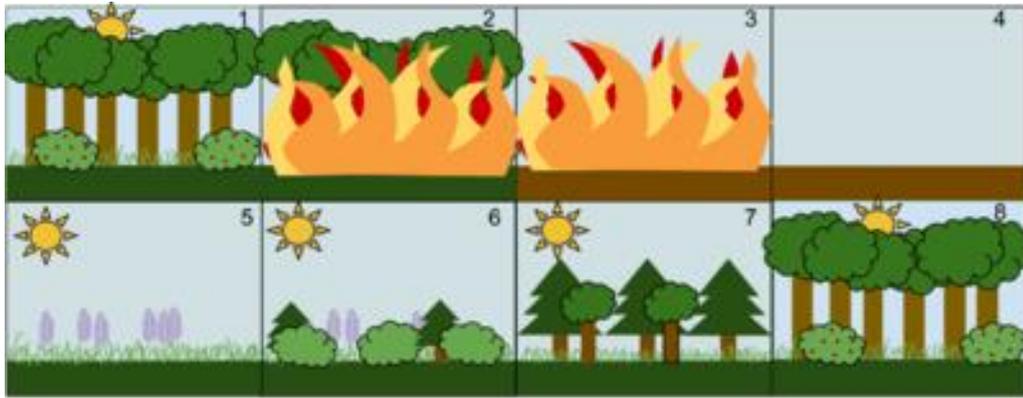
A disturbance is a mixture of large, infrequent and small frequent events and they can occur from the result of numerous, interconnected factors. Disturbances are categorized by type, severity, intensity, frequency, and timing. The word disturbance makes it seem like it has a negative effect on ecosystems, but the opposite is true. For example, most natural disturbances help renew ecosystems and diversify the landscapes. As stated earlier, they often lead to ecological succession. However, anthropogenic disturbances, ones related to humans, often have negative effects. For example, if humans introduce invasive species into the environment, they can hunt and prey on native species and disrupt the ecosystem's stability.

Within each type of succession is a stage. These stages include

- Pioneer
- Establishing
- Sustaining
- Producing.

Each of these is found in the types of succession new. It is and creature or plant that starts to grow or live there. It is the start of the ecosystem. This next stage is very similar to the pioneer stage.

The establishing stage is when animals or plants find things that sustain their lives and allows them to live in the area. The sustaining stage is usually in the climax succession. It is when the area can sustain life and allows life to continue in the area. The animals also do not have to leave in order to find food. The other stage is the producing stage. This is usually during the secondary succession. It happens when the population of animals is growing but many drift to other places in search for food. These places can sustain life but at a limited population. These types of succession, the stages and the disturbances that cause them all create and change an ecosystem through the years.



**Figure 3.2.1 Secondary succession**

[Source: [https://en.wikipedia.org/wiki/File:Secondary\\_Succession.png](https://en.wikipedia.org/wiki/File:Secondary_Succession.png)]

### Example of Secondary Succession by stages:

1. A stable deciduous forest community.
2. A disturbance, such as a fire, starts.
3. The fire destroys the vegetation.
4. The fire leaves behind empty, but not destroyed soil.
5. Grasses and other herbaceous plants grow back first.
6. Small bushes and trees begin to colonize the public area.
7. Fast-growing evergreen trees and bamboo trees develop to their fullest, while shade-tolerant trees develop in the understory.
8. The short-lived and shade-intolerant evergreen trees die as the larger deciduous trees overtop them. The ecosystem is now back to a similar state to where it began

### Drivers and Ecosystems

An ecosystem consists of all of the natural elements in a specific environment and the relationships among them. Ecosystems possess not only living components, such as plants and animals, but also non-living components, like air, water, soil and rocks.

### Types of ecosystems :

It include

- Forests
- Grasslands
- Tundra
- Lakes

- Wetlands
- Deltas and
- Coral reefs.

Drivers are any events or processes that change an ecosystem. Some have a direct influence on an ecosystem. Severe weather, such as a tornado, blizzard, hurricane or hail are natural events that directly impact an ecosystem. Animals such as a bear or mountain lion roam in search of new territory. This could have a direct impact on an ecosystem as the animal hunts food in its new territory, thereby reducing existing flora or fauna. The predatory animal's behavior is natural, but it can alter an ecosystem. Direct drivers may also be human influenced. The introduction of a species not normally associated with a particular ecosystem such as kudzu, silver carp or zebra mussels has a devastating impact on that ecosystem.

Wind, rain, predation and earthquakes are all examples of natural processes which impact an ecosystem. Humans also affect ecosystems by reducing habitat, over-hunting, broadcasting pesticides or fertilizers, and other influences. The line between natural and human caused effects often blurs. For example, sediment in streams and rivers can damage these tender ecosystems. But the cause may have been a post-storm mudslide or acreage stripped bare for farming. Anything that enters an ecosystem from sunlight to rain to contaminants has the potential to change it. Scientists refer to these factors as drivers.

A driver is any natural or human induced factor that directly or indirectly causes a change in an ecosystem. A direct driver unequivocally influences ecosystem processes. An indirect driver operates more diffusely, by altering one or more direct drivers. Indirect drivers of change are demographic, economic, sociopolitical, scientific and technological, and cultural and religious. Important direct drivers include climate change, plant nutrient use, and land conversion leading to habitat change, and invasive species and diseases.

#### **Changes in Key Indirect Drivers :**

- Demographic
- Economic
- Sociopolitical

- Cultural and Religious
- Science and Technology

### **Changes in Key Direct Drivers :**

- For terrestrial ecosystems, the most important direct drivers of change in ecosystem services in the past 50 years, in the aggregate, have been land cover change (in particular, conversion to cropland) and the application of new technologies, which have contributed significantly to the increased supply of services such as food, timber, and fiber.
- Deforestation and forest degradation affect 8.5% of the world's remaining forests, nearly half of which are in South America.
- For marine ecosystems and their services, the most important direct driver of change in the past 50 years, in the aggregate, has been fishing.
- For freshwater ecosystems and their services, depending on the region, the most important direct drivers of change in the past 50 years include modification of water regimes, invasive species, and pollution, particularly high levels of nutrient loading. The introduction of non-native invasive species is one of the major causes of species extinction in freshwater systems.
- Over the past four decades, excessive nutrient loading has emerged as one of the most important direct drivers of ecosystem change in terrestrial, freshwater, and marine ecosystems. Synthetic production of nitrogen fertilizer has been the key driver for the remarkable increase in food production that has occurred during the past 50 years.
- Excessive nitrogen loading can cause algal blooms, decreased drinking water, eutrophication of freshwater ecosystems (a process whereby excessive plant growth depletes oxygen in the water), hypoxia in coastal marine ecosystems (substantial depletion of oxygen resulting in die-offs of fish and other aquatic animals), nitrous oxide emissions contributing to global climate change, and air pollution by nitrogen oxides in urban areas.
- Phosphorus application has increased threefold since 1960, with a steady increase until 1990 followed by leveling off at a level approximately equal to 1980's applications. These changes are mirrored by phosphorus accumulation in soils,

which maintains high levels of phosphorus runoff that can cause eutrophication of freshwaters and coastal waters.

- Climate change in the past century has already had a measurable impact on ecosystems.
- Biological invasions are a global phenomenon, affecting ecosystems in most biomes. Human-driven movement of organisms, deliberate or accidental, has caused a massive alteration of species ranges, overwhelming the changes that occurred after the retreat of the last Ice Age.
- Introductions of alien species can also be beneficial in terms of human population; most food is produced from introduced plants and animals.

### **Ecological Succession**

Most ecosystem changes occur over time rather than as a result of a single, sudden event. Scientists call one such slow process ecological succession. As this process plays out, species populations fluctuate and sometimes disappear entirely. A new species entering the ecosystem such as the bear or mountain lion example is one possible trigger to launch ecological succession. Evolutionary changes that improve a particular species' adaptation is another driver. For instance, depleted food sources might change migration patterns, or one species might adapt behaviors that allow it to best its competitor species. Ecological changes to one species often influence the adaptation of others. When plants first developed flowers millions of years ago, insects adapted an attraction to nectar which had the benefit of spreading plant pollen.

### **Severe Storms**

The sheer destructive force of storms, floods, tropical storms and tornadoes often impact ecosystems. Cataclysmic storms, such as hurricanes, bring with them high winds, storm surges and drenching rains. These factors damage ecosystems that include coral reefs, coastal marshlands and inland forests. Storm surges pour saltwater inland along coastal areas, killing freshwater vegetation and some invertebrates such as clams. Although storms are initially destructive, they may bestow some benefits to an ecosystem, such as washing away pollutants.

## Other Contributors

Droughts also affect ecosystems as plant species adapted to drier climates replace those that thrive on moisture. Extended droughts increase fire risk, a natural event which can swiftly reduce a forest ecosystem. When forests redevelop, exotic foreign species may colonize there, growing faster than native ones. Naturally occurring geological hazards that affect ecosystems include volcanoes, earthquakes and tsunamis. Biological factors disease, invasive species, algae blooms also contribute to changes in ecosystems.

