

STAAR Science Tutorial 43 **TEK 7.10B: Biodiversity**

TEK 7.10B: Describe how biodiversity contributes to the sustainability of an ecosystem.

- **Biodiversity** is the number of different species living in a defined area. Scientists have identified almost 2 million different species on Earth, but believe that there may be as many as 10 to 12 million different species.
- The biodiversity of an area is dependent on its size, its climate and the diversity of niches.
 - The larger the continuous area of the ecosystem, the greater the biodiversity. Larger areas provide room for many different microhabitats, and the boundaries between those microhabitats, called **ecotones**, are often rich in biodiversity. Physical barriers around an ecosystem, such as an ocean surrounding a small island, will likely limit biodiversity, by preventing migration in and out of the ecosystem, and increasing the chance of a catastrophic event wiping out an entire species.
 - Climate is a major determinant of biodiversity. Warm and wet climates usually have higher biodiversity. Climates with a year-round growing season and constant water availability encourage large populations, which in turn create much competition between species. Rain forests are thought to have the highest biodiversity on Earth, while the polar biome has the lowest biodiversity. In the oceans, coral reefs have the highest biodiversity.
 - The number of niches in an ecosystem is determined by the amount of primary production (the mass of the producers), the number of different microhabitats, and the availability of resources on a year-round basis.
- The benefits of high biodiversity in an ecosystem include community sustainability, resistance to damage from climate change and catastrophic events, control of pest species, increased food and wood production, enrichment of soil nutrients and production, potential for medical discoveries, and a gene pool for future genetic engineering of food crops.
 - **Sustainability** in an ecosystem is a measure of its stability, its ability to survive over time, and how resistant it is to collapse due to outside influences, long term environmental change or catastrophic events. High biodiversity creates greater competition between species and the filling of all available niches. The large number of predator-prey and symbiotic relationships creates checks and balances that keep populations balanced.
 - The population of **pest species** is best controlled through high biodiversity. In areas where humans have removed natural communities to raise single species crops, the population of pest species, specialized consumers for that one crop rises in turn because of the increased food

supply. Because all of the natural predators of that pest species have also been removed, the pest population explodes and can only be controlled with pesticides, at great expense and with likely collateral damage to other beneficial species.

- Diverse forests with many different species often yield more wood than single species forests, because more of the available nutrients are used.
 - Soils in diverse plant communities are often better protected from erosion and contain greater amounts of essential nutrients.
 - Many disease-fighting drug discoveries have come from rainforest plants. These plants manufacture the drugs to fight off insects or other feeding animals. It is the extreme competition in such rich biodiverse areas that creates the need for such plant defenses.
 - The genes in many plants may be valuable for future genetic engineering of food crops. Most of today's food crops were developed from wild species with selective breeding techniques over long periods of time. If human civilization is to continue to grow enough food for its growing population, it will need even better food crops.
- The larger the area that a species occupies, and the more different habitats that it can adapt to, the greater its **gene pool diversity**, and the more likely it is to survive environmental change.
 - Every community has one or more **keystone species** that greatly influence the survival of many other species. Keystone species are often 2nd level consumers—predators that control the population of 1st level consumers. If the keystone species is removed, the population of the 1st level consumers grows until all the producers in the area are eaten. The entire community then collapses, because without the producers, no other life is possible. Humans often do not realize the importance of a species until it is removed, setting off a chain reaction of effects to the food web. Areas high in biodiversity often have multiple keystone species, making each less essential to the entire ecosystem.

Practice Questions

1. _____ is the number of different species living in a defined area.
2. Scientists have identified almost _____ million different species on Earth, but believe that there may be as many as _____ to _____ million different species.
3. The biodiversity of an area depends on its: (1) _____: (2) _____; and (3) _____.
3. The boundaries between habitats, which are usually high in biodiversity, are called _____.

4. The benefits of biodiversity include (1) _____
_____; (2) control of _____ species; (3) higher forest
_____ yields; (4) better _____ protection and enrichment;
(5) sources for medical _____ discoveries; and (6) sources of
_____ for future bioengineering.
5. The wider the range of a species, the greater diversity it has in its
_____, _____, giving it a better chance to survive
environmental change .
6. A _____ _____ is an animal that influences
the survival of many other species.