

PATTERNS OF BIODIVERSITY

The background of the slide features a faint, dark gray graphic. On the left side, there is a large, stylized spiral shell, possibly a nautilus, with its lines radiating from a central point. Overlaid on this and extending towards the right is a graphic of a telescope or a similar optical instrument, with its lens or eyepiece pointing towards the upper right corner. The overall background is a solid dark gray.

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SPECIES DIVERSITY

Species diversity is the effective number of different species that are represented in a collection of individuals.

Species diversity consists of two components, **species richness** and **species evenness**.

Species richness is a simple count of species, whereas **species evenness** quantifies how equal the abundances of the species are.

DIVERSITY INDICES

Researchers have used the values given by one or more diversity indices to quantify species diversity. Such indices include the **Shannon index**, the **Simpson index** and the **Gini-Simpson index**.

When interpreted in ecological terms, each one of these indices corresponds to a different thing, and their values are therefore not directly comparable.

The **Shannon index** equals $\log({}^qD)$, and in practice quantifies the uncertainty in the species identity of an individual that is taken at random from the dataset.

The **Simpson index** equals $1/{}^qD$ and quantifies the probability that two individuals taken at random from the dataset (with replacement of the first individual before taking the second) represent the same species.

The **Gini-Simpson index** equals $1 - 1/{}^qD$ and quantifies the probability that the two randomly taken individuals represent different species.

TRENDS IN SPECIES DIVERSITY

The observed species diversity is affected not only by the number of individuals but also by the heterogeneity of the sample.

If individuals are drawn from different environmental conditions (or different habitats), the species diversity of the resulting set can be expected to be higher than if all individuals are drawn from a similar environment.

Increasing the area sampled increases observed species diversity both because more individuals get included in the sample and because large areas are environmentally more heterogeneous than small areas.

SPECIES RICHNESS

Species richness is the number of different species represented in an ecological community, landscape or region.

Species richness is simply a count of species, and it does not take into account the abundances of the species or their relative abundance distributions.

In contrast, species diversity takes into account both species richness and species evenness.

APPLICATIONS

Species richness is often used as a criterion when assessing the relative conservation values of habitats or landscapes.

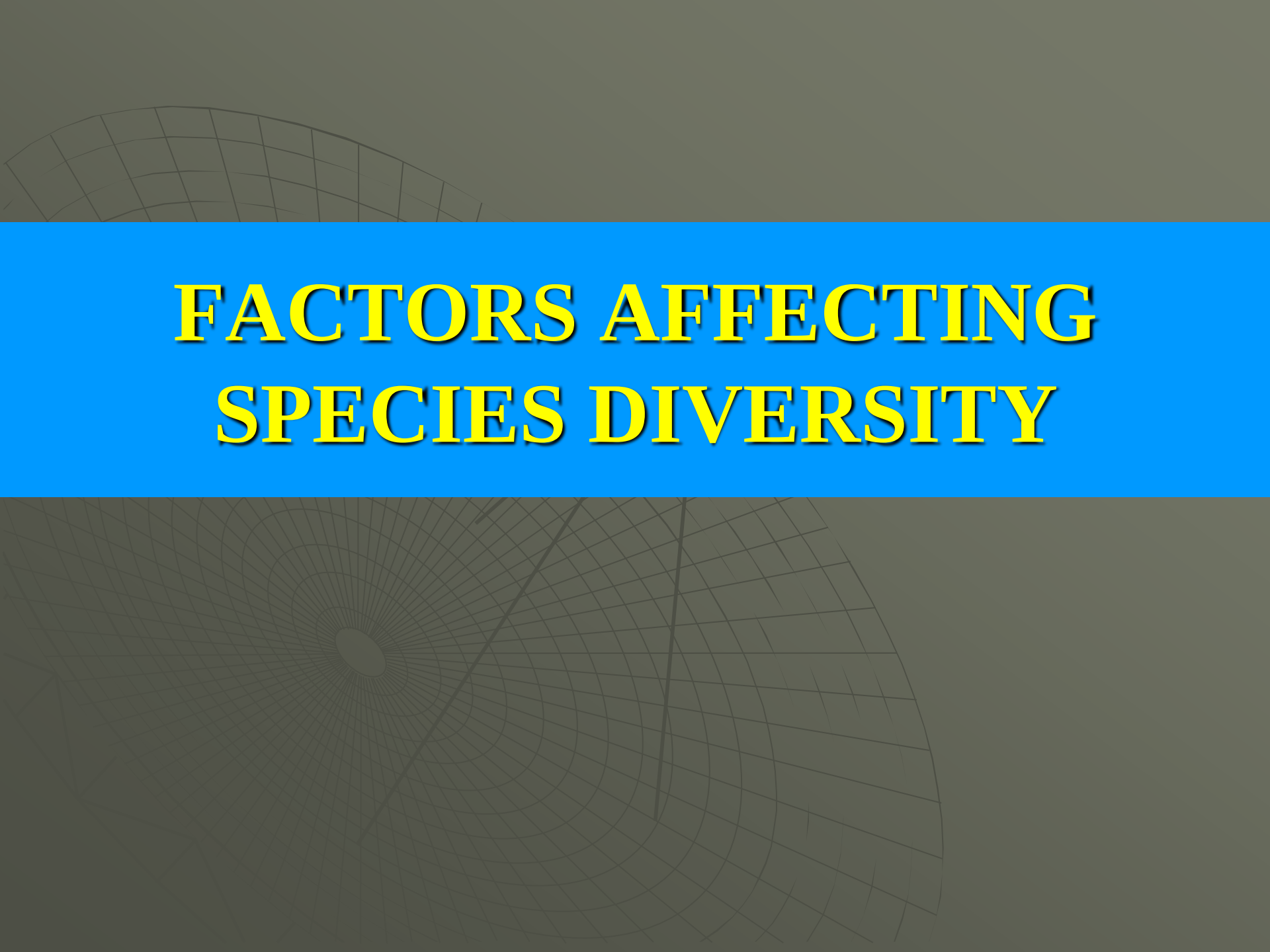
However, species richness is blind to the identity of the species. An area with many endemic or rare species is generally considered to have higher conservation value than another area where species richness is similar, but all the species are common and widespread.

SPECIES EVENNESS

Species evenness refers to how close in numbers each species in an environment are. Mathematically it is defined as a diversity index, a measure of biodiversity which quantifies how equal the community is numerically.

So if there are 40 dolphins, and 1000 whales, the community is not very even. But if there are 40 dolphins and 42 whales, the community is quite even.

The evenness of a community can be represented by **Pielou's evenness index**:

The background of the slide features a dark gray globe with a white grid pattern representing latitude and longitude. The globe is centered in the lower half of the image, with the top half of the slide being a solid blue band.

FACTORS AFFECTING SPECIES DIVERSITY

ABIOTIC FACTORS AFFECTING SPECIES DIVERSITY

There are many factors which affect species diversity. Some of them are external or abiotic while others are internal or biotic coming from within the community

Size of Habitat: The size of the habitat affects the number of species which can live in it. For eg, a large forest can support more species than a rock pool of a few square meters.

Spatial patchiness: The spatial patchiness allows organisms with different requirements to live together. A rock pool with crevices, a sandy floor and stones provides more microhabitats than a smooth walled rock bottomed pool.

Harshness of habitat: The harshness of habitat affects the number of species that are able to survive in the community. For eg, rock pool which is frequently scoured by storms has low species diversity.

ABIOTIC FACTORS AFFECTING SPECIES DIVERSITY

Predictability of change in the habitat: If the changes in a habitat are cyclic, then different species can use the same habitat at different times in the cycle. For eg, in oak woods, during winter, light demanding species dominate the ground flora which are replaced by shade tolerant species as spring progresses.

Disturbances in a habitat: Occasional severe or frequent low level disturbances affect population size. For eg. In a rock pool a heavy winter storm removes algae from the rocks, this allows other species to colonize the bare space.

Isolation of habitat: If an area is far away from a similar habitat, fewer species can colonize it. This is seen on islands at large distance from the main land.

BIOTIC FACTORS AFFECTING SPECIES DIVERSITY

Age of community type: The length of time the community type has existed affects the species diversity. The longer it has existed the more species will have the opportunity to join the community.

Age of community particular type: The length of time any one community has existed in one site affects its species richness. A newly developed community may contain only a few species and the number increases as more species invade and establish.

Primary productivity: If primary productivity is high, then the herbivores have abundant food as a result their number increases which influences the carnivore and so on along the food chain.

Community structure: If the community structure is complex, then the community will contain more niches. For eg. a Corals has more niches and microhabitat than a grassland.

OTHER FACTORS AFFECTING SPECIES DIVERSITY

Invasive species: When a new species that is not native moves into an area, it often won't have natural predators and can thus survive better than natives. They take over, and lower diversity levels by killing off other species.

Keystone species- a keystone species is a species which many others in the food chain rely on, if the keystone species has a problem or decrease in population the diversity of the population will also decrease.

Availability of resources- For instance food, shelter, nutrients, notice that rain forests which are abundant in rain forests show much diversity, while a tundra shows very little diversity.

Stability of the community- for instance, temperature shifts will cause a decrease in diversity because certain species have a small range of temperature that they can live in. This is why coral reefs are decreasing in diversity, they are very limited in the temperature they can live in.

OTHER FACTORS AFFECTING SPECIES DIVERSITY

Natural Selection - If a gene proves to be detrimental to an organism's health and fitness, it may be at greater risk of dying or not being able to reproduce. Eventually, the population of that species may die out, thus, decreasing the diversity.

Destruction of Habitat - Let's say a certain plant or animal are a source of food for an animal and that this plant or animal has medicinal purposes so we overharvest it in a region. The food chain is disrupted because the animal that was dependent on the plant no longer has its food source so it dies out. Other animals that may have eaten that animal will die out and the cycle will perpetuate. The diversity in the region will decrease significantly.