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SEMESTER 2

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TOPIC: RESOURCE PARTITION IN NICHE

Definition:

Similar species commonly use limiting resources in different ways. Similar species can coexist in the same ecological community without one pushing the others to extinction through competition.

Introduction:

Understanding resource partitioning among species may help us to predict how ongoing species declines will impact the functioning of ecosystems.

One of the most striking features of life on Earth is its amazing diversity. There are so many species, in fact, that even after centuries of exploring different ecosystems, describing species, and cataloguing them, the total number of species on planet Earth is still unknown. Estimates range from 5–30 million, but we have only named and described a mere 2 million. Individual ecological communities can hold almost unbelievable numbers of species.

How is this incredible diversity of life maintained (i.e., why do so many species coexist), and what are the consequences of the current rapid extinction of species on ecosystem functioning? Understanding resource partitioning could be critical in resolving both of these problems.

Competition for resources among similar species:

There are only a limited number of ways of "making a living" within ecological communities. For example, on a coral reef, there are hard-skeleton corals that gain food from capturing planktonic animals in their tentacles and, in exchange for providing a suitable habitat and nutrients, gain extra sources of energy from sugar-synthesizing symbiotic algae. Within groups of species that make a living in a similar way, species compete for the same resources. These resources, which include nutrients and habitat, are the raw materials needed by organisms to grow, live, and reproduce. However, resources are not unlimited, and individuals from different species commonly compete for resources (interspecific competition).

The method of coexistence:

Classic experiments and mathematical models show that two species cannot coexist on the same limiting resource if they use it in the same way: The superior competitor will always win out. If ecologically similar species (like corals on a

reef or plants in a field) compete with one another for limiting resources, what stops the best competitor from out-competing all the others? The answer may lie in species "doing their own thing" — specializing in their use of resources and thereby limiting their competition with others.

Division of resources:

Species can divide up a limiting resource, such as food, water, or habitat (in other words the resource "pie"), by using different slices or even using the same "slice" but in different places (i.e., they are dining in different restaurants, to take the analogy one step further) or at different times ("do you have a table free at eight o'clock?").

How Do Potential Competitors Partition Resources in Nature?

Perhaps the most obvious way that species can partition resources is in terms of *what* they consume. This is often underpinned by differences in their morphological adaptations that allow differential resource use. For example, a detailed study of bumblebees in the mountains of Colorado (Figure 1) neatly shows how different species can be best adapted to specific forms of a resource (Pyke 1982). Bumblebee species all compete for nectar from flowers, but crucially these flowers vary in the length of their corolla. Matching this variation, different bumblebees in this area appear to be adapted to specific species of plant that have different corolla lengths in their flowers. Careful observations of bumblebee visits to different flowers revealed clear resource partitioning — different species preferred different length corollas in accordance with their proboscis length (i.e., long proboscis, long corolla; short proboscis, short corolla).

Resource Partitioning, Species Extinction, and the Functioning of Ecosystems:

Humans are causing widespread extinctions of species on local and even global scales. Recently, ecologists have realized that resource partitioning may have important implications for our understanding of the effects of losing species on the functioning of entire ecosystems.

Groups of ecologically similar species may all contribute toward the same, aggregate ecological processes; for example, grasses in a meadow all contribute towards overall primary production and predatory spiders in the same meadow may all contribute towards the control of plant herbivores. Maintenance of such ecological processes is important for the overall functioning of ecosystems, including ecosystem services that humans benefit from.

Resource partitioning can help scientists understand how aggregate ecological processes will be impacted by species extinction. If species show a high degree of resource partitioning, when a species is lost so too is the capacity of the

ecological group to exploit the particular slice of the resource pie that the deleted species was adapted to exploit. For example, extinction of a species of grass that was uniquely specialized to use ammonium as a source of nitrogen would leave ammonium in the soil unused. Because this slice (ammonium) of the resource pie will not be exploited, the overall rate of new growth of meadow grass (primary production), as well as associated processes like uptake of carbon dioxide and production of oxygen, will be reduced.

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