

# SNC1D BIOLOGY

## SUSTAINABLE ECOSYSTEMS

### Factors That Affect Populations (P.38-42)

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### Biotic & Abiotic Influences on Ecosystems

Various combinations of abiotic and biotic factors cause populations to increase or decrease. For example, if there is an unlimited amount of food, water, and space, populations can grow very quickly. Without any limits, 10 breeding pairs of rabbits could expand to 10 million breeding pairs in only 3 years. In a healthy, properly functioning ecosystem, limiting factors prevent overpopulation from happening. A **limiting factor** is any factor that restricts the size of a population or where it can live.



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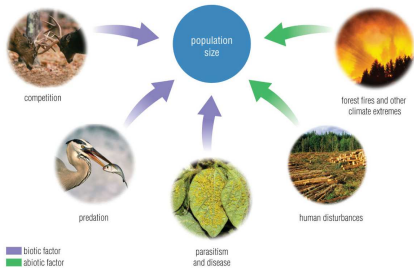
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### Biotic & Abiotic Influences on Ecosystems

Limiting factors may be biotic, such as the availability of food, or abiotic, such as access to water. Human influences often act as limiting factors.



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### Biotic & Abiotic Influences on Ecosystems

**LIMITING FACTOR**

- ❖ any factor that restricts the size of a population or where it can live
- ❖ can be abiotic or biotic
- ❖ help prevent overpopulation
- ❖ 4 major factors:
  - food
  - space
  - water
  - predators

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### Abiotic Limiting Factors

*Temperature and precipitation are both abiotic factors that can influence where a species lives. For example, cacti thrive in dry conditions. Too much rainfall could destroy their shallow roots by flooding them or causing them to rot in unusually wet soil.*

**ABIOTIC LIMITING FACTORS (KEY)**

- ❖ includes:
  - amount of light, water, nutrients, and space
  - temperature, acidity, and salinity
  - natural disturbances (storm, fire, drought, ...)
  - human disturbances (logging, mining, ...)

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### Abiotic Limiting Factors

*Every species has a **tolerance range**, which is the range of an abiotic factor that a species can endure. Species with a wide tolerance range tend to be more widely distributed. Raccoons, for example, are found in both tropical rainforests and northern forests.*

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### Abiotic Limiting Factors

**TOLERANCE RANGE**

- ❖ range of abiotic conditions within which a species can survive

The graph plots population size on the y-axis (from low to high) against an abiotic factor on the x-axis (from low to high). A bell-shaped curve represents the population response. The central peak is labeled 'high population'. The range of the abiotic factor where the population is present is labeled 'tolerance range'. The range where the population is at its highest is labeled 'optimum range'. Outside the tolerance range, the population is zero, labeled 'no population'. Within the tolerance range but outside the optimum range, the population is low, labeled 'low population'.

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### Biotic Limiting Factors

While abiotic factors determine where a particular species is able to live, biotic factors often determine how easily a species can survive in an ecosystem. For example, having a lot of a specific food can influence how well a species may survive. Biotic factors also include how the species in a community interact with one another. These interactions include **competition, predation, and symbiosis**.

The first image shows a bird in flight. The second image shows a group of lions in a savanna. The third image shows clownfish in a sea anemone.

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### Biotic Limiting Factors

**BIOTIC LIMITING FACTORS (KEY)**

- ❖ competition (two species vie for the same resource)
- ❖ predation (one species feeds on another)
- ❖ symbiosis (two species live in/on/near each other)

The first image shows a bird in flight. The second image shows a group of lions in a savanna. The third image shows clownfish in a sea anemone.

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**Biotic Limiting Factors**

**NOTE!**  
Symbiosis can be further broken down into 3 subcategories.

For example, bacteria living in nodules on the roots of a soybean plant is an example of **mutualism** (i.e. the two species benefit each other).



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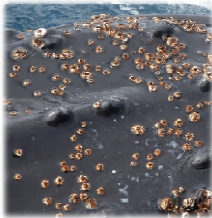
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**Biotic Limiting Factors**

**NOTE!**  
Symbiosis can be further broken down into 3 subcategories.

The barnacles on a humpback whale – which pose no threat to the whale – are an example of **commensalism** (i.e. one species benefits while the other is unaffected). In this case, the barnacles simply feed on microorganisms in the water as the whale swims along.



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**Biotic Limiting Factors**

**NOTE!**  
Symbiosis can be further broken down into 3 subcategories.

Finally, tapeworms – which attach themselves to the intestinal wall of its host with hooks or suckers and then proceeds to feed off the host – are an example of **parasitism** (i.e. one species lives/feeds on a host species).



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### Carrying Capacity

As a population grows, it requires more food, water, and space. At some point, the population reaches the maximum number of organisms that can be continuously supported by the ecosystem. This limit is called the **carrying capacity** of the ecosystem.

**CARRYING CAPACITY**

- maximum population size of a species that an ecosystem can sustain

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### Carrying Capacity

**NOTE!**

The carrying capacity can be altered through natural or human activity when resources are removed from or added to the ecosystem. A forest fire can increase the number of blueberry bushes since more light/space is available. Irrigation, which increases the productivity and fertility of land, can change a desert into a lush oasis. The removal of wolves by human hunters can cause an increase in the deer population since there are fewer predators.

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### Carrying Capacity

For an ecosystem to be sustainable, none of the populations in the community can exceed its carrying capacity by very much or for very long. Consider a population of snowshoe hares, which are prey for lynx. As the population of snowshoe hares increases/decreases, so too does the lynx.

**Snowshoe Hare and Lynx Population Cycles**

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 **Check Your Learning**

1. Two species of bird compete for food in a forest. Both eat worms, but one has a narrow beak that allows it to pull worms out of cracks more easily.

(a) If a drought caused the number of worms to decrease, which species would be more successful?

(a) the bird with the narrow beak – can gather worms more easily

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 **Check Your Learning**

1. Two species of bird compete for food in a forest. Both eat worms, but one has a narrow beak that allows it to pull worms out of cracks more easily.

(b) Identify the limiting factors. Are they biotic or abiotic? Explain.

(b) drought – abiotic  
competition - biotic

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 **Check Your Learning**

2. Fertilizer used by homeowners often ends up in nearby natural ecosystems. What effect do you think this has on the carrying capacity for plant life in these ecosystems?

the carrying capacity will increase as there is more food for the plants

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 **Check Your Learning**

3. A predator is a factor in determining the population of the prey it eats, but a parasite may not be. Why do you think this is so?

most parasites feed off their host without killing them

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 **Check Your Learning**

4. Classify each of the following interactions based on its description.  
(a) Flatworms live attached to the gills of horseshoe crabs obtaining bits of food from the crabs' meals. The crabs are unaffected.

(a) symbiosis (commensalism)

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 **Check Your Learning**

4. Classify each of the following interactions based on its description.  
(b) A wood turtle lays its eggs on sand or gravel-sand beaches and banks along streams. A raccoon eats the turtle's eggs.

(b) predation

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 **✓ Check Your Learning**

4. Classify each of the following interactions based on its description.  
(c) Lichens found on tree bark consist of algae and a fungus. The fungus obtains food from photosynthesis of the algae and the algae has a place to live.

(c) symbiosis (mutualism)

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 **✓ Check Your Learning**

4. Classify each of the following interactions based on its description.  
(d) Both bluebirds and starlings nest in holes in trees, poles, and fence posts. Neither species is able to dig holes. Both must rely on holes that already exist.

(d) competition

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 **✓ Check Your Learning**

4. Classify each of the following interactions based on its description.  
(e) A flea feeds on the blood of a ground squirrel.

(e) symbiosis (parasitism)

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 **Check Your Learning**

**TEXTBOOK**  
P.46 Q.2-7

**WIKI (BIOLOGY)**  
 1DBIOL - ASG3 (Aquatic Ecosystem Factors)

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