Ecosystems and population change slide deck

Biology 20

Unit B: Ecosystems and population change

Habitats and niches

One lynx, four levels

- A single Canada lynx is one member of a species.
- The hares, spruce, and snow around it belong to a larger system than the lynx alone.



Niches within an ecosystem

- A population is one species in one area.
- A community is the populations living together.
- A niche is the role, and a habitat is the place where that role happens.

Key terms

ecosystem

The community of organisms plus the abiotic surroundings they use in one place.

niche

The role a species plays, including what it eats, where it feeds, and the conditions it tolerates.

habitat

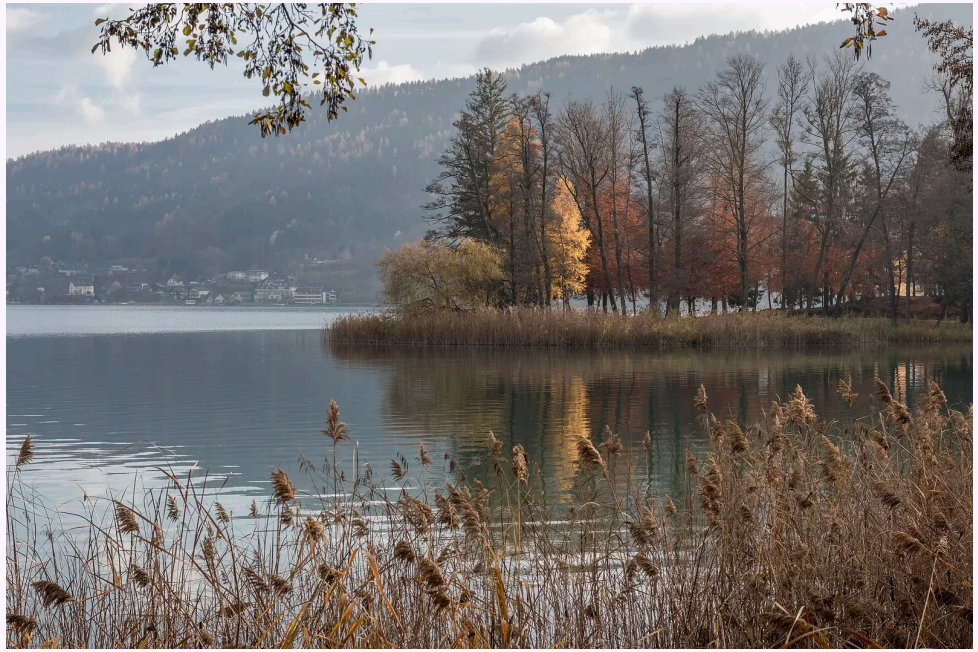
The physical place where a species lives, such as the forest floor or the littoral zone.

population

A group of organisms of one species living in the same area at the same time.

Layers in the forest and the lake

- Terrestrial layers run from canopy to sub-canopy, forest floor, and soil.
- Lake zones run from littoral shallows to limnetic open water, profundal dark water, and benthic bottom.
- Each layer offers habitats, and several niches can share one layer.



Plant and microclimate study

- The question names the dominant plant and one abiotic measure.
- The plan says where the samples sit, under the plant and in the open.

A one-line niche

- A niche line names food, feeding place, and one condition.
- A habitat line names only the layer or zone.

Stack and role

- Define population, community, and ecosystem with one local example.
- Separate habitat from niche for one lake organism.

Limits decide who stays

- The next lesson measures abiotic and biotic limits in a local place.
- A niche can be empty when a limit sits outside what the species tolerates.

Image credits

Johann Jaritz, Pörtschach Halbinselpromenade Naturpark im Landschaftsschutzgebiet 18112021 1711, CC BY-SA 4.0

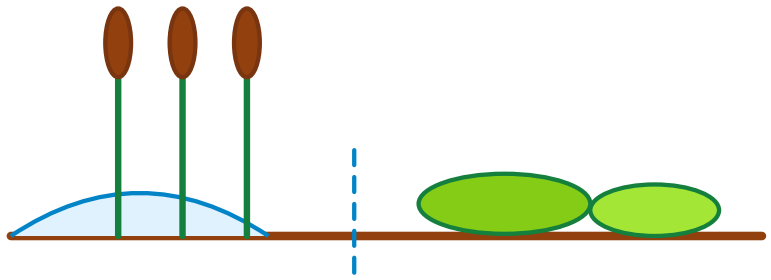
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Local ecosystems and limiting factors

Cattails stop where the water stops

- Cattails ring the slough and fade out within a few metres of dry prairie.
- Grass covers the upland where the cattails are absent from the stand.



The cattail edge is the habitat boundary

Abiotic and biotic limits

- Abiotic factors include moisture, temperature, light, soil, oxygen, and nutrients.
- Biotic factors include competitors, predators, and parasites.
- A limiting factor is the condition that most restricts distribution or population size.

Key terms

limiting factor

An abiotic or biotic condition that restricts where a species lives or how large its population grows.

abiotic factor

A physical or chemical condition, such as temperature, moisture, light, oxygen, or soil nutrients.

biotic factor

A living influence, such as a competitor, a predator, or a parasite.

range

The geographic area where a species is found.

A limiting factor sets the habitat edge

- Cattails require saturated soil, so moisture limits their upland range.
- Trout require cold, oxygen-rich water, so temperature and oxygen limit warm ditches.
- Competitors and predators limit abundance even when the abiotic setting is suitable.



Measurement precision

- Write the reading and the plus-or-minus precision of the tool.
- Compare two sites with the same tool before you claim a difference.

Rebuild a disturbed patch

- A reclamation plan names the limiting factors the disturbance created.
- The plan chooses plants that match the moisture and soil that remain.

Limits and tools

- Give one abiotic and one biotic limiting factor for a local species.
- Explain how tool precision changes a conclusion.

Names make the field list usable

- The next lesson assigns binomial names and kingdom-level nutrition.
- Human changes to biodiversity use the limits you measured.

Image credits

Diane9247, Pond, cattail grass, sunlight (North of Klamath Falls, OR), CC BY-SA 3.0

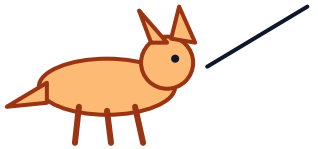
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Scientific names and human impact

Lynx canadensis on a label

- The name card uses two words, and the first word starts with a capital L.
- People in another language can still look up that same lynx.



Lynx canadensis

Genus species

Genus is the group. Species is the kind.
A capital on the second word breaks the name.
Italic in print. Underline when you handwrite.

Feed first, then the two-word name

- Plants build food with light, animals eat other organisms, and fungi absorb digested food.
- The genus is the group. The species epithet picks one member.
- A field list writes the genus with a capital and the species word in lowercase.

Key terms

binomial nomenclature

The two-word scientific name: a genus and a species epithet.

introduced species

A species people bring into an ecosystem where it was absent from the local community.

genus

The first word of a scientific name, shared by closely similar species.

species epithet

The second word of a scientific name, which picks out one species in the genus.

A new arrival can take the space

- Purple loosestrife can crowd out cattails along a marsh edge.
- Tropical fish released in the Banff hot springs live where the water stays warm.
- A drained wetland removes the shallow habitat whole communities use.



Scientific name format

- Capitalize the genus. Keep the species epithet lowercase.
- Add the feeding type when the question asks for the kingdom clue.

Marsh restoration options

- Name the introduced plant and the local plant it crowds.
- Pick one action and say which animals gain nesting space.

Names and change

- Write one binomial with the capital in the right word.
- Explain one introduced species using a local habitat.

A named species still varies

- The next lesson stays with one species and looks at differences inside it.
- Those differences are the raw material for natural selection.

Image credits

U.S. Fish and Wildlife Service, National Conservation Training Center, Purple Loosestrife, public domain

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Variation and natural selection

The lynx sees the brown hare

- On patchy snow, the white hare blends in and the brown hare stands out.
- The lynx catches the hare it can see, and that hare leaves fewer young.



Differences first, then sorting

- A heritable mutation can change a trait the offspring receive.
- Sexual reproduction mixes traits so litters are uneven.
- Natural selection keeps the versions that leave more young.

Key terms

natural selection

Heritable traits that help survival or reproduction become more common in the next generation.

heritable mutation

A change in DNA that can be passed to offspring and may help, harm, or do little in a given place.

sexual reproduction

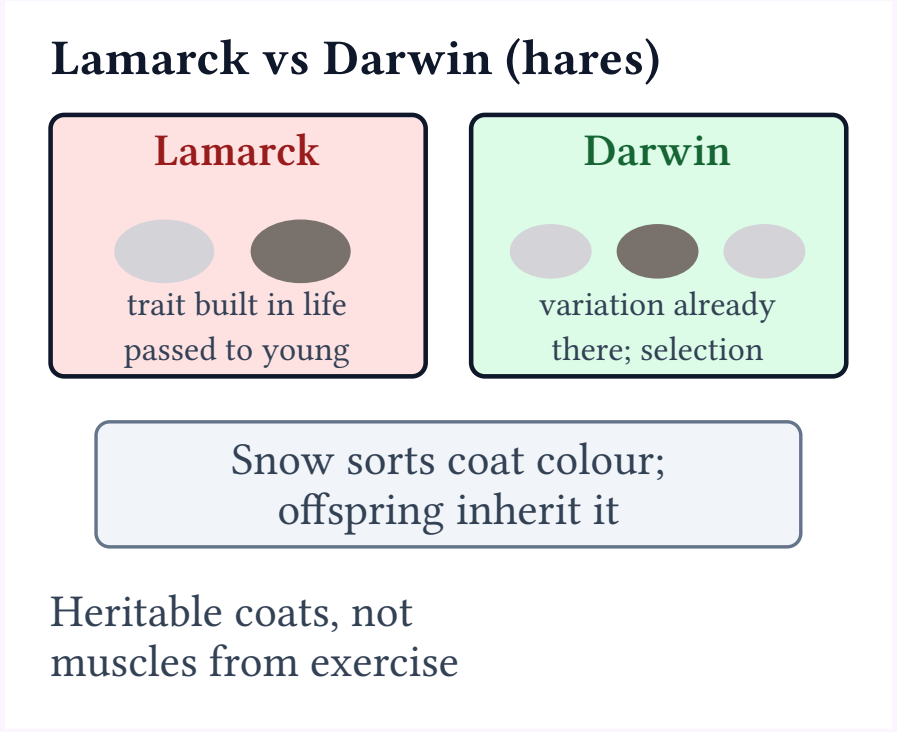
Reproduction that combines genetic material from two parents, so offspring differ.

acquired trait

A feature gained during one lifetime, such as a muscle built by exercise.

Lamarck’s idea and Darwin’s explanation

- Lamarck said a trait built during life is passed to the young.
- Darwin said heritable variation is already present, and some individuals leave more young.
- The hare example sorts coats that the young can inherit.



Measuring inherited variation

- Pick one trait you can measure on many individuals of one species.
- Say how you will know the differences are worth graphing.

Explanations for hare colour

- Point to the coat the young hares can inherit.
- Leave the exercise story on the acquired-trait side.



Sorting and sources

- Explain the hare coats with natural selection.
- Name mutation and sexual reproduction as sources of heritable differences.

The long record of this sorting

- Fossils, limbs, embryos, and DNA are the next evidence.
- Speciation is what this sorting can do when populations are split.

Image credits

Colin Canterbury/USFWS, Snowshoe hare transitioning, public domain

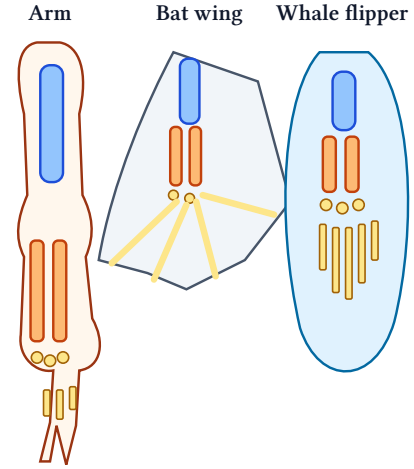
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Evidence for change and speciation

Arm and whale flipper

- Each outline shows one humerus, then a radius and an ulna, then carpals and pha-langes.
- The arm holds, the bat wing flies, and the whale flipper swims, and the bones stay in that same order.



Blue: humerus (one upper bone)
Orange: radius and ulna
(two lower bones)
Yellow: carpals and phalanges
(wrist and fingers)

Several lines, one conclusion

- Fossils show earlier forms and the order of change.
- Homologous limbs share a plan. Analogous wings share a job.
- DNA similarities line up with the groups the bones suggest.

Key terms

homologous structure

A body part with the same underlying bones or plan in different species, used for different jobs.

analogous structure

A body part with a similar job and a different underlying plan, such as an insect wing and a bird wing.

speciation

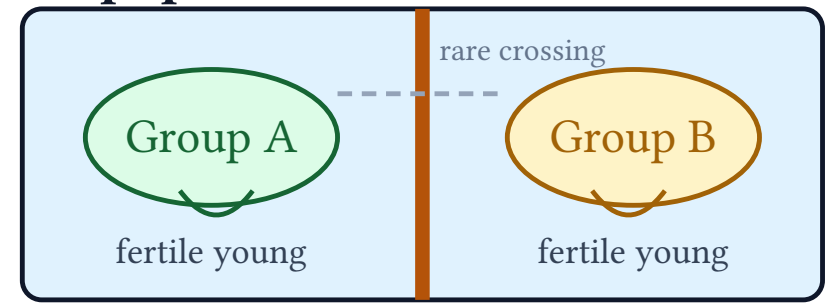
The splitting of one population into two species that produce fertile young within their own group.

reproductive isolation

A barrier that keeps two groups from producing fertile young together.

What has to happen for two species

- A barrier splits one population into two groups.
- Each group faces its own food, climate, or mates.
- Fertile young are produced within each group, and cross-group matings become rare.



Each group faces its own food, climate, or mates

A small data set

- A table of beak depth can show a shift after a dry year.
- A DNA match can show which finches are closer.



Homologous and analogous structures

- Same bone plan means homologous, even when the job differs.
- Same job with a different plan means analogous.

Bones and splits

- Define a homologous structure with the limb example.
- List the conditions for finch speciation.

Pace is the remaining question

- Gradualism and punctuated equilibrium describe tempo.
- The Burgess Shale will sit in that argument as evidence.

Image credits

Andrew Katsis, Medium ground finch on Floreana Island in the Galápagos Islands, CC BY 4.0

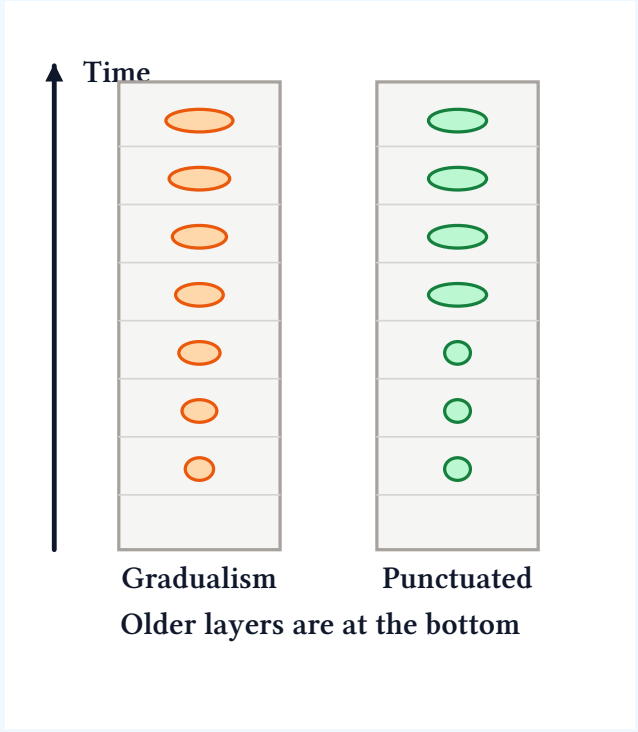
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Gradualism and punctuated equilibrium

Gradual change and long stable stretches

- One sketch rises smoothly from older layers to younger layers.
- The other stays flat, jumps, and stays flat again.



Fossil layers show the tempo of change

- Gradualism means steady change through the layers.
- Punctuated equilibrium means long stability and shorter bursts.
- A mass extinction clears many species and opens space for later bursts.

Key terms

punctuated equilibrium

A pattern of long stable stretches in the fossil record with shorter bursts of change.

gradualism

A pattern of steady change in form across the fossil record.

fossil record

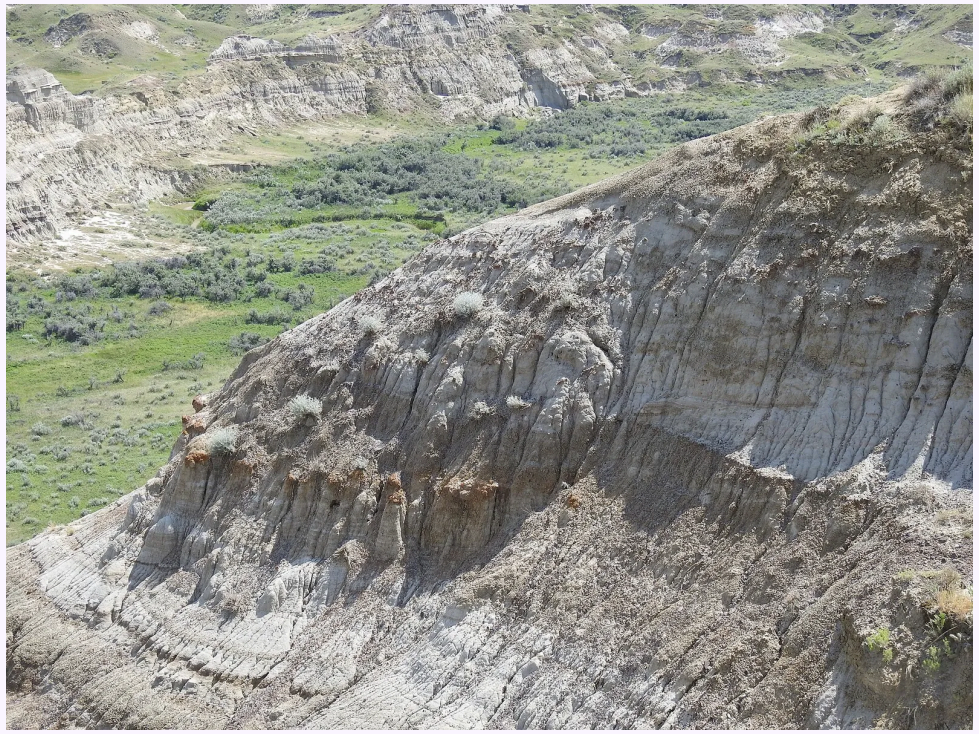
The ordered remains of past life that show when forms lived.

mass extinction

A time when many species disappear from the fossil record together.

Sketches and claims

- A steady series of intermediate fossils supports gradualism.
- Long stretches of the same form, then a new form, support punctuated equilibrium.
- Say when the rock layers are too incomplete to choose.



Plotting a small series

- The axis needs a unit and even spacing.
- The sentence you choose has to match the shape you plotted.

Evidence that changes a conclusion

- A new intermediate fossil can turn a jump into a slope.
- A long stable stack can turn a slope hypothesis into a staircase.

Two tempos

- Describe gradualism and punctuated equilibrium from the sketches.
- Say how a fossil gap can affect the choice.

Producers store the energy

- Unit C: Photosynthesis and cellular respiration opens the chloroplast and asks how light becomes sugar.
- The species in this unit depend on that stored energy.

Image credits

Hirgax, Badlands in Dinosaur Provincial Park, Alberta, CC BY-SA 4.0