Teaching with EcoGEM

A Grade 6 inquiry sequence for EcoGEM Lab

Begin with the explanation students already have, then give them a reason to reconsider it. This sequence adapts my EcoGEM design: a short orientation followed by competition, connected food webs, and disturbance. Each lesson returns to Generate-Evaluate-Modify so students connect what they predicted with evidence and a revised explanation. I can start with Guided mode, then move to Independent mode as students become more confident. Teacher controls in the lab Menu reveal or hide pattern hints without changing the model or resetting a run.

Learning goal

Explain how a change can travel through an ecosystem, using a food-web pathway and evidence from more than one model step.

Prepare for the sequence

1. Plan one 10-15 minute orientation and three 40-55 minute lessons. Work in pairs, then compare explanations with another pair. Swap the driver and evidence-recorder roles halfway through each lesson.
2. Open EcoGEM for the embedded lab and notebook. The standalone lab is useful for projection or free investigation. Enter the lesson's question in Our question below the embedded lab.
3. Check that students can identify a producer and a consumer, follow an arrow from food to consumer, and read a line graph. Use drawings and oral explanations before requiring written responses.
4. Rehearse each setup. Start fresh for each fair comparison and hold resources, starting abundances, and run length constant unless one of these is the variable being tested.

Keep this rhythm visible

Generate	Evaluate	Modify
Make an explanation and prediction visible before running.	Use a fair comparison, the food web, and numerical evidence.	Revise the explanation and identify what still needs checking.

Open the EcoGEM lesson and student notebook

Open the online teacher guide

10-15 minutes | Before the investigations

Lesson 0 · Learn the three views

Today the goal is to learn the instrument, not to find the right ecological answer. Show how the food web, illustrated habitat, and graph describe the same selected organisms in different ways.

1. Choose Atlantic Ocean, open Set up, and select Build your own. Click Algae and include it. Before running, locate its portrait, name, and graph legend entry.
2. Press Play once. Pause for discussion. Move across the graph to see the step and population beside the thin line. Nothing locks when I click; on a phone, drag across the graph. Inspect and Data table show exact model values.
3. Demonstrate the full name and diet on a species click. Explain that arrows show food moving to a consumer; no arrow does not prove that a relationship never occurs in nature.
4. Turn scene motion off and on. Its depth and movement are illustrative; positions, collisions, portrait counts, and sizes are not measurements of animal behaviour or population size.

Ready to continue?

Ask each pair to show how to include a species, find an exact graph value, pause, and start fresh. Continue only when both learners can explain which representation answers which kind of question.

Make the first evidence record together

At each checkpoint, record the organism, model step, baseline abundance, changed-run abundance, and the relationship that could explain the difference. A direction or a single screenshot is not enough on its own.

Organism	Step	Baseline	Changed run	What this supports
Phytoplankton	25	Record value	Not yet tested	Describe only what this run shows.
Phytoplankton	50	Record value	Not yet tested	Use model units, not real counts.

Clarify the comparison before Lesson 1

In Menu, Experiments opens A, B and Compare. A and B preserve independent setups and results in this browser. I copy A's starting setup to B, change one factor, and inspect the same step in both runs. Reset starts the current configuration at step 0 with my chosen starting values; selecting a preset restores that preset's values. The other scenario survives both. I can download both scenarios from the experiment actions menu. Repeating the same setup produces the same result, so it is not a new independent ecological observation.

One useful teacher question

Which view tells you the feeding relationship, which helps you see the selected organisms, and which gives you evidence of change over time?

Start small, then open the web

I open Set up in the food web and choose Simple chain or Small food web. Full ecosystem, Producers only, and Build your own offer other starting points. I can add organisms after students explain the pathway they already see.

Ecosystem	A starting pathway	A question to develop
Atlantic Ocean	Algae to Animal plankton to Herring	What changes if another fish shares the plankton?
Sahara Desert	Grasses to Jerboa to Sand cat	What changes when plant resources are reduced?
Amazon Rainforest	Brazil nut to Agouti to Ocelot	How could a predator affect plant food resources?
Urban City	Grass to Rabbit to Fox	What changes when Hawk shares the rabbit prey?
Arctic Ocean	Algae to Copepod to Arctic cod	What changes when Ice algae supplies another food source?

Make starting abundance the variable

I use Menu, then Teacher controls, then Edit starting values. I click an included species in the food web and open Starting amount at the bottom of its details. I can edit it only at step 0. I record my chosen values and hold other conditions constant. Reset keeps those values; Restore preset replaces them with the preset values. These controls are local teaching options, not a password-protected teacher account.

Inspect the same step in each scenario

I move across the graph to see the step and nearest population beside the thin line. Nothing locks when I click. On a phone I can drag; the Inspect slider also chooses a step. Compare pairs each food web with its graph. Selecting a species in either web updates both graphs; one slider inspects matching steps. On a phone, the graphs stack and Food web reveals either web. Excluded organisms are omitted from the graph and value list, but their recorded history remains in exports. Exclusion changes the model, so I do not use it simply to hide a line.

Run length and model units

Play advances to the next 100-step mark; Step advances once. Runs can reach 2,000 model steps. Reset restarts the current web at step 0 with its chosen starting values. In Set up, Restore preset returns to the selected preset's starting configuration. Neither changes the other saved scenario. Model steps are not real days.

Sahara Desert | 40-50 minutes

Lesson 1 | Competition and coexistence

Return to the producer from the orientation. Now place two producers in the same system. They share a resource limit, so a change to one may affect the other even without a feeding arrow between them.

Investigation question

How can a consumer change the relationship between two producers?

Set up

Open Menu · Experiments and select A. Choose Sahara Desert and Producers only. Grasses and Saltbush are on; all consumers are off. Keep Rainfall at 100%.

Generate | Predict and explain

Before running, ask whether both producers can persist and what evidence would show competition. Each student draws a predicted pair of curves and explains the relationship in words.

Evaluate | Compare evidence

1. Run to step 100 and record both producers at steps 25, 50, and 100. In Menu, open Experiments; A and B preserve separate runs. Copy A's starting setup to B before changing one factor. For an optional test of competition, repeat with one producer alone and compare the same step.
2. Switch to B, which has the copied producer-only starting setup. Include Locust; retain its Grasses feeding link. Predict again before pressing Run.
3. Run to step 100. Open Compare in Experiments and inspect A and B at the same step. Ask which change is direct consumption and which might follow from changed competition.

Modify | Revise the explanation

Have pairs revise a two-step explanation: a consumer changes one producer; that can change the resources available to the other. Ask them to attach a numerical comparison to each claim, then exchange explanations with another pair.

Teacher move

Ask, 'What evidence would make you change your explanation?' Do not require one plant to disappear. This model allows producer coexistence; competitive exclusion in the original lab is not a required result here.

Look for: Students distinguish a feeding link from competition and use matched-step evidence to explain an indirect effect.

Next, follow the effects beyond the producers. A change can reach organisms that share no direct feeding link.

Atlantic Ocean | 45-55 minutes

Lesson 2 | From a chain to a connected web

Start with a chain students can trace with one finger. Then add a branch. The purpose is to coordinate several relationships, rather than assume that every organism has only one cause of change.

Investigation question

Can one new feeding pathway change several populations at once?

Set up

Open Menu · Experiments and select A. Choose Atlantic Ocean and Build your own. Include Algae, Animal plankton, Herring, and Cod. Their active pathway is Algae to Animal plankton to Herring to Cod. Keep Nutrient supply at 100%.

Generate | Predict and explain

Ask each pair to predict which populations might change early and later. They should explain their prediction using the food web before observing the graph.

Evaluate | Compare evidence

1. Run the four-organism chain to step 100. Record values at steps 25, 50, and 100; keep it as scenario A and copy its starting setup to B before making a change.
2. Switch to B at step 0 and include Shrimp. Leave its selected Algae and Animal plankton links on; Cod can also eat Shrimp. Predict how this new branch could alter the original chain.
3. Run to step 100. Compare at the same steps. Look for two changes happening together and an indirect change elsewhere in the web.

Modify | Revise the explanation

Ask students to explain a pathway involving at least three organisms. They should identify where the evidence supports their original idea and where the explanation needs another cause or a different sequence.

Teacher move

Point out that Shrimp both shares food with Animal plankton and can consume them. Adding it changes several ecological relationships, even though the experimental intervention is one added group. Curve order alone does not establish causation; use the controlled comparison and the feeding diagram together.

Look for: Students coordinate more than one interaction, compare the same model steps, and qualify causal claims when the evidence is incomplete.

A web is now familiar. Next, disturb an established run and compare it with an unchanged baseline.

Lesson 3 | Disturbance and indirect effects

Show the full web and ask students to identify a change that might travel beyond a predator's immediate prey. Treat the first run as a baseline, not as proof that the ecosystem is permanently stable.

Investigation question

What happens beyond the prey when a predator is removed?

Set up

Open Menu · Experiments and select A. Choose Amazon Rainforest and Full ecosystem. Keep Plant productivity at 100%. The disturbance will be removal of Harpy eagle at step 100.

Generate | Predict and explain

Students predict a direct effect on Howler or Sloth and a possible indirect effect on a producer. Ask them to state what would count as evidence against their prediction.

Evaluate | Compare evidence

1. Run the unchanged full ecosystem to step 200 by pressing Run twice. In Menu, open Experiments; A and B preserve separate runs. Copy A's starting setup to B before changing one factor. This supplies an undisturbed baseline beyond the future disturbance point.
2. Switch to B, which has the same starting setup, and run to step 100. Remove Harpy eagle at that step. Do not reset after removal; continue to step 200.
3. Compare scenarios A and B at steps 100, 125, 150, and 200. Record two consumers and at least one producer. Distinguish immediate removal from later changes.

Modify | Revise the explanation

Students revise their food-web explanation with a supported multi-step pathway and one model limitation. Challenge them to identify what additional evidence would be needed before making the same claim about a real forest.

Teacher move

The original EcoGEM design used a newcomer to investigate disturbance. This version uses a documented predator-removal pathway. Adding a native model organism is not evidence of invasion. A cascade is a sequence of effects; call it a feedback loop only if the causal path returns to influence an earlier population.

Look for: Students separate direct, indirect, and delayed effects and support their explanation with the unchanged baseline.

Transfer the reasoning to an Ontario biodiversity issue using real observations and research, rather than treating the simulation as a forecast.

Listen for a change in reasoning

At each checkpoint, record the organism, model step, baseline abundance, changed-run abundance, and the relationship that could explain the difference. A direction or a single screenshot is not enough on its own.

Organism	Step	Baseline	Changed run	What this supports

Exit ticket

One relationship I understand differently now is... My evidence at step... is... One assumption I would check outside the model is...

What you hear	Evidence in the explanation	Next teacher prompt
Describing	Names organisms and a graph trend, but gives little evidence for how the change travels.	Ask for a matched-step value and one food-to-consumer link.
Explaining	Connects a direct and an indirect effect using a food-web pathway and a numerical comparison.	Ask what other relationship could also contribute to the change.
Reasoning about a system	Coordinates multiple relationships, compares baseline and disturbance, revises an explanation, and names a limitation.	Ask which real-world observations would test the revised explanation.

Make participation possible

1. Use colour together with organism names and line patterns. Data table gives exact values for included organisms. Excluded organisms are hidden from the graph and value list, while their recorded history remains in exports. Exclusion changes the food web, not just its display.
2. Offer oral, annotated-diagram, or written explanations. Provide frames such as 'When ___ changes, ___ may change because ___. At step ___, the comparison shows ___.'
3. Disable scene motion when it distracts. The lab respects reduced-motion preferences and can be operated using keyboard controls.
4. With limited devices, project one run, collect individual predictions first, and have groups propose the next controlled change. Avoid allowing the quickest operator to replace everyone's reasoning.
5. Download notes and data before leaving a shared device. The notebook saves locally and has no teacher dashboard or automatic submission.

Connect the reasoning to Ontario

Connections are paraphrased from Ontario's 2022 Grade 6 Science and Technology curriculum. This sequence supports selected expectations; it does not cover the full biodiversity strand. Genetic variation, coding, and a local action project require additional learning.

Expectation	Connection	Use in this sequence
B2.5	Interrelationships among organisms and their environment.	Core: explain feeding, competition, and resource effects.
A1.2; A1.5	Investigation and communication of findings.	Core: predict, control a variable, compare evidence, revise.
B2.4; B1.1	Community resilience and the consequences of biodiversity loss.	Supported discussion; connect model results to real evidence.
B2.6; B1.2	Local invasive species and action on a biodiversity issue.	Extension: research an Ontario example, then plan and carry out an appropriate class response.

Official Ontario curriculum | Grade 6

Bring the reasoning home

I can bring the reasoning home with Urban City's spongy moth, documented by Mississauga, or investigate another Ontario example such as zebra or quagga mussels. I establish that it is introduced and harmful using reliable local sources, compare documented mechanisms with model assumptions, and consider different community perspectives. Students can plan and carry out a feasible class action, such as a sourced prevention-information display. I assess the real evidence and the action separately from the simulation.

Ontario example | Zebra and quagga mussels

Keep the model limits visible

The food webs combine selected observations from different places, seasons, and life stages. Some nodes represent groups. Feeding links do not specify how often a prey is eaten. Numerical parameters are educational choices, and the model omits migration, decomposers, genetic variation, and many environmental processes. A resource slider is not a climate forecast. Repeating an identical deterministic run does not supply independent field replicates. Urban Oak combines leaves and acorns: caterpillars eat leaves, while changes to acorn-eating mammals through that single pool are a teaching assumption. The Arctic productivity slider does not simulate sea-ice loss, and no Arctic invader is asserted.

Feeding-link evidence and model specification

Investigate an invasion

After exploring a native food web, I open Set up and choose Invasive species where available. We click the newcomer, read the short explanation, and predict one direct effect and one effect that might travel through the web before pressing Play.

Ecosystem	Invader	A first comparison at 100% resources
Atlantic Ocean	Sea squirt	Full ecosystem; watch Algae, Animal plankton and Shrimp.
Sahara Desert	Mesquite	Include Grasses and Jerboa before adding Mesquite.
Amazon Rainforest	Gamba grass	Include Cecropia and Sloth before adding Gamba grass.
Urban City	Spongy moth	Include Oak, Mouse and Hawk before adding the caterpillar.

Use two matched scenarios for each test

1. I open Experiments from the Menu. I prepare the native setup in A and copy its starting setup to B. I run A to step 200.
2. In B, I introduce the invader at step 0 and run to step 200. Compare shows both populations at matching steps. I download both scenarios before reusing them for a different question.
3. For removal, I use the same invaded starting setup in both scenarios and enable Human intervention only in B at step 0. I keep other settings the same. Copy at this step can also branch a run to test later intervention.

Human intervention represents repeated removal informed by monitoring. Watching alone does not remove an invader. Recovery may be incomplete, delayed, or temporarily above the baseline; an extinct model population does not return by itself. Dashed links show plant competition, not feeding. No collapse or recovery is scripted.

A local example, with an important simplification

Mississauga documents spongy moth caterpillars eating oak leaves. Mice eat acorns, not leaves. This model combines leaves and acorns in one Oak resource pool, so downstream changes in acorn consumers are a teaching assumption. Healthy oaks can regrow leaves; repeated defoliation can weaken them.

City of Mississauga | Spongy moth and management

I have not added an Arctic invader without an appropriate documented example. A native predator expanding its range is not automatically an introduced invasive species. The Arctic productivity control does not simulate sea-ice loss.

Teaching lineage and references

I designed EcoGEM around Generate-Evaluate-Modify inquiry and built this independent lab with Codex. Codex selected equations and numerical settings using established ecological modelling ideas, not measurements fitted to the featured species. Feeding sources support the selected relationships, not their strengths or timing. The original Annenberg Ecology Lab inspired the experience; its source credits Eli Meir and colleagues with the original model and Ginger Booth with the HTML5 port. I have not reproduced that engine.

Credit the original simulation

The original Ecology Lab was developed by Ginger Booth with the Harvard-Smithsonian Science Media Group for Annenberg Media's The Habitable Planet. Booth dates the original work to 2006 and the HTML5 revision to 2015. In-text acknowledgement: (Booth, 2006/2015). This project is not an official sequel or endorsed by the original authors.

References

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Open source

About this guide

Prepared November 4, 2026 for model ecology-lab-2.3. This inquiry sequence is my teaching proposal, not a report of classroom evaluation. I preview the setups on my device and adapt the pacing to my students.