Extinction Evidence Lab: NYSSLS Alignment

Teacher guide for the student worksheet at mrsajdak.com/extinction (two pages, 17 questions; a low-write version has the same numbering). Environmental Science, Chapter 7 Case Study and Lesson 7.1: What Causes Extinction and What Are Its Impacts? (SE pp. 212-220). The answer key is a separate file, kept off the public site.

Performance expectations

> **HS-LS4-5**
> Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. *"The heart of the lab: the Big Five show changed conditions, then extinction; the model shows the same change raising generalists and pushing specialists out."*

> **HS-LS2-7**
> Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. *"Building toward it: students see what habitat loss does to six real species, which sets up 7.2 (human causes) and 7.3 (saving species)."*

> **HS-ESS3-3**
> Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. *"Building toward it: students run and critique a simple habitat-loss simulation (Model check, Q16)."*

Practices and concepts, where students do them

Practice or concept	Questions	What students do
SEP 4 Analyzing and Interpreting Data	1, 2, 7, 8	Read the Big Five and real counts of vertebrates lost since 1900.
SEP 5 Using Mathematics and Computational Thinking	9	Divide lost by expected: how many times faster than the background rate.
SEP 2 Developing and Using Models	12, 13, 16	Run a habitat-loss model at two settings; name a way it is simpler than real life.
SEP 6 Constructing Explanations	5, 15	Explain why a species ends, and which traits raise the risk.
SEP 7 Engaging in Argument from Evidence	11, 17	Answer "extinction is a thing of the past" with a number; evaluate the evidence for a claim (what changed, what happened, do they link).
CCC Cause and Effect	3, 17	In every mass extinction the change in conditions came first.
CCC Scale, Proportion and Quantity	9, 10	22 times the expected rate; losses that should have taken 800 to 10,000 years.
CCC Stability and Change	12 to 14, 17	One change, different results: some species increase, others become threatened, endangered or gone.

Opening: pick a phenomenon

The slideshow's first slides offer three openers. Pick one per class. Friday's choice day offered a honeybee video and a Crash Course extinction video, so neither is used here.

Opener	What happens	Notes
Video: Forty Million Almond Trees	PBS on trucking hives to pollinate California's almonds (2:00). Then AP Archive, Collapsing bee colony mystery, and	Clips were checked to embed; start and stop times were not watched end to

	Clean Wisconsin's rare footage of the endangered rusty patched bumble bee.	end. Preview on the school network. Do not explain colony collapse yet.
Activity: Breakfast Without Bees	4 minutes. Pairs cross out every food on a card of twelve that needs insects to carry pollen.	Needs one food card per pair. Eight need bees; wheat, rice, corn and oats do not.
Photos: Two Bees	A honeybee and a rusty patched bumble bee. Which one is more likely to go extinct?	Most pick the honeybee. Beekeepers replace lost hives; the wild bee was listed as endangered in 2017.

Part by part

Part 1, The Big Five (Tab 1). Explore: Q1 to Q3. Learn It on how a change in conditions ends a species sits between Q3 and Q4. Apply: Q4 to Q6.

Part 2, How fast now? (Tab 2). Explore: Q7 and Q8. Learn It on the background rate and a sixth mass extinction sits between Q8 and Q9. Apply: Q9 to Q11. Q11 is the plan's misconception.

Part 3, Who wins, who loses? (Tab 3). Explore: Q12 and Q13 (run 40%, then 60%). Learn It on endangered, threatened and risk traits sits between Q13 and Q14. Apply: Q14 to Q16. The Model check is Q16. Q17 closes the lab with the evaluate-evidence routine.

About the model. Tab 3 is a teaching model, not data. Each species starts at 100 and loses the same share of its habitat. Each risk trait after the first multiplies the drop; species that need a large territory fall to 0 once less than half the habitat is left; generalists gain. It shows the textbook's idea (Figure 7-4: traits make some species more vulnerable), not real population forecasts.

The district section

BPS Environmental Science Unit 3, Chapter 7 Case Study (A Honeybee Mystery, p. 212) and Lesson 7.1. This lab serves the section's core ideas (the causes of extinction and its part in Earth's history; past mass extinctions and why Earth might be entering a sixth; endangered and threatened; how extinction threatens natural capital) and its vocabulary (endangered species, threatened species; bioprospector is taught in the direct instruction deck). From the district list it uses Interpret Visuals: Mass Extinction (p. 214), Vertebrate Extinctions (p. 215) and Vulnerable to Extinction (p. 216), and the Ready To Go Cause-and-Effect Chart (the evaluate-evidence routine). **Additions, beyond the district list:** the Ceballos 2015 vertebrate data set and the habitat-loss model. HIPPCO is left for 7.2, and saving species (ESA, CITES, captive breeding) for 7.3.

Sources. Ceballos, G., and others (2015). Accelerated modern human-induced species losses: entering the sixth mass extinction. Science Advances 1: e1400253, Table 1 (IUCN Red List 2014). Bambach, R. K. (2006). Phanerozoic biodiversity mass extinctions. Annual Review of Earth and Planetary Sciences 34; Raup and Sepkoski (1982). Ages: International Chronostratigraphic Chart. U.S. Fish and Wildlife Service, rusty patched bumble bee listing (2017). Environmental Science (National Geographic Learning / Cengage), Chapter 7 Case Study and Lesson 7.1, Figure 7-4. Images are listed on the lab page.