Who Took Them? Lab: NYSSLS Alignment

Teacher guide for the student worksheet at mrsajdak.com/hippco (two pages, 15 questions; a low-write version has the same numbering). Environmental Science, Chapter 7, Lesson 7.2: What Role Do Humans Play in the Loss of Species and Ecosystem Services? (SE pp. 221-231). Plan book objective (ES.3.7.5): Students will be able to construct an evidence-based explanation of human drivers of species loss. 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. *"Students weigh numbers from six real declines (tigers, ash trees, native mussels, ospreys, polar bears, rhinos) and name the change in conditions behind each one."*

> **HS-LS2-7**
> Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. *"Students compare four road plans for the same forest and pick the one that keeps a deep-forest bird; the DDT ban and the eagle comeback show a solution that worked."*

> **HS-ESS3-3**
> Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. *"The forest grid is a simple simulation: the same 9 squares cut two ways give very different interior habitat. Building toward the PE; students run the model, they do not write it."*

Practices and concepts, where students do them

Practice or concept	Questions	What students do
SEP 2 Developing and Using Models	1, 5	Run the forest grid; say what a square and a hatched square stand for, and one thing the model leaves out.
SEP 4 Analyzing and Interpreting Data	1, 6, 11, 12	Read interior counts, DDT levels, eagle pairs and case-file numbers.
SEP 5 Using Mathematics and Computational Thinking	2, 7, 8, 14	Subtract interior lost; "how many times more" (25 ÷ 0.5 = 50; about 8,300,000 times from water to osprey).
SEP 6 Constructing Explanations (plan book)	4, 9, 10, 13, 15	Explain fragmentation with edge and interior; put the DDT chain in order; match each case to a HIPPCO cause.
SEP 7 Engaging in Argument from Evidence (plan book)	15	Claim, evidence and reasoning for why one species declined.
CCC Cause and Effect	4, 10, 15	A middle road causes more edge; DDT causes thin shells.
CCC Scale, Proportion and Quantity	7, 8	A dose too small to measure in the water is millions of times bigger at the top.
CCC Stability and Change (plan book)	11, 14	Eagle pairs rise after the 1972 ban; population grows from under 1 billion to about 7.9 billion.

Opening: pick a phenomenon

The slideshow's first slides offer three openers. Pick one per class. All three lead to the same Observe, Wonder, Predict slide and the driving question: **Species are disappearing. How much of that is caused by people, and how?**

Opener	What happens	Notes
Video: Mussels Clean the Lake	Wisconsin Sea Grant, quagga mussels feeding, sped up 10 times: a jar of cloudy water goes clear. Backups: Michigan	Preview all three. Ask "The water got clearer. Is that good?" The answer is in

	Sea Grant's GLANSIS cartoon on zebra and quagga mussels (first 1:30), and jumping silver carp on the Illinois River (0:45, muted).	Tab 3: the mussels eat the plankton native fish and mussels need.
Activity: Pass the Poison	5 minutes. 200 white beans (food) and 5 red beans (DDT) in a tray. Ten minnows scoop, keep only red beans; two needlefish eat five minnows each; one osprey eats both needlefish and counts.	Needs beans, a tray, 10 small cups. Do not name biomagnification. Collect every bean.
Photos: Roads in the Rain Forest	A rain forest in Rondônia, Brazil, from space: long straight roads with cleared land along each one, like the bones of a fish. Beside it, one road through a forest from the air.	Ask what the roads did besides cut trees. The answer is Tab 1: the forest breaks into pieces.

Part by part

Part 1, Break up the forest (Tab 1). Explore: Q1 and Q2. Learn It on habitat loss, fragmentation and why edges hurt sits under the graph, between Q2 and Q3. Apply: Q3 to Q5. The model check is Q5. The hands-on Edge of the Woods lab uses the same 9 x 9 grid and the same four plans, so its numbers match.

Part 2, Up the food chain (Tab 2). Explore: Q6 to Q8. Q8 names the misconception head on: a chemical that is tiny in the water is not too small to matter. Learn It on bioaccumulation, biomagnification and the birds' crash sits between Q8 and Q9; it unlocks the After the ban card for Q11. Apply: Q9 to Q11.

Part 3, Case files (Tab 3). Explore: Q12. Learn It on HIPPCO, population as the driver, how invaders arrive and how to build an explanation sits between Q12 and Q13; it unlocks the letter buttons. Apply: Q13 and Q14. Q15 (Argue it) closes the lab and is the plan book's evidence-based explanation.

Second misconception. "Any species from somewhere else is invasive." The Learn It says invasive means it *harms* the new place; most crops and many garden plants come from somewhere else and are not invasive.

The district section

BPS Environmental Science Unit 3, Lesson 7.2. This lab serves the section's core ideas (human population growth and activities lead to habitat fragmentation and extinctions; invasive species disrupt ecosystems; examples of pollution and their effects; overexploitation threatens wild species) and its vocabulary (habitat fragmentation, bioaccumulation, biomagnification). From the district list it uses Interpret Visuals: Threats to Biodiversity (HIPPCO), Interpret Visuals: Shrinking Ranges (the tiger), Interpret Visuals: Impacts of Asian Carp (an opener clip), Interpret Visuals: Human Population Growth (the Tab 3 graph), Interpret Visuals: Biomagnification (Tab 2 is Figure 7-14's numbers), Arts in Science: Silent Spring, and the Take a Closer Look rhino case. **Additions, beyond the district list:** the forest-grid model of edge and interior; the Western New York cases (emerald ash borer in Buffalo, zebra mussels and round gobies in Lake Erie, the New York bald eagle comeback); the bean biomagnification opener.

Sources. Environmental Science (National Geographic Learning / Cengage), Lesson 7.2, Figures 7-8 and 7-14 (DDT data from Woodwell, Wurster and Isaacson, 1967). U.S. Fish and Wildlife Service: bald eagle breeding pairs, 1963 and 2007; invasive species and endangered species. NYS Department of Environmental Conservation: bald eagle restoration in New York. Cornell University Cooperative Extension and WBFO: emerald ash borer confirmed in Buffalo, 2011. U.S. Geological Survey Nonindigenous Aquatic Species program: zebra mussel. Ontario Invading Species Awareness Program: round goby. Dahl (1990), Wetlands Losses in the United States 1780s to 1980s, USFWS. United Nations, World Population Prospects. Images are listed on the lab page.