

8.1 - Biodiversity & Extinction Unit, Packet 1

Score
<input type="checkbox"/> Above & Beyond
<input type="checkbox"/> Meets Expectations
<input type="checkbox"/> Near Expectations
<input type="checkbox"/> Incomplete – fix the following pages:

First & Last Name: _____ Period/Hour: _____

NOTE: Packets are due after completing Part 5. Check each page to be sure all blanks are completed.

<p>Driving Question: Why is biodiversity being lost?</p>	<p>Semester Schedule</p> <p>5. Traits & Genes</p> <p>5.1: What determines the traits of an organism?</p> <p>5.2: How are traits inherited from parents?</p> <p>5.3: Can we predict traits?</p> <p>5.4: Unit Assessment</p> <p>6. DNA & Proteins</p> <p>6.1: What is DNA and how does it work?</p> <p>6.2: How does DNA affect protein assembly?</p> <p>6.3: Unit Assessment</p> <p>6.4: How are genes modified? (<i>mini-unit</i>)</p> <p>7. Mutations & Change</p> <p>7.1: How does a protein get its shape & function?</p> <p>7.2: How do mutations change genes & proteins?</p> <p>7.3: How can mutations create new traits & species?</p> <p>7.4: Unit Assessment</p> <p>7.5: How Does Antibiotic Resistance Occur?</p> <p>8. Biodiversity</p> <p>8.1: How does biodiversity affect ecosystems? Why is biodiversity being lost?</p> <p><i>These materials were partly developed with assistance from artificial intelligence.</i></p>
<p>Anchoring Phenomenon: We know that mutations and natural selection can change species over time. How does the diversity of traits and species support ecosystem function? We'll also explore how changes to environments can lead to extinctions, including in habitats surrounding our school & community.</p>	
<p>Deeper Questions</p> <ol style="list-style-type: none"> Why do some species go extinct? How does today's rate of extinction compare to other periods? How do extinctions affect ecosystem services & resiliency? 	
<p style="text-align: center;">Schedule</p> <p>Part 1: Introduction</p> <ul style="list-style-type: none"> Questions for Generating Questions Discussion & Developing Explanations <p>Part 2: Core Ideas</p> <ul style="list-style-type: none"> Core Ideas Revisions of Part 1 Explanations <p>Part 3: Investigation</p> <ul style="list-style-type: none"> Habitat Threat Scavenger Hunt <p>Part 4: Review & Assessment</p> <ul style="list-style-type: none"> Ranking Your Readiness Formative Assessment & Mastery Check <p>Part 5: Life Connections</p> <ul style="list-style-type: none"> Life Connections: Writing to Elected Officials 	
<p>NGSS Standards (<i>PEs & CCCs are summarized below. SEPs are noted throughout the packet.</i>)</p> <p>HS-LS2-6 - Changing conditions (e.g., hunting, flooding, volcanoes) may result in a new ecosystem</p> <p>HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity</p> <p>HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity, especially related to threatened or endangered species.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> Patterns</div> <div style="text-align: center;"> Cause and Effect</div> <div style="text-align: center;"> Scale, Proportion, and Quantity</div> <div style="text-align: center;"> Systems and System Models</div> <div style="text-align: center;"> Energy and Matter</div> <div style="text-align: center;"> Structure and Function</div> <div style="text-align: center;"> Stability and Change</div> </div>	
<p>Resource Links: Class Website; Core Ideas; Practice Test; Summary Video; Extinctions Video; Google Earth Engine; EPA Air Pollution Map; USGS Pollution Map; WI Endangered Species; WI Invasive Plants</p>	

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Part 1: Introduction – Rates of Extinction (8.1.1)

Sample Questions - Complete the sample standardized test below. Use the space on the right to annotate the text as you are reading. Be prepared to discuss your ideas. SEP: Obtaining, Evaluating, and Communicating Information

Passage I: Ceballos *et al.* (2015) assessed whether human activities are causing a new mass extinction. They first calculated the background rate of extinction (the average rate at which species naturally go extinct) at 2 mammal extinctions per 10,000 species per 100 years (2 E/MSY).

They then estimated extinction rates using either *highly conservative* methods (using data only for documented extinctions), or *conservative* methods (also includes likely species extinctions). Both of these values underestimate the actual rate of extinction. Their data are included below.

Their findings indicate that recent extinction rates are unprecedented in human and Earth's history. If this trend continues, humans could lose biodiversity benefits within just three lifetimes. Preventing this requires urgent efforts to conserve species and address factors like habitat loss and climate change, which are linked to human population growth.

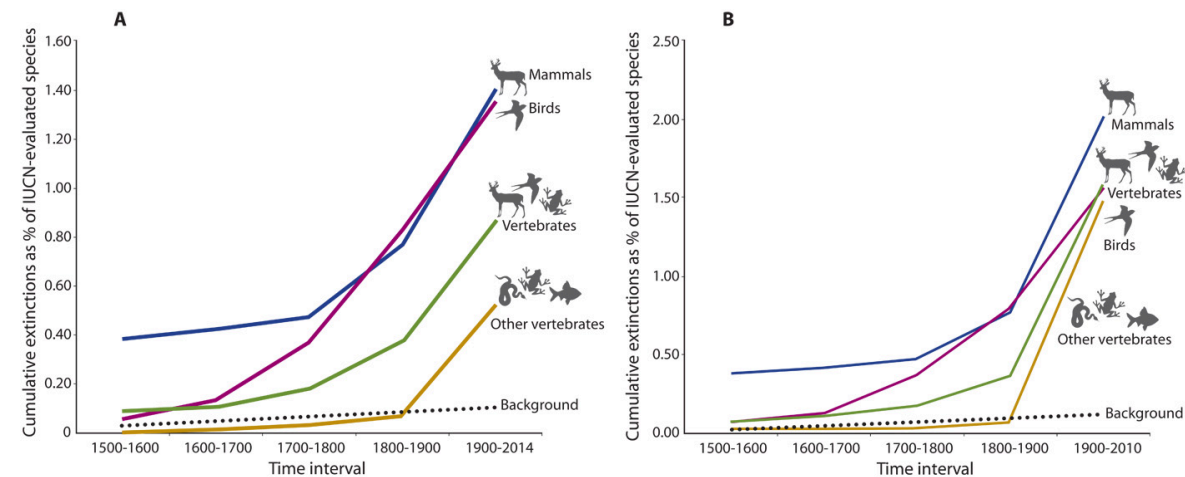
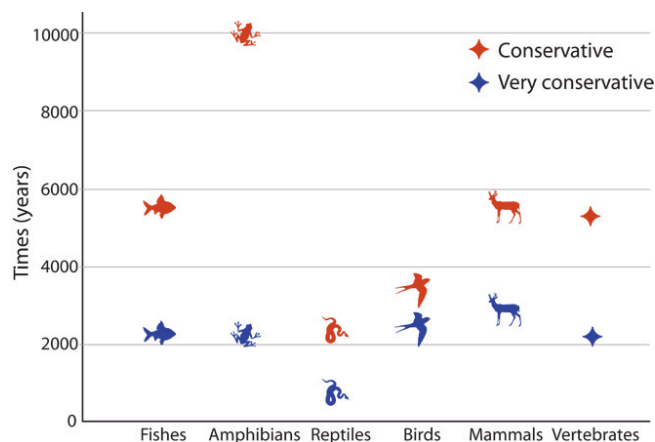


Fig. 1 Cumulative vertebrate species recorded as extinct or extinct in the wild by the IUCN (2012). Graphs show the percentage of the number of species evaluated among mammals (5513; 100% of those described), birds (10,425; 100%), reptiles (4414; 44%), amphibians (6414; 88%), fishes (12,457; 38%), and all vertebrates combined (39,223; 59%). Dashed black curve represents the number of extinctions expected under a constant standard background rate of 2 E/MSY. (A) Highly conservative estimate. (B) Conservative estimate.

Fig. 2 Number of years that would have been required for the observed vertebrate species extinctions in the last 114 years to occur under a background rate of 2 E/MSY. Red markers, highly conservative scenario; blue markers, conservative scenario. Note that for all vertebrates, the observed extinctions would have taken between 800 to 10,000 years to disappear, assuming 2 E/MSY. Different classes of vertebrates all show qualitatively similar trends.



Driving Questions:

1. What is the main idea? What are they trying to figure out in this experiment?
2. Identify both of their variables (independent & dependent) and their control.
3. How do their methods test the relationship between their variables?
4. What are the key trends and patterns in their data?
5. What was their research question & hypothesis?
6. What might explain their outcomes?

Follow-up Questions: Record your ideas separately. Be prepared to discuss. *SEP: Asking Questions*

1. Observational Questions:

What do you notice about this experiment's results?
What are the key trends or patterns in their data?

2. Model and Theory Questions:

Can you explain their results with prior knowledge & models? What additional info is needed?

3. Variables Questions:

What are their independent and dependent variables?
How are these variables related to each other?

4. Creating a Research Question

What is their research question (RQ)?
Is it testable and measurable?

5. Developing a Testable Hypothesis:

What could be an effective hypothesis & rationale?
Would an alternative hypothesis be more appropriate?

6. Testability Evaluation:

How do their methods test their RQ & hypothesis? What limits the validity of these methods & findings?

Question 1 (Factual): According to the passage, what was the background rate of mammalian extinctions per 10,000 species per 100 years? A) 2 B) 22 C) 15 D) 53

Question 2 (Factual): Which of the following statements is supported by the graph?

- A) The number of vertebrate extinctions has remained relatively stable over time
- B) The modern extinction rates for vertebrates have increased dramatically compared to the background rate.
- C) Extinction rates for fish are consistently lower than those for other vertebrate groups
- D) Mammals have experienced the highest number of extinctions among all vertebrate groups

Question 3 (Interpreting Trends): What is their main finding regarding current extinctions vs. the background rate?

- A) Modern extinction rates have been decreasing over the past century
- B) Modern extinction rates have remained relatively constant compared to the background rate
- C) Modern extinction rates have increased sharply in 200 years and are considerably higher than background rates.
- D) Modern extinction rates have only increased for amphibians, while other vertebrate groups have remained stable

Question 4 (Factual): Based on the data provided in Fig. 1, which vertebrate group had the greatest number of total species evaluated? A) Mammals B) Birds. C) Amphibians D) Fishes

Question 5 (Interpreting Trends): Which timeframe most accurately reflects the years needed for the observed vertebrate species extinctions in the last 114 years to occur under a background rate of 2 E/MSY?

- A) 800 to 10,000 years. B) 10,000 to 100,000 years C) 100,000 to 1,000,000 years D) 1,000,000 to 10,000,000 years

Question 6 (Factual): Which of the following statements best describes the discussion of the passage?

- A) The extinction crisis is not as severe as previously thought
- B) The current extinction rates are comparable to those seen in Earth's history
- C) Recent extinction rates are unprecedented in human history and highly unusual in Earth's history.
- D) The analysis suggests that human activities have not significantly impacted biodiversity

Question 7 (Interpreting Trends): What does the passage suggest as necessary to avoid a true sixth mass extinction?

- A) Enhancing exposure of endangered species to mutagens
- B) Raise entrance fees to parks and conservation areas
- C) Continuing current human activities without changes
- D) Slow human population growth to limit habitat loss and climate change.

Question 8. How does the current rate of extinction compare to the normal background extinction rate?

Part 2: Core Ideas (8.1.2)

Overview: In this activity, you will use an [intro video](#) and a [short presentation](#) to provide you with information that will help you improve and revise your initial ideas. Your instructor will decide on how to implement this portion. You will then work in small teams to address the questions listed below.

Driving Questions - Record your ideas separately (e.g., on a white board or scratch paper).
SEP: Developing & Using Models

- | | |
|--|--|
| <ol style="list-style-type: none">1. What is biodiversity? What are three different kinds of biodiversity?2. How can we determine the level of biodiversity in an ecosystem using species richness?3. What are ecosystem services? Summarize the four types of ecosystem services with examples.4. How does biodiversity relate to the amount of ecosystem services that can be provided in an area?5. What is ecosystem resilience? What does this indicate about a particular ecosystem?6. What is species redundancy? How and why does this relate to biodiversity and ecosystem resilience? | <ol style="list-style-type: none">7. How do biodiversity, ecosystem services, and ecosystem resilience relate to photosynthesis, respiration, biosynthesis, and the 10% Rule?8. How do biodiversity, ecosystem services, and ecosystem resilience relate to DNA, proteins, mutations, natural selection, and evolution?9. What is extinction? Why/when do extinctions occur?10. Why did the mammoths become extinct? Why didn't they just adapt to their changing environment?11. How does today's rate of extinction compare to previous rates of extinction? How could this affect human populations?12. What kinds of disturbances are responsible for the current rate of extinction? |
|--|--|

Revising Explanations - Record your ideas in the spaces below. SEP: Constructing Explanations & Developing Solutions

What is biodiversity? What are ecosystem services? How do they affect each other?

How are the concepts of biodiversity, resilience, and species redundancy similar and different?

Why do some species go extinct? _____

How do current rates of extinction compare to background extinction rates? Why is this happening?

Part 3: Habitat Threat Scavenger Hunt (8.1.3)

Pre-Investigation Questions - Work as a group to prepare verbal responses for these questions. When you think you are all ready to provide responses, raise your hand. Your instructor will listen to your explanations, provide feedback, and determine if you are ready to move on to the investigation.

SEP: Developing & Using Models

1. What is biodiversity? What are ecosystem services? How do they affect each other?
2. How are the concepts of biodiversity, resiliency, and species redundancy similar and different?
3. Why do some species go extinct?
4. How do today's rates of extinction compare to the past? What causes this rate of species loss?

This activity was completed _____ (instructor signature)

Overview: In this investigation, you will explore a local habitat to identify potential risks for extinction.

Investigation Overview: In this activity, you will be visiting a habitat near your classroom and performing a risk assessment to determine if your habitat is at risk for extinctions due to habitat loss, invasive species, pollution, and/or overharvesting.

Directions: Prior to visiting an ecosystem, your instructor will provide you with details about how human activity & development in the surrounding area may affect **habitat loss or degradation**. One option for this information is <https://earthengine.google.com/timelapse/>. Use this link (or search for *Google Earth Engine*) and enter an address near the local habitat. Observe how ecosystems, fields, and undeveloped areas have changed.

An internet search can also provide you with information about potential **pollutants** in your area. The EPA provides interactive maps of air pollution. Do an internet search for [EPA AirData Map](#); then type in the address. Zoom out to see if the area is color-coded as a “nonattainment zone” (*i.e.*, fails to meet minimum standards for air pollution); make sure all layers are turned on; consult the map legend for details. Various maps of water contamination are also available through the [USGS](#), [USDA](#), [EWG](#), and other sources (click links to view maps).

Your instructor may also have information available about **hunting and fishing** regulations and/or whether there are any **threatened or endangered species** in the local area. One option is the [EPA EcoBox Tools](#) with state-by-state information. For example, WI provides an [Endangered & Threatened Species List](#). Instructors may be able to work in advance to determine if any species in the area are on their state's list of at-risk species.

While visiting the ecosystem, look for signs of habitat loss or habitat fragmentation. You might also observe evidence of pollutants (such as litter, ash, or algal blooms in water). Your instructor may also be able to provide you with printed [photographic guides](#) to determine the prevalence of **invasive species**; if not, check to see if it would be ok to use a phone or other device in order to find a state department of natural resources website (a good example can be found by searching for *WI Field Guide Invasive Plants*).

If time is too limited, your instructor may modify this investigation. If you are assigned a specific topic, you only need to complete the sections of the following page that pertain to this focus. If it is not possible to go outside, your instructor may opt to exempt you from some sections on the next page.



Habitat Loss: is this habitat at risk for local extinctions due to habitat loss? Yes / Possibly / No

What evidence supports this conclusion? _____

Invasive Species: is this habitat at risk for local extinctions due to invasive species? Yes / Possibly / No

What evidence supports this conclusion? _____

Pollution: is this habitat at risk for local extinctions due to pollution? Yes / Possibly / No

What evidence supports this conclusion? _____

Overharvesting: is this habitat at risk for local extinctions due to hunting or overharvesting? Yes / Possibly / No

What evidence supports this conclusion? _____

Summary: are there heightened risks for extinction in this area due to human activity? Yes / Possibly / No

What evidence supports this conclusion? _____

Part 4: Review & Assessment (8.1.4)

Step 1: Rank each Driving Question in Part 2 based on your comprehension (you can rank them as 1,2,3 or green/yellow/red, or any other method). Then work in teams to review anything that is still unclear.

Step 2: Identify any remaining areas of confusion or concern. Then review these topics with your instructor.

Step 3: Complete the Formative Assessment (*last page of the packet*). Your instructor will determine if you will work individually, in pairs, or in small groups. Then compare and evaluate your responses as a class.

Step 4: Individually complete a Mastery Check. If your performance indicates that additional support is needed, your instructor will determine how to help you move forward.

Part 5: Life Connections – Writing Elected Officials (8.1.5)

Introduction: writing a letter to your state and federal elected representatives can be an effective way to help influence the policies that affect your community, nation, and world. In this exercise, you will be drafting a letter to send to an elected representative at the state or federal level. If well done, your instructor may actually send your letter to your senator or representative.

How to find your elected representatives: the following website provides detailed information on how to find the contact information for state and federal representatives: <https://www.usa.gov/elected-officials>

9 Essential Tips for Writing Your Congressman: Every letter to an elected official should be...

1. **Direct:** State your subject clearly in the first sentence. Stick to just one issue per letter.
2. **Informative:** Identify yourself as a constituent. State your views, support them with your expert knowledge and, when appropriate, cite the bill number of relevant legislation (e.g., S.3456).
3. **Inquiring:** Ask for the policymaker's point of view and how he or she plans to vote on relevant legislation. Expect an answer to your letter.
4. **Factual & Courteous:** Rely on the facts, but personalize the issue. Explain how the issue affects your life. Avoid personal attacks, threats of political influence or demands.
5. **Constructive:** Be positive about your issue and offer recommendations about how you want the member to address concerns.
6. **Specific:** Always explain the hometown relevance of the issue. Use "I" statements and cite specific times and examples.
7. **Helpful:** Offer to provide additional information if needed, and provide your contact information.
8. **Appreciative:** Remember to thank members for their attention. Follow the issue and thank them later if they vote your way.
9. **Concise:** Keep your letter to one page, or your email to 500 words or less.

Taken from "How to Write a Letter or Email" by the American Psychological Association: <http://www.apa.org/advocacy/guide/letter-email.aspx>



Sample letter:

June 5th, 2022

The Honorable Senator (last name)
United State Senate
Washington, DC 20510

Dear Senator (last name):

The legislation addressing (*briefly describe issue or proposed legislation*) is of particular interest to me because I am a (*describe your relationship to this issue*). This issue directly impacts (*describe how this issue specifically affects you and other Americans*).

I am primarily concerned about (*go into detail about a specific aspect of this issue that is particularly important to you*). This particular issue is especially important because (*provide evidence, numerical data, and/or personal anecdotes to demonstrate why this issue matters most*).

I am writing to you in part to ask for your specific stance on (*this issue*). (*Either follow up by requesting how they will vote on a specific bill, or if this is more general and not about a specific piece of legislation, ask them to clarify their stance on the topic at large*). As someone with a background in this issue as well as a personal connection to this topic, I would hope that (*summarize how you think they should vote and why*).

Thank you for your consideration of my letter and for your attentiveness to this issue. I would be particularly appreciative if you would consider my advice the next time you are asked to vote on (*the specific legislation or issue at large*). If you would like additional information on this topic, I would be happy to provide more information. You are welcome to contact me using the information below.

Thank you again, and thank you for your service to our (*country/state*).

Sincerely,

Handwritten signature

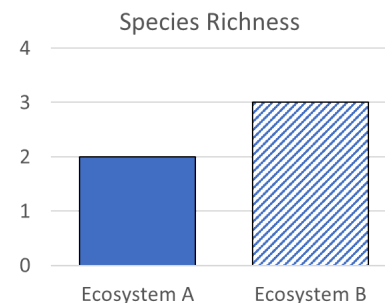
Your printed name,
Address
Phone Number
Email Address



Biodiversity & Extinctions - Packet 8.1 Formative Assessment

Name: _____ Hour _____ Date: _____ Score: _____ / _____

Directions: A 3x5 notecard with handwritten notes can be used to guide your answers. Your instructor may allow you to work in assigned groups. If so, have a different person write each response while others assist.



1. Data for two ecosystems is shown here. **Based on this data, what can we conclude about the a) ecosystem services, b) species redundancy, and c) ecosystem resilience in one ecosystem compared to the other?** Explain each term in your response.

Writer's Name:

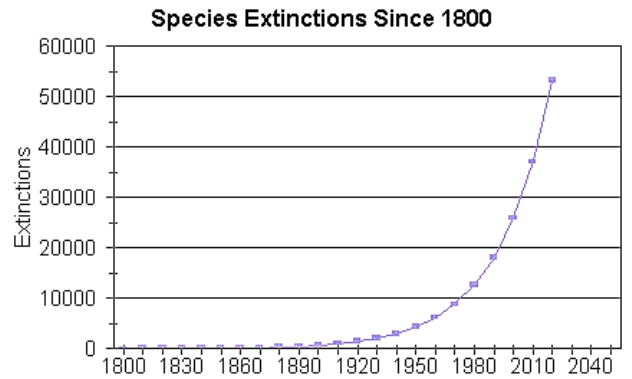
2. Three students shared their ideas about why species are currently going extinct at a rapid rate (4-6 per hour). **Do you agree or disagree with each student's claim?**
 - a. Nina: "I think this is occurring because of natural selection - if only species with beneficial adaptations survive and reproduce, a lot do not survive." Agree/ Disagree
 - b. Marisol: "I think that this is because of increased volcanic activity and natural disasters disrupting ecosystems worldwide." Agree / Disagree
 - c. Bristol: "I think this primarily due to human activities such as deforestation, pollution, and climate change." Agree / Disagree

3. **Which claim(s) is/are most accurate?** _____ **Why?** _____

Writer's Name:

CR

4. The data provided here shows how the rate of extinctions are changing over time. In the space below, a) explain how the current rate of biodiversity loss compares to previous rates of extinction; and b) what we can expect to happen in the future if current trends continue. Use the data provided to justify your responses.



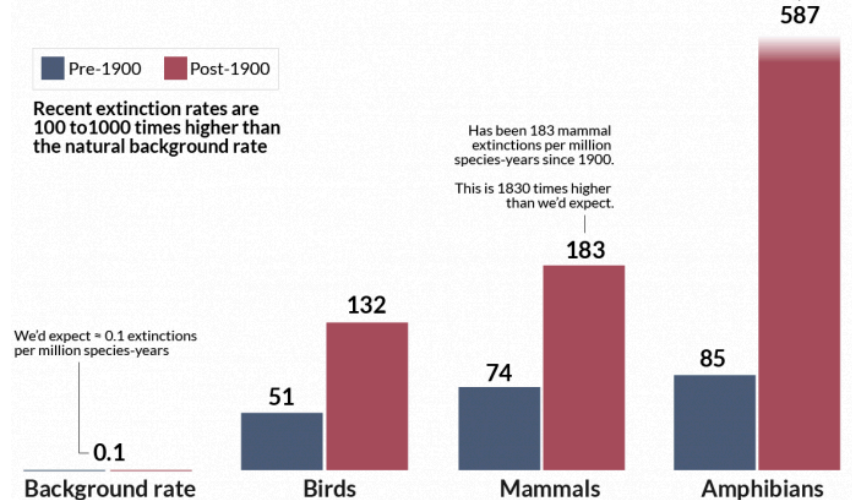
Writer's Name:

5. The current rate at which we are losing biodiversity is roughly 300 times faster than the rate at which dinosaurs went extinct. Will this impact human populations? Explain.

Are species going extinct faster than we'd expect?

Species extinction rates are measured in extinctions per million species-years (E/MSY). If the E/MSY was equal to one, this would mean that if we had one million species, one species would go extinct every year; or if there was only one species it would go extinct in one million years.

Our World in Data



Writer's Name: