Explain: Nature's Call: Fixing What We Broke

INSTRUCTOR:
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Objective:

Students will explain the effects of human activities on ecosystems and propose actionable, evidence-based solutions for reducing these impacts.

Background:

Human activities have profound effects on ecosystems, which are systems made up of living organisms (plants, animals, microorganisms) interacting with non-living components (air, water, soil). These activities, such as deforestation, pollution, and climate change, disrupt the delicate balance of ecosystems, leading to a range of environmental issues. The impact of human actions can cause biodiversity loss, species extinction, habitat degradation, and disruptions in food chains. However, solutions do exist, and understanding the problems and possible strategies to address them is essential for creating a sustainable future.

Case Studies:

1. ***Plastic Pollution in Oceans***
   Each year, more than 8 million tons of plastic waste end up in the ocean, causing harm to marine life. Plastic pollution disrupts the food chain and degrades water quality. Marine animals like sea turtles and birds mistake plastic for food, leading to injury or death. The accumulation of microplastics in the ocean also harms marine organisms at the microscopic level. This issue affects both marine biodiversity and human activities such as fishing and tourism.

2. ***Deforestation in the Amazon Rainforest***
   The Amazon rainforest, one of the most vital ecosystems on Earth, is losing approximately 10,000 square kilometers of forest every year. Deforestation is driven by logging, agriculture, and mining activities. This loss of trees not only destroys habitats for many species but also contributes to climate change by increasing carbon dioxide levels. The Amazon is also home

to indigenous communities, whose way of life is being disrupted as they lose their natural environment.

3. ***Wildfires***

   Wildfires, often worsened by climate change, are becoming more frequent and intense. These fires devastate forests, wildlife habitats, and air quality. Rising temperatures and prolonged droughts create conditions ideal for wildfires to spread rapidly. Human activities, such as land clearing and improper management of forests, also contribute to the severity of wildfires. In addition to their immediate destruction, wildfires leave ecosystems vulnerable to long-term environmental changes, including soil erosion and loss of biodiversity.

4. ***Oil Spills in Coastal Areas***

   Oil spills, such as the Deepwater Horizon disaster, release massive amounts of oil into oceans, causing severe harm to marine ecosystems. Oil coats animals, destroys habitats, and disrupts the balance of food chains. The long-term effects on biodiversity are profound, as many species of fish, birds, and marine mammals are affected. Coastal ecosystems and fishing industries are also heavily impacted, leading to economic and environmental consequences.

5. ***Urban Expansion and Habitat Loss***

   As cities expand, natural habitats are replaced by buildings, roads, and infrastructure, leading to the displacement of wildlife. This loss of habitat can result in reduced biodiversity and fragmented ecosystems, making it harder for species to survive. Urbanization also leads to increased human-wildlife conflict, as animals move into cities in search of food and shelter. This disruption in the natural world can affect ecosystems both locally and globally.

6. ***Overfishing in Global Oceans***

   Overfishing is a major threat to marine ecosystems, as it depletes fish populations and disrupts food chains. With 33% of global fisheries considered overexploited, the consequences are far-reaching. When fish populations decline, other marine species dependent on them for food also suffer. Overfishing also affects the health of coral reefs and other vital ecosystems in the oceans, leading to long-term environmental damage.

7. ***Climate Change and Melting Ice Caps***

   Rising global temperatures are causing the polar ice caps to melt at an accelerating rate, contributing to rising sea levels and affecting Arctic ecosystems. Loss of sea ice threatens species such as polar bears, seals, and walruses, which rely on it for habitat and hunting. Indigenous communities that depend on Arctic resources for their livelihoods are also being impacted. The melting ice is a visible sign of the broader issue of climate change, which disrupts ecosystems worldwide.

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Gallery Walk Instructions:

As you walk around the classroom and engage with each case study, think about the problem, the mechanisms causing it, and possible solutions. For each case study, work with a partner to complete the following on different colored post-it notes:

- **Red Post-it Note:** Write down the problem (the core issue being faced in this case).
- **Yellow Post-it Note:** Write down the mechanisms (the causes or processes that lead to the problem).
- **Blue Post-it Note:** Write down possible solutions (actions that could address or resolve the issue).

Once you've discussed and recorded your thoughts on the post-it notes, place them on the designated area of the gallery walk. This will help organize the information and guide a group discussion.

Step 3: Reflect and Summarize

Complete a reflection sheet summarizing what you learned from each case study. Use the guiding questions and sentence frames below to structure your reflection.

Student Reflection Questions:

1. **What was the most surprising or interesting problem you learned about today? Why?**
2. **Which case study had the greatest impact on you? How did it change the way you think about human impacts on ecosystems?**
3. **What solution to a problem seemed the most effective? Why do you think it would work?**

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4. **How can individuals, communities, or governments contribute to solving these issues? Provide specific examples.**
5. **What new questions or ideas do you have after completing this activity?**
6. **If you could make one change in your community to reduce human impact on ecosystems, what would it be?**

***Sentence Stems for Writing and Thinking*:**

***For Describing the Problem*:**

- *"The problem in this case study is _____. It affects ecosystems by _____."*
- *"One example of this problem is _____. It has caused _____."*

***For Explaining Mechanisms*:**

- *"This problem impacts ecosystems by disrupting _____, which leads to _____."*
- *"When _____ happens, it causes _____."*

***For Proposing Solutions*:**

- *"One solution to this problem is _____. This strategy works because _____."*
- *"An example of this solution in action is _____, which has helped by _____."*

***For Reflection*:**

- *"I found the case study about _____ interesting because _____."*
- *"The most effective solution I learned about was _____ because _____."*
- *"A question I still have is _____."*

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Teacher Instructions

Nature's Call: Fixing What We Broke

Grade Level: 9th Grade Biology
Duration: 60 minutes
Topic: Human Impact on Ecosystems and Actionable Solutions

Objectives:

- Students will explain the effects of human activities on ecosystems.
- Students will analyze case studies, identifying problems, mechanisms, and solutions.
- Students will propose evidence-based solutions to mitigate the negative impact of human activities on ecosystems.

Materials List:

- Whiteboard and markers
- Post-it notes (red, yellow, blue)
- **Case study handouts (printed or projected)**
- Reflection sheet handouts if necessary
- Pens/pencils
- Timer/Clock
- Chart paper for group discussion (optional)
- Markers for writing on chart paper (optional)

Background Review:

Before diving into the activity, provide a brief review of key concepts:

- **Ecosystem:** A community of living organisms (plants, animals, microorganisms) interacting with their nonliving environment (air, water, soil).
- **Human Impact:** Human activities such as deforestation, pollution, and climate change that disrupt the balance of ecosystems.

- **Case Studies:** Specific examples of how human actions affect ecosystems, such as plastic pollution, deforestation, and climate change.

Make sure to remind students that these activities have far-reaching consequences for both the environment and human well-being. This lesson will explore these impacts and propose real-world solutions.

Instructional Plan:

1. Introduction (10 minutes)

- **Objective Overview:**
  Start by stating the lesson objectives and explaining what students will be doing during the class. Introduce the case studies they will explore and briefly explain the terms "problem," "mechanism," and "solution."
- **Background Review:**
  Conduct a brief discussion to assess prior knowledge. Ask students:
  - **"What do you know about how humans impact ecosystems?"**
  - **"Can you think of any examples of human actions that have harmed the environment?"**
- **Engagement Hook:**
  Show a short video or a set of powerful images depicting a recent environmental disaster (e.g., oil spill, wildfire). Ask students, **"What do you think caused this? How does this affect the living organisms around it?"**

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2. Gallery Walk Activity (25 minutes)

- **Instructions:**
  - Split students into small groups (3-4 students per group).
  - Set up case study stations around the room. Each station will have one of the seven case studies (Plastic Pollution, Deforestation, Wildfires, etc.).
  - **At each station, students will participate in a "Think-Pair-Share" activity. They will:**
    - Read the case study.
    - Discuss and write their responses on red, yellow, and blue post-it notes:
      - **Red Post-it:** Identify the core problem (e.g., plastic waste harming marine life).
      - **Yellow Post-it:** Describe the mechanisms (e.g., marine animals ingesting plastic).
      - **Blue Post-it:** Propose potential solutions (e.g., reducing plastic use or organizing beach cleanups).

- After 5 minutes per station, students will rotate to the next station until all have been completed.

- **Gallery Walk Setup:**
  - Place each case study on a large poster or chart paper for students to read as they work.
  - Provide enough space for students to move around and interact at each station.

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3. Whole-Class Discussion (10 minutes)

- Facilitate a class discussion based on the responses collected during the gallery walk. Use the following guiding questions:
  1. **Which problem surprised you the most, and why?**
  2. **Which mechanism do you think has the most widespread impact, and why?**
  3. **What solutions seemed the most feasible or realistic in each case?**
  4. **How can individual actions help address these problems?**
  5. **What role do communities and governments play in solving these issues?**

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4. Reflection and Summarizing (10 minutes)

- Distribute Reflection Sheets to students. Allow them 5-7 minutes to respond to the following reflection questions:
  - **What was the most surprising or interesting problem you learned about today? Why?**
  - **Which solution seemed the most effective? Why?**
  - **How can you contribute to reducing human impact on ecosystems?**
- Allow students to share their reflections with a partner or in small groups to promote peer discussion.

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5. Conclusion (5 minutes)

- Summarize the key points from the class discussion and student reflections.
- Reinforce the importance of understanding human impact on ecosystems and encourage students to think about ways they can reduce their own environmental footprint.
- Assign a follow-up homework or project, such as researching one of the issues in more detail and proposing a class project to help mitigate the impact.

Engagement Tips:

- **Incorporate multimedia:** Show a short video (2-3 minutes) of an environmental disaster (e.g., plastic pollution in the oceans, deforestation) to grab students' attention.
- **Use real-world examples:** Mention current events that students might be familiar with, such as recent wildfires or plastic bans in certain areas.

- **Interactive Participation:** During the gallery walk, encourage students to engage with the materials by adding their own post-its to the stations as they walk around.

Guiding Questions for Students During the Gallery Walk:

1. **What is the main problem this case study presents?**
2. **How do human activities contribute to this problem? What mechanisms are at play?**
3. **Who or what is most affected by this issue?**
4. **What are some potential solutions that could help mitigate the impact?**
5. **What roles do individuals, communities, and governments play in addressing these issues?**

Inspection and Assessment Strategies:

- **Observations During Gallery Walk:** Walk around the room during the activity, observe group discussions, and check for understanding.
- **Exit Ticket:** At the end of the class, ask students to submit a short response (exit ticket) answering one question: **"What is one action you can take to help reduce human impact on ecosystems?"**
- **Peer Review:** During the reflection discussion, allow students to share their responses and provide peer feedback.

Differentiation Strategies:

- **For English Language Learners (ELLs):**
  - Provide visual aids (images, videos) alongside the case studies.
  - Offer sentence stems or vocabulary lists to help ELLs engage in the discussion and complete their reflection sheets.
  - Pair ELL students with peers who can support their language development during the gallery walk.
- **For Struggling Learners:**
  - Use simpler case studies or provide additional explanations and visual representations of the problems, mechanisms, and solutions.
  - Offer scaffolding by guiding students through one case study together as a class before they work in small groups.
- **For Advanced Learners:**
  - Challenge them to explore more complex solutions or propose innovative actions that could further reduce human impact.
  - Encourage them to create posters or presentations about one of the case studies to share with the class as a follow-up project.

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Helpful Hints for Engagement:

- Create small, manageable discussion groups to prevent students from feeling overwhelmed during the gallery walk.
- Use time limits for each station to keep the activity moving and maintain energy.
- Encourage critical thinking by asking open-ended questions and prompting students to think about the long-term impacts of human actions.

Closure:

Finish the lesson by highlighting the importance of understanding how human activities affect ecosystems. Emphasize that it's not just about learning the problems but also about actively finding and implementing solutions.