

AP[®] Environmental Science

LOSS OF BIODIVERSITY

Student Workbook



AP[®] with WE Service



Table of Contents

Getting to Know the Topic—Globally.....	4
Getting to Know the Topic—Locally.....	5
Ecosystem Services—Putting a Price Tag on Nature.....	6
Formative Quiz: The Value of Biodiversity.....	8
Problem Tree.....	9
Needs Assessment.....	10
Solution Tree.....	11
Reflect: Investigate and Learn.....	12
Summarizing Your Investigation.....	13
Scoring Guidelines.....	14
Approaches to Taking Action Information Sheet.....	15
Creating an Action Plan.....	16
Five Action Planning Pitfalls Tip Sheet.....	17
Reflect: Action Plan.....	18
Student Log Sheet.....	19

Getting to Know the Topic

Loss of Biodiversity: Globally

Research shows that human activity can lead to rising overall global temperatures, causing sea levels to rise, glaciers to melt, and creating frequent and extreme weather events like hurricanes, floods, and tsunamis. Changing climate affects the air we breathe, the safety of drinking water, food production, shelter for the more than half of the world's population that lives within 37 miles of the sea or ocean, and loss of biodiversity. Further human actions, such as deforestation, deep-ocean fishing, overharvesting of plant and animal species, as well as war and conflicts, also contribute to biodiversity loss.

Fast facts

- ▶ By 2025, half of the world's population will be living in water-stressed areas.
- ▶ 17 of the 18 warmest years on record have occurred since 2001.
- ▶ Populations of freshwater species have declined by 81% between 1970 and 2012.

Taking Action Globally

There are a number of ways that students can take action in their own school and community to help developing communities around the world restore their natural resources or become more resilient to climate change. Some ideas include:

- ▶ Volunteer at an organization that works for global issues—many organizations offer ways to get involved on their websites and in their offices
- ▶ Collect supplies (in consultation with the organization) or raise funds for an organization that will share the outcomes of the donations
- ▶ Create a campaign writing letters to the United Nations, government bodies, and other leaders to ask for added resources on the issue

Another option is to support and fundraise for the WE Villages program and help provide communities with the resources to become sustainable. Students can support this program by visiting [WE.org/we-schools/program/campaigns](https://www.we.org/we-schools/program/campaigns) to get ideas and resources for taking action.



8 million tons of plastics leak into the ocean each year. That's the same as one garbage truck every single minute.

Getting to Know the Topic

Loss of Biodiversity: Locally

Our everyday choices can have an environmental impact. The average American residence uses over 100,000 gallons of water a year, and in 2013, 254 million tons of trash was discarded in landfills or through other disposal methods. In addition, species are dying off at a rate 1,000 to 10,000 times higher than the natural extinction rate—mostly due to pollution, overexploitation, and deforestation. Reducing our use of natural resources by recycling, conserving water and energy, and reducing fuel consumption can directly impact our future and the future of our planet.

Fast facts

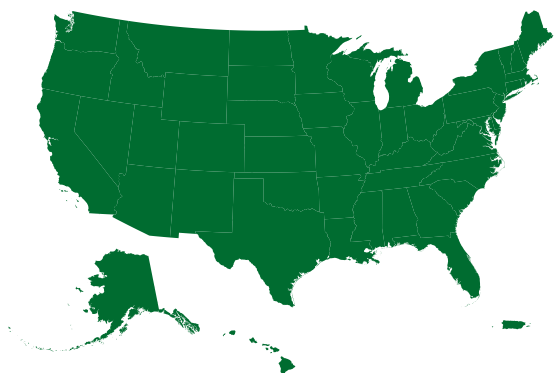
- ▶ Approximately 24 million U.S. homes are powered by wind energy.
- ▶ More than 125 million people in the U.S. live in counties where there are unhealthy levels of air pollution, including ozone and particle pollution.
- ▶ Temperatures in the Southwest have increased by almost two degrees Fahrenheit in the last century.

Taking Action Locally

Within their local or national community, students can:

- ▶ Work with a local organization working on environmental preservation issues
- ▶ Organize a clean-up or restoration project at a local environmental site
- ▶ Create and deliver an educational workshop to raise awareness about the topic and its local impact with a strong call to action that leads to enacting change

With both their global and local actions, encourage students to be creative with the ideas they develop through their action plans.



Americans produce 4.4 pounds of trash every day—that's more than 700,000 tons of garbage daily.



NAME: _____

TEAM MEMBERS: _____

Ecosystem Services—Putting a Price Tag on Nature

(1 of 2)

Directions:

Read the document on ecosystem services on the National Wildlife Federation website:

<https://www.nwf.org/Educational-Resources/Wildlife-Guide/Understanding-Conservation/Ecosystem-Services>

Using your definitions and examples in Table 1, brainstorm examples of how your local ecosystems provide some of these same services. Describe the local ecosystem in the second column and provide an explanation as to how this ecosystem fulfills the ecosystem service in the last column of Table 2.

Table 1: Ecosystem Services of Wetlands

TYPES OF ECOSYSTEM SERVICES	DEFINITION	EXAMPLE	HOW DO WETLANDS FULFILL THIS SERVICE?
Provisioning			
Regulating			
Cultural			
Supporting			



NAME: _____

TEAM MEMBERS: _____

Ecosystem Services—Putting a Price Tag on Nature

(2 of 2)

Using your definitions and examples in Table 1, brainstorm examples of how your local ecosystems provide some of these same services.

Table 2: Ecosystem Services in My Community

TYPES OF ECOSYSTEM SERVICES	DEFINITION	HOW DO WETLANDS FULFILL THE SERVICE	HOW DO FORESTS FULFILL THE SERVICE	HOW DO OCEANS FULFILL THE SERVICE
Provisioning				
Regulating				
Cultural				
Supporting				

Formative Quiz: The Value of Biodiversity

1. Which of the following would a biologist in Yellowstone National Park study to assess the biodiversity of the park?

- ▶ I. DNA samples from individuals within the reintroduced wolf population.
- ▶ II. The differences between the grasslands, aspen stands, and pine forests.
- ▶ III. The number of different trout species living in Yellowstone River.

- a. I only
- b. II only
- c. I and II only
- d. I, II, and III

2. Which of the following describes a regulating ecosystem service?

- ▶ a. A farmer gets \$4.00 per bushel of corn.
- ▶ b. Ocean water stores carbon as carbonate ions.
- ▶ c. The beauty of the Hudson River Valley has inspired artists and writers.
- ▶ d. The pH of rainwater in the U.S. ranges from 5.6–5.8.

3. It has been estimated that it would cost \$7/acre to replace the pest-control services of birds in forests with chemical fertilizers. If there are 750 million acres of forested land in the United States, what is the value of preserving forest habitat for these species?

- ▶ a. \$107
- ▶ b. $\$1.07 \times 10^8$
- ▶ c. \$5250
- ▶ d. $\$5.25 \times 10^9$

4. Which of the following describes the food web relationship between grizzly bears, red squirrels, and white bark pine trees in Yellowstone National Park?

- ▶ a. Red squirrels bury pine cones that the grizzly bears dig up and eat for their high nutrient content.
- ▶ b. Mountain pine beetles carry a virus that is transmitted to red squirrels and then to grizzly bears.
- ▶ c. Grizzly bears climb the pine trees to eat the pine cones and frighten the red squirrels from their nesting sites.
- ▶ d. Clear cutting of mountain pine in the park has destroyed the habitat for the red squirrel and grizzly bear.

5. What global environmental impact is threatening the complex relationship between grizzly bears, red squirrels, and white bark pine trees?

- ▶ a. acidic forest soils
- ▶ b. climate change
- ▶ c. over-hunting
- ▶ d. fungal infections



NAME: _____

TEAM MEMBERS: _____

(1 of 1)

Problem Tree

In your Problem Tree graphic organizer, start by writing the problem in the trunk of the tree, and then look at the causes and effects of an issue. Keep digging to go deeper on the issue to find its supporting and root causes.

Leaves/branches: Effects

These are the results created by the problem. At first, this part of the issue appears easy to tackle, but when leaves and branches are trimmed, they grow back quickly. Consider the multi-layered effects, or “effects of effects,” that can arise when a problem goes unaddressed. Always ask: “Then what happens?”

Ex: Declining ecosystem health.

Trunk: Problem

This is the key issue that is being studied. Because it is not as apparent as the leaves, the core problem itself sometimes takes a little longer to identify.

Ex: Loss of biodiversity.

Roots: Causes

These are the situations or factors that have led to the problem. When exploring the root causes of a problem, ask yourself “Why does this problem exist?” Dig deeper to consider the “causes of causes”—the multiple layers of factors that contribute to a problem.

Ex: Invasive species.



NAME: _____

TEAM MEMBERS: _____

Needs Assessment

The following series of questions helps you to analyze and identify ongoing areas of need within organizations addressing your issue.

1. Identify 3-5 organizations working on issues related to the issue your team is working on.

2. What does each organization do well in response to the issue and/or related issues?

3. What could each organization do better in its response?

4. What areas of need related to access to your issue have you learned about that each organization is NOT addressing?

5. Considering all 3-5 organizations, where are there ongoing needs that are not being adequately addressed?

6. Considering all 3-5 organizations, where are there ongoing needs that are being addressed successfully, and to which you can add further efforts to support the issue?



NAME: _____

TEAM MEMBERS: _____

Solution Tree

(1 of 1)

In your Solution Tree graphic organizer, start by rewriting the problem from your Problem Tree, and reframing it as a goal at the trunk of the tree. Then consider the different solutions (the roots) and possible outcomes of the solutions (the branches).

Leaves/branches: Outcomes

These are the results created by the solution. Results may appear as straightforward as having achieved goals, but when you consider the ripple effects and outcomes of sustainable results, the impact is far-reaching and long-lasting. Always ask: "Then what happens?"

Trunk: Problem

Trunk: Goal

Roots: Solutions

These are the actions needed to solve the problem and achieve the goal stated at the center of the Solution Tree. When exploring solutions, ask yourself "How will this solve the problem?" Dig deeper to think holistically, so that you are looking beyond the short-term and addressing not only the symptoms of the problem but the root causes as well.

Solution Tree Worksheet: Copyright © 2018 WE. All rights reserved.



NAME: _____

TEAM MEMBERS: _____

Working Independently: Free Response Question

Biodiversity can be described as the variety of different types of life found on earth. Many biologists believe that human activities are threatening this variety of life and that we are losing the benefits that these species provide for us.

- a. **Identify** and **describe** TWO levels of biodiversity. (2 pts.)
- b. The benefits that human get from biodiversity are called ecosystem services.
 - ▶ **Identify** TWO categories of ecosystem services. (2 pts.)
 - ▶ **Identify** and **describe** ONE ecosystem of forests. (1 pt.)
 - ▶ Many ecosystem services can be assigned a monetary value. It has been estimated that wetland ecosystems provide as much as \$10,000 per acre by filtering water, preventing flooding, and providing nurseries for wildlife. **Calculate** the amount of money a community could save if they preserved 400 acres of wetlands. (2 pts. 1 pt. set up, 1 pt. answer.)
- c. **Identify** ONE specific human activity and **explain** how it has lowered biodiversity. (2 pts.)
- d. **Describe** ONE specific strategy humans can take to reduce their impact on local or global biodiversity. (1 pt.)



Approaches to Taking Action Information Sheet

(1 of 1)

DIRECT SERVICE	
WHAT IS IT?	Personally engaging with and providing hands-on service to those in need (usually in conjunction with an organization).
EXAMPLE GOAL	By the end of the semester, we will support a local food bank and shelter by packing and serving food to people in the community. We will also visit our neighboring elementary school and teach a lesson on food insecurity in our community.
ACTIONS	<ul style="list-style-type: none"> Reach out to local shelters and food banks to arrange a day for the class to visit and provide hands-on support Once a date has been decided, make sure students all have permission to travel to the food bank (if during school hours) Connect with teachers/administration at local elementary school and arrange to visit a classroom to teach a lesson to young students on food insecurity Create and print worksheets to use with younger students

INDIRECT SERVICE	
WHAT IS IT?	Channeling resources to the needs of a community—locally, nationally, or internationally.
EXAMPLE GOAL	By the end of the year, we will create a storage and donation system for local families in need, where they can access furniture and other household items. We will develop a system for donations, pick-ups, and inventory.
ACTIONS	<ul style="list-style-type: none"> Conduct research into which items are most needed by community members (e.g., bed frames, dining tables, household goods, etc.) Reach out to local businesses to try to get a storage space donated Connect with school social workers/administration to gain their support Put up flyers around school and in the community, asking for donations (list specific items needed), including instructions on how/where to donate Develop an online database for tracking donations and pick-ups, and maintaining inventory Share pick-up information with local shelters, churches, community centers, etc. Share the donation system with school social workers, so that they can maintain the project in future years

ADVOCACY	
WHAT IS IT?	Educating others about an issue to increase visibility and following up with an action that focuses on enacting change. Actions around advocacy often look like raising awareness, but without a strong call to action within the initiative as a whole. Educating others is not considered service in and of itself.
EXAMPLE GOAL	Through an informative art piece, we will educate our school community about the waste created by single-use plastic water bottles, and the impact they have on the environment. Then, we will sell reusable water bottles at school, and the proceeds from the sale will go toward clean water projects in developing countries.
ACTIONS	<ul style="list-style-type: none"> Research the impact of single-use plastic water bottles around the school and in the local community Plan out and create a 3D sculpture that incorporates informative text on the issue of single-use plastics Seek permission from school administration to display the piece in a common area of the school Design and order water bottles to sell at school Research and select an international organization that focuses on clean water projects Organize a selling schedule for the water bottles, donate profits



NAME: _____

TEAM MEMBERS: _____

Creating the Action Plan

This outline serves as a basic template for your action plan. Use additional space and resources to help you build out each part with the right amount of detail and flow to ensure you have the strongest action plan that you and your team can implement with ease. Remember, this is your road map for your service project!

TEAM GOAL:

MEASURES OF SUCCESS:

Required Network and Resources

In order to complete this goal, our team will need to develop the following network and access the following resources:

NETWORK:

RESOURCES:

ROLES AND RESPONSIBILITIES

Each team member will take on the following roles and associated responsibilities:

TIMELINE

Our team will use the following timeline to complete tasks and successfully carry out the action to meet our goal(s):



NAME: _____

TEAM MEMBERS: _____

Five Action Planning Pitfalls Tip Sheet

(1 of 1)

Once your team has completed the major components of your action plan (creating your teams and setting goals, timeline, and network), review the five action planning pitfalls provided below to ensure these have been avoided. Review your plans—individually first, then together as a team. After the review, rework your action plans, if necessary.

1. Setting an unclear goal

The first and most important part of any action plan is defining the goal, or what you want to achieve. It should be clear and easy to understand, for example, “We want to collect 500 cans of food,” or “We want 200 people to learn about WE Villages.” If the goal is not clearly defined, proper planning will be difficult if not impossible. As a best practice, have a peer from another team review your goal to ensure it is as clear as you hope.

2. Planning unrealistic actions

After the goal is set, begin planning the actions necessary to achieve it. It is important that the steps make sense and are achievable. Do not plan unrealistic actions, such as working at times that will interfere with schoolwork, overestimating how many people can help out, or planning to go to places that would be difficult for you to reach. Consider each team member’s school and community schedule, such as work and extracurricular activities. Before planning an action, ask yourself, “Is this action realistic?”

3. Rushing the process

Do not be too hasty in planning actions. While you may be excited to start, proper planning takes time. The better the planning and organization, the more

success you will achieve. Even if it means slowing down to figure out details, do not rush and leave out important steps.

4. Not asking for help

Do not be afraid to ask for help. When a network is created, bigger goals can be achieved faster. Reach out to friends, parents, and mentors. People generally enjoy helping, especially if it is for a worthy cause.

5. Not learning from mistakes and giving up too quickly

We all make mistakes—it is normal and healthy. Mistakes allow us the opportunity to learn and grow. So, learn from the mistakes. Ask, “Why did this happen?” and “How can I avoid this problem next time?” Actively think about the mistakes and how it will be better the second time around. If something does not go as planned, do not stop!

Want more?



Follow @WEmovement
#APWEServe