

SciREN Lesson Plan Template

Lesson Abstract:

Lesson Plan Title: Nature's Benefits Card Game	Essential Question: How does human well-being depend on stewardship of the environment and the natural resources that ecosystems provide?
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Abstract to Lesson Plan: This lesson plan uses a science-based card game developed for the 8 th grade level (though adaptable for 6 th through 12 th grade levels) to supplement and reinforce environmental science instruction on NC Essential Science and AP Science standards, particularly recognizing that human health and well-being require good stewardship and conservation of natural resources (also known as ecosystem services). During gameplay, each student plays a role as a decision-maker who creates card chains linking ecosystems to natural resources to the people who benefit from those resources. These card chains can be disrupted or augmented by Event cards, including natural disasters, human activities, and sustainable management events that may be drawn during the game. While natural disaster events are unavoidable, decisions about human development activities, sustainable management, and natural resource use are choices people make. This aspect of the game reinforces the students' understanding that their decisions have an impact on the sustainability of ecosystems, the way the environment provides natural resource benefits to people, and ultimately an individual's own personal/community well-being. Through gameplay, the concepts associated with the stewardship of natural resources can be taught and reinforced in a fun and engaging way by integrating and applying them within a card game construct/context.	

Lesson Plan Information:

Class Subject and Grade Level: Earth/Environmental Science Targeted to 8th grade Adaptable for 6th-12th grades	Learning Objectives (L.O.): After playing the game, students will understand that: ➤ Human health and well-being depend on ecosystems and natural resources. ➤ Both natural disasters and human activities can impact the quality and availability of natural resources. ➤ Good stewardship and conservation of ecosystems can help ensure sustainability and resilience of natural resources. ➤ Different management strategies (cooperative vs. competitive) can affect availability of natural resources and benefits to people.
Class Duration: 10 minutes of instruction 20-30 minutes per game (recommend playing both game versions with class) 10 minutes of discussion	
Class Setting: Indoors, in class; Online (virtual) play is possible	
Class Size: Game typically played with 4 students. Divide class into multiple groups of 4 players. Each group will need their own set (deck) of cards.	
Materials Needed for Teacher: • Game rules: PowerPoint presentation and/or handout • Quick reference rule handout • Printed card decks: Can be laminated or on card stock	Lists of Standards: NC Essential Standards: Ecosystems: NC – ES (Middle School) • <u>6.E.2.4</u>. Conclude that the good health of humans requires: monitoring the lithosphere, maintaining soil quality and stewardship. • <u>7.E.1.6</u>. Conclude that the good health of humans requires: monitoring the atmosphere, maintaining air quality and stewardship. • <u>8.P.2.2</u>. Explain the implications of the depletion of renewable and nonrenewable energy resources and the importance of conservation. • <u>8.E.1</u>. Understand the hydrosphere and the impact of humans on local systems and the effects of the hydrosphere on humans. NC Essential Standards: Earth/Environmental Science: NC – EEn (High School) • <u>2.2.1</u>. Understand how human influences impact the lithosphere • <u>2.4</u>. Evaluate how humans use water • <u>2.7.3</u>. Explain how human activities impact the biosphere. • <u>2.8</u>. Evaluate human behaviors in terms of how likely they are to ensure the ability to live sustainably on Earth. AP Environmental Science Standards: APES • <u>ERT-2.B</u>. Describe Ecosystem Services. • <u>ERT-2.C</u>. Describe the results of human disruptions to ecosystem services. • <u>EIN-2</u>. When humans use natural resources, they alter natural systems. • <u>STB-3</u>. Human activities, including the use of resources, have physical, chemical and biological consequences for ecosystems.
Materials Needed for Students: • One printed card deck per group • One quick reference rule sheet per group • Scrap paper and pen/pencil to keep score	

Lesson Activity:

Activity Logistics:

Prior to lesson:

Decide on game play version (cooperative or competitive play) and options (see below) and game time (20-30 minutes), based on class size and time available. It is recommended to play both versions of the game and compare the game strategy and lessons from each: 1) competitive individual play in which individuals compete against other members within their group to earn the highest individual score; and 2) cooperative team play in which each group competes as a team against other groups (teams) to earn the highest team score.

Depending on available class time, the lesson can follow one of three options:

- Allow all students (in groups of 4) to play both game types (in a single long class period, or over two classes). **Recommended**
- Split the class such that half the class plays the competitive individual game (as groups of 4) and the other half plays the cooperative team game (against other groups of 4).
- Play only one version of the game (cooperative or competitive); students could choose which to play, or these could be alternated between different classes if there is more than one section of the class.

Lesson:

Introduction/Background (10 minutes):

- Engage students with prompts such as:
 - What are examples of natural resources?
 - How do people benefit from nature?
 - What effects can people have on natural resources (positive or negative)?
- Introduce game and review Game Rules (PowerPoint or Handout) with the class.
- Divide students into groups of 4 and distribute card decks and quick rule sheets.

Activity (20-30 minutes per game):

- Play **Nature's Benefits Card Game** as cooperative team play; Identify winning team and debrief on winning game play strategy.
- Play **Nature's Benefit Card Game** as competitive individual play; Identify individual winners and debrief on winning game play strategy.
- After each game type, do a short debrief about game strategy for cooperative vs. competitive play (Questions 1 & 2 in Debrief).

Discussion (10 minutes):

- Have students discuss additional questions in discussion section (Questions 3-5) and/or revisit initial prompts from beginning of lesson.

Activity Background/Introduction:

Human health and well-being are connected to natural ecosystems through the enjoyment of natural resources or ecosystem services, such as clean air, clean water, food, and recreational opportunities. These natural resources are often taken for granted as being limitless but can be impacted or even lost if not managed and used sustainably.

Individuals, throughout their lifetimes, will encounter numerous situations that require them to make decisions on how they interact with their environment and use natural resources, and these

decisions can have lasting and far-reaching impacts on personal well-being, on community sustainability, and at larger societal levels. It is important for students to have the ability to recognize, understand, and appreciate the dependencies and interconnections that exist between people and the natural environment.

Understanding the dependence of their own future health and well-being on the continued provision (sustainability) of these ecosystems and the natural resources they provide, as well as how forces (both natural and human-induced) can impact the quality and availability of these resources, will help students be better equipped, as future decision-makers, to avoid unintended and sometimes irreparable consequences.

Activity Content:

The goal of the **Nature's Benefit Card Game** is to connect ecosystems, the natural resources they produce, and the groups of people that benefit from or use them to create ecosystem service chains.

Refer to the Game Rules PowerPoint or handout for in-depth instructions.

Overview of Rules:

1. Each player is assigned a Role. This Role represents a leader in society who is responsible for helping 4 groups of People who Benefit connect with or access the natural resources they benefit from using.

- People who Benefit cards should be placed face up on the table next to the Role card responsible for them.

2. Each player draws 7 cards from the play deck and holds them in their hand. At the start of their turn, each player draws a new card before putting one down in the play space.

3. Players take turns playing Ecosystem cards and Natural Resource cards until they can play one of their four People who Benefit cards which (with a completed chain) score points. Sometimes, another Role (player) also scores points on that completed chain. Points earned are indicated on each card in the colored shapes corresponding to the Role(s) that earn points from that card.

- During each turn, a player may play 1 Ecosystem, Natural Resource or Event card from their hand, AND if possible, play 1 People who Benefit card in front of them.
- Natural Disaster Event cards must be played immediately if drawn during a player's turn.

4. Players take turns for the allotted game time (30 mins). If playing the cooperative version, the team with the most points out of the classroom wins. If playing individual competitive version, the player with the most points in each group wins.

Process/Debrief Activity

For each game type (cooperative play or competitive play), students should be encouraged to discuss with the class what their individual or team strategy was. Once both types of games (cooperative and competitive) have been played, students should be encouraged to discuss (or write in a journal) about how their game strategy differed when they were trying to maximize their own individual points versus when they were trying to maximize team points.

Example discussion questions:

- Question 1. What was your game strategy during cooperative team play?

[NC-ES 6.E.2.4, 7.E.1.6, 8.P.2.2, 8.E.1.4; NC-Een 2.8, APES-STB-3]

Answers could include: i) playing Ecosystem cards at the expense of one's own score so that teammates would have places to play their cards, or so that natural resources would be buffered from natural disaster events; ii) playing Sustainable Management Event cards so that ecosystems were protected from human activities and resilient to natural disasters; iii) communicating with teammates about what Ecosystems or Natural Resources cards were best to put down to benefit the group as a whole; iv) planning ahead (rather than waiting until it is too late) to buffer ecosystems against natural disasters or human activities minimizes their negative impacts on the team, even if it comes at a cost to your individual score; or v) playing Human Activities Event cards in a way to minimize damage to ecosystems and natural resources.

- Question 2. What was your individual strategy during competitive (individual) play?

[NC-ES 6.E.2.4, 7.E.1.6, 8.E.1; NC-Een 2.7.3; APES-ERT-2.C, EIN-2]]

Answers could include: i) trying get as many of their People who Benefit cards connected to Natural Resources cards on the board/play space as possible, even if at the expense of other players; ii) selectively protecting the ecosystems you are relying on from natural events or human activities if it was in your own best interest, regardless if it caused damage to other players; iii) playing as few Ecosystem cards as possible, because they do not immediately earn you points and could actually benefit other players at your expense; or iv) planning ahead (rather than waiting until it is too late) to buffer ecosystems against natural disasters or human activities in order to minimize their negative impacts on you.

- Question 3. What are some ways humans affect ecosystems (positively or negatively)?

[NC-ES 6.E.2.4, 7.E.1.6, 8.E.1; NC-Een 2.2.1,2.7.3,2.8; APES-ERT-2.C, EIN-2, STB-3]

Answers could include: i) through activities that alter ecosystems, habitat, or water flow and impact the ability of those ecosystems to provide natural resources, ii) by overusing natural resources so that there are not enough natural resources for everybody, or iii) by managing ecosystems to sustainably provide resources and to be resilient to natural disasters.

- Question 4. Why should humans care about conservation of natural resources?

[NC-ES 6.E.2.4, 7.E.1.6, 8.P.2.2, 8.E.1.4; NC-Een 2.4; APES-ERT-2.B]

Answers could include: i) because almost all people use natural resources in some way; ii) because natural resources are important for human health and happiness in a lot of different ways (the food we eat, recreation, clean air, clean water, raw materials, beauty); iii) because the people in our community are connected so just because something is not important to me, it may be important to my friends and neighbors; or iv) because resources are more vulnerable to human activities and natural disasters if we do not protect them.

Discussion could further be guided to explore specific topics such as lithosphere & soil quality [NC-ES 6.E.2.4], atmosphere & air quality [NC-ES 7.E.1.6], the hydrosphere & water [NC-ES 8.E.1, NC-EEn 2.4], or the biosphere [NC-EEn 2.7.3].

- Question 5. How can humans be better stewards of the environment?

[NC-ES 6.E.2.4, 7.E.1.6, 8.P.2.2, 8.E.1.4; NC-Een 2.4; APES-ERT-2.B]

Answers could include: i) by not overusing natural resources; ii) by managing ecosystems to be used sustainably and resiliently; or iii) by working with other community leaders about ecosystem management and the use of natural resources so that the community as a whole benefits.

Final Product/Assessment of Activity (What will educator be looking for/listening for; how will

students self-evaluate, process, reflect; Connect this assessment to EQ or Standard)

Prior to the lesson and game instruction, the teacher may assess what students think they know about natural resources and the people who benefit from. After game play, students should have a broader understanding of the variety of benefits people get from nature, and how natural disasters and human activities can impact the availability of natural resources.

Pre-lesson questions, that can be revisited at the end of the lesson, could include:

- What are examples of natural resources?
- How do people benefit from nature?
- What effects can people have on natural resources (positive or negative)?

Students should be encouraged to actively reflect on and discuss with group members play strategy during game play, particularly during cooperative play. As students play, they should be actively identifying game play strategies that are also lessons, including the choice to:

- *Play Ecosystem cards (even though they do not immediately earn points)* – Natural resources are a limited resource if ecosystems are not available to provide them.
- *Link Natural Resources cards to more than one Ecosystem card* – The natural resources people enjoy may be vulnerable to overuse, natural disasters, or human activities unless ecosystems are maintained in good quantity. If natural resources are lost, people may seek out alternative places to find those resources.
- *Play up to three People who Benefit cards per Natural Resource cards* – Natural resources are not unlimited and can only support a limited number of users.
- *Play a Human Activity Event card* – People have alternative motives in how they use the environment, and what is good for one person may have a negative effect on others.
- *Play a Sustainable Event card* – Humans can manage ecosystems in ways that make them resilient to natural disasters and make sure natural resources are not depleted, but instead are available sustainably to many different types of people.

At the end of the lesson, students should be able to identify the following:

- Examples of natural resources;
- Examples of how people benefit from nature;
- Examples of negative impacts people can have on nature;
- Examples of positive impacts people can have on nature; and
- Examples of how and why people should be good stewards of their environment.

Students may also be encouraged to think creatively or draw from their own experience and knowledge about additional examples for each of these, above and beyond what was included in the game.

Differentiation Strategies:

Modifications for Online/Hybrid Classroom: <i>(Are there ways to run this activity online?)</i> This game can be played virtually on Google Jamboard¹, using a digital play space, with players copying and pasting digital card images. Contact authors for more information about this option.	Differentiation Strategies: • Cooperative vs Competitive Play: ○ Cooperative (team) play means the team is working together to score the most points against other teams in the classroom. ○ Competitive (individual) play means the students in each group are competing against each other gain the most points. ○ Teachers should evaluate which version they prefer to start with. Teaching moments for each game strategy are described in the Debrief section. ○ If there is enough time in the schedule, we recommend teachers play both. • Remove certain cards for simpler play: ○ Remove Natural Disaster Event cards from the deck for a less 'destructive' game play for sensitive players. ○ Remove all Event cards for simplest game play, to just focus on the connections between ecosystems, resources, and beneficiaries. • Modifications for different grade levels or advanced players: ○ Discussion questions can be modified to more directly bring in class content (glossary terms, concepts).
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Extra Materials:

List Extra Materials for Activity *(List any images, PowerPoint slides, worksheets, appendices, or extra reading that should be included with this activity)*

Mandatory materials:

- Game Rules guide and PowerPoint slide deck (Game_Rules.pdf, Game_Rules.ppt)
- Quick Reference Rule Sheet handout (Quick_Reference_Sheet.pdf)
- Printable Card deck (Card_Deck_Printable.pdf)

Supplemental materials: Extra activities for advanced students could include:

- Visiting EPA's National Ecosystem Services Classification System NESCS+ website to discover how natural resources and their users can be classified:
<https://www.epa.gov/eco-research/national-ecosystem-services-classification-system-nescs-plus>
- Mapping levels of ecosystem services in your area using EPA's EnviroAtlas:
<https://www.epa.gov/enviroatlas>
- Additional activities about ecosystem services using EPA's EnviroAtlas:
https://www.epa.gov/sites/default/files/2019-10/documents/508compliant_epa_enviroatlas_educational_curriculum_fact_sheet_7.29.19.pdf

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