



Lesson Six: New to the Web

Grade Level: 5th Grade

Time: 60 minutes

Essential Question: How can we be stewards of Wyoming's agriculture to benefit current and future generations?

Objectives: Students will:

- Read or re-read and reflect on a text of a Wyoming rancher facing a challenge with invasive species.
- Describe the impact of newly introduced species on a food web and the species' ability to meet their needs.

Purpose: Students learn that newly introduced species can affect the balance of an ecosystem and that the changes can be positive or negative. Students learn that humans introduce species for a variety of reasons including to solve problems.

Required Materials/Resources:

- Video: <https://www.youtube.com/watch?v=hdTBQvbZHSU>
Leafy Spurge, A Noxious Weed (Source 1) Video Length: 1 minute 34 seconds
- *Ryan Fieldgrove Family* text (one per student and teacher) - (Sources 3-5)
- Video <https://www.youtube.com/watch?v=pGnHeaN2ZX8>
(optional) *Fieldgrove Ranch - 2011 Leopold Conservation Award (Wyoming)* (Source 9) *Video Length: 11 minutes 32 seconds*

TEACHER NOTE:
You may choose to show the Fieldgrove Ranch video. It contains the same information as the text. However, some minor numerical information (7 days/10 days; 10 acres/5 acres) varies. The video length is 11:32; the portions dealing with goats/leafy spurge are from 3:00-4:10 and 6:30-8:00)

- Electronic devices so students can play the Invasive Species game:
<http://pbskids.org/plumlanding/games/invaders/index.html> (one per student) - (Source 2)
- Scenario 4 card (one per student) - (Sources 6-8)
- Student Recording Sheet - Scenario 4 (one per student)

Suggested Teacher Preparation:

- Practice using the simulation game to test and predict the outcomes that the students might encounter.
- Review the lesson texts.
- Preview the videos and make sure they play.
- Decide whether or not to use the optional Fieldgrove Ranch video.

Standards:

Science: 5-LS2-1 (CCC,DCI), 5-ESS3-1 (Explicit), 3-5-ETS1-2 (DCI,SEP) - (Practiced/Encountered)

ELA: 5.RI.6, 5.RI.9, 5.W.8, 5.SL.1 (Practiced/Encountered)

Vocabulary:

- **Invasive species** - species that grow and disperse easily, usually to the detriment of native species and ecosystems
- **Native** - found originally in a place; not introduced from another place
- **Noxious weeds** - plant that has been introduced, accidentally or intentionally, into an environment and causes or is likely to cause environmental or economic harm; plants that have been declared by a legislative body as worthy of regulation and management
- **Pesticide** - a substance used for destroying insects or other organisms harmful to plants or animals
- **Simulation** - allows us to test and make sense of a process or a change without having to observe it in the real-world. Simulations can help us answer complex questions and slow down or speed up processes

Instructional Procedure/Steps:

1. Say: **“Today’s lesson focuses on how the introduction of a species can affect the balance of an ecosystem. We will start by discussing leafy spurge. Leafy spurge is an invasive species that is not native to Wyoming. It was introduced to Wyoming ecosystems and has caused problems for farmers and ranchers because it pushes out other plants, and it is toxic to horses and cattle. It is very hard to control (get rid of).”** Play video on leafy spurge: <https://www.youtube.com/watch?v=hdTBQvbZHSU>. After the video, say: **“Discuss with a partner some of the characteristics that make leafy spurge problematic when it is introduced into an ecosystem.”** Possible responses include: *it’s “aggressive and tenacious”; it infests large areas of land; it costs millions of dollars a year; seeds can “explode” as far as 20 feet away from the original plant; it spreads through an underground root system; it spreads very quickly, so it pushes out other plants and ruins habitats; cattle won’t eat it because it’s filled with milky sap that tastes bad.*
2. Say: **“Clearly, leafy spurge is a plant that can be very problematic. Next, we’re going to read a short article about how one Wyoming ranch has tried to deal with this invasive plant.”** Pass out the *Ryan Fieldgrove Family* text. After reading the text, ask students the following questions:
 - **“How does leafy spurge impact the food web of an ecosystem?”** *It is toxic to horses and cattle; it pushes out other plants that they would eat.*
 - **“How does leafy spurge impact the ability of the species to meet their needs?”** *When horses and cattle try to eat the plant, they are harmed; other plant species suffer because they are competing for resources.*
 -  **“What kind of impact does leafy spurge have on an ecosystem? Why?”** *Students should understand that from the perspective of a rancher or*



In this task, students will be engaged in the higher order thinking skill of analysis.

farmer, leafy spurge has a non-beneficial impact on the ecosystem because it harms cattle, competes with other plants for resources, and is very hard to control.

3. Say: **“Because the leafy spurge was such a problem on their ranch, the Fieldgroves introduced another species to their ecosystem - goats. Let’s think about the effect of that species on the ecosystem.”** Ask the following questions:

- **“Why did they introduce goats into the ecosystem?”** *To try and decrease the amount of leafy spurge, so the ecosystem would be better for the cattle.*
- **“How do goats impact the food web of the ecosystem?”** *They are an addition to the food web; they eat the leafy spurge but leave the grass for other animals.*
- **“How do goats impact the ability of the species to meet their needs?”** *By removing the leafy spurge, they allow other plant species to better meet their needs.*
- **“What kind of impact did the goats have on the ecosystem? Why?”** *Overall, the impact of the goats was pretty positive; although they required a lot of management from the people, they helped to manage the leafy spurge.*

4. For bonus points in the game, ask: **“Does anyone remember two other species that were mentioned in the leafy spurge video as potential organisms that can be introduced into an ecosystem to help control leafy spurge?”** *Grasses that compete with spurge and flea beetles*

5. Say: **“Next, you will be playing a game that explores invasive species. The game will serve as a type of simulation for how the introduction of a species can impact an environment. When scientists want to study the impact of a species on an ecosystem, they**

will often use a simulation to do so because it allows them to use models to predict what might happen in a particular situation. A simulation allows us to test and make sense of a process or a change without having to observe it in the real-world. Simulations can help us answer complex questions and slow down or speed up processes, so we can make predictions and test ideas. This process allows you to look through a scientific lens while exploring problems and solutions.”

6. Assign devices to students. Once everyone has accessed the website

<http://pbskids.org/plumlanding/games/invaders/index.html>,

say: **“You will have about 10 minutes to explore the game. After the first few rounds, it will start to get increasingly difficult. As you play the game, think about ways in which the simulation might be similar to what can actually happen when a species is introduced into an ecosystem. After you’ve successfully completed a few levels, you might also try not intervening to see what happens in the ecosystem.”** After students have had time to explore, bring them back together to discuss their observations. Ask: **“What did you notice when there was an invasive species in the ecosystem? How was the simulation similar to real world situations?”** Some suggested connections:

- *Sometimes the new species had a small impact on the ecosystem, and sometimes it had a large impact.*
- *Invasive species posed a problem for native species when they were competing for resources.*
- *When species multiply/spread quickly, they can be very difficult to manage.*
- *The ecosystem could get crowded.*
- *Without human intervention to “manage” the ecosystem, one or more species would sometimes be threatened.*

Students should also be encouraged to see what the effects are if they do not intervene at all during a round of the game. Depending on the scenario, they might notice: *that species die, that the environment gets really crowded, that one species starts to really dominate the ecosystem, and/or that sometimes things balance out.* Be sure to check in on students' understanding of this concept by reviewing the question for Scenario 4: **"What impact does the introduction of the species have on the ecosystem?"** in the Student Recording Sheet. This should be done to collect evidence of students' understanding of the concept that the introduction of a species can have an impact on the ecosystem.

7. After wrapping up the simulation discussion, award a game point to students who made relevant observations about how the simulation shows what can actually happen when a non-native species is introduced into an ecosystem.
8. Have students move their game pieces.
9. Say: **"For our scenario today, we'll be looking at the introduction of a species that is having a negative effect on the ecosystem. Your job will be to try and be good stewards by managing that species to reduce its impact."** Pass out the Scenario 4 card and Student Recording Sheet. Proceed with the scenario using the same protocol as the previous lessons. After they are finished, review the student responses and award points for today's work based on the following:

Scenario 4 - Alfalfa Weevil

- **1 point** – Student accurately responds to: **What impact does it (alfalfa weevil) have on the ecosystem?**

- **1 point** - Student accurately responds to: **How does your choice change the ecosystem described in the scenario (positive and negative)?**
- **1 point** - Student accurately responds to: **How does it show good stewardship of the agricultural resources?**
- Even though students are asked only to pick ONE option, award **a bonus point** for any student who suggests the idea of using more than one of the techniques and provides an analysis of each.

Assessment: See end of step 6 and step 9.

Credits/Sources:

1. University of Wyoming Extension. (2009, January 5). *Leafy Spurge, A Noxious Weed*. Retrieved August 26, 2017, from <https://www.youtube.com/watch?v=hdTBQvbZHSU>
2. WGBH Educational Foundation. (2017). *Plum Landing: Invaders*. Retrieved August 26, 2017, from <http://pbskids.org/plumlanding/games/invaders/index.html>
3. Zoom Information, Inc. (2017) *Ryan Fieldgrove*. Retrieved August 20, 2017, from <http://www.zoominfo.com/p/Ryan-Fieldgrove/1742236532>
4. Commission for Environmental Cooperation. (2011, February 11). *Field Grove ranch, Buffalo Wyoming*. Retrieved August 20, 2017, from <http://www.nagrasslands.org/field-grove-ranch-buffalo-wyoming/>
5. Wyoming.pdf. (n.d.). *Invasive Species in Wyoming*. Retrieved August 20, 2017, from <http://www.defenders.org/sites/default/files/publications/wyoming.pdf>
6. University of Wyoming, Department of Plant Science, Dr. Andrew Kniss.

7. Kinney, K.K. Peairs, F.B. Colorado State University Extension. (2011, May). *Alfalfa Weevil*. Retrieved August 26, 2017, from <http://extension.colostate.edu/topic-areas/insects/alfalfa-weevil-5-500/>

8. Brewer, Michael J. Legg, David E. Gray, Alan M. University of Wyoming. (1993, June). *Alfalfa Weevil Biology and Management*. Retrieved August 26, 2017, from <http://www.wyomingextension.org/agpubs/pubs/B983.pdf>

9. Sand County Foundation. (2011, August 25). *Fieldgrove Ranch - 2011 Leopold Conservation Award (Wyoming)*. Retrieved August 11, 2018, from <https://www.youtube.com/watch?v=pGnHeaN2ZX8>