



Deer Tracks Lesson Plan

Overview

In this lesson, students:

- learn fundamentals of graphing on the coordinate plane.
- use satellite imagery and a map of a forested region to develop mathematical, ecological, and technological concepts.
- learn about deer ecology and strategies for tracking animals.
- use coordinates to identify and discuss various landmarks in the imagery and their ecological implications.

Suggested Lesson Sequence	Please see the Earth Systems and Humans , and Maps and More module descriptions.
Lesson Level	Extended
Mathematics Connections (Keywords in BOLD)	<ul style="list-style-type: none"> · Students will explore the coordinate plane: axes and the origin. · Students will graph using ordered pairs. · Students will compute distances using a scale. · Students will develop number sense: value placement to the hundreds place. · Students will measure using the metric unit of a meter. · Students will identify compass directions on a map. · Students will develop spatial sense using maps and images.
Science Connections (Keywords in BOLD)	<ul style="list-style-type: none"> · Students will use a satellite image with a coordinate plane to track the movement patterns and learn about behavior of deer. · Students will use satellite imagery to investigate plant distribution across a landscape.
Technology Connections (Keywords in BOLD)	<ul style="list-style-type: none"> · Students will examine and interpret satellite imagery of the earth. · Students will use a computer to compare a satellite image with a map.

Cultural Connections (Keywords in BOLD)	<ul style="list-style-type: none"> Students will learn about customs and language of Lakota Sioux peoples.
Lesson Assessment Tools	<ul style="list-style-type: none"> Assessment and Standards Table (Word) Assessment task description (below) Authentic assessment (below)

Materials

- This lesson requires [Quicktime Player](#) and [Adobe Reader](#).
- [Deer Tracks: Pixel the Satellite Animation](#) (Quicktime)
- [Deer Tracks: Activity Sheet I](#) (PDF)
- [Deer Tracks: Activity Sheet II](#) (PDF)
- [Deer Tracks: Forest Image 1](#) (GIF)
- This lesson depends upon students seeing color imagery. If color hardcopies are not available, use projections of Activity Sheet I and Forest Image 1 on a computer or large screen.
- Pencil (colored pencils optional)

Vocabulary Words

- Approximately - nearly correct or exact
- Coordinate - a number that can be used to determine a location along a line. Two coordinates can be used on different lines, or *axes*, to determine a location on a map or image.
- Ecology - the study of how living things relate to the environment
- Ecological - relating to ecology
- Ecologists - scientists who study ecology
- Estimation - a guess to judge the size or worth of something
- Mato - a Lakota Sioux word meaning "bear"
- Outcrop - bare rock
- Outpost - a place where a small number of people go to make scientific or other observations
- Paha - a Lakota Sioux word meaning "hill"
- Representation - the use of symbols or codes to describe other objects
- Research station - a place where scientists work (and sometimes live). Many research stations are located far away from cities.
- Sage - a small plant with a strong smell that is used for cooking and ceremony.
- Tatanka - a Lakota Sioux word meaning "buffalo" or "bison"
- Tipi - a portable home once used by Native Americans
- Tipi ring -- Rocks that were placed along the circular outer edge of a tipi to keep it from blowing away.

Procedure

1. In this lesson, students will continue to develop their understanding of maps and coordinate systems as they explore *actual satellite imagery* of this forest. Therefore, students will work with a map that is in fact a picture of this region as captured by a satellite orbiting hundreds of kilometers overhead.

Most of this lesson will unfold through explorations described in the student activity sheets. Students will be involved in the tracking of a herd of deer near the Tatanka Ecological Research Station. The steps below will provide teachers with ideas to help guide the students through various stages of the activity sheets.

2. To help introduce this lesson, a one-minute Pixel the Satellite "Deer Tracks" Animation is available for your use in the classroom. You may wish to play this animation on a large screen before distributing any paper materials to the students. This animation has been designed to help excite students about the lesson, as well as to set the stage for the lesson context. The transcript of this Pixel the Satellite Animation is as follows (this and all other Pixel the Satellite Animation [transcripts](#) can be printed for students with hearing impairment):

DEER TRACKS ANIMATION:



1. "Oh where, oh where have my little deer gone? 2. Oh where, oh where could they be??" 3. Oh, hi there everybody! 4. Have you ever known that an animal was around you, without even seeing it? 5. Well, I just got a message from some of my friends at the Tatanka Ecological Research Station, who asked if I could help them with finding a herd of deer in the forest. 6. They told me that they had some good maps of the area, but wanted to know if I could send them a picture of the forest from way up in space. 7. Well, I looked at their map, waited until I orbited over that exact area, and presto! 8. Click! I snapped a picture of the exact same spot where the deer were last spotted! 9. How could you use this picture to help my friends at the Station study the deer? 10. That's what you'll find out in the next lesson. 11. As for now, I'm off to check out a snowstorm over Mt. Everest! 12. See you soo-oon!!!!

3. Distribute Deer Tracks: Activity Sheet I. (Students may also view this on the computer.) On this page, students will be asked to compare a map with an actual satellite image of the identical region. The area mapped is identical to that used in the Search and Rescue lesson. As they will be using the image the rest of the lesson, it is important to allow them

ample time to explore the image itself - what do the different colors mean? What might the lines in the image be? Make sure to help them see connections between the map and image - the map as a human creation that attempts to represent actual, physical landforms seen in the image. The satellite image was acquired from 680 kilometers above the earth by the IKONOS satellite. The IKONOS satellite is a "high resolution" imager, with a pixel size of 4 meters, enabling it to detect large individual trees. Some things to help the students consider as they look at these two images:

- The darker the green on the satellite image, the denser the foliage. You can see two large areas in particular that are heavily wooded forests.
- Light green could be either a grassy meadow, or perhaps sections of the forest that have been deforested (logged or burned) and are now growing back with smaller trees and shrubs.
- Blue indicates the presence of water.
- The sandy tan and grayish colors indicate sand, dirt, or rocks.
- The curvy lines you see on the map are likely small dirt roads providing forest access for logging and recreational purposes.

4. *Building and discussing the context.* When the students are ready to move on, distribute Deer Tracks: Activity Sheet II and read the first paragraph together with the children. Give the students several minutes to work on Task #1.

Possible discussion points and some suitable answers for Task #1 (among others): *Why is this deer research important?*

- To see if the population is growing or declining;
 - To gauge the relative health of the herd;
 - To consider the extent to which human recreation in the forest might affect the deer population;
 - To determine places for roads, campgrounds, etc. that will not disrupt the daily and seasonal patterns of deer movement or migration;
5. Distribute Forest Image #1. Note that grid lines have been added to the image. These lines will be used throughout the story as students navigate the coordinate plane.

Assessing prior knowledge. Prior to engaging the children in Task #2, spend several

minutes discussing what they might know about deer. Some initial ideas are provided in the bulleted list above. This might be a good place to encourage interested students to do more research on deer and their habitat. Numerous sites exist on the Internet, and can be found by searching for "deer."

Possible answers (there are many that work) for Task #2:

- 1) *List the coordinates of two likely places where the deer might seek shelter:* (400E, 900N) or (700E, 400N)
 - 2) *List three places the deer might feed on shrubs and grasses:* (1000N, 1000E), (700E, 600N) or (400E, 1000N)
 - 3) *Where would deer coming out of the Southeast Woods likely go for water if the plants were dry?* Near (800E, 500N) or (900E, 700N). NOTE: These answers are approximate. Some students may want to get more specific, for example, (800E, 525N). This should be encouraged. To the extent possible, encourage students to be as specific as possible, even if it means that the coordinates listed are not places where the grid lines intersect.
 - 4) *Do you see any paths on the image that might be used by the deer as they travel through the forest? Highlight one of these paths on Forest Image #1 with a crayon, and describe why the deer might use it.* Several answers might be suggested including: the Mato Path, the trail that connects the Tipi Rings with the rock outcrop near Paha Hill, the curving trail that cuts through the North Woods at approximately (500E, 900N), etc.
6. For Task #3, make sure the students use a large enough "D" to be seen on the forest image map. You might encourage them to use a colored pencil for clarity. Also, you should encourage them to number each camp accordingly. If the triangle is big enough, students can place the number inside the triangle. For the second part of Task #3, look for the reasoning behind the choices the students make for each outpost camp location. Their explanations should be connected to what they discussed earlier about the deer. For example, in answering questions about where to locate campsites: "We chose to put Camp #1 next to Tatanka Lake because it is likely that the deer will go there for water at least once a day."
7. Task #4 requires the students to think about the four compass directions. In this case, it is important that they identify that the deer were heading *west*. You might take a few moments to discuss the four directions (north, south, east, west), in addition to bearings that fall in between these directions (e.g., southeast, or northwest).
8. Task #5 requires students to use the coordinate plane to think about linear distances. Each grid line represents a distance of 100 meters. Since Team #3 is walking due east, only the horizontal coordinates need to be examined. They started at 400E, and arrive at 700E for a total distance of 300 meters. For part two on Task #5, students need to build

upon their prior knowledge to think about how long it would take to walk roughly 300 meters. They might think in terms of a 100-meter dash race, or a 400-meter race (once around a standard running track), or roughly the length of three football fields placed end to end. It is important to help them make these connections as they think about linear distances that are represented on a two-dimensional map. Also, be aware that the gridlines on the map do not account for gains in elevation. Although it may look like 300 meters "as the crow flies," it may in fact require more than that by foot if the trail ascends and descends, or twists and turns, along the way. Again, take this opportunity to informally develop students understanding of maps and measurement in particular. Using the "as the crow flies" metaphor is particularly helpful in fostering understanding of ground measurements as depicted on maps.

9. Tasks #6 and #7 ask students to think critically about what they see on the image. They should be able to do this if they had ample chance in step #2 above to discuss various landforms found on the image on Student Activity Sheet #1.

Answers for Task #6:

- *How would you describe the forest along the east edge of the lake?* Heavy forest; probably quite dense with large pine trees
- *Would it be easy to spot the deer if they had gone that direction? Why/why not?* It would be difficult to spot deer in such a heavily treed area

Answers for Task #7:

- *What are the coordinates of this new location for Team #2?* (1000E, 1100N)
 - *Based on what you can tell from **Forest Image #1**, at this location, are the students still under the protective cover of the forest? Yes, they are still under the protection of the forest, although this part of the forest is not as dense as others. How do you know?* It is still green, but not as dark as other places on the image.
 - *If Team #2 was to continue to creep forward (still directly east), in approximately how many meters would they reach the place where the edge of the forest appears to meet the grassy meadow?* Approximately 500 - 600 meters.
10. *Assessment Task:* Task #8 contains several questions that would be excellent assessment items to determine whether or not the students had enhanced their understanding of the coordinate plane, satellite imagery, and habits of deer through the activity.

Answers for Assessment Task (Task #8):

Possible answers include...

1. *What is a coordinate?* A coordinate is a number that represents a specific location

on one of the axes of a coordinate plane.

2. *How did you use coordinates in this activity?* Coordinates were used to label and identify specific locations on a map (e.g., Where is Tatanka Lake?). Coordinates were also used to calculate distances of travel.
3. *When you looked at the satellite image of the forest, what things could you identify?* Water (lakes and streams), forests, trails or roads, rocks, sand, grassy meadows, etc.
4. *What did you learn about the habits of deer?* Answers will vary. Insightful answers incorporate information about how deer move with relation to the features on the images and the daily needs of the deer.

At this time, you may also wish to re-play the Pixel the Satellite Deer Tracks Animation for the students and use this animation as a vehicle for further assessment and discussion.

Lesson Extensions for Authentic Assessment

- 1) Finding the Lost Lakes: Give students another copy of Forest Image 1. To reinforce their understandings of the coordinate plane, students could play a version of "Battleship" on the grid. Playing in pairs, one partner draws onto the map five different lakes, each of a different size. One lake must cover a minimum of 5 different ordered pairs (5 specific points at which two grid lines intersect). The next lake must cover 4 ordered pairs, the next 3 ordered pairs, and so on. Each player gets a chance to hide the lakes, with the winner being the person who finds each of the "Lost Lakes" in the fewest number of guesses.
- 2) Track Watch: Even if your school is in the middle of the city, there is a strong likelihood that children can find various animal tracks near the school, if not on the playground itself. In this extension activity, children could be encouraged to begin a "Track Watch" journal. Using either drawings, a digital camera, or perhaps even a video camera, children should take an excursion in which they keep their eyes open for tracks of any kind. If possible, the "Track Watch" activity could be incorporated into a field trip in which students go for a hike in outdoors, seeking wild animal tracks such as deer, coyote, etc. But this activity need not be limited to nature walks. Students could also look for (and be able to identify) tracks of more common neighborhood animals like birds, squirrels, cats, or dogs. If you live in a climate where snow falls, students will have an excellent chance of seeing animal tracks during the winter. Encourage the children to enter pictures (either drawn or photographic) into their "Track Watch" journal over time, and use the pictures as a springboard to research and learn more about the animals that made them.

A related idea is for children to search for different types of human "tracks" on the playground. Have them think about what they can tell about a person making such a track.

Does the track look to be from a tennis shoe? From a dress shoe? From an adult, or from a child? From a 1st grader, or from a 5th grader? Which way was the person walking? Is Does the track "dig in" to the ground, to imply the person was running? Having children think about how their observations can help them to learn more about the person making the tracks, and is good practice for developing wildlife tracking skills.

3) Vocabulary Story. After mastering the vocabulary words listed above, have students create a story describing a day in the life of a field scientist using as many of the words as possible.

Related Lessons

This lesson is connected to a number of other lessons in the ESC program. Most specifically, the familiarity students develop with the coordinate plane will help in the migrations lessons (such as *Separate Vacations*) in which students trace the migratory patterns of birds. Also, the opportunity for students to view and decipher images and identify ground features fits nicely with lessons in the [Global Visions](#) module.

Acknowledgment

This lesson includes material derived from IKONOS imagery, © Space Imaging L.P., acquired through NASA contract No. NAS13-98048.