



Search and Rescue Lesson Plan

Overview

In this lesson, students will be introduced to the fundamentals of graphing on the coordinate plane. Given maps of a forested area that is culturally important to a tribe of Native Americans, students are asked to help field ecologists locate an injured crow named Kangi. Additionally, they will explore Native American cultural sites and other landmarks that appear on the map. Through the lesson, students are introduced to concepts of axes, coordinates, ordered pairs, and the origin. Students will be asked to identify the coordinates of a particular object on a map, as well as determine a location on a map given a set of coordinates. This lesson provides exposure to mathematical skills and understandings that are prerequisites for later lessons that involve the tracking of animal migrations, as well as lessons that further develop understanding of the four-quadrant coordinate plane.

Suggested Lesson Sequence	Please see the Maps and More , and Earth Systems and Humans module descriptions.
Lesson Level	Extended
Science Connections	<ul style="list-style-type: none"> Students use a satellite image with a coordinate plane to locate an animal in the forest.
Math Connections	<ul style="list-style-type: none"> Students will explore the coordinate plane: axes and the origin. Students will graph using ordered pairs. Students will develop number sense: value placement to the hundreds place. Students will measure using the metric unit of a meter. Students will explore and use scale units and direction. Students will develop spatial sense using maps and images.
Technology Connections	<ul style="list-style-type: none"> Students will examine interpret a map using a coordinate system to locate an animal. Students will learn that the movements of some animals can be tracked using satellite technology.
Cultural Connections	<ul style="list-style-type: none"> Students will learn about customs and language of Lakota Sioux peoples.
Lesson Assessment	<ul style="list-style-type: none"> Assessment and Standards Table (Word) Assessment Activity Description (below)

[Authentic Assessments \(below\)](#)

Materials

Powerpoint Reader ([Windows](#) / [Mac](#)), and [Quicktime Player](#)

Forest Map #1 ([Powerpoint](#))

Forest Map #2 ([Powerpoint](#))

Navigating the Coordinate Plane activity sheet ([Word](#))

Tracking the Motion slideshow ([Powerpoint](#))

Coordinate Plane Assessment slideshow ([Powerpoint](#))

Meet Leonard Little Finger ([Quicktime](#)). This movie file is in the "Animal Tracking" folder.

Kangi the Crow ([Quicktime](#)), with Leonard Little Finger

Forest Landmarks: Sage ([Quicktime](#)), with Leonard Little Finger

Forest Landmarks: Tipi Rings ([Quicktime](#)), with Leonard Little Finger

Vocabulary

This series of lessons contains a significant amount of text that includes numerous vocabulary words in science, mathematics, and Native American culture. There may be other words that appear in the lesson activities that are not listed below. Use those opportunities to encourage students to seek the meaning of words and phrases they may not know.

Earth Systems Science Vocabulary

Ecologist: a scientist who studies the interactions among living things and the environment.

Rock outcrop: a place where large rocks (with little or no soil and plants) are naturally exposed at the surface of the ground

Transmitter: a small electronic device that sends information to a scientist by way of a satellite.

Mathematics Vocabulary

Axis: One of the reference lines of a coordinate system. The plural of *axis* is *axes*.

Coordinates: Two numbers that identify a particular location on a map. For example, the coordinates of a particular point might be (3,4), where the first coordinate, (i.e., 3) represents the horizontal distance away from the origin. The second coordinate (i.e. 4) represents the vertical distance from the origin.

Meter: A unit of measurement in the metric system equivalent to approximately 39 inches.

Origin: The location on a map or grid where the x- and y-axes intersect. This intersection point is labeled with the coordinates (0, 0).

Ordered pair: An "ordered pair" is another way to refer to the *coordinates* of a given point. For example, the location described by the *ordered pair* of (3,4) would have an x-coordinate of 3 (i.e., three units to the right of the origin) and a y-coordinate of 4 (i.e., 4 units up from the origin).

Lakota Sioux Culture Vocabulary

Inipi: A Lakota Sioux word for a sweat lodge. A small hut made out of branches where water is poured over hot rocks to create conditions much like a hot sauna.

Kangi: A Lakota Sioux word meaning "crow" in English.

Lakota Sioux: A tribe of Native American peoples living in the north-central plains of the United States.

Mato: A Lakota Sioux word meaning "bear" in English.

Paha: A Lakota Sioux word meaning "mountain" in English.

Sage: A good-smelling plant that has many cultural uses among many Native American tribes. The Lakota Sioux word for "sage" is *pejihota*.

Tatanka: A Lakota Sioux word meaning "bison" or "buffalo" in English.

Tipi: traditional Native American shelter made of tree branches and *Tatanka* hides that is easily moved from place to place.

Tipi rings: Rocks arranged in a circle that held the *Tatanka* hides of a tipi on the ground to keep cold air, rain, and snow out of the tipi. Tipi rings that are hundreds of years old may still be found today.

Procedure

This lesson is designed to familiarize students with graphing on the coordinate plane. Students will describe a location on a map using ordered pairs (e.g., What are the coordinates of the Tatanka Ecology Research Station?), as well as determine a location on a map when given an ordered pair (e.g., Find the lake located near the point [800E, 600N]). The concepts introduced in this lesson are more fully developed in three subsequent lessons: [Deer Tracks](#), [Two Ways About It](#), and [Quad Squad](#).

I. Assessing Prior Knowledge

This lesson introduces students to the idea that animals can be "tracked" both by natural means (i.e., their footprints in snow), and by other means that employ technology. Specifically, this lesson introduces students to the idea that animals (and in this case, birds) can be "tracked" by satellites even though we may not be able to physically see the animal. Ask students to think about how scientists might follow (study) various wild animals. For example, whales migrate thousands of miles, most of it under water and out of our sight. Birds fly both day and night on their long migrations. How do scientists track the behavior of these animals that are so often on the move?

In fact, scientists track all kinds of animals - birds, turtles, whales, wolves, bears, and other animals as well. After informally assessing the students' understanding of this process, show them the [Tracking the Motion](#) photo essay. This slide presentation not only illustrates the process, but also provides rich material to prepare students for the following lesson.

II. Contextual Preparation

Story Time with Leonard Little Finger: Leonard Little Finger is a well-known elder of the Lakota Sioux Native American Tribe. He has a rich heritage and ancestry, and is a strong voice for Native peoples in this country. In this lesson, Leonard Little Finger will help set the context for the activities the students pursue. This is a rare opportunity for many students to listen to the stories and words of a Native American with a strong legacy and connection to his ancestors, and recollections of previous ways of life for Native peoples.

To introduce this lesson, teachers should load the Earth Systems Connections CD-ROM into a computer with the capability of playing audio and video, and click on the "Leonard Little Finger Speaks: [Introduction](#)" button on the Search and Rescue lesson plan. Other video clips of Leonard Little Finger will be used later in this lesson.

III. Lesson Activities

1. The Story of Kangi the Crow.

A second video clip provides the introduction to the primary activity for the lesson. Play the "[Kangi the Crow](#)" movie. In this story, Leonard describes a hypothetical situation in which students will have to help rescue an injured bird. The text for this audio introduction is as follows:

Story Time with Leonard Little Finger: The Story of Kangi the Crow

Now, let me tell you a story that happened just recently. In this story, we will need your help to solve a mystery about a missing bird. A few months ago, a special crow was found by biologists at the Tatanka Ecology Research Station. The scientists gave the bird a

Lakota name -- Kangi -- which means "crow". When they found Kangi, she had a broken wing, and certainly would not have survived without special care and attention. After aiding in Kangi's recovery, the biologists placed a small device called a *transmitter* on Kangi that could be recognized by satellites. They did this so that once Kangi was released back into the wild, they could use satellites to track her location, and learn more about how crows behave in the wild.

After releasing Kangi, the scientists were pleased to see how active she was for the first several weeks, and that she had appeared to make a new nest near the wildlife ecology station. The transmitter was working perfectly! Several days ago, however, the scientists became worried because it appeared as though Kangi had stopped moving. They wondered if Kangi had been injured again, or if perhaps the transmitter had fallen to the ground. How could they find out if Kangi was still okay? They need your help...

At this point, teachers should make sure that students understand the context fully. Sample questions for discussion might include: How many of you have seen a crow before? Where are crows usually found? Why do you think the scientists chose to track Kangi's movements? How are the scientists able to use satellites to track Kangi's movements? What do you think has happened to Kangi? What do you think the scientists should do next?

2. The Forest Map

When students have demonstrated their understanding of the context, the teacher may continue to build upon the story by presenting students with a copy of [Forest Map #1](#) (or view on a computer screen). Students should be asked to identify several locations on this map such as the Tatanka Ecology Station, or the Mato Path. Students should notice that the map contains a number of features that are of cultural significance to the Lakota Sioux tribe. Take the time now to explain any of the cultural landmarks that the students point out, using the [vocabulary list](#) above as a guide. The students will hear Leonard Little Finger discuss the significance of these cultural landmarks later in the lesson.

3. Locating Kangi

If students have not already seen it, the teacher should identify the symbol of the bird located in the Northwest Woods. This symbol designates the approximate location of Kangi's transmitter as detected by satellites. Ask the students to imagine that they are responsible for helping the ecologists find Kangi. They should respond in writing to the following questions:

- How would you describe Kangi's location?
- What directions would you give the field ecologists so that they could get to Kangi as quickly as possible?

Descriptions by the students may include compass directions such as north and east, cultural landmarks such as the tipi rings or inipi, or geographic landmarks such as Tatanka Lake, the

grassy meadow, etc.

In any case, encourage students to be as specific as possible in order to help the field ecologists locate Kangi quickly. Either individually or in small groups, ask students to record these directions. Then, the teacher could select one or two groups, and have them share their directions with the class as the teacher (and other students) try to follow the directions on the map.

4. The Coordinate Plane

Students will experience various degrees of success as they try to describe the location of Kangi. Teachers should lead a discussion about how general landmarks and descriptions could get the ecologists "in the ballpark," but that they are probably not exact enough to lead them directly to Kangi's transmitter. Ask students:

- Can you come up with a better way (or a better map) to give directions?

As students will see with the next map (distribute [Forest Map #2](#)), describing Kangi's location can be done much more precisely with the use of a coordinate grid. Teachers should continue the story about Kangi by sharing the following information:

5. Kangi Part 2

Tell students:

Much as you just tried to do, the first thing the biologists used was [Forest Map #1](#), along with the satellite information, to search for Kangi. Although they looked for several hours in the general area of the Northwest Woods where Kangi was thought to be, they realized that they were going to need more detailed and specific information to find her.

Therefore, after thinking about it for quite some time, the scientists decided to make a new map with grid lines that could be used to help narrow the search. They called this new map [Forest Map #2](#). Take a look at that map now to see how it might be more helpful in locating Kangi...

This may be the first time that students have been exposed to a coordinate grid system. Therefore, teachers should take some time to explore the grid with students, eventually asking them to think about how the grid lines could be used to help locate Kangi. Students' responses could be recorded on the overhead or board. The variety of answers can then be used by the teacher to help motivate the need for one standard way of describing locations on a grid. Some ideas for facilitating this discussion are included below.

6. Ideas for a Teacher Directed Discussion of the Coordinate Plane

Inform students that, in order to minimize confusion and improve efficiency, locations on maps

can be determined precisely through the use of *coordinates*. That is, every location on a coordinate plane can be identified through the use of two numbers - the *coordinates* of the point. In this case, the coordinates refer to distances both to the North and to the East of the Tatanka Ecology Research Station (i.e., the *origin*).

Explain to the students that the distance (in this case, the unit of distance is the metric unit *meter*) and the direction (in this case, North and East) are two distinct pieces of information about a coordinate. So, for example, if we wanted to identify the coordinates of Kangi's location, we would do so according to an accepted convention. First give the horizontal direction (or coordinate) -- in this case, 200 meters East -- and then give the vertical direction (coordinate) -- in this case, 800 meters North. In other words, we could shorten the coordinate names and describe Kangi's location as (200E, 800N).

Again, when using coordinates, we always present them in the same way: the horizontal coordinate (*horizontal* distance from the origin) is listed first, and the vertical coordinate (*vertical* distance from the origin) is listed second. When both coordinates are written together - such as the (200E, 800N) - they are called an *ordered pair*. In the ordered pair above the letters E and N represent East and North respectively. Sometimes the labels of East and North are not necessary and are omitted. Moreover, on many coordinate graphs the directions are often replaced with positive and negative signs as will be explored in a subsequent lesson entitled [Two Ways About It](#).

7. Activity Sheet

After completing the previous steps and discussion, students should be given a copy of the [Navigating the Coordinate Plane](#) activity sheet. This activity builds upon the previous context, and provides students with opportunities to develop their graphing skills and understandings as they continue to explore [Forest Map #2](#). There is a considerable amount of reading required on this activity sheet as students learn new vocabulary, invest in the context, and complete the problems. You may wish, therefore, to encourage students to work in small groups on the activity sheet.

Answers: Navigating the Coordinate Plane Activity Sheet

1. (0, 0); Answers will vary.
2. Rock outcrops are layers of rock that are exposed above the soil.
3. (600, 100) (100, 400) (1200, 500) (600, 1000); the rock outcrop at Paha Hill (600, 1000); Because it is the shortest distance to the site of the tipi rings. Approximately 500 meters from the rock outcrop to the tipi rings.
4. (1000, 200), (800, 0).
5. They have the same x-coordinate (or horizontal coordinate, or distance East of the research station); the rock outcrop in the southeast woods.
6. (700, 600), (600, 500) (other answers are also correct).
7. (200, 800); Answers will vary.
8. No, that point is in the middle of the lake; part two answers will vary.
9. Answers will vary.

10. See definitions in lesson plan. Answers will vary, but should include references to identifying locations and measuring distances.
2. It is now time for more stories from Leonard Little Finger. Now that the students have familiarized themselves with the maps in some detail, play the "[Forest Landmarks: Sage](#)" and "[Forest Landmarks: Tipi Rings](#)" movies. After the students view the videos, lead a discuss about how they think the Lakota Sioux who visit this part of the forest might use the cultural landmarks for their ceremonial uses, or other related questions of interest. Use this time as an open time for sharing the students' perceptions and new knowledge.

IV. Assessment

Throughout this lesson, look for opportunities to assess children's thinking about how the coordinate plane helps to make maps both understandable and useful. As a more formal assessment, return to the vocabulary list at the beginning of this lesson, and ask students to share definitions for each of the terms. Look for students to express understanding of the mathematics of the coordinate plane, and also how maps and graphs are more than just numbers on a grid - they can contain important information about relationships between ecology and human culture. Finally, you may use the [Coordinate Plane Assessment](#) activity as a more formal way to measure students' learning.

Lesson Extensions for Authentic Assessment

- Go back to the vocabulary list at the beginning of the lesson and repeat the words again with your students. Students could develop a creative writing story using all of the words in the vocabulary list.
- After watching and listening to the storytelling of Leonard Little Finger, have the students use the landmarks on the map to create a story of their own about a visit they took to this region. Perhaps they could write a story that details a new friendship with a Lakota Sioux child or some adventure that he or she encountered.
- Students should now be encouraged to explore the next three lessons, entitled [Deer Tracks](#), [Two Ways About It](#) and [Quad Squad](#). In these lessons, students will extend their explorations in this lesson to include: the relationship between maps as human creations and actual imagery of the earth (Deer Tracks), negative numbers (Two Ways About It) and graphing concepts in all four quadrants (Quad Squad). In addition, the students will now be prepared with the knowledge for tracking the long migration of Osprey birds in [Osprey Journey](#) and [Separate Vacations](#).