

The
**NATURE OF
TEACHING**



UNIT 1

Animal Diversity and Tracking

Animal tracks are useful to reveal the diversity of organisms within different environments.

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ESTIMATED TIME

Three 30–90 minute lessons

VOCABULARY

- Habitat
- Generalist
- Specialist
- Plantigrade
- Digitigrade
- Unguligrade
- Stride
- Straddle
- Gait
- Track

UNIT OBJECTIVES

Students will be able to:

- Identify wildlife species using tracks
- Recognize that animal diversity can be high even when we do not see the animals
- Predict which species tracks they are likely to find based on habitat requirements
- Create molds of tracks and interpret animal behavior

LESSON STANDARDS

Lesson 1

Next Generation Science Standards
4-LS1-1

English/Language Arts

<u>RL.K.1</u>	<u>SL.K.2</u>	<u>SL.1.2</u>	<u>RL.3.7</u>	<u>SL.4.1</u>
<u>RL.K.2</u>	<u>RL.1.1</u>	<u>RL.2.1</u>	<u>SL.3.1</u>	<u>SL.4.2</u>
<u>RL.K.3</u>	<u>RL.1.2</u>	<u>RL.2.7</u>	<u>SL.3.2</u>	<u>RL.5.1</u>
<u>RL.K.4</u>	<u>RL.1.3</u>	<u>SL.2.1</u>	<u>RL.4.1</u>	<u>SL.5.1</u>
<u>RL.K.7</u>	<u>RL.1.7</u>	<u>SL.2.2</u>	<u>RL.4.2</u>	<u>SL.5.2</u>
<u>SL.K.1</u>	<u>SL.1.1</u>	<u>RL.3.1</u>	<u>RL.4.7</u>	

Math

<u>K.CC.C.7</u>	<u>K.MD.A.1</u>	<u>K.MD.A.2</u>	<u>2.MD.A.1</u>	<u>3.MD.B.4</u>
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Lesson 2

Next Generation Science Standards

<u>K-LS1-1</u>	<u>K-2-ETS1-2</u>	<u>3-LS4-3</u>	<u>3-5-ETS1-3</u>	<u>4-LS1-2</u>
<u>K-ESS3-1</u>	<u>2-LS4-1</u>	<u>3-5-ETS1-2</u>	<u>4-LS1-1</u>	

Math

<u>K.MD.A.1</u>	<u>K.G.B.5</u>	<u>2.MD.D.10</u>
<u>2.MD.A.1</u>	<u>1.MD.C.4</u>	<u>3.MD.B.3</u>

Lesson 3

Next Generation Science Standards

<u>K-2-ETS1-2</u>	<u>3-LS4-3</u>	<u>4-LS1-1</u>
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English/Language Arts

<u>RI.K.1</u>	<u>RI.1.1</u>	<u>RI.2.2</u>	<u>RI.3.7</u>	<u>SL.4.2</u>
<u>RI.K.2</u>	<u>RI.1.2</u>	<u>RI.2.4</u>	<u>SL.3.1</u>	<u>RI.5.1</u>
<u>RI.K.3</u>	<u>RI.1.3</u>	<u>RI.2.7</u>	<u>SL.3.2</u>	<u>RI.5.2</u>
<u>RI.K.4</u>	<u>RI.1.4</u>	<u>SL.2.1</u>	<u>RI.4.1</u>	<u>RI.5.4</u>
<u>W.K.2</u>	<u>RI.1.7</u>	<u>SL.2.2</u>	<u>RI.4.2</u>	<u>SL.5.1</u>
<u>W.K.3</u>	<u>SL.1.1</u>	<u>RI.3.1</u>	<u>RI.4.3</u>	<u>SL.5.2</u>
<u>SL.K.1</u>	<u>SL.1.2</u>	<u>RI.3.2</u>	<u>RI.4.4</u>	
<u>SL.K.2</u>	<u>RI.2.1</u>	<u>RI.3.4</u>	<u>SL.4.1</u>	

Math

<u>3.MD.A.2</u>

Lesson 4

Next Generation Science Standards

<u>K-ESS3-1</u>	<u>K-2-ETS1-2</u>	<u>K-ESS2-2</u>	<u>3-LS4-3</u>	<u>4-LS1-1</u>
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Math

<u>K.G.B.5</u>	<u>3.MD.A.2</u>
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Lesson 5

Next Generation Science Standards

<u>K-ESS3-1</u>	<u>K-2-ETS1-2</u>	<u>K-ESS2-2</u>	<u>3-LS4-3</u>
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English/Language Arts

<u>W.K.2</u>	<u>SL.1.1</u>	<u>SL.2.2</u>	<u>W.4.1</u>	<u>W.5.2</u>
<u>W.K.3</u>	<u>SL.1.2</u>	<u>W.3.1</u>	<u>W.4.2</u>	<u>SL.5.1</u>
<u>SL.K.1</u>	<u>W.2.1</u>	<u>W.3.2</u>	<u>SL.4.1</u>	<u>SL.5.2</u>
<u>SL.K.2</u>	<u>W.2.2</u>	<u>SL.3.1</u>	<u>SL.4.2</u>	
<u>W.1.1</u>	<u>SL.2.1</u>	<u>SL.3.2</u>	<u>W.5.1</u>	

Math

<u>K.CC.C.7</u>	<u>K.MD.A.1</u>	<u>K.MD.A.2</u>	<u>2.MD.A.1</u>	<u>3.MD.B.4</u>
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REFERENCE MATERIALS

Natural History of Indiana Mammals (FNR-413) by Robert N. Chapman and Rod N. Williams

How to Construct a Scent Station YouTube video ([FNR-525-WV](#))

REQUIRED MATERIALS

- 1 50 lb bag of masonry or play sand
- Yardstick or meter stick
- 2 ml vials
- Scent of bait (cooking extracts, deer urine, rabbit urine, or other)
- Flour sifter
- 1 pen or pencil per student
- 1 clipboard per student
- Ruler
- 1 Scent Station Data Sheet per student
- 1 Animal Tracking Data Sheet per student
- 1 Habitat Sketch worksheet per student
- Camera to document activities
- *Natural History of Indiana Mammals* (FNR-413) by Robert N. Chapman and Rod N. Williams
- *Big Tracks Little Tracks: Following Animal Prints* by Millicent E. Selsam
- *Peterson Field Guide to Animal Tracks* by Olaus J. Murie, Mark Elbroch, and Roger Tory Peterson

ACTIVITY ICONS

Use these icons — located at the top of each lesson plan — to indicate the disciplines to which certain activities belong. These disciplines include:



READING



WRITING



MATH



SCIENCE



STEM

(science, technology, engineering, math)



STEAM

(science, technology, engineering, art, math)

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Animal tracks are an easy and fun way to identify which mammals and other wildlife can be found on your school property. You can use animal tracks and animal tracking to determine the distribution of wildlife species, the species diversity of an area, and also as a measure of the population size of mammals. For example, wildlife biologists with the Maine Department of Inland Fisheries and Wildlife use snow-tracking (following animal tracks in the snow) to determine where Canada lynx are found within the state.

Beyond identifying animals, animal tracks found in nature can tell a story about the animal's life and how it moves through your school property. Many features of animal tracks can help determine the species that left the track and help paint a picture of the animal's daily life.

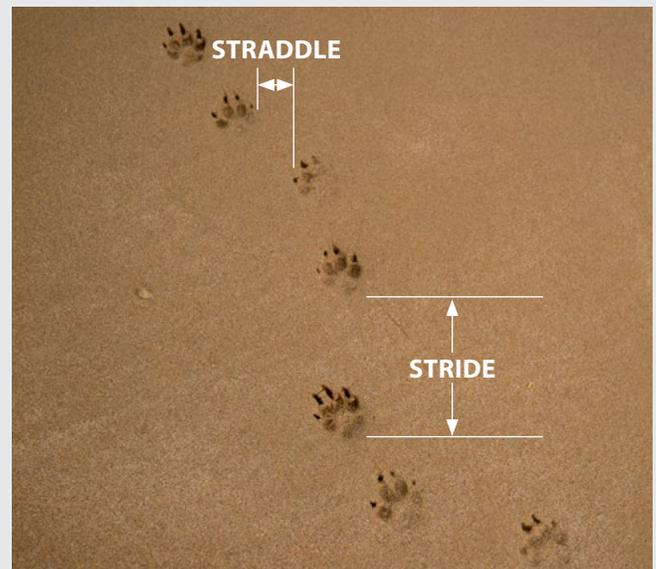
FOOT TYPES

Mammals typically have 1 of 3 foot types: plantigrade, digitigrade, or unguligrade. Each type determines what part of the foot is left in the track and how the animal moves. Animals with a plantigrade type walk on the entire sole of their feet. Bears, raccoons, and humans all have a plantigrade foot type. Animals with a digitigrade type walk on their toes (digits). Coyotes, bobcats, and birds have a digitigrade foot type. Animals with an unguligrade type walk on the tips of their toes (i.e., toenails). Animals with hooves, such as white-tailed deer, moose, and bighorn sheep, have an unguligrade foot type.

Identifying animal tracks can be a fun way to introduce students to wildlife and the outdoors. Tracks can also be used as a way of telling a story about the animal's life and its adaptations to its environment. Many great resources are available online. Many mammal tracks found in Indiana are in the Common Mammals of Indiana publication available on the Nature of Teaching website.

STRIDE, STRADDLE, AND GAIT

The stride, straddle, and gait of an animal's track pattern help you identify animals and tell you what the animal was doing when it left the track. **Stride** refers to the distance between the heel of the front foot and the heel of the back foot when the animal moves. **Straddle** refers to the distance between the left track and the right track. Think of stride as the length between tracks and straddle as the width between tracks. **Gait** refers to the way the animal moves, such as walking, trotting, galloping, or bounding. You can determine the gait by looking at the pattern of tracks. The gait provides clues as to what the animal was doing when it left the track.



PARTS OF A TRACK

Knowing the parts of an animal track can help you pick out key characteristics and will aid in identifying the animal.

- 1 Nails or claws
- 2 Digits or toes
- 3 Metacarpal pads
- 4 Interdigital space
- 5 Hoof



JARRED BROOKE



JARRED BROOKE



This activity teaches students to identify animal tracks.



ESTIMATED TIME

30–40 minutes

PROCEDURE

1. Introduce the term “track” (a footprint made by an animal). Ask students where they are likely to find animal tracks (snow, mud, sand, riverbanks, etc.). Explain that tracks can tell a lot — what kind of animal left the track, how fast it was moving, the direction it was moving, and whether it was alone or with other animals.
2. Read *Big Tracks Little Tracks: Following Animal Prints* by M. Selsam (or any grade-level-appropriate book) to the class.
3. Introduce the following terms that describe foot types. (See Foot Types in Teachers’ Notes).
 - a. Planigrade: walking with the entire sole of the foot on the ground

- b. Digitigrade: walking on the toes

Ask students to give examples of animals with each foot type: plantigrade (e.g., bears, raccoons, and people); digitigrade (e.g., dogs and cats)

- c. Unguligrade: walking on tips of their toes (e.g., deer and moose)

4. Have the students examine a selected group of tracks from the *Natural History of Indiana Mammals* sheets. (Note: the tracks are not printed to scale here.) Make sure to have examples from each foot type. Have students take measurements of the length and width of each track, record their measurements on paper, and compare them to *Peterson Field Guide to Animal Tracks*.

Point out that tracks from the front feet often differ from those made by hind feet. Explain that taking accurate measurements of an animal track is an important part of identifying the animal that left it.

REQUIRED MATERIALS

- 1 pen or pencil per student
- Ruler
- *Natural History of Indiana Mammals* (FNR-413) by Robert N. Chapman and Rod N. Williams
- *Peterson Field Guide to Animal Tracks* by Olaus J. Murie, Mark Elbroch, and Roger Tory Peterson
- *Big Tracks Little Tracks: Following Animal Prints* by Millicent E. Selsam





This activity familiarizes students with techniques used for assessing wildlife diversity.



MISSOURI DEPARTMENT OF CONSERVATION

ESTIMATED TIME

50 minutes

PROCEDURE

1. Introduce the term “habitat” (the area that provides adequate food, water, space, and shelter). Explain to the students that different animals can be found in different habitats (forest lands, agricultural lands, wetlands, deserts, etc.). Some animals are habitat specialists and occur within only a few types of habitats (e.g., northern water shrews occur only in clear, fast-moving streams with forested edges). Other species are habitat generalists and can be found in a wide range of habitats, such as forests, grasslands, agriculture lands, and wetlands (e.g., raccoon).
2. You may want to further discuss which species are likely to be found within various habitats. Explain that different animals have different habitat requirements and, thus, different habitats may contain different species. Some habitats can contain a great diversity of wildlife species. Despite this diversity, some wildlife species are seldom seen. Many are shy, nocturnal animals that are best identified by the tracks they leave within their environment. An effective way to obtain an animal’s tracks is to lure it to a station using scents or attractants.
3. Scent Station Installation
 - a. Choose your location for the scent station carefully. The area should be relatively flat and positioned where animals are likely to encounter it during daily movements (e.g., habitat edges, intersections of paths, etc.)
 - b. Clear an area 1 meter in diameter down to bare soil. The area should be free of grass, sticks, rocks, and other debris that could obscure tracks.
 - c. Pour 2/3 of the masonry sand onto the cleared area. Evenly cover the area with sand. Use a yardstick to create a full circle. Take care to ensure that the edges are well defined; that will increase the chances of detecting tracks along the periphery of the circle. Animals will often step on the edge of the scent station while inspecting the attractant located in the center of the station.
 - d. Place a vial of lure/attractant directly in the center of the scent station (see Figure 1). The cap of a plastic bottle works great to hold the lure.



ROBERT CHAPMAN

Figure 1. Completed scent station. Note the small scent vial located in the middle.

REQUIRED MATERIALS

- 50 lbs of masonry or play sand
- Yardstick or meter stick
- 2 ml vials
- Scent or bait (cooking extract, deer urine, rabbit urine, or other)
- Flour sifter
- 1 pen or pencil per student
- Ruler
- Notebook paper
- 1 clipboard per student
- 1 Scent Station Data Sheet per student
- *Natural History of Indiana Mammals* (FNR-413) by Robert N. Chapman and Rod N. Williams
- *Peterson Field Guide to Animal Tracks* by Olaus J. Murie, Mark Elbroch, and Roger Tory Peterson



4. Divide the class into groups and have them install scent stations in one or more habitats/ locations. Scent stations should be at least 20–30 meters apart.
5. Leave the scent stations in place overnight, then check them once daily for 2–3 consecutive days. On the scent station data sheets, have students record the species detected and the number of tracks. Students should record data only for scent stations that they installed. To identify the tracks, have students compare tracks found at scent stations to those printed on the *Natural History of Indiana Mammals* sheets.
6. Practice identifying tracks again by stamping tracks in a tub of sand in the classroom. This will give students an opportunity to identify tracks in a situation similar to the scent stations outside.
7. After checking the stations and recording data, you may need to use the remaining sand to repair stations. Use the sifter to shake sand over the station each day to cover any existing tracks.
8. You may want to show the class the YouTube video that demonstrate the proper way to install and reset scent stations as well as collect data: [FNR 525 WV](https://youtu.be/gtSIT3x8lh0) (<https://youtu.be/gtSIT3x8lh0>)
9. Explain to the class that this activity will help them identify animal tracks and recognize that some species are found only in certain areas, while others are found in nearly all areas. Students also should be able to determine the diversity of animals in their areas.
10. Additional Activities (advanced)
 - a. Have the students experiment with different scents and attractants. Ask the students to predict how the results will change.
 - b. Have the students simultaneously construct scent stations within different habitats. Ask the students to predict which species are likely to be detected within each habitat type based on their knowledge of species habitat requirements.
 - c. Graph actual results. Use a graph to record the actual species tracks that were found at the scent stations. Some graphs could be bar, frequency tables, pie, etc. The “x” axis represents wildlife species and the “y” axis represents the number of tracks.



ACTIVITY SCENT STATION DATA SHEET

Date: _____

Observer(s): _____

Scent Station #/Location: _____

Weather Conditions: _____

Habitat Type: _____



DAY	SPECIES	# HIND FOOT	# FRONT FOOT	LURE	COMMENTS
1					
2					
3					

LESSON 3 INDOOR TRACK CASTING



This activity provides students with an opportunity to create plaster casts of common species.



ROBERT CHAPMAN

Completed set of track casts. (Virginia opossum shown here.)

ESTIMATED TIME

30 minutes

PROCEDURE

1. Explain to the students that tracks are important signs left behind by animals. They can provide clues about what an animal was doing. Different animals leave different tracks. Explain that you can identify the tracks by examining key features (e.g., presence or absence of claw marks, size of a track; see Parts of a Track in Teachers' Notes).
2. The students will be creating their own tracks from molds using the following recipe.
 - a. Using the measuring cup, place a full cup of plaster of Paris into the mixing bowl.
 - b. Measure $\frac{1}{2}$ cup of water and add slowly while mixing, until it is as thick as heavy whipping cream or pancake batter.
3. Immediately pour the mix into a track mold until it fills the entire mold. Let the plaster-filled mold sit for at least 20–40 minutes to harden.

4. Repeat steps 1–2 for each mold you want to create. When finished, rinse the mixing bowl with water. (**Note: do not pour down the sink.**)
5. While the molds and mixes are hardening, read *Tracks, Scats, and Signs* by Leslie Dendy to the class.
6. To remove the tracks from the molds, simply turn the mold upside down and pry out the plaster. Take caution not to break off the tiny digits of the feet.
7. Have students describe how to identify the tracks.
8. Ask students which of the species tracks are digitigrade, plantigrade and unguligrade.
9. Additional Advanced Activities (optional)
Create a landscape in which an animal might live by drawing trees, streams, and grasslands onto a clean white tablecloth or sheet. Have students paint the tracks and stamp them onto the sheet to create a "story" about how their animals move and use the environment.

REQUIRED MATERIALS

- Track molds
- Mixing bowl
- Spoon
- Measuring cup
- Plaster of Paris
- Water
- *Tracks, Scats and Signs* by Leslie Dendy
- Paint and paint brushes (optional)
- White sheet (optional)





This activity demonstrates how to create plaster casts of animal tracks in the field

ESTIMATED TIME

30 minutes



DAN ANWARINO

PROCEDURE

1. Explain to the students that tracks are important signs left behind by animals. Tracks can provide clues about what an animal was doing. You can tell what kind of animal left the track, how fast it was moving, the direction it was moving, and whether it was alone or with other animals. Explain that you can identify the tracks by examining key features (e.g., presence or absence of claw marks, size of the tracks; see Parts of a Track in Teachers' Notes).
2. In this activity students will create plaster casts from animal tracks found within different habitats.
3. Before taking the students to the woods, cut the tops and bottoms off several 2-liter bottles. The center rings should be 3–4 inches tall and will be used to surround tracks and hold the plaster of Paris. You can keep the bottom portions of the bottles as mixing containers, if needed.
4. Instruct students to focus on likely paths used by animals (intersections, along habitat borders, along ditches or creek banks, etc.) during their searches for tracks. Once a track is discovered, have the students follow this protocol.
 - a. Remove any debris from inside and around the track.
 - b. Place the plastic ring over the track and press firmly one-half inch into the ground.
 - c. Using the measuring cup, place a cup of plaster of Paris into the mixing bowl.
 - d. Measure $\frac{1}{2}$ cup of water and add slowly while mixing until it is as thick as heavy whipping cream or pancake batter.
 - e. Immediately pour the mix into a track until it fills the entire mold. Let the plaster-filled mold sit for at least 20–40 minutes to harden.
5. Once the mold hardens, carefully lift the mold and remove the plastic ring.
6. To prepare for later discussion, have students thoroughly inspect the habitat and surroundings where the track cast was made.
7. Have each student return to the classroom to create a mold inset from the track collected from the field. Follow the steps below:
 - a. Rub a thin coating of petroleum jelly over the track and surface of the entire cast. Replace the plastic ring of the track cast.
 - b. Using the measuring cup, place a cup of plaster of Paris into the mixing bowl.
 - c. Measure $\frac{1}{2}$ cup of water and add slowly while mixing until it is as thick as heavy whipping cream, as before.
 - d. Immediately pour the mix into a track until it fills the entire mold. Let the plaster-filled mold sit at least 20–40 minutes to harden.
8. To remove the tracks from the molds, carefully separate the two layers of track casts. Wipe any excess petroleum jelly from the casts.

REQUIRED MATERIALS

- Mold ring
- Mixing bowl
- Spoon
- Measuring cup
- Plaster of Paris
- Water
- Petroleum jelly



This activity teaches how to interpret animal behavior by tracking.

ESTIMATED TIME

90 minutes

PROCEDURE

1. Explain to the students that tracks are important signs left behind by animals. You can identify the tracks by examining key parts of the tracks (e.g., presence or absence of claw marks, size of the tracks; see Parts of a Track in Teacher's Notes). Tracks can provide clues about what an animal was doing. This lesson will focus on using tracks to understand how animals use their habitat. Students will focus on the following:
 - a. Identification: examining track parts to tell what kind of animal left the track
 - b. Stride: distance between the front and back track (see Teachers' Notes)
 - c. Straddle: distance between left and right track (see Teachers' Notes)
 - d. Gait: how the animal was moving as indicated by the track pattern (see Teachers' Notes).
 - e. Direction: the direction it was moving through the habitat
 - f. Activity: predict what the animal was doing by examining habitat surroundings
 - g. Number: whether it was alone or with other animals.
2. Before taking the students outside, give each student one clipboard with one pencil, Habitat Sketch worksheet, Animal Tracking Data sheet, and several pieces of notebook paper. Instruct students to focus on likely paths used by animals (intersections, along habitat borders, along ditches or creek banks, etc.) during their searches for tracks. It is important for students to focus on substrate that allow tracks to be easily observed: snow (Figure 1), mud, sand, wet soil, etc. Have



Figure 1. Set of rabbit tracks in the snow.

students thoroughly inspect the habitat and surroundings for a set of tracks (a single track will not work for this activity; a set of tracks consists of at least two or more tracks in succession).

3. Once a set of tracks is discovered, have students complete the following steps:
 - a. Sketch the habitat surroundings in which the set of tracks were found using the Habitat Sketch sheet
 - b. Determine if the set of tracks are digitigrade, plantigrade or unguligrade
 - c. Identify the set of tracks to species by examining the parts of the track (see Parts of a Track in Teachers' Notes) and comparing with your track ID guide
 - d. Once the foot type and species are known, have students measure the stride and straddle with a yardstick. This information will be used to predict the gait and what the animal may have been doing in the habitat (see Teacher's Notes). Also have them enter this data, foot type, and track ID into the Animal Tracking Data sheet.
4. Back in the classroom, students will use all of the data they collected to write a story about the species (or group of species) that left their tracks using evidence, linking words, and providing a concluding statement. Ask students to interpret what the animal was doing when it left the set of tracks. Use the following prompts to help get started: What species did you find? Did the set of tracks belong to a predator or prey species? Was it searching for prey? Tracking prey? Evading a predator? Simply traveling from place to place? In what habitat was the track found? How many different species were collected? How many habitats were represented? Based on the data collected, what are the habitat preferences of the various wildlife species?
5. Have students read their stories aloud to the class. Were the sets of tracks interpreted differently? If so, how and why? What led the students to interpret the data differently? Did they find the same animals in different habitats? Why or why not? How do different foot types indicate how animals are adapted to different habitats? What do different animals need to survive? How do different animals seem to interact in different ecosystems?

REQUIRED MATERIALS

- 1 Habitat Sketch worksheet per student
- 1 Animal Tracking Data Sheet per student
- 1 pencil per student
- 1 clipboard per student
- Notebook paper for each student
- *Peterson Field Guide to Animal Tracks* by Olaus J. Murie, Mark Elbroch, and Roger Tory Peterson
- Yardstick

HABITAT 1

HABITAT 2

HABITAT 3