Futuristic Wilderness: How AI is Shaping Animal Conservation

Gr. 8-12 Activity Write Up

Futuristic Wilderness: How AI is Shaping Animal Conservation

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Futuristic Wilderness: How AI is Shaping Animal Conservation

Activity Summary

In this activity, participants will learn about artificial intelligence and how it is being developed to assist with wildlife conservation and management. Participants will identify the information that can be learned about an animal from its tracks and how artificial intelligence can help in gathering this information faster for conservationists as well as assisting in tracking animal migration. By the end of this activity, participants will have learned new coding and tracking skills to give them more confidence in pursuing further education in wildlife management and computer science.

Developed by Actua, 2025.

Delivery Environment	Activity Duration	Intended Audience	Tech
In-Person	1 Hour and 30 Minutes	Grades 8-12 (*Ages 13-18*)	**Facilitators should have access to a laptop, projector, speakers, and a screen or blank wall to project onto.** • Projector • Speaker • Screen/Blank Wall • Laptops/Tablets

Achievement Goals

Learning Goals

Following this activity, participants will:

- **Explore** what animal tracks can tell us about animal behaviour and the environment.
- **Decipher** animal tracks to gather information about an animal population and learn how we utilize this information for conservation purposes.
- **Understand** what artificial intelligence is and how it can be used to help with animal conservation.

Success Criteria

Following this activity, participants can express:

- **I can analyze** information like relative height and stride length from animal tracks to better understand animal behaviour and gather ideas regarding animal conservation.
- **I can explain** how artificial intelligence is being used to help support animal conservation efforts.
- **I can simulate** how computers achieve deep learning to better understand the use of AI in animal conservation.

Logistics (Timing, Group Sizing, Materials)

Section Title	Time	Group Size	Materials
Opening Hook	10 minutes	*Whole Group*	**Facilitators** • Animal Track Example (In Soil) (*Appendix C*) • Animal Track Example (In Snow) (*Appendix C*)

Section Title	Time	Group Size	Materials
Section 1: Animal Track Stories	45 minutes	*Small Groups (3) or Pairs*	**Facilitators** • Graph Chart Paper • Arctic Animal Tracks (*Appendix C*) • Stride Pattern Diagram (*Appendix C*) **Per Pair or Small Group** • Outdoor GPS device (Garmin eTrex 10) • Ruler • Measuring Tape • Writing Utensil • Blank sheet of paper (2) • Two (2) objects to mark start and end (e.g., sticks, pylons, etc) • Timer • Calculator • Animal Tracks Data Collection Worksheet (*Appendix C*) • Animal Tracks Glossary (*Appendix C*)
Section 2: Deep Learning	30 minutes	*Small Groups (3)*	**Per Group** • Blank sheets of paper • Writing Utensil • Dry-erase markers • Timer • Deep Learning Game Cards (*Appendix C*)

Section Title	Time	Group Size	Materials
			• AI and Animal Track Classification Worksheet (*Appendix C*)
Reflection & Debrief	10 minutes	*Whole Group*	• N/A

Safety Considerations

Safety considerations have been provided below to support safety during this activity, however they are not necessarily comprehensive. It is important that you review the activity and your delivery environment to determine any additional safety considerations that you should be implementing for the delivery of these activities.

Emotional Safety

- Facilitators should understand that participants have different lived experiences and prior knowledge about AI safety, AI, and digital citizenship. This activity may involve or lead to discussions of sensitive topics, such as ethical implications of AI. Facilitators should encourage open, respectful discussions and acknowledge all perspectives. Facilitators should always keep the participants' emotional safety in mind in these discussions, and defer to training from their institution and training received.

Slips, trips, and falls

- Set out a clear area for the Animal Tracking Data Collection Activity (Section 1) and ensure that anything that could be tripped over (e.g., branches) are tucked away or put out of reach.

Curriculum Links

This activity aligns with these components found in the UNESCO AI Competency Framework for Students:

AI Techniques and Applications: AI Foundations

- Learners are expected to develop basic knowledge, understanding and skills on AI, particularly with respect to data and algorithms, and understand the importance of the interdisciplinary foundational knowledge required for gradually deepening understanding of data and algorithms. They should also be able to connect conceptual knowledge on AI with their activities in society and daily life, concretizing a human-centred mindset and ethical principles through an understanding of how AI works and how AI interacts with humans (p. 32-34).

AI Techniques and Applications: Application Skills

- Learners are expected to be able to construct an age-appropriate knowledge structure on data, AI algorithms and programming, and acquire transferable application skills. (p. 41).

AI Systems Design: Problem Scoping

- Learners are expected to be able to understand the importance of 'AI problem scoping' as the starting point for AI innovation. They are also expected to acquire the knowledge and project-planning skills needed in order to conceptualize and construct an AI system (p. 35).

Human-Centered Mindset: AI Society Citizenship

- Learners are expected to be able to build critical views on the impact of AI on human societies and expand their human-centred values to promoting the design and use of AI for inclusive and sustainable development (p. 45-47).

This activity can be connected to the following subject areas:

Science

- Analyze data to understand animal behaviour, populations, and their relationship with the environment.
- Develop and apply field research skills by collecting and recording data.
- Understanding the role of science and technology in society and the environment.

Mathematics

- Analyze and solve problems involving two-term and three-term ratios.
- Represent and analyze linear relationships using expressions, tables, and graphs.
- Use graphs and tables to interpolate and extrapolate approximate values.

Community Connections

Community connections are suggestions from Actua, grounded in our approach, on how facilitators can adapt the activity to reflect the strengths, interests, and priorities of the community where or with whom it is delivered. Consider the following guiding questions to adapt the activity in meaningful ways:

- **Consult with community:** Are there local organizations, Knowledge Keepers, or community members who could contribute insight or context to this topic?
- **Draw on youth experience:** How can you give participants opportunities to share, reflect on, and apply how this learning is relevant to them or their community? Invite participants to identify what knowledge, who, and where they already learn from.
- **Integrate local examples:** How can you tailor this activity to local or regional interests, industries, or community priorities (e.g. land and environment, health, technologies)?

Activity Procedure

To Do in Advance

<table>
<tr><th>SECTION</th><th>PREPARATION</th></tr>
<tr><td>General</td><td>Think ahead and be ready to adapt:
Determine your delivery method and leverage ideas from the delivery recommendations and adaptations sections.
While estimated times are provided, it will be helpful to think about how much time you would like to spend on different activities and discussions.
While group sizes (individual, pairs, groups) are suggested, many activities are flexible for whatever will work in your classroom.
Prepare for the content:
Have answers in mind to share with participants for the various reflection questions asked.
Examine the provided materials to determine if they are suitable for your participants.
Equipment:
Ensure device, screen and projector are set up.
Prepare participant devices.</td></tr>
<tr><td>Opening Hook</td><td>Print or prepare to display the Animal Track Examples (in Snow and in Soil) (Appendix C) to participants
<u>Optional:</u> Take photos of tracks you have recently come across in the community to use in place of the Animal Track Examples.
Consult with local Elders, knowledge keepers, or hunters / trappers regarding animal patterns in the area and invite them to speak to the group.</td></tr>
</table>

SECTION	PREPARATION

Section 1: Animal Track Stories	• Gather and print all the materials required for each small group as outlined above.
	• Ensure the outdoor GPS device has a full battery life (replace batteries if needed)
	• Familiarize self with outdoor GPS device:
	    ○ For the **Garmin eTrex 10**, the following video provides a quick overview GARMIN eTrex 10 GPS User Guide (geogibby, April 9, 2020).
	    ○ Change GPS unit to Decimal Degree (DD) format.
	        ■ Go to "Setup" then "Position Format"
	        ■ Under "Position format" choose "hddd.ddddd°"
	    ○ Waypoint is a reference point to the physical location on earth where the cache is hidden. Waypoints are marked using coordinates (longitude and latitude).
	        ■ Marking a Waypoint
	            • Go to "Mark Waypoint".
	            • Use the thumb stick to move up to the name and change to the waypoint you are marking. When the name is completed choose "ok".
	• Identify if there are any animal tracks in the area.
	    ○ If there are none, use the Arctic Animal Tracks Example (*Appendix C*) to facilitate the ending of this activity section
	• Identify if there are any patches of mud, dirt, or sand that participants could use to make a footprint.
	    ○ If there isn't, participants can use paper and banner paper to trace their footprints.

SECTION	PREPARATION
	• Create two graphs (track size - in cm vs height - in cm and speed vs stride length) on the chart paper. • Invite local Elders, Knowledge Keepers, or hunters / trappers to speak about how they use animal tracks to gather information.
Section 2: Deep Learning	• Gather and print all the materials required for each small group as outlined above. • Invite an Elder/knowledge keeper or hunter/trapper to speak about how they utilize technology on the land and how they could utilize AI in this way.

Opening Hook

1. Gather participants together in a circle and pass around or present the Animal Track Examples (in Snow or in Soil, or both) (*Appendix C*):
2. Ask participants: “Can anyone try to identify the animals based on the tracks?”
    a. Use the answers on the back of the Animal Track images to support participant answers.
3. Discuss with participants how we use tracks and how to recognize different tracks:
    a. “What are some reasons that people want to **track animals**?”
    b. “What are some **signs** that indicate an animal's presence?”
        i. Tracks, food waste, fur on branches, disturbed plants, etc.
    c. “How can you tell the difference between a **bird and a land animal**?”
        i. Birds have a back toe (halix) and toes are often thin, while animals usually leave a toe pad track.

d. "What **features** can you use to identify animal tracks?"
    i. Number of toes
    ii. Presence of claws / nails
    iii. Width / length
    iv. Depth
    v. Webbing (water-based animals only)
    vi. Stride and straddle (walking pattern)
    vii. Examples:
        1. Plant-eating hoofed animal (e.g., deer, moose, elk) - two toes (front and rear)
        2. Canine animals (e.g., wolf, fox, coyote) - four toes with claws (front and rear)
        3. Feline animals (e.g., bobcat, lynx, cougar) - four toes without claws (front and rear)
        4. Rodents - four or five toes, with or without claws (lots of variability)
            a. E.g., The beaver has four toes on front and five toes on the rear, with webbing on the rear.
        5. Bears - five toes with rounded heel pad (front and rear)
        6. Anisodactyl (e.g., songbirds, hawks, crows, ravens) - three toes at front and one in rear (halix).
        7. Game birds (e.g., turkey, ptarmigan) - three toes as halifax (back toe) is reduced or absent.
        8. Webbed foot birds (e.g., ducks) - three toes with webbing in between, halifax has no webbing.
        9. Zygodactyl tracts (e.g., owls, woodpeckers, osprey) - two forward toes and two rear toes.

4. Discuss with participants what animals they know inhabit the area and which tracks they might expect to find and what they will look like.
    a. "Do they expect to recognize any of the tracks they saw in the images? Which ones?"

    b. Have an Elder, knowledge keeper, or hunter / trapper speak about local animal patterns (refer to To Do In Advance).

Section 1: Animal Track Stories

1. Divide participants into small groups (2-3) and distribute an Outdoor GPS unit to each group.
    a. Instruct participants to go find animal tracks in the surrounding area and to mark waypoints using their GPS device to identify where these tracks are located.
        i. Demonstrate for participants how to mark a waypoint on their device:
            1. Go to “Mark Waypoint”.
            2. Use the thumb stick to move up to the name and change to the name of the animal that left the track. When the name is completed choose “ok”.
    b. Once they have found tracks, they can return to the teaching area to continue the activity.
2. Have groups exchange their GPS units and use the marked waypoints to go out and explore the locations where other groups found animal tracks.
3. Have groups return to the activity area and discuss with participants:
    a. “How many tracks did you find?:
        i. “Were different tracks on top of each other or spread out?”
    b. “Could you identify all of the tracks? Which one(s) did you have difficulty with? Could another group identify them?”
    c. “What information about the animal could you infer from these tracks?”
        i. “Could you tell the colour of the animal?” No
        ii. “Could you tell the size of the animal?” Relative size (big vs small)
4. As a group, discuss the type of information you can gather from animal tracks about the animal.
    a. Based on tracks, you can identify the **species** of animals, its relative **size**, the **speed** at which it was moving, perhaps if it had **any injuries**.
    b. Tracks <u>cannot</u> give us information about the colour of the animal, etc.

Animal Tracking Data Collection

1. Provide an overview of the animal tracking data collection activity to participants:
    a. Using our own tracks, we will practice gathering information from tracks such as height, stride length, and determining whether someone is walking, trotting, or running.
    b. We'll then apply this practice to classify the movement pattern of the animal tracks we found (or to the picture provided).
2. Arrange participants into partners/pairs and distribute the Animal Tracks Data Collection Worksheet (*Appendix C*), a writing utensil, ruler, measuring tape, and two blank pieces of paper.
    a. ***Note:*** If participants are able to make a distinctive footprint in an area of soil, they do not need to have the paper.
3. Share with participants that we are going to find the **relationship between track length and relative height** using our own footprints and height.
    a. Instruct each participant to make an imprint of their foot in the ground or trace their foot on a piece of paper.
    b. Measure the length of their footprint from heel to longest toe in centimeters and record this on their Animal Tracks Data Collection Worksheet (*Appendix C*).
    c. With the help of their partner, use the measuring tape to measure their height in centimeters and record it on their Animal Tracks Data Collection Worksheet (*Appendix C*).
    d. Taking turns, have participants record their data as a scatterplot on the track length vs height graph.
    e. Debrief with participants:
        i. Ask: "What relationship do we notice between track length and height?:
            1. **Linear** - the longer the track length, the taller the individual.
            2. Draw a **trendline** on the graph.

        ii. Ask: “Do you think we can expect to notice this relationship modeled by other animals?”
            1. Yes!

4. Show participants the Stride Pattern Diagram (*Appendix C*) and have them examine the different walking patterns.
    a. Ask: “What other animals can they think of that would fit into these classifications?”
5. Then show them the distance between one track on one foot to the corresponding tract of the same foot, called the **stride length**, and how it can indicate whether an animal is walking, trotting, or running.
    a. Stride length is correlated with speed.
    b. Ask: “Do you think a longer stride length would indicate faster (e.g., running) or slower (e.g., walking) movement?”
6. Arrange participants back into their groups of 2 and distribute a timer and objects pre-determined to mark start and end of 20 m, to each group.
7. Share with participants that we are going to find the **relationship between stride length and speed** by noticing how many steps we can take in a given distance.
    a. In their partners, have them measure a distance of 20 m using their tape measure, and mark the start and end of the distance with a piece of designated objects.
    b. Each partner will take turns **walking** the 20 m and counting the number of steps they take, then recording this on their worksheet.
    c. As one participant walks, the other times their partner to observe how quickly they can arrive at the 20 m mark. Record this on their worksheet, then calculate speed by dividing distance by time.
    d. To calculate their **stride length**:
        i. Divide the number of steps by 2 to get a stride.
            1. There are 2 steps in a stride.
        ii. Divide 20 by the answer to get stride length.
        iii. Record this on their worksheet.

e. Repeat steps b to d for **trotting** and **running** 20 m.
    i. Trotting is "fast walking".
f. Taking turns, have participants record their data as a scatterplot on the stride length vs speed graph.
g. Debrief with participants:
    i. Ask: "What relationship do we notice between stride length and speed?"
        1. **Linear** - longer stride length indicates greater speed.
        2. Draw a **trendline** on the graph.
h. Do you think we can expect to notice this relationship modeled by other animals?
    i. Yes!

8. Using their knowledge of the linear relationships examined, participants can now return to the tracks they found earlier to try to determine relative height of the animal that left a track and to determine if the animal was walking, trotting, or running.
    a. If tracks are unavailable, participants can use the Arctic Animal Tracks Example (*Appendix C*) to draw conclusions.
    b. To predict height of the animal, participants can refer to the class graph and insinuate that tracks smaller than their footprint will likely be smaller than a human, and vice-versa.
    c. Participants will need to do further calculations using their Animal Tracks Data Collection Worksheet (*Appendix C*) to determine if an animal was walking, trotting, or running.
        i. Measure the track length and multiply it by 4 to obtain the hip height.
        ii. Counting how many steps there are in a specific range (e.g., 20 m), calculate stride length as they did in step 10.
        iii. Find the ratio between stride length and hip height:
            1. A ratio of less than 2 means the animal was walking.
            2. A ratio between 2 and 2.9 means the animal was trotting.
            3. A ratio of 3 or greater means the animal was running.

9. If an Elder/knowledge keeper or hunter/trapper is present and given consent to share (refer *To Do In Advance*), they can share how they use information from animal tracks in the field.

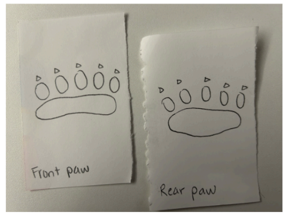
Section 2: Deep Learning

1. Gather participants and host a discussion about how computers might help us to recognize animal tracks.
    a. Ask: "How do you think we can use computers/technology to help us determine which track belongs to which animal?"
        i. We can use **drones and artificial intelligence (AI)** to help us collect images of animal tracks and analyze information about them, such as species and the information we gathered in Section 1 activity.
    b. Ask: "Why might it be helpful to have computers help us with this?"
        i. Make faster predictions, analyze more tracks at once than a human, discover tracks in areas where it is difficult for humans to travel to, etc.
2. Explain what AI and deep learning are and share with participants how conservationists are using AI. Use *Appendix B* to support.
    a. Terms:
        i. **Artificial Intelligence (AI)** is the ability for computers and machines to have intelligent thought.
        ii. **Deep Learning** is a method of AI that teaches computers to process information similar to how a neural network processes information in a human brain.
    b. **Conservationists** use drones or satellites to collect images of animal tracks, then process that information with AI to be able to identify the tracks and collect information about animals.
    c. An application called WildTrack is inspired by African Indigenous trackers' ability to track animals in the wild non-invasively and determine information about animals from their tracks.

        i. It uses footprint identification technology (FIT), which partners statistical analysis and AI to be able to identify a species from an animal track, as well as the animal sex, and their age-class.

3. Share with participants that we are going to play a game to demonstrate how AI is able to identify animal species from their tracks:
    a. For each group, distribute the blank sheets of paper, writing utensil, dry-erase markers, timer, Deep Learning Game Cards (Appendix C), and AI and Animal Track Classification Worksheet (Appendix C)
    b. Arrange participants into groups of three and have participants choose a role:
        i. <u>Partner A - Image Collector</u>
            1. Select one of the six images (make sure the other members of the group don't view it!) and draw two pictures to represent the tracks: one of a front foot and one of a rear foot, on a blank sheet of paper.

            2. Partner A must complete both images in 30 seconds. Partner C can time Partner A.
        ii. <u>Partner B - Data Analyzer</u>
            1. Using the pictures drawn by Partner A, write down the number of toes, presence of claws / nails, if toes are wide or thin, and if front and rear foot tracks are identical, on the provided cards.



Number of toes: __5___

Claws yes or no

Toes thin or wide

Identical front and rear paws? yes or no

iii. <u>Partner C - Data Output</u>

1. Using the information provided by Partner B, match that information with the provided table and identify the animal from the tracks. Write the name of the animal on the back of the original image used by Partner A and set this aside.

Number of toes: __5___

Claws yes or no

Toes thin or wide

Identical front and rear paws? yes or no

Tracks	Number of Toes	Claws?	Thin or Wide Toes	Identical Front and Rear Tracks?
Fox	4	Yes	Wide	Yes
Lynx	4	No	Wide	Yes
Caribou	2	No	Wide	Yes
Owl	4	Yes	Thin	N/A
Rabbit	0	No	Thin	No
Bear	5	Yes	Wide	Yes

c. Repeat this process for all six images. Group members can switch roles part way through, if needed.

4. Once every group has finished classifying their animal tracks, compare answers and determine which group was able to correctly classify the tracks.

5. Recap the game with participants and connect their actions in the game to how AI uses a similar process, only much faster, to sort and classify data.

6. The game represents how a computer neural network works to achieve deep learning. Use Appendix B to support.
7. Discuss with participants how utilizing AI in this way for animal track identification can be useful for their community and hunters/trappers (refer to *Appendix B*).
8. Invite an Elder/knowledge keeper or hunter/trapper to speak about how they utilize technology on the land and how they could utilize AI in this way.

Reflection & Debrief

1. Gather participants together into a circle and discuss:
    a. What have you learned about animal tracks?
    b. What have you learned about animal conservation?
    c. What do you think the future of animal conservation might look like with the advancements in technology?
    d. What career options interest you now that you know computer science and biology are connected?
    e. What are ways you might want to get involved with animal conservation after today?
2. Discuss the different careers listed in *Appendix A: Career & Mentor Connections*.

Delivery Adaptations

How might you adapt the time, space, materials, group sizes, or instructions to make this activity more approachable or more challenging? **Modifications** are ways to make the activity more accessible, **extensions** are ways to make the activity last longer or more challenging.

Modifications

SECTION 1: ANIMAL TRACK STORIES

- If animal tracks are not present in the area, provide participants with the Arctic Animal Tracks (*Appendix C*).
    - Using the Animal Tracks Glossary (*Appendix C*), encourage participants to try to identify any tracks they find..
- Have participants use paper to trace their footprint, in order to measure their track length.

SECTION 2: DEEP LEARNING

- For groups with less than 3 participants, participants can take on multiple roles (e.g., identifying shapes and classifying the animal track).
- For groups with more than 3 participants, multiple participants can perform one role.

Extensions

GENERAL

- Indigenous practitioners can discuss local knowledge regarding how to recognize the difference between animal tracks and how hunters / trappers in the community utilize this knowledge.

SECTION 1: ANIMAL TRACK STORIES

- If there is more than one animal track found, participants can determine the stride ratio for more than one animal.
- Using the GPS devices, each group can mark down where they found specific animal tracks as waypoints. Other groups can then use the waypoints to visit the tracks.

SECTION 2: DEEP LEARNING

- For an online version of the deep learning simulation game, guide participants through the Getting Started with Machine Learning tutorial on Apple's Swift Playgrounds or use Google's Teachable Machine to classify animal tracks.

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Appendices

Appendix A: Career & Mentor Connections

BIOLOGIST

- Studying life in all its forms is key to our understanding of many elements of the world around us. From the depths of the oceans to the deserts, swamp and wetlands, temperate regions and tundra and ice sheets, life is everywhere.

CONSERVATION OFFICER

- Conservation officers are members of law enforcement that enforce laws and by-laws to protect wild animals and ecosystems.

CONSERVATION SPECIALIST

- A Nature Conservation Specialist helps protect the wilderness, ecosystems, and species by educating organizations.
- Fun fact: Parks Canada has many summer positions available to students! If your community is home to a park, look into available opportunities that you can share with participants for future years.

EVOLUTIONARY BIOLOGIST

- Evolutionary biology is a subfield of biology that examines how living things evolve and change over time and draws connections between the evolutionary relationships between living things in order to solve the process by which every living thing on Earth evolved from one common ancestor.

HUNTERS AND TRAPPERS

- Hunters and trappers hold a lot of knowledge about wildlife biology, habitats, animal populations, movement and life cycle patterns, and the land on which this activity takes place.
- Hunters and trappers also have knowledge of processing animals, the responsibility they hold, and cultural significance of wildlife and

hunting/trapping activities. Trappers and hunters capture wild animals for their fur or use as meat or bait.

- A hunter might hunt in different places all the time, where a trapper has their own trap line that they care for.
- Trappers are responsible for both obeying the law and enforcing it. This involves following all hunting regulations and safety laws. They must also protect wildlife and people, and trap animals that threaten the well-being of other animals and humans. This may mean trapping and removing an animal that poses a danger.

WILDLIFE BIOLOGIST

- Involved with wildlife conservation and management programs. They study and monitor wildlife populations and the biotic and abiotic elements that affect them, conduct field research, make recommendations in regard to land use, and help make and implement regulations to protect wildlife.

Appendix B: Background Information

ANIMAL TRACKS GENERAL IDENTIFICATION GUIDE

Many animal tracks have distinguishable shapes and patterns that allow for biologists, conservationists, and hunters / trappers to be able to recognize what animal has recently been in an area. By looking at tract patterns and characteristics, tracks can be classified into the major animal groups first (canine, feline, birds, hoofed animals, rodents, other small animals, and reptiles / amphibians), then examined more closely to determine the specific species.

One of the first things you can identify is the walking pattern, to help narrow down what group of animals the track belongs to. Four unique track patterns are:

- **Perfect walkers** - form a zig-zag pattern between tracks as the rear foot falls where the front foot was previously.
  - Examples: Moose, fox, coyote, deer, and bobcat.
- **Waddlers** - move one side of the body then the other - the rear foot does not fall where the previous front foot had landed.
  - Examples: Bear, skunk, beaver, porcupine, and muskrat.
- **Bounders** - place front feet down and leap using back feet, which land where front feet were placed. Tracks appear as two paws side-by-side.
  - Examples: Otters and weasels
- **Hoppers** - rear feet are placed slightly in front of front feet, creating a leapfrog like motion and pattern.
  - Examples: Mice, rabbits, and chipmunks.

After identifying the track pattern, track characteristics can then be identified to help further narrow down the animal group and specific species:

- Width / length
- Number of toes
- Nails / claws
- Depth of tract
- Front vs rear foot

- Webbing
- Stride (distance between steps) and straddle (width of animal's tracks)

Indigenous Tracking Knowledge

In an effort to track animals in Canada, organizations like the territory government of Nunavut and individuals, are developing ways to incorporate Indigenous knowledge. The Government of Nunavut works with hamlets, and hunter and trapper organizations to collect information about animals and ensure that proper protocols are being followed.

Jesse Popp, a wildlife specialist in Sudbury, has worked to develop an app that merges Anishinaabe hunting knowledge with modern technology. When out on the land, people can use the app to document the number of moose they find or harvest, allowing for researchers to track moose population trends through time.

Trailmark System is another company that has created an online platform and mobile app for Indigenous hunters to use as a tool to help track animal migration or for community members to perform spatial analysis, environmental monitoring, and identify areas of land use for traditional purposes, digitally.

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is a branch of Computer Science that deals with a machine's ability to simulate intelligent behaviour. This includes cognitive functions we associate with human minds, such as perceiving, reasoning, learning, and adapting.

AI is becoming increasingly vital in our lives. From digital assistants, GPS navigation, and autonomous vehicles to tools like Siri/Google Home and generative AI tools (e.g., OpenAI's Chat GPT), its impact on our daily lives is growing. AI plays a crucial role in various aspects of work, enhancing efficiency, and taking on hazardous or monotonous tasks. As AI applications grow, discussions on AI ethics and responsible practices are increasingly important.

AI in Animal Conservation

AI is also being used for animal conservation efforts. Conservationists are interested in tracking animal locations, migration routes, and learning more about animals in specific areas. Gathering this information will help conservationists to decide which ecosystems and animal populations need protection. A popular technique is to collect images of animal tracks through phone apps, drones, or satellites and then process the information using AI. WildTracks is one example which uses a special-type of newly developed AI technology called footprint identification technology (FIT), which is able to identify a species from an animal track, as well as the animal sex, and their age-class

MACHINE LEARNING

Machine learning (ML) is a type of artificial intelligence where computers learn from data, improve at tasks over time, and adapt without being programmed step by step. Instead of giving the computer every possible instruction, we give it ways to learn from experience, similar to how people practice and improve.

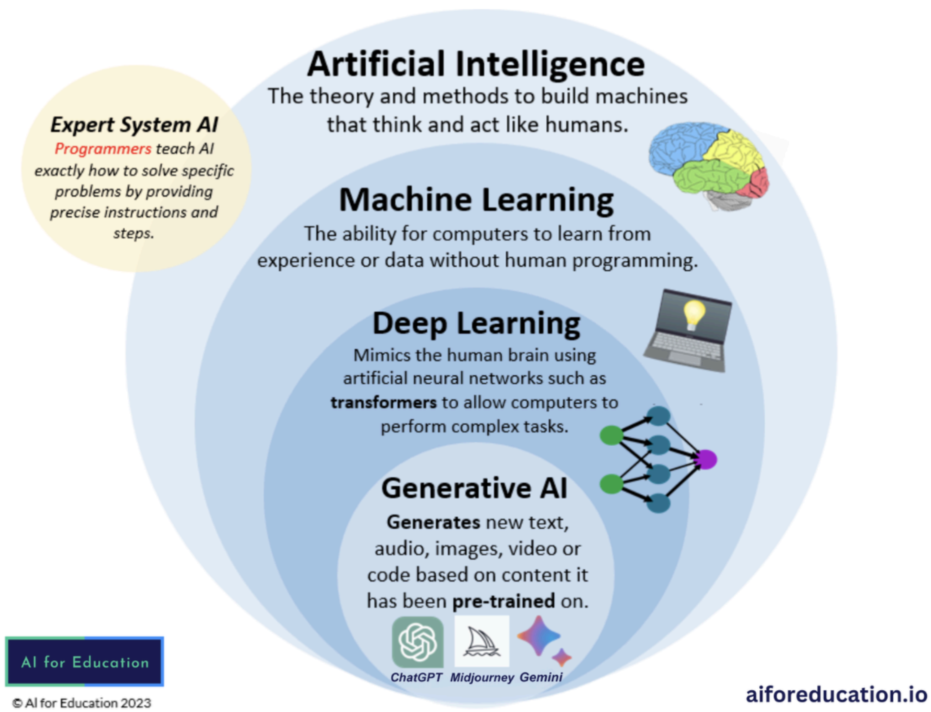
For example, you might teach a computer to play checkers. Rather than listing every possible move, you could program it to learn from playing many games. Eventually, it could get so good that it plays better than the person who wrote the program

The learning process usually includes a few steps:

1. **Give it Data:** First, the computer is given a lot of data to process. This could be pictures, numbers, text, or sounds.
2. **Find the Patterns:** The computer then analyzes all this data and starts to find patterns, building its own “rules” based on experience.
3. **Make Predictions or Actions:** Using these patterns, the computer can make decisions or predictions when it encounters new data.
4. **Get Better and Better:** As the computer gets more data, it can adjust its patterns to become more accurate. The more data and computing power it has, the better its predictions become

Machine learning is used across different fields and in our everyday lives. In your daily life, ML works quietly behind the scenes in many of the tools and apps you use. It powers autocorrect and predictive text on your phone, suggests videos to watch on streaming platforms, and runs the filters on social media apps that recognize and track your face. It also helps your phone unlock through facial recognition by learning your unique features, and it keeps your email inbox clean by filtering out junk mail.

In addition, ML is making an impact in the wider world. In healthcare, it helps doctors diagnose illnesses more accurately, such as spotting broken bones in X-rays. It is also the "brain" behind self-driving cars, enabling them to observe and respond to the world around them. In industries like agriculture and manufacturing, ML supports smarter ways to grow food and produce goods more efficiently.



AI for Education. (2023). *Generative AI Explainer*. aiforeducation.io/ai-resources/generative-ai-explainer

Artificial Intelligence VS Machine Learning VS Deep Learning

You might come across the terms “artificial intelligence” and “machine learning” used together, but they aren’t exactly the same thing. AI is the broad idea of creating machines that can act or think in ways similar to humans. This can range from simple tools like a smart thermostat that adjusts the temperature based on rules, to more advanced systems like voice assistants or even robots. AI systems can learn over time, sense their environment, and make decisions on their own. Within AI, there are different types:

- **Classification AI**: Systems that identifies and sorts things (e.g. Tiktok or Snapchat face filters).
- **Predictive AI:** Systems that use data to make decisions about the future (e.g. Spotify and Apple Music recommendations).
- **Generative AI:** Systems which create new things, such as text, images, or music (e.g. CoPilot and ChatGPT).

Machine Learning is a specific approach within AI. It’s a specific way of achieving AI by having computers learn from data instead of being programmed with a long list of rules. So, all machine learning is AI, but not all AI uses machine learning.

Deep Learning (DL) is a more advanced type of ML that uses structures called neural networks, designed to work a bit like the human brain. Deep learning is what enables high-performance AI systems, including many generative AI tools that can create new and transformative outputs.

Appendix C: Additional Resources

OPENING HOOK

Activity Page(s)

- Animal Track Example (In Soil) (refer below)
- Animal Track Example (In Snow) (refer below)

SECTION 1: ANIMAL TRACK STORIES

Activity Page(s)

- Animal Tracks Data Collection Worksheet (refer below)
- Animal Tracks Glossary (refer below)

Supporting Resources

- Arctic Animal Tracks (refer below)
- Stride Pattern Diagram (refer below)
- GARMIN eTrex 10 GPS User Guide

SECTION 2: DEEP LEARNING

Activity Page(s)

- AI and Animal Track Classification Worksheet (refer below)
- Deep Learning Game Cards (refer below)

Webpages

- Getting Started with Machine Learning tutorial on Apple's Swift Playgrounds
- Google's Teachable Machine

Futuristic Wilderness: How AI is Shaping Animal Conservation

Animal Track Example (in Soil)

Images obtained from various sources through Green Belly (2022).

Answers (left to right): wolf, lynx

Images obtained from various sources through Green Belly (2022).

Images obtained from various sources through Green Belly (2022).

Answers (left to right): moose, turkey

Images obtained from various sources through Green Belly (2022).

Images obtained from various sources through Green Belly (2022).

Answers (left to right): squirrel, black bear

Images obtained from various sources through Green Belly (2022).


Images obtained from various sources through Green Belly (2022).

Answers (left to right): crow, fox

Images obtained from various sources through Green Belly (2022).

Images obtained from various sources through Green Belly (2022).

Answers (left to right): coyote, deer

Images obtained from various sources through Green Belly (2022).

Futuristic Wilderness: How AI is Shaping Animal Conservation

Animal Track Example (in Snow)

Images obtained from various sources through Green Belly (2022).

Answers (left to right): coyote, rabbit

Images obtained from various sources through Green Belly (2022).

Images obtained from various sources through [Green Belly (2022)](#).

Answers (left to right): bear, squirrel

Images obtained from various sources through [Green Belly (2022)].

Images obtained from various sources through [Green Belly (2022)].

Answers (left to right): fox, caribou

Images obtained from various sources through Green Belly (2022).

Images obtained from various sources through Green Belly (2022).

Answers (left to right): mountain lion / cougar, moose

Images obtained from various sources through Green Belly (2022).

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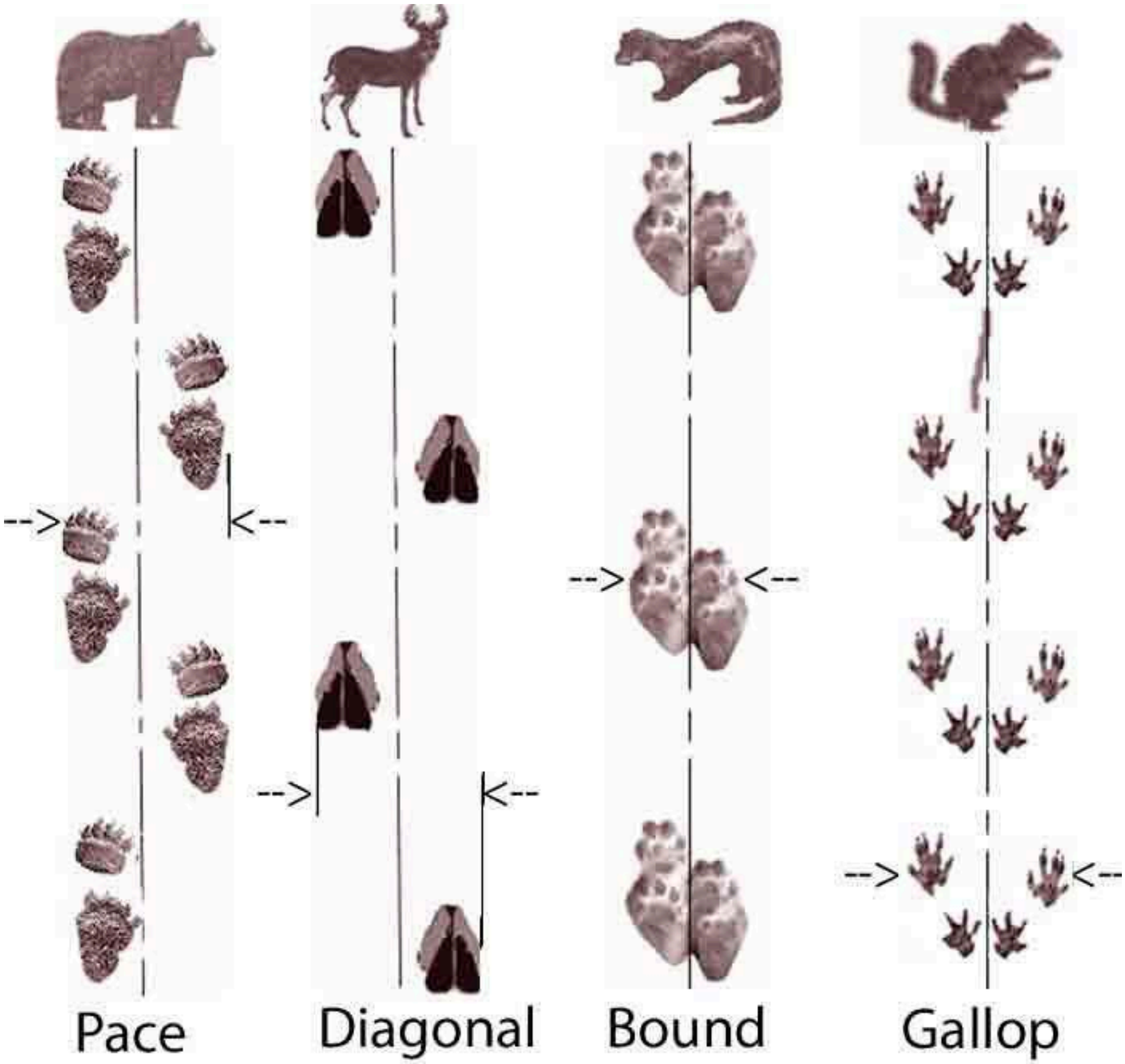
Arctic Animal Tracks


cm
0
60

Futuristic Wilderness: How AI is Shaping Animal Conservation

Stride Pattern Diagram


Pace
Diagonal
Bound
Gallop

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Animal Tracks Data Collection Worksheet

Human Tracks: Data Collection

Use this page to collect data about your track length and stride length. Fill in the tables below:

Table 1: Track length and height

Track Length (cm)	Height (cm)

Table 2: Stride length and speed

Pace	No. of steps in 20 m	No. of strides (Steps ÷ 2)	Stride length (20 ÷ no. of strides)	Time (seconds)	Speed (m/sec) (distance ÷ time)
Walking					
Trotting					
Running					

Animal Tracks: Data Collection

Use this page to collect data about animal stride length. Fill in the table below:

Table 3: Classify the animal as walking, trotting, or running

Animal	**Track length (cm)**	**Hip height** (track length x 4)	**No. of tracks**	**No. of strides** (no. of tracks ÷ 4)	**Distance of animal** (distance from first to last track)	**Stride length** (distance ÷ no. of strides)	**Ratio** (stride length ÷ hip height)

If ratio is less than 2.0, the animal is **walking**

If ratio is between 2.1 - 2.9, the animal is **trotting**

If ratio is above 3.0, the animal is **running**

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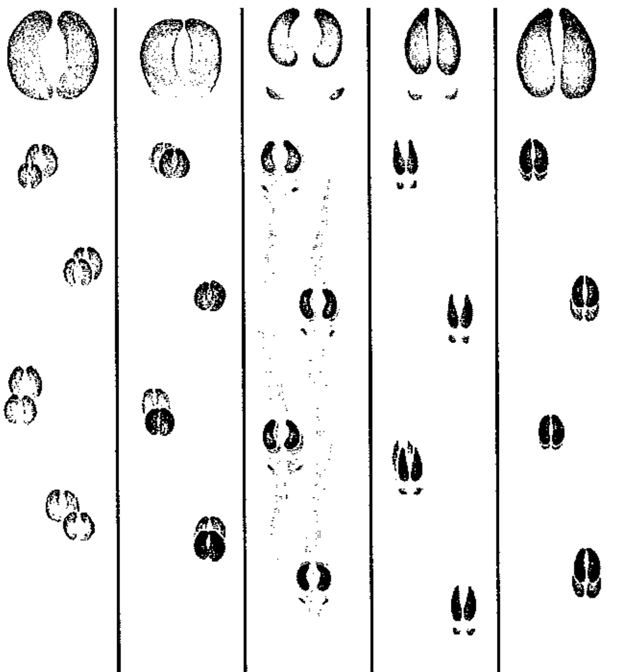
Futuristic Wilderness: How AI is Shaping Animal Conservation

Animal Tracks Glossary



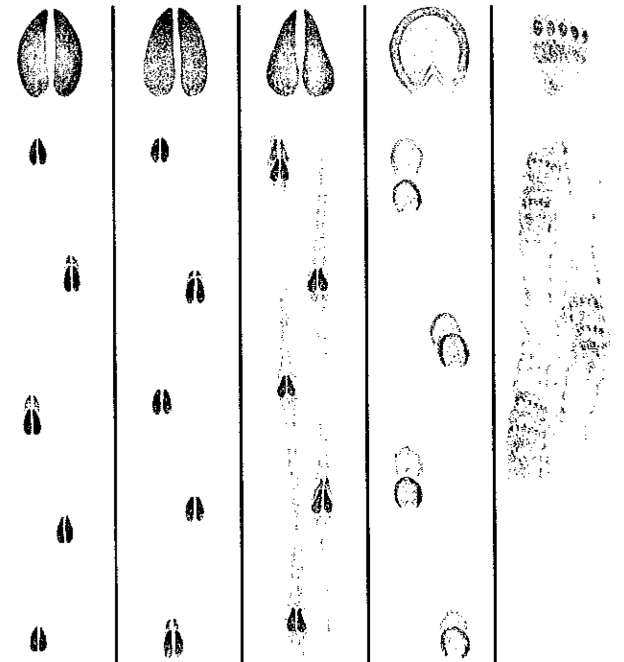
Muskox p. 18

Bison p. 20

Caribou p. 22

Moose p. 24

Elk p. 26



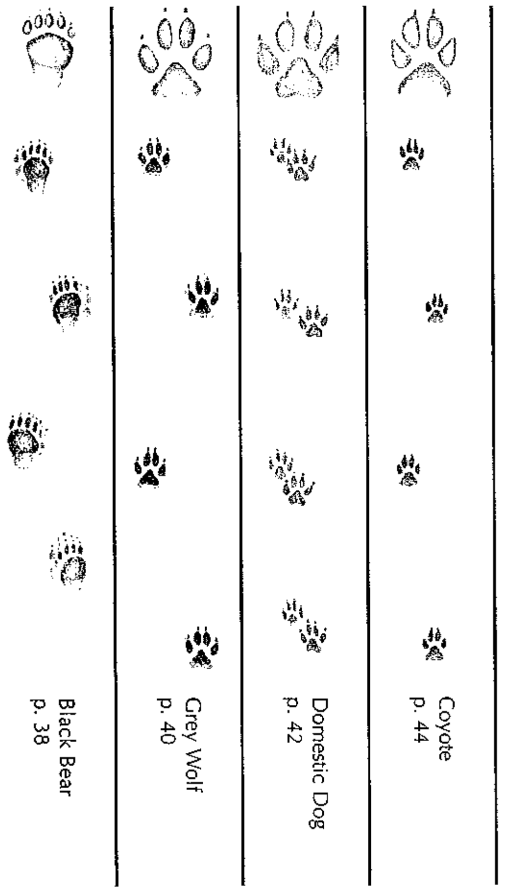
Mule Deer p. 28

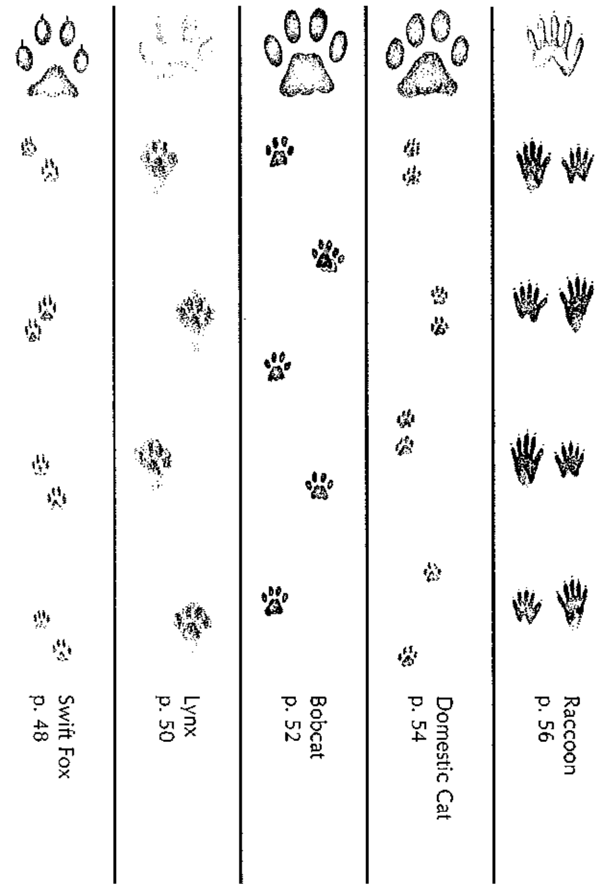
White-tailed Deer p. 30

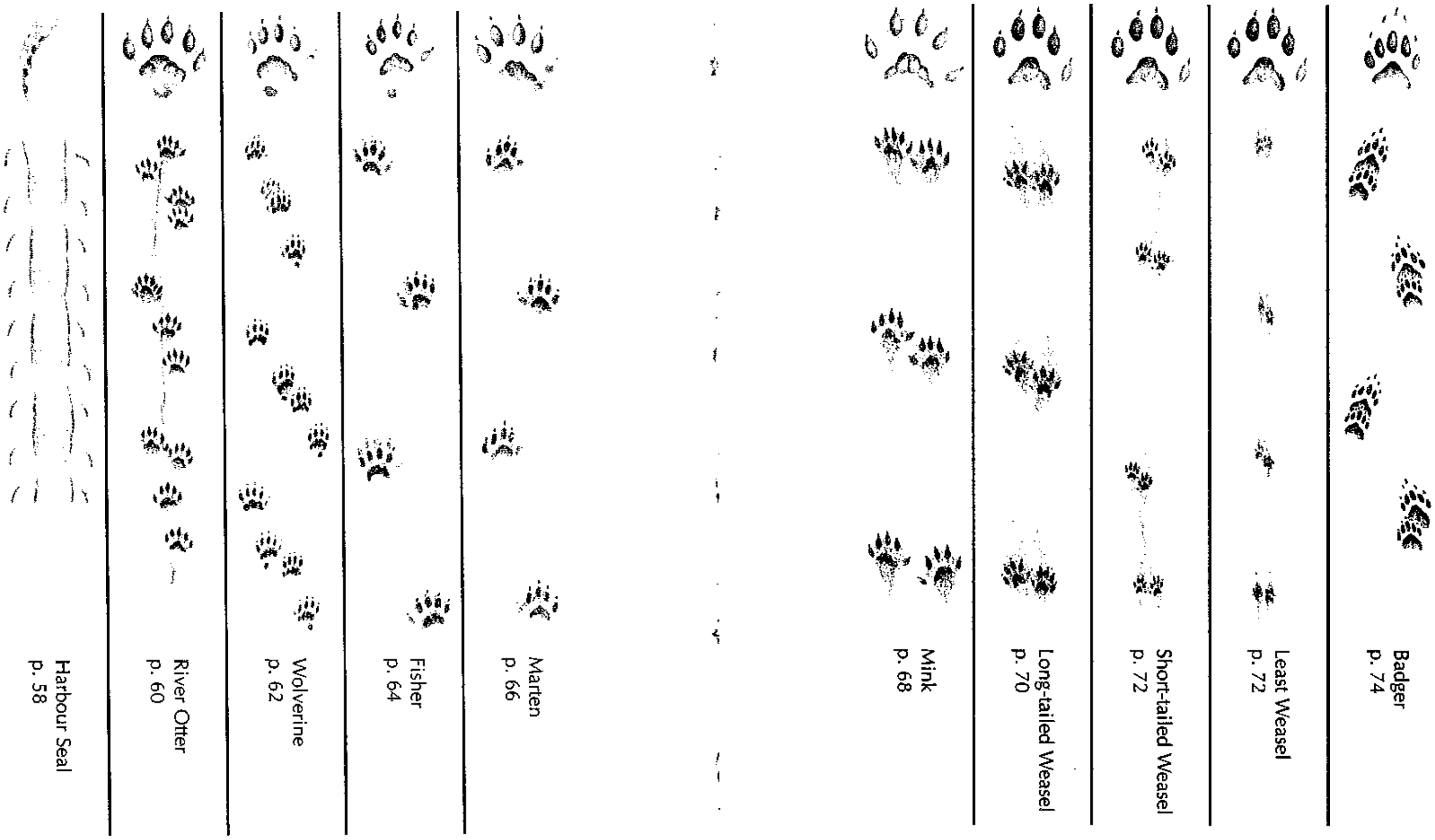
Pronghorn Antelope p. 32

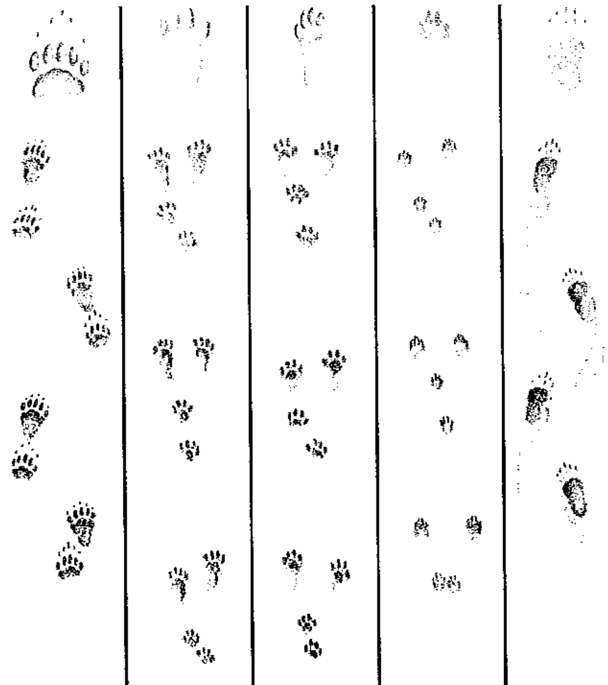
Horse p. 34

Polar Bear p. 36


Black Bear
p. 38
Grey Wolf
p. 40
Domestic Dog
p. 42
Coyote
p. 44
Red Fox
p. 46


Swift Fox
p. 48
Lynx
p. 50
Bobcat
p. 52
Domestic Cat
p. 54
Raccoon
p. 56


Harbour Seal
p. 58
River Otter
p. 60
Wolverine
p. 62
Fisher
p. 64
Marten
p. 66
Mink
p. 68
Long-tailed Weasel
p. 70
Short-tailed Weasel
p. 72
Least Weasel
p. 72
Badger
p. 74



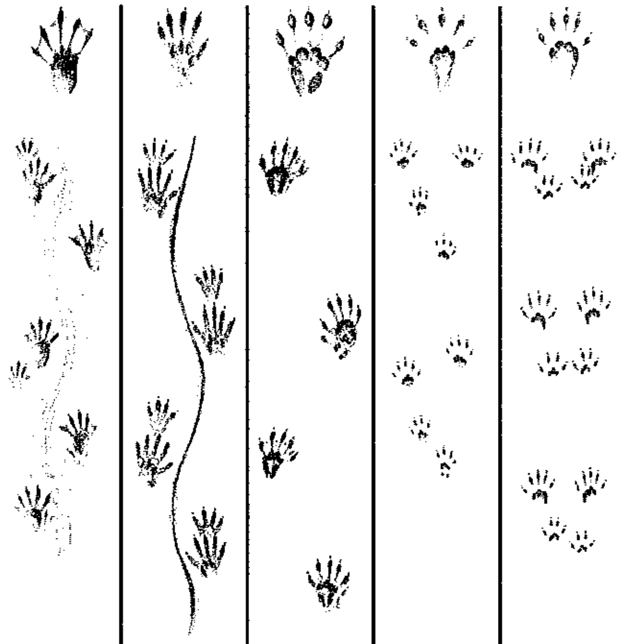
Striped Skunk p. 76

Snowshoe Hare p. 78

White-tailed Jackrabbit p. 80

Eastern Cottontail p. 82

Porcupine p. 84



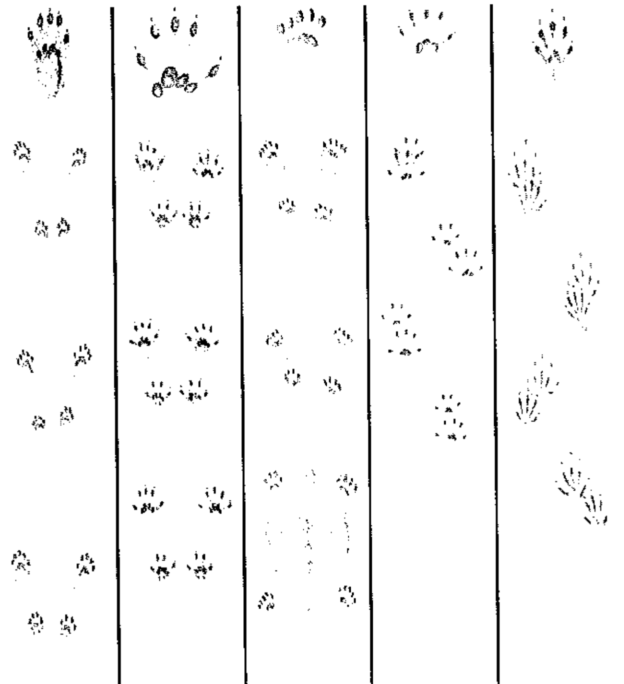
Beaver p. 86

Muskrat p. 88

Woodchuck p. 90

Thirteen-lined Ground Squirrel p. 92

Least Chipmunk p. 94



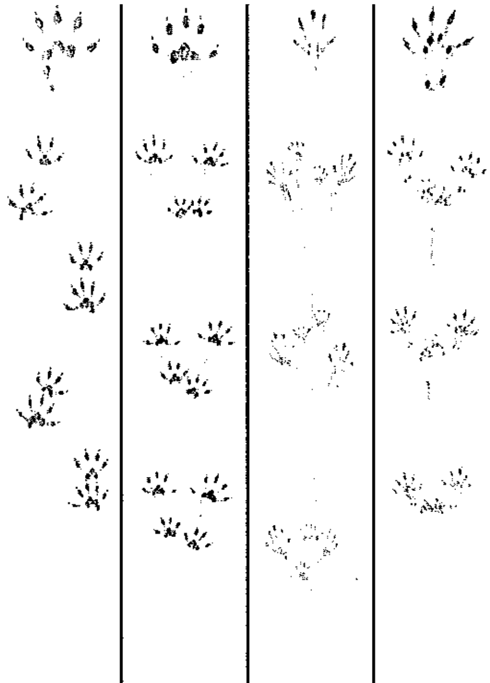
Eastern Grey Squirrel
p. 96

Red Squirrel
p. 98

Northern Flying Squirrel
p. 100

Norway Rat
p. 102

Northern Pocket Gopher
p. 104

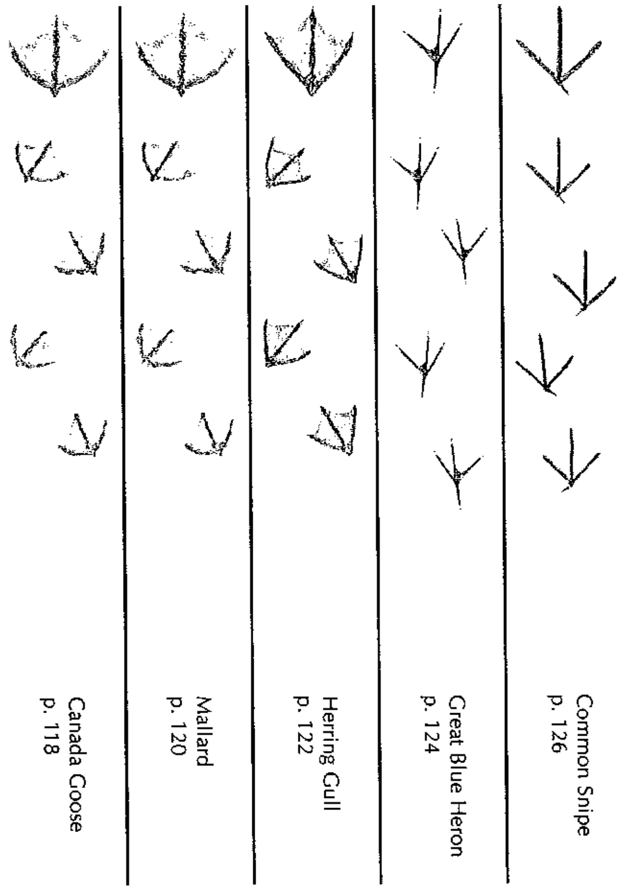


Meadow Vole
p. 106

Deer Mouse
p. 108

Meadow Jumping Mouse
p. 110

Masked Shrew
p. 112



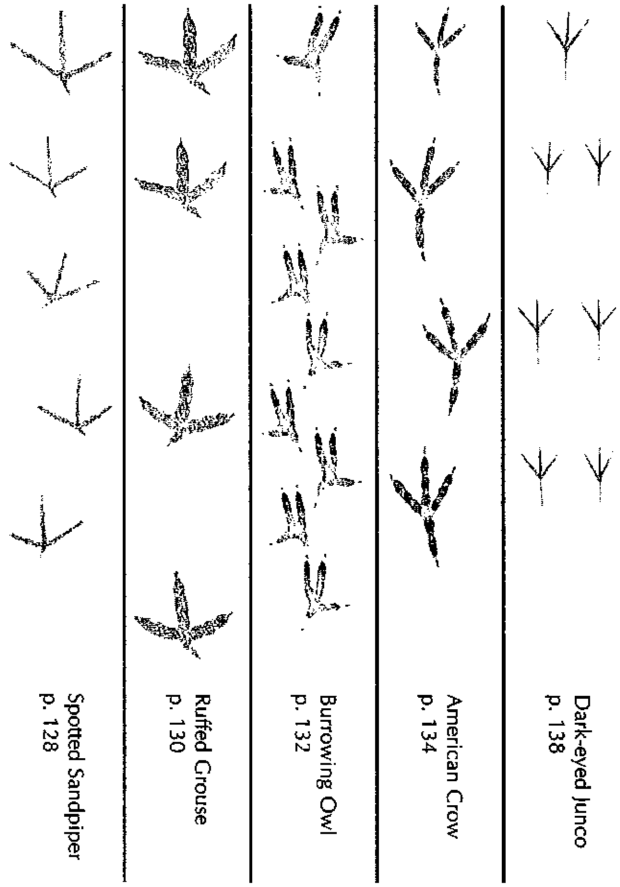
Canada Goose p. 118

Mallard p. 120

Herring Gull p. 122

Great Blue Heron p. 124

Common Snipe p. 126



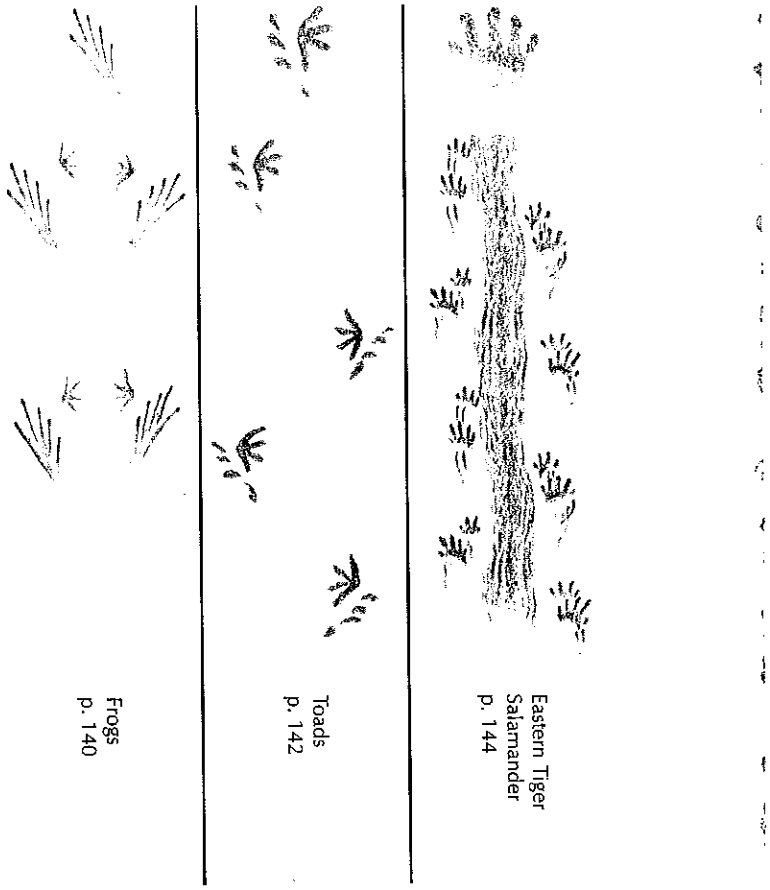
Spotted Sandpiper p. 128

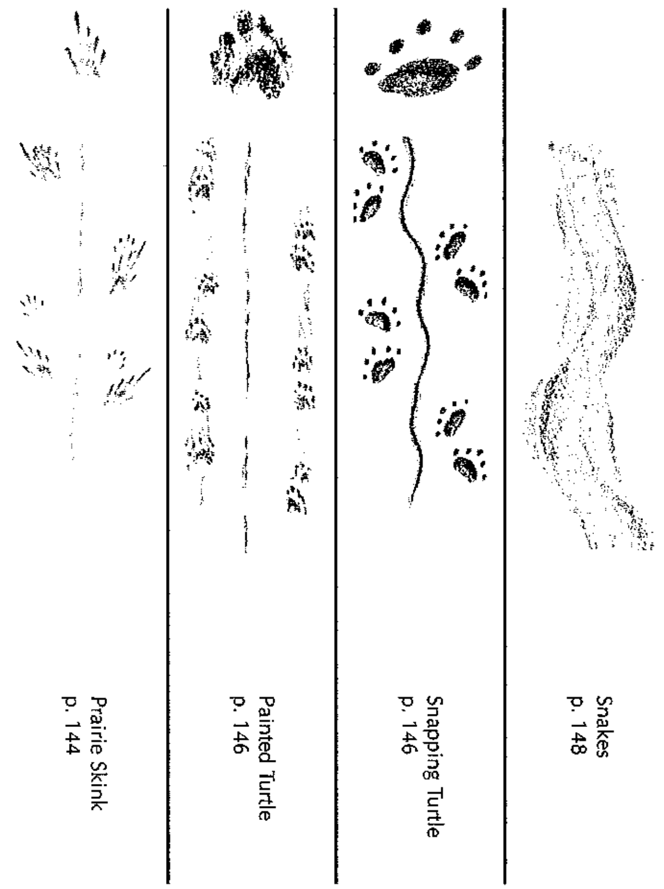
Ruffed Grouse p. 130

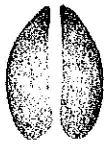
Burrowing Owl p. 132

American Crow p. 134

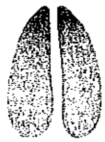
Dark-eyed Junco p. 138


Frogs
p. 140
Toads
p. 142
Eastern Tiger
Salamander
p. 144

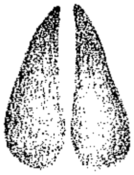

Prairie Skink
p. 144
Painted Turtle
p. 146
Snapping Turtle
p. 146
Snakes
p. 148



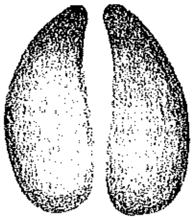
Mule
Deer



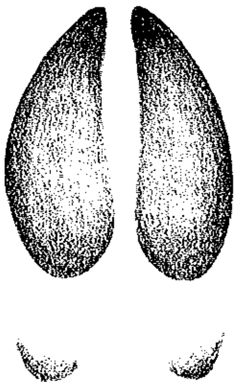
White-tailed
Deer



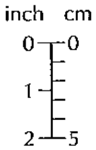
Pronghorn
Antelope



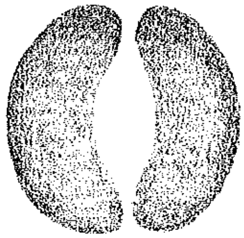
Elk



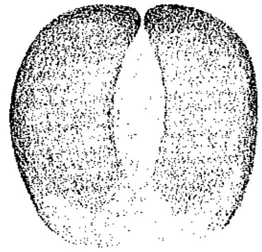
Moose



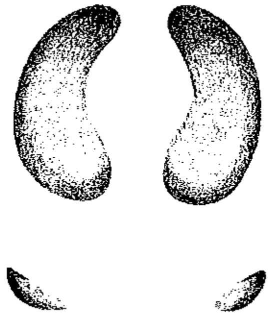
HOOFED PRINTS



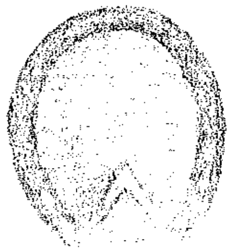
Muskox



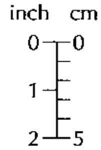
Bison



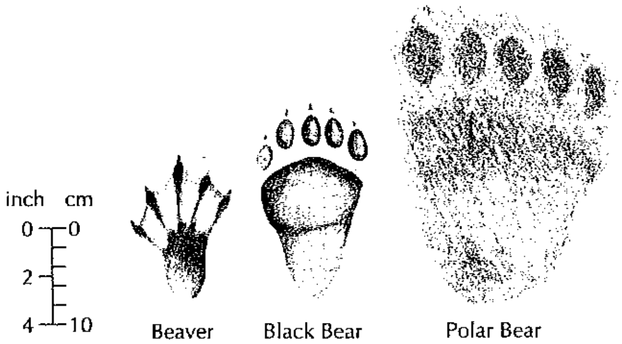
Caribou



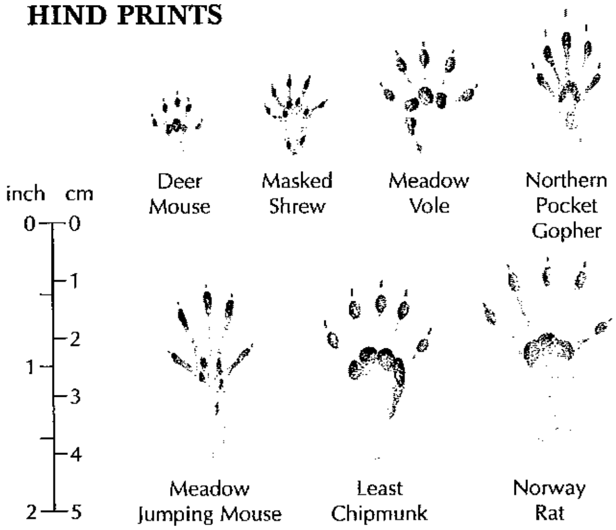
Horse



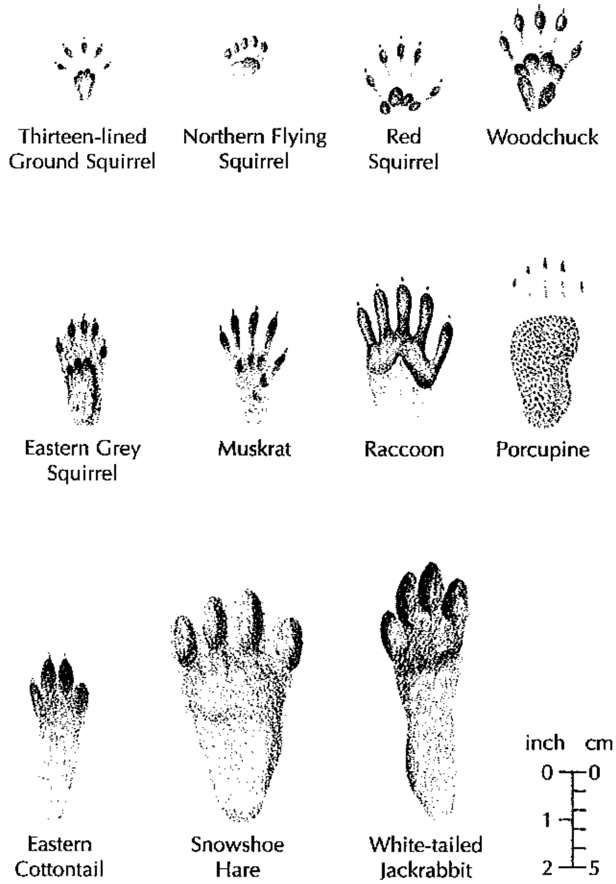
HIND PRINTS



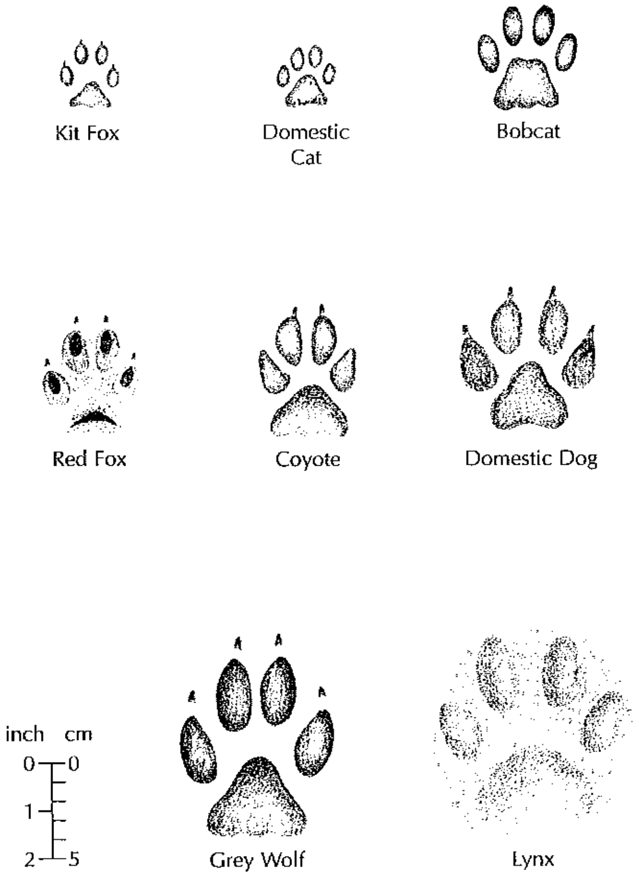
HIND PRINTS



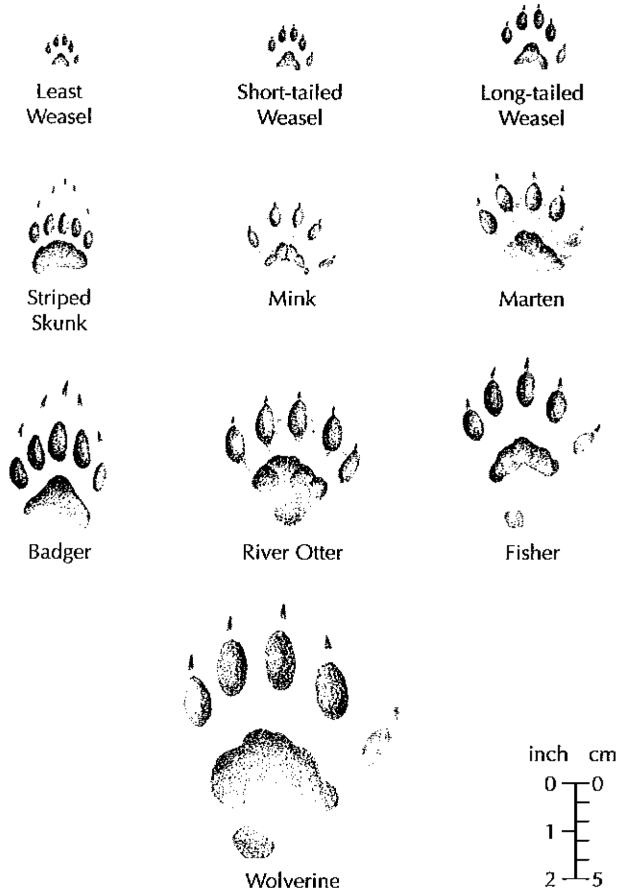
HIND PRINTS



FORE PRINTS



FORE PRINTS



Futuristic Wilderness: How AI is Shaping Animal Conservation

AI and Animal Track Classification Worksheet

AI and Animal Track Classification

Partner A - Image Collector: Draw two pictures of the animal track: front and rear foot

Partner B - Data Analyzer: Identify the following from Partner A's picture:

- Number of toes
- Presence of claws
- Thin or wide toes
- Identical front and rear tracks

Partner C - Data Output: Use the table below to help classify the animal tracks:

Tracks	Number of Toes	Claws?	Thin or Wide Toes	Identical Front and Rear Tracks?
Fox	4	Yes	Wide	Yes
Lynx	4	No	Wide	Yes
Caribou	2	No	Wide	Yes
Owl	4	Yes	Thin	N/A
Rabbit	0	No	Thin	No
Bear	5	Yes	Wide	Yes

Futuristic Wilderness: How AI is Shaping Animal Conservation

Deep Learning Game Cards






Number of toes: ________

Claws **yes** or **no**

Toes **thin** or **wide**

Identical front and rear paws? **yes** or **no**

Number of toes: ________

Claws **yes** or **no**

Toes **thin** or **wide**

Identical front and rear paws? **yes** or **no**

Number of toes: ________

Claws **yes** or **no**

Toes **thin** or **wide**

Identical front and rear paws? **yes** or **no**

Number of toes: ________

Claws **yes** or **no**

Toes **thin** or **wide**

Identical front and rear paws? **yes** or **no**

Number of toes: ________

Claws **yes** or **no**

Toes **thin** or **wide**

Identical front and rear paws? **yes** or **no**

Number of toes: ________

Claws **yes** or **no**

Toes **thin** or **wide**

Identical front and rear paws? **yes** or **no**