Brief Synopsis

The winter activity of snowshoeing will be explored by students in this class at Eagle Bluff. While the class will focus more on the history of snowshoeing and actually participating in the activity, these Pre-visit activities will help the students understand the science of weight distribution on snow.

Ages: Designed for 5th–8th grade

Time Considerations: Approximately 30–45 minutes for each activity.

Materials:
- **Attached worksheets, one of which needs to be copied on to a transparency.**
- **Calculators**
- **Packing peanuts**
- **Box to hold packing peanuts.**
- **Cardboard**
- **Scissors**
- **Scale**

Vocabulary: Snowshoe, force, surface area

Outcomes:
- Students will gain a better understanding of how the surface area of snowshoes help people stay on top of snow.

Minnesota Academic Standards:
Math: 5.I., 5.II.B., 6.V.C., 8.II.B.
Language Arts: 4.I.A, 4.I.B, 4.I.C, 5.I.A, 5.I.B, 5.I.C, 5.II.C, 6.I.A., 6.I.B, 6.II.C, 7.IB, 8.I.A
Science: 7.I.D, 8.I.D

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Activity 1: Snowshoe Feet!

Background: Of all of the seasons winter can be the harshest. For modern people to survive, they need to layer their clothing and spend time indoors. Prehistoric people didn't have that luxury—they had to cope with the cold and the snow. When they realized that traveling through snow was difficult, they took a cue from the Snowshoe Hare. It's large back feet allow it to rest on top of the snow, instead of sink down into it.

To understand how having a large foot/feet aids in travel through snow, the students are going to calculate the foot force of some animals that do a lot of winter traveling and compare it to their own foot force.

Instruct the students to calculate each animal's foot force by following the directions below and on the attached forms along with the track and grid* sheets. After students have completed the first worksheet, there is a second worksheet so they can calculate their own foot force. *The Grid Sheet will need to be copied onto transparencies for the students to use.*

Procedures:
1. Record the average weight of each animal from the track sheets onto the table.
2. Divide the average weight by the number indicated to determine the average weight on each foot.
3. Depending on the animal for which you are determining the foot force, take the transparency grid and place it over the track of that animal to determine that animal's approximate foot area. For the Cottontail Rabbit and Snowshoe Hare, calculate the foot area using both paws and the result should be one number.
4. Divide the average weight (lbs.) on each foot by the foot area (square inches).

*You divide by 2 rather than 4 for the Cottontail Rabbit and Snowshoe Hare because the area that you calculated was for both a front and rear foot. The Dog and the Wolf have the same size feet, so you divide by 4 or those animals.

Activity 2: Snow Surfing USA

Background: This activity is an easy extension of the first activity. The students will try out the idea of how wearing snowshoes spreads their weight over a larger surface area. Using packing peanuts, the students will compare standing in "snow" in their shoes and standing in "snow" with snowshoes.

Procedures:
1. Fill a large box with collected packing peanuts.
2. Have students (one at a time) step in to the box to see if they will remain on top of the packing peanuts, or if they will sink to the bottom. (They

should sink in the box of packing peanuts)

3. To demonstrate how snowshoes helps to spread out the weight of the person standing on it, have the students cut out an Eagle Bluff -size cardboard snowshoe.

4. Have the students then stand in the box of packing peanuts on top of the cardboard snowshoe. They should remain on top of the packing peanuts, not sink into them.

Start a discussion with your class after everyone has tried using the cardboard snowshoes to stand on top of the packing peanuts.

- Did they sink to the bottom, or the did the "snowshoes" spread their weight out enough to keep them on top of the packing peanuts?
- What did they believe would happen?
- How do they think snowshoeing will work at Eagle Bluff?
- How does snow affect native animals?

Teacher Tips

- The "Snowshoe Feet" activity flows nicely into the "Snow Surfing USA" activity, you may want to put them together.

- Depending on the grade level of the students, you may want to have students work in pairs.

- Review how to determine square inches of an area.

- Option: Copy off grid on white paper for each student The paw is then cut out and traced on the grid to determine the foot area.

Additional Resources

http://www.snowschool.org/snow/kids/snowshoes.htm

A great web page with activities that you can do while snowshoeing.

http://www.redfeather.com/content.asp?id=548

This website is a good intro to snowshoeing for students.

http://www.hikercentral.com/snowshoe/

This website provides links to different winter related websites.

http://www.dnr.state.mn.us/young_naturalists/snowshoeing/index.html

Information on the history of snowshoeing as well as the safety of it.

Eagle Bluff Environmental Learning Center   **Lanesboro, Minnesota www.eagle-bluff.org**

Snowshoe Feet Worksheet

Some animals are more equipped for winter travel more than others. Why is that? We'll have to look at animal feet to find out!

Follow the steps below and complete the table.

1. On the <u>Track Sheets</u>, the Average Weights of the animals are listed. Record the weights in the appropriate box in the table below.
2. Divide the average weight by the number indicated to determine the average weight on each foot. (You divide by 2 rather than 4 for the cottontail rabbit and snowshoe hare because the area you calculate is for both a front and rear foot. The other animals have the same size front and rear feet, so you divide by 4.)
3. To figure out the foot area, take the outline of the animal track and place the clear square-inch grid over it. This will give you the approximate food area. For the Cottontail Rabbit and Snowshoe Hare, calculate the foot area using both paws and the result should be one number.
4. To determine the foot force for each animal, divide the average weight on each foot and record those numbers on the table below.

Animal	Average Weight		Avg. Weight On ea. Foot		Foot Area		Foot Force
Golden Retriever	÷4	=		÷		=	
Wolf	÷4	=		÷		=	
Cottontail Rabbit	÷2	=		÷		=	
Snowshoe Hare	÷2	=		÷		=	

→ Which Animal has the lowest foot force? _____ Do you think this animal can stay on top of the snow? _____

→ Which animal has the highest foot force? _____ Do you think this animal can stay on top of the snow? _____

→ How do you think an animal's foot force might change when it's moving compared to when it's standing still? (Are all 4 feet of the animal on the ground at the same time when the animal is moving?)

Your Snowshoe Feet!

Now that you've determined the foot force for some of the animals that travel in winter, you're going to figure out your own foot force to find out if you have what it takes to travel in winter.

1. Step onto a scale and record your weight in the table below.
2. Divide your weight by 2 (how many feet you walk on) to determine the average weight on each foot.
3. Trace your shoe onto a piece of paper and place the clear square-inch grid over the tracing of your foot to determine your foot area.
4. Just like you figured it out for the animals, divide the average weight on each foot (lbs.) by your foot area (sq. in.) to determine the foot force (lbs./sq. in.)
5. Now, compare your foot force with your shoes to the foot force you would have with snowshoes. To do that, you need to calculate the foot force that you would have with snowshoes below. The foot area with snowshoes is given to you.

Animal	Weight		Avg. Weight On ea. Foot		Foot Area		Foot Force
You	÷2	=		÷		=	
You with Snowshoes	÷2	=		÷	267 sq. in.	=	

→ Is this a high or a low foot force? _____ Do you think you could stand up on top of the snow without snowshoes?_____

→ Which animal's foot force are you the closest too without snowshoes? _____ With snowshoes? _____

→ What do you think will happen when you stand on top of snow in Snowshoes?

Snowshoe Feet Worksheet – ANSWER KEY

Some animals are more cut out for winter travel more than others. Why is that? We'll have to look at animal feet to find out!

Follow the steps below and fill them out on the table.

1. On the <u>Track Sheets</u>, the Average Weights of the animals are listed. Record them in the necessary box in the table below.
2. Divide the average weight by the number indicated to determine the average weight on each foot. (You divide by 2 rather than 4 for the cottontail rabbit and snowshoe hare because the area you calculated was for both a front and rear foot. The other animals have the same size front and rear feet, so you divide by 4.)
3. To figure out the foot area, take the outline of the animal track and place the clear square-inch grid over it. This will give you the approximate food area. For the Cottontail Rabbit and Snowshoe Hare, calculate the foot area using both paws and the result should be one number.
4. To determine the foot force for each animal, divide the average weight on each foot and record those numbers on the table below.

Animal	Average Weight			Avg. Weight On ea. Foot		Foot Area		Foot Force
Golden Retriever	60 lbs	÷4	=	15lbs.	÷	6	=	2.5
Wolf	80 lbs.	÷4	=	20 lbs.	÷	12	=	1.67
Cottontail Rabbit	3lbs.	÷2	=	1.5 lbs.	÷	2	=	0.75
Snowshoe Hare	3.5 lbs.	÷2	=	1.75 lbs.	÷	8	=	0.21

→ Which Animal has the lowest foot force? __Snowshoe Hare__ Do you think this animal can stay on top of the snow? _____Yes_____

→ Which animal has the highest foot force? __Wolf__ Do you think this animal can stay on top of the snow? __No__

→ How do you think an animal's foot force might change when it's moving compared to when it's standing still? (Are all 4 feet of the animal on the ground at the same time when the animal is moving?) An animal's foot force becomes greater while moving because not all feet will be on the ground at once. Since the animal is not on all of its feet, the foot force becomes greater on the feet that are actually on the ground.

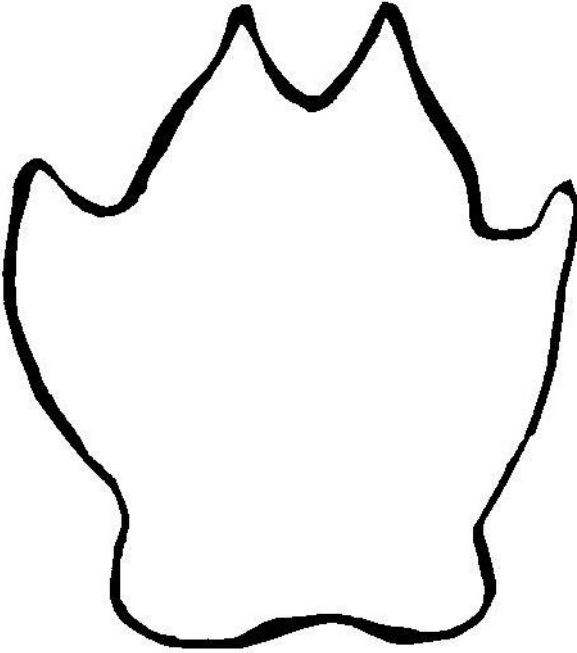# Track Sheet
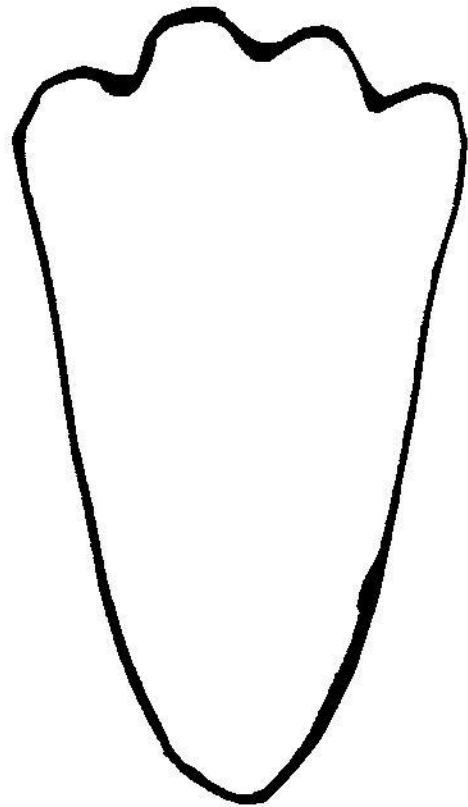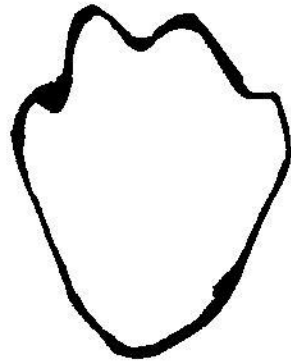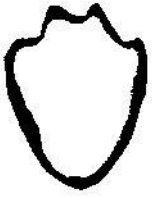
Eastern Cottontail Rabbit
Average Weight: 3 lbs.

Foot Area:

Snowshoe Hare
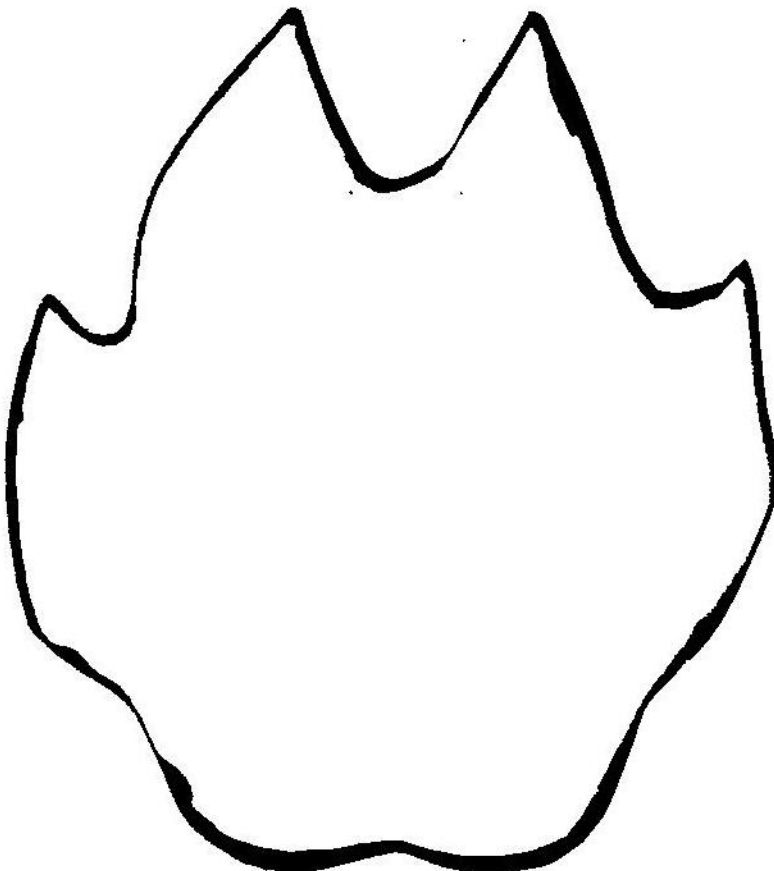Average Weight: 3.5 lbs.

Foot Area:

Track Sheet

Golden Retriever
Average Weight: 65 lbs.

Foot Area:

Wolf
Average Weight: 80 lbs.

Foot Area: