

Discover Musk Oxen

The Domestication of an Ice Age Survivor



The Musk Ox Farm Palmer, Alaska



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The Domestication of an Ice Age Survivor

Multidisciplinary Investigations for Grades 3-5

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Mission Statement:

The Musk Ox Development Corporation (MODC), a 501 (c)(3) non-profit organization, is dedicated to the domestication of the musk ox and to the promotion of qiviut production as a gentle and sustainable agricultural practice in the Far North, with a focus on public education and providing additional income opportunities to Alaska Natives.

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Dear Educator,

The Musk Ox Farm has developed these multidisciplinary materials to supplement your classroom instruction. The materials explore the following topics:

- Natural history of the musk ox in Alaska
- Domestication of the musk ox as seen through the efforts of the Farm
- Benefits of musk ox farming
- Musk oxen as a sustainable resource

These materials are designed to introduce students to the world of the musk ox and the Musk Ox Farm. As well as an introduction to the musk ox, these materials also serve as a means to sharpen a student's math, science, reading, writing, as well as critical and creative thinking skills. They can be used to prepare students for a visit to the Farm or as a stand alone classroom resource. Seven separate Investigations examine different topics relating to the musk ox. You may choose to complete all the Investigations or choose the ones that best suit your instructional needs.

See **Investigations At A Glance** for an overview of the sections. Investigations build upon each other and taken as a whole present a complete and cohesive multidisciplinary unit of study.

Each Investigation is structured as follows:

The Teacher's Page

Designed to enable you to present confidently the materials and activities to your students. The Teacher's Page is divided into;

- Notes: Overview of the Investigation
- Learning Objectives: Specific skills your students will sharpen by completing this section
- Materials: What you will need to complete the Investigation
- Vocabulary: Words that may be unfamiliar to your students that they will encounter in the Investigation

Discover!

This page will contain brief reading segments that contain information related to the Investigation topic. We recommend that you make a copy of **Discover!** for each of your students. Third or fourth grade teachers may need to provide extra assistance to students as they read the material.

Explore!

This page contains activities that allow your student to explore fully the Investigation topic. Each Investigation will have several activities ranging from simple to more indepth. The difficulty/complexity of activities is designated by a musk ox hoof graphic: one hoof is the easiest, two is moderate, and three is the most difficult. The activities were designed this way to allow you to select the level best suited to your students, instructional needs, and/or time constraints.



In addition, the **Supplemental Materials** page will point you towards other materials available for use in your classroom, including videos and a hands-on kit produced by the Musk Ox Farm.

We hope that these materials help you to introduce the musk ox, the Musk Ox Farm, and the valuable resource both provide, to your students. We encourage you to schedule a field trip to the Musk Ox Farm so that your students can further explore these wonderful animals in real life. Experienced guides are available at the Farm to customize your visit. Musk Ox Farm staff is also available for in-classroom presentations at local schools.

Mark Austin
Executive Director
Musk Ox Development Corporation

About The Musk Ox Farm

In the 1940s and 50s wild musk oxen, though gaining a foothold after being reintroduced to Alaska in the 1930s, were still just a disaster or two away from extinction. At the same time, the villages of coastal Alaska were looking for ways to bring income into a traditionally subsistence culture. Where others saw two disparate situations. John Teal saw an opportunity; for Native people to live together with and use the musk oxen in such a way that both would thrive.

After more than a decade of research, Teal started the Institute for Northern Agriculture Research (INAR) which later came to be known as the Musk Ox Project in Alaska. Supported by funding from W.K. Kellogg Foundation, as well as assistance from the University of Alaska and countless volunteers, the Project started Alaska's first attempted domestic musk ox farm in Fairbanks in 1964. Each year the herd grew. Each year their qiviut (musk ox underwool) was harvested and spun into exquisite yarn.

In 1968 the Project began workshops teaching Alaska Native women in villages such as Mekoryuk, Bethel, St. Mary's and Tununak how to knit the unique lacy patterns for qiviut garments. Within a year, a knitter's cooperative was formed Oomingmak, Musk Ox Producer's Cooperative and within ten more years over two hundred Alaska Natives were supplementing their subsistence lifestyle with a cash income vital to supporting their families through the year. The Cooperative continues to thrive today.

In 1984 the Farm incorporated as a 501(c)(3) non-profit corporation and moved to its present location in the Matanuska Valley near Palmer, Alaska in 1986.

Members of the project and a host of volunteers continue the work begun nearly sixty years ago. The commitment to the domestication of the musk ox, and to the establishment of a cottage-based textile industry, is as strong now as it was when John Teal began the project.

Supplemental Materials

Hands on Kit

The Musk Ox Farm has produced a kit filled with hands-on items related to musk oxen. Contact the Farm for availability of this kit.

Videos

The Musk Ox Farm has created a series of videos exploring many different aspects of life on the Farm and the musk oxen. Videos can be accessed on the Farm's website, www.muskoxfarm.org. Visit the website often as new videos will be added.

On The Internet

The following websites contain information relating to musk oxen. Due to the dynamic nature of the Internet we cannot assure that all these links will remain active over time.

- National Geographic: animals.nationalgeographic.com
- Oomingmak: www.qiviut.com
- www.ultimateungulate.com
- www.enchantedlearning.com/subjects/mammals/muskox/Muskoxprintout.shtml
- www.tundraanimals.net/tundraanimals/muskox.html
- Animal Planet: animals.howstuffworks.com/mammals/musk-ox-info.htm
- exhibits.museum.state.il.us/exhibits/larson/muskox.html
- Smithsonian: www.mnh.si.edu/arctic/html/mammals.html

- Encyclopedia Britannica: www.britannica.com/EBchecked/topic/399336/musk-ox
- www.alaskawildlife.org/animals/musk-oxen/
- BBC: www.bbc.co.uk/nature/life/Muskox
- Alaska Fish and Game: www.adfg.alaska.gov/index.cfm?adfg=muskox.main
- Harvard's Encyclopedia of Life: education.eol.org/podcast/muskox (a podcast exploring musk oxen as sentinels of climate change)
- Arctic National Wildlife Refuge: arctic.fws.gov/muskox.htm
- PBS Nature series episode segment: www.pbs.org/wnet/nature/episodes/white-falconwhite-wolf/musk-ox-of-the-arctic/3485/
- UAF Large Animal Research Station: www.muskoxuaf.org
- National Park Service: www.nps.gov/cakr/naturescience/upload/MuskOxFactSheet.pdf
- Frozen Planet video segment - Bulls charging: www.wired.com/wiredscience/2012/04/frozen-planet-video
- Frozen Planet video segment - musk oxen save calf: dsc.discovery.com/tv-shows/frozenplanet/videos/musk-ox-save-calf-from-wolves.htm
- Gates of the Arctic National Park and Preserve: www.nps.gov/gaar/naturescience/muskox.htm
- Wildlife Conservation Society: www.wcsnorthamerica.org/wildlife/muskox.aspx
- Forest Preserve District of Cook County (IL) - Musk ox bones found in Illinois: www.newton.dep.anl.gov/natbltn/700-799/nb740.htm

Children's Books

- Little Polar Bear and the Reindeer*, Hans de Beer
Musk Ox Magic, Carol Nash Reed
The Sourdough Man, An Alaskan Folktale, Cherie B. Stihler
The Itchy Little Musk Ox, Tricia Brown
A is for Musk Ox, Erin Cabatingan and Matthew Myers

WHAT IS A MUSK OX ?

Investigations At A Glance

The following table shows the skills that each Investigation incorporates. Please refer to this table when planning your lesson.

Investigation	Skill Area							
	Math	Science	Reading	Writing	Critical Thinking/ Reasoning	Creative Thinking	Arts	Social Studies
1 - What is a Musk Ox?		x	x	x	x	x		
2 - Ice Age Survivor		x			x			x
3 - Where is Home?		x	x	x	x	x		
4 - Inside & Out		x			x			
5 - It's a Musk Ox's Life		x			x			
6 - Start a Musk Ox Farm	x	x	x	x	x	x	x	x
7 - Qiviut, Art & the Musk Ox				x		x	x	x

Teacher's Page

Notes:

This Investigation is a brief introduction to the musk ox.

Learning Objectives:

The students will:
 Learn what a musk ox is,
 learn what a mammal is, their characteristics, and how this relates to the musk ox,
 and learn basic taxonomy.

Materials:

- Copies of **Discover!** page for each student.
- Copies of **CARD A** if the **Mammal or Not?** activity is to be completed

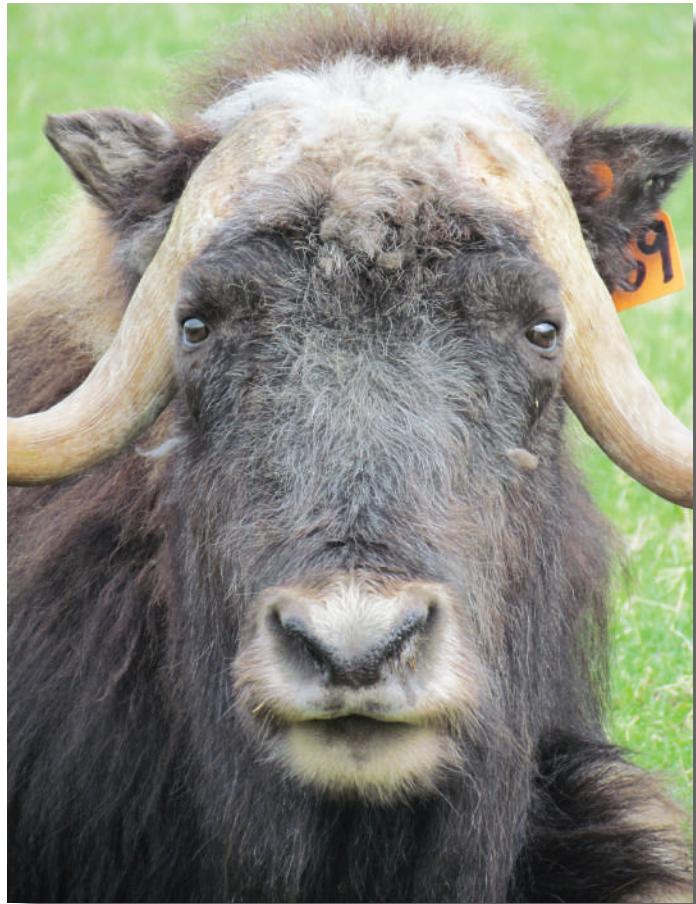
Vocabulary:

Characteristics = a distinguishing trait or quality

Musk = a substance with a pungent odor obtained from a sac beneath the abdominal skin of the male musk deer. It is also used to describe anything with a similar odor.

WHAT IS A MUSK OX ?

Discover!



The Name Problem

Large, shaggy and bearded the musk ox is not an ox and it doesn't produce musk. So why are they called this?

The confusion may have been because they look similar to an ox. Although an animal known as the musk deer is the only one that produces true musk, glands beneath a bull musk ox's eye produce a strong musky odor.

Put these two things together and you get the name musk ox! The plural of musk ox is musk oxen.

WHAT IS A MUSK OX ?

Discover!

Ovibos Moschatus

See those two strange words above? They are part of what is known as taxonomy, a method scientists use to put plants and animals into groups using their shared characteristics. There are eight different levels of groups in taxonomy.

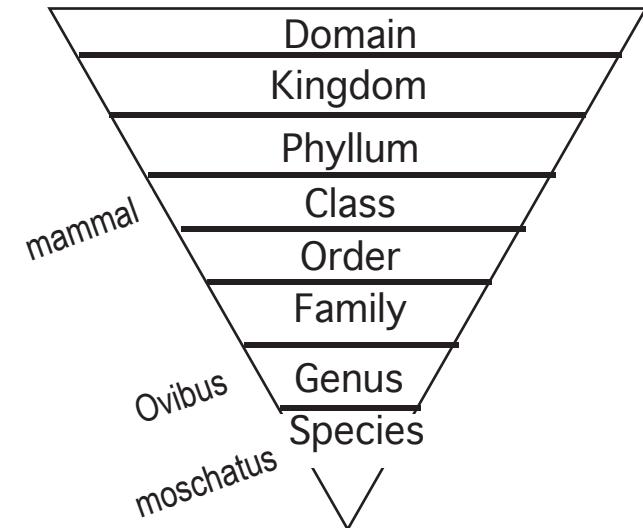
Each level has fewer and fewer members as the number of characteristics shared by members becomes less and less. Think of it as an upside down pyramid.

A musk ox is in the Animal Kingdom - that is a level at the top with many members. A musk ox is in the Mammal Class, two levels down in the pyramid, fewer members.

Now back to those strange words at the top of this section, *Ovibos moschatus*, which are Latin words.

Musk ox is in the *Ovibus* Genus, a level one up from the bottom of the pyramid and in the *moschatus* Species, the very bottom level.

Ovibus moschatus is the scientific name for.....can you guess?



So What Are They?

Musk oxen are mammals. Mammals are a class, or type, of animal that share certain characteristics.

Humans are mammals too! All mammals are warm blooded, give live birth, nurse their young, and have body hair.

Take a moment and think: How many mammals can you name?

Oomy's fun fact!!

Alaskan Natives know the musk ox as "Oomingmak", which means the bearded one.



1

WHAT IS A MUSK OX ?

Explore!



Mammal or Not?

Look at the photos on card A. Which are photos of mammals?

Write under each photo why you think it is or isn't a mammal.

Remember the characteristics that all mammals share.



The Name Game

You are an explorer and come across a herd of animals that has never been seen by a human before. They need a name so you know what to call them as you speak to others about your discovery. Write a short story about this animal and how you named it. Use your imagination!



A Part of the Family

Musk ox are in the family: Bovidae. Research, online or in the library, this Family.

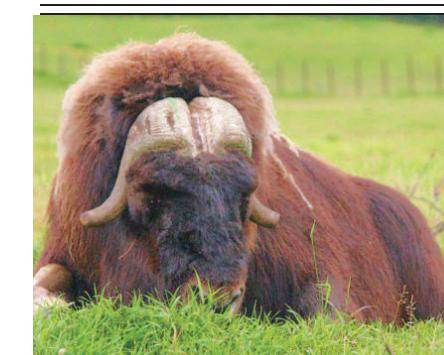
Prepare a report, written or oral, that includes the characteristics of members of this family, examples and a brief description of one member of Bovidae.

WHAT IS A MUSK OX ?

Card A

1

Mammal or Not?



ICE AGE SURVIVOR

Teacher's Page

Notes:

This Investigation is an introduction to the topics of geologic time, ice ages, and musk oxen as survivors of this ancient time.

Learning Objectives:

The students will:
 learn the meaning of geologic time and how its used,
 learn when the Pleistocene Era was and its relationg to musk oxen,
 learn what an ice age is,
 and learn what Beringia and Bering Land Bridge were and the importance to musk oxen.

Materials:

- Copies of **Discover!** page for each student.
- Copies of **Card A** and/or **Card B**, if the corresponding activities are to be completed

Vocabulary:

Fossil = a remnant, impression or trace of a plant or animal of past geologic ages that has been preserved in the earth's crust.

Geologist = a scientist who studies the history of the earth as recorded in rocks

Extinct = no longer existing

ICE AGE SURVIVOR

Discover!

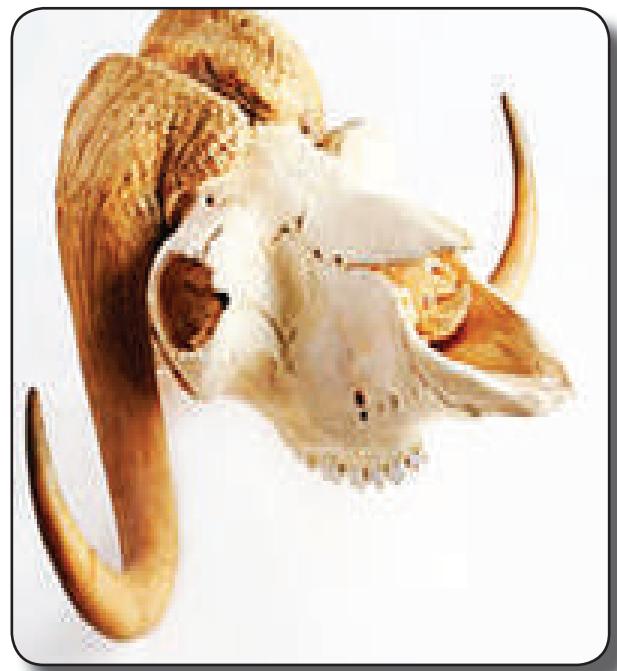
It's About Time

The Earth is very old; billions of years old. This amount of time is difficult to understand using the units of months and years, or even centuries.

The secret of the Earth's age is locked up in its rocks. Rocks are not all the same age -- or even nearly so -- but, like the pages in a long book, they record the events and life of the past, through fossils.

By looking carefully at the rocks, geologists have been able to determine when certain plants and animals lived on Earth.

Geologists have used what they have learned to create a timeline known as geologic time, dividing the Earth's history into Eras - broad spans of time based on the general type of life that existed during these times.



ICE AGE SURVIVOR

Discover!

The Ice Age

Musk oxen evolved during the Pleistocene Era, 2,588,000 to 11,700 years ago. This Era is known for its ice ages; times when many glaciers covered many parts of the Earth.

Musk oxen lived in Beringia, the area we now know as northern Russia, northern Alaska and some of northwest Canada.

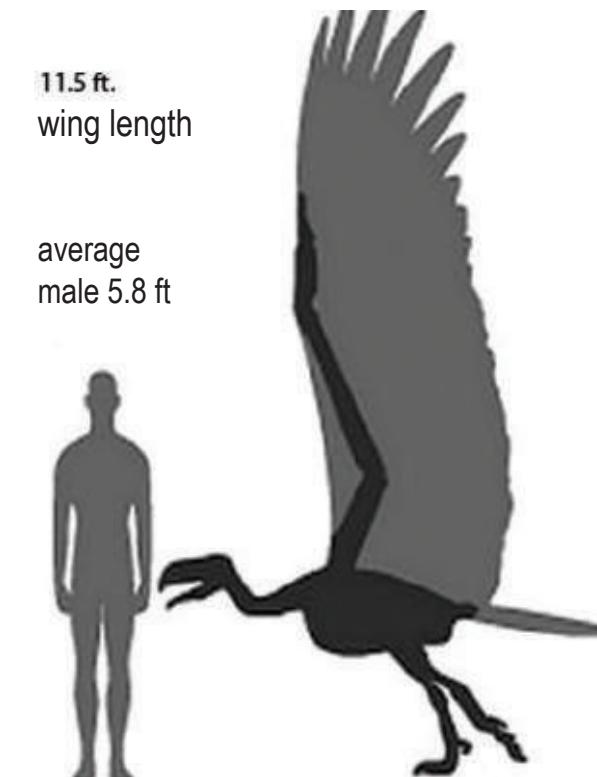
Much of Beringia was a grassland and during the ice ages did not have glaciers. It also includes the Bering Land Bridge, a vast area of land of roughly 1,000 miles which connected Siberia with North America at various times during the ice ages.

Musk oxen travelled along this land bridge from Asia into Alaska. When the glaciers melted at the end of the Pleistocene, the sea level rose and the Bering Land Bridge was submerged.

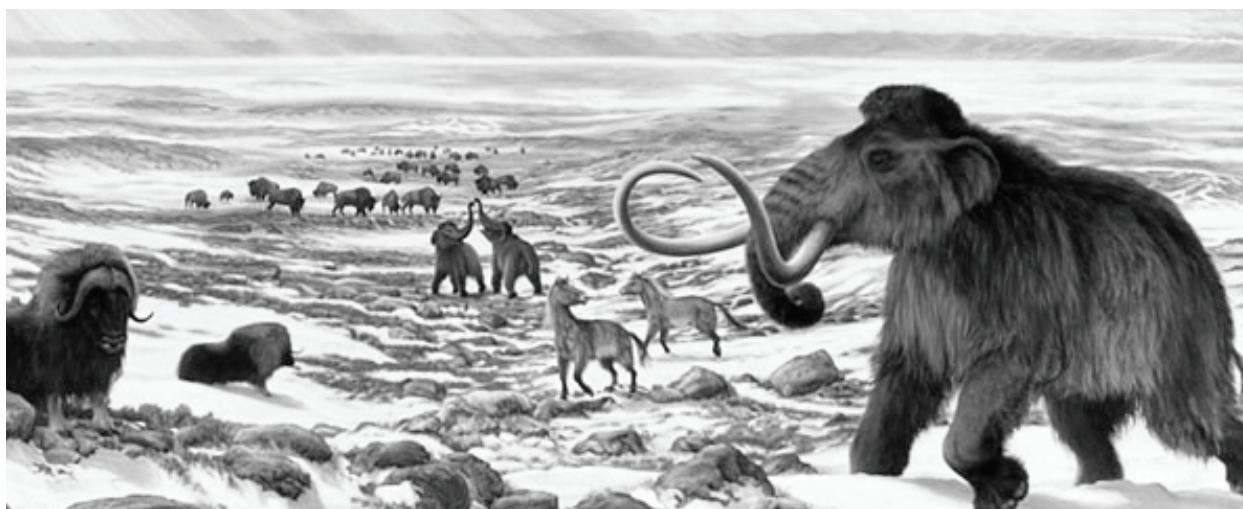


11.5 ft.
wing length

average
male 5.8 ft



Triceratops's height compared to an average adult male



ICE AGE SURVIVOR

Discover!

Survivors

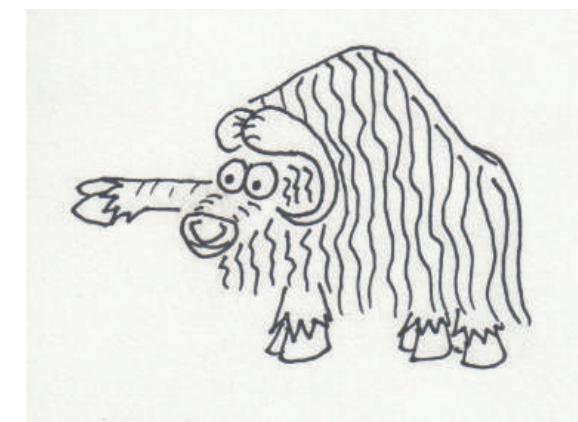
Mammoths, Mastodons, Saber-toothed cats, and Teratorns - birds with a 25-foot wingspan! These animals lived in the Pleistocene Era, but are not alive today. These ancient giant animals had very specific needs to survive; needs that often could not be met after the ice ages.

Many animals did survive and can still be seen in Alaska, and elsewhere, including the caribou, Dall sheep, elk, marmot, porcupines and musk oxen.

Humans too are ice age survivors. Why do you think some animals survived while others became extinct?

Oomy's fun fact!!

Did you know that the musk ox is one of the oldest mammals in all of North America? At the University of Alaska Fairbanks Museum of the North, prehistoric musk ox fossils are on display.



ICE AGE SURVIVOR

Explore!

 **Ice Age Maze
Card A**

Help the lone musk ox make it over the Bering Land Bridge to his herd on the other side.



 **Classroom Timeline**

Construct a timeline for your classroom. Choose as many important events as you wish, but be sure to include answers to the following:

When musk oxen first appeared on Earth (about 2.5 million years ago)

When Alaska became a state

When the Musk Ox Farm was founded

When your school was founded

When your teacher was born

 **Detective Stories
Card B**

Geologists learn about what happened on Earth in the past by looking at rocks and fossils. By looking at what was left behind, a story can be told.

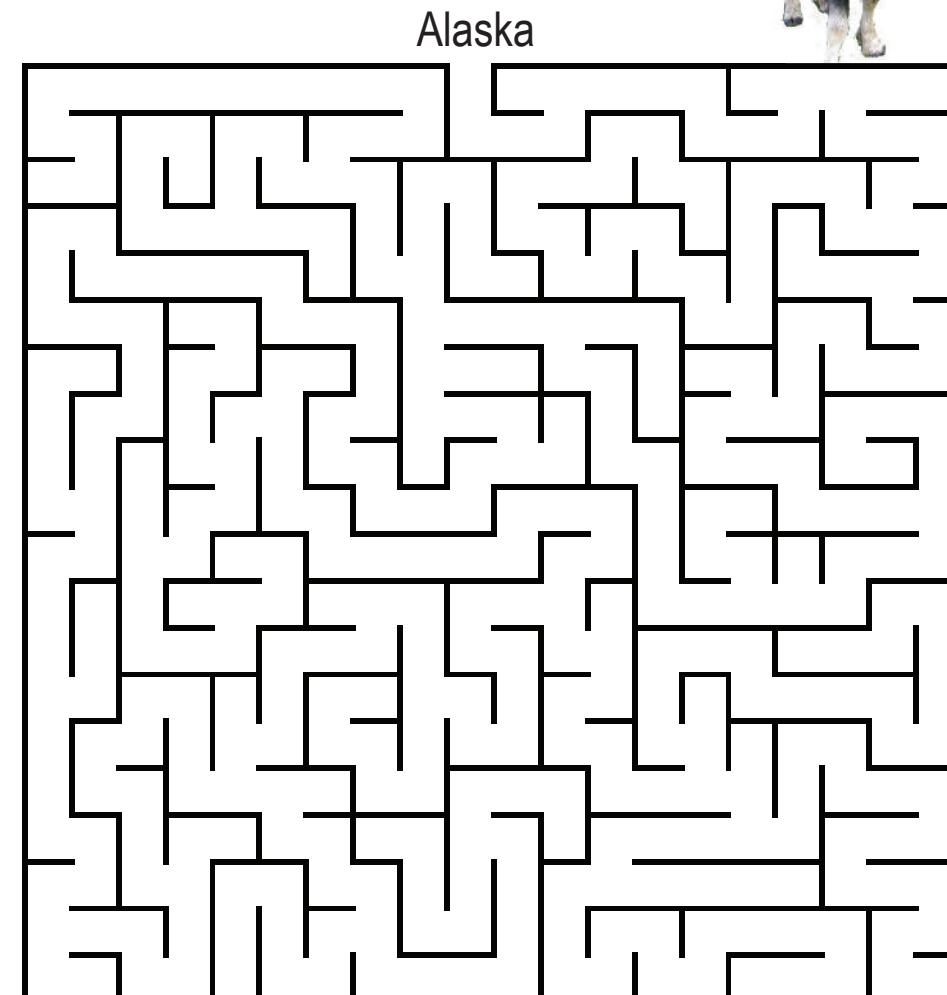
Look at the rocks and fossils on **Card B**. What story do they tell? Write it!

ICE AGE SURVIVOR

Card A

Ice Age Maze

Help the lone musk ox make it over the Bering Land Bridge to his herd on the other side.



ICE AGE SURVIVOR

Card B Detective Stories



WHERE IS HOME?

Teacher's Page

Notes:

This Investigation introduces the topic of habitat and the concept that an animal has characteristics that enable it to thrive within its habitat.

Learning Objectives:

The students will:
 learn what a habitat is,
 learn what the musk ox habitat is,
 and understand that animals have characteristics that allow it to live in its habitat.

Materials:

- Copies of **Discover!** page for each student.
- Copies of **Card A** and/or **Card B**, if the corresponding activities are to be completed

Vocabulary:

Habitat = the place or environment where a plant or animal naturally lives and grows

Tundra = a level or rolling treeless plain in arctic or subarctic regions

Arctic = lands in and adjacent to the Arctic Ocean or located above the Arctic Circle

Herbivore = an animal that eats only plants

WHERE IS HOME?

Discover!

Picture This

Habitat is the natural environment in which an animal lives. Take a close look at the photo of a musk ox.

- What does it tell you about where this animal would live?
- Would the habitat be warm or cold? Why?
- Would it be land or water? Why?
- Would it be hilly or flat? Why?
- What else can you discover about the Musk ox's natural habitat by looking at the photo?



WHERE IS HOME?

Discover!

Musk Oxen Around the Globe



Putting It All Together

Look closely at the map. The hoof marked countries are places where musk oxen live. Make a list of those countries.

- What do these places have in common?
- Are they warm or cold?
- Are they near the equator or closer to the North Pole?
- If you were to live in one of these areas, what kind of clothing would you need?
- From what you discovered from the photo of the musk ox and the map, describe the musk oxen's habitat.

WHERE IS HOME?

Discover!



There's No Place Like Home

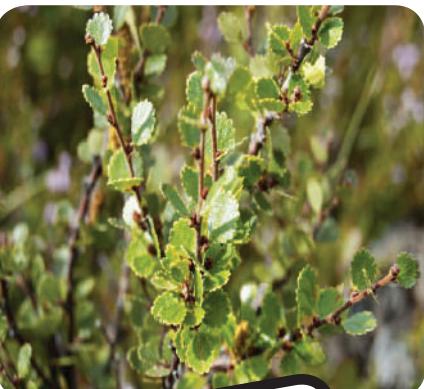
Musk oxen live throughout the Arctic. They can be found in the Arctic tundra of Canada, Greenland, Russia, Sweden, Norway, and of course, Alaska.

During the summer, musk oxen live in wet areas, such as heavily vegetated river valleys, moving to higher elevations in the winter to avoid deep snow. Musk oxen are herbivores, animals that eat plants only.

Musk oxen will eat grasses, mosses, lichens, and woody plants including dwarf willows, dwarf alders and dwarf birch.



lichen



dwarf birch

WHERE IS HOME?

Explore!

Match Game Card A

Match the animals to their habitat. Be able to explain why you think the animal lives where you matched it.

Who Lives There? Card B

Read the description of each habitat. Next to the habitat, create a list of characteristics of an animal that would live in this habitat. Would they need wings, fins, legs, fur, scales? Would they be big or small, tall or short? And so on.

Imagine That!

Select one item from each row below to create a habitat. Now, using your imagination, create the animal that would live there. Either draw a picture of your animal in its habitat or write a detailed description of the animal and explain why it lives where it does.

Row 1: Hot Cold Warm Cool
 Row 2: Dry Wet Rainy Snowy
 Row 3: Flat Rolling Hills Canyons Mountains
 Row 4: Grassy Forested Watery No Plants

Research It

Select one of the countries in which musk ox are found. Using your library and/or the internet try to find out as much as you can about the musk oxen in the selected country. Report what you have learned to your class.

WHERE IS HOME?

Card A

Match Game

Match the animals to their habitat



WHERE IS HOME?

Card B

Who Lives There?

Read the description of each habitat. Below the description, create a list of the characteristics the animal would need to live in this habitat. Would they need wings, fins, legs, fur, or scales? Would they be big, small, tall, or short? Would they need feet designed for traction, running, or swimming? And so on.

1. Mountains: steep slopes, cold in the winter with snow, warm in the summer with little rain, some trees, brush, and small streams at lower elevations, rocky at higher elevations

2. Deep water: warm temperatures all year round, underwater plants only

3. Grasslands: small shrubs and tall leafy trees that have tasty fruits and nuts, dry and hot most of the year with some rainfall in the spring, watering holes or streams are present but far apart

4. Swampy: water covers most of the area with shallow water along banks of land, trees and plants grow out of the submerged land, warm to hot all year long

5. Treetops: windy, temperatures range from cold to hot throughout the year

6. Cold and treeless flatlands: yearly precipitation, including melting snow, is 6-10 inches

7. Desert-like: low shrubs, willows, mosses and grasses

INSIDE & OUT!

Teacher's Page

Notes:

This Investigation take a thorough look at the musk ox's appearance and physiology and how these determine and are determined by how and where an animal lives.

Objectives:

The Students will:
describe a musk ox: both outside appearance and internal functions,
and understand and relate how these factors determine how and where the animal lives

Materials:

Copies of **Discover!** for each student.

Copies of **CARD A** if Parts with A Purpose is to be completed.

Vocabulary:

Ruminant = an herbivore that chews cud and has a four compartment stomach

Cud = food brought up into the mouth by a ruminant from its first stomach to be chewed

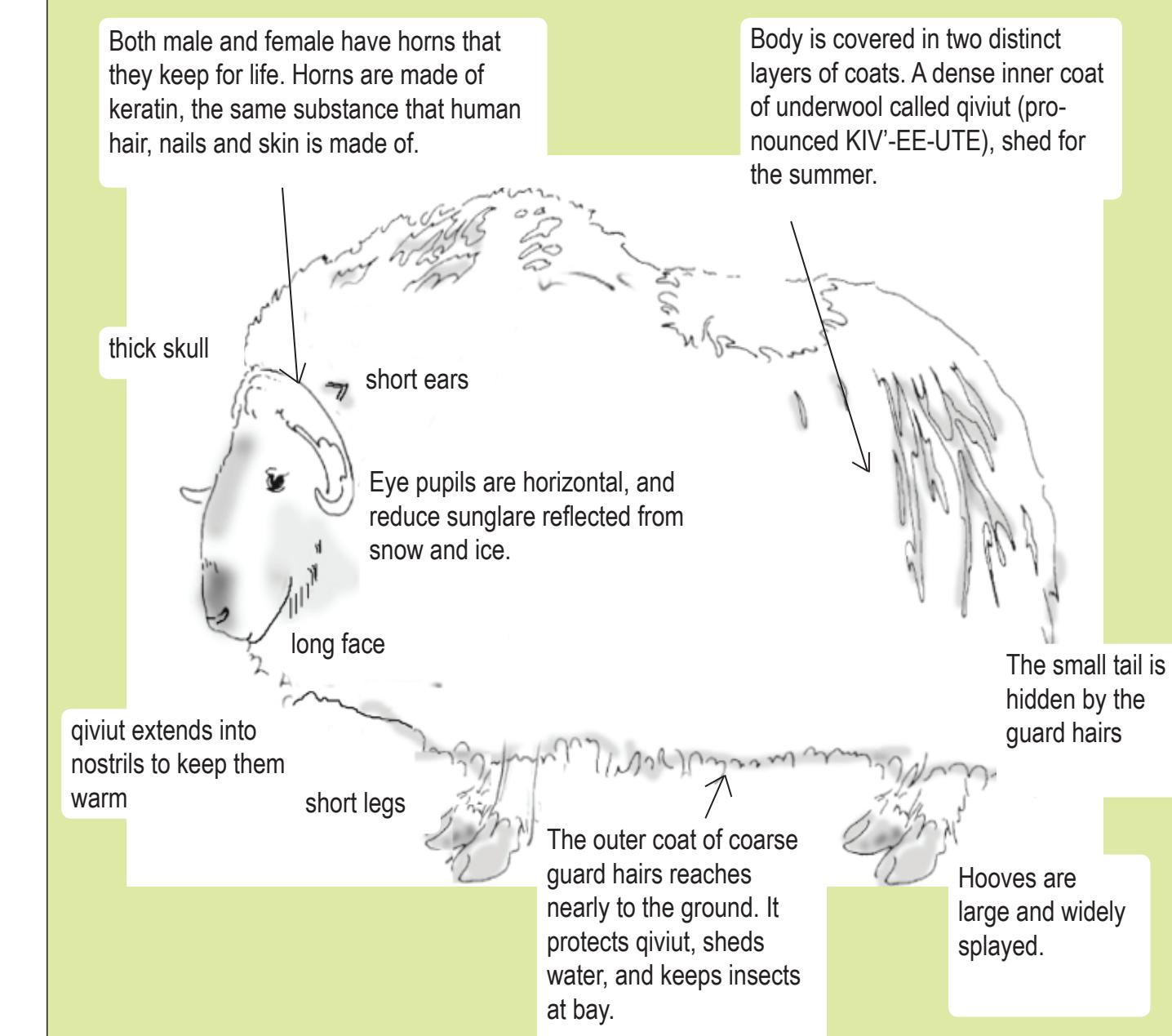
Migratory = an animal that moves on a regular schedule from one region to another for feeding or breeding

Digestion = the process of breaking down food into a form that can be absorbed by the body

INSIDE & OUT!

Discover!

Musk Oxen From the Outside



INSIDE & OUT!

Discover!

Musk Oxen From The Inside

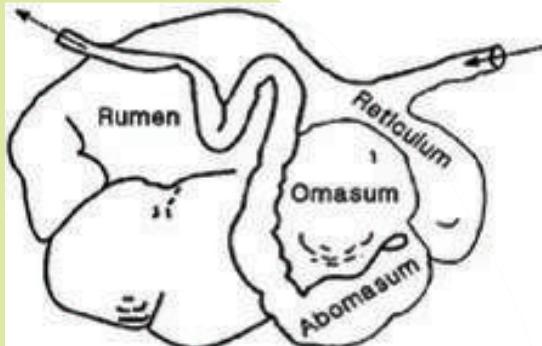
Musk oxen are ruminants, mammals whose stomachs have four compartments.

They digest plant-based food by initially softening it within the first compartment of their stomach, then regurgitating the semi-digested mass, now known as cud, and chewing it again.

Ruminants eat now and digest later! They quickly consume large amounts of food that are digested later when the animal is at rest.

This unique digestive system allows musk oxen to maximize as much energy and nutrients as possible from the plants they eat.

4 compartments
- 1 stomach



Teeth

Another feature of ruminants is their continuously growing teeth. Unlike humans, whose teeth stop growing at a particular age, ruminants' teeth continue to grow to compensate for the abrasion, wearing down of the teeth, caused by grazing.



Musk ox teeth, after years of chewing

INSIDE & OUT!

Discover!

An Uniquely Suited Animal

Put the outside and the inside together and you have an animal uniquely suited to life in the Arctic. Musk oxen live farther north than most other hoofed animals. Horizontal pupils allow less glare from snow and ice to enter the eye and result in better vision. Along with providing warmth, the double layer coat protects from biting insects and sheds rain and snow.

Short ears, short tails, stocky bodies and short legs minimize heat loss. Their compact size helps them conserve energy and eat less to maintain their weight. The thick skull and horns are used for defense against their main natural predators, bears and wolves, and in dominance displays. Their hooves provide good traction and a tool for pawing through snow to vegetation.

With their stubby legs, musk oxen are not migratory like caribou and polar bears, or great dashers like reindeer. Their approach to the harsh winter is: Save energy --Just stand or lie there! Extremely energy efficient musk oxen slow their breathing, heart rate and digestion in winter so they can survive on less food until the spring.



INSIDE & OUT!

Explore!



Parts with a Purpose

See CARD A. Draw a line between the musk ox “part” and the purpose it serves.

Pick a Part

What three musk ox characteristics, outside and/or inside, do you think are the most important for their life in the Arctic? List those characteristics and explain why you feel these are the most important. Share your list with your classmates. Be able to defend your list!

Arctic Expedition

You have been chosen to be a member of an expedition to the Arctic tundra to study how well humans can live in that environment. You must bring with you **everything** that you will need to survive for a month. Your expedition will occur in the winter. Write your provisions list. What will you take and why? Can you get any clues from what you learned about musk oxen that will help you develop your list?

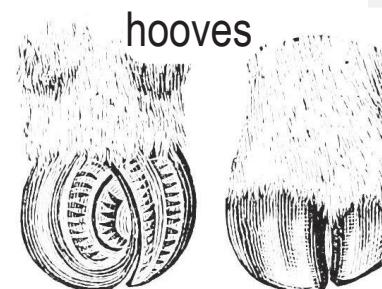
INSIDE & OUT!

Card A

Parts with a Purpose

Draw a line connecting the Part to its Purpose. Some purposes may be used more than once.

Parts



horizontal pupils



stocky body and over-coat

Purpose

Defense

Eat now, Chew later

Warmth

Shed snow and rain

Traction

Like sunglasses

Parts



qiviut



four-chambered stomach

IT'S A MUSK OX'S LIFE

Teacher's Page

Notes:

This Investigation takes a look at the life of musk oxen in the wild including birth, herd structure, mating, and defenses. **It's A Musk Ox's Life** has only one **Explore!** activity, suitable for all grade levels and abilities. A variation of the classic children's game Red Rover, **Stand Your Ground** is an active game designed to mimic, in a general way, musk oxen's main defense strategy.

Learning Objectives:

The Student will:
 learn the life cycle of musk oxen,
 learn about life in the herd,
 and understand how musk oxen defend against predators; the advantages and disadvantages of this strategy

Materials:

Playground, gym, or large area suitable for an active game.

Vocabulary:

Bull = a male musk ox that can be used for breeding
Cow = a female musk ox that can be used for breeding
Calf = a young musk ox up to one year old
Gestation = the length of time an animal is carried in its mother before it is born
Predator = an animal that preys (hunts to eat) another animal

IT'S A MUSK OX'S LIFE

Discover!

A Musk Ox's Year

Musk oxen breed from August through October. Cows give birth to a calf the following April, May, or June. Gestation is 8 months long.

They may not give birth every year if food is scarce and the weather is harsh.

Although they do not migrate, musk oxen will range about 50 miles between summer and winter feeding areas.

Musk oxen form small herds, usually some bulls and cows with their calves. These small herds may come together for short periods, forming larger herds. But, to insure that they have enough food, musk oxen will eventually split up to find separate grazing areas. In the summer the musk oxen stuff themselves to put on enough fat to help them survive the long winter.



Musk ox cow with new born calf



Musk ox cows in spring at the farm

IT'S A MUSK OX'S LIFE

Discover!

Growing Up Musk Ox

At birth a calf weighs 18 - 25 pounds. Cows reach adult stature at 3-4 years, bulls at 6-8 years.

Young bulls are driven out of their herd as they approach breeding age. They may form their own bachelor herds until they are old enough and strong enough to overpower a dominant bull to take over his herd.



During rut, mating season, bulls will compete for mates by ramming their heads together.

Their skulls and horn bosses are thick: the skull of an adult male is 3 inches thick, and the horn boss is four inches thick. The horn boss refers to both horns, which protects their brains when two bulls collide with each other at speeds of up to 35 miles an hour!

They will repeat this ramming until one bull gives up and leaves the area.

IT'S A MUSK OX'S LIFE

Discover!

Standing Their Ground

When threatened, musk oxen form a defensive circle or line. If attacked by a predator, they will first run to a higher location, then turn and stand shoulder to shoulder, facing outward, heads lowered, forming an impressive wall of musk oxen.

The calves are safely protected behind this wall, in the middle of the ring. If necessary, an adult or two may charge from the circle to attack the predators, and the circle would close behind them.

This defense works well against their natural predators, wolves and bears, but makes them vulnerable to human hunters. Why do you think this strategy makes them vulnerable to hunters?



Oomy's fun fact!!

Musk oxen live to be about 20 years old!!



IT'S A MUSK OX'S LIFE

Explore!

Stand your Ground - An Active Game

Basic Game

What you need to play: Students and a large area like a playground or gym

Objective of the Game: break through the other teams line

Set up: Split students into two equal teams. Teams line up holding hands parallel to each other with lots of space in between.

How to Play: The first team will choose a player from the other team to try and break through their line.

After the child is chosen the team will yell, "Musk Ox! Musk Ox! Say the word! Let.....join the herd." (Fill in the blank with the name of the chosen child.)

The chosen child will run to the other team and try and break through the hands of any two children. If the runner breaks through they then choose someone from that team to take to their team.

If they don't break through then they must join the team.

The game ends when all the children are on one team.



IT'S A MUSK OX'S LIFE

Game Variations:

Use this game to explore how musk oxen defend themselves against predators.

- Play the basic game with students holding hands at arms length and relaxed, standing in a line.

- Play the basic game, but this time with the students holding hands and standing almost shoulder to shoulder in line. Is it easier or harder to get through the line?

- Play the game, but this time have one team of students be "musk oxen" while the other team of students are "wolves. Have the "musk oxen" choose a student from their team to be a "calf" that they will defend from the "wolves."



The objective for the "wolf pack" is to tag the "calf." They may do so by trying to run through or around the "musk oxen." The "musk oxen" must work to protect the "calf," if one "musk ox" moves to the right (or left) the entire herd must move with it.

For the sake of the game, so the "wolves" do not get frustrated, the "musk oxen" cannot completely encircle the "calf."

Start with ONE "wolf" trying to tag the "calf." If the "wolf" is not successful after its first attempt, it returns to its pack. Then, send TWO "wolves" to try to tag the "calf." If they are not successful after the first attempt, they return to their pack.

Keep adding "wolves" until the "calf" is tagged. How many "wolves" did it take to tag the "calf?"

Switch sides; "wolves" will now be "musk oxen," "musk oxen" will now be "wolves."

START A MUSK OX FARM!

Teacher's Page

Notes:

This Investigation is split into two parts.

Part A: The Cooperative Musk Ox will cover the reintroduction of musk oxen to Alaska, the mission of the Musk Ox Farm, and the Knitter's Cooperative.

Part B: Taming the Wild Musk Ox will introduce the concept of domestication and how this is being accomplished on the Musk Ox Farm.

Learning Objectives- Part A

The student will:

- learn the possible reasons for musk oxen extinction in Alaska,
- learn how musk oxen were reintroduced to Alaska and elsewhere,
- understand the importance of qiviut to the Musk Ox Farm,
- learn how the Musk Ox Farm was started,
- and understand the importance of the Knitter's Cooperative.

Learning Objectives- Part B

The student will:

- learn what domestication is,
- understand how domestication occurs in general and on the Farm,
- and learn the needs and costs associated with operating the Farm.

Vocabulary:

Relocate = to move to a new location/area.
Reintroduce = to bring back to a place where an animal once lived.
Cooperative = an organization owned by and operated for the benefit of those who use it.
Crop = a plant or animal product that can be grown and harvested for profit or subsistence.
Subsistence = producing enough, through hunting, fishing, gathering, growing, etc. for your own use or consumption.
Domestication = a change that happens in wild animals, when they are kept by humans for a long time.
Steer = a male musk ox that has been neutered and therefore cannot breed.

Materials:

- Copies of **Discover!** for each student.
- Copies of **CARD A** and **CARD B** if associated activities are to be completed.

START A MUSK OX FARM!

Discover!

Part A: The Cooperative Musk Ox

A Musk Oxen Crisis

Though musk oxen had lived in Alaska for thousands of years, by the late 1800s there were no musk oxen left in Alaska. In fact, there were as few as 5,000 in the entire world.



No one knows exactly why the musk oxen became extinct in Alaska, but it was probably because of climatic changes that made it hard for the animals to live and find enough food.



Capturing animals off Nunivak Island, Alaska

Saving the Musk Oxen

In 1930 the U.S. government relocated 34 musk ox calves from Greenland to Alaska. Their first stop was Fairbanks, where they spent 5 years, before they were moved to their permanent home on Nunivak Island.

The program was a success and since then musk oxen have been relocated or reintroduced to other parts of Alaska, Canada, Siberia, Greenland, Norway and Sweden. There are now about 125,000 musk oxen in the world!

START A MUSK OX FARM!

Discover!

The Musk Ox Farm

In the 1940s and 50s wild musk oxen in Alaska were still few and endangered. At the same time, the villages of coastal Alaska were looking for sources of income to supplement their traditional subsistence culture.



A man by the name of John Teal saw an opportunity for Native people and musk oxen to live together, so that both would thrive. After more than a decade of research, Teal started the Institute for Northern Agricultural Research, later known as the Musk Ox Project in Alaska. With help from the University of Alaska Fairbanks and countless volunteers, Alaska's first attempted domesticated musk ox farm started in Fairbanks in 1964, with 33 calves captured on Nunivak Island.

Each year the herd grew. Each year their qiviut was combed and spun into exquisite yarn. The qiviut was, and is, the Musk Ox Farm's crop! Eight times warmer than sheep's wool by weight and incredibly soft, qiviut is one of the finest wools in the world.

The Farm moved to its present location in the Matanuska Valley in Palmer, Alaska in 1986.

The Musk Ox Farm is dedicated to the domestication of the musk ox and to the promotion of qiviut production as a gentle and sustainable agricultural practice in the Far North.

With a focus on public education and providing additional income opportunities to Alaska Natives, Farm staff and volunteers continue the work begun nearly sixty years ago.

START A MUSK OX FARM!

Discover!

The Knitters Cooperative

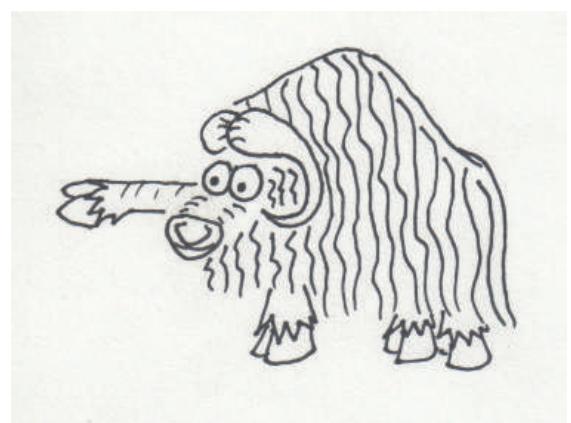
In 1968 the Project began workshops teaching Alaska Native women in villages such as Mekoryuk, Bethel, St. Mary's and Tununak how to knit the unique lacy pattern for qiviut garments.



Within a year, a knitter's cooperative was formed - Oomingmak, Musk Ox Producer's Cooperative. Today, over 200 Alaska Natives are earning some of the cash income so vital to getting their families through the year; to pay for such things as electricity and heat and other modern expenses every family faces.

Oomy's fun fact!!

Qiviut sells for \$ 100 an ounce!!



START A MUSK OX FARM!

Explore!

Word Search Card A

Find the hidden words. How many can you find AND define?

Farm Index Card B

Take a close look at two charts on CARD B. These charts show real data from the Musk Ox Farm.

What type of information can you get from each chart?

Using the charts, answer the following questions:

How many musk oxen are on the Farm?

Which are there more of, males or females?

Which appear to live longer, males or females?

Does qiviut production vary by age? By male or female?



A Closer Look Card B

Use the charts on this CARD B to answer the questions asked in the Farm Index activity. Now take an even closer look at what the charts are showing and answer the following questions:

- In addition to the information you gathered by answering the Farm Index questions, what other information do the charts provide?
- Is there a relationship between the number of musk oxen, their age/sex, and Qiviut production? What is it?
- What is happening with numbers and Qiviut production at 16-20 years of age? Is this a problem? Why or why not? (Look closely at the other age groups.)

START A MUSK OX FARM!

Card A

WORD SEARCH

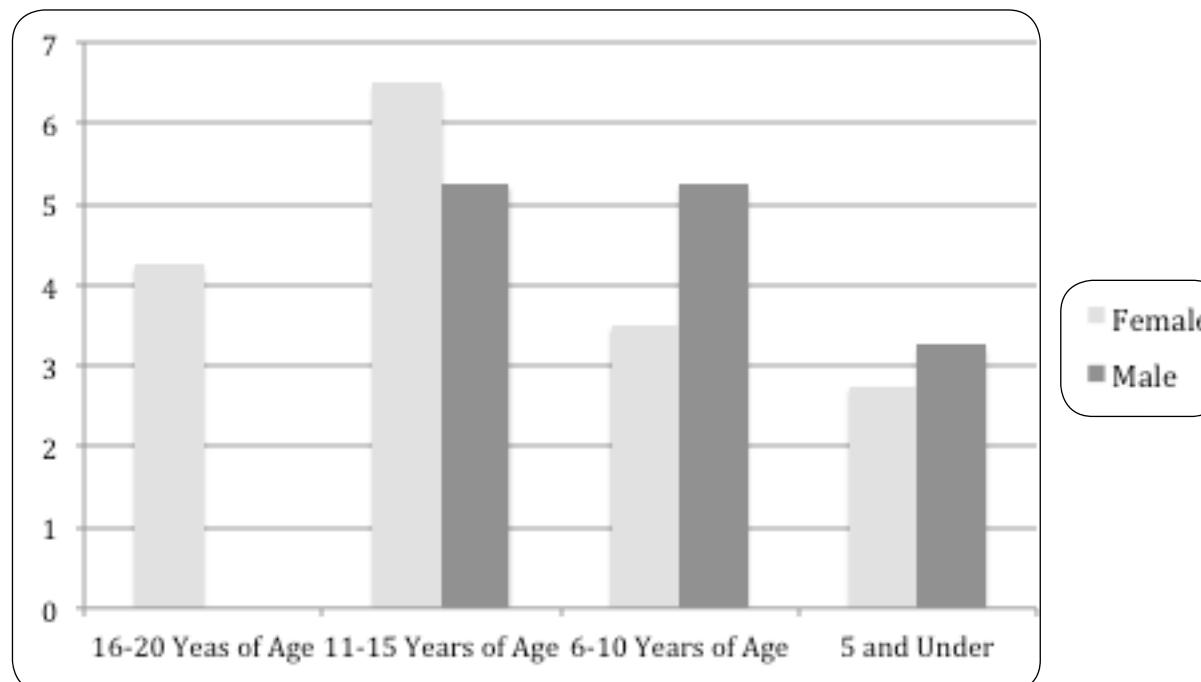
Find the hidden words. How many can you find AND define?

Z	M	M	M	K	I	B	G	A	J	Q	I	R	K	G
O	F	Z	S	B	A	A	K	G	P	I	Q	F	R	R
E	G	N	I	P	L	M	F	O	W	V	V	J	V	E
A	V	V	O	A	I	J	G	I	G	I	F	P	C	E
N	S	I	S	R	J	O	J	N	V	U	G	H	M	N
H	D	K	T	O	W	Z	N	W	I	T	H	A	E	L
I	A	F	R	A	G	A	I	U	L	M	T	T	X	A
Q	O	G	I	I	R	Q	Y	U	Q	A	O	V	T	N
C	Y	X	B	I	O	E	I	A	N	B	R	O	I	D
K	A	V	I	N	U	N	P	U	I	K	Q	X	N	N
L	M	H	T	U	M	H	S	O	Z	R	S	K	C	T
C	A	N	A	D	A	K	G	U	O	Y	E	U	T	K
W	T	A	Q	C	A	K	G	O	P	C	M	B	M	V
D	E	T	A	C	O	L	E	R	W	A	I	X	I	Y
C	C	R	O	P	R	T	F	G	M	Q	S	F	G	S

Word Bank

Alaska Crop Matanuska Nunivak Canada Extinct Norway Qiviut

Musk Oomingmak Relocated Cooperative Greenland Siberia

START A MUSK OX FARM!**Card B- Farm Index****START A MUSK OX FARM!****Musk Ox Population on the Farm****Qiviut Production by Age/Sex****Discover!****Part B: Taming Wild Musk Oxen****What is Domestication?**

Domestication is a change that happens in wild animals, when they are kept by humans for a long time. They become dependent on the humans who keep them, and they change in ways that are better for human use.

This change (domestication) is helped by humans choosing which animals to breed for the next generation. For example, dogs were domesticated by humans. When humans began farming, people domesticated sheep and goats, and later cattle and pigs. People domesticated animals to be livestock, used for food, clothing, and work, or to be kept as pets.

It can take hundreds of years for a species of animal to become domesticated. At the Farm, musk oxen are in the process of being domesticated as livestock.



Henrik Frederickson came to the farm in the mid 70s, to study musk ox management in the hope of starting a wool industry for the native people of Greenland.

START A MUSK OX FARM!

Discover!

So How is This Done?

The first step in domestication is getting the animal used to people, also known as taming. At the Farm, this begins when the calves are young, with gentle, consistent handling.

At two months, calves begin to be bottle-fed by handlers. This helps to socialize them to human-musk ox interaction.

Afterward calves are exposed to a variety of people, so that they do not become used to one person while remaining afraid of other humans.

As the calves grow to maturity, and throughout their lives, they will continue to be handled by humans during feeding, combing, and when they are moved from barn to pasture, and so on.

When it is breeding season, Farm managers will select the animals to breed. They choose those animals with traits most desired in a domesticated animal, in the hopes that these traits will be passed on to their offspring.



START A MUSK OX FARM!

Discover!

On The Farm

The Musk Ox Farm is much like any other farm. There are barns for shelter, pastures for grazing and romping, troughs for water, bales of hay and bags of grain for feed, calf formula, and miles of fence to keep the animals enclosed.

There are even toys, such as tires and floats, for the musk oxen. Musk oxen are the livestock and qiviut is the crop. The Farm's musk oxen follow a yearly pattern similar to that of wild musk oxen. Calves are born in the spring, all musk oxen shed their undercoat for the summer, and mating between adults occurs in late summer and fall. There ARE differences on the farm, however. Musk oxen are combed by handlers to harvest the valuable qiviut. Grain is added to their diet to provide nutrients found in their natural Arctic habitat, which are not found on the Farm. Veterinary care, vaccinations and medications are provided.

During breeding season, bulls do not need to compete for mates. Instead Farm staff select a bull and several cows to be bred and they designate a pasture for the bull and his harem. Each



Average Yearly Costs Per Musk Ox

Hay	\$250
Grain	\$50
Minerals and Salt Licks	\$25
Veterinary Care	\$200
Vaccinations and Medications	\$36
Fencing	\$100
Calf Formula and Supplements (per 15 calves)	\$900

START A MUSK OX FARM!

Explore!



Name the Calves

When calves are born they are given names. All calves born the same year are given names from the same theme. In 2013, the theme was Tree species - all calves were given the name of different spices such as Hickory, Olive, Maple, Cedar, and so on. What benefits do you see to using a theme in naming calves born in the same year?

Imagine you are given the task of naming this year's calves. What theme would you use and what would be the names? Plan on needing 10 names for boys and 10 names for girls.

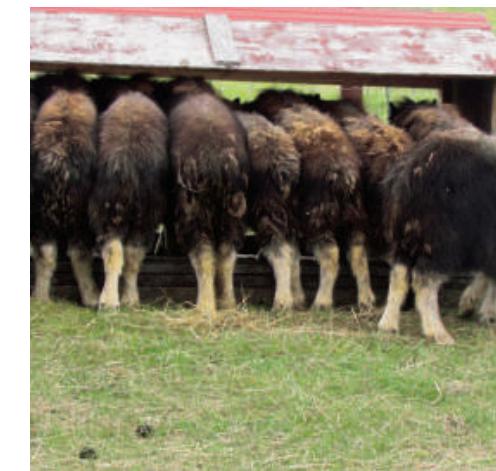


START A MUSK OX FARM!

Explore!



All levels!



2012 "Spice" calves, eating grain



The Cost Of Farming

Look at the figures below. These figures represent the annual cost and supply used for hay, feed and calf formula for 58 adults and 15 calves.

Hay	Use - 1750 bales	Cost - \$ 8.50 per table
Feed	Use - 12,000 pounds	Cost - \$3.25 per pound
Calf Formula	Use - 375 pounds	Cost - \$2.50 per pound

- What is the annual cost for hay? For feed? For calf formula?
- If a bale of hay weighs 50 pounds, how many pounds of hay are used each year?
- If 15 calves are fed, what is the cost of calf formula for each calf annually?
- Use this figure to determine the annual cost for 20 calves. What other annual costs would a farm have?
- What things other than the food items listed above would be needed to run a farm?

Classroom Cooperation

Would you like to be a member of the herd? Develop a class project to benefit the Musk Ox Farm. The Farm can use help educating people about the Farm and musk oxen, help around the Farm itself, and of course there is always a need to help meet Farm costs.

Some classroom project ideas could include:

- Set up a display in the library or on a hallway bulletin board that informs your schoolmates about the Musk Ox Farm.
- Contact the Farm and see if there are any projects or tasks your class can help with. Tackling even the easiest chores provides a benefit to the Farm.
- Design note cards for sale, have a bake sale or collect pennies in a classroom jar and donate your proceeds to the Farm.
- Adopt a musk ox for your class!
- Brainstorm with your classmates for more ideas.

QIVIUT, ART, & MUSK OX**QIVIUT, ART, & MUSK OX****Teacher's Page****Notes:**

This Investigation introduces the concept of art as an extension/reflection of daily life experience. The depiction of musk oxen in art, as well as the use of qiviut to make wearable art, will be explored.

Learning Objectives:

The student will:
learn about depictions of musk oxen in art,
and understand that art is often inspired by daily experiences, what we see
and do in our daily life.

Materials:

Copies of **Discover!** and **Explore!** for each student.

Vocabulary:

Inspiration = the action of awakening emotions and intellect.

Shaggy Inspirations

Musk oxen have inspired artists for thousands of years. In the Chauvet Caves of France, images of musk oxen, dating back 30,000 years, are painted on the cave walls. They are proof of a time when musk oxen lived much farther south than they do today.

Inuit people of the North have for generations made bone, fossil, and stone carvings of musk oxen, an animal they share the Arctic landscape with. Paintings of musk oxen can be found in many museums and galleries, particularly in northern countries.

A drawing of a musk ox even found its way onto a postage stamp in Canada



An early cave painting of a musk ox in France



Musk Ox, 1903–1904 Fullerton Harbour,
West Coast of Hudson Bay, Nunavut

**Art Today**

Today, photographers both professional and amateur continue to attempt to capture musk oxen's shaggy beauty in their photos. The Musk ox has also recently become a featured character in children's picture books!

QIVIUT, ART, & MUSK OX

Discover!

Qiviut

Perhaps what musk oxen have become most famous for is their qiviut, their soft undercoat of fur valued by knitters and weavers. Eight times warmer than sheep's wool, incredibly soft to touch, and feeling almost weightless to wear, qiviut garments such as caps, scarves, and shawls are highly valued. Unlike sheep's wool, qiviut is not scratchy and will not shrink when washed in any water temperature.



Oomingmak

Oomingmak is the Alaskan co-operative owned by over 200 Alaska Natives, some of whom live in remote coastal villages of Alaska, who knit the qiviut items by hand. Each village has a signature pattern derived from traditional aspects of village life and Eskimo culture; these patterns may come from an ancient artifact or a beadwork design.

To Think About

Why are musk oxen seen in the art of Alaska Natives? Why might musk ox show up in the art of countries such as Canada, Russia, Greenland, Sweden or Norway? What does this tell you about how or where artists find their inspiration?

QIVIUT, ART, & MUSK OX

Explore!

Art Walk

Look around your classroom. Is there any art on display of musk oxen? Or of other animals or subjects found in Alaska? Now take a walk through your school and look for these same things. Did you find any? How about in your community? The next time you are going somewhere with your family - shopping, to the movies, etc. - or on your way home from school on the bus, look for art depicting musk oxen or other Alaskan animals or subjects.

Remember: Art can be paintings, drawings, photographs, carvings, weavings, sculptures, glasswork, jewelry, books...what else?!

A Just So Story

The British author, Rudyard Kipling wrote a series of stories known as Just So Stories. They are make believe stories that claim to tell how animals got their most noticeable characteristic. The titles of Just So Stories include:

- How the Camel Got His Hump
- How the Elephant Got His Trunk
- How The Leopard Got His Spots

Write a Just So Story for Musk Ox titled How the Musk Ox Got His(or Her).

You fill in the blank with the characteristic you want to highlight! If interested, ask your school or local librarian if she can show you any of Kipling's Just So Stories.

Explore!

Create It!

Using the musk ox as your inspiration, write a story or poem, paint or draw a picture, make a sculpture from clay or other material, create a postage stamp. Make Art! The sky, and your imagination, is the limit. Set up an exhibition of your art work in your classroom and invite other classes to visit.

Create It Too!

Working together as a class, develop an art project - inspired by musk oxen - that will decorate your school. Is there a bare hall bulletin board or display case that you can enhance with artwork? Could you make a wall hanging or a mobile that could be placed in a public spot in school? Brainstorm with your teacher and classmates about possible school art projects.

Musk Oxen Fast Facts

- **Scientific Name:** Ovibos moschatus
- **Taxonomic Category:** mammal, hoofed
- **Natural Habitat:** Arctic tundra
- **Where in The World:** Alaska, Canada, Greenland, Siberia, Sweden, Norway
- **Estimated Worldwide Population:** 125,000
- **Diet:** Herbivore
- **Weight:** over 400 - 1,000 pounds
- **Length:** 6.5 - 7 feet
- **Height:** 4-5 feet at the shoulder
- **Gestation:** 8 months
- **Personality:** Just like with people, personality varies from musk ox to musk ox. Many are gregarious and social, some would prefer to be left alone.

Overview

With wide hooves, hefty horns, weatherproof undercoats, and watershedding long hair dangling nearly to the ground, musk oxen can take whatever the tundra has to offer, from frigid temperatures to roaming packs of hungry wolves.

See Real Musk Oxen!

To view videos of musk oxen and life on the Musk Ox Farm, visit www.muskoxfarm.org.

New videos will be added, so visit the site often to see what is happening down on the Farm.