



Grade 9 Teacher Resource- Surviving the Ice Age Guide

Curricular Outcome: Science 9 “Cells are Derived from Cells” and “The biosphere, geosphere, hydrosphere, and atmosphere are interconnected.”

Core Concepts:

Students will investigate what organisms needed to survive in Beringia and how survival depended on the interactions between living things, climate, water, land, and atmosphere. This program connects ideas of ecosystems, adaptations, climate, survival of populations, and environmental systems. The central idea for students is that survival in the Ice Age depended on Earth’s interconnected systems.

Big Questions:

What did it take to survive the Ice Age?

How were living things connected to their surroundings?

Why did some species survive while some didn’t?

How did earth systems shape Beringian life?

Learning Outcomes:

Students should understand:

Ecosystems are dependent on interactions in the Earth’s systems

The climate affects various populations

Living things respond to their environment

Survival depends on energy, water, shelter, and adaptation

Environmental change reshapes ecosystems

Introduction

Imagine a world where the vast steppe stretches unbroken as far as the eye can see.

It was a time when vast glaciers covered most of northern North America, locking up much of the world’s water as ice. During these “glacial periods”, global sea levels dropped as

much as 100-150 metres, revealing the floor of the Bering Sea and creating a connection of land between Alaska and Siberia.

This land bridge was part of the area we now call *Beringia*—an area stretching from Yukon to Siberia.

Unlike the rest of North America, the Beringian landscape in the far north remained free of ice. Glaciers did not form here because the climate was too dry. The lack of moisture also caused the boreal forests to disappear, turning the land into a vast plain full of nutritious grasses, herbs and flowering plants—an ecosystem that we now call the *mammoth steppe*.

The mammoth steppe was home to large herds of grazers, including woolly mammoths, steppe bison, and Yukon horses. It was also home to their predators—American lions, scimitar cats, giant short-faced bears, and the first humans to arrive in North America.

However, the earth’s climate was not always cold. Over the last 2.5 million years, earth’s climate has been made up of repeated cycles of cold “glacial” and much warmer “interglacial” periods. In the warmer interglacial periods, temperatures were similar to what we see today.

The last of these warm spells ended around 100,000 years ago. The warmer temperatures brought with them more moisture. The familiar boreal forests returned and the Bering land bridge was submerged once more. With these changes, a different set of animals thrived in the region. The huge Jefferson’s ground sloth, the giant beaver and the mastodon are just a few examples of the animals that once roamed Yukon’s ancient interglacial forests.

Beringia was much more than simply a region on a map, or a place where mammoths roamed a cold grassy plain. It was a gateway between continents.

The great North American ice sheets may have cut off Yukon from the rest of North America, but because of the Bering land bridge, this northwest corner of North America wasn’t completely isolated—it was connected to Siberia.

The land bridge allowed for the migration of species between the Americas and Eurasia. Many species of plants and animals were able to move from one continent to another. Horses, camels, caribou and black bears migrated out of North America, while bison, mammoths, moose, [elk](#) and humans migrated into North America. We may even find that woolly rhinoceros once moved across Beringia into North America! Without Beringia, the world would be very different from the way we know it today.

The Earth completed its last transition from cold glacial times to the present warm period around 11,000 years ago. The massive glaciers melted, flooding the land bridge and once again separating Asia and North America. Many of the ice age plants and animals, like woolly mammoths and the Yukon horses, disappeared — but others like caribou, sheep and grizzly bears can still be seen today.

The pilot question would be asking students if they could survive in these environments, and why or why not. In the upcoming steps, students will find out if they have what it takes to survive in Beringia.

Survival Simulation

Dice are required to play this game.

Important terminology to note: when this game refers to ‘members of population’ or similar, this is not referring to students. At no point should a student be removed from the game, rather the total number of animals within a species is altered.

This interactive, immersive experience will put students in the shoes of different creatures surviving the Ice Age. Students will be divided into groups of mammoths, bison, caribou, wolves, scimitar cats, and humans. The teacher, or whoever is leading the activity, will take the role of the ecosystem, where food resources can be obtained. Each group will have their own respective strengths and weaknesses. The game will take place over 6-10 rounds, which equate to one “Ice Age year”. In every round:

1. Environmental events occur
2. Species make survival decisions
3. Resources are distributed/lost
4. Population changes occur
5. Ecosystem consequences happen.

This will be repeated for 6-10 rounds, depending on teacher preference and time constraints.

Each species will receive a species card, which is in a separate file. The species card includes their food source, strengths, weaknesses, habitat needs, energy requirements, starting population, and what they can do on each turn.

Each round, species will need food. There will be tokens and/or cards provided in a separate file for these.

Food Population Changes

Food Requirement Met- No Population Loss (Except bison, who gains +1 when fully fed, and humans who lose one member of population when fully fed)

If 1 food short- lose one member of population

If 2 food short- lose two members of population

No food at all- lose four members of population

If 1 food surplus- Gain one member of population

If 2 food surplus- Gain two members of population

If 3 food surplus- Gain four members of population

Ex. A mammoth needs 3 food to maintain their population every round. If they get a surplus, their population grows. If they don't, their population declines.

The round-to-round population of each species can be tracked via the excel spreadsheet in a separate file.

Goal

The goal is to retain as much of your population as possible by the end of the game. The team with the highest percentage of population retained wins the game. If a population loses the entirety of their population, they are extinct and eliminated for the rest of the game. The members of the eliminated group are dispersed to other groups.

Species Cards

Mammoths- Herbivore

Strengths: Survives cold very well, large body makes them hard to hunt

Weaknesses: Requires huge amounts of food, slow reproduction, vulnerable to overhunting

Energy per round: 4

Food Requirements: 3 food

Starting Population: 12

Special Rule: Mammoths gain +1 food automatically during grassland boom

Strategy hint: Mammoths win through ecosystem stability, not aggression

Steppe Bison- Herbivore

Key prey species for predators

Strengths: Efficient grazers, moderate population growth, adaptable

Weaknesses: Heavily hunted, less cold protection

Energy per round: 4

Food Requirements: 3 food

Starting Population: 18

Special rule: gains +1 population if fully fed

Strategy hint: Survival comes from strength in numbers

Caribou- Herbivore

Flexible grazer with a stable population base

Strengths: Efficient food use, high survival in poor conditions, good at avoiding total collapse

Weaknesses: Lower strength against predators, very sensitive to hunting

Energy per round: 4

Food Requirements: 3 food

Starting Population: 14

Special Rule: Needs 1 less food during bad weather events

Strategy hint: Consistency beats power

Wolves- Predator

Controller of Herbivore Population

Strengths: Gaining food through hunting, flexible prey options, strong under stable ecosystems

Weaknesses: Depends entirely on prey availability, Collapse if prey decline too much

Energy per round: 5

Food Requirements: 3 food

Starting Population: 10

Special Rule: If wolves hunt and fail all hunts, they lose one population

Strategy hint: Balanced ecosystem needed for survival

Scimitar Cats- Predator

Specialized Apex Predator

Strengths: High hunting success, taking down large prey

Weaknesses: High energy demand, poor survival when prey is low, sensitive to ecosystem collapse

Energy per round: 5

Food Requirements: 3 food

Starting Population: 8

Special rule: Double food from successful mammoth hunts, failure results in -1 population loss.

Strategy hint: Early game is key

Humans

Flexible organism affecting all species

Strengths: Can choose multiple food sources, not dependent on one species, can adapt strategy each round

Weaknesses: Low survival rate, ecosystem collapse sensitivity, reliant on decision-making not biology.

Energy per round: 5

Food Requirements: 3 food

Starting Population: 10

Special Rule: Gather ability that guarantees food

Strategy Tip: Humans win by flexibility

In another file, there will be cards. These should be printed and shuffled into a deck. One card should be drawn before every round (except for the first round) to alter the in-game environment. Event effects last for one round and do not stack.

Climate Events

Extreme Winter +1 food cost for all species, humans lose ability to gather.

Rapid Warming- Mammoth, bison, wolf, scimitar cats- +1 food cost

Resource Shifts

Grassland Boom- If a herbivore successfully forages twice, they gain +1 additional food

Poor Vegetation Quality Year- Herbivores need +1 food

Biological Pressure

Predator Surge- When hunting, predators need -1 below the listed number to succeed.

Prey Collapse- When hunting, predators need +1 on top of the listed number to succeed.

Rare Events

Flood- The two 'winning species' give two members of their population to the two teams in last position.

Stable Year- Everyone receives 1 food and 1 member of population

Resource System

Each species will receive limited amounts of energy per round that they can spend or save for the next year. Herbivores receive less energy because they have more stable survival outcomes, while predators and humans have more variability but higher risk and consequences. Below is the amount of energy each species receives per round:

Mammoth- 4 energy

Bison- 4 energy

Caribou- 4 energy

Wolves- 5 energy

Scimitar Cats- 5 energy

Humans- 5 energy

Action System

Each year, species use their energy tokens towards actions. Below are the actions that can be taken each year. Groups can spend all their energy on one thing (ex. Foraging three times) or split it up into different things. All spending must be completed after the climate cards are drawn, but before the year begins. Groups may not roll once, then spend more energy to roll again, it must all be done at the start of the year.

Herbivores:

Forage- 1 Energy: Every time a herbivore forages they roll one die. Each time they roll a 4 or higher, they gain one food token. If they roll below a 4, their foraging was unsuccessful and they receive no food.

Graze- 2 Energy: Roll one die. On a roll of 5-6, you recover one member of your population.

Defend- 1 Energy: Defend yourself if you are hunted this year. Every one energy spent defending reduces the predator's number of dice by one. (Ex. Mammoth defends twice, wolves hunt them, they receive no dice and lose the energy spent attempting to hunt). If two predators hunt a herbivore, defending only protects against the first predator that attacks.

Predators

Hunt- 2 Energy: Before rolling two dice, predators must choose who they are hunting. If they hunt a mammoth, they must get a 6. If they are successful, each 6 will grant them 2 food from the ecosystem. If they hunt bison, they must roll a 4+, with each 4+ granting them 1 food from the ecosystem. If they hunt caribou, they must roll a 3+ to gain 1 food from the ecosystem. However, if caribous have chosen to defend that round, the hunting team needs to roll a 4+ instead of a 3+.

Any successful hunt will also drop the hunted herbivore population by 1, regardless of the number of successful dice rolled.

Risk Hunt- 3 Energy: Still roll two dice, selecting what species you want to hunt. Outcomes are the same as a regular hunt, but if successful in a risk hunt the food you receive is doubled (ex. A successful bison hunt would regularly be 1 food, but now grants 2). If a risk hunt is failed, the species that rolled the dice loses one member of their population.

Humans

Hunt- 2 Energy: Before rolling two dice, select who you are hunting. If both dice land on 4+, gain 2 food from the ecosystem. If one die lands on 4+, take one food. If neither die lands on 4+, you receive no food and lose the energy spent.

Gather- 2 Energy: This does not require any rolling. If humans gather, they immediately receive one food token from the ecosystem.

Pressure Hunt- 3 Energy: Select who you are hunting and roll two dice. You receive 2 food from the ecosystem per dice roll 4 or above. However, each unsuccessful roll loses one member of your population.

Teacher Script

Every Round:

1. **Draw Event Card:** Read the effect(s) that are in play for the round.
2. **Teams Choose Actions:** Prompt the groups to choose their actions for the round. Teams should write their selected actions on a whiteboard or piece of paper to ensure they do not change their selections. We recommend ensuring that the species do not talk to each other during this time.
3. **Resolve Hunting/Actions:** Teams take turns sharing their actions and completing them. In round 1, mammoths go first, round 2 bison go first, etc. Groups will collect their resources from a pile that you, “the ecosystem”, oversees.
4. **Collect Resources:** Collect food from the groups. Each group must pay 3 food to survive. Any leftover food can be used as surplus for the next year.
5. **Update Populations:** We recommend displaying this on a projector, smart board, or white board so that students can see it. It can then be updated either digitally or with a whiteboard marker.

Post-Game Reflection

These questions are intended to develop an understanding of why things happened the way they did in the activity.

Which species survived the best? Why?

How did humans impact the environment? Did they help or destabilize the ecosystem?

Were extinctions results of one event or many small pressures?

Why did your species survive or go extinct? What strategies did your species use? What would you change next time?

Compare the game to reality. Did the species that are extinct in real life go extinct in the game?