Johnny Morris's
WONDERS OF WILDLIFE
NATIONAL MUSEUM &
AQUARIUM

Arctic & Antarctic

Ecosystem Exploration Activity Workbook Teacher Guide

Arctic & Antarctic Ecosystems

Subject Area: Science – Geography, Ecosystems, Biodiversity

Grades: K-5

Time: This lesson can be completed in 1 day (6 hours).

Essential Questions:

- Where is the Arctic & Antarctic?
- How are they similar and different?
- Who survives there and how?
- What are the changes they face today?

Purpose and Overview:

Classes will learn where the Arctic & Antarctic are and why they have such extreme climates. You will lead your students using videos from our team and materials provided to engage in an expedition through Arctic and Antarctic ecosystems. At the end of the lesson students will have a better understanding of how these regions share similarities and differences, what kind of life they sustain, as well as what changes they are both facing today.

Introduction:

With this lesson students learn about two of the most extreme regions on the planet. Students will explore the ecosystems found in both and meet the organisms that call them home and discover how they survive such harsh climates. They will also take part in discussion about the changes these regions are facing today and what the cause and effects could be in the future.

They share both similarities as well as differences. The Arctic and the Antarctic are the two farthest points from the equator and two of the coldest places on earth. Both rotate in and out of darkness throughout the year and have diversity in wildlife. They both also have an impact on climate change.

There are however environmental changes happening that are affecting these ecosystems and are having global reactions. Efforts to understanding these impacts is key to helping preserve our planets diverse wildlife and habitats.

Objectives:

- Locate where the Arctic & Antarctic are using geographical maps.
- Compare similarities and differences between the two regions.
- Study how the organisms found in each region survive.
- Examine the impacts these regions are facing today and the effects it could have over time.

Standards:

Next Generation Science Standards

Disciplinary Core Ideas

- ESS2.D: Weather and Climate
- ESS3.B: Natural Hazards
- LS1.A: Structure and Function
- ESS2.A: Earth Materials and Systems
- ESS2.3: Biogeology
- ESS3.A: Natural Resources
- LS2.A: Interdependent Relationships in Ecosystems
- ESS3.C: Human Impacts on Earth Systems

Crosscutting Concepts

- Patterns
- Cause and Effect
- Systems and System Models

Science and Engineering Practices

- Evaluating and Communicating Information
- Constructing Explanations

Vocabulary

Adaptation: A characteristic or trait that allows an organism to be better suited for survival and reproduction within a given habitat.

Biodiversity: When many different types of animal and plant species live in a particular ecosystem or habitat.

Biome: Area on earth that have similar climates, plants, and animals. Biomes are defined by their average precipitation rates and temperature.

Climate: The regular prevailing weather and temperature conditions of an area over a long period of time.

Climate Change: Refers to the rapid increase in global temperatures. It is the result of an increase of carbon dioxide and other greenhouse gases in the atmosphere from the burning of fossil fuels.

Desert: A barren area of landscape where little precipitation occurs and, consequently, living conditions are hostile for plant and animal life.

Ecosystem: A community of living organisms in conjunction with the nonliving components of their environment, interacting as a system.

Endangered Species: A species of animal or plant that is in danger of going extinct.

Erosion: The process of wind, water, or other natural forces breaking down something over a period of time.

Extinction: Event when an entire species dies out and no longer exists.

Food Web: The mapping of the flow of energy through an ecosystem: who eats what, and who gets energy from whom.

Habitat: The natural home of a living thing.

Marine Animals: Any of numerous animals inhabiting the planets oceans and seas.

Organism: An individual living thing.

Precipitation: Water vapor that has condensed to fall to earth as rain or snow.

Survive: To continue to live or exist, especially in spite of danger or hardship.

Terrestrial Animals: Animals that live predominantly or entirely on land, as compared with aquatic animals, which live predominantly or entirely in the water.

Materials:

Teacher:

- Computer, Project Printouts, Screen, Internet

Videos:

- Videos are located throughout the document. Load them prior for quick access.

Printouts:

*****Attached throughout and at the end of the lesson plan*

Students:

- Writing Utensil
- Note Paper
- Printouts (best for your grade level)
- Scissors

Individual Supplies Per Lesson Craft: Student will need the supplies listed below for each craft.

Where in the World

- Markers for coloring regions

Identification T Chart

- Markers or Colored Pencils
- Glue/Tape

Polar Blubber Experiment

- Empty Ziploc baggie
- Tape
- Baggie of shortening
- Bowl of ice water

Penguin Paper Tube Craft

- Paper Tube
- Paper (Black, White, Orange)
- Googly Eyes
- Paint (Optional)

Classroom Discussion & Activities:

I. To begin, start off by asking your students some engaging questions. They can either be in a group discussion or asked and then have students write the answers down for later reference to see what they have learned after the lesson. Here are some questions you can ask…

- **a.** Why do you think they are called the North and the South poles?
- **b.** Where do you think they are on the planet?
- **c.** What do you think they have in common or makes them different?
- **d.** How do you think organisms survive in these extreme environments?
- **e.** Who do you think is affected by them?

II. With those questions answered and the discussion started, prepare video(s) and printouts for presentation to class.

- **a.** Hand out desired printouts
- **b.** https://www.youtube.com/watch?v=4t3J3YkCmwE
- **c.** Tailor the structure for your class

Where is the Arctic and the Antarctic?

1. Explore the globe with students and find the Arctic and Antarctic regions, point out key features on a globe or map. The world is divided into two main hemispheres: the northern hemisphere and southern hemisphere. They are separated by the equator which is evenly distant from the north and south poles.

- **a.** The Arctic is centered around the north pole in the northern hemisphere. Some surrounding countries are Russia, Greenland, and Canada. The Antarctic in centered around the south pole in the southern hemisphere. There is a centralized land mass here called Antarctica.

- **b.** Have students label, on their map, the distinct global markers and the locations of the Arctic and the Antarctic.

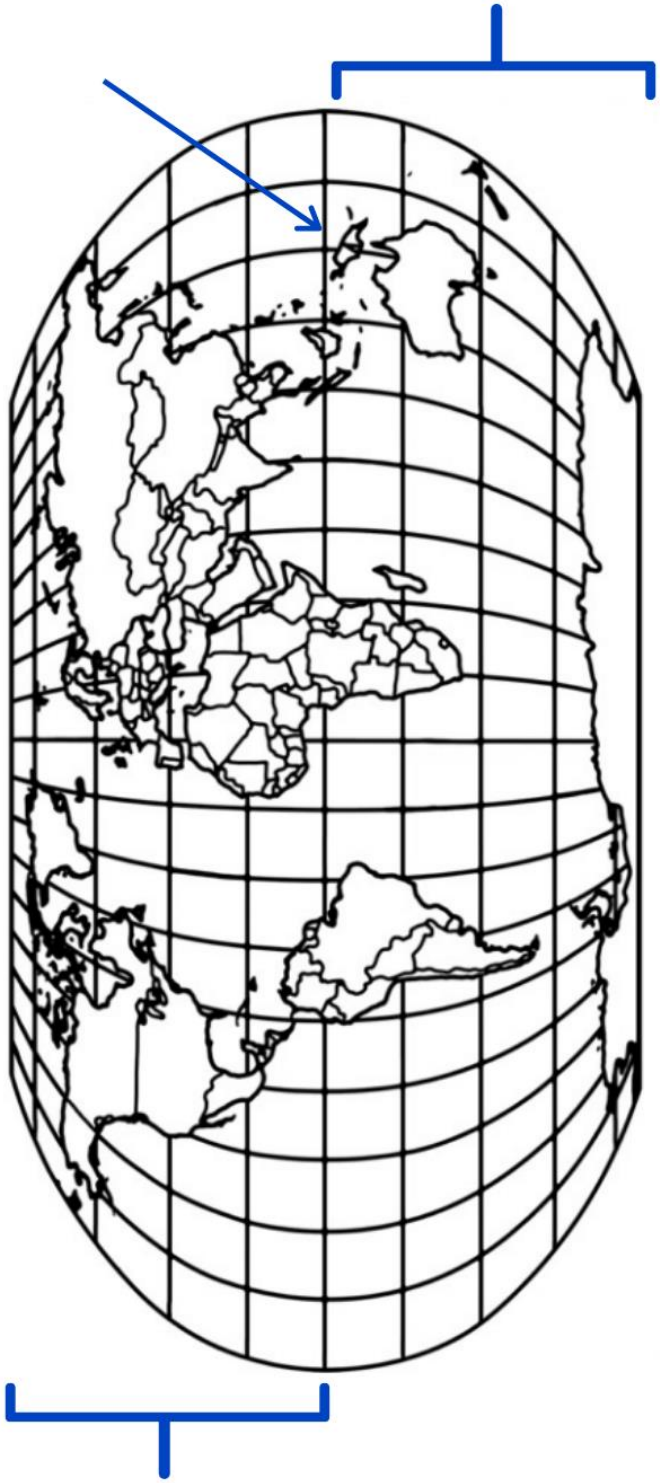
- **C.** Feel free to add any additional directions.

Student Name:

Where in the WORLD!?

Color in on the map the regions of the Arctic and the Antarctic can be found.

Additional Directions: Label both hemispheres and the equator



What similarities and differences do they have?

2. Have students make notes and utilize the Venn diagram in this section to compare the two regions. You can also use this as a group discussion section if you have them research facts using in class resources. For older students you can save the lesson sheet for after group discussion to see how much they have retained.

a. <u>The Arctic</u>

i. The Arctic Circle is the northern most part of the globe.
ii. There is land mass around the edges of the Arctic while the majority area is a frozen sea comprised of massive thick pack ice covered in snow. Essentially a frozen ocean surrounded by land.
iii. Because of its climate, the small portions of land mass within the Arctic are classified into the Tundra biome. This area has extremely low yearly precipitation.
    1. Provide students with the definition of climate. The regular prevailing weather and temperature conditions of an area over a long period of time.
    2. Provide students with the definition of biome. Area on earth that have similar climates, plants, and animals. Biomes are defined by their average precipitation rates and temperature.
    3. Provide students with the definition of precipitation. Water vapor that has condensed to fall to earth as rain or snow.
iv. The winter temperatures average between -45°F to -15°F (-43°C to -26°C).
v. The Arctic hosts a diversity of species such as: marine and terrestrial mammals, birds, fish, and invertebrates. On land grow plants like grasses, dwarf shrubs, some trees, mosses, lichens, and under the ice there's algae.
    1. Provide students with the definition of biodiversity. When many different types of animal and plant species live in a particular ecosystem or habitat.
    2. Provide students with the definition of marine animals. Any of numerous animals inhabiting the planets oceans and seas.
    3. Provide students with the definition of terrestrial animals. Animals that live predominantly or entirely on land, as compared with aquatic animals, which live predominantly or entirely in the water.
vi. The Northern Lights can also be seen in the Arctic.
vii. The region will experience days of 24hr darkness as well as days of 24hr sunlight depending on the season.
viii. There are roughly 4 million people who live the Arctic all year round.

b. The Antarctic

- **i.** The Antarctic is the southern most part of the globe.
- **ii.** The Antarctic tundra is located on the continent of Antarctica. A mountainous landmass covered with ice and snow.
- **iii.** This is the driest place on earth making it the world's largest desert.
    1. Provide students with the definition of desert. A barren area of landscape where little precipitation occurs and, consequently, living conditions are hostile for plant and animal life.
- **iv.** Not only is it the driest place on the earth, it is also the coldest. Winter temperatures here average between -80°F to -67°F (-62°C to -55°C). The coldest temperature ever recorded for the planet was -128.6°F (-89.2°C) in 1983 at the Southern Geomagnetic Pole in Antarctica.
- **v.** The barren landscape is so hospitable that only a few types of plants grow, and they are found in specific places, there are no trees found here. Algae can be found under the ice shelves where they thrive.
- **vi.** There are no land mammals that live here. The majority of animals that visit the continent primary are various species of sea birds and penguins. In the water are hosts of fish, seals, and whales.
- **vii.** However, Antarctica does have only one true native land-dwelling animal making it the largest terrestrial predator and only insect, the Antarctic midge. They are between 2-6mm long, that is as tall as a standard staple (not stapler, staple).
- **viii.** Within the Antarctic waters you will find marine mammals, invertebrates, and fish.
- **ix.** The Antarctic is on a reverse season calendar from the Arctic. When it is Winter in the Antarctic it is Summer in the Arctic.
- **x.** The Antarctic only has visitors and tourists who frequent it for limited periods at a time. No one lives here continuously throughout their life.

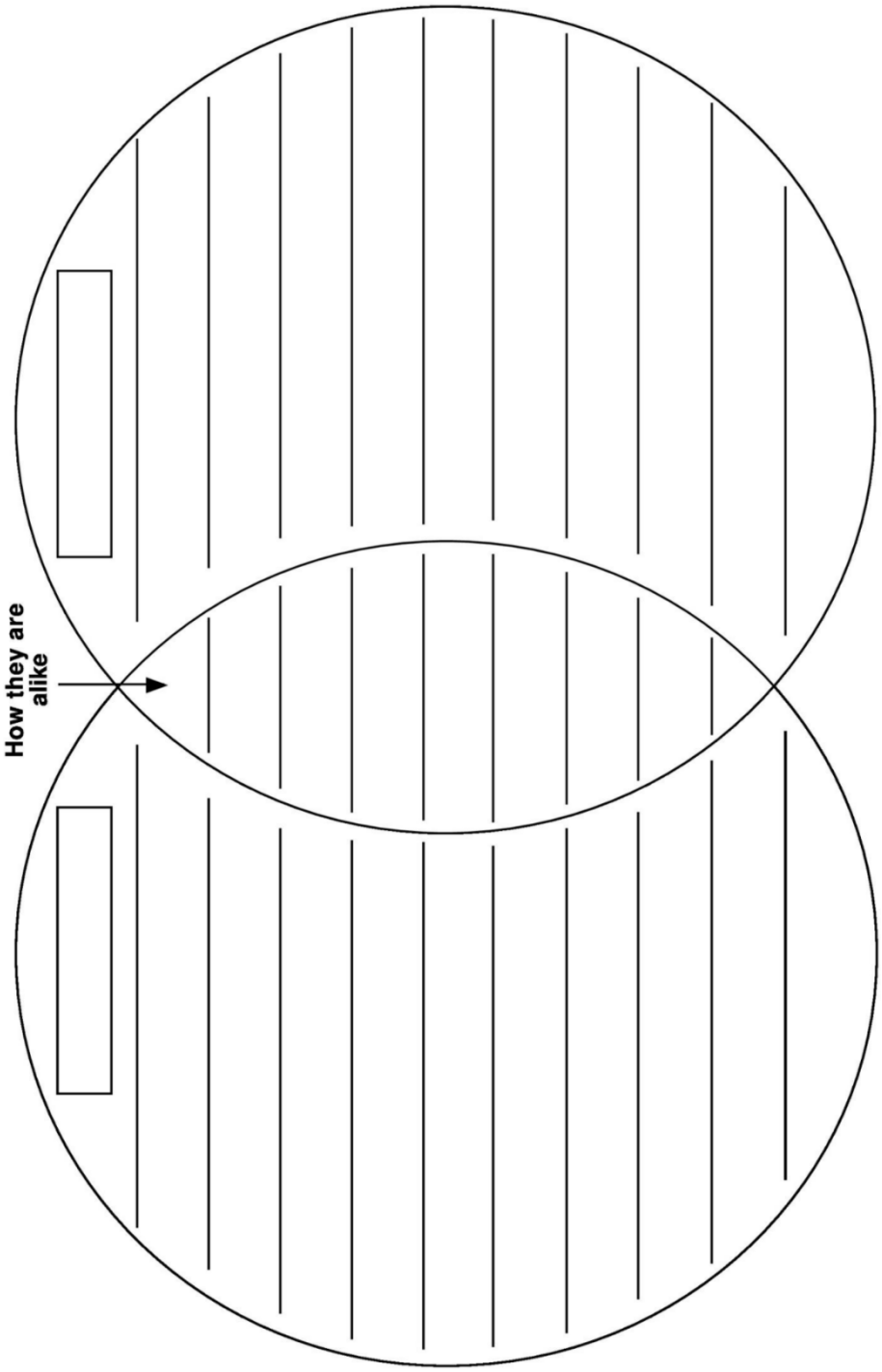
c. Other similarities

- **i.** They both go through periods of large algae blooms which are the bases for both regions' food webs. These blooms will bring animals from all over to feed on the abundance of food.
    1. Provide students with the definition of a food web. The mapping of the flow of energy through an ecosystem: who eats what, and who gets energy from whom.
- **ii.** Both act as giant reflectors for from the sun. Because they are so white, this bounces a lot of the sun's rays and heat from the earth's surface which helps regulate the planets other climates.

Student Name:

Arctic vs Antarctic

In the bubbles below, label one "Arctic" and the other "Antarctic". In the middles you will write down similarities that they share. In their bubbles, write down facts that are specific only to them.



Lands of Survival

3. Now that students have learned more about each region and briefly discussed some of the organisms that are found in them, lead a discussion focusing on how the organisms survive in these ecosystems and their specific habitats with the help of specialized adaptations.

-Provide students with the definition of organism. An individual living thing.
-Provide students with the definition of ecosystem. A community of living organisms in conjunction with the nonliving components of their environment, interacting as a system.
-Provide students with the definition of habitat. The natural home of a living thing.
-Provide students with the definition of adaptation. A characteristic or trait that allows an organism to be better suited for survival and reproduction within a given habitat.
-Provide students with the definition of survive. To continue to live or exist, especially despite danger or hardship.

a. Engage

i. Show students various pictures depicting different wildlife from both the Arctic and Antarctic. Have them label the two sides.
ii. Ask students to identify the wildlife and list them under Arctic or Antarctic.
iii. Have students use deduction and ask them what kind of adaptations they see and how they help the organisms survive within their environments.
iv. After activity, discuss how some organisms travel to both at different times of the year and why. (Humpback whales & Orcas)

b. Activity

i. For older students:
1. Have them list the organisms into separate columns on the T Chart between “Arctic” and “Antarctic”.
2. Then have them list 2 adaptations for each organism (just what the trait is, not how it works).
3. At the bottom have them pick an organism from each category and then explain how their adaptations work for survival.

ii. For younger students:

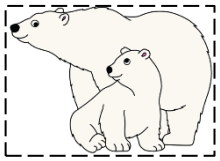
1. Have them cut-out the pictures of the animals and trait descriptions.
2. Next have them match the traits with the corresponding animals.
3. Then have them glue or paste the paper slips in the correct category of “Arctic” or “Antarctic”.

Identification T Chart

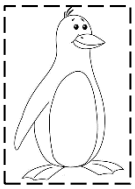
Name: _____

Animals

Polar Bear

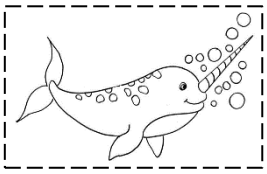


Gentoo Penguin

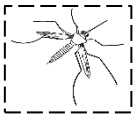


Leopard Seal

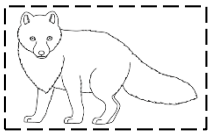
Narwhal



Antarctic Midge



Arctic Fox



Traits

Thick fur to keep warm, small ears to conserve heat, preferred meal rabbits

White appearance for camouflage on snow & ice, thick warm layer of fat & fur

Stands completely still to hibernate during winter, its blood keeps it from freezing, only insect that lives here

Thick feathers that trap air for insulation underwater, modified wings that act as “flippers” for swimming

Long protruding “tusks” with millions of nerve endings for finding food and warding off rivals

Spotted streamline bodies for speed underwater, curved teeth perfect for hunting penguins

Blubber Adaptation Hands On

With this experiment students will get a "firsthand" experience with what it would kind of feel like to have a blubbery layer to help keep them insulated to the frigged cold.

- Step 1: Fill a large bowl with ice. Fill with more ice as needed to keep water as cold as possible.
- Step 2: Pass out 1 empty baggie to each student and have them tape it around their wrist. Give instruction not to cut off circulation to the hand.
- Step 3: Fill a larger baggie with shortening. Enough so that when students put their bagged hand in, it will be surrounded completely by a layer of shortening.
- Step 4: Have students take turns coming up and putting their unbagged hand in the ice water. They will not need to leave it in long before they feel it starting to numb/stiffen/"burn"
- Step 5: Have students put their bagged hand within the shortening baggie into the ice water. If they feel the cold at all it is either because there is a gap in the shortening somewhere or the water has gone into the bag.
- Step 6: Clean up

Explain to students the properties on insulation and how blubber acts as avital adaptation for many animals that live within Arctic and Antarctic environments.

*Added learning: Have students write down predictions before the experiment and then record results after the experiment is complete.

Changes in the Poles

4. Lead students on a discussion about the changes the Arctic are Antarctic are facing. Discover what this means for the regions and the impacts they could have across the world. With each topic, give students the problem (cause) and have them write down or respond with they think the outcome (effect) would be.

a. Where there are fish, there are fisherman.

i. The Arctic Circle is teeming with fish that are eaten all over the word by different people who have never been to the Arctic before.
ii. Sustainable fishing is key to preserving the wild diversity of fish that not only we enjoy, but the fish that many other wildlife rely on.

b. Where in the world did all the ice go?

i. Both the Arctic and Antarctic may be two of the coldest regions on the planet, but they are still susceptible to change. With temperatures and climates changing, we can see the affects this in having in our polar regions.
1. Provide students with the definition of climate change. Refers to the rapid increase in global temperatures. It is the result of an increase of carbon dioxide and other greenhouse gases in the atmosphere from the burning of fossil fuels.

ii. Up north many of the icebergs and pack ice patches are getting smaller and smaller each year. Down south huge ice shelves are breaking away and drifting out into warmer waters. This is due to the rise in global temperatures.
iii. As temperatures rise the glaciers and ice begin to erode, releasing large quantities of fresh water that has been frozen and trapped for centuries.
1. Provide students with the definition of erosion. The process of wind, water, or other natural forces breaking down something over a period of time.

iv. When the water is introduced into the oceans, it causes sea levels to rise which can impact island and coastal communities and habitats.
v. As these areas shrink, so does their effect on combating the sun's rays, which cause even more rise in temperatures.
vi. Habitats are also impacted and many organisms that rely on certain conditions are struggling to survive. The iconic polar bear is one such organism that is greatly affected by the loss of pack ice. They use the pack ice to navigate their way across long distances of the frozen sea in search for food. With less and less

ice, polar bears are unable to find seal holes as well as find suitable areas for den building to raise young.

1. https://www.youtube.com/watch?v=yzD7zzsRw_k

c. With the loss of key habitats, many organisms face dire situations which can result in the species becoming endangered or even going extinct.

i. Provide students with the definition of endangered species. A species of animal or plant that is in danger of going extinct.

ii. Provide students with the definition of extinction. Event when an entire species dies out and no longer exists.

What You Can Do

5. Engage with your students and ask them what are some sustainable practices that they can do to help their environment and to explain how they would go about it.
   a. Here are some practices to help get them going if they are having a difficult time thinking of something.

i. Educate
ii. Volunteering
iii. Alternative energy
iv. Reduce, reuse, recycle
v. Reduce landfill waste
vi. Sustainable fishing & agriculture
vii. Protect wildlife
viii. Conserve water
ix. Regulations
x. Sustainable fishing
xi. Manufacturing practices
xii. Speaking up, raise your voice

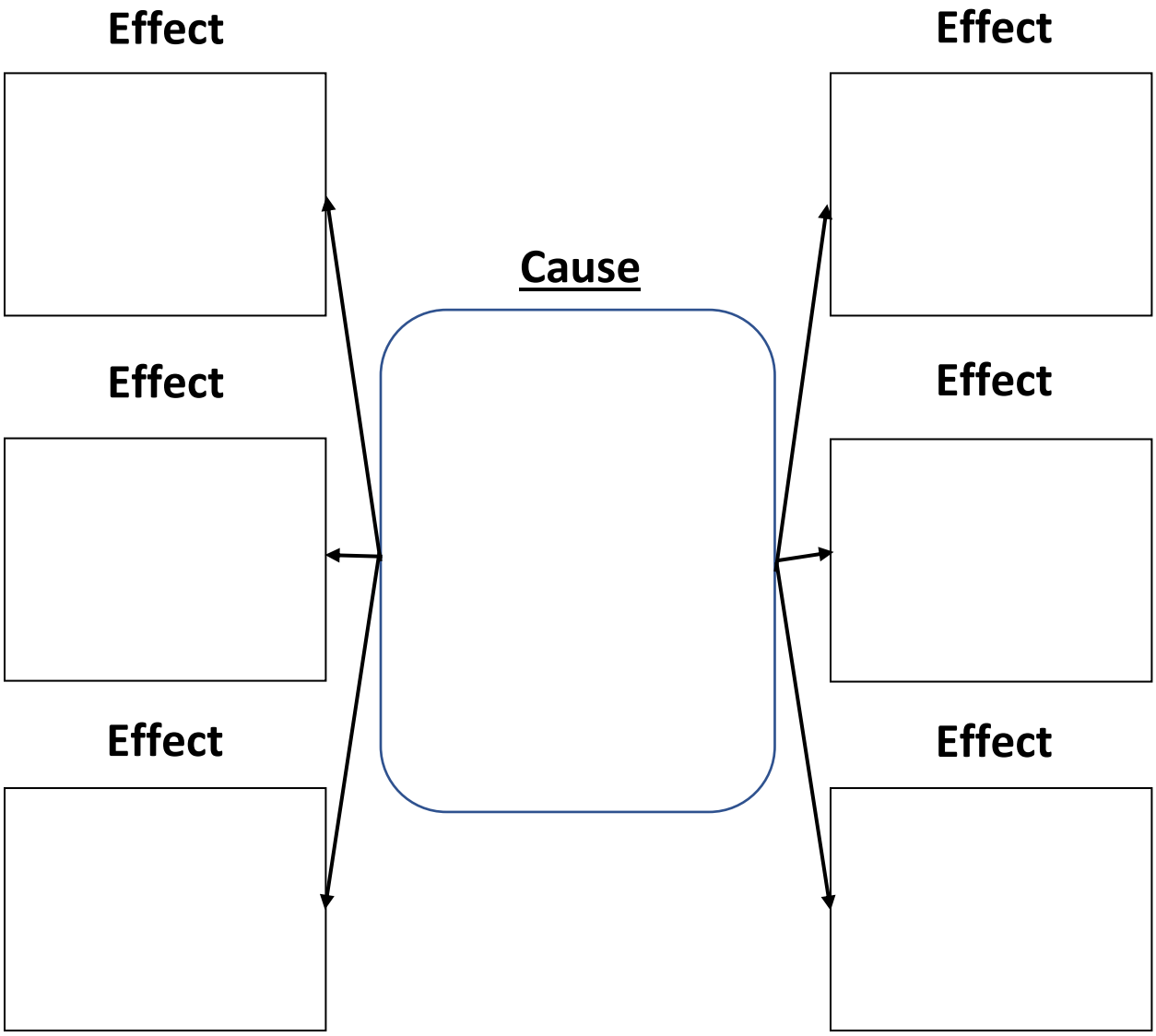
6. Hand out “Cause & Effects” lesson sheets.

d. Have the students list the major threat (Cause) that both regions face and SIX different impacts (Effects) it can have.

e. At the bottom have students list some of the ways they can help reduce their impact their environments.

Cause & Effects

Name: _____ **Date:** _____



What can you do?

_____

_____

_____

_____

Evaluation

7. Evaluate your students and see what they have learned.

    a. If you had the students write down the first questions and answer them, have them go back and answer the questions again to see if their answers have changed or stayed the same.

Additional Resources

Additional Videos:

- Need a brain break? Chill out with our resident Gentoo penguins!
    - https://www.youtube.com/watch?v=fzI4Gt2zIeg

Partners:

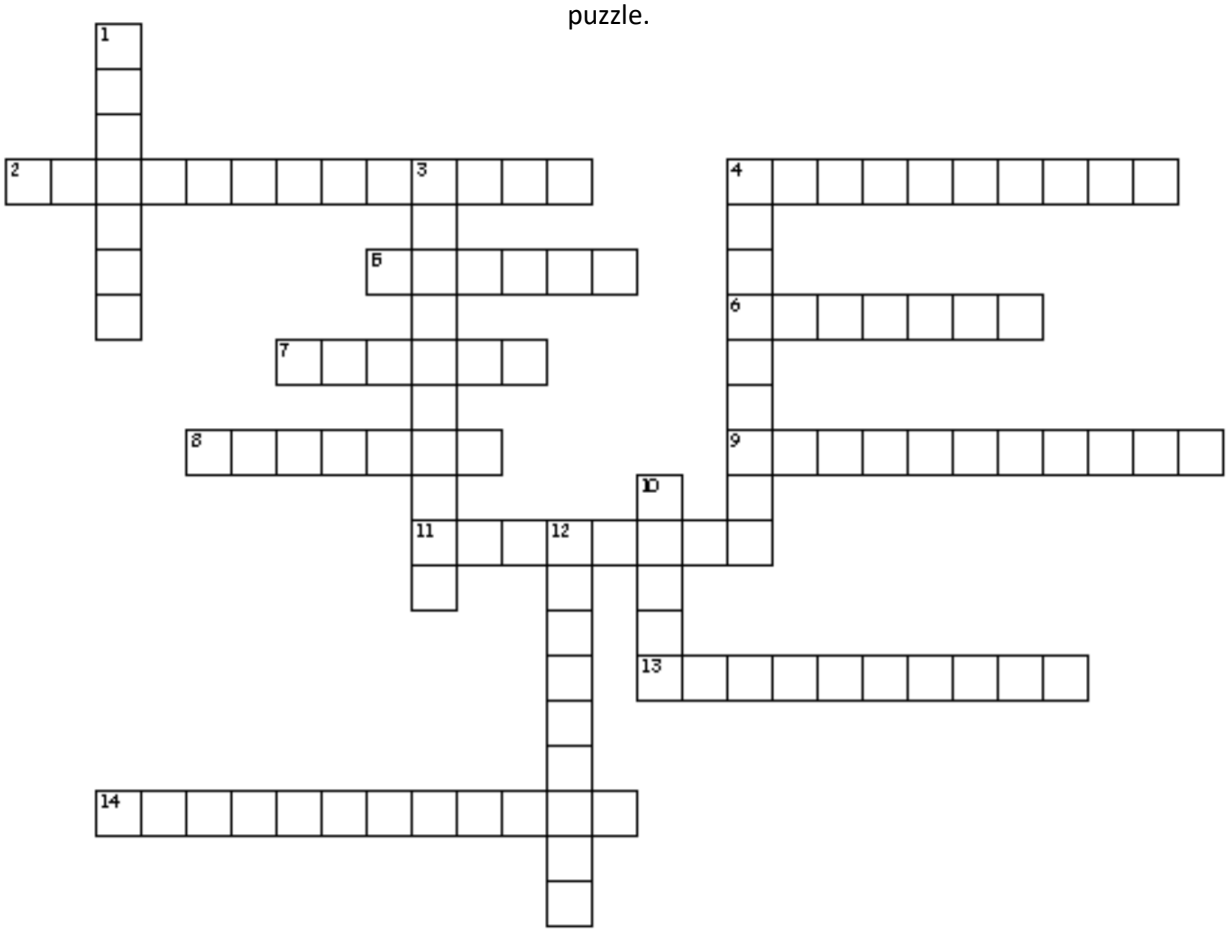
- National Wildlife Federation (NWF)
    - https://www.nwf.org/Kids-and-Family/Connecting-Kids-and-Nature

- Ranger Rick (NWF)
    - https://rangerrick.org/?_ga=2.83952921.1827964308.1609455164-139200432.1609455164

Thin Ice Crossword

Student Name:

Directions: Like a polar bear navigating the pack ice of the Arctic, you will need to use your knowledge obtained today to navigate your way around the tiles and complete the puzzle.



Across

2. the change in global temperatures
4. when an entire species dies out
5. type of animal that dwells in the oceans and seas
6. to continue to live in spite of danger or hardship
7. located in the northern hemisphere
8. the regular weather and temperature for a region
9. type of animal that primarily dwells on land
11. an individual living thing
13. is a category a species is placed in if they are in danger of going extinct
14. many different plant and animal species living together

Down

1. the natural home of a living thing
3. a trait that aids in survival
4. a community of living organisms
10. area with similar climate, animals, and plants
12. located in the southern hemisphere

Penguin Craft

This craft is designed for younger students and would be well paired with the "Penguin Brain Break" video playing in the background.

Materials:

- paper roll
- black paper (or black paint)
- orange paper (or orange paint)
- white paper (or white paint)
- scissors
- glue
- wiggle eyes stickers or googly eyes

Steps:

1 – Cutting

Cut out a black strip of paper that is the same width and circumfrance of the paper roll (or paint roll). Then cut a half oval shape out of white paper (or paint onto roll). Cut two wings out of black paper. Also cut out a beak shape (or paint onto roll) and two feet out of orange paper.

2 – Gluing

Glue black paper around paper tube so there is no exposed area.

Next glue on white half oval for belly and chest.

Then glue on sticker or googly eyes

Finally glue on beak and feet cutouts

1

2

Polar Word Search

Student Name:

C W V S N D U F S A Y V B V S

Y K H E U W S N Z Z Y W P U S

N G I A I G I A R C T I C N N

C J V L L U A M R R Q N O J J

I I H S G E W X A R D W Q U H

L X T N P K S E T A G L A C E

M Y E C O E X C V E S N O P U

G P A T R H S I F B H R E C Q

G L C E X A W Z L R K P M B H

X O U O C K T O R A T T S Y Y

K K H A Z G A N D L Z L A R A

U D E F G U K F A O P Y P Z L

D D F I Y K S I P P R I P Y Q

U K K Y B H P X Y R U S Q H W

S Z K N A M V O G C M O R S A

ANTARCTIC
FISH
POLARBEAR
WHALES

ARCTIC
ICE
SEALS

COLD
PENGUINS
SNOW