

GRADES K-8

ACTIVITIES GUIDE

nWAVE PICTURES DISTRIBUTION
PRESENTS

THE SEARCH FOR SNOW

A FILM BY
JACQUELINE FARMER & CYRIL BARBANÇON



nWAVE PICTURES & SAINT THOMAS PRODUCTIONS PRESENT
AN ASSOCIATION WITH OURAGAN FILMS, COPAN FILMS, AMBERJACK. A FILM BY CYRIL BARBANÇON & JACQUELINE FARMER
WITH JOHN FLANDERS. SCREENPLAY BY PHILIPPE CHAPUIS, JACQUELINE FARMER, CYRIL BARBANÇON, ANDREW BYATT, JOHN FLANDERS
MUSIC BY SAMUEL SAFA. DIRECTOR OF PHOTOGRAPHY CYRIL BARBANÇON
CINEMATOGRAPHY KEIR BYATT, FRANK NEVEU, JAY HUNTER, BERGSTEINN BJORGULFSSON. ASSISTANT DIRECTOR OLIVIER LARPIN
LOGISTICS BRYNDIS ERIKSDOTTIR. SOUND JACQUELINE FARMER, MARTINA FRANCO GOTA, OLIVIER LARPIN. EDITORS LUC PLANTIER, PIEL BOURCIER
EXECUTIVE PRODUCERS CYRIL BARBANÇON, JOLAN BARBANÇON. VISUAL EFFECTS nWAVE PICTURES. 3D FROM MARS. SOUND EDIT & DESIGN STUDIO FLOPIPO. PRODUCED BY JACQUELINE FARMER. ASSOCIATE PRODUCER ERIC DILLENS
CO-PRODUCED BY BENJAMIN SARFATI, BERTRAND LOYER, ANDY BYATT. PRODUCTION MANAGER DOMINIQUE LAGADEC. PRODUCTION ACCOUNTANT FÉLIX NAUD. SENIORITY MARIE BIRAGOLE. FINANCIAL ADMINISTRATION MANAGER LAURA KARLE
EXECUTIVE PRODUCER HASSIMA LATAMIA. INTERNATIONAL DISTRIBUTION nWAVE PICTURES DISTRIBUTION. MONTAGE WITH LES ORBES. LE PARC NATIONAL DES ÉCRINS. VULCANIA. PARC D'EXPLORATION DES VOLCANES ET DE LA PLANÈTE TERRE
CENTRE NATIONAL DU CINÉMA ET DE L'IMMAGÉ ANIMÉE. 86° NORTH. IZELANDAIR



www.thesearchforsnow.com

ACTIVITY I THE SHAPE OF SNOW

The Search for Snow is a new 3D movie about what happens when it snows. The movie shows how plants and animals survive snowy winters. It shows how snowstorms move from place to place, and how they change from year to year.

PART 1: SNOW FACTS

Have you ever gone out to play in the snow? Write three words to describe what it was like.

Now complete these sentences to learn more about snow. Fill in the blanks using these words.

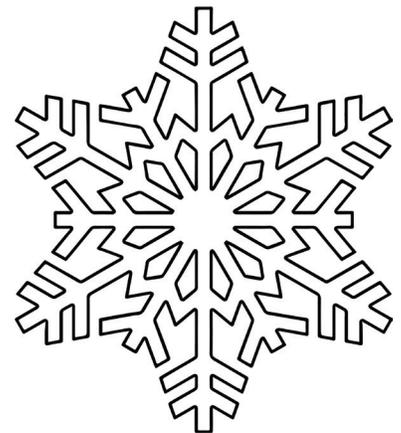
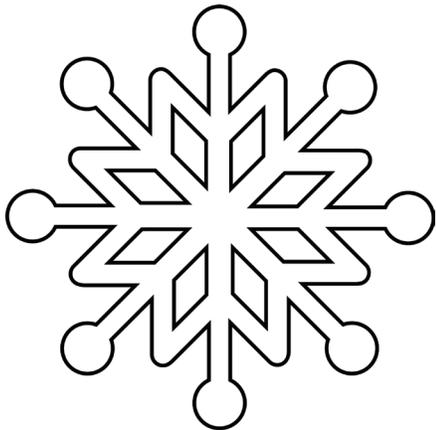
atmosphere changing crystal hexagons vapor

1. Snow forms high in the _____.
2. Snow begins as water _____.
3. The water vapor freezes into a _____.
4. All snow crystals are _____, meaning they have six sides.
5. Snow is always _____.
As a snow crystal falls from the sky, more water vapor attaches to it, and it grows bigger.



PART 2: SNOW SHAPES

Have you ever looked closely at a snowflake? Here are three examples. Study each one, then answer the questions.



What is the same on every snowflake? _____

What do you see that is different? _____

Now use the back of this sheet to draw and color your own snowflakes!

ACTIVITY 2 LIFE IN SNOW

In **The Search for Snow**, you meet some of the animals and plants that live in snowy climates. Let's learn more about them!

PART 1: ADAPTIVE ANIMALS

How do animals survive snowy weather? Many don't even try. They *migrate*. That means they move to a warmer place during the winter. Other animals, like bears, *hibernate*. That means they find a sheltered place to sleep until spring. But some animals can stay active all winter. They have special *adaptive features* that help them live in the cold weather. Read about these animals in the chart below. Then identify each animal by writing the correct number under its picture.



A. _____ B. _____ C. _____ D. _____ E. _____

Animal	Adaptive Features
1. Alpine Ibex	Moves up and down the mountains to stay where the temperature is just right.
2. Arctic Fox	Has thick fur that turns white in winter.
3. Chamois	Has special hooves that allow it to walk on snow.
4. Rock Ptarmigan	Has feathers on its feet to keep them warm, and turns white in winter.
5. Snow Hare	Has wide flat feet that don't sink into the snow and fur that turns white in winter.

PART 2: ADAPTIVE PLANTS

Plants can adapt to winter weather, too. Read about these four plants. Then match each one to its adaptive feature by writing the letters in the correct spaces.



- 1. Alpine snowbells have small, flat leaves. _____
 - 2. Tulips have bright flowers that stand tall in spring. _____
 - 3. Conifers (like pine trees) look like triangles. _____
 - 4. Rhododendrons are evergreen shrubs. _____
- A. Underground bulbs are kept cool until the flowers emerge in spring to bloom.
- B. Snow forms a blanket to keep them warm.
- C. Their thick leaves curl up in winter.
- D. Their sloping sides and needles help the snow slide to the ground instead of building up.

ACTIVITY I SPOTLIGHT ON SNOW

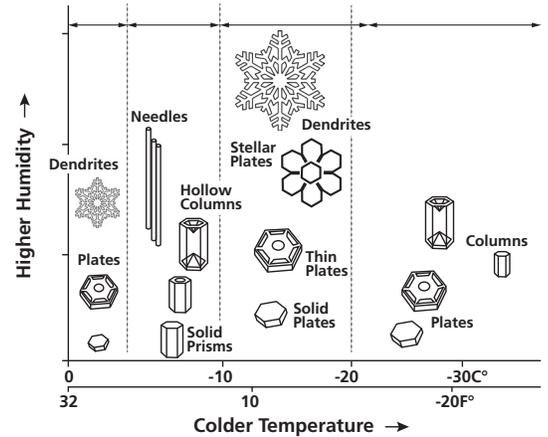
The Search for Snow is a new 3D movie that shows the beauty of snow in a whole new way. It also shows the impact snow has on the environment and living things. You will travel across the globe from icy mountain peaks to sunny valleys, from the Great Lakes to the Alps and beyond. You will learn how weather connects and creates ecosystems, how plants and animals survive in snowy habitats, and how the planet's changing climate will affect them and us in surprising ways.

PART 1: AS IT FALLS

First, take a look at how snow forms. Use the word bank and chart to complete the paragraph below.

atmospheric **dendrites** **precipitation**
columns **humidity** **temperature**
crystals **plates** **vapor**

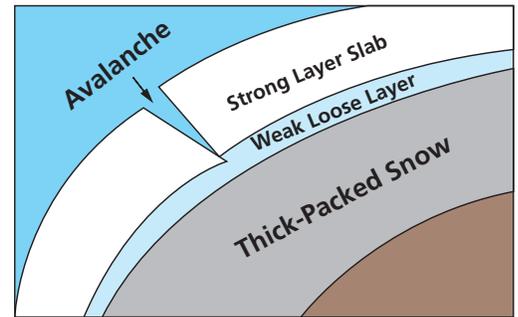
Snowflakes are clusters of _____. They form in the clouds when water _____ (a gas) freezes directly onto a small solid particle (pollen or dust) called a *condensation nuclei*, without ever becoming a liquid! Other icy forms of _____, like sleet, start as raindrops which then freeze. Snowflakes come in many shapes based on the _____ conditions. As snowflakes fall, they continue to grow and change shape based on _____ and _____. In cold conditions with low humidity, snow crystals will be simple _____ and _____. Lacy _____ like we see in movies and coloring books require warmer temperatures and more moisture in the air.



PART 2: ON THE GROUND

Snow is always changing, even after it hits the ground. As it piles up during the winter, it builds layers called a *snowpack*. Every time there is a snowstorm, it adds another layer to the snowpack.

In places where temperatures remain freezing over a long winter season, as in the mountains and Arctic climates, the snowpack can be very deep and complex. When a thick, heavy layer builds over a looser layer, where snow slides around, it can cause an avalanche.



Use the materials your teacher provides to build a model snowpack. Then test how different snowflake shapes react to "avalanche" conditions.

1. Use a textbook to represent the dense layer at the base of the snowpack.
2. Now sprinkle some "snowflakes" on the base. Use round toothpicks for the column and needle shapes, sticky notes for plates, small pieces of paper for dendrites, and salt for pellets of icy snow. Test one shape at a time rather than mixing different shapes together.
3. Stack another textbook on top of the "snowflake" layer, then lift one end of the bottom book to cause an "avalanche." Observe what happens. How long does it take for the top book to slide off? At what angle does it begin to slide? Record your observations of time and angle on the back of this sheet.
4. Keep experimenting. Try putting two or more layers of "snowflakes" between the books (toothpicks over salt, for example). Record your conclusions here:

Which stack is the most stable? _____ Which is the least stable? _____

What happens if you layer denser materials on top of looser materials? _____

ACTIVITY 2 SNOW AS A HABITAT

In *The Search for Snow*, we meet many different animals and plants that live in the Great Lakes region, Iceland, and the Alps. How do they survive the cold and snowy weather?

PART 1: ADAPTATIONS

Animals must adapt to survive in winter climates. Many birds and mammals *migrate*. That means they move their home to a warmer place during the winter. Other animals, like bears, *hibernate*. That means they find a sheltered place to sleep until spring. But some animals can stay active all winter. They have special *adaptive features* that help them live in the cold weather. Some plants also have adaptive features, but many go *dormant* in the winter, which is similar to hibernation.

This quiz describes how different plants and animals adapt to snowy winters. For each description, write an **M** for **migrate**, an **H** for **hibernate/dormant**, and an **A** for **adaptive feature** on the blank line. The first one has been done as an example.

1. **H** **Alpine marmots** stay in underground burrows from September until March.
2. **Arctic foxes** have thick fur that turns white in winter.
3. **Chamois** have special hooves that allow them to walk on snow.
4. **Conifers** have thin needles instead of flat leaves, and sloping sides that allow snow to slide to the ground instead of weighing down branches.
5. **Golden plovers** travel to the west coast of Europe and North Africa in winter.
6. **Green alder trees** are so flexible they can bend all the way to the ground without breaking.
7. **Hedgehogs** spend winter curled up in places like log piles and village gardens.
8. **Insects** and **reptiles** drop their body temperatures and stay hidden until weather warms.
9. **Rhododendrons** are evergreen shrubs, but their thick leaves curl in winter.
10. **Rock ptarmigans** turn white in winter and have feathers on their feet to keep them warm.
11. **Rock thrushes** fly from the Alps to Africa in winter.
12. **Snow hares** have wide, flat feet that don't sink in snow, and their fur turns white in winter.
13. **Tulip bulbs** live underground in winter and sprout flowers in the spring.
14. **Voles** live in underground tunnels when it snows.
15. **Alpine ibex** move up and down mountains to where temperatures suit them.



Snow can be a danger for plants and animals, but it also provides much-needed water. With your class, discuss all the ways in which people and wildlife use water.

PART 2: A LOCAL STORY

Consider the plants and animals (including humans) that live in your region. Could they adapt to a snowy habitat? Have they adapted? Choose one and answer these questions:

The plant/animal I chose is: _____

What features and/or habits does it have to help it survive in snow? _____

How might its life cycle be affected by shorter, warmer winters with more rain and less snow? Consider its habits, the availability of food, and the presence of predators: _____

How do you think it could evolve to thrive in this changing environment? _____

ACTIVITY 3 SNOW AS A SYSTEM

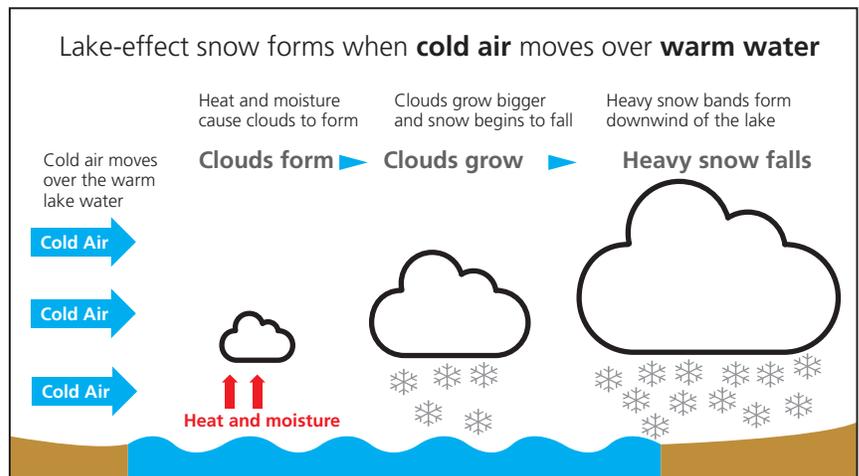
Snowstorms are part of large systems of weather that form in the atmosphere. As the Earth rotates and revolves around the Sun, large swirls of air move and shift with it. These air masses change as they move. They get warmer and colder. They rise and they fall. They crash into each other. They cross over mountains and oceans. They collect moisture, and they release that moisture as snow and other forms of precipitation.

PART 1: LAKE-EFFECT SNOW

Lake-effect snow is a very special type of snow system that causes huge localized blizzards in certain regions. This type of storm needs three very specific conditions. Read about lake-effect snow below and study the diagram. Then unscramble what these conditions are:

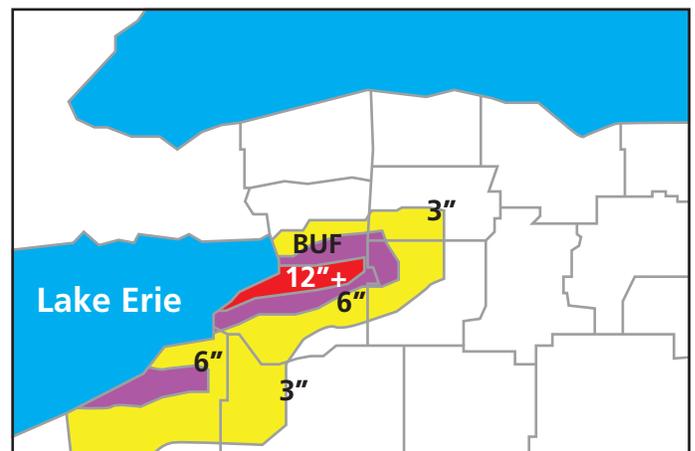
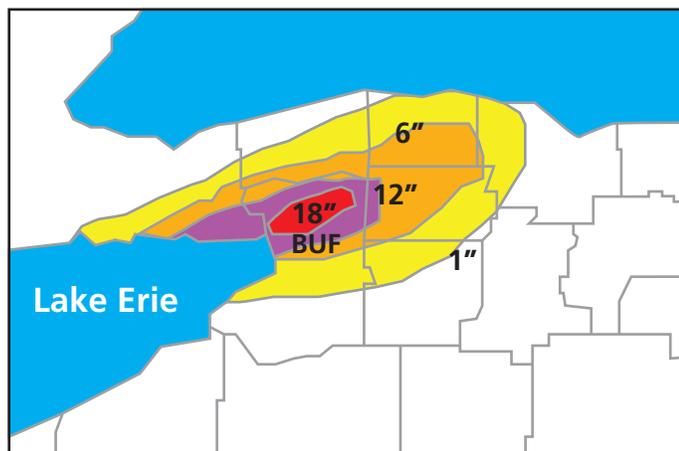
1. _ _ _ _ _ 2. _ _ _ _ _ 3. _ _ _ _ _
 L C D O I R A R M A W T W R E A R E L G A A S F E U C R

When cold air moves across a large body of warmer water, like a large lake, it picks up a lot of moisture, or water vapor, and heat. Clouds form. As the cold air continues to move across the water's surface, the amount of moisture grows, generating snowflakes (dendrites), and the clouds also grow bigger and bigger. When the snowflakes get big enough, gravity pulls them out of the clouds. This causes a quick, intense blizzard in a small band around the lake, and a much smaller amount of snow in neighboring areas. Since the process takes time, you need a large surface area of water (approximately 100 square miles/259 square kilometers) for lake-effect snow to form.



PART 2: MEASURING THE LAKE EFFECT

The Great Lakes in North America are a perfect setting for lake-effect snow. The lakes face cold, Arctic winds that come down from Canada. The lakes are wide and long, so when the Arctic winds blow at the right angle, they pass over a lot of surface area for picking up moisture. The weather maps below show the amounts of snowfall around Buffalo, New York (BUF) from two separate lake-effect snowstorms over Lake Erie. Draw arrows to show the direction that the cold Arctic winds traveled for each one.



ACTIVITY I ESSENTIAL SNOW

The Search for Snow is a stunning new 3D movie that shows the beauty of snow as well as its impact on the environment and living things in a whole new way. You will travel across the globe from icy mountain peaks to sunny valleys, from the Great Lakes to the Alps and beyond. You will learn how weather connects and creates ecosystems, how plants and animals survive in snowy habitats, and how the planet's changing climate will affect them and us in surprising ways.

PART 1: HAIKU FOR SNOW

Snow is always evolving. From the moment it forms, when water vapor freezes into a crystal around a *condensation nucleus* like a bit of dust or pollen, every snowflake is a unique arrangement that continuously grows and changes, based on the temperature, moisture, and wind along its journey. Think about your experiences with snow or what you learn from the film and recall its effect on all five senses, your emotions, and your activities. Use the lines below to write a **haiku** about your experience of snow.

A haiku is a special type of poem that originated in Japan and was often used to describe nature. It contains three lines, the first and last with five syllables, and the middle line with seven syllables. Here's an example to get you started:

Heavy snow falls fast.
Cold and wet it glistens bright.
I can't wait to play.

5 syllables _____

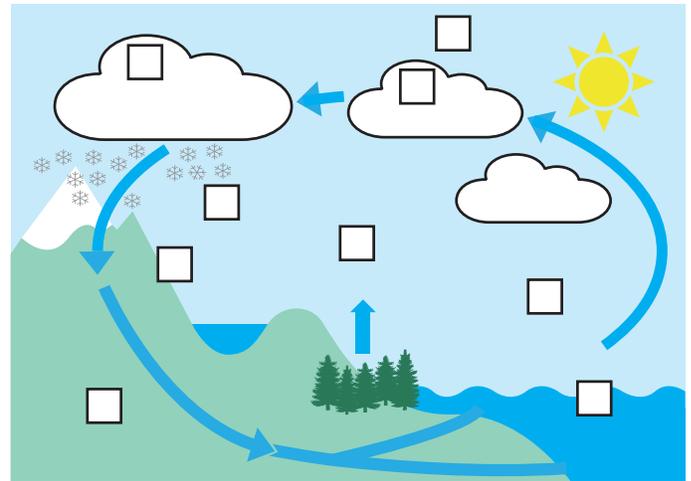
7 syllables _____

5 syllables _____

PART 2: THE WATER CYCLE

Snow continues to evolve after it lands, piling on the ground in a snowpack. In some climates, this snowpack builds up over time, forming a dense layer of snow that provides water to the region, a habitat for wildlife, and a source of income and entertainment for local communities. Where snowpack has built up over hundreds or even thousands of years, it eventually formed glaciers. In spring and summer, bits of these glaciers melt slowly, flowing into streams and rivers, and eventually into the oceans. Some of the snowmelt sinks into the ground, becoming groundwater, while the surface water evaporates to become water vapor.

This diagram shows how snow contributes to the water cycle. Complete the diagram by writing the letter for each label below into the correct box.



- A. Condensation
- B. Evaporation
- C. Ground-water discharge
- D. Ground-water storage
- E. Transpiration
- F. Sublimation
- G. Water storage in ice and snow
- H. Water storage in oceans
- I. Water storage in the atmosphere

Now use online resources to define the following terms:

- Condensation: _____
- Evaporation: _____
- Sublimation: _____
- Transpiration: _____

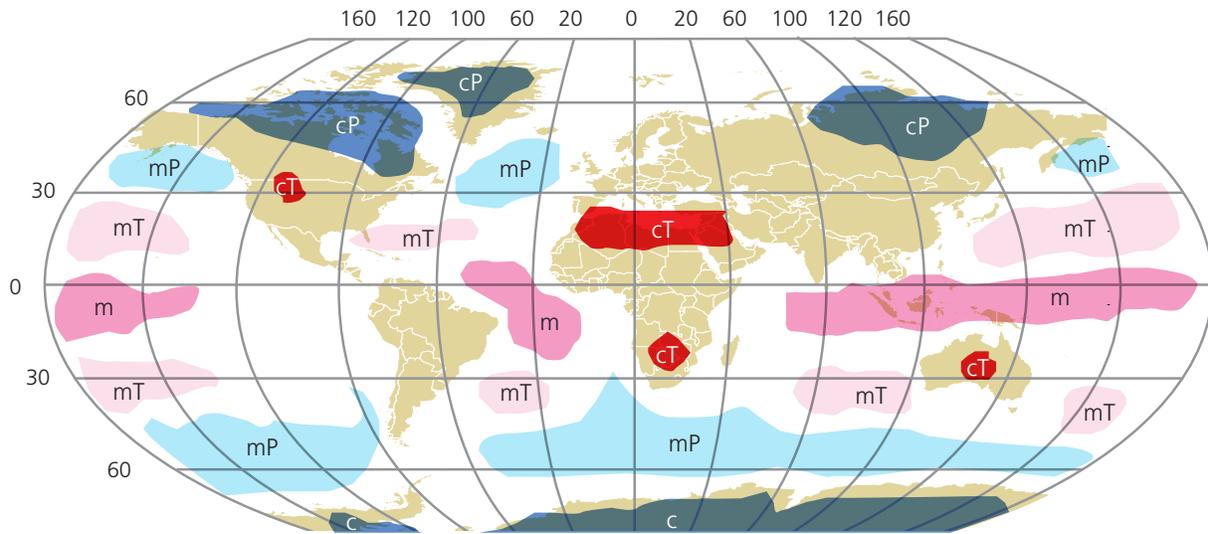
ACTIVITY 2 SNOWY CLIMATES

PART 1: CLIMATE PATTERNS

Weather events around the world are connected by the way air masses move and interact. Learn more by using these words to fill in the blanks in the paragraph below.

Arctic **condensation** **continental** **Equator** **maritime** **moisture**
Polar **precipitation** **rotates** **Tropical** **water cycle**

As our planet _____ and revolves around the sun, the layers of air surrounding it move and shift in large swirls. Warm air masses near the _____ are called _____, while cold air masses near the _____/Antarctic are called _____. When they pass over an ocean, air masses are labeled _____. These air masses pick up _____, which forms clouds through _____. By contrast, _____ air masses, which pass over land, are dry. Together, these different types of air masses form the systems that cause storms and _____, and in this way, maintain the _____ across the globe.



Bergeron classification system map of air masses

Continental (c), Maritime (m), Polar (P), Tropical (T)

PART 2: HOW SNOW FORMS

Snowstorms usually begin when a mass of cold, dry air moves down from the Arctic and meets with a swirl of warm, moist air coming up from the Equator. This is called a weather front. The warm air is forced to rise and cool, forming an area of low pressure. As the warm air cools, the water vapor condenses into a liquid drop of rain or freezes into a snowflake (dendrite) and falls as precipitation. If the temperature is low enough, the precipitation will be in the form of snow.

Snow also forms when a warm air mass is forced to rise over a range of mountains. The air cools at higher elevations, creating a weather front aloft, forming snowfall across the mountain tops.

You can see these weather fronts in the U.S. weather map your teacher will provide (see page 9). Use the map to answer these questions:

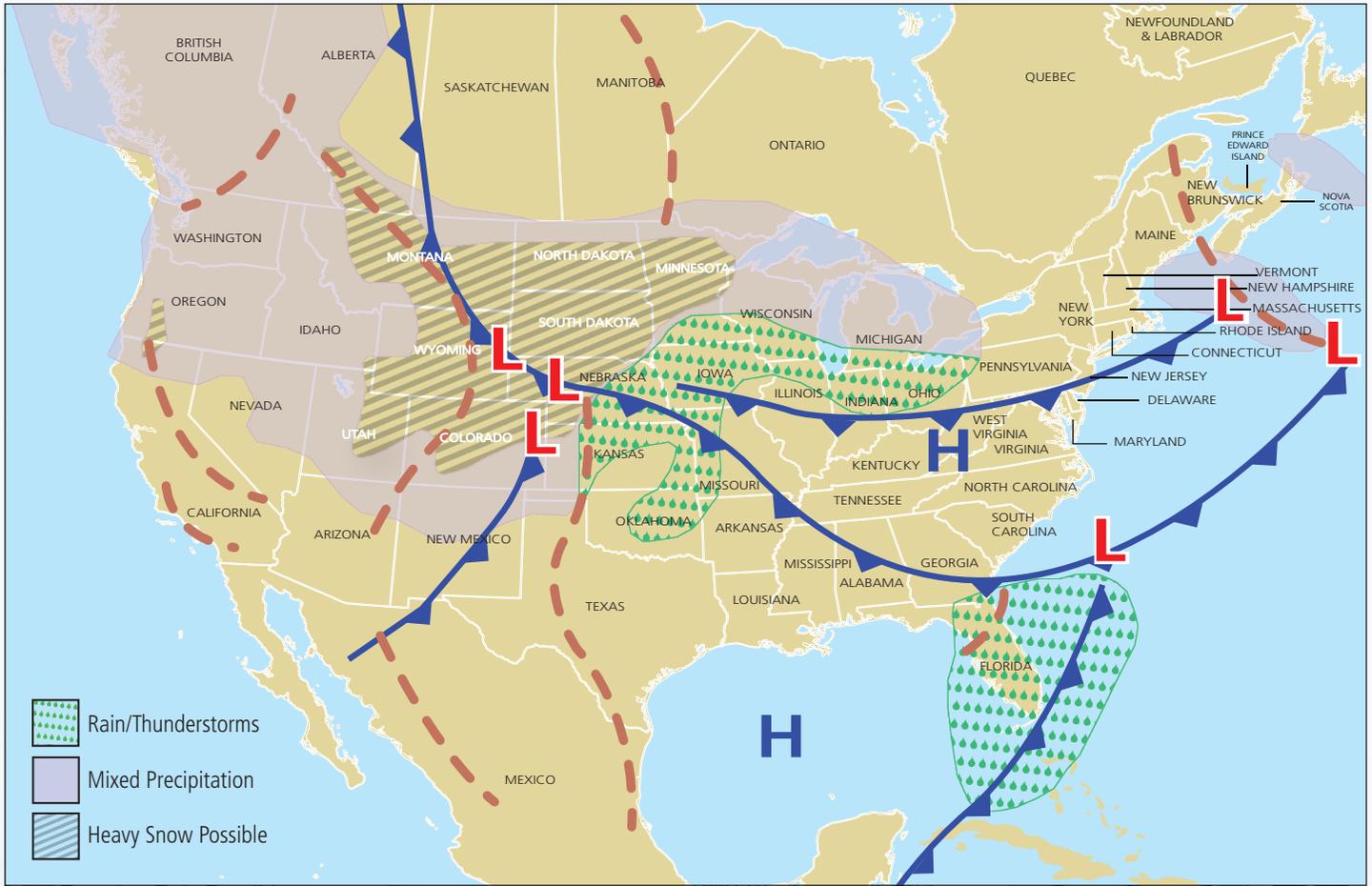
1. Where on the map will there be snow? _____
2. Why do some places have snow and others have rain? (Think about topography and latitude.) _____

3. Where are the low-pressure areas relative to the precipitation? Where are the high-pressure areas? _____

4. Why do you think some areas are labeled "mixed precipitation"? _____

ACTIVITY 2 SNOWY CLIMATES (CONTINUED)

Weather Forecast Map, April 10, 2019 — Snowstorm in Central U.S.

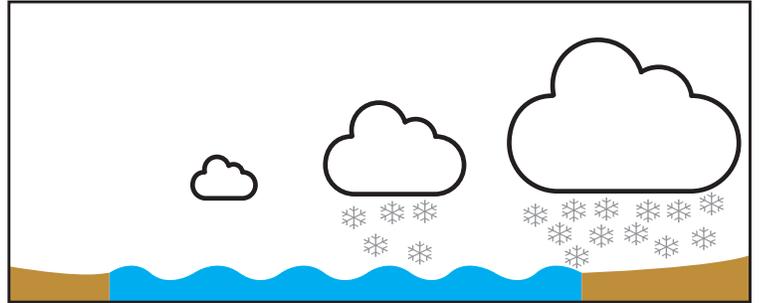


ACTIVITY 3 THE LAKE EFFECT

Lake-effect snow is a very special type of weather system that causes intense blizzards in concentrated geographical areas. As we see in **The Search for Snow**, this phenomenon is very common in the Great Lakes region of North America.

PART 1: WHAT IS LAKE-EFFECT SNOW?

When cold powerful winds move across the large, relatively warm waters of one of the Great Lakes, they pick up a lot of moisture and heat. Clouds form. As the air continues to move across the water, the clouds grow and the number of snowflakes (dendrites) increases. When snowflakes grow large enough, gravity pulls them out of the clouds, producing a small area of snow that looks like a belt around the edge of the lake. The resulting storm can dump as much as 2-3 inches of snow per hour, with zero visibility and drifts as high as six feet.



Draw arrows to label the direction of the wind, the evaporation of water vapor from the lake, and the location of the central impact of the blizzard in the diagram above showing how lake-effect snow is generated.

PART 2: MEASURING THE EFFECT

Lake-effect snow makes winters challenging for the cities around Lake Erie. Note the locations of Buffalo, NY, Cleveland, OH, and Toledo, OH on this map. Then tally the snowfall amount for each city as shown in the chart below. Use the map and chart to answer these questions.



- Which city gets the most annual snowfall from October through January? _____
The least? _____
- During which two months do these two cities experience the biggest difference in snowfall?
_____ and _____
- For each of those two months, what is the percentage difference?
 - In _____ (month), _____ (city) gets ___% more snow than _____ (city).
 - In _____ (month), _____ (city) gets ___% more snow than _____ (city).
- For the period from October through January, what is the annual difference?
On average, _____ (city) gets ___% more snow than _____ (city).
- These two cities are both part of Lake Erie's lake-effect snow belt. Why do they get such different amounts of snow? (Hint: Think about wind direction and distance.)

		Toledo, OH	Cleveland, OH	Buffalo, NY
October	Snowfall in inches	0.0	0.0	0.0
November	Snowfall in inches	1.6	3.6	6.2
December	Snowfall in inches	5.7	8.9	19.0
January	Snowfall in inches	11.2	15.0	29.2
Average Annual Snowfall Oct-Jan				
Average Annual Temp °F (High / Low)		60 / 41	60 / 43	56 / 40

- Based on what you've learned, which way do the cold Arctic winds travel? _____
- Lake-effect snow generally occurs in the first few months of winter. Can you guess why? (Hint: Think about the temperature of the water.)

Note: Because Lake Erie usually freezes over by late January, lake-effect snow in this region after that date is attributable to Lake Huron, which rarely freezes over due to its size and depth.



ACTIVITY 4 FUTURE STRATEGIES

What happens in snowy regions as climates grow warmer? In places like Iceland, the glaciers begin to melt. Surprisingly, this causes the land to rise as the weight of the ice decreases. It also causes certain species of fish, which have provided food and income, to leave the region as fresh water flows from the melting glaciers into the ocean, changing the habitat.

In the Alps, warming climates threaten hundreds of plant and animal species that have adapted to a snowy climate. In Écrins National Park, for example, the rock ptarmigan will likely lose more than 90% of its habitat by 2090. With less snow, color-changing animals, like the Arctic fox and snow hare, find themselves exposed because they no longer blend into their surroundings. And the Alpine ibex must try to survive on less grazing land as they seek colder temperatures higher in the mountains.

Humans are affected, too. Alpine ski resorts must now use snow machines to remain open during the tourist season, tapping into water supplies that would otherwise sustain the water cycle. In the Great Lakes region, warming climates mean that the lake water freezes for shorter periods and the ice covers a smaller area. This reduces winter tourism in the region, which removes billions of dollars from the local economy.



PART 1: UNDERSTANDING THE PROBLEM

Choose one of the regions featured in the film and conduct a brief internet search to find out more about how climate change is impacting its snowpack and/or winter weather. Here are some articles to begin with:

- **Artificial Snow Harms Alpine Water System**, <https://www.reuters.com/article/us-alps/artificial-snow-harms-alpine-water-system-scientists-idUSL1855373020070418>
- **Focus on the Ptarmigan** (you may need to click the “translate” button in your browser), www.ecrins-parcnational.fr/dossier/zoom-sur-le-lagopede-alpin
- **What worries Iceland? A world without ice. It is preparing.** www.nytimes.com/2019/08/09/business/iceland-ice-melt-global-warming-climate-change.html (also found at www.newsrust.com/2019/08/what-worries-iceland-world-without-ice.html)
- **Lake Effect Snow Season**, <https://medialibrary.climatecentral.org/resources/lake-effect-snow-season>

Write three new facts you’ve learned from your research:

1. _____
2. _____
3. _____

PART 2: FINDING A SOLUTION

What is the solution? In Les Orres, France, a ski resort is being used as a Living Laboratory to help find ways to reduce carbon emissions and energy consumption in winter tourist locations. There are two other labs, one in Italy and one in Austria. Each facility is making efforts to reduce energy used in all its functions — ski lifts, snowmaking machines, hotel rooms, etc. Read more about the SMART Altitude project at www.alpine-space.eu/projects/smart-altitude/en/home.

Now it’s your turn. Can you think of some ways that local governments and communities can evolve to meet their changing weather patterns? Brainstorm with your classmates ways to prevent snow from disappearing as a result of climate change. For every idea, weigh the pros and cons below.



Idea 1: _____

Pros: _____

Cons: _____

Idea 2: _____

Pros: _____

Cons: _____



A passion for skiers, a child’s dearest wish, a village’s deepest desire — snow is cause for joy. It is also a necessity for world water resources and for some, a sole source of revenue.

In an ever-changing world climate, *The Search for Snow* follows the patterns of weather systems to help us understand different types of snow, where it falls, and why — as well as its crucial impact on vegetation, wildlife, and people.

© 2021 Saint Thomas Productions

An **nWave Pictures Distribution** release

For additional educational resources and online activities, please visit <https://thesearchforsnow.com>



NORTH/SOUTH AMERICAN SALES

Janine S Baker
+1 818-565-1101
jbaker@nwave.com

INTERNATIONAL

Goedele Gillis
+32 2 347-63-19
ggillis@nwave.com