

This is one of two activity books about water and watersheds, centered on the Yukon River—with familiar images for coloring and first language word puzzles. The first book introduces water and watershed science. This second book introduces ecology, weather, and climate.

Activities in both books include “Ask an Elder” questions to encourage conversations about the natural world. There are also crossword puzzles, word finds, column matches, and fill-in-the-blanks. We hope these books make learning about water and watersheds fun for kids of all ages!!



From the Mountains to the Ocean Water is Life

All animals like birds and bees,
plants like berries and trees, and
other forms of life like worms and lichen,
are *all* mostly made of WATER!



What is a Watershed?

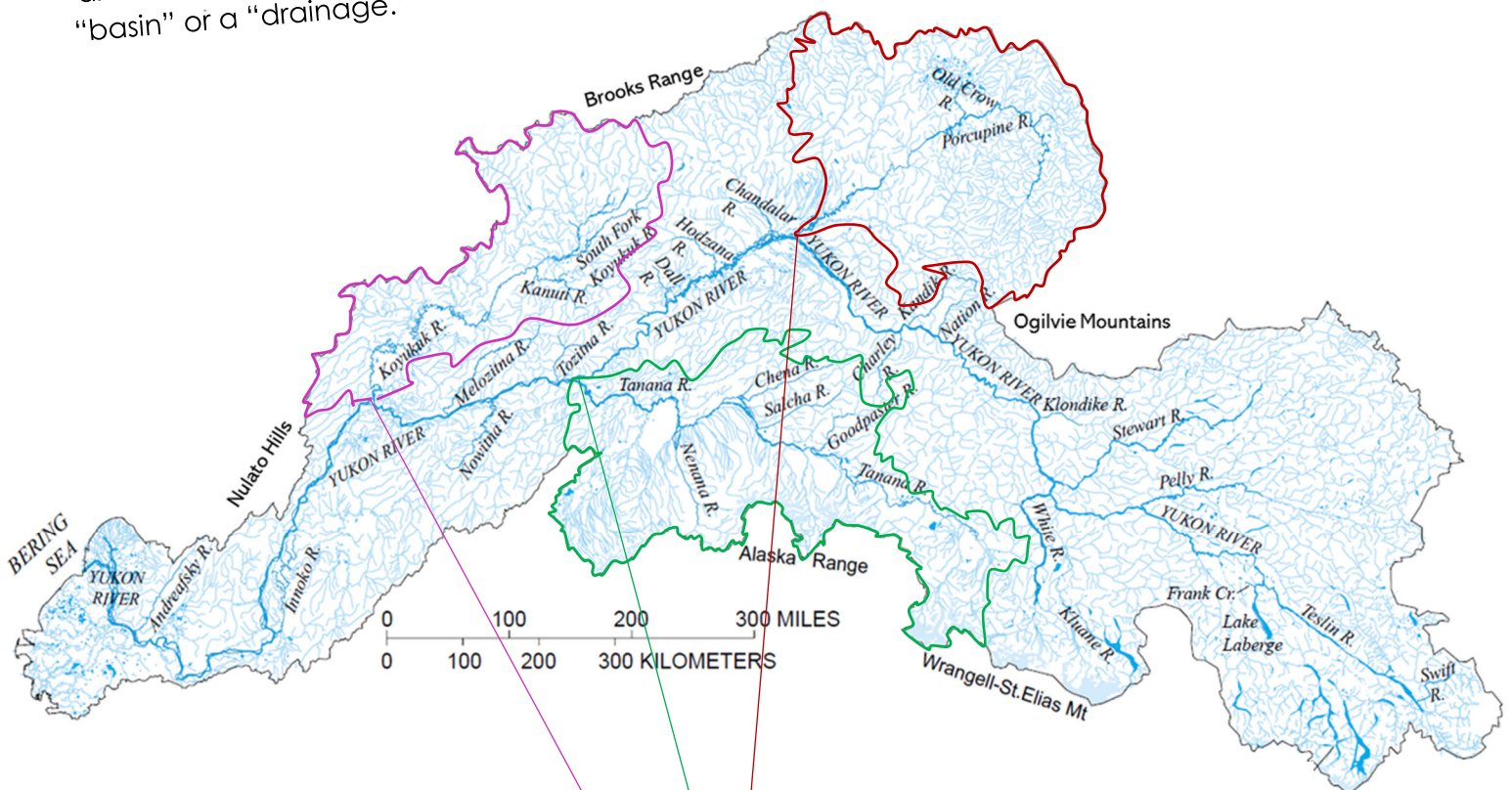
An area of land that all drains to the same place

A watershed catches all the water that falls from the sky onto it, and 'sheds' that water down to the same place. Every little creek in the Yukon River watershed has its own little watershed, and they all flow together to make the YUKON RIVER!

Water pushes and carries rocks of all sizes (including silt, which is rock powder) from mountains to the ocean over millions of years.

Water and rocks are the foundation of living systems:
plants grow from soil and
animals eat the plants
— and each other!

Watersheds are named for their river, and they are sometimes called a "basin" or a "drainage."



The Yukon River Watershed is made of many smaller watersheds, including several major river systems.

What watersheds are these??

What is so special about water??

Water has (at least) three really important properties

WATER has high HEAT CAPACITY

Water warms up and cools off slowly

WATER is the "UNIVERSAL SOLVENT"

Water dissolves many substances, like sugar and salt

WATER is COHESIVE ('sticky')

Water holds itself together and follows itself around

Match the property

Because WATER ...

has a high HEAT CAPACITY

is a SOLVENT

is COHESIVE

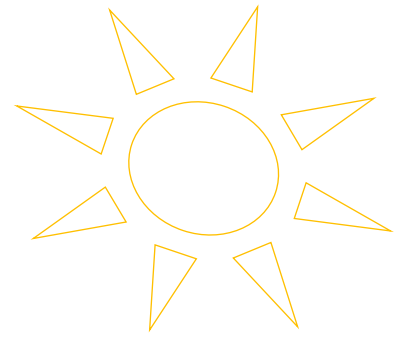
with the process

... living creatures can
turn our food into muscles and energy
eliminate waste from our bodies

move blood up to our brains,
move sap to our highest leaves,
run on water with webbed feet!

keep our cool when it's warm
and stay warm when it's cool

SUNSHINE turns Landforms & Waterbodies into HABITATS & ECOSYSTEMS



A **HABITAT** is a home, where a plant or an animal has what they need. Red Squirrels eat spruce cones and nest in spruce trees, so spruce trees are their main habitat—and they collect mushrooms from the forest floor.

An **ECOSYSTEM** is a set of habitats with plants and animals that live together—and they might eat each other. Plants stay still but their habitat might change seasonally; most animals use different habitats at different times of the day or year.

For example,

sea ice is a habitat in Arctic Ocean ecosystems, and
trees are a _____ in forest _____.

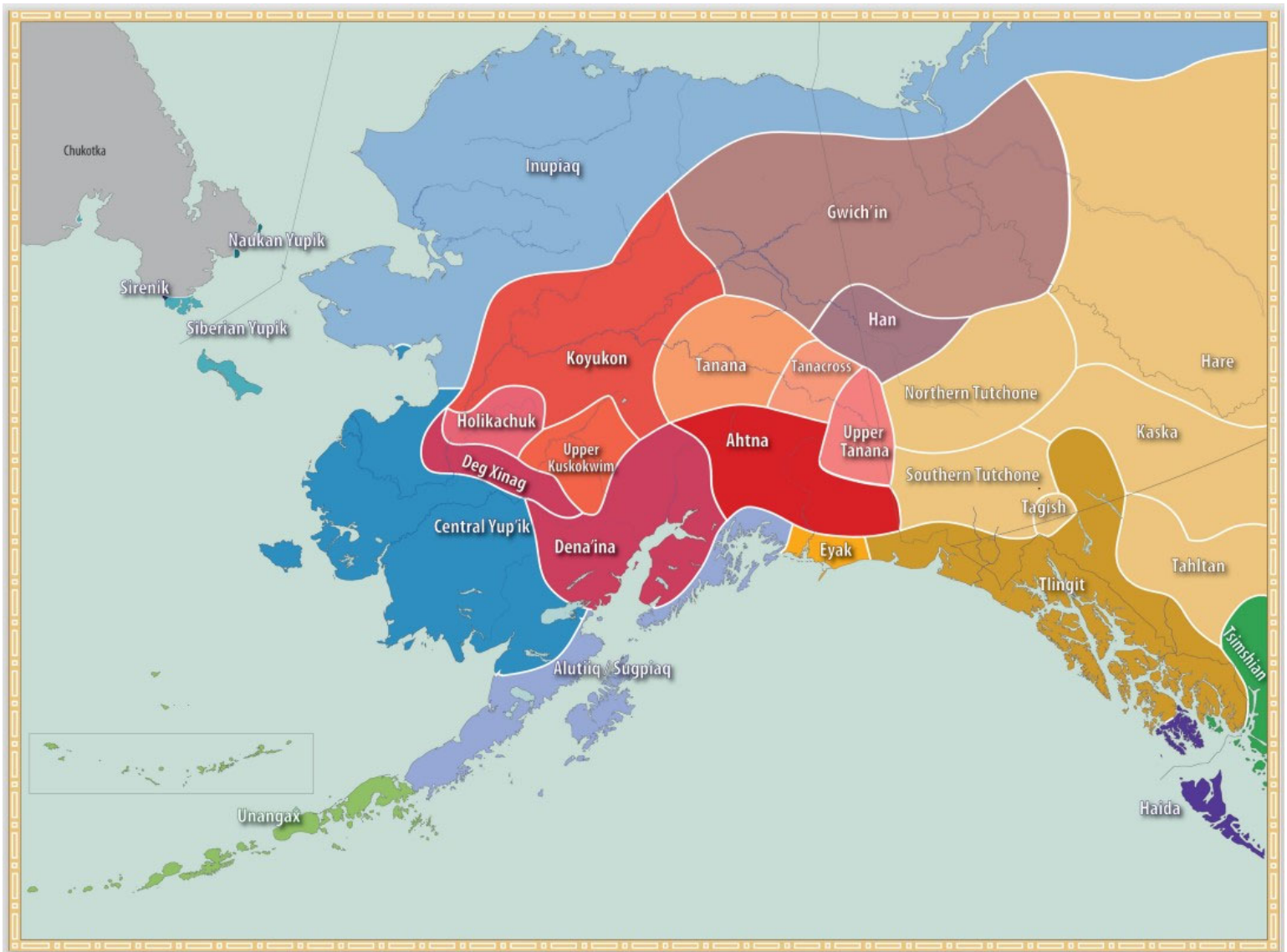
Ecosystems have many habitats.

A habitat is always part of an ecosystem.

For example, a lake is an ecosystem of plants and animals (mostly fish and insects) that need each other, especially for food. Some animals use the lake shore habitat of shallow water and soft mud, and other animals use the darker and cooler floor of the lake. Some animals use the top of the water (especially birds), and some stay at the edges (especially muskrat).

*How many habitats
can you see in this
picture? Draw arrows
for these animals
to go home.*





There are sixteen different Indigenous languages in the Yukon River Watershed: Lingít, Tahltan, Tagish, Kaska, Southern Tutchone, Northern Tutchone, Hän, Gwich'in, Upper Tanana, Tanacross, Lower Tanana, Denaakk'e (Koyukon), Holikachuk, Deg Xinag, Inupiaq, and Yugtun. You'll find water related words from across the Yukon River Watershed throughout these books, including landforms, waterbodies, weather, seasons, animals, and plants.

Ten of the languages are in Alaska, and ten are in Canada; five languages were spoken in cross-border territories for unknown years before the border came (1904).

These languages hold deep ancestral knowledge about the land, rivers, animals, plants, and fish. The languages also contain how Indigenous peoples saw the world around them. For example, "vitseezhau" is a Gwich'in word for certain cloud formations that literally means "her stomach fat." That one word says that the clouds above resemble lace fat on the stomach and includes our perspective, looking up at the sky from within our mother earth's womb. Another example is when Elders look at willow buds and take the ptarmigan's perspective as they say "ch'ik'eh yaa'ii," meaning that ptarmigans see those willow buds as their fat.

*What are some words in your language about the natural world?
How do those words represent a world view?*

Yukon River Watershed Indigenous Languages

Seasons

Language	spring	summer	fall	winter
Yugtun (Yup'ik)	kiapauq	kiak	uksuaq	uksuq
Iñupiaq	upingaksraġu	auraq	ukiaq	ukiuq
U. Tanana	saania'	shiin	noolut	xa iy
Tanacross	saa ndeeth	sheen	noxluu	xey
L. Tanana	sronot	sanh	khwyts'e	khwy
Hän	sränänn'	shenn	khayts'ä'	khayy
Gwich'in	shreenyaa	shin	khaii ts'a'	khaii
Denaakk'e	sonot	saanh	khuyts'en'	khuyh
Deg Xinag	xilegg	sanh	xiyts'in'	xiyh
Holikachuk	xulooggi	sanh	xiyts'in'	xiyh

Word Match

<p>Winter - Upper Tanana</p> <p>Ukiuq</p> <p>Spring - Denaakk'e</p> <p>Shreenyaa</p> <p>Summer - Hän</p> <p>Xiyts'in'</p> <p>Fall - Yugtun</p> <p>Sheen</p>	<p>Fall - Holikachuk</p> <p>Xaiy</p> <p>Summer - Tanacross</p> <p>Uksuaq</p> <p>Spring - Gwich'in</p> <p>Shenn</p> <p>Winter - Iñupiaq</p> <p>Sonot</p>
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*Ask an Elder:
How have seasons changed since you were little?*

Ecosystems are made of all the plants and animals that live in a place, and also the rocks, soil, and water that support the plants and animals. Out in the wild, it's all about who eats who!

"Omnivores" eat everything!

*Tthiikaan -Upper Tanana
(Canis lupus pambasileus)*



Omnivores eat both plants and meat so they can usually find a meal! Black bears and brown bears are omnivores—
what about you?



*Srisr -Deg Xinag
(Ursus americanus)*

"Carnivores" eat meat

Predators hunt (usually herbivores) and scavengers eat the leftovers. Fresh raw meat is loaded with protein and water. Cooking meat takes out a lot of the water and makes it easier to eat.



*Tuttuvak -Iñupiaq
(Alces alces)*

"Herbivores" eat plants

Plant eaters turn sunshine into protein, which all animals use to make muscles and brains and other body parts that are mostly made of WATER.

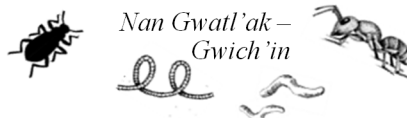
Plants 'eat' sunshine and soil

Soil holds water, minerals, and nutrients from dead plants and animals and also supports microscopic organisms (microbes). We call these bacteria, fungi, and bugs "the decomposers."

The Decomposers eat all the dead stuff

And they feed little bugs that feed bigger bugs and small mammals that feed birds, fish, and mammals that feed other birds, fish, and mammals. Predators like wolves and bears hunt prey and scavengers like fox, raven, and grey jay clean up the messes they make.

Everyone feeds the decomposers eventually.



*Nan Gwatt'ak -
Gwich'in*



*Ch'enëyy -Tanacross
(Leccinum alaskanum)*

Language	black bear	wolf	moose	king salmon	willow	blueberry
Yugtun (Yup'ik)	paugnaq	kaganaq	tuntuvak	taryaqvaq	uqvigpiaq	surav'ak
Iñupiaq	aklaq	amaġuq	tuttuvak	iqalukpak	uqpigauraq	asiavik
U. Tanana	shoh	tthiikaan	diniign	luugn delt'al	k'aiy'	jign
Tanacross	shos	tiikâan	dendiġ	luug chox	k'éy'	jêġ
L. Tanana	sresr	tukoni	denigi	gath	k'wy'	jega
Hän	shär zraÿy	zhùr	jèjuu	tr'ojà'	k'ày'	jeyy
Gwich'in	shoh	zhoh	dinjik	luk choo	k'aii	jak
Denaakk'e	ses	tookkone	deneege	ggaat	kk'uyh	geege
Deg Xinag	srisr	nigughun	dineg	gath	triti	nilyagh
Holikachuk	sis	nik'ighun	dineg	ggath	q'iy	nilyagh

P A U G N A Q T K A S O F A O
 M Y W B D V G U H A I H K J N
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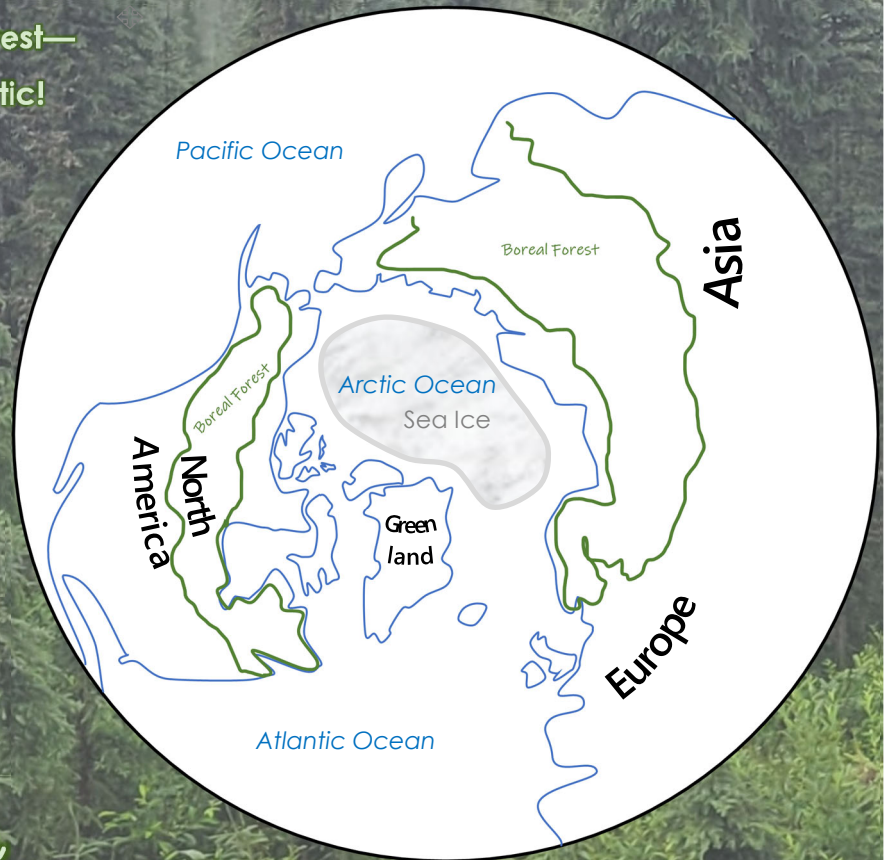
The Yukon River Watershed is mostly covered with

Boreal Forest

"BOREAL"
means
NORTHERN
in Latin

The boreal forest is the world's biggest forest—
it wraps all the way around the Arctic!
Russians call the boreal forest "Taiga,"
which means 'land of little sticks.'

Can you find where the
Yukon River Watershed
should be on this map?



Color the world's oceans blue,
the boreal forest dark green, and other land light green.
Except Greenland—Greenland is green around the edges but still covered with ice!!

The Yukon River Delta is mostly covered with

Tundra

"TUNDRA" comes from a Finnish word that means "treeless plain."



TUNDRA is CHANGING—

Historically tundra was treeless because it is cold and windy and has permafrost. As the world climate warms, permafrost is thawing and the land is changing. One big change is that more willow and black spruce are growing. Of course, moose love to eat willows, so now there are more moose out on the Yukon Delta!

There are also more beaver and one built a lodge in this pond—can you see the beaver trails?

Ask an Elder: How has the land changed since you were a kid?

How do WETLANDS work for us?

Wetlands are important _____ with many different
_____ for fish and other animals that we love to eat,
such as _____ and _____.

(burbot habitats ecosystems goose what's-your-favorite?)

Wetlands provide many habitats
and
Wetlands store and filter water

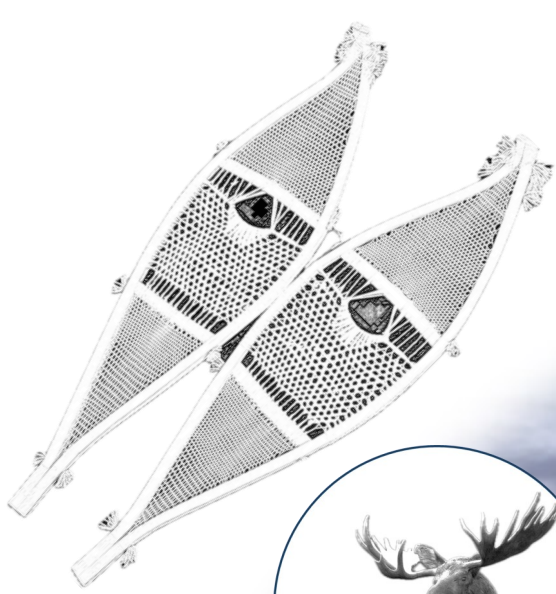
Try to imagine how much water
you're looking at...

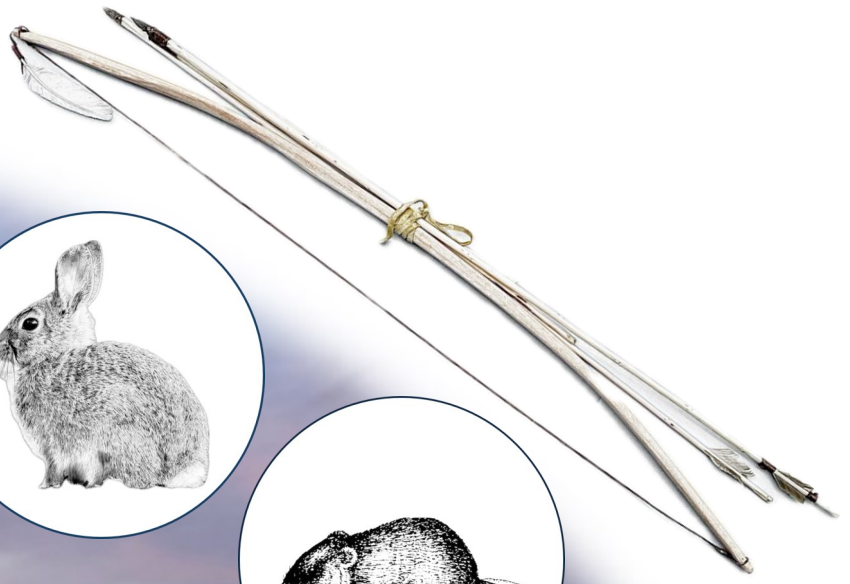
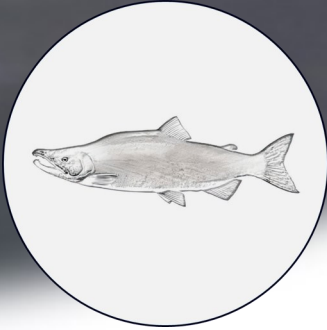
Imagine you are in a boat on one
of these lakes with a 5 gallon bucket.

How many times
could you fill it??

If one square mile of wetlands
holds about **650 MILLION**
gallons of water,
and there are about
50 square miles of
wetland in this picture...

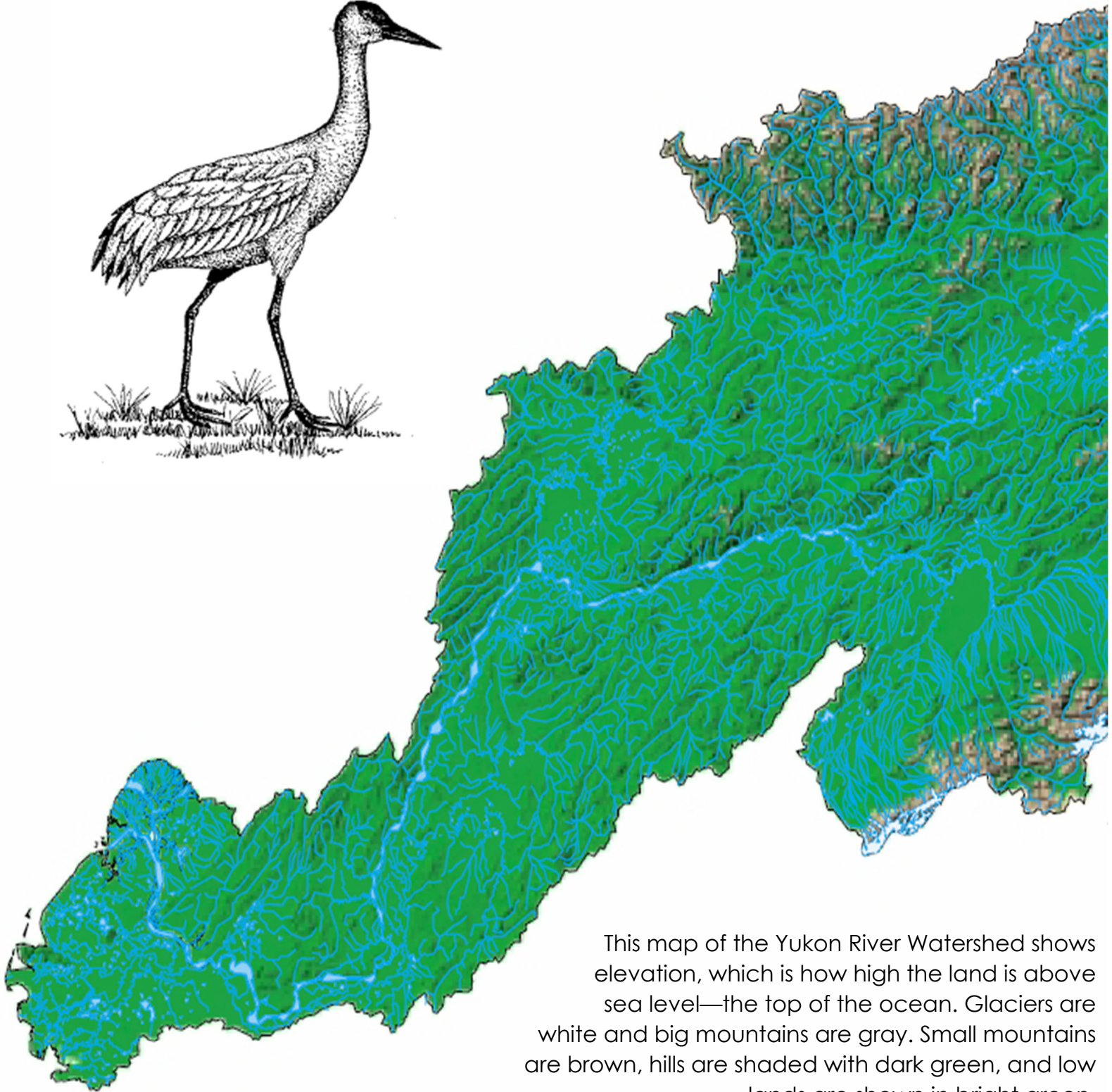
then there are **650,000,000 X 50**
= 32 BILLION GALLONS OF WATER
in this picture, and you could fill your bucket
32,000,000,000 / 5 = 6,400,000,000 times!!!!!!!!!!!!!!!!!!!!





Predators hunt and prey get hunted. Scavengers follow and clean up the mess.

To see the food web, draw arrows from the prey to the predator—in the direction that nutrition and energy flow.



This map of the Yukon River Watershed shows elevation, which is how high the land is above sea level—the top of the ocean. Glaciers are white and big mountains are gray. Small mountains are brown, hills are shaded with dark green, and low lands are shown in bright green.

Where in the watershed are you?



The lowest areas,
the river valleys and
lake beds, hold
water - shown in blue.

Where is the nearest wetland?

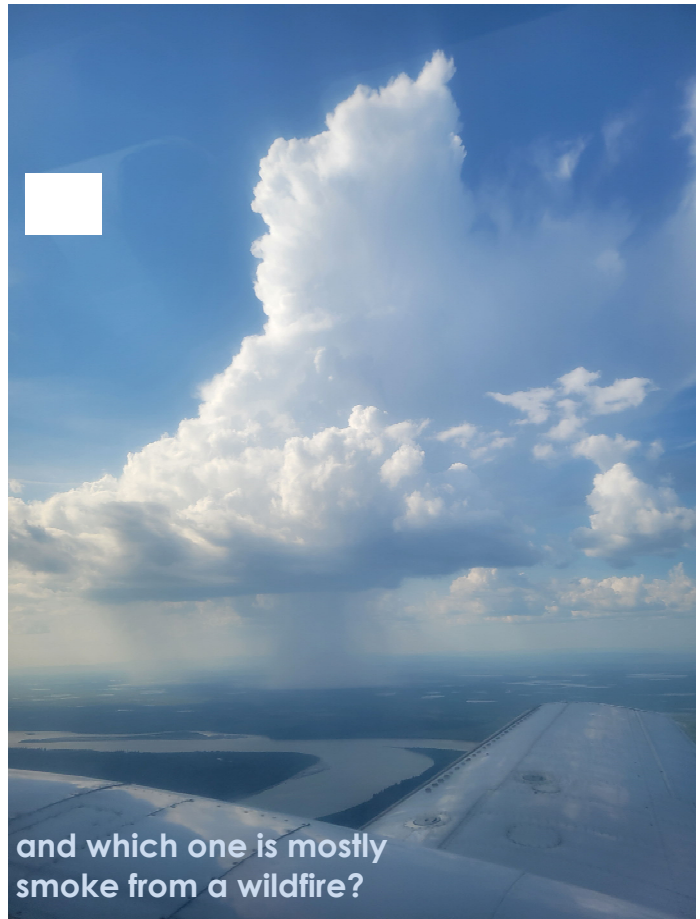
WEATHER

Conditions in the air between earth and space

Weather is temporary, like a rainstorm or a hot day, but sometimes weather lasts a while — for example, a drought is an extended period of dry weather, and a heat wave is an extended period of temperatures above normal.

What kind of weather do you see in these pictures?

- 1. partly cloudy
- 2. hot and sunny
- 3. scattered rain showers
- 4. dry and smokey
- 5. rain and hail



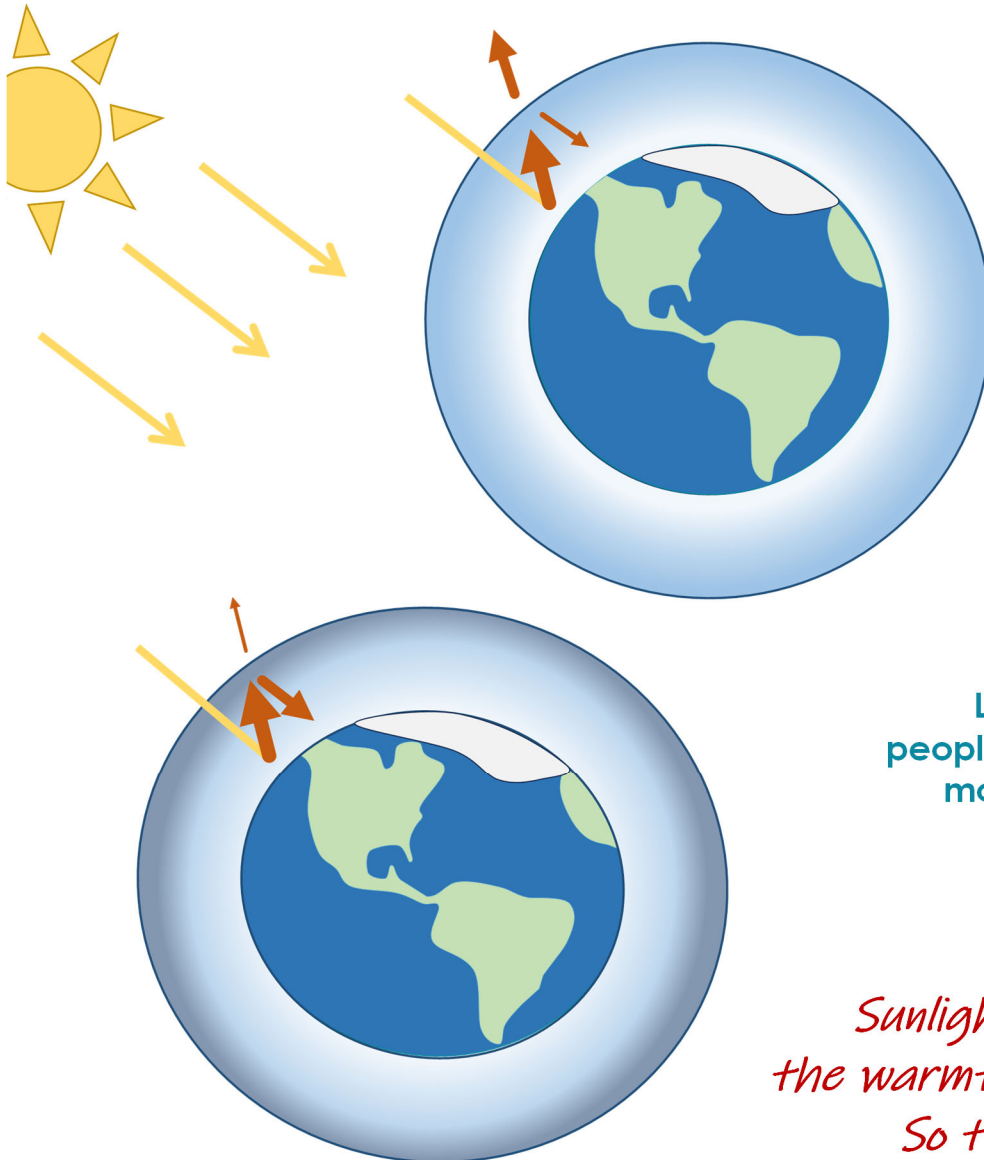
Ask an Elder:
How did you learn to read the sky?

CLIMATE

"Normal" weather in a place, including seasons

Climate is the *pattern* of weather in a certain place. Weather changes from day to day but climate changes over years and decades.

You've probably heard about climate change, and how hot the world is getting. Before we talk about that, let's think about how earth's climate has worked for millions of years



The air between earth and space is called the atmosphere. Light (→) passes through the atmosphere easily. So sunlight comes in and warms the Earth.

Heat (→) does not pass through the atmosphere as easily as light.

The atmosphere actually traps heat—it always has!!

Lately, for about 150 years now, people have been adding more and more "greenhouse gasses" to the atmosphere, which makes the "greenhouse effect" stronger:

*Sunlight still comes in, but less of the warmth goes back out to space...
So temperatures are going up!!*

Ask an Elder:

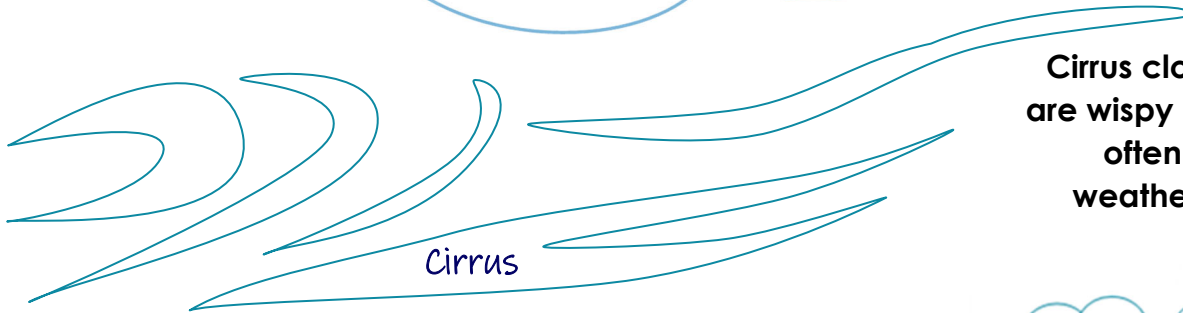
How has the sky changed since you were little?

CLOUDS

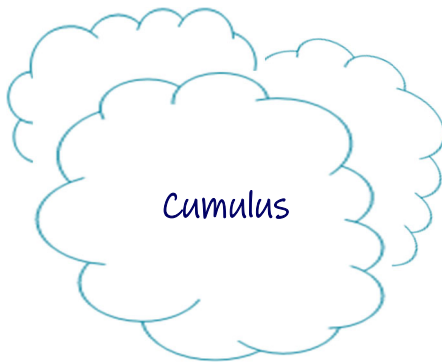
As infinite as shades of blue!

There are three kinds of clouds that are usually combined.

The combinations are endless.

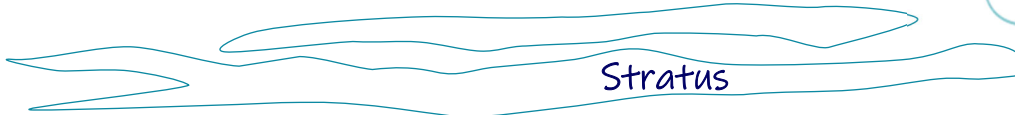


Cirrus clouds form up high and are wispy like a horses tail. They often mean rainy or stormy weather is coming—or that a plane went by.

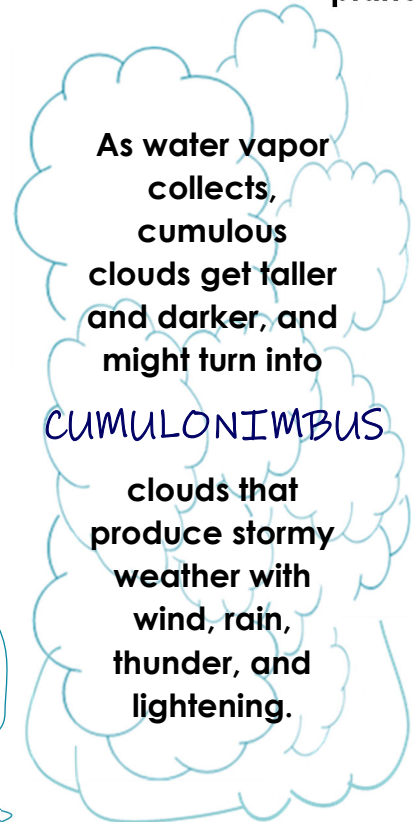


Cumulus clouds form in the middle and lower atmosphere and are puffy like cotton balls.

As water vapor collects, stratus clouds get thicker and darker and might turn into NIMBOSTRATUS clouds that block the sun and produce extended periods of rain or snow.



Stratus clouds are wide and mostly form low in the sky. They are large and uniform, they don't really have edges, and when they touch the ground we call them fog.



As water vapor collects, cumulous clouds get taller and darker, and might turn into

CUMULONIMBUS

clouds that produce stormy weather with wind, rain, thunder, and lightening.

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NIMBUS or NIMBO means a cloud is producing or is expected to produce rain or snow. CUMULONIMBUS and NIMBOSTRATUS clouds are very dark and produce precipitation.

On a day with some clouds but not all grey, go out to compare clouds to these cloud shapes. What combinations of clouds do you see? Try to draw the sky.

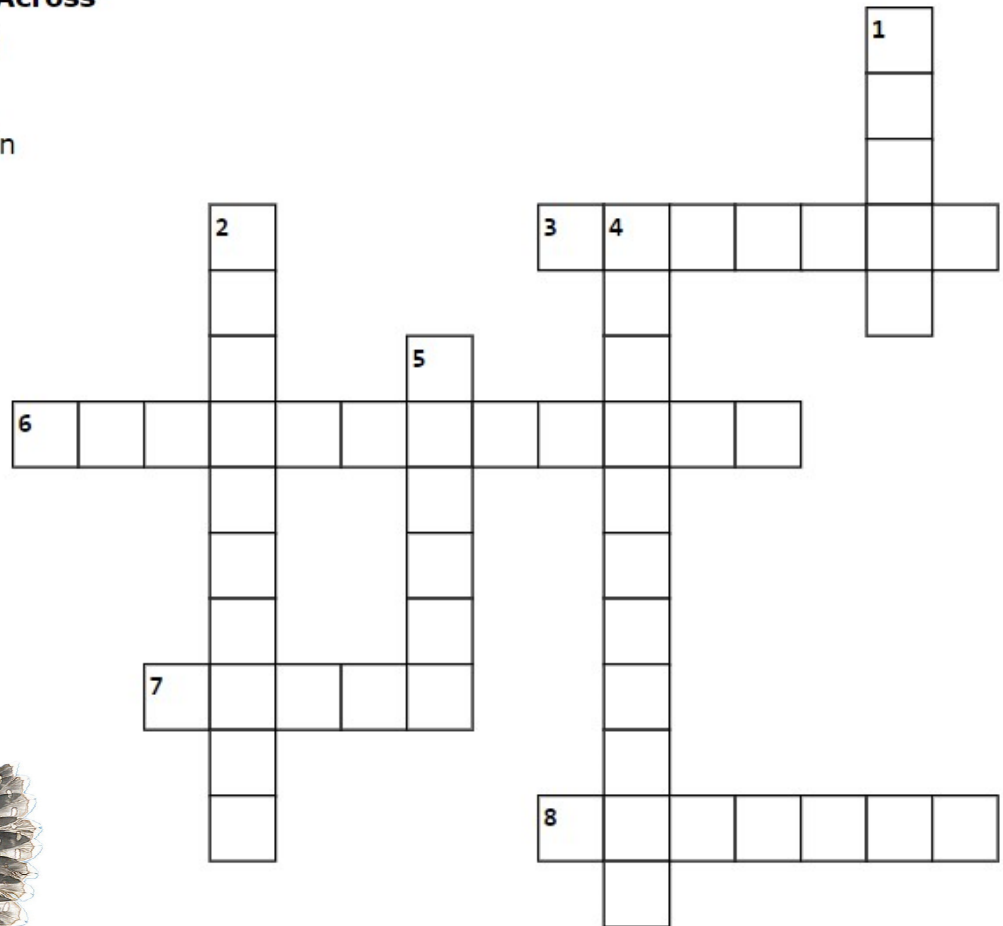
Language	Foggy	Sunny	Snowing	Cloudy
Yugtun (Yup'ik)	Taicirtuq	Akercirtuq	Qanniksuq	Amirtuuq
Iñupiaq	Niptaitchuq	Siqiññaraaqtuq	Qanniguq	Nuviyaliquq
U. Tanana	Ch'itsaġ huule'	Hesaadih'aq	Ehshyuh	K'oh yaa k'e'eedeek
Tanacross	Nátsí'áldox	Xesadin'aq	Ehsháatth	K'oth xúnġġ
L. Tanana	Tok'wth khughila'	Khech'edi'onh	Eġyoth	K'wth khulanh
Hän	Ch'ötr'áw	Sraa nindaġ	Hohshäh	K'oh holi
Gwich'in	Neech'agwah'ee	Gashreii'naii	Ahshii	Gwit'eh goo'aii
Denaakk'e	Okk hoolaanh	Hech'edee'onh	Eġyoġ	Yokk'uġ hoolaanh
Deg Xinag	Eq xelanh	Xigide'on'	Iġyoth	Q'uth xelanh
Holikachuk	Oq			

Across

- 3. Ehshyuh (Upper Tanana)
- 6. Cloudy (Iñupiaq)
- 7. Neech'agwah'ee (Gwich'in)
- 8. Snowing (Hän)

Down

- 1. Khech'edi'onh (Lower Tanana)
- 2. Sunny (Deg Xinag)
- 4. Foggy (Tanacross)
- 5. Amirtuuq (Yugtun)



*Ch'akwäi Chan Ts'ik – Gwich'in
(Falco peregrinus)*

Ask an Elder: How does weather change what animals do?

Ask an Elder: How does wind drive water around here?

WEATHER OBSERVATION SHEET

What is the weather like today?

Observer Name: _____

Time: _____ (AM/PM)

Location: _____

Date: _____ (YEAR/Month/Day)

What is in the Sky?

Just Air
Clouds
(describe)
Rain
Fog
Snow
Blowing Snow

Smoke
Dust
Volcanic Ash
Haze



Sky Cover

Clear/mostly sunny (<10% cover)
Isolated (10-25% cover)
Scattered (25-50% cover)
Patchy (50-90% cover)
No blue, just shades of gray
No blue, just dark gray

Visibility

Unusually Clear
Clear
Poor
Very Poor

Temperature: _____

Wind speed and direction: _____

Thunder and / or lightening: _____

On the ground: Snow/Ice Standing Water Muddy Dry Ground

How was the weather different yesterday?

How do you think it might be different tomorrow?

Ask an Elder: how did you learn to observe and forecast the weather?

As the world warms, lands and waters are changing

It used to be that 'climate is what we expect and weather is what we get,'
but with climate change, we hardly know what to expect!!

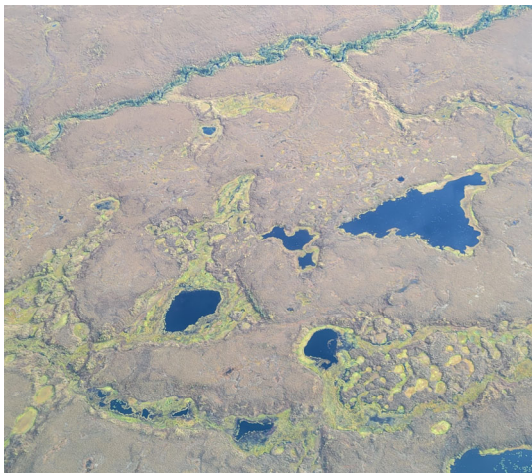
Less ice forms so
travelling on it is more dangerous

In a lot of ways, it's easiest to travel around Alaska in winter, when the landscape is frozen. But as climate changes, the ice is less reliable and people have to be extra cautious.

Learn more at jukebox.uaf.edu/dangerice



Frozen ground is thawing and habitats are changing



Water expands when it freezes, and shrinks when it melts. That's true for water in soil, too. So, when permafrost melts, the land sinks, because water takes less space than the ice did. The water might drain away, or the low spot might hold water.



River water running over this old riverbank into a lake might turn the lake into part of the river.



Rural Alaskans have noticed that rivers and bays are getting wider and shallower, which makes it more likely that river debris, like drift wood, will get caught on the bottom—and boats, too.



Ask an Elder: How is the climate changing here?

How is the changing climate changing our land?

Community infrastructure is impacted by erosion

As permafrost melts, river erosion speeds up and puts infrastructure like pipes, roads, and sewage lagoons at risk.



Wildfires burn longer and hotter

Fire is a natural and necessary process in the Yukon River Watershed, and burn areas grow back quickly. When forests are extra dry, like they have been in recent years, fires burn hotter and the regrowth happens more slowly. Today's fires also seem to thaw permafrost more quickly than they used to.

Other impacts: mining and military

Mining and military activities are part of Alaska's social and economic life but they have environmental effects that need management to keep people and the environment healthy.



THE WWII ALASKA-SIBERIA ROUTE



World War Two made Alaska an important location for military activity and brought airports and military bases to communities across the Yukon River Watershed.

Currently, most—but not all—military activity is upriver from Fairbanks in the Tanana River valley.

Ever since the Alaska Gold Rush (1897-1904) miners have been “placer mining” in the Yukon River Watershed—sifting streambeds to get the gold dust out of them. They used water cannons to melt ancient streambeds out of permafrost, and built dredges in remote creeks. Modern “hard rock” mining is more about the mountains than the valleys: miners blast and process gold-bearing rock from open pits—especially upstream from where the placer miners were finding all that dust ~100 years ago. It makes money, and also pollution.



Environmental Science Careers for love of water



BIOLOGY

Biologists study how life works—and there are many kinds of biologists. For example, wildlife biologists focus on how different animals affect each other, like the way snowshoe hare numbers go up and down depending on how many lynx are around. Evolutionary biologists study how life changes over thousands of years, and nutritional biologists are most interested in how an animal's body turns food into muscle and energy.



GEOGRAPHY

Geographers study land and people, especially human interactions with the environment and other animals, including where people choose to live and why, the ways that they adapt their buildings and roads for local conditions, and the ways that people use available resources to build their homes and produce their food. Geographers make maps, and help communities plan for the future.

"Natural Resource" Management



Natural Resource Managers work to protect the natural resources that people need, such as animals, plants, and water. They also work to make sure people have access to use those resources—it's a complicated job!!



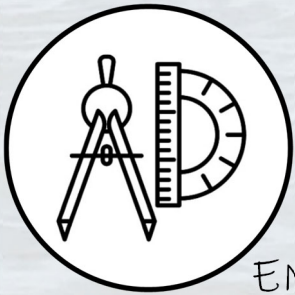
HYDROLOGY

Hydrologists study the ways that water flows on the surface of the land and also into and through the land, and how those pathways of water are changing with global warming and permafrost thaw.



METEOROLOGY

Meteorologists study the atmosphere (the air between earth and space), including air quality, weather patterns, and climate change. Some study how the surface of the earth and ocean influence the atmosphere, and some study how patterns of rain change from season to season and over time.



ENGINEERING

Engineers solve problems and build things. Some engineers build bridges, some build roads, and some build computers. Engineers use MATH, and if you want to build things, you will too!



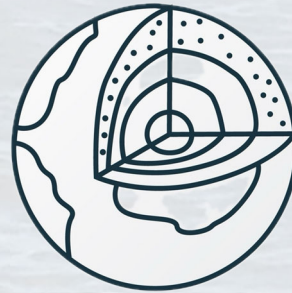
FORESTRY

Foresters study everything about forests, from the soils that different trees like best, to the insects that eat the very top leaves.



HEALTH

Environmental Health Scientists recognize that human and environmental health are deeply linked, and they study how things like pollution and climate change affect the health of humans and other animals.



GEOLOGY

Geologists study rocks and how they form and how they are shaped at the surface of the earth by water and weather. Understanding geology is important to finding gold and oil—and to managing the effects of those activities.



CHEMISTRY

All substances are made of chemicals—even water has a chemical name: H_2O . Chemists study the invisible structure of substances and how different conditions change materials at the "molecular level." Chemists study water quality,

Ask an Elder: What kinds of jobs have you had?

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Yukon River Inter-Tribal
Watershed Council
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www.yritwc.org

This activity book is meant to foster environmental engagement among youth in the Yukon River Watershed, especially by encouraging conversations with Elders about the natural world. If you have questions or comments about this book, or to request copies, please contact us! info@yritwc.org



Images from YRITWC and:

Alaska Native Knowledge Network "clipart" collection: <http://www.ankn.uaf.edu/publications/clipart/clipart.html>

Alaska Department of Fish and Game Wildlife Ecology Cards.

https://www.adfg.alaska.gov/static/education/educators/curricula/pdfs/alaska_ecology_cards.pdf

National Oceanic and Atmospheric Administration <https://www.noaa.gov/stories/how-do-snowflakes-form-science-behind-snow>

The European Space Agency https://www.esa.int/ESA_Multimedia/Images/2018/01/Yukon_Delta

The Alaska Native Language Center Map https://www.uaf.edu/anla/collections/map/IPLA_simple.pdf

Dangerous Ice [Tanana River ice research (2005-07 & 2010-2013)] jukebox.uaf.edu/dangerice

Env & Hydro Overview of the YR Basin maps <https://pubs.usgs.gov/wri/wri994204/pdf/wri994204.pdf>

Yukon Flats Changing Environment <https://www.fws.gov/media/yukon-flats-changing-environment-2021.pdf>

First Language from :

Making of the World (1982) John Fredson, Edward Sapir Haa Googwandak (Stories Told by John Fredson to Edward Sapir)

Deg Xinag Learners' Dictionary <http://ankn.uaf.edu/ANL/file.php/7/DegXinag.html>

Tanacross Learners' Dictionary <http://ankn.uaf.edu/ANL/file.php/3/dictionary.html>

Doyon Languages Online <https://doyonfoundation.com/language/dlo>

Yugtun Online Dictionary <https://www.yugtun.com>

Iñupiaq Online Dictionary <https://inupiaqonline.com>

Hän Dictionary (1978) Ritter, John

Upper Tanana Dictionary (1979) Milanowski, Paul G.

Behnti Kenaga' Dictionary (In Prep) Kari, James & Tuttle, Siri

Koyukon Athabaskan Dictionary (2000), Jetté, Jules ; Jones, Eliza

Gwich'in to English Dictionary (2011), Alexander, V., & Alexander, C. .

Holikachuk Dictionary (1978), Kari, James with Jimmy Alexander, John Deacon, and Olga Deacon

Other resources

<http://ankn.uaf.edu/Curriculum/Units/>

<https://usgs.gov/special-topics/water-science-school>

<https://www.nps.gov/subjects/tek/learning.htm>

<https://uaf-iarc.org/education>

<http://aswc.seagrant.uaf.edu/>

<https://climatekids.nasa.gov>