

WHAT ARE ECOSYSTEMS?



Overview

In this lesson, students will use their problem solving skills to determine the names of four communities in Alaska using only a brief description of those places, along with temperature and precipitation graphs. Then students will make a temperature and precipitation graph of a nearby community, or of their community.

Objectives

On successful completion of this lesson, students will be able to:

- analyze temperature and precipitation graphs;
- associate graphs and descriptions of communities with the community names; and
- make a temperature and precipitation graph.

Alaska Standards

Alaska Science Standards / Grade Level Expectations

- [6] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [6] SA3.1 The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by gathering data to build a knowledge base that contributes to the development of questions about the local environment (e.g., moose browsing, trail usage, river erosion).
- [6] SC1.2 The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by recognizing that species survive by adapting to changes in their environment.

Alaska Cultural Standards

- [E2] Culturally knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to:
- [E.2] understand the ecology and geography of the bioregion they inhabit.



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Bering Strait School District Scope & Sequence

M.S. Sequence 6.9: Ecosystems

Materials

- Student Worksheet: Ecological Regions in Alaska

Activity Preparations

1. Make copies of the student worksheet.

Additional Resources

Glencoe Life Science Ch 21-22

Whole Picture

An ecosystem is a community of living (biotic) and non-living (abiotic) things that interact in the same environment. Biotic organisms include things like plants, animals, microbes, and people; abiotic components include things like rocks, minerals, and water. Ecosystems can be vast, like the tundra or the ocean, or they can be small, like a classroom terrarium. In either case, each component of the ecosystem depends on the others for survival. When one part is disrupted, it can throw the entire system out of balance.

In the Bering Strait School District, the primary ecosystem is “subarctic tundra.” The vegetation in higher elevations consists mostly of alpine tundra, which includes many lichens and sedges, while the lower elevations are home to dwarf shrubs like alder and willow, and the occasional birch or spruce. In some areas, where the ground has more water content, the landscape is dotted with moist tussocks (ADFG, p. 41). These low-lying plants and water features allow for the habitation of many animal species, including moose, caribou, arctic foxes, and Alaska hares, not to mention the many riverine species including river otter and an abundance of fish: five species of Pacific salmon, Dolly Varden, Arctic grayling, Bering cisco, and Alaska blackfish.

In the waters just offshore, the marine ecosystem is equally prolific. For example, near St. Lawrence Island, is an extremely rich and productive pocket of invertebrate life that includes mollusks and amphipods, in addition to a diversity of marine fish, “including Pollock, halibut, salmon, and forage fish, such as herring, Pacific sandlance, capelin, and lanternfish (Myctophids)” (ADFG, p. 44). In turn, these species support marine mammals and waterfowl, including several seal species (ribbon, spotted, bearded, and ringed),



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whales (bowhead, gray, beluga, and minke), walrus, polar bear, “Black-legged Kittiwake, Parakeet Auklet, Crested Auklet, Least Auklet, Northern Fulmar, Red-faced Cormorant, Pigeon Guillemot, Leach’s and Fork-tailed Storm-petrels, and Common and Thick-billed Murres” (ADFG, p. 43).

People are also an important component of the ecosystem in this region — Iñupiaq, Yup’ik, and Siberian Yupik people have called the area home for thousands of years. Alaska Native people have long been aware of the fine balance in the various ecosystems they call home. In many communities, people believe that spiritual practices help to maintain the balance, and ensure that future years will bring continued hunting success. One such example is the Yup’ik Bladder Festival, where seal bladders are sent back to their watery world in order to “help insure the rebirth of the yuit, or ‘persons,’ of the animals” and ensure continued abundance of the seals the following season (Fienup-Riordan, 1994, p.256). Similarly, in many Iñupiaq communities ceremony practices dictate that when a marine mammal is harvested and brought to land, it should be given a sip of fresh water. The practice is meant to show the harvested animal that the people are respectful; in this way, the animal spirit will go back to others of its kind and encourage them to give themselves for harvest, as well.

Nevertheless, many Arctic ecosystems are in danger. Especially along the coast, once stable habitats are eroding, and animal behavior and plant timing are changing unpredictably and are disturbing other components of the system. One such example can be seen in changes to sea ice. “As ice conditions change, so does the presence of seals that make it their home” (Fienup-Riordan and Rearden, 2012, p. 306). People on St. Lawrence Island “have long reported a delay in fall sea ice formation, which now commonly occurs in early December — instead of late October or November as in the ‘old days.’ ... In recent years, solid ice is often broken by leads, ice cracks, and patches of open water, even in the middle of winter” (Krupnik and Jolly, 2002, p.166). The delay in sea ice causes problems for animals that depend on the ice for survival — seals, walrus, and polar bears — as well as for hunters, who use the ice to haul out their harvest and return it safely and quickly to the village.

Ecosystem changes are being witnessed not only on the sea, but also along the coast and further inland. Kenneth Kingeekuk, the former Vice President of the Savoonga Tribal Council, explained: “We’ve lost a lot of coastline. We’ve lost a lot of lakes and ponds where migratory birds lay their eggs in the summertime”(Kingeekuk, 2010). The loss of these lakes and ponds means that the birds will necessarily find somewhere new to raise their young. In turn, the loss of birds will mean an eventual change in the rest of the habitat, for each living organism fulfills a specific niche in an ecosystem. What these changes mean for the people who depend on the various species remains to be seen, but together with scientists, people are discussing changes and ways to adapt.



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Vocabulary

- ecosystem** a community of living (biotic) and non-living (abiotic) things that interact in the same environment.
- precipitation** water in form of rain, snow, sleet, hail that falls to earth.

Activity Procedure

1. Ask students what non-living factors determine what living things are found in an ecosystem. Explain the importance of temperature and precipitation in an ecosystem.
2. Hand out the Student Worksheet and explain the activity. In Part 1 students will need to use both the descriptions and graphs on the separate data page in order to identify the communities. A map of Alaska is also included to help with the location of the communities. If students need help determining the different towns have them look at the map. A useful hint would be to let them know Town D is 475 miles west of Town C and Town B is 425 miles south of Town D. When finished with Part 1 students should complete Part 2 by making a temperature and precipitation graph for a nearby community (or for their own community if its on the list.)
3. When finished discuss with students how climate change, with increasing temperatures and precipitation in the Arctic, will effect the ecosystem around their community.

Extension Activity

- Have students research to find the average monthly temperature and precipitation data for their community (or another nearby community). If the data is available, have them graph that information as well.

Answers

Part 1

1. Town C
2. Town D
3. Town A
4. Town B
5. Town A – Dillingham
Town C – Fort Yukon
- Town B – Bethel
Town D – Kotzebue



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Part 2

The graphs should accurately show the average monthly temperature and precipitation.

6. a. Answers will vary.
- b. Answers will vary.
7. Answers will vary

References

Alaska Department of Fish and Game. "Wildlife Action Plan, Section IIIB: Alaska's 32 Ecoregions." Accessed from:

<http://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.ecoregions>

Fienup-Riordan, Ann, and Alice Rearden. (2012) *Ellavut: Our Yup'ik World and Weather. Continuity and change on the Bearing Sea Coast.* Seattle and London: University of Washington Press.

Fienup-Riordan, Ann. (1994). *Boundaries and Passages: Rule and Ritual in Yup'ik Eskimo Oral Tradition.* Norman and London, University of Oklahoma Press.

Kingeekuk, Kenneth. (2010). "Overview of Impacts from Savoonga." *Stories About Adaptation and Subsistence: Native Voices from the Frontlines of Climate Change.* Aksik. Accessed from: <http://aksik.org/content/2010-overview-impacts>.

Krupnik, Igor, and Dayna Jolly. (2002). *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change.* Arctic Research Consortium of the United States and Smithsonian Institution Presses.

Western Regional Climate Center. "Comparative Data for the Western States" Accessed from <http://www.wrcc.dri.edu/climatedata/comparative/>

United States Forest Service. "Ecological Subregions of the United States." Accessed from <http://www.fs.fed.us/land/pubs/ecoregions/toc.html>



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Student Worksheet: Ecological Regions in Alaska

Name _____

Overview

An ecosystem is a community of living (biotic) and non-living (abiotic) things that interact in the same environment. Biotic organisms include things like plants, animals, microbes, and people; abiotic components include things like rocks, minerals, and water. The temperature and amount of precipitation in a region plays an important role in the local environment and the living organisms that are found there.

Alaska is a large state with many different ecosystems, ranging from the abundant rainfall and mild temperatures in the forests of Southeast Alaska to the cold temperatures and low amount of rainfall in Northern Alaska.

Part 1 Mystery Communities

Directions

Below are descriptions of communities from four different ecological regions in Alaska. Carefully read the descriptions of each community and then examine the graphs on the Data page. A map of Alaska is provided to help as well. Determine what description goes with what town (A, B, C or D), and then circle the correct answer. After you've matched all four descriptions with their graphs, you will guess the name of each town.

Community Descriptions

1. This community only gets about 15cm of precipitation annually. It is known for having cold winter temperatures and some of the highest summer temperatures. The area is relatively flat with braided streams and oxbow lakes. It is productive Arctic habitat for wildlife with many species of birds and aquatic freshwater furbearing mammals. Circle the correct answer:

Town A

Town B

Town C

Town D



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2. This coastal community receives approximately 24cm of precipitation per year. The ocean around it freezes early in the winter due to its northern latitude. It has cold winter temperatures and cool summer temperatures. During the summer standing water is abundant with many thaw lakes connected by waterways. Black spruce forests can be found along rivers. Circle the correct answer:

Town A

Town B

Town C

Town D

3. This coastal community averages approximately 65cm of precipitation per year. Because it is along the ocean the temperature does not have the extreme low, or high temperatures that are often found in interior Alaska. Wetlands comprise 55 percent of the area. Spruce and birch trees grow along major rivers and streams that come from nearby mountains. Circle the correct answer:

Town A

Town B

Town C

Town D

4. The community gets approximately 44cm of precipitation per year. The area is generally flat with occasional low hills. Slow flowing streams and lakes are found along with tundra and sedge flats. Wetlands make up over 75% of the surrounding area, making it prime habitat for birds. Circle the correct answer:

Town A

Town B

Town C

Town D

5. The communities are Kotzebue, Fort Yukon, Bethel, and Dillingham. Using the both the graphs and descriptions, identify each community.

Town A - _____ Town B - _____

Town C - _____ Town D - _____

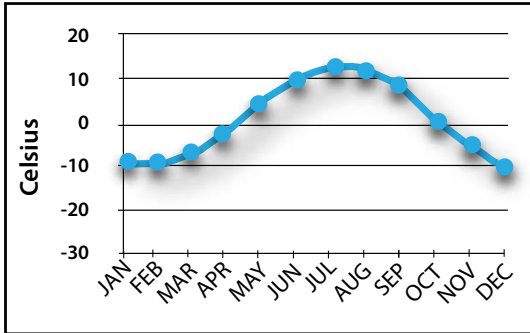


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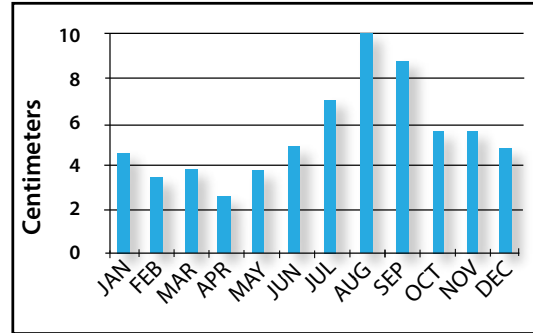


Data

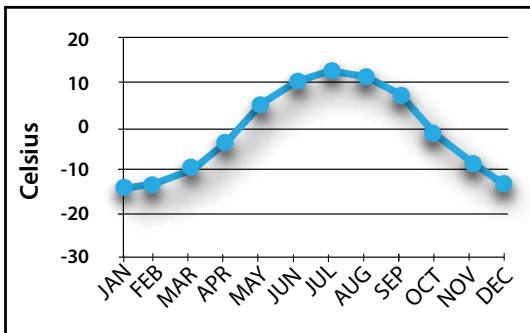
Town "A" Average Monthly Temperature



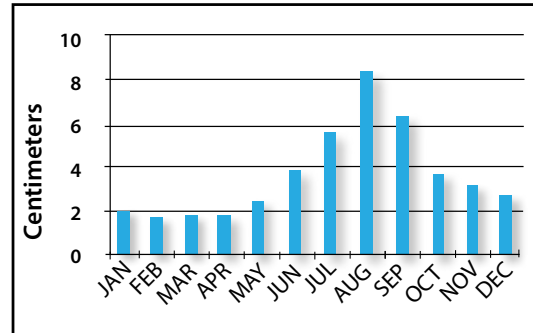
Town "A" Average Monthly Precipitation



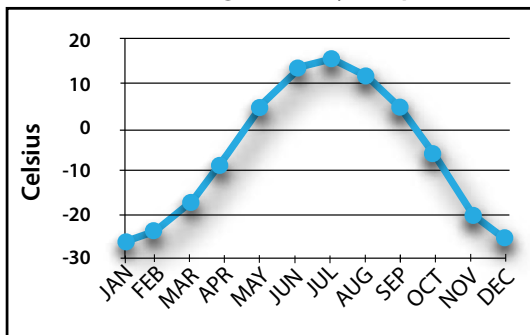
Town "B" Average Monthly Temperature



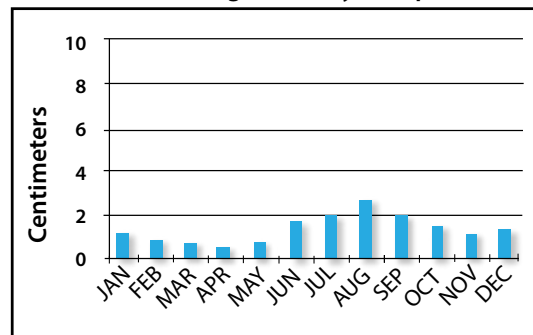
Town "B" Average Monthly Precipitation



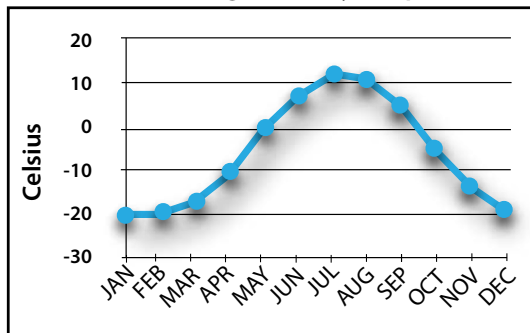
Town "C" Average Monthly Temperature



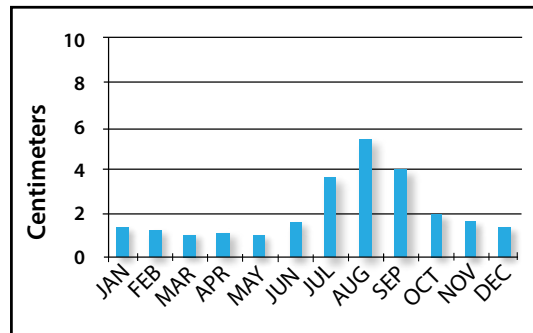
Town "C" Average Monthly Precipitation



Town "D" Average Monthly Temperature



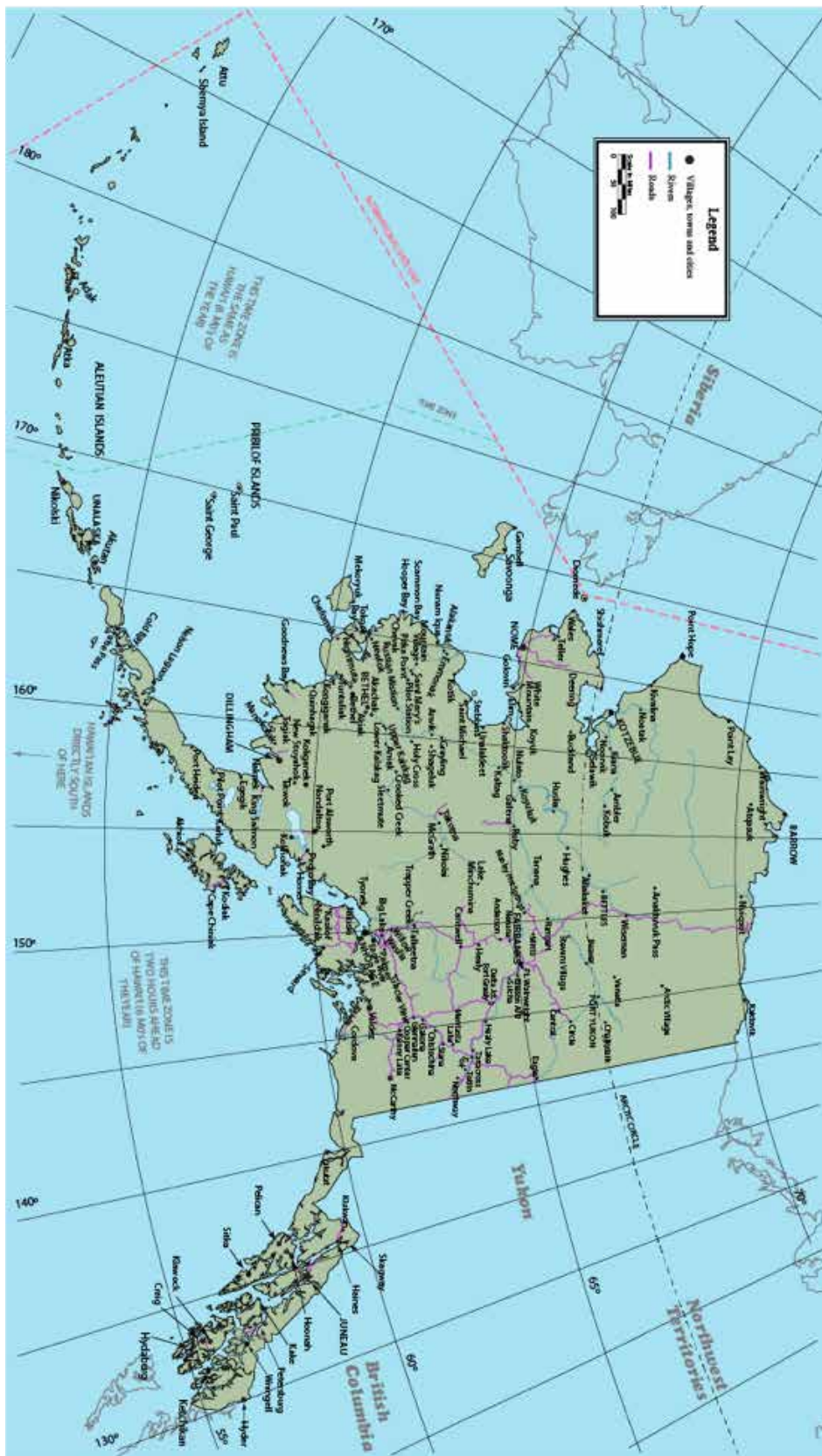
Town "D" Average Monthly Precipitation



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Alaska Map



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Part 2 Your Region

Directions

In Part 1, four different areas in Alaska were compared. What town in Part 1 do you think would be most like the community you live in? Below is the average monthly temperature and precipitation for five different communities. Chose the place nearest to you and plot the average monthly temperatures and precipitation on the blank graphs on the following page.

Nome	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temp (C)	-14.5	-14.6	-12.9	-7.0	2.3	8.0	10.7	9.9	5.8	-1.9	-8.4	-13.8
Prec (cm)	2.3	1.9	1.5	1.8	1.8	2.8	5.4	8.1	6.2	3.7	2.8	2.2

Gambell	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temp (C)	-13.4	-16.6	-14.9	-9.5	-1.5	3.6	7.5	7.6	4.6	-0.1	-4.2	-8.7
Prec (cm)	2.7	3.1	4.0	3.9	2.3	1.5	2.7	6.3	4.2	3.9	4.8	5.0

Teller	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temp (C)	-16.2	-18.2	-16.7	-9.7	0.8	7.1	10.6	10.2	5.5	-1.7	-7.8	-17.2
Prec (cm)	2.0	1.9	2.1	1.0	0.8	1.2	2.3	6.1	2.7	1.5	1.6	1.2

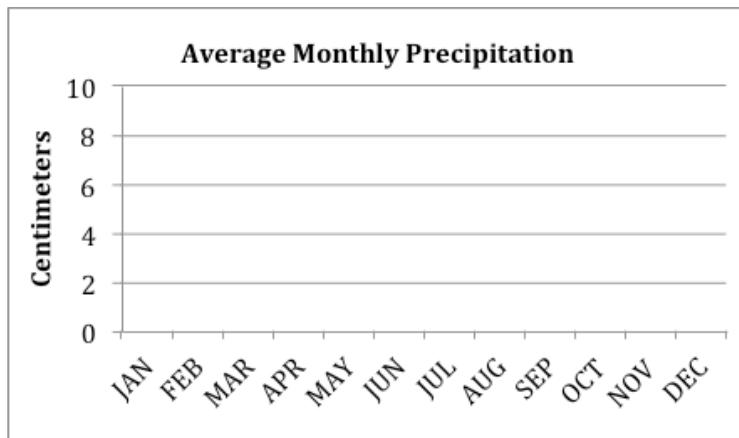
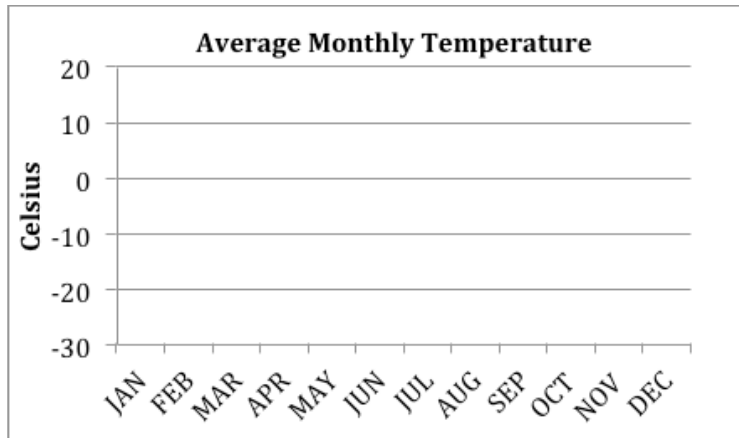
Unalakleet	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temp (C)	-15.9	-16.0	-13.1	-6.1	3.4	8.8	12.3	11.5	6.5	-2.8	-10.3	-16.6
Prec (cm)	1.3	1.1	1.4	1.1	1.6	2.7	5.1	8.3	5.5	2.2	1.4	1.2

Wales	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temp (C)	-16.9	-19.7	-18.3	-12.2	-2.5	3.5	7.9	8.0	4.5	-1.8	-8.5	-15.6
Prec (cm)	1.1	0.9	1.1	0.8	1.3	1.7	3.6	6.7	5.5	3.6	1.8	1.0

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1. Name of nearby community _____



2. a. What town from Part 1 is most similar to the one you made the graph of?

b. Describe how they are different.

