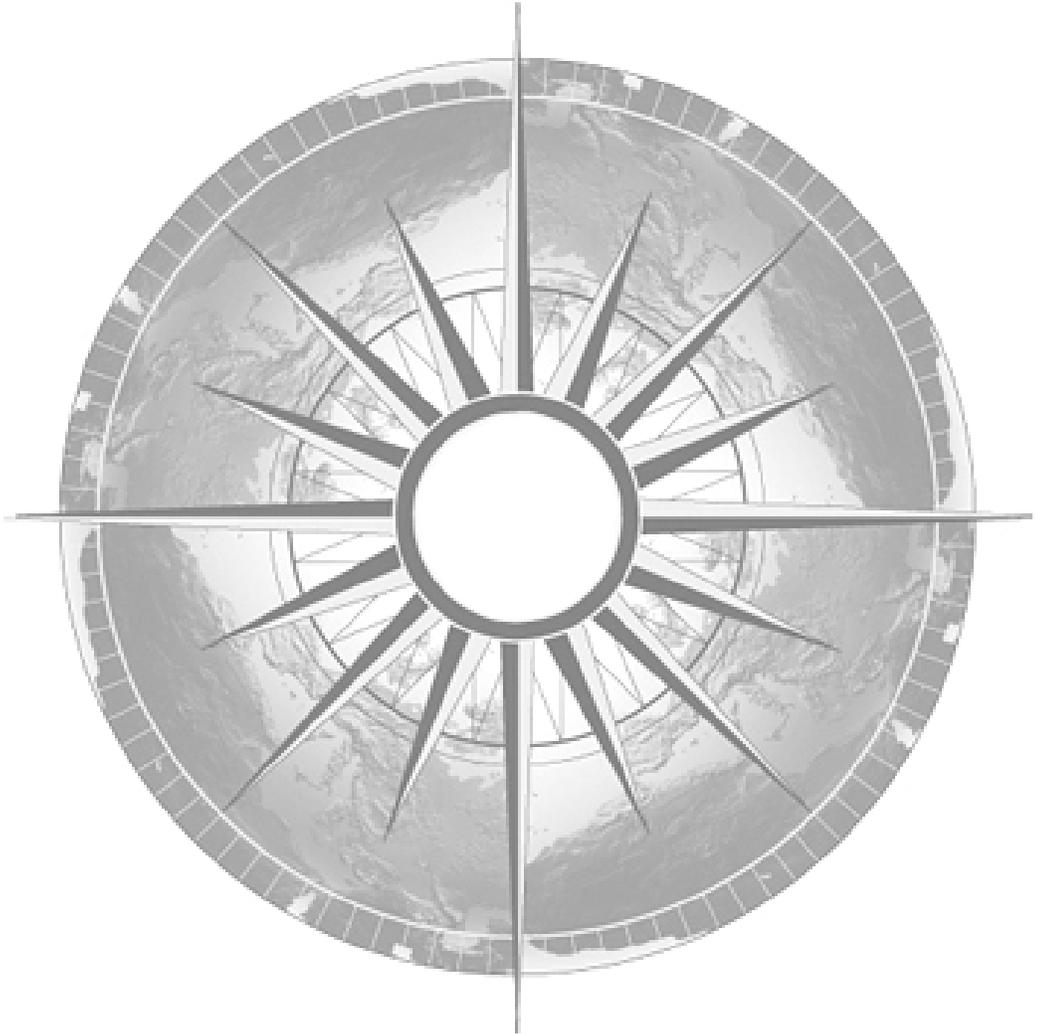


HEMISPHERES

People and Place Curriculum Resources on Human-Environmental Interactions

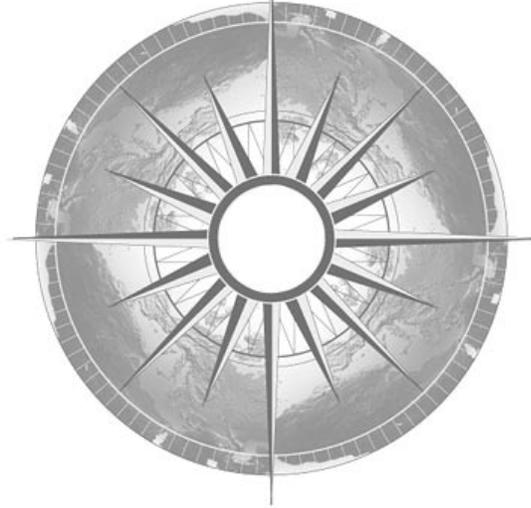


Hemispheres is a joint project of:
Teresa Lozano Long Institute of Latin American Studies
Center for Middle Eastern Studies
Center for Russian, East European & Eurasian Studies
South Asia Institute

in the College of Liberal Arts
at The University of Texas at Austin

People and Place

Curriculum Resources on
Human-Environmental Interactions



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People and Place
Curriculum Resources on
Human-Environmental Interactions

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TEACHER NOTES

GOALS

This case study will help your students learn about climate and temperature variations, and explore ways that people who live in cold climates have adapted to extreme temperatures.

ASSESSMENT EVIDENCE

T-Chart Activity: Living in Yakutia: Students will consider the pros and cons of living in an extreme environment.

LEARNING ACTIVITIES

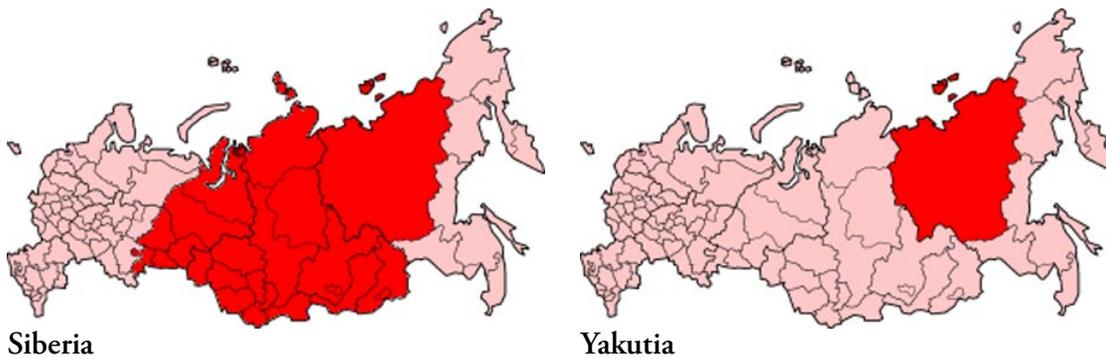
- In the *Siberian Curse: An Introduction to Yakutia* reading and worksheet, students will learn about the extreme temperatures found in the Republic of Sakha (Yakutia) and consider some of the hardships caused by these temperatures, as well as reasons that people have moved to such a remote area.
- Most of the world now uses the Celsius (or centigrade) scale of temperature. Using the *Temperature Conversion* worksheet, students will learn to convert Celsius to Fahrenheit so they can better understand and relate to the temperatures discussed in the text.
- In the *Deciphering Climate* activity, students will plot several major cities on a world map and, using a temperature chart, analyze the factors that influence climate. A chart of world cities containing temperature and latitude information is provided. Students should review the *LACEMOPS* information sheet as preparation for the climate study activities.
- *The Environment of Yakutia* reading gives an overview of the flora and fauna of Yakutia, as well as its industries, both native and modern.
- *The Population of Yakutia* reading and graph activity will give students the opportunity to understand the variety and quantities of ethnic populations in Yakutia.
- In the *Understanding Permafrost* map and reading, students will learn about permafrost and how the freezing and melting cycle affects the environment.

SOURCE

Josh Newell and Emma Wilson. 1996. *The Russian Far East: Forests, Biodiversity Hotspots, and Industrial Developments*. Friends of the Earth—Japan.

Siberian Curse: An Introduction to Yakutia

What do you know about Siberia? Most people, when they hear the name “Siberia,” think of freezing cold temperatures. The Sakha Republic, also known as Yakutia, is the part of Siberia that is the farthest east and the farthest north; Yakutsk is the capital city. What are temperatures like in the very coldest part of Siberia? Read the article below and begin to find out.



Map source: Wikipedia.org, <http://en.wikipedia.org/>

Siberian Curse: You Think This Was Cold? Try Yakutsk

The International Herald Tribune, January 30, 2004

Fiona Hill, Senior Fellow, Foreign Policy Studies

This month the U.S. Northeast froze—solid. Arctic blasts swept across Europe. Snow and near-record low temperatures closed schools, caused traffic accidents, and raised fears of powergrid failures, burst water mains and skyrocketing home fuel bills. In New Hampshire, presidential candidates shivered on the campaign trail. Fortunately, this is a temporary phenomenon.

But imagine this extreme cold as the average temperatures one might expect in January in New York, Boston, Paris, Rome and other major U.S. and European cities. This is Russia’s winter burden. Russia has more people in large, cold cities than any other country in the world. Most of them are in the Ural Mountains and extending east into Siberia.

Nearly a dozen Russian cities with populations over half a million have average January temperatures equal to or colder than New York’s near record low of 1° F/−17° C. This was an anomaly for New York. It is routine for Russia. The coldest temperature recorded in New Hampshire, of −44° F/−42° C on the top of Mount Washington (a place where no one lives) was the same as the temperature recorded the same day in Yakutsk, a city of about 200,000 people in Siberia.

These are the kinds of temperatures at which not just water mains break, but standard steel shatters. In Yakutsk, temperatures regularly fall below −58° F/−50° C in January for prolonged periods of time. The coldest temperature ever recorded outside Antarctica, of −90° F/−68° C, was recorded in the same region of Siberia as Yakutsk.

Every Russian winter is replete with stories of cities that become virtual refrigerators when utilities fail. All across Siberia, infrastructure buckles and crumbles under the onslaught of the cold. People

freeze to death in icy apartments. They die of hypothermia on the streets. The cost of emergency winter fuel deliveries alone to large Siberian cities and remote regions is at least \$700 million. Domestic energy prices are heavily subsidized by the government.

This problem of extreme cold and the costs it entails is not simply the fault of Russia's climate. It is a man-made problem. In the 20th century, Russia did something unprecedented elsewhere in the world. It relocated vast numbers of people from warmer parts of the country to inhospitably cold areas. Millions were moved across the Ural Mountains into Siberia, initially as slave laborers through the gulag prison labor camp system, then enticed out by higher wages to build Communism on the permafrost. Prior to the Soviet Union's drive to colonize and industrialize Siberia, none of Siberia's cities existed on the scale they are today. Siberia's largest city, Novosibirsk, had only 8,000 people in the last census before the Russian Revolution. Today it has about 1.5 million. Other cities were built from scratch by slave labor around giant industrial enterprises.

Maintaining huge cities in conditions of such extreme cold has become a permanent burden on the Russian economy. It is a drag on growth, and an obstacle to Russia's integration into the global economy. Millions of people are frozen in place in declining cities with bankrupt industries, rising unemployment, and increasing costs of living.

Administrative residence restrictions in cities like Moscow, lack of savings, poorly developed job and housing markets, and fears of Chinese immigration or even claims against Russian territory, all conspire to prevent people from moving to other, warmer parts of Russia where they might live and work more productively.

In a matter of days it is always business as usual for New Yorkers and Parisians. Temperatures rise. The Big Freeze is over. But frigid temperatures continue for Russians and Siberians. So does the challenge of keeping the heating and the lights on in Siberia, and helping people move in from the cold. It is a challenge we can appreciate a little more this winter.

Source: The Brookings Institution, Global Politics, <http://www.brookings.edu/views/op-ed/hillf/20040130.htm> (Reprinted with permission, International Herald Tribune.)

Name: _____

Temperature Conversion

In the United States, we use the Fahrenheit scale to measure temperature. The Fahrenheit scale was invented by Daniel Gabriel Fahrenheit in Amsterdam in about 1717. On the Fahrenheit scale, water boils at 212° and freezes at 32°.

In Europe, they use the Celsius or centigrade scale. It is called “centigrade” because it uses a scale of 100 as a measurement, but it is also called “Celsius” after its creator, the Swedish astronomer Anders Celsius. In 1742, he chose two “fixed points” for a temperature scale: the temperature of thawing snow or ice and the temperature of boiling water—water boils at 100° and freezes at 0°.

The two scales coincide only at -40° : -40 degrees Celsius is the same as -40 degrees Fahrenheit.

In the following pages, all the temperatures are given in Celsius because they come from European sources. Becoming familiar with temperatures in Celsius will help you relate to the numbers mentioned.

How to convert between Celsius and Fahrenheit

To convert Celsius into Fahrenheit
Multiply by 9, divide by 5, and add 32

To convert Fahrenheit into Celsius
Subtract 32, multiply by 5, and divide by 9

Convert the following Celsius temperatures into Fahrenheit:

12° C

27° C

35° C

- (1) What is considered “room temperature” in America? What does that translate into in Celsius?
- (2) In Yakutia, school is cancelled only if the temperature dips below -54° C. What temperature is that in Fahrenheit?

Complete the graphs below:

- (1) Find out the average temperatures in winter, spring, summer, and fall in your town/city. Make a line graph to show these temperatures in Fahrenheit.
- (2) Now make a graph to show those same temperatures in Celsius.

100° F				
75° F				
50° F				
25° F				
0° F				
	Winter	Spring	Summer	Fall

40° C				
30° C				
20° C				
10° C				
0° C				
	Winter	Spring	Summer	Fall

Name: _____

Deciphering Climate

Read the information below. Then look at the chart of annual temperatures in various cities around the world. Do research to find out the average temperature in your town. Then use the latitude map on the next page to plot all the cities, including your own. How is the temperature of your town similar to or different from the temperatures of other cities at the same latitude? What affects the climate? Why are some cities colder or warmer? Review the LACEMOPS information sheet for factors that affect world climates.

Why do coastal areas have warmer winters and cooler summers than inland places?

Land and sea differ in their ability to absorb, transfer, and radiate heat. The sea can absorb and transfer heat better than land because of its transparency. Water requires twice as much energy to warm up, but takes longer to cool than land.

Wind from the sea tends to raise temperatures in winter (sea is warmer than land), and cool in summer. Wind from the land tends to cool in winter (land is cooler than sea) and warm in summer. Thus places on west coasts (e.g., San Francisco) have milder winters, cooler summers and a smaller annual temperature range than places in the same latitude on east coasts (e.g., Washington, DC).

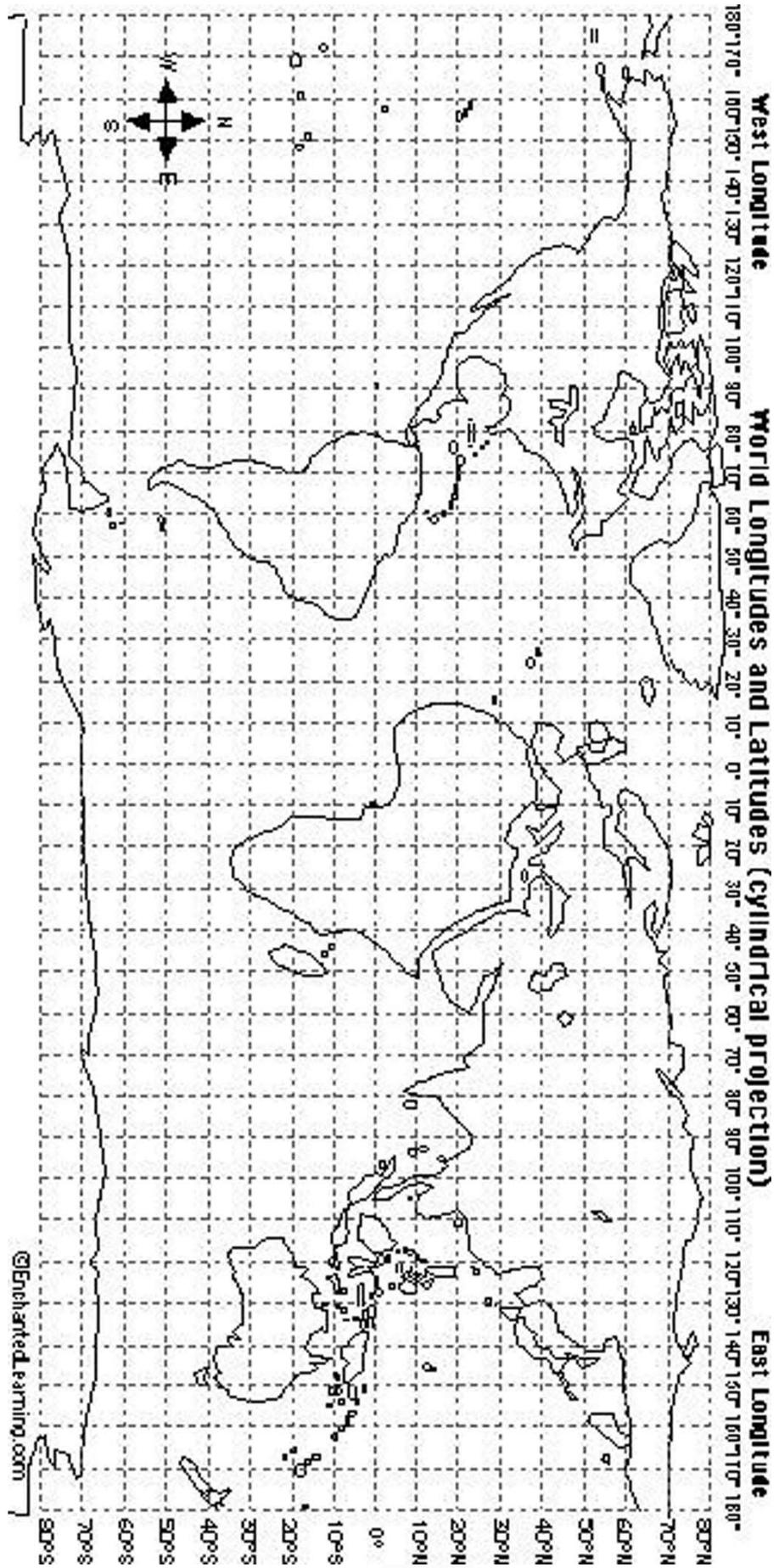
Text and table extracted from Devon Curriculum Services, <http://www.devon.gov.uk/dcs/ict/models/moweath.html>

City	January	February	March	April	May	June	July	August	September	October	November	December	Average Temp	Altitude	Latitude
Baghdad	9	12	17	22	27	33	36	36	31	28	17	11	23.3	30	33
Yakutsk	-42	-30	-18	-8	4	17	19	12	6	-10	-30	-40	-10	100	62
Reykjavik	-1	-1	0	5	7	10	12	11	8	4	1	-1	4.6	30	64
New York	0	-1	2	8	12	18	22	21	20	12	7	2	10.3	96	41
Quito	15	15	16	15	14	14	14	15	15	15	14	14	14.7	2800	0
Dublin	3	4	6	8	11	14	16	14	12	9	6	4	8.9	50	53
Los Angeles	13	14	15	16	17	18	21	21	21	18	15	13	16.8	113	34
Singapore	27	27	28	28	28	28	28	28	28	28	28	27	27.8	5	2
Your town															

(Degrees are in centigrade.)

Plot the cities from the chart on the preceding page onto this map.

Name: _____



LACEMOPS is an acronym for the eight factors that determine world climates. Latitude is the most important, but its effects may be weakened or strengthened by other factors, such as Elevation and Continentality.

Latitude determines the amount and intensity of sunlight received in a given area. In the tropics (between 23.5° N and S), the intensity of incoming sunlight is high and the amount ranges between 11–13 hours daily, with exactly 12 hours at the equator. Intensity decreases with increasing latitude, but the amount depends on the season because of the Earth's tilt.

Air masses take on the temperature and moisture characteristics of the surface over which they form and carry those characteristics to other locations through surface wind and the jet stream. There are four basic types: the cold and dry Continental Polar (CP); the cold and wet Maritime Polar (MP); the warm and dry Continental Tropic (CT); and the warm and wet Maritime Tropic (MT).

Continentality shows the impact of a large landmass on climate and weather patterns. The interior parts of continents have greater temperature extremes with the seasons, especially at mid-level and high latitudes. These areas are generally subhumid to arid. Proximity to large bodies of water moderates temperatures and may cause high humidity and rain.

Elevation affects temperatures, regardless of latitude. Temperatures cool with increasing elevation because the air is thinner at higher altitudes and is further removed from the land and water surfaces that, after being warmed by the sun, provide heat to the atmosphere. As air moves up the windward side of the mountain, it cools. As it cools, it loses the ability to hold water and releases moisture (rain). If the air continues to rise, the air temperature will reach freezing and might release snow or ice. After reaching the peak, the air descends on the other side of the mountain, warming as it moves down. The increased warmth allows the air to hold water, which results in warm and dry conditions on the leeward side of the mountain.

Mountain ranges affect temperature and the levels of precipitation (their “rain shadow” effect on the land downwind from the mountains). Because all of the moisture is dropped on one side of the mountain, the dry zone on the other side can extend for hundreds of miles. Mountains also block and funnel the movement of air masses.

Ocean currents show the impact of air off of water. In both hemispheres, continental west coasts tend to have cool offshore currents because of effects from the earth's rotation. East coasts have warm offshore currents. Where a very cold current is dominant at any latitude, dry conditions are found onshore because little atmospheric moisture is available.

Pressure systems, both global and local, cause the movement of the atmosphere through wind, which blows from areas of high pressure to those with low pressure. High pressure brings clear skies and no rain, while rain generally accompanies low-pressure systems.

Storm tracks include mid-latitude cyclones, and tropical cyclones or hurricanes. Both tend to follow similar paths because of existing global wind patterns, so some areas are very stormy.

Name: _____

Deciphering Climate Comprehension Exercises

Use a map or atlas that shows geographic features such as mountains, rivers, etc.

- (1) Find Yakutsk on a map and describe the environment.

- (2) Find Reykjavik on the map and compare its location to that of Yakutsk. Which city is farther north? Which city has a colder average temperature? Explain.

- (3) Find Baghdad on the map and on the chart. The temperature in Baghdad ranges from 9° C to 36° C, a range of 27 degrees. Convert the temperatures to Fahrenheit. Are these temperatures comfortable?

- (4) Find the city on the chart that falls at a latitude similar to Baghdad. What range of temperatures does this city have? What LACEMOPS factors might affect it?

- (5) Look at Singapore and Quito. Both are at or near the equator and have very modest temperature changes throughout the year. Why is Singapore generally 10 degrees warmer than Quito?

- (6) Now compare Quito and Dublin. Why are summer temperatures in Quito similar to summer temperatures in Dublin?

- (7) Compare the average summer and winter temperatures of your town with other towns on the chart. How much does the temperature vary throughout the year? What factors in your environment affect the temperature?



Source: Josh Newell and Emma Wilson. 1996. *The Russian Far East: Forests, Biodiversity Hotspots, and Industrial Developments*. Friends of the Earth—Japan.126.

The Environment of Yakutia

Yakutia has three distinct ecological regions: the arctic desert, which is covered by snow most of the year; subarctic tundra, where lichen and moss can grow; and the *taiga* forest, which is predominantly made up of larch trees, with some areas of pine trees. The length and severe cold of winter keep the ground frozen for most of the year (this is called *permafrost*). However, most people aren't aware that the summers in Siberia, though brief, are also hot. In the southern areas of the region there is a short agricultural growing season.

The Flora and Fauna of Yakutia:

Yakutia is one of the rare places on Earth where the purity of nature and a correspondingly amazing variety of flora and fauna are left untouched. The northern tundra is covered with moss and reindeer moss. It is a region of tundra birch that can easily fit in the palm of one's hand. In the taiga, there are pine, spruce, larch, cedar, aspen, and birch trees. The northern flowers are bright and intensely colored. The northern berries are rich in taste. A favorite flower of the people of Yakutia is called sardaana and grows only in Yakutia. The inhabitants of the vast lands of Yakutia—moose, fox, sable, wolverine, brown bear, polar bear, walrus, Manchurian deer, northern deer, musk deer, and bighorn sheep—live freely. Numerous rivers and lakes are rich with fish, omul, white salmon, sturgeon, and karas, to name but a few.

Source: YakutiaTravel.com, <http://www.yakutiatravel.com/eng/facts/envir.htm>

Sardaana (*Lilium pensylvanicum*)



© 1998 Pavel Golyakov

Source: Center for Russian Nature Conservation, <http://www.wild-russia.org/bioregion8/8-olekma.htm>

The original inhabitants of Yakutia were Yakut natives whose main economies were reindeer herding and horse raising (the word “Yakut” means “horse people”). The Yakut pony looks different from European horses in that it is smaller, fatter, furrier—in short, much hardier and well-adapted to living through the frozen winters. Like reindeer, the Yakut pony can scrape through the snow to find food (lichen and moss), and does not need to be fed by humans. This is very important in a land where the growing season is only a couple of months long; there are no fields of hay in Yakutia. Ponies are used for riding but are also eaten. Pony meat is very nutritious and is said to be quite tasty.



Source: The World and I, http://www.worldandi.com/peoples/2000/5_jan/Html/page4.asp

Other native populations include the Evens, Evenks, Dolgane, Chukchi, and Yukaghirs. There are several villages in Yakutia where natives continue their traditional way of life of reindeer herding, hunting, and fishing. However, for the most part people live in cities or towns associated with particular industries, such as mining. The capital city of Yakutia is Yakutsk, which lies on the banks of the Lena River.

The most important industries in Yakutia are diamond and gold mining. Also important are the production of coal, iron, oil, natural gas, and timber, as Yakutia is an area rich in natural resources.

Comprehension Exercises

- (1) Is it always cold in Siberia?

- (2) What is one of the main activities of native populations?

- (3) What is one of the main industries?

Name: _____

The Population of Yakutia

Before the 1960s, Yakuts made up the majority of the population in Yakutia. As the Soviet system increased its interest in mining, more Russian and Slavic immigrants arrived from European Russia. Good benefits were given to those who would relocate to the frozen north, such as double pay, long vacations, and free trips to “the mainland,” as the rest of Russia was called. The great number of migrants resulted in a shift in the population demographics. By 1970, less than half the population was Yakut, and by 1990, Yakuts made up just one-third of the population.

However, since the breakup of the Soviet Union, many ethnic Russians have left the republic. The benefits they once received have been discontinued, and many have chosen to make their living in an area with fewer hardships.

Graph Activity

Use the numbers below to make a bar graph of the ethnic populations in Yakutia. In 1997, the population of Yakutia was approximately 1,094,000. (The numbers below do not add up to 1,094,000—the remaining population is made up of more than 20 smaller ethnic groups.)

Main Ethnic Groups in the Population of the Republic of Sakha (Yakutia), 1997

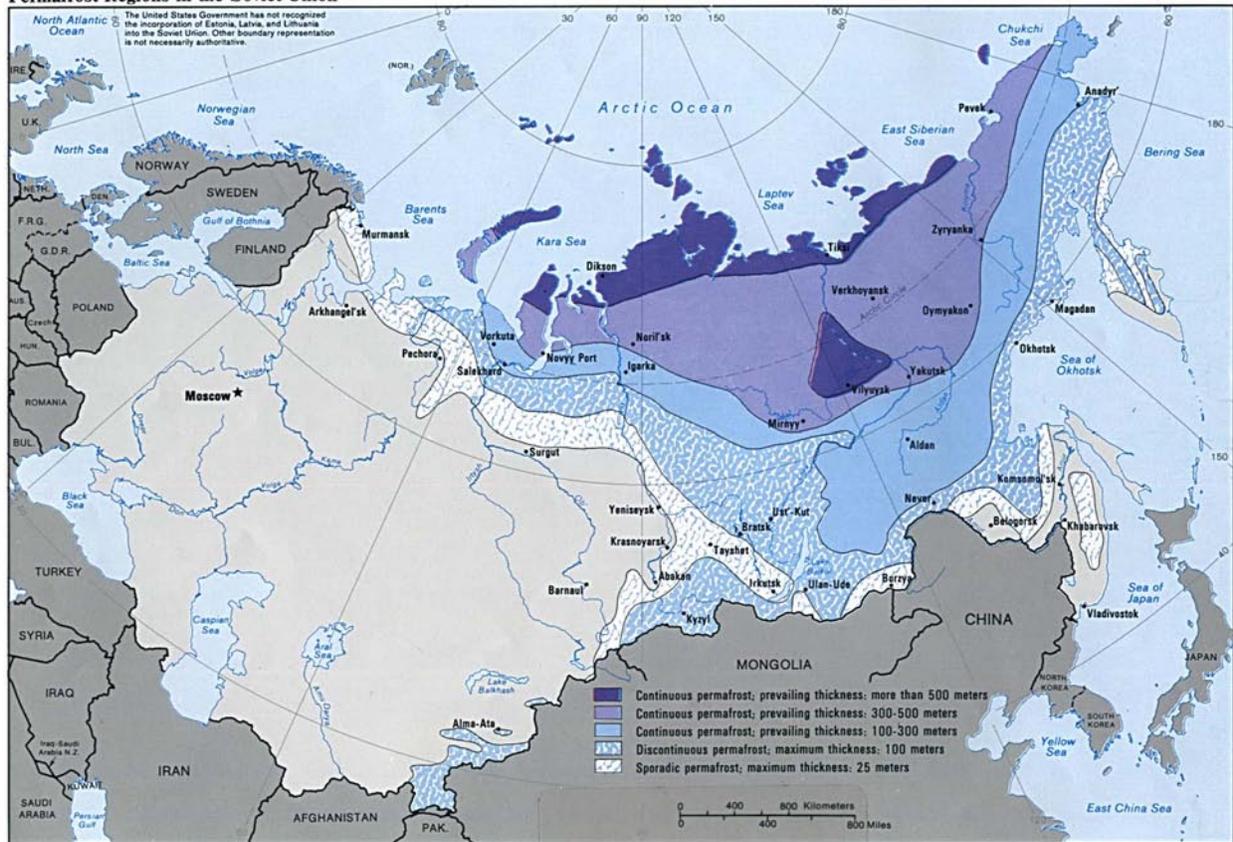
Ethnic group/number
Yakut 365,236
Evenk 14,428
Ukrainian 77,114
Russian 550,263
Tatar 17,478

600,000					
550,000					
500,000					
450,000					
400,000					
350,000					
300,000					
250,000					
200,000					
150,000					
100,000					
50,000					
	Yakut	Evenk	Ukrainian	Russian	Tatar

Statistics from: Tjeerd de Graaf. 1997. *The Ethnolinguistic Situation in Yakutia*, <http://odur.let.rug.nl/~degraaf/publications/1997yakutia.htm>

Understanding Permafrost

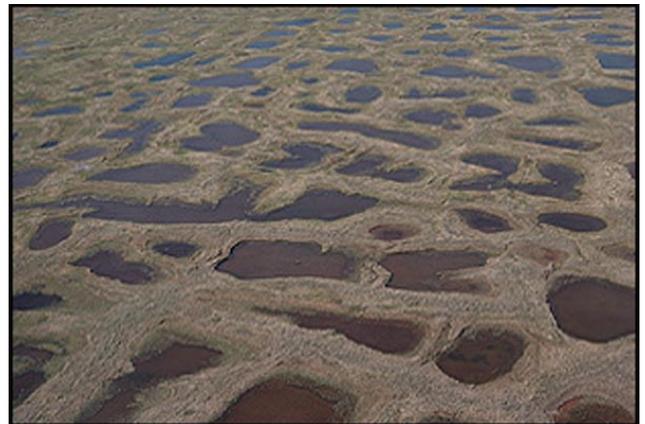
Permafrost Regions in the Soviet Union



Source: Perry-Casteñeda Map Collection, University of Texas at Austin, http://www.lib.utexas.edu/maps/commonwealth/soviet_permafrost_84.jpg

More than 40% of Yakutia lies above the Arctic Circle. Throughout Yakutia it is so cold that the ground is frozen solid. This is called *permafrost* because the ground is permanently frozen. It does warm up in the summer, but for such a short period that only the top layer of soil melts. Because the soil underneath remains frozen, the top layer can become boggy, with many small lakes.

This brief melting period allows plants to grow, and a wide variety of plants do grow in the tundra, many of which have specially adapted to the harsh conditions of the north. However, the permanently frozen ground can cause problems for people. For example, the earliest wooden buildings in Yakutsk were built directly on the ground, but as the warmth of the buildings and the changes throughout the year melted the top layer of soil, the buildings began to buckle and sink. Nowadays buildings in Yakutsk are built on concrete stilts so that the heat of the buildings don't affect the soil below. The buildings also shade the soil in the summer so that it doesn't warm up as much. The result is fewer sinking buildings.



Source: Department of the Interior, U.S. Geological Survey, <http://carbon.wr.usgs.gov/>

Name: _____

Understanding Permafrost Comprehension Exercises

Do research on the Internet and in the encyclopedia to find out more about permafrost.

(1) What is permafrost?

(2) Can anything grow if the ground is frozen?

(3) What are some of the problems associated with building on permafrost?

(4) Are there any places in the United States with permafrost? If so, where, and what do you know about these places?

T-Chart Activity: Living in Yakutia

A T-chart gives your students the opportunity to examine the pros and cons of a decision. Before beginning this exercise, have students complete all the readings and also do some additional research on an aspect of Yakutia that interests them (history, environment, ponies, reindeer, etc.). Some of the conclusions drawn during this exercise will be based on facts from the readings and some will be based on inference or personal preference.

Before you begin, draw a T-chart on the chalkboard. First ask the students to list reasons why people might want to stay in Yakutia, despite the hardships of living in such an extreme environment. Then ask them to list reasons why people might want to leave.

Ask the students these follow-up questions:

- (1) What sort of benefits might encourage you to live in an extreme environment?
- (2) Would you want to live in Yakutia if it meant you got double your usual salary?
- (3) If you had grown up in Yakutia, would you want to live in a warmer place if it meant leaving your family?
- (4) What subjects could you study in school that would prepare you for a job outside of Yakutia?
- (5) What sort of jobs would you not be able to do elsewhere?

Further Information

Permafrost

U.S. Fish and Wildlife Service Arctic National Wildlife Refuge:
<http://www.arcticwildlife.org/fws/permpics.html>

Scott Polar Research Institute, Cambridge, UK:
<http://www.spri.cam.ac.uk/resources/rfn/sakha.html>

The Canadian Encyclopedia:
<http://www.thecanadianencyclopedia.com/index.cfm?PgNm=TCE&Params=J1ARTJ0006229>

UNEP (United Nations Environment Programme):
http://www.unep.org/GC/GC21/permafrost_map.jpg

The Yakut Pony

Oklahoma State University, Breeds of Livestock:
<http://www.ansi.okstate.edu/breeds/horses/yakut/>

The World and I Online Magazine:
http://www.worldandi.com/peoples/2000/5_jan/Html/index.asp

General Information on Yakutia

World Wise Ecotourism Network (first-person account of travel in Yakutia):
<http://www.traveleastrussia.com/siberia.html>

Wikipedia—general information on Yakutia:
http://en.wikipedia.org/wiki/Sakha_Republic

Center for Russian Nature Conservation, Olekminsky Zapovednik (nature preserve):
<http://www.wild-russia.org/bioregion8/8-olekma.htm>

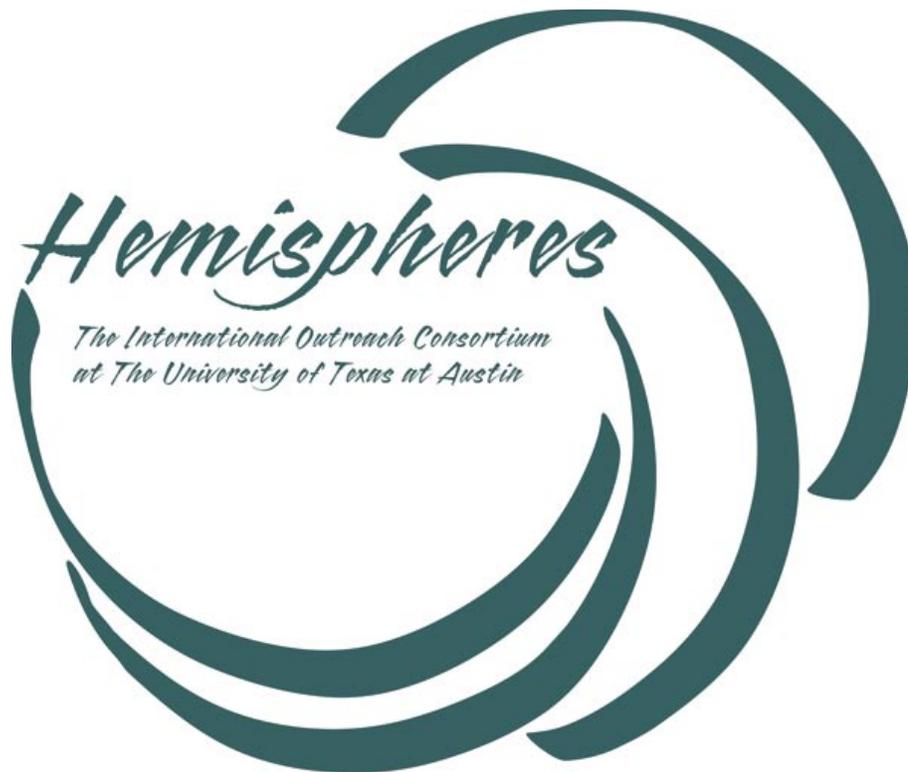
About Hemispheres

Created in 1996, Hemispheres is the international outreach consortium at the University of Texas at Austin. Hemispheres utilizes University resources to promote and assist with world studies education for K-12 and postsecondary schools, businesses, civic and non-profit organizations, the media, governmental agencies, and the general public.

Comprised of UT's four federally funded National Resource Centers (NRCs) dedicated to the study and teaching of Latin America; the Middle East; Russia, East Europe & Eurasia; and South Asia, Hemispheres offers a variety of free and low-cost services to these groups and more. Each center coordinates its own outreach programming, including management of its lending library, speakers bureau, public lectures, and conferences, all of which are reinforced by collaborative promotion of our resources to an ever-widening audience in the educational community and beyond.

Hemispheres fulfills its mission through: coordination of pre-service and in-service training and resource workshops for educators; promotion of outreach resources and activities via exhibits and presentations at appropriate state- and nation-wide educator conferences; participation in public outreach events as organized by the consortium as well as by other organizations; and consultation on appropriate methods for implementing world studies content in school, business, and community initiatives.

For more information, visit the Hemispheres Web site at:
<http://www.utexas.edu/cola/orgs/hemispheres/>
or e-mail: hemispheres@austin.utexas.edu



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