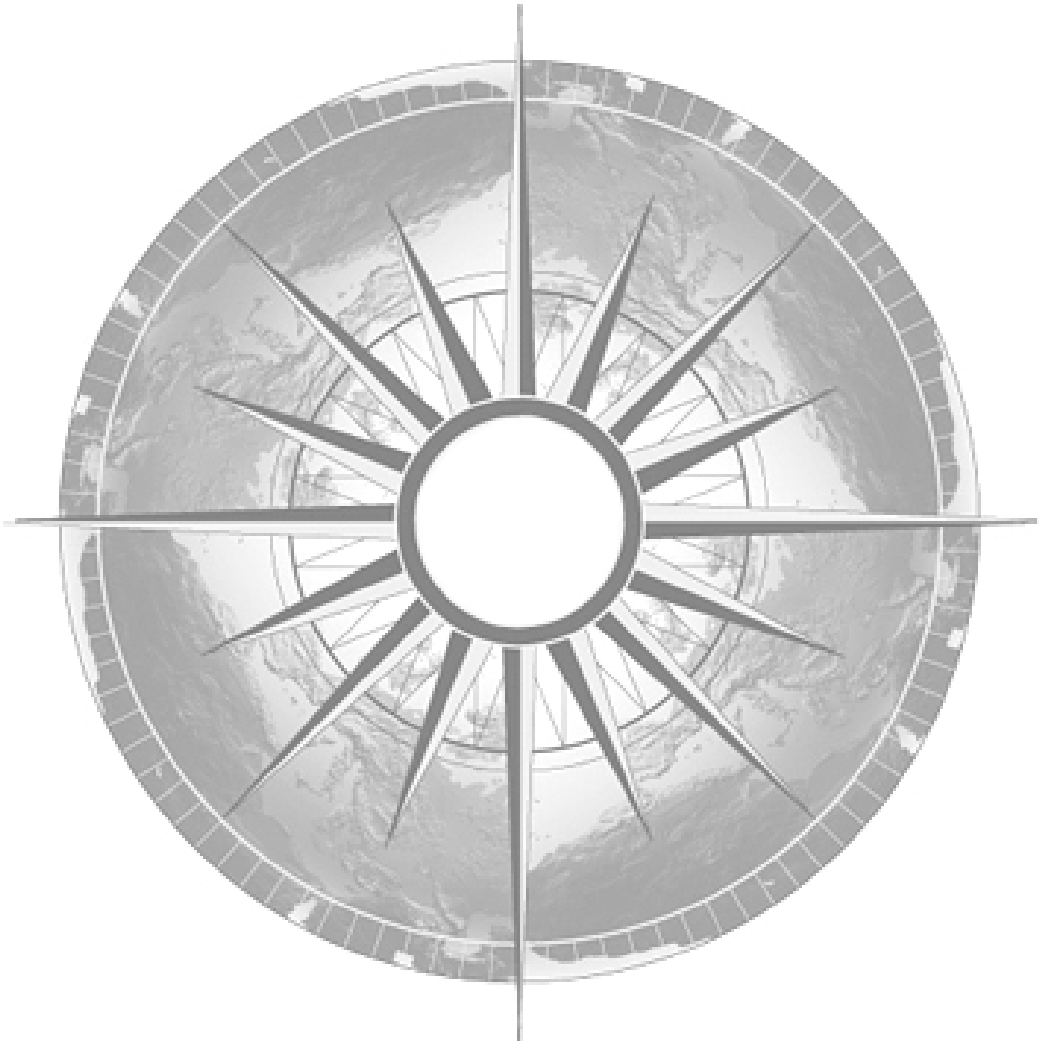
Hemispheres

People and Place

Curriculum Resources on Human-Environmental Interactions



Hemispheres is a joint project of:
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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

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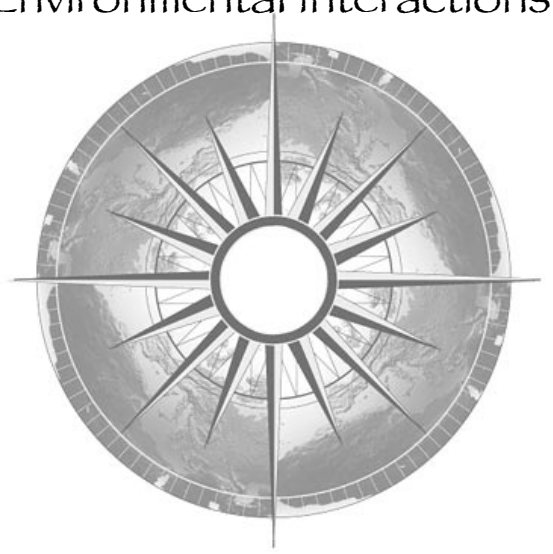

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The International Outreach Consortium at The University of Texas at Austin

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TEACHER NOTES

GOALS

This case study will help your students learn about the causes and effects of water pollution in the world by looking at Lake Baikal, located in Siberia. As a major source of the world's fresh lake water, Lake Baikal is exceptional in its size and ability to withstand pollutants. However, because of residents' assumptions that the lake will endure anything, it is also highly threatened (see **The Aral Sea** case study for an example of what can happen when water is not managed well). By studying Lake Baikal, students will learn that: (1) the causes of pollution are complex; (2) the remedies for pollution are multifaceted; and (3) pollution has a serious impact on the environment.

ASSESSMENT EVIDENCE

Create an Appeal Poster: Environmentalists vs. Factory Workers: "Environmentalists" will study the unique habitats of Lake Baikal as well as the effects of pollution on the fragile ecosystems. "Factory workers" will research pollution reduction techniques. Students will create posters to advocate their positions.

LEARNING ACTIVITIES

- The *Pearl of Siberia National Geographic* map shows the nature preserve surrounding Lake Baikal and indicates the source of some pollutants that affect the lake. Note: This map is best viewed in color to distinguish between the blue of the lake and the green of the coastal protection zone. If you cannot print it in color, use the basic outline map at the back of the unit so students can see the accurate shape of the lake.
- In the *Locating Lake Baikal* map exercise, students will locate and identify important geographic features of Lake Baikal.
- In the *Siberian Lake a Source of Debate* reading and *Understanding Lake Baikal* worksheet, students will get an overview of Lake Baikal, including its unique aspects, such as its depth and the number of species that make their home there, and the threats posed by pollution. Students will begin to think about the complexities of how to manage pollution.
- In the *Lakes around the World* activity, students will build graph-reading skills by creating graphs and answering questions about lake depth, area, and volume.
- The *Pollution in Lake Baikal* reading describes sources of pollution, including "point" pollution and "non-source point" pollution.
- The *Further Information* page contains links to Web sites for further research on Lake Baikal.
- *Outline Maps:* The outline map of Lake Baikal will help your students to identify the main rivers flowing into and out of Lake Baikal. The outline map of Russia will help them learn the location of Lake Baikal in Russia.

Pearl of Siberia Map

Source: Lake Baikal Homepage, http://baikal.irkutsk.org/ng/ng.jpg

Locating Lake Baikal

Introduction
Lake Baikal is located in the heart of Siberia, an area legendary for being remote and sparsely populated, and yet pollution is an increasing problem in this region. Lake Baikal is the deepest lake in the world, with parts that are over a mile deep. More than 300 rivers flow into Lake Baikal, but only one flows out: the Angara River. In the 1960s, a paper mill (factory) was built on the southern shore, which released untreated water into the lake. Other sources of pollution are the large cities along the Selenga River from which pollution flows into the southern part of the lake. Through the years, there have been numerous attempts to call attention to the problems caused by pollution. Environmentalists continue to work to improve conditions at Lake Baikal and to preserve the unique species that make the lake their home.

Map Exercise
Use the *Pearl of Siberia* map as your source.

(1) Locate the city of Baikalsk. This is the location of a large pulp and paper mill, the source of some of the pollution in Lake Baikal.

(2) In the Russian language, "severo" means "north." Can you find the town Severobaikalsk?

(3) The city of Selenginsk lies along the Selenga River. How can you tell from looking at the map that the Selenga River flows *into* Lake Baikal?

(4) The Angara River flows out of Lake Baikal. Name 3 large rivers that flow into Lake Baikal.

Siberian Lake a Source of Debate

Chicago Tribune
December 4, 2000
SIBERIAN LAKE A SOURCE OF DEBATE
ENVIRONMENTALISTS, MILL CLASHING OVER POLLUTION
By Colin McMahon
Tribune Foreign Correspondent

BAIKALSK, Russia—Some Siberians believe their majestic Lake Baikal has a healing, mystical quality. But there is nothing soothing or spiritual about an environmental controversy surrounding the storied waters.

Despite years of protests by local and international environmentalists, a paper mill on Lake Baikal's shore is pouring wastewater into the world's oldest and deepest freshwater lake.

Mill officials say the discharge is safe. Environmentalists say it has damaged Baikal's special and sensitive ecology. The Russian government looks on, unsure how or whether to intervene.

The conflict has drawn international scrutiny because Lake Baikal is a natural wonder.

The lake holds nearly a fifth of the world's fresh water contained in lakes, more than that in the Great Lakes combined. Scientists estimate its age at 25 million years, compared with 20,000 years or less for the average lake. Most of Baikal's plant and animal life is found nowhere else.

For sheer beauty, Baikal is unmatched in Russia. The UN Educational, Scientific and Cultural Organization named it a World Heritage Site, indicating the UN thinks it should be federally protected.

"Pearl of Siberia," is Russians' fanciful name for Lake Baikal. People who live around it sometimes call Baikal simply, "sea."

Framed by mountains and woods, Baikal is a long and relatively thin strip out of the Siberian forest. Bigger than some European countries, it stretches nearly 400 miles. Near the western shore, Baikal reaches its deepest point—more than a mile to the sediment-filled bottom.

Baikal water is bottled and sold in stores. On the lake itself, the cold water is so clear that rocks resting at the bottom several feet below appear to be within arm's reach. Visibility can be more than 100 feet; some people complain of vertigo when they look down.

In more than 30 years of existence, the Baikalsk Pulp and Paper Mill has not muddied Baikal's waters. Its damage to the lake, opponents say, is less obvious but quite serious.

"Changes have been observed in the ecosystem of Baikal since the paper mill opened," said Jennie Sutton, a transplanted Briton who co-directs Baikal Environmental Wave in nearby Irkutsk. "The changes being observed are big over such a short time, and these changes are indicative of pollution.

"If you compare the level of Baikal's pollution to some lakes in North America or Europe, then it is nothing," Sutton said. "But Baikal is a very pure system, and the endemic organisms have evolved over 25 million years without any pollution."

Of its 2,000 or so identified plant and animal species, about 1,500 are unique to Baikal.

Among them is the omul, a gray and oily fish that is a culinary favorite in the region. A more exotic inhabitant is the nerpa, an exclusively freshwater seal whose closest cousin lives nearly 2,000 miles away in Arctic waters. Thousands of the seals died in 1987–88 during an epidemic that remains unexplained but that ecologists blame in part on dioxins.

Because Baikal is so big, the dioxins and other pollutants that enter from various sources are dispersed more easily than they would be in a smaller lake. But Baikal's ability to withstand a toxic assault also lulled Soviet officials into thinking they could exploit the lake. Baikal was so big, they argued, it would never get too polluted.

On top of that, some scientists and officials at Baikalsk Pulp and Paper say Baikal has a unique but unexplained ability to clean itself. They say that even though the main river flowing into Baikal, the Selenga, is heavily polluted, the lake itself is almost pristine. Baikal has 335 other tributaries, most of them minor, as well as other less-severe sources of pollution.

"I don't want Lake Baikal to be ruined any more than Greenpeace or the rest of them do," said Raisa Zaykova, who heads the mill's environmental protection unit. "We live here, too. We want our children to live here. This is why we are making the plant cleaner and safer."

She said the mill, owned by the government, by the workers and by private stockholders, hopes to invest more than $50 million by 2005 to replace old treatment equipment. In the long term, Baikalsk Pulp and Paper envisions a $300 million project designed to stop waste from being dumped into the lake.

All of this, though, depends on government approval.

It also depends on funding, which Zaykova admits could be an issue. But she suggested that the World Bank would lend what the mill cannot raise.

Zaykova produced graphs showing that pollutants in the plant's wastewater have fallen each year since the early 1990s. She acknowledged that problems remained, yet she said progress is being made.

"No one except our team thought about the ecology during the decay of Russia over the last decade," Zaykova said. "Despite all the problems, despite the crises, the plant did not stop working.

"If the mill shut down, Baikalsk would have died like a lot of other towns died in Russia."

About 29,000 people live in Baikalsk, a tidy place of five-story apartment buildings and some spectacular views of Baikal. More than half are dependent on the salaries from the mill, which are high by Russian standards.

"There are a lot worse places in Russia where people are getting sick and need help," said Natasha Matyukhina, 22, an engineer who works at Baikalsk Pulp and Paper. "Why don't the environmentalists call attention to those places?"

Sutton and the others worry that the people of the Baikalsk region have become complacent. They warn that the threat to the great lake is too big to ignore.

"If you get this lake polluted, you are not going to be able to clean it up," Sutton said. "This is the reason that something needs to be done."

Source: Center for Defense Information, Johnson's Russia List, http://www.cdi.org/russia/johnson/4670.html

Name: _____

Understanding Lake Baikal
Comprehension Exercises

After reading the article "Siberian Lake a Source of Debate," consult a map or atlas to help you locate geographic features of Lake Baikal.

(1) Where is Lake Baikal located?

(2) How old is Lake Baikal?

(3) Name two sea creatures that are unique to Lake Baikal and explain what they are.

(4) Approximately how many different species of plant and animal life are found in Lake Baikal?

(5) How many rivers flow into Lake Baikal?

(6) How many rivers flow out of Lake Baikal?

(7) What are two sources of pollution in Lake Baikal?

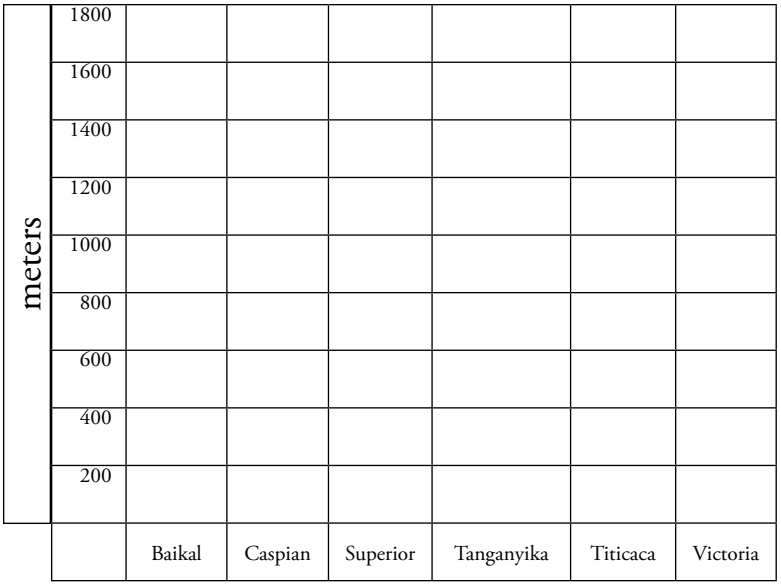
(8) Based on the article, do you think efforts should be made to protect Lake Baikal now or that environmentalists should focus on other areas first? Explain your response.

Name: _____

Lakes around the World
Graph Activity

There are many ways to measure the size of a lake: **depth** (how far to the bottom), **area** (how much land it covers), and **volume** (how much water it holds). Below are graphs showing these three methods of measuring lakes around the world.

Deepest Lakes (depth)
Lake Baikal, 1637 meters
Caspian Sea (Central Asia/Russia), 1025 m
Lake Superior (North America), 406 m
Lake Tanganyika (East Africa), 1435 m
Lake Titicaca (Western South America), 370 m
Lake Victoria (East Africa), 82m



Largest Lakes by Size (area)
Lake Baikal, 31,500 square kilometers
Caspian Sea, 394,299 sq. km
Lake Superior, 82,414 sq. km
Lake Tanganyika, 32,893 sq. km
Lake Titicaca, 8,135 sq. km
Lake Victoria, 69,485 sq. km

Lakes around the World, Graph Activity, p. 2

Largest Lakes by Amount of Water (volume)
Lake Baikal, 23,600 km^3
Caspian Sea, 78,200 km^3
Lake Superior, 12,100 km^3
Lake Tanganyika, 19,000 km^3
Lake Titicaca, 932 km^3
Lake Victoria, 2,760 km^3

Data source: LakeNet: http://www.worldlakes.org/lakedetails.asp?lakeid=8385

The measurements are given in meters and kilometers
because most countries uses the metric system.
To convert from kilometers to miles, multiply the kilometers by 0.62.
To convert from miles to kilometers, multiply the miles by 1.61.

Questions for Comprehension

(1) Which lake is a mile deep?

(2) Which lake is the "biggest" overall?

(3) Why might a lake with a small area have a large volume?

Pollution in Lake Baikal

Lake Baikal is in an area of Siberia that is heavily forested. In 1961 a paper mill was built on the southern shore to process timber into wood pulp, fiber, and paper. In order to make high quality paper, the mill uses chlorine to bleach the pulp. Processing wood is a procedure that uses a lot of water, and the wastewater was allowed to flow directly into Lake Baikal. Directors of the factory claim that the wastewater only affects a small area of Lake Baikal, and that the lake is so deep and large that the effect is minimal. They are also concerned that closing down the factory, as some environmentalists claim is necessary, would be disastrous for their city, which was built specifically because of the paper mill. Most people in the city work for the factory—closing it down would mean massive unemployment.

Other factors also affect the quality of the lake water: there is another factory on the northern shore of Lake Baikal, as well as industries along the Selenga River. In addition, there is "non-source pollution"—water from rainfall and snowmelt picks up pollutants as it flows across the landscape and into the rivers that feed the lake. Air pollution from cities also drifts over parts of the lake. The city of Ulan Ude, some 150 km away, is a major pollutant of the Selenga River, and thus of Lake Baikal.

Environmentalists have been fighting to protect Lake Baikal for years. International organizations often aid local organizations such as BaikalWave. Some progress has been made in protecting the lake: the factory in Selenginsk has been converted to a closed-water system (so no wastewater is released), and the World Bank has given funding to the Baikalsk paper mill to convert to a closed system, but there is a dispute as to whether the factory is complying.

Lake Baikal © Greenpeace Russia

Baikalsk Pulp and Paper Mill in 2003, still producing, still bleaching with chlorine.
© Greenpeace Russia / Katya Zaspa

Create an Appeal Poster: Environmentalists vs. Factory Workers

Instructions to the Teacher:
Discuss with the class the concept of "persuasion" and techniques for using graphic design to convey a message visually. The posters will need to capture the viewer's attention and get the message across with few words.

Divide the class in half. One half will be ecologists who want to preserve the natural environment in order to protect the flora and fauna of Lake Baikal. They can do research on the unique creatures of Lake Baikal, such as the nerpa and omul. The other half of the class will be factory workers in Baikalsk. They depend on the factory for their livelihood and will research ways to reduce pollution in the lake without closing the factory. Working in pairs, the students will create posters supporting their views.

Materials: 11x17 drawing paper, markers, rulers.

Further Information

Baikal Web sites
Irkutsk.org is a local Web site created by an Irkutsk resident, with photos and videos of Lake Baikal: http://baikal.irkutsk.org/

Baikal Web World has a wealth of detailed information and photographs of Lake Baikal, its flora and fauna, and the dangers facing the lake: http://www.bww.irk.ru/index.html

Limnological Institute, a department of the Russian Academy of Sciences dedicated to the study of Lake Baikal: http://www.lin.irk.ru/eng/about.htm

LivingLakes.Org is an international network and partnership whose mission is to enhance the protection, restoration, and rehabilitation of lakes, wetlands, other freshwater bodies of the world, and their catchment areas. The Living Lakes partnership promotes voluntary international collaboration among organizations that carry out projects benefiting lakes, wildlife, and people: http://www.livinglakes.org/baikal/

Lake Baikal has been declared a World Heritage Site by the United Nations Environment Programme World Conservation Monitoring Centre: http://www.wcmc.org.uk/protected_areas/data/wh/baikal.htm

Lake Baikal in the News
National Geographic News, December 2001, "Mysterious Deaths Deepen Concerns about Russia's 'Sacred Lake," http://news.nationalgeographic.com/news/2000/12/1201_russianlake.html

Radio Liberty, 1996, "Siberian Factory Town Struggles to Balance Man and Nature": http://www.icc.ru/fed/rliberty.html

Web sites about the Baikal seal (nerpa)
Baikal Watch report on endangered nerpa: http://www.earthisland.org/project/reportPage2.cfm?reportContentID=11&subSiteID=1&pageID=71

Seal Conservation Society: http://www.pinnipeds.org/species/baikal.htm

Learn for Life: Wildlife and Wetlands Trust, information on Lake Baikal and nerpa:
http://www.wwtlearn.org.uk/index0.html?factfile/world-wetlands.htm&2

Sources on Pollution
Protecting Water, information on non-source point pollution: http://protectingwater.com/index.html

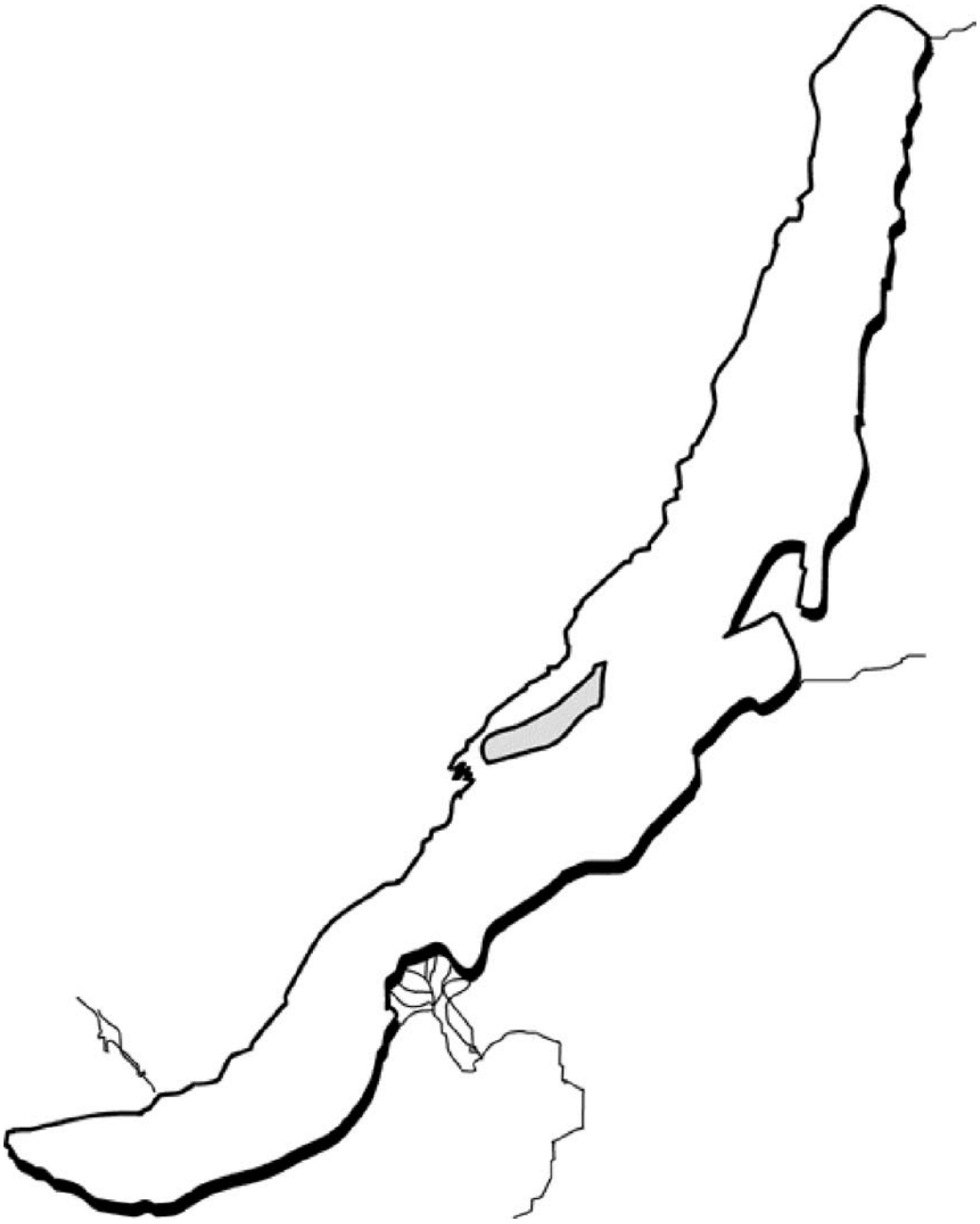
Earthday Network, What's in your water?: http://www.earthday.net/programs/currentcampaigns/waterforlife/water_whats_in.aspx

Ecological catastrophe – pollution at Lake Baikal: http://www.bww.irk.ru/pollution/pollution.html

Clean Water Lesson Plan: http://media.shs.net/earthday/pdf/programs/educators_water_guide.pdf

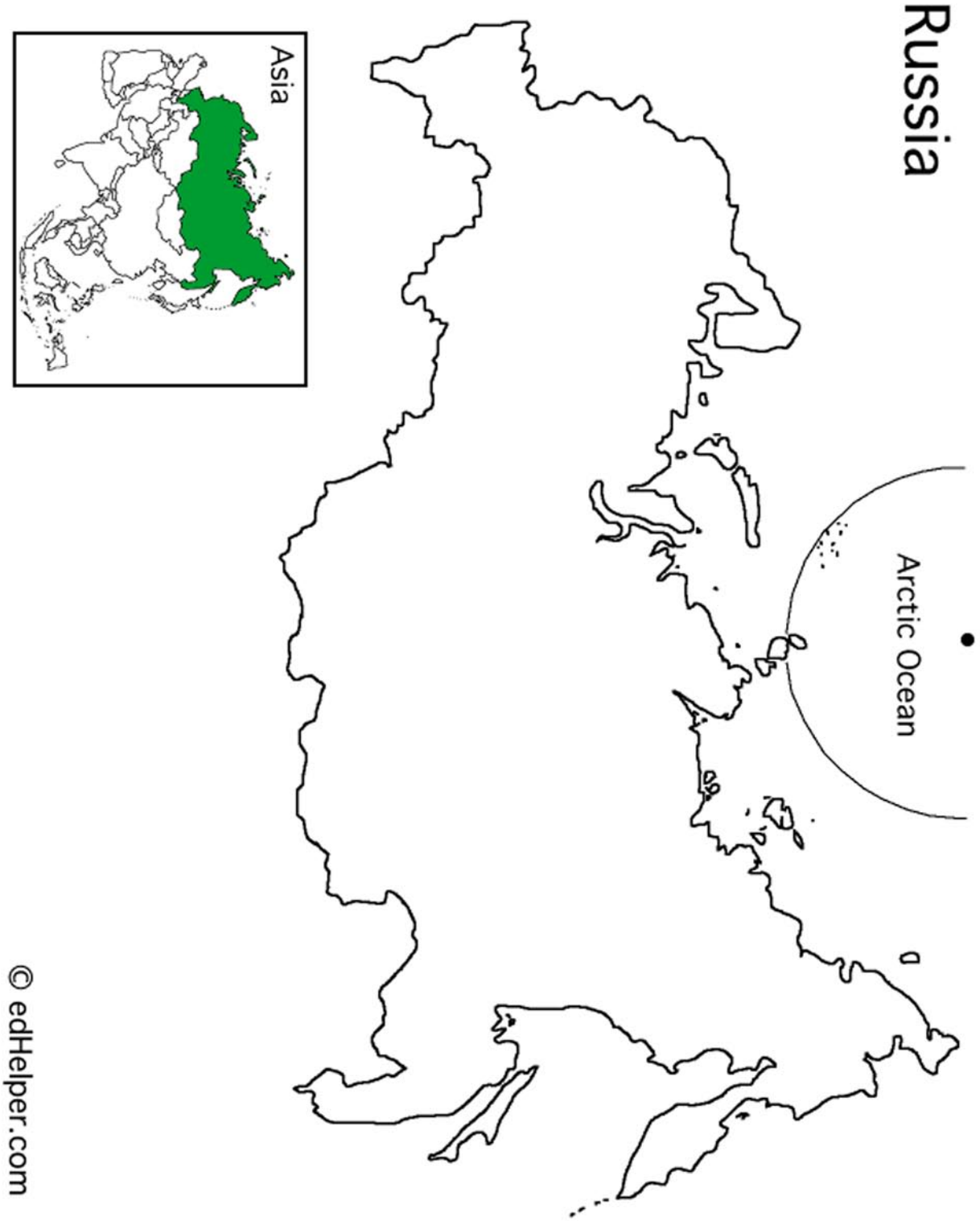
Outline Maps

Use this map of Lake Baikal to help your students identify the main rivers flowing into and out of Lake Baikal, and to locate the polluting cities of Baikalsk, Selenginsk, and Ulan Ude.



Source: Limnological Institute of the Russian Academy of Sciences, http://www.lin.irk.ru/images/c04x.gif

Use this map of Russia to help your students locate Lake Baikal.



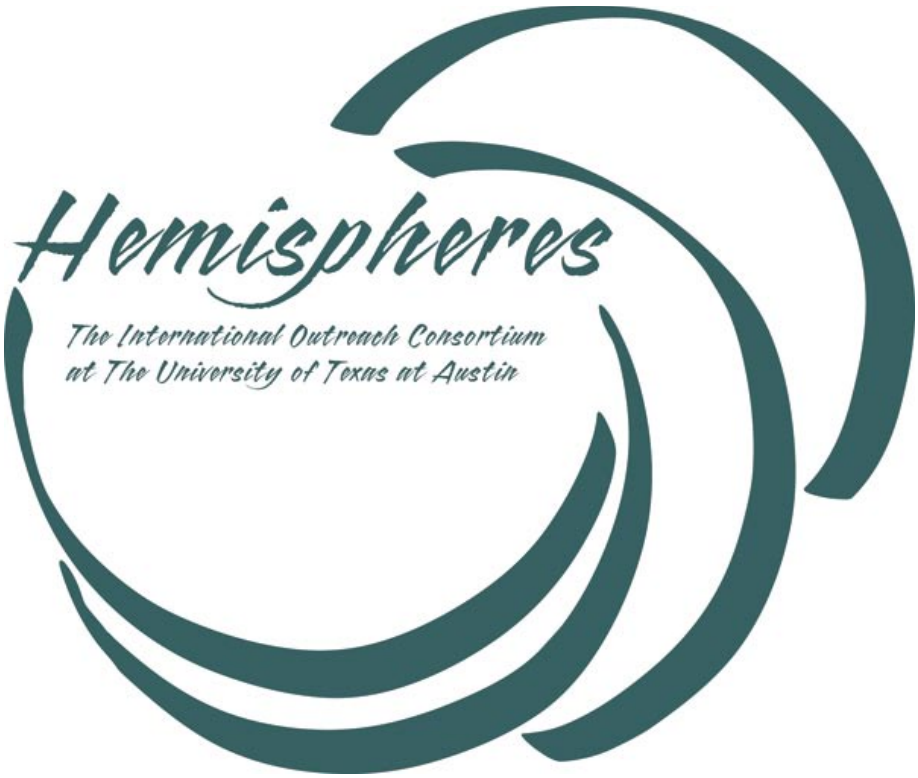
About Hemispheres

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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