Lake Baikal Watershed

Management Experience and Lessons Learned

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Introduction

The Lake Baikal Watershed, a critical watershed for both Russia and Mongolia, faces enormous management challenges, many not uncommon in post-Soviet economies. In particular, issues such as inadequate coordination among federal and state resource management agencies, increasing pressure for economic development in the region, and declining levels of domestic and international funding for resource management programs are prevalent within the basin.

This paper focuses on the Lake Baikal Watershed and includes a brief summary of the science, policy, and economics of the region; an assessment of the current watershed management structures around Baikal; an assessment of the GEF Russian Biodiversity Conservation Project and its smaller Baikal component; and a summary of "Lessons Learned" and Next Steps for the Region.

Insert Figure 1

Background

Lake Baikal is well known as the planet's deepest (1,637 m), oldest (more than 25 million years old), and most voluminous freshwater lake (23.600 cubic kilometers [km^3]). Baikal holds as

much water as the Baltic Sea, and as much as North America's five Great Lakes combined. Its water volume represents 20% of all unfrozen freshwater on Earth. Lake Baikal draws its water from a catchment area of 571,000 km^2, an area slightly smaller than the size of France. The length of the lake is 636 km and width ranges from 80 to 27 kilometers. Lake Baikal is home to over 1,500 endemic animal and plant species, a characteristic that is closely connected with its age and unique natural development.

Over three hundred and sixty rivers and streams flow into Baikal with only one river flowing out, the Angara River located on Baikal's northwest shore. Clarity within the lake reaches 40-50 meters in some areas. The residence time of water flowing into Lake Baikal is over 300 years. The main tributary of the lake is the Selenga River that starts in Mongolia and brings over 60% of inflow waters annually.

Table 1 shows land uses within the Selenga watershed. Pasture and grazing lands make up the majority of the Selenga's land-use. It is interesting to note that over 33% of the area is under some type of protected zone.

Table 1: Approximate Land-Use Allocations for Lake Baikal's Selenga River Region

Land Use Zone	Hectares	%
1. Pasture Lands	9,410,000	32
2. Pasture Lands with Scattered Forest	5,499,000	19
3. National Nature Parks	4,596,000	16
4. Protected River System & Landscapes	2,316,000	8
5. Managed Forest Resource Areas	1,973,000	7
6. Natural Anthropological Reserves	1,583,000	5
7. Arable Lands	1,375,000	5
8. National Wildlife Refuges	900,000	3
9. Limited Production Forests	647,000	2
10. Reserved Forests	554,000	2
11. Industrial Lands	323,000	1
12. Native Hay Lands	190,000	1
13. National Nature Reserves	71,000	<1
14. Resort & Recreation Areas	13,000	<1
TOTAL:	**29,450,000**	**100**

Source: Ministry of Natural Resources, Russia, 1994

** Does not equal 100% due to rounding

Global Significance

In 1996 Lake Baikal was added to the United Nations Educational, Scientific, and Cultural Organization (UNESCO) list of World Heritage Sites (WHS) citing Lake Baikal as "the most

outstanding example of a freshwater ecosystem" (UNESCO, 1996). In particular, Baikal's outstanding variety of endemic flora and fauna and protected areas were noted.

In 1994, Lake Baikal's largest wetland delta area, the Selenga, was listed on the RAMSAR international wetland list for its significant flora and fauna, as well as its important role in filtering pollution flowing into the lake.

The Lake Baikal Basin also attracts global attention because it is considered an outstanding example of the evolutionary development of a rift zone of global scale and includes contrasting landscapes of mountains, forests, steppes, tundra and lake. It contains the most ancient and largest freshwater reservoir on Earth. The surrounding area is also rich in biological diversity, landscape values and cultural and scientific values

Biodiversity

The great variety of plants in the basin is due to climatic asymmetry: light coniferous forests and mountain steppes occupy the western part of the basin; pine forests predominate in the east whilst deciduous forests dominate the north. Terraces near the shore in the north support larch (*Larix dahurica* and *Rhododendron dahuricum*) grading into the more fertile mixed fir-Korean pine (*Pinus koraiensis)* taiga and larch forests of (*Pinus sibirica* and *Larix sibirica)*, with some spruce (*Picea obovata)*, monotypic willow (*Chosenia macrolepis)*, and an understorey of honeysuckle (*Lonicera periclymenum)* rowan (*Sorbus aucuparia)* and currants (*Ribes rubrum)*. In the southern part of the basin, in Baikalskiy Zapovednik for example, a well- marked altitudinal zonation also occurs. Sphagnum bogs and forests of poplar and the monotypic willow (*C. macrolepis)* occupy low-lying areas, while the river valleys contain bird cherry (*Prunus padus)*, rowan (*S. aucuparia)* and alder (*Alnus glutinosa)*. The northern slopes of the mountains have taiga of korean pine (*P. koraiensis)*, spruce (*Picea)* and 'cedar' (*P. sibirica)*, with fir (*Abies sibirica)* dominant in places. In total, 800 species of vascular plant have been recorded (Borodin, 1983).

Lake Baikal fauna is of the most diverse in the world with, for example, 255 species of shrimp-like amphipod species and 80 species of flatworm. The most famous aquatic species is the unique freshwater Baikal seal (*Phoca sibirica)*. The terrestrial fauna by comparison is less distinctive, being characteristic of the wider region. The south eastern lake shores, for example at Barguzinsky Zapovednik, has a faunal diversity that is characteristic of the taiga, with 39 species of mammal recorded, including pika (*Ochotona hyperborean)*, Siberian chipmunk (*Eutamias sibiricus*), marmot (*Marmota baibacina)*, flying squirrel (*Pteromys volans)*, fox (*Vulpes vulpes)*, brown bear (*Ursus arctos)*, stoats and weasels (*Mustela altaia)*, *M. erminea*, *M. nivalis* and *M. sibirica)*, otter (*Lutra lutra)*, large numbers of sable (*Martes zibellina princeps)* noted for its exceptionally valuable fur, wolverine (*Gulo gulo)*, a local race of musk deer (*Moschus moschiferus)*, Siberian red deer (*Cervus elaphus sibiricus)*, moose (*Alces alces)* and reindeer (*Rangifer tarandus)*. The avifauna includes 243 bird species, among them white-tailed eagle (*Haliaeetus albicilla)* and capercaillie (*Tetrao urogallu)*. To the south in Baikalsky Zapovednik there are 37 mammal species and 260 species of bird.

Human Demographics and History

Human remains have been found around Lake Baikal dating back almost 30,000 years proving the regions long history of human settlement. Today's native people of the Baikal region—the Evenk and Buryats—connect their origin and identity with Lake Baikal. Mongols believe their ancestors, dating back to the days of Genghis Khan, came from Siberia and traveled across Lake Baikal, or the "Inland Sea", as it is named. In the 13th Century Genghis Khan proclaimed the Sea and the land around it "the Great Forbiddance Zone" prohibited from development. In the 17th Century the first Russian pioneers came to the Lake and, profoundly impressed by its enigmatic power and incomparable purity, named Baikal the "Sacred Sea". Over 1,200 archaeological sites have been found around Baikal, including rock drawings, stone walls and remains of ancient settlements. The Huns, Kaganates of the Zhouzhanhs, ancient Turks, Uighurs and Kidanhs were known to have lived around the lake and were even mentioned in ancient Chinese chronicles and historical Muslim manuscripts.

Along the eastern shore of Baikal is the Republic of Buryatia where the Buryats, of Mongolian descent, are the largest ethnic minority group in Siberia. The republic was created in 1923 with the joining of Buryat- Mongol and Mongol- Buryat Oblasts. The capital of the Republic is Ulan-Ude, and has a population of 386,000 people. Buddhism and Russian Orthodox are the two primary religions in the area with several Buddhist temples just outside the city center.

On the northern shore of Baikal is the Irkutsk Oblast where the city of Irkutsk, the chief administrative and economic center of Siberia, is located. Irkutsk was settled in the early 1660's and was home to the "Decembrists" (one of several final destinations) of the 1825 uprising who were exiled to the area bringing a Siberian renaissance to the area. Irkutsk is now a central destination on the popular Trans-Siberian Railroad and is known for it's educational institutions, scientific contributions, and culture. The first Siberian branch of the USSR Academy of Sciences was established in Irkutsk in 1946.

Political Overview

The territory of the Baikal watershed is extremely complex in terms of its political and administrative arrangements. Political borders split the Baikal watershed practically in half between Russia and Mongolia, although Lake Baikal itself lies entirely within Russia. Within the watershed there are 3 separate Russian states (Oblasts or Republics) and 1 Autonomous Region; 12 different Mongolian states (Aimags); over 45 national parks, strict nature reserves and significant cultural sites in both regions; and over 25 counties (rayons) in Russia and 116 counties in Mongolia (28 of which are divided by the watershed boundary).

Both Russian and Mongolian national, state, and local environmental regulations are administered by their respective Ministry of Natural Resources, with each state having separate branches responsible for maintaining state and local environmental quality standards. In 1993, the Baikal Commission was established to coordinate policies between the three sub-federal governments of the Baikal region. The mission of the Baikal Commission was to facilitate the involvement of all levels of government and stakeholders while focusing on the Basin as a single entity. In 1994, the Baikal Commission drafted the "Baikal Law", a law designed to regulate all economic and environmental activities in the Basin, which was not passed by Parliament until

1999. In 2000, the Baikal Commission was abolished by the Ministry of Natural Resources, and a Federal Environmental Protection Agency for Baikal—"Baikalpriroda"—is now responsible for coordinating amongst resource management agencies in the Watershed (see Section 4 for more information on policy developments).

Economic Status

Differences in economic development both within the Russian states of the Baikal watershed and among the Russian and Mongolian portions of the watershed are significant. First, overall economic development within each country, as measured by Gross Domestic Product (GDP) per capita, was $4000 for Russia and $2200 for Mongolia (World Bank, 2001, PPP method). In Russia, both Irkutsk and Buryatia's economies are based on their considerable mineral wealth of gold, coal, oil and gas, rare metals (niobium, tantalum, lithium, rubidium), 47 kinds of precious and semi-precious stones (lazurite, charoite, etc.), common salt and potassium carbonate, iron ore, manganese, titanium, and mineral building materials (magnesite, dolomite, etc.).

Tourism is an upcoming economic sector within the Baikal Basin. Before the fall of the Soviet Union, over a million domestic tourists travelled to Lake Baikal each year. Since 1990, this number has significantly dropped with roughly 100,000 tourists visiting Baikal each year (Cook, 2003). The early 1990's saw a number of international efforts to develop tourism, and eco-tourism in particular, as an alternative to unsustainable economic development. The designation of Lake Baikal as a UN World Heritage Site in 1996 promised locals a host of new tourists that would travel to Baikal. International tourist numbers appear to be rising slowly, but domestic tourist visits have risen significantly in the last decade as "New Russians" increase leisure spending within the country. International tourists are still hesitant to visit Baikal due to outdated transportation modes, poor accommodations, and difficulties getting to Baikal.

The tourism sector is also expected to grow in the coming years due to recent laws making it easier for Russians to purchase second and third homes around the lakeshore, and due to international efforts to increase eco-tourism in the basin. For example, the recently completed GEF Biodiversity Project funded, among many other projects, over 100 different organizations working to develop environmental awareness projects with many providing environmentally friendly tourism opportunities as a side benefit. The US Agency for International Development (USAID) also recently funded an effort to promote low-impact tourism at Baikal by developing the "Great Baikal Trail" (GBT). The GBT will circumvent the lake drawing visitors from around the world.

Irkutsk

The Irkutsk region continues to be the base of Russian economic expansion towards the Far East. The most productive sector within Irkutsk has been its energy sector. Timber is also a major driver of the Irkutsk economy producing 8% of Russia's cardboard and over 50% of its pulp, including almost 100% of Russia's cord pulp and over 50% of its viscose pulp. The regional share of the total volume of timber production in the Russian Federation increased from 12.5% in l994 to 15.3% in 1995. The largest enterprises are the Bratskkomplex, the Ust-llimsky factory, and the BPPM. The region is one of the largest consumers of electrical and thermal energy in

Siberia (EIA, 2001). Irkutsk produces almost a quarter of Russian aluminium with two central aluminium manufacturers in Irkutsk and Bratsk. The Angarsk Oil and Chemical firm produces 31% of the regional oil production, with the Irkutsk region accounting for more than half of the commercial chemical production of East Siberia.

Significant high-quality timber resources exist within the Baikal watershed. The Russian portion of the watershed has over 20 million hectares of forested land (42% is estimated to be harvestable) and over 2.1 billion cubic meters of timber. The Mongolian portion of the watershed has over 5 million hectares of forested land (30% is estimated to be harvestable) and over 500 million cubic meters of timber (TACIS, 1999). Forests are predominantly coniferous with larch and pine covering over 80% of the total forested area (Bisnes, 2000).

The Republic of Buryatia

The Republic of Buryatia is abundant in natural resources but remote and dependent on federal subsidies. The region is also currently undergoing a difficult economic and social transition. The major industries in Buryatia are power production, mining, timber, machine building, and sheep husbandry. In 1999, industrial enterprises produced 29% of the Republic's GDP, and total production grew by 14%. Buryatia has over 500 known minerals, including large deposits of lead, gold, silver, quartz, sandstone, molybdenum, tungsten, fluor-spar, and asbestos. In terms of production, the region process over 15% of Russia's total tungsten with the third largest facility of its kind and over 30% of all molybdenum (including 20% of high grade ores in Russia). There are over 205 placer and 13 ore gold fields in Buryatia, which produced a total of 4,080 kilograms in 1994.

Mongolia

The economy in Northern Mongolia is based on agriculture, husbandry, and mining. In Mongolia, large deposits of uranium, gold, tungsten, and lead are found in the Baikal watershed basin. Over the last 10 years gold mining has boomed in Mongolia's northeast region. There are 42 licensed mines in the Zaamar gold field alone, which is located in the Yeroo sub-watershed. As of 1998, at least 25 other placer gold mines were active in the same drainage area.

The Mining sector is Mongolia's single largest industry, accounting for 55% of industrial output and more than 40% of export earnings. In recent years, gold mining has emerged as one of the most dynamic sectors of Mongolia's economy. Gold production has grown ten-fold from 1993 to 2000 making the country currently the 15th largest producer of gold in the world.

Environmental Impact Assessment

Environmental impacts within the Lake Baikal Basin are generated from numerous point and non-point pollution sources. The most significant air pollution sources are located just north of Lake Baikal (the Irkutsk Oblast) and in several Russian industrial centers just south of the lake at Selenginsk and Ulan Ude. Water pollution sources flow almost entirely into the southern portion

of Lake Baikal from Russia and Mongolia, leaving the northern end of the lake relatively pristine.

Russian academic sources often state 40-60% of total non-point source water pollution is generated from the Mongolian portion of the watershed. However, this is nearly impossible to confirm since no environmental assessment has identified the most significant pollution sources and the highest concentration sources for both the Russian and Mongolian portions of the Baikal Watershed. However, much is known about point sources in the basin. Consequently, environmental clean-up efforts are focused largely on improving water quality conditions in and around the major cities of Ulan Ude (Russia) and Ulan Bator (Mongolia) and several of the most significant pollution sources downstream from Ulan Ude to the shores of Lake Baikal (about a 100 mile stretch of the Selenga river)

The most famous and contested air and water pollution source at Lake Baikal is the only major source on the lake—the Baikalsk Pulp and Paper Mill (BPPM). The factory is found on the southern shore of Baikal and creates over 50,000 cubic meters of water pollution and 20,000 tons of air pollution each year. Despite significant domestic and international efforts to close the factory, it is still operating with a relatively uncertain future. Unfortunately, significant financial and political resources have focused on the Baikalsk factory over the last decade taking attention away from other more significant pollution sources within the Baikal Watershed.

Below is a brief assessment of major environmental impacts in the region. The information is separated by major industrial sources and includes general descriptions of the types of pollutants as well as available information on pollution levels and concentrations. In general, there is an abundance of information on point and non-point source pollution sources for the immediate lake watershed. However, gathering and synthesizing this information has been a Herculean task leaving the current situation of an inadequate supply of reliable, current, coordinated information on environmental impacts in both Russia and Mongolia. Basin-wide environmental quality data does not exist, and the scattered information that does exist is largely for the Russian watershed. Mongolia environmental quality information typically focuses on sub-watersheds flowing into the Selenga watershed (typically the Tuul and Urdun rivers, or Lake Khuubsugal).

- <u>Oil and Mineral Resources</u>

  The Baikal watershed is rich in mineral and energy resources. Unfortunately, gold, molybdenum-tungsten, granite, uranium, and sand mine operations in both Mongolia and Russia are typically inefficient, use little or no environmental mitigation measures, and use outdated technologies and methods. For example, the 10-12 gold mining operations in the Russian portion of the watershed still use cyanide and mercury to extract gold, as well as large water canyons to separate gold from soil and rock. These operations, typically found near the Russian/Mongolian border, generate significant levels of iron, sulphur, chloride, mercury, and nitrogen into the Selenga River.

  Recent environmental assessments of mining operations in Buryatia ranked the tungsten and molybdenum mining sites as having the highest environmental impacts in the region (Robinson, 2001). The uranium mine in Khiagda (also within the Selenga watershed) is

currently being considered as a national "catastrophe" area (similar to receiving US-based Superfund status) due to its significant mine water discharge impacts, acidic tailings seepage, and community radon exposure. (Robinson, 2001)

Countless copper and gold mines also exist in Mongolia, which are renowned for having little or no mitigation efforts in place. For example, the regional government in Zaamar has an environmental inspection budget of roughly $1200/year for a gold field that in 2001 produced almost $40 million in revenues.

One future environmental impact is the transport of gas around the southwestern shores of Lake Baikal. Russia already has the world's largest gas reserves with a significant portion lying within the Irkutsk Oblast. Irkutsk processes over 441,000 barrels of oil per day (EIA, 2002). Currently, Russia is planning to export gas from a large gas reserve just 200 kilometers north of Baikal at the Kovykta deposit to China and/or Japan. The issue is the proposed gas pipeline would potentially travel 2,400 kilometers to the Daging field in northern China requiring pipelines to be built along the shores of Lake Baikal through several national parks and several sensitive areas for migratory birds. Besides visual impacts and threats to wildlife habitat, seismic activities in the region threaten oil spills that could risk human health and safety. Environmental Impact Assessments are currently being conducted to assess the proposed pipeline routes.

- Municipal Wastewater Treatment Facilities

There are 4 large municipal wastewater treatment facilities within the Russian portion of the Baikal watershed at Ulan Ude (200,000 cubic meters/day), the Severobaikalsk BAM Facility (2,000 cubic meters/day), the Severobaikalsk facility (1,600 cubic meters/day) and the Selenginsk facility (capacity unknown). All of these facilities are known to use secondary treatment or activated sludge treatment. In 1991, none of these operations met discharge standards and "would need significant upgrades which will include facilities for nutrient removal, alternative technologies to chlorine disinfections." (Williams, et al., 1991)

- Pulp and Paper Industries

Timber harvesting within the basin has been declining over the last decade due to decreasing domestic demand, increased transportation costs, and an increase of uncontrolled forest fires. Before 1990, almost all harvesting was conducted by clear cutting and was directed at large sized pine sawlogs. Timber harvesting was outlawed within the immediate "ecological zone" in the early 1990's.

Two of the largest pulp and paper plants are in the southern Baikal cities of Baikalsk (on the lake shore) and Selenginsk (40 kilometers south of the lake). Both plants use a sulfate processing technique and produce between 170,000-200,000 tons per year of bleached pulp, and consume close to 250 cubic meters of process water per ton of pulp produced. The Baikalsk plant has an additional bleaching process that uses chlorine dioxide that produces organo-chlorine compounds, but now has a closed loop system that collects the majority of pollutants before entering the lake.

The BPPM is the only industrial enterprise actually located and discharging its wastewater directly into the lake. Countless attempts to close the plant have failed due to the local communities dependence on the factory for jobs and sustenance (over 3,000 of the 15,000 residents of Baikalsk work at the plant). In addition, numerous plans have been developed that would shift operations from cellulose production to a less-resource intensive use.

The most recent plans to retrofit the BPPM was initiated in a 1992 Federal Decree (#925), and secured in a recent presidential decree from Vladimir Putin (#574), that would develop a comprehensive program on "The re-profiling of the BPPM and socio-economic development of the town of Baikalsk (2000-2010)", developed by the Siberian Branch of the Russian Academy of Sciences. The plan, reviewed by the Federal Government in 2001, has a two-step process for retrofitting the plant including: (1) installing a closed wastewater treatment plant (which assumes the bleaching process cannot be eliminated); and (2) develop a paper and cardboard production facility while continuing to produce pulp. Only the first phase has been approved; step 2 is still under review by the Federal Government. The World Bank has promised $25 million to develop the retrofit program for BPPM.

- Thermal and Electric Power Stations

Within the Baikal watershed, major electric and thermal power stations are found near the city centers of Irkutsk, Ulan Ude, and Ulaan Baator. Over 18,000 MW stored capacity resides in the Baikal watershed including coal-fired, hydropower, and diesel plants.

Within Russia, Irkutsk is the major electricity provider in the Basin with "Irkutskenergo" being the 2nd largest power generating company in Russia. The company's key advantage is that 70% of its 13.000 MW capacity is from hydropower stored within the Irkutsk and Angarsk dams. Construction of the dams in the 1950's raised the lake level by 3-5 feet flooding valuable wetlands, depleting forests due to inundation (e.g. north of Ust-Barguzin) depletion of sensitive fish habitat, and flooding of settlements located in the northern and southern shores of Baikal. In 1999, a law was passed that created a maximum and minimum water level to reduce environmental impacts. The other 30% of Irkutsk's power is generated from 13 coal-fired thermal plants that co-generate electricity and heat. Irkutskenergo provides more than 5% of Russia's total electricity production with 61% of total electricity provided for regional smelters, pulp and paper manufacturers, refineries and chemical producers.

In Buryatia, the major power stations in Ulan Ude, Guzinoozersk, and Severobaikals are all coal-fired stations. The power plants use low-sulphur coal and have not met air quality standards since 1991 due to flue gas de-sulfurification facilities not being installed (Williams, 1991). No hydroelectric stations exist in Buryatia.

- Agricultural Pollution

Agricultural pollution is assumed to be significant within the Baikal watershed, but data on its impacts has been sparse. Pollutants such as suspended solids, nutrients, organics, toxic

organics, human pathogens, and inorganic salts are known to exist from the intensive agriculture and husbandry practiced within the watershed.

- Hunting/Fishing

Fishing and hunting are relatively minor threats across the watershed, but are becoming bigger problems in centralized areas along the lakeshore, and within the larger watershed. Poverty within the region has exacerbated the problem in addition to significant declines in funding for monitoring fish and wildlife populations. Fishing has become less of an impact since the mid 1990's after the state fishing enterprise collapsed. There are 15 "commercial" fish species within the lake and over 50 different registered commercial fishing enterprises (Buyentuev, 1999).

In Mongolia, among the 25 fish species inhabiting the Selenga and its tributaries is the largest, wholly freshwater salmonid, the taimen (*Hucho taimen*) historically reached weights up to 95 kg and 2 meters in length (Matveyev et al., 1998). Unfortunately, taimen populations have decreased in their native habitat and are facing similar problems as western salmonids such the alteration of spawning habitat, increased water quality degradation, and over fishing. The taimen is now listed as an endangered species in both Mongolia and Russia (Matveyev et al., 1998, Baasanjav and Tsend-Ayush, 2001). Recent intensive placer gold mining in Mongolia is drastically altering the riparian landscape in some regions (Bazuin et al., 2000) and threatening the natural river ecosystems posing serious dangers for environmentally sensitive species such as the taimen.

Hunting in the region is focused on sable, rabbit, deer, and the Baikal "Nerpa" seal. Hunting for the Nerpa has attracted international attention due largely to Greenpeace and the local NGO Baikal Wave campaigning for their protection, but also because of the questionable calculation of the average of 6,000 hunting licenses distributed each year. The total population is estimated at over 80,000 seals, which decreased significantly in the 1997-1999 due to a massive die off blamed on several potential causes including high toxin concentrations found within the seals generated from local pollution, and a viral infection similar to that found in Caspian Sea seals.

- Air Pollution

Air pollution at Lake Baikal is generated largely from sources in the north, and from sources close to the lake in the South. Air pollution is deposited largely along the southern shores of Baikal and consists of *particulates,* sulphur, nitrogen, carbon oxides, and other pollutants. Sources include power plants, the Baikalsk and Selenginsk cellulose factories, agriculture and other industrial sources. Although the industrial sector remains the major contributor to Baikal's air pollution, the transportation sector (autos, bus, and trains) is playing an increasingly significant role.

Table 2 below shows air emission trends in a select number of Baikal settlements. The table shows two interesting trends including, first the majority of total emissions in each city has declined significantly since 1998. Second, the four out of five cities that show increased air

pollution totals since 1998 (highlighted in grey) are located either on, or right next to the shores of Lake Baikal.

Table 2: Total Air Emissions in Russian Baikal Settlements (1998-2001) (1000 tons/year)

Territory	1998	1999	2000	2001	% Change
Krasnochikoi rayon	15.46	12.25	5.90	1.30	-92
Port Baikal	0.08	0.06	0.07	0.02	-75
Settlemtnt Kultuk	0.47	0.47	0.20	0.27	-43
City of Irkutsk	82.50	54.00	56.40	53.00	-36
City of Angarsk	176.80	155.80	131.50	128.00	-28
City of Sludjanka	4.90	4.75	4.35	3.60	-27
Gusinoozerks region	42.00	30.85	32.26	32.00	-24
City of Cheremkhovo	13.00	11.40	11.30	10.00	-23
City of Usolie-Sibirskoe	40.70	38.50	37.10	33.20	-18
City of Petrovsk-Zabaikalsky	7.04	5.90	1.50	5.80	-18
Setllement Selenginsk	3.68	1.63	3.49	3.20	-13
City of Ulan-Ude	61.85	53.49	55.96	55.00	-11
City of Shelekhov	30.00	27.30	28.30	27.40	-9
Listvjanka village	0.05	0.05	0.05	0.05	0
Kyakta region	6.16	5.89	6.22	6.20	1
City of Baikalsk	8.05	8.76	8.84	8.57	6
City of Severobaikalsk	3.90	4.57	5.04	4.90	26
Khilok region	2.28	2.09	12.20	12.40	444
TOTAL	**498.92**	**363.76**	**400.68**	**384.91**	**-23**

Source: Baikal Commision Report for 1999, and 2002 state environmental reports from MNR office in Irkutsk, Buryatia, and Chita.

- Water Pollution

Pollution point and non-point sources are located both within the Russian and Mongolian portions of the watershed. Major pollution point sources in Russia are located south of Lake Baikal in the cities of Ulan Ude, Selenginsk, Gusinoozersk and Baikalsk; in the mining complexes in Kabansk, Kamensk, Zakamensk, and Kyakta in the south; and in the mining districts of Mongolia and in Ulaan Baator. The most intensive pollution sources are generated from mining of ore, uranium, and gold and through the processing of limestone, clay, sand, and gravel. Chemicals such as cadmium, lead, zinc, and fluorine are still used for gold mining, which are caught in mine residue and eventually leak into local water systems.

Table 3 shows total water effluent in six major Russian settlements between 1998-2001. Table 3 shows total emissions in this cross-section have increased only slightly. However, similar to air emissions within this same period, total concentrations have decreased for all cities but the BPPM, which has had total emissions increase almost 47% in this period. This is troubling since Baikalsk is located right on the lakeshore.

Table 3: Total Water Effluent in Russian Baikal Settlements (1998-2001) (m^3 effluent/year)

	BPPM	Sludjanka	Ulan-Ude	Kabansk Rayon	Severo-baikalsk	Chita Oblast	Total
1998	33.70	2.00	51.60	4.52	2.15	25.00	**118.97**
1999	42.20	1.67	50.20	4.39	2.69	22.70	**123.85**
2000	48.20	1.88	51.89	4.29	1.83	22.00	**130.09**
2001	49.40	1.81	50.70	4.20	1.95	22.00	**130.06**
% Change	**47**	**-10**	**-2**	**-7**	**-9**	**-12**	**9**

Source: Baikal Commission Report for 1999, and 2002 state environmental reports from MNR office in Irkutsk, Buryatia, and Chita.

Watershed Management Assessment

Over the last 50 years, watershed management efforts at Lake Baikal have progressed from a strictly resource extraction focus in the 1950's, to a management and educational development focus in the 1990's to the current period of transition. Policy-makers currently have a number of development paths to choose from including the choice of utilizing progressive watershed management tools and methods developed in the last decade that balance environmental, social, and economic goals, or to pursue intensive development options that could increase economic gains in the short term, but jeopardize environmental integrity and human health in the long run. The path taken in the next decade in regards to environmental policy could very likely guide development within the region for the next century. This long-term trajectory is based on current decisions because economic development is just beginning to take hold in Russia, in general, and at Baikal, in particular. For example, recent legislation allowing housing developments around the shores could bring a huge influx of development pressures on Baikal's shoreline. Once constructed, it would be impossible to then reverse development trends towards conservation priorities.

Despite the difficult institutional and economic situation within the watershed, progress has been made in protecting Lake Baikal and its watershed over the last 15 years. The sections below provide a brief summary of these developments, an assessment of the current resource management institutions in place, and an assessment of one project that has worked to improve resource management efforts at Lake Baikal – the Global Environmental Facility's Russian Biodiversity Conservation Project. Information is focused largely on the Russian portion of the watershed due to the limited number of projects, financing, and assistance to Mongolia focusing on improving environmental management conditions for the Baikal Watershed.

Watershed Management History

The first period of coordinated resource management at Baikal began in the 1950's when Soviet leaders saw Baikal as an engine for national economic development. The Irkutsk dam, constructed in 1956, was one of the first large scale water diversion projects in Siberia. The dam and its resulting hydropower preceded the development of a series of resource extraction or mineral processing enterprises in the region. Construction of the dam raised the entire surface of the lake 3-6 feet, depending on the time of year. The Baikalsk pulp and Pulp and Paper Mill (BPPM) was built just after 1960. The BPPM's construction on Baikal's lakeshore caused

considerable controversy when constructed and spurred local protests thought to be the birth of Russia's current environmental movement. Numerous aluminium processing, timber harvesting, and mining operations were also developed around Baikal prior to 1985.

In the early 1980's, signs of environmental damage around Baikal from logging, transport of these logs on Baikal, and pollution from BPPM brought Baikal's first watershed management legislation. Federal Decree #434 was passed in 1987 and banned logging and their transport in the Baikal watershed. In 1989, a second monumental Federal Decree was passed that forced Irkutsk, Chita, and Buryatia to develop a "Comprehensive Plan for Watershed Protection" for Lake Baikal, and areas 4-6 kilometres inland from Baikal's shore. Although the resulting plan was more a vision statement than management plan, it began a decade long process in widening policy-makers geographic perspective of what "watershed" actually means.

The fall of the Soviet Union in 1991 created an institutional vacuum in developing watershed management plans and programs for the Basin. Domestic efforts to develop plans were greatly enhanced from assistance from international multi-national and unilateral development programs such as the World Bank, Global Environmental Facility (GEF), USAID, German Development Agency (GTZED), EU/TACIS, which have funded thousands of projects supporting government, NGO's, scientists and local citizens (see the Appendix for reference materials).

From 1991 to 1996, a USAID funded team cooperated with Russian and Mongolian policy-makers and scientists to develop the first land-use plan for the entire Lake Baikal watershed. This plan (often called the "Davis Plan" after the project's leader George Davis) provided the groundwork for subsequent international projects to understand the vast scale and challenges in trying to develop a coordinated watershed management plan for the area. Unfortunately, the plan received minimal political support due to poor planning by project leaders, and was difficult to interpret to Russian and Mongolian circumstances since it was based on planning efforts developed in the United States.

In 1993, the Russian Federation established a "Baikal Commission" which included 17 representatives from Federal, State, and Local government. The Commission's task was to establish a coordinated Russian effort to protect the Russian-portion of the Baikal watershed. This was the first regional government body formed to look at the regional economic and environmental conditions within the Baikal watershed and was a major step in coordinating Baikal's multiple political players. However, Mongolia was still left out of watershed management discussions. In trying to develop a regional management plan framework for the Baikal watershed, the Baikal commission developed a draft "Baikal Law" which included specific environmental and social goals for the watershed, work plans for their realization, and indicators measuring the progress of these plans in meeting objectives. As will be explained below, the Baikal Law was probably too progressive for its time and was significantly altered, stripped of substance, and eventually passed in 1999.

Between 1994 to 1996, the Russian portion of the watershed received significant international attention boosting its stature as a global treasure. The Selenga Delta connected to Lake Baikal was made a Ramsar site in 1994 for its significant wetland and bird populations. In 1996, Lake Baikal and its immediate catchment area was made a UN World Heritage Site, but the

designation excluded four settlements within the catchment area: Baikalsk, Severobaikalsk, Selenginsk, and Sluydyanka. In Mongolia, the Terhiyn Tsagaan Nuur reserve southwest of Lake Khubsugal was made a Ramsar site in 1998.

In 1996, the Global Environmental Facility funded a $20 million Russian Biodiversity Conservation Project, implemented by the World Bank. The project had a specific component looking at the Lake Baikal watershed, which is described in more detail below.

Current Watershed Management Assessment

Four major issues characterize the current resource management situation at Baikal.

First, there is little or no coordinated management:

- between the two countries within the watershed (Russia and Mongolia);
- between policy-makers, scientists, and non-profit agencies representing the four Russian states surrounding the Russian portion of the watershed (Irkutsk, Chita, Buryatia, and the Ust Orda Autonomous Region), or
- between Russia's Federal Government and State Agencies.

Second, funding is declining at the Federal, State, and International levels for environmental protection planning, monitoring and restoration programs.

Third, Federal and State priorities emphasize regional economic development over environmental conservation.

And fourth, there is no coordinated environmental research and monitoring program for Lake Baikal or its watershed.

INSERT FIGURE 2

In attempts to coordinate resource protection efforts within the Baikal watershed, the Russian Parliament passed the "Baikal Law" in 1999 that became the first Federal land-use regulation for a specific Russian territory. The Baikal law includes four main sections: (1) a general overview of problems at Baikal; (2) an outline of the three regions (presented in Figure 2 below) requiring special protection including the "central ecological" zone, the "atmospheric influence" zone, and the "buffer" zone; (3) a description of maximum allowable pollution within the central ecological zone; and (4) a list of existing Federal regulations on the protection of Lake Baikal.

The Baikal Law has been an important step in providing the foundation and coordinating framework for protection of Lake Baikal amongst the numerous resource management agencies within the basin. However, details within the law are not specific in how state and local governments must comply with "keeping air quality to acceptable standards", for example. Due its lack of specific direction, several subsequent laws associated with the Baikal Law have been passed such as Federal Order 234 (passed 26 March 2001), which regulates the required water

level of Baikal, by the Irkutsk Hydropower Plant. This law restricts the water level variation to one meter. In August 2002, a decree was passed providing a list of forbidden activities within the "Central Ecological Zone" as presented in Figure 2. This decree is important in providing more detail for specific restrictions such as the extraction of oil and gas exploration. However, the 3 core zones have still not been specifically defined leaving a gray area in terms of where specific boundaries begin and end. Two additional laws are currently being discussed in Russian Parliament including a law on ecological monitoring and another on ecological thresholds for the use, disposal, and resulting impacts of "harmful substances to Lake Baikal," as stated in Article 14 of the Baikal Law.

Further weakening the strength of the Baikal Law is the lack of a strong regulatory agency responsible for enforcing the law. The Baikal Commission previously coordinated resource management issues amongst the Russian territories. However, when the Ministry of Natural Resources incorporated the former State Committee on Ecology in 2000, the Baikal Commission was abolished leaving another policy vacuum for the protection of Lake Baikal. Despite the Baikal Commission's slow process in developing policies, it was useful for coordinating and mediating amongst the numerous agencies within the Baikal basin.

In September 2002, the Federal Government established a Federal Environmental Protection Agency on Baikal, titled "Baikalpriroda", formed with special jurisdiction to enforce the Baikal Law, and to coordinate the numerous Federal and State agencies at Baikal, as presented in Appendix 1. Figure 3 shows a rough outline of the current government structure with Baikalpriroda placed between the Local Coordination Council (responsible for working with local governments, NGO's, and public service organizations) the Regional and Federal MNR agencies, as well as the responsibilities of "other" Federal Agencies.

INSERT FIGURE 3 HERE

Baikalpriroda is also responsible for coordinating with Mongolia on all transboundary water issues, and on the Selenga watershed, in particular. This role as international transboundary coordinator is Russia's first government led effort to look at the entire Baikal watershed and determine a management structure that works for both Russia and Mongolia. Figure 4 shows the structure of the "Russian/Mongolian Transboundary Water Agreement", its governing structure, and the specific project themes within this agreement. The goal is to complete a land-use plan and implementation schedule between the two countries by 2010. An Annual Report looking at Transboundary issues is currently being planned between the two countries.

INSERT FIGURE 4 HERE

Despite the importance of Baikalpriroda's role in coordinating policies within the watershed, its financial and staffing roles are inadequate for this role. In 2002, Baikalpriroda's budget was slightly less than 30 million rubles (less than $1 million USD) with a total staff of 15.

While Baikalpriroda's budget has at least remained constant over the past two years, state and international funding for resource protection efforts have significantly declined. For example, state agencies promised almost 200 million rubles in 2002, but only 96 million was actually

distributed. In addition, long-term international development programs funded through the GEF, USAID, EU/TACIS, GTZED, are closing down, shifting to projects that promote "economic development" or environmental advocacy programs, or significantly decreasing resources to existing projects. For example, the 6-year, $7 million GEF Biodiversity project ended in May 2003; GTZED has completed its land-use planning programs; EU/TACIS completed its projects focusing on watershed management, feasibility studies on the pulp industry and national and local forest fire protection; and USAID is focusing largely on small, segregated environmental advocacy and economic development programs in cooperation with the Foundation for Russian and American Economic Cooperation (FRAEC).

Mongolia's watershed management efforts within the Baikal Basin have focused on developing legislation that will amend their existing "Water Law" and focus on "responsibilities for pollution of nature and the environment" which will set pollution fees. Federal funding is going towards finishing a land-use plan for the Selenga Watershed, strengthening monitoring capacity on the Selenge and Tuul Rivers, restoring water quality on the Tuul River (especially downstream from urban areas and mining sites), and purifying wastewater on these two rivers.

Assessment of the GEF Biodiversity Conservation Project

In 1996, the GEF initiated a project focused on protecting Russia's biodiversity, and improving Russia's national and regional biodiversity conservation management infrastructure. The $20.1 million dollar project was completed in May 2003. The project included four components including: (1) a "Strategic Overview Component" (13% of total costs); (2) a "Protected Areas Component" (53% of total costs); (3) a "Lake Baikal Regional Component" (25% of total costs); and (4) a "Project Management and Coordination Component" (9% of total costs). More specific objectives for the overall program included:

> *"i) supporting the development of federal and regional biodiversity strategies; ii) developing and implementing mechanisms and approaches which will mainstream biodiversity conservation and environmental protection into the policy making process; iii) assessing the protected area institutional framework and subsequently strengthening its effectiveness; iv) enabling the participation of all interested stakeholders, including aboriginal peoples and local communities into biodiversity conservation; and v) developing an inter-regional demonstration of inter-sectoral biodiversity conservation and environmentally sustainable natural resource management. (World Bank, 1996, page 11)*

The Lake Baikal component (titled "Component 3" in project documents) of the GEF project received $7 million dollars to complete three programs including:

1. Inter-regional activities ($950,000) – This program focused on linkages between economics and environmental protection, data collection and dissemination and development of uniform legal, environmental, and economic regulatory mechanisms;
2. Regional Activities ($2.5 million) – This program focused on sustainable forest management, environmental education, modelling agriculture projects and management plans for three of Baikal's river watersheds in each of the three surrounding states; and

3. Local Biodiversity Initiative ($2.5 million) – This program distributed small grants to NGOs, institutions, local communities, businesses and individuals to encourage small-scale biodiversity protection and sustainable development activities in the Baikal watershed.

Although the GEF Baikal project was specifically focused on biodiversity protection efforts within the Russian portion of the Baikal watershed, many projects were directly related to improving inter-regional management, environmental education, and strengthening the mentioned Baikal Law—all necessary in improving watershed management efforts at Lake Baikal. Table 4 below provides a partial list of objectives and results from the GEF Baikal component to date.

Table 4: Objectives and Partial Results of the GEF Baikal Regional Biodiversity Component
Source: Annex 4: Baikal Regional Component, Draft Results Overview

Category	Primary Objective	Results
1. Interregional Activities	• Supporting the development of a general biodiversity policy for three administrative territories of the Baikal Region (BR); • Involvement of local population in biodiversity conservation, including public discussion of the Lake Baikal Declaration, Strategy and Action Plan; • Development and implementation of an interregional administration of Lake Baikal in the framework of the GEF project; • Creation of common computerized databases relevant to the protection of living nature in the BR	• Approval of Strategy and Action Plan for Lake Baikal Ecosystem Biodiversity Conservation by the Republic of Buryatia, Irkutsk and Chita Oblasts and the Ministry of Natural Resources of the Russian Federation (RF) • 73 protocols signed by organizations on Baikal protection • Baikal Component Supervisory Committee and Project Implementation Group (PIG) established • Databases created
2. Regional Activities	• Sustainable Forest Management • Environmental Education • Management plans for Zakazniks	• Improvement of the Env. Monitoring System in Buryatia • Designation of Ecological Network sites • Improvement of land-use system in Khilok River Basin • Reforestation at model territories in the Republic of Buryatia • GIS mapping of Forest Resources in all regions • Improvement of nature use mgmt system in model territories
3. Local Biodiversity Initiatives	• Implementation of Local Initiatives Small Grant Program • Stimulation and Support of local initiatives on biodiversity conservation in Baikal Region to shape "Baikal Ideology" and unified interregional environmental policy	• Ecological Education concepts developed Designation of 8 new Natural Protected Areas (NPAs) • Habitat restoration of 35 threatened species • Refuges established for conservation of wetland and flood-lands • Natural Landscapes reconstructed • Disposal of man-made waste • Establishment of new reserves • Creation of Education programs, manuals, and handbooks • 103 training programs • 30 field ecological camps • Consultative information centres created in 5 cities and 6 villages • Contacts established with mass media • 60 publications • 100 booklets brochures and bulletins • TV and films created • Exhibitions • 28 Internet sites • 251 seminars and conferences • Over 69 mass public actions with an ecological slant

		• 73 public environmental organizations created • New areas allotted for outdoor leisure activity • Support of environmental protection initiatives

Overall, despite a very slow start for the Baikal component, the project was successful in:

- developing significant written and visual environmental education media;
- supporting a wide range of environmental education and research entities evenly distributed across the entire watershed;
- assisting the development of the tools and institutional frameworks for improved resource management;
- and in passing a regional "Biodiversity Strategy" tied to the Baikal Law.

A significant portion of the project's success was in the Local Grants Initiative, which created a more public arm of the program that helped energize the other two parts of the Baikal Component. In total, GEF staff have estimated over 80,000 people were reached through the life of the program.

A brief look at the Local Grants Initiative in Table 5 shows nearly 300 grants totalling $2 million were distributed over a three-year period with 60% of the grants for less than $5,000. Over 50% of the grants were distributed in Buryatia, 35% in Irkutsk, and around 15% in Chita to individuals, NGO's, academic institutions, national parks, schools, and others.

Table 5: Summary of GEF Baikal Local Grants Initiative

	TOTAL
Number of Grant Competitions (1998-2001)	14
Grant Applications Received	1758
Grants Approved by Board and Financed	296
Total Grant Money Distributed	$1,939,866
% of total grants distributed for less than $5,000,	59.50%
% of total grants distributed between $5,000 and $20,000	38.7%
% of total grants greater than $20,000	1.87%

Of the 296 grants distributed, over 100 were for development and distribution of environmental education media; 70 were for actual restoration projects; 13 were for environmental management related projects, and 16 supported scientific research.

In reviewing the GEF Baikal Biodiversity Component, it should be remembered the difficult political environment in which this project was implemented. During the development of this program, the Ministry of Environmental Protection and Natural Resources was significantly altered with a large number of project managers turning over. In addition, the project was contained within two levels of projects implemented by the World Bank including the Russian Biodiversity Conservation Project and the $280 million Russian Environmental Management

Project making management for this specific sub-project difficult. Finally, the former Federal Baikal Commission responsible for coordinating all policies at Baikal was disbanded in 2000, which would have been responsible for assisting in regional biodiversity conservation efforts.

With the difficult political issues aside, several areas could have been improved within the GEF project. First, within the design of the project, more effort should have been made to incorporate international (Mongolian), regional and local government goals into the regional planning efforts to ensure its long-term success. This idea was discussed in the initial GEF project planning stages, but was thrown out since it would have increased the project implementation time, and would have required a regional GEF project. In addition, this project should have incorporated scientists or policy-makers from the Mongolian portion of the watershed. It is understood this was a biodiversity project and not an international waters program. However, if the project was truly planning to conserve regional biodiversity, flora and fauna are seldom influenced by political boundaries and should be managed in a bio-regional framework. The Regional Biodiversity Strategy does seem to be the main policy success of the program which did work to coordinate with all levels of government.

Second, the majority of follow up materials and reviews for the GEF project provide limited information about the regional and inter-regional activities of the Baikal program and how they have influenced regional biodiversity planning in the Baikal watershed. One successful product has been regional biodiversity legislation.

Third, despite the obvious success of the local grant initiative, there seems to be no larger focus on how selected projects will help in the larger goal of either protecting regional biodiversity or improving capabilities of regional resource management institutions.

Fourth, it is unclear how successful projects developed under the GEF project will continue to receive funding now that the project is over. A "Lake Baikal Foundation" was developed within the project to help fund and continue certain projects, but little information is available yet as to the structure of this organization.

Lessons Learned and Next Steps

In looking at domestic, regional, and international watershed management efforts at Lake Baikal over the last 15 years, several important lessons can be learned that should be incorporated into future resource management efforts.

Strong, effective, regional coordination among government resource management institutions at Baikal is essential for effective long-term watershed management. Currently, this does not exist.

The lack of an intergovernmental and interregional body to facilitate communication between national, state, local, and international government and non-government agencies is one of the most important gaps in watershed management at Lake Baikal. A successful coordination effort could assist the region harmonize regional environmental legislation which in turn could assist economic development. Coordination would also assist regional monitoring efforts in

synthesizing, analyzing, and assessing new and existing data and presenting environmental thresholds for protection of the basin.

Lake Baikal Watershed Management policies must link with regional economic development priorities, or risk being ignored.

Policy-makers should work hard to show the economic and social benefits of proposed environmental conservation legislation, projects, or policies in the Baikal basin. For example, improvements to water quality should be connected with the resulting health benefits, or increases in tourism potential. In the mining sector, it is relatively straightforward to show how small investments in new technology can greatly reduce environmental impacts in some regions.

Mongolia should be incorporated into all Baikal watershed management discussions.

The definition of "watershed management" to many working at Baikal has progressed from meaning only the lake, to typically just the Russian portion of the watershed. The Selenga watershed in Mongolia provides over 60% of all water, and possibly an equivalent level of pollutants, flowing into the river providing almost 70% of the water flowing into Lake Baikal. Expected future economic growth in Mongolia could bring a significant rise in pollution levels increasing pressures between the two countries. Both countries should work together through their respective Federal environment ministries to coordinate land-use, monitoring, and restoration projects for the basin.

Programs such as the GEF Local Grant Initiative should continue in order to empower and educate local communities on the benefits of protecting the environmental quality of Baikal.

Visitors and residents to Lake Baikal can easily see the benefits of the $2 million in GEF small grant funds distributed to over 260 individuals and organizations in the Russian portion of the Baikal watershed. Environmental conservation and education messages are now apparent in every type of popular media in Baikal. Although these types of programs could be more focused, the Baikal program reached out to a wide sector of local constituents empowering individuals in all economic strata to highlight their personal efforts in protecting Lake Baikal.

Local government agencies, staff, NGO's and residents have built up significant knowledge capital on watershed management tools and methods over the last decade. Now, assistance is needed to develop, implement and enforce creative new watershed management strategies.

Millions of dollars in development assistance has been brought to Baikal since 1990 in the form of regional planning tools such as GIS, international experts, and other significant educational resources. After a decade of learning these tools and developing plans, now is the time for regional agencies to fully implement a unique strategy. This would also include passing and enforcing laws that fall under the guidance of the existing Baikal Law and developing more concrete boundaries for its 3 defined "ecological zones".

A coordinated research and monitoring program is needed looking at environmental impacts within the entire Baikal watershed.

Currently, no coordinated research and monitoring program exists within the Baikal watershed. However, significant regional environmental quality data exists on Lake Baikal. Regional budgets continue to decrease with less money being applied to scientific research. Consequently, policy-makers do not possess any cohesive set of water quality information that would help them decide upon future development in Buryatia and Mongolia. Efforts should be made to establish a long-term research and monitoring program that measures environmental impacts throughout the Basin. This would also greatly assist resource management decisions in preserving the world's largest freshwater lake.

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APPENDIX 1
Russian State and Regional Resource Management Institutions Cooperatimg with the Ministry of Natural Resources (MNR) for Protection of Lake Baikal

1. **Federal Service of Hydrometeorology and Environmental Monitoring (Roshydromet)** (Irkutsk Agency of Hydromet, Transbaikal Agency of Hydromet (Chita) and Buryat Center for Hydrometeorology (Ulan-Ude).
   - state ecological monitoring

2. **State Agency of Sanitary and Epidemiological Control of the Russian Federation** (4 territorial centers in particular):
   - state water monitoring
   - water protection zones
   - licensing of water use
   - state control in water protection and use
   - exploitation of reservoirs
   - trans-boundary pollution control

3. **State Fishery Committee of the Russian Federation, its territorial bodies Baikalrybvod** (Baikal Basin Fishery Agency with headquarters in Ulan-Ude and branches in 4 subjects of the Russian Federation):
   - licensing and quotas for water use
   - development of two comprehensive schemes of use and protection of natural resources on the Baikal Natural Territory and on the Selenga River
   - research and restoration of fish and bioresources
   - research and protection of rare and endemic species
   - ecological zoning
   - East Siberian Fishery Research Institute (Vostsibrybvod) Ulan-Ude
   - research and restoration of fish and bioresources

4. **Territorial Agencies for control, protection and restoration of game and wildlife Resources of the Republic of Buryatia, Chita and Irkutsk regions**:
   - development of comprehensive schemes of use and protection of natural resources on the Baikal Natural Territory
   - assessment of permissible number of game for hunting
   - research and protection of rare and endemic species
   - ecological zoning

5. **State Land Resources and Land Planning Committee of the Russian Federation** (Land use Committee of Buryatia, Chamber of the Land Cadastre Irkutsk region, etc.):
   - water protection zones
   - ecological zoning
   - development of two comprehensive schemes of use and protection of natural resources on the Baikal Natural Territory and on the Selenga River

6. **Ministry of Emergencies**:
   - control of safety of hydrotechnical facilities
   - flood prevention
   - forest and steppe fire prevention
   - prevention of technogenic catastrophes

7. **Ministry of Health Care of the Buryat Republic, State Committee for the Affairs of Youth, Tourism and Sports of the Republic of Buryatia, Ministry of Culture, Ministry of Education of the Buryat Republic and corresponding departments of the regional Administrations of Chita and Irkutsk oblasts**:
   - management and licensing of recreational resources
   - environmental education
   - cultural environmental traditions

8. **Attorney General office and inspectorates; territorial divisions of state technical inspection of mining and industry, inspectorates on oil, transport, and river transportation:**
   - control and inspections of environmental compliance and enforcement

9. **Local self-governance and NGOs**
   - public hearings of proposed decisions
   - public control
   - environmental initiatives
   - promotion of ecological awareness

Figure 1: The Lake Baikal Watershed

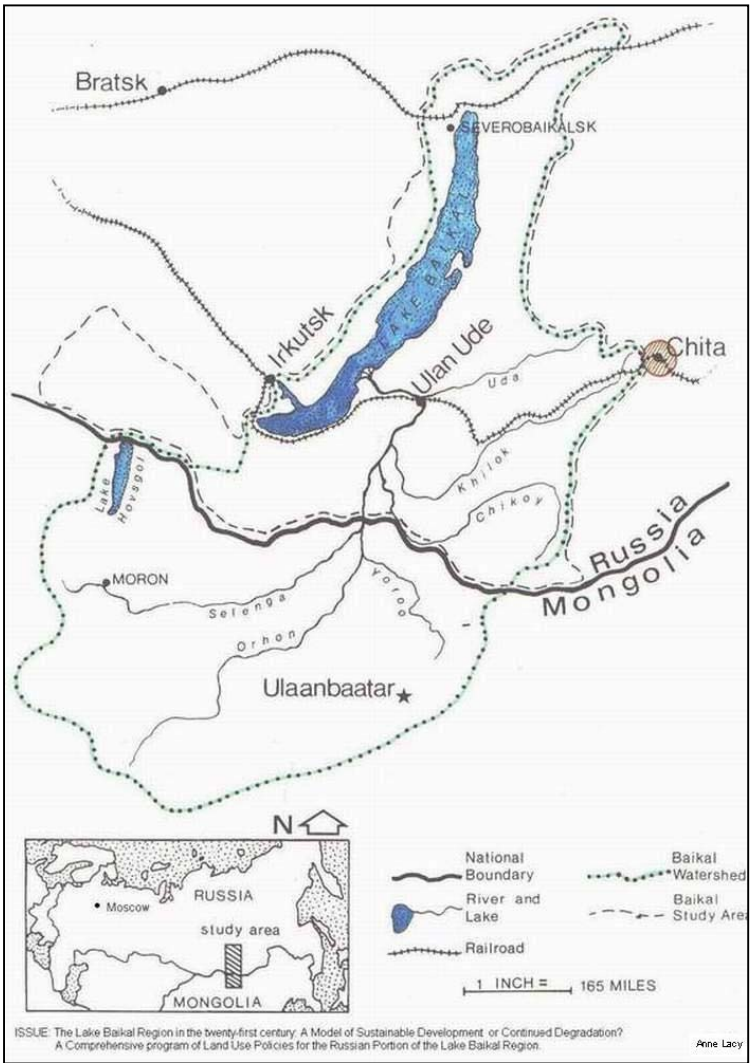

Figure 2: Baikal "Zones of Influence" as explained in Baikal Law

Figure 3: Russian Federal Structure for Management of Baikal Watershed

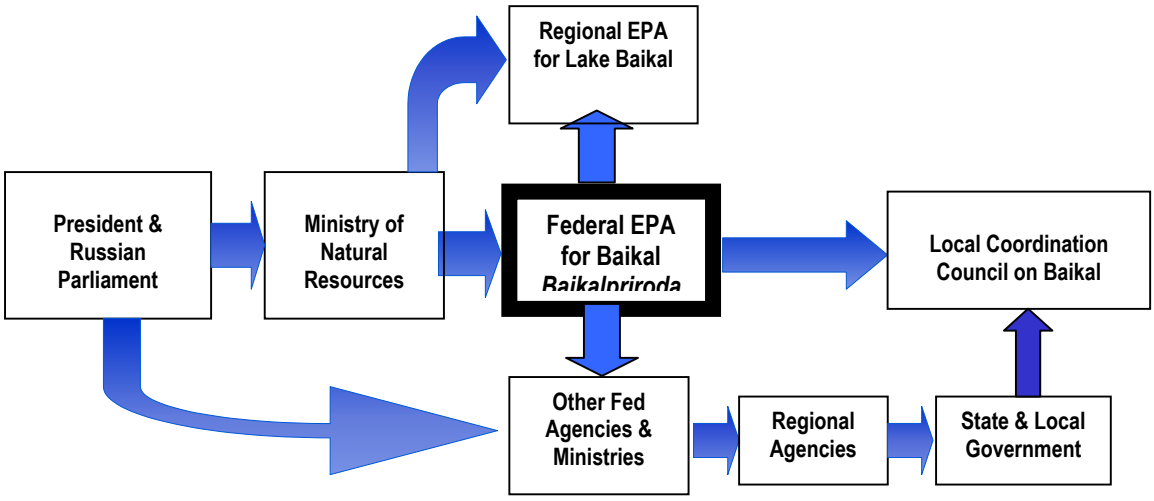

Figure 4: Russia and Mongolia Transboundary Cooperative Agreement Structure