The Environmental Effects of Development in the Angaro-Yenisei Region

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Abstract

The exploitation and development of energy resources in the Barents Sea has stimulated the development of central Siberia's society, economy, industry, as well as transport systems for the transfer of resources to markets. The Angaro-Yenisei region, which covers the Yenisei River basin and partially that of the Ob River's tributaries, together with rivers flowing into the Kara Sea and the Laptev Sea, is blessed with vast natural resources. The region, however, has economic development problems. Due to the region's fragile environmental conditions, development should be encouraged in harmony with the environment and the traditional life of the region's indigenous peoples. The region's situation is similar to the Russian Far East with respect to environmental and economic issues.

Current and future projects for the Russian North's development and their effects on the region's environment and indigenous peoples will be briefly discussed.

Introduction

Oil production has decreased substantially due to a drop in production efficiency. Recovery of production in the energy sector is undoubtedly the key for revival of the Russian economy with respect to fiscal revenue, earning foreign currencies, stimulating other industries, and improving local infrastructure and living standards. Preferential credit is now being extended for converting military industries to promote the efficient use of energy in wider energy markets. The European Energy Accord, which aims to attract investment from foreign capital, was established to invite international bids for licenses, with which foreign investors are able to participate in the Russian oil industry.

The transfer or transition of a formerly planned economy into a market economy in Russia has turned out more difficult than previously expected. Russia has been facing serious problems such as reduced production and stagnant investment, mostly because Russia has had little experience in market activities. Particularly in central Siberia and the Russian Far East as well (Miller & Karp, 1994), social and industrial activities in the regions have remained at extremely low levels since the late 1980s. It is therefore difficult

to make reliable predictions about the development of central Siberia or to carry out effective proposals. Reliable data available for statistical analyses, particularly in Japan, are less than satisfactory. For the moment, quantity should now come before quality.

Fortunately the International Northern Sea Route Programme, INSROP, has been carried out in cooperation with Russia, Japan and Norway, for six years since 1993 (Ostreng, 1999). The aim has been to address the main navigational features of the Northern Sea Route (NSR) or North-East Passage (Raurala, 1992) and assess the possibilities of using the route as a prospective commercial seaway for international use. Through this programme, various technical, social, environmental and political issues have been reviewed. Some of the issues examined include: an assessment of the cargo generating potential of central Siberia, the NSR's environmental effects, effects on indigenous peoples' societies, related political and legal ramifications, etc. The author is deeply indebted to the INSROP Working Papers, reviewed and written mainly by Russian experts.

Background of Development

Natural Resources and Industries

Data and information on potential natural resources are still uncertain in Siberia, and statistics on present or recent resource production and export activities will be more useful for updating various issues related to the region's industries and environment (Stonehouse, 1990).

(1) Hydrocarbon Reserves and Production

The most promising oil and gas fields in the Angaro-Yenisei region are located in the Irkutsk region and Krasnoiarsk Krai. Krasnoiarsk Krai along with the Evenk and Taymyr Autonomous Districts are blessed with vast oil and gas resource potential. More than twenty oil and gas deposits have been discovered. The amount of estimated oil and gas reserves in the region is shown in Table 1 (Bandman, et al., 1999) and Fig. 1 (Kriukov, et al.,1996).

Table 1. Hydrocarbon Resources (Bandman, et al., 1999)
Located extracted reserves of hydrocarbons in the zone of proximity of the "Yenisei-NSR" transport system (by 1. 1. 1995)

Areas	Oil, Mill tons		Gas, bill m3		Condensate, Mill tons	
	C1	C2	C1	C2	C1	C2
Evenk (VI)	65	0.4	252	428	17.5	34
Lower Angara (VII)	-	-	0.6	30	-	-
Norilsk (II)	0.5	33	217	35	8	7.4
Turukhansk (III)	116	247	114	105	1.5	2.1
Total	181.5	280.4	583.6	598	27	43.5

Needless to say, development of energy resources is a key issue for both the central Russian government as well as the local governments in western Siberia since industrial and consumer systems depend heavily on energy. For the moment, only the oil and gas sector seems able to attract foreign investment. The present unstable system of Russian taxation is often criticized as a serious hindrance to further foreign investment. What can be cured must be endured.

The only current production of energy resources, however, is along the lower tributary of the Yenisei River by Noril'skgazprom. Gas is being produced at two sites, the South and North Solenino deposits, on the river's west bank, with pipelines of natural gas and condensates. The pipelines cross the Yenisei River to the city of Noril'sk to provide production energy for the Noril'sk mining-metallurgical plant. Noril'skgazprom also produces crude oil. The region's energy resource deposits might only contribute to the development of local mining and forestry sectors unless effective infrastructure in the region or an energy export scenario such as direct pipelines to the Chinese market are actually realized.

(2) The Non-Ferrous Metals Industry: Aluminum

The aluminum production industry requires vast quantities of energy. Production can be divided into five stages;

a) bauxite extraction,
b) alumna production,
c) refining alumna into primary aluminum,
d) semi-processed components production,
e) industrial aluminum products production.

The products at each stage can be transported and exported to other industrial zones or markets. Bauxite production from domestic Russian deposits has been reduced by slightly over 1 million tonnes in the period between 1991 to 1996, as shown in Table 2 (Ramsland, 1999).

Table 2. World Bauxite Production 1991-1996 (Ramsland, 1999)
Source: Lloyds Shipping Economist 1998

	1991	1992	1993	1994	1995	1996
Australia	40.500.000	39.750.000	41.320.000	41.650.000	42.660.000	43.000.000
Guinea	17.070.000	16.000.000	17.040.000	11.120.000	12.390.000	12.500.000
Jamaica	11.610.000	11.370.000	11.180.000	11.560.000	10.860.000	11.000.000
Brazil	10.360.000	9.370.000	9.670.000	8.670.000	8.670.000	8.760.000
China	5.930.000	6.660.000	6.470.000	6.620.000	6.700.000	7.000.000
Venezuela	2.000.000	1.120.000	2.530.000	4.770.000	5.180.000	5.200.000
India	4.740.000	4.900.000	5.280.000	4.810.000	5.160.000	5.100.000
Suriname	3.140.000	3.250.000	3.160.000	3.800.000	3.580.000	3.700.000
Russia		4.580.000	4.260.000	3.630.000	3.500.000	3.500.000
Total	95.350.000	97.000.000	100.910.000	96.630.000	98.700.000	99.760.000

Russia dominated aluminum production within the former Soviet Union, representing about 91% of the total output. East Siberia dominates the actual output in Russia, and about 75% of the output originates in eastern Siberia. Bratsk, in Irkutsk Oblast, is the major producer and Krasnoiarsk is the second largest. The Saiansk works in Khakasia and the amalgamated Siberian-Ural Aluminum (SUAL) company with production facilities in Irkutsk and Perm have marked outputs as shown in Table 3 (Ramsland, 1999).

Table 3. Major Prime Aluminum Producers and Exporters (Ramsland, 1999)

Russia : Major Prime Aluminum Producers and Exporters 1994-98 000' Tonnes

Name	Region	Products	1994	1995	1996	1997	1998
Bratsk	Irkutsk	Primary A	751	768	783	800	
Krasnoyarsk Alu	Krasnoyarsk	Primary A	717	756	777	787	
Sayan Aluminium	Khakasia	Primary A	285	315	325	327	
Siberian Urals Alu Company	Sverdlovsk	Primary A			322	331	
Total Primary Aluminium Production			1753	1838	2207	2245	3347
Krasnoyarsk Metall W	Krasnoyarsk	Roll Aluminium	22	40	9	9	

Source: Russian State Custom Committee - Interfax Newsagency 1998

Russia has a unique advantage in the export of aluminum. Most of the industrialized countries in the Northern Hemisphere have an equal disadvantage in terms of material abundance.

An important factor in determining the location of aluminum production is access to a cheap, renewable, continuous and abundant electricity supply, primarily based on hydroelectric power. Power supplies for aluminum production should adjoin or be relatively close to large reservoirs, such as the Bratsk plant near the Bratsk dam, the Krasnoiarsk plant near the similarly named dam, the Saiansk plant near the Saiano-Shushensk dam, and the Volgograd plant near the 22nd Congress dam.

Proximity to a littoral is also an important factor in determining the location of aluminum production, as suggested by Kandalaksha and Nadvoitsy's works.

(4) Nickel and Copper

It is well known that Russia is one of the world's major non-ferrous metals producer in the world and aluminum is of the most importance. Nickel and copper also have significant production and export figures. As for Russian nickel, Noril'sk Nickel has a monopoly in production; while copper production is conducted by more companies, about half the production is controlled by Noril'sk Nickel.

The North Taimyr Peninsula in Krasnoiarsk Krai and Murmansk Oblast are major nickel producing regions. Together with these regions, copper production takes place south of the Urals, in Magadan, etc.

(5) Wood

The region is abundant in natural resources, such as minerals, oil and gas, and wood.

Wood reserve figures for 1993 showed that Russia's wood-covered areas comprised about 655 million hectares and that the total wood reserves were about 73 billion cubic meters, more than half of which were concentrated in Siberia, as shown in Table 4 (Ramsland, 1999). The wood reserves in eastern Siberia amount to 37% of the total.

Table 4. Production of the Main Types of Products of the Woodworking Complex of Russia

Types of products	Production in Russia					Siberian part. in %%				
	1970	1980	1988	1990	1996	1970	1980	1988	1990	1996
Timber logging mill. m^3	277	256	280	242	74	27.0	28.5	30.7	32.2	28.2
Sawn timber mill. m^3	92	81	85	75	22	25.3	31.2	33.2	33.8	32.0
Plywood 1000 m^3	1421	1460	1727	1597	850	7.3	11.0	17.0	16.4	13.0
Shaving wooden plates 1000 m^3	...	3491	5490	5490	1472	...	...	...	...	20.0
Fiber wooden plates mill. m^2	171	386	501	483	184	5.2	18.1	19.3	19.5	25.0
Pulp. 1000 tons	4735	6765	8349	752	4200	18.6	22.6	25.4	29.3	32.3
Paper. 1000 tons	3476	4462	5334	5240	1800	3.6	2.7	2.2	2.1	...
Cardboard. 1000 tons	1973	2536	3249	3085	1310	13.6	19.7	20.4	19.0	25.0

As mentioned earlier, statistical analyses should be performed for data from the late 1980s. In the 1980s, wood products such as timber logging and sawn timber products (65%), pulp and paper production (25%), plywood (4.5%), cardboard (5%) and wooden shaved plates and wooden fiber plates (2.5%) were exported from Russia. European countries were the main consumers of these wooden products. Sawn wood products were the only exception; they were exported to Asian countries, mainly Japan and China.

Ecology

The Angaro-Yenisei region is characterized by the confluence of three ecological zones. The Taimyr peninsula is located mostly in the tundra zone, where short shrubs and lichen-covered hummocks in the warm season support the Taimyr population of wild tundra reindeer and a wide variety of waterfowl. Intersecting the tundra and the central Siberian taiga is an im-

mense area of dense forests of larch and pine interspersed with large patches of tundra and marsh. This patched micro-ecological zone along the tree-line provides a favourable environment for fur-bearing animals, i.e., the arctic fox, forest reindeer and other large mammals such as bear and moose. Traditional native settlements are located along the forests' edge. Classic Siberian taiga fir trees and cedars with luxurious fur-bearing animals such as sable characterize the third zone along the right bank of the Kureika river north to the port of Igarka.

The Pultoran plateau, starting on the right bank of the Yenisei River, has a marked ecological effect, pushing the tree-line zone far past the Arctic Circle.

Table 5. Population Figures for the Indigenous Peoples of the North (Sokolova & Iakovlev, 1998)

Indigenous Peoples	Number of indigenous peoples in 1989 and % 1979			
	Total number of indigenous peoples	% 1979	Including rural	% 1979
1. Nenets	34665	115,9	28340	112,5
2. Evenks	30233	110,8	23909	111,9
3. Khanty	22521	107,6	15649	97,5
4. Evens	17199	137,3	12769	124,5
5. Chukchi	15183	108,4	12995	108,5
6. Nanaitsy	12017	114,3	7210	109,3
7. Koryaki	9242	117,3	6371	113,9
8. Manci	8459	111,8	4490	93,3
9. Dolgany	6092	137,0	5283	123,5
10. Nivhi	4673	106,3	2284	99,0
11. Selkups	3612	101,3	2664	93,5
12. Ulchi	3233	126,7	2287	125,2
13. Itelmens	2480	181,0	1485	154,4
14. Udegeitsy	2011	129,6	1186	110,6
15. Saami	1890	100,1	1117	97,3
16. Eskimos	1718	113,8	1315	115,1
17. Chuvantsy	1511	-	639	-
18. Nganasany	1278	147,4	915	121,5
19. Yukagirs	1142	136,8	698	122,5
20. Kety	1113	99,2	891	100,3
21. Orochi	915	-	468	96,1
22. Tofalary	713	95,8	625	124,5
23. Aleuty	702	128,6	408	124,4
24. Negidalts	622	123,4	363	108,0
25. Entsy	209	-	117	-
26. Oroki	190	-	28	-
TOTAL	184478	116,5	134503	110,9

Human Geography

It is said that the first appearance of native peoples in the lower Yenisei valley goes back eight thousand years. These peoples possess their own cultures, languages, and attitudes towards each other, which are far from uniform. The population figures for the indigenous peoples of the north are shown in Table 5 (Sokolova & Iakovlev, 1998). They have been practicing, however, a similar type of economy based on harvesting what their land gives them for their own use and for trade.

Reindeer herders, who have managed to operate transportation systems without fuel oil or machine-made devices, have visited numerous pastures hundreds of kilometers away from their home and found the most appropriate feed or most favourable weather for the reindeer. Some peoples have preferred to fish and placed traps. Mechanical devices and snowmobiles or all-terrain vehicles, however, have become gradually common, even for the native peoples in this region.

The other type of land use, as Anderson stated, is based on the industrial economy that produces the means for people to keep their immediate environment as stable and uniform as possible on the basis of the sale of a single-commodity export in world markets. This type of civilization appeared in Russia as early as the 17th century in small confined areas but became common across the country only after the Second World War (Forsyth, 1992). This relatively new type of land use in the region created conflicts between people who used immense areas of land against people who used land intensively. Conflict was also created between people and the environment. The imprudent and destructive attitude of Russian colonialism towards indigenous cultures, seen through most of its history, and frequently seen in other countries, has improved greatly in the post-Soviet period of the Russian Federation.

Development and Environment

Land-users

Industrial development and environmentally hazardous large-scale extraction of natural resources by colonists were confined to areas adjoining the Trans-Siberian Railway, at least until the 1930s. Intensive forestry in the lower Yenisei area, nickel mining at Noril'sk and gold mining in Iakutiia were typical examples of large industrial projects from 1930, which naturally caused severe environmental damage. In the mid-1950s, other large projects started in the far north, with timber operations expanding over enormous areas. Large amounts of timber were left to rot. The indigenous peoples lost vast hunting grounds. Data collected by Vakhtin indicated that 30% of the forests were cut in the Russian Far East, 21% in Magadanskaia Oblast, 39% in Primorskii, 34% in Khabarovskii, 9% in Sakhalin and 42% in Amurskaia.

The hydrocarbon development boom started in the mid-1960s. Again

forests were cut down around Surgut and Samotlor in the Khanty-Mansiyskii Autonomous Okrug, where the largest oil deposits were located, polluting rivers and bogs, devastating the land for the indigenous peoples. Aipin[7] criticized the environmental exploitation wrought by industrial development and lamented the abuse of the indigenous population, the pillage and destruction of cultural sites, the decimation of the reindeer population and other shameful actions and behavior. The exploitation of energy resources caused an enormous loss of land and water resources. Similar to the Alaskan pipeline, railways and pipelines cut off reindeer migration routes, which had a significant impact on the natives. The wild reindeer population has been increasing in recent decades, but the hunting trade is still vulnerable to any kind of environmental disruption. Winter shipping on rivers, especially, causes shifting migration routes. The shortage of transportation facilities in the region makes solving this problem difficult. There is no legal protection for most pasture-lands, although the government has expressed its intention to support land use by indigenous peoples. (Dallman, 1997).

The government has tried resettling indigenous peoples as compensation, attempting to provide a "civilized" mode of living with heated houses and electricity. Such measures have had certain benefits in industrialization, but they have accelerated the decline of indigenous cultures.

Mining activities have created severe pollution problems in the vicinity of mines and smelting works. Nickel plants on the Kola Peninsula and the Noril'sk industrial area in the lower Yenisei valley are the most typical examples. Mining business brings a lot of problems in Northern Iakutiia. Pollution and the littering of beaches and river deltas in bio-resource zones is reported to have affected Iakutiia's wildlife population.

Pollution problems caused by mining activities as well as other industries are aggravated by Russia's present economic and political conditions.

Radioactive contamination has also had a significant impact on the environment. Large areas have suffered radioactive pollution, affected by atomic bomb testing in Novaia Zemlia.

In this region, nuclear explosions were often used for civilian purposes, such as mining, seismic sounding, and controlling river flows. Despite its distance far from the testing area, some of the worst contamination was reported in Chukotka. Background radiation levels in 1990 were still the same as in the controlled zone around Chernobyl (Lupandin & Gaer, 1990).

Marine Pollution and Marine Mammals (Belikov, et al., 1998)

Russia unfortunately lacks precise, updated information on the distribution, abundance, migration, breeding and feeding areas of major marine mammals in the polar region. These mammals include the polar bear, walrus, bearded seal, ringed seal, white whale, gray whale and bowhead whale, all of which are deeply associated with the indigenous peoples' daily lives. It is well- known that estuaries of large rivers in Russia are more or less contami-

nated, but the negative effects of pollution on certain marine mammals have not been clarified. Contamination of sea-water by oil and waste has been reported in large sea ports such as Amderma, Dickson, Tiksi and Cape Shmidt. The white whale, for instance, appears near these ports every year and risks suffering from the pollution's toxic effects.

The real danger for marine mammals, in particular gray whales, is found in pollutants such as heavy metals, DDT and PCBs (polychlorinated biphenyls). As Stirling-Calvert (1983) pointed out, increasing levels of pollution are inevitable due to the long-lasting nature of many of these compounds. They continue to move through the ecosystem's food chain in ever-increasing concentrations. Samples of plankton and benthos show high levels of chlororganic pollutants. It is widely recognized that the accumulation of toxic materials in the tissues of marine mammals greatly reduces the reproductive rate, increases the rate of miscarriages, birth deformities and stillbirths in mammals (Delong, et al. 1973).

Industrial waste, for the moment, is the main source of pollution. The development of shore infrastructure, coastal settlements and ports and harbors in the future will cause an increase in pollutants. An increase in the frequency of shipping traffic will have negative effects on migrating gray whales or other marine mammals. During migration, gray whales are sensitive to noise from ships. Ship noise forces whales to leave their feeding sites.

Every pollution-caused issue has various negative effects on the indigenous peoples who have long relied on marine products. They essentially have no legal protection for recourse.

Civilization or Industrialization

Due to budget shortfalls and the general economic crisis, Russia's infrastructure in society and industry has become old and inadequate, discouraging foreign capital investment to a large extent. For the growth of the entire country and/or local, individual regions, regional economic zones created in each district may be effective. Benefit principles on the use of infrastructure should be introduced as much as possible. Local governments should be authorized to take over many of the functions that belonged to the central government under the old system. Simultaneously, a clarification of the demarcation between the central and local governments in development policies including financial burden sharing should be required. The initiative in planning local development should pass to the local government. Regional development plans, in harmony with each region's particular natural, ecological and population conditions should be formulated and executed with the cooperation of local governments in the area.

Environmental Protection in the Russian Arctic

On a national scale, Russia is becoming more and more dependent on the Arctic regions. Hard currency revenues from abundant natural resources in the Russian Arctic might be the key to the country's survival. Despite efforts by the Russian government to establish new institutional frameworks for environmental protection and new patterns of interactions between the government and economic actors during the 1990s, there have been no encouraging signs of a shift towards sustainable development (Brubaker, 1993, et al.).

The development of legislation for environmental protection is vital in all regions of the Russian Arctic and, officially, is one of the government's top policy priorities. Protection is essentially granted under the following system (Kotov & Nikitina, 1999),

(1) federal environmental laws cover general and specific competencies,

(2) regional environmental legislation for northern Federation subjects

(3) agreement on the division of authority between the Federation and northern Federation subjects in environmental matters.

This legislative framework is, however, underdeveloped and contains serious gaps that need to be revised urgently, as experts pointed out.

An attempt has been made to introduce a new concept of national environmental management to create incentives for producers to reduce their emissions and to shift towards investing in purification facilities. This includes licenses and agreements for pollutant discharges, payments for pollution, and a system of environmental funds, federal, regional and local. Putting this system into effective operation should be a top priority.

Concluding Remarks

The ecosystem in the Angaro-Yenisei region is extremely vulnerable and lacks rehabilitation potential. There are, however, many other problems in the Russian Arctic, such as the lack of a unified policy on social and industrial development, unstable environmental controls over hydrocarbon and mineral resource development, low public attention towards environmental issues, shortages in financial support for environmental measures, etc.

By way of conclusion, the following passage is cited from Kotov's paper, as a warning against further development in the region and the Russian Arctic.

"According to some experts, areas with high levels of environmental pollution account for about 1.5 - 2% of the Arctic territory (not including marine areas), and areas with suffering critical ecological conditions account for about 15%. Man has transformed the ecosystem in more than 60% of the Arctic, and 2% has been completely destroyed. Air and water pollutant concentrations in areas of intensive industrial development regularly surpass allowable norms by 2 to 5 times the allowable limits, and during certain periods exceed the norms by 10 to 13 times, and sometimes by up to 300 times. Such pressures endanger the ecosystem and human health. The level of chronic diseases and infant mortality is high in Arctic regions with critical environ-

mental conditions. Life expectancy in the Arctic is 3 to 4 years lower than Russia in general, and among indigenous people is 10 to 11 years lower. Unfavorable environmental conditions, especially in areas of industrial development, negatively affect the demography of indigenous peoples: they are on the verge of extinction, and are losing their cultural and ethnic distinctiveness, as well as their traditions that are closely linked to nature."

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