

## **VI. Republic of Sakha (Yakutia)**

### **Overview of the Region**

*Josh Newell*

#### **Location**

The Republic of Yakutia (Sakha), situated in northeastern Siberia, stretches to the Henrietta Islands (77 N) in the far north and is washed by the Arctic Ocean (Laptev and Eastern Siberian Seas). These waters, the coldest and iciest of all seas in the northern hemisphere, are covered by ice for 9 to 10 months of the year. The Stanovoy Ridge (55 D. 30 D. N) borders Yakutia in the south, the upper reaches of the Olenyok River form the western border, and Chukotka forms the eastern border (165 E).

#### **Size**

Almost one-fifth of the territory of the Russian Federation (3,103,200 sq. km.) and greater than the combined areas of France, Austria, Germany, Italy, Sweden, England, Greece, and Finland.

#### **Climate**

Winter is prolonged and severe, with average January temperatures about -40C. Summer is short but warm; the average in July is 13C and temperatures have reached 39C in Yakutsk. In the northeast, the town of Verkhoyansk reaches -70C (-83F) and is considered the coldest inhabited place on Earth. There is little precipitation - from 150-200 mm. in Central Yakutia to 500-700 mm. in the mountains of eastern and southern Yakutia.

#### **Geography and Ecology**

Forty percent of Yakutia lies within the Arctic Circle and all of it is covered by eternally frozen ground-permafrost - which greatly influences the region's ecology and limits forests to the southern region. Yakutia can be divided into three great vegetation belts. Arctic desert defines the northern region that is covered by snow most of the year. In the spring and summer scattered patches of grass, moss, and lichen grown on it. Arctic and subarctic tundra define the middle region, where lichen and moss grow as great green carpets and are favorite pastures for reindeer. In the southern part of the tundra belt, scattered stands of dwarf Siberian pine and larch grow along the rivers. Below the tundra is the vast taiga forest region. Larch trees dominate in the north and, in the south, stands of fir and pine begin to appear. Taiga forests cover about 47% of Yakutia, and almost 90% of this cover is larch.

The great Lena River watershed begins in the steep mountains that border the western shores of Lake Baikal. Then the river meanders northeast and is joined by the Vitim River, followed by the Olyokma, Aldan, Amga, and Vilui Rivers before flowing out of a wide delta and into the Arctic Ocean. It spreads through Yakutia like a huge pitchfork and, with its tributaries, forms the great river network that supports this immense region's ecology. The Lena is over 4,000 km. long and the entire basin is 2.5 million sq. km.

Yakutia's greatest mountain range, the Verkhoyansk, runs parallel and east of the Lena, forming a great arc that begins in the Sea of Okhotsk and ends in the Laptev Sea (Arctic Ocean). This great range has hundreds of small tributaries that feed the Lena as it moves northward. The Cherskiy Range runs east of the Verkhoyansk and has the highest peak in Yakutia, Peak Pobeda (3,147 m.). Even further east are the gold-rich Kolyma Mountains, which stretch all the way to Chukotka.

Geologically, Yakutia is very old, particularly in the west which is one of the most ancient portions of the Earth's crust and source of Yakutia's massive diamond reserves. The region's complex and diverse geological structures are extremely rich in minerals and are well known throughout Russia for gold deposits in the Aldan, Indigirka, and Yana River basins, tin in the northeast, and natural gas and oil in the Vilui basin.

## **Flora And Fauna**

Polar bears den and hunt in Arctic regions near the Henrietta Islands. Each year over 30,000 geese migrate to the wetlands between the Yana and Kolyma Rivers and 200,000 to 300,000 ducks migrate to the region between the Kolyma and Alezeya Rivers.<sup>4</sup> White Siberian cranes (sterkh), Canadian cranes, Ross' gulls, geese, and other waterfowl nest on the left bank of the Khroma River and along the lower Indigirka and Alezeya Rivers. Over half of Yakutia's Bewick swans nest between the Kolyma and Konkovaya Rivers. Sandhill cranes, eider, and other waterfowl also nest here. Little curlews, hooded cranes, and black storks nest between the Lena and Kolyma Rivers. In total there are 28 species of mammal, 285 species of bird, 43 of fish, and around 4,000 insect species.

Yakutia's flora includes 1,831 species of vascular plant, 526 species of moss, more than 550 species of lichen, and more than 510 species of mushroom. Many species of plant (331 species or 18.6% of the total flora) are listed in the Russian Red Data Book.<sup>5</sup> Among them are 67 endemics and sub-endemics, including some growing in very limited areas.

## **Forests**

*Dr. Aleksandr Dobrynin, Forest Ecologist, Russian Academy of Sciences*

Forty-seven percent of Yakutia (257 million ha.) is covered with forest. The total forest supply is estimated at 9.3 billion cu. m. The dominant tree species is larch, 86% (114 million ha.) of the forest cover. Other species include common pine (6.3%), dwarf Siberian pine (6%), Siberian spruce (less than 1%), and small stands of fir, birch, and aspen. In the southwest, there are Siberian pine and fir forests and, in the south, Ayan fir forests. In the north, the forests are mainly found along river valleys. Although vast, most of Yakutia's forests are not very productive due to the extreme cold and the dry winters. In general, the bonitet or commercial productivity of the forest doesn't rise above IV or V. Productivity increases towards the south.

## **Forest Hotspots**

- 1. Sub-tundra forests of Northern Sakha**
- 2. Between the Lena and Amga Rivers**
- 3. Between the Aldan and Uchur Rivers**
- 4. Tuimaada Valley**

## **INDUSTRY**

### **Population**

The population of Yakutia is 1,073,800. The main nationalities are Russian, Yakut, and Ukrainian. Native peoples include Evenki, Eveni, Dolgane, Chukchi, and Yukagiri.

### **Largest Cities**

Yakutsk, the capital (pop. 198,000), is the industrial center.

Neryungri (pop. 76,000) in the south is the coal mining center and has a large thermal power plant.

Mirniy (pop. 40,000) is the center for Yakutia's diamond industry and the second-largest producer in the world.

Aldan (pop. 27,400) is in the gold mining region.

Lensk (pop. 31,200) is a major river port.<sup>6</sup>

### **Main Resources**

Diamonds, 4.4 billion tons of coal, phosphate deposits, 13 trillion cu. m. of natural gas, oil, tin, gold, and furs. There are 9 billion cu. m. of timber.

**Main Industries**

Diamond, gold, tin, and coal mining make up 63% of Yakutia's total industrial production. The region also produces 1.5 billion cu. m. of natural gas and 3 million cu. m. of wood annually.

**Economic importance in the RFE**

Produces 99% of Russia's diamonds

23% of total Russian gold production; more than any other region in Russia.

RFE coal production, 42% of all reserves

11% of RFE timber production

20% of Russia's fur output

43% of all RFE tin reserves

38% of RFE oil reserves

59% of RFE natural gas reserves

79% of RFE iron reserves

49% of total land area of the RFE

*As a republic, the Republic of Sakha can create its own systems of protected areas and therefore some forms are different in the region than other administrative territories of the Russian Far East. These different forms are described below.*

## THE PROTECTED AREA SYSTEM

*Lyudmila E. Shmatkova*

Deputy Minister for Nature Protection, Republic of Sakha

The first protected natural areas of Yakutia were the Olekminskiy (1984) and Ust-Lenskiy (1996) *zapovedniks* (strictly protected state nature reserves). At the same time a number of *zakazniks* (wildlife reserves) were created as well. These protected areas made up less than 2% of Sakha's land area and thus did not adequately protect the region's ecosystems and biodiversity. Years of destructive diamond and gold mining have destroyed over 25,000 ha. of land and today these devastated areas remain; due to a lack of financing, there has been no recultivation of these areas. The Sakha government has recognized the necessity to protect ecosystems for indigenous people's use, for biodiversity conservation, and to provide for sustainable development of the territory. In August 1994, President Nikolayev of Sakha issued Presidential decree ("Ukase") #837 titled "On Measures to Develop Specially Protected Areas". This document is a predecessor and in many cases a catalyst for creation of similar networks of protected areas in other regions of Russia. It appeared considerably ahead of the Pan-European Biological and Landscape Diversity Strategy (PEBLDS) adopted by the European Union in October 1995; This strategy is considered the main European contribution towards fulfilling the goals of "Agenda 21", which has become the cornerstone of sustainable development efforts in many regions worldwide.

According to the Decree, before the year 2000, 25% of Yakutia will have protected status in an effort to preserve pristine natural areas, their biological and landscape diversity, and to ensure untapped natural resources for future generations.

The first step in establishing a network of protected areas for the Republic of Sakha was to create a legal basis for such territories. To augment the two main existing laws, "On Nature Protection" and "On Administrative Responsibility for Environmental Offences", a new law on "Specially Protected Natural Areas (SPNA)" was developed and adopted by the legislature (*Il Tumen*) based on article 2 of the federal Russian law "On Specially Protected Nature Areas". For the first time in Russian Federation, these territories were given names in the local Yakut language: *Ayan Ayilgy* (national nature parks), *Erkeyi Sirder* (resource reserves), *Uluu tuolbeler* (protected landscapes), *Ayilba meneler* (monuments of nature), and also so-called "reserved territories".

In addition to this new laws, Standard Guidelines (*tipovye polozheniya*) were developed and adopted by the Yakutia Government covering:

- 1) Reserved territories (RT),
- 2) National nature parks (NNP),
- 3) Resource reserves (RR)
- 4) Public inspectors of nature protection.

The Republic's network of SPNA or *Yityk Kere Sirder* combines into one system both the federally protected areas (*zapovedniks*), Republic level territories (national nature parks, resource reserves, *zakazniks*) and a whole array of district (*ulus*) level and municipal territories. The *Yityk Kere Sirder* system includes two *zapovedniks* - Olekminskiy and Ust-Lenskiy, 4 national nature parks - Lenskiy Stolby, Siine, Momskiy, and Ust-Viluiskiy, 40 resource reserves, 43 reserved territories, a few protected landscapes, a few dozen nature monuments, and 26 unique lakes of national significance. In most cases, protected areas are connected by transit "ecological corridors", e.g., buffer zones along the river systems.

All SPNA in the Republic are administered through the Ministry of Nature Protection of the Sakha Republic (Yakutia). Individual SPNAs are administered by the Department of SPNA of the Ministry, by

district-level Committees and Inspections on Nature Protection, as well as by Directorates of each respective zapovednik and national park, both categories being legally recognized organizations with staff.

Today the total area of protected territories in Yakutia is 587,000 sq. km., or about 18.9% of the land area of the republic. The protected territories conserve some of the habitat for the 17 species of mammals, 54 species of birds, and 311 vascular plants listed in the Sakha Red Data Book.

### **Different Forms of Specially Protected Natural Areas (SPNAs) in Sakha**

Strict Nature Reserves (*Zapovedniks*) in Sakha are under the jurisdiction of the Russian Federal government. (The functions of zapovedniks are described in other sections of this report). However, in Sakha, indigenous groups strongly disagree with the zapovednik systems as it contradicts their traditional notion of land use. Whenever, proposals for new zapovedniks arise, indigenous peoples are some of the strongest critics.

National nature parks of Yakutia (*Aan Ayilgy*) are organized by the government of the Republic of Sakha. They are formed to be used for nature conservation, educational, scientific, cultural, and recreational purposes, and for regulated eco-tourism. In the national nature parks use of natural resources is allowed, when compatible with the stated goals, and if the forms of such use provide for preservation of traditional environmental use of the indigenous population. A number of zones with different protection regimes are designated within each park, namely:

- (tyytylybat sirder), where all industrial, agricultural, and recreational uses are prohibited, protected zone
- (yityk sirder), places of traditional spirituality, worship and ritual activity, sacred areas
- recreation zones, limited
- recreation zones, active
- nature use zones (*torut sirder*), traditional
- and captive breeding zones for endangered wildlife, enclosures
- historical or archeological zones protected

When national nature parks are created, all land, minerals, and biological resources are removed from use, except in zones of traditional nature use. The parks are administered by the Ministry of Nature Protection (*Minprirody*) of the Republic and each has its own Directorate. Regulations (*Polozhenie*) prepared for each park vary and determine particular zoning and protection regimes.

National resource reserves (*Erkeyi sirder*) are created to protect land, water, mineral and biological resources and natural habitat of indigenous peoples. They are used also for environmental education and ecotourism. A number of zones are designated:

- protected zones
- sacred lands
- licensed resource use zones
- seasonal protection of biological resources,
- traditional nature use

Again, regulations for each reserve determine zoning and protection regimes. Interactions between land-owners and users in each reserve is regulated on the basis of negotiated agreements. Tourism and recreation are regulated on a project-by-project basis through use of licenses for such activities.

Protected landscapes (Uluu tuolbeler) are areas of land and water surface that are specially protected to preserve unique landscapes. They are used for recreational and tourism with other limited activities also allowed. Protected landscapes are organized without withdrawal of land and other resources from their current users. Regulations for each landscape determine the protection regime.

Nature monuments are rare or unique objects having environmental, scientific, historical or cultural value. Their protection and use are determined based on the Standard Regulations adopted by the Government of Yakutia.

Reserved territories are protected by the administrative and legislative acts and regulations. They are aimed at protecting, sustaining and restoring natural habitats and their components and preserving the ecological balance. Limited use of natural resources is allowed, however, no industrial development or mining may take place in those areas, but only traditional nature use.

### **List of Protected Areas in the Republic of Sakha**

#### *Lena River Basin*

Total Area currently under some form of protection: 17,668,651 ha.

#### **Zapovedniks**

1. Olekminskiy Zapovednik

Established: 1984

Size: 847,102 hectares

2. Ust-Lenskiy Zapovednik

Established: 1996

Size: 1,433,00 ha.

#### **National Parks**

1. Lenskiye Stolbi

Established: 1995

Size: 868,000 ha.

2. Sinyaya

Established: 1996

Size: 1,467,517 ha.

3. Ust-Viluiskiy

Established: 1997

Size: 1,016,000 ha

4. Momskiy

Established: 1996

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Size: 2,175,600 ha.

**Zakazniks**

1. Bolshoye Tokko

Established: 1983

Size: 265,800 ha.

2. Beloozerskiy

Established: 1974

Size: 35,800 ha.

3. Tomporuk

Established: 1983

Size: 285,600 ha.

4. Pilka

Established: 199

Size: 216,00 ha.

5. Ochuma

Established: 1982

Size: 615,000 ha.

6. Dzhunkun

Established: 1987

Size: 200,000

7. Dzherono

Established: 1969

Size: 60,000 ha.

8. Kharialakh

Established: 1969

Size: 280,000 ha.

9. Ungra

Established: 1979

Size: 200,000 ha.

10. Undulung

Established:

Size: 500,000 ha.

11. Timirdikeen

Established: 1995

Size: 520,000 ha.

12. Tamma

Established: 1995

Size: 177,200

13. Verkhne-amginskiy

Established: 1975

Size: 500,000

### **Resource Reserves**

1. Kyzikyzmyz

Established: 1995

Size: 93,632 ha.

2. Kharbail

Established: 1996

Size: 32,600 ha.

3. Bzs-Kuel

Established: 1996

Size: 108,000 ha.

4. Kylyz

Established: 1996

Size: 30,000 ha.

5. Lena Delta

Established: 1996

Size: 5,932,000 ha.

6. Belyanka

Established: 1997

Size: 262,400 ha.

7. Prialdanskiy

Established: 1997

Size: 46,000 ha.

8. "WWF-Sakha" (Charyoda)

Established: 1997

Size: 1,372,000 ha.

### **Indigirka River Basin**

*Total Area currently under some form of protection: 8,237,45 ha.*

### **National Nature Parks**

1. Momskiy

Established: 1996



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Size: 2,175,600 ha.

**Zakazniks**

1. Sailik

Established: 1980

Size: 700,000 ha.

2. Verkhne-Indigirskiy

Established: 1992

Size: 700,000 ha.

3. Khroma

Established: 1992

Size: 523,000 ha.

**Resource Reserves**

1. Suntar-Kharyata

Established: 1996

Size: 63,1000 ha.

2. Okhogino Lake

Established: 1996

Size: 241,250 ha.

3. Sutoryokha

Established: 1996

Size; 500,000 ha.

4. Zselyakh

Established: 1996

Size: 2,402,000 ha.

5. Kitalik

Established: 1996

Size: 1,607,900 ha.

*Kolyma River Basin*

*Total Area currently under some form of protection: 95,100 ha.*

1. Silgi-Bitar

Established: 1984

Size: 14,000 ha.

2. Troitskoye

Established: 1975

Size: 5,100 ha.

3. Khirkovo

Established: 1971  
Size: 11,000 ha.

4. Sededema  
Established: 65,000 ha.  
Size: 1995

*Yana River Basin*  
*Total Area currently under some form of protection: 95,100 ha.*

#### *Zakazniks*

1. Irianna  
Established: 1974  
Size: 185,000 ha.

2. Tuostakh  
Established: 1997  
Size: 500,000 ha.

3. Omolon  
Established: 1996  
Size: 332,500 ha.

*Alazeya River Basin*  
*Total Area currently under some form of protection: 2,375,600 ha.*

1. Chairugino (3 different sections)  
Established: 1982  
Size: 2,375,600 ha.

**Anadyr River Basin**  
*Total Area currently under some form of protection: 1,112,000 ha.*

1. Ternei-Tumus  
Established: 1997  
Size: 1,112,000 ha.

### **Forest Hotspots of Republic of Sakha**

#### **1. Sub-Tundra forests of Northern Sakha**

*N.D. Sedel'nik*  
Main Forestry Officer of the Republic of Sakha (Yakutia)

#### Description of the Territory

In forests, as is well known, is concentrated the basic life force of the Earth, the energetic basis of its living skin--the biosphere, and the main factor in the resilience of the latter. They comprise nearly 2/3 of living material produced on the planet, account for an enormous mass of living substance and colossal energy, the

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great intensiveness of biological circulation, and affect the energy and mass exchange in the biosphere and overall on its functioning, formation of natural conditions, transformation of climatic, hydrological, geochemical, biophysical and other factors.

According to tentative calculations, the overall area of the forests belonging to the permafrost zone is 860 million ha, of which, about 480 ha is inhabited. The forest, growing in soil with severe permafrost conditions, requires special methods of utilization, and in a number of cases, must not be drawn into the sphere of industrial use. Disturbance by elementary technological methods of forestry in soil which has been frozen for many years leads to collapsing thermokarsts, landslides, erosion and other undesirable results, after which, it is too late to restore the forest, even from a distant perspective. And now the question has been brought up about conservation of northern and, in particular, near-tundra forests.

In the territory of the Republic of Sakha (Yakutia), to this category, firstly, belongs the protected belt of near-tundra forests. The overall area of this belt is 19,716,000 ha. Near-tundra forests comprise an extensive, 100-kilometer band in which it is risky to conduct forestry, where, in principle, cutting should not be done in view of the important central function these forests fulfill. Namely, here there is too high a probability of unpredictable ecological consequences, resulting from the interference of people. The territory is under the threat of degradation from industrial exploitation of raw material resources--mining of diamonds, gold, tin, etc.; and in the future, of probable development of mining for niobium and polymetals. It is characterized by the uniqueness and delicacy of the ecosystem, which is easily damaged, and has developed at the junction of two natural zones: taiga and tundra.

Here many species of rare animals and plants live and grow, and rare species of bird nest--the Siberian white crane, spectacled eider, Ross's gull, etc. In the territory traditional forms of natural resource use are practiced by the indigenous people, most notably, reindeer herding. A part of the territory is still poorly studied and little disturbed. Its ecosystems may be characterized as virgin. The near-tundra forest, as a matter of fact, is one of the most important territories for virgin forests and has value for the entire planet as it belongs to the world's reserve territories with primordial nature. They constituted a special category of renewable biological resources, which are characterized by prolonged, complicated and not always guaranteeable end results of the cycle of restoration. Under modern conditions, the degree of this indeterminacy depends not only on the objective conditions of natural development, but also on subjective, casual estimations and technological decisions, often conflicting with the biogeographical nature of the forests. It is difficult even to guess at the ecological consequences of disturbing the dynamic balance, historically complicated among components of forest biogeocoenoses in the near-tundra zone.

The near-tundra forests determine the climatic and soil-hydrologic conditions of an extensive region, and regulate hydrological conditions and water flow in rivers, circulation processes of the atmosphere, wind and radiation conditions of regions located much to the south. Here are concentrated rich reserves of nutritional and medicinal materials and other useful things.

Within the boundaries of the near-tundra forests of Yakutia there are companies of the mining industry. In the region, large tin and gold mining companies (Deputatskiy and its sub-divisions, gold mines of "Kularzolota") have functioned and continue to function, diamond mines are being developed (the "Ebelyakh" mine), and unique deposits of niobium have been discovered and partially prospected (the Tomtor" mine). During development of commercial minerals by strip-mining, large areas of forest ground are destroyed, primarily in valleys, where the most productive and valuable forests grow. The territory is not recultivated and becomes a "lunar landscape."

Although in the region there are practically no forests of exploitable value, a real factor of destabilization has been forest cutting for the needs of the local population, firstly, for heating. In aggravated

circumstances this often leads to cutting of whole valley (riparian) forests, because here they are in fact the only source of wood for fires and other purposes. The demand in the region for constructional wood and wood fuel brought in from other regions was not satisfied in the past, much less in recent years. A great loss to forest ecosystems is also brought by forest fires. Although they occur relatively rarely here, their impact is enormous.

Forests and sparse forests in the zone of contact of forest and tundra vegetation are very easily damaged by outside influences and weak at recovering after forest fires and cutting. Often in burns which occurred 100-150 years ago, forest vegetation has not yet regenerated, and pyrogenic tundra grows. Also reflected poorly on the condition of ecosystems are non-rational approaches to reindeer herding, which is connected with the movement of people working in this business but living a settled lifestyle.

The territory remains poorly studied. The main research work was initiated for the most part for the study of nature and the effect on it of economic activities in the eastern part of the region--in the Yano-Indigirsky inter-stream area. It should be noted that integrated work has been done with regard to studying the Siberian white crane and the effect of gold and tin mining companies on the basis of international and republic-wide research programs.

#### Current Measures

Resolution No. 798 of the Council of Ministers of the RSFSR from 16 May 1959 and Resolution No. 237 of the Council of Ministers of the Yakutia ASSR from 2 June 1959, with the goal of regulating the use and conservation of forest resources in the northern part of the near-tundra forests, established beginning 1 January 1960 a protected 100-kilometer strip of near-tundra forests. In the territory of the strip were created and are being created specially preserved natural territories, which are supposed to protect nature in a pristine form.

#### Recommended Measures

With the goal of supporting conservation and rational utilization of near-tundra forests, it is essential to organize ecological monitoring. "Paper" data bases, held by the Forestry Authority of the RS(Yakutia) could provide the basis for information. It is important to pay attention to research on determination of the range of compensatorial properties of forest ecosystems in the near-tundra sub-zone, which allows qualitative and quantitative parameters of possible effects to be discovered and irrecoverable degradation of natural complexes to be prevented. It will be necessary to carry out the entire complex of recultivation work of the ground disturbed by the gold and tin mining companies, and furthermore, to have the multitude of mines in current times conserved, and to have the local economy and population switch to alternative types of fuel to the maximum degree.

## **2. Between the Lena and Amga Rivers**

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#### **Description of the Territory**

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The Lena-Amginski inter-river area occupies the territory of the Amginski, Megino-Kangalasskii, Ust-Aldanskii and Churalchinskii Uluses and covers an area of 9.5 million ha. In terms of geomorphologic relationships, the proposed territory is a southeasterly, more elevated (from 150 to 300 meters) part of the Central Yakutski Plain. The climate is sharply continental, which is reflected in annual swings in temperature, small quantities of atmospheric precipitation (200-280 mm a year), of which about 80% falls in the summer-autumn period.

72% of the region is forested. The forest covers 7.64 million ha with a wood supply of 780 million cubic meters. Larch predominate the forest cover, accounting for 87.4% of the forested area. The share of pine trees is only 3.7% of the forest cover area, where pine forest-bearberry flora predominate. The distinguishing feature of the forest-covered region is a relatively high share of native birch forests (3.2%), dwarf forests and birch shrub (5.6% of the forest-covered area). The diverse herb birch forests have varieties of steppe plants known among the local population as "charany" have unique associations and are characteristic only of the Lena-Amginski inter-riparian area. Spruce forests, aspen forests, willow forests and poplar forests are rare and more likely to be found on the left bank of the Aldana River. 28% of the area is comprised of alases ---a unique complex of wetland, pond-steppe and forest-steppe vegetation.

The territory is under threat of degradation from intensive, non-rational agricultural assimilation. Moreover, it is one of the most populous regions of Yakutia, and thus it receives a heavy recreational load. The ecosystems of the region are extremely sensitive to various types of disturbance, which can cause activation of the thermoclastic phenomenon, which frequently leads to major changes in the landscape. A traditional type of natural resource utilization is practiced by the Yakut in the territory--cattle herding. The alases comprise a communal-ancestral place for the livelihood of the Yakut, the cradle of their culture and place of traditional communion with nature

The main factors in the destabilization are forest fires, agricultural assimilation of forest territories without ecological basis, and expropriation of the forests for construction of industrial facilities. Large areas are being overtaken for pastures, plowed fields and other agricultural plots, which after two decades will become too poor for further use of the soil. This leads to deforestation of large areas, which in turn aggravates the already harsh conditions for securing moisture for the region and is reflected in reduced productivity of agricultural land (this indicator has decreased by half over the past 30 years). Many alases have become very shallow and are polluted by the waste products of farm animals and human populations, mineral fertilizers, herbicides and pesticides.

For construction and firewood for the growing population, each year tens of thousands of hectares of taiga are cut, which recovers very slowly. Because of the absence of outlets for the younger generation under the extreme conditions of "Zaryechia," the forestry turnover is being prolonged, which means that restoration of ripe forest with normal market values after cutting and fires takes 200-300 years. With the construction of a network of automobile highways, water transport systems and in the future, railroads, forest area is expropriated, thus disturbing for centuries the complicated ecological balance in the region. As a result of anthropogenic degradation of the forest in this territory, its water-storage value have been lost and this is leading to local changes in climate: it has become more drought-prone.

Disturbance of the ecological structure of the forests leads to reduction in the wealth of avifauna. Waterbirds which used to live in these areas can now be seen only during migration and the former multitudes of squirrels and weasels have become rare. Bears have nearly disappeared, and even elk have become a rarity. Further worsening of the situation may lead to a natural catastrophe for the region, because the process of desertification, passing beyond critical boundaries, will spread to the other parts of

Central Yakutia. The reality of formation of deserts under the conditions in Yakutia can be demonstrated convincingly by the presence of extensive sandy massifs in the basin of the central Lena.

In recent times, the natural-climatic conditions and plant and animal world of the region have been studied sufficiently well. Research is being conducted on the rise of modern conditions and regularity of the functioning of the taiga-alas ecosystems.

### **Current Measures**

Adoption of the republic-wide program "Ecology of Zaryechia," developing measures for improvement of the condition of nature and the biological and hydrological resources of the region.

### **Recommended Measures**

For conservation of forests that have not yet been disturbed, planned measures are needed for withdrawal from wooden construction and massive transfer of the private sector from firewood to other types of fuel. For restoration of the media-generating role of the taiga around habitable territories, massive planting of forests is needed. This problem requires special study, because after destruction of forest cover, the former forest soil under the influence of freezing conditions very quickly becomes alkaline and saline. For this reason, naturally, reforestation here is made much more difficult. For conservation of the unique taiga-alas landscape in its pristine form, it is necessary to accelerate the organization of nature reserves. Research on monitoring is necessary in all alases of the Lena-Amginski inter-river area.

## **3. Between the Aldan and Uchur Rivers**

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### Description of the Territory

The Aldan-Uchur inter-riparian zone occupies a sizable area in the Aldanski mountainous region in the southern part of Yakutia. Administratively, it is distributed between the territories of the Nyeryungrinski and Aldanski region and constitutes a mountainous-taiga region between the valleys of the Aldan River and a large tributary to the east, the Uchur. Here mid-alpine permafrost lands predominate, with altitudes of 650 to 2200 m.

A large portion of the inter-riparian zone occupies alpine mid-taiga larch and larch-pine forests with some dark-pine forest species and some cedar and spruce-fir forests. As an admixture to the basic forest-forming species, birch, pine and aspen are seen, and more rarely, poplar and chozenia.

The territory is characterized by high biodiversity. The Southern Yakutski natural territory complex is located at the juncture of various geographical regions--the Far Eastern, East-Siberian (Yakutski) and Siberian--and bears the markings of each of these. Here grow more than 850 species of vascular plants. Among them are endemics and Red Book listed species (creeping fir, orchids, dryads, saxifrages, thyme, etc.). The animal kingdom of the territory is likewise characterized by biodiversity. Plenty of species of predators, and hooved and fur-bearing animals are found here which are comparatively rare in other regions. Ichthyo-, ornitho- and entomofauna are widely represented.

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The ecosystem is highly diverse. In addition to the complex of ecosystems of the larch taiga typical of Yakutia, elements are encountered here of dark-pine taiga, including one formed from a Far-Eastern montane type--Ayan spruce, alpine-taiga/Arctic-alpine mixes, etc.

The Andan-Uchurski region is a living place of indigenous people of the North (Evenki), few in number, who live both settled lifestyles (in the settlement of Khatystyr) and traditional, joining together in nomadic clan communities. In the valley of the Aldan River and its tributaries over a number of decades, there has been active development of deposits of gold, coal mica and stones for craft work.

Economic activities on the territory, construction of towns (Nyeryungri) and industrial settlements (Trompton, Byerkakit, Kanku and others) and construction of a railroad have brought about a significant transformation of the natural landscapes with a high degree of anthropogenic disturbance.

In the region described, construction of a cascade for the Uchurski hydroelectric station has been proposed along with mining of the El'ginski coal deposit, located in the immediate vicinity of the unique, protected lake Bol'shoe Toko, which has classic moraine land form complexes of alpine -valley glaciation along its edges and development of the "Taezhnoe" ("Taiga") iron-ore deposit. As a result, intensive effects on the region should be anticipated and, as a consequence, a decrease in the level of biodiversity with the result of species being exterminated, the area they live in and the unique moraine land forms being degraded, and the hydrological and hydrochemical conditions of Lake Bol'shoe Toko being changed. Disturbance of the ecosystem connections should also be anticipated along with reduction in the stability of the taiga and alpine inter-zonal land forms and disturbance of frost conditions and activation of cryogenic processes.

### Current Measures

For optimization of the quality of the natural environment, part of the territory of the Aldan-Ychurski inter-river area has been put under special conditions of protection and has received the status of especially protected natural resource reserves (NRR) of significance to the republic (or Ulus). These are the NRRs "Ulakhan-Tary," "Ungra," "Tynym," "Dzhanda," "Gonam," "Bol'shoe Toko" and "Tromptonski Cascade," and the reserve territory "Synnagino-Silinskaya" has been organized.

### Recommended Measures

In the disturbed gold and coal mining areas it will be necessary to conduct recultivation work with biological recultivation of developed proving grounds;

Develop a program of sustainable development for the South-Yakutski industrial region taking into account rational natural resource usage and introduction of new resource-preserving effluent-less technology, which makes provision for measures to conserve and protect the inter-river and valley ecosystems;

Introduce measures for integrated forest usage with full utilization of the wood and non-wood resources of the forest, making provision for forest restoration;

Conduct an ecological impact assessment of projects for developing the El'ginski deposit and constructing the Uchurski hydroelectric station with evaluation of their effects on the natural environment of the region.

#### 4. Tuimaada Valley

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##### Brief Description of the Territory

Tuimaada is a part of the valley of the Lena River, situated on its left bank. To the north it is bounded by the Kangalasski promontory and to the south, by the Tabaginski promontory, both of which are steep cliffs of Jurassic sandstone. The mountainous part, bordering the valley to the west is formed of loose ancient alluvial deposits. The length of the Tuimaada Valley from north to south is 65 km, and the width from east to west is from 6 to 12 km. The area including adjacent islands is 55,000 ha.

The territory is characterized by an unbroken expanse of permafrost. The thickness of the permafrost is 25-50 m on the islands, and 250-400 m in the mountains. In the formation of the ecological conditions of the valley, the defining role is played by the alluvial activities of the river, its ability to form substrates and conditions of flooding. In comparison with the influence of the river, the role of atmospheric precipitation (200-300 mm) in the hydrological conditions is less. The richness of the alluvial soils, flow conditions of moisture and good thermal conditions of the soils have enabled vegetation of the mid-taiga belt to predominate with light pine forest species--pine and larch--in the majority, with dark pine forest species also present--spruce. The inclination of the bed of the river to the right bank and reduction of the intensity of flooding has strengthened the general dryness of the valley's climate. This has had a determining influence in changing the characteristics of the soil and brought on their destruction and heightened concentration of salt. Changes in the vegetation cover have proceeded in the direction of xerophytization.

The dominant trend in the economy of the first inhabitants toward livestock herding determined the nature and intensity of the effects on nature. In order to expand and clear pasture, forest cutting began, followed by fires. The present condition of nature in the valley is noteworthy for sharp contrast with the forest cover of the mountainous part, where the forest cover is more than 60%, and super-littoral terraces. On these, meadow-steppe vegetation predominates. On average, forest cover accounts for about 9% of the land. In the valley, there is 4.5 ha of forest for each 1000 inhabitants, which is 3.3 times lower than normal.

Growth of the city in both width and height has caused more heat to enter the soil as a result of shielding of the heat flow by tall buildings and entrance of water into the soil from faulty heating networks and water supply pipes. In other words, as the valley was settled, the heat flow in the soil increased and the protective frost-preserving ability of the land decreased.

In a small area of the valley there is high diversity of the ecosystem (forest, shrub formation, meadow, steppe, forest-steppe and swamp). Forest-steppe landforms unique for the taiga zone are encountered here. In the valley, unique land forms are widely distributed, and in special need of conservation: the Tulagino-Kil'dyamski lake-steppe complex with spruce groves, which are unique in the Tuimaada Valley, and rare species of plants listed in the Red book; the Zhatayski forest-steppe complex with combinations of charans and fragments of steppe and halophytic vegetation; Vladimirski and Shestakovski forest massifs with bear-berry and diverse-herb pine forests, birch forests and whortle-berry larch forests; and natural monuments, including Sergelyakhski, Prigorodny, Kyutyur-Kal' and others.



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The ecosystems of the region are extremely vulnerable ecologically, which is expressed in their extreme instability, although in certain steppes they still maintain their self-restorative ability and are characterized by abundance of flora. Here very rare species are encountered, seen only in 2 or 3 places (first category--one species), under threat of complete extinction (second category--11 species), not found outside of Yakutia, endemics of the northeast, relicts of various epochs, and species with very narrow ecological niches (third category--13 species). The main factors causing ecological trouble in the territory are town planning and, in connection with this, various types of technological and anthropogenic disturbances affecting the ecosystems directly or indirectly: industrial facilities, infrastructure and agricultural industry. Complex conditions within the valley are combined with pollution of the airspace and soil.

Underestimation of the role forests play in protecting the ground under conditions of distribution of frost and excessive reduction of these forests together with technical factors brought about by urbanization and acceleration of the processes has led to the beginning of degradation not only of the natural landscape of the valley, but also of the territory of the city of Yakutsk.

### Current Measures

The importance of measures for conserving the ecosystem of the valley has been supported by a resolution of the expanded meeting of the Coordination Council for decision on the global problems of the urban sphere of Yakutsk in administration of the city. In this resolution, the necessity has been recognized for declaring an emergency situation without delay in view of the threatened condition in the urban sphere of the permafrost underground and adoption of immediate measures for overcoming this critical situation.

### Recommended Measures

For optimizing the role which the forests of Tuimaada fill, their landscape-architectural properties should be improved, their recreational capacity increased and the productivity of other vegetational interactions increased, and, most importantly, for strengthening natural protective functions, it will be necessary in the near future to develop a plan for reconstructing the existing natural complex of the valley. It will be essential to create protective forest strips in the valleys of the Markhinka, Maganka and Shestakovka rivers and around all lakes in the Tuimaada Valley. Forest vegetation around lakes regulates and filters outflow and may help desalinate lakes and preserve aqueous regions. With the goal of conducting forest-restoration work and conservation and protection of the forests of Tuimaada, it will be necessary to create specialized city forest park management without delay. For solving organizational and management problems combined efforts of state, municipal, scientific and other interested organizations will be necessary both within Russia and abroad.