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These rodents are known for their proverbial building skills and zeal. Beavers produce some really amazing "hydrotechnical wonder" and can even "improve" natural landscapes.

Tundra "blossoms" in the north of Western Siberia.

"GREEN MOUND" ON THE ARCTIC CIRCLE

by Acad. Vladimir BOLSHAKOV,
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For the Institute of Ecology of Plants and Animals of the RAS Ural Branch (UrO) the year 2004 is a double jubilee. At the height of the Great Patriotic War with Nazi Germany, in July 1944, the Institute was established in Sverdlovsk (now–Yekaterinburg) under the name of the Institute of Biology of the Ural Branch of what was then the USSR Academy of Sciences. The Institute got its present name 20 years later. And the change was not accidental. It was in honor and memory of Acad. Stanislav Shwartz who conducted his studies in the Ural. He was the founder of the key areas of research of what is known as fundamental ("classical") ecology–the branch of biology investigating the regularities of natural systems and problems of adaptation of living organisms to their environment. The scientist believed that many problems on his agenda have to be investigated in specific conditions, above all in an "extreme" environment in which features of adaptability and accommodation are most apparent, such as the northern regions or the mountains. That is why another jubilee being commemorated now marks the establishment in May 1954 in Salekhard–on the Arctic Circle–on the bank of the Ob River–of one more center of research. It was originally called Presidium of the Ural Branch of the USSR Academy of Sciences, and a couple of years later became part of our institute. Right from the start our main "field of interest" included methods of increasing hunting stocks, and the fodder and forage "base" for northern reindeer feeding. In a word, it was our institute which was this country's first academic center with the term "ecological" in its title.

"Foundation stone" of the station in Labytnanga (Salekhard).

LABYTNANGA PERMANENT ESTABLISHMENT

Salekhard was a very fitting place for the location of a center of ecological research. The surrounding area contains different natural zones and landscapes and diverse vegetation and animal world. The area is located in the forest-tundra zone. In the south there are miles of taiga of Western Siberia and in the north there are the tundra areas on the Yamal and Gydan peninsulas. And not far away there are the mountains of the Polar Urals and the spacious lower Ob flood-plain.

Subzero temperatures remain in the region for almost 8 months in a year and the snow-cover lasts for 230 days. The coldest month is January (mean temperature -24-25°, the absolute minimum -55°C). The usual mean monthly temperatures from December to March are below -20°C. Annual periods with temperatures above zero last for 130 days on the average, but there are summers with temperatures of only up to -5°C. There are no polar nights, but in June the sun shines round the clock.

In 1959 the center was moved to what was then the neighbouring village of Labytnanga where it remains to this day although it is now a town. In 1989 it got its present name of Ecological Permanent Scientific-Research Establishment.

The region is a most convenient "testing ground" for ecological studies and it has a railway, airfields and a network of streams and canals which make it easy to send research teams to different places.

The permanent establishment occupies an area of 3.4 hectares. This includes "testing grounds" of 0.3 hectares with a variety of acclimatized plants from different regions of Russia. But more than half of the whole territory is occupied by forest and willow grove-meadow associations. This green spot was nicknamed "Green Mound".

It took us some time to establish a permanent research staff. In the 1960s-70s many of them focused on the studies of Subarctic birds and mammals. It took but a short time for the preparation of a series of studies of Lev Dobrinsky on the morphophysiology age structure and variability of birds of the north and the ornitofauna of the territory.

Our scientists continued studies of the fauna of the region and the biology of the musk rat (Vladislav Balakhonov, Veneamin Bakhmutov). Its ecology and propagation in the mountains of the Polar Urals were investigated by Nikolai Gashev. The comparative ecology of the meadow and pink pipits has been studied by Vyacheslav Ryzhanovsky. Since 1978 he and other ornithologists of our institute have been breeding birds to trace their migrations and other phenomena of the yearly cycle. On the banks of Yamal and Gydan Vladimir Smirnov and Vyacheslav Sosin banded polax foxes to study their migrations and other predators.

Interesting data have been obtained on the fauna of vertebrates and invertebrates of this little studied region and 1959 saw the publication of the first volume of works of the Salekhardsky Center "Materials on the Fauna of the near North Ob and its Uses" which summed up some of the obtained results. Siberian lemming, big narrow-skull Myagrum and ermine (Ken Kopein) have also been studied.

In the mid-1960s scientists embarked on the implementation of the International Biological Program (IBP). Its central objective was an assessment of the productivity of the biogeocenoses of the Earth. Materials on the productivity of biogeocenoses of the Subarctic Zone (tundra and forest-tundra) were prepared by members of the Center and of our institute headed by Acad. S. Schwartz. Ten km away from Labytnanga they set up a support center "HARP" where they studied the flora of vascular plants, brush-

Laboratory wing of the Labytnanga station.

wood and shrubs, mosses and lichens, their morphological and phenological features, productivity of plant communities, resources of surface and subsurface phytomass, rate of disintegration of plant residues and regularities of distribution of plant communities. They also studied the soil microflora of forest-tundra, assessing the "populations" of microorganisms in swamp, cryogenic and podzolic-gleyey soils, established their characteristics: high activity, low levels of humus and useful microorganisms, etc.

An activization of studies in the Nizhneye Priobye and South Yamal in the late 1960s-70s was associated with the arrival of new specialists and the establishment of field stations, above all on the Khadytayakha river, near Labytnanga and in the mountains of the Polar Urals (Krasny Kamen). Studies on the Severnaya Sosva river and its main tributaries and in other areas along the Nizhnyaya Ob proved their significant role in the reproduction of stocks of white-fish (Vladimir Bogdanov, Valery Shishmarev).

Problems experienced by fishing factories of the Obskaya and Tazovskaya bays in boosting their raw materials base were investigated by a team of ichthyologists headed by A. Leshchinskaya. They prepared a map of fodder fields in the regions of interest (lake Yarro-to on the Yamal, etc.), traced the routes of migration of commercial fish during the fishing seasons. Their findings were summed up in the articles on the ecology of peled, Siberian whitefish, arctic chars, and cisco. At that time studies were conducted in conjunction with experts from the Ob-Tazovsky branch of the All-Union Scientific-Research Institute of Fishery. They were located on board the ship ORYOL and later on the trawler ICEBERG of that same institute. But later on the Center acquired vessels of its own—ZOOLOG, ECOLOG and NAUKA, which made it possible to conduct investigations on the Ob and also on its tributaries.

Published in 1970-80 were materials on the bioenergetics of populations of smaller mammals (V. Balakhonov), ecology of the water vole, caribou (V. Sosin, V. Bakhmutov), wolf, grey, crow, rare and extinct bird species, etc.

By the mid-1970s it became necessary to broaden the area of our studies further to the north- to the tundra regions of the Yamal. In 1975-80 there was a series of expeditions on Yamal peninsula and this stage of ornithological explorations ended with the publication of a monograph by N. Danilov, V. Ryzhanovsky and V. Ryabintsev *Birds of the Yamal* in 1984.

At that time S. Shwartz, N. Danilov and V. Ishchenko published several books under the general title *Ways of Accommodation of Terrestrial Verteb-*

Arctic circle–a happy geese family.

rates to the Conditions in the Subarctic Zone (Vol. 1–Mammals, Vol. 2–Birds, Vol. 3–Amphibia). As an example, one can focus on the mechanisms of adaptability of amphibians.

They have no permanent body temperature and their habitat beyond the Polar Circle is characterized by many features different from more southerly varieties. Penetrating into the Subarctic Zone are 4 of their species: *R.arvalis*, *R.temporaria* and wood frogs, as well as Siberian salamander which form stable and relatively large populations. And how do they do this? They mostly rely on a diet of water insects. Actively "mobilized" in the liver is "reserve" substance–glycogen, which stimulates their development.

They are able to maintain their high vitality even at temperatures of the environment about +5°C and the same applies to their embryos and larvae.

The aforesaid features of adaptability of the amphibia to the conditions in the Far North are of great general biological interest. They demonstrate that in the process of accommodation to a new environment by populations of different species there occur comprehensive changes of their main morphophysiological characteristics, which are identified to an insignificant degree even by modern methods of systematics. This conclusion is of considerable importance for understanding of the microevolutionary process and for assessing the possibilities of using the taxonomic structure of a species as a "mirror" of evolution.

Very indicative, at the same time, is the coincidence of ways of accommodation of different species to similar conditions of existence. That concerns not only the aforesaid amphibia, but the development of similar adaptations in "representatives" of other classes. Say, subtropical populations of mammals, birds and amphibia possess equal "abilities" of storing energy resources in the organism, increasing the rate of development, broadening the "menu" of accessible fodders, boosting the activity of their digestive ferments.

As was said before, in 1978 zoologists of the station started studies of the biological resources of the Yamal. The studies were initiated by V. Sosin who substantiated their importance in preparation for an "advent" of oil and gas industrial plants on the peninsula. The studies are still in progress, but they are already on the scale of monitoring. These studies were constantly supported by the present Director of the permanent establishment Prof. Viktor Shtro, Cand. Sc. (Biol.).

Now we "give the floor" to researchers who have studied for years the natural conditions of Sub-

On the Yamal–flowers blossom between stones.

arctic Zone, Polar Urals and Arctic Regions.

The head of the Laboratory of Ecology of Fish of our institute, Dr. Bogdanov, and research assistant Ye. Bogdanova have been working at the center for over 20 years. They believe that if one asks some locals of the North Ob about the "priorities" of its natural resources they would point to water and fish, despite the booming prospecting of minerals and their mining. The whole way of life of the Khanty, Mansi, Nentsi and Komis is largely geared to their traditional fishing which rapidly becomes a "way of life" even with settlers from the "mainland".

To this day the Ob remains the most "plentiful' among the northern rivers of Russia. The lower reaches of the Ob, the Taza and their tributaries are a unique realm with a unique diversity and "stocks" of whitefish. The region accounts for one third of their world resources, with annual outputs of about 10,000 tons of cisco, peled, muksun, broad, Siberian whitefish, tugun, Arctic cisco and inconru, which makes up almost half of the whitefish catch in our country, or the third in the world. Other local species of commercial importance include pike, burbot and ide. The fresh-water reservoirs of the Yamalo-Nenets Autonomous Area contain 36 fish species and one of the Cyclostoma.

FOR FISHERIES AS PLENTIFUL AS EVER

That is the main objective of studies by a whole number of ichthyologists and hydrobiologists who have linked their carriers with the Ob north. Studies of the local ichthyofauna were initiated by Nikolai Varpakhovsky in the late 19th century and reached an unprecedented pace later on. A vast scientific "legacy" was left by Pavel Borisov and Alexei Berezovsky–researchers of the 1920s-30s, and also by Pavel Dryagin, Yevgeny Burmakin et al. who conducted their studies in the hard war years and after the war. They were succeeded by researchers of the Salekhard Station, our institute and SibrybNIIproekt. They focused their studies on 3 main directions–fish populations, resources and fish farming. The central problem before the region is to maintain natural fish reproduction and develop fish farming.

The results of ichthyological and hydrobiological studies in the basin of the Ob and the Yamal Peninsula are interesting and important not only in practical terms, but because of their value for fundamental research. Here is one example: scientists have solved the "mystery" of the kingdom of the aforesaid whitefishes, their "ecological" optimum. One finds a perfect balance of their different "requirements" for the key vital periods upon which

Red stone–Rayiz–in Polar Urals mountains.

depends the existence of whole generations and–in the final analysis–of the whole population.

The whitefish perform migrations for spawning, fattening and wintering. And in many water reservoirs they run into problems: conditions favorable for multiplication turn out to be unfavorable for their growth and survival (fattening) or the other way round. And in that particular basin fattening and spawning sites of whitefish are separated by great distances and have sharply different environment. For example, spawning migrations in water can last for over 3 months, and the distances to the spawning sites in the middle and upper reaches of the river are of 1.5-3 thous km. Some whitefish varieties breed only in the Ural tributaries of the Ob–Severnaya Sosva, Syna, etc. In that case their migration route amounts to "only" several hundreds of kilometers. And the spawning sites of these fish can also be on lowland and piedmont river section (the latter being more preferable). And there is no "overpopulation" of the fish and roe on spawning sites in the Ural tributaries because they are located outside of the zone of oxygen-poor water. The fertilized fish eggs are carried away by current over short distances and then precipitate on the bottom where they continue to develop over the whole winter.

Now, about southern tributaries of the Ob: at most spawning sites the rate of survival of whitefish, especially in the Severnaya Sosva, is very high–of up to 93 percent in piedmonts. This depends not only on small populations of predators (insects, feeding on roe) but on ideal abiotic conditions, such as stable ground feeding, abundant ice jam phenomena and low rates of ice formation.

And in the shallow northern tributaries of the lower Ob freezings over of spawning grounds in some years can kill all roe. It has been established that the more to the north a tributary is located, the smaller is the size of the local spawning sites. Say, in the Lyapin river basin it is 5.5 km^2, in the Kharbei–0.8 km^2. So apart from tugun and cisco, other whitefish are represented by one population. That is why high mortality of fish in some years on northern tributaries does not threaten the existence of these species in that basin. And it turns out that nature has provided ideal conditions for their proliferation: all they have to do is survive and "breed and multiply". Mother Nature provided unique flood-plains with plenty of channels, meadows (sors) and lakes spreading over thousands of kilometers. In spring-time–fish "of all ages"–from hatchlings to fish of reproductive age who wintered in the Ob bay. They find plenty of food in the local lakes and rivers, including plankton and bottom invertebrates which are there in large numbers.

Siberian salamander.

In the sors of the lower Ob the mean biomass of plankton organisms amounts as a rule to 1-3 g/m^2, benthos 5-10 and at some biotops reaches 19 and even 30 g/m^2. This is enough to feed not only whitefish, but also other species which grow and gain weight. That, however, is not always the case. At low floods and short times of filling the flood-plain, young fish "fatten" but poorly, and mature ones do not have enough fat for moving to better spawning sites. What we have in mind is peled, as different from other whitefish varieties, it is a typical planktophage whose consumption of plankton organisms depends on the qualitative "abundance" of the above factors and not from benthonic organisms.

So, it is on the flood-plain that the future of every new generation of whitefish is decided. Larvae getting into shoals (especially of peled) are very sensitive about temperature (larvae of peled, for example, stop feeding in water with temperature below +6°C, and larvae of tugun and broad–below +5°C) and also about the numbers, size and even body shape of fodder organisms–barnacles, tiny larvae of insects and rotizera. Fish larvae in shallow places are facing another menace–stormy waves (the most perilous factor) and predators (few in number, as a rule). Nevertheless, most shallow grounds on the Lower Ob and its spawning tributaries provide excellent conditions for larvae growth. Only in years when the time of flooding of pastures does not coincide with the time of arrival of larvae from spawning grounds, the situation can produce a damaging effect in some of them. During the first 10-15 days of fattening some 80 percent of larvae perish. For ordinary fish this rate of survival is believed to be good, but for the prosperity of whitefish populations every percent of larvae surviving during the first few days is important as later on young and more mature fish perish at a much lower rate.

Unfortunately, the favorable conditions provided by nature can be upset and some alarming signs are already there–although all whitefish varieties still exist, their populations dwindle significantly. So, at what stage of their development do these fish face the greatest danger? In the opinion of our colleagues from the SibrybNIIproekt the problem is caused by river pollution with hydrocarbons as a result of mining and transportation of oil and gas. According to our studies in the basin of the Lower Ob, most of the spawning grounds, fattening and wintering reservoirs for whitefish are so far in satisfactory conditions and fish populations dwindle mostly because of growing volumes of fishing, above all poaching.

Next we turn to our recognized expert on blood-sucking insects–Natalya Nikolaeyva, Cand. Sc. (Biol.).

Fish catch on the Ob.

ARITHMETICS OF MOSQUITO MENACE

It is really no exaggeration to say that visitors to one of the northern regions of Western Siberia during summer months are mostly "impressed" by clouds of blood-sucking insects–mosquitoes, midges and gadflies. From the middle of June to mid-August swarms of these blood-suckers attack each and every warm-blooded creature, and above all people. And people happen to be the most attractive pray because of the absence of any natural "protective covers", such as thick fur or feathers. And some mosquito species in different corners of the globe, which are in constant contact with people in cities and villages, develop anthropophilic varieties and that increases the threat of epidemics many times over. This is even more so because no currently available insecticides or repellants can offer us as yet absolute protection from these blood-suckers.

But why are there so many of them here in the North and why do they exist in nature in general? These questions were before us when we launched in 1972 studies of the ecology of blood-suckers within an international program at biological stations HARP and HADYGA of our institute on the south Yamal. Our results were unexpected and offered us a new look at these creatures and their role in ecosystems.

We established that the Culicidae family on the Yamal is represented by 22 species and takes a very modest place in the entomofauna of the peninsula which includes some 2.5 thous. insect species. At the same time the region "feeds" nearly 25 percent of all mosquito species observed within the territory of the Russian Federation and the better half of these species exist on the vast northern territories of both hemispheres of the Earth. One typical feature of mosquito "communities" of the Subarctic Zone as a whole, and of the Subarctic regions of Siberia in particular, is the obvious presence of species with what is called circumpolar and circumboreal propagation–tundra, forest and arcto-Alpine varieties.

And it is not accidental that one of these species–aedes–first found by us on the Yamal is called "Churchillensis" in honor of the city of Churchill in the Canadian province of Manitoba where it had been discovered earlier. Another trait in the organization of these insect communities on the Yamal, which, incidentally, is typical for many taxonomic groups of the same region–is the clearly expressed predominance of 2-3 species which are best adopted to life in the north and which exceed 80 percent of the number of Culicidae. And the limited diversity of species in the conditions of tundra, forest-tundra and northern taiga is fully "made up for" by the size

Blood-suckers of the north.

of populations. But since female insects, attracted by humans, concentrate around them from distances of 150 m and more, one cannot have an objective idea about their numbers in biocenoses only by the intensity of their attacks. And that can vary from 20 to 50 times at one and the same geographical point even within 24 hours depending on weather, wind velocity, air temperature and the individual "attractiveness" of a person who is counting the insects, say with a landing-net. That is why an automatic extrapolation of data about the numbers of attacking females surrounding a person on an area of, say, 2 m^2, may not fit entomological literature data for greater areas (figures were of the order of 25-50 mn insects per hectare of tundra or taiga).

Our statistics for mature larvae and aedes pupa in water reservoirs on considerable areas of tundra and floodplain forests provided for more accurate assessments of the numbers of insects, beginning from the southern tundra on the Yamal. Established, first of all, was considerable variability of the figures of larvae "density": depending on ecological characteristics of reservoirs and especially–on their "heating", larvae density varied from 20 to 15,000 of insects per 1 m^2 of water. Counting per 1 hectare of tundra by the years, the mean mosquito "populations" varied from 4,500 to 14,200 insects, and per 1 hectare of floodplain forests–from 23,400 to 96,900. We registered the maximum numbers of mosquitoes in the vicinity of Urengoi (another region of the Yamalo-Nenets Autonomous Area) where there developed per 1 hectare of floodplain north taiga forest an average of 1,044,800 larvae. These data indicate that the density of blood-sucking larvae in certain reservoirs of the North fully matches the range of their variability in other landscape zones.

The assessment of numbers and biomass of aedes larvae in different biocenoses in the north of Western Siberia indicates that their role is big enough in the functioning of the aquatic and terrestrial insect communities of the region. In different years their mass per 1 m^2 of forest water reservoirs varies from 5 to 40 g (maximum of 102 g) of raw matter, and per 1 m^2 of tundra ones from 1 to 2.5 g. Counting per 1 hectare of water surface that would be tens and hundreds of kilos (in only 1 flooded forest near Urengoi the biomass of larvae averaged 5 kg per hectare).

More than half of all larvae appearing in water reservoirs in spring perish in the process of their development, falling pray to insects, fish and near shore birds, being included into various trophic chains already at that stage. And then "adult" mosquitoes carry the organic substance contained in their bodies on dry land, promoting

Valley of the Sob on the Ob tributaries.

their redistribution in new food chains with the participation of rapacious bugs, dragon-flies, spiders and insectivorous birds.

Finally, in the conditions of the North larvae function as zoosaprophages which actively feed on sunk last-year grass and fallen leaves together with microorganisms they contain, Protozoa, periphyton. In our laboratory experiments we have calculated the amounts of fodder which they consume in 20-22 days of stay in water reservoirs: from 140 to 270 g of dry matter per 1 m^2, which promotes the circulation of matter and energy in local ecosystems. The absence of obvious competition for food and living space is one of the major factors of high numbers of Culicidae there.

Problems of a very different kind preoccupy Dr. Margarita Magomedova, a botanist, who with enthusiasm focuses on studies of the growing impact upon vegetation of human activities linked with the industrial development of this region.

NATURE IS RICH, BUT VULNERABLE

The north of the West-Siberian plane is a wonderful, as if for a textbook, illustration of zonal changes of natural conditions, including vegetation. Moving from north to south, the tundra zone is "replaced" with forest-tundra and that–by taiga. The eastern slope of the Polar Urals is a world of its own. There one can find most of the plants listed in the Red Data Book of the Yamalo-Nenets Autonomous Area (1997). The station had a tremendous role to play for studies of the diverse plant cover of the region. The station has been used not only by scientists of our institute, but also of RAS Botanical Institute named after Vladimir Komarov, state universities of Moscow and St. Petersburg and experts from the United States, Denmark, Finland, Switzerland and other countries. Its most comprehensive assessment is offered in the book of Acad. Pavel Gorchakovsky *Phytoworld of Alpine Urals*. On the basis of this station scientists carried out in the 1980s-90s a cycle of studies of the plant cover of Yamal.

Of growing importance during those years became studies of the technogenic impact upon ecosystems. That was linked with intensive development of industrial complexes for mining and transportation of gas. The station became the base for studying the impact of cross-country transport upon vegetation. Among other things, they tested special machinery designed to inflict minimal damage to the plant cover. Finally, it was demonstrated that vegetation is extremely vulnerable to technogenic impacts. This takes place due to the fact that during a very short season without snow and frosts vegetation receives

Pink loon in its nest.

very little warmth for the formation of an appreciable green "mass", including flowers, fruits, seeds or heat for vegetation proliferation. In addition to that local substrates are "mobile", have little nutrients and are saturated with ice. In cases of upsets of the productive process, compensating such loses in that region is problematic, especially in tundra.

Mechanical damage of plant cover in this region reaches a giant scale. For example, in the construction of every kilometer of roads it covers an area of more than 16 hectares. Upon 1 hectare vegetation is completely destroyed and on 3 hectares and more it is damaged on up to 90 percent of the area and only on the remaining 12 hectares such damage is insignificant. And plants respond in different ways to technogenic mechanical impacts. One third of them does not tolerate them at all, and as many have practically no response, while others can even "activate" their positions. The unfortunate circumstance consists in the fact that the first group includes plants which provide the basis of vegetation communities adapted to that given region.

The advent of people to these formerly desert territories has increased cases of fires which are especially dangerous for lichen forests. Their restoration, even after "low-level" fires, which are not recurrent, takes a period of 40-50 years.

Summing it up, specialists at the station have been paying considerable attention to studies of anthropogenic changes of the resource potential of the northern part of Western Siberia. Nevertheless, its phytoworld is still rich and diverse. That includes timber resources, although the slow rate of their restoration limits their uses. The list of medicinal plants includes some 150 entries. From nutritional plants of the greatest value are berries like cloudberry, foxberry, blueberry, cranberry and bilberry. Fodder resources are of exceptional importance for deer-breeding in the northern regions.

The very important fact is that pastures for this animal amount to some 85 percent of the territory of the Yamalo-Nenets Autonomous Area. Besides, this area has the biggest stocks, great length of drive routes, well adjusted production of venison, poor conditions of pastures, vulnerable ecosystems, high level of employment of the local population in the traditional branches of economy even despite the discoveries of giant deposits of gas and the resulting intensive industrial development of the northern territories.

REINDEER BREEDING AND GAS: SEARCH FOR ALTERNATIVE

At the present time the stock of reindeer here approaches 600,000. Their intense grazing leads to pro-

Caribou on the Yamal.

found transformations of the plant cover, its lower productivity and nutritional value. Appropriate efforts for altering local resources potential and preventing "overpasturing" were focused on the Yamal peninsula and Polar Urals where "loads" on pastures are the greatest. As a result the size of local stocks exceeds the optimal from the point of view of fodder resources by no less than 2 times. And these pastures are used in the snowless time of the year when the plant cover is exposed to damage by cattle hooves. The worst damage is done to lichens with more valuable varieties being replaced with worse kinds of fodder. As a result of "overpasturing" 70 percent of pastures on the Yamal and Polar Urals now belong to the lowest category.

The aforesaid plant covers, first described back in the 1930s by Vladimir Andreev and Kapitolina Igoshina, have all been destroyed. And the resources of green fodders have not increased. That is why the rate of utilization of grass fodders amounts to 90 percent. And lichen tundras are being replaced everywhere with moss ones. For example, from 1985 to 1995 their area in the piedmont of Polar Urals diminished by 3.5 times.

And more. Active industrial development of northern territories interferes with deer breeding. A set of technogenic factors (alienation of land, damage of plant cover and pollution) reduces the areas of pastures and affects the quality of green fodders. On the Yamal peninsula where deer live-stock is "exaggerated" and there are no "reserve" pastures, damage from industrial reclamation of land is increased twofold.

At the same time, at present recognized as very important, are problems associated with global climatic changes. And it is the northern ecosystems which respond to them especially strongly. The on-going changes are being investigated by our station. The most informative factor is believed to be the annual increase in the amounts of wood. Interesting insights are offered by studies of lichens, changes of their structure and composition, "associations" on the surface of rocks and tree trunks. Correlation between the rate of frost damage and its "nature" confirms a possibility of this kind.

Rates of industrial development of the north of Western Siberia were rapid with human impact upon the ecosystems of the Subarctic Zone becoming stronger. And that means that we have to study the response of birds to this impact not only in the natural or similar conditions, but in strongly damaged landscapes. That is exactly what is on the agenda of a member of our station staff, Sergei Paskhalny, Cand. Sc. (Biol.). Apart from that our specialists took stock of

The "colors" of tundra.

populations of birds and mammals on an area of 150-200 km^2 in all types of their tundra habitats and gathered data on the ecology of species on landscapes with different degrees of damage.

Preparations have been started for the exploitation of gas-condensate deposits on the Yamal and for building a main pipeline there. Considerable research potential of our institute and the station were focused there in 1988-90. In 1990-91 zoological maps were prepared for areas of primary development of deposits and measures taken for the protection of birds. The main results of this work were summed up in the collective monograph *Monitoring of the Biota of the Yamal Peninsula in Connection with the Development of Objects of Gas Extraction and Transportation*.

Despite of its limited research staff and material base, the station has been for many years a reliable forward base of ecological studies on Yamal. After the collapse of the former system of biostations, which functioned in northern regions of the Soviet Union, it remains the only one and truly unique research establishment. Relying on its assistance are many scientists in this and other countries who are planning studies in the Arctic and Subarctic Regions. Working there have been ornithologists from Ukraine, Poland, Germany, France, Great Britain, Spain, Norway, the United States, Czechia, ecologists from Estonia and the United States, entomologists from Finland and archeologists from the United States.

In 1996 the Station was used as the venue of the 5th International Conference of mycologists which was attended by prominent scientists from Denmark, Finland, Switzerland and Norway. Behind us are years of work in different areas of biology and ecology, scientific expeditions to all corners of the region and hundreds of scientific publications. One wants to believe that the knowledge and experience of specialists of our Ecological Station, its potential as an expedition base for ecological studies will be used in the interests of Russian science in general and of the Yamalo-Nenets Autonomous Area today and in the future.

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