CONSERVATION ISSUES

History, Administration, Goals, Value, and Long-Term Data of Russia's Strictly Protected Scientific Nature Reserves

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ABSTRACT: One of the most comprehensive attempts at biodiversity conservation in Russia and the former Soviet Union has been the establishment of an extensive network of protected natural areas. Among all types of protected areas in Russia, zapovedniks (strictly protected scientific preserves) have been the most effective in protecting biodiversity at the ecosystem scale. Russia has 101 zapovedniks with a total area of 34.3 million ha, representing 2% of Russian territory. The mission of zapovedniks is to protect native biodiversity and ecosystem processes as well as to facilitate the study of natural ecosystem processes and functions. In this manuscript, we provide a brief history of Russian ecosystem preservation and outline the goals and administrative organization of the Russian zapovednik system as it currently functions, as well as the characteristics, problems, and values of the system.

Index terms: administrative organization, climate change, history, policy, Russia, zapovednik

INTRODUCTION

The establishment of an extensive network of protected natural areas is among the most comprehensive attempts to conserve biodiversity in Russia and the former Soviet Union. This network of protected areas incorporates several categories of land preservation including: (1) zapovedniks, or strictly protected scientific nature reserves (World Conservation Union, or IUCN, category I, State Nature Reserves or Scientific Reserves); (2) national parks (IUCN category II, public property with intent for preservation for recreation and culture); (3) natural parks (IUCN category V, protected landscapes); (4) zakazniks (IUCN categories IV, V, natural refuges, wildlife sanctuaries); (5) natural monuments, which preserve unique biological objects on a small scale (IUCN category III); (6) dendrological parks and botanical gardens; and (7) salubrious areas (Colwell et al., 1997).

Among all types of protected areas in Russia, zapovedniks have been the most effective in protecting biodiversity at the ecosystem scale. The mission of zapovedniks is to protect native biodiversity and ecosystem processes as well as to facilitate the study of natural ecosystem processes and functions. Zapovedniks represent a series of unique territories, unparalleled in the world as models for comparison to areas of human disturbance (Volkov and Yazan 1987; Ponomarenko et al. 1990; Dezhkin 1993; Williams 1996; Colwell et al. 1997). Due to the rather unique biological characteristics of Russian Federal Zapovedniks, others (Ponomarenko et al. 1990; Antipova 1995) have noted the important role of zapovedniks in maintaining the stability of ecological processes in all regions of Russia. These zapovedniks also are unique in extent; for instance, in 1995, Russia had 71 federal zakazniks with a total area of 11.5 million ha (Sokolov et al. 1997). By 2007, Russia had 101 zapovedniks with a total area of 34.2 million ha, or 2% of the Russian territory. In addition, Russia has 35 national parks that cover about 7 million ha.

Historically, the activities conducted within Russian zapovedniks (as well as those found in the former USSR) were guided by a federal framework, which served to maintain continuity in research and management objectives. This framework focused on issues such as the collection of data on a year-round schedule by a permanent scientific team, creation of repeatable study plots and techniques, and the accumulation of long-term data. This underlying framework facilitated the accumulation of massive datasets on a variety of ecosystems throughout Russia. A major factor contributing to the temporal continuity of data collection and a uniform approach in developing research programs has been the Chronicles of Nature (CON). The CON is a report that is produced annually by each zapovednik staff, and its standardized format prescribes categories of data that are to be collected each year. Some zapovedniks accumulated data in this manner for over 50 years. Collection of data associated with the annual compilation of the CON represents a significant achievement of the Russian Federal Zapovednik system and provides a unique opportunity, at an enormous scale, to study the long-term impacts of natural and/or human disturbances upon a wide variety of ecosystems in a comparative manner

(Volkov 1996; Colwell et al. 1997). Few, if any, such opportunities for ecosystem level comparisons of this type and scale exist anywhere else in the world today.

The goal of this paper is to provide a brief history of the zapovednik system and to outline the administrative organization and goals of the Russian zapovednik system as it currently functions. In addition, we will discuss current problems experienced by the zapovednik system, in light of the current political and economic crisis in Russia, and offer potential approaches to address these problems.

ZAPOVEDNIK HISTORY

Targeted efforts to protect nature in Russia and the former USSR have a long history. In fact, the concept of comparing unaltered landscapes with those across a range of management intensities predated the idea of simply preserving unique or representative ecosystems. The idea of preserving pristine territories as standard models with the intent of investigating their practical and scientific significance first appeared near the end of the 19th century. At this time, V.V. Dokuchaev (Dokuchaev 1879, 1893) argued for the protection of Russian steppes remnants in the black soil region and suggested that a scientific station be created. Dokuchaev also was influential in organizing a zapovednik network on the basis of landscape-geographical zoning under the framework of natural zones. Dokuchaev's landscape-geographical and phytocoenosis principles were the basis upon which Russia's network of zapovedniks were organized from their inception. In addition to the contribution made by Dokuchaev in 1894, the principles of nature preservation in Russia were shaped by the efforts of G.A. Kozhevnikov in 1908 (Kozhevnikov 1909), I.P. Borodin (Borodin 1938), and G.F. Morozov in 1910 (Morozov 1912).

The first official Russian statute for nature preservation was developed in 1909 and was accompanied by the development of a program for scientific research in the system of preserves. The establishment of the first zapovedniks followed quickly with Kitoiskiy established in 1914, followed by Sayanskiy in 1915, Kedrovaya Pad in 1916 (still exists), and Barguzinskiy in 1917 (still exists). The system of strictly protected nature preserves (zapovedniks) was fully established after the Great October Socialist Revolution, as all land became federally owned (1917 – Decree "On Land"), and formation of the net of Soviet zapovedniks was facilitated by the People's Commissariat of The Public Education. The first geographically descriptive project of the zapovednik network was developed in 1917 by V.P. Semenov-Tian-Shanskiy in his work *About the Types of Territories Within Which Should Zapovedniks Like American National Parks be Organized* (Shtilmark 1979). In 1925, the Science Committee of the People's Commissariat of The Public Education started to publish a series of books entitled *Efforts of Zapovednik Studies* to document the work performed by zapovednik scientists (Shtilmark 1996).

A difficult period for the zapovednik system began in the late 1920s. A change in policy from protection to utilization of nature was outlined by the Nature Protection Congress in 1929. Zapovedniks were encouraged to focus on the introduction and regulation of animal populations, and scientists across Russia were forced to change priorities from the study of nature to the exploitation of minerals and forest resources. These policy changes were accompanied by the devastation of the Academy of Sciences in Moscow and St. Petersburg and the beginning of scientific repression. Ironically, the period of political repression of university scientists had positive effects on studies conducted at zapovedniks; and in order to escape persecution, many top-level scientists moved to small isolated zapovednik villages and began working directly with zapovednik staff.

In 1934, the first monitoring program for zapovedniks in Soviet Russia was developed. This monitoring program was the basis for what was later called the Chronicles of Nature, the first volume of which was completed in 1945 (Shtilmark 1996). The CON is an annual report compiled by each preserve that includes data about natural ecosystem processes and other natural phenomenon. There is a general format for the CON with specific divisions that reflect biogeographical position and traditional monitoring studies for individual preserve territories. Volumes of the CON are stored at the zapovedniks and in a special library at the Ministry of Environmental Protection in Moscow (Filonov and Nukhimovskaya 1990).

During World War II, scientific activities on most preserves were reduced, and many preserves were impacted by people trying to supply themselves with food and pharmaceutical plants. After the war, the societal concept of "nature preservation" was linked to "rational management" – a social change resulting in two waves of zapovednik closures (in 1951 and 1961) followed by periods of re-establishment. A total of 24 zapovedniks were closed, reducing the total area of zapovedniks in the Russian Federation to 6.8% of the pre-war size. In 1964, the situation began to improve, however, and with improvement came change. In some zapovedniks, tourism was allowed. During this period of reestablishment, the system of zapovedniks was split between three departments: (1) The Nature Committee within the Ministry of Agriculture; (2) The Hunting Committee of the Russian Federation; and (3) The Academy of Sciences of the USSR (Shtilmark 1996).

An attempt to coordinate activities among preserves was made in 1968 during the all-Soviet conference of zapovedniks entitled "Ways to Improve Federal Zapovednik Activities." The conference was followed by publication of proceedings, *Efforts of Zapovednik Studies*, and a book, *Zapovedniks of the Soviet Union*. Probably the most beneficial period for zapovedniks was the so called period of "stagnation" from 1971 to the mid 1980s. The Hunting Committee of the Russian Federation started to expand the system actively during this period; and from 1971-1975, the Central Research Laboratory of Hunting and Protected Areas analyzed and reorganized the general plan of the zapovednik network (Zikov and Nuhimovskaya 1979; Zikov et al. 1981; Dezhkin et al. 1988). The basis for this attempt was a detailed physiogeographical zoning and geobotanical map of the

USSR. It highlighted 13 biogeographical regions and served as the basis for recommendations as to the optimal distribution of zapovedniks. Concurrently, the Nature Committee within the Ministry of Agriculture was actively developing the methodological base (instructions and regulations) for zapovednik monitoring activities.

The activities outlined in the CON were thought to be the primary tasks of zapovedniks during the period of reestablishment. However, zapovedniks administrated by different departments had different strategies. "Hunting Committee" zapovedniks paid more attention to animal populations while "Agricultural" zapovedniks focused on natural resources and management techniques. An important event of that time was the development of the concept of "Biosphere Reserves" within the Man and Biosphere program of the United Nations Educational Scientific and Cultural Organization (1970-1971). However, the concept of biosphere reserves was different from that of zapovedniks and emphasized studies and comparisons of managed and unmanaged lands as well as zoning of territories, rather than the focused study of natural processes.

By the early 1970s, zapovedniks had begun to increase in numbers and area and were gaining recognition as serious scientific organizations. During this time, the objectives of zapovedniks shifted from management to science. The main themes for research in zapovedniks were changed to focus on the: (1) study of natural phenomena and ecosystem processes; (2) geobotanical mapping and inventories of flora and fauna; (3) study of ecological mechanisms that regulate populations of animals; and (4) methods of protecting valuable objects of nature. In 1979, the All-Russia Research Institute of Nature Conservation and Reserves (zapovedniks) was created and the number of publications about zapovedniks greatly increased.

The "Perestroyka period," during the late 1980's, was a time of reconstruction and opened a new phase in zapovednik history. This period was characterized by an increase in "green" movements. In 1988, under the Decree of The Central Committee of the Communist Party of the Soviet Union, the Committee of Nature Conservation was created, uniting all zapovedniks within the Zapovedniks Department. The Russian Academy of Science Zapovedniks Commission began to actively collaborate with zapovedniks during this period, facilitating seminars and conferences and publishing methodological procedures and inventory lists.

In 1991, the Committee of Nature Conservation was reorganized into the Ministry of Environmental Protection, and at that time the USSR had 164 federal zapovedniks (including 22 biosphere reserves) and 19 national parks. However, with the collapse of the USSR in 1991, control of zapovedniks was decentralized as the central department lost control of preserves within non-Russian republics. By 1997, Russia had 94 zapovedniks with total area of 30.9 million ha and 31 national parks encompassing 6.5 million ha (Sokolov et al. 1997). In 2007, Russia's zapovedniks had increased to 101 with a total area of 34.5 million ha. These zapovedniks represent the breadth of Russia's natural diversity (Danilina 2001) but are not without problems (Ostergren 2004). However, they represent one of the most extensive networks of biodiversity conservation in the world.

ADMINISTRATIVE ORGANIZATION

Work within the individual zapovedniks is supervised by directors who are responsible for all the zapovednik activities. The zapovednik director is appointed by and reports to the Federal Agency of Environmental Control of the Russian Federation. There are two subdivisions in the zapovednik staff structure: the forest guard division and the scientific division. Appointed by and reporting to the director of the preserve, the chief of the forest guards is responsible for leading the forest guard department in the enforcement of regime violations. The main task of forest guard division is to prevent preserve policy violations such as trespassing, fishing, hunting, etc. The forest guards also participate in different research activities, such as mammal and bird counts; they fill out questionnaires designed by the scientific personnel concerning data on animal and plant distribution, phenology, and disturbance events.

The scientific department is headed by the scientific director at the preserve and is responsible for organizing monitoring activities, data collection, and compilation of the CON each year. In addition to these two primary divisions, the zapovednik staff usually includes accounting specialists, drivers, and technical workers. Some zapovedniks also have an education subdivision in their structure.

Each zapovednik has a scientific council that is composed of the director of the preserve, the deputy director for scientific research, the chief of the forest guards, key scientific personnel, other selected qualified members of the preserve staff, and – in some circumstances – selected representatives from other scientific organizations and universities. Through formal meetings held every two months, the scientific council outlines strategic plans for the zapovedniks, addresses difficult managerial problems, evaluates proposed research or collaborations involving zapovednik staff, and critiques active studies. Since 1994, a newspaper "Zapovedniy Vestink" (Preserve Bulletin) was established to facilitate communication among zapovedniks.

SYSTEM CHARACTERISTICS AND GOALS

The main tasks of zapovedniks were formulated in the beginning of the 20th century. Kozhevnikov (1909, 1911, 1928) postulated that zapovedniks should study nature nondestructively in order to gain insights that might be useful for sustainable resource use. Through time, the perceived mission of zapovedniks has evolved. This evolution has been a consequence of the rampant landscape level destruction that has occurred in Russia as well as the influences that ideological and political shifts have had on scientific views regarding protection of nature in the country. In accordance with the *Regulations on Federal Nature Zapovedniks in the Russian Federation*, zapovedniks traditionally have had the following tasks:

(1) protection of the zapovednik territory in order to preserve biological diversity and maintain ecological complexes in their natural state; (2) organization and implementation of scientific research; (3) ecological monitoring; (4) ecological education; (5) participation in federal examination of environmental impact statements for various development projects; and (6) assistance in teaching scientific personnel and specialists in the field of nature protection. Of these, the primary functions of zapovednik territories are preservation of biological diversity and ecological monitoring of biota. Monitoring is conducted in order to evaluate the condition of biotic resources and to assess the effectiveness of ecosystem preservation within zapovednik boundaries. As a consequence of monitoring activities in zapovedniks, several focal areas of research have emerged (Sokolov et al. 1997). These include: (1) biodiversity studies focusing on causes of ecosystem change and temporal trends; (2) studies of biodiversity as a factor of ecosystems stability within zapovedniks; (3) evaluation of zapovedniks in terms of biodiversity maintenance; (4) improvement of preservation regime and scientific justifications for management of biodiversity dynamics; and (5) evaluation of environmental quality.

Starting in the late 1970s, zapovedniks were designed to serve as model Russian territories (controls) in the overall framework of ecological monitoring and studies of biological diversity throughout the country. Zapovednik staff does not conduct research using methods that interfere with the natural processes, and they avoid the implementation of studies that could be conducted on other, non-protected territories. The vast experience of zapovednik scientists in non-invasive data collection and the long history of the zapovednik system as a network of protected areas were instrumental in the selection of the former USSR as the site of the First International Congress on Biosphere Reserves in Minsk in 1983.

Twenty-eight zapovedniks were designated by the United Nations Educational, Scientific, and Cultural Organization as biosphere reserves. The zapovedniks Kostomukshskiy, Pasvik, Daurskiy, and Khankaiskiy represent the Russian component of international zapovedniks (Russian-Finnish, Russian-Norwegian, Russian-Mongolian-Chinese). In addition, 10 zapovedniks are included into the World Heritage List and are under the jurisdiction of the World's Culture and Nature Convention. Twelve zapovedniks are included in the list of wetland territories that have international values according to the Ramsar Convention of 1971.

A combination of four features of the zapovednik system distinguishes it from most protected natural areas in the world (Dezhkin 1993; Puzachenko et al. 1993; Shadrina 1993; Kuleshova and Rusanova 1995; Shtilmark 1996). First, efforts were made to set aside entire ecosystems, which would function normally without human interference. Historically, expansion of the system was based not only on preserving species rarity or habitat uniqueness but on biogeographical zoning of the country. To ensure representativeness of ecosystems, a detailed physiogeographical zoning and geobotanical map of the USSR (1:4,000,000) was developed to highlight 13 biogeographical regions, and it served as the basis for recommendations as to the optimal distribution of zapovedniks. The result is the system as we see it today – preserving "samples" of a tremendous diversity of natural communities.

A second distinguishing feature of the zapovednik system is that, for decades, long-term research and monitoring has been conducted on preserve territories and accumulated in zapovednik archives (CON). These archives create a valuable yet underutilized scientific resource. The first monitoring program for Russian zapovedniks was designed in 1934. Its focus was on long-term studies, mapping of biomes, flora, and fauna as well as the collection of meteorological and phenological data. In 1945, annual volumes of the CON began to be produced by zapovednik staff.

The third and fourth unique qualities of the zapovednik system are that all research is centered on ecosystem processes and natural phenomena, and human activities are restricted in zapovedniks. The research conducted on zapovedniks is not manipulative or experimental and public visitation is not allowed on zapovednik territories.

The choice for a zapovednik location is determined by the following criteria: (1) natural diversity, including species richness and taxonomic representativeness; (2) how typical and intact the ecosystems are; and (3) ecological stability of the systems. The founders of the preserve system in Russia considered large sizes of preserves to be crucial for maintaining effectiveness of ecosystem preservation. With this emphasis, 52% of zapovedniks range from 10 to 100 thousand ha, and 37% lay within a size range of 100 to 1000 thousand ha. However, during that period, organizing large steppe zapovedniks in the European part of Russia already was impossible due to high human population densities. As a result of similar complications, 40% of the zapovedniks are not contiguous areas. Historically, the size and exact location of zapovedniks were determined intuitively and often were greatly altered by the local administrations. This situation revealed the absence of a theoretical concept underlying the optimization of zapovednik location and size. Concepts governing the distribution and size of zapovedniks appeared relatively recently, and they are mainly represented by the theory of island biogeography of MacArthur and Wilson (1967). This theory raised a debate about optimal sizes and preserve distribution in Russia, and revealed the complexity of decisions connected with preserve size.

Zapovedniks are not evenly distributed across Russia. There are more zapovedniks in the European part of the country; however, their sizes are significantly smaller than those in the Asian part of the country. Often zapovedniks are located on the boundaries of different natural regions and contain features of the transition zones. In addition, they are usually (with a large enough area) characterized by a higher level of biodiversity than surrounding landscapes.

Areas in which zapovedniks do not exist include continental tundra, forested tundra, and the sparse forests of Kolskiy peninsula, Russian Plain, Western Siberia, Chukotka,

and some other regions. More specifically, steppes are not adequately represented by the zapovednik system. For instance, there is a need to organize more zapovedniks in the steppe zones in the European part of the country (Sokolo et al. 1997) to more fully represent their diversity.

CURRENT PROBLEMS

The current difficulties faced by the zapovednik system include various forms of anthropogenic influence, severe economic crisis, and political instability. Many of these problems developed as a consequence of the growth of the zapovednik network. For instance, zapovedniks sometimes lack the necessary spatial area and connectivity to adequately meet the needs of many of the plant and animal species that they are designed to protect. Zapovedniks differ greatly in size, financial support, and history**.** A historical lack of communication and inter-preserve variability in resources has led to a situation wherein the system of data collection for the CON often is not uniform or comparable through time within and among zapovedniks (Korneeva 1990). For instance, data sometimes are collected in formats that differ among zapovedniks (Semenov and Lihackiy 1990; Shaldibin 1990), and quite often new zapovedniks are not supplied with basic information such as forest inventory data and vegetation or soil maps.

A number of zapovedniks suffer from strong anthropogenic influences from surrounding industrial landscapes (Alekseeva and Zikov 1985; Filonov 1993; Nukhimovskaya et al, 1995). Preliminary analyses indicate that at least 15%-20% of the territory of Russia has experienced some form of negative environmental influence and, unfortunately, more than half of all Russian zapovedniks are located in regions where critical ecological threats exist. For example, 25% of zapovedniks are under direct and indirect influence of industries, 18% are influenced by human caused changes in hydrology, 30% are influenced by intensive agriculture and stock management (including reindeer herding), and 20% are under the influence of timber harvesting (Sokolov et al. 1997). Losses of biodiversity within zapovedniks are inevitable as anthropogenic pressures cause the decline or extirpation of plant and animal species, the degradation of ecosystems, and the synantropization of flora.

POTENTIAL APPLICATIONS AND EXAMPLES OF LONG-TERM WORK

It is possible to create regional research programs for groups of zapovedniks that are located in a single geographical unit – zapovedniks of the Caucasus, Ural zapovedniks, etc. Recently, the necessity of creating hierarchically structured research programs ranging in focus from individual zapovedniks to regional networks within the overall federal system was recognized.

Understanding the fluctuations in natural ecological processes on the basis of long-term research is viewed as the largest pragmatic value of the Chronicles of Nature (Puzachenko et al. 1993). Data could be summarized annually and over decades to perform analysis of individual population and community phenomena at different territorial scales – at the level of an individual zapovednik or a region (country). Unfortunately, there are not many examples of summaries of large amounts of data in zapovedniks. There are subjective and objective reasons for this: differing volumes of data, changes in staff and territory of the zapovednik, quality of data, and many others. However, there are some long-term data that provide sufficient information for a relative analysis of temporal change in environmental conditions. In addition, the large amount and regular character of data collected across the zapovedniks somewhat compensates for the imperfection of data collection methods.

Climate change lies at the base of environmental changes in Russia. Thus, analysis of the CON should begin with analyses relating changes in ecological data to shifts in regional climate. In some zapovedniks, such analyses have been performed. For example, evaluation of weather station data in the Okskiy Biosphere Zapovednik identified a trend for cooler summers, warmer winter and spring temperatures, and increased summer precipitation over a 100-year period (Puzachenko et al. 1993). Within the last 50 years, the level of the spring floods also decreased in three main rivers of the Okskiy Biosphere Zapovednik, and the timing of the spring floods has changed (it begins later). The climate becomes less continental, thus directly influencing ecosystem functions.

In many older zapovedniks, data concerning changes in flora and fauna have been accumulated. These data were published by the Russian Academy of Science Zapovednik Commission in the series *Flora and Fauna of Zapovedniks* and in some other publications. Within the last 10-20 years, there appears to be significant changes in lichen and fungi flora of small zapovedniks within the European part of Russia (Galichia Gora, Zhiguliovskiy) and the southern portions of far eastern Russia (Dalnevostochniy Morskoy) (Saricheva 1995; Skirina 1996; and others). Noticeable changes were revealed in the flora of some of the "older" zapovedniks (Astrakhanskiy – a 40 year period) (Zhivogliad 1970).

The publication of Semenov-Tyan-Shanskiy and Gilazov (1991) devoted to birds of the Kolskiy peninsula reports on ornithological studies of Laplandskiy Zapovednik over a 58-year time span. It was written on the basis of 30 years of data collected for the Chronicles of Nature and other data that were accumulated in the zapovednik since the 1930s. Most attention was devoted to the changes in numbers of birds and their population dynamics, including long-term dynamics (within a century), phenology of migrations, and correlation of migrations with weather conditions. Phenological trends cover a 50-year period and are unique for all of the sub-arctic. A similar eco-phaunistical (eco-zoological) summary was done by Darman (1990), which contains 25 years of data on the changes in diversity and abundance of mammalian populations within the Khinganskiy Zapovednik (Amur region).

Analyses of the dynamics of avian species composition, numbers, and habitat have been performed for several zapovedniks, including: Ilmeskiy (Ural) (Guriev 1978) – 50-year period; and Stolbi (Krasnoyarsk

region) (Polushkin 1988) – 60-year period. Mammal population dynamics and species composition were analyzed for the Centralno-Chernoziomniy Biosphere Zapovednik (Kursk region) (Vlasov 1997) over a 30-year period and for the Shulgan-Tash Zapovednik (Bashkortostan) (Loskutova 1996) over a 110-year period (using retrospective analysis). Climatic and anthropogenic influences appear to be the main causes of dynamic change in the faunal composition of these zapovedniks.

Over a 25-year time span, three cartographic descriptions of vegetation were completed (oak forests (*Quercus* spp.), steppes, and meadows) on a part of Centralno-Chernoziomniy Zapovednik and in oak forests of the Les Na Vorskle Zapovednik. Those studies revealed a trend toward more mezophytic flora, a pattern repeated for all vegetation communities of mid-Russia forested steppes.

In the Voronezhskiy Zapovednik, there has been a study of eco-genetic and onthogenetic development of forests within the last 50 years (Utekhin et al. 1990). Since 1946, studies of forest succession influenced by creation of a big water reservoir were conducted in the Darwinskiy Zapovednik (Pisanov 1993). Many zapovedniks also have accumulated long-term data on seed and berry productivity of woody species and shrubs that are significant food sources for many fauna species.

Changes in numbers of ungulates, predator-prey dynamics, and population dynamics of deer for a number of zapovedniks in the former USSR were analyzed in works by Filonov (1989, 1993, 1997) and Sokolov et al. (1997). Using the Chronicles of Nature from different zapovedniks, the authors addressed predator-prey system stability and made predictions of future zapovednik stability.

Butorina and Krutovskaya (1972) prepared a summary of phenological observations for the Stolbi Zapovednik and its surrounding region using 25 years of data. This allowed them to build a complete picture of seasonal change in mountain taiga habitat and to identify reliable indicators of phenological periods and the pattern of different natural zones of the region. The "Calendar of Nature," one of the chapters of the Chronicles of Nature, compares seasonal development of more than 100 different indicators. The Calendar of Nature for Laplandskiy Zapovednik was compiled over a half-century (Semenov-Tyan-Shanskiy and Ablaeva 1983).

Recently several regional coalitions of zapovedniks have developed to coordinate scientific research. An association "The Sredniaya Volga," which joins 10 zapovedniks, prepared a book, *Attempts in Evaluation of Conditions of Natural Complexes of Zapovedniks and National Parks of Association Sredniaya Volga.* At present, the Federal Committee for Environmental Protection is trying to encourage zapovedniks to summarize and analyze the accumulated data and prepare publications on dynamic processes of their ecosystems.

There are data inconsistencies among zapovedniks within regions. However, even with these inconsistencies, general trends can be ascertained – as demonstrated in the preceding examples – for long-term climate trends and local environmental changes, changes in floral and faunal abundance, population dynamics, vegetation, and phonological observations. With studies that can extend to 100 years or more, the temporal value of these data is rare, and the value of the tendencies and trends revealed with such long-term and geographically broad data are nearly inestimable. Analysis of regional data among zapovedniks should be encouraged in order to continue to bring such valuable trends to light.

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