Traditional Forest Related Knowledge, Biodiversity Conservation and Sustainable Forest Management in Eastern Europe, Northern and Central Asia

IUFRO World Series Volume 26

Papers
From the conference held in Bishkek, Kyrgyzstan
From 28-30 June, 2009

Jointly organized by
IUFRO Task Force on Traditional Forest Knowledge
IUFRO Special Programme for Developing Countries (IUFRO-SPDC)
Global Forest Coalition
NGO Ecological Movement "BIOM", Kyrgyzstan
Kyrgyz National University named after Jusup Balasagyn, Kyrgyzstan

Editors
Andrey Laletin
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Ilya Domashov



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Introduction and Meeting Report

Background and Objectives

Forests and woodlands that are the traditional homes of local communities in Eastern Europe, Northern and Central Asia have historically been managed by these communities themselves, or more recently in collaboration with government agencies. Traditional forest-related knowledge (TFRK) and innovative forest management practices, developed over centuries, have contributed significantly to the natural and cultural heritage of the region, and sustained production of multiple goods and services that enhance livelihood security and quality of life for people.

Traditional uses of forests and other ecosystems in this vast region reflect the rich history of hundreds of culturally distinct peoples. Over countless generations each group has developed its own ways of interacting with nature. Unique expressions of such interactions are found in the traditions, customs, folklore, and forest resource uses that have survived among contemporary communities. The distinctive characteristics of the region's varied ecosystems have shaped the evolution of traditional knowledge and practices that sustain the cultures and livelihoods of indigenous peoples and local communities—guiding the hunting, fishing, and gathering activities of communities who are directly dependent on a diversity of natural resources to meet their daily needs.

The sustainable management of biodiversity by traditional communities has, for generations, provided foods, medicines, dyes, tanning agents, clothing fabrics, tools and utensils, construction materials, and means of transport. In the case of communities that rely on hunting, fishing, and gathering of wild plants for food and medicine, such knowledge includes a profound understanding of ecosystems and habitats, weather, and plant phenology used to determine the timing and methods for collection, storage and processing these non-timber forest products. Such knowledge, accumulated over hundreds of years of observation and experience and passed down through the generations, has enabled the survival of communities settling throughout the region to adapt to often harsh environmental conditions. For this reason, traditional forest-related knowledge is becoming increasingly recognized for its value in solving problems related to biodiversity conservation and sustainable use of natural landscapes.

The increasing emphasis being placed on ecological, social, cultural, spiritual, and economic components of sustainable forest management requires enhanced collaboration among government agencies, forest managers, local and indigenous communities, and the scientific community to develop forest management objectives and forest management practices that meet diverse criteria for sustainability.

The conference provided a platform for sharing of information and exchanging experiences among scientists, the holders and users of traditional knowledge, non-governmental organizations, forest managers and other relevant stakeholders related to forest biodiversity and traditional forest-related knowledge. The conference highlighted the importance of traditional knowledge towards achieving the Millennium Development Goals, the objectives of the Rio Conventions, and its contributions to sustainable forest management.

ORGANIZATION

The International Conference on Forest Biodiversity, Traditional Forest Related Knowledge and Sustainable Forest Management in Eastern Europe, Northern and Central Asia was held in Bishkek, Kyrgyzstan on 28-30 June 2009. The conference was jointly organized by the Kyrgyz National University named after Zh.Balasagyn, the Global Forest Coalition (GFC), the Ecological Movement "BIOM", and IUFRO's Task Force on Traditional Forest Knowledge in collaboration with the IUFRO Special Programme for Developing Countries. Two excursions were included in conjuction with the conference, to Chon-Kemin National Park (on June 28, 2009) and Issyk-Kul State Reserve (on July 1-5, 2009).

The principal aim of the conference was to share results of research in the fields of forest biodiversity, forests and climate change, traditional forest-related knowledge, and international forest policy . The meeting also sought to foster greater international collaboration in these spheres.

According to Kyrgyzstan's renowned ecologist Professor Emil Shukurov, people in local and indigenous communities that have existed for many centuries possess an amazing treasury of wisdom about human interactions with the environment which we (in mainstream society) are often unaware of, or not sufficiently respectful of. Traditions, ideas about the world and beliefs of peoples of Central Asian countries, the Caucasus and Russia are invaluable resources in the search for new approaches for solving ecological problems; they could enrich us culturally, intellectually and materially.

In addition to traditional forest-related knowledge and its role in sustainable forest resource management, considerable attention was given during the conference to forests and their relevance issues related to biodiversity conservation, water resource management, and climate change. Forest ecosystems harbor a significant proportion of the world's biodiversity, and serve important hydrological regulation functions. Given the critical role of forests as regulators of local, regional and global climatic processes, their protection deserves special attention.

In the famous Kyrzyz national epic "Manas", there are verses that describe how Manas with his army become lost in the forest. Today it is difficult to imagine such a place in the territory of Kyrgyzstan where this could be possible, for natural forests comprise only 4% of the total territory. However, under existing climatic conditions, forest cover in Kyrgyzstan could potentially be as high as 30-40%. According to participants of the conference, the environment in general and forests in particular are being treated as an enemy on a battlefield. Such approach is destructive and today there is a need to integrate the efforts of all strata of society within and among countries for preservation of forest ecosystems, their biodiversity and vital ecosystem services, including stabilization of our planet's climate .

A total of over 90 participants including representatives of governmental organizations, experts from local communities, non-government organizations, education institutions, took part in the conference (full list of participants provided in Appendix 3). Among the conference participants were 16 international scientists and specialists from Russia, Georgia, Kazakhstan, Uzbekistan, Ukraine, Tajikistan and Turkmenistan; 34 participants from Kyrgyzstan representing universities, other educational organizations, and state agencies; and 33 representatives from local (Kyrgyz) and international non-governmental organizations. Also participating in the conference were media specialists representing television, newspapers and news agencies in Kyrgyzstan, including members of the Union of Photojournalists of Kyrgyzstan.

Conference Participants

Based on the results of the conference, a resolution was adopted by participants. Also discussed during the conference were plans for further work in the spheres of traditional forest related knowledge, conservation of forest biodiversity, and climate change mitigation and adaptation.

The resolution (Appendix 2) dealt with the conservation of traditional knowledge in the sphere of climate change and conservation of biodiversity in Eurasia. It called on scientists and other experts, people from local communities, non-government organizations and all those who appreciate the experience of our ancestors and their deep-rooted traditions which can give us today new approaches and solving of burning problems took an active part in the discussions.

Following the meeting, a press conference was held to discuss questions related to forest biodiversity conservation, protection of traditional knowledge and other relevant issues that had been considered during the conference. (See the press release in Appendix 4).

Acknowledgements

This conference was made possible by the generous financial assistance provided by donors. In particular, we wish to thank the Netherlands Federal Ministry of Foreign Affairs, and the Korea Forest Research Institute. We also gratefully acknowledge IUFRO's Special Programme for Developing Countries (IUFRO-SPDC) for their assistance in the organization of the conference

PRESENTED PAPERS

INDIGENOUS PEOPLES OF RUSSIA AND THEIR TRADITIONAL ECOLOGICAL KNOWLEDGE: PAST, PRESENT AND FUTURE CHALLENGES

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Abstract

Концепция биоразнообразия становится все более привычной для лиц, принимающих решения, причем именно для той категории, кто профессионально занимается экологической проблематикой. И обсуждаемая здесь принципиальная потребность для разрешения определенного противоречия между необходимым и имеющимся уровнем знаний в области биоразнообразия объясняет, что данное обстоятельство должно быть радикально устранено. Представляется вероятным, что именно благодаря опыту реализации Конвенции на международном уровне, возможной будет организация и осуществление согласованной работы по сохранению биоразнообразия России в долгосрочной перспективе. Ожидается, что осязаемый прогресс может быть достигнут лишь в процессе регулярного применения и последовательного развития комплекса из научных подходов, взвешенных политических решений и вовлечения традиций, опыта, знаний и инноваций коренных малочисленных народов России. Конвенция по биологическому разнообразию (КБР) является международным соглашением высокого ранга, которое определяет приоритеты природоохранной политики в современном мире. И именно международные политические решения такого уровня, безусловно, диктуют необходимость их адекватного национального исполнения. Одним из наиболее важных достижений КБР является признание того факта, что все виды знаний необходимы и должны быть активно привлечены для сохранения биоразнообразия в мире. Непосредственно в Конвенции эта позиция закреплена в статье 8,отдельным параграфом (j), но постоянное исполнение этого, весьма своеобразного пункта, предусматривается во многих других ее документах. В России даный процесс участия коренных малочисленных народов все активнее происходит в последние годы, и должное представительство аборигенов в международных и национальных процессах обеспечивает Ассоциация коренных малочисленных народов Севера, Сибири и Дальнего Востока Российской Федерации, более известная за рубежом по своей англоязычной аббревиатуре - RAIPON.

Introduction

Sustainability science seeks to understand the interactions between society and nature, specifically the interaction of global processes with the ecological and social characteristics of particular places and sectors. It recognizes that the well-being of human society is closely related to the well-being of natural ecosystems. The knowledge and experience of local communities are important parts of this relationship that need to be acknowledged and respected. Thus, sustainability science needs to draw on the collective intellectual resources of both formal sciences and local knowledge systems.

It is widely accepted that the world’s biological diversity cannot be saved without ensuring protection of cultural diversity, most of which resides with the world’s indigenous peoples. Traditional ecological knowledge developed by indigenous peoples is an important element of this cultural diversity. It includes knowledge and techniques related to plants and animals, used for food, medicine or other purposes. It is developed not on a systematic basis, but though individual or collective interactions within a cultural environment. Such knowledge has been preserved for centuries by traditional communities in different regions of the world. Its variety reflecting the spirit of these peoples, their cultures and traditions, and the environments in which they developed. Traditional knowledge is common property, presented in different forms: in stories, songs, folklore, proverbs, cultural values, folk beliefs, rituals, community laws, peculiarities of local language and natural resource management practices. Traditional knowledge is used for practical purpose, and has been passed on orally from their knowledge-holders to the heirs and relatives. The rapid disappearance of languages consequently leads to the loss of traditional knowledge.

An understanding of the experience and knowledge of traditional societies related to the natural resource management may help to create new models of human development in the face of increasing global environmental problems. The appreciation of traditional culture by representatives of dominant societies, however, is too often impeded by the ethnic and anthropocentric attitudes of their own culture. As a result, those who consider "western" models of sustainable development as "scientific" and the only legitimate ones are short-sighted, unable to appreciate the cultural context in which they operate - i.e., their world views, principles of social organization, power relationships, etc. that are part of Western culture – which limits their ability to appreciate the value of other perspectives,.

An analysis of the cultural context of traditional natural resource management of northern peoples shows that their management of biological resources, in contrast to "western" models of natural management, does not belong exclusively to the sphere of scientific thought and practice. It is a part of broader system that combines methods of cognition, perception of the world around them, and their lifestyles. Ideas about how the world works form the basis of relationships between indigenous peoples and their natural environment. The system of relations between *ethnos* and landscape is more a product of culture, than of the individual observations of the natural environment. Indigenous northern peoples have combined symbolic and empirical knowledge in the development of their unique views of nature that guide traditional natural resource management of natural resources. Thus, traditional utilization of natural resources is really an expression of the environmental culture of traditional societies, which differs from "western" approaches, and underlies sustainable development strategies arising from a different cultural context.

In this report, the historical and current status of traditional ecological knowledge, and of the indigenous communities who are its custodians, will be considered. Challenges for the protection of this knowledge, including cultural and legal protection, and the future of traditional communities are also discussed.

Traditional natural resource management, historical changes, and modern life of indigenous peoples

Challenges faced by the indigenous peoples of Russia

Closely linked to the ongoing loss of biological diversity is the decline in the world's cultural and linguistic diversity. A major proportion of this cultural diversity resides with indigenous peoples, who represent an estimated 75% of the world's six thousand languages. Many of the regions of the world with the greatest biodiversity are inhabited by indigenous peoples. In the Russian Federation, 45 peoples (with populations up to 50,000 each) are recognized under the official list of indigenous peoples, of which 40 live in the North, Siberia and the Far East in the territories of 28 provinces – all are subjects of the Russian Federation.

Land rights, land utilization and efficient management of resources remain the most important issues for indigenous peoples around the world. Construction projects, mining, deforestation and agricultural programs still lead to the expulsion of indigenous peoples from their lands. Moreover environmental damage to traditional lands can have serious impacts on indigenous peoples: species of flora and fauna are disappearing or are at risk, unique ecosystems are being lost, and rivers and other water reservoirs are becoming being polluted. Many species of plants used for commercial purposes displace native species which have been used in the traditional farming systems. The result is an expansion of the usage of industrial farming methods.

For many years, especially in the Soviet Union, traditional cultures had been under such pressure that they underwent significant transformations. Many members of indigenous communities have already lost contact with their traditional cultures. Today, ten of the indigenous communities who live in the North in Russia are on the brink of extinction, and conditions of physical and psychological health in are poor most of Russia's indigenous communities. Russia's indigenous and local communities who continue to practice traditional natural resource management based on their traditional knowledge face a number of difficult, social, economic and political challenges and obstacles to sustainable development. The general health conditions in many such communities is poor, due to the prevelance of diseases, such as alcoholism and tuberculosis, decreases in social welfare, disharmony in family relations, etc. While indigenous peoples and many long-time residents of the Arctic region have knowledge, skills and traditions of sustainable natural resource management, these are still not in proper demand by the state.

The preservation of culture and language is an aspect of the deeper challenge of conservation of non-industrialized consciousness, traditional lifestyles and social structures. For the traditional communities of Russia, the loss of lands in which they have been living from the time of their ancestors is a major obstacle. This situation is not unique to Russia. Similar problems exist in Scandinavia for the indigenous Sami people in Norway, Finland, and Sweden (as well as in Russia's Kola peninsula), who are being negatively affected by expansion of tourism. In Sweden and Finland, where hunting tourism is developing, the Sami have succeeded in obtaining compensations for the animals killed in their traditional lands[1].

Historical background

While the current crisis in many areas of the North is associated with the contemporary political and economic situation in Russia, its roots lie deeper, in earlier periods of political, social, economic, and cultural change.

After the colonization of Siberia by Russians since beginning of 17th century, the rights of indigenous peoples remained as they were earlier. On the one hand, almost nobody claimed to their lands, and the State was interested only in taiga for strategic and geopolitical reasons. The state was interested in the friendly relations with aborigines. During the 17th and 18th centuries colonization was aimed at obtaining new resources, in particular furs, which yielded big profits to the State. In the 1822 "Code on Affairs of Natives", it was stated that people living in Siberia can live the way of life that they want, and that they should be protected from external influences. For example, it was forbidden to sell alcohol to them, and local authorities were even forbidden to lease their lands, i.e. their autonomy was respected as much as possible.

This situation lasted until the end of the 19th century, when Prime Minister Stolypin instituted reforms that were highly destructive to indigenous communities. Large farms were established encompassing traditional indigenous lands and indigenous peoples were equated with peasants. In Yamal Nenets autonomous territory people revolted against this in 1898-99. After the October Revolution of 1917 ethnographers and researchers of Siberia started to pay attention to the situation of the region's indigenous peoples. They believed that these peoples should not be left in their current condition, and that they needed assistance for development, including agricultural intensification, creation of written languages, etc. Autonomous self-governing communities were officially recognized, when the Soviets (Councils) of settlements and national districts were established in late 1920s. This was the first attempt to integrate the indigenous peoples of the North and Siberia into the official state system.

In the 1930s this attempt towards integration represented a limited level of understanding of the problem. On the one hand, the territorial-administrative units (national autonomous areas) were established which bore the names of peoples (although their administrative boundaries did not always coincide with the traditional boundaries of the peoples' settlements). On the other hand, there was an official list of "The Peoples of the North and Siberia" consisting of 26 nations who were the targets of the government's assistance. Collectivization during this period was a powerful blow to the indigenous peoples, changing their traditional livelihood practices, and initiating the state's struggle against their autonomy. For example, the new system for reindeer herding was forcibly created: in place of their nomadic economy, people were required to live in villages and reindeers taken out to graze on a rotational basis by teams. A compulsory education system was created under which children were taken from their parents and placed in boarding schools.

In the mid-1950s the industrial exploitation of Western Siberia began. Where oil and gas were found, ancestral territories began to be withdraws from farming utilization. Many holders of traditional knowledge (especially shamans) were murdered during this period. In the 1960s a generation of indigenous peoples which had been separated from their roots had grown up. While these people may have had the desire to engage in traditional farming and to follow to the traditional way of life, in practice they could not do it due to lack of knowledge and skills. In the result, a series of environmental disasters happened in 1980s. In the early 1990s some autonomous regions were

[1] The Sami have created the Sami Parliaments which allocate money for the development of Sami culture in these countries and try to deal with the issues affecting the interests of traditional communities; these issues are environmental issues.

incorporated into the independent units of the Russian Federation. These changes did nothing to improve the lives of the indigenous communities.

Indigenous peoples, natural resources and livelihoods in the post-Soviet era

The official establishment of territories for traditional natural resource management was solved differently in different regions. For example, in 1992 in the Amurskiy and Khabarovskiy regions, territories for indigenous natural resource management at the community level were established. An attempt was made to withdraw tenant rights on forest from logging enterprises and to transfer these rights to Udege, Ulchi, Nanai, Orochi peoples for their preferential use. In Primorskiy region such territories were allocated only on paper (formally). After elections the authority was changed and the new authority decided that it is better to use these territories for profit. A joint venture for timber exploitation was established with the South Korean Hyundai corporation in Primorskiy's Terneiskiy district. Despite the recommendations by state experts, a decision was made to start logging. Udege people with guns came to defend their territories and cutting was discontinued. However, attempts to implement large-scale industrial logging on indigenous territories in this area are not yet over.

Similar events have recently taken place in Western Siberia, where a decree allocating community territories in Yamal-Nenets and Khanty-Mansiysk national districts has been adopted, although defining their boundaries has presented difficulties, particularly in cases when oil and gas exploration and exploitation are involved. Conflicts have arisen, as in the case of the Khanty people, who took direct actions to halt mining and oil and gas exploitation on their lands by moving their nomadic camp to areas to prevent mining, and organizing pickets in the district centre by placing nomadic tents by oilers' offices. Similar direct actions have taken place in Sakhalin in relation to activities of gas companies. On the Sob River, considered sacred by the Khanty, they blocked the river with their boats to stop a ship from dredging gravel out of the river. Unfortunately, indigenous peoples do not always succeed in their efforts to preserve their traditional livelihoods by efforts aimed at combating industrial exploitation and destruction of their traditional lands.

In the early and mid-1990s many resolutions on the establishment of indigenous areas with community self-government were adopted, but these communities were not recognized at the federal level. Over the past decade, such communities have been created reluctantly as the process involves many difficulties. The recent economic crisis has significantly worsened the situation. With the suspension of government subsidies, and unprofitability of traditional economic activities, many people are abandoning their traditional farming practices and moving to settlements to find work, typically maintenance workers. As meager as salaries from such jobs may be, they are still often better than the jobs they left behind; beyond the polar circle, only people from the "mainland" earn decent salaries. Nowadays people do not have sufficient resources to create a new economy; in many places, unemployment rates are as high as 60-70% of the population. Many of them go into taiga, where they are engaged in traditional farming.

Another variant of the integration model is found in the Sakha Republic (Yakutia). The idea of the national statehood was to provide independent access to the international market for the sale of diamonds that are mined there. The Sakha Republic is highly centralized, the president has considerable power, diamond profits are not distributed to the lower levels of society, and the district administrations are unable to support people who follow traditional lifestyles.

For the implementation of a model of sustainable development in Arctic region, it is essential to preserve the natural environment of the North in the territories and in a condition adequate to the needs of the traditional economy, i.e. at least to preserve biodiversity at the level of commercial species and utilized ecosystem types. In reality, this can be realized only through the zoning of the North. It is essential to zone the areas for priority industrial development and economic development (in the settlements where it is necessary to provide conditions for normal life and work for the indigenous population), and areas for priority traditional exploitation of natural resources. In the latter it is essential to provide conditions for the preservation of game animals and in whole developed ecosystems, and for the traditional exploitation of natural resources by indigenous peoples of the North, providing them acceptable living conditions. The territories of nature reserves should take a special and separate place outside these zones.

The impact of industrial development of the North to the indigenous people (due to their small population and cultural dependence on traditional reindeer herding) is revealed in the development of the processes of cultural, linguistic, ethnic, and genetic assimilation. While the numerical dominance of alien population in areas of industrial development plays a role in these processes, the loss of the traditional natural resource management practices and lifestyle of indigenous people is highly significant, forcing indigenous people into rather large multi-ethnic settlements. In 1990s this occurred due to fundamental changes in government economic policy in the North, the reduction of biological productivity of large areas because of pollution and other forms of anthropogenic transformation of natural environment, the alienation of part of lands for the development of mineral and hydrocarbon raw materials and transport infrastructure. The best alternative for the organization of natural resource management in Arctic region may be collaborative resources management, or co-management.

Natural resources co-management is a system of measures, developed through an agreement between government agencies with relevant authorities and representatives of various groups of biological resources users, including the indigenous northern peoples. The basic idea of co-management is the integration of two approaches to resource management: "Western," based on public administration and scientific knowledge, and aboriginal, traditional approach. Evaluating the possibilities of collaborative resource management in the northern regions of Russia, it is necessary to consider that traditional attitudes, which had limited load on the environment in the past and have been based on the unity of economic and cultural life of indigenous peoples, nowadays in many places have eased or even stopped to function (Tishkov, 2003).

Prospects for sustainable development of Russia's indigenous peoples

The preservation and/or revitalization of of traditional ethnic culture may provide opportunities for sustainable development, which *should* arise from within societies and enable people to determine their own path between past and future.

A critical question is whether young generation of indigenous peoples wants, and is able, to revive and conserve the values of their cultures, or be assimilated into the margins of urban instustrial society. The need for improving the the conditions for the survival of indigenous peoples is even more urgent. So while it is necessary to create conditions on the one hand for the preservation and dissemination of traditional knowledge and practices of indigenous peoples to promote sustainable development, it is also necessary to improve health conditions and economic prospects for indigenous peoples given the ongoing deterioration of social, economic and environmental conditions within their traditional territories.

Perhaps one of the main questions of the 21st century is whether indigenous peoples will be able to continue to maintain their sense of identity ability as a part of the nature as they struggle to adapt to current conditions without exhaustion of natural resources which are essential for the sustainable development. The consumer society, with its unsustainable model of exploitation of natural resources, has left its mark in the deterioration of environmental conditions on the lands of indigenous peoples. This mark of consumer society, which affects the whole world, is not just a problem of ecology, but also a problem of human rights, equality and morality.

Despite the considerable influence of western culture on (numerically small) indigenous peoples, their traditional resource management practices, language, social, cultural and religious traditions survive, although they are unlikely to develop in the future without special support measures. Under the influence of the market economy, the preservation of material and spiritual aspects of traditional ethnic culture of indigenous populations of the Arctic region may be profitable to the development of cooperation in the commercial and reindeer economy.

The policy of state protectionism has been reflected in the legislation aimed at protecting the rights of the (numerically small) indigenous peoples of the Russian Arctic and ensuring adequate living conditions; it has also been reflected in federal target programs. In recent years such policies have not been sufficient to meet the goals of ensuring the transition of the indigenous population towards sustainable development. There are a number of reasons for this, including an incomplete legal framework for its implementation; lack of mechanisms for their realization and weak control of execution of the existing laws; and limited participation of indigenous peoples in self-government processes.

The transition to partnership has been problematic. Indigenous peoples and longtime residents of the region's population should be regarded as a subject of the region's development, and should be provided with the rights required to solve the issues concerning the development of the Arctic region. The current approach to environmental conservation and development of the region in isolation from the interests of its indigenous population not only fails to meet the basic provisions of the sustainable development concept, but also leads to the considerable aggravation of the socio-ecological situation in the region.

In the Russian North, Siberia and the Far East, two related alternative models for sustainable development are required: one for areas in which traditional natural resource management are or could be practiced, and another for areas with industrial development. For either alternative the interests and prospects for the further survival of the indigenous population of the North should be taken into consideration. As mentioned above, sustainable development must be based on ethnic and cultural foundations, unification of age-old traditional and modern industrial approaches are unacceptable. Different levels and lines of development of society should not be viewed as a problem (of "delay" or “backwardness” of certain segments), but rather a reflection of ethnic and cultural identity, and the need for different forms and methods of development.

In these regions of Russia, export-oriented production of oil and gas, mining, construction of large dams, industrial logging, and intensification of agriculture have led to the degradation of nature, particularly the territories of traditional use of natural resources and the ecosystems which sustain life for many indigenous peoples. While such activities may improve the state's budget, inequalities of access rights to resources have been harmful both economically and environmentally. The unsustainable exploitation of natural resources deprives the majority of the population of access to resources (including those needed for traditional foods, clothing, and other goods), thereby limiting the population’s ability to maintain and improve their quality of life. In fact, the industrial model of economic growth in these regions destroys their spiritual and organic environment and their traditional way of life, as discussed earlier.

The legal basis for the conservation of traditional knowledge and practices in Russia

The most widely accepted means for ensuring intellectual property protection for traditional knowledge are to register such knowledge in the system of International Patent Classification (IPC)[2], and also to create and maintain information databases. Unfortunately legal and regulatory frameworks for protection of traditional knowledge as intellectual property are still absent in Russia. While knowledge from the formal sector (i.e., private and public institutions) is well-documented and protected by national and international laws, knowledge of the informal sector (communities and individuals) is often verbal, not documented and therefore not protected. This category of knowledge is actually not protected, as there are no relevant laws.

There is a process in Russia, driven mainly by Rospatent (Russian Agency for Patents and Trademarks), to create an information database of traditional knowledge. This is based on the recommendations of the World Intellectual Property Organization (WIPO: the specialized UN body responsible for intellectual property), experience of other countries, and the National Action Plan for biodiversity conservation in Russia. This would include traditional knowledge related to the conservation of genetic resources[3].

The current Russian system for intellectual property protection is based on the following laws:

- Patent Law of the Russian Federation of 23 September 1992 # 3517-1 (with amendments and additions made by the Federal Law on 7 February 2003 # 22-FZ).
- Federal Law of the Russian Federation of 23 September 1992 # 3520-1 “On trademarks, service marks and appellations of origin" (with amendments and additions made by the Federal Law on 11 December 2002 # 166-FZ "On Amendments and Additions to RF Law On Trademarks, Service Marks and Appellations of Origin").
- Federal Law from 6, August 1993 # 5605-1 “On selection”.

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[2] The IPC is a regularly updated hierarchical patent classification system created under the 1971 Strasbourg Agreement, administered by the World Intellectual Property Organization (WIPO).

[3] Genetic resources, with the exception of microbiological material (microorganisms: bacteria, viruses, bacteriophages, algae, microscopic fungi, etc., and their consortiums, and also plant and animal cells, including their lines and cultures) cannot be considered as the patentable inventions, as they are not the result of intellectual activity.

Despite the current absence of specific legislation, traditional knowledge related to a number of products and technologies can legally protected under the Patent Law of the Russian Federation: These patentable applications include: medicinal products based on herbs (medicinal herbal tea, tinctures, nutritional supplements with pharmacological value, cosmetics with therapeutic action, homeopathic remedies, etc.); minerals; waste products of bees and various animals, algae and aquatic organisms; poisons; urine and activated water; tools and methods to influence the human body and environment (devices and methods of reflexology, bio-correctors, applicators, neutralizers, methods and devices for recording characteristics of medicinal drugs).

It should be noted that the major step towards protection of traditional knowledge has been made under the Convention on Biological Diversity, which asserts, in its preamble:*"... recognizing the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components...".* The Convention also states (in Article 15, paragraph 1): *"... recognizing the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation".*

Governments that ratified the Convention on Biological Diversity agreed to introduce a domestic legislation or amend their constitutions in order to ensure the participation of indigenous peoples in conservation and sustainable utilization of their environment. The rights of indigenous peoples to participate in utilization, efficient development and conservation of natural resources are also recognized in Convention № 169 of the International Labor Organization (ILO) concerning indigenous and tribal peoples in independent countries, and in the United Nations Declaration on the Rights of Indigenous Peoples. This Declaration provides for the right of indigenous peoples to own traditional lands and to manage their environment and its resources.

The rights of indigenous peoples coincide with many other human rights. Many important rights of indigenous peoples are not included in international agreements on the rights of indigenous peoples, but are a part of more general agreements, such as the Universal Declaration of Human Rights or the Convention on the Prevention and Punishment of the Crime of Genocide. Just a violation of the Genocide principle towards indigenous peoples is the main reason of failure of the implementation of conventions and international agreements. The right of peoples for maintenance of their cultural identity is recognized in the modern world everywhere, including in Russia. History has shown that the possession of this right is of incomparably greater value than political sovereignty and economic self-determination of ethnic communities. But how to preserve cultural identity, if there are no mechanisms for the protection and rapid recovery from the devastating effects of modern technological world?

The principles and objectives of the CBD are still not widely understood by politicians and the public. The biggest obstacle to fulfilling the CBD's aims is the choice between short-term benefits and long-term prospects: the genuine care for our planet requires all countries to review their policies concerning land utilization, agriculture, water, and energy, and much depends on the activities and choices of individuals worldwide. Within the framework of the CBD, efforts are undertaken to evaluate and raise the awareness about the effectiveness of national actions and work programs related to the Convention's implementation at the national level. It is important that indigenous peoples' organizations should respond to the proposals to submit factual information about how the implementation of the Convention affects their communities.

In this context, it is recommended that the following topics be given priority:

- the relationship between traditional knowledge and other forms of knowledge and biodiversity conservation and sustainable utilization of natural resources;
- the influence of international agreements, mechanisms for protection of intellectual property rights and current laws and policies on traditional knowledge related to biological diversity;
- the extent to which traditional knowledge is taken into account in decision-making processes regarding development and natural resource management;
- development of guidance for researchers on the ethical conduct of research on traditional knowledge in indigenous and local communities;
- issues related to prior informed consent, fair and equitable sharing of benefits, and nature conservation in the territories of indigenous and local peoples

The results of such studies should be submitted to the World Intellectual Property Organization and made available for the use of the CBD Parties for implementation of Article 8(j) and related provisions.

The Russian Association of Indigenous Peoples of the North, Siberia and Far East (RAIPON) began to participate actively in this process in 2000 when it was asked by a non-governmental international organization - the Earth Council - to prepare a report on indigenous peoples' issues. When RAIPON found out that a national report of Russia on sustainable development was being prepared by Russian non-governmental organizations, it appealed to the organizers of this report to include a section on Indigenous Peoples of the North, Siberia and Far East of Russia. Initially, this initiative was not supported, but after the reference to a special chapter 26 in the agenda, the section prepared by RAIPON was included to the national report on behalf of non-governmental organizations. In 2001 at the 4th Congress of Indigenous Peoples of the North, Siberia and the Far East, which involved 326 delegates and over 200 observers from the regions, "the Charter from Indigenous Peoples of the North" was discussed and adopted. The section on indigenous peoples was included into the national report from the Government of Russia for the World Conference on Sustainable Development "Rio+10" in Johannesburg in 2002 without RAIPON's submission. On the two subsequent congresses the unique ethnic associations had considerably strengthened their positions in the conduct of a balanced policy in all regions of Russia, which have preserved traditional natural management (Turaev et al., 2005).

Conclusion

The complete replacement of traditional natural resource management by government regulation means deprive the traditional communities of the possibility to develop and adapt to modern conditions. The roles and activities in the management of biological resources in the areas inhabited by indigenous peoples should be rationally distributed among the various "stakeholders". For this purpose, it is essential to legally separate the roles of the state and active bodies representing the interests of indigenous people in the sphere of environmental management. Some issues should be designated (e.g., an issue concerning management of local bio-resources), in which public services will not intervene, and where all issues will be solved by indigenous people.

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TRADITIONAL KNOWLEDGE OF INDIGENOUS PEOPLES AND ITS CONTRIBUTION TO BIODIVERSITY CONSERVATION IN RUSSIA

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Abstract

За последние десятилетия XX века глобальные экологические проблемы стали наиболее сложными и противоречивыми в системе международных отношений и мировых политических процессов. Постепенно происходит переоценка ценностей, и развитие экономического кризиса показало всю шаткость современной мировой экономики. В природопользовании и сохранении окружающей среды важнейшим условие стало привлечение традиционных знаний в сферу изучения, сохранения и устойчивого использования биоразнообразия. В такой ситуации представляется очень важным обеспечение более активной вовлеченности коренных народов из России. Исторический опыт культурного развития коренных народов Севера позволил накопить им традиционные знания в народной медицине, фольклоре, народных промыслах и ремеслах, в рациональном природопользовании, обычаях, верованиях и во многом другом, во что был вложен коллективный разум поколений. В них содержится богатейший народный опыт бережного использования природных ресурсов, уважительного отношения к окружающему миру, нашедшего отражение в обычаях и религиозных мировоззрениях коренных народов. Традиционные знания народов Севера передавались из уст в уста, от одного поколения к другому и дошли до наших дней в виде легенд, обычаев и религиозных обрядов, совершаемых ими в специально отведенных для этого священных местах. Религиозные мировоззрения коренных народов неразрывно связаны с традиционными формами хозяйствования – оленеводством, охотничьим промыслом, собирательством и рыболовством, которые являются неотъемлемой частью их традиционного образа жизни. Коренные народы имеют особую привязанность к своим землям, носящую глубоко духовный характер, поскольку они рассматривают эти земли как нечто основополагающее для своего существования, существующее в его верованиях, обычаях, традициях и культуре. Неразрывная связь духовной жизни коренных народов с Матерью-Землей, со своими землями, находит свое отражение в бережном отношении к окружающей среде, сохранении и преумножении возобновляемых природных ресурсов. Для коренных народов земля не является лишь объектом владения, средством производства или товаром, который можно присвоить, а материальным элементом, которым необходимо пользоваться в условиях свободы. Обсуждаются наиболее важные аспекты использования знаний коренных малочисленных народов в современном природопользовании.

Introduction

The close relationships of indigenous peoples and local communities to their natural environment depend on the availability of the biological resources that have sustained them over many centuries, a situation that is becoming increasingly rare worldwide. The centuries-old traditions and lifestyle of indigenous peoples are tightly connected with the specifics characteristics of the environments in which they live, where their ancestors have lived, from whom they have inherited the practice of coexistence and careful preservation of the environment.

The reduction of biodiversity harms not only the state of ecosystems and their potential to provide natural resources but also impacts traditional communities whose cultural awareness is rooted in their environment. The loss of this connection is permanent. These relationships are expressed in many ways. Plants and animals are symbols of the world - their images are on flags, in sculptures and other artistic expressions. In traditional societies of the the Russian North, Siberia, and the Far East,in contrast to modern societies in which Western consciousness dominates, traditional knowledge[4] is specific and concrete, characterized by a diversity of detailed expressions closely connected with the most important and oldest activity of peoples - hunting, fishing and gathering. Traditional knowledge is also related to the whole range of relations in society, family, social behavior and relationships (Podmaskin, 1998; Kulebyakin, 1985; Gumilev, 1990). The study of the knowledge of traditional cultures is increasingly recognized as important for the development of new solutions to present-day problems (Podmaskin, 2006; Kutalo, 1996; Krupnik, 1989).

Conceptions about how the world works form the basis of relations of indigenous peoples with their natural environment. The system of relations between *ethnos* and landscape is more a product of culture than of observations of natural environment. Each of the indigenous northern peoples, combining symbolic and empirical knowledge, has developed a unique view of nature, which is part of their traditional culture and is integral to their systems of natural resource management. These resource management systems express an environmental culture which differs from “Western” culture and allows these societies to develop their own sustainable development strategies based on their own social and cultural traditions.

The deeper understanding of traditional cultures by representatives of the dominant society is impeded primarily by ethnocentric and anthropocentric attitudes of their own culture. The analysis of the cultural context of traditional natural management of northern peoples shows that the management of biological resources in it, in contrast to "western" models of natural management, does not solely belong to the sphere of scientific thought and practice. It is a part of an integrated unit, combining the methods of cognition, perception of the surrounding world and lifestyle.

Natural resource management should not be dominated of any single knowledge (such as Western science), but needs to take into consideration the plurality of knowledge systems. Application of scientific research and local knowledge contributes to equity, opportunity, security and empowerment of local communities, as well as to the sustainability of natural resource utilization. Local knowledge can help in scenario analysis, data collection, management planning, designing of the adaptive management strategies, and to gain institutional support to put policies into practice. Science, on the other hand, provides new technologies, or can help in improving existing ones. It also provides tools for networking; storing, visualizing, and analyzing information; and for projecting long-term trends so that efficient solutions to complex problems can be found.

In order to be effective, biodiversity conservation efforts can learn much from indigenous and local communities and their knowledge systems -- context-specific local knowledge and institutional mechanisms such as cooperation and collective action; intergenerational transmission of knowledge, skills and strategies; concern for well-being of future generations; reliance on local resources; restraint in resource exploitation; gratitude and respect for nature; management, conservation and sustainable use of biodiversity outside formal protected areas; and transfer of useful species among the households, villages and larger landscape. These are some of the useful attributes of local knowledge systems. In the Russian Far East, traditional knowledge related to biodiversity conservation is as diverse as the region’s approximately 2503 communities and their geographical contexts, farming strategies, food habits, subsistence strategies, and cultural traditions.

In this paper, I examine the relationship between traditional knowledge and practices and biodiversity management in the light of contemporary research on traditional and formal knowledge systems. I also consider the recent developments in local knowledge research, and how local knowledge can be useful to address the biodiversity conservation.

Traditional knowledge and natural resource management in the Russian Far East

Overview of earlier scientific studies and publications

The ethnographer V.A. Podmaskin’s extensive, integrated, work on the systematization and description of the practical relevance of traditional knowledge (Podmaskin, 2006), includes a list of researchers who have made the greatest contribution to the study of traditional knowledge in the Russian Far East. The earliest information on traditional knowledge of the aboriginal peoples of

[4] In this discussion the term "traditional knowledge" is used interchangeably with “local knowledge” and "traditional ecological knowledge".

Siberia and the Russian Far East goes back to the 18th century, through the works of S.P. Krasheninnikov, G.V. Steller, and G.I. Shelikhov (for Siberia); and A.F. Middendorf, L.I. Schrenk, R.K. Maak, K.I. Maksimovich, L.I. Berg, M.I. Venyukov, N.M. Przewal'ski, and V.K. Arseniev (for the Far East). The modern researchers dealing with this topic include the following:

L..Ja. Shternberg (1925): carried out a comparative study on traditions and specificity of traditional knowledge of American Indians and aborigines of the Lower Amur and Sakhalin regions;

E.A. Kreinovich (1929): described the similarity in fine arts and in the counting system between Nivkhs and Australians, Indians, Chinese, and some peoples of Africa;

V.J. Nekrasova (1934): described the utilization of plants by the Ainu, Gilyaks and Oroch peoples;

A.M. Scherbak (1961): systematized the existing names of wild and domestic animals;

S.V. Ivanov (1954, 1963), P.J. Gontmakher (1988), and N.V. Kocheshkov (1995, 1997): described the process of obtaining traditional knowledge about flora and fauna among the Nanai, Nivkh and other peoples of Amur region;

L.I. Sem (1971): considered the spatial notion of Turkic, Mongolian and Tungus peoples in accordance with the specificity of their traditional economy;

G.G. Vostrikova and L..A. Vostrikov (1974): studied traditional medicine of Nanai, Ulchi and Udege peoples;

A.V. Smolyak (1976): collected information about the differences in the names of animals depending on their sex and age, the ideas about weather-signs and the methods of weather forecasting by Nanai and Ulchi peoples;

V.A. Turaev et al (2005): summarized information about ways of life of indigenous peoples of Russia;

A.F. Startsev (1994, 1996): summarized descriptive data about traditional life and ways of life of Udege and Nanai peoples in river basins of large rivers of Sikhote-Alin' mountains;

U.A. Sem and L.I. Sem (1988): presented vocabulary of Nanai language connected with plants;

G.A. Otaina (1994): discussed herbal treatment of Nivkh people based on the knowledge of many generations;

A.S. Kolosovskiy (1989, 1990): summarised customs and rituals of Nivkh people connected with fauna; and,

S.V. Bereznitskiy (1999) described the knowledge of Oroch people about fauna, flora, celestial bodies and phenomena.

In addition, a large body of information on traditional knowledge of the Evenk, Even, Eskimo, Nenets, Kety, Altaian, Buryat, Ainu and other peoples of Siberia in the following publications: A.F. Anisimov (1959); G.M. Vasilevich (1969); G.M. Mikhailov and B.B. Batuev (1972); V.A. Nikonov (1973); L.V. Khomich (1974); E.A Alekseenko (1974); G.A. Menovschikov (1974); Ju.A. Karpenko (1981); A.B. Spevakovskii (1988); N.K. Starkova (1990).

Traditional knowledge and livelihoods

The characteristics of the geographical environment (climate, relief, flora, fauna) have contributed to the origin of the concept of "feeding landscape" (Gumilev, 1990) and the main directions of adaptation of aboriginal peoples in different regions of the world to them (Tishkov, 2003). In the vast territories of Siberia and the Far East, Tungus-Manchurian and Nivkh peoples share similar geographical environments, forms of economy and way of life, animistic and mythological notions about the world and the traditional knowledge about forest. This knowledge evolved in the process of hunting, fishing, gathering under various conditions using a variety of existing food resources (Podmaskin, 2001; Sunik, 1985; Smoliak, 1984).

Traditional hunting practices, which vary with environmental conditions, were often shared and became common practices. Over time, these skills expanded with new knowledge, such as finding the right place for a summer or winter camps, building shelters in bad weather, making and keeping fires, and knowledge of animal behavior and the use of horses, dogs, hunting birds, traps, etc. The ability to find and make food in the wild is an equally important element of traditional hunting practices. There are also a wide variety of practices and means of transport used for hunting in the region. For example, the Orok people from the Far East use reindeer, while the Kety people from Central Siberia travel on skis, pulling hunting sledges behind them. Horses are popular in the south of Siberia, while dog sledges were used to hunt and move around the area in the North.

Traditional fishing practices, found throughout Russia, vary across regions and play different roles in local economies. Both fishing and hunting activities have also been an important source of knowledge about the environment. Success in these activities by indigenous peoples, and therefore survival, has always depended on good general knowledge of the environment as well as specific knowledge of numerous ecological and other natural phenomena—such as the migration routes of animals, birds, and fish, natural disasters, etc.

Researchers also note the cultural and adaptive functions of traditional natural resource management practices, which ensure the flexibility and their adequacy under changing environmental conditions. For example, it has been found that reindeer breeders switched to sealing during the periods of climate warming, returning to herding activities when it grew colder. Traditional resource management systems are often highly complex involving a combination of different forms of management in different landscapes of the same territory. They typically include combinations of different economic activities such as reindeer breeding, sea mammal hunting, commercial fishing (in inland waters or in offshore waters), and collection of wild and useful plants. The traditional economic complex of the northern settlements also includes various activities connected with processing of these resources.

The seasonal changes of plants also helped to determine when it was time to start hunting and other activities. For example, by changes in larch the Udege and Oroch knew that it was time to start fur hunting. The blooming of wild rose was indicative of the start of salmon spawning, while a rich harvest of Siberian pine nuts indicated good hunting prospects for fur and hoofeds The Udege people from the Bikin River basin are an example of an indigenous population that adapts its fishing and hunting activities based on an understanding of local ecological conditions; when salmon are abundant in rivers, for example, forest dwellers adjust by increasing their fishing activities and then drying and storing surplus catches for the winter months.

Indigenous hunters in the Russian Federation are well-adapted to life in the forests of Siberia and the Far East, and have long depended on hunting to provide not only food, but also materials for clothes, the home, and transport. Sustainable hunting and fishing play a key role in the economy of local and indigenous communities and have contributed to the conservation of the region's unique biodiversity. The indigenous communities of the Amur River area in particular have developed sound traditions of environmental conservation, which has played a key role in their forest-related resource use and livelihoods.

Hunters in the region have traditionally used their knowledge of forest, rivers, and mountain wildlife and its behaviour to improve their hunting skills, a necessity for the survival of their families. The indigenous peoples of the Lower Amur River and Sakhalin Island are famous for their fur hunting skills, for example; hunting in taiga forests has always been the preferred activity of the Tungus-Manchurian ethnic group (Turaev et al. 2005); and local professional hunters in Siberia and the Russia's European North have long used large areas to provide for themselves and their families. Trade of hunting products is also common in the region; the Nanai and Udege peoples, for instance, exchange reindeer antlers and ginseng for other goods.

V.K. Arseniev (1948) wrote: "Forest inhabitants of Ussuriiskiy region are the most skilful hunters in the world. They know all animals, knowledge of where and when they can find them, and in this regard they have no match throughout the Far East. Oroch and Udege peoples determine the likely location of animals in a forest based on the abundant of forage. Constant observation allows a hunter to predict the nature of migration of animals in different seasons, to notice their interconnection with natural phenomena such as snowfall, regular winds, and phases of the moon. "

These traditions had a noticeable impact on the conduct and culture of hunters, fishers, gatherers, dog handlers, and reindeer keepers. The elders considered any offense to nature leads to problems which come from the spirits of taiga, hills, rivers, lakes, seas and others. In indigenous communities, traditional rites were conducted to appease the spirits of animals and to ensure a successful hunt; these practices were closely connected with the cult of individual (totemic) species of animals such as whale, elk, bear, seal, wild boar, and tiger (Bocharnikov 2011).

The indigenous peoples of the Far East treated forest-related resources carefully. The Nivkh and Oroch people harvested firewood not with an axe, but with a boat-hook, by breaking dried branches from standing trees. They used brushwood and fallen and sunken (submerged) trees for heating, felling trees with an axe only when urgently required (Taksami and Kosarev 1986). The Udege, Olchi, and Nanai peoples considered it a greatest sin to pollute water bodies; it was common for them to remove windblown trees from berry fields and to burn the previous year's grass cover.

Forest-related cultural and religious traditions of indigenous and local communities

The connection between culture and environment is clearly realized by indigenous peoples. All indigenous peoples maintain the spiritual, cultural, social and economic ties with their traditional lands. For traditional societies, natural resource management is close to the everyday notion of "economy", but is more inclusive, involving the ecosystem as a whole and its spiritual dimensions. In studies of traditional natural resource management practices of indigenous people, interaction between resource use and all aspects of culture are emphasized.

Until the 19th century foreign scientists were ignorant and dismissive of the indigenous peoples' knowledge of their local flora and its utilization. An American anthropologist B. Lauder, a member of the North Pacific expedition in 1887, noted in his records that Nanai people borrowed floral motifs in the manufacture of clothes from the Chinese. However, the studies of the Soviet period (Ivanov, 1963; Podmaskin, 1991; Kocheshkov, 1995) showed that Nanai, Udege, Oroch peoples' crafts made from the bark often have images of local climbers, flowers, leaves, petals and stems. And the reason of the presence of stylized images of plants in the ornaments is a large role of plants in all spheres of life of indigenous peoples. Wild plants provided humans with food, medicines, dyes, tannin, and also the material for clothing, construction, vehicles, tools and household utensils. In the case of peoples who rely heavily on wild plants for food and medicine such knowledge includes a profound understanding of weather, ecosystems, habitats, individual plant species and their phenologies (see for example Sem & Sem (1988), Podmaski (1998), and Kreinovich (1929) on the botanical knowledge of the Tungus-Manchurian and Nivkh peoples). Such knowledge is essential for determining the timing and methods of collection, as well as storage and processing techniques for these products - activities practiced mostly by women and their children.

Customs and religious beliefs regarding nature among indigenous communities of the Russian North, Siberia, and the Far East have shaped the evolution of their traditional forest-related knowledge and practices. Indigenous peoples of the northern Eurasian region clearly identify the connections between their cultures and the environment. Animistic traditions, including the belief that human beings as well as animals and plants are endowed with spirits, support the idea of mutual respect and esteem between humans and nature. Totems play an important role in nature conservation in these indigenous cultures. In the past, peoples of the Amur River area considered the moose, otter, wild hog, bear, tiger, and other animals as totems, and prohibited or strictly regulated their hunting. Similar prohibitions and restrictions existed in this region for certain birds, snakes, frogs, and turtles, which were considered sacred. Some trees, including the birch, larch, and oak, also represented protective spirits. Furthermore, the indigenous peoples' names for wildlife species show that they believed in an interaction of animals, plants, and people. For example, the people living along the Amur River and in Sakhalin Island believe that plants have a 'soul'; therefore, one cannot break trees, or tear grass without a household purpose. The knowledge of plants was also used in the aboriginal arts: hunters found plants that can be used for making traditional musical instruments, for example.

Traditional taiga forest hunting by the indigenous peoples of Siberia and the Far East, including those of the Finno-Ugric peoples inhabiting European Russia, were once wide-spread among the forest-dependent peoples in the forests of the temperate zone. In the harsh conditions of the northern areas, indigenous peoples and local communities were highly dependent on forest resources for their subsistence. In these communities strict hunting restrictions developed over centuries. These included ban on hunting female ungulates, and designation of 'protected areas' where no hunting was permitted. The Finno-Ugric peoples based these bans on ancient religious beliefs, while the Russian people developed restrictions through community consultations.

The designation and protection of sacred natural objects and sites is the most ancient form of nature conservation, rooted in the pre-religious past of all peoples' cultures. In Russia these traditions are maintained only among some indigenous peoples who have not experienced conversion to more modern religions of one variety or another. Since the sacred places that remain within the limited lands managed by indigenous peoples of Russia have not lost their functional purpose even today, it is very important that the traditional social and cultural mechanisms that continue to provide protection to such places also be given protection and support. This is especially important as a preventive measure in the forthcoming denationalization of land ownership in Russia.

The protection of traditional forest-related knowledge and practices

The maintenance of traditional life support systems indigenous people of the North requires natural resource management supported by traditional values and knowledge. While traditional management practices may provide financial incomes, the emphasis should remain on use of resources for personal and family consumption rather than on profit maximization. To be sustainable, natural resource use should be based on traditional values, special skills and comprehensive knowledge about the local environment, using appropriate technologies, with the distribution of final products through traditional systems of exchange, i.e. among a large group of relatives and friends. In contrast to the industrial production which is based on a division of labor, traditional natural resource management may be considered as a special kind of *craft*, i.e. an activity in which each practicioner is involved in the whole production cycle, which requires a broad perception of the environment. Traditional natural management and life support may be considered as ecological basis for sustainable development of northern peoples due to these features.

Sustainable natural resource management within traditional societies has been possible where the size and density (and size) of the population remain within certain limits, and when individual consumption of natural resources is also limited. It also requires the survival of sufficient knowledge about nature and the utilization of natural resources, and the social regulation of resource utilization based on spiritual beliefs and attitudes. Sustainable natural resource management practices by indigenous peoples of the North have a long history in the wilderness of the tundra, mountains, taiga, and coastal regions. The monitoring system used by traditional sea hunters of the Eastern Chukotka peninsula, characterized by a high degree of organization and equity among groups, involves active use of traditional knowledge and practices of indigenous populations and consutative processes for decision-making among resource users.

Knowledge of surrounding vegetation and methods of rational utilization has been consistently reflected in the hunting, fishing and gathering activities of traditional communities in the past. Nowadays in connection with the study and conservation of biodiversity, this knowledge acquires the exceptional importance. Unfortunately, in Russia, as elsewhere worldwide, the loss of traditional knowledge and skills is widespread. The reduction of the traditional activities of indigenous peoples and the commercialisation of NTFPs for trade is a serious contemporary problem in most parts of Russia inhabited by indigenous peoples. Urgent action, including economic, social, environmental and legal measures, is needed to help address these problems.

A first step was recently made with the creation of an official list of places where indigenous peoples may live and follow their traditional ways of life. The list was imposed by a Russian Governmental Edict (# 631-p) on May 8, 2009. In accordance with this Edict, the approved list of activities which are considered as traditional included:

1. Animal husbandry, including migratory husbandry practices (reindeer breeding, horse breeding, yak breeding, sheep breeding).
2. Processing of animal products, including collection, and curing of hides, wool, hair, ossified horns, hooves, antlers, bones, endocrine glands, meat, and byproducts.
3. Dog breeding (sled and hunting breeds, and dogs for driving reindeers).
4. Animal breeding, processing and selling of animal breeding products.
5. Wild-honey farming, bee-keeping.
6. Fishing (including sea hunting) and selling of aquatic and marine biological resources.
7. Commercial hunting, processing and sale of hunting products.
8. Agriculture (market gardening), and also breeding and processing of valuable medicinal plants.
9. Harvesting of timber and non-timber forest resources for personal use.
10. Gathering (harvesting, processing and selling of wild food forest resources, collection of medicinal plants).

11. Extraction and processing of common minerals for personal use.
12. Art crafts and folk-crafts, including: blacksmithing, iron and steel trade, manufacture of utensils, equipment, boats, sledges and other traditional vehicles, musical instruments, birch bark products, stuffed animals and birds, fishing, souvenirs made of fur of deer and hunting animals and birds, and other materials, plaiting with grasses and other plants, knitting of nets, bone and wood engraving, sewing of national clothes and other crafts and folk-crafts related to the processing of fur, hide, bone and other materials.
13. Construction of national traditional dwellings and other buildings necessary for implementation of the traditional economic activities.

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OVERVIEW OF TRADITIONAL KNOWLEDGE FOR SUSTAINABLE USE OF NATURE IN KYRGYZSTAN AND CENTRAL ASIA

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Abstract

Территория Центральной Азии (ЦА) находится в поясе пустынь, полупустынь и сухих степей с минимальным количеством осадков. Горные системы в этом регионе становятся важным водообразующим элементом региона. Это предопределяет отношение к природным ресурсам, в том числе, к лесам. На данной территории можно выделить отношения как кочевой, так и оседлой культур народов ЦА и их влияние на сохранение и устойчивое управление лесами. Народы ЦА существующие на пустынных территориях имеют свои природоохранные традиции, которые позволяли им существовать в сложных климатических условиях продолжительное время. В охране лесных территорий ЦА большое значение играли сакрализация и наименование участков леса. В настоящее время традиционные знания практически не используются в системе управления лесами в ЦА. Существуют только единичные случаи использования тех или иных традиционных механизмов в управлении лесами на локальном уровне. Так же нет процесса сбора и распространения традиционных знаний, в том числе через систему образования. Все реализованные инициативы фрагментарны и не достаточны для сохранения потенциала традиций по экологически грамотному управлению природными ресурсами в странах ЦА. Нужен комплексный подход, основанный не только на сборе, восстановлении и хранении традиционных знаний, но и распространении этих знаний среди местного населения и защите прав местного населения на уникальные традиции, способные содействовать переходу Кыргызстана и всей Центральной Азии на путь Устойчивого развития.

Introduction

Central Asia encompasses an area of about 4 million km^2, located at the crossroads of Europe and Asia between 35-55° north latitude and 48-87° east longitude. It includes the new sovereign states of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, which declared their independence in 1991 after the collapse of the Soviet Union. The population of the Central Asian subregion is more than 59 million people, with an average population density of nearly 15 people per km^2 (Anonymous 2007).

The countries of Central Asia are dominated by dry habitats. Deserts and semi-deserts occupy the southern regions below latitudes 41–42° N. In the mountain systems of the eastern and southeastern regions—the Pamirs (in Tajikistan and Kyrgyzstan) and Tien-Shan ranges (including parts of Kazakhstan, Kyrgyzstan, and Uzbekistan)—moisture is absorbed from the upper atmosphere at elevations above the snow line, feeding the streams and rivers that flow into the Aral Sea and the Tarim basins, making agriculture possible over vast areas of the adjacent plains. All countries of Central Asia are united not only by common borders but also by the common cross-country network of water resources.

A wide variety of ecosystems are represented in the territory of Central Asia including deserts, steppes, meadows, forests, aquatic ecosystems and a variety of bordering landscapes, which are common for mountains. Forest and shrub ecosystems comprise up to 4.3% of the Central Asia territory (Shukurov 2008). The majority of the forests of Central Asia fall into the following groups: fir, spruce-fir, juniper, fruit and nut, pistachio, maple, poplar-willow, birch forests (Golovkova 1957).

The wealth of existing traditional knowledge and technologies for sustainable use of nature by Central Asian peoples reflect their cultural diversity and accumulated experience.

A profound historical background helps to explain the integration of traditional knowledge that can be seen across the Central Asia region. Our countries were linked into an integrated cultural and economic network - the Great Silk Road. Later these countries were included in the Soviet Union. The countries of Central Asia are still strongly linked by these shared historical experiences in socio-culturally and economical ways.

Considering the traditions of natural resource management in Central Asian countries during the pre-Soviet period, particularly forest exploitation, two patterns connected with traditional ways of life – nomadic or settled - can be distinguished.

The utilization of forest resources by the nomadic cultures of Central Asia well illustrates the expression - "nomad is an enemy of forest". The natural resources of greatest importance for nomads were water and pastures, while forests had lesser value. In some cases, forests were cleared by nomads to create additional pastures or water resources. The uses of forests by nomadic peoples were primarily extractive – wood for heating, manufacturing of wooden parts for yurts and other household utensils. Despite this the nomadic peoples also had their traditional customs and practices for nature protection. Forest lands belonged to certain communities and clans, and permission from the community was required for felling of trees. Some areas were named in honor of famous and respected people.

Although nomadic cultures had historically dominated in this area, there were traditions of forest management among settled communities in the region. In comparison with nomadic peoples, settled cultures in Central Asia have stronger traditions for, and greater interest in, forest resource conservation. This is not surprising given the greater reliance on natural resources close to their places of residence. For example, the inhabitants of permanent settlements in remote areas enforced strict bans on felling trees in the immediate vicinity of their villages. The harvesting of wood within a radius of 3-5 km from the village could result in the expulsion from the community, although collection of dead wood was permitted. These traditions remain to this day in some villages in Uzboe in the central part of the Karakum desert, where residents are heavily dependent on local natural resources (Anonymous 2006). For such communities the value of trees and forests for preventing soil erosion was well recognized. Stepped terraces found in Tajikistan have a thousand-year history; the use of terraces for cultivation of fruit and nut orchards, particularly in low rainfall areas, has been known to the inhabitants of this mountainous country since ancient times. In order to bind loose soils and windblown sands, which occupy rather large area in southern Tajikistan, farmers have traditionally planted forest shelterbelts of mulberry trees.

"Hanging gardens" techniques were developed by mountain dwellers (who lack sufficient arable land or irrigation water) to create small oases with fertile soil on otherwise poor lands on which it is possible to plant trees that will survive and grow during the hot, dry summer season. This technology was widely used in the mountain villages of Tajikistan during the pre-Soviet period. The essence of the technology is the enrichment of very poor, stony, highly erosion-prone soils with fertile silt from riverbeds, which is mixed with dung and used to fill holes created for planting seedlings of fruit trees and agricultural crops. This technology allows for an increased fruit harvest and serves to decrease soil erosion and the amount of water needed for irrigation.

Modern and past diasporas have permanently affected the evolution and sustainability of cultures. This influence is directly related to natural resource management, as all cultures have their own natural resourse management practices and mechanisms for controlling destructive activitities within their communities. The historical migration of peoples from Russia has had a great influence on Central Asian countries. Immigrants to the region brought their own cultural traditions, knowledge, and practices related to natural resource management. These were often very different (and less well adapted to local conditions) than those of earlier communities who had long resided in the region. For example, settlers from the fertile Chernozemic (“black earth”) zone of southern Russia arrived with a belief that forests could be harvested anywhere because natural regeneration would be rapid, which was not usually the case in the more fragile Central Asian environments.

In the midlands of Russia, peasants treated forest as a "their perpetual enemy" (Knize and Romanyuk 2005). This culture, transported with settlers to Central Asia, gradually transformed attitudes of local Central Asian peoples towards nature. These changes, along with the increased settlement of nomadic peoples in the region, eroded local practices and traditions of natural resource management and transformed Central Asian forest management without taking into account the local ecological conditions.

After the establishment of Soviet power in Central Asian countries the main principles and methods of forest management "came down" from the centre. Imposing a settled way of life among traditionally nomadic peoples was a major governance challenge of Soviet power, as management from the centre was virtually impossible under a nomadic way of life. (Anonymous 2006; Anonymous 2007).

At the same time, the culture of woodcutters, arising in Western Europe, spread throughout the world, including Russia and the countries of Central Asia, without consideration of the specific features of forests growing there (Gorshkov and Makarieva 2006). In the 1920s and 1930s, the official view of the economic value of forests was summarized as follows: 'standing forest never could be considered as goods because it hasn't exchange value and also until it is cut down it will not have using value' (Kalinin 1932). This view shows that the real value of standing forests was not taken into account (in forest policies and practices). As in other parts of the world, forest management focused on the exploitation and replacement of mature forests with forests established by planting seedlings on their place. In Kyrgyzstan, for example, all old trees in walnut, juniper, and spruce forests were harvested, followed by clearance and replanting with young trees to create even-aged stands, which were considered to be of equal or greater value than the mature forests they replaced (Shukurov 2008).

In recent years, attempts are being made to partially recover the lost traditions of nature management in Central Asian countries, including those related to forest management.

Methodology

The evaluation of traditional forest-related knowledge and forest management practices in the Central Asian countries presented below is based on limited published information available since the early 20th century (Anonymous, 2005; Shukurov, 2005; Balbakova, 2008). Available sources collected by the author considered only certain localities and topics, demonstrating the insufficient attention given to questions of traditional forest knowledge and forest management by the scientific community. Until 1920, rare indirect references on forest utilization are found in historical-geographical and ethno geographical descriptions of region of the Central Asia. All of these were published in the periodical «Turkistanskiye Vedomosty» (Turkistan Sheets). The more recent analysis of traditional forest-related knowledge and practices has been based on meetings and conversations carried in 2008-2009 with elderly local persons who shared their memories and experiences of their parents and ancestors.

Results and Discussion

The contribution of traditional knowledge to conservation and sustainable utilization of forest resources

At the present time there are several ways by which traditional knowledge contributes to forest conservation and management in Central Asia:

Sacralization of nature - elements of culture, traditions and beliefs contributing to forest conservation.

Protection of forest resources based on religious beliefs are characteristic of Central Asia, where the sacralisation of nature is expressed in cultural traditions and practices connected with particular species and sites. For example, one of the national traditions of the Kyrgyz people is reverence for holy sites. Here, the Abeliya bush (*Abelia corymbosa*), known as 'asa-musa' or 'Moses staff,' is considered sacred. Abeliya is strictly protected by traditional communities in the Tian-Shan mountain range. The shrub is imbued with religious significance, embodying the Source of Life, and pilgrims offer prayers and make special offerings by tying strips of fabric torn from their clothing to its branches. Forests surrounding holy places such as burial sites are also strictly protected, and tree planting in such areas is an important traditional activity.

Naming sites after people who are important for the community

In Central Asia, it was a common practice to name certain sites after famous people. Tracts of land and winter huts were commonly named after the man who settled there. Even certain trees were named, and these were protected from felling. In some walnut forests in Central Asia, local people still show with pride trees supposedly planted by Alexander the Great) or his soldiers, and springs created or visited by one saints. Such beliefs and practices, widespread in Central Asian countries, have helped to preserve many natural and cultural monuments, where activities such as tree felling and cattle were prohibited.

Utilization of forest products in traditional health practices;

Local people in Central Asia have long used plants in traditional medicine to treat humans and livestock. Kazakhs used more than 200 species of plants to treat various diseases of humans and animals. Soap made from ashes of various herbs and saxaul was used as antibacterial agents. For example, since ancient times such plants as Aconite Karakolsky (*Aconitum karakolicum* Rapes.), which grow in the area of spruce forests of Priissyk-Kul in Kyrgyzstan, have been used by local residents as a treatment for rheumatism, radiculitis, pulmonary tuberculosis and other ailments.

Among the most commonly used plants of medicinal value in this region are: dog rose (*Rosa canina*), oblong barberry (*Berberis oblonga*), felt burdock (*Arctium tomentosum*), karakol aconite (*Aconitum karakolcus*), jungar aconite (*Aconitum soongoricum*), and sea buckthorn (*Hippophae rhamnoides*). In southern Kyrgyzstan, where the world's largest natural walnut woodlands are found, local populations since ancient times have used both the fruits and leaves of the Circassian walnut (*Juglans regia*) for treatment and prevention of various diseases.

Utilization of forest products for food, manufacture of household goods, construction materials, and fuel.

Forest plants are widely used for food in this region, where unique methods exist for the drying and preserving fruits and berries. Many national dishes use forest plants, including spices and herbs such as Marshall's thyme (*Thymus marschallianus*), oregano (*Origanum vulgare*), and blue mint (*Ziziphora clinopodioides*).

The use of plants for preparation of dyes for wool and fabrics is widespread and has a long history in Central Asia. The plants most often used for dyes by local people are Circassian walnut, great nettle (*Urtica dioica*), juniper (*Juniperus*), and willow (*Salix*), among others. Some work has been done to preserve this traditional knowledge, including through programs carried out by such organizations as Helvetas Kyrgyzstan, the Central Asian Mountain Partnership Program (CAMP), and others.

The fruits and leaves of walnut are also used for preparing various dishes, and walnut wood is used for making traditional tableware and interior elements in houses. In some settlements local people still depend strongly on forest products for their livelihoods, particularly walnut. For example, in the settlement of Arkyt (Kyrgyzstan), the majority of social and cultural events in the lives of people are connected with walnut yields. In productive years people get married, build new houses and renovate existing homes and other structures; while 2-3 consecutive years of low walnut production can cause deterioration of living standards of families.

The traditional way of life of local people in this region is closely connected with the moderate utilization of natural resources. Such utilization is related to the strategy of survival of whole groups of villages. In mid-May the heads of settlements and clans gather for the annual spring *Kurultai*, where matters related to pasture yields, grazing area allocations and migration routes, and other matters important to the survival of the communities are discussed. Among nomadic peoples, the wood of dried apricot, willow, and other tree species is used for the construction of yurts, the traditional houses of nomads. Juniper wood is traditionally used for manufacturing of *beyshik* - cradles for infants.

Many nomadic peoples of Central Asia commonly use dry dung (from their domestic animals) as their principal fuel. In some places strict bans have traditionally been imposed on grazing in mountain and tugai forests (riparian forests of Central Asia, consisting mainly of poplar, willow, oleaster, tamarisk, giant grasses and herbaceous lianas). Also there is still a custom in some places after the birth of a boy to plant ten trees which he can use in the construction of his house in the future. These traditions have spread from the indigenously settled peoples of Central Asia.

In desert areas, the walls of settlements built during the construction of wells are strengthened by tree trunks, usually of saxaul (*Haloxylon*). Local residents gather saxaul, selectively over a very large area. In the Pamir region each family traditionally had its own forest site assigned by the community for collecting brushwood and firewood. Rules were also established that permitted brushwood and firewood collection only in autumn and winter (before Navruz Day); these activities were strictly prohibited during the spring and summer in order to not damage trees and shrubs during their growth period. Usually sites were used no more than one season, after which new sites were assigned amont families. (Anonymous, 2006). Re-utilization of sites for these collection activities was permitted only after an interval of 2-3 years. These regulations contributed to the protection of slopes from erosion. All wood carried by freshets, mudflows and floods were considered the property of the community distributed among families, with special days assigned for its collection.

Problems related to preservation and utilization of traditional knowledge in forest management in Central Asia

The traditions of utilization of such natural resources as pastures, water and biodiversity are the most well-studied for Central Asia. At present, however traditional knowledge is practically not used in the system of forest management in Central Asia. One important reason for this is that the family is no longer a strong institution for transmission of traditions related to the sustainable use of nature. As a result, there is a high risk of extinction of traditional knowledge, in particular that related to forest management. There are only isolated cases of utilization of certain traditional mechanisms in forest management at the local level.

The collection and study of traditional knowledge related to utilization of natural resources is not included in centralized programs of research institutions and universities in the Central Asian region. Specialized courses or educational modules on traditional knowledge in universities and schools have yet to be introduced. In some schools, however, there are courses that include elements of traditional knowledge implemented through the initiative of individual teachers. Unfortunately, the number of such initiatives is critically low.

Recently, partial information on traditional sustainable land and water use in the countries of Central Asia has been gathered within the framework of the Central Asian Mountain Partnership Program (CAMP). This work has resulted in the organization of an exhibition of nature conservation technologies, including traditional approaches. Among the traditional technologies documented, several practices of forest exploitation and management in Kyrgyzstan and Tajikistan are notable—for example, the terracing of slopes for tree-planting; the use of poplar as a rhizofiltrator on saline lands and a technique for creating 'hanging gardens.'

Recent work has also been carried out in this region to document and share knowledge on traditional medicine, and on the traditional uses of wild plants for food and for extraction of dyes. For example, within the framework of Global Environment Facility (World Bank) projects in western Tien-Shan, traditional conservation and utilization practices of 40 species of plants used in traditional medicine and for colouring hair and dyeing wool and fabrics was described (Orolbaeva 2003).

While helpful, such initiatives are not sufficient to preserve the traditions of environmentally friendly management of natural resources in Central Asian countries. There is a need of a comprehensive approach based not only on documentation and preservation of traditional knowledge, but also on spreading this knowledge among local populations, and giving greater protection to the rights of local communities to practice their unique traditions. Such comprehensive approach can assist the transition of Kyrgyzstan and other Central Asia countries towards sustainable development.

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CRITERIA FOR THE ECOLOGICAL AND ENVIRONMENTAL ASSESSMENT OF GREENHOUSE GAS EMISSIONS

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Abstract

Согласно прогнозам наиболее драматические изменения климата ожидаются в бореальных районах Северной Евразии. Для борьбы с нежелательным изменением климата были приняты важные международные соглашения – Рамочная конвенция ООН об изменениях климата и Киотский протокол. После ратификации Протокола Россией в 2005 году он вступил в силу. Красноярский край имеет огромные потенциальные возможности в выполнении Россией Киотского протокола, как в области сокращения промышленных эмиссий, так и в части регулирования землепользования и ведения лесного хозяйства. В основу работы по оценке влияния экосистем на глобальный бюджет основных парниковых газов было положено последовательное использование системного анализа и новейших научно-методических результатов по исследованию бюджета парниковых газов. Леса, которые занимают наибольшую часть территории края, являются одним из важнейших природных комплексов, обеспечивающих поглощение углерода. В целом леса Красноярского края содержат свыше 2 % запаса фитомассы лесов мира в сухом веществе, что делает их явлением глобального значения. Представляется необходимым системный анализ и разработка опережающей региональной нормативно-справочной базы мероприятий по противодействию климатическим изменениям, которые могли бы учитываться в рамках механизмов Киотского протокола. Отдельные научные разработки не могут полностью обеспечить потребности непрерывного учета эмиссий и поглощений парниковых газов из всех источников. Краю нужна постоянно действующая система инвентаризации эмиссий во всех классах земельного покрова. Радикальное решение проблемы видится в создании специальной интегральной системы наблюдений, для чего существуют достаточные научные и технологические предпосылки.

Introduction

According to generally accepted forecasts, the most dramatic climatic changes in the 21st century are expected to occur in the boreal regions of Northern Eurasia.

The world scientific community, and in particular, the conclusions of the 3rd and 4th reports of the Intergovernmental Panel on Climate Change (IPCC) generally support the view that climate change is anthropogenic. In order to counteract undesirable climate change, two important international agreements have been brought into force: – the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. After the ratification of the Kyoto Protocol by Russia (2005), it came into force. According to the Kyoto Protocol, Russia has undertaken a commitment not to exceed the level of anthropogenic emissions of greenhouse gases[5] reached by 1990. In 2006 the greenhouse emissions in Russia were approximately one third less than in 1990.

This gives Russia special opportunities, as the Kyoto Protocol has created important special economic arrangements for benefits associated with the fulfillment of national commitments to reduce greenhouse gas emissions. It is very important that all international negotiating processes on climate change are linked to the need to make transitions to sustainable development.

[5] Greenhouse gases include: carbon dioxide (CO_2), carbon monoxide (CO), methane (CH_4), nitrogen oxides (N_2O and NO_x) and nonmethane volatile organic carbons (VOC)

Methodology

In this study, we carried out a quantitative assessment of the basic greenhouse gas budgets of plant ecosystems using methods developed by the International Institute for Applied System Analysis (Austria) together with the V.N. Sukachev Institute of Forests of the Siberian Branch of the Russian Academy of Sciences (SB RAS). The combined use of system analysis and the latest methodological results of research into basic greenhouse gas budgets of vegetation guided this work. The landscape and ecosystem method of Shvidenko & Nilsson (2003) was used as the methodological basis, which provides reliable estimates of errors for intermediate and final results. The landscape and ecosystem method is used in two of its basic forms.

The first is based on an estimation of change of carbon stocks in ecosystems:

$$\Delta(C) = C_{\text{syst},\, t+\Delta t} - C_{\text{syst},\, t}, \qquad (1)$$

where $\Delta(C)$ = change of carbon stocks; $C_{syst,\, t+\Delta t}$ = volume of carbon stocks at the end, and $C_{syst,\, t}$ = at the beginning, of some period (Δt).

Storage of organic carbon within the ecosystem is estimated for plant phytomass (live plants biomass), detritus biomass (dead plant mass, in particular, large mill culls) and soils (including forest floor litter, carbon contained in peat and gleysols). In this research phytomass is divided into 7 fractions. This method for calculating changes in carbon stocks change through time is considered the most basic one by the IPCC. While this method enables the calculation of changes in ecosystem carbon storage in phytomass, it does not provide highly accurate estimates of other parameters, for example, estimates of soils carbon change.

The second method used is based on the measurement of element flows. The essence of the method is to estimate a net biotic ecosystems production (i.e., quantity of carbon absorbed by ecosystems over large territories during a period of no less than one year):

$$NBP = NEP - DC,$$

$$NEP = NPP - HSR - DEC - FLIT - FHYD, \qquad (2)$$

where *NBP* = net biotic production; *NEP* = net ecosystem production; *NPP* = net primary production; *HSR* = heterotrophic soil respiration; *DEC* = flow of carbon due to decomposition of large forest residue; *FLIT* = flow in lithosphere; *FHYD* = flow in hydrosphere; *DC* = flow due to natural and anthropogenic disturbances (e.g., forest fires or insect outbreaks).

A systems approach is the basis of this method. A plant ecosystem is considered the system of interacting units (vegetation and soil), each of which interacts with the atmosphere. These are divided into subunits: aboveground and belowground biomass; mineralizable and stable fractions of organic substances in soils. The pool of organic substance (e.g., carbon) in the units is formed and maintained through interaction of basic flows associated with net primary production (NPP), plant mortality and litterfall, decomposition of organic matter (phytodetritus), mineralization and humification of decomposing animal waste, mineralization of humus, etc. The keyword parameters of the carbon cycle are stock (density) of organic substances (in Mg (= tonne) C ha^{-1}), and intensity of flows (in Mg C ha^{-1} $year^{-1}$). Its critical characteristics are net primary production (NPP) – inputs of carbon from the atmosphere into the ecosystem; and heterotrophic respiration (Rh = HSR + DEC) – return of carbon to the atmosphere. Their ratio determines the value of net ecosystem production (NEP). The size of NEP is highly significant for biosphere balance calculations as it quantitatively defines the status of the forest ecosystem in the biosphere (as a stock for CO_2 atmosphere or its source into atmosphere).

Special databases and models were developed for the equation-based assessments (1) and (2) of indicators of the carbon budget. In the work the estimation of the total budget of the main biotic elements has been made on the basis of joining the methods (1) and (2) with the development of a required database, empirical models and algorithms.

Results and discussion

Database for the greenhouse gas assessment of the Krasnoyarsk region

An Integrated Geographical Information System (IGIS) for the territory of the Krasnoyarsk region is used as the database for the accounting of the main greenhouse gases. The IGIS consisted of a multilayered geographic information system including a map element (scale 1:1,000,000, to encompass the wide territory of the region) and relevant attributive databases. Base layers of IGIS include various maps (landscape, soil and others); the results of the remote of soils from space; numerous ecological, biological and other indicators of direct measurements and estimations, including the results of studies human activities. The region's territory is divided into 12 ecological areas (ecoregions) based on: 1) assessments of biodiversity of the Krasnoyarsk region's territory, 2) estimation of the numerous indicators dependent on the regional environment variations, and 3) a need for the development of the various geographically distributed models (Sokolov, 1997; Sokolov & Farber, 2006; Shvidenko, et al. 2000) (Fig. 1).

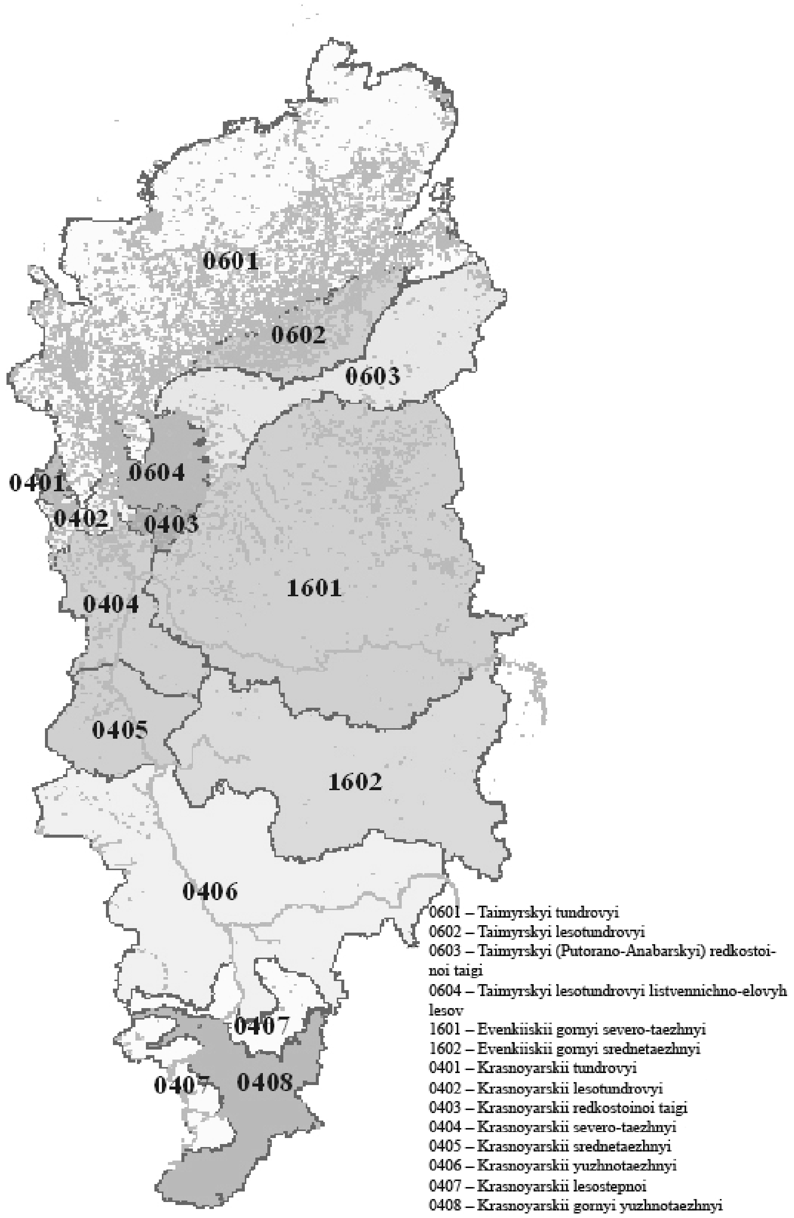

Figure 1. An example of one of the main layers of integrated land information system for the Krasnoyarsk region, with districts divided by ecological characteristics. Ecoregions were used for evaluation of regional distinctions of the environment, for estimating ecosystems' functioning, and for a structuring of greenhouse gas budget calculations. The adjoining ecoregions of the former administrative districts within the region's territory are included.

Since inventory data on land reserves across the Krasnoyarsk region were based on earlier measurements and estimations of unknown accuracy (more than a half the data on forest estates was based on a forest survey carried out more than 15 years ago), validations of land and forest inventory data were carried out in relation to the distribution of basic land cover classes of the region's territory. These validations helped to assure that the quality of the information conformed with the international codes. For this purpose, a comparison with satellite measurements data and other ground data was conducted.

As of January 2006, land areas totaled approximately 72.4 million ha in the Krasnoyarsk region (Table 1), 76.3 millioon ha in the Evenkiiskii autonomous region (Table 2) and 88.0 million ha in the Taimyrskii autonomous region (Table 3).

Table 1. Distribution of land reserves in the Russian Federation and the Krasnoyarsk region as of 1st of January 2006. *Source*: Official statistics data

Land category	Russia		Krasnoyarsk region	
	million ha	%	million ha	%
Forest estate lands	1103.1	64.6	58.0	80.2
Agricultural lands	400.8	23.4	8.6	11.8
Reserve lands	107.9	6.3	3.8	5.3
Lands of specially protected nature areas and sites	34.2	2.0	0.9	1.2
Water fund lands	27.8	1.6	0.6	0.8
Lands of settlements	18,9	1.1	0.3	0.4
Industry lands and lands for other special purpose	17.1	1.0	0.2	0.3
Total	***1709.8***	***100.0***	***72.4***	***100.0***

Table 2. Land reserves of the Evenkiiskii autonomous region (in thousand ha).
Source: Official statistics data

Land category	01.01.2005	01.01.2006
Agricultural lands	8.0	8.0
Settlement lands	1.7	4.0
Industry lands and lands for other special purposes	0.8	0.8
Lands of specially protected nature areas and sites	1,377	1,377
Forest estate lands	74,892	74,889
Water fund lands	–	–
Reserve lands	40.7	40.7
Total	***76,320***	***76,320***

Table 3. Land reserves of the Taimyrskii autonomous region as of January 2006.
Source: Official statistics data

Land category	Thousand ha
Agricultural lands	31,247
Settlement lands	17.1
Industry lands and lands for other special purpose (energy, transportation, communication, radio broadcasting, television, etc.)	12.6
Lands of specially protected nature areas and sites	7,314
Forest estate lands	23,689
Water fund lands	–
Reserve lands	25,713
Total	***87,993***

A comparison of available sources of information has shown that for the southern part of the united Krasnoyarsk region, the inventory data of lands and forests are quite reliable. The satellite observations used included: visual range products such as MODIS TERRA and MODIS VCF (resolution 500 m); Landsat TM (resolution 30 m, used for a part of the territory); radar imagery with the synthetic aperture JERS, ERS-1 and ERS-2 (resolution 20 m for the southern part of the region); MERIS-ASAR (resolution 150 m for the assessment of land cover in the northern part of the region); and others.

The necessary database for the evaluation of the main components of the carbon budget inventories (phytomass and primary production of ecosystems, wood detritus, etc.) have been set up. Much attention has been paid to the gathering and the evaluation of the information on natural and anthropogenic damage in the region's ecosystems as part of this analysis.

The main carbon and nitrogen storages in plant ecosystems of the Krasnoyarsk region

Forests, the main land cover class over the greatest part of the region, are one of the most important natural ecosystems for carbon sequestration. Therefore, our assessment of the impact on the greenhouse gas budgets of the region's forests, forestry management and forest industry, was been given special attention. In our analyses, forests have been defined by the existing forest management regulations. For example, shrubs growing in an environment where "high" forests cannot grow due to certain natural conditions were considered as forested lands.

Indicators relevant for assessing the budgets of the main greenhouse gases - wood detritus, current increase of actual reserves and gross productivity, etc. - were also determined for forests. Some important indicators were determined by independent methods as well. For example, forest phytomass was determined by the method and models described by Sivola et al., 1996 using the calculations of the forest estate in 2003 and the map of the region's land cover, based on satellite observations, and different kinds of background information. Calculations using the data from the governmental forestry fund accounting (GFFA) were carried out for each of the forest enterprises of the region. A summary of the administrative regions' data are presented in Tables 4 and 5.

In order to assess the dynamics of phytomass during the last decade a similar calculation was made based on the GFFA data of 1993 (see Table 5). According to these data, the forests of the Krasnoyarsk region contain 9.6 billion tons of dry phytomass (or more than 2% of the world's forests' phytomass stock). This makes the forests of the Krasnoyarsk region globally important. Over the last 10 years the phytomass stock has decreased by by an estimated 3.4%, mainly due to the decrease in the amount of forested lands and timber reserves during this time period (by 1.9% and 4.1%, respectively).

Using data on wood detritus in the region's forests (dead standing trees, dead fallen wood, stumps and dry branches of growing trees) the stock of carbon in this category of organic matter was estimated. For the same purpose, the data on forest management in the region's forests was used as results from other studes (Anonymous, 2002).

Organic carbon stocks in other vegetation compartments were determined on the basis of estimates obtained using satellite technology and databases of experimental observations carried out in the region and in adjacent regions. The carbon stocks in the phytomass of agricultural lands were calculated on the basis of the actual productivity of agricultural crops, including by-products (e.g., straw and roots for cereal crops).

Organic carbon stocks in soils were estimated based on the soil-type database of typical soil profiles. The database of mineral soils included forest litter and upper 1 m soil layer.

The most important aggregated data of carbon and nitrogen in plant ecosystems are summarized in Table 6.

Table 4. Phytomass of forests of the Krasnoyarsk region in 2003, according to GFFA data on forestry enterprises of the region (in Tg = 10^6 tons of dry matter).

Tree species and groups of species	Phytomass fractions, Tg dry weight of organic matter							Total biomass	GP
	Trunk	Bark	Branch crown	Leaves & needles	Roots	Young growth & under-growth	Field layer		
Krasnoyarsk region									
Conifers	2792.4	360.1	441.0	184.0	980.4	105.1	190.0	4693.0	291.5
Pine	754.2	73.0	118.5	46.5	270.4	16.6	80.4	1286.6	83.6
Fir	337.1	49.9	56.4	29.9	195.4	24.6	29.2	672.5	49.0
Silver fir	405.3	51.6	79.1	44.6	92.3	13.2	15.6	650.1	54.8
Larch	553.0	93.7	66.2	13.6	218.3	16.8	26.3	894.3	29.2
Cedar	742.9	91.9	120.8	49.5	204.0	34.0	38.5	1189.6	75.1
BLTs, incl.	777.4	130.4	165.8	32.8	271.5	36.4	57.5	1341.4	66.7
Birch	605.0	103.2	129.2	27.1	211.3	30.6	47.9	1050.9	55.4
Aspen	171.8	27.0	36.5	5.6	59.9	5.8	9.5	289.2	11.1
Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Shrubs	0.0	0.0	5.2	2.3	4.1	0.0	3.1	14.7	3.5
Total	**3569.8**	**490.5**	**612.1**	**219.2**	**1256.0**	**141.6**	**250.6**	**6049.2**	**361.9**
Taimyrskii autonomous region									
Conifers	46.6	8.9	7.5	1.8	25.3	5.2	12.8	99.2	8.5
Fir	5.5	0.9	1.1	0.6	3.7	1.0	1.4	13.2	1.5
Larch	41.1	8.0	6.4	1.2	21.6	4.2	11.4	86.0	7.0
BLTs	0.8	0.1	0.2	0.0	0.4	0.2	0.3	1.8	0.2
Birch	0.8	0.1	0.2	0.0	0.4	0.2	0.3	1.8	0.2
Shrubs	0.0	0.0	4.1	1.8	3.2	0.0	7.4	16.5	4.8
Total	**47.4**	**9.1**	**11.8**	**3.7**	**28.9**	**5.4**	**20.5**	**117.6**	**13.5**
Evenkiiskii autonomous region									
Conifers	1878.5	315.9	249.1	68.4	745.2	85.7	187.0	3214.0	168.9
Pine	202.2	23.5	24.0	15.5	43.6	5.5	29.3	320.1	28.9
Fir	43.8	6.5	7.4	3.8	25.4	5.1	5.8	91.4	7.7
Silver fir	1.1	0.1	0.2	0.1	0.3	0.1	0.1	1.9	0.2
Larch	1505.0	269.5	197.5	41.2	640.7	67.6	143.6	2595.6	118.9
Cedar	126.4	16.2	20.0	7.8	35.3	7.4	8.2	205.1	13.3
BLTs	88.4	16.5	19.6	4.2	38.8	8.3	12.9	172.3	11.9
birch	84.9	15.8	18.7	4.1	37.6	8.1	12.6	165.9	11.6
Aspen	3.6	0.6	0.9	0.1	1.3	0.2	0.4	6.4	0.3
Shrubs	0.0	0.0	10.7	4.7	8.3	0.0	24.8	48.5	14.6
Total	**1966.9**	**332.3**	**279.4**	**77.4**	**792.4**	**94.0**	**224.7**	**3434.8**	**195.5**

Note: GP – green parts (photosynthetic apparatus) of ecosystems, BLT - broad-leaved trees.

Table 5. Estimated forest phytomass in the Krasnoyarsk region in 1993 and 2003 (in Tg = 10^6 tons of dry matter).

Tree species and groups of species	Phytomass fractions, Tg, dry weight of organic matter							Total biomass	GP
	Trunk	Bark	Branch crown	Leaves & needles	Roots	Young growth & under-growth	Field layer		
Krasnoyarsk region 1993									
Conifers	4902.5	710.4	729.7	274.3	1807.6	209.5	414.1	8337.8	502.8
Pine	989.6	103.3	147.0	69.0	314.6	23.4	120.0	1663.5	124.0
Fir	441.5	65.7	74.2	39.2	257.0	32.5	38.6	883.0	64.4
Silver fir	457.1	58.1	88.8	50.1	104.3	15.1	17.6	733.0	61.7
Larch	2069.3	365.2	268.5	55.4	871.0	91.3	184.8	3540.3	156.7
Cedar	945.0	118.1	151.3	60.7	260.7	47.2	53.1	1517.9	96.1
BLTs, incl.	861.3	148.1	185.6	37.4	316.7	45.3	71.7	1518.1	79.7
birch	690.8	120.8	148.8	31.7	256.9	39.4	62.1	1229.7	68.4
Aspen	170.0	27.1	36.7	5.6	59.6	5.8	9.5	287.2	11.1
Shrubs	0.0	0.0	20.5	9.1	16.0	0.0	35.7	81.3	23.4
Total	**5763.8**	**858.5**	**935.9**	**320.9**	**2140.3**	**254.8**	**521.5**	**9937.1**	**605.9**
Krasnoyarsk region 2003 (total from Table 4)									
Total	**5584.1**	**831.9**	**903.3**	**300.3**	**2077.3**	**241.1**	**495.8**	**9601.6**	**570.9**
% change: 1993-2003	–3.1	–3.1	–3.5	–6.4	–2.9	–5.4	–4.9	–3.4	–5.8

Note: GP – green parts (photosynthetic apparatus) of ecosystems, BLT - broad-leaved trees.

From these data we can draw the following conclusions:

- The organic carbon stock in the region’s plant ecosystem's phytomass is 6.6 Pg (billion tons) of carbon; the main phytomass stock (85%) is concentrated in the region’s forests;
- There is a large stock of wood detritus (35.4% of the phytomass stock) with the territory of the region, mainly on the forest lands owing to a high proportion of uneven-aged forests and frequent creeping fire, leading to partial mortality, and low rates of decomposition of organic matter, especially in the northern areas of the region;
- The carbon store in the region’s soils has been estimated to be 40.3 Pg of carbon, with the ratio of soil carbon to carbon in vegetation being 4.5:1. For the forests of the Krasnoyarsk region, this value is 2.46:1, for Evenkiya’s forests it is 3.58:1 and for Taimyr’s forests it is 5.23:1;
- The total nitrogen stocks in the soils of the region has been estimated at 2.7 Pg; the average ratio of carbon to nitrogen in soils is 14.8:1.

The significant amounts of carbon in the soils (the above results also include the cryosolic part of the soil profile on the permafrost to the specified depth) and in detritus represent primary sources for increase in carbon emissions in the case of warming temperatures and melting of permafrost , as well as considerable emissions due to vegetation fires (Organizatziya…, 2009).

It was found that the amount of nitrogen in the vegetation was nearly equal to the amount of nitrogen in the boreal vegetation reported in the scientific literature. The ratio C:N of phytomass, calculated for all classes of vegetation, was 175 for aboveground tree biomass, 39 for green (photosynthetic) biomass, 91 for belowground (root) phytomass, and 117 for the whole phytomass. The variability of these parameters is large, although in general the results conform to the previously published data for the boreal zone (Organizatziya…, 2009). For example, the ratios C:N of vegetation measured in different parts of the polar latitudes areas have ranged from 18 to 70 in tundra, and from 50 to 180 in the boreal forests (the average for plant phytomass).

Table 6. Estimated organic carbon and nitrogen in plant ecosystems of the region

Indicators	Administrative regions			Total	Average, Mg C ha^{-1}
	Krasnoyarsk region	Evenkiiskii autonomous region	Taimyrskii autonomous region		
Area of production lands, million ha	69.16	75.47	76.16	220.79	
Phytomass, Tg C	3704	2201	730.5	6635	30.1
Including forests	3542	1871	230.1	5643	50.7
Wood detritus, Tg C	735.2	823.0	790.7	2349	10.6
Organic carbon of soils, Tg C	13815	12732	13742	40290	182.5
Nitrogen content in soil, Tg	996.1	924.5	801.2	2722	12.3
Ratio C vegetation/C soil	0.32	0.24	0.11	0.22	
Ratio C:N of soils	13.9	13.8	17.2	14.8	

Main flows of carbon and nitrogen in the ecosystems of the Krasnoyarsk region

Net primary production. Two main flows determine the carbon budget of ecosystems: net primary production (NPP) and heterotrophic respiration (DG).

The NPP of forest ecosystems in the region, estimated using the data of 2003 from the Governmental Forestry Fund Accounting, are considerable (see Table 7). According to table 7, forests of the region produce about 321 Tg C (million tons of organic carbon) per year which is stored in the phytomass of canopy cover. This currently accounts for 327 g C m^{-2} y^{-1} in the Krasnoyarsk region, 166 g C m^{-2} y^{-1} in the Taimyrskii autonomous region and 285 g C m^{-2} $year^{-1}$ in the Evenkiiskii autonomous region (Organizatziya…, 2009).

The NPP of forests has been estimated by a specially developed modeling algorithm which enables the avoidance of constant errors inherent in many methods of NPP estimation (Shvidenko et al., 2007). The need to develop a new NPP estimation method for forests appeared due to the fact that multiple measured results in the published works contained serious systematic errors (Shvidenko et al, 2008; Crow & Wieder, 2001; Vogt et al., 1986). It seems that negative systematic errors are also typical for NPP measurements in other classes of land cover, particularly wetlands. Sufficiently comprehensive measurements from the last few years are not numerous, and often contradictory. For example, according to previous NPP data for marshes, NPP of wetlands ranges from 100 to 280 g C m^{-2} $year^{-1}$ of which 15-20% is belowground. According to the results of careful measurements mace over the last few years in of Western Siberian wetlands, NPP averages of 270 g C m^{-2} $year^{-1}$ were obtained, but with a much higher proportion of NPP occurring belowground - between 40 and 52%. Estimated NPP in southern taiga wetlands are even higher, ranging from 350 to 520 g C m^{-2} $year^{-1}$. At the same time, results of experiments obtained much lower values. For instance, the average NPP for oligotrophic swamps in Tomskii region was 145 g C m^{-2} $year^{-1}$ in 1998-2000. In general, NPP of non-forest land cover classes was obtained using the data of field measurements originally collected in a database of N.I. Bazilevich (Bazilevich, 1993) augmented by the results of research of the last decade.

Table 7. Net primary production of the Krasnoyarsk region's forests, estimated using GFFA data (Tg C $year^{-1}$)

Tree species and groups of species	Phytomass fractions NPP, Tg C/year							Total NPP	GP
	Trunk	Branch crown	Leaves & needles	Roots	Young growth & under-growth	Field layer	total		
Krasnoyarsk region									
Conifer	10.7	4.1	31.3	36.8	11.9	23.9	118.7	316	44.4
Pine	4.4	0.9	6.5	6.2	1.6	9.3	28.9	286	10.7
Fir	1.0	0.6	4.3	7.9	2.6	3.5	19.9	323	6.5
Silver fir	2.0	0.9	4.5	4.4	1.8	2.4	16.0	267	6.0
Larch	1.1	0.5	7.4	6.8	1.3	2.7	19.9	302	8.9
Cedar	2.3	1.2	8.5	11.4	4.6	5.9	34.0	389	12.2
BLT, incl.	8.6	2.3	13.2	12.4	5.0	9.1	50.6	362	18.3
Birch	7.0	1.9	11.3	9.9	4.2	7.6	41.9	366	15.6
Aspen	1.5	0.4	1.9	2.5	0.8	1.5	8.6	346	2.7
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	457	0.0
Shrubs	0.0	0.3	0.4	0.2	0.0	0.2	1.1	183	0.5
Total	**19.3**	**6.8**	**44.9**	**49.4**	**17.0**	**33.2**	**170.5**	**327**	**63.3**
Taimyrskii autonomous region									
Conifer	0.1	0.0	0.5	0.6	0.4	0.9	2.6	144	1.0
Fir	0.0	0.0	0.1	0.2	0.1	0.2	0.6	321	0.2
Larch	0.1	0.0	0.4	0.4	0.3	0.7	2.0	124	0.8
BLT	0.0	0.0	0.0	0.0	0.0	0.0	0.1	290	0.0
Birch	0.0	0.0	0.0	0.0	0.0	0.0	0.1	290	0.0
Shrubs	0.0	0.9	1.1	0.4	0.0	0.5	2.8	189	1.3
Total	**0.1**	**0.9**	**1.6**	**1.1**	**0.5**	**1.4**	**5.5**	**166**	**2.3**
Evenkiiskii autonomous region									
Conifer	11.4	4.4	44.3	39.2	7.8	20.5	127.8	298	54.8
Pine	1.1	0.2	1.5	1.6	0.3	2.9	7.7	201	2.8
Fir	0.1	0.1	0.9	1.5	0.7	0.9	4.2	331	1.5
Silver fir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	211	0.0
Larch	10.0	4.0	40.7	34.5	5.8	15.6	110.5	307	48.7
Cedar	0.2	0.1	1.2	1.7	1.0	1.2	5.3	321	2.0
BLT, incl.	0.9	0.2	1.5	1.6	1.2	2.1	7.5	255	2.7
birch	0.8	0.2	1.4	1.6	1.1	2.1	7.3	253	2.6
Aspen	0.0	0.0	0.0	0.1	0.0	0.1	0.2	304	0.0
Shrubs	0.0	2.9	3.5	1.3	0.0	1.6	9.4	189	4.1
Total	**12.3**	**7.6**	**49.4**	**42.2**	**9.0**	**24.2**	**144.7**	**285**	**61.8**
Regional Total	**31.7**	**15.3**	**94.9**	**92.7**	**26.5**	**58.8**	**320.7**	**302**	**127.4**

Note: GP – green parts (photosynthetic apparatus) of ecosystems, BLT - broad-leaved trees.

Conclusion

The existing accounting system for greenhouse gases provided by the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and subsequent decisions of the Conferences of the Parties, is rather complicated and contains several provisions that require improvement and amendments. At the present time almost all decisions (e.g., on joint implementation projects) are made at the federal level in the Russian Federation. Such centralization is unnecessary, requires much time, and can lead to inefficient decisions. The existing (considerably incomplete) regulatory framework, and the consideration of the current joint implementation projects' practice cannot be applied to the characteristics of long-term projects (such as reforestation) and it requires serious modification.

System analysis and the development of an advanced regional normative and referral database of the activities counteracting climate change which could be considered in the framework of the Kyoto mechanisms, are required. The goals of such work are quite extensive: from the creation and implementation of the control system of greenhouse gas emissions at industrial plants to the legal selection of activities in land use, forestry and agriculture which could be incorporated into the economic mechanisms of a post-Kyoto agreement, and the selection of an evaluation procedure for emissions from these activities.

Scientific developments alone cannot entirely meet the requirements needed for continuous accounting of emissions and absorption of greenhouse gases from all sources. The Krasnoyarsk region requires a permanent operating inventory system of anthropogenic emissions (energy, industry, transport), and natural emissions in all classes of land cover. Such a system could be combined with the monitoring of pollutants and more generally of the state of the environment. Establishment of a special integrated observing system could be a radical solution to the problem. There is a sufficient scientific and technological background for it.

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Carbon stocks in the main Georgian forest formations

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Abstract

В результате проведенных исследований установлено, что в лесах Грузии запасы древесины составляют 923,6 т/га в абсолютно сухом состоянии, а общий запас углерода в ней – 462,1 т/га. Общий запас фитомассы (стволы, ветви, кроны, листья, корни) в лесах Грузии составляет 384,131 тыс. тонн. В них депонировано более 191,403 тыс. тонн углерода.

Introduction

During recent decades dramatic increases in concentrations of carbon dioxide (CO_2), methane (CH_4), nitric acid (N_2O), and other greenhouse gases in the atmosphere has increased global warming. This is resulting in such unfavorable processes melting of polar ice in the northers and southern hemispheres and sea level rise. Among the greenhouse gases that contribute to the global warming, CO_2 is most important as it determines 60% of the above-mentioned processes. Since the times of the industrial revolution up to the modern age concentration of carbon dioxide in the atmosphere has increased from 280 to 366 ppm. The increase of carbon dioxide concentration in the atmosphere has been caused by fastest growing industrial and mining activities, processing and burning of fossil fuels, decreasing area covered with forests, forest fires, among others. As a result, 6.6 x 10^{15} g. of C is added to atmosphere each year (Mann, 1986). Increasing concentrations of carbon dioxide in the atmosphere have led to increased efforts by scientists worldwide to study not only global but regional patterns of carbon storage and fluxes in terrestrial, freshwater and marine ecosystems. In this paper we report the results of research conducted to estimate carbon storage in the phytomass of the main forest types found in the Caucasus, specifically in Republic of Georgia.

Georgia is a mountainous country where the distribution of forest types is determined by altitudinal zonation of soils and climate. Sub-alpine forests between alpine and high mountainous forest zones between, located at 1900-2700 meters a.s.l., are relatively limited in their distribution. The more continental the climate and higher the mountains, the higher the upper elevational range of these forests in Caucasus ranges and slopes of Lesser Caucasus (Trialeti range). In western Georgia, under the influence of the sea climate these forests occur at 1900-2000 m to 2100-2150 m, while in eastern Georgia under continental climate conditions they occur at 2150-2700 m. The climate in sub-alpine zone is characterized by short cool summers and long cold winters. The length of the non-freezing season is 3-4 months. Average annual temperatures vary from 3.2 to 7.7 C^{o}. Average annual precipitation ranges from 1500-2000 with most falling during non-freezing period of the year.

Sub-alpine forests in Georgia are comprised of beech (*Fagus orientalis)*, maple *(Acer traitvetteri)*, birch (*Betula* verrucosa, *B. medvedevii)*, oak *(Quercus macranthera)*, pine *(Pinus sosnowskyi)*, Caucasus rhododendron *(Laurcerasus officinalis)* and juniper (*Juniperus spp.*). Pine forests are found only in parts of Caucasus range where the climate is more dry and continental. In Georgia such conditions exist in central part of the Caucasus range, where the climate is characterized by short, dry summers and cold winters with moderate precipitation. Average annual temperature of the area varies from 5.8 to 7.8 C^{o}. The mean temperature during the summer months is 15.2 C^{o}; in the coldest month (January), mean temperatures range from -3 to -5,8 C^{o} with an absolute minimum temperature of -31 C^{o}. During the winter, snowfall occurs on average 95 days. The length of the growing season in the pine forest zone is five months, less at upper elevations. During summer, absolute maximum of temperatures range from 35-38 C^{o}. An annual temperature amplitude of 62-66 C^{o} is indicative of the continental character of the climate. Average annual precipitation in these areas varies from 500 to 700 mm, most of which occurs in April, May and June.

Fir *(Abies nordmanniana)*are generally considered together with spruce *(Picea orientalis)* forests given the similar ecological conditions in which they coexist. Spruce-fir forests occur in conditions of moderate climate with cool summers and harsh winters, a growing season of 3-4 months, and average annual temperature varying from 3.7 to 6.1 C^o. Average temperatures in this forest zone range from -3.2 to -7.6 C^o in January, and from 12.4 to 16.8 C^o in July. Average annual precipitation varies from 788 to 1103 mm, with relative humidity of 75-81%.

Beech forests are another dominant forest type in Georgia occurring under more favorable climate, soil and site conditions that other forest types described above. Important differences are found among beech forests in western and eastern Georgia. Average annual temperatures vary between 4.2 and 12.2 C^o. with mean monthly temperatures ranging from -7,4 C^o in January to 21.1 C^o in July. Precipitation occurs primarily during the months of April and October. Climatic conditions in beech forests in western Georgia sharply differs from climate conditions of beech forest zones in eastern Georgia. In the west, the average precipitation ranges from 1500 mm (at Rikoti Pass) to 4000 mm (at Tsiskara) mm, and the length of the growing season is considerably longer than in eastern Georgia, while winter is relatively short and warm.

In Georgia, oak woods form a separate zone. According to V.Z. Gulisashvili Georgian oak (*Quercus iberica*) forests occur as independent subzones on southern slopes of the Caucasus range, and on the northern slopes of the Lesser Caucasus range in eastern Transcaucasia (Gulisashvili, 1977). The climate of this zone is moderately warm, with average annual air temperature varying from from 9.3 to 11.4 C^o, and temperatures during the coldest (January) and warmest (July) months ranging from 0.9-2.6 C^o and 19.8 to 23.6 C^o respectively. The number of snowy days ranges from 38-77 days, while the vegetation period lasts for six, or rarely seven, months. Annual precipitation totals to 432-742 mm.

Methodology

Estimates of carbon in the main forest ecosystems were determined by the volume-conversion method (Zamolodchikov et al., 1998) using national forest inventory data. Phytomass carbon reserves was estimated based on conversion coefficients specific to different fractions of phytomass in copses to wood stocks (Zamolodchikov et al., 1998). For areas covered with forests, calculation of phytomass and carbon reserves was carried out according to the follows formulae:

$$Ph_i = M_i \cdot \sum_{j=1}^{3} Ph_{ji} + S_i\, Ph_{ji} \qquad (1)$$

$$C_i = M_i \cdot \sum_{j=1}^{3} K_1 \cdot Ph_{ji} + K_2 \cdot S_i\, Ph_{ji} \qquad (2)$$

Where *Ph_i* = total reserve of phytomass t/ha;

i = age group of forest trees;

j = fraction (component) of copses;

M_i = wood stock; of i age group, M^3;

S_i = area covered with an age group of i, ha;

Ph_{ji} = phytomass of j fraction; age group of i, (conversion coefficients), t/ha;

$\sum_{j=1}^{3} Ph_{ji}$ = Sum of phytomass from branches, needle leaves & roots), t/ha; and

K_1, K_2 = transferable coefficients from phytomass to carbon; K_1 = 0.5 (coefficient for wood and roots); K_2 = 0.45 (coefficient for needle leaves and leaves) ;

Forest inventory data used for these calculations was obtained from fhe Forestry Department of the Ministry of Environment Protection and Natural Resources of Georgia (Ministry of Environment, 2006), and the Department of Statistics (Anonymous, 2006) according to different forest age groups.

According to non-categorized mass tables of major forest tree species of Transcaucasia, the distributions of phytomass (and carbon) among different tree components (branches, needle leaves, roots) and its content as a percentage were calculated using the following equations.

$$AGB = SB + GF \qquad (3)$$

Where AGB is reserve of aboveground biomass; SB = wood biomass; and GF = green phytomass;

$$SB = GS \cdot BD \qquad (4)$$

Where GS is wood stock, m^3; and BD = average density of wood, t/m^3

$$GF = SB \cdot K_f \qquad (5)$$

Where K_f is a conversion coefficient from wood stock to phytomass in crown, in accordance with non-categorized mass tables.

$$BGB = AGB \cdot R \qquad (6)$$

Where BGB is stock of belowground biomass, t; and R = Coefficient of stock in roots;

$$LWB = AGB + BGB \qquad (7)$$

Where LWB is stock of live biomass in forest stand; t

$$C_{total} = (SB + BGB) \cdot 0.5 + GF \cdot 0.45 \qquad (8)$$

Where C_{total} is total carbon stock, t; 0.5 is conversion coefficient of phytomass to carbon for wood and roots; and 0.45 is conversion coefficient of phytomass to carbon for needle leaves and leaves;

Results and discussion

Esimated phytomass and carbon in the major forest types of Georgia are summarized in Table 1. The greatest estimated biomass reserves among Georgian forests are found in the coniferous fir and spruce forests – 43.9 and 20.9 million tons respectively. In beech forests, which occupy 51.2% of the country's total forested area, total biomass equals 223.6 t per hectare while in other forest formations (oak, birch, pine, hornbeam, chestnut) total biomass varies from 33.0 t/ha (hornbeam-*Carpinus orientalis*) to 159.5 (chestnut-*Castanea sativa*) t/ha.

A maximum reserve of wood accumulates in fir forests – 260.4 t/ha; beech forests – 223.6 t/ha; and spruce forests – 208.4 t/ha. The maximum volume of stored carbon occurs in beech forests where more than 121 million t of carbon is accumulated. In dark coniferous forests, which occupy 12.6% of the total forest area about 33.4 million tons of carbon is stored. Based on our calculations, the total phytomass (including stems, branches, crown (leaves), and roots) in the main Georgian forest cenosis is estimated at 384.1 million tons, and net volume of stored carbon associated with this phytomass are estimated to be 191 million tons.

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Table 1. Estimated phytomass and carbon [in brackets] of main Georgian forest formations

Formations	Stand phytomass and carbon stock (t ha^{-1})						Total. area of forest type *(ha x 10^3)*	Total. phytomass and carbon stocks (*t x 10^3*)
	Timber			Crown (leaves & needles)	Roots	Total. stand phytomass		
	Stem wood	Branches	*Total*					
Beech *(Fagus orientalis)*	123.6 [61.8]	40.8 [20.4]	164.4 [82.2]	9.9 [4.5]	49.3 [24.7]	223.6 [111.4]	1,089	243,216 [121,173]
Oak *(Quercus macranthera, Q. iberica)*	55.2 [27.6]	16.5 [8.3]	71.7 [35.9]	4.4 [2.0]	25.1 [12.6]	100.9 [50.3]	248.3	25,051 [12,488]
Hornbeam *(Carpinus caucasica)*	63.6 [31.8]	17.2 [8.6]	80.8 [40.4]	5.1 [2.3]	24.2 [12.1]	110.1 [54.8]	192.4	21,188 [10,546]
Fir *(Abies nordmanniana)*	139.6 [69.8]	47.5 [23.8]	187.1 [93.6]	20.9 [9.4]	52.4 [26.2]	260.4 [129.2]	168.6	43,901 [21,782]
Spruce (*Picea orientalis)*	115.0 [57.5]	42.5 [21.3]	157.5 [78.8]	11.5 [5.2]	39.4 [19.7]	208.4 [103.7]	100.2	20,875 [10,388]
Pine (*Pinus sosnowskyi*)	56.3 [28.2]	15.8 [7.9]	72.1 [36.1]	5.1 [2.3]	20.2 [10.1]	97.4 [48.5]	91.9	8950 [4457]
Chestnut *(Castanea sativa)*	90.2 [45.1]	27.1 [13.6]	117.3 [58.7]	7.2 [3.2]	35.2 [17.6]	159.5 [81.1]	74.5	11,890 [6046]
Hornbeam (*Carpinus orientalis*	19.4 [9.7]	5.2 [2.6]	24.6 [12.3]	1.0 [0.45]	7.4 [3.7]	33.0 [16.5]	42.3	1397 [699]
Alder *(Alnus barbata)*	37.9 [19.0]	10.2 [5.1]	48.1 [24.1]	3.0 [1.4]	14.4 [7.3]	16.5 [32.7]	117.0	7663 [3826]
Total			**924 [462]**				**2123**	**384,131 [191,403]**

Note: Conversion factors used to calculate total C for all biomass components and forest types based on photomass estimates: 0.5 = coefficient for wood and roots); 0.45 = coefficient for leaves and needle leaves.

ROLE OF FLOODPLAIN FORESTS OF TALAS RIVER BASIN IN BIODIVERSITY CONSERVATION.

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Abstract

Статья затрагивает проблемы значимости биоразнообразия для устойчивости экосистем и роли лесов Кыргызстана в их сохранении. Рассматривается современное состояние пойменных лесов Таласской долины. Традиции воспитания любви к природе у кыргызов передающиеся с древности. Мысли философа Асан Кайгы об охране, защите природы. Галерейные леса, лесистость, тугаи, рекреанты, лесонарушение, вторичный лес

Introduction

The natural world of Kyrgyzstan is rich and diverse; its beauty gives true esthetic pleasure to man. For centuries the Kyrgyz determined the harmfulness or usefulness of plants and animals, and observed natural phenomena in order to meet their needs. Historically, an attentive and careful attitude towards natural vegetation came naturally for the breeder-nomads of Kyrgyzstan, illustrated by the popular saying: *Osumdugu joc, jer olum manan barabar* ("land without plants is like lifeless space"). Compassionate and life-wise Kyrgyz elders have often told us that living creatures do not bring any harm to a man. On the contrary, they are very necessary for people because they have been created by nature: "*Har bir zhandykty zharatylysh bekerinen zharatkan Emes" ("Nature created a variety of animal species not for nothing"*). If a snake crawled into a house and did not leave it for a long time the Kirghiz people would place a flat cup of milk before it. Everyone tried not to be "*mykaachy*" – bloodthirsty person, which is killing innocent creatures (Baibosunov, 1990).

Living in the rough mountain conditions taught the Kyrgyz to value plants not only as fodder for their cattle, but also as a necessary addition to their own nutrition and for treatment of diseases (Baibosunov, 1990). In ancient times, the nomadic philosopher Asan-Kaige, who is well-known among Kyrgyz and Kazakh peoples, advised that we must maintain what the nature has created in order to preserve the total harmony of our world. He also emphasized the usefulness of all living things in nature. He was so right. His thoughts are in keeping with our time.

According to E.J. Shukurov "... in nature there are no selected species, worthy of conservation, and there are no useless species, with the loss of which we can reconcile. All of them are essential parts of a sophisticated mechanism of the biosphere, which constantly, every hour, every second creates from a non-life - Life. Man completely depends on this process. He himself is not able to perform the functions of the biosphere and in this regard he is not self-sufficient. Of course, he can remove a ship to plummet, on which he floats, but then he would inevitably sink" (Shukurov, 2007).

In order to maintain the Earth's biological diversity, it is of paramount important to preserve their habitats, the planet's natural ecosystems. Among the Declarations and Conventions agreed upon at the UN Conference on Environment and Development in Rio de Janeiro (1992), two of them were devoted to biological resources and the conservation of biological diversity. They are "Statement of Principles on Forests" and "Convention on Biological Diversity. (Sytnik et al.,1994). Along with the economic and social aspects of biodiversity conservation the ecological importance of this problem was emphasized in these agreements. It was noted that without the conservation of biodiversity sustainable development is impossible (Voronkov, 2000).

Status of Kyrgyzstan's forest ecosystems and biological diversity

The territory of Kyrgyzstan comprises only 0.13% of the Earth's land surface, but is rich in biodiversity. This territory is inhabited by 3500 faunal species (about 3% of the world's total), and more than 7400 species of plants. This rich biodiversity is due to a physical-geographical variability of the territory, from the glacier-covered mountain ranges to the arid river valleys. Due to the complexity of relief and a certain isolation of the territory from surrounding countries, the republic's biota includes an estimated 230 endemic species of flora and fauna. These rates of endemism are higher than the average for Central Asia, which attracts many interested researchers.

Kyrgyzstan's rich biodiversity exists at both the species and at the ecosystem level. The concentration of species per unit area exceeds those of many temperate-zone countries, as well as the global average. There are more than 20 categories of natural ecosystems which occupy more than a half of the country. The high degree of biodiversity and the relative protection of wildlife determine the general stability of the environment. The maintenance of ecological balance is important not only for Kyrgyzstan itself, but also for the neighboring countries, where the natural communities are fragmented over approximately 80% of the territory. Retention of precipitation and maintenance of freshwater resources also depend on the degree of preservation of natural ecosystems. Freshwater resources originating in Kyrgyzstan provide more than 40 cubic kilometers of water to neighboring countries (Shukurov, 2007).

The country's biodiversity is concentrated in a variety of forest landscapes (principally juniper, spruce, nut-fruit, and floodplain forests) which occupy small proportion (4.2%) of the total area area. Despite the fact that forests occupy less than 5% of the country's area, they support about half of Kyrgyzstan's species diversity (Shukurov, 2007). For this reason the country's forests are enormous importance for the sustenance of the region.Over the last 50 years more than a half of forest land has disappeared in the territory of the republic, and the remaining forests are fragmented among separate territories. There is a strong possibility that we could irretrievably lose forest ecosystems in the near future. But despite this, many forest ecosystems remain intact and are still able to self-regenerate.

Despite measures taken by the State including the ratification of the Convention on Biological Diversity (in 1996), a package of laws to support biodiversity, the Kyrgyz Republic Biodiversity Strategy and Action Plan (1998), other laws passed since 1992, and the establishment of 6 reserves and 8 national parks, virtually all natural ecosystem in the country, are subject to human activities.

Increasing anthropogenic impacts on the environment are leading to impoverishment of biodiversity in ecosystems of Kyrgyzstan. In 1985, 65 species of higher plants, 5 species of insects, 2 species of fish, 3 species of reptiles, 20 species and subspecies of birds, and 13 species and subspecies of mammals were included in the IUCN Red Book for Kyrgyzstan. In nearly all reservoirs, ichthyofauna has been altered, and 21 of 54 species of fish are non-native. 71 species of flora are classified as endangered, as are 122 species of animals, 67 species of which are listed in the Red Book. Continued unregulated commercial hunting and poaching contributes to this ongoing loss of Kyrgyzstan's faunal biodiversity.

Concern about rare and critically endangered species of animals and plants prompted preparation of of lists of rare and endangered species of animals and plants 1985 and 2007. The methodology used for classification of data on rare species by the international program of IUCN (for the Red Book listings) was adopted by the scientists of Kyrgyzstan. For more than 4 years field studies were conducted in most regions of Kyrgyzstan to estimate the state of rare and vanishing species of animals and plants. To approve the resulting lists of rare and endangered species a commission of representatives of public institutions was formed that included first the State Agency for Environment Protection and Forestry, the Academy of Sciences of the Kyrgyz Republic, representatives of science, non-governmental organizations, and others. After scientific approval, a number of meetings were held prior to approval of this document by the government. In 2008, a 2nd edition of the Red Book of Kyrgyzstan was prepared with the assistance of FAO program for forests (Ionov & Lebedeva, 2003; Shukurov, 2007)

Compared to 1985, the 2008 Red Book lists an additional 18 species of higher plants, 13 species of insects, 5 species of fishes, 2 species of amphibian, 5 species of reptiles, 37 species of birds, and 10 species of mammals. While this suggests an increase in the numbers of endangered species, although scientists who have worked on the new edition of the Red Book say that the situation is not so dire. The increase in the number of species in the new Red Book list for Kyrgyzstan does not necessarily mean that that there has been an actual increase in the number of species threatened with extinction. For some newly included species, there is evidence of significantly deterioration in their populations since earlier assessment. However, for many other newly listed, species, their inclusion indicates a better understanding of their population status: species which were formerly considered as relatively abundant were found to be less secure as a result of more complete research. Furthermore a species which is relatively common in Kyrgyzstan, may be endangered on a global scale and must also be provided with proper protection, especially if it is included in the IUCN Red List).

Floodplain forests and their importance

In the work discussed above, field studies and evaluation of data for determination of the conservation status of Kyrgyzstan's fauna and flora did not include assessments of the country's bottomland ecosystems. In the present study, we evaluated the characteristics and conservation status of these important ecosystems based information available from the National Statistical Committee, the State Agency for Environment Protection and Forestry, published works of the Academy of Sciences of the Kyrgyz Republic, and reports of international initiatives and other projects.

Floodplains of the majority of large and small rivers throughout the country are occupied by gallery forests dominated by species of poplar, willow, sea buckthorn, birch, and ash. Other tree and a variety of shrub species are also characteristic of these formations. These gallery forests are the habitat of many species and play important water regulation and river/streambank protection roles.

There is also a zonal distribution of species among these forests. The lower parts of mountain rivers are dominated by shrub riparian forests formed by tamarisk (*Tamarix* spp.), while upland sites are dominated by German (or false) tamarisk (*Myricaria germanica*) a thorny shrub. Middle elevation riparian forests may include tree species - willow, ash, and poplar. Further upstream they include *Betula* species – Tien Shan birch (*B. tianschanica*) and Turkestan birch (*B. turkestana*) birch. In many floodplain sites walnut (*Juglans regia*), hemispherical juniper (*Juniperus ashei*), apple (*Malus* spp.), alycha (*Prunus divaricata*), maples (*Acer* spp.) and hackberry grow together with floodplain species, and on the floodplain of Chychkan River Schrenk's spruce (*Picea schrenkiana*) is found. The grass cover in these forests is ample and heterogeneous.

The floodplain forests of the Talas valley play an important role in biodiversity conservation. The Talas is a transboundary river with a number of tributaries located in the north-central region of Kyrgyzstan. It stretches for 217 km through the territory of Kyrgyzstan into Kazakhstan, where its flow is diminished before disappearing in the sands of Kazakhstan's Muyunkum Desert. Riparian forests occur along the Talas at altitudes of 700 to 1800 meters, with the majority of forests clustered between the villages of Minbulak and Chatbazar. They are highly degraded in the vicinity of settlements and constantly subjected to anthropogenic influence. The width of the floodplain covered by thes forest varies from 120 meters up to 1.5 km. In order to protect biodiversity in these forests the 2511-ha Talas Complex Reserve has been established. In addition forest areas have been designated which are management for economic purposes. Grass cover within these riparian forests is dense due to good moisture availability, although the soils are poor in humus. Various hardy shrubs, which can form dense impenetrable stands, provide excellent protection against soil erosion and cover for wildlife. These moist sites provide important habitat for many species of birds and mammals.

Despite the protection given to these forests, local people manage to graze cattle, to cut down trees, and use some lands near forests for farming. Riparian forest are favorite places for recreation for the people of the valley and very often forest fires are caused by holidaymakers. Floodplain forests were also subjected to intensive anthropogenic influence in the early 1990s during the period of economic hardshiop in the country. Despite prohibitions, many residents used these forests as sources of fuelwood to heat their homes in winter, and harvested berries, mushrooms, and birch sap and caught fish from the river. Currently, as a result of increased controls over forest use (including imposing of fines), and improvements in the standard of living in these areas (due to some extent to expanded cultivation of beans for export), anthropogenic impact on riparian forest has weakened somewhat. In many territories where riparian forests have been felled even-aged stands of various tree species have been planted, which do not fulfil all of the ecological functions of natural forest ecosystems. The reduction of the area of natural forests and the increase of the area of secondary forests has led to the undeniable impoverishment of riparian forests' biodiversity in the Talas valley, a reduction in the role of these forests in maintaining the environmental sustainability of floodplain ecosystems.

Conclusion

Riparian floodplain shrub and forest formations play an important role in maintaining the stability of river and stream-banks. With the degradation and loss of these vegetation formations, damage from floods and mudflows will increase. On the other hand, the amount of precipitation retained by forest vegetation will decrease, springs and streams will dry up, and water flow in small rivers will be reduced, some becoming only temporary watercourses. The stabilizing effect of forests on climate and hydrology will cease. Artificial planting will not compensate for the loss of natural forests, because they themselves may be sources of environmental instability, and because they lack the stature and complex structure that contribute to the positive environmental benefits associated with intact riparian forests. Actually these planted forest stands are typically located 50-100 meters from the river edge.

Today, we have a small number of healthy, intact riparian forests and woodlands. Their continued loss represents an significant threat to biodiversity conservation in Kyrgyzstan. However, thanks to favourable moisture conditions that characterize these habitats, there is a high potential (relative to mountain forests) for their natural recovery and restoration of their biodiversity if the remaining riparian forests are effectively preserved

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BIODIVERSITY OF MOUNTAIN FOREST ECOSYSTEMS SUPPORTING THE SOCIO-ECONOMIC WELL-BEING OF LOCAL COMMUNITIES IN SOUTH-EASTERN TAJIKISTAN

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Abstract

Леса в системе природопользования, должны рассматриваться не как потребляемый ресурс, а как среда обитания, растительных и животных организмов и их сообществ, экологическое благополучие которой необходимо для жизни человека. Сложность сохранения ценных горных лесов, часто обусловлена низким уровнем социально-экономического развития территории. Но деградация лесов ухудшает жизнь местного населения, увеличивая бедность. Вместе с экосистемами, деградирует общество. Есть ли выход? Хороший практический опыт совместных усилий общественности на примере Шуробадского района Таджикистана, демонстрирует НПО «Ноосфера» с примерами и расчетами возможных перспектив. Охрана и пользование лесными ресурсами организуются для того, чтобы предупредить нарушения процессов естественного развития лесных экосистем и без нужды не вмешиваясь в них. Есть возможность, но нужна заинтересованность. Заинтересованность местных общин в сохранении лесов связана с их экономическим и социальным благополучием. В докладе, на примере одной территории Таджикистана, предлагается обзор о том, как наработанные теоретические подходы реализуются на практике и кому это надо.

Introduction

The forests of Tajikistan are a important part of the world's natural wealth. Despite the costs of economic development and environmental policy, at the present time Tajikistan has maintained its unique natural forest ecosystems and their biological diversity. Forests are a strategic resource of the country, ensuring the survival of local population and future generations. They are also a valuable environmental resource, exerting favorable influences on climate and the water regime of rivers, and help to prevent soil from erosion by wind and water (Mahmadalieva et al., 2003; Novikova et al., 2003).

Although the percentage of forests and woodlands in the country is small (3%), all of Tajikistan's forests have a great environmental importance. All forests are the property of the state. The total area of the state forest fund is 1.8 million hectares (of which 410,000 ha are forested), or 13% of the entire territory of the country. Of the total forest area, 90% of are natural forests occurring in mountain areas; the remaining 10%, i.e. about 50 thousands hectares, are planted forests (Safarov, 2005; Anonymous 2009)

The country's forests are high in biodiversity, with a total of 268 tree and shrub species, 26 of which are listed in the Red Book of Tajikistan. The distribution of the country's major forest types are shown in Figure 1.

However, due to financial and technical constraints, forest management, has been neglected for many years. Further, the technical quality of reforestation efforts have decreased over the years, which directly affects the survival of forest crops and their further growth, development and preservation.

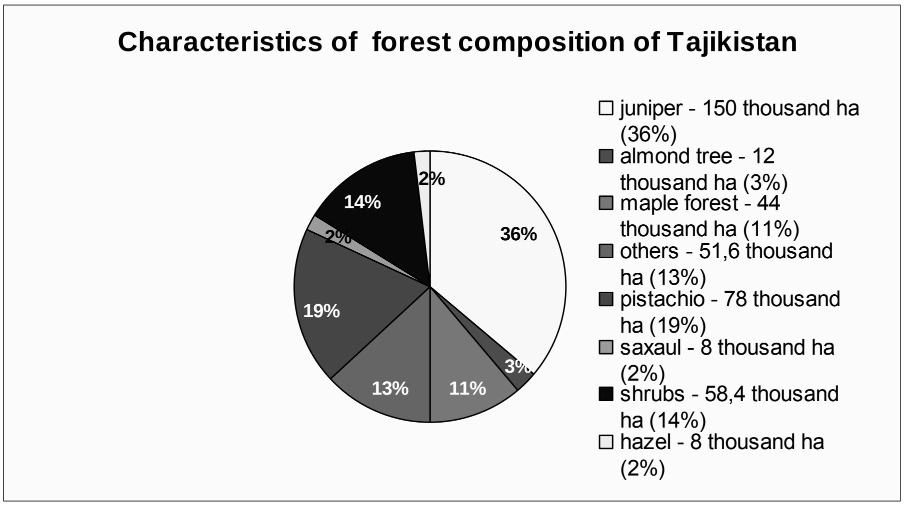

Figure 1. Major forest types comprising Tajikistan's total forest and woodland area.

Forest degradation and deforestation have increased considerably in various regions of the country during the last decade, including areas that are the habitat of valuable wild fruit and genetic resources. As natural forest ecosystems are degraded, they are being replaced by ruderal or introduced exotic species in some areas.

The condition and quality of forests in Tajikistan has been influenced by natural processes, such as climate change, as well as anthropogenic factors, associated with meeting the energy and food needs of the country's population. These include large-scale illegal felling of trees, unsystematic and excessive grazing on public forest lands; expansion of cultivation in mountainous areas to grow grain and other crops, and tree felling for the construction of mountain villages.

Poverty of the population in addition to the absence of property (i.e., land) rights underlie the rise in illegal felling and excessive harvest of non-timber forest products from which local people obtain at least some profit (in the case of wood products), or direct use nutritional and health benefits in the form of additional food resources (seeds, fruits, wild food plants), and medicinal plants collected from wild sources (figs. 2 and 3).

Currently Tajikistan is interested in improving the productivity of mountain forests, and in the conservation and enhancement of forested parts of the country to enhance their environmental and economic benefits. At the state level some strategic documents have been approved, in which the improvement of the condition of forests are clearly identified as a priority. Still lacking, however, are viable mechanisms to address these problems. The current legislation pertaining to these issues remains to be improved and updated, which exacerbates the weakness of administrative mechanisms for the implementation of laws and regulations.

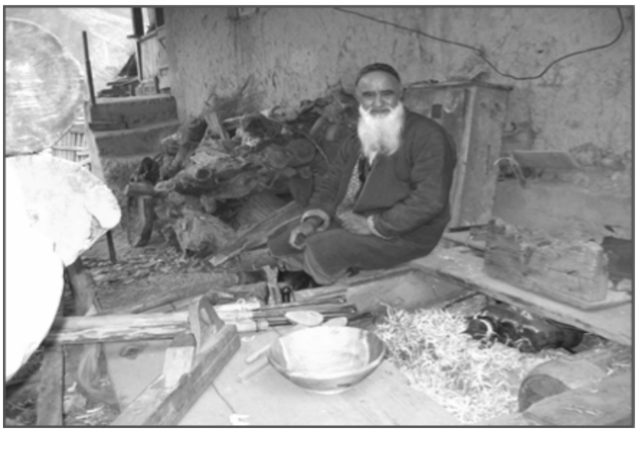

Figure 2. Local traditional crafts are an important source of income in many communities

Figure 3. Local communities are highly dependent on limited forest and woodland resources for their fuelwood and fodder needs.

There is a very urgent problem of life-support for local, mostly very poor, people living in mountainous forest areas who are directly dependent on forest products for their livelihoods. As population growth, and poverty, in mountain areas increase so does forest exploitation for short-term economic benefit, since there are currently few if any alternatives for economic development aside from exploitation of natural resources. Outstanding issues and disputes related to land utilization in forest areas creates conflicts between local administrations and people which complicates state control and enforcement of environmental and forestry legislation.

Unfortunately there are practically no mechanisms for public forest management in the country. In addition, there is an insufficiency and in some areas even complete absence of educational activities on the value of forests for the population, including both cultural and aesthetic values, or training programmes for local people to promote sustainable forest resource management practices. The development of mechanisms for involving local communities in reforestation and sustainable exploitation of forest ecosystems is urgently needed to help balance the socio-economic wellbeing of local people and sustainable management of forest resources.

However recent initiatives for community involvement in reforestation and conservation of mountain forests have been implemented during the last three years. These projects, discussed below, have been quite effective in demonstrating the benefits of sustainable forest management.

Project background

The activities described in this paper were initiated as part of the Dashtidzhum Biodiversity Conservation Project funded by the World Bank's Global Environment Facility. Within the framework of this project the Environmental Association NGO "Noosphere" has worked with communities on awareness-building and implementation of small grants to communities aimed at development of environmentally friendly business in a remote mountainous area near protected natural areas. (Anonymous, 2008; Anonymous, 2010)

Location and characteristics of the project area

The project area is located in southern Tajikistan on the border with Afghanistan (Fig. 4). The relief is high-altitude (Hazratishoh mountain ridge), sharply dissected, with an elevational range of 700 to 3,500 meters a.s.l. The area includes 5 types of natural ecosystems of global importance for biodiversity conservation. The majority of forests of the mid-elevation mountains within this area are subject to economic exploitation.

Throughout the project area the composition and structure of forests are becoming increasingly fragmented, especially in areas where native pistachio trees (*Pistacia vera*) are found (Fig. 5). Measures to protect and improve forest condition are urgently needed.

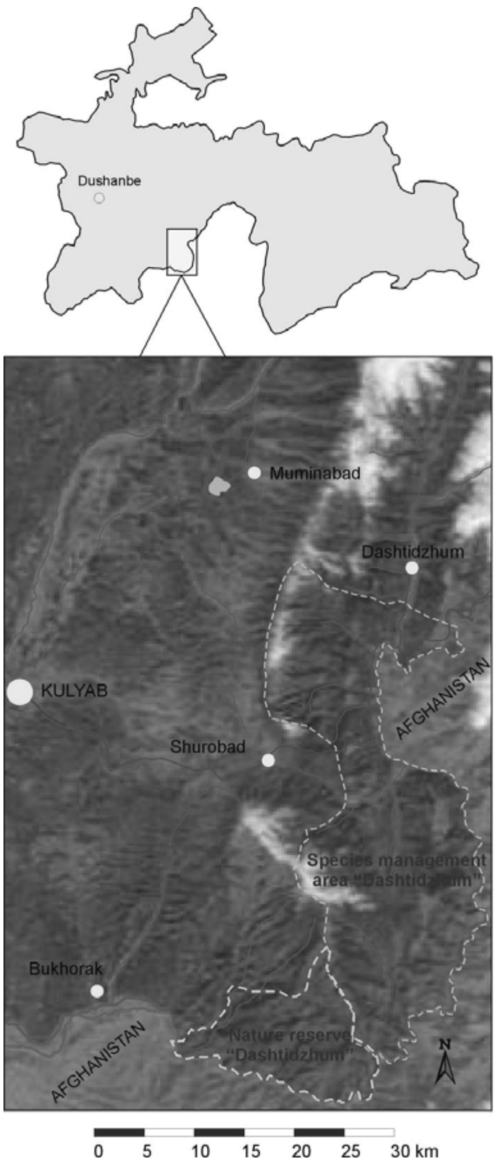

Figure 4. Study area location

Figure 5. A degraded mid-elevation woodland ecosystem.

This remote area is characterized by undeveloped infrastructure, including lack or extremely poor condition of roads, virtual absence of industrial and economic facilities, and high rates of unemployment. There is a shortage of energy resources for the population; electricity, extremely limited in small valley settlements, is completely absent in the highlands and high-mountain areas. Because of the high level of poverty it is impossible to buy coal or other energy sources. Local people therefore depend directly on natural (biomass) resources for their domestic energy needs. Therefore an important goal of this project is to develop natural resource management practices with communities that are environmentally friendly and provide additional income to the local people.

For more effective project development, joint research was carried out by NGO “Noosphere” and local communities on the socio-economic causes of forest and biodiversity degradation in the project area. This study involved surveys in two jamoats (local administrative divisions), and collection of statistical information on economic and social characteristics of the local population.

Project Activities and Results

The results of the background study identified the main cause of forest degradation and depletion of resources in mountain forest ecosystems is their exploitation primarily for household energy and construction timber needs. This has led to the significant alteration of their structure and species composition, the destruction of habitats of wildlife and rare plant species, and the degradation of pastures. As a result, the productivity of these mountain forest ecosystems is declining, leading to the impoverishment of the local economy (Anonymous, 2008; Anonymous, 2010).

The annual fuel demand per household (each household in the area includes an average of 7.7 people) is 10-15 m^3 of timber. In the area studied, an estimated 7600 m^3 of timber is harvested each year (including sanitary fellings). Given an average volume of wood in forest vegetation (trees, shrubs) in the mid-elevation mountains of 30 m^3 per ha, the 7600 m^3 annual wood removal represents the standing volume, and loss, of 253 hectares of natural forests (not counting natural regeneration and planting). Moreover minimum 15 m^3 of forest materials (or 1.5-2.0 hectares of forest) are used for local construction annually. Additionally, the population cuts and sells and estimated 20-30 m^3 of timber to neighboring areas.

Reforestation of 1 hectare of forests in this mountainous area costs about US$2000. Thus, the annual economic loss of deforestation (or replacement cost through replanting) is more than US$500,000. Local inhabitants pay an annual fee of approximately US$5 to the forest administration for the regulated collection of firewood in forest territories. The fee paid by households in the studied area is somewhat lower, about US$3.5 dollars. There is a clearly a significant gap between the funding that would be needed for reforestation and the funds received these fees and from the normative timber sales by forest administration.

The study of socio-economic causes of forest and biodiversity degradation in the project area found that the following to be the most significant:

- Deforestation for household needs: wood used for heating, cooking, construction of residential houses and auxiliary construction (barns, sheds, kitchen, fences, etc.), and for the sale of firewood to the surrounding areas;
- Over-harvesting of forest products: unregulated collection of non-timber forest products, including food and medicinal plants, and lack of market infrastructure for sale of forest products;
- Poor management of pasture lands: unregulated grazing, irrational mowing and laying-in of winter fodder for cattle; the lack of rotational grazing; undefined permissible limits for grazing periods and number of cattle grazing density.
- Unsustainable land utilization: forest areas leased for agricultural activities (cultivation of cereals and leguminous plants); illegal utilization of steep forest slopes for agricultural purposes.
- High percentage of population living poverty (more than 70%), and 45-80% of local population directly dependent on forests and other natural resources.
- Low level of environmental awareness of the population: lack of understanding among the population and schoolchildren about the uniqueness of forests and protected areas.

In addition, the assessment found a lack of infrastructure necessary for forest management activities within the reserve, no reafforestation activities nor a nursery to grow seedlings; lack of knowledge, low level of education and inefficient work of forest gards; lack of funding for forest service, including means for the purchase of materials and pesticides needed to protect forests from disease and parasites; lack of research within the reserve; and absence of zoning and limited plans for natural area management.

In an effort to help improve these conditions, the NGO “Noosphere” has begun working with local communities to develop environmentally friendly modes of natural resource management for business development. Local communities have been trained on how develop environmentally friendly and economically profitable joint activities, how to write project proposals and apply for available grants. The NGO, in coordination with the local administration of two selected jamoats, has conducted trainings, provided consultation on these topics involving scientists, other experts, and household in order to ensure success of initiatives. The high dispersion of households and extremely poor transportation and communication infrastructure, the presence of military units and the proximity of the national border (with an especially tough regime of restrictions) have created considerable difficulties for working with communities. Moreover local people had no prior experience in applying for grants and loans. Only occasionally has humanitarian aid been given for the survival of mountain villages in difficult times.

Within two years a number of community-based projects were initiated for reforestion activities, establishment of a tree nursery and development of gardens and beekeeping.

The communities by themselves carried out all works and used funds from grant to buy essential equipment and other goods such as nets for fencing the tree nursery, pipes for water supply, and for the purchase or raising of local varieties of forest plants and other goods.

The results of the works implemented to date include:

- Restoration of 63 ha of pomegranate plantations – these are already yielding crops;
- Creation of 27 ha of mountain community gardens. The marketing of fruit has been begun, mainly apples, based on the genetic resources of wild fruit varieties from the area. The market price of local variety of apple trees has always been the highest at towns’ market.
- Development of 4 ha of tree nurseries, the first in this area. Farmers were trained in establishment of planting stock, soil preparation, and other nursery techniques. After the first year the nursery has yielded a substantial profit from the sale of seedlings of fast growing species. According to the result of the final assessment it was found that due to the prospect of real economic benefits young men, from some families who had worked in Russia over the the last 5 years on construction jobs, returned home and wanted to work in the nurseries and gardens.
- Households involved in development of vegetable gardens commited themselves to carry out afforestation of degraded mountain slopes in areas identified by the local administration, and provided care and survival of plants.
- Community initiatives supporting the development of beekeeping included special courses, trainings, consultations, practical assistance and the allocation of necessary equipment and bees for new apiaries. The efficiency and real income derived from beekeeping is so great that the number of apiaries are expected to increase in the coming years. Already in the first season 206 new nuclei were separated from 466 honey-bee colonies and 4 tons of high quality organic honey has been obtained.

Conclusions

These projects, implemented by local communities with the direct involvement and coordination of the NGO "Noosphere", helped to improve the environmental situation in the project area, to improve the condition of mountain forest ecosystems, and consequently to improve the state of biodiversity. Moreover, during this period the cooperation of local communities with foresters has been developed and strengthened. They jointly conducted a field selection of seed trees for forest species which were suitable for nursery propagation and future planting in arboreta and reforestation.

The project activities that were new to the local population were accompanied by field training, consultations, practical methods. The knowledge and experience obtained became the basis for long term activities of the local population. Natural scientists and agronomists had prepared the written recommendations for all natural zones of project area, which were translated into the Tajik language, published and made available to communities as a guide for the future work.

According to the experience of the NGO "Noosphere" involving local communities is a very effective approach for conservation and rehabilitation of mountain forests. But for continuous development and improvement of this process, appropriate legislative mechanisms are necessary. Community groups and local authorities will effectively participate in conservation of nature and forest ecosystems only if benefits received from this activity will exceed costs. The result of our work with communities has shown that if everything is properly managed it is possible to provide protection to forests and other natural resources and at the same time to achieve the important objective that local people benefit from the conservation and sustainable use of these ecosystems.

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THE NATURAL HERITAGE AND CONSERVATION OF TIEN SHAN FORESTS

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Abstract

В статье рассматривается современное состояние охраны природного наследия и сохранения лесов Тянь-Шаня, а также затрагиваются основные стимулы и механизмы сохранения биологического разнообразия. Основные вопросы биоразнообразия леса, включающие в себя дендроэкологические, социально-экономические аспекты и лесной политики, которые тесно связаны с развитием лесной отрасли Кыргызстана в будущем. Сохранение природного наследия и создание генетического банка лесных насаждений – все это залог успешного сохранения генетических ресурсов лесов.

С приобретением независимости страны в регионах Тянь-Шаня, и особенно для Кыргызстана, начали развивать собственные программы лесного сектора важного сектора экономики страны. Для этого этапа характерны развитие национальной лесной политики, децентрализация, определение национальных интересов, вовлечение общественности в процесс использования и управления природными лесными ресурсами, расширение площадей лесовосстановления и территорий особо охраняемых природных территорий, дисскусия о предоставлении лесами Кыргызстана экосистемных услуг и др. Статья освещает основные усилия специалистов по охране, сохранению рациональному использованию и восстановлению лесов Кыргызстана.

Introduction

Today, as never before, we have to think about the future of forests in general, and in particular about natural heritage and conservation of forest ecosystems in the regions of the Tien Shan in Kyrgyzstan and neighboring countries of Central Asia. The forests of Tien Shan in have their own uniqueness, and are of great ecological importance for global processes of environment regulation and prevention of adverse climate change in Central Asia. As they grow on the slopes of the mountains, they stabilize soils, preventing soil erosion, landslides and avalanches and regulate hydrology of the region, making rivers flow more evenly throughout the year.

Kyrgyzstan's forests are located in mountain ranges at altitudes from 700 to 3600 m above sea level. They represent a significant part of the country's natural wealth and are an essential part of the national heritage. All forests of the Republic are highly valued. According to the Forest Code of the Kyrgyz Republic they have been given important nature conservation status. This status emphasizes forest management for environmental, protective, hygiene and sanitary objectives; industrial logging is prohibited.

Forest Policy in Kyrgyzstan

A new Forest Policy, adapted to the socio-economic situation in the country, has been developed in accordance with generally accepted principles of sustainable development considering national, social and environmental significance of forests, their global importance for conservation of biological diversity, the specificity of forest management practices in mountainous areas (Musuraliev, 2004; Burkhanov, 2004).The fundamental documents of Forest Policy have already been approved. They are the outlook for forest sector development in Kyrgyzstan by 2025, which defines the state strategy for the development of forest sector; the National Forest Programme 2005-2015; and the National Action Plan for the development of forest industry for the period up to 2010. The Forest Code of the Kyrgyz Republic and the draft of the Law "Specially protected nature areas" are being revised in order to improve the legal framework. This will enable to regulate the regulations governing activities in the forest sector of the republic in order to favour the sustainable forest development and conservation of biological diversity.

Despite the difficult economic situation of the current period, reforestation in the forests of the Kyrgyz Republic is still an important part of the public policy of the country. The policy concerns the reproduction of forest resources, improvement of the environment (including air quality), and improvement of living conditions of people in Central Asia.

Do to the injurious treatment of mountain forests in the past, especially in the last 10 years, there has been degradation of ecological systems, which has decreased their capacity for filtration and creation of freshwater supply for the whole Ferghana Valley. Part of the problem, in Kyrgyzstan (as in many countries worldwide) is that legislative regulations relating to environmental management are not integrated, but always cover only only sector; i,e,, Forest Code, Water Code, Land Code, etc.

Multifunctional forest management and conservation of biological diversity requires forest management that simultaneously takes into account the capacity of the resource base, the needs and concerns of all parties concerned (foresters, regional and district administrations, regional and local organizations, state register, local population, and NGOs) for joint forest management (JFM) on the basis of partnership and decision-making on an equality in the regions of the Tien Shan. Joint forest management should aim to conserve and increase forests through afforestation and reforestation, development of nursery management, improve forest governance, and production and processing of wood and non-timber forest products by private timber companies.

Conservation of Kyrgyzstan's Unique Forest Genetic Resources

The walnut–fruit forests of Kyrgyzstan (Fig. 1) are the habitat for a diversity of wild forms of cultivated nut and fruit species as well as medicinal plants (Sukachev, 1949; Gan,1982; Kolov 1984; Shevchenko & Amankulov, 1998; Musuraliev, 2004; Zukkov, 2004; Toktoraliev et al., 2004; Orozumbekov, 2004; Orozumbekov et al., 2010). These forests are a critical part of the local land utilization systems, and are important for local communities who use them for collection of nuts and fruits, as forest pastures and haymaking, and harvesting of firewood.

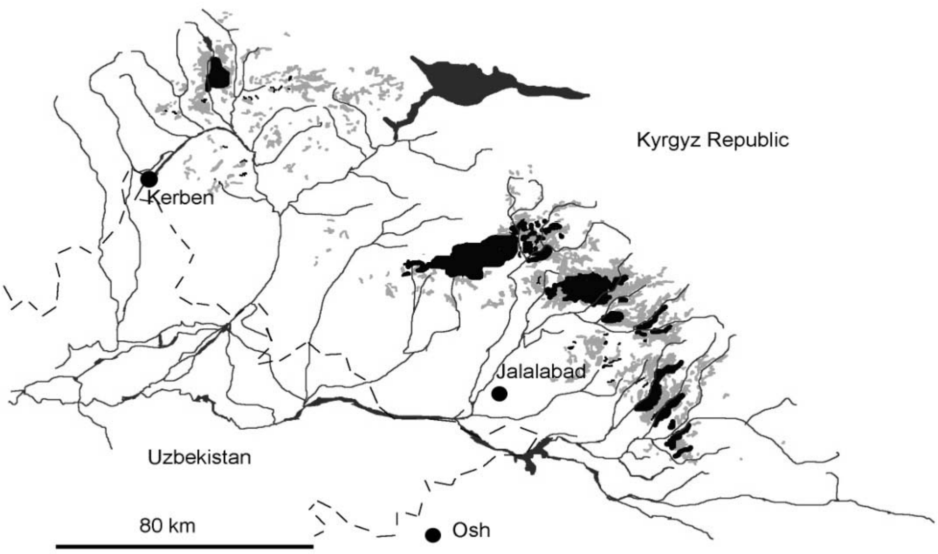

Figure 1. Distribution of walnut-fruit forests (light shaded)

These unique forest ecosystems are also of great importance for the conservation of the world's genetic resources as the natural habitat of economically important trees and shrubs, including walnut (*Juglans regia*), which have the original home there, wild apple (*Malus niedzwetskyana*, *M. siversii*), and diversity of species of *Prunus*, *Acer*, *Rosa*, *Crataegus*, among others (Zukkov 2004). The climatic conditions prevalent in these forest areas include an arid summer period, which enhances their value for the selection of varieties of walnut and other economically valuable species for cultivation in stands under difficult site conditions (Zukkov 2004).

Dendrochronological research has shown that walnut is an interesting species for the study of spatio-temporal dynamics of fruit and nut forests and environmental rehabilitation (Orozumbekov, 2004). Depending on soil and climatic conditions the maximum height of walnut trees in walnut–fruit forests is 30 m, with maximum stem diameters of 1.5-2.0 m. The maximum age attained by these trees is 200-258 years, Research carried out jointly with German scientists in the laboratory of dendrochronology at the University of Bonn (Germany) found that the annual growth rates Persian walnut (*Juglans regia*) have been increasing, and that these trends are related to changes in climate and other environmental factors.

The present and future condition of these forests is of great concern. Since the recent transition to a market economy in the region, particularly in Kyrgyzstan, new approaches to forest resources utilization have been introduced. As forest health issues become more important in Kyrgyzstan, the maintenance and development of a viable forest industry requires protection of forests from pests and diseases, implementation of measures to reduce environmental pollution, and to reduce impacts of climatic change. One of the main challenges for ensuring the health of these unique forests is their protection against the most damaging species of insects (including gypsy moth, fall webworm, pine capricorn beetle) through development of monitoring systems and biological control measures.

At the present time nut forests of Tien-Shan are worthy of support from UNESCO as world natural heritage. The Convention concerning the Protection of World Cultural and Natural Heritage, adopted by the General Conference of UNESCO in 1972, was agreed upon by representatives of 176 countries, including Kyrgyzstan. In order to protect the genetic diversity of fruit tree stands, and the natural dynamics of the forest ecosystems containing these species, the most vulnerable areas with these valuable genetic resources that include a whole range of different forest types should be given priority in the selection of reserve sites. In the designation of boundaries for forest stands and reserves, the fundamental scientific organization plan and monitoring must be developed (Zukkov, 2004; Gottshling et al., 2004).

Despite the generally acknowledged importance of the region's fruit and nut forests, their protection in existing state reserves is insufficient, especially in the most valuable areas such as Arstanbap-Ata, Kyzyl-Unkur and Kara-Alma, located in the Fergana range of Tien Shan. Sarah-Chelek (Fig. 2) already has the status of state Biosphere Reserve, recognized by UNESCO in 1979.

Figure 2. The walnut-fruit forests in the Sary-Chelek Biosphere Reserve. Photo: A.Orozumbekov

In April 2007 the Government of the Kyrgyz Republic approved a cluster of fruit and nut forests on the western slope of Fergana Range (Arstanbab, Kara-Alma sites) and the southern macro-slope of Chatkal Ridge (Sary-Chelek site) for inclusion in the UNESCO List of World Heritage Sites. While the

Sary-Chelek site is under protection as a Biosphere Reserve, issues related to the protection of the other two sites are under discussion including the establishment of Arstanbabskyi and Kara Alminskyi state natural national parks.

Among the conservation areas of the Kyrgyz Republic which have an international importance are the Issyk-Kul National Park. Since 1976, this park together with Issyk Kul Lake have been included in the International List of Wetlands of the Ramsar Convention, due to their importance as resting places along major bird migration routes and as wintering habitat for waterfowl species. In 2005 the reserve site 'Chatyr - Kul' was included in the List of Wetlands.

Conclusion

The unique walnut–fruit forests of Tien Shan are an important natural heritage of the planet. The results of recent studies have shown how important these forests are for humanity as a genetic resource. The recognition of fruit and nut forests in the territory of Kyrgyzstan by UNESCO as a World Heritage Site may support the development of regional economy for many years to come through the nature tourism that this international recognition provides. Moreover the conservation of these forest ecosystems and their genetic resources is an important basis for continued regional and international scientific cooperation.

Acknowledgement

We would like to express our gratitude for the cooperation of the Kyrgyz-German project “The Impact of the Transformation Process on Human-Environmental Interactions in Southern Kyrgyzstan”. This project was supported by the Volkswagen Foundation (Germany, 2003-2005).

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POTENTIAL FOREST VEGETATION AND ITS GEOGRAPHIC DISTRIBUTION IN KYRGYZSTAN

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Abstract

Для устойчивого развития и обеспечения социально-экономического благополучия страны определение потенциальной области произрастания лесов в Кыргызстане имеет большое значение. На современном этапе развития потребность рационального управления лесными ресурсами приобретает новый смысл в связи с потенциальными угрозами изменения климата в регионе, потерей биологического разнообразия и деградацией экосистем. Кроме того, технологизация и повышение наукоёмкости управления природными ресурсами, в том числе лесными, ставит перед национальными и международными институтами новые задачи по рациональному их использованию и эффективному мониторингу. В современной международной практике лесоуправления наблюдаются новые тенденции, направленные на создание условий, необходимых, в первую очередь, для реализации экосистемных функций и, во вторую - обеспечении людей древесными и не древесными продуктами леса. Такое управление продиктовано внедрением экосистемного подхода и отношением к лесу не как к потенциальной древесине, а как к одной из наиболее важных экосистем Земли, создающих саму возможность существования Жизни на нашей планете.
В основу методологии выделения территорий потенциального произрастания лесов лег принцип, предложенный Уиттекером Р., рассматривающий зависимость распространения биомов земного шара по отношению к влажности и температуре с учетом горной специфики произрастания лесов, особенностей припойменной увлажненности, рельефа, уклона и т.д. Результаты данных исследований могут быть использованы для формирования природоохранной политики Кыргызстана, более чувствительной к сохранению экосистем, в первую очередь лесных.

Introduction

The conceptual basis for forest management in most countries date back to a utilitarian and user-specific principles of natural resource use. (Gorshkov & Makarieva, 2003; Shukurov, 2004; Scott, 2008; Domashov, 2010). While the interest in ecosystems functions in relation to wildlife is increasing, there is a new wave of specialists who study a role of forests from the point of view of ecosystem management (Gorshkov, 1995; Gorshkov & Makarieva, 2003; Shukurov, 2004, 2009). Of particular interest today is the function of ecosystems, and particularly forest ecosystems, in the regulation of climate, through their stabilization of atmospheric gas balances (Le Chatelier's principle), and attraction of atmospheric humidity inside continents (Gorshkov, 1995; Gorshkov & Makarieva, 2003; Makarieva et al., 2006).

Present-day and historical forest vegetation formations are determined by succession processes of communities whose trajectories are generally associated with increases in total ecosystem biomass. As illustrated in Figure 1, a desert ecosystem, under favorable hydrothermal conditions that allows some vegetation development and normal functioning of the biotic pump mechanism[6], sufficient biomass will accumulate for its succession to a meadow-steppe community which, in turn, through

[6] http://www.bioticregulation.ru/pump/pump8.php#01

further accumulation of biomass is converted to a forest ecosystem. Significant reductions in biomass cause either degeneration and collapse of an ecosystem or its regression to the previous stage.

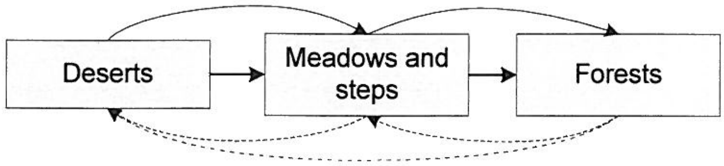

Figure 1. Diagram of successional shift of ecosystems. Arrows and broken line show conversion upon accumulation of biomass; broken line shows conversion upon a loss of biomass.

Since the development of forest vegetation is conditioned primarily by the hydrothermal regime of an area, it is possible to identify geographical ranges of possible and historically probable vegetation of forests based on climatic data. However, the estimated extent of these areas will be *less* than those of actual historical forest vegetation. This discrepancy occurs because many forests increase humidity at the local level, thereby expanding the area favourable for forest development. This process is generally characteristic of a developed and ecologically balanced forest community.

The majority of dryland biomes have particular hydrothermal optimums (Whittaker, 1980; Drozdov & Myalo, 1997). Evaluation of the distribution of hydrothermal optimums of the main biomes of the world (Fig. 2) in relation to their geographical locations, taking into account climatic conditions of the area , allows an estimation of the degree of anthropogenic impact on ecosystems resulting from historical and contemporary natural resource use. Evaluation of long-term statistical data may shed light on peculiarities of distributions of anthropogenic impact at different time periods.

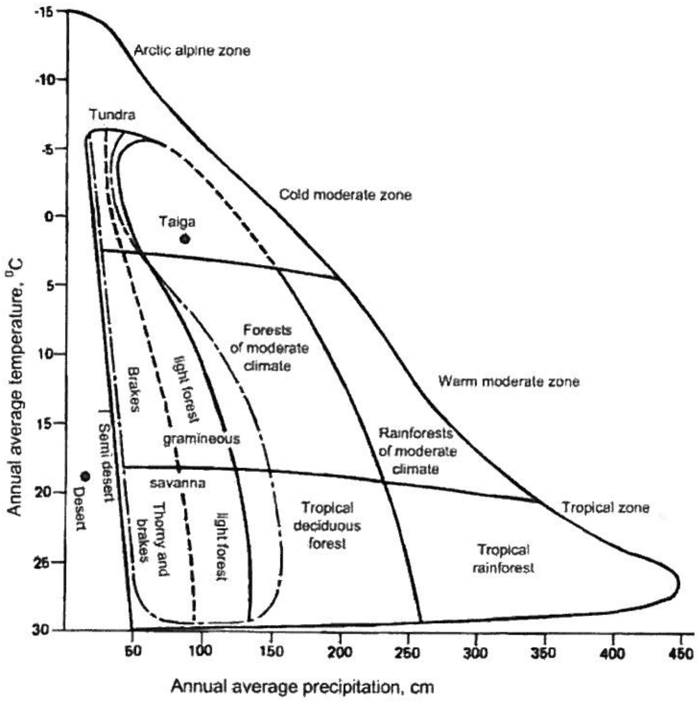

Figure 2. Location of the earth's major biomes in relation to humidity and temperature. Boundaries between types of biomes are approximate. Differences in climate between biomes; soil properties; fires, and other factors may change boundaries between forests, shrubs and grasslands (*Source*: Whittaker, 1980)

In this paper, we summarize the results of an evaluation of present-day distribution of ecosystems in Kyrgyzstan based on analysis of data related to: hydrothermal regimes, climatic zonation and local peculiarities, and topographic relief. We also consider how cumulative historically and modern impacts on ecosystems has determined their current geographic distribution. We also consider how such evaluations can be used useful for efforts towards the restoration and management of forest ecosystems and their biodiversity.

Uniqueness and vulnerability of forests in Kyrgyzstan

A study of potential forest sites was based on an analysis of the country's climate, its peculiarities in various regions and localities. Areas suitable for afforestation were identified by evaluating the moisture regine during the warm periods of the year in Kyrgyzstan. Analysis of river flows and watershed gradients, slope and aspect were used to determine specific characteristics of the distribution of possible forest areas and forest types. Evaluation of elevation determined the upper altitudinal limits of for potential forest communities.

Geoinformational analysis techniques were used for this study, based on vectorial and scanning layers of relief, river network, layers of vegetation, etc. These data were graciously provided by the regional geoinformational laboratory of the World Bank's project "Preservation of Biodiversity in the Western Tian-Shan" (2004). Data from Ponomarenko's (1987) map "Moisture regime: Precipitation. Warm period" (scale: 1:3, 000,000) was also used.

Environmental complexity and history of its formation accounts for the degree of biological diversity in forests. In Kyrgyzstan forest biodiversity increases in relation to the following main factors:

1. A variety of forests types are concentrated in a relatively small area. These include coniferous forests with pine, fir trees, of several types of juniper, various deciduous forests including relict nut orchards, pistachio- and almond-woodlands, and flood-plain forests.
2. Forests generally occur in the middle belt of mountains from 1,500 to 3,000 meters above sea level; conditions in the lower part of forest belt are significantly different from those at the upper limits of forest vegetation.
3. Hydrothermal regimes differ depending on latitude of the area and direction of the valley and the slope.
4. Forests do not occur in large, continuous areas but are mainly of an open, park-like character being adjacent to grass and shrub ecosystems, rock stones, mountain rivers and lakes. They often include a combination of purely forest species as well as ecotone species and those of adjacent ecosystems'.

These characteristics make mountain forests a centre of biodiversity. Although they occupy less than 5% of the land area, forests preserve about a half of the entire biological diversity of the country.

On the other hand, park-like character of forests is mainly due to human impacts. The substitution of forests by grassland communities has occurred over very large areas due to anthropogenic influences. This is confirmed by the presence of forest understory species growing under the shelter of tall grasses on currently treeless slopes. Spore-and-pollen analysis of soil horizons reveals a much broader distribution of forest and woodland communities on the territory of the country in the not-distant past.

After "Ala-Archa" State Natural Park was established in 1976, the government initiated intensive efforts for natural recovery of juniper forest on bare areas previously used for continuous cattle grazing. Despite of significant reduction of its territory in the post-Soviet period, Kyrgyzstan is presently one of the leaders among the neighbouring countries dealing with problems associated with overgrazing by cattle.

Alarming trends of climate change increase with devastation of natural ecosystems and, particularly, forests. Indeed, there are no other mechanisms but them to form climate favourable for contemporary existence on the Earth, including human existence. Absolute cease of anthropogenic greenhouse gas emission with absolute devastation of natural ecosystems (especially, forests!) will result in a fateful climate change inconsistent with human existence.

Forest ecosystem management for biodiversity and other benefits

Historical and scientific precursors of forest ecosystems management

The extent and condition of current forest areas within the territory of Kyrgyzstan are closely connected to the history of scientific forest management in the country. Scientific forestry, which has spread throughout the world over the past 200 years, was developed in Europe during the period of 1765-1800, mainly, in Prussia and Saxony (Scott, 2008). In fact, forestry developed as a sub-discipline of cameralistics[7]. Such an approach facilitated transformation of traditional (or spontaneous) natural resource uses by people to more rigorously planned ones. It developed during the late 18th century in response to increasing shortage of timber in Europe, with its principal goal being the production of a maximum quantity of wood from forests on a continuous basis. After a century of applying such a scientific approach to forest management, the majority of countries with developed forestry sectors had created single-use forests which were simplified models of natural forest communities. These developments raised a great number of problems of both a socioeconomic and environmental nature (Scott, 2008; Domashov, 2010)

Accumulated scientific and practical capacity is suitable for managing anthropogenic systems, such as agricultural lands, but only because a number of species involved is a very small fraction of that in natural ecosystems. However, there are still unpredictable changes in these systems that arise and require enormous human effort to control, such as pest and disease outbreaks, uncontrolled fire, etc. Human efforts to control natural ecosystem processes by humans result in degeneration of complex ecosystems to simpler ones, which destroys self-control mechanisms of these ecosystems.

New concepts, principles and mechanisms for forest management on the basis of the ecosystem approach

Despite the current situation, there are number of approaches and mechanisms which can contribute to ecologically sustainable natural resource use, and help to preserve communities and ecosystem functioning. We use the term "management" in a general sense, including approaches of classic management theory, as well as new concepts for management that promote forest ecosystems' functions. This view forest ecosystem management is considered not only as an ecologically sensitive approach to natural resource use but also as a new relationship between a humans and nature. The mechanism to realize this approach may be the "proper state" principle applied in the framework of forest management.

The "Proper State" principle. The proper state of ecosystems is the one that ensures performance of its ecosystems functions. Ecosystems' resource utilization should not exceed the limits of their proper state since overexploitation results in the degradation of ecosystem structure and function. Natural communities within ecosystems will be preserved when influencing factors push them beyond their proper states.

Maintenance of an ecosystem's proper state does not necessarily mean absence of human activities. For some fragile ecosystems (fenland, for example), even low levels of natural resource use by a humans may lead to a breach of this principle. For other ecosystems which have already been affected by humans, continued anthropogenic influence is needed to maintain their proper state. An example of such a situation is use of grazing lands in Kyrgyzstan, where domesticated cattle have have taken over the role of now-absent natural regulators and consumers of these ecosystems' biomass (i.e., wild hoofed mammals and other herbivores). Where distant-pasture cattle tending has been abandoned, these ecosystems have undergone natural succession with associated changes in species composition. In order to preserve grazing lands in their earlier condition, strictly regulated cattle grazing is required.

To determine the proper state of ecosystem, a preliminary evaluation of natural areas should be done. Such an evaluation is possible through the use of indices, or bioindicators, of the proper state and under conditions of anthropogenic pressures. Restoration to the proper state is possible through creation of a matrix of small plots, or micro-reserves, of relatively preserved sites of natural ecosystems.

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[7] Cameralistics is a discipline oriented to definition of principles and approaches of managing governmental finances on a scientific basis. It included an aggregate of administrative and economic knowledge required for office (royal and, generally, governmental) management.

Micro-reserves are a relatively small plots in which economic activities, such as ploughing, cattle grazing, or other major disturbances, are excluded. A micro-reserve is an island of natural biological diversity within a wider landscape that includes land uses such as grazing, agriculture, orchards, etc. Unlike specially protected natural areas, micro-reserves do not require formal designation or withdrawal of large areas from economic use. They may involve sites which do not have a special practical value, including areas not suitable for cultivation, ravines, etc. Such micro-reserves do not require a financial resources for their establishment and maintenance, nor staff for their protection apart from fencing or other means to prevent intrusion by cattle. Labour and materials required for their creation are minimized and acceptable to all. Micro-reserves can directly provide habitat for biodiversity, and provide other environmental benefits such as decreasing incidence of agricultural pests, and increase agricultural productivity.

The purpose of a micro-reserve is to restore biodiversity within as well as on adjacent territories on which biodiversity has been lost due to excessive grazing or agricultural activities. By providing habitat for species of birds that are important seed dispersal agents for a variety of plant species, micro-reserve on grazing land lets provide a nucleus for the dispersal of plant species into surrounding areas, althouth the radius of this beneficial effect of a micro-reserve is restricted by the distance of seed distribution by birds, wind or other seed-dispersal vectors. Therefore, the optimal arrangement for micro-reserves is establishment of a maximum number of small plots distributed throughout the landscape rather than fewer larger ones.

Beneficial fauna breeding in a micro-reserve can also lower a number of pest and revitalize agricultural lands. In some cases, in order to attract beneficent species, i.e., natural enemies of agricultural pests, one may arrange artificial nesting sites (shelters) and perform other biotechnological procedures consistent with conditions of recovery of biodiversity.

The main principles for micro-reserve organisation are as follows:

- Use of locally available resources, i.e. their creation should not be accompanied by use of additional resources brought into the ecosystem: fertilizers, chemicals, etc.
- Minimize human disturbance, so as to facilitate natural regeneration and development of ecosystems through natural processes.
- Provision of favourable conditions for the survival of species on this site, which may include, for certain bird and mammal species, creation of special special feed boxes, special places for dwelling, etc…
- Substitution of local destructors with constructors. Generally, such areas are developed by planting or otherwise introducing different species of plants. On grazed lands ruminant animals periodically reduce biomass in ways that often do not favor biodiversity maintenance or its restoration; in micro-reserves, if biomass reductions are needed to maintain certain habitat requirements for desired species or favor vegetation succession, pattern and band cutting should be carried out. This principle is mostly used for steppe and meadow micro-reserves.
- Limitation and/or termination of natural resource use within the micro-reserve area, ensured by means of fencing the site using both natural and artificial materials as required.

Conclusion

Forests are an important basis for a country’s environmental security. Profits derived from unsustainable forest exploitation cannot compensate for the enormous, often large-scale, damage to natural ecosystems, people and their economy, resulting from reduction of biodiversity, creation of ecological imbalances including climate change, reduced quantity and quality of water flow in river systems, increased frequency and destructive power of floods and mudslides, outwash of hundreds of tons of fertile land.

It is critical that the status of forests, their legal protection, and regulations for their used provided by the government reflect their environmental, economic and social importance. In Kyrgyzstan forests must be protected against their loss and degradation, and should not be exploited for economic purposes except under strictly regulated conditions.

In the long run, the government must act as a guide and organizer of long-term policies to restore forests. Natural forests in Kyrgyzstan were reduced by more than 50% from the beginning of the

Soviet period until the current post-independence period. However, there are many areas in Kyrgyzstan whose hydrothermal regime is favourable for vegetation of forests (see Fig. 3). If forests could be restored on half of this area, there is no doubt that the country's environmental situation would be well-balanced, and that river flows would increase and stabilize. Of course, it is not only Kyrgyzstan that should be interested in this problem (and its solution), but also neighbouring countries and, ultimately, all the world.

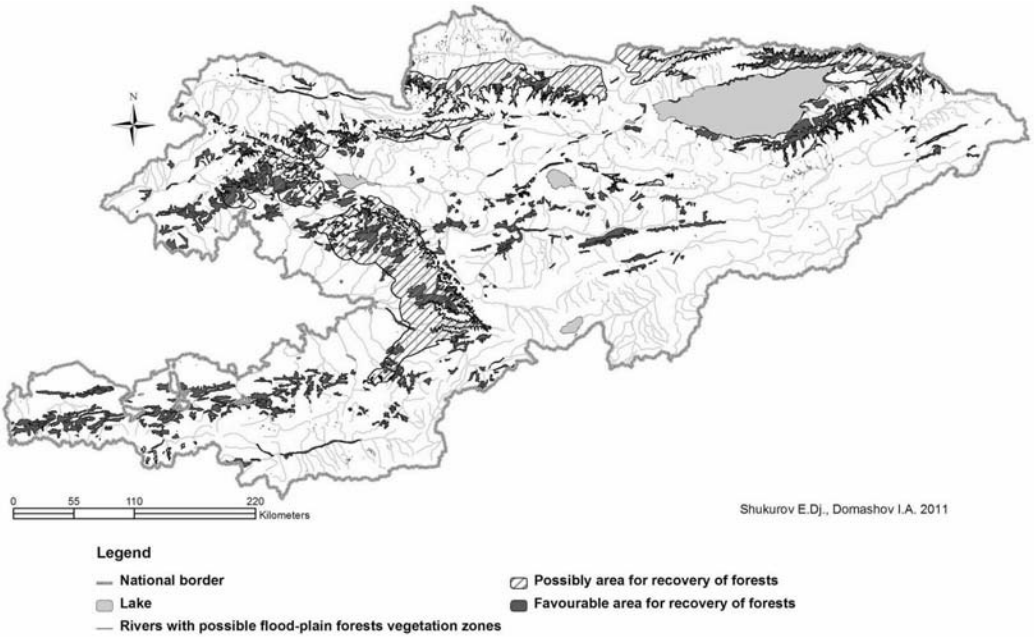

Figure 3. Possibly favourable area for recovery of forests in Kyrgyzstan. Shown are the main rivers where flood-plain forests lower than 3000 thousand meters below the sea level can be recovered.

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ASSESSMENT OF HUMAN IMPACTS ON MOUNTAIN LANDSCAPES OF THE NORTHERN SLOPE OF THE TURKESTAN-ALAI RANGE

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Abstract

Проблема рекреационного лесопользования наиболее актуальна для регионов, где есть условия, способствующие развитию рекреационной инфраструктуры, а рекреационное лесопользование становится основным видом пользования, приносящим устойчивый доход. В связи с проводимой политикой по организации экотуризма в КР возрастают потребности в организованном отдыхе. Одним из направлений развития индустрии отдыха и является рекреационное лесопользование.

Introduction

National parks can be an effective for both conservation of the natural environment and providing recreational resources for people. While there are similarities in national park design and management among countries, there are also significant differences among them due to their particular natural and historical conditions that influence their functional zoning. One important purpose of protected areas established in forested areas is the protection and regulation of water resources and associated and soil protection functions. These environmental services are enhanced in forested watersheds that included sites with old-growth stands of different ages.

The Fergana valley in Kyrgyzstan separates the Tien Shan and Pamir mountain ranges, the northern part of which is called the Pamir-Alai, where the northern slope of the Turkestan and Alay ranges (the focus of this study) is situated (Mukhamedshin & Talantsev, 1982). The Turkestan and the Alai mountain ranges are the watersheds of two rivers: the Syr Darya River and Zarafshan River. All rivers of the northern slope of both ranges are part of the Syr Darya basin. The largest of these within Kyrgyzstan are the Ak-Suu, Isfara, Kazbala, Shakhimardan, Sokh, Isfayram-Sai Abshyr-Sai, Chiylisay, Kyrgyz-Ata, Ak-Buura, Gul'cha and their numerous tributaries. The waters of most of these rivers do not reach the Syr Darya as they used completely for irrigation. In order to control flow and to provide waters to irrigated areas, the Papanskoe reservoir has been created on the river Ak-Buura. Also the Naiman reservoir has been created on a number of smaller water flows such as Kyrgyz-Ata, Chiylisay, Abshyr-Sai and others.

Melt-water of mountain snows feeds all of these rivers. Although there are numerous glaciers, only a small percentage of the waters feeding the rivers are glacier-derived: 19% in the Isfara river basin, and 21% river Sokh. Rivers of Turkestan-Alai region rated as the snow-ice nourishment type. Rain nourishment does not usually exceed 1-2%, while seepage flow comprises 10-25% of the annual flow. All rivers have extended flood periods which lasts for about 6 months, and a steady flow period in the cold months of the year (Toktoraliev et al., 2005). While rainfall does not play a significant role in the annual runoff, intensive spring storm precipitation occurring every 3-5-10 years in the deforested mountain zone causes significant erosion of slopes and channels, causing great damage to the national economy.

Since the Fergana Valley is protected from the cold northern winds, the study area has a relatively warmer climate, affecting elevation of the snow line and glaciers, which are almost in 500 m higher than in Northern Kyrgyzstan. As a result, boundaries of natural vegetation zones are shifted. The mountain vegetation, especially forests, plays a vital role in the conversion of surface water into groundwater. Junipers, the main forest species in this area, are deep-rooted and significantly reduce runoff and increase groundwater, thereby preventing soil erosion on slopes and regulating river flow.

Methodology

Studies on hydrological and protective features of juniper forests were carried out in middle- and high-mountain juniper forest zones of the northern slopes of the Alay ridge in the Kyrgyz-Ata river basin. Other research related to topics including natural vegetation recovery, influence unregulated pasturing on a juniper forest condition, and recreational pressures, were carried out in a *leshoze* (local forestry enterprise) in the Turkestan-Alay range.

Hydrological and protective features of juniper forest were evaluated in 7 permanent and 6 temporary study areas which have been established in different types of forest. Formation of a snow cover, retention and redistribution of snow and ice reserves, and snow melt, were evaluated using the snow metric pole method. This involved density and snow metric pole measurements on a monthly basis from the beginning of snow cover (October), and every three to five days during the period of snow melting. Detention of rain and snowfall by juniper and shrub canopies was measured using subsidence metric tools of different constructions in 17 permanent plots and more than 500 temporary plots. In the permanent plots, inventory and mapping of vegetation was also carried out.

The condition of juniper forests, natural regeneration processes, and the impact of anthropogenic influences (recreation impacts in particular) were also evaluated in over 400 permanent and temporary plots.

Results and Discussion

Effects of logging on forest climate and hydrology

The water protection and local climate regulation functions of intact juniper forests of different ages are important. Their climate regulation function relates to their accumulation of significant amount of solar radiation (up to 66 kcal cm^{-2} during the growing season) and significant (9 times) reduction in heat flow to the soil surface within these forests compared to open areas. As a result, soil and air temperature amplitudes within forests are moderated, particularly their daily regimes. By reducing maximum and increasing the minimum an air temperature in forest in comparison with logged forest, differences between daily maximum and minimum temperatures are, on average, 20% less in winter and in 40% less in summer. Under the forest canopy heat exchange in soil (up to 300 cal cm^{-2} per month) and expenditure of heat on physical evaporation from the surface (up to 5.6 kcal cm^{-2} for vegetation) are relatively small, while evapotranspiration reaches maximum possible values of evaporation (about 300 mm during the growing season). This affects the temperature and soil moisture pattems. Comparisons of soil temperatures under forest canopy and in logging areas show an average temperature increase of 2.5-2.9° in logging areas. The amplitude of seasonal and daily soil temperatures is also higher in logged forests. Large reserves of moisture in soil layer and low amplitude oscillation across seasons (35-100 mm in soils to 1 m depth) and are typical of the dynamics of moisture content in these soil.

Because brown forest soils have high initial water permeability and moisture holding capacity (up to 500-550 mm), even on steep slopes rain which had fallen in the belt of juniper forests rarely results in surface runoff. However, logging activities in these forests increase surface runoff, thereby decreasing absorbtion and subsurface flow, affecting the hydrology of these watersheds

Deforestation in watershed areas that contribute the most to runoff leads to a steady decline in groundwater replenishment and an increase of river runoff turbidity (from 9-26 times as much compared to intact forest watersheds areas) due to increased erosion associated with soil disturbances in logged forest stands. It should be noted that there is some delay (up to 5 years) of changes in river flow regime due to changes in the intensity of forest utilization as well as the presence of complex regularities of variation of runoff for a long period.

Analysis of the variation in hydrological regimes of rivers as affected forest exploitation regimes has shown that the intermediate forest harvests have a significant impact on the runoff regime and suspended sediment loads in mountain rivers. The changes in the mode of river runoff that occur after cutting are greater in a certain parts of the river basin, the most vulnerable part being in headwaters (i.e., upper watershed areas). It is therefore recommended that timber harvesting in upper catchment areas should be strictly limited.

The duration of the impact of forest harvesting (i.e., logging) on water protection and water-regulating functions of mountain forests is of great practical importance. It is crucial to determine whether or not these hydrological regulating functions are eventually restored to their original levels, and the length of time required. Based on the 20 years of data evauated in this study, is appears that restoration of the original forest ecosystems' hydrological properties does not fully occur within this time period.

Cutting in river catchment areas has negative and long-term effects on forest hydrology, especially on runoff. Slope runoff, which is an integral indicator of changes in hydrological conditions in catchment areas, is the most likely to change. The surface horizons of forest soils due to their water-physical properties play a drainage system role, which mainly can be seen during intense rainstorms. As a result the main part of precipitation is converted to slope runoff, which impedes the minimizes erosion processes on the surface of soils and helps to supply moisture in lower horizonsand belowground reservoirs.

The research of water balance elements of the experimental catchment areas in the Turkestan-Alai forest region has shown a significant reduction of infiltration and an increase of slope (fast) runoff during tree harvesting, and also a very gradual reduction of the hydrological functions of forest vegetation. In juniper stands the maximum reduction of water regulation functions appears not during the year of cutting, but 10-15 years later. It has been experimentally shown that in order to stabilize water regulation and protection functions, a significant period of time is required. In most cases, full recovery initial level of functions does not occur. Such forest ecosystems acquire other characteristics that are less effective in their hydrological control functions than undisturbed juniper forest stands.

The economic exploitation of mountain forests for timber or other products should not lead to the loss of their ability to self-repair nor reduce their production potential and environmental quality. I Development of management standards are required to maintain the water-protection role of forest stands at the level of river catchment areas (as the area of young trees in the basin increases with logging activities). International experience shows that if more than 25-30% of of the forest area within a river catchment area is harvested, the hydrological patterns of these watersheds do not return to the original state even after a long period.

The peculiarities of the dynamics of water protection, water regulation and soil protection functions of forest vegetation should be emphasized. The analysis of long-term monitoring has showed that in the dynamics of restoration of these essential forest functions, better results were obtained in the areas of voluntarily and selective tree harvests than in areas where group-gradual harvests were carried out.

The results of a 15-year survey of juniper forests in permanent test areas have revealed a deterioration of almost all high-altitude zones of juniper. Among the main factors which had caused the deterioration, are the following: unregulated grazing, lack of forest pathology monitoring, and as a consequence, disease and pests. Better monitoring these forests and ecosystem processes is required. Moreover it is very important to attract a broad section of experts for the solving these problems.

Recreation impacts on juniper forest vegetation

Recreational forest sites within the study area has been developed unevenly, with areas bordering with or situated near populated places being used intensively, with fixed forms of recreation predominating. Maximum anthropogenic impact on forest ecosystems are also found in these sites. In more remote areas, tourism and leisure activities which are not connected with staying in the area (collection of flowers, walking, etc.) are more dispersed. Such areas are characterized by periodic and weak anthropogenic impact. The recreational load greatly vary among the areas studied, from 0-2 to 19-23 people per ha. The average length of stay of visitors on holiday in forest areas ranges from 5 hours to 1-4 days. The recreational usefulness of forests declines in areas with very steep and steep slopes (34-64%) and lack of amenities such as accessible roads and organized recreational areas.

Recreational usage leads to the alterations in the normal functioning of all structural components of forest ecosystems, including damage to surface soils, compaction of forest litter and soils, trampling of living ground cover, including woody species regeneration. The magnitude these recreation impacts depend on their intensity and duration; the changes that occur in forest stands reflect different degrees of disturbance of the forest environment.

At the present stage, evaluation of the recreational potential of different forest areas, criteria and indicators, are used as the basis for such assessments. Each criterion is quantitatively and qualitatively evaluated using relevant set of indicators characterizing the state of forest areas used for cultural, recreational, tourist and other purposes. In order to preserve the natural resources of Kyrgyzstan both in the in the near-term and long-term, regulations are needed to maintain the land's balance, including minimizing impacts on the condition of forest ecosystems and their hydrological protective functions for the main river basins forming the transboundary waters of the Fergana Valley.

Conclusion

The years following Kyrgyzstan's new sovereignty were not the best years for the development of strategic documents and policies for forest and water management. Due to the growing water and energy problems in Central Asia, an important issue on the agenda concerns a transition to integrated management of forest ecosystems and water resources. Sustainable development without conflicts over limited forest and water resources in our region demands new solutions.

In the development of Kyrgyzstan for tourism, the primary objective is a creation of environmentally friendly, world-class tourist destination, taking into account the best global practices. The development of mountain territories must necessarily be linked with the demands and preferences of tourists, which are determined by the quality and level of utilization of modern technologies for the creation of tourism facilities and products, and above all with environmental tourism markets. The problems of development of tourist industry as an alternative source of income in the area of mountain forests need to be studied from all angles, including a recreation and environmental aspects. There is an important task for us - to develop a scientific basis for recreational utilization of mountain forests and to identify the priorities in its economic activities. During the ongoing implementation of this research, it is necessary to evaluate these questions further, to analyse the existing recreational utilization in the belt of juniper forests of the Turkestan-Alai Range, and also to determine its recreational potential. The results will be used for the development of principles of functional activities, in particular GPNP "Kyrgyz-Ata" in the context of development of the Kyrgyz Republic as a mountain-climatic resort.

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SOCIAL AND ECOLOGICAL PUBLIC RELATIONS IN NATURE PROTECTION AND FORESTRY ACTIVITIES

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Abstract

Экологическая идеология, по сути, является не альтернативной, а протестной по отношению к доминирующему экономико-политическому вектору цивилизационного развития. Но протест, не подкрепляемый изменением системы массовых и профессиональных ценностей, остается на уровне деклараций отдельных группировок, не переходя на уровень конструктивного изменения ведущих ценностей и приоритетов социального развития. Развитие экологического движения, в частности, направленного на сохранение лесов, с точки зрения менеджмента, включает четыре основных направления деятельности: выполнение своей миссии, поддержание своей структуры, воспроизводство своей структуры и распространение своей идеологии среди широких слоев населения для внедрения экологических ценностей и императивов в массовое сознание и в массовую культуру. Но экологическая культура неконкурентоспособна без мощной информационно-идеологической поддержки со стороны тех же институтов формирования общественного мнения, которые поддерживают и развивают общество потребления. К социальным институтам, формирующим массовую культуру и общественное мнение, относятся, в первую очередь, образование, просвещение и СМИ, которые в комплексе способны оказывать решающее воздействие на динамику социокультурных процессов. По нашему мнению, природоохранному движению не хватает профессиональных кадров, владеющих навыками работы с массовой аудиторией. Поэтому в сфере профессиональной PR-деятельности необходимо развивать такое направление, как социально-экологический PR и привлекать к работе по этому направлению вузы, которые готовят PR-специалистов. Такие инициативы повысят эффективность разрешения конфликтов между природопользованием, в частности лесопользованием и охраной окружаюей среды.

Summary

In contrast to scientific activities, public relations (PR) is a practical activity managing communicative processes aimed at forming public opinion to promote interests of particular people, groups, organisations, etc. In their efforts to spread ecological ideology, values and imperatives, and further the development of professional and mass ecological culture, ecological and environmental organizations need to involve professional public relations specialists into their activities and use all available PR instruments and technologies. However, there are two factors that presently constrain such an approach. First, NGO leaders and employees don't often have sufficient knowledge about this sphere of activity. Secondly, opportunities for social and ecological public relations training do not exist in the formal educational preparation of natural resource specialists. One of the ways to solve this problem is to engage with universities which prepare PR specialists, providing them with opportunities to use their knowledge and skills in the work of ecological and environmental organizations as part of their educational and professional development.

THE NEED TO ASSESS ECOLOGICAL AND ECONOMIC AVAILABILITY OF FOREST RESOURCES

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Abstract

Сейчас в России наблюдается структурный кризис в лесном секторе, выражающийся в низкой доходности сектора в целом по стране и трудностью с обеспечением нужд страны лесными ресурсами. Лесной сектор развивается по экстенсивному пути, причем отсутствие экологической и экономической устойчивости лесопользования изначально заложено в модель развития отрасли. Одним из путей перевода лесопользования на постоянную основу является оценка запасов лесных ресурсов с учетом их экономической доступности. Проведение такой оценки позволит привести в известность экономически доступные эксплуатационные запасы лесных ресурсов, что поможет избежать крупных просчетов в оценке сырьевого потенциала региона и страны. В условиях рыночной экономики определение эколого-экономической доступности лесных ресурсов крайне важно. Поэтому перед лесной наукой стоит задача создания эффективного регулятора, способствующего упорядочению лесопользования и установлению норм пользования лесом с учетом экономической доступности лесных ресурсов. Разнообразное сочетание экологических и экономических факторов определяет доступность для использования лесных ресурсов в конкретных условиях времени и пространства. Исследования по экономической доступности лесных ресурсов осложнены объективными причинами, связанными с коренной перестройкой функционирования лесной отрасли. Более того, доступность ресурсов не статична, содержание экономической доступности изменяется по мере изменения природно-производственных условий. Устойчивое управление лесным хозяйством возможно только в таком контексте использования земель лесного фонда, которое обеспечивает экологически здравое, экономически жизнеспособное и социально приемлемое использование лесных ресурсов.

Summary

Sustainable forest management acts as a proper land use of the forest estate only if it ensures ecologically sensible, economically viable and socially acceptable utilization of forest resources. In recent years, however, industrial interests have dominated decision-making processes regarding the choice of forest utilization approaches in Russia. Neither forest restoration and environmental problems, nor the need for other forest uses (for hunting, harvesting of nontimber forest products, forest recreation, etc.) have not been considered. If multi-purpose forest utilization is to be a primary objective of forest management, it is necessary to choose the main aim for each particular parcel of the forest estate - biological diversity conservation, protection of soil and water resources in watersheds, game management, logging, etc.. Among the goals of forest management should be consultation over the intended use of forest parcels. This requirement is especially important in the richly wooded regions of Siberia where logging operations involve harvesting of all timber from extensive forest areas (often 1000 ha or more), then moving to other areas of old-growth forest to repeat the process, until it is discovered that there is no remaining high-value old-growth forests to be exploited. Moreover because of the inefficient forestry and processing operations loss of timber may reach 40-60 % of standing volume, and the areas of annual harvest exceed the planned limits by 150%. Such practices have led to premature timber resource depletion by forest enterprises in Siberia and have altered vast areas of wildlife habitat with consequences for biodiversity conservation, and other negative ecological consequences, including extensive soil degradation.

MOUNTAIN FORESTS AND WATER RESOURCES AS A BASIS OF PRESERVATION OF ECOLOGICAL STABILITY IN CENTRAL ASIA

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Abstract

Леса и вода всегда рассматривались как часть окружающего мира. Вода является основой жизни на нашей планете, особенно пресная, без которой все живое в наземных экосистемах гибнет. Современное состояние рассмотренных проблем все ближе подводит нас к необходимости пересмотра роли лесов и воды в экономике. Прежде всего, следует четко определить их экономическую составляющую. Леса могут остаться источником товаров и услуг при условии ведения научно обоснованного лесного хозяйства, в ряде случаев исключающего примитивное (рыночное) отношение к лесам как к одному из видов природных ресурсов. Вода чрезвычайно важна для сохранения здоровья и жизни, для производства продовольствия и ведения экономической деятельности. Но при любом сценарии развития экономической системы Кыргызстана должна быть существенно укреплена регулирующая роль государства в управлении всеми природными ресурсами.

Summary

In the contemporary world, public and private sectors have to make very difficult decisions in the management of forest and water resources. Therefore international cooperation is crucial for the sustainable utilization of common water resources and the forests which protect these vital water resources. The sectoral fragmentation of long-term problems related to forests and water is outdated. Issues related to both forests and water resources should be considered systematically from the standpoint of preservation of the main conditions of people's life provided by these natural resources. In the countries of Central Asia, a transition towards complex (integrated) management of forest ecosystems and water resources could be an effective way forward, because sustainable development without conflicts over limited forests and water in these countries requires new solutions and approaches as well as the utilization of advanced technologies.

APPENDIXES

Appendix 1: Workshop Program

P R O G R A M

INTERNATIONAL CONFERENCE ON TRADITIONAL FOREST RELATED KNOWLEDGE, FOREST BIODIVERSITY AND SUSTAINABLE FOREST MANAGEMENT IN EASTERN EUROPE, NORTHERN AND CENTRAL ASIA

28 – 30 June 2009

Venue: Kyrgyz National University (KNU) named after Zh.Balasagyn. Main building of KNU, conference room Big School Hall, 547 Frunze str., Bishkek, Kyrgyzstan.

Sunday, 28 June 2009 – Thematic excursion.

Monday, 29 June 2009,

09.00-10.00 **Registration of participants**

10.00-11.00 **Opening of the conference**

Opening speeches:

A.M. Dzhuraev A.M., Ph D (Physics and Mathematics), Pro-rector of KNU named after Zh.Balasagyn.

A.M. Burkhanov, Deputy Director of the State Agency on Environment Protection and Forestry, Kyrgyz Republic.

A.P. Laletin, Ph D (Biology), Acting Chairman of the Global Forest Coalition, Krasnoyark, Russia.

11.00-11.25 *Coffee break*

11.25-12.15 **Biotic mechanisms of climate regulation** – E.D. Shukurov, Dr. Sc. (Geography), Professor, Chairman of the Ecological Movement of Kyrgyzstan “Aleyne”.

12.15- 13.00 **Traditional forest related knowledge of Indigenous Peoples of Russia – international significance and problems of preservation**, V.N. Bocharnikov, Professor, Pacific Institute of Geography, Far Eastern Branch of Russian Academy of Sciences.

13.00-13.30 Discussion

13.30-14.30 *Lunch*

14.30-16.30 ***Section 1***: **Forests, conservation of biodiversity of Kyrgyzstan.** Chair: A.A. Orozumbekov, Ph D (Biology), Senior scientist, Agrarian University, Kyrgyz Republic.

Section 2: **Forests and traditional knowledge.** Chair: V.N. Bocharnikov

Section 3: **Activities of the Global Forest Coalition.** Chair: A.V. Lebedev, Bureau of Regional Social Campaigns, Vladivostok, Russia.

16.30-17.00 *Coffee break*

17.00-18.30 ***Further work of Sections 1, 2 and 3.***

18.30-19.00 **Presentation of Sections’ work.**

Tuesday, 30 July 2009

09.00-09.30	**Traditions and innovations in the system of water consumption and forest exploitation in Central Asia for environmental stability preservation.** B.A.Toktoraliev B.A., Professor, Osh TU, Kyrgyzstan.
09.30-10.00	**The Caucasus: biodiversity and climate change.** T.F. Urushadze, Professor, & Y.E. Nakaidze, Dr.Sc., NGO "Dzelkova", Tbilisi, Georgia.
10.00-11.00	**Discussion**
11.00-11.25	*Coffee break*
11.25-11.45	**Social and ecological PR in the structure of nature-conservative activity**. N.M. Domanova, Ph D (Biology), Moscow, Russia.
11.45-12.05	**The role and significance of local knowledge in ecological problem solving.** A.S. Karpov, Ph D (Biology), Research Center ECOM, St. Petersburg Society of Naturalists, Russia.
12.05-12.25	**Issues on legal and civil liability for conservation of forests of the Far East after the forest reform.** A.V. Lebedev, Honoured ecologist of the Russian Federation.
12.25-13.00	**Discussion**
13.00-14.00	*Lunch*
14.00-16.30	**Further work of Sections 1, 2 and 3.**
16.30-17.00	*Coffee break*
17.00-17.40	**Presentation of Sections' work.**
17.40-18.00	**Formal closure of the conference**
	Closing speeches:
	A.M. Dzhuraev, Pro-rector of KNU named after Zh.Balasagyn
	V.A. Korotenko, Ph D (Philosophy), Chairman of the Ecological Movement "BIOM"

Wednesday, 1 July 2009 – Press conference for journalists.

Appendix 2:

RESOLUTION

OF INTERNATIONAL CONFERENCE ON TRADITIONAL FOREST RELATED KNOWLEDGE, FOREST BIODIVERSITY AND SUSTAINABLE FOREST MANAGEMENT IN EASTERN EUROPE, NORTHERN AND CENTRAL ASIA

28 - 30 June 2009, Bishkek

Participants of the conference, organized on initiative of the Global Forest Coalition (GFC), IUFRO, Kyrgyz National University named after Zh.Balasagyn, and Ecological Movement “BIOM”, representatives of state organizations, the community, business, expert community, science and education, experts from Russia, Georgia, Kazakhstan, Uzbekistan, Ukraine, Tajikistan, Turkmenistan and Kyrgyzstan

NOTE that:

Forests in the Kyrgyz Republic fulfil a number of important functions, namely environmental, antierosive, mudflow-retaining and water-retaining functions. I.e. forests of Kyrgyzstan create favourable conditions for the Life both at local and global levels;

Forests of the Kyrgyz Republic are unique component of the world resources;

In spite of costs of economic development not oriented at environmental sustainability currently Kyrgyzstan has unique natural forest ecosystems and species diversity;

Forest is a strategic resource of the Kyrgyz Republic ensuring survival of further generations;

There is high potential of scientific manpower and skilled specialists particularly in the sphere of forest exploitation in Kyrgyzstan.

EXPRESS THEIR ANXIETY, that till now there are following problems in the forest sphere of Kyrgyzstan:

- Assessment of present condition of forests doesn’t set forth enough in normative documents;
- Work in the sphere of forest productivity conservation is poorly developed;
- The program on community forestry management is poorly developed;
- Till now vermin and diseases of forests are wide spread indicating of critical condition of natural forest ecosystems of Kyrgyzstan;
- At present the structure of forestry management doesn’t conform to needs in this sphere;
- Till now there is strong man impact on forests – (haymowing, pasturing, cutting, fires, littering, ecologically destructive tourism);
- High intensity of natural factors (mudflows, landslides, avalanches) negatively influences on condition of forests of Kyrgyzstan;
- Insufficient level of specialists in the sphere of forests conservation and exploitation, that negatively influences on forest management in Kyrgyzstan;
- Poor level of informational campaigns about biological and forest diversity;

- Poor support of forest science and lack of scientific and research base in the sphere of forests conservation.

PROPOSE:

1. It is necessary to support revival processes of positive traditional experience of forest exploitation and preservation (activation of research and educational programs and implementation of best practices, assistance of forest ecosystems natural renewal, relevant changes in legislation);
2. Keeping in mind indispensable role of Central Asia forests in climate forming (softening) and stabilization of ecological situation it is necessary to intensify the work on study of integration of traditional forest related knowledge of Central Asia people in practice;
3. Modern approaches to preservation, exploitation and renewal of forests should be supplemented with account of local communities' interests and traditional knowledge;
4. To make changes in the Forestry Code to intensify work on involvement of population into the process of forests management by tender;
5. To support existent specially protected natural sites in scientific and research activity for inventory of bioresources, including forest through strengthening of scientific potential and material base;
6. To introduce legal protection of natural ecosystems, ban on substitution of natural ecosystems with man-made one;
7. To work out measures on stimulation of local communities initiatives on preservation of forest biodiversity and productivity;
8. To reform a system of forestry management with the purpose of differentiation between management and control functions;
9. To favour improvement of planning of forest exploitation at local level (taking into account local specificity);
10. To favour renewal of traditional practice of natural resources management (for example, distant-pasture cattle tending promoting reduction of load on forests and pastures in rural areas);
11. To impose sanctions on storage, transportation, trade and use of Red Book species and goods made of them;
12. To impose a ban on import and introduction of unusual (alien) species of plants and animals, that can damage biodiversity of Kyrgyzstan, particularly forest;
13. Involvement of the community in making of ecologically significant decisions, especially in the sphere of forest management;
14. Improvement of the community awareness about nature-conservative activity, particularly in the sphere of forest exploitation;
15. To hold annual public consultations both at republican and regional levels on biodiversity condition, large projects that can have consequences for biodiversity with the participation of key specialists and responsible people;
16. To work out mechanisms of improvement of forestry specialists' competence level in the sphere of forestry and reforestation activities;
17. To facilitate creation of microreserves and national parks and to introduce new nature-conservative technologies, that can provide forest ecosystems preservation;
18. To work out the system of income alternative sources assignment to population facilitating reduction of natural forest communities destruction;
19. Central Asia peoples have centuries-old experience of natural resources use including forests, that didn't lead to its destruction.

30 June 2009

Appendix 3: Conference Participants

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Appendix 4: Press Release

Press conference – News agency "Kabar" office, 1 July 2009

Press conference speakers: (*left to right*) Ilya Domashov, Emil J. Shukurov, Andrey P. Laletin and Tatyana Novikova

The International Conference on Traditional Forest Related Knowledge, Forest Biodiversity, and Sustainable Forest Management in Eastern Europe, Northern and Central Asia was held in Bishkek on 28-30 June 2009. The conference was organized on initiative of Kyrgyz National University named after Zh.Balasagyn, the Global Forest Coalition (GFC), IUFRO and Ecological Movement "BIOM".

The aim of the conference was to share results of research on forest biodiversity, the role of forests in climate change, traditional knowledge about forests and international forest policy, and to facilitate international collaboration in these spheres. The conference provided a new site for discussion of these issues.

The significance of traditional forest related knowledge in today's world is without doubt. According to the famous ecologist of Kyrgyzstan, Professor Emil Shukurov, peoples who have lived for many centuries possess an amazing treasury of wisdom regarding their interaction with their environment which we often do not respect today. Traditions, ideas about the world, and beliefs of peoples of Central Asian countries, the Caucasus and Russia are a deep resource in the search of new approaches for solving ecological problems. These traditional societies could enrich our culture both intellectually and materially.

During conference, special emphasis was given to forests and related issues of climate change. Forest ecosystems are natural climatic regulators and today they need special protection. In Kyrgyzstan the area of natural forests only slightly exceeds 4% of the total territory of the country. Under existing climatic conditions, up to 30-40% ot our republic's territory could potentially support forests. In famous epic "Manas" there are verses that describe Manas and his army being lost in the forest. Unfortunately, today it is difficult to imagine such place on the territory of Kyrgyzstan where this could be possible. According to participants of the conference, man continues to treat the environment, and forests, as an enemy on on a battlefield. Such approach is destructive and today there is a need for an integration of efforts among all strata of society and among different countries the region, and the world, for the preservation of forest ecosystems and stabilization of our planet's climate.

Scientists and specialists dealing with forests from different countries – Kyrgyzstan, Russia, Georgia, Kazakhstan, Uzbekistan, Ukraine, Tajikistan, Turkmenistan – took part in the conference. In addition to scientists and other experts, people from local communities, non-government organizations and those who appreciate the experience of our ancestors, and value their deep-rooted traditions which can provide us with new approaches for solving critical environmental problems, took an active part in these discussions. As a result of the conference, a resolution was adopted addressing conservation of traditional knowledge in relation to climate change and conservation of biodiversity in Eurasia.

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