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Preparation stage for the Project on Fire Management in High Conservation Value Forests of the Amur-Sikhote-Alin Ecoregion
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F I N A L R E P O R T

Project on Fire Management in High Conservation Value Forests of the Amur-Sikhote-Alin Ecoregion

Environmental Impact Assessment

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Summary

Report: 125 pages, figures 4, tables 12, references 70, supplements 2

AMUR-SIKHOTE-ALIN ECOREGION, HIGH CONSERVATION VALUE FORESTS, MODEL TERRITORIES, RESERVES, FOREST FIRE MANAGEMNT, CONSERVATION, BIODIVERSITY

Analysis and assessment of Project on Fire Management in High Conservation Value Forests of the Amur-Sikhote-Alin Ecoregion

Goals: assessment of Project environmental impact and contribution to the implementation of the program on forest fire prevention, elimination and control in the Amur-Sikhote-Alin ecoregion.

Present-day situation, trends and opportunities for developing a fire prevention, elimination and control system were in the focus of attention. Existing data and materials have been studied to reveal forest fire impact on environment as well as Project environmental impact.

Project under consideration is aimed at improving current fire management system and strengthening protection of ecoregion forests from degradation, which make it extremely socially and ecologically valuable and important.

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Contents

Introduction

Implementation of GEF Project on Fire Management in High Conservation Value Forests of the Amur-Sikhote-Alin Ecoregion (Project) is extremely important to conserve unique moderate climate zone forests, characterized with high biodiversity and a rare combination of northern, southern and relict plant and animal species. Present day conditions of these forests are getting worse because of extensive timber logging operations (including illegal) and forest fires. It is quite evident that the existing fire management system can not change the negative trends and lessen fire impacts in the Amur-Sikhote-Alin ecoregion (ASAR), such as reducing forest area and diminishing biodiversity.

Vast territories of ASAR south foothill and low-mountain belts, as well as the Lower Amur basin are covered with secondary forest of low value or no forest at all. Increasing fragmentation of high biological value forests (HCVF) causes forest ecosystem degradation, makes forest fire preventive activities in remaining fragments of virgin taiga more difficult. Further ASAR forest conservation is viewed not possible without effective fire management in the region. That is why there is no doubt that in the recent 20 years the proposed Project would be the most considerable and effective contribution to the protection and conservation of unique forest ASAR ecosystems.

It is a comprehensive project with components, which fields of application, tasks set and results predicted are well interrelated. The Project focuses on several issues, namely:

- unified fire management system in the region, with HCVF fire-prevention priorities;
- forest fire management improvement in HCVFs of the ecoregion;
- increasing public awareness and participation in fire management;
- Project management on regional level with the leading role in the Project of the RF Federal Forestry Agency.

Essential Project advantages include:

- integrated approach to pursue the main goal of the Project;
- by-component feasibility analysis of Project activities;
- defined specific criteria to assess Project deliverables;
- defined specific criteria for Project activities monitoring.

The present study is an addition to Project feasibility study and is focused on special environment conservation issues, as all activities undertaken or not have a certain impact on natural environment. Ecological assessment tasks were the following:

1. Environmental assessment of proposed Project activities.
2. Optimization of certain Project activities to increase efficiency of the Project.

The authors group includes consultants B.A. Voronov, A.L. Antonov, A.K. Danilin, A.N. Makhinov, Z.G. Mirzekhanova, S.D. Shlotgauer and co-authors M.V.

Kryukova and T.N. Tolmachova. Different materials have been used, such as World Bank operational policy, Russian MNR concept works on forest fire management, numerous studies in the Far East, field works of 2004, reference and scientific books. The environmental community, Fart East scientists and specialists also participated in discussions.

Project activities were approved by the public at the meetings arranged (Attachments 1,2,3). Local forest services and the population at large are greatly interested in the Project and its small grant program. Government institutions responsible for fire management and local authorities also welcome the Project.

While collecting and analyzing available materials the authors found support and understanding of government representatives, forest service, academic and environmental communities, and the public. Khabarovsk Wildlife Foundation rendered effective and qualified support. Special thanks are given to all organizations and individuals who assisted to the present study and to the preparation of the report.

Chapter 1. Executive Summary

1.1. Assessment of biological value of forests in Amur-Sikhote-Alin ecoregion

Forest fire management in the forests of high biological value in the Far East is a complicated and new task, targeted at the forests with high biodiversity index. Beside biodiversity, the project will take into consideration some other complex parameters, such as low level of disturbance and damage, high potential of forest self recovery, rare and extincting species, ecological functional role of forest ecosystems.

In order to introduce these parameters into the system of Project Activities it is necessary to define a concept of high conservation value forests (HCVFs).

Thus a new approach should incorporate concrete qualitative and quantitative criteria for flora and fauna biodiversity objects. The following key indicators are proposed to be included into the Project:

- rare and extincting plant species, registered in Red Data Books of different levels, including the Red Data Book of the IUCN, CITES List, Russian Federation Red Book, regional registers of such kind;
- quantitative biodiversity parameters for vegetation cover and animal world of model plots;
- biodiversity indexes of ecoregional and model levels;
- autonomy coefficient as an indicator of ecosystem uniqueness;
- representation of flora and fauna in model territories, for which forest prevention measures are worked out.

No doubt, that these parameters will vary significantly from model territories to not specially protected areas (PAs), from the north to the south of this ecoregion. Comparative biodiversity characteristics and representation in the best studied reserves (Kedrovaya Pad and Bolshekhektsirsky) are shown in Tables 1 and 2 (Melnikova, 2002; Azbukina et al, 1986; Kukharenko, 1986; Chardantseva, Gambaryan, 1986; Korkishko, 2004)

Table 1: Comparative Characteristics of the Largest Taxons in Two Model PAs (number of species)

Vegetation	Reserves	
	Kedrovaya Pad	Bolshekhekhtsirsky
Vascular plants	917	1012
Fungi	1804	385
Moss	189	52
Lichen	250	148
Algae	373	293

Biodiversity parameters may be used to range model forests by priority criteria and thus help to develop fire prevention strategy and tactics for various areas of Amur-Sikhote-Alin ecoregion.

Table 2: Biodiversity and flora representation in reserves of Northern Amur-Sikhote-Alin ecoregion

Protected Area	Area (th. ha)	Number of vascular plant species	Representation (%)
Bastak	91771	500	27.0
Bolonsky	103600	277	14.7
Bolshekhekhtsirsky	45439	1012	51.2
Bureinsky	358440	510	54.8
Komsomolsky	64413	634	43.7

The zone with high biodiversity stretches along the west macroslope of the Sikhote-Alin mountain range and practically coincides with the northern boundaries of Korean pine range. Evident decrease in biodiversity is registered on the left bank of the Amur River, where local floras have 346-400 vascular plant species (Shlotgauer, Kryukova, Antonova, 2001). Biodiversity decrease is also observed in the Sikhote-Alin axis zone and on its eastern macroslope (local flora of the Tumnin River basin – 380 and Botch flora – 588 vascular plant species). It turns out, that it is not relict conservation objects but endemic high-mountain flora species, which take the first place in boreal biomes of central and northern Sikhote-Alin axis zones. Local flora of Tordoki-Yani mountain massif, for example, is composed of 582 vascular plan species, only 10% of which are endemics (Shlotgauer, 2002).

Ecological and geographic structure of biodiversity in model forests, established on developed territories (# 1,3 and 5) is very mosaic and complicated. It is represented by very fragmented massifs. Biological communication channels between them are disturbed significantly. That is why, biodiversity self-supporting and recovery processes became difficult mostly due to heavy anthropogenic impacts and expanding ecotone zone because of fires on adjacent territories.

Considering the factors mentioned above, additional approaches for HCVF selection are proposed. For examples, one of them is based on maps from the ‘Atlas of little-disturbed forest areas of Russia’ (scale 1:1500000; squares FE-9 – FE-17) (2002), vegetation maps for Primorsky Krai, Khabarovsky Krai south and Jewish Autonomous Oblast (scale 1:1000000 and 1:500000) (Petropavlovsky, 2001: Shlotgauer, Bulgakov, 1988; Slotgauer, Kryukova, 1999, etc), map-charts of ASAR territory zoning by biodiversity levels (Selegets et al., 2001; Slotgauer, Kryukova et al., 1999, etc). Six integrated criteria (categories) used in the approach reflect the level, degree or scope of:

- conservation importance;
- functional importance of the territory in biodiversity conservation;
- size of territories, damaged by fires;
- threats;
- isolation;
- importance for indigenous communities.

Such approach will improve legislative base for management, fire prevention and monitoring in various HCVFs.

Levels of conservation importance include:

A. Global importance status means the presence of unique or rare biomes and/or species, registered in the International Red Book. Sikhote-Alin biosphere reserve is included into the international system of model forests.
B. National importance status means the presence of rare ecosystems and/or species, registered in the Russian Federation Red Book (2001). Federal state nature reserves are Botchinsky, Bolshekhekhtsirsky, Lazovsky, Ussuriisky, Kedrovaya Pad, Khankaisky and others. Federal special reserves are Barsovy, Badzhalsky, Khekhtsirsky, Udyl, Tumninsky and others. National parks Anyuisky, Kema-Amginsky, Sredne-Ussuriisky, Verkhne-Ussuriisky are planned to be established.
C. Regional importance status (krai and oblast) means the presence of species, included into Khabarovsky Krai (2000), Primorsky Krai (2002) and Jewish Autonomous Oblast (1997) Red Books. Khasansky national park, several regional special reserves (Chukensky, Mataisky, Khutinsky, Pikhtsa, Mopau, Dalzhinsky, Bobrovy, Birsky, Shukhi-Poktoi, Khalkhadjyan, Churky, Tajozhny, Goraly, Berezovy, Tikhy, Chernye Skaly, Losiny, Zaliv Vostok, Poltavsky, etc.) and numerous landscape, botanical, zoological, hydrological, geological nature monuments have this status. Nature parks Khoso, Byazemsky and Yuzhno-Primorsky are planned to be established.
D. Local importance status (district level) means conservation and / or limit of land use in areas of plant and animal populations, which are decreasing because of constant fires. 200 nature monuments and several reserves planned to be established in the near future serve as examples.

According to their importance HCVFs can be included into any of the four categories.

According to ***functional importance of the territory for biodiversity conservation*** HCVFs can be subdivided into:

A. Middle-mountain HCVFs (reserves Kedrovaya Pad and Ussuriisky in the Primorsky Krai south, Khorsko-Bikinsky area, Anyuisky national park in Khabarovsky krai).
B. Mountain-taiga model areas in Sikhote-Alin axis zone (Sikhote-Alin biosphere reserve, reserves Taezhny, Chukensky and others).
C. High-mountain and mountain-taiga HCVFs on Badzhal and Bureisky Ranges (reserves Badzhalsky, Dudlinsky and others).

D. Swamped HCVFs in the Middle-Amur, Evoron-Chukchagirskaya, Udyl-Kizinskays, Amgun-Amur lowlands (Bolonsky state nature reserve, special reserves Bobrovy, Kharpinsky, Alkan, Udyl and others).

The *size of territories, damaged by fires* may be described as:
A. Large (over 50 th. ha) blocks of HCVFs, with little damage from fires;
B. Middle-size (10-50 th. ha) blocks of HCVFs, with little damage from fires in ASAR priority regions;
C. Small (1-10 th. ha) HCVF territories with high biodiversity, with little damage from fires. They should be identified in highly fire-endangered areas.

According to *fire threats* HCVFs may be classified as:
A. Highly fire-endangered areas, such as Pikhtsa-Tigrovy Dom, Siny mountain range (Primorsky krai), Bikinsko-Khorsky area (Koenini), Nelma-Borchi-Samarga area, etc., – which need urgent measures to be taken and ranking as HCVFs.
B. Less fire-endangered areas are Botchi-Koppinsky and Kafe-Katensky divines, Kur-Urmiisky, Omeldinsky mountain ranges in Khabarovsky krai, Sutarsky and Pompeevsky mountain ranges in JAO and Alchan-Bikin area in Primorsky krai and some others. They also need the HCVF status.
C. Potentially fire-endangered areas, such as some areas in Sikhote-Alin axis zone and the Amur valley, which may be affected by the future economic development.

HCVFs have different *isolation degree*, to include:
A. Isolated HCVFs surrounded by anthropogenic infrastructure or strongly damaged by fire and degraded ecosystems (Birsky forest, Komsomolsky nature park, etc.)
B. Isolated HCVFs surrounded by burned-out forests, secondary forests or other natural ecosystems, bogs, meadows, which have high fire potential (reserves in JAO Churky, Uldury, Dzhevdukha, Zhuravliny, etc.)

Various forests have *different importance to indigenous communities*:
A. Extremely important to support life of indigenous and local communities are coniferous and broad-leaved forests, rich in game, nuts, berries and mushrooms, medicinal herbs; flood-plain forests along spawning rivers and the similar.
B. Important for life support are hunting areas and forests, where non-forest products are harvested.
C. Forests of limited use by locals include sparse swamped forests, mari, dwarf alder groves, sparse forest with a low biodiversity index.

Comparisons should only be made within the category, but not between categories, mentioned above.
In addition to the forest resource and the baseline-reference functions, additional criteria to be used include functional role of the little-disturbed forests. Their landscape-stabilizing and environmental functions support biodiversity in Sikhote-Alin mountain range and in Priamurje.

Environmental role of HCVFs is closely connected with landscape characteristics of a certain area. In the bald mountain belt tundra and sparse forests have water-regulating importance. In river valleys forests have water-protecting role. In the mountains forests prevent erosion. In flat permafrost plains they stabilize permafrost processes. *Water-saving function* of model territories serves to support high water level in ASAR rivers and general water reserves in the Amur basin. Forests of such importance are first of all flood-plain forests and valley dark-coniferous, larch and broad-leaved forests. Bogs play a great water-protecting role as well. *Erosion-preventing function* of HCVFs is important in mountain areas of Sikhote-Alin, Badzhalsky and Bureisky ranges. *Permafrost-stabilizing function* of HCVFs helps to maintain the stable permafrost level. It is rather important for landscapes with not deep seasonal frost and permafrost in the northern part of the region. Burned-out forests and logging operations in these areas lead to swamping and formation of thermokarst lakes and bogs. When the upper permafrost layer melts the soil sinks and its density increases. Thus depressions are formed, water and snow accumulate there and soil freezes more deeply. This depression gradually grows and turns into a lake or a bog. On the slopes this thermokarst process is coupled with erosion. This double process is more intensive than the thermokarst. HCVFs *biostation role* should be assessed by the degree of association of particular plant and animal species with certain vegetation communities.

Several forested areas of the ASAR should be considered HCVFs. These forests may include fire-damaged areas, areas of intensive logging, heavily fragmented areas which all still carry on their biotopic functions and are home for tigers, leopards, red wolves, Amur forest cat, etc.

Table below describes key HCVFs of the ASAR.

I. Ecoregional level Ecoregion has high biodiversity of relict species and high endemism level due to peculiar historic development of Sikhote-Alin territory	Main nature values: - high-value biological representation of the ecoregion in the Far Eastern coniferous-broad-leafed zone; high-level autonomy of flora and fauna in Sikhote-Alin endemic center (presence of monotype genera and families); - populations sustainability capacity of major animal and plant species that form natural ecosystems of the given territory; - capacity of fauna species for local migration, dependant on long-term dynamics of natural landscapes; - representative water objects with their drainage systems (Bikin, Bolshaya Ussurka, Khor, Anui, Ussury rivers); - natural and cultural environment that

	supports local customs and traditions based on traditional land-use practicies of indigenous people.
II. Model area level 1. Large natural landscapes are changed under anthropogenic impact, including fires that fragmented large forest massifs (Central-Sikhote-Alin, Bidzhan-Khingan and Khor-Khekhtsir model territories) 2. Large territories, significantly changed by human activity, populated, fragmented to various degree (Middle-Amur lowland with forest-meadow-bog ecosystems (model territory #1)	Main nature values: - major part of biodiversity elements is preserved; - populations of most existing plants and animals have self-sustaining and self-regeneration capacity; - medium to high level of “boundary effects” due to local frequent fires. Main nature values: - populations of the majority of the existing plants and animals have self-sustaining and self-regeneration capacity or can be regenerated artificially; - high level of “boundary effects” due to spring and autumn fires; - natural dynamics of forest ecosystems and rather sustainable populations of big mammal species; - ranges of many relict plant and animal species are highly fragmented.
III. Level of specific objects (PAs) 1. Habitats of rare relict and endemic plant and animal species, migration routes or habitats of endangered and extincting species (tiger, leopard, yew tree) 2. Key habitats of rare and extincting species, (for example in case the specie is presented by a number of populations but only this particular one is sustainable or lives in a typical habitat). 3. Critical areas for migratory species (like places of rest, feeding for migrating birds, roe deer and other animals).	Main nature values: - rare species as such Main nature values: - sustainable populations of those species, which present state in other places is not sustainable (for example the population of awl in Bikin river basin) Main nature values: - meadow-forest territories in JAO, Ussuri and Amur valleys, lakes Evoron, Chukchagirskoe, Udul and others with little

	or heavy damage from fires.
IV. Economic entities (forestry enterprises (leskhozes) and their subdivisions) 1. Mostly untouched areas of zonal ecosystems on territories which suffered from economy–driven transformations. For example, ranges or isolated areas of polydominant broad-leafed forests in the ASAR south (Katen river basisn) or spruce forests (Pikhtsa river basin) 2. Rare ecosystems (naturally or which became rare due to economic activities)	Main nature values: - last remaining areas of extincting vegetation types. This category includes various spots with forest vegetation, which are well preserved compared to the surrounding areas.
V. Forests with especially important ecological functions 1. High-mountain forests along the upper forest boundary on the steep slopes (1400-1700 m above sea level) 2. Forest belts along big rivers, lakes, bogs and sea coast 3. Water-saving forests in watersheds of the major spawning rivers (Anui, Amgun, etc.) 4. Reproduction areas of rare and valuable game species (Tigrovy Dom)	Main nature values: - larch, spruce and dwarf Siberian pine forests on the Sikhote-Alin north and southern slopes of Maly Khingan and Bureisky mountain ranges form environmental conditions, prevent erosion and avalanches, stabilize permafrost, regulate river water regimes and play the biostation role.
VI. Forests of great importance to local communities, including support to culture, religious traditions, etc	The fact that locals select a particular forest plot indicates its importance for local communities.

1.2. Potential project adverse environmental impacts

Forest fires damage vegetation, the most important component of the biogeoceonose and cause transformations in natural complexes on territories, which are much larger than those directly affected by fire. The degree of such transformations depends on particular natural conditions and fire intensity.

More dynamic landscape and biological components suffer the most. Non-biotic components that provide living conditions for plants and animals, such as soils, relief, water streams also suffer. The relief undergoes little change after the fire, mostly microrelief is changed. But relief forming processes change significantly.

In ASAR, especially in its southern part, forest fires activate exogenous relief-forming processes, which in their turn, influence the dynamics of other environment components and normal functioning of biogeoceonoses.

On the steep slopes (15° and more), dominant in the ASAR mountain parts, after the fire heavy rains wash out the upper soil horizon (weak in the mountains) and open rock debris layer. Thus stone streams and slides are formed, where vegetation will not be generated for 100-150 years or even more. Vast areas on the North Sikhote-Alin, Low Priamurje mountain ranges (Omalsky, Kivun, Myao-Chan and others) have no forest.

In recent years runoff of many rivers is becoming unstable because many fires have destroyed the surrounding forests. In small river basins over 50% of forests are destroyed, in middle-size river basins – more than 30% and in big river basins – over 10 %. Catastrophic floods are disastrous. They activate riverbed deformations, formation of sub-streams, which, in their turn, reduce the number of reaches and rifts and simultaneously cause the expansion of remaining ones. Thus the spawning fund of the river decreases not only because of the reduction of the number of spawning places but also because their quality turns to the worse due to silting.

Soil cover destruction in drainage areas in the first years after the fire increases discharge of terrigenous and dissolved substances into the streams, thus spoiling water quality significantly.

Landslide processes occur due to weakness of unconsolidated mantle on the steep slopes. They become more intensive in areas of industrial activities, such as road construction or other activities that mechanically disturb the upper soil horizon. Sliding of soil blocks, even of medium size, is dangerous for people. At the end of winter – beginning of spring on the steep slopes up in the mountains snow slides process may become active.

In natural conditions mudflows usually accompany small and temporary streams. But after the fire they expand to bigger streams (category 2) and even rivers, causing riverbed deformations and solid material discharge increase. Mudflows also significantly transform river-valley bottoms, activate deep erosion, reduce ground water level.

The Project is important for the Far Eastern Region and for its southern part in particular, as biodiversity in HCVFs suffers frequent systematic fires. That is why main Project activities are focused on fire monitoring and prevention, developing GIS, integrating ecoregional fire management system into the Russian Ministry of Natural Resources information system of remote forest fire monitoring, based at Regional Forest Fire Center. Thus a unified dispatch service, capable to address fire risks will be established in the ecoregion.

Activities mentioned will bring only a positive effect. The most valuable Project input is the support of expensive fire management activities in PAs (forest management, GIS, communication, etc.). Besides, the Project will enhance

population awareness and involvement in fire management. Technical, training and methodological base for ecological education in the region will be improved. No doubt, this is the best contribution to the formation of the proper environmental attitude and understanding of the young generation (about fire and its impact).

Irrespective of overall positive outcome of the Project, some small-scale negative impacts on environment, flora and fauna might occur.

Several field activities are planned in the Project framework, which may have certain impact on some components, including plant and animal world, namely:

a) annual controlled experimental burnings;
b) development of the network of fire-brakes, paths, helicopter pads, especially in remote PA territories.

Positive and negative impacts of these activities on plant and animal world has been analyzed and the results are described below.

A. Proposed activity: annual controlled experimental burnings.

Probably these activities are possible in already burned areas with dead wood and branches, which may cause new fires, and in areas, where natural forest regeneration is difficult. In any case, each site should be carefully inspected in terms of future impact. Size of the plots may vary depending on the site specifics. Some of them may be bigger or smaller. This work is recommended to follow the fires or be carried out next year. Later on such activities seem less necessary as natural regeneration of plants and animals takes place there. If such a site is burned, remaining and/or regenerating plants and animals will be destroyed. Only in places, where regeneration is problematic, such burnings are necessary.

B. Possible negative impacts of the construction of fire-brakes on the area of 660 ha (1100 km x 6 m – average width) are assumed as follows:

- access to HCVFs becomes easier and the risk of fire increases; unregulated harvesting of medicinal, rare, extincting plants and food forest products, etc.;
- hydrological regime changes in small rivers;
- planar and linear soil erosion development;
- construction wastes accumulation along the fire-brake, including such inflammable materials as wood, tree stumps, etc;

Possible negative impacts of fire-brake construction may cause linear soil erosion and animal habitat and migration route disturbance. It is a known fact, that each timber-truck driver has a gun under his seat. Road construction will increase poaching of big animals, which use clearings in snowy winters and like open spaces in summer.

Possible negative impacts of path construction in area of 55 ha (1100 km x 0.5 m) are assumed to be soil compression under the paths and underground drainage disruption, trampling out rare and extincting plants (most fragile are orchids, ferns, lilies), as well as easier access to HCVFs that will cause negative biodiversity transformations.

Total area under all fire watchtowers will not exceed 1 ha. One tower foundation will occupy 1/100 ha. In the immediate vicinity of the tower trees are cut

to avoid their contact with the tower. To lessen wind pressure on the tower tree-cutting on larger areas is not recommended (Danilin, 2002).

If a watchtower is built on the forest fund territory, it will result in insignificant loss of range for some plant and animal populations.

On the whole, the proposed Project, if implemented, will have positive effect on ASAR flora and fauna. Forest management improvements in HCVFs will contribute to habitat conservation for all forest species.

1.3. Project positive impact enhancement opportunities

To enhance positive impacts of the Project it seems important to increase the role of biodiversity conservation during the Project implementation and after the Project is completed, to form awareness of ecological and economic importance of HCVFs for the sustainable functioning of natural and natural-economic systems, as well as to form awareness of the scope of damages, that might be caused by fires.

Vital priority is the *formation of the category of economic value of biodiversity* in the context of the regional and national well-being.

For the time being there is no single method developed on federal or regional level, which can be applied to calculate compensations for fire losses, or profits lost for local communities.

Present loss estimates for non-timber forest products are 200 times lower than market prices (Trushkin, Shapkhaev, 2003). The same stands true for the calculation of losses from illegal harvesting of and damage to the Russian Red Book species.

Project positive impact will increase if biodiversity value in PAs is assessed on the basis of the concept of general economic value. This value is composed of indirect costs for the use of water-regulating, water-protecting, environment-forming, erosion-preventing and other functions.

The following activities will enhance positive impacts of the Project:

- support of the initiatives that enforce ecological and fire-prevention education
- publications of ecological literature for small children and teenagers (fairy tales, booklets, teaching aids, etc.);
- involvement of pre-school and school children in training and play activities, aimed at promoting fire prevention;
- implementation of minor *monitoring* programs in ecological summer camps for children to expand participation of different age groups in the Project;
- description and analysis of positive sides of indigenous people economic activities in HCVFs in order to use positive experience gained;

The benefits from the Project to conservation would be maximized if the developed GIS would contain adequate layers of *biotic components*, which constitute the most essential value of forests. These data can be found in various scientific reports, done by specialists from the Institute of Water and Ecology Problems FEB RAS for Khabarovsk Krai and Jewish Autonomous Oblast governments, different organizations and in the frame of WWF and GEF activities. They are “Biodiversity conservation” (1997-2003), “Establishment of PAs net to protect Northern Sikhote-

Alin ecosystems", "Special protected areas in Jewish Autonomous Oblast", "PAs in Primorsky krai", "Amur green belt" and others. Studies completed include: "Ecological and economic feasibility study for Anuisky national park" (with a set of biodiversity maps), "Ecological feasibility study for Vyasemsky and Khoso nature parks" (2002-2003), "Assessment of PAs condition in JAO" (2003), "Assessment of planned timber operations impact on Khutu river basin environment" (2001), "Vegetation biodiversity in Botchinsky reserve in Mulpa river basin and adjacent protected zone" (2002), "Conditions of rare plant and animal species, registered in the Khabarovsk Krai Red Book, after catastrophic fire in 1998-2001" (2003), "Electronic data base on rare and extincting plants, registered in the Khabarovsk Krai Red Book" (2004) etc.

Based on forest management maps and materials, compiled under the projects enumerated above, the following maps may be included into GIS:

- on the ecoregional level several 1:1000000 scale survey maps should be compiled to include such layers as " HCVF zoning by vulnerability to fires", "Levels of risk of pyrogenic degradation of HCVF biodiversity", "Map of protected nature objects in ASAR";
- on the level of model territories maps would include "Catastrophic fires and biodiversity", "Vegetation communities of key sites in model territories".

To assess the effectiveness of conservation and fire management activities planned, monitoring is needed on levels of the ecoregion and model territories. Ecoregional assessment will allow understanding of a large-scale situation and predictions of its changes, whereas assessment of model sites and leskhozes will provide necessary information on changes in biodiversity, hydrological regimes and water quality, caused by fires.

1.4. Project development

GEF Project on Fire Management in High Conservation Value Forests of the Amur-Sikhote-Alin Ecoregion is viewed as the World Bank's initial support to three Far Eastern entities of Russian Federation in the period of institutional transformations of forest economy in Russia. The Project sets the basis for cooperation at the ecoregional level, stresses active population involvement and local role in fire management.

World practice shows how important are positive tendencies and tangible results for the project implementation, as well as the gained experience to be used after. They include:

- implementation of Project fire-management scheme in high biological value forests of Amur-Sikhote-Alin ecoregion;
- adaptation of acquired experience in other regions, states and projects;
- improvement of methods, approaches to fire management;
- improvement of legislative base;
- formation of ecological culture of the population through education and involvement in fire-management.

Actuality of the tasks set in the Project will increase.

Chapter 2. Strategy, legislative and administrative systems

2.1. Forest fire management on the ecoregional level in Russian legislation.

There are lots of normative acts that regulate activities in environment and rational nature and land use spheres. Several of them have direct or indirect reference to forest fire situations. The list includes Federal Laws (FL), resolutions of the Russian Federation Government (RRFG), ministry instructions and regulations (Rosleskhoz, Russian Ministry of Natural Resources) and similar documents, adopted by the regional governments. Besides, there are international conventions and agreements that have a certain relation to fire management. For example, under several international conventions Russia takes the responsibility for conservation of rare and extincting plant and animal species and their habitats.

All main documents are grouped by topics.

Population

FL "On General Organization Principles of Local Self-Government in the Russian Federation" (2003);

FL "On Territories of Traditional Nature Use by Indigenous Peoples of Siberia and Far East of the Russian Federation"(2001);

FL "On General Organization Principles of Legislative (Representative) and Executive Organs of Power in the Entities of the Russian Federation"(1999);

FL "On Protection of Population and Territories from Natural and Technogenic Disasters"(1994)

Regional documents:

Governor resolutions:

"Regulations on Citizens Behavior in Primorsky Krai Forests"(2002).

"On Strengthening Fire Safety Measures in Khabarovsky Krai Settlements" (1999)

Environment protection

International documents:

Biodiversity Convention. Rio de Janeiro . 05.05.1992, ratified by FL 17.02.95

Convention on Wetlands of International Importance as Water Fowl Habitats. Ramsar, 02.02.1972, ratified by USSR 1976

Joint Protocol of Russian and Chinese Governments "On Tiger Protection". Beijing, 10.11.1997

Russian Federation documents:

FL "On Environment Protection" (2002)

FL "Russian Federation Forest Code" (1997)

FL "On Special Protected Natural Territories" (1995)

FL "On Animal World" (1995)

Red Book of the Russian Federation (2001)

RF Ecology State Committee order "Statute on Assessment of Planned Economic or Other Activity Impact on Environment in the Russian Federation" (2000).

All-union standard 56-108-98. Industry standard. Forestry. Terms and Definitions. Rosleskhoz (1998)

Regional documents:

Red Book of Jewish Autonomous Oblast (2004)

Red Book of Khabarovsky Krai (1999)

Nature use and nature-use management (Federal Laws)

FL "Russian Federation Land Code" (2002)

FL "Russian Federation Forest Code" (1997)

FL "Russian Federation Water Code" (1995)

FL "On Mineral Resources" (1992, revised addition 2004)

Responsibility

FL "Russian Federation Criminal Code" (1996)

FL "Russian Federation Code on Administrative Infringements" (1995)

FL "Russian Federation Civil Code" (1994)

Fires

Russian Federation documents:

FL "Russian Federation Forest Code" (1997)

FL "On Fire Safety in the Russian Federation" (1994)

RRFG "Statute on The Russian Federation Ministry of Natural Resources" (2004)

RRFG "Statute on Federal Forestry Agency of the Russian Federation" (2004)

RRFG "On fixed rates to calculate penalties for damages to forest fund and other forests, violation of forestry legislation of the Russian Federation"

Recommendations for firebreaks construction in forest fund areas by burning dry grass (Rosleskhoz, 1999).

RRFG "Statute on the Russian Federation State Forest Guard" (1998)

RRFG "Fire Safety Rules in Forest of Russian Federation"(1993)

Statute on fire-chemical stations. Rosleskhoz, (1993)

Instructions on fire protection measures in forests and forest fire activities. Rosleskhoz, (1993)

Norms on fire equipment and fire-extinguishing tools for forest fund owners and users. Rosleskhoz, approved by Russian Ministry of Internal Affairs, (1993)

Concept of Forest protection from Fires in the Russian Federation (2003, draft)

RRFG "Concept of Forestry Development in the Russian Federation for 2003-2010" (2003)

Russian MNR Order "On the Results of Forest-Fighting Activities, Performed by the State Forest Services in 2003 and Organization of Fire Prevention in 2004" (2004) – issued annually

Regional documents:

JAO Law "On procedures of Involving Citizens and Businesses in Fire-Fighting in the Territory of Jewish Autonomous Oblast" (2003)

Khabarovsky Krai Law "On Fire Safety in Khabarovsky Krai" (2000)

Primorsky Krai Law "On the Division of Power between Primorsky Krai State Organs of Power in the Sphere of Use, Protection and Conservation of the Forest Fund and Forest Regeneration." (1999)

Governor Resolutions:

"On Forest Fire Prevention Measures in the Khabarovsk Krai Territory" (2004) – issued annually. Similar one is adopted in Primorsky Krai annually as well

"On Forest Fire Prevention Measures in the Territory of Jewish Autonomous Oblast" (2004)

"On Strengthening Fire Safety in Khabarovsky Krai" (2004)

Targeted Programme "Forest Protection from Fires in 2003-2010 in Khabarovsky Krai", Khabarovsk, 2000

Targeted Programme "Forest Protection from Fires in PAs in Khabarovsky Krai Territory", Khabarovsk, Far East Forestry Research Institute, 2000

The analysis of Russian legislation as a system of interrelated federal and regional laws, norms and regulations follows the problems targeted by the Project and stated in its feasibility study, namely

1. Agricultural burnings, fires on transportation, state land reserve and municipal territories.
2. Fires in high biological value forests.
3. Business involvement in the Project
4. Protection of settlements from fires.
5. Support for nature reserves and other special protected territories.
6. Fire management on the ecoregional level.

When the present Russian laws on this topic were analyzed, two main aspects were taken into consideration, the first one being the subjects of law and the second – forest fire regulation principles.

<u>The subjects of law are:</u>

- *on the federal level*: RF President, RF Federal Assembly, RF Government, Russian Ministry of Natural Resources, a special organ, authorized to manage national resources;
- *on the regional level*: representative organs of power in RF entities, executive organs of power in RF entities, prosecutor's offices in RF entities, regional representations of federal natural resource management authorities;
- *on the municipal level*: local authorities, district bodies of natural resource management.

<u>Forest fire regulation principles include:</u>

- equal power of regional and municipal authorities in fire management;
- legislative and financial backing for fire management systems;
- returning rights and authority to forest inspection and other structures with similar functions;
- enforcement of responsibility for breaking the law

2.2. Agricultural burnings, fires on transportation, state land reserve and municipal territories.

Situation: Burnings for agricultural purposes, road construction, and other purposes more than often turn into forest fires. In autumn and spring they cause 35-45% of fires. Farms, owners of summer houses, tourists, fishermen and hunters violate forestry regulations. Fires are linked to automobile and railroads, large settlements. The entire region, including nearly all model territories is endangered, with the Sikhote-Alin model territory being an exception. Most of fires occur in JAO and Primorje south.

Burnings affect the condition of wetlands in Khabarovsky and Primorsky krais, including objects of global importance. Wildlife suffers the most, especially many red-book species, such as Far Eastern and black storks, crane, big white, middle and red herons, gray goose, ducks and others. Spring fires are most damaging as many birds lay eggs before the fires start.

The problem is caused by the insufficient legal base for fire management and financing of fire prevention activities. There exists only one document "Recommendations for firebreaks construction in forest fund areas with the help of controlled fires". Federal Forestry Agency divisions, RF MNR, although responsible for fire management, are not allowed to finance fire extinguishing activities outside the fund area. Transportation authorities are responsible for the area close to the roads. It turns out that there is no legal frame for regional and municipal fire management.

Fire expansion is provoked by:

- legislative nihilism and illiteracy, violations of fire regulations by farmers and other agricultural enterprises;
- complicated and bureaucratic procedures of investigation and bringing to court for administrative infringements and civil crimes;
- absence of or insignificant punishment for breaking the law, not comparable with the damage caused;
- absence of moral restriction factors to prevent and blame antisocial conduct;
- absence of a chief coordinator – manager and fire-management system

Legal Grounds: A very clear-cut norm on burnings is stated in Fire Safety Rules for the forests of the Russian Federation, which became legally effective with Resolution of the RF Government in 1993.

Laws are not as strict as "Fire Safety Rules…". Only Article 28, FL "On Animal World" stresses the prohibition to burn out vegetation, as it spoils animal habitat. Animal habitat is mostly forest habitat. The law "prohibits vegetation burning; storage and use of toxic chemicals, fertilizers and other substances, harmful to animal species and their habitat; materials, raw materials and industrial wastes

without implementing measures, which guarantee prevention of diseases and mortality of animals and their habitat degradation".

All other legal acts contain only preventive norms, which are related to anthropogenic forest fires. Some limits are set in industry regulations for forest users. But nowhere agricultural fires are specified.

Art. 42, FL "On Environment Protection" may serve as an example. "When agricultural facilities are used, environment protection requirements should be followed, measures should be taken to protect land, soil, water objects, plants, animals and other organisms from negative economic and other activities impact.

Only activities that cause damage to the habitat of red-book plant and animal species are described as prohibited in Article 60, FL "On Environment Protection". It states that "in order to conserve and register rare and extincting species of plants, animals and other organisms Red Book of the Russian Federation and Red Books of the subjects of the Russian Federation are established. Species of plants, animals and other organisms registered in these books are exempted from any economic use…. Activities, which cause reduction in number of species of plants, animals and other organisms and their habitat degradation, are prohibited."

Responsibilities: Irrespective of legal prohibitions and limits, responsibility for agricultural fires is not regulated by any forestry law. Never the less, there are several other norms of FL "Russian Federation Criminal Code" (RF CC), FL "Russian Federation Code on Administrative Infringements" (RF CAI) and FL "Russian Federation Civil Code" (RF CC), which give government authorities the right to take legal steps against infringers.

Administrative infringements: Russian Federation Code on Administrative Infringements contains minimum 5 articles that define responsibilities of individuals, businesses, and, which is most important, senior executives for anthropogenic fires and other activities that cause forest damages.

<u>Article 8.29. RF CAI</u> deals with issues of natural object destruction. Administrative notification and fines from three to five minimum wages are imposed for destruction (damage) of ant hills, nests, holes and other places of animal habitat (*The only need is to prove that burning damaged the habitat*).

<u>Article 8.32. RF CAI</u> describes penalties for violation of fire safety rules in the forest. Administrative fines for breaking fire safety rules are imposed on individuals - from 10 to 15 minimum wages, on officials – 20-30 minimum wages, on legal entities – 200 – 300 minimum wages (*this is one proper provisions – the only need is to prove them guilty)*

<u>Article 8.33. RF CAI</u> describes penalties for violation of animal habitat conservation rules. Administrative fines for violating animal habitat conservation rules are imposed on individuals - from 3 to 5 minimum wages, on officials – 5-10 minimum wages, on legal entities – 50 – 100 minimum wages (*there are no rules of animal habitats and migration routes conservation – other document might not be valid to court)*

<u>Article 8.35. RF CAI</u> states penal sanctions for destruction of red-book plant and animal species. Penal sanctions are imposed for destruction of rare and extincting plant and animal species listed in RF Red Book, or in international conventions, and

for other actions (not actions) that may cause degradation, number reduction or habitat changes of plants and animals, as well as for collection, transportation, buying and selling of listed plants and animals, their products and parts without legal documents. Fines for individuals are 15-20 minimum wages with/without confiscation of plants, animals and hunting tools; for officials – 30-40 minimum wages with/without confiscation of plants, animals, their parts or derivatives and hunting tools; for legal entities – 300-400 minimum wages with/without confiscation of plants, animals, their parts or derivatives and hunting tools. (*It is a pity that this provision excludes regional Red Books. It is important that officials (directors of agricultural facilities) can be fined for not extinguishing burning that cause destruction of red-book species and their habitats).*

Civil responsibility is defined in FL "On Environment Protection" as related to environment damage, caused by certain actions taken or not taken.

Article 77, FL "On Environment Protection" states that "individuals and legal entities, which damaged environment by pollution, destruction, irrational use of nature resources, degradation and damage to natural ecological systems, nature complexes, landscapes or which violated environmental legislation, should compensate the damage in full scale as defined by law.

Subjects of economic or other activity, which caused environment damage, compensate the losses by paying fixed fines or paying the cost of recovery measures to be taken, actual losses and missed profit.

Authorized investigation bodies: Legal acts defining who and how can take legal steps against infringers are very important. Authorities, which can protocol the case, initiate legal procedures and impose penalties, include:

Art. 8.29, 8.32, 8.39 – bodies specially authorized for forest fund conservation and use (*Federal Inspection in the sphere of natural resource use, RF MNR - at present).*

Art. 8.33, 8.35 - bodies specially authorized for conservation, control and regulation of the use of animal objects (*department of conservation and rational use of hunting resources, Russian Ministry of Agriculture – at present*)

Art. 8.39 – directors of state nature reserves and national parks.

Claims for environment damage are initiated by specially authorized bodies in the sphere of environment protection and environment conditions control and then taken to ordinary or arbitration court. Article 78 FL "On Environment Protection" defines the procedure of environment damage and loss compensation.

Public involvement: The situation with the anthropogenic fires may be radically changed if the public is involved in fire control and management. Such provisions are made in Articles 11 and 12, FL "On Environment Protection".

Article 11, FL "On Environment Protection" states that citizens have the right to:

- assist RF government, regional organs of state power and local authorities in solving environmental issues;
- apply to RF government, regional organs of state power and local authorities with claims, appeals and suggestions on environmental issues and get timely and valid answers;

- bring their claims for environment damage to court

Article 12, FL "On Environment Protection" states that public and non-commercial organizations and other institutions have the right to:

- apply to RF government, regional organs of state power and local authorities with claims, appeals and suggestions on environmental issues and get timely and valid answers;
- bring their claims for environment damage to court

Very important provision is that citizens and public organizations can bring their claims for environment damage to court. It should be mentioned that there is a sufficient legal base for public participation in environmental control (Art. 68 FL "On Environment Protection"). Article 28.1, RF Code on Administrative Infringements states that the case may be brought to court according to:

- materials directed from law enforcement bodies, local authorities, public organizations, which contain information as evidence of administrative infringement;
- information or reports of individuals and legal entities, as well as mass media information, which contain information as evidence of administrative infringement

Strategy: The problem of agricultural fires and vegetation burnings constitute a serous health threat for people, who live on the Amur banks and in western districts of Primorje. Smoke in Khabarovsk, Komsomolsk-on-Amur and other towns lasts from 2-5 days up to several weeks. Children and sick people (heart diseases, asthma, etc) suffer most of all.

Although such problem has an interregional character it should be addressed on the municipal level. Much depends on the population awareness in particular cities and towns, what work is being done with summer house owners, farmers, tourists. Municipal system to manage this kind of fire should be organized. Fig 2.2.1. shows the structure of a system, proposed by the authors.

The basic management principle is the principle of integration of all interested parties:

- *fire management* – local authorities, district branches of federal bodies (land committees, leskhozes, fire and sanitary inspections, etc) should compose a commission, chaired by the head of municipal administration;
- *fire prevention* – mass media, leskhozes, schools and other educational establishments, pedagogical, cultural and medical institutions, scientific community and ecology NGOs, reserves, farmers' associations, etc.
- *fire extinguishing* – professional organizations, volunteer fire brigades, other organizations;
- *investigations* – representatives of internal affairs and prosecutor's offices, municipalities should compose a commission, chaired by the head of municipal administration;
- *settlement of losses* – municipal authorities, Ministry of Emergency Situations, law infringers.

Public involvement in the fire management process seems crucially important. Fire safety enforcement and public education should be carefully planned, open and

professional. Activities with targeted groups (summer house owners, hunters, tourists, farmers, etc) are very efficient. Political parties, well-known public figures, folk groups, etc. should be involved. Both control and assistance should be provided to education organizers.

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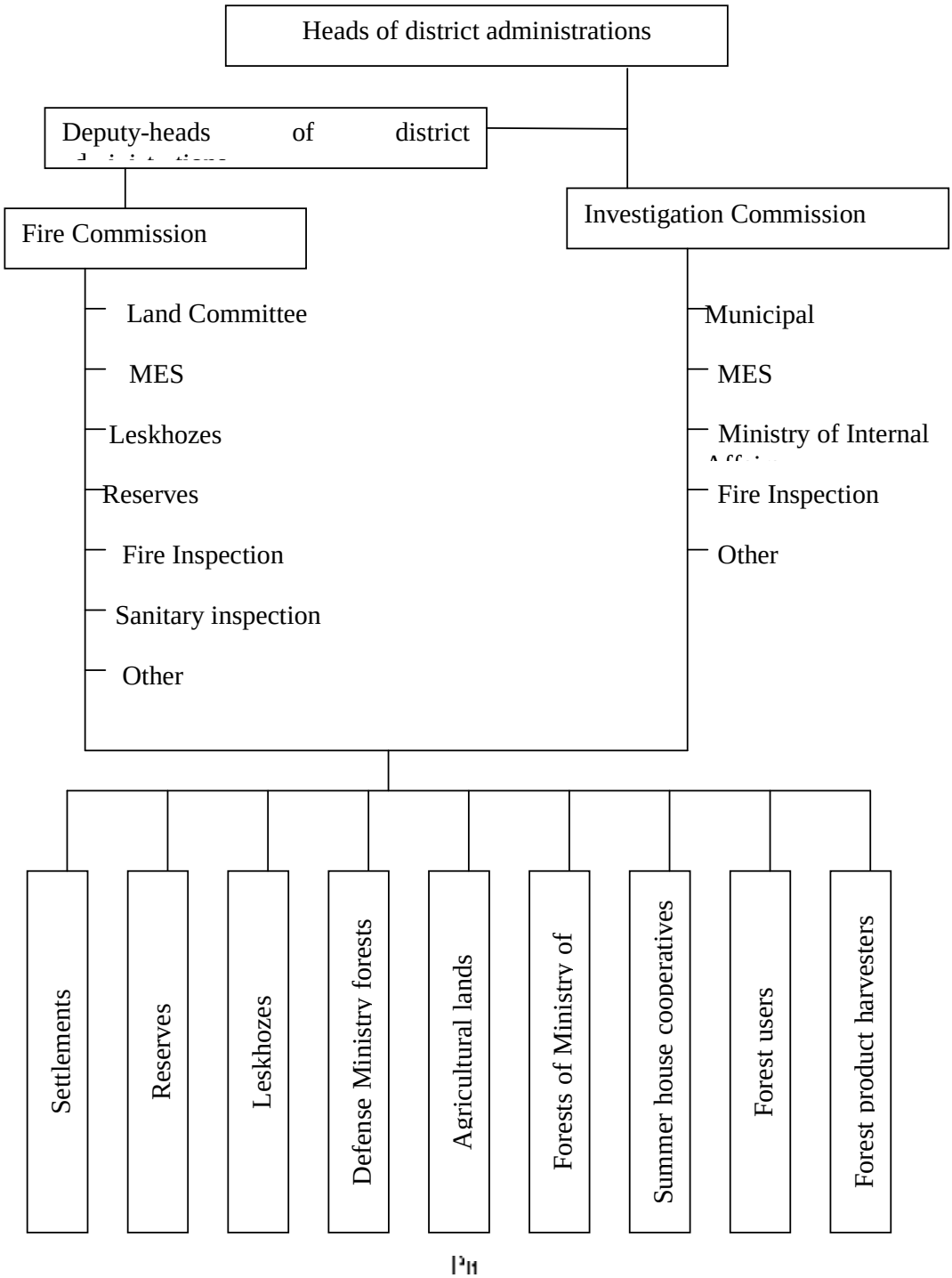

Fig. 2.2.1. Scheme of fire management on municipal level

Much also depends on the youth. Children of different age groups should be addresses (kindergarten, school, etc.). Special curriculum can be designed, focusing on historical traditions that link man and nature.

Mass media and TV in particular play a key role in public education.

Several measures to solve this problem can be proposed:

- legal base formation to manage agricultural burnings, fires on transportation, state land reserve and municipal territories;
- appointing particular authority responsible for extinguishing and preventing fires;
- financing fire prevention and burnings liquidation from budgets of different levels;
- attracting public attention to this problem;
- conducting fire-prevention activities.

2.3. Fires in high biological value forests.

Situation: Issues of fires in HCVFs are developed in detail and described in Project feasibility study. Analysis done by “Forest” Project in Khabarovsky and Krasnoyarsky krais and Sakhalinskaya Oblast shows how important and timely they are. 75% of respondents consider forest fires the most serious regional problem. Information of the sources of forest fires, collected throughout 1973-2003 reveals the following:

- careless attitude to fires – 60%,
- agricultural burnings – 6%,
- lightning – 6%;
- logging operations – 4%,
- railway – 4%,
- expeditions – 2%,
- other organizations – 4%,
- unknown sources – 14%.

The statistics shows that 80% of fires are caused by man. That is why much attention in fire management should be given to the work with population, especially with targeted groups. The analysis of questionnaires, distributed among city, village and indigenous population groups, helped in identify the share of different population categories in causing fires:

- unorganized tourists – 43%,
- non-timber forest product harvesters – 28%,
- forest company workers – 17%,

- expedition workers – 4%,
- hunters – 3%,
- others – 5%.

Three groups should be primarily addressed. Most tourists and forest product harvesters keep close to automobile and rail roads. Forest companies operate throughout the entire ASAR. Government control is insufficient. Only strengthening company owners personal responsibility can improve the situation.

Many problems are associated not with legal grounds for forest fire management, but with numerous transformations in the forestry sector. Before it became a subsidiary of the MNR, all its divisions from leskhozes to federal bodies knew their responsibilities and fire management roles. Although complicated, but financial and technical issues were somehow resolved. Nowadays financial experts determine policy of financing fire operations after the fire. This is absolutely ineffective and money consuming practice.

The situation is made worse, because private sector bears no responsibilities for forest conservation. In the first years of Russia's transition to market economy burned areas of forest leasing fund in the Far East south were compensated with new ones. "Symbolic" cost of timber gave rise to consuming attitude to nature.

Legal Grounds: Positive fire management experience and forest fire problems actuality are reflected in Russian legislation. Respective legal base includes lots of industry rules and regulations, which describe practically all forest fire situations possible. Russian Federation Forest Code (RF FC) fully defines forest fire management procedures. Fore example:

Article 46, RF FC defines government rights for forest fund use, protection, conservation and regeneration, including:

- developing, adopting and implementing federal target programs for forest fund use, protection, conservation and regeneration;
- government control of forest fund use, protection, conservation and regeneration;
- announcing forest fund area as zones of ecological disaster and emergency ecological situations.

Article 83, RF FC states forest users responsibilities, including fire safety regulations, fire prevention activities and in case of fire its extinguishing to be observed by forest fund users.

Article 92, RF FC sets forest conservation goals and tasks. Forests should be protected from fires…

Ground and aviation methods and means of leskhozes, aviation watch bases and other organizations belonging to federal forestry management bodies are used for forest protection and conservation.

Article 93, RF FC describes forest protection and conservation procedures.

RF government, regional organs of state power, federal forestry management authority and its local branches conduct activities to protect and conserve forest, to fight forest fires, pests and diseases, as well as attract labour, equipment, transportation means of commercial and non-commercial organizations and population to fight the fires.

When fire risk is high regional organs of state power, federal forestry management authority and its local branches have the power to forbid individuals and vehicles to enter forests and carry our certain types of activities in certain forest fund areas.

Procedures of attracting population and legal entities to fire extinguishing are determined by regional organs of state power.

Article 100, RF FC determines participation of regional governments in organizing protection of forests from fires, pests and diseases, namely they:

- organize development and implementation of action plans for fire prevention in forest fund and non-forest fund areas;
- adopt fire-fighting measures plan every year before fire-risk season starts;
- determine procedures of attracting population, businesses, fire equipment and transportation means to fire fighting;
- during high fire risks organize forest fire teems and provide everything needed for emergency actions;
- make fuel reserve for fire-risk season;
- assist organizations responsible for forest protection and conservation and forest users in construction and repairs of firebreaks, airfields, fuel supplying, and also maintain vehicle reserve with fuel enough to be used by local branches of state forestry management authority in fire-risk season
- organize public fire safety education, regular mass media coverage of forest conservation and fire prevention issues (*RF legislation shifted the burden to regions, but forgot to provide financing and RF government did not correct the discrepancy*).

In 1998 Russian Federation State Forest Guard was organized as part of forest management. Forest Guard is organized within state forestry management authority. Its tasks include:

- providing forest protection and conservation,
- implementing state control of forest protection and conservation

Its other tasks include organizing ground and aviation fire management services, investigations and control of fire safety regulations, fire watch in forest fund areas, public education and mass media involvement.

The list of State Forest Guard officials was approved by RF MNR Minister order in March 2003.

The other very important document is “Fire Safety Rules in the Forests of Russian Federation”, adopted in 1993. They are obligatory for all organizations, institutions, businesses and individuals.

In the period of high fire risks, i.e. since snow melts in the forest till it starts raining or snowing in autumn, it is forbidden to:

- make fires in young coniferous forests, old burned and damaged forests (forest debris), peat, logging areas with wastes left, dry grass areas, under the trees. Places used for fires should be surrounded by a mineralized belt (upper soil layers are removed) 0.5 m wide. The fire should be then covered with soil or poured with water.
- through burning matches, cigarettes and hot ash from pipes;

- leave wastes that contain fuel;
- refuel vehicles with working engines, smoke or use open fire near the engine;
- leave household and industrial wastes in the forest;
- burn dry grass, etc.

Fire preventive procedures are defined in “Instructions for Fire Prevention in Forests and for Forest Fire Service activities”. This document states that federal forestry management authorities supervise fire prevention, development of a state program of forest conservation, fire prevention promotion, publications of legal documents and educational materials. Forestry management regional authorities work out forest management plans, organize fire prevention promotion. Leskhozes also include fire prevention activities into their long-term and operation plans.

Increase of fires and destroyed areas made RF forest service to develop the “Concept of Protection of Forests from Fires in the Russian Federation”. Concept draft was discussed at the international seminar “Forest Fire Management on the Ecoregional Level” (September 2003, Khabarovsk). The concept states main principles, strategy and implementation mechanisms for fire fighting and prevention. The concept also stresses the necessity to expand authorities and responsibilities of RF entities and municipalities in forest fire management and forest fund conservation.

“Concept of Forestry Development in the Russian Federation for 2003-2010” was adopted 18.01.2003 with RRFG # 69-p. Its special chapter is devoted to forest protection and conservation, forest legislation improvement, more active RF entities involvement in fire management.

Statute on Federal Forestry Agency was adopted 16.06.2004 with RRFG #283. The Agency is responsible for state policy implementation, state services and forest property management. It organizes the work of State Forest Guard, except for its state control function.

It is a pity that municipality participation in fire management is small. RF FC contains no provision on that. FL “On General Organization Principles of Local Self-Government in the Russian Federation” and other legal acts contain issues of community participation in prevention and liquidation of disasters, primary fire safety measures within settlement boundaries, but they do not define community rights or responsibilities.

Responsibilities: Responsibilities for violating law that caused forest fires are well defined in forest legislation and special codes. Some legal acts, adopted in perestroika time are still in action, for example “Instruction on penalties for forest law violation” (USSR Gosleskhoz Resolution # 1, 22.04.1986) or Instructions on designing fire prevention measures in USSR forests”.

RF Forest Code and other special codes contain the following provisions:

Article 95, RF FC regulates state fire inspection issues.

In order to enforce fire safety rules and regulations State Forest Guard officials conduct state fire inspection of forest fund and forests, not included into it.

Forest users, other individuals and legal entities that work in forest fund or surrounding areas, as well as those, who organize cultural, public and other activities

there bear administrative, criminal and other responsibility for breaking fire safety requirements and regulations as defined by RF legislation.

Administrative infringements:

Articles 8.29, 8.32, 8.33, 8.35, 8.39 RF Code on Administrative Infringements

Criminal liability:

Crimes are defined in Russian Federation Criminal Code.

Article 246, RF CC defines penalties for environment conservation violations when objects are designed, located, constructed, used. If radioactive background is changed, or people's health is threatened, or a great number of animals died, those found guilty are sentenced to imprisonment for up to 5 years and forbidden to hold their position and do certain work for up to 3 years. (In Far East south smog over Komsomolsk-on-Amur because of heavy fires may serve such a case).

Article 259, RF CC defines penalties for damaging habitat, critical to survival of RF red book species.

Article 261, RF CC deals with forest damage and destruction.

Destruction and damage of forest, as well as vegetation, not included into forest fund, caused by improper fire practices, are subject to fines, equal to 200-500 minimal wages or 2-5 month income, or corrective labour for up to 2 years, or imprisonment for up to 2 years.

Destruction and damage of forest, as well as vegetation, not included into forest fund, caused by fire set-up, other unsafe means, pollution with hazardous substances and wastes are subject to imprisonment for up to 8 years.

Authorized investigation bodies: Crimes are investigated by the Ministry of Internal Affairs and the Prosecutor's office. Foresters and the public bring them reports and information.

Denial to take legal proceedings can be appealed in court.

Federal Forestry Agency as stated in its Statute has the right to bring forest law violation cases to Federal Inspection in the sphere of natural resource use, as well as to MIA departments, prosecutor's offices and court. It may also bring environmental claims to ordinary or arbitration court.

Public involvement: Forest Code defines population participation in these processes.

Article 96, Forest Code states the following.

Volunteer fire brigades may be organized to protect forest fund and forests, not included into it, from fires, to prevent fires and fight them. Volunteer fire brigades organizing procedure is defined by RF legislation. Procedures of volunteer fire brigades financing and supplying with materials and equipment is determined by organs of state power of RF entities (*Appropriate financing from the federal budget should be provided, as these forests are federal property*).

Article 96, Forest Code states the following.

Individuals and public organizations may participate in providing rational use, protection, conservation and regeneration of forest in accordance with RF legislature.

Strategy: It looks like the government has considered every minor detail. There is Ministry of Natural Resources, a responsible authority with lots of rights, a forest guard of more than 100 000 professionals employed, sufficient legal base, and

all parties involved in the process are “kept busy” (regional governments, federal ministries, land users, environment conservation prosecutors’ offices). But the situation has not been improved very much. Fires increased, forest damages and destruction expanded. The reason for that is insufficient work with population, ineffective fire prevention measures, inadequate financing of fire management activities.

No doubt, fire management system should be improved. RF MNR reformation has not been completed yet. Nevertheless, a general forest fund management system is more or less formed (fig. 2.3.1.). Its structure looks better as many different authorities (environmental, forestry, inspection, fire managing) are united under the RF Ministry of Natural Resources.

In reality, such transformations turned out to be more formal than practical. Thus, Federal Inspection, which manages state nature reserves, is not properly linked with Federal Agency. Reserves were before and are now neglected and have to rely in fire management on their own means and sources. Chief department of Federal inspection in the sphere of natural resource use in the Far East federal okrug is now responsible for investigations. Their efficiency is doubted as the department staff is limited and has no specialists to investigate criminal cases.

Federal Agency is better organized and its functions are more definite. That is why Federal Agency leading the Project is hoped to be successful.

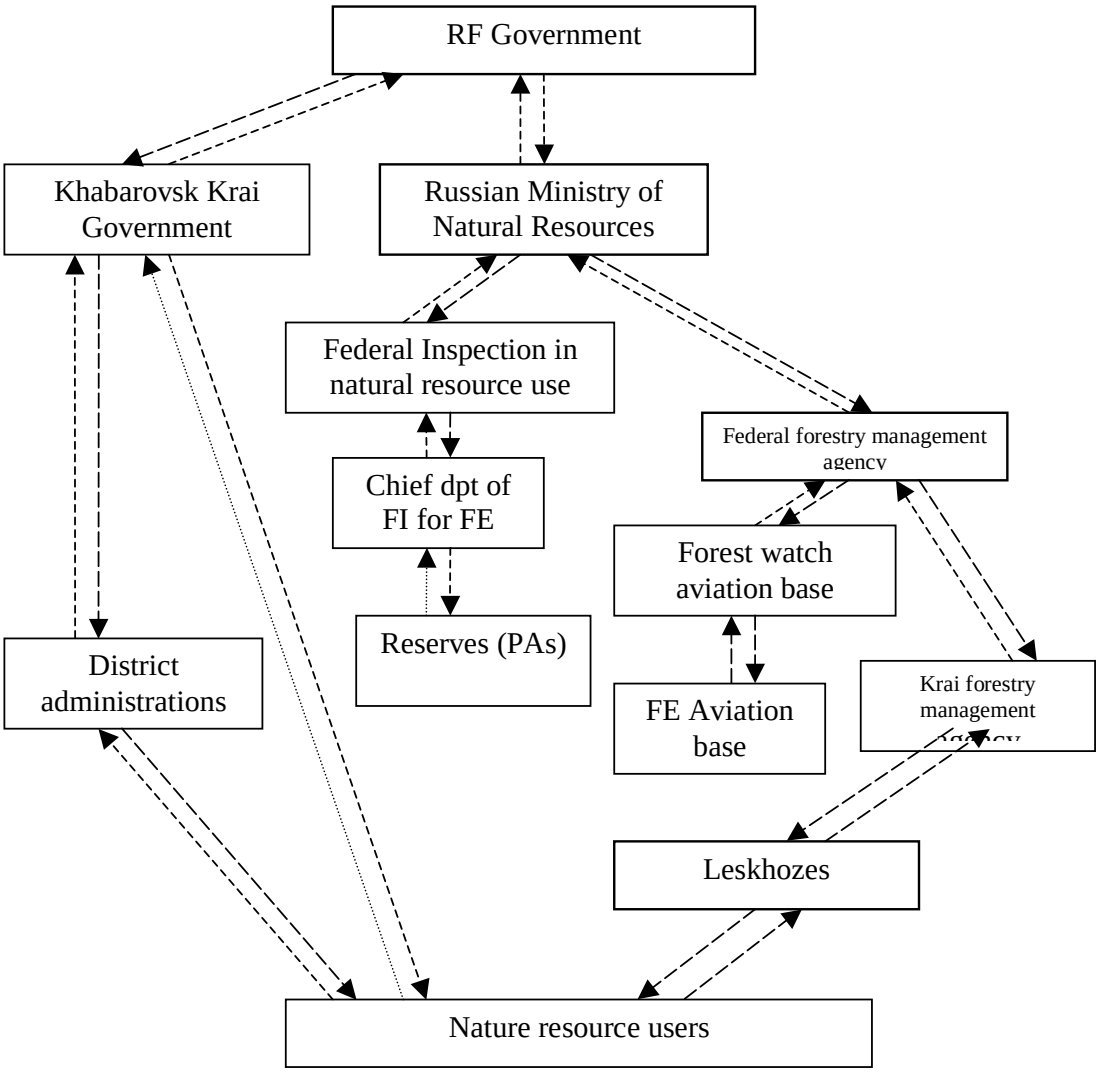

Fig. 2.3.1. State forest fund management scheme (after 2004)
Relations and influence:

strong
moderate
weak

After new amendments to federal laws on regional and local authorities were adopted in August 2004, Khabarovsky krai government lost most of its rights (not responsibilities!) in the sphere of environment protection and forestry.

For comparison purposes the state forest fund management scheme, in action up to 2001, is given in fig. 2.3.2. Most attractive are the following features:

- better linkage between the parties, thanks to feedback, big number of professionals in federal and regional forestry management bodies;
- easier document circulation, more reliable “vertical” and “horizontal” links;
- more power and rights of regional government allow regions to create an effective fire management system.

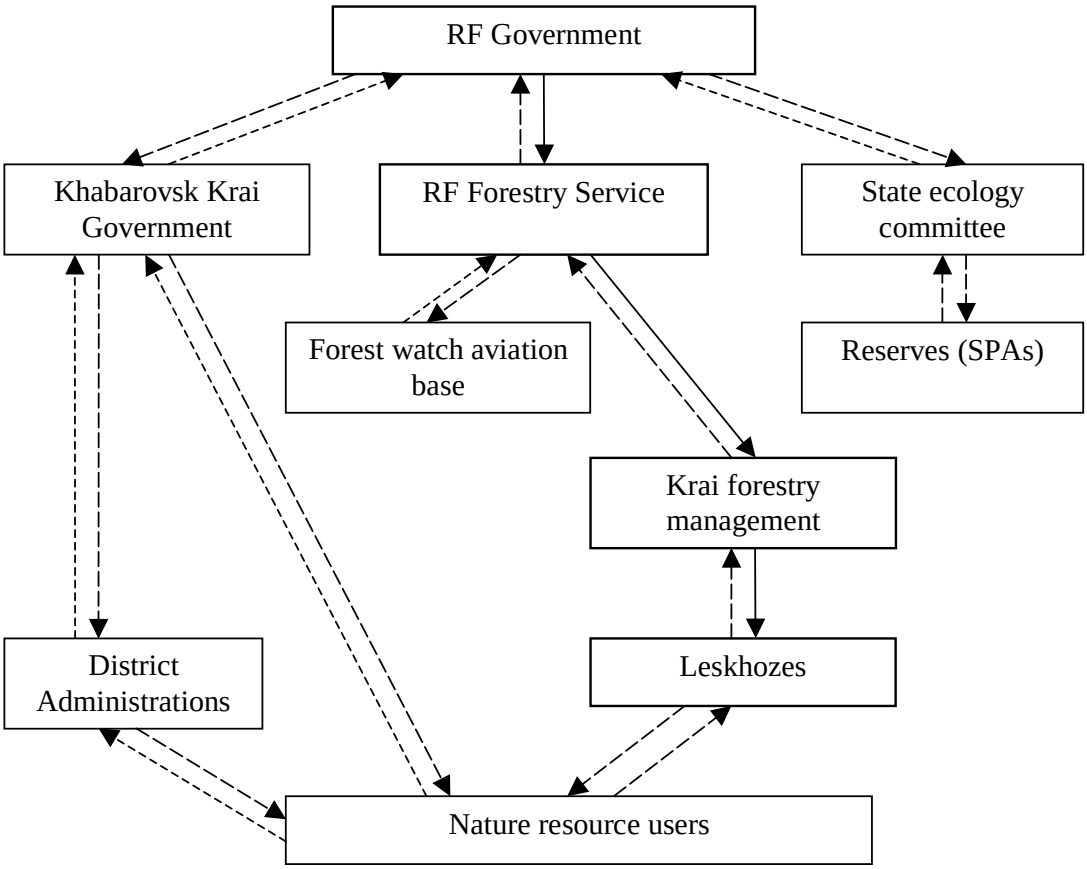

Fig. 2.3.2. State forest fund management scheme (before 2001)
Relations and influence:

——▶ very strong
– – – –▶ strong
- - - - -▶ moderate

Fire management improvement in high biological value forests will include:

- strengthening legal grounds for fire management system formation in the regions;
- developing legal norms for participation of population in fire management;
- rendering technical, financial, labour support to specialized fire brigades;
- making public education more professional and systematic;
- organizing training programs and seminars on different aspects of the fire management;
- conducting fire-prevention activities.

2.4. Business involvement in the Project

Situation: Nowadays major forest users are leaseholders. They all take part in forest fire prevention and conduct appropriate activities under the supervision of leskhozes. In spite of that many fires occur on the leased territories. Khabarovsk krai

forests leaseholder statistics showed 10% of fires and 15% of forest fund destroyed by fire in 2003. Questioning also proves that timber company workers set many fires.

Many forest leasing companies develop their areas quite actively, but not the infrastructure. When fire happens, more than often nobody takes care because of the difficulties to get there. Fires expand as a rule to other areas, often of high biodiversity value. Even leased plots may have biodiversity value.

Three problems are connected with business involvement into fire management:

- leaseholders practically bear no responsibility for the area burned and for the government losses;
- leaseholders cover "their property" conservation expenses from government sources;
- insufficient control of other forest users (tourists, hunters, non-timber forest products harvesters, etc) from state forestry conservation bodies.

Legal Grounds: Article 94 of RF Forestry Code defines forest user responsibilities.

Forest users should develop and adopt fire prevention action plans, coordinate them with respective forestry authorities and implement them in a fixed period. Federal forestry management authorities specify the list of fire prevention activities and fire prevention plan requirements.

When carrying out industrial, cultural and public activities in PAs any individual or legal entity is obliged to have fire-extinguishing equipment according to norms adopted by Federal forestry management authorities, RF Ministry of Internal Affairs. Moreover this equipment should be maintained in order to be immediately used in case of fire.

Responsibilities: Forestry law punishes only breakers of law. Leaseholders whose area was damaged by fire are not responsible for the losses. This issue has never been discussed till nowadays.

Authorized investigation bodies: Authorized staff of state forest guard, environment protection prosecutor's office, MIA can participate in investigations.

Strategy: Lengthening lease terms, stated in a new Forest Code, will not improve the situation and change leaseholders attitude. They get timber at a very low cost – $4.5-5 for a cubic meter. In other countries timber costs 5-8 times more. What costs more, is valued higher. Timber operations are intensively developing in the Far East south, lots of tees are cut and sold as round timber. Temporary logging companies are very profitable. That is why the system of economic levers should be used to regulate their activities.

Besides, there are a lot of other forest users such are tourists, hunters, bee keepers, non-timber forest products harvesters, many of whom neglect forest law. Their nihilism is based on temporary-use ideology.

Several directions of business involvement can be identified:

- improving legal grounds for business participation in fire management;
- changing the psychology of forest fund leasing companies in terms of strong protection of government property they lease;

- attracting environment-concerned public to work with targeted groups (unorganized tourists, forest products harvesters, etc);
- organizing systematic government control of the use of forest safety regulations by forest leaseholders.

2.5. Protection of settlements from fires

Situation: Major part of ASAR is covered with forests. Many so-called "forest settlements" are situated there. Forest fires often expand and damage them. Lots of cases are reported during fire peaks, especially in Khabarovsky krai.

Legal Grounds: Forest legislation does not regulate these cases. LF "On General Organization Principles of Legislative (Representative) and Executive Organs of Power in the Entities of the Russian Federation" may be applied to some extent. LF "On Fire Safety in the Russian Federation" (1994), Khabarovsk Krai Law on Fire Safety (2000) and governor's resolutions are applicable to activities in forest settlements. Local authorities have lots of responsibilities but lack adequate financing and material and technical supplies for their fire services.

In general local authorities should play the decisive role in fire management system, which will be hopefully created as the result of Project initiatives.

Responsibilities: parties or individuals, found guilty should bear all responsibility

Authorized investigation bodies: Prosecutor's office, MIA and MES departments do investigations

Public involvement: Volunteer fire brigades will be organized in the frame of this activity. They will be responsible less for fire extinguishing and more for preventive activities addressed at potential forest fire sources.

This activity may also serve as an indicator of Project effectiveness.

Strategy: Legal base for this activity is least developed. The study of Russian previous experience and international practices seems necessary. Approaches to agricultural fire management may be also used.

2.6. Support for nature reserves and other special protected territories.

Situation: There are 11 state nature reserves, 30 special reserves of different status, and several dozens of nature monuments in the Amur-Sikhote-Alin ecoregion. In most cases aviation and ground services fight forest fires. But reserves and PAs, as legal bodies, are not supported by the Russian forest service. In most cases the reserves have to form their own fire-fighting teams or contract aviation bases. As reserves financing is rather irregular and not sufficient enough, they cannot pay in time for the services provided. That is why the government looses a lot.

The transition of state reserves and other PAs under the jurisdiction of RF MNR, its Federal Inspection in the sphere of nature resource use would make the situation worse.

State reserves problems include shortage of financing, skilled staff to prevent and fight the fires, materials and technical equipment.

Legal Grounds: RF Forest Code contains no norms to regulate fire situations in state nature reserves and other PAs. The law gives a general description of forest conservation.

Article 125, RF Forest Code.

State nature reserves manage forest fund areas located there as described in RF legislation. State nature reserves are responsible for protection and conservation of forest fund areas and if necessary for forest regeneration...

The words "fire safety" are only once mentioned in the article on special protection regime in state reserves of FL "On Special Protected Territories in the Russian Federation".

Article 9, FL "On Special Protected Territories in the Russian Federation".

In state nature reserves measures and activities are restricted to those which are aimed at:

a) conservation of nature complexes in their natural state, their recovery and prevention of their changes under anthropogenic impact;
b) support the conditions that provide sanitary and fire safety;
c) prevent situation that might cause disasters that endanger life of the people and their places of living;
d) ecological monitoring…

Responsibilities: Although legal grounds for forest fire management are not precise, penalties for various violations involving nature reserves are well defined.

Administrative infringements:

Article 8.39, RF Code on Administrative Infringements deals with violations of regime and rules for environment conservation and resource use. Administrative notification and fines from five to ten minimum wages are imposed on individuals for violating the existing regime and conservation rules and practices of resource use within the territory of state nature reserves, national parks (*at present this category is excluded*), as well as on territories possessing nature monuments, special protected areas or their conservation zones (districts). Fines are coupled with confiscation of tools or other equipment and nature products, illegally gained. Administrators responsible pay 10-20 minimum wages and companies pay 300-400 minimum wages. Tools or other equipment and nature products, illegally gained are also confiscated (*a good article*).

Article 8.39 also states penalties for damage to red-book plant and animal species and their habitats.

Criminal liability:

Article 262, RF Criminal Code deals with violations of regimes of special nature reserves, national parks, nature monuments and other PAs, which caused serious damages. Fines ranging from 100 to 500 minimum wages are imposed. The accused may also be deprived of the right to hold certain positions and be engaged in certain work activities up to three years.

Authorized investigation bodies: State inspectors of reserves are authorized to act against infringers under Art. 34 and 36, FL "On special Protected Territories in the Russian Federation".

Art. 34, FL “On special Protected Territories in the Russian Federation” declares that

1. Employees of state nature reserves and national parks who are authorized to be state inspectors of reserves and parks protection have the rights:

- within the boundaries of state reserves, national parks and their protected area to arrest those, who break RF laws in protected areas and deliver them to law-enforcement bodies;
- compile materials on law infringers in state nature reserves and national parks.

2. Chief state inspectors (*they are directors of reserves*) and deputy directors for protection of nature reserves and national parks also have the right to:

- impose administrative penalties for breaking RF laws on special protected areas;
- take legal steps to recover losses caused by damage to natural complexes and objects of state nature reserves and national parks due to violation of the existing regime and conservation rules and practices of resource use within the territory of state nature reserves, national parks

Art. 36, FL “On special Protected Territories in the Russian Federation” describes penal sanctions.

RF legislation defines criminal liability for breaking special protected area regime. Damage to nature objects and complexes within PA boundaries should be compensated according to existing taxes and loss assessment methods.

Prosecutor’s office and internal affairs agencies investigate infringements of administrative and criminal codes.

Public involvement: Communities help to fight the fire in critical situations.

2.7. Fire management on the ecoregional level.

Situation: Fire management system on the regional level, i.e. at RF entities, has been formed and works rather effectively. In all the entities of the RF real decision making power is concentrated in governor’s hands/ chairs of the regional governments or administrations. They represent real power that coordinates and directs labour forces, material and technical recourses to particular spheres and objects. But fire management is organized by local forest services.

The role of local authorities depends much on their initiatives and governor’s resolutions. District administration’s financial and labour resources allow addressing only small fires of easy excess.

The problem is that there are no regional bodies, which are authorized to organize interregional cooperation and fire management. Such cooperation is vital for several reasons, namely:

- cooperation in fire preventive measures is needed;
- regional fire monitoring, fire identification, alarm, extinguishing should be enforced;

- fighting fires in adjacent territories;
- joint activities to increase population awareness

Legal Grounds: It is the first time that the issue of interregional fire management and establishment of forest fire management centers is stated in the RF concept of forest fire management.

Authorized bodies: Interregional forest fire management bodies should be organized within the Federal Agency. Such body has been practically organized as a Regional forest fire center at Far Eastern forest guard aviation base. It is a pity that according to new approaches to forestry management this base has been made the subsidiary of Pushkinskaya aviation base.

Public involvement: It is important to increase and expand the participation of the public in fire prevention promotion and fire management.

Strategy: Far Eastern forest guard aviation base and Regional forest fire center are operating in the region. Interregional association of economic cooperation of RF entities "Far East and Zabaikalje" is responsible for general management of joint efforts. Besides, there is a chief department of Federal Inspection in the sphere of natural resource use, which undergoes constant transformation. To join efforts of these organizations and organize an ecoregional fire management authority seems feasible and important.

It is also crucially important that the Federal Forestry Agency would make Khabarovsk Krai Forestry Agency responsible for the Project implementation and Primorsky Krai and JAO agencies would be responsible for their parts of the Project respectively. Regional forest fire center fits this fire management scheme quite well. During Project implementation this Center is supposed to take the forest fire management functions in the eco-region.

The fact that Project Supervisory Committee authority increases with high positions of its members, representing regional governments, attracts attention. Committee co-chairs are planned to be vice-governors/ vice-chairs of the governments of RF entities, which take part in the Project. Committee responsibilities include Project strategic management, for instance, reviewing and adopting action, finance, procurement plans. Such policy not only stresses the real role of the regions in fire management, but will also increase it in the future.

This tendency is evident in the proposed draft FL # 95911-4 "On Amendments to Russian Federation Legislation on Issues of Joint Jurisdiction between the Russian Federation and the Entities of Russian Federation Due to Expansion of the Authority of Organs of State Power in the Entities of Russian Federation, as well as due to the expansion of the List of Municipal Issues of Local Importance". It is planned to transfer responsibilities for fire management to regional authorities and provide adequate financing from the federal budget to regional budgets.

Thus, it is supposed that the Project will result in a more structured and effective fire management system. This system should be based on equal rights of the Federation and its entities, broad public participation, professionally designed fire

prevention, targeted fire extinguishing, close attention to agricultural burning plans and municipal fire management.

There are sufficient legal grounds for state forest conservation activities and services. Main provisions are stated in FL “Russian Federation Forest Code” and clarified in many forest industry documents.

On the contrary, although local governments practically manage the fires, their rights and authorities are not described in full. If the legal authority of RF entities is more or less clear, management aspects of interregional fire prevention have no legal backing yet.

The Project contains certain activities to form institutional foundation for fire management on the regional level.

Certainly Project activities will not remedy all the fire management problems but they will improve and contribute to:

- creating the foundation for further cooperation of RF entities in joint fire management;
- testing mechanisms of interaction between government bodies of federal and regional levels, local authorities and the public;
- forest fire monitoring and defining threats at landscape and watershed levels;
- rendering initial support for a great number of organizations (reserves, leskhozes, NGOs, etc.) in fire prevention and extinguishing;
- involving public in fire management with a help of small grants;
- assessing and expanding fire management experience gained to regions with similar situations.

Chapter 3. Project Description

All direct and indirect fire management activities under the Project are distributed into 3 components:

Component 1. Integration of high conservation value forests into a unified ecoregional fire management system.

Component 2. Improving efficiency of forest fire management in high conservation value forests of the ecoregion.

Component 3. Increasing public awareness and community participation in fire management

Beside, Project management activities are presented in Component 4. Project Management.

Assessment of the main fire management activities is listed below.

3.1. Natural conditions of the ecoregion

A short summary of natural conditions of the ecoregion addresses all main environmental components that have a direct or indirect impact on occurrence, frequency, longevity, intensity and other forest fire parameters as well as on pyrogenic situation in the ecoregion. These components change in space and time significantly and thus determine complex character of fire distribution. Four mountain relief types can be identified in ASAR, which have their own peculiar formation conditions and fire distribution specifics, and thus, specific fire management activities planning.

The first type is a prevailing one. It is a middle-mountain extensively dissected relief of Central Sikhote-Alin, Badzhalsky and Bureinsky ranges, Yam-Alin, Maly Khingan and others. Its peculiarities are steep slopes, narrow valleys and 400-600 m variations in altitude.

The second relief type is less common. It is low-mountain, with rather wide river valleys with steep slopes and 200-400 m variations in altitude (Omalsky, Mevachan, Chayatyn ranges and others).

The third type is vastly distributed (mostly in Sikhote-Alin). Mountain systems occupy a high volcanic plateau of a flat relief, deeply cut with canyon-like valleys (Sovgavanskoe, Bikinskoe, Shkotovskoe, etc.)

The fourth type includes isolated low-mountain massifs within lowlands (Khekhtsir, Vandan, Kholan, etc.). Their heights do not exceed 1000m above sea level.

Mountain relief type distribution should be kept in mind when ASAR fire management zoning is developed.

Geographic specifics of ASAR determine climatic differences throughout the territory. Assessment of those climatic parameters, which directly influence the occurrence, length and frequency of fires, seems important. ASAR territory zoning according to the complex of climatic factors is used to identify the most fire hazardous regions.

Regional climate specifics much depend on the mountain relief, uneven monsoon influences and atmospheric circulation pattern. Major part of the region can be described as having ultra- and sharp continental climate. Only in the sea coastal belt, which expands to the south, moderate continental climate dominates. Other climate characteristics are big deviations of winter and annual average temperatures from the latitudinal average (for 10-20^{0}C and 3-5^{0}C respectively) and significant variability of weather regime and several meteorological components in time and space. In some years precipitation exceeds the norm by 2 or more times and sometimes in the same summer month precipitation may be 5-10 times more or less.

In the ocean and continent contact zone thunderstorms are frequent due to highly active atmospheric processes there. This is an important fire factor, especially when summer thunderstorms happen without rain. ASAR areas differ much in this respect and thus have different fire-hazard situation. This regional peculiarity is taken into consideration in the fire-management-zoning scheme, used in the Project.

3.2. HCVF integration into ecoregional fire management system

To fulfill the tasks of Component 1 “Integration of high biological value forests (HCVF) into a unified fire management system in the ecoregion” various activities are proposed, the main of which are the following.

1. Clarifying and selecting pilot territories for Project implementation.

No doubt, this activity is the key activity not only for this component, but also for the entire Project. Project goals are stated as “ to reduce risks of fire hazards in high biological value forests of the Amur-Sikhote-Alin ecoregion, and first and foremost, identify and define natural objects of biodiversity value” (“Developing a feasibility study of Project activities”, p. 30).

Five model territories are identified in the Project: two in Primorsky krai, two in Khabarovsky krai and one in Jewish Autonomous Oblast. As specific objects all state nature reserves (11 total) within ASAR boundaries are included. Seven objects are defined as individual.

It should be noted that there are HCVFs in all model territories and specific objects. In Khabarovsk part of ASAR the proposed Khorsko-Khekhtsirskaya model territory is the most valuable. Various HCVFs are well presented there. On the other hand, plant and animal world has changed significantly because of logging operations, fires and poaching. Close to original are only several spots in the Chuken river basin, very upper reaches of the Khor, Katen, Kafe rivers, Ko mountain massif and some other places.

Strongly changed is also vegetation of the plain to the west of Khabarovsk-Nakhodka highway up to the Ussuri river in the Ussuri basin part of the ecoregion. Most transformations occurred along automobile and railroads between Khabarovsk and Vladivostok. To the end of 20 century nearly all plain areas were turned into agricultural lands. Forests along Kruglikovo-Mukhen railway also underwent significant changes due to multiyear timber harvesting. Forest cover of swamped plains was reduced and original larch and broad-leafed forests were substituted by

derivatives. Timber industry expansion in 70-90-ies substantially changed the Khor river left bank area, Khor upper reaches and Sukpai river basin. Although the Matai river basin is rather forested, forest structure has changed significantly as Korean pine stands were cut down and the remaining areas were rejuvenated by selective cuttings. The same happened to the Kafe, Katen, Nempty, Obor and Kiya river basins. Numerous secondary birch and aspen forests emerged on the cut areas.

Although the vegetation was transformed severely, the animal biodiversity remains almost unchanged. In recent 100 years Far Eastern leopard, Amur ghoral and probably red wolf became extinct. In all, the territory provides home for 425 vertebrate species, about 60 fish species (including Khor low reaches), 7 amphibia and 9 reptile species, about 280 birds and 63 mammals. The precise number of species that inhabit this territory is yet unknown. Special long-term research is needed.

Khorsko-Khekhtsirskaya model territory has nearly the same number of species as have more southern regions, like Bikin river basin with 375 vertebrate species (Bikin…, 1997) and much more than Bolshekhekhtsirsky state nature reserve, which is included in this territory and has only 322 species (Vertebrates of Bolshekhekhtsirsky nature reserve.., 1993).

No doubt, this territory is important, because it contains HCVFs and all ASAR problems are evident there. That is why, Khorsko-Khekhtsirskaya territory inclusion in the Project is vitally important.

The peculiarity of Komsomolskaya model territory is the northern boundary of coniferous- broad-leafed forest range, which lies there. Besides, it can serve as a testing ground for fire prevention, control and management methods, reforestation techniques, forest conservation promotion and educational activities. This region has the reputation as the most fire active because of low environmental culture of its population (industrial centers Komsomolsk-on-Amur, Amursk and Solnechny are situated there). Vast areas are burned or cut out, regeneration of forest vegetation is either absent at all or very difficult. Wildlife and its biodiversity is poorer than in the first model territory described. The list of Komsomolsk state nature reserve, a part of the model territory, contains 334 vertebrate species, 44 fish included, 6 amphibia and 6 reptile species, 233 birds and 45 mammals (Vertebrates…, 1994).

Some experts (Antonov A.L., Danilin A.K.) consider that the selection of only two model territories in such a large Khabarovsk krai part of ASAR is not enough. Several other territories with unique HCVFs may be considered to be model territories in future, for instance Anuisky national park, nature parks Khoso and Vyazemsky, Gassinsky nut and hunting area, Gur river basin.

The Project highlights the importance of forest conservation for indigenous people. The proposed five model territories represent traditional living conditions and practices of ASAR indigenous peoples. The Project addresses traditional living areas of such communities as orochi (Vaninsky district), negidaltsi (Polina Osipenko district), evenki (Verkhnebureinsky district), nivkhi (Nickolaevsky district) and ulchi (Ulchsky district). Some traditional areas of nanai and udege communities are partially included into pilot regions. Udege settlement Gvasugi is a part of the Khor-

Khekhtsir model territory and evoron group of nanai people is a part of Komsomolsk model territory.

It seems important to expand Project results to other ASAR territories, including areas of indigenous people traditional settling and practicies. In Khabarovsky krai these areas may be:

1. Verkhne-Bureinsky district (its part within Bureya basin boundary), including Shakhtinskaya traditional territory, Bureinsky state nature reserve and Dublinsky special reserve;
2. Vaninsky district – Khutu and Ulike river basins;
3. Polina Osipenko district – Low Amgun basin, down Vladimirovka village;
4. Nikholaevsky district – entire;
5. Ulchsky district – lake Udyl basin;
6. Sovgavansky district – Koppy river basin;
7. Nanaisky district – Anui, Khar and Pixtsa river basins;
8. Komsomolsky district – Low Tugur basin down Snezhny settlement;
9. Amursky district – Vandan mountain range;
10. Khabarovsky district - Kukan, Amer, Ulika river basins

Criteria to select HCVF and the territory as a whole are very important. The Project suggests general and additional criteria. But other characteristics are also important, if biodiversity conservation is pursued. For instance the size of the forested area. Small-size forests can not secure their biodiversity. Multi-year experience in Priamurje (Khabarovsky krai south) shows that to provide decent existence to a tiger family (male, female and periodically kittens) an area of 45 000 ha is needed (Bolshekhekhtsirsky state nature reserve data, Tkachenko, 2004) or even 60-80 th. ha as usual (Sudakov, Nikholaev, 1987). For a wild boar, the tiger's prey, massive migration in poor-crop years is common. Migration routes are hundreds kilometers long (Rakov, 1965) and small HCVFs are not able to provide normal population functioning. Many other animals and plants need large space.

When HCVFs are selected, natural biodiversity level and rare, endemic and endangered species and their habitat should be identified. It is a difficult task. Plant and animal biodiversity studies in Project selected areas (4-5 model territories) will take at least 2-3 years. As additional the research on biodiversity assessment and identification of unique, rare, endemic and endangered plant and animal species in pilot HCVFs is proposed. Additional criteria initially proposed in the Project do not fully consider biodiversity of a particular HCVFs. They may be described as forest industry criteria, whereas the Project is targeted at biodiversity conservation. When certain Project activities are carried out under Component 1, valuable, unique, etc. natural objects need to be also described, such as animal concentration places, migration routes and paths of animals, natural salterns, valuable fish spawning brooks, "maternity homes", rare bird nests, bear dens, tall tree species (gigantic Korean pine, oak, etc.), highly-productive berry fields, ungulate resting rocks, big ant hills, springs, etc., as well as geological, geomorphologic, historic and cultural objects like indigenous people sacred places and traditional activity areas, region pioneers research sites and routes, etc. All of them make HCVF more valuable (Attachment 4).

2. Developing methods for and carrying out forest-fire zoning, forest fire regime identification and investigating the use of fire by indigenous people.

This activity will allow forest-fire zoning of the ecoregion that reflects the value of certain objects for global biodiversity, levels of social and economic development, forest fire regimes, levels of fire threats and risks of HCVF pyrogenic degradation. A complete fire-management priority list of HCVFs will be finalized.

Modeling nature objects (ecosystems) in forestry science is based on forest-use and forest-inventory zoning. When practical activities are being developed a wide range of thematic maps is created. For the pilot objects of the Project the following maps should be used:

- landscape;
- vegetation communities (present conditions of ASAR forests destroyed by fires, forest formations, rare and extincting species, endemics, etc);
- animal world (like mentioned above);
- unique nature objects: animal concentrations, migration routes and paths of big animals, natural salterns, valuable fish spawning brooks, , rare bird nests, bear dens, etc.;
- objects, assisting atmospheric electricity discharge (iron ore and sulfide deposits, natural and artificial constructions, etc);
- climate charts and maps (temperature, wind directions, etc.)

These activities will help to differentiate legal norms of nature conservation and fire prevention in HCVFs, help the fire management decision making and fire-prevention activities organization based on forest-fire zoning.

3. Developing GIS for model objects and for every protected area.

Implementation of such activity will result in forest fire GIS, which will incorporate all the above mentioned parameters. It will contribute to HCVFs integration into regional forest management system and their conservation.

Forest fire GIS for all reserves will be compiled and integrated into a united GIS of the ecoregion, which will help to make fire management and HCVF conservation decisions rapidly.

When GIS are developed ecoregional fire management systems will be included into national and international information exchange and weather forecast network. Fire management authorities in ASAR will use the information system of distant monitoring.

All planned activities will provide a rather complete HCVF integration into ecoregional fire management system. They are aimed at developing eco-regional fire management system.

3.3. Increasing efficiency of fire management in HCVFs of the ecoregion

This part of the Project is presented in Component 2, which activities are focused on fire management in HCVFs.

The following activities are supposed to increase fire management efficiency:

1. Enforcing legal base for prevention of big fires and minimization of fire damage, as well as introducing unified norms, standards and working agreements between the parties interested in forest fire management.

These activities are vitally important as the lack of legislative backing disrupt effective mobilization of resources, needed to fight the fire.

One of most useful activities is "development, adoption and implementation of rules and measures that regulate people access to allowed areas with special regulation in fire-risk seasons". Such rules have to be urgently developed and further controlled. If not in the entire ecoregion, such control should be organized in HCVFs.

2. Increasing fire management capacity in PAs of different categories and affiliation.

Helicopter pads in PAs of difficult access, construction of firebreaks on the borders of protected zones of reserves may have certain impact on biodiversity in PAs. Number of poachers may increase, thus increasing fire risks in PAs.

Out observations in Priamurje showed that firebreaks, constructed in winter or spring, in the first year already overgrew with reedgrass. In autumn it turned into an area full of dry grass easy to ignite. In case firebreaks were made in summer, they were partially overgrown and the next year they were completely covered with vegetation. That is why such firebreaks should be cleared at the end of every vegetation period (Chapter 7). Such work, preliminarily agreed with PA administrations, should also be done in PAs, where firebreaks are already constructed. We think that mineralized firebreaks 5-10 m wide are better to be constructed not along PA borders, but along the most vulnerable protection zones (including those rather remote from PAs and HCVFs), as well as along automobile roads (Chapter 7).

Following experts' suggestions, certain reserve specifics will be considered, in particular that isolation of animal population in small-area nature reserves (Bolshekhekhtsirsky and Kedrovaya Pad) is very high. Both mentioned reserves are surrounded with forests, heavily destroyed by man, and non-forest landscapes, their flora and fauna are rather isolated from main parts of geographic ranges. It is just the case with Bolshekhekhtsirsky reserve, where local populations of some animal species are represented only by single animals (Antonov, Voronov, 2000). Construction works in the above mentioned reserves could be allowed only in very particular circumstances with substantial preliminary evaluation of positive effects and negative impacts.

Besides, it seems advisable to construct recreation stops along forest roads, frequently attended by public, and to equip them with fire spots, fire-fighting water tanks and reservoirs, fire-preventing materials and HCVF information (Attachment 4). The following roads should be first targeted:

- Khabarovsk – Vladivostok: sections 18-35 km, 140-218 km;
- Khabarovsk – Komsomolsk-on-Amur: sections 51-119 km, 122-395 km;
- Khabarovsk – Krasny Yar: section 37 km – Bikin river;
- Lidoga – Vanino: entire;

- Selikhino – Nikolaevsk-on-Amur: entire;
- All automobile roads, connecting forest settlements with highways;
- All forest roads in city vicinity.

These activities, together with public education and fire prevention promotion will bring positive effects.

The following additional activities may serve to increase fire management efficiency (Attachment 4):

1. Zoning of different scale should be based on documents (maps, schemes, charts, etc.), describing various natural components, phenomena and processes.
2. Detailed assessment of fire damages in HCVFs.
3. Control of the dynamics of inflammable materials accumulation in the cutting areas of HCVFs, and of illegal felling of high biological value tree species.
4. Organizing processing of timber left in logging areas.
5. Enhancing publications on fire management.

3. Management to reduce forest fuels and enhance habitats at the landscape level.

Development and implementation of plans to reduce the amount of inflammable materials in the forest, including controlled fires, is very important element of fire-system control efficiency. But it should be kept in mind that this activity becomes affective only if coupled with other Project activities. If controlled burning of forest inflammable materials are planned in areas, damaged by fire, forest regeneration activities should be also planned. Usually even in heavily burned areas natural regeneration of vegetation cover and animal world starts gradually. However, in many cases, regeneration proceeds very slowly and men assistance is needed.

Several Project activities are focused on assessment of fire risks in the region, identification of priority HCVFs and determining combustibility rates of different forests. They will help to make more correct predictions of fire occurrence and distribution, to estimate the impact on forest formations on the basis of their combustibility rate, to quickly select priority areas on fire to be addressed.

4. Training in landscape level reconstruction and ecological restoration.

These are educational activities (“Teaching all staff of PA system, responsible for decision-making, to use models of fire prediction by weather, relief, vegetation conditions and to evaluate forest fire impact on biodiversity”). No doubt, it is an important activity, resulting in better decisions to be made in fire situations. In general, Component activities will significantly improve the efficiency of fire management in HCVFs.

3.4. Strengthening public awareness and participation in fire management in the ecoregion

Activities focused on attracting the public to fire management are proposed in Component 3.

Component 3 activities are aimed at increasing education and information of the public. They are focused on fire prevention and help to involve the population into fire management.

It is important to explain the national and world value of the unique forests of the region. Only having understood it, the population will volunteer to participate in fire prevention and fighting.

The following activities could complement those in Component 3 (see Attachment 4):

1. Preparing, publishing and distributing throughout the region a photo album and reference book " High biological value forests in ASAR and their biodiversity". Number of copies should be not less than 20 000. Preliminary book content:

- general information about the Project;
- ASAR forest characteristics and role on the biosphere level;
- ASAR HCVFs and their biodiversity.

2. Preparing and publishing a photo album "Fires in ASAR and their impact on biodiversity"
3. Publishing a fire-prevention handbook to be distributed in schools and other educational establishments, forest settlements, etc.

3.5. Assessment and monitoring of the Project environmental efficiency

Subjects for the Project environmental impact monitoring include the following:

- vegetation cover (biodiversity of species and vegetation conditions);
- biodiversity of animals (fauna and animal population);
- soil cover (quality of soil cover);
- hydro meteorological regime (water and air);
- social and medical (population, including health and living conditions).

A general scheme of monitoring activities includes:

1. Analysis of landscape and ecological situation:

- zoning of the territory;
- describing space and time characteristics of ecosystems which compose ASAR landscapes;
- defining forests according to fire-risk levels;
- identifying ecosystems most vulnerable to pyrogenic impacts;
- assessment of former and current fire impacts on ecosystem functioning;
- identifying forests that highly need protection to support their functioning.

2. Description of zones for fire management activities, their location and development of content and legend for GIS maps.

3. Development of unified methods to monitor environment quality parameters based on existing experience.

a) instructions and techniques;
b) books and papers (Borodin, Krapivin, Potapov, 1999; Voronov, Shlotgauer, Chakov, 2000; Zamyshlyaev, 1998; Kosov, Ivanov, Ivanov, 1996, Mennig, Feder, 1985; Yurtsev, 1997, Shlotgauer, Kryukova, Dobrovolnaya, 2000 and others).

4. Definition of criteria indicating the necessity for corrective measures.
5. Identification of monitoring sites both in Project area and other areas for comparison purposes. Monitoring site location will be included into data base and geoinformation systems.
6. Estimation of monitoring organization and implementation expenses.
7. Monitoring.
8. Development of an information and analytical system for monitoring. Design and maintenance of monitoring results database, including GIS, and information storage.
9. Analysis of monitoring results and development of proposals and recommendations.

Efficiency assessment of Project activities.

Assessment of environmental efficiency is an internal process and instrument of Project management that serves to provide reliable information to Project decision-makers. This information helps to determine whether Project environmental efficiency corresponds to selected criteria.

Collected information on Project ecological efficiency will allow to:

- work out measures to ensure that Project efficiency corresponds to selected criteria;
- identify important ecological aspects;
- find possibilities to improve management of these ecological aspects;
- clarify tendencies of ecological efficiency changes;
- increase efficiency and success of the Project;
- define strategic opportunities.

Assessment of ecological efficiency is the final stage of environmental monitoring and includes continuous process of collecting and processing various data to make reliable assessment of Project efficiency and tendency of its changes. This assessment is based on numerous Russian State Standards, such as SS R ISO 14031-2001 Ecological efficiency assessment. General Requirements; SS R ISO 14001-98 Environment management systems. Requirements and management guide; SS R ISO 14004-98 Environment management systems. General guide to principles, systems and methods to provide their functioning; SS R ISO 14010-98 Ecological auditing guidelines. General principles; SS R ISO 14011-98 Ecological auditing guidelines. Auditing procedure. Auditing environment management systems; SS R ISO 14040-99 Environment management. Life-cycle assessment. Principles and structure; SS R ISO 14041-2000 Environment management. Life-cycle assessment. Defining

research goals and spheres and inventory analysis; SS R ISO 14050-98 Environment management. Glossary.

Project efficiency assessment means assessment of Project ecological, social and economic outcomes of fire management and environment conservation activities in ASAR high conservation value forests. Their future sustainable and balanced development relies much on present day investments into forest conservation. Numerous existing approaches to economic assessment of biosphere resources and biodiversity are generally based on estimating the following values:

- direct use values (use value of timber, medicinal raw materials, tourist resources, etc.);
- indirect values (value of ecological function of the forests);
- possible values (conservation of biological resources for their possible use in future);
- non-use values, based on values of existence (assessment of esthetic, ethic, heritage etc. values).

That is why various qualitative and quantitative assessment criteria for conservation of HCVF biodiversity were used to make “expenses – Project ecological efficiency” analysis.

The scheme, proposed by V.V.Trushin and S.G.Shapkhaev (2003) served as a basis for developing methodic approaches to ecological efficiency assessment. The scheme includes:

- viewing the whole Project implementation period;
- modeling financial flows;
- principle of positiveness and maximum efficiency;
- time factor consideration;
- “with project” and “without project” alternatives comparison;
- assessment of all most significant Project impacts;
- multi-stage assessment;
- assessment of risks and uncertainties, relating to Project implementation.

Based on the scheme, mentioned above, the model of Project ecological efficiency assessment includes the following stages: planning – implementation – checking – activities.

1. <u>Planning</u>

- selecting specialists able to conduct the assessment of ecological efficiency;
- planning of assessment of ecological efficiency;
- selecting indicators of ecological efficiency (selecting from the existing indicators and developing new ones);
- developing methods for efficiency assessment.

2. <u>Implementation</u>

- collecting data according to selected indicators;
- analysis and processing of data into information to describe Project ecological efficiency;
- ecological efficiency information assessment compared to selected criteria;
- report preparing and delivering information that describes Project ecological efficiency.

3. Checking and activities include Project assessment evaluation and improvements of assessment system when the Project is being implemented.

Efficiency assessment of fire management in ASAR HCVFs is based on environmental quality monitoring data. One of its indicators is the stability of ecosystems in the region. Ecosystem stability means self-regulation as the inner quality of the system, which is aimed at its functional program realization in changeable environment conditions (Golubets, Tsarik, 1992). Sustainability of structural elements of the system is the measure of ecosystem stability. For the Project, the sustainability of ASAR vegetation cover, animal populations and their main components may serve as an ecosystem sustainability indicator.

Sustainability of vegetation cover and animal population is determined by number and heterogeneity of their element composition, their structural and functional organization, capacity for fluctuational qualitative and quantitative changes to adjust to different environmental impacts. In case impact scope, intensity and longevity exceed the norm for natural changability, dynamic processes in the structure of vegetation cover and animal population will become irreversible, the sustainability will be impossible and original formations will be substituted by their derivative communities.

Monitoring of Project activities.

When in 1997-1999 a group of scientists from the Institute of Water and Ecology Problems, FEB RAS, headed by Profs S.D. Shlotgauer and B.A. Voronov, carried out the Project " Monitoring of Biological Indicators for Natural Ecosystem Sustainability in Gassinsky Model Forest", general methodical approaches to select indicators for forest ecosystem sustainability were clarified and tested in Gassinsky Model Forest (Voronov, 2000; Voronov, Shlotgauer, Chakov, 2000; Shlotgauer, Krukova, Dobrovolnaya, 2000).

The system of analysis, selection and monitoring of biological indicators includes three levels:

1. Regional level.
2. Model territory level.
3. "Topogeosystem" level.

To select indicators for plant and animal species, which would characterize the degree of ecosystem sustainability, several qualitative and quantitative indicators of living organism conditions were analyzed, such as the range character, the degree of ecological adaptation and flexibility, population dynamics character, etc. According to the character of plant and animal species distribution in the ASAR and model territories, their link to specific habitat conditions and ability to survive under different external environmental impacts, three groups of criteria were identified.

The most important criteria for bioindicators, which indicate the stability of HCVF natural ecosystems, are as follows.

I level bioindicators criteria:

a) spatial extent of the range in longitudinal direction (circumborial, circumpolar, eurasian, eurasian-north-american and other species); latitudinal distribution (arctic-alpine, arctic-boreal, hypoarctic-boreal, hypoarctic-mountain and other plant and animal species);
b) ecological optimum for the indicator is located in ASAR;
c) population stability within minimum range, high vitality, for plants: abundance 4-6 points, occurrence on inventory sites 20-60%;
d) ability to occupy to different extent ecological niches on local and regional levels;
e) evident ecological valency, for example, long-vegetative plants prevail in phenorythm.

II level bioindicators criteria

a) spatial distribution of plants and animals is limited, mostly by latitudinal differentiation (ASAR and the south of Asia continent);
b) species are distributed in marginal eastern or northern zones of their ranges;
c) disjunctive character and incompleteness of populations;
d) pulsing and sharply reduced population number;
e) for plants: low abundance (2-0 points) and occurrence (2-10%);
f) low specialization of a specie to habitat;
g) increase of limiting factors, which negatively influence the population structure.

III level bioindicators criteria:

a) range fragmentation and incompleteness of populations, which are represented in a few areas within the eco-region and model territories;
b) a very low number of species in the population, low gradients of occurrence, low vitality and plasticity.

Other additional criteria were also used, such as an extinct specie, an extincting specie, a threatened to be extinct specie, a vulnerable specie, a specie with a shrinking range, and a non-defined specie.

Extinct specie is a specie, which morphophysiological and behavioral specifics do not match present environment conditions and which genetic adaptability to environment came to an end. It is ranked Category 1 (EN) by the Commission on rare and extincting species.

Specie threatened to be extinct is a specie, which is likely to disappear, and which further existence is impossible without special conservation assistance. It is ranked Category 1 (CR) by the IUCN Commission on rare and extincting species.

Vulnerable specie is a specie, which morphophysiological and behavioral specifics can make its population to become extinct because of little environmental changes. It is ranked Category 2 (VU) by the IUCN Commission on rare and extincting species.

Decreasing in number specie is a specie rather widely spread and numerous, but having a tendency of reducing in number and geographic range under natural and anthropogenic impacts. It is ranked Category 3 (NT) by the IUCN Commission on rare and extincting species.

Non defined specie is a specie, which probably is threatened to be extinct, but the threats are not distinguished due to the lack of data. It is ranked Category 4 (DD) by the IUCN Commission on rare and extincting species. Collection procedure or the data on indicators must be reliable and depend on such factors at accessibility, adequacy, scientific and statistic value, as well as it must include identification, input, storage, selection and presentation of data and information.

Chapter 4. Model Object Characteristics

To plan Project activities 4 levels of objects were identified:

- ecoregion;
- model territories;
- existing reserves;
- single objects of management and infrastructure.

4.1. Characteristics of regional ecology specifics for Project implementation on the ecoregional level

High conservation value forests of different affiliation and use will be included into the regional system of fire management (Table 4.1.1).

Table 4.1.1 Forest Affiliation in the Ecoregion (Th. ha)

#	Affiliation	Entities of Russian Federation			Total	
		Primorsky krai	Khabarovsky krai	JAO	area	%
1	Forestry Agency	11805.5	32560.7	2137.2	46548.4	82.2
2	State Nature Reserves	515.9	735.5	91.8	1343.2	2.4
3	Ministry of Agriculture	433.1	67.7	14.1	514.9	0.0
4	Ministry of Education	21.7	--	--	21.7	--
5	Defense Ministry	209.3	171.4	--	380.7	0.7
6	Municipal forests	101.2	4.4	6.8	112.4	0.2
7	Total	13131.7	33543.4	2249.9	48925.0	86.4
7.1	Forest fund	12821.2	33367.6	2243.1	48431.9	85.6
7.2	Forest fund excluded	310.5	175.8	6.8	493.1	0.9
8	Funds of other lands	3028.3	3248.5	1380.1	7656.9	13.5
9	Total area of ecoregion	16160 29%	36791.9 65%	3630 6%	56581.9 100%	100

Forest fund record for 01.01.2003 shows that the area of the ecoregion is 56.6 mln ha and forests managed by RF Ministry of Natural Resources cover the area of 47.89 mln ha (85%), including 2.4% of state nature reserve lands.

There are kolkhoz and sovkhoz (farm ownership forms) forests in ASAR of total area 0.5 mln ha, which together with Forestry Agency and state nature reserve lands compose forest fund (Art.7, Forest Code). The estimate is not precise as forestry management there was not properly controlled and forest fund and sovkhoz estimates differ.

Strips of forest along automobile and railroads 15-30 m wide belong to transportation lands. Further from the roads stretch kolkhoz and state land reserve

forests. Mineralized strips (firebreaks) are made in transportation forests. Minimum fire-prevention measures are implemented in Defense Ministry and municipal forests. No forest protection and fire prevention activities are conducted in forests, which belong to sovkhozes, state land reserve fund and agricultural facilities. There is no fire statistics on those areas, but several small villages were reported to be destroyed by fire. As a rule fires from these forests expand to HCVF.

Fires often start in places with sources of fire and dry easy burning materials. Agricultural lands with tree and shrub vegetation are such fire-risk areas.

In its annual reports environment conservation service does not pay much attention to fire management problems in forest not included into forest fund. Report chapter on forest protection and conservation provides forest fire data and describes fire protection activities only for forests that belong to State Forestry Agency. There are no data in this report on fires in forests of other affiliation. No lessons were learned after pyrogenic catastrophe in 1976, when several settlements were burnt and people died (Kurbatsky, Sheshukov, 1978), as well as the ecological situation and fires in 1998-99, when Khabarovsk krai citizens suffered from heavy smoke and part of Litovko village was damaged (Far East Forestry Research Institute). Badly managed forests remain the cradle of future catastrophes.

Constant fires cause forest degradation and substitution by less commercially valuable forests. Though their timber is of low commercial value, these new forests preserve forest environment, maintain potential for high value forest natural and artificial regeneration and soften anthropogenic pressure on HCVFs.

In recent years Federal forestry service and now RF Ministry of Natural Resources gradually transfer former sovkhoz forests to RF Forestry Agency jurisdiction. The reason for that is that there are no more government-owned agricultural enterprises. Forests are left without management, poaching is flourishing there, fires are frequent and often expand and damage HCVFs.

This forest affiliation transfer process should be speeded up, while Project is implemented. These non-managed forests should be included into ASAR fire management system. If not, the whole system of HCVF management will not be efficient as targeted by this Project. After that Project second stage can be implemented, i.e. differential survey of forests in the ecoregion. Their fire risks and fire extinguishing priorities would be assessed based on social, economic, ecological and forestry value of forest ecosystems.

Within ASAR lots of work is being done to expand PA network, to improve ecological situation in the forests. Nevertheless, some evidence shows changes of PA regime status into less strict (Analysis of Khabarovsk krai environmental legislation, Eurasia Foundation, 1999).

1. In 1993 Birsky special reserve was established as having krai status. Mining exploration was forbidden and only intermediate felling was allowed there. In 1998 according to the resolution of the head of Khabarovsk krai Administration a buffer zone was formed in Birsky reserve for limited hunting and a mining exploration was allowed. Three months later the next resolution allowed principal felling in this reserve.

2. In 1997 Chukensky Special Reserve Statute, adopted by Khabarovsk krai government forbade mining exploration and mining activities in the reserve. In 1998 the same government gave Amur Company the right to conduct their exploration and mining activities on 6170 reserve hectares.

3. In 1992 Khabarovsk Krai Governor's Resolution # 217, dated 13.05.92, announced an area of 1371.5 th ha in Umaltinsky leskhoz to be Verkhnebureunskaya territory of traditional nature and land use. Up to now one of its provisions is not fulfilled. After Korean felling operations were completed Khabarovsk krai forest management department did not provide necessary documents to transfer the forest of the traditional territory into the first forest category.

In 1960-ies Far East Forestry Research Institute developed a fire risk scale, which was published in the Far East Forester Handbook (1973). Later some other types of inflammable materials and integrated fire indicators were added. This scale was included into Recommendations for forest fire prevention in the Far East (1983).

Sheshekov et al (2000) describe the following forest inflammable materials: 1/ gramen and herb vegetation; 2/ dry leaves of trees and shrubs; 3/ green moss; 4/ sphagnum and peat; 5/ fruticose lichen and small shrubs; 6/ forest litter; 7/ acerose foliage

These inflammable materials together with weather conditions determine the degree (class) of fire risk (Table 4.1.2.), types and intensity of fires, burning capacity level, fire-extinguishing equipment and tactics.

Table 4.1.2 Fire-risk class distribution of State Forestry Agency forests

#	RF entity	Fire-risk class					total	Average class
		I	II	III	IV	V		
1	Khabarovsky krai	2705.1	5713.5	15528.5	6846.7	1767.1	32560.7	2.97
2	Primorsky krai	474.8	1755.2	6348.5	2571.0	701.0	11805.5	3.12
3	Jewish AO	403.5	532.2	948.0	234.8	18.7	2137.2	2.50
4	ASAR total	3583.4	8000.7	22825.0	9652.5	2486.8	46548.4	2.98
	In %%	8	17	49	21	5	100	

There are no fire-risk data on state nature reserves and former sovkhoz forests. Fire risks in ASAR forests, belonging to Federal Forestry Agency are ranked as moderate (class 2.98) and in JAO as medium high (class 2,5).

To make fire-risk assessment of the territory for GIS every forest object should be evaluated (in leskhoz or nature reserve). There is some experience of classifying small forest objects, namely in Vyazemsky leskhoz and Bureinsky reserve in Khabarovsky krai and in Chernigovsky leskhoz in Primorsky krai. But some serious mistakes were made there and estimates showed lower risks as compared to real situation. Thus Bureinsky reserve was ranked 4.0 instead of 2.15, Vyazemsky leskhoz was ranked 3.7 instead of 2.5 and Chernigovsky 3,4 instead of 2,5.

Main factors that determine inflammable material accumulation in the forest (besides fires) are intermediate, principal and sanitary felling, illegal waste dumping, road construction, etc.

Felling cause additional wastes accumulation due to ineffective operations. Up to 40% of stemwood is left in the area. Logging residue like treetops and branches may also cause fires. To minimize losses timber wastes recycling should be practiced. In such case less inflammable wastes are left in the forest.

Table 4.1.3 Characteristics of timber left in logging areas in Primorsky and Khabarovsky krais

#	Leskhozes	Amount of timber left (cu m/ ha)							
		Undercut		Tree-length logs	Trees with root	Debris	Left at upper landing	Total	
		Green	Dead					Mer-chant-able	% of initial resource
Khabarovsky krai									
1	Amgunsky	9.3	1.9	16.9	9.2	19.4	15.8	72.5	31.6
2	Evoronsky	6.7	2.2	14.2	18.4	23.8	6.7	72.0	32.5
3	Tumninsky	5.4	17.1	4.2	19.7	20.1	14.5	81.0	37.5
4	Sukpaisky	9.6	5.3	9.9	16.2	14.6	12.3	67.9	29.4
Primorsky krai									
5	Chuguevsky	6.4	9.1	3.1	16.5	18.8	12.6	66.5	30.1
6	Melnichny	0.7	1.1	0.7	9.8	12.7	3.5	28.5	18.6

Lots of inflammable wastes accumulate at road construction sites, when forest users built their roads with old forbidden technology. Bulldozers push cut trees and stumps to the sides and the road is paved in the middle.

To reduce inflammable timber wastes the following fire preventive measures are used:

- clearing felling areas;
- removing wastes and shrubs near the roads
- removing forest debris (windthrown plants) and dry wood (sanitary felling) are practiced in forest recreation zones, in protective strips along automobile and railroads, along rivers and fish spawning streams and in protected areas and I group forests
- complete sanitary felling are used to remove dead wood.

Effective clearing of felling areas means complete removing of felling residue, which is not always possible (Kovalev, 2004). That is why fire risks in felling areas are high as substantial amounts of inflammable wastes speed up fire distribution. Excessive inflammable wastes (stemwood) complicate fire extinguishing and localization.

Controlled burning to reduce timber wastes is limited by several factors. Firstly, in Russia forest regeneration is mostly natural. It is estimated that 80% of

mature and overmature woods have sufficient underwood to form young forests after mature wood is cut. Forests with forming species particularly vulnerable to fire (spruce, Korean pine, larch) and high value biodiversity areas should be also excluded from the remaining 20% of mature and overmature woods. Besides, burning is not allowed in young and middle-aged woods, in areas with thick underwood, dead wood, forest debris and windthrown trees.

Thus lots of factors should be kept in mind before deciding on controlled burning. In ASAR it may be used in mature larch forests, which have limited distribution (Chapter 7).

This type of wastes burning can be recommended only if it is strictly controlled and the following rules of forest fire safety and biodiversity conservation are strictly followed (also see Chapter 7):

1. Complete burning of forest debris, felling residue and dead wood in felling areas should be followed by planting forest species.
2. Autumn burning of dry grass on hay and grazing fields.
3. Autumn burning of dry grass in forest edges at the boundary of open areas.
4. Burning of grass and debris between roads and mineralized strips (firebreaks) along the roads.

In Jewish Autonomous Oblast and south-west of Primorje experimental burning of strips 10 km long and 15-20 m wide at forest edges can be recommended.

The following violations of forest rules in HCVF, which increase fire risks can be mentioned.

- In nut and game areas (NGA) and other areas with limited activities, protected areas, principal felling is forbidden and only sanitary and tending felling is allowed as stated in Instructions for tending felling (1994). Dry trees, forest debris and windthrown trees are to be removed from the area. In reality, commercial felling takes place and the best trees are cut, biodiversity on the remaining part is decreasing and fire risks are increasing.
- Forest leasing companies choose felling areas themselves, but don not want to increase their payments for using natural resources. So they report smaller areas and smaller estimates of timber resources there (already underestimated by the forest managing authorities). Forest guard does not control this process. Thus actual felling areas are far bigger than reported and after complete timber harvesting the wastes are not utilized or cleared away.
- As forest guard control is insufficient or lacking at all, timber companies try to complete allowable amounts of felling by high-grade timber, leaving low-grade timber in their felling areas.

The following features of today's situation in forestry should be kept in mind while planning forest management and fire prevention activities:

- for various reasons forest management authorities used to lower actual commercial timber resource in their reports for 15-20%, the one reason being inefficient inventory methods;
- as the responsibilities for assigning intermediate fellings in the forest inventory process became more strictly controlled, enumeration officers tend to register reduced (within allowable limits) inventory data and thus certain areas are

excluded from intermediate felling plan. It happens because forestry authority control is insufficient.

So actual fire risks in the forest are much higher than shown in leskhoz data. Felling rules in the Far East forests (2000) are not fully observed. For example, satellite images show concentrated felling in Sovetsky leskhoz in Khabarovsky krai. Every forest resource leaseholder, engaged in timber harvesting, has the Plan of principal felling and forest management in the leased forest fund area. Still, as leskhoz control is weak, many leaseholders neglect forestry requirements, stated in the Plan. Felling areas are chosen at random, felling occurs in protected zones, wastes are not utilized and cause high fire risks, forest regeneration is not organized in 3-year time after the operations are finished.

Felling area description based on large-scale aerial photography to be done by forest management authorities can be introduced to investigate illegal fellings, felling rules violations and to collect reliable data on how timber companies manage their leased forest areas. This can be implemented only in Khabarovsky krai, as in Primorsky krai clear felling is not being practiced and in Jewish AO its volume is limited.

4.2. Project implementation specifics on modal territory level.

The Project views HCVFs as objects of forest area level and higher (leskhoz, district). In reality forest boundaries are not fixed and risks of various management conflicts remain possible. Boundaries of green zones, protective strips along roads, rivers and spawning streams, nut and game forests and other protected zones of I category forests are made along cuttings between forest blocks, which in most cases have never been cleaned. Since 1992, cleaning old and making new cuttings have been considered as ineligible spending of budgetary funds. Besides many block boundaries go along rather vague watershed boundaries, while the protected strips along spawning streams and rivers, water protecting zones 500 m wide and less were, as a rule, marked without considering the relief.

Conflict risks would be overcome when GIS of PAs, model territories and of all the ecoregion is completed and forest management is improved. New electronic maps will show all the boundaries from inventory units and forest blocks to entities of the Russian Federation. With the help of GPS, the boundaries, designed firebreaks and walking paths can be clearly identified, any mapped object can be easily found in the forest.

Joint mapping and inventory base, equipped with moden computers will allow making any type of maps, such as forest planting plans for mobile groups and maps for constructing fire-prevention facilities. Such GIS (to be more precise – a joint mapping and inventory base) has been already made for 4 leskhozes in Jewish AO (of 6 total) and for several leskhozes in Khabarovsky and Primorsky krais.

That is why it seems reasonable to provide GPS navigators (with 10-15 m accuracy) to controlling inspectors, mobile patrol groups, fire brigades, PAs and forest managing enterprises.

It is also necessary to enhance the use of maps in forest management activities. Formation (unit) approach should be used to identify, describe and define native and conventionally native forests. In Russian forestry formations are defined according to dominant forest-forming species (Kolesnikov, 1956). Formations can be rather definitely described if inventory information on forest type and composition is used. But forest management instructions do not envisage developing special formation maps. Nevertheless, several landscape and geobotanical maps (scales 1:500 000 and 1:1 000 000) were created based on forest management data. These maps reflect the formation structure of forest cover. Possibilities to use and further develop such maps should be also discussed (Attachment 4).

It is practically impossible to separate continuous HCVF blocks using available schemes of forest distribution in Vyazemsky leskhoz, which is all located in coniferous-broad-leaf forest zone. HCVF locations are mosaic and they are divided with small-leaf forests that grew after logging operations in Siberian pine forests in 1950-1970-ies. Khorsky, Anuchinsky, Kuldursky and many other leskhozes have similar schemes. Certain detailing is needed to work out HCVF criteria. Nowadays GIS allows making all kinds of maps and schemes, including maps based on forest formation and vegetation types. Such maps will provide the necessary details (Attachment 4).

Verkhnebureinskaya territory in Khabarovsky krai is quite representative. It includes Bureinsky state nature reserve, Umalta River basin on the right bank of the Bureya River and on its left bank - the eastern part of Urgalsky leskhoz with Dublikansky special reserve of krai importance.

This territory should be paid attention now or in the nearest future for the following reasons:

1. Besides Bureinsky state nature reserve and Dublikansky special reserve of krai importance, Verkhnebureinskaya model territory includes Verkhnebureinskaya territory of traditional land use, where commercial logging takes place irrespective of the fact that this territory is ranked Forest Group I (Resolution of the Head of Khabarovsk Krai Administration # 217, dated 13.05.1992).

2. Protected strips of forest along the Bureya River and along the Baikal-Amur Mainline (BAM) 250 m wide on each side of the rail road are also ranked Forest Group I. Following forestry regulations in BAM zone, it was planned that after the construction of the railroad, 3-km wide forest area along the road would be ranked Forest Group I. However, for already 30 years, forest resources in this area are being actively destroyed (Danilin, 2000, pp. 276-283).

3. Verkhnebureinskaya territory represents Bureinskaya mountain taiga forest fire zone. According to geobotanical zoning (Kolesnikov, 1961) this territory belongs to Selemzhinsko-Bureinsky larch forest zone and is the south-east margin of East Siberian taiga sub-region of light-coniferous forests. *Pinus silvestris* is rare here. This ASAR part is characterized by the most severe climatic conditions, permafrost dominance and forest fragility and vulnerability as felling and fires there cause damage of upper soil level, permafrost thawing and soil swamping.

4. Far East Forestry Research Institute data (Sheshukov et al, 2000) proved that this region is one of the 6 fire centers in Khabarovsky krai, where fire rate is 101-

200 fires per 1 mln ha (fire center II). As a rule large areas are destroyed by fire as natural fire risks are high and relief is complicated. There are no roads in the reserve. The roads in areas of commercial logging are poorly maintained, repairs and bridge construction is needed.

According to forest management data, collected in 1981, when the Bureinsky reserve was planned to be established within Verkhnebureinskoe subdivision of Umaltinsky leskhoz, the reserve forests were described as having high fire risks (class 2.15).

4.3. Reserves' and other PAs' specifics that influence the Project

The following scope of construction and forest management activities is planned under the Project:

- mineralized strips/firebreaks construction – 1100 km;
- cutting and clearing the system of walking paths – 1100 km;
- construction of fire watchtowers – 22.

This is of course not enough for such a vast area (56.7 mln ha) of the ecoregion or even its model territories (9.4 mln ha). But it can help to solve several fire management problems in the reserves (1.6 mln ha). However, to provide the entire ASAR with fire prevention facilities is not the aim of the Project. This is the task for RF MNR. Project planned firebreaks are to improve the existing fire prevention system, make it more effective in HCVFs, especially in reserves.

ASAR leskhozes annually make firebreaks for 8-10 thousand km, but they are mostly made to localize and stop the fire. After the fire no maintenance of these firebreaks is organized and in a year they grow over and loose their function. Revision of leskhoz activities for the recent 12-15 years showed that 1.5-2 thousand km of firebreaks are registered in the books but only 50-100 km of them serve their purpose. They mostly surround forest plantations and run along the roads. No leskhoz has completely implemented forest fire prevention activities and firebreaks development plan. There are no firebreaks, which divide areas of different forest leaseholders, circle forest settlements, felling areas and natural young coniferous forests.

The reported 24.9 thousand km of fire barriers in ASAR do not exist in reality. Following Recommendations for fire prevention and extinguishing in the terrestrial protection zone of Far Eastern forests, forest management authorities designed dividing leskhoz territories with the system of fire barriers into isolated blocks of 10-12 thousand ha. Big and small rivers, roads, electric lines, forest edges, firebreaks were to be the barriers. But most of them could not serve the purpose, being full of debris and not properly cut.

A wrong opinion is still supported in forest management that mineralized strips should be cleared once in two years. In summer of the first year they overgrow with grass, in autumn leaves fall and next year they are not able to stop the fire. Fires stop at mineralized ground with no inflammable material. The same mistake in made in the regional targeted program "Protection of forest from fires for 2003-2010" in Khabarovsky krai. The program plans to make 28 000 km of mineralized strips in 7

years (4 000 each year) and maintain them in area of 47 000 km. Estimations reveal that after 7 years 84 000 km of firebreaks will have to be maintained.

Estimations in thousand kilometers.

Years		2004	2005	2006	2007	2008	2009	2010	total
Firebreaks construction		4	4	4	4	4	4	4	28
Maintenance	2005	4							4
	2006	4	4						8
	2007	4	4	4					12
	2008	4	4	4	4				16
	2009	4	4	4	4	4			20
	2010	4	4	4	4	4	4		24
	total	24	20	16	12	8	4	-	84

Thus, it seems necessary to clarify the amount of firebreaks to be maintained, including previously made. Besides, seminars and consultations planned should be used to promote the necessity of annual firebreak clearing (Attachment 4).

Up to now mineralized strips have no alternative. They serve as passive barriers to fire expansion, counter-fire setting point and as roads for fire vehicles and brigades.

There are also no alternative firebreak construction methods. When the trees are cut, bulldozers or similar machines (MRP-1) remove stones, debris and stumps and then plowing or milling is done.

There are alternatives in firebreak maintenance, such as mechanical mineralization of soil, or using herbicides, arboricides, defoliants, etc.

To address surface fires no-grass-cover larch barriers may be used. Larch is easily planted and grows quickly. Such larch barriers are recommended for external boundaries of Kedrovaya Pad reserve and Komsomolskaya model territory.

Mechanized group equipment includes a bulldozer, Sadko and UAZ-type cross-terrain automobiles, fire all-terrain vehicle, blowers, petrol-driven chain saws, branch removers, ultra short wave portable and mobile radio stations, automobile satellite terminals, motor pumps. It seems important to work out procedures to transport a bulldozer and a fire all-terrain vehicle to fire locations (the use of existing and leasing/purchasing of a new trailer) (Attachment 4).

All vehicles and equipment, planned to be purchased, are certified and environmental impact will not exceed allowable standards.

To make forest fire GIS and forest fire management plans for ASAR, HCVFs and model territories inventory of the existing fire equipment should be completed. Each leskhoz is required to have a fire-chemical station (FCS). FCS of the second type must have a heavy tractor, 1-2 wheel-tractors, a truck with a tank, two lorries to carry people, heavy motorcycle, etc. Besides, leskhoz is required to have machines and equipment to carry out forest management, forest regeneration and other activities. As stated in Recommendations for forest fire management activities (1993), all vehicles and equipment should be repaired before fire-risk season and be ready to fight the fire.

The current state of the fire equipment reserves and the fire management of the territory is not adequate. In is necessary to make fire equipment inventory in each leskhoz and PA to be able to create reliable GIS and fire management plans for every leskhoz, PA, as well as for the entire ASAR (Attachment 4).

Under Component 2 it is recommended to undertake an inventory of fire equipment in each leskhoz and nature reserve. The review should not be limited to record books but should be organized in the field, where fire equipment and facilities should be inspected.

The following activities and measures to be implemented by the Russian forestry service can minimize negative impacts of expanding fire management infrastructure in HCVFs (Attachment 4):

1. When firebreaks are cut all the wastes should be removed or buried there.
2. In PAs (as more valued forests) firebreaks should be made along external boundaries of the protected zones (on leskhoz territory in fact).
3. In PAs firebreaks should be made along the existing roads (for example, in Ussuriisky reserve), around settlements and facilities.
4. To reduce damage to HCVFs from the increased number of forest product harvesters, warning notices should be placed along roads, paths, and firebreaks.
5. In places, where firebreaks are connected with the roads used by citizens, check points should be organized in fire risk periods.

Chapter 5. Project Environmental Impact

The Project is focused on fire management improvement in high conservation value forests of Amur-Sikhote-Alin ecoregion. It is an ecological project from the very beginning as it is aimed at optimizing pyrogenic impact on functionally important territories in the region, HCVFs in particular.

Any project contains a complicated set of activities ranging from organizational, informational and ideological to practical ones that although designed to “serve” the main and rather ecological idea of the project still directly (positively or negatively) cause certain impact on environment components. It is important to assess such impacts, calculate economic, organizational and first and foremost “ecological costs” of proposed activities as the given Project is aimed at addressing the problem of fire management and fire prevention in natural ecosystems, extremely urgent in the Russian Far East.

It is a well-known fact that 70-90% of fires is caused by man. It happens so because nowadays in people’s mentality regional natural resources and ecological potential are separated from the population of the region, ecological culture of individual nature users and nature-use process leaves much to be desired, legal grounds are insufficient and claims for environmental damages are insignificant. All this provoke different violations of nature use and conservation legislation. Compared to anthropogenic, natural fires are not so frequent, catastrophic fires in dry years being the exception. That is why the Project is focused on man and his activities. Thus, it becomes important to assess Project impact on environment and its components in HCVFs.

5.1. Project impact on plant communities

Project results are viewed as positively affecting vegetation community conditions. Even forest fire zoning stage in the frame of Component 1 includes evaluation of territory importance for global biodiversity conservation, biodiversity inventory, fire risks and threat assessment. Objective grounds for fire management, adapted to regional conditions will be formed. This will allow lessening pyrogenic stress on biota. Pyrogenic situation monitoring, optimizing forest fuels, fire-prevention measures in PAs and other Component 2 activities will also help to remedy the situation. In addition positive results are expected due to adoption of appropriate fines and penalties for vegetation destruction and damage.

Fire monitoring scheme composition and performance pursue the goal of biodiversity conservation in general and vegetation in particular. Vegetation studies are needed to clarify reactions of different species to pyrogenic stress, to assess efficiency of anti-pyrogenic measures, to create effective fire management and protection of most fragile components. Project-targeted improvement of methods to assess unrecoverable losses of unique plant communities and rare species, caused by fire, will for sure enforce responsibilities for vegetation conservation.

Controlled burnings of timber wastes should be strictly determined by biodiversity conservation priorities. Although they serve to reduce the wastes, fires are rather dangerous and should be initiated only in very special situations under a very strict and responsible control.

It is evident that all fire management plans proposed in the Project are aimed at biodiversity conservation including plant communities. Nevertheless, several Project activities may cause some localized negative impacts. Such activities include firebreaks network development, construction of paths, watchtowers, and helicopter pads. This localized minor impact would be further reduced through implementation of the selected specific measures (see Chapter 7). Thus, if ecological value is kept in mind when sites for watchtowers and helicopter pads are selected, their negative impact will be negligible. Vegetation losses will be minimal (the area for all fire watchtowers will not exceed 1 ha).

Firebreaks and paths in reserves should be carefully planned. Although they support reserve functioning, they are still considered causing stress on environment and vegetation. That is why their construction in reserves should be minimized.

Such Project activities as creation of a system for quick identification and documentation of fires and illegal wood-cutting operations, mapping current and predicted fire situations and predicted fire impact on biodiversity will definitely contribute to flora conservation and provide grounds for effective fire management.

A wide range of Project activities is proposed to enhance public awareness and education. It is an essential work spectrum that forms friendly attitude to nature. Proposed ecological educational activities; formation of material, technical and methodical base for ecological education in the region, special programs, seminars and conferences will increase ecological literacy and provide conditions for NGOs involvement, prevention of damage to biodiversity from fires, and for the further development of the Project. No doubt, these activities will attract local population to participation in the Project, including conservation of landscape and vegetation complexes specific to the region.

Assessment of Project positive and negative impact on plant communities leads to the conclusion that negative effects are small in scope, localized in space, not strong and indirect, whereas positive outcomes are multilevel and multiform, ranging from concrete actions to preserve rare plant species, plant communities, forest ecosystems and biodiversity in general to organizational and management decisions on ecologically adapted Project implementation and forming friendly, interested and ecologically literate public background.

Thus overall positive ecological Project impact, as well as positive impact on vegetation communities should be noted. Overall positive impact of the Project may be increased and its negative impacts - minimized with the implementation of the specific measures, including identification of unique, fragile and functionally important plant communities, rare and extincting species and their habitats; selection of optimal ecologically-friendly location for firebreaks and water reservoirs; development of the scheme of ecologically adapted forest use practices in the eco-region (see Chapter 7 and Attachment 4).

5.2. Project impact on the animal world

Project impact on animal world is viewed as being similar to Project impact on plant communities. Many project aspects seem rather progressive and having long-term positive effects. These aspects are related to assessment and forecast of ecoregion biodiversity, fire impact on forest biodiversity, including changes in animal feeding base, habitats, and species.

Fires play a double role for the wildlife. They may cause a positive effect if only small areas are burned, thus creating new habitat and feeding space, enriching biodiversity with new species and whole zoocomplexes. On the contrary big fires are real disaster for the animals, as they destroy their habitats and even populations. Growing economic activities in the region, consumption of forest products, fires increase anthropogenic stress and in some places can cause zoocomplex degradation. For example, a year after the fire in the flood plain fir and spruce forest, a most productive biotope, bird population decreased 35 times (from 373 to 11 birds per 1 km^2) and species composition decreased 4 times (from 16 to 4 species) (Voronov, 2000). That is why any forest-fire prevention measures should be welcomed and supported, especially if they are of an integrated character.

The Project fully demonstrates an integrated character of its activities. A large spectrum of activities will directly or indirectly influence the life of animals. For instance, forest-fire zoning of the region to optimize and mobilize anti-pyrogenic efforts in the region and in model territories will provide data on forest fire regimes, pyrogenic degradation risks in these territories. Project activities are also aimed at enforcing responsibility for fire damage to the animal world. Adopting penalties and compensations for animal world damages from fires can serve as an example.

Component 2 activities include determining key animal habitats for conservation, fire monitoring and testing optimal conservation measures. Project fire management activities will be obligatorily coordinated with biodiversity conservation activities, protection and assessments of rare animal species and their habitats. Regional and model territory resource users are planned to be also involved.

Component 3 contains large-scale informational and educational programs, focused on professional training for forest users and those, whose activities affect forest ecosystems, and on educating the youth, who will determine attitude to nature in the future. Project activities include participation of young people in environment protection, specialized ecological teams, exhibitions, contests, etc.

Planned activities for fire management coordination and public awareness in Component 4 are also viewed in unity and conformity with biodiversity conservation.

It also should be kept in mind that some Project activities may have certain negative localized impact. Such activities include firebreaks network development, construction of paths, watchtowers, and in some cases the controlled fires.

When mineralized strips/firebreaks are constructed, historically developed migration routes of small animals (forest and field mice, etc) may be damaged. Firebreak construction will cause changes in biotic distribution, population density, and competitive relationships.

Analysis of the entire range of Project activities reveals their positive impact for biodiversity conservation, diminishing fire risks and aftereffects on environment and its biotic complexes. Project functional priorities also include studies of zoocomplex present state and dynamic tendencies, identification and conservation of key animal habitats, rare species, their feeding areas.

Insignificant negative impacts are well compensated with substantial positive effect of ecologically balanced measures, planned in the Project to stabilize ecological situation in the ecoregion.

Besides, several Project activities serve zoocoenoses conservation purposes and are focused on the assessment of animal population and habitat conditions (Chapter 7), including identification and mapping habitats of fragile zoocomplexes, rare and extincting animal species, as well as areas functionally important for conservation of animal biodiversity.

5.3. Project impact on wetlands.

In wetland ecosystems fires considerably change hydrological regime, transform habitats of many animals. Bog fires in the Udyl lake basin sharply reduced bird nesting and populations there. Dahurian crane stopped nesting in grass moors and wet meadows in JAO after severe fires. Birds returned only 5 years later. Fires also destroy berries fields, used by many small animals, birds, amphibia and reptiles as feeding grounds. In many places after the fire vegetation cover is changed and in permafrost areas thermokarst processes become active.

Proposed Project is supposed to decrease fire impact on wetland ecosystems. Biodiversity conservation priorities, measures to support normal functioning of key territories, active environmental education and training will create grounds for qualitative and quantitative improvement of wetland ecosystems. Lessening fire effects will help to stabilize ecological situation and recover wetland functional value for overall natural functional balance in the ecoregion.

5.4. Potential changes in natural ecosystems

Potential ecological risks of the Project are caused by the necessity of certain fire management activities, which affect the environment, and the vulnerability of landscapes, which are formed with rather dynamic processes. Main environment vulnerability factors are as follows:

- steep slopes with intensive soil sliding in a form of massive shifts (defluxion) or separate unconsolidated soil blocks;
- very intensive precipitation during typhoons and strong cyclones causes soil overmoisturizing;
- significant exposition differences of natural complexes;

- intensive chemical weathering of rocks and resulting soil silting;
- in northern ASAR areas - degrading permafrost;
- general climate warming and precipitation increase in ASAR.

Local and time-limited impacts of Project activities cannot cause significant negative changes of landscape components. As the environmental impact is localized it may be considered acceptable. More detailed assessment of environmental impact should be done for particular activities planned in the Project. Project activities will allow not only to lessen negative tendencies in forest ecosystems, caused by anthropogenic impacts and fires, but also remedy the situation with creating necessary recovery conditions for ecosystems, their biodiversity and productivity. So the significant positive impact of the Project activities is evident.

Chapter 6. Alternatives Analysis

Lots of forest fire management problems demand the analysis of several Project alternatives.

Variant when the Project is not implemented: Current situation in forest fire management is characterized with many complicated and less complicated problems, which are not and will not be addressed by the government in the near future. In general these problems may be grouped as referring to agricultural prescribed burnings, private business involvement and activities of the state nature reserves.

To eliminate fires set for agricultural purposes several problems have to be resolved, including financial and material support of the following proposals:

1. There is no authority that is responsible for agricultural prescribed burnings. Thus fire prevention and extinguishing, losses and damage recovery are not effective. It seems appropriate to authorize local authorities to implement fire management functions and provide them with financial resources for that. A stable working linkage between them and regional centers is also important.
2. Agricultural fire control is not efficient due to insufficient legal backing. It is a pressing need to develop FL "On agricultural prescribed burnings and burnings of vegetation on transportation and state reserve lands, agricultural facilities and settlement areas". Other legal acts are also needed (resolutions of Russian Federation and regional governments, local authorities decisions on issues of fire management financing and action plans, law enforcement, investigation of fire cases, etc.). Instructions and handbooks on fire prevention and extinguishing are also in demand.
3. Another serious factor that reduces fire control efficiency is a weak coordination of fire management issues between environmental, law enforcement and other responsible organizations and the public.
4. Last year the process of transferring forests that belonged to former agricultural cooperatives (sovkhozes and kolkhozes) to Federal Forestry Agency jurisdiction was stopped. Any fire-extinguishing activities in such forests initiated by RF MNR and regional bodies are considered improper and fire expenses are considered ineligible. That is why most fires in these forests remain neglected by government institutions.

Forest transition process is slowed down because forest area has to be estimated, necessary documents should be delivered to MNR, a general fire management scheme for these forests is not developed yet. As these activities are not being financed at present, the situation of agricultural lands is not improving and forests will remain unmanaged there.

5. Local authorities are used to fight the fires with their own means and mobilize local population in critical situations. Recruiting unprofessional "firemen" causes various losses. Bringing to life former well-trained fire brigades (including volunteers from local communities) can remedy the situation.

Organizational, financial and material support of such fire brigades in the districts raises many issues to be addressed. Members of volunteer fire brigades must be specially trained and acquire practical fire-fighting experience.

A training center for firemen, capable to fight forest and agricultural fires may solve some of these issues, future demand for qualified specialists in particular.

6. There is no system of fire prevention awareness in the ecoregion. RF MNR and regional governments set the task to enhance fire prevention awareness of the public on professional basis and to attract prominent and respected citizens, political leaders to fire prevention education activities. But up to now this task has been addressed only by the public itself with the support of various grants.

7. Extremely ineffective are investigation procedures, providing evidence materials and bringing “fire cases” to court. The situation became worse due to numerous changes of the Russian government system.

Attracting private sector to fire management activities in forest fund areas would have lessen the problem. The role of forest resource leaseholders becomes very important as the new Forest Code allows 100-year leasing terms. They nearly become owners of state property and should be responsible for its proper management.

To ensure positive effect of these measures the following tasks should be fulfilled:

1. Enforcing personal responsibilities of owners of business that lease forest fund. Necessary federal and regional legislative backing should be developed and enacted.
2. Developing draft FL “On Covering the Losses, Caused to Russian Federation Forests”.
3. Developing draft frame law of the RF subject “On Attracting Forest Users to Forest Fire Fighting”.
4. Enforcing forest fund leaser responsibilities for damages of state property due to improper management and protection.
5. Developing regulations for state forest service inspections of environmental activities, implemented by forest fund users.
6. Organizing and carrying out inspections.
7. Working out incentives for those forest fund users, who respect the law and support state forest service activities.

Fire prevention activities in nature reserves and protected areas should also be improved and expanded. The following issues have not been solved yet.

1. Developing a statute on integration of nature reserves and other categories of protected areas into a unified system of fire prevention measures.
2. Constructing mineralized strips not at the boarders of PAs, but at certain most vulnerable parts of reserve buffer zones, as well as their annual cleaning at the end of vegetation season.
3. Organizing professional fire management training for nature reserve and PAs staff.
4. Forming fire brigades from specialists of nature reserves and other PAs and supplying them with technical and material resources.
5. Developing general plans for fire management in nature reserves.

In case the Project is not implemented, the current fire management practice will be continued and many urgent problems, mentioned above, will not be addressed and thus the fire situation in the region in the future will aggravate.

Variant when firefighting equipment is purchased and a personnel is trained in the Regional Forest Fire Center: This variant can positively influence only one aspect of forest protection from fires, i.e. making fire-fighting more effective. No doubt, fire brigades will be supplied with modern and efficient firefighting equipment and their members will acquire skills to address fires in difficult forest fire conditions in the Far East.

But this variant has significant drawbacks, which will not allow using equipment bought and skills leant most effectively. These drawbacks include:

- insufficient prediction of fires based on natural specifics of the territory will result in ineffective planning and conducting of fire prevention and firefighting activities;
- the attention could not be focused on HCVFs, as HCVFs of PAs are under different jurisdiction;
- biodiversity conservation issues could not be properly addressed when management strategic and operational decisions are made;
- public and local population participation in fire prevention, timely reporting and fighting would not be made more active than it is today.

Variant when the Project is implemented: Based on the analysis of the present ecological situation in ASAR and the potential role of the Project in its improvement, several predictions of the character of expected changes in natural ecosystems could be made.

1. Pyrogenic risks in the ecoregion and its model territories will be significantly reduced. All available mechanisms to solve the problem of fires and biodiversity conservation in ASAR are planned to be involved in the Project. As these activities will influence not only ASAR, but the adjacent areas as well, fire risks and areas under the fire are expected to decrease and fire identification and necessary fire management and fire-fighting measures to be improved.
2. It is also expected that gradual stabilization of ecoregional situation will take place, the role of natural evolution processes in the formation of this situation will increase and negative anthropogenic impacts will be reduced. The role of anthropogenic successions of ecosystems will also be reduced.
3. Forest biodiversity recovery processes will be activated: recovery of ecosystems – to greater degree, and genetic and species diversity – less evident. Although in small localized areas of experimental burnings pyrogenic communities will have less diverse and more unified composition of flora and fauna species.
4. Probably forest covered areas in ASAR model territories will increase, especially in the Jewish Autonomous Oblast. Recovery processes of shortened succession line in forest ecosystems will become more active.
5. Number of plant and animal species, conservative in habitat, and rare and extincting species, to which the fire was a limiting factor, will increase.

6. Thanks to ecological educational and other public programs, population involvement into the process of fire management and environment protection, various kinds of poaching are predicted to reduce.

7. Forest use processes in the ecoregion and in its model territories will be better regulated and more adapted to the environment, which in its turn will contribute to reducing negative anthropogenic impact on the ecosystems and to enlarging the role of natural processes in ecosystem dynamics.

8. Hydrological and temperature regimes of water objects in the forest zone of vast burned areas will gradually stabilize. The processes of covering riverbanks with trees and shrub will also stabilize water regime in the rivers. The level of discharge of pollutants from burned watersheds into rivers and streams will reduce. Water balance of the territory will gradually resume its initial state, determined by natural landscape and climatic specifics of the region.

9. Ecological-carcass function of key areas that ensure genetic exchange in biodiversity of plants and animals will increase. This function supports nature and landscape specifics of the region.

10. Erosion danger in mountain forest landscapes will decrease, as well as the number of slides of soil and snow in winter, leading to vegetation regeneration on the mountain slopes.

11. In places of active regeneration of burned areas in plain landscapes, bog drainage and drying processes will become intensive.

12. After several decades without fires, coniferous and broad-leaf forests will be regenerated in the northern part of their former range (Komsomolskaya model territory).

13. Salmon spawning conditions will be improved throughout all model territories of the ecoregion owing to the reduction of terrigenous material discharge from overgrowing burned areas into the streams, and thus river silting. As water quality and temperature regime in taiga streams will improve, populations of taimen, grayling and other fish species will grow in number.

In all, Project implementation will allow slowing down the development of negative tendencies in forest ecosystems, which are formed under the impact of anthropogenic activities and fires, associated with them. After maximal possible reduction of pyrogenic factor impact the situation may be reversed by creating conditions necessary for the recovery of the ecosystem, its biodiversity and productivity.

These positive impacts are expected as outcomes of the formation of vertically and horizontally integrated system of forest fire management, well equipped with means of communication, control and notifying. The Project might turn to be a catalyst of fire management activities of RF Ministry of Natural Resources. Besides, owing to the Project and namely its Small Grant Program the role and participation of population in fire management will become more important.

Chapter 7. Environment Management Plan

Although in general the Project will significantly improve the ecological situation, several activities to enhance positive impacts on environment, reduce potential negative impacts, and to monitor the Project activities are proposed.

7.1. Lessening Project negative impact

It has been mentioned already that several Project activities can create a negative environmental impact. They are:

- forestry activities such as experimental controlled burnings;
- construction works, including construction of mineralized strips/firebreaks, fire watchtowers, walking paths, etc.

Controlled burnings are planned for model plots of three forest types (four experimental burnings for each forest type at 50 ha plots). Provided the necessary control is implemented these prescribed burnings will help nature. Still for various reasons, including subjective, the fire can expand. So experimental plots should be selected in the areas with natural barriers, which will not allow the fire to expand further, even theoretically.

Preventing negative impacts of Project implementation: It is necessary to think of additional measures and conditions for constant monitoring of Project results and correlating their real efficiency with the expected one in the frame of preventing and lessening Project negative impacts. It is very important for timely correction of activities to be able to either develop them further or entirely stop them. Moreover, the activities that can have a certain environmental impact should be preferably implemented in the territories already changed or being changed by man. Preliminary analysis of possible negative impacts of activities on valuable and functionally important natural objects should be combined with developing appropriate measures, norms and rules of their implementation. Thus it seems important to:

1. Preliminarily inspect the areas for controlled burnings, construction of firebreaks, watchtowers, walking paths and assess their functional importance and biodiversity value.
2. Assess in detail forest areas selected for experimental controlled burnings and exclude areas of high biodiversity value, with thick underwood, with deadwood and forest debris, easy inflammable forest-forming species like fir, spruce, Korean pine, etc.
3. Strictly control the burnings of deadwood, forest debris and timber wastes in felling areas with forest regeneration activities to follow. Localized autumn prescribed burnings in hey and grazing fields, dry grass and other inflammable materials at forest edges in Jewish AO and Primorsky krai south should be in form of 15-10 m wide and 10 km long strips along mineralized strips. They should follow the perimeter of forest settlements, bee farms, agricultural plantations and other facilities.

4. Supply leskhozes with special equipment and materials, financing them in the frame of the budget of controlled burning activities planned for forest fund model plots.

5. Develop instructions for controlled burnings.

6. Conduct systematic observations (monitoring) at experimental plots.

7. Clarify the length and location of firebreaks based on specifics of the territory and annual maintenance. Advocate annual maintenance of firebreaks at seminars, consultations and other activities.

8. Ensure obligatory and timely removal, transportation and dumping of the firebreak construction wastes. In reserves, mineralized strips should be constructed only at external boundaries of their protection zones, around settlements and facilities, along the roads and boundaries between land users. They should be rather remote from PAs, run along highways and roads, made in less valuable forest, etc.

9. Control that the fire-prevention objects constructed are used for the initially intended purposes. Provide strict control of the use of mineralized strips and walking paths. Equip paths, firebreaks and roads with notifying signs and in the fire-risk period, install check points to lessen negative impact on protected HCVFs, caused by forest product harvesters and other forest users, mostly unorganized.

Reducing fire-risk factors: A fire management system should concentrate its efforts on factors, which provoke fire development and factors, which limit the increase of the number and scope of fires. The group of “fire catalysts” includes inflammable material accumulations, agricultural prescribed burnings, fires along transportation arteries, violations of felling technology regulations, felling activities in various protected zones, etc. Fire-limiting factors also vary, including existing water streams and reservoirs, forest density, groves of trees, which can stand the fire, etc. The Project also includes measures focused on improving the efficiency of those activities that reduce fire risks.

Compensatory activities: The scale of possible damage due to Project implementation is so small that compensation to natural ecosystems or population of the ecoregion seems not necessary. Project implementation will produce a significant economic effect as it allows to substantially reduce fire damages, to save natural resources of the region and to increase local population activities. Addressing the fires, the Project thus helps to remedy ecological situation in the ecoregion, especially in the fire-risk period.

Decrease of fire rate and fire-damaged areas is important for the whole Far East south. Thus, the Project will positively effect biodiversity conservation in this ecoregion.

7.2. Project Monitoring

Monitoring Project outcomes during its implementation stage: Project monitoring allows collecting information on key ecological aspects and includes two main blocks.

The first one is focused on the assessment of the quantity and quality of the Project activities planned. A good reporting system will help to correlate data in the form of information and general reports.

Equally important seems monitoring of environment quality, as it is the indicator of efficiency of fire-prevention activities, planned in the Project (Table 7.4.1.). According to N.F. Reimer's description (1990) environment monitoring comprises the system of observations, evaluations and predictions of environment dynamics and prevention of critical situations, hazardous for people and other living organisms.

Neither of the above mentioned tasks can be solved only on the level of formal indicators. A special comprehensive survey of environmental conditions is necessary. The following criteria (Zakharov et al., 2000) may be used to select environment monitoring approaches and methods:

1/ evaluating the degree of deviations from the optimum (allowance of changes, loads fixing, etc.);

2/ using common parameters, which characterize important features of the system and its functioning;

3/ sensitivity of methods used to evaluate environmental conditions becomes very important when low and medium-intensity deviations are viewed to return the system to the condition close to the original;

4/ universality in respect to the investigated systems, ecosystem types, biodiversity of species;

5/ suitability to the assessment of real nature situations;

6/ possibility of wide use.

An environment survey is panned both in time (observations of nature object parameters with fixed frequency at model plots) and in space (analysis of different areas of the ecoregion). The main object of environment monitoring is the biosphere in general and its spatial subdivisions, i.e. ecosystems of different ranks, which may be singled out according to the multilevel structure of the Project.

The first level is linked with a small-scale general evaluation of the situation and its possible changes in time within the ecoregion. Objects for monitoring at this level are landscapes, vegetation cover, animal populations, ecological and functional relations between biological communities and several other general parameters. Regularity of observations depends on the capacity of research organizations and respective services (mostly laboratories). Such monitoring seems appropriate at the beginning and final stages of the Project.

The second level is supposed to provide information on possible changes in the ecosystems within model territories, leskhozes or their subsidiaries. This information will be reflected in medium-scale maps and schemes. Objects for monitoring at this level are possible changes of biodiversity, water quality, hydrological regime, soil cover conditions, etc. As in case of the first level, this monitoring will be conducted by research institutions under the supervision of Khabarovsk Krai Forestry Agency. Observation frequency is once in 1-2 years.

The third level of monitoring is the level of economic activities, testing sites, detail observations. Assessment of environmental conditions comprises traditional

observations, including field and laboratory tests, biotests, bioindications and results of other assessments of particular organisms in nature. Observation frequency is determined by the time range of fire-risk periods in the ecoregion, such as April-June and October-November, as well as August, an in-between period and may be 2-4 sets of series per year.

Environment quality monitoring in the Project frame is based on the following documents:

- RF Government Resolution #307 “On Adoption of the Statute on Implementation of State Monitoring of Water Objects”, adopted 14.03.1997;
- RF Government Resolution #1425 “On Adoption of the Statute on Information Services in the Sphere of Hydrometeorology and Environment Monitoring”, adopted 15.11.1997;
- RF Government Resolution “On Adoption of the Statute on State Control of Activities, Causing an Active Impact on Meteorological and Other Geophysical Processes on the Territory of the Russian Federation”, adopted 25.08.1999;
- Resolution of RF Government Council of Ministers #491 “On Land Monitoring”, adopted 15.07.1992
- Resolution of RF Government Council of Ministers #1229 “On the Establishment of the Unified State System of Ecological Monitoring”, adopted 24.11.1993
- Order of the RF Ministry of Natural Resources “On Improvement of State Ecological Monitoring Activities”, adopted 28.10.2003.

The following regular reports will help to create conditions for timely indication of specifics and shortcomings that need to be further addressed with additional measures to lessen their negative impacts:

- an information report every half a year;
- a general report after the Project is finished.

Assessment of recommendations to lessen any Project negative impacts and identification and rehabilitation of the areas affected will be timely and continuous.

7.3. Skills development and training

Environment conservation efficiency depends much on the system of government in the subjects of the Russian Federation.

At present, there are staffing problems in the forestry management system on territory and local levels, including the sphere of:

- ecoregional fire management;
- municipal forest fire management;
- organization of cooperation between leskhozes and reserves and other PAs.

These problems become even worse because of frequent reforms of the RF Ministry of Natural Resources. Constant changes in forestry service staff result in substituting forestry management specialists with “managers-generalists”. On the regional level such substitution caused management system misbalance. Staff

changes normally do not affect the level of leskhozes. But the problem of staff deficit always was the key issue there.

In the meantime, qualified specialists in forestry and forest management work now in regional governments, model territories and PAs, divisions of Rosleskhoz and Rosprirodnadzor. They are trained professionals in geography, biology, ecology and other related fields. These specialists could meet the demand of the Project implementation.

Another important aspect is how well Project managing authorities are prepared to implement the Project. These managing authorities include organs of executive power in the RF subjects, territorial forestry agencies there, and Project implementation group. Certainly Khabarovsk Krai Forestry Agency bears major responsibilities as it is authorized together with Project implementation group, represented by the Khabarovsk Regional Wildlife Foundation to supervise the Project. These organizations are rather experienced in implementing various projects, including international.

7.4. Schedule of activities and their financing

To integrate the Environment Management Plan into the entire Project the experts discussed both activities that clarify original proposals and activities, added to the list of original activities.

Activities, added to the list of original activities, described in the Project feasibility study need financing. Activities, which clarify original proposals, do not need financing (Table 7.4.1.).

The approaches, discussed in this research are rather specific. They are of interest as an integrated evaluation of the situation prior to Project implementation.

Table 7.4.1. Environment management plan activities

Project activities	Recommendation of the environmental assessment
A. Integration of high conservation value forests (HCVFs) into an ecoregional fire management system	
A.1.Defining areas and baseline requirements for fire management	
Develop techniques and conduct forest-fire zoning according to the types of forest fire regimes, survey the use of fire by indigenous people	Zoning methodologies should properly account for the distribution of biologically valuable, critical and endangered ecosystems
A2. Standards and Monitoring	New activity added (total budget US$ 75,000): Monitoring Project outcomes in model areas
B. Improving effectiveness of forest fire management in HCVF of the ecoregion	

B.1. Reconciliation, compensation and mitigation for legally enforcable wildlife damage	
Development and introduction to legal environment of fines and compensation for fire-related damage to wildlife and cultural resources	Specifically consider also damage to rare and extincting animal and plant species and habitats
	New activity added (total budget US$ 25,000): Development of legislation to support re-classification of forests on agricultural and other areas as forest fund
B.3 Wildfire management – emergency operations in model areas	
Developing field infrastructure for fire management, to include: (i) a network of firebreaks near PA buffer zones (involving leskhozes and neighboring forest users) – as guided by the zoning to minimize impacts on biodiversity and cultural resources; (ii) watchtowers; (iii) helicopter pads; (iv) taiga sheds and bases; and other non-intrusive elements	1. Undertake environmental, floristic and faunistic assessments to determine the location of firebreaks, watchtowers and helicopter pads. Account for the annual cleaning of firebreaks. 2. Ensure timely removal from the area of fuel (wood, etc) resulting from establishing firebreaks. In PAs establish firebreaks only (i) along the outer boundaries of their buffer zones; (ii) around the existing infrastructure facilities, buildings, constructions, villages; (iii) along the boundaries of forest-user plots; and (iv) along the existing roads. Establish firebreaks primarily in the areas outside PAs – along the roads, in low-value forests, etc. 3. Control should be established to secure that the infrastructure (particularly – firebreaks) is used for the intended fire management purposes only. During fire hazard seasons the infrastructure and facilities should be inspected to monitor compliance and minimize fire risks from the forest visitors.
B.4 Management to reduce fuels and enhance habitat at the landscape level	
Development of maps for 11 nature reserves. Reducing threats of fire	Develop and employ unified and consistent methodology of mapping

management impacts by locating and characterizing ecosystems, species of animals and plants, and habitats in the PAs and surrounding forest matrix for inclusion to fire risk and management GIS maps.	
Implementation of pilot reduction of forest fuels and enhancement of habitats by forest and fire management. Establishing regulatory, technical and methodological framework for the management of forest fuels with due regard to biodiversity and socio-cultural factors. Activities on-the-ground would (i) test 2 silvicultural (even- and uneven-age) and 2 logging systems for relative impacts on fuels, fire risk and habitat compatibility; (ii) support re-creation of normative stand structure and composition by testing combinations of thinning and prescribed fires in 3 forest types and measuring effects on fuels and habitats; and (iii) support restoration of the selected fire-modified critical forest habitats of tiger and leopard.	1. Undertake environmental expertise for activities on-the-ground involving prescribed burning. 2. Selection of forest plots subject to prescribed burnings should be made on the basis of the detailed biodiversity assessment to avoid loss of critical habitats and rare and endangered species. Burnings should not take place in high biodiversity value areas, in forests of high fire risk, and in forests dominated by tree species highly vulnerable to fire (young and middle-age fir-tree, spruce and Korean pine).
C. Increasing participation of local population in fire management	
Administration of the small grants program	Ensure adequate screening of the small grant proposals for potential environmental impacts.

7.5. Environment management plan implementation

Implementation of the environment management plan will address:

- increasing positive effects of the Project and reducing possible threats;
- monitoring and correction;

Increasing positive effects of the Project and reducing possible threats: An integrated approach to fire management developed in the Project will maximize positive environmental impacts of its various activities. Fire management should be considered as an integral component of forestry economy, which has a strong linkage with other components. Reliability of prospects made and options selected to address fires increases, when integrated assessments are made.

Some negative environmental impacts associated with firebreaks and watchtowers construction, controlled burnings will be addressed with concrete conservation measures proposed in experts' analysis.

Proposed activities are incorporated into the Project Plan of activities and will be further considered when particular activities are worked out and carried on. They will be financed in the frame of a general budget of the Project.

Monitoring the Project and its environmental impacts is of special importance. Principles and techniques of ecological monitoring are widely used in practice and are proposed by the authors as they are based on particular projects specially designed and implemented in the Russian Far East. Thus they are adapted to the region.

Monitoring of Project activities much depends on Project administration, whereas systematic observations of Projects impacts on the situation, description of all changes in the forestry complex during the Project period, analysis of results and working out recommendations to correct fire management are the tasks of scientific and research institutions. Monitoring of results and permanent analysis of Project activities efficiency will allow making the right decisions in rapidly changing situations. Proposed mechanisms help to collect complete information, process it and make appropriate recommendations to adjust Project activities to the real situation.

Implementing environment management plan activities: Several activities (table 7.4.1.) have crucial importance for increasing Project effectiveness. Together with regional organs of state power local authorities should play the key role in fire management. They are much closer to the citizens, they follow the situation, and they are very practical compared to other participants of the process. They are able to be more effective in:

- managing agricultural burnings and prescribed burnings along automobile and rail roads;
- attracting private businesses to fire management;
- developing public initiatives.

Thus, various organizations, capable to provide high-level management, perform and coordinate forest fire prevention activities in HCVFs, are involved in the Project. They include different state forestry divisions, federal and local authorities.

Overall, the Environment Management Plan adapts the recommendations described in the feasibility study to various specific landscapes of the Far East south. The Project is valuable and important because it attempts to address HCVFs fire problems by including them into the unified fire management system, incorporating various reserves and protected areas with high biological value forests.

Project activities will not only reduce fire risks in the ecoregion, but also serve to improve forest fire management and define the priorities of fire prevention for all participants of the process. The experience of ecoregional (across administrative and jurisdictional boundaries) cooperation in fire management seems extremely important. This experience will be one of the most valuable Project results.

Concluding remarks

The successful completion of the Project will result in creation of a unified effective fire management system to serve ASAR HCVFs and its integration with fire management network of the Fart East south. The Project is targeted to further improvement of fire management system and enforcement of unique forest conservation and protection from fire-caused degradation.

Project management at preparatory stage has been carried on the regional level (entities of the Russian Federation) for the first time in case of large-scale environmental projects. Project implementation stage organization will be also managed on the regional level.

It should be highlighted that certain long- and short-term activities are of basic character and importance for Project efficiency and success. They include:

- creating a unified ecoregional fire management system;
- forming municipal systems to manage local fires (forest, agricultural, etc.);
- fire prevention activities, including education of those categories of population whose activities may cause forest fires;
- lessening or elimination of forest fire factors (forest fuels, logging regulation violations, uncontrolled burning, etc);
- supporting reserves and other protected areas.

No doubt, Project results will facilitate HCVF integration into ASAR fire management system, improve forest fire management in HCVFs and expand population participation in it. Forest fires and areas burned decrease, ecological situation stabilization in the region are also expected. Fire prevention measures proposed in the Project virtually have no alternative. “No Project” alternative means returning to the past, when fire situation got worse from year to year, HCVFs degraded, population health conditions were unfavorable.

One of the important tasks of the Project is improving fire situation information system, information exchange and analysis, transparency and public awareness of gained results. Project activities are well-defined and well-fit to social, economic and legislative regional framework. They correspond to Project tasks and financing.

Integrated and well-focused Project activities, wide range of fire management aspects and experience of existing organizations, legal grounds developed allow to conclude that the Project is feasible, extremely important for the social and economic development of the region and for solving a problem of the global scale.

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Attachment 1

Protocol # 2
of the meeting of the Public Council for a GEF Project on Fire Management in High Conservation value forests of the Amur-Sikhote-Alin Ecoregion

14.09.04 Khabarovsk

Participated: A.V.Ermoshkin, NCO "Strazh Taigi"; S.K.Bereznyuk, "Phoenix" Fund; Yu.A.Panin, NCO "Bagulnik"; V.M.Panevin, Fishermen and Hunters Society; V.B.Skachkov, All-Russia Environment Conservation Society, Far Eastern Branch

Agenda:

1. Discussing TOR for the Environmental Assessment of Project on Fire Management in High Conservation value forests of the Amur-Sikhote-Alin Ecoregion.
2. Developing proposals to the TOR.

Listened to: A.V. Ermoshkin described the essence of the TOR, which can be summed up as follows:

- the goal of the environmental assessment of the Project is to identify Project impacts on the environment, analyze possible alternatives to project activities, and develop Environment Management Plan;
- environmental assessment includes several activities, such as the study of report documents and operation policy of the World Bank, the investigation of the scope of potential threats to nature in case the Project is implemented, the review of Project implementation variants with no damage;
- Environment Management Plan development is a very important part of the assessment, because it should include measures to reduce possible negative impact on environment;
- The Project is supposed to be reviewed by the World Bank in December 2004 and to be submitted to the World Bank Board for approval in March 2005;
- making report on Project Environmental Assessment.

Spoke: V.V.Skachkov, Yu.A.Panin, L.S.Bereznyuk. The speakers stressed the importance of the Project for the region and its positive character for the forest territories and for forest ecosystem conservation in general. Ecologists expect that fire-prevention activities among the population will be in demand in the course of the Project. Ecological public may be also involved.

Decided:

1. The Project promises positive results in forest ecosystem conservation as it is targeted at fire prevention and fighting.
2. TOR is complete, but complicated. As the specialists have started their work, no changes to the TOR are recommended.
3. Forecasting outcomes of different Project alternatives in Environmental Assessment is desirable.

Public Council Chair /signature/ A.V.Ermoshkin

Attachment 2

Protocol
of the expanded Presidium meeting of the Priamurskoe Geographic Society
October 19, 2004 Khabarovsk

Participated: Simakov V.I., Antonov A.L., Vezhnovets A.F. Voronov B.A., Danilin A.K., Efimenko Yu.V.Kryukov V.G., Makhinov A.N. Mirzekhanova Z.G., Ryabinin N.A., Saikov V.V., Sapaev V.M., Simakhin V.V., Spizhevoi N.E., Sudarikov I.K., Filinov A.M., Shlotgauer S.D.

Agenda:
Environmental Assessment guidelines and activities for the GEF Project on Fire Management in High Conservation value forests of the Amur-Sikhote-Alin Ecoregion.

Listened to: Voronov B.A. – head of environmental assessment activities: The work has turned out to be rather complicated mostly because of conceptual differences as it does not fit into the common frame of numerous ecological assessments, done before. The team is composed of qualified experts, who without exception are busy people. Thus the work goes slowly. We've studied respective documents and scientific works, started the analysis of the Project and proposals to it. We think that the most attention should be given not only to providing comments, but also to constructive proposals with the priority being given to the Environmental Management Plan.

Questions asked: Spizhevoi N.E., Filinov A.M., Simakhin V.V., Sudarikov I.K. Comprehensive answers were given to all the questions asked.

Spoke: Simakov V.I., PGS Scientific Secretary stressed the necessity of adapting the existing environmental assessment experience to concrete tasks and insufficient concreteness of proposals. He supported the Project in general and approved Environmental Assessment activities. Ryabinin N.A., Amur Fund Board Chair, stressed high qualification of specialists, engaged in Environmental Assessment and shortage of time to produce a high-quality document, as the specialists had just returned from expeditions and had to complete their annual reports for 2004 and develop plans for 2005. Thus they have to be given more time. He also marked that fire management projects are very important and supported Environmental Assessment guidelines. Efimenko Yu.V. Adviser for the Far East-Zabaikalje Interregional Association for Economic Cooperation remarked that the Project Feasibility Study was the joint effort of many regional specialists and the Project is extremely important for the region; stressed the urgency of fire management in forest ecosystems, the complexity of the assessment task and the understanding of the difficulties. High qualification of specialists can guarantee Environmental Assessment success but time is limited. He also approved the activities and stressed the necessity to focus attention on Project adaptation to conditions and natural specifics of the region.

Decided:
1. Approve and support Environmental Assessment guidelines and activities for the GEF Project. It may be necessary to grant the time extension for the task.
2. The reviewers should pay special attention to the necessity of Project adaptation, which should be reflected in the Environmental Management Plan.
3. Recommend to minimize Environmental Assessment size and maximize constructive assessments and proposals.

Priamurskoe Geographic Society
Scientific Secretary /signature/ V.I.Simakov

Attachment 3

Approved by
A.B. Levintal
Chairman, Supervisory Board
January 21, 2005

Fire Management in High Conservation Value Forests of the Amur-Sikhote-Alin Ecoregion Project Preparation (PDF-B Phase) Supervisory Board Meeting
Minutes

Khabarovsk

January 18, 2005

Held in the premises of: Khabarovsk Kray Government (Muravyev-Amursky Str., 19 - 401, Khabarovsk)
Attended by: 10 members of the Supervisory Board and 14 invited participants
Chaired by: A.B. Levintal

Agenda:

1. Opening (A.B. Levintal, Deputy Chairman, Khabarovsk Kray Government)
2. GEF Project Arrangements and Potential Benefits (A.N. Kulikov, Board Chairman, Regional Non-Governmental Khabarovsk Wildlife Foundation)
3. GEF Project Environmental Assessment (B.A. Voronov, Director, Institute of Water and Environmental Problems, Far East Branch, Russian Academy of Sciences, Consultant Group Leader)
4. GEF Project Social Assessment (S.P. Bystritskiy, Deputy Director, Far East Market Research Institute under the Ministry of Economic Development and Trade of the Russian Federation, Consultant Group Leader)
5. Decisions

As regards the sequence of the presentations, G.M. Volkova proposed to pass over to the Social Assessment Report right upon hearing A.N. Kulikov.

A.B. Levintal: enumerated the final activities to complete the project preparation phase.

From September through November, specialists from the Foundation of Enterprise Restructuring (FER, Moscow) were preparing the Project Implementation Plan. They worked in close cooperation with the Khabarovsk specialists to design project management and project implementation arrangements. We succeeded in convincing the Bank and the FER of the need to manage the project from the regional level. At the implementation phase, the project would be managed by the Khabarovsk Kray Forestry Agency with the project implementation unit functions to be performed by the Khabarovsk Wildlife Foundation. It has been agreed to expand the authority the Supervisory Committee to be chaired by the Deputy Chairmen of the Regional Governments/Administrations.

The second half of the year included the following activities:

- Project Environmental Assessment by a group of consultants led by B.A. Voronov, Director, Institute of Water and Environmental Problems, Far East Branch, Russian Academy of Sciences (August - December); and

- Project Social Assessment by a group of consultants led by V.K. Zausayev, Director, Far East Market Research Institute under the Ministry of Economic Development and Trade of the Russian Federation (September - December).

The project preparation phase produced the following outputs:

1) The documents accepted by the World Bank.
2) The Report, Aid-Memoirs of the World Bank and proceedings of the seminars used as a basis to prepare the application to the Global Environmental Facility for launching the project. In July: the application submitted to the GEF, reviewed; and in September: decision made to provide the funding for the project.
3) The need to increase the grant amount from US$ 5 million to US$ 8.6 million justified. This output should be largely attributed to successful efforts of the Project Preparation Unit.
4) Currently: the project processing is underway following the Bank's procedures (reviews of the Project Rationale, Environmental and Social Assessments, and its Implementation Plan).
5) In February: the World Bank mission is expected to visit the Far East to appraise the readiness of the respective regions and other project participants for the project implementation.

The Project Preparation Unit and the territorial agencies are requested to prepare the needed information and documents for the visit of the World Bank team. The Project Directorate should consider and draft Regulations on the Supervisory Committee.

I would like to thank all the project preparation participants for their successful work.

A.N. Kulikov: covered the following issues:

- description of the project sites;
- financial resources and project-specific arrangements to finance the activities;
- project management;
- implementation of the project activities.

He emphasized the potential catalyzing role of the project for important activities to set up a fire management system at the regional and municipal levels, to enhance forest fire prevention efforts, and to ensure effective integration of nature reserves and other protected wilderness areas into a single system of fire management. The project is of critical importance since its start-up coincides with the devolution of the forest fire fighting authority and responsibilities to the regional level in the Russian Federation. In this setting, as a project based on international best practices, it may provide a model to be replicated in other regions of Russia.

Questions to A.N. Kulikov were asked by G.M. Volkova, Yu.A. Darman, D.F. Efremov, V.V. Gorobeiko, and A.M. Palachev.

Proposed to:

- expand the list of beneficiaries to include research institutions therein;
- specify the costs under Component D and submit the breakdown to the Supervisory Board and the Public Council;
- clarify the position of nature reserves within the system of fire management under the project;
- change the "Far East Association of Indigenous Small-Numbered Peoples of the North" for the "Association of Indigenous Small-Numbered Peoples of the Khabarovsk Kray".

S.P. Bystritskiy: summarized the project social assessment. It was built upon: information provided by the Statistics Department, literature for references, surveys, data from *leskhozes*, publications in local newspapers, etc. The study was focused on: model areas (with due regard to the boundaries of the *leskhozes*), local communities, forest using enterprises, NGOs, and illegal activities.

Conclusions:

- forest comprises an integral part of the relations between Man and Nature;
- forest visiting rate amounts to 80 % of the population in the project regions;
- people seek to meet their own needs for forest products and to sell part of the products;
- from 60 % to 80 % of forests fires have anthropogenic causes, with recreation-purpose forest visitors and wild plant gatherers being the most common categories to be blamed for fire occurrence.

The key objective is to raise the public awareness and proactive involvement in forest conservation. The speaker highlighted the main public awareness and education activities, with an emphasis on the need to revive the voluntary fire teams and to equip the fire centres. He referred to the experience gained by the Melnichny Leskhoz in public education and involvement and to the commitment of its staff as a good example of such work. In general, he stressed the improved control over the fire situation in the Primorsky Kray (fire control, effective forest fire prevention, poaching control, etc.).

Questions were asked by G.M. Volkova and A.S. Sheingauz.

Proposed to:
- specify/refine the information about the populations of the indigenous small-numbered peoples; their communities; and forest fire prevention practices.
- include a targeted programme for aborigines into the programme of small grants.

B.A. Voronov: presented the project environmental assessment and noted the conservation importance of the project, and particularly, its biodiversity conservation value. He stressed that the activities included in the feasibility study would be instrumental to improve the efficiency of forest fire control.

The ecologists deem it necessary to specify (and somewhat expand) the scope of seven activities and to add the following two new activities:

- project performance monitoring within the model areas (budget: US$ 75,000); and
- development of regulations on transferring the forests (tree and shrub vegetation) located on agricultural lands and lands of other categories into forests of subjects of the Russian Federation (budget: US$ 25,000).

In addition, the authors of the Environmental Assessment consider it possible to draw the attention of the Russian Forest Service to some activities which it should undertake in view of its functional responsibilities. The GEF project could give an impetus to these activities (They are summarized in the Attachment to the Report).

Discussion:
Proposals were made by: G.M. Volkova, Yu.A. Darman**,** D.F. Efremov, V.V. Gorobeiko, A.M. Palachev, and A.I. Cherednichenko.

Decisions:

1. Take into consideration the information from:

A.N. Kulikov (Project Implementation Plan and specifics of the project implementation arrangements);
S.P. Bystritskiy (GEF Project Social Assessment)
B.A. Voronov (GEF Project Environmental Assessment)

2. Agree to undertake the activities as proposed by the consultants in charge of the project social and environmental assessments. Request the World Bank to accept the proposals of the project implementation bodies.

3. Instruct the Project Implementation Unit to mainstream the environmental and social consultants' recommendations into the Project Implementation Plan in view of the proposals made to and accepted by the Supervisory Board.

4. Approve, in principle, the proposed GEF project management arrangements; to consolidate all the NGOs under the Public Council, and make its representative a member of the Supervisory Committee.

5. Request the Regional Governments/Administrations to prepare their proposals on how to arrange the work of the Supervisory Committee and on the inclusion of their representatives therein.

6. Request the Regional Governments/Administrations to consider the issue of co-financing under the project implementation.

7. Instruct members of the Supervisory Board to make inputs in drafting the Regulations on the GEF Project Supervisory Committee.

V.G. Kryukov
PFD-B Phase Coordinator

Attachment 4

Additional activities proposed to be implemented by forest service during and after the Project

##	Activities	Implementation years	Responsible parties
1	Creating legal basis to form fire management system in the ecoregion.	2006-2009	RF MNR, RF subjects
1.1	Developing draft FL “On agricultural prescribed burning of vegetation on transportation, state land reserve, agricultural and settlement lands”.	2006-2007	RF MNR
1.2	Developing draft FL “On compensation of damage to RF forests”.	2005-2006	RF MNR
1.3	Developing draft frame law of the RF subject “On attracting nature resource users to fire-fighting”.	2006	RF subjects
1.4	Developing drafts of various legislative acts (resolutions of RF Government, of governments/administrations of RF subjects, decisions of local authorities on financing and organizing fire management, investigation of law infringements, etc.).	2007 and later on	RF MNR, RF subjects
1.5	Developing instructions and handbooks on prevention and fighting fires and on prescribed burnings.	2006-2007	TFA
1.6	Developing a Statute on coordinating activities of environmental, law enforcement and public organizations aimed at prevention and fighting fires and prescribed burnings and liquidation of their consequences.	2005-2006	FFA
1.7	Developing instruction for state forest guard to conduct inspections of environmental activities of nature resource users. Organizing and carrying out inspections.	2007	FFA, TFA
1.8	Developing a Statute on integration of reserves and other categories of protected areas into the unified fire management system.	2007	RF MNR
1.9	Improving investigation procedures and material preparation for bringing a “fire” cases to court.	2006-2007	RF Government,RF MNR
1.10	Creating educational materials and handbooks to train fire specialists and executives.	2006-2008	TFA
2	Forest fire management.	2006 and later on	RF MNR, RF subjects
2.1	Increasing reliability of forest inventory materials on HCVFs to serve forest management further development and improvement.	2006 and later on	FFA
2.2	Shifting main responsibilities for agricultural fires and prescribed burnings to the heads of local authorities together with granting them respective rights and financial support. Providing permanent linkage with regional centers.	Evenly throughout Project implementation period	RF Government,RF MNR

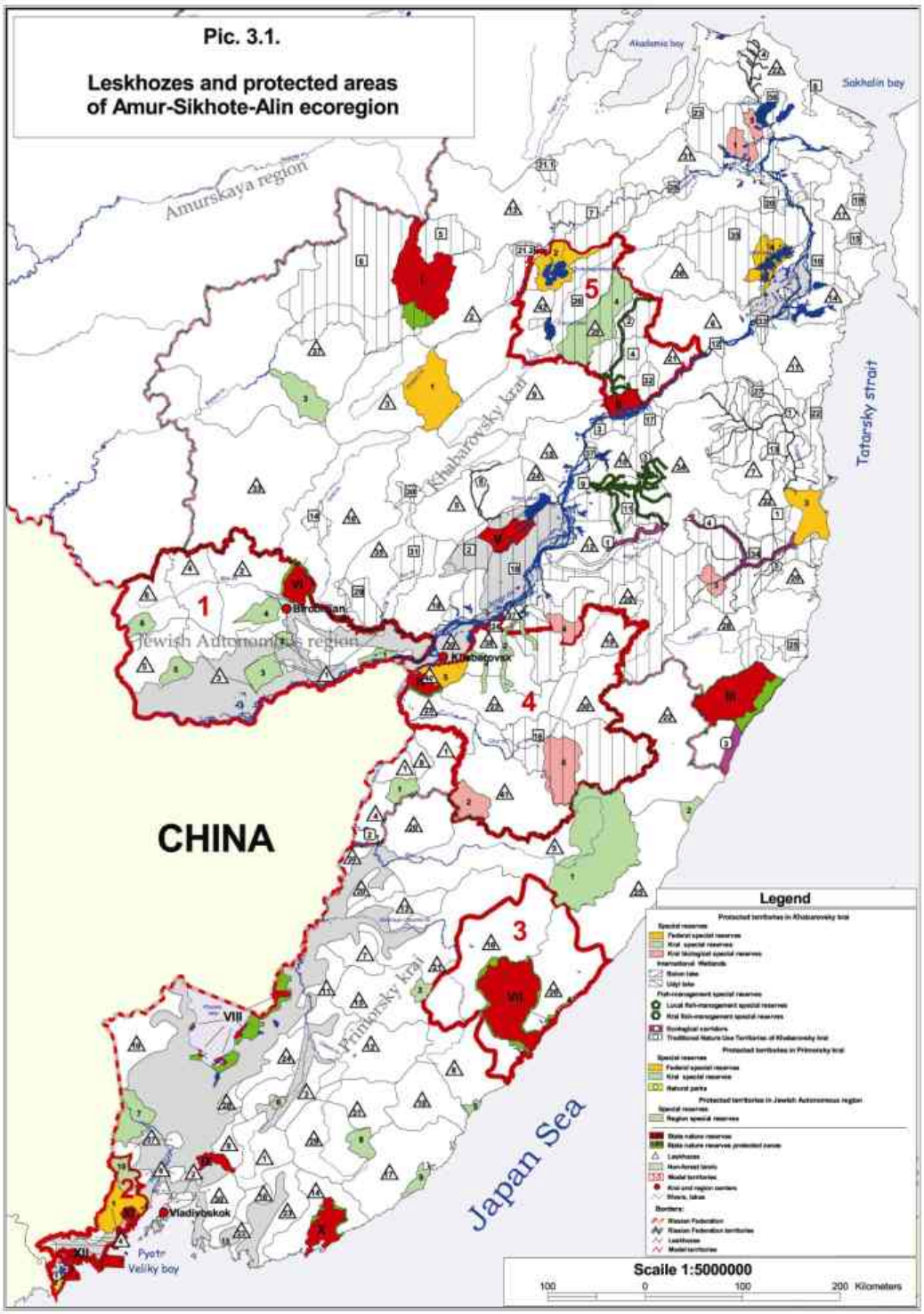
2.3	Activating former sovkhoz forest transition into the jurisdiction of RF subjects. Clarifying their area and preparing necessary documents for RF MNR.	2006-2007	RF subjects
2.4	Developing plans for forming, and special training of volunteer fire brigades to fight forest fires and prescribed burnings; supplying brigades with materials, technical aids and finances.	2006-2007	TFA, local authorities
2.5	Assessment of fire equipment in each leskhoz and reserve to be able to develop adapted forest-fire GIS and operation plans for each leskhoz, reserve and for ASAR in general.	2006-2008	TFA
2.6	Discussing possibilities of using GPS (and purchasing if needed) for forestry activities and controlling functions, including fire prevention, to make them more correct and effective	2006-2007	TFA
2.7	If natural forest regeneration on burned experimental plots seems difficult forest regeneration by planting typical for the area tree and shrub species should be conducted	2006 and later on	TFA
3	Attracting private businesses to fire management activities	2006 and later on	RF MNR, RF subjects
3.1	Estimating amounts of inflammable wastes in felling areas of HCVF, illegal felling of high biological value trees and damage of valuable underwood.	2006 and later on	TFA, forest managers
3.2	Developing and implementing plans to reduce inflammable wastes in intermediate felling areas, including annual cleaning of firebreaks	2006-2007	TFA, local authorities
3.3	Enforcing forest fund leaseholders' responsibility and increasing fines for severe damage of state property due to its insufficient protection.	2007 and later on	RF MNR
3.4	Organizing processing of timber left in felling areas (working out issues of employment of local population, small and family business creation, starting support of newly formed businesses in forest settlements).	Every year	RF subjects, local authorities
3.5	Creating a system of fire reservoirs close to firebreaks and in suitable places.	2006 and later on	TFA, local authorities
3.6	Establishing protected zones at Botchinsky reserve in Primorsky krai, Bastak reserve in Jewish AO, at the border of Tyrminsky leskhoz in Khabarovsky krai.	2007-2010	RF MNR
3.7	Constructing recreation stops along forest roads, frequently attended by the public, and equipping them with fire spots, fire-fighting water tanks and reservoirs, fire-preventing materials and HCVF information. The following roads are targeted: - Khabarovsk – Vladivostok: sections 18-35 km, 140-218 km; - Khabarovsk – Komsomolsk-on-Amur: sections 51-119 km, 122-395 km; - Khabarovsk – Krasny Yar: section 37 km – Bikin river; - Lidoga – Vanino: entire;	2007 and later on	RF subjects, local authorities

	- Selikhino – Nikolaevsk-on-Amur: entire; - All automobile roads, connecting forest settlements with highways; - All forest roads in city vicinity.		
3.8	Increasing the number of model territories, including areas of ASAR indigenous people traditional settling and practices. In Khabarovsky krai these areas may be: 11. Verkhne-Bureinsky district (its part within Bureya basin boundary), including Shakhtinskaya traditional territory, Bureinsky reserve and Dublinsky reserve; 12. Vaninsky district – Khutu and Ulike river basins; 13. Polina Osipenko district – Low Amgun basin, down Vladimirovka village; 14. Nikholaevsky district – entire; 15. Ulchsky district – lake Udyl basin; 16. Sovgavansky district – Koppy river basin; 17. Nanaisky district – Anui, Khar and Pixtsa river basins; 18. Komsomolsky district – Low Tugur basin down Snezhny settlement; 19. Amursky district – Vandan mountain range; 20. Khabarovsky district Kukan, Amer, Ulika river basins	2008 and later on	FFA, TFA
4	Inventory, assessment, control and monitoring	2006 and later on	RF MNR, RF subjects
4.1	Inventory of fire impacts in HCVFs (area, inventory of burned, damaged and not destroyed forest, soil destruction, etc.).	2006-2009	TFA, forest managers
4.2	Creating a unified and adapted to the region scheme of forest monitoring, educating staff of leskhozes and reserves to carry out monitoring procedures.	2006-2007	Science and Research Institute
4.3	Analyzing possibilities and necessity to improve the forest management practices by compiling maps of forest formations, identifying and describing parent and relatively parent forests, based on formation approach or based on forest management materials available.	2006-2007	FFA, TFA
4.4	Using forest formations and vegetation type maps to clarify criteria for ranking forests as HCVFs	2006-2007	RF subjects, TFA
4.5	Identifying and mapping unique, vulnerable and functionally valuable plant and animal communities, habitats of rare and extincting species in the ecoregion and model territories for their more effective protection from fires.	2006-2008	RF MNR, RF subjects, TFA, local authorities
4.6	Using for different-scale zoning the whole complex of available information, including maps of landscapes with factors that influence development or suppression of fires; maps of vegetation communities; maps of present conditions of ASAR forests destroyed by fires, forest formations, rare and extincting species, endemics, etc; maps of animal world (like mentioned	2006-2010	Science and Research Institutes

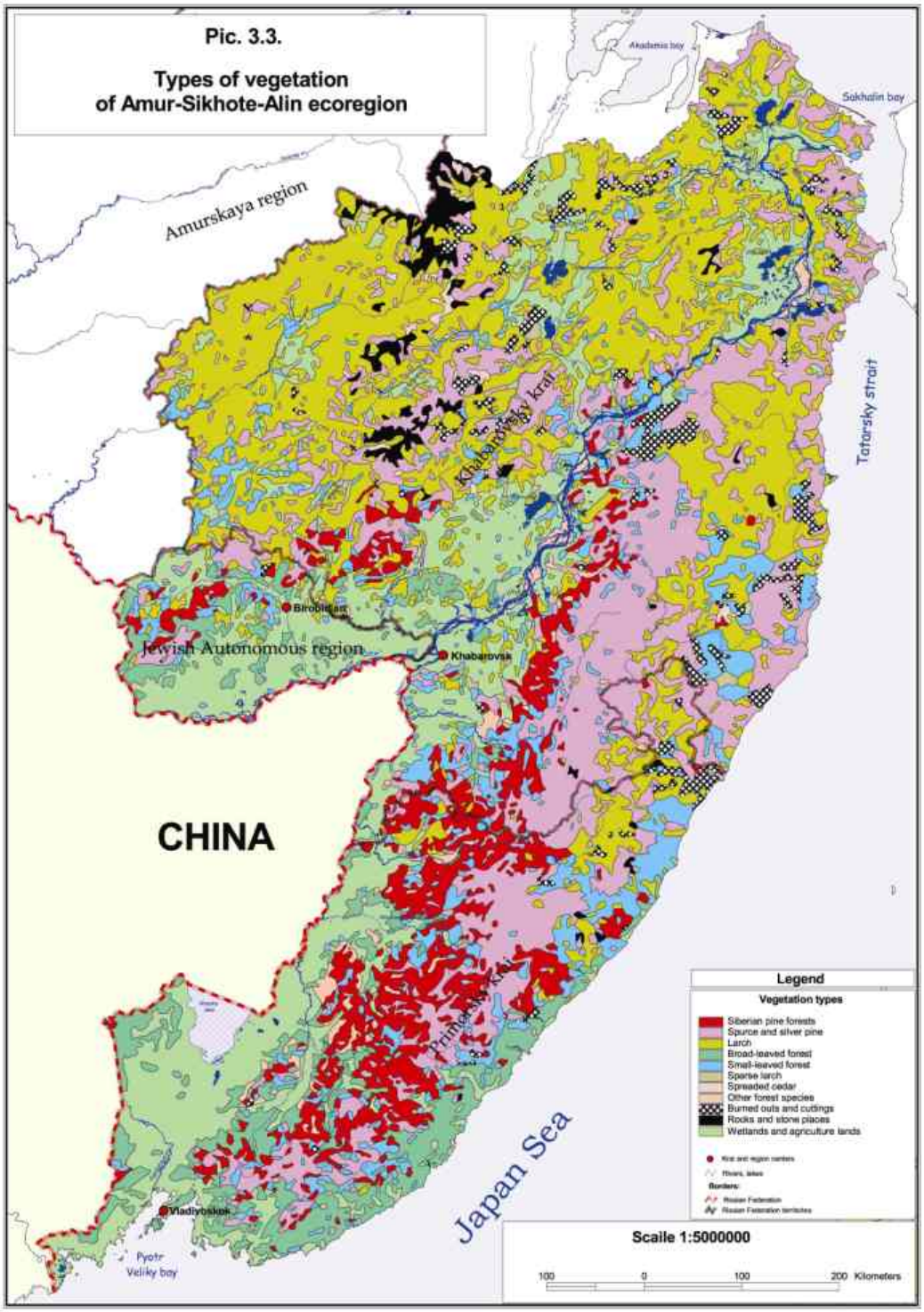
	above); maps of unique nature objects (animal concentrations, migration routes and paths of big animals, natural solonets, valuable fish spawning brooks, rare bird nests, bear dens, etc.); maps of objects, assisting atmospheric electricity discharge (iron ore and sulfide deposits, natural and artificial constructions, etc); climate charts and maps (temperature, wind directions, humidity, thunder storm distribution. etc).		
4.7	Reviewing existing data on pyrogenic situation dynamics in ASAR and its determining factors. Compiling a set of schemes and graphs to reveal the tendencies and regularities. Developing 20-30-year predictions of ASAR forest fires and recommendations for fire management	2006-2007	RF subjects, TFA
5	Fire prevention and its promotion	2006 and later on	RF MNR, RF subjects
5.1	Strengthening public awareness of fire prevention in the ecoregion, using mass media, visual aids, etc	2006 and later on	RF subjects, TFA, local authorities
5.2	Organizing fire-prevention education activities on professional basis and attracting famous people and political leaders to participate in them.	2006 and later on	RF subjects, TFA, local authorities
5.3	Organizing children forest schools and ecological groups at ecological education departments of reserves.	2006 and later on	Reserve admi-nistrations
5.4	Expanding the network of children forest schools (in model territories they should be organized at every school of a settlement, where administrations of reserves, leskhozes and their divisions are situated). Designing forest school projects.	2006 and later on	TFA
5.5	Publishing a children comics book (for kindergarten senior groups and primary school children), based on “Why is taiga on fire?” by S. Kucherenko (2000)	2008-2009	Regional governments/ad ministrations, TFA
5.6	Designing, publishing and distributing fire prevention materials, such as “Fires in ASAR and the impact on biodiversity”, “Fire safety rules in the forest” and others.	2008-2009	Regional governments/ad ministrations, TFA

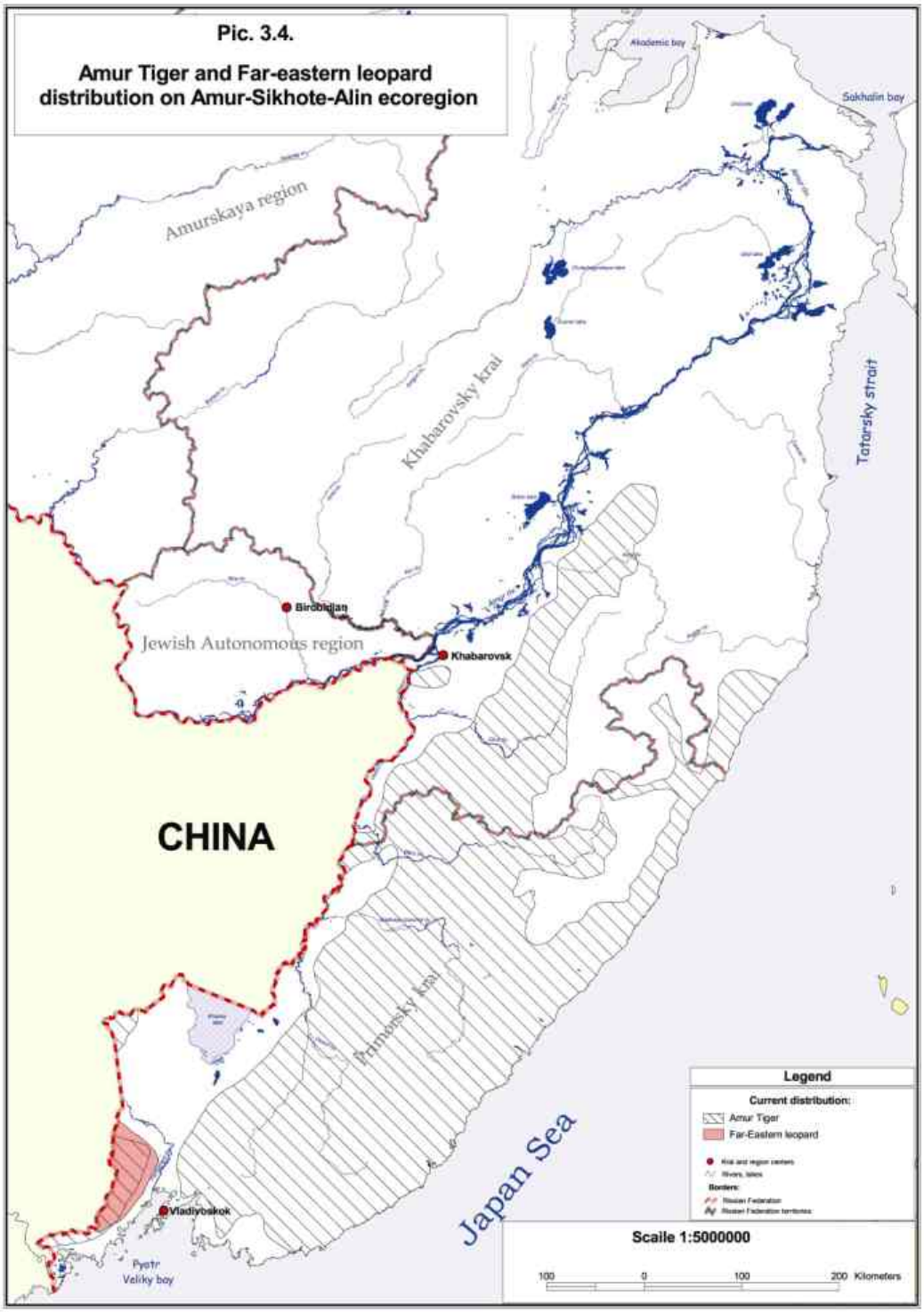
Attachment 5

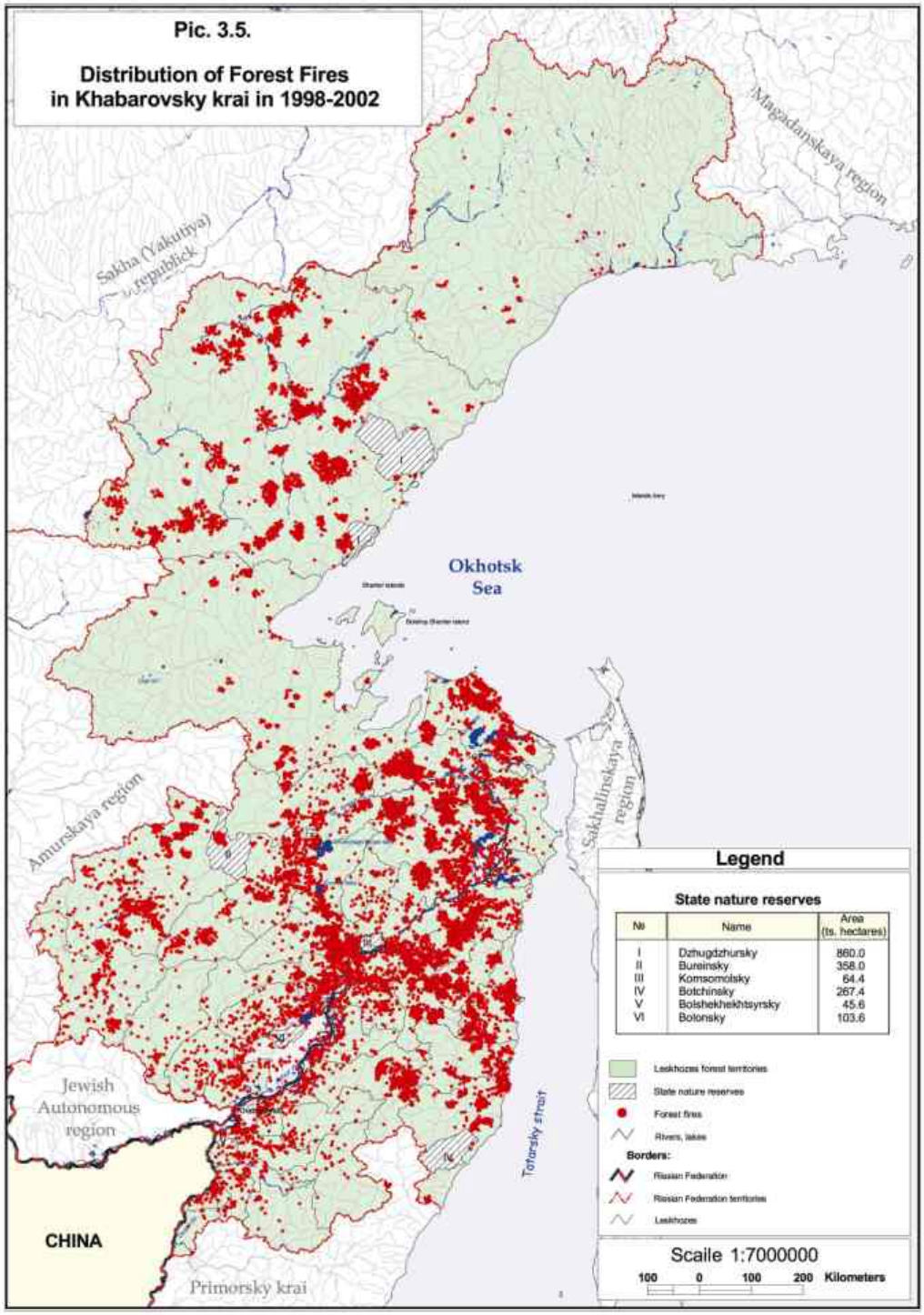
Maps of the proposed Project areas and activities

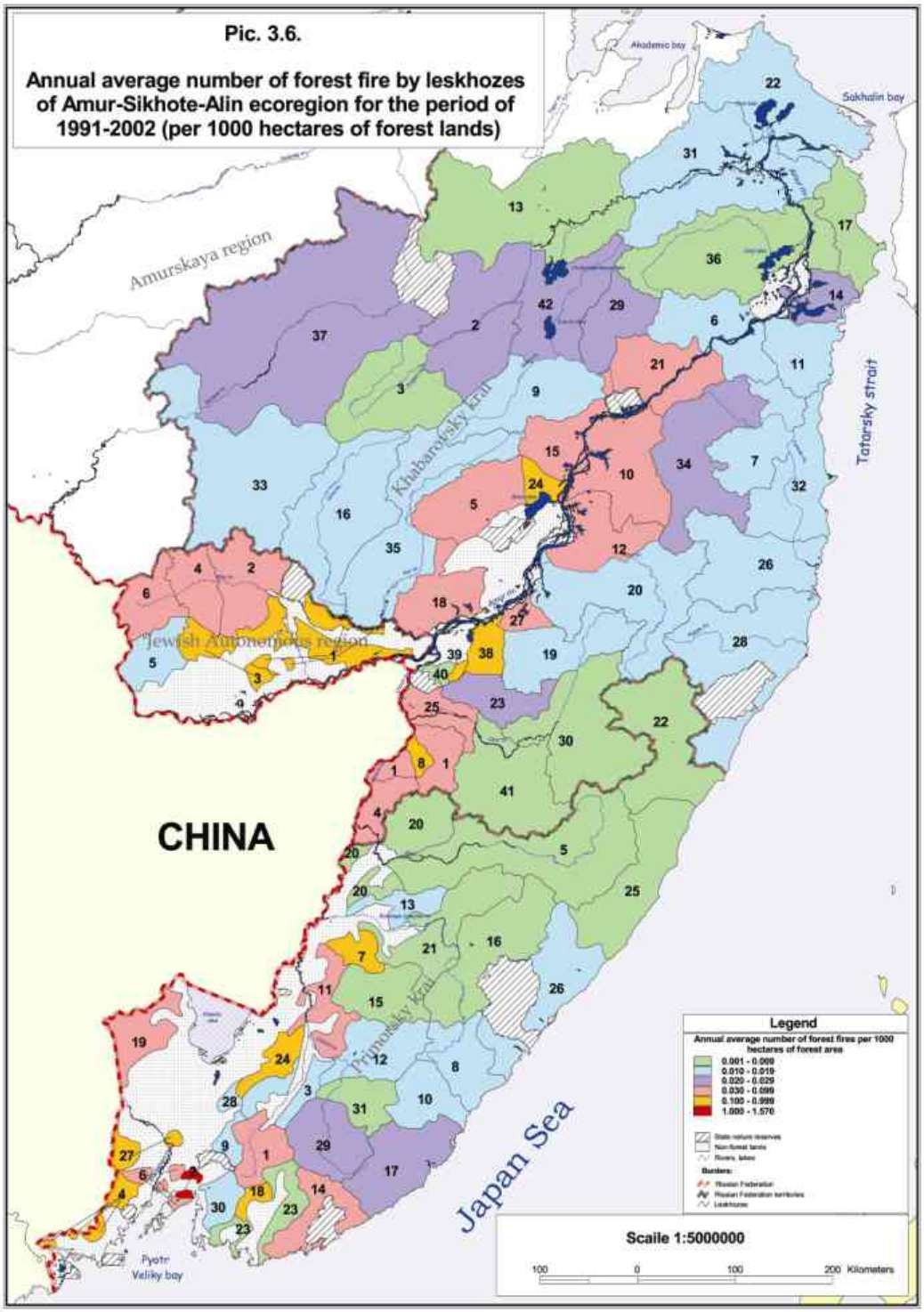


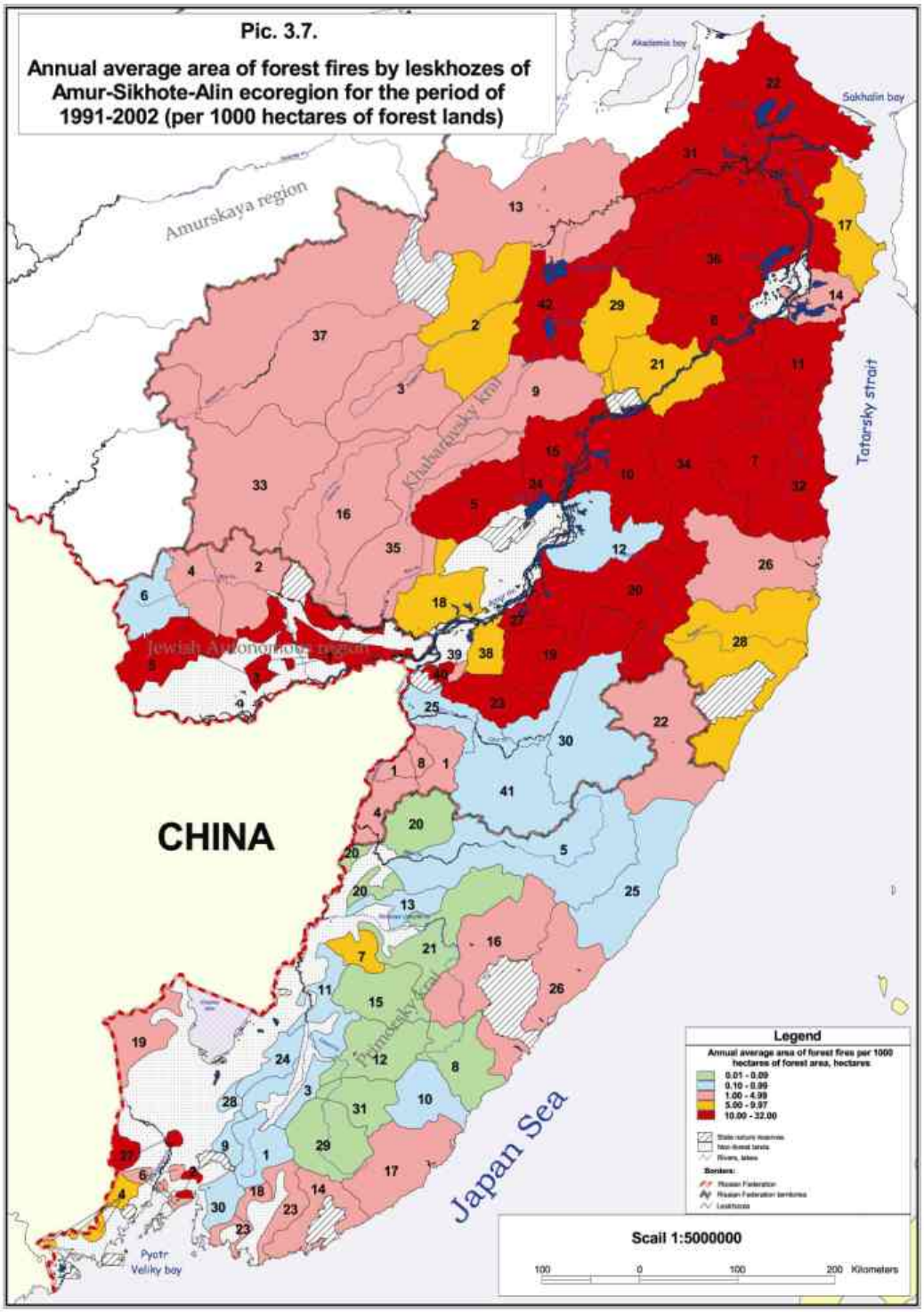

Pic. 3.2.
Types of relief of
Amur-Sikhote-Alin ecoregion
Akademii bay
Sakhalin bay
Amurskaya region
OMALSKY RANGE
TURAN RANGE
BUREINSKY RANGE
BADJALSKY RANGE
PRIMORSKY RANGE
Tatarsky strait
Birobidjan
Jewish Autonomous region
Khabarovsk
CHINA
BOGOLADZA RANGE
SIKHOTE-ALIN
Japan Sea
PARTIZANSKY RANGE
Vladivostok
Pyotr
Velikiy bay
Legend
Relief types
Mountains
Intermontane and submountain plains
Kraj and region centers
Rivers, lakes
Borders:
Russian Federation
Russian Federation territories
Scaile 1:5000000
100
0
100
200 Kilometers

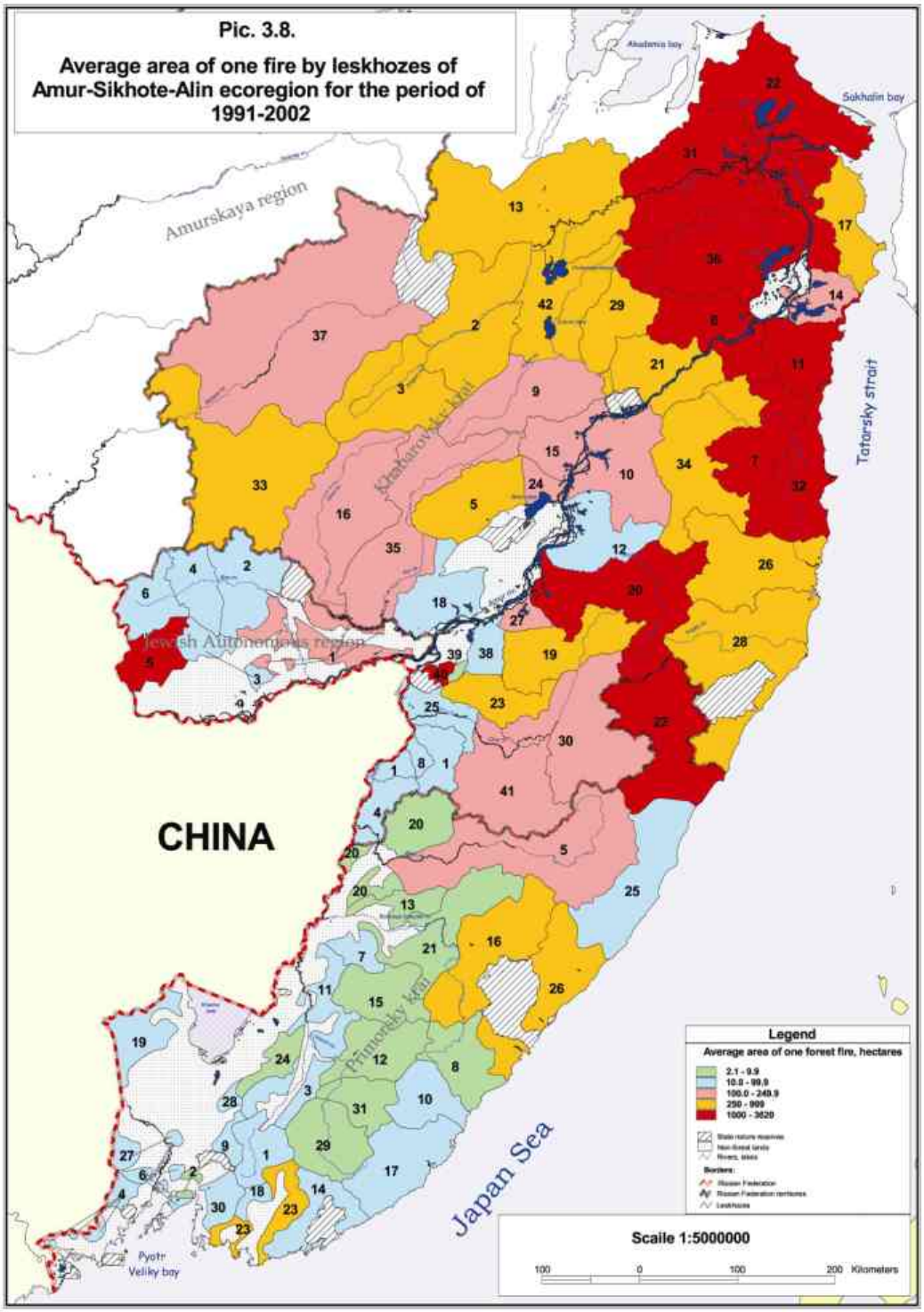

Pic. 3.3.
Types of vegetation
of Amur-Sikhote-Alin ecoregion
Akademia bay
Sakhalin bay
Amurskaya region
Tatarsky strait
Khabarovsky krai
Birobidzan
Jewish Autonomous region
Khabarovsk
CHINA
Primorsky Krai
Japan Sea
Vladivostok
Pyotr
Veliky bay
Legend
Vegetation types
Siberian pine forests
Spruce and silver pine
Larch
Broad-leaved forest
Small-leaved forest
Sparse larch
Spreaded cedar
Other forest species
Burned outs and cuttings
Rocks and stone places
Wetlands and agriculture lands
Borders:
Scaile 1:5000000
100
0
100
200 Kilometers

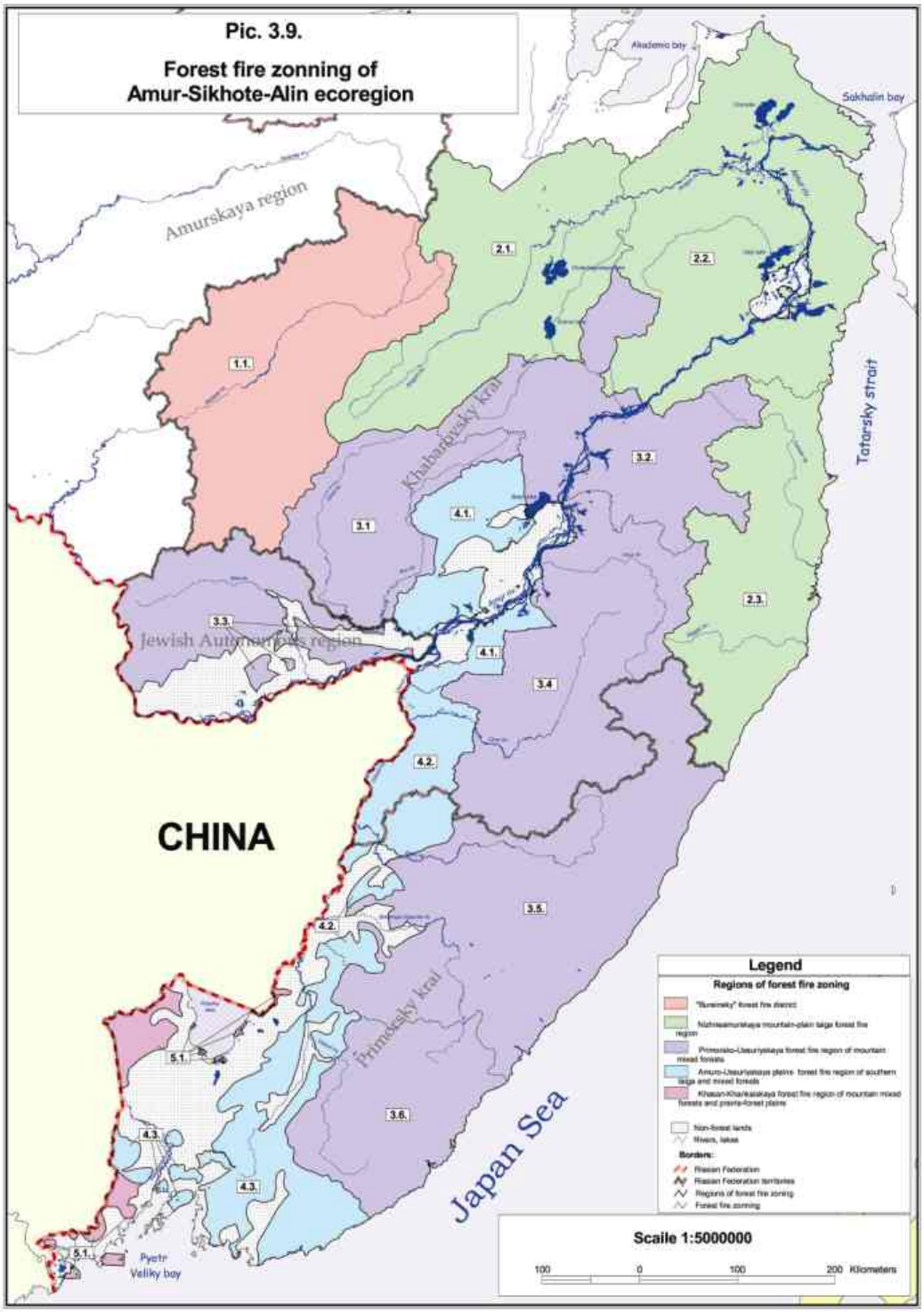

Pic. 3.4.
Amur Tiger and Far-eastern leopard distribution on Amur-Sikhote-Alin ecoregion
Akademic bay
Sakhalin bay
Amurskaya region
Khabarovsky krai
Tatarsky strait
Birobidjan
Jewish Autonomous region
Khabarovsk
CHINA
Primorsky krai
Japan Sea
Vladivostok
Pyotr Veliky bay
Legend
Current distribution:
Amur Tiger
Far-Eastern leopard
Borders:
Scaile 1:5000000
100
0
100
200 Kilometers


Pic. 3.5.
Distribution of Forest Fires
in Khabarovsky krai in 1998-2002
Magadanskaya region
Sakha (Yakutiya)
republick
Okhotsk
Sea
Amurskaya region
Sakhalinskaya
region
Jewish
Autonomous
region
CHINA
Primorsky krai
Tatarsky strait
Legend
State nature reserves
№ | Name | Area (ts. hectares)
I | Dzhugdzhursky | 860.0
II | Bureinsky | 358.0
III | Komsomolsky | 64.4
IV | Botchinsky | 267.4
V | Bolshekhekhtsyrsky | 45.6
VI | Bolonsky | 103.6
Leskhozes forest territories
State nature reserves
Forest fires
Rivers, lakes
Borders:
Russian Federation
Russian Federation territories
Leskhozes
Scaile 1:7000000
100 0 100 200 Kilometers


Pic. 3.6.
Annual average number of forest fire by leskhozes of Amur-Sikhote-Alin ecoregion for the period of 1991-2002 (per 1000 hectares of forest lands)
Akademec bay
Sakhalin bay
Amurskaya region
Khabarovsky Krai
Jewish Autonomous region
Primorsky Krai
Tatarsky strait
CHINA
Japan Sea
Pyotr Veliky bay
Legend
Annual average number of forest fires per 1000 hectares of forest area
0.001 - 0.009
0.010 - 0.019
0.020 - 0.029
0.030 - 0.099
0.100 - 0.999
1.000 - 1.576
Borders:
Scaile 1:5000000
100
0
100
200 Kilometers


Pic. 3.7.
Annual average area of forest fires by leskhozes of Amur-Sikhote-Alin ecoregion for the period of 1991-2002 (per 1000 hectares of forest lands)
Amurskaya region
Sakhalin bay
Tatarsky strait
Khabarovsky kray
Jewish Autonomous region
CHINA
Primorsky kray
Japan Sea
Pyotr Veliky bay
Legend
Annual average area of forest fires per 1000 hectares of forest area, hectares
0.01 - 0.09
0.10 - 0.99
1.00 - 4.99
5.00 - 9.97
10.00 - 32.00
Borders:
Russian Federation
Russian Federation territories
Leskhozes
Scail 1:5000000
100
0
100
200 Kilometers


Pic. 3.8.
Average area of one fire by leskhozes of Amur-Sikhote-Alin ecoregion for the period of 1991-2002
Amurskaya region
Sakhalin bay
Tatarsky strait
Khabarovsk kray
Jewish Autonomous region
CHINA
Primorsky kray
Japan Sea
Pyotr Veliky bay
Legend
Average area of one forest fire, hectares
2.1 - 9.9
10.0 - 99.9
100.0 - 249.9
250 - 999
1000 - 3620
Borders:
Russian Federation
Russian Federation territories
Leskhozes
Scaile 1:5000000
100 0 100 200 Kilometers


Pic. 3.9.
Forest fire zonning of
Amur-Sikhote-Alin ecoregion
Akademii bay
Sakhalin bay
Amurskaya region
Tatarsky strait
Khabarovsky kray
Jewish Autonomous region
CHINA
Primorsky kray
Japan Sea
Pyetr
Veliky bay
1.1.
2.1.
2.2.
2.3.
3.1
3.2.
3.3.
3.4
3.5.
3.6.
4.1.
4.2.
4.3.
5.1.
Legend
Regions of forest fire zoning
Non-forest lands
Rivers, lakes
Borders:
Russian Federation
Russian Federation territories
Regions of forest fire zoning
Forest fire zonning
Scaile 1:5000000
100
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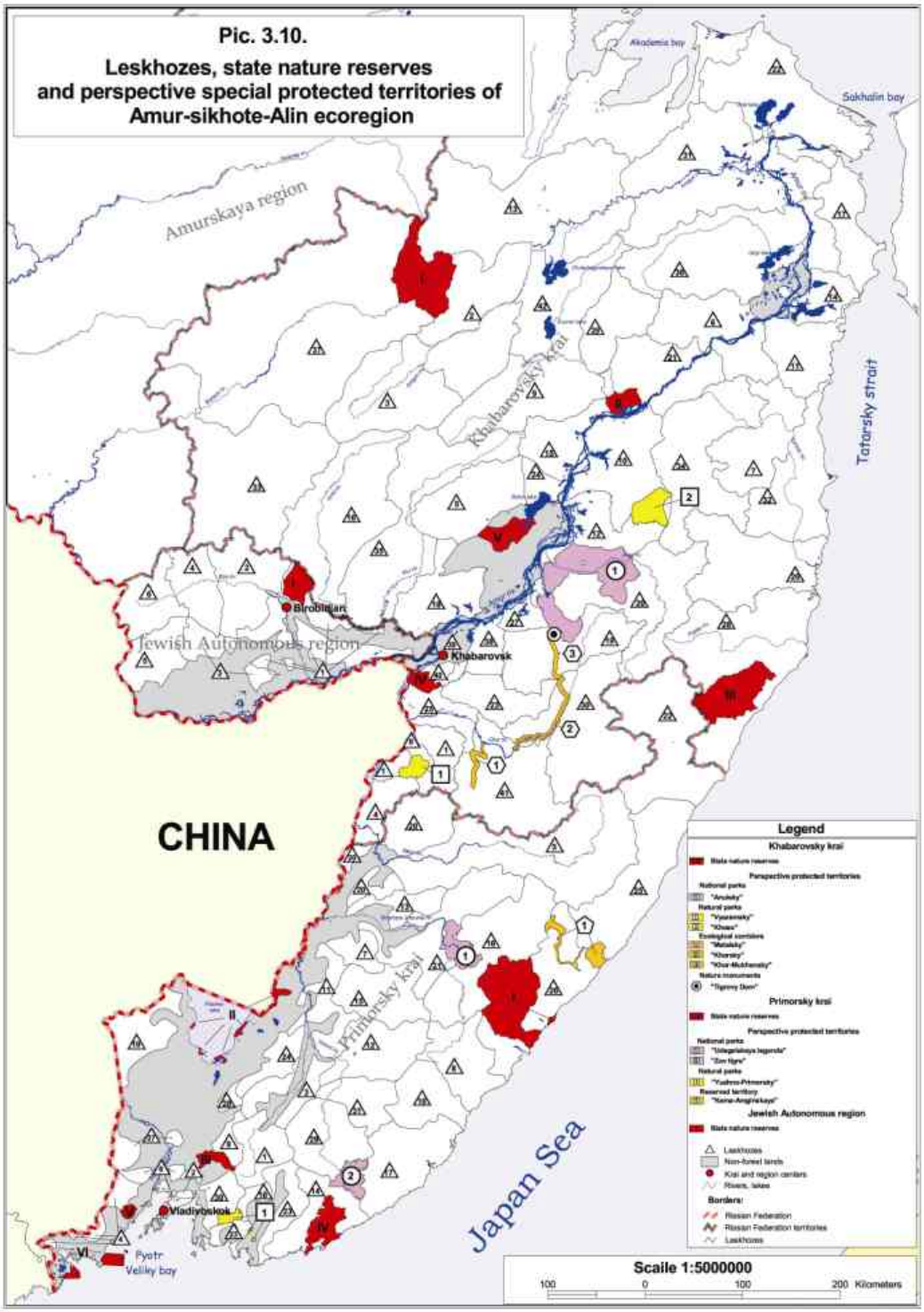
100
200 Kilometers


Pic. 3.10.
Leskhozes, state nature reserves
and perspective special protected territories of
Amur-sikhote-Alin ecoregion
Akademia bay
Sakhalin bay
Amurskaya region
Khabarovsky kral
Tatarsky strait
Birobidjan
Jewish Autonomous region
Khabarovsk
CHINA
Primorsky kral
Japan Sea
Vladivostok
Pyatr
Veliky bay
Legend
Khabarovsky kral
State nature reserves
Perspective protected territories
National parks
"Anuisky"
Natural parks
"Vyazemsky"
"Khaas"
Ecological corridors
"Malokly"
"Khorsky"
"Khor-Mukhensky"
Nature monuments
"Tigrovy Dom"
Primorsky kral
State nature reserves
Perspective protected territories
National parks
"Udegeiskaya legenda"
"Zov tigra"
Natural parks
"Yashno-Primorsky"
Reserved territory
"Kiana-Angirskaya"
Jewish Autonomous region
State nature reserves
Leskhozes
Non-forest lands
Krai and region centers
Rivers, lakes
Borders:
Russian Federation
Russian Federation territories
Leskhozes
Scaile 1:5000000
100
0
100
200 Kilometers