Forest Fires in the Russian Taiga: Natural Disaster or Poor Management?

TAIGA RESCUE NETWORK FACTSHEET

Summary

Catastrophic forest fires in Russia are a serious threat to both the unique biodiversity of boreal forests and the global carbon balance. In recent years, the Russian fire management policy has been unclear, ineffective and non-transparent. The current situation is even more alarming, since ongoing administrative reform and permanent changes in forest legislation lead to the dismantling of the present system of forest management in the country, not to improving its efficiency. As a result, the Russia's fire management system risks be soon destroyed completely.

To restore Russia's fire management capabilities, the government urgently needs to do the following: provide the public with reliable, accurate and complete data on forest fires and their impacts on the environment; move the fire management policy into a public arena, since humans are the main cause of the country's forest fires; and clearly specify the division of responsibilities and to provide efficient cooperation among the federal agencies and regional and local authorities in fire suppression and to provide adequate financial resources and personnel training. International and national awareness of catastrophic forest fires in Russia needs to be raised, as public pressure could force the Russian government to change its forest fire management policies. Non-governmental organizations can play a vital role in this process by using pilot research projects to demonstrate the real scale of the problem and to analyze the causes and impacts of forest fires. NGOs can also show how to run effective campaigns for fire prevention at local and regional levels.

Introduction

During that last few decades, many European countries have managed to almost completely eradicate wildfires, as the result of extremely efficient fire suppression systems and the overall low percentage of human caused fires. Yet, a great deal of scientific evidence [National Association of State Foresters, 2000] has shown that this policy was inadequate in terms of achieving the sustainable management of commercial forests. Long periods of fire suppression increase the probability of catastrophic fires and may be a reason for the extinction of many plant and animal species that are dependent on fire. Governments in Europe and North America are now trying to reintroduce fire by using prescribed burning and other methods. The situation in Russia, however, is completely different as its fire suppression system has never been very effective in managed forests, let alone the huge parts of the country that remain outside of a system of forest fire suppression. Human agency is believed to cause 80-90% of all fires in Russia [Zakharov, 1977; Noga, Tikhonov, 1979; Sofronov, Vakurov, 1981; Odintsov, 1995; Sergienko, 1996, 1999; Furyaev, 1996, etc] and their impact on forest ecosystems significantly exceeds the natural threshold, above which we may expect losses of biodiversity and ecosystem stability [Nasi et al., 2002]. Therefore, reduction of the negative impacts of fires is one of the most acute challenges for the sustainable and responsible management of Russian forests.

Forest managers have, thus far, been unable to handle this problem and devastating forest fires have repeatedly been on the top of Russia's mass media reports for the past few years. Most of the publications have presented forest fires as a powerful natural catastrophe and, each season, catastrophic fires seemed to come as a surprise for the relevant authorities. At the end of each fire season, media interest quickly disappeared, leaving civil society largely unaware of human's role in the ignition of wildfires and of the government's forest fire management strategy and long-term action plan. Human's impact on natural fire dynamics calls for a well-coordinated, long-term public campaign on fire prevention and for a technical program aimed at fire fighting. Yet, such a campaign is severely hindered by the facts that information on the impact of forest fires reported by the Russian authorities is incomplete, inaccurate and biased. There are significant discrepancies between official figures and data of independent research, giving the general public inconclusive information of the real impact of fires on Russia's timber resources, biodiversity values and carbon stock.

Figure 1. Pine forest after a ground fire in Murmansk Oblast.

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The Role of Fire in Natural Ecosystem Dynamics

Wildfire is a natural phenomenon in boreal forest landscapes and intact forests often carry signs of fires that took place hundreds of years ago. Lightening strikes are the main natural cause of fires; although the spread of fires is dependent on weather, soil conditions, topography and the amount of dry organic matter (fuel) on the soil surface. The combination of these factors forms the fire regime, which is characterized by the intensity, pattern of distribution and type of fire (i.e. ground or crown fire). By knowing a specific site's forest type, habitat and local climate, it is possible to determine the natural frequency of fire, which can vary from just a few years to hundreds of years. For example, wildfires develop more often in forests under a more continental climate (e.g. in Eastern Siberia) and in drier habitats with sandy soils (e.g. on the fluvial-glacial plains of Western Siberia).

Where fires occur more frequently, plant communities often have special ecological mechanisms to make them more resistant or even adapted to fire. Some examples of these kinds of adaptations include thicker bark on older trees and seed cones that only open after a fire. The composition of such plant communities is often dominated by "pioneer" (early successional) tree species that are able to withstand short-term droughts and form open canopy stands, making them less susceptible to the development of crown fires.

In European Russia and Siberia, a typical example of such a community would be the Siberian larch and Scots pine forests on sandy or rocky soils (Fig. 1), whereas hardwood forests dominated by Mongolian Oak (Fig. 2) would be an example from the Russian Far East. In such communities, seed trees of dominant species may survive even strong ground fire, allowing for a quick regeneration of the same forest type. Plant communities originating from fire have many generations of trees, each of whom designates a particular fire event, the oldest of which can reach the age of 400-500 years. When a burnt area continuously escapes additional fires, late successional, shade-tolerant species, such as Norway spruce and Siberian fir, develop under the canopy of fire-tolerant pioneer species. When shade-tolerant tree species reach a certain size, they start to inhibit the regeneration of pioneer species, due to a lack of light. Finally, in the absence of severe canopy disturbances, early successional species become a minor admixture in the stand.

Figure 2: A Mongolian Oak Forest in the Russian Far East after multiple ground fires caused by burning grass in agricultural fields and along the forest roads.

Wildfires that ignite during periods of continuously dry weather in dark coniferous or mixed forests on fertile soils will have a significant impact on this ecosystem. Following the fire, most of the trees will decline and many species of trees and herbs will simply disappear from such a forest, because of the loss of valid habitats. Yet, the situation is quite different, when viewed at the landscape level. A fire regime that reaches a state of equilibrium will produce a pronounced structure in the boreal landscape. There will be areas shaped by frequent fires, but also fire refuges or spots, which, for various reasons, escape fires for long periods, such as wet sites along rivers and creeks. Together, such areas form a mosaic that influences the biological diversity and the sustainability of the landscape as a whole. However, any increase in the frequency of fires could affect the landscape's natural fire mosaic. The amount of forest in an early succession stage will increase, decreasing or perhaps even eliminating fire refuges. Increased numbers of fires could also affect the water balance, the permafrost horizon and the intensity of erosion.

Forest Fires as Natural Disaster

Russia has 25% of the world's forests, of which only one quarter – around 400 million hectares – are still intact. Russian forests are of significant importance for their large storage capacity of carbon, which mitigates climate change. Forest fires have a serious effect on the carbon balance in Russian forests, by increasing carbon dioxide emission when burning the biomass of forests and extensive peatlands. A recent research project in Siberia investigated fires' role in the emissions of greenhouse gases to the atmosphere (Kajii et al, 2003). It showed that the fires that affected 1.1 million ha consumed about 35 million t of phytomass and released close to 18 million tons of carbon into the atmosphere, which contributed to the formation of 52 million t of carbon dioxide, 5 million t of carbon monoxide and other radioactive trace gases and aerosol particles (Goldhammer, 2003). The inability of the Russian authority to reduce the impact of human-caused fires may seriously affect Russia's position with regard to global climate change debates and the Kyoto Protocol.

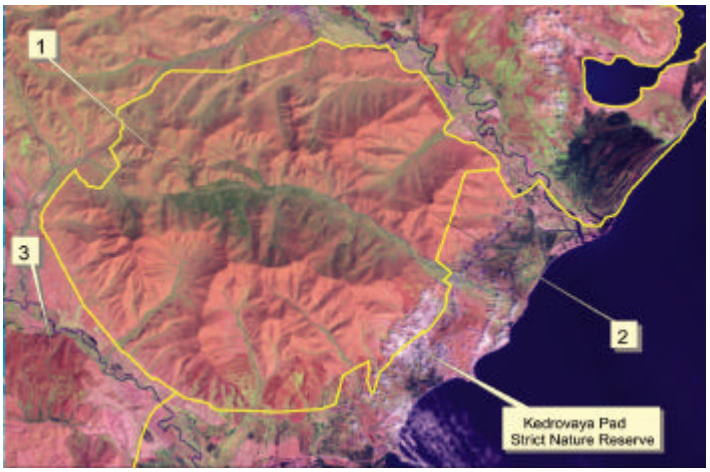

Figure 3. Impact of multiple ground fires on Kedrovaya Pad Strict Nature Reserve: 1. Rich untouched mixed forest dominated by Manchurian Fir; 2. After-fire deciduous forest dominated by Mongolian Oak; 3. Fresh ground fire.

In addition, catastrophic fires have detrimental effects on biodiversity, especially in forest communities enriched in relic species and species on the northern edge of their occurrence (e.g., common for temperate forests). This can be observed in the south of the Russian Far East, in the famous Ussuri Taiga with its abundant Manchurian and subtropical relics. Thus, in northern and central Sikhote-Alin, strong repetitious burns lead to gradual replacement of rich uneven-aged mixed Korean Pine-dominated forests by simple larch communities. In the very south of the region, multiple ground fires, which develop mainly because of agricultural burns, and are especially destructive during drought periods, lead to substitution of mixed forests with Korean pine (*Pinus koraiensis*) and Manchurian Fir (*Abies holophylla*) by simpler deciduous communities dominated by Mongolian oak (*Quercus mongolica*) (Fig. 3). Even in typical boreal forests, more frequent and severe fires could lead to complete elimination of fire refuges – habitats, which are extremely important for survival of many late successional species [Nasi *et al.,* 2002].

Forests are also crucial for thousands of local and indigenous communities dependant on non-timber forest products (NTFPs) and the services offered by forests. With thus respect catastrophic fires could threaten to abundance of wildlife and many NTFPs (e.g. Siberian and Korean pine nuts) by destroying their key habitats.

Humans and Fire

Humans have historically had a significant impact on the natural fire regime, as fire has been used to maintain grasslands, in the practice of slash and burn agriculture and have often followed industrial practices, such as logging, mining and charcoal production (Ponomarenko, et al, 1996). Currently, the majority of Russia's anthropogenic fires are caused by agricultural burns; the careless behavior of children, local hunters, fishermen and berry/mushroom collectors; and sparks from vehicles. Most of these fires take place in close proximity to settlements, roads, agricultural fields and other forms of human infrastructure (Fig. 4).

Yet, the exact proportion of anthropogenic fires is unknown, since the official statistics contain a "fires of undetermined cause" category. Moreover, the classification of lightning fires is often rather dubious in that the analysis of the link between lightning and forest fire is based on visual inspection. Within the next few days after a thunderstorm all fires are classified as caused by lighting, without consideration of possible anthropogenic causes (Ivanov, 1985), meaning that the proportion of natural caused fires is likely overestimated. Even still, most authors point to the overwhelming dominance of anthropogenic fires (Zakharov, 1977; Noga, Tikhonov, 1979; Sofronov, Vakurov, 1981; Odintsov, 1995; Sergienko, 1996, 1999; Furyaev, 1996, etc.). For Russia as a whole, the average proportion of anthropogenic fires is estimated to be 80-90%. The proportion of spontaneous fires is higher only in areas with a

pronounced continental climate, such as the area around the Irtysh River and in Evenkia and Yakutia in northern Siberia, where it has been estimated that 33-67 percent of fires are spontaneous, depending on the time period (Noga, Tikhonov, 1979; Ivanov, 1985; Filippov, 1977). However, the occurrence of fires is connected with population density and land use even in these areas (Valendik, Ivanova, 1996) and published statistical evidence suggests that spontaneous fires are only dominant in unusual years and in remote regions.

Everything else being equal, the influence of a fire on a forest ecosystem does not depend on its origin and an individual fire caused by a careless match is fully analogous to a fire caused by a lightning strike at the same spot. Although the effect of individual fires does not depend on their origin, the combined effect on the landscape of all anthropogenic and natural fires is very different from that of a natural fire regime. Intensified land uses and other forms of human disturbance have a profound effect on a landscape's post-fire succession.

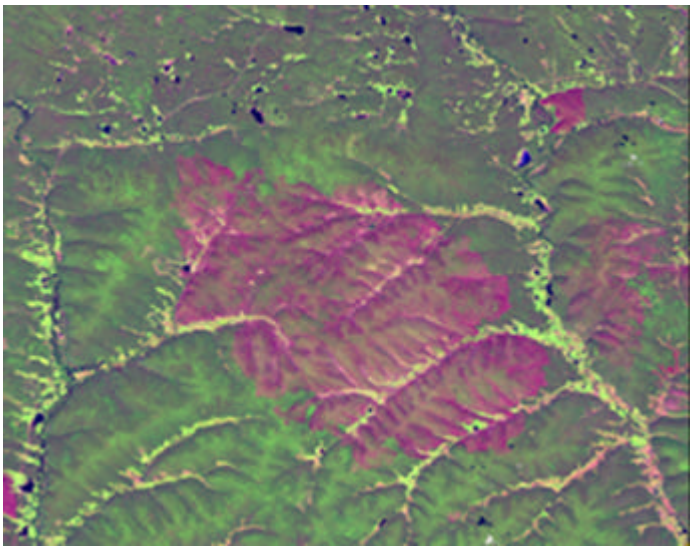

Figure 4. A large forest fire started near logging infrastructure, Republic of Sakha (Yakutiya).

Important Milestones in Fire Suppression

In the early 20th century, when a system of state firefighting was virtually absent, forest fires are believed to have affected between 600,000 and 700,000 hectares per year. This number climbed to 12.5 million hectares of forest in 1915, after a particularly dry year. Still, anthropogenic fires were largely concentrated around the most populated rural areas and the seemingly endless taiga was able to persist according to its own natural cycles. A new era of catastrophic fires began in the 1930s and 40s and especially in the 1950s and 60s, as the Soviet authorities sent thousands of people into the sparsely populated taiga to survey and exploit the areas' precious natural resources. Thousands of kilometers of ground and railroads penetrated to the taiga, making it more accessible for people and, since that time, tens of millions of hectares of pristine taiga in European Russia, Siberia and the Russian Far East have been destroyed by fire. The strategic needs of the Soviet economy have forced the authorities to close their eyes to this side effect of resource development, hiding the real scale of the problem.

That being said, a great deal of time and resources has been invested into fire suppression. The use of aviation began as early as 1931 and the application of remote sensing data began in the 1970s. As a result, data of the state forest fund accounts show that the area occupied by fire scars and dead stands decreased by two times in the period of the 1960-1970s (Fig. 5). During the Soviet times, the method of direct firefighting was also accompanied by insistent, straightforward and regular public education, which was actively engaged in publishing posters on fire prevention and installing special signs in the forest. In recent years, however, active fire suppression has been seriously degraded, due to the termination of public education programs, a lack of financing and overall inefficiency.

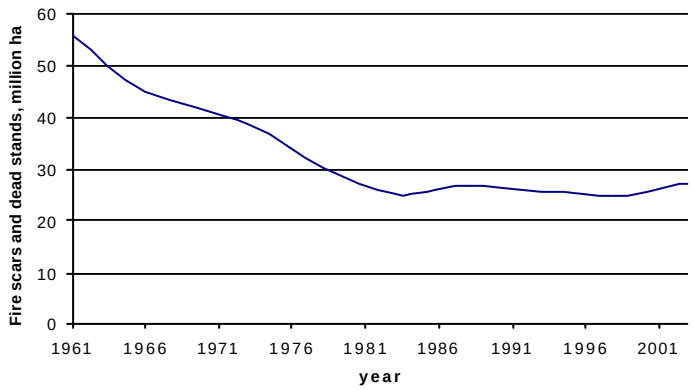

Figure 5. The area of fire scars and dead stands according to the State Forest Fund Accounts (Alekseev and Markov, 2004; State Forest Fund Account of 2003, 2003).

The major force in fire detection and fighting is the Aerial Forest Fire Service of Russia, *Avialesookhrana* (part of the Federal Forestry Agency) with 24 regional airbases across the Russian Federation, a fleet of 102 aircraft and more than 3800 firefighters. It is currently charged with the task of protecting between 640-690 million hectares, out of Russia's 1.2 billion hectares of forests. Despite these figures, *Avialesookhrana*'s ability to fight large wildfires has been seriously called into question. The reduced availability of modern equipment, personnel and flight equipment has meant that their ability to suppress fires has dropped by 40% from the early 1990s, when firefighters managed to suppress around 80% of all fires (Sergienko, 2004) and the time spent on suppression of individual fires increased significantly. For although the area affected by forest fires decreased by 5 times from 2003 to 2004, these gains are believed to be the result of favourable weather conditions, as opposed to effective fire suppression. Fire prevention, on-ground detection and suppression are also major responsibilities of the forest management staff of leskhozes (administrative units for forest management of the Federal Forestry Agency) – 180 thousand people all over the country. However, their work in recent years was low effective because of inadequate and untimely budget financing and personnel's poor qualification and lack of motivation. Overall the current federal policy on fire prevention remains inefficient, with poor interagency coordination and absolutely no public education campaigns.

Some changes were made in 2005 as the regional authorities became responsible for preparatory and organization activities for fire suppression and for firefighting itself, while the Federal Forestry Agency became responsible only for public education and fire prevention work. However, the procedure for how the regional authorities would receive special funds from the federal budget (subventions) remains unclear, inflexible and long. Currently, all relevant authorities in charge are largely unaware of the new system and are hardly prepared to work according to it, meaning that is unlikely that the situation with fire suppression will improve this year.

Official Fire Statistics: Incomplete, Inaccurate and Biased

According to the official statistics, 20 to 35 thousand wildfires annually affect between 0.5 and 2.5 million hectares of Russian forest and state forest inventory data have indicated that the area of fire scars (unvegetated burnt areas) by 7.4 times exceeds the area of unvegetated clear-cuts (State Forest Fund Account of 2003, 2003). Despite the high overall number of individual fires, the serious environmental impacts are generally caused by large wildfires (greater than 200 ha) and especially by catastrophic fires, for which the area of an individual fire scar may exceed tens (and even hundreds) of thousands of hectares. On average, 5% of large wildfires are responsible for more than 90% of the whole area damaged by fires.

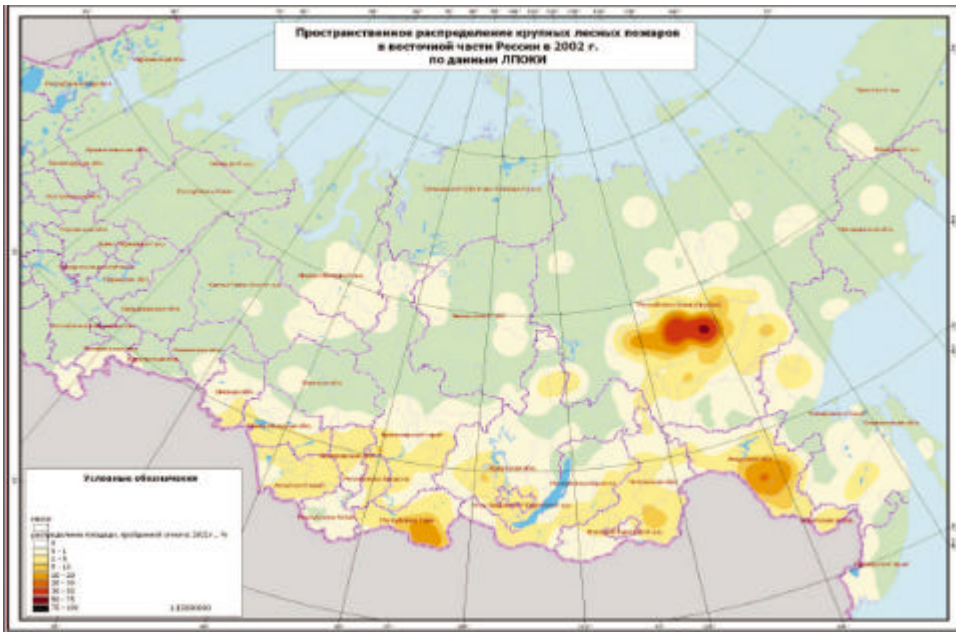

Figure 6. Spatial distribution of burnt areas in the Asian part of Russia during the fire season of 2002, derived from interpolated NOAA AVHRR forest fire data. Zones are delineated by colours that represent the ratio of the burnt area to the total area marked by the colour (Sukhinin, 2003).

While European Russia is characterized by high numbers of fires, the share of burnt area here is much lower comparing with Asian Russia. This is partly due to a different capacity of fire suppression but also is due to more favorable natural conditions for fire to spread in Asian Russia. Many regions are known as having a high hazard of occurrence of wildfires. However, in a particular year massive development of fires is driven by weather conditions. Therefore each year the majority of fires tend to concentrate in a small number of regions (see Fig. 6), which could differ from year to year.

Table 1. Official statistics of forest fires (Source: the Ministry of Natural Resources of the Russian Federation)

Parameters/Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Number of Fires (thousands)	24.1	31.6	18.8	20.9	37.3	27.0	22.0
Forest area affected by fires (million hectares)	2.3	0.7	1.2	0.9	1.3	2.4	0.4
Forestry's economic losses due to fire (billion rubles)	5.4	1.6	3.7	2.9	4.6	14.0	No data

Still, massive forest fires in Russia generally do not attract the public attention they deserve. This lack of attention can be attributed to the Russian Forestry Agency's unwillingness to report the full scale of the problem and forest policy is based on biased, incomplete and contradictory data. The data on wildfires that is available to the public is very general, only reporting on the area affected by fires, number of fires, direct economic losses and main regions affected by fires. The official data is not supplied with relevant maps, nor with any sort of comprehensive analysis of the situation or corrective action plans. The quality of this data has been cause for concern and serious scepticism amongst both the scientific and NGO communities. Official figures for forest fires seriously underestimate the forest area burnt for a number of reasons. Remnants of the old Soviet policy of secrecy and hiding the truth are certainly one possible explanation, but the absence of a systematic approach and reliable monitoring methods must also be considered.

Until recently, there were only two real sources of data on the extent of forest fires: state forest inventories and *Avialesookhrana*. Data on the size of the burnt scars was collected during regular state forest inventories; although, it was not until the early 1960s that state forest inventories covered 100% of country's forests. These inventories are supposed to be repeated in each leskhoz after 10-20 years. Initially, these inventories were often of poor quality. For example, the State Forest Fund Account of 1961 indicated that only 28% of managed forests possess fair quality inventories that have been at least partially verified by field surveys [Alekseev and Markov, 2004]. The introduction of remote sensing technology in the 1970s resulted in some improvements in the quality of the forest resource inventories. By 1998, the proportion of Russian forests that are only studied by aerial inspection methods was reduced to 5%.

However, the five-year national summaries of forest inventory data (State Forest Fund Accounts) are only partially based on these regular forest inventories and the field data provided by leskhoz staff, as most of the data is manually updated using suspect statistical methods. A recent analysis of the state forest inventories found that they were subject to falsification in order "to improve statistics" on a number of different parameters, included burnt areas [Alexeyev, 2004]. As a result, an accurate account of the inter-annual dynamics of forest fires is often difficult to obtain.

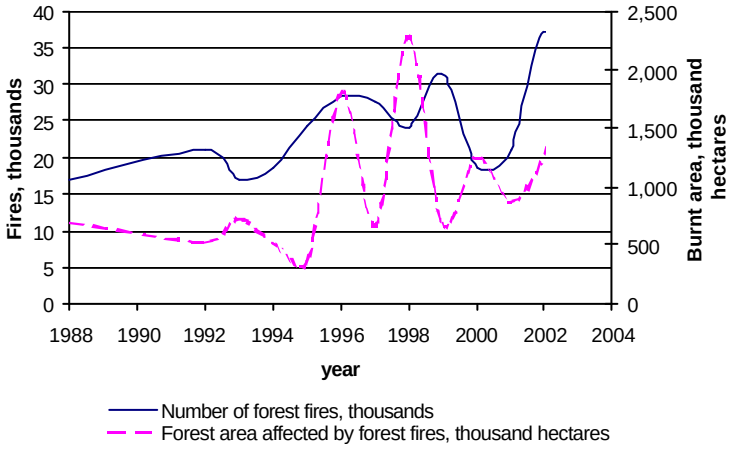

Figure 7. Dynamics of the number of fires and burnt area in forests managed by forest authorities during recent years (Source: Ministry of Natural Resources, 2002-2004).

The second source of forest fire statistics is the reports on fires detected by *Avialesookhrana*. *Avialesookhrana's* 20 year-old system of monitoring of forest fires and collecting daily fire summaries is based on aircraft and ground surveys, data which can be updated later by leskhoz staff. However, the data reported by *Avialesookhrana* are also incomplete and inaccurate, since the main objective of the service was to detect the fire and suppress it, not to produce accurate maps of burnt areas. In addition, monitoring of forest fires has been performed in the so-called "protected" forests (640-690 million ha of 1.2 billion ha under the category of forest lands). Since the 1990s, this system has also been negatively impacted by financial and logistical constraints.

The wide use of aerial photos in forest inventories, which began in the 1970s, generally provided a good basis for monitoring of the state of forests. However, in the 1990s, due to overall economic and politic crisis and a series of reforms of the Forest Service, plans for a nationwide forest monitoring system were abandoned. A new attempt to establish a federal-level system of remote sensing to monitor forest fires was initiated in 1996, through a cooperative arrangement between *Avialesookhrana* and several state research institutions. However, the Information System for Remote Sensing Monitoring of Forest Fires at the Ministry of Natural Resources of the Russian Federation only became fully operable in the early 2000s and it is unable to produce reliable maps of burnt areas. This deficiency is partly due to the fact that the system lacks the ability to detect all the areas that have been affected by fire, especially ground fires. Another problem is that the classification of land categories on satellite images is quite different from those used in forest inventories, making it difficult to compare the data.

In recent years, extensive independent research on Russian forest fires has been conducted by the Global Fire Monitoring Center, based in Freiburg, Germany. This research concluded that the 1.834 million ha of burnt land (1.2 million ha forest land and 0.634 million ha non-forest land) that *Avialesookhrana* reported in 2002 for their jurisdictional area may not be an accurate reflection of the complete picture [Goldammer, 2003]. These findings were further supported by the Krasnoyarsk Fire Laboratory (Sukachev Forest Institute), which found that 11.7 million ha burnt during the same period in Asian Russia alone [Sukhinin, 2003]. Additional researchers have also found major discrepancies with other *Avialesookhrana* data. For example, the Global Burnt Area 2000 initiative (GBA-2000), which has produced a global dataset on burnt vegetated areas for the year 2000, found that 3.11 million ha forest and 3.31 million ha woodland burnt in Russia, compared to the 1.64 million ha that was reported by *Avialesookhrana* . For 1998, the satellite data showed that 13.3 million ha burnt in Siberia, five times higher than the area reported by *Avialesookhrana*.

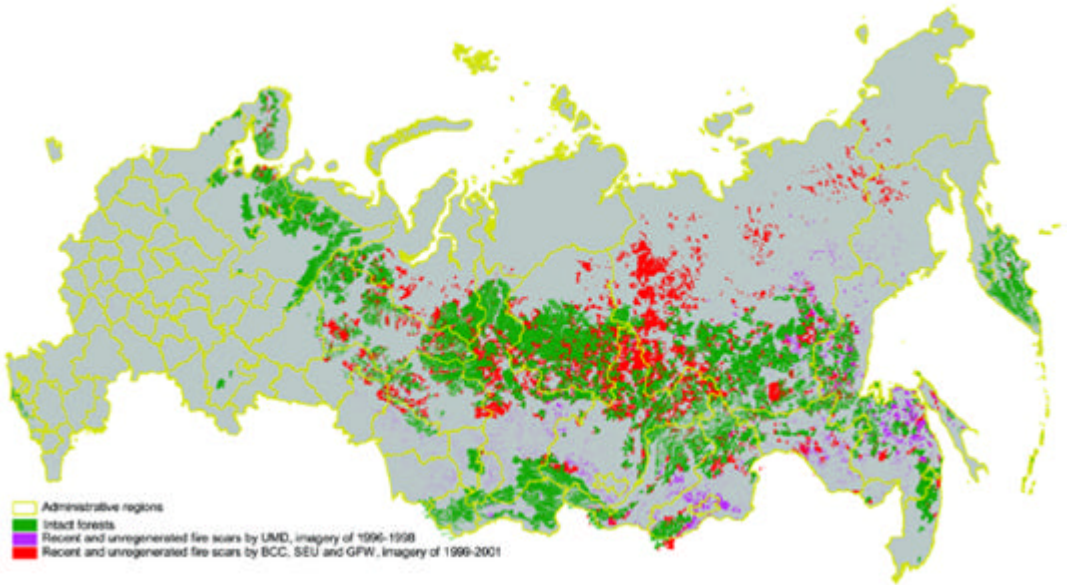

Figure 8. Recent and unregenerated fire scars identified by Landsat images of 1996-2001 in the vicinity of intact forest landscapes. Sources: University of Maryland (imagery of 1996-1998), BCC, SEU and Global Forest Watch (imagery of 1999-2001).

In addition to these discrepancies, the official data sets lack important mapping on the location and extent of recent fire scars. The Biodiversity Conservation Center and the Socio-Ecological Union (two Russian environmental NGOs) are collaborating with the Global Forest Watch initiative to produce such analyses, using Landsat images (30 m per pixel resolution). One such map shows that the share of such areas along the periphery of intact forest landscapes is surprisingly high (Fig. 8). There is also an urgent need to a produce a series of retrospective maps of burnt area and to date any particular large fire scar.

Recommendations and Avenues for NGO Action

To improve the state of forest fire management, the Russian government needs to clearly specify the division of responsibilities; facilitate efficient cooperation among the federal, regional and local authorities involved in fire suppression; and ensure that personnel are adequately trained and have enough financial resources. The fire management policy should be moved into a public arena, since humans are the country's primary source of forest fires. However, such changes are necessitate public access to reliable, accurate and complete data on forest fires and their negative impacts on the environment.

The main tasks of NGOs work should be:

1. To ascertain the real scale of the problem through independent monitoring of forest fires in Russia. This information should form the basis for an analysis of the official forest management policy with respect to its current content, relevancy and efficiency.
2. To raise international and national awareness of Russian forest fires and to promote policy dialogue between civil society, the forestry industry and government agencies. Greater media attention and increased public debate could stimulate the Russian authorities to start a dialogue on forest fire policy with NGOs, local communities and the private sector. NGOs need to clearly demonstrate the ineffectiveness of current fire management policies and should propose alternative ways of fire prevention.
3. To develop the organizational capacity of grassroots organizations so that they can work on forest fire prevention at regional and local levels. To ensure their credibility, regional NGOs need to be provided with independent and reliable information that they can use to develop educational materials and, when communicating with the media and government agencies on fire management issues.
4. To develop pilot research projects that provide concrete examples of how to improve the effectiveness of governmental forest fire management policies.

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