Symposium on Fire Management in Cultural and Natural Landscapes, Nature Conservation and Forestry in Temperate-Boreal Eurasia -- Freiburg, Germany, 25-27 January 2008

PRESCRIBED FIRE EXPERIMENTS IN KRASNOYARSK REGION, RUSSIA

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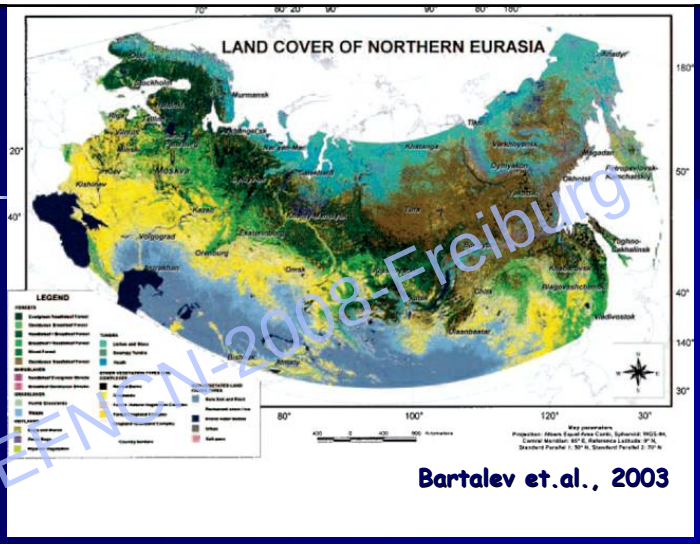
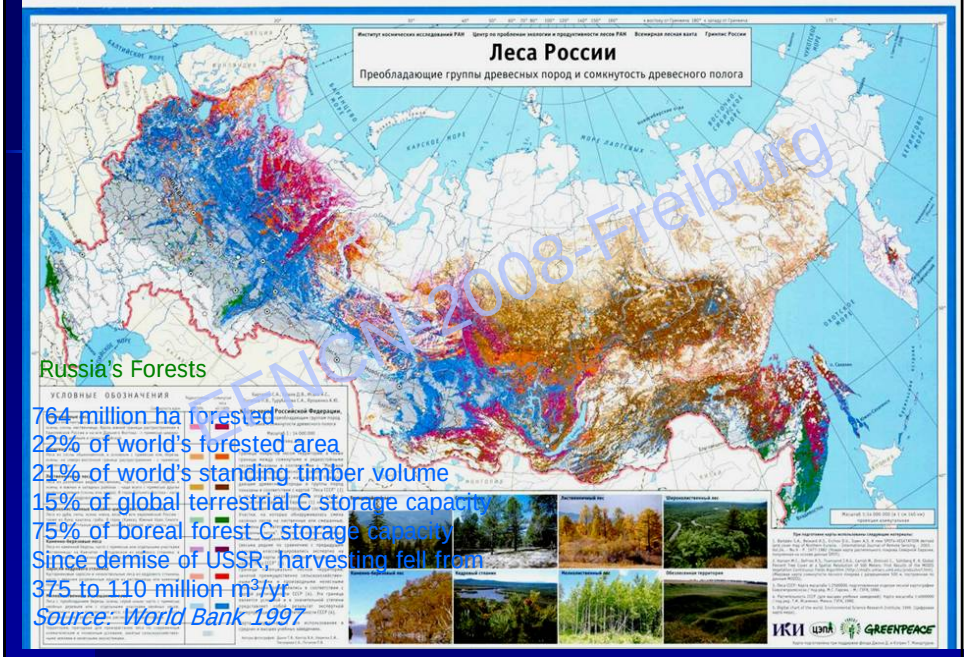
The worlds total boreal forests and other wooded land within the boreal zone cover 1.2×10^9 ha of which 920×10^6 ha are closed forest. The latter number corresponds to ca. 29% of the worlds total forest area and to 73% of its coniferous forest area (ECE/FAO 1985).

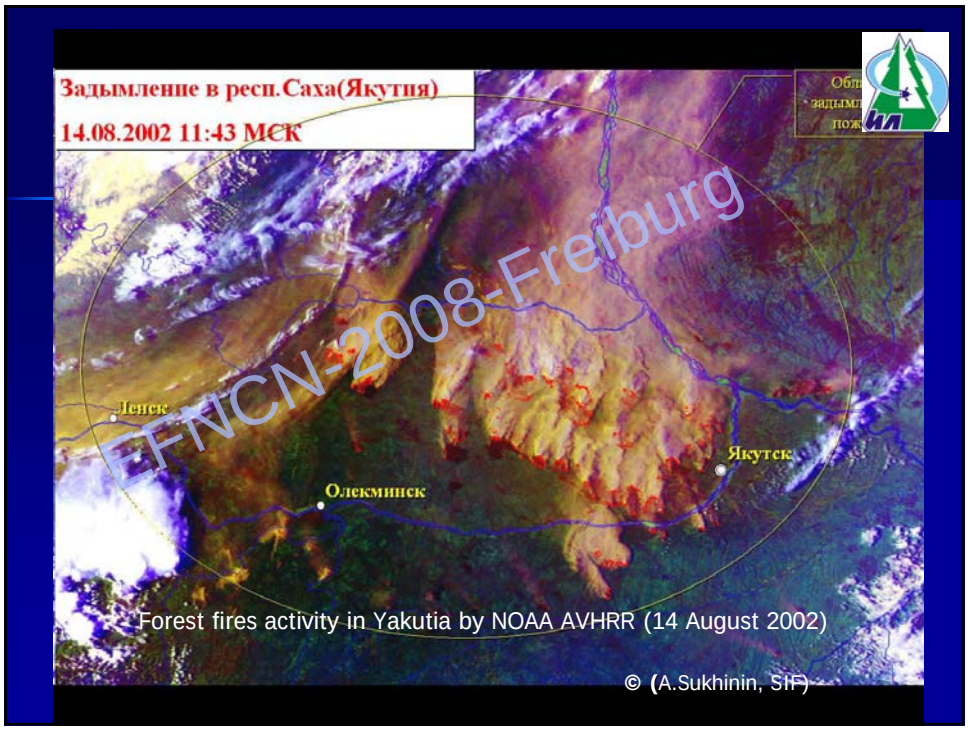


The vast majority of the boreal forest lands (*taiga*) of Eurasia are included in the Russian Forest Fund, covering ca. 900x10^6 ha. Depending on the criteria used to define "boreal forest", the area of closed boreal forest in the Russian Federation varies from 400 to 600x10^6 ha (Pisarenko and Strakhov 1993). These numbers correspond to a 43-65% share of the worlds closed boreal forest.



Russia's Forests

764 million ha forested
22% of world's forested area
21% of world's standing timber volume
15% of global terrestrial C storage capacity
75% of boreal forest C storage capacity
Since demise of USSR, harvesting fell from 375 to 110 million m^3/yr.
Source: World Bank 1997


Задымление в респ.Саха(Якутия)
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Forest fires activity in Yakutia by NOAA AVHRR (14 August 2002)
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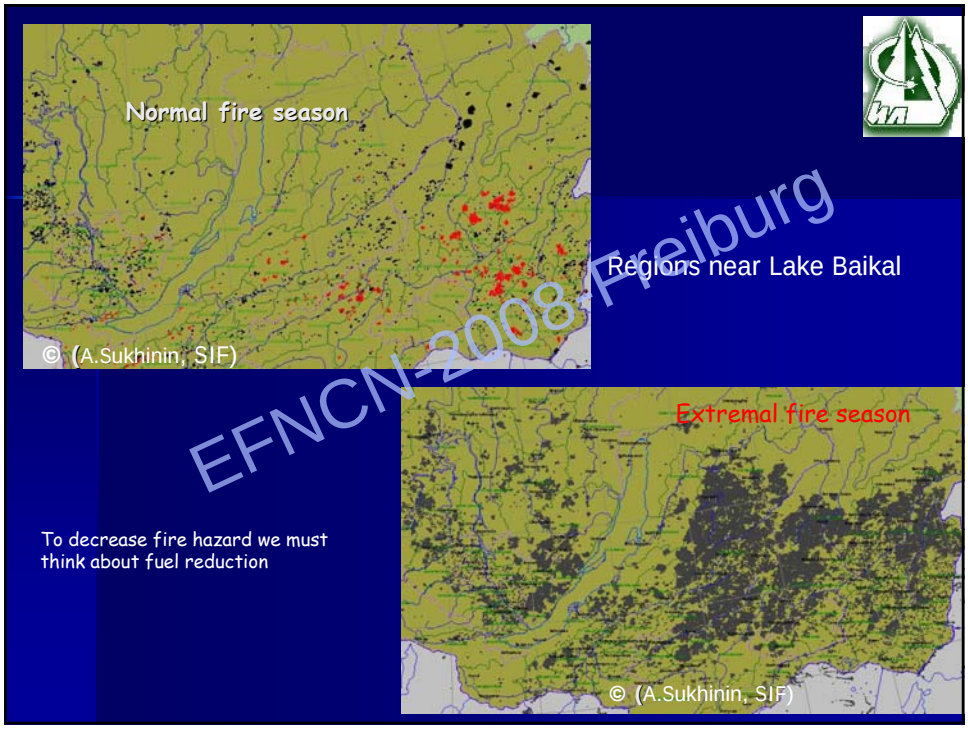
Normal fire season
© (A.Sukhinin, SIF)
Regions near Lake Baikal
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Extremal fire season
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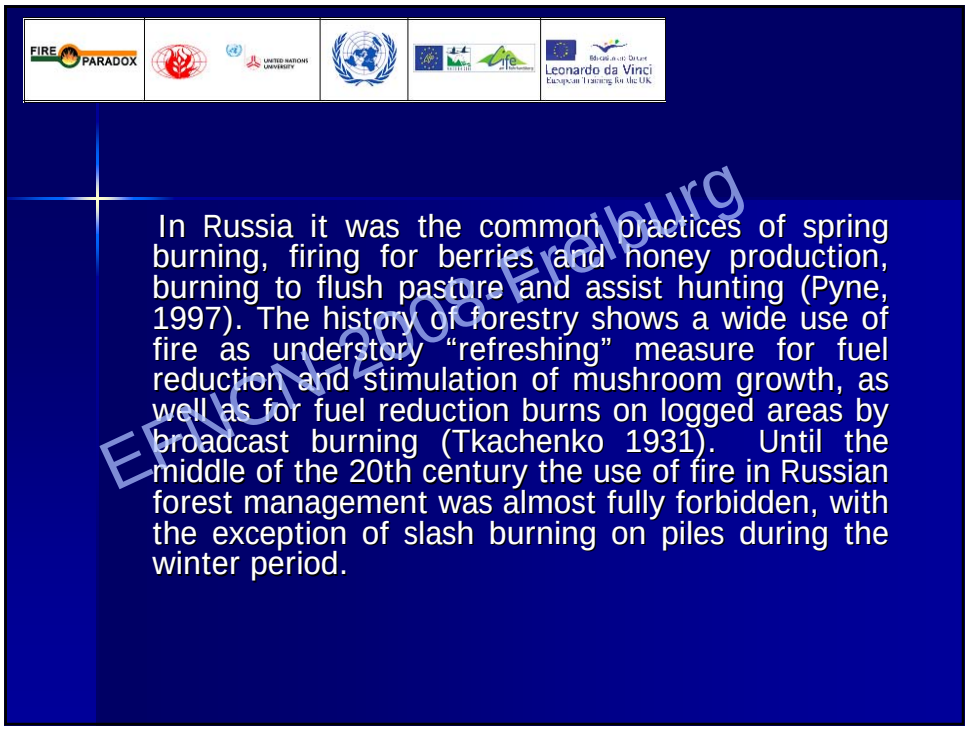
To decrease fire hazard we must think about fuel reduction


In Russia it was the common practices of spring burning, firing for berries and honey production, burning to flush pasture and assist hunting (Pyne, 1997). The history of forestry shows a wide use of fire as understory "refreshing" measure for fuel reduction and stimulation of mushroom growth, as well as for fuel reduction burns on logged areas by broadcast burning (Tkachenko 1931). Until the middle of the 20th century the use of fire in Russian forest management was almost fully forbidden, with the exception of slash burning on piles during the winter period.
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However, positive influence of surface fires on a forest had been noted in the beginning of last century and it was offered to use fire as helpful instrument for planting (Tkachenko 1911).
Some authors offered prescribed fires
for broadcast burning of slash fuels after logging (Pobedinsky 1955)
understory burning in mature pine stands 5-10 years before logging (Belov 1973)
surface fire using as thinning instrument of pine saplings (Furyaev 1974)
broadcast prescribed understory burning of pine and larch stands of 40-50 years for wildfire hazard reduction (Melekhov 1983)
But in a reality these studies were only as recommendations and the use of understory burning and prescribed burnings on logged sites were prohibited. Only after 1995 the use of early spring burns in grass fuels near roads had been permitted to mitigate fires starting near roads during fire season (Valendik 1996).
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The new era of fire use in forestry of Russia encouraged foresters and scientists to look for more effective and cheap methods of cleaning logged areas and facilitating reforestation. Following the large basic scientific experiment and a regional fire analysis in the frame of the Fire Research Campaign Asia-North (FIRESCAN) in Krasnoyarsk Region in 1993 (FIRESCAN Science Team 1996; Goldammer and Furyaev 1996) the development of prescribed burning techniques was supported by international projects, such as Sustainable Forestry, FIREBEAR, ROLL USAID (Valendik et al. 2000).

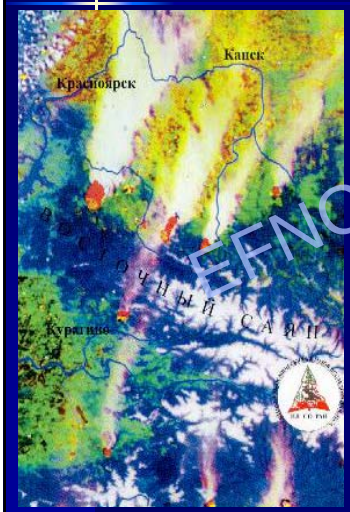
Fire Research Campaign Asia-North (FIRESCAN)

The experimental site is in the central part of the Krasnoyarsk Region of Siberia, about 28 km west of the Yenisey River (60° 45'N, 89° 25'E) at an elevation of approximately 150 m above sea level. The study site is a nearly level, slightly elevated, sandy island, about 50 ha in size, which is surrounded by bogs dominated by mixed-grass, sphagnum and tall sedge. The site was referred to as Bor Forest Island, after the town of Bor, 90 km to the North, which served as the transportation base for research activities.

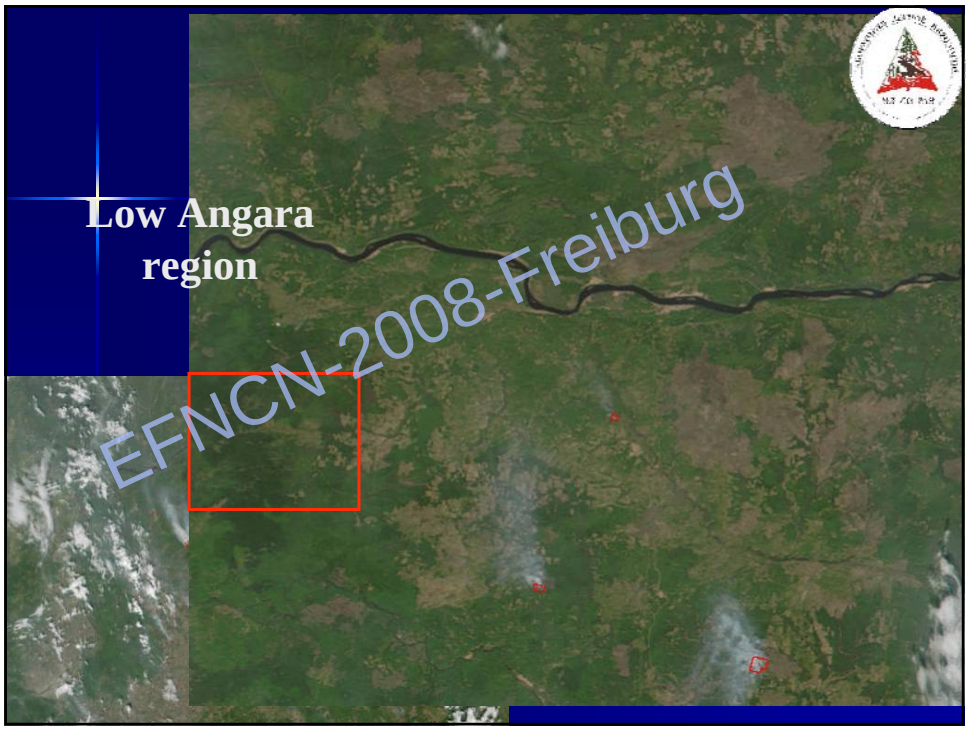
Central Siberia Sustainable Forestry Project

1993-2004

Wildfires reach huge area, going through clearcuts and spreading on surrounding forests



1999 wildfire moved through logged areas and forests in Mana region. Its burned area was more than 30 000 hectares


Low Angara
region
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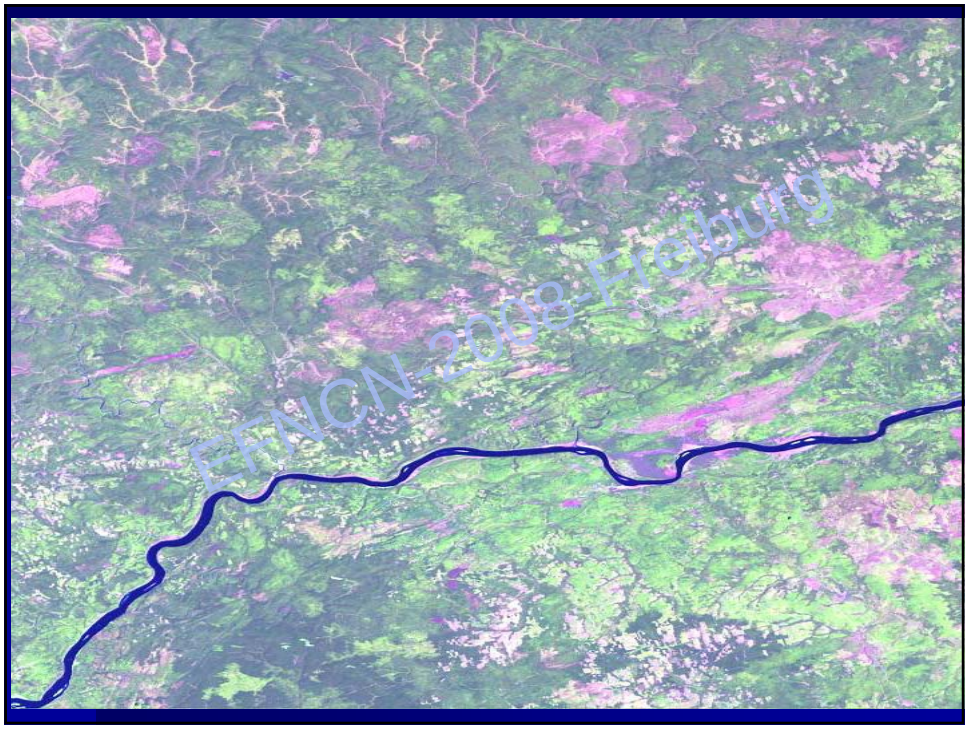
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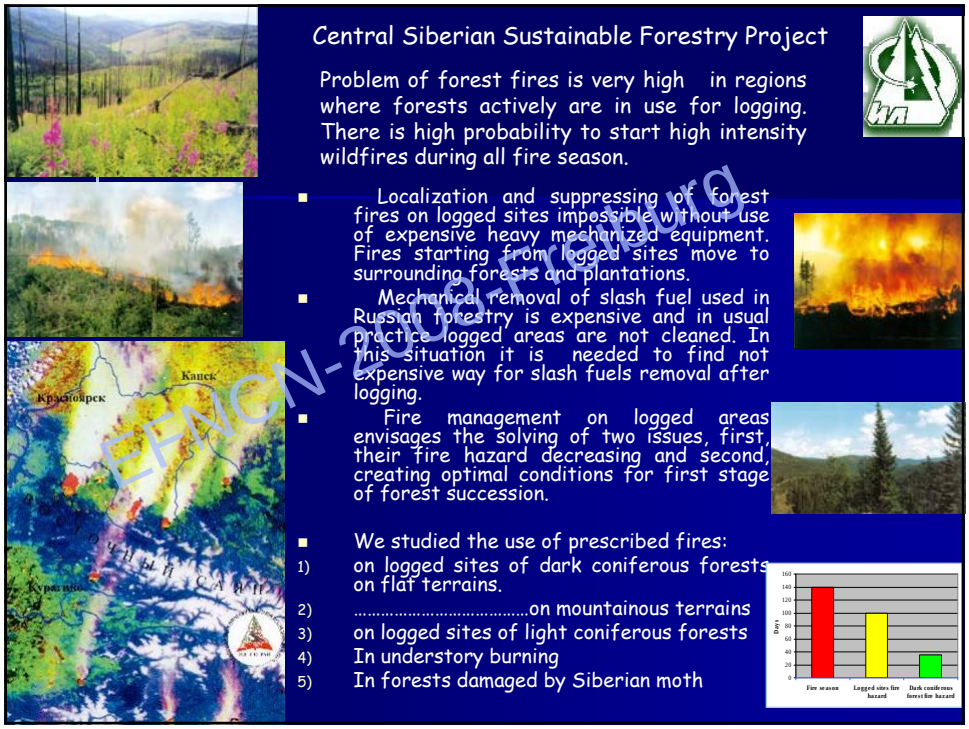
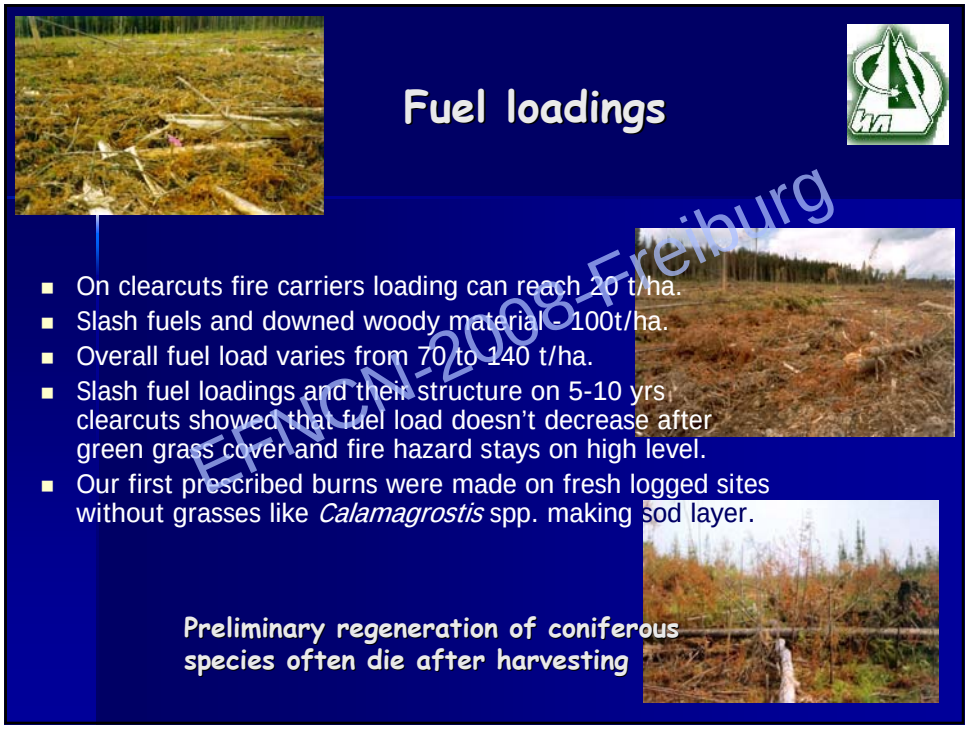


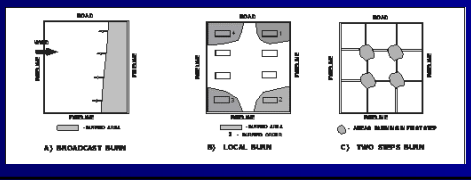


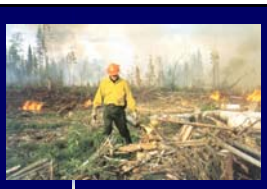
Prescribed burn methods

Three methods have been used for prescribed burning on logged sites:

- 1) broadcast burning – on clearcuts with uniformly distributed slash fuels;
- 2) two stages burning – on clearcuts where large downed woody fuels have been piled
- 3) local burning – on logged sites with alive regeneration.

- Selection of prescribed burn methods depend on forest type before logging and weather.
- Prescribed burn characteristics also depend on forest fuels moisture content, loading, their structure and arrangement, relief etc.
- Flame height and other characteristics of burning define possibility to control burning and define needed man power and heavy equipment.
- So it is needed to forecast prescribed burn characteristics before the burn for that we used software BEHAVE which allowed to forecast fire behavior and make prescriptions for burning.



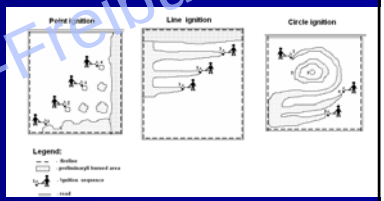


Ignition procedures

For ignition we used procedures:

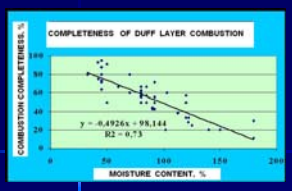
- ✓ Point ignition
- ✓ Line ignition
- ✓ Circle ignition
- ✓ Combined ignition

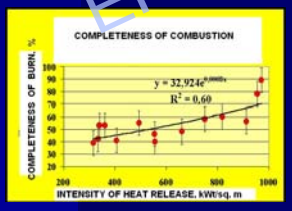
- Fire spread rate, flame length and width have been measured after ignition and burning line formation
- In each experiment air humidity, mean wind velocity etc. were measured before, in time and after prescribed burning.
- Using initial data and experimental results it has been defined prescriptions for prescribed burning for different periods of fire season.



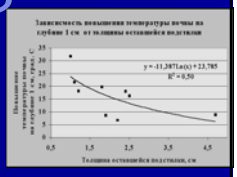
Period of fire season	III tdp of May – I tdp of June	II tdp of June – I tdp of July	II-III tdp of July– I tdf of August	II-III tdp of August – I tdp of September
Fire danger class	II–III	III	III–IV	III–IV
Nesterov Index	600–1600	1700–2000	2100–3000	3100–4000
Wind velocity, m/s	< 2	< 3	< 4	< 5
Relative humidity, %	> 60	> 40	> 30	> 30
Dry bulb temperature, °C	15–18	19–22	20–24	18–20

Results





- Slash fuels with diameters up to 7 cm were utilized by 70-90%, pieces larger than 7 cm – 40-50% in prescribed burning of fresh logged sites.
- Duff depth is decreased up to 1-2 cm.
- Ash content after prescribed burning was up to 2 t/ha which enriched soil.
- Upper soil temperatures in 1-5 cm layer were not higher than 45-50°C that don't destroy soils properties.
- On 2/3 of site it was suitable for seeds and seedlings growing.
- After prescribed burn live surface cover formed by fireweed create microclimate suitable for seeds and seedlings growth.
- Due to forest management enterprises (leskhoz) data soil treatment using prescribed burn 8-10 times cheaper than usual mechanical treatment for planting.



Summary

Experimental prescribed burns have been made on fresh clearcuts of 900 ha area in Krasnoyarsk Region.

- The use of the prescribed fire technologies on clearcuts allow to decrease slash fuels loading by 60%, in particular forest fire carriers by 80% significantly decreasing fire hazard.
- The completeness of duff layer burn depend on its moisture content and combustion rate and is equal to 60%. And 2/3 of logged area is suitable for planting and seeding without preliminary mechanical soil treatment.
- Prescribed burns allow to eliminate *Calamagrostis spp.* and turn the process to fireweed formation promoting seeds and seedlings growth in first steps of succession.

1998 2004


Prescribed understory burning
1996-2005
1996
2004
Russian - U.S. team for prescribed fire experiments
Old logged sites burning
Prescribed burning of forests damaged by Siberian moth
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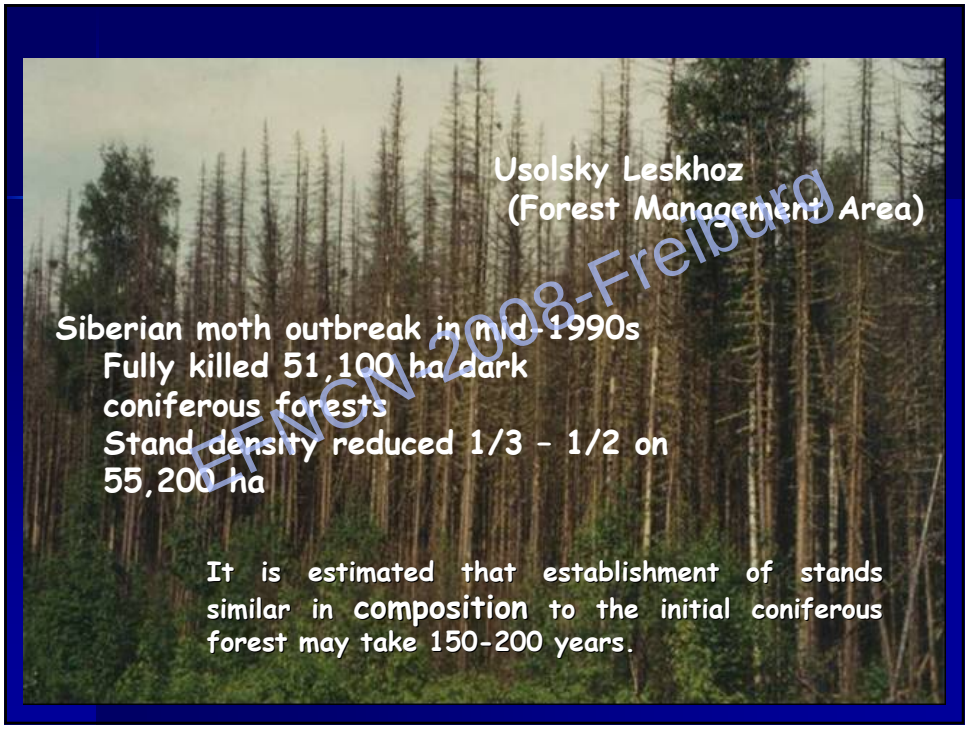
Usolsky Leskhoz
(Forest Management Area)
Siberian moth outbreak in mid-1990s
Fully killed 51,100 ha dark coniferous forests
Stand density reduced 1/3 – 1/2 on 55,200 ha
It is estimated that establishment of stands similar in composition to the initial coniferous forest may take 150-200 years.
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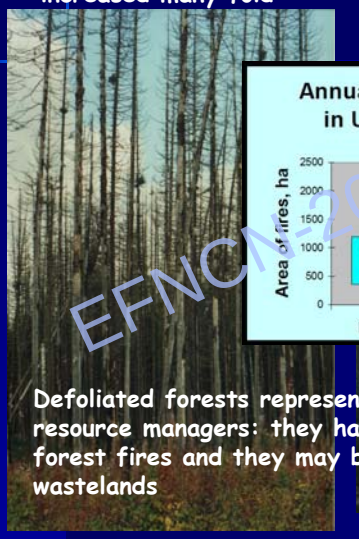
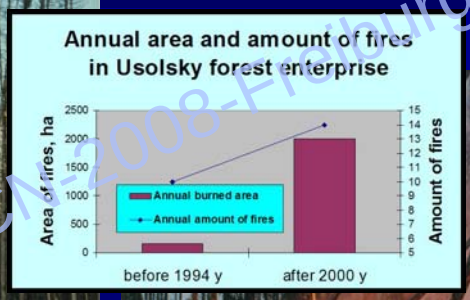
In the Usolsky Leskhoz the number of fires 6-8 years after the most recent outbreak of Siberian moth doubled compared to before the outbreak but the total area burned increased many fold





Defoliated forests represent two major problems for resource managers: they have high potential for forest fires and they may become unproductive wastelands

Special bulldozer was used to knock down snags and for firelines preparation

Reducing fire hazard in these forests requires removing dead woody material and accumulated ground fuels as a first step.


Volume of standing snags
Post-Treatment
Pre-Treatment
0
50
100
150
200
Cubic meters/ha
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Downed dead wood before and after mechanical treatment
Piece size diameter (cm)
>7.5
2.5-7.5
0.7-2.5
<0.7
Post-Treatment
Pre-Treatment
0
40
80
120
160
Metric tons/ha


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Our test of mechanically knocking down snags followed by controlled burning was effective for reducing dead wood and killing *Calamagrostis* grass on moth-killed sites, thus enhancing forest regeneration and restoration. This combined method resulted in an area suitable for both natural conifer regeneration and planting without additional mechanical site preparation.


Prescribed burns are also powerful sources of greenhouse gases but then carbon sequestration due to coming regeneration as carbon sink compensate first powerful carbon emissions
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Conclusions

- Special rules and guidelines for prescribed burning have been developed and published in cooperation with regional forest enterprises. Crews of foresters and firefighters have been trained during these experiments.
- A range of demonstration plots of prescribed burning was established to serve for long-term monitoring of postfire succession.
- These plots will be integrated into the Eurasian Fire in Nature Conservation Network as well as in the Fire Paradox demonstration plot network.
- The cooperation with these networks will allow further studies of both prescribed burnings (fire danger, fire behaviour, fire effects) and long-term fire successions in Siberian forests.
- The results will be important to extend to other regions of the Russian Federation.



Acknowledgements:

- Many thanks to Bolshaya Murta, Mana, Usolie leskhozes employees who supported and took active part in experiments
- Special thanks to Steve Eubanks, John Brisette, Rich Lasko (USDA Forest Service)
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Thank you for your time!

Спасибо за внимание!

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