

POST-FIRE SUCCESSION OF GROUND VEGETATION OF CENTRAL SIBERIA IN SCOTS PINE FORESTS

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INTRODUCTION

Fire is a natural factor that determines the boreal forest structure and species composition. Scots pine forests (*Pinus sylvestris* L.) are widespread in central Siberia and each year large areas were burnt. Post-fire succession is a complex phenomenon which depends on a combination of factors from local physiographic, climate and pre-fire vegetation conditions (Quinn 1986; Pausas and Vallejo 1999; De Luis *et al.* 2001, 2004; Lloret and Vil`a 2003). The aim of this study was to evaluate the effect of experimental fires on ground vegetation including small shrubs, herbs, mosses, and lichens in central Siberian Scots pine forests.

STUDY AREA



Fig. 1. Pre-fire forest

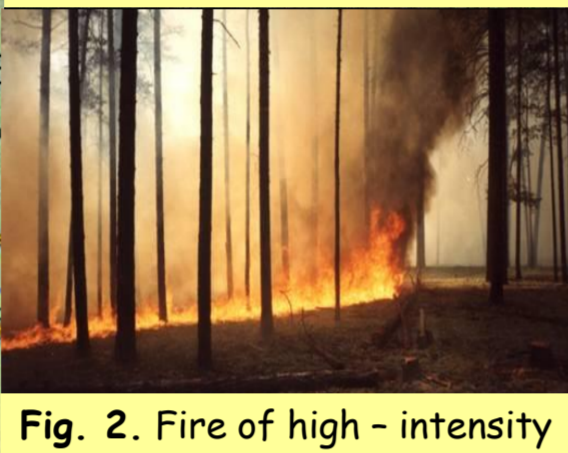


Fig. 2. Fire of high-intensity



Fig. 3. Post-fire forest (8 years)

EXPERIMENTAL DESIGN

Fire experiments were conducted on nine plots (4 ha each) in 2000–2002 as a part of an international Russian-American FIRE BEAR (Fire Effects in the Boreal Eurasia Region) project (fig. 1-3). The aim was to model varying fire intensity. The experimental fires spread downwind and were contained within sample plots (fig. 2). The fire parameters measured included fire rate of spread, flame length, temperature, and depth of burn.

Five plots were burnt by low-intensity surface fire; three by moderate-intensity one, and one plot was gone by high-intensity surface fire. Several of these plots (plots 3, 4, 19 and 21) were burnt incompletely (from 53% to 84% of the total plot areas).

METHODS

- Species composition, percent cover and biomass of ground vegetation (Sukachev and Zonn, 1961; Ponjatovskaja, 1964).
- The data obtained on ground vegetation percent coverage and species composition was also analyzed using Shannon's Diversity Index (Megarran, 1992).
- Structure of ground vegetation (plant microgroups) was mapped pre- and after fire on all plots. The main mapped unit was a microgroup (Ramensky, 1929).
- The degree of ground vegetation burnout (McRae *et al.*, 1979).

RESULTS

- Fire intensity had a clear effect on percentage cover, biomass and structure of ground vegetation (fig. 4, 5, 7).
- This biodiversity decrease of ground vegetation has been connected with destruction of moss-lichen layer (fig. 6).
- The cover of green mosses became progressively lower with increasing intensity fire (table).
- Lichens were completely destroyed by fires of any intensity (fig. 7).
- The dominating species (*Vaccinium vitis-idaea* and *V. myrtillus*) regained the cover values above or close to 6–8 years.
- Post-fire structure of ground vegetation was determined by fire intensity, burn depth of litter and initial species composition (fig. 7).
- Maximum changes were discovered in the post-fire structure of plant microgroups after high-intensity fire which resulted in intensive invasion by post-fire mosses (*Polytrichum strictum* and *P. commune*).

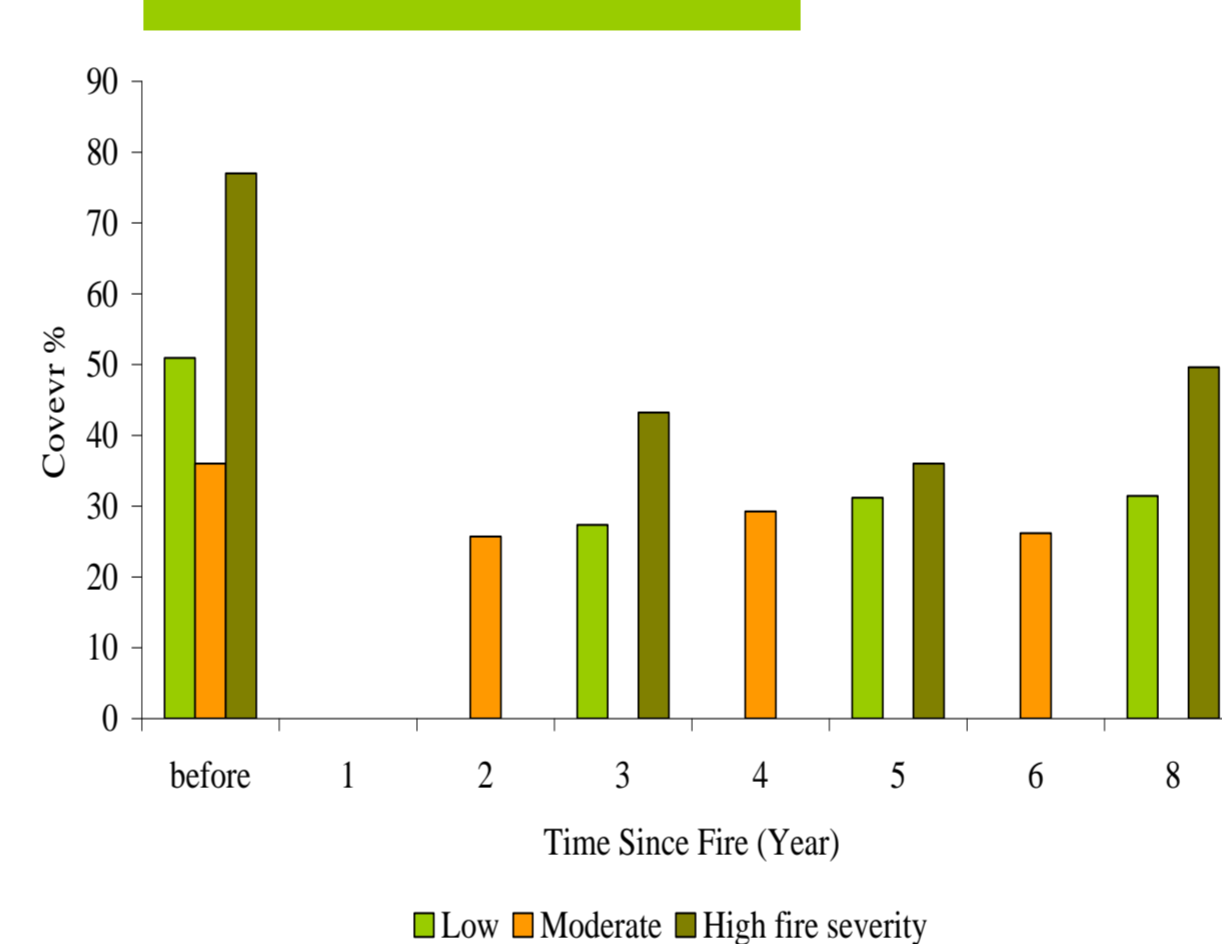


Fig. 4. Cover of small shrubs and herbs pre- and after fires.

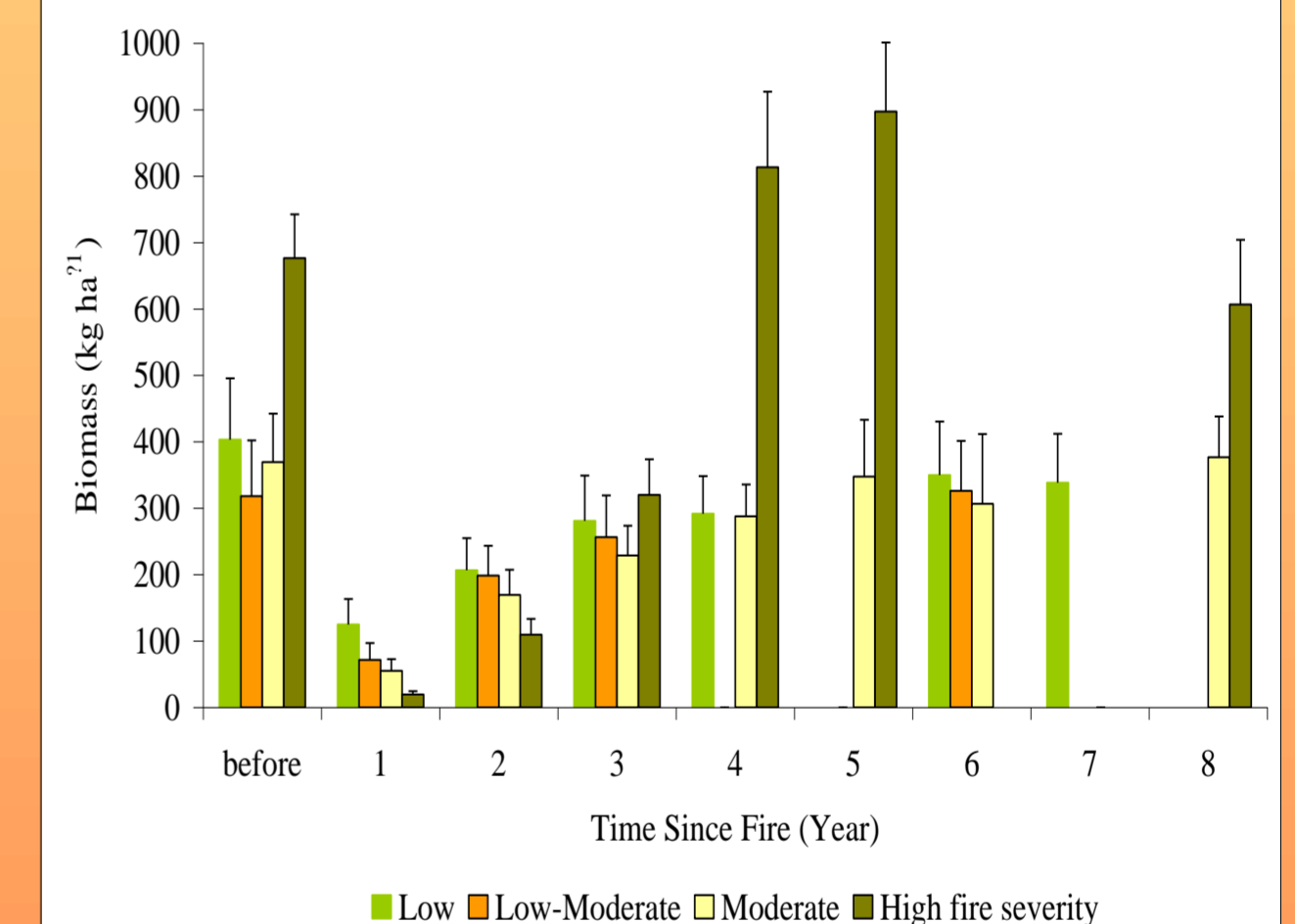


Fig. 5. Biomass of small shrubs and herbs pre- and post fires.

Table. Changes in percent cover of plant life form groups as related to fire intensity, depth of burn and years since fire (Year), Dispersion analysis were calculated in Excel.

Life form	Source of variation	MS	F	p
Shrubs	Year	382.20	4.48	0.003
	Fire intensity	942.99	11.05	0.001
	Depth of burn	764.38	7.29	0.001
Herbs	Year	32.94	62.95	<0.001
	Fire intensity	0.42	0.80	0.503
	Depth of burn	0.50	0.87	0.472
Mosses	Year	353.01	2.05	0.083
	Fire intensity	2471.68	14.33	<0.001
	Depth of burn	1794.29	10.93	<0.001
Lichens	Year	105.49	2.05	0.082
	Fire intensity	5492.55	106.99	<0.001
	Depth of burn	4844.99	82.74	<0.001

Fig. 6. Shannon's Diversity Index for the burned sample plots.

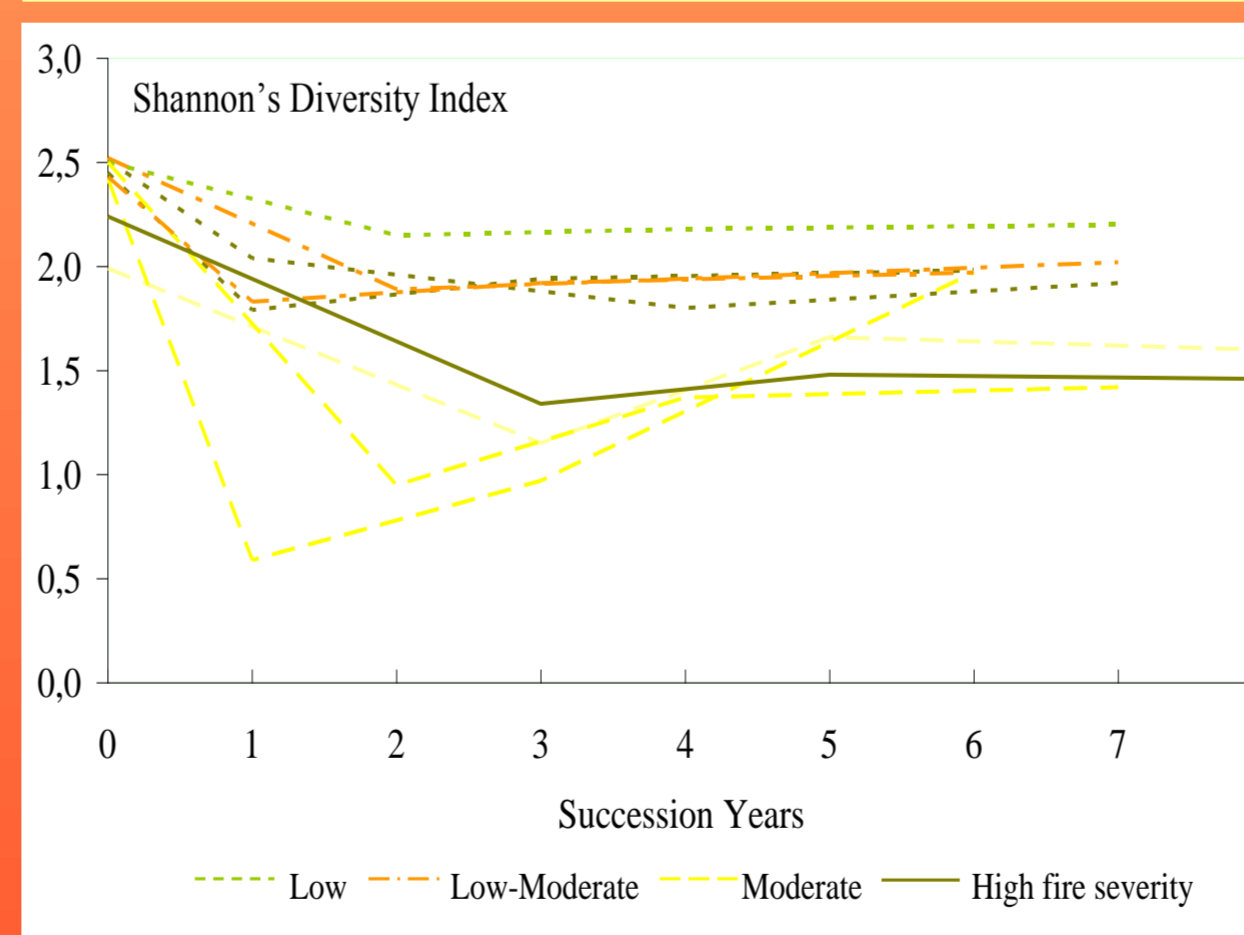
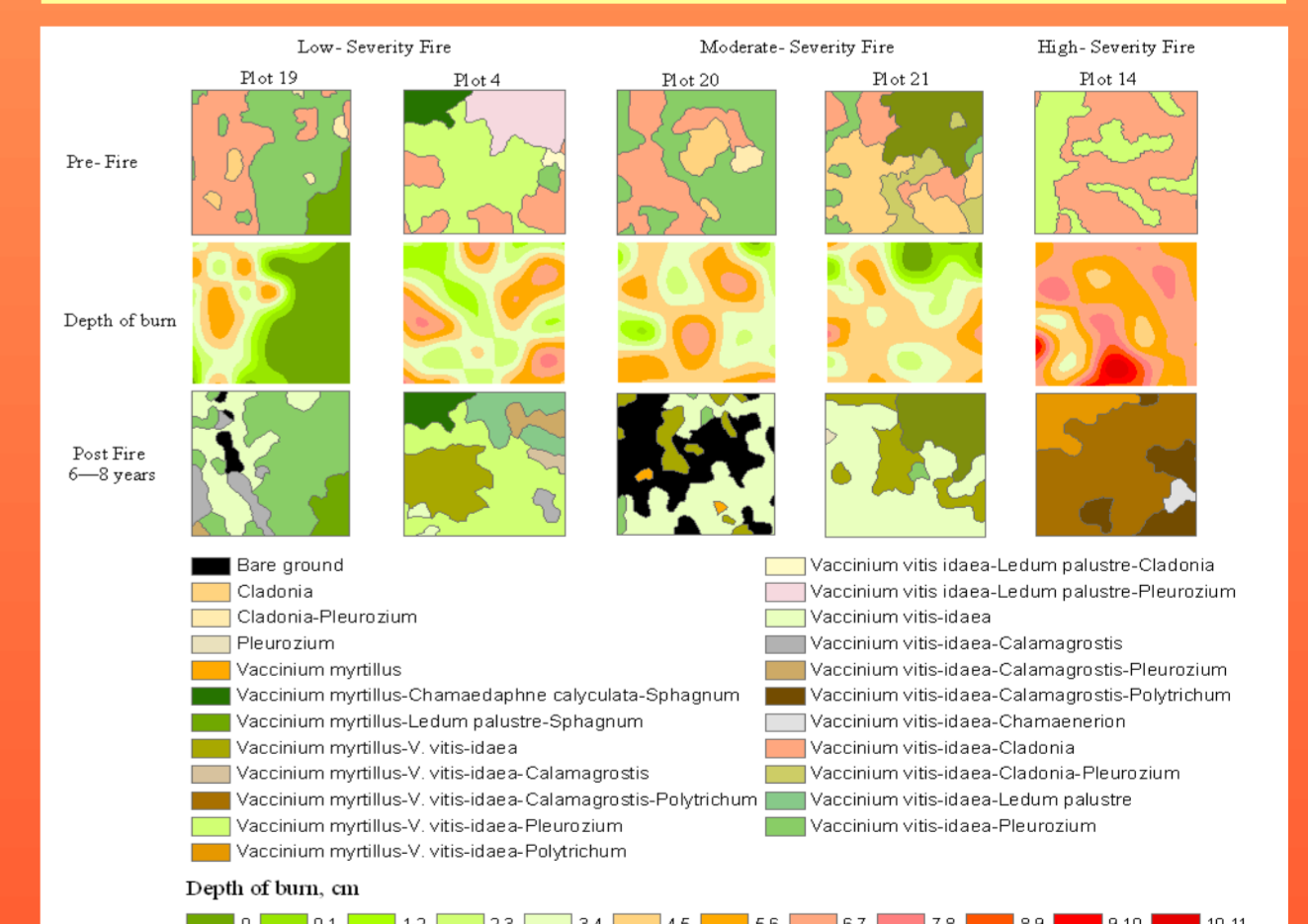


Fig. 7. Scheme of plant microgroups and depth of burn litter on the experimental plots.



CONCLUSIONS

Our investigation showed that post-fire recovery of the ground vegetation is determined by initial forest type, fire intensity and litter burning depth. In pine forests mosses and lichens suffer to a greater degree after ground fires than the small shrubs. Lichen layer was completely lost after the fires of any intensity. The post-fire cover and species diversity of the green mosses were progressively lower with increasing the fire intensity during the observation period. There is a positive trend of green moss microgroups recovery after fires of moderate- and low-intensity.

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