



Introduction

P. proximus is a bark beetle that has recently invaded the dark coniferous forests of Southern Siberia (Fig.4). Over the last decade, this four-eyed fir bark beetle destroyed *Abies sibirica* Ledeb stands on more than 500 thousand hectares. This study considers the initial stages of natural reforestation, which can define the restorative succession scenario for completely dead forest stands after the outbreak fades.

Methods

We estimated forest stands structure and natural regeneration, morphometric parameters and vital condition of trees. Field works were conducted on 21 circular sample plots (400 m²).

Study site

Dark coniferous forests in central part of Kemchug highlands, northern part of the Altai-Sayan mountainous forest region.

Results & Discussion

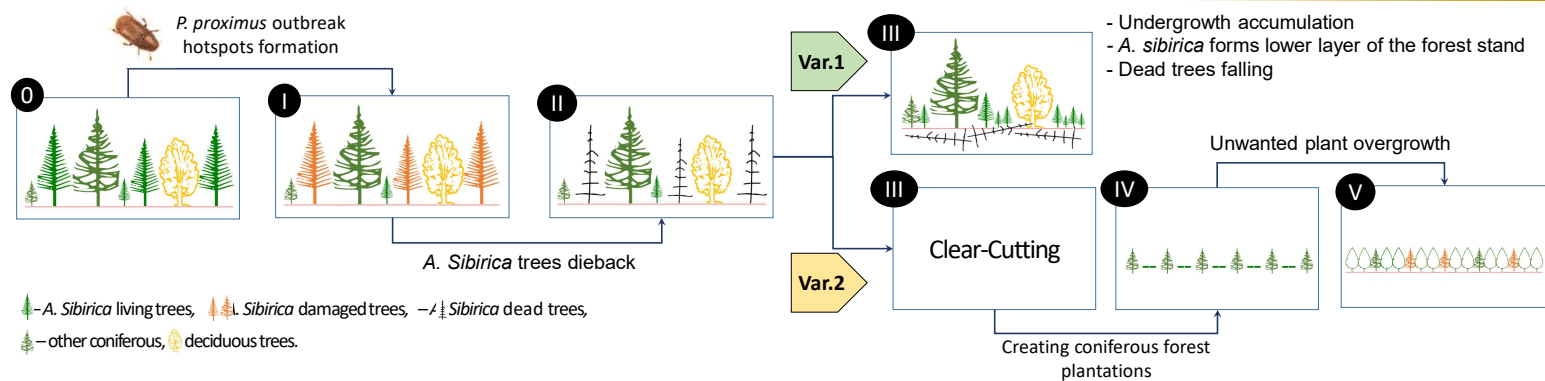


Fig.1 Succession stages in former *P. proximus* outbreak areas and variants of its development: Var. 1 - natural succession, Var. 2 - artificial succession.

Tab.1 The structure of new generation of trees depending on the succession stages

Parameter	Var.	I	II	III	IV	V
Succession stage duration, years	-	1-2	2-9	4-6	1	3
Trees young generation, species composition thousand pcs.	1	90% Fir 10% Spruce	100% Fir + Spruce	100% Fir + Spruce 21	-	-
	2	14	21	-	100% Spruce 4	80% Aspen 20% Birch 35

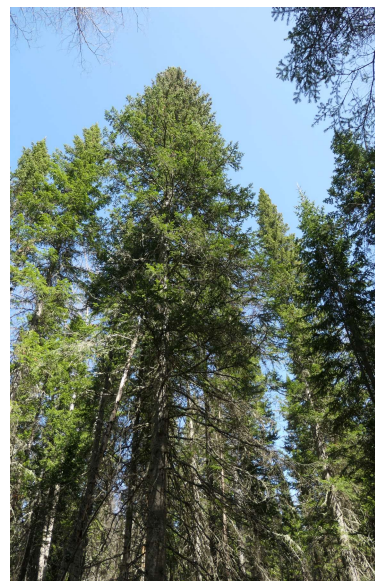


Fig. 4 Forest stands without *P. proximus* damage (stage 0)

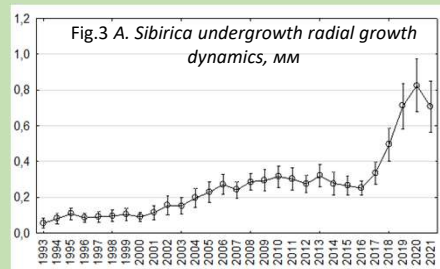


Fig. 2 Natural *A. sibirica* regeneration in former *P. proximus* outbreaks areas (III stage)



Fig. 5 Intensive overgrowth in outbreaks areas after human impact (stage V)

Var. 1 In five years after outbreak, a successful, sufficient for the future forest formation, young generation density (13,000 trees / ha) is observed. Because of the upper forest layer death, the young generation grows more intensively (Fig.3).



However, in some disturbed areas with considerable amount of forest fuels the risk of undergrowth damage by wildfire remains until the canopy closing occurs.

Var.2 - In former outbreak foci, where clear-cutting was implemented, healthy trees were cut down and the existing young coniferous generation destroyed. To date, clearings have been overgrown with secondary species (*Betula pendula* Roth., *Populus tremula* L.) (Fig.5). Ground cover communities have transformed into open-type phytocenosis where cereal grasses prevail. This led to turfing and significant litter and dry grass accumulation.

Conclusion

Faded *Polygraphus Proximus* outbreaks areas strong young forest generation ensures reforestation without dominant species change. To reduce risks of species change and conserve valuable *Abies sibirica* species, it is necessary to strengthen wildfire protection.