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Process of Natural Regeneration of Daurian Larch in the Gornen Forest Area in the Upper Part of Zei River, Amur, Far East Russia

Процесс естественного возобновления лиственницы даурской на гарях в Горненском лесничестве Верхнезейского лесхоза

NAUMOVA N. U.

Far East State Agriculture University, Blagoveshchensk, Amur, Russia

(Translator: Ms. Maya Matsuoka (Shogakukan Production Co., Ltd, Sapporo, Japan))

Abstract

Forest fires are a natural process, which in most cases determine the vegetation types and dynamics of plant communities. Fires occur and spread as a result of the influence of climatic, biotic and geographic factors, which define the level of impact on the forest ecosystem and it surrounding environment. Forest fires induce sometimes the progress of succession. Therefore, fires should be considered to have not only negative but also a positive effect on plant communities. Here we show an example of natural regeneration after forest fires in Daurian larch forest in Far East Russia.

Key words: Forest fire, larch stand, vegetation cover, succession, Far East Russia

Introduction

There is a constant danger of forest fires in the world. However, in some cases fires play a positive role in local economies – they diminish the stock of burnable materials and hence lower the danger of further fires in the forests, damage the habitats of harmful insects, and stimulate the natural regeneration of juniper and deciduous forests. In every year, 300 to 500 fires occur in the state forests of the Amur district, Russia. The fires spread usually in 100.000 to 250.000 hectares; Arhainsk, Blagoveshchensk, Bureisk, Zeisk, Zavitinsk, Mazanovsk, Magdagachinsk, Selemjinsk, Svobodnensk, Tyndinsk, and Shimanovsk are some of the regions most endangered by forest fires.

The goal of this survey is to show the tendencies in the formation of larch forests growing in areas damaged by fires in the northern part of the Amur district. We focused on the study of Upper-Zei forest district as an example.

Study sites and Methods

All the observations were conducted in the Gornensk forest region in the Upper-Zei forest district on two experimental areas, each of them measuring 0.25 hectares. The two experimental areas were situated in District 105 (Forest compartment of Part 2) and in District 89 (Forest compartment of Part 9), respectively. For stock-taking of young plants and grass cover, we designated two test plots (2 x 2 meters each), one in each experimental area. The test plots are square. The variety of species, percentage of cover and plants' height in the two test plots were observed simultaneously.

The abundance of plants was measured by the percentage of vegetation coverage and viability of plants (5 levels). The variety of newly regenerated seedlings (hereafter, new growth) was examined. The age of the plants was measured by the annual growth levels of three plants in every species. The new growth was assessed by its condition (viability or lack of it). The objective of the study was to define the percentage of different undergrowth types, their height, the crown projection area and average height of the undergrowth.

To assess the percentage of coverage of the undergrowth plants, the entire crown projection area and height of plants were measured and divided by the number of individuals in the test plots. The frequency of species occurrence (in this case calculated as a relative number) was calculated by dividing the number of undergrowth plants by the number of test plots. Then it was multiplied by 100 for expressing as percentage (%). The survey was conducted in different types of larch forests where all were affected by low intensity fires which occurred in the Gornensk forest area in different years.

Results and Discussion

Experimental area No. 1 was damaged by forest fire in 1996, and experimental area No. 2 was burnt in 2001 (Table 1). The data in Table 2 shows that there are 5.566 viable new growth plants per hectare in the larch forests burnt 9 years ago. By the idea of natural forest regeneration proposed by V.G. Nesterov, it is considered that good and does not require forestation activities. In the larch forests burnt four years earlier, number of regenerated seedlings is 1.833 plants per hectare, which

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by the criterion of V.G. Nesterov is considered to be well (large amount of seedlings was regenerated) and requires partial tree-planting or the other assisting activities for accelerating natural regeneration. Also, the new growth in the first experimental area was mainly large or medium, i.e. the new growth after the fire with the higher viability. Observation of the undergrowth indicates that plant competitiveness may depend on the abundance of newly-growing species in a decided area.

By the criterion proposed by Dr. Drud, the undergrowth in the experimental areas covers 25-30% of the areas and does not significantly affect the development of new growth. Thus the regeneration of larch forests burnt by low intensity fires was satisfactory and some of the new growths included the species with commercial high value. This fact also proves that forest renewal in the district will continue without altering the variety of junipers.

Table 1. Description of experimental areas.

Study site, (year of fire)	Forest area, quarter, (Compartment)	Location (river basin, name of slope)	Type of forest	Class of bonitet*	Soil	Thickness
No.1 -1996	Gornensk District 105 (part 2)	V – 15 urb. river Malmugakan	Larch Cowberry-wild rosemary	IV	Mountainous – taiga, turf-grey	0.5
No.2 -2001	Gornensk District 89 (part 9)	UV – 10 urb. river Sujirican	Larch Cowberry-reed grass	IV	Borax – taiga fresh, sandy	0.4

Note: “Bonitet” means forest environment including soil condition, climate condition and biological environment as a whole. Namely it indicates the site quality.

Table 2. Description of natural regeneration in the experimental areas.

Study site, (year of fire)	Species	Number of trees at undergrowth (per ha)					All together	Including viable
		Main trees	Low (< 0.5 m)	Medium (0.6-1.5 m)	Large (1.5 m>)	Dead trees		
No.1 -1996	Larch	182	395	2547	1920	88	5654	5566
	Birch	102	213	1730	2240	65	4350	4285
	Total	284	608	4277	4160	153	10004	9851
	(%)*	5	12	41	39	3	100	97
No.2 -2001	Larch	250	363	305	915	282	2115	1833
	Birch	238	134	210	304	147	1033	886
	Total	488	497	515	1219	429	3148	2719
	(%)*	12	9	13	56	10	100	90

*: Percentage of total individuals per all trees.

Table3. Description of undergrowth in the experiment areas.

Study site, (year of fire)	Vegetation	Average height (m)	Abundance by the criterion of Dr. Drud	Projection. area ($m^2 \cdot m^{-2}$)	Number of plants per ha
No.1 -1996	Marshland reed grass	1.3	Cop	0.2	216
	Shrub birch	1.5	Sp	0.2	185
No.2 -2001	Shrub fir	1.8	Sp	0.2	160
	Shrub birch	1.7	Sp	0.2	173

Note: Dr. Drud proposed the criteria for explaining the abundance of vegetation cover as follows: soc (socialis)- plants close up in the crowns, cop3 (copiosae)- plants are very abundant, cop2 - plants are abundant, cop1- plants are less abundant, sp (sparsae) - species is rather rare in the ground floor, sol (solitaries) - solitary piecies of the species in the association. For example, cop3 is equal to 60-80% of the coverage. The explanation

Fig. 1. A photograph of forest fire in a larch stand.