РОЗДІЛ І. ГЕНЕТИКА, ФІЗІОЛОГІЯ РОСЛИН ТА ПРИКЛАДНА БОТАНІКА

UDC 630.431

THE EFFECT OF THE PYROGENIC FACTOR ON DISTINCTION *PINUS SYLVESTRIS L.* ON THE FALLOW ECOSYSTEMS

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The mechanism of gradual seizure of the territory by pine is investigated, as a result of non-periodic burning of dry grass on the floodplains of the Transdniesteria Opilia. The seizure speed of the territory depends on the frequency and strength of fires on the fallows. The destruction of the overground part of herbaceous plants of the fallows makes these lands available for the self-seeding pine. Subsequently, the displacement of the outer boundary of the planting in the depths of the fallows occurs. A scheme of the distribution of pine trees on the investigated territory was construct based on the analysis of the spatial structure.

Key words: fire, fallows, distribution of pine, reforestation of the fallows.

Шевчук С. Є. ВПЛИВ ПІРОГЕННОГО ФАКТОРА НА ПОШИРЕННЯ *PINUS SYLVESTRIS L.* НА ПЕРЕЛОГОВИХ ЕКОСИСТЕМАХ / Прикарпатський національний університет ім. Василя Стефаника, 76018, Україна, Івано-Франківськ, вул. Шевченка, 57

Досліджено механізм ступеневого захоплення території сосною, що відбувається в результаті неперіодичного випалювання сухої трави на перелогах Придністерського Опілля. Швидкість захоплення території залежить від частоти та сили пожеж на перелогах. Знищення вогнем надземної частини рослинності перелогів робить доступними ці землі для самосіву сосни. Згодом відбувається зміщення зовнішньої межі насадження в глибину перелогу. На основі аналізу просторової структури створена схема поширення сосни на досліджуваній території.

Ключові слова: пожежі, перелоги, поширення сосни, заліснення перелогів.

Шевчук С. Е. ВЛИЯНИЕ ПИРОГЕННОГО ФАКТОРА НА РАСПРОСТРАНЕНИЕ *PINUS SYLVESTRIS L.* НА ЗАЛЕЖНЫХ ЭКОСИСТЕМАХ / Прикарпатский национальный университет им. Василия Стефаника, 76018, Украина, Ивано-Франковск, ул. Шевченко, 57

Исследован механизм ступенчатого захвата территории сосной, который происходит в результате непериодического выжигания сухой травы на залежах Приднистерского Ополья. Скорость захвата территории зависит от частоты и силы пожаров на залежах. Уничтожение огнем надземной части растительности залежей делает доступными эти земли для самосева сосны. Впоследствии происходит смещение внешней границы насаждения в глубину залежи. На основе анализа пространственной структуры создана схема распространения сосны на исследуемой территории.

Ключевые слова: пожары, залежи, распространение сосны, облесение залежей.

INTRODUCTION

The fire as an ecological factor has a significant impact on the performance of the ecosystem. This influence is dualistic – on the one hand, it leads to depletion of the species composition of the groups, on the other hand there is a number of phytocenosis that can exist only under the influence of fire [6]. The special role of fires is that they are stimulators of flash natural storation of pines. This fact lies in basis the so-called hypothesis of impulse pyrogenic restoration and stability of pine groups [4]. The basis of the hypothesis and ways of its use were laid by a number of authors [5] in relation to the pine forests of the forest zone of Western Siberia. The main mechanism of impulse pyrogenic restoration of pine forests is the mosaic-step structure of their woodstate, which is formed as a result of repeated fires. This theory is quite fair to the main part of the habitat of the pine common, where this species is the main forest-forming breed.

The aim of the work was the investigation of the successional processes on the fallows, ascertaining of the role of fires in the pine plantations moving into the depths of the meadow territory.

METHODS OF RESEARCHES

Based on theoretical data and on our own reseches, we investigated the effect of the pyrogenic factor on the restoration of the pine in the area where it does not occupy a dominant position. In particular, we studied successional processes on the fallows of Transdnisteria Opillia (Ternopil region), where the pine has entered in a rigid competitive struggle with herbaceous and deciduous species in the process of reforestation of the fallows.

The area of our reseach is a hilly locality, which is quite fragmented (Fig.1). Agricultural fields alternate with forests and thrown areas – fallows? a lot of which is concervated by inoculation or reforestation.

Fig. 1. The fallows of Transdnisteria Opillia

The research was carried out on the territory where there was sometimes spring or autumn fall of dry grass on the fallows. On some areas fall entered in pine plantations, which are directly bordered on the following fallows. We compared the areas where the base fire took place and where it was not. The parameters of dynamics of groups were investigated. For this purpose, there were laid transects that stretched from the maternal plant wall to the depths of the fallows until the place where no pine seedlings were met. Also along the transect we laid fixed platforms (20 × 40 m), where we calculated the number of pine trees, their age and condition, and measured morphometric parameters [7]. Plants of pine were identified by the method of periodization of ontogenesis of wood species [1] (Fig.2). Vital status was indetified with the scale of the state category adopted in the forest pathology. The mass of 1000 pieces of completely dry needles was calculated using the thermogravimetric method, using the moisture scales AXIS ADGS°200.

Fig. 2. The measurement of morphological parameters of plants

RESULTS OF THE RESEARCH

At the top of the hills of the investigated area, which are unsuitable for the agricultural use, there are pine plants aged 70 years, which reproductive potential and the ability to regenerate we have researched. As the soils in this area are limestoned, they are easily subjected to mineralization due to the influence of environmental factors, so the overgrowth of the slopes with the pine is in the direction from the top of the slope (the parent plant) to its foot. When the steepness of the slope becomes more flat, the thickness of the soil and turf on it is greater than at the top, the pine compete with herbaceous species. Pine seeds can not get fixed in the soil, because they can not break through the litter, and single sprouted seedlings suffer from oppression from herbaceous species by shading. This leads to inhibition of the growth of such individuals and their death. However, after burning of herbs (intentional or occasional) the pine has an opportunity for active development of living space. The fire destroys an overland part of herbaceous plants, their seeds, litter and bare the soil, making it more accessible to the seeds of pine. Periodic burning of herbs (in spring or autumn) leads to a reduction of phytomass with herbage by 20-60 %, a total projective coating of 10-40 %, and the height of stems of herbaceous plants decreases by 1,5-2 times (2.3). The variety of herbs decreases, their pressure is weakened on the depressed species such as pine. The time that grass needs to be restored allows the pine seed to germinate massively and consolidate the territory for itself. The number of seedlings at the area after the fire is quite significant (7,7-9,5 thousand/ha.). Selfseedings form on a scorched area a thick “brush”, later they come in the stage of the undergrowth.

We can argue that the studied of pine group have a peculiar spatial structure, which is a key factor in the process of resettlement. Three zones are visually observed from the woodstand wall, each of which is formed by plants of approximately the same age and the same size. The first zone is a band approximately 70 meters wide, where the formed structure of the woodstand is visible. The virgin (v1, v2) and young generative (g1) individuals are grouped into compact groups of 9-36 individuals (trees). The earth in the middle of these aggregations is spread with a layers of fallen pinenidles in the thickness of 5-7 cm. Virgin, imaturic (im1, im2) and juvenile (j) individuals (plants), as well as sprouts (p) are commonly encountered on the thinned out areasoutside the clusters. Fallen pine nidles do not cover the ground completely, there are herbaceous plants. From the calculation we can see the density of pine species in this zone is 5438 ± 0.54 individuals (trees) per hectare. The height of the plant create several tiers. The lowest is up to 1m. It is formed by the numeral immaterial and virgin individuals (trees), the bulk of plants has a height of 7-11 m., Some individuals rise to 14-15 m. The tree stand status index is 2.06.

The height of most individuals is lower (2,5-4,5 m) in the second zone. Most often are found individuals aged 10-11 years, virginal and intolerant individuals sprout in groups of 6 to 9 trees. Single plants are more evenly distributed over the territory of the zone, therefore, the mosaic is slightly different than in the zone number 1. There is no unbroken layer of fallen pine nidles, but there is a large number of juvenile individuals (j) and seedlings (p). The tree stand status index is 1,8.

There are no clearly defined clusters of pine species in the third zone. The contrary, isolated individuals are unevenly located on the territory, creating a “wavy border” with a change. The influence of the edge effect is observed in this zone. There is a large variety of herbaceous plants and significant phytomass. The density of the grass and the considerable turfed soil are the factors that inhibit the further propagation of the pine tree.

Values of individual morphometric parameters of *P. sylvestris* plants are given in the table 1.

Authentic positive correlation was found between the length of the needle and the weight of 1000 pieces of completely dry needles for both areas (the coefficient of correlation r is 0,93 and 0,90, in accordance); between the number of needles at 10 cm of a sprout and a mass of 1000 pieces of needles ($r = 0,81$ and $r = 0,83$, in accordance). The correlation is observed between the plant height and the diameter of their stem ($r = 0,61$ and $r = 0,63$).

Table 1 – Values of individual morphometric parameters of *P. sylvestris* plants on the fallows of Transdniestra Opillia

№	Morphometric parameters and their units	Sampling point	
		Fallows	Maternal planting
1	Mutations number, pcs	5,5 ± 0,70	4,7 ± 1,4
2	Needle length, mm	73,7 ± 8,14	65,5 ± 6,65
3	Amount of needles per 10 cm sprouts, pieces	130 ± 0,91	127 ± 0,87
4	Weight of 1000 needles, g	7,63 ± 0,20	6,23 ± 0,15

The coefficient of variation for most morpho-parameters is $v > 10$ %, so we can come to a conclusion about the high level of plasticity of the dimensional values of the *P. sylvestris* in various groups of Transdniestra Opillia.

Based on the obtained data, we can construct a scheme for the distribution of pine trees in these areas. The first wave occurred 25 years ago by mass germination of self-seeding on mineralized slopes of the hill directly near the wall of the parent planting. Gradually, the main mass of seedlings, individual plants increased significantly in size and began to suppres those species which have lagged in growth. Due to the lack of sunlight, the bulk of seedlings died, and remained seedlings were formed on the captured territory a peculiar "mosaic" structure of the woodstand, it means conglomeration of individuals and small meadow with several trees. The further promotion of the diaspora was hampered by the dense herbage. However, a fire destroyed the grass cover, litter, exposed the soil. At the same time, a certain number of young pines was damaged, but significant areas became available for fixing and germination of pine seeds. Bulk of germinatings secured a fairly significant band for the pine, but in the process of intraspecific competition there were a significant drop out seedlings. However, this allowed to form another lane with a characteristic mosaic placement of pine species in it. In addition, only some individuals of the pine managed to survive on part of the territory that directly bordered on the fallows, the rest were eliminated by herbaceous or shrub species, which also began intensively to recover after burning.

The next wave of pine propagation occurred in 2014-2015. A number of fires took place on the experimental areas in summer-autumn period. They cleared the ground part of the soil from vegetation. Individual pines from the third zone also suffered from damage, about 20 % of them died. Massive germination of seedlings was observed in the cleared by fire areas in spring. The limit border "fallow-pine plantation" moved toward the fallow at 23-38 meters.

CONCLUSION

Thus, non-periodic burning, which occurs on the fallows of Transdnisteria Opilia, is a factor that allows pine to capture the territory, creating bands or zones with a predominance of individuals of the same age and development. It is so-called gradual spread. Even if the underlying fire deeply enters into the pine plantings, it still allows the species to recover quickly. In the damaged generative individuals accelerates rapidly the maturation of cones and seeds, and in the spring the density of self-seeding increases sharply, which compensates for the loss of the group due to the fire and leads to an increase of the territory occupied by this species.

We can conclude that minor fires that destroy the main mass of grass cover are a mechanism for weakening of the competitive pressure of meadow species on the pine and rather contribute to the widening of this species on fallows.

Further investigations allow us to use the hypothesis of impulsive pyrogenic restoration and stability of pine groups for successional groups on the fallows of Transdniesteria Opilia. After receiving the data about the dynamics of the group development, we can provide its development. We will receive natural forest bands between agricultural lands on condition of the transition of planting to stable woodstands with a characteristic structure. It allows to suspend degradation processes in hilly areas by the eliminating of the slopes cultivation with their subsequent reforestation provided by the National Action Plan for struggle against land degradation and desertification for 2016-2020.

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