International Journal of Recent Advances in Multidisciplinary Topics
Volume 5, Issue 8, August 2024
https://www.ijramt.com | ISSN (Online): 2582-7839

Phytocoenotic Analysis of Forest Plant Associations in Dry Boreal Forests of the Drevlyansky Nature Reserve

Volodymyr Ustymenko*
Associate Professor, Department of Ecology and Nature Technologies, Zhytomyr Polytechnic State University, Zhytomyr, Ukraine

***Abstract*: The article presents the results of a study of the species composition and phytocoenosis structure of the forests of the Drevlyansky Nature Reserve. The main attention is paid to the analysis of growing conditions, components of vegetation layers and the main species that form these ecosystems. The main phytocoenoses are separately identified: lichen pine forests, thyme-lichen forests, and hair-polytrich forests, which are characterized by low stand completeness and significant fire hazard. Lichen pine forests were the most widespread, occupying 92.37% of the reserve's dry boreal forest area. The specific ecological conditions that contribute to the formation of these phytocoenoses are described, and their high representativeness for Polissia is noted. The importance of preserving these natural complexes as part of the region's biodiversity is clearly defined.**

***Keywords*: biodiversity, lichen, pine forest, protected areas, vascular plants.**

1. Introduction

The average forest cover in Polissya of Ukraine is 32.1%, with pine, pine-oak, oak-hornbeam and alder forests (Buzun *et al*, 2018).

The forest fund of Polissia is characterized by a predominant number of coniferous plantations, which occupy 50% of its territory. In particular, Scots pine (*Pinus sylvestris* L.) is the dominant species in these plantations. Scots pine is one of the most common tree species in the forests of Polissia and in Ukraine in general. This species is highly adaptable to different environmental, climatic and soil conditions, so it can be found in most forest types of Polissia.

Pine forests in Ukraine grow in the highest areas with poor sandy sod-podzolic soils, which provides them with less competition from other plants. Green moss forests occur on wetter soils, while lichen pine forests are found on dry soils. In the wettest conditions, blueberry pine forests with highly productive stands can be found. In terms of area, green moss pine forests predominate in Ukraine, followed by birch forests, which mainly consist of young trees (Ivchenko, 1978).

The vegetation cover of the forests of Zhytomyr Polissya is an important subject of research, as they are one of the key components of the eco-system of this region, both in terms of the occupied area and functional significance (Koval *et al*, 2005).

Boreal forests (hereinafter Bors) are one of the poorest forest trophotopic zones in Ukraine, and their genetic affinity is associated with fluvio-glacial sand deposits that arose during the post-glacial era, as well as with characteristic accumulative landforms such as lakes, dunes, and the sides of glacial valleys. It is noted that boreal forests are predominantly distributed in the northern part of Ukrainian Polissya. The total share of bors in the forested area was 12.6 %, including dry bors - 1.5 %, fresh bors - 7.7 %, wet bors - 1.7 %, raw bors - 0.8 %, wet borers - 0.9 % in Zhytomyr Polissia (Martynenko *et al,* 2020).

According to National Agency for Forest Resources of Ukraine the forest areas of Narodychi district consist mainly of fresh boreal forest (29.0%), sub-boreal forest (30.6%) and wet sub-boreal forest (26.7%). However, this distribution is not typical for the entire Zhytomyr region, as sub-boreal conditions dominate in the western part of the region, and this area is characterized by sod-podzolic clayey soils. In the southern part of the region, degraded soils and chernozems contribute to the formation of oak woodland and sub-bog conditions.

2. Material and Methods

The study was conducted on the territory of the Drevlyansky nature reserve in 2019-2020. The Drevlyansky Nature Reserve is located in Narodychi district, Zhytomyr region, southeast of Narodychi village, Ukraine. The territory of the Drevlyansky nature reserve is structured mainly by forest ecosystems that were previously part of the State Enterprise Narodytske Specialized Forestry. According to the comprehensive forestry zoning of Ukraine's forests, the plant is located in the Polissia forestry zone of the Western and Central Polissia Forestry District. In terms of physical and geographical zoning, the territory of the Reserve is located in the zone of mixed forests in the Kyiv region of Narodytsko-Ivankivsky district, and partially in Norinsko-Zherivsky district of Zhytomyr Polissya (Ustymenko, 2019).

The total share of bors in the forested area is three times higher than in Zhytomyr Polissia in general, and amounts to 38.67 % (5808.2 ha), including including dry bors - 2.81%, fresh bogs - 35.72%, wet bors - 0.10%, raw bors - 0.04%, wet

*Corresponding author: vovaustimenko@gmail.com
DOI: 10.5281/zenodo.13342067

bors are absent on the territory of the reserve.

A significant area of forests (13633.5 ha) is covered with Scots pine (*Pinus sylvestris* L.), which is 90.76% of the total area. The rest of the forest area is occupied by: hanging birch *Betula pendula* Roth. - 741.4 hectares (4.94%), *Alnus glutinosa* L. Gaertn. - 463.1 hectares (3.08%), *Quercus robur* L. - 144.9 hectares (0.96%), and several other species whose share in the composition does not exceed 0.5%. The territory of the reserve consists of 13 edaphotopes. Among the trophotopes, there are all but oak forests, and among the hygrotopes, all levels of humidity are expressed. The largest area in sub-boreal conditions according to the trophotopic series is 8521.0 ha, and the smallest - in the sub-humid conditions - 691.9 ha (4.60 %).

The study of the flora of the Drevlyaskyi nature reserve has been conducted since the reserve was founded. The flora of vascular plants of the Reserve, according to the results of the previous research conducted in 2016, includes 720 plant species. According to preliminary estimates of scientists, the modern vascular plant flora of the Drevlyansky Reserve may include more than 900 species (Martynenko, 2021).

Several routes were laid out that passed through different parts of the dry bogs of the nature reserve. The routes covered both areas that are typical of dry bogs and those that may contain variations in species composition due to differences in microclimatic conditions or topography.

Sample plots were established at regular intervals along the routes to allow for a more detailed study of the plant composition and association structure. These were squares or circles of a certain size of 10x10 m, where an inventory of all plant species was carried out, and estimates of projective cover, plant height and tree trunk diameters were made.

To study changes in vegetation cover from the peripheral to the central zones of the boreal forest in more detail, the transect method was used. Regular measurements were made along straight lines through the plot and vegetation characteristics were recorded. This made it possible to identify gradual changes in the floristic composition and structure of plant associations at different distances from the edge of the boreal forest.

3. Results and Discussion

During the study of species composition, we analyzed the composition of phytocoenoses typical for the boreal forests of the nature reserve. Dry forests in the Reserve are characterized mainly by flat, leveled areas with poor, dry soddy-weakly podzolic sandy soils with an underdeveloped humus-eluvial horizon and a water table depth of 4 m or more. Geographically, the largest number and total area of their plots is in the southeastern part of Narodytske forestry, with a smaller number in Zalishche forestry and a small number in Klishchivske forestry of the natural area.

The mentioned edaphotope occupies 7.26% of the area of the Reserve's forests. The native type in such conditions is pure plantations with the dominant species of *Pinus sylvestris* L., and only as a rare exception - with the rare participation of *Betula pendula* Roth. Depending on the shape of the landscape, in a dry boreal forest, the scots pine often has curved and twisted trunks. As a rule, these forests are characterized by the age of 50-60 years, older forests in this type are very rare, as they are extremely fire-prone.

Undergrowth, as a rule, does not form a continuous layer in dry forests, but is represented by single specimens *Chamaecytisus ruthenicus* (Fisch. & Woł.) Klásková, *Chamaecytisus pineticola* Ivczenko, *Genista tinctoria* L.. In the Drevlyansky Nature Reserve, the floristic composition and coenotic structure of the lower levels of vegetation is determined by the types of phytocoenoses that form in dry forests. Among them, lichen pine forests *Pinetum cladinosum* prevail in the Reserve, thyme-lichen pine forests *Pinetum thymoso* (serpylli)-*cladinosum* occupy smaller areas, and pine forests with *hair-polytrichosum* (piliferum) are found in small areas. This range of dry forest phytocoenoses is typical for Ukrainian Polissia, which indicates a significant representativeness and value of the Reserve's natural complexes.

On the territory of the Reserve, in lichenic pine forests (*Pinetum cladinosum*), there is a herbaceous-shrub layer, not dense, with a projected cover of 1-5 (10) %, uneven, clumped arrangement, with unexpressed dominance. Such species as *Jasione montana* L., *Thymus serpyllum* L., *Solidago virgaurea* L., *Koeleria glauca* (Spreng.) DC., *Dianthus borbasii* Vandas, *Festuca ovina* L., *Psammophiliella muralis* (L.) Ikonn., *Festuca polesica* Zapał., *Linaria genistifolia* (L.) Mill., *Arctostaphylos uva-ursi* (L.) Spreng., *Hieracium umbellatum* L., *Pilosella officinarum* F.Schult. & Sch.Bip., *Sedum acre* L. and *Helichrysum arenarium* (L.) Moench.

The basis of the living aboveground cover in lichen pines is formed by a layer of epigeous bushy lichens of the genus *Cladonia* with a projective cover of 65-95%. Among them, *Cladonia rangiferina* (L.) Nyl., *Cladonia mitis* Sandst. And *Cladonia gracilis* (L.) Willd. often dominate or co-dominate in the reserve. More than 10 more species of epigean lichens are found as a common impurity with a high constancy and projective coverage of 3 to 5%, including *Cladonia uncialis* L. (F. Weber ex F.H. Wigg.), *Cladonia crispata* (Ach.) Flot. and *Cladonia rangiformis* Hoffm.. Small cladonia, such as *Cladonia subulata* (L.) Weber ex F.H. Wigg., *Cladonia fimbriata* (L.) Fr., *cladonia deformis* (L.) Hoffm., *cladonia pyxidata* (L.) Hoffm.), etc. There is no moss layer in lichenic pine forests, although in the shade of pine crowns on the northern side there are common clumps of *Dicranum polysetum* Sw., *Dicranum scoparium* Hedw.) and in lighted areas with sandy outcrops - *Polytrichum piliferum* Hedw.

In the forest vegetation conditions of dry forests, thyme-lichen pine forests (*Pinetum thymoso (serpylli)-cladinosum*) in the Reserve occupy smaller areas than lichen pine forests. They are characteristic of forest edges and sparse areas of pine forests in conditions of slightly higher moisture. The stand consists of However, the grass and shrub layer is characterized by a much higher projected cover, which reaches 15-20 (30) %. The floristic composition of the tier is rich, with a pronounced dominance of *Thymus serpyllum* L. - 10 - 15 (20) %, permanent species with a projective cover of 1 - 3 (5) % are: *Festuca ovina* L., *Koeleria glauca* (Spreng.) DC. and *Pilosella officinarum*

F.Schult. & Sch.Bip.. The following species are found as assimilators: *Helichrysum arenarium* (L.) Moench, *Calluna vulgaris* (L.) Hull, *Anthericum ramosum* L., *Knautia arvensis* L), *Carex ericetorum* Pollich, *Hypericum perforatum* L., *Dianthus pseudosquarrosus* (Novak) Klokov, *Dianthus borbasii* Vandas, *Peucedanum oreoselinum* (L.) Moench, *Rumex acetosella* L., *Campanula rotundifolia* L., etc.

The basis of the living ground cover is formed by epigean bushy lichens, the projective coverage of which varies between 60 and 80%. The lichen layer is dominated or co-dominated by such species as *Cladonia rangiferina* (L.) Nyl., *Cladonia mitis* Sandst., *Cladonia uncialis* (L.) F. Weber ex F.H. Wigg. and *Cladonia gracilis* (L.) Willd. The moss layer is represented by separate small clumps of *Polytrichum piliferum* Hedw. and *Ceratodon purpureus* (Hedw.) Brid.

Pinetum polytrichosum (piliferum*)* pine forests occupy the driest habitats in the Reserve, with the poorest and driest soils. Their stands are usually low-completeness, with a fullness of 0.3 - 0.5. with no undergrowth. The herbaceous-shrub layer is very sparse, with a projective cover of 1-3%, often represented by individual specimens of oligotrophic xerophyte species, such as *Festuca ovina* L., *Corynephorus canescens* (L.) P.Beauv., *Jasione montana* L., *Pilosella officinarum* F.Schult. & Sch.Bip., *Sedum acre* L., *Helichrysum arenarium* (L.) Moench, *Thymus serpyllum* L., *Rumex acetosella* L., *Calluna vulgaris* (L.) Hill, *Hypericum perforatum* L., *Dianthus borbasii* Vandas, *Psammophiliella muralis* (L.) Ikonn., *Spergula morisonii* Boreau, *Scleranthus annuus* L., etc. Among the lower tiers of vegetation, the moss cover plays a decisive role, characterized by a projective coverage of 80-95%, where *Polytrichum piliferum* Hedw. dominates.

4. Conclusion

In the Drevlyansky Reserve, the most common are fresh boreal forests (92.37% of the area), dominated by Scots pine. Dry boreal forests occupy only 7.26% of the area, concentrated mainly in the southeastern part of Narodytske forestry.

Dry boreal forests are characterized by a diverse floristic composition, dominated by lichens of the genus Cladonia, which form a dense epigean cover. The herbaceous and shrub layer in these forests is usually sparse and uneven, with low projective coverage.

Three types of phytocoenoses of dry forests: lichen pine forests, thyme-lichen forests, and hair-polytrich forests were found on the territory of the nature reserve. Each of them has its own characteristics in terms of vegetation composition, the degree of development of different layers, and environmental conditions.

References

[1] V. O. Buzun, V. M. Turko, and Yu. V. Siruk, *Knyha lisiv Zhytomyrshchyny: istoryko-ekonomichnyi narys: monohrafiia*. Zhytomyr: O. O. Yevenok, 2018, 440 p. [in Ukrainian]

[2] I. S. Ivchenko, "Analiz dykorosloyi dendroflory Ukrainskoho Polissya," *Ukr. Bot. Zhurn.*, vol. 35, no. 1, pp. 46–50, 1978.

[3] N. V. Koval, R. I. Hural, and V. M. Rodenko, "Botanichni osoblyvosti lisiv Zhytomyrskoho Polissya ta yikh znachennya dlya lisovoho hospodarstva," *Naukovyi Visnyk NLTU Ukrayiny*, vol. 15, no. 10, pp. 96–100, 2005.

[4] V. V. Martynenko, "Ecological and fire characteristics of forest ecosystems of the 'Drevlyansky' Nature Reserve," *Scientific Horizons*, vol. 24, no. 1, pp. 85-92, 2021.

[5] V. V. Martynenko and V. V. Konishchuk, "The typological characteristics of Natural Reserve 'Drevlyansky' covered with forest vegetation of tree," *Agroecological Journal*, no. 3, pp. 33-40, 2020.

[6] National Agency for Forest Resources of Ukraine, "Public report of the State Agency of Forest Resources of Ukraine for 2019," State Agency of Forest Resources of Ukraine. [Online]. Available: http://www.dalru.com.ua/publ%D1%96chnij-zv%D1%96t-dalru-za-2019-rik/. [Accessed: Aug. 01, 2024].

[7] V. I. Ustymenko, "Vydove riznomanittya vyshchykh sudynnykh roslyn svizhykh boriv pryrodn'oho zapovidnyka 'Drevlyansky'," *Naukovi Horyzonty. Scientific Horizons*, no. 7(80), pp. 75–79, 2019.