Ya. Didukh

BASIC SCIENTIFIC PRINCIPLES AND CRITERIA FOR THE PROTECTED AREAS FORMATION AND ASSESSMENT

The 12 fundamental principles (consistency, diversity, representativeness, dimension, environmental friendliness, functionality, regularity, scientific, etalon, organization (structured) value and informativeness) and criteria (selection, value, dimension, vulnerability, integrity, sustainability, utility) have been defined and characterized, underlying organization and assessment of protected areas.

Keywords: protected areas, organization, assessment, principles, criteria.

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SPECIES FEATURES OF TREE GROWTH IN FOREST PHYTOCENOSIS assoc. *CONVALLARIO MAJALI-QUERCETUM ROBORIS* AT THE RESERVE "LISNYKY" OF NATIONAL NATURE PARK "GOLOSIIVSKY"

The study deals with the species difference in the growth rate of broad-leaved trees from association Convallario majali-Quercetum roboris. The ratio of tree growth in diameter to growth in height for different species is investigated. The relative growth rates of species could be relevant indicators for the growth processes in forest ecosystems. The role of species diversity and competitiveness as key factors in supporting of biomass and sustainability of forest plant communities is discussed.

Keywords: forest plant communities, tree growth rate, species features.

Deciduous forests in Ukraine are very diverse. They are formed by over 30 types of tree species, including oak hardwood (*Quercus robur*), beech (*Fagus silvatica*), birch (*Betula pendula*), alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*), and hornbeam (*Carpinus betulus*). Oak forests are typical for the Forest and Forest-steppe zones that form different associations depending on environmental conditions. According to the State Forest Resources Agency of Ukraine [2], forests cover 15.9 % of the country area. Forest area occupies 22.2 % in Kyiv region.

In recent years, most of the forest ecosystems researches [1; 4; 5] were aimed at studying of forest biological productivity and phytomass storage features for different types of forests, due to the

practical significance of such studies. At the same time, studies in Central Europe [6; 7] have shown that above-ground biomass of natural forests mainly related to the species diversity of trees, and less to the type of a forest. The aim of this study was to investigate the specific growth features of various tree species in natural oak plant community.

Materials and methods

The study was conducted during 2008 and 2015 on the site of deciduous forest represented by the association *Convallario majali-Quercetum roboris*. The plot is located in the floodplain of Siverka river in the nature reserve "Lisnyky" at the National Nature Park "Golosiivsky" sq. 12. Coordinates: N = 50º17′39,9″ and E = 030º32′57,3″, 101 m above sea level.

At the test site we found trees of oak, linden, ash, hornbeam and 3 species of maple. Several oak trees were more than 90 years old, but other species were represented by 30–40 year old trees.

The species distribution of trees on the site is presented in Fig. 1. Table 1 shows the number of trees that were taken into calculation. Trees with a diameter under 4 cm did not account for the statistical analysis. Also, pear trees (*Pyrus*) were not included in the analysis due to a small number on the site. Measurement of trees diameter was provided according to standard methods at a height of 130 cm, trees height determined by a portable altimeter B-3.

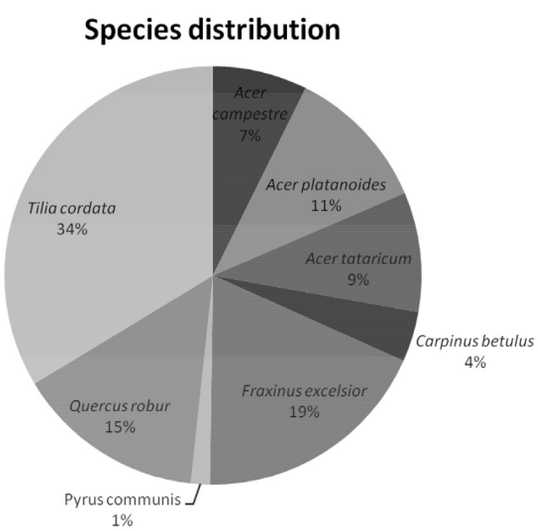

Fig. 1. Species distribution

Table 1. **Species distribution**

Species	Trees number
Acer campestre	15
Acer platanoides	23
Acer tataricum	19
Carpinus betulus	8
Fraxinus excelsior	38
Pyrus communis	3
Quercus robur	30
Tilia cordata	69

Results and discussion

The value of annual growth of diameter (ΔD, cm) and height growth (ΔH, m) is presented in Table 2. The annual linear growth in the diameter for different species had small differences (Fig. 2). It was the highest for oak and hornbeam (0.29 cm / year) and slightly lower than the average for the Tatar maple (0.15 cm / year). Annual linear growth in height showed greater differences between species, it was the largest in beech and ash (0.48 m / year) and the least in oak (0.26 m / year) and Tatar maple (0.35 m / year).

Table 2. **Species distribution**

Species	ΔD, cm	σ (st dev)	ΔH, m	σ (st dev)
Acer campestre	0.22	0.13	0.43	0.15
Acer platanoides	0.23	0.13	0.42	0.20
Acer tataricum	0.15	0.09	0.35	0.11
Carpinus betulus	0.29	0.08	0.48	0.08
Fraxinus excelsior	0.20	0.07	0.48	0.17
Quercus robur	0.29	0.18	0.26	0.13
Tilia cordata	0.22	0.09	0.45	0.19

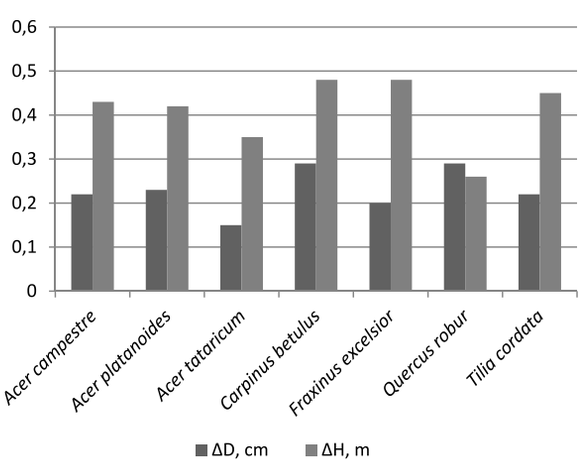

Fig. 2. Annual linear growth of the diameter (ΔD, cm) and height (ΔH, m)

Differences in annual linear growth may be associated not only with the peculiarities of specific

processes of growth, but also with the tree ages. Young trees have greater values of ΔD and ΔH. To focus on species peculiarities regardless of initial diameter and height, we also calculated relative annual increases in diameter (ΔD / D) and relative annual growth of height (ΔH / H). Results are presented in Table 3.

Greater diversity between species was observed when we analyzed relative growth. Hornbeam (0.033) and field maple (0.029) had grater relative annual increase in diameter (0.033 and 0.029), while the oak relative diameter growth was only 0.006. Similarly, the relative increase in height was the lowest (0.012) for the oak trees (Figure 3). For other species, the relative height growths were about 0.050–0.053.

Table 3. **Relative annual growth of diameter (ΔD / D2008) and height (ΔH / H2008)**

Species	ΔD / D	σ (st dev)	ΔH / H	σ (st dev)
Acer campestre	0.029	0.023	0.052	0.020
Acer platanoides	0.022	0.011	0.042	0.013
Acer tataricum	0.022	0.015	0.050	0.020
Carpinus betulus	0.033	0.009	0.052	0.016
Fraxinus excelsior	0.025	0.009	0.051	0.017
Quercus robur	0.006	0.003	0.012	0.007
Tilia cordata	0.024	0.012	0.053	0.023

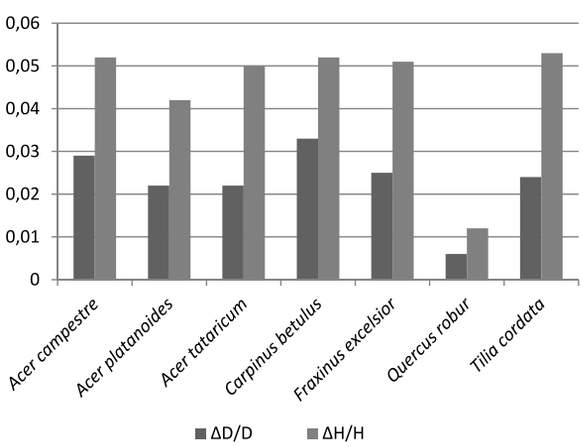

Fig. 3. Relative annual growth of diameter (ΔD / D2008) and height (ΔH / H2008)

To assess the general state of testing area, we calculated the ratio D / H as an indicator of tree stand "normality" by density [3]. This data were practically the same for all species (except oak) and tended to decrease with tree age (Fig. 4).

Table 4. **The ratio of diameter to height (D / H)**

Species	D / H 2008, cm / m	σ (st dev)	D / H 2015, cm / m	σ (st dev)
Acer campestre	1.02	0.20	0.89	0.13
Acer platanoides	1.07	0.23	0.95	0.21
Acer tataricum	1.04	0.22	0.89	0.17
Carpinus betulus	0.95	0.22	0.86	0.16
Fraxinus excelsior	0.90	0.16	0.77	0.12
Quercus robur	2.44	0.37	2.34	0.35
Tilia cordata	1.13	0.23	0.97	0.19

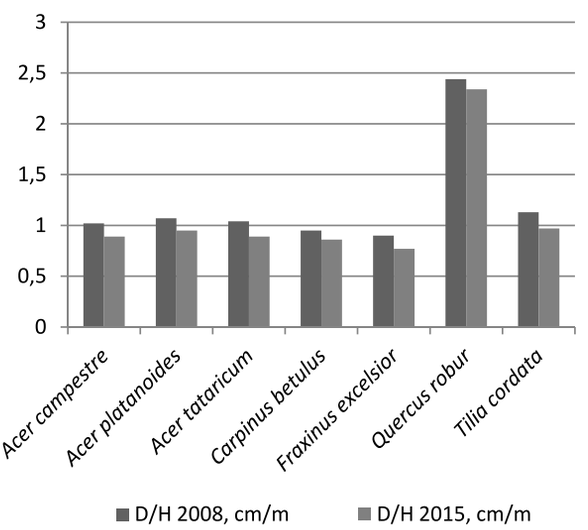

Fig. 4. The ratio of diameter to height (D / H)

The growth of oak trees, in general, has significant difference. Oak trees, as long living plant, have predominance in the accumulation of tree stand biomass due to its quick growth in diameter and relatively slow growth in height.

Conclusions

The study showed species differences in the growth rates of broadleaved trees. The highest linear growth in tree diameter was observed in oak and hornbeam trees, and the highest growth in height – in beech and ash. The oak trees growth in height was rather small. Features of growth and accumulation of biomass, obviously, are crucial to oak trees competitiveness and the role of ecosystem edificators in plant community.

As we see, the relative diameter and height increase is more species-dependent than absolute increase. So the values of ΔD / D and ΔH / H can be

recommended as the relevant indicators of growth processes in forest ecosystems. Another value – the ratio D / H – may serve as an indicator of a certain stability of the phytocenosis. The methodology used in the study can be useful in further investigations for the understanding of species diversity role in stability and biological productivity of the forest ecosystem.

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Вишенська І. Г.

ВИДОВІ ОСОБЛИВОСТІ ПРИРОСТУ ДЕРЕВ У ЛІСОВИХ ФІТОЦЕНОЗАХ ас. *CONVALLARIO MAJALI-QUERCETUM ROBORIS* ЗАКАЗНИКА «ЛІСНИКИ» НПП «ГОЛОСІЇВСЬКИЙ»

Показано видові особливості приросту діаметра та висоти широколистяних дерев ас. Convallario majali-Quercetum roboris. Встановлено видові закономірності співвідношення приросту дерев у діаметрі до приросту у висоту. Виявлено, що відносні показники приросту для різних видів є найбільш відповідними характеристиками ростових процесів у лісових екосистемах. Обговорюється роль видового різноманіття та конкурентоспроможності видів як основних чинників приросту біомаси для підтримки стабільності лісових фітоценозів.

Ключові слова: лісові фітоценози, приріст дерев, видові особливості росту.

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