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7.1. INTRODUCTION

Vegetation of Lithuania from the botanical-geographical point of view is in the junction of the zones of coniferous and broad-leaved forests. That is why the vegetation of swamps is azonic. Biological, geographical and ecological optimums of some species of swamps and their communities are to the north from Lithuania. Therefore, the vegetation of swamps is especially sensitive to the changes of ecological environment.

When investigating the ecological sustainability of the whole Baltic Sea basin it is important to ascertain if the tendencies of species extinction in all ecosystems are the same. They are distinct in coniferous forests and swamps. Intensive changes take place in the freshwater ecosystems, as well.

In 1970 it was suggested to start the investigation of selected species in order to accumulate reliable data on the change of their production and other parameters in the distribution area. These investigations have been continued on since then.

The aim of the investigations analysed in this study is to ascertain the state of art of the model plants and animals species in Lithuania, in neighbouring countries and in the whole Europe. It is important to determine if the noticed extinction of many species and the reduction of their sustainability is a local, regional or global phenomenon.

Long-term investigations of model species and the analysis of the results accumulated in the database have showed that a number of species in the zone of their ecological optimum (ZEO) distinguish themselves by the highest sustainability. The regularity of the change of a number of parameters of model species in time and space has been determined. It has been found out that the coordinates of the ZEO of species periodically "move" under the impact of long-term, global cyclically recurring processes.

Investigating the change of vitality of the population of a species in one region we have to investigate it considering the tendencies of the change of parameters of populations and individuals in the whole distribution area. For land fauna and flora on the territory of Lithuania we can determine only phytocoenotic and biotopic ecological optimums of model species. For water flora and fauna the ecological optimum correlates with vertical optimum (the spread of the population of a species in a certain depth).

7.2. RESULTS AND DISCUSSIONS

Edafic optimum and increment fluctuation of *Pinus sylvestris (L.)*. The climatic changes which have recently taken place are probably a natural phenomenon. As dendrochronological data showed (see also Chapter 8) they appear approximately every 22 years under the recurring rather favourable climatic conditions - warm hydrologic years sufficiently "supplied" with precipitation. 1989, 1990, 1991 years demonstrated that. Statistical data show that in earlier years as well as at present in the slope of the fall of Solar activity and in the minimum of it the tree-rings in XXth century are narrow or in the best case - average.

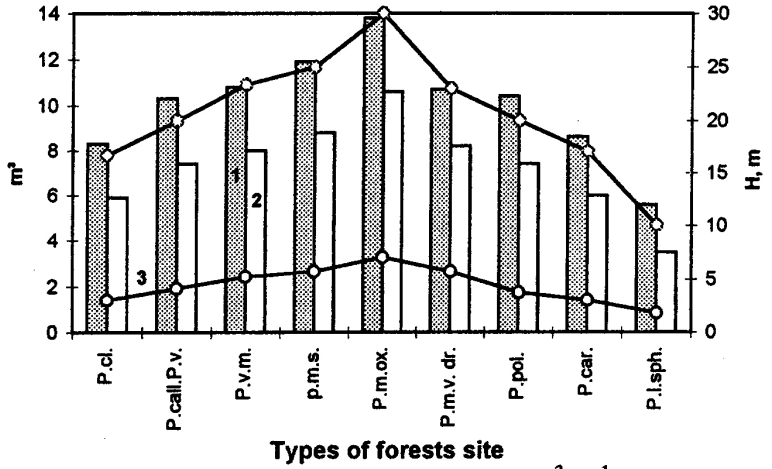

Fig. 7.1. Productivity of *Pinus sylvestris:* Increment (m^3ha^{-1}) under optimum and pesimum conditions. 1 - the optimum of increment; 2 - the average of increment; 3 - the pesimum of increment

Fluctuations of the increment of pines in the "normally" humid soils reflect the 11 years rhythm, in less humid soils - 13 years rhythm, and in swampy places - 22 years rhythm. Depending on the Solar activity (when its amplitude is high, in 22-year cycle) maximum fluctuations of a radial increase take place. Most significant falls of an increase in normal and swampy places reflect themselves in 22-year cycle after the second Solar activity maximum and in the phases of a decrease of the Solar activity. It was observed in 1991-1996 during the 22nd Solar activity cycle. Fig. 7.1 demonstrates the volume (m^3ha^{-1}) and high (m) increment of 80 years old pine stands growing in different site conditions. In Figure one can see large differences in increment when trees are growing during climatic optimum (1) and minimum (3).

Edafic optimum of swamps species. There are investigated 3 ecological groups of the species of swamps: species, growing only in swamps (*Eriophorum gracile, Carex chorodorrhiza, Carex diandra, Oxycoccus palustris*); species, growing in swamps and in mineral ground in the same climatic zone (*Pinus sylvestris, Calluna vulgaris, Pleurozium screberi*); species which grow in swamps or mineral soils in different climatic zone (*Betula nana, Ledum palustre, Andromeda polyfolia*). It was found that in the temperate zone of Lithuania the species *Saxifraga hirculus, Tomenthypnum nitens, Campylium stellatum* grow only in eutrophic limy swamps. In tundra they grow widely in dry acid soils. The phytomass of mosses (up to 48%) dominates in oligotrophic habitats, whereas the phytomass of grasses and bushes is low. The layer of grasses and bushes produces some 30% - 32%, and the layer of mosses produces from 19 % in eutrophic habitats to 24% in mezotrophic habitats. Consequently, edafic optimum of the species investigated was assessed (Fig. 7.2).

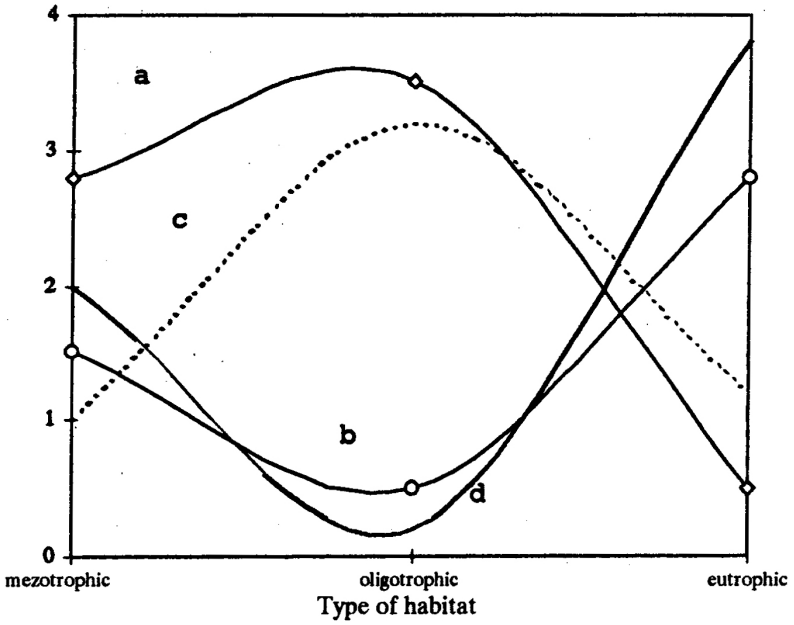

Fig. 7.2. Ecological optimum of selected species in swamps of different trophicity. 1-4 - scores of the abundance - coverage scale according to Braun-Blanquet. Selected species: *a - Eriophorum vaginatum ; b - Sphagnum angustifolium; c - Sphagnum magellanicum; d - Sphagnum cuspidatum*

Relation of selected species with the water acidity of ecotopes. Vitality and abundance of the populations of the species of swamps are related with the acidity of the water of swamps. The ecological distribution area in the swamps is considerably wider than the distribution area of predominating edificatory species of the community. That is why the relation with the concentration of water acidity does not always correspond to the trophicity degree. For example, Ledum palustre reaches its biological optimum of the population in the swamps of Lithuania in the oligotrophic Ledo-Pinetum community, whereas the species in single bushes grow in eutrophic and mezotrophic swamps. In the communities of Molinio-Pinetrum of mineral forests they make abundant populations.

It should be noted that the optimum acidity zone for the growth of species considerably differs in different climatic zones. In borealic zone all selected species grow in a considerably wide acidity zone: pH 2.5-5.1. In Lithuania this zone is rather narrow, especially for the species growing only in swamps. E.g., the pH growth zone of Sphagnum fuscum in Lithuania 3.5 - 4.2 in borealic zone - 2.5-4.3. Carex limosa in Lithuania is 2.8 - 3.5, in borealic zone - 2.3 - 3.7; Chamaedaphne calyculata in Lithuania - 2.3 - 3.7, in borealic zone - 2.0- 6.0.

Zones of ecological optimum for the Charophyta species. On the basis of recent investigations and literature data the ecological optimum zones for the Charophyta species have been ascertained. Optimal conditions for *Chara aspera* growth are in mezotrophic lakes. The most abundant population of the species is observed at 1-2 m depth on mineral ground. Populations are formed of sterile and fertile individuals of 10-20 cm height.

Fig. 7.3. Zones of ecological optimum of *Charophyta* species in waters of different trophicity. (In the axis of ordinates - abundance)

The most abundant populations of *C. tomentosa* have been observed in eutrophic lakes at 1-3 m depth on organic ground. Fertile individuals of 50-80 cm height were of the greatest abundance. *Nitella opaca* can be characterized as the species of a wide ecological amplitude (Fig. 7.3). The most abundant were the populations of sterile individuals of 30-80 cm height. Such populations have been observed at 3-6 m depth on organic ground in the lakes of various types.

The most suitable conditions for the surviving of charophyta are in large mezotropic or polytropic lakes, which are characterized by various ecotopes. Namely, in such types of lakes the ecological niches for various species can be found. The possibility for the great variety of forms of the same species exist there as well.

Specific gravity of the population of *Vimba Vimba L.* fry in the coastal ichthyocoenosis. It has been determined that the following factors have the influence on the density of *Vimba* fry: yield of a river, water level, water temperature in March-April, the quantity of suspended matter.

When investigating the abundance of vimba fry in the biotopes of different types it has been determined that river bays with sandy bottoms covered with a thin layer of silt correspond to optimal conditions.

According to the long-term investigation data the most favourable biotopes for Vimba fry are in the Šventoji river at the Širvinta confluence, in the Nemunas river at Vilkija and in the Neris river at Antaviliai. Their greatest abundance per area unit has been determined there.

7.3. CONCLUSIONS

The investigations of species abundance and the change of their productivity in the zone of their ecological optimum (ZEO) widen our knowledge about the regulations of the change of biodiversity.

Abundance, growth rate, production and other parameters of selected species moving from ZEO (within certain limits) regularly decrease.

For explaining the perspective of conditional sustainability and preservation of species the long-term investigations in ecological optima and pesima are necessary.

The formation of the radial increment of conifers is limited by cold autumns, winters, late springs, cool first summer months. The shortage of humidity in spring and at the beginning of summer negatively influences the late formation of wood. Warm winters, early and warm springs, damp and warm summers as well as warm autumn months optimise the formation of the radial increment of conifers.

Trophicity, level of ground water and water acidity are the main ecological factors for the existence of the species in the swamps. Phytogeographical optimum of species in the swamps of different trophicity has been determined. The attachment of selected species to water acidity of ecotopes has been ascertained.

Most favourable conditions for development of *Charophyta species* are in big mezotrophic lakes having a wide diversity of ecotopes. Comparing the data of recent investigations with the data accumulated in the middle of the century it was ascertained that the distribution area of *Charophyta* population decreased. 3 zones of the ecological optimum of *Charophyta* species have been indicated.

Long-term investigations of selected species of *Vimba vimba (L.)* showed that the usage of the complex of biotechnical and protectional measures stabilized its disappearance and increased the perspective of preservation.

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