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**GROUND COVER VEGETATION DEVELOPMENT IN *HYLOCOMIOSA*  
FOREST SITE TYPE AFTER THE CLEARCUT**

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**ABSTRACT**

Most of the ground cover vegetation descriptions given for characteristic of certain forest site types are made for mature forest stands. However the site type estimation for the practical forest inventory needs knowledge about the vegetation in every age class of forest. The clearcut as an artificial forest disturbance causes dramatically changes in plant community. Especially fast changes proceed during the first years after the clearcut. Due to increase of temperature and nutrient availability there proceeds several processes causing significant changes in ground cover vegetation. In 2015 a research was started to clarify the changes in ground cover vegetation in *Hylocomiosa* forest site type. This forest site type is most abundant in Latvian forests taking around 22%. The dominant tree species in *Hylocomiosa* is Scots pine (*Pinus sylvestris* L.) although the silver birch (*Betula pendula* Roth), Norway spruce (*Picea abies* (L.) Karsten) and aspen (*Populus tremula* L.) can form a tree stand there. The chronosequence method was used by providing the inventory at 5 tree stands dominated by pine. Six sample plots at each forest stand with size of 10 m<sup>2</sup> were established. The point-square method by using of 1mm thick and 1m high metallic needle was used for registration of plants at each square of sample plot. The inventory showed significant changes of species composition and projective cover of moss species and caulescent plants. The results of calculation of the Ellenberg's ecological values and Tschekanovsky coefficient suggest of appearance of plants with another attitude to the ecological factors.

**Keywords:** *forest typology, ground cover vegetation, hylocomiosa forest site type, clearcut.*

**INTRODUCTION**

Forest site type merges similar growth conditions and describes how to recognize them. Latvian forest site type descriptions are obtained for age of pre-mature and mature forest stand (Buss, 1981). However, till up to now, there is little knowledge about the ground cover vegetation succession during all the forest rotation cycle.

The forest typology in Latvia started in the beginning of 20<sup>th</sup> century when I. Gutorovics for the first time defined forest site types in Latvian according to the specific growth conditions and the tree stand parameters (Sarma, 1954). In 1920 K. Melderis established grounds of Latvian forest typology and during the time several forest scientists (Kirsteins, 1926; Sarma, 1954; Buss, 1976) upgraded descriptions of forest site types which included biological and silvicultural information for various forestry actions in forest. K. Buss (1981) summarized forest typology information available in Latvia that forestry field is using even in nowadays. In Latvia is used complexed or ecosystematic forest site type classification where description is consistently coordinated demands of forest biology, ecology and silviculture (Liepa *et al*, 2014).

The present research aim is to estimate the succession of ground cover vegetation in *Hylocomiosa* forest site type with Scots pine (*Pinus sylvestris* L.) as a dominant tree species which is one of advisable tree species growing in this forest site type (Liepa *et al*, 2014). This forest type is called *Pinetum hylocomiosum* (Sarma, 1954) which is forest site type on dry mineral soil with well-aerated medium fertile sandy loam, loamy and clay soil. The texture class depends of soil parent material, geographical location and hydrological regime (Buss, 1981).

### MATERIALS AND METHODS

To clarify this scientific question was the *chronosequence method* used which assumes that different sites are similar except in age (Johnson and Miyanishi, 2007), when the forest stands of the same forest site type and dominant tree species at different ages in different places are taken. For the beginning we took forest stands of the first 5 years after the clearcut. Six sample plots with size of 10 m<sup>2</sup> per each forest stand (see Fig. 1) – clearcut were established in indicative – hillock, plain and decline places.

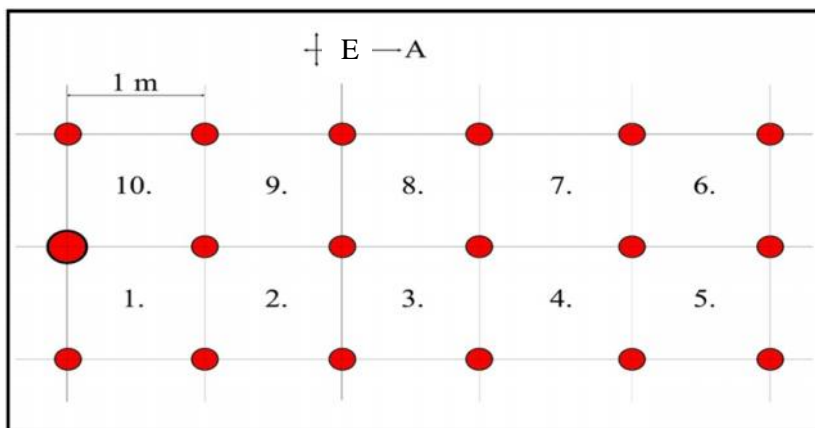


Figure 1. Structure scheme of sample plot.

Both, the Brown-Blanquet (Wikum and Shanholtzer, 1978) and the point-square methods by accounting of ground cover plants were used. Species with coverage of 2 % or smaller are counted together in section “Other”. Twenty sticks of 1 mm thick metallic needle were made in each square to estimate the taxonomic structure and abundance of plant species.

The ecological values of Ellenberg (Ellenberg, 2009) were used to describe the environmental status of each site. The coefficient of Tschekanovsky was used to estimate the difference between plant communities in forest young growths of different age. The forest site type investigated was the *Hylocomiosa* site type with Scots pine (*Pinus sylvestris* L.) as a dominant tree species. This forest site type is dominant in forests of Latvia, taking 20% of total forest area (State Forest Service, 2015).

### RESULTS AND DISCUSSION

The results suggest considerable changes in taxonomic structure and abundance of ground cover plants in first years after the clearcut (see Figure 2. – 4. ). Visual differences are visible in Fig. 2.



Figure 2. *Pinetum hylocomiosum* mature stand (a), first year after the clearcut (b) and pine young growth 5 years after the clearcut.

During the first two years after the cutting the average height of ground cover plants reduces by 3.25 cm. Later the height of ground cover vertical structure increases. In five years old clearing it is 8.25 cm bigger than in stand before cutting. There are registered changes in vascular plants, mosses, lichens and trees projective covering's proportion.

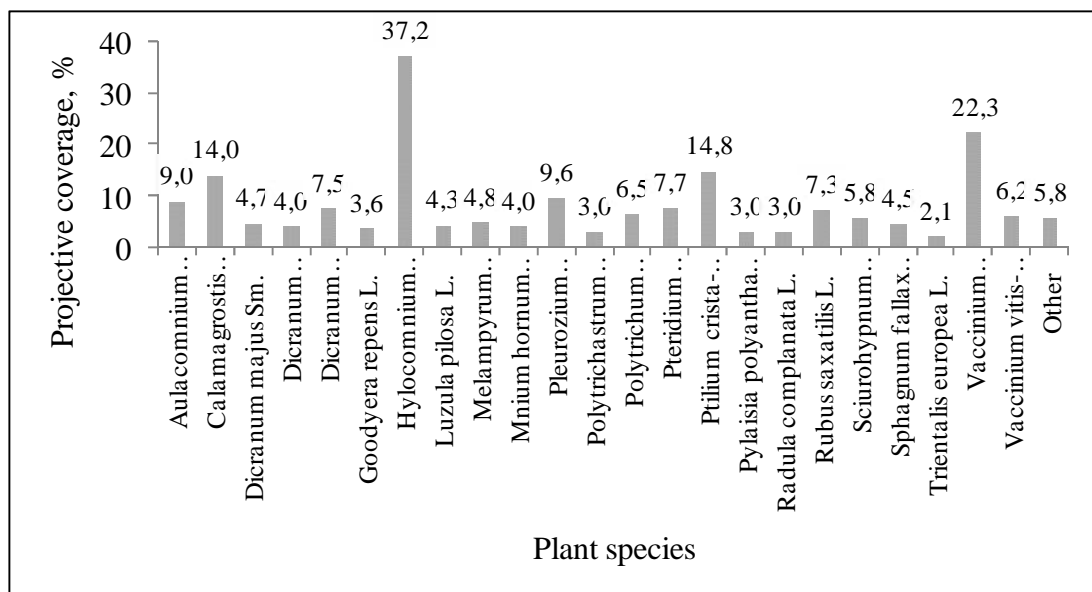


Figure 3. Projective cover of plants in mature *Pinetum hylocomiosum* forest stand before the cutting.

Mosses in mature pine stand are most often encountered species (see Fig. 3). From all ground cover and regrowth species average projective coverage of one moss species reaches 19.86 %. One tree and vascular plant species projective coverage is equal – 10.35 % and 10.58 % but comparatively small was lichen projective coverage of one species.

During forest felling used heavy machinery decrease coverage of understory trees, shrubs and larger vascular plants but instead increases sun-demanding plants, also moss and lichen coverage. The splendid feather moss (*Hylocomium splendens* Hedw.) one year after clear cut stays with largest projective covering (see Fig.4). Other *Hylocomiosa* forest site type ground cover plant species are observed but in different proportion comparing to mature pine stand. Projective coverage proportion after both registering methods increased for red-stemmed feathermoss (*Pleurozium schreberi* Brind.Mitt.), wood cow-wheat (*Melampyrum nemorosum* L.) and reed grass (*Calamagrostis arundinacea* L.) but using point-square method also notable projective coverage gained Pellucid four-tooth moss (*Tetraphis pellucida* Hedw.), bilberry (*Vaccinium myrtillus* L.), common wood sorrel (*Oxalis acetosella* L.), rare spring-sedge (*Carex ericetorum* Pollich.), European goldenrod (*Solidago virgaurea* L.), sweet vernal-grass (*Anthoxanthum odoratum* L.), toothed plagiomnium moss (*Plagiomnium cuspidatum* Hedw.) and cypress-leaved plait-moss (*Hypnum cupressiforme* Hedw.). Count of species with projective coverage under 2% decreased one year after clear cut was made.

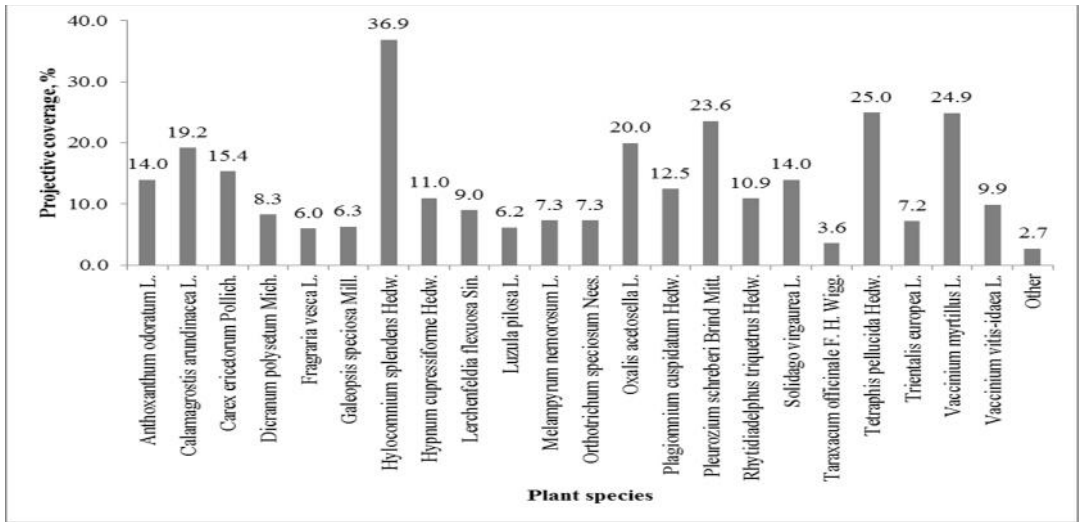


Figure 4. Projective cover of plants in *Pinetum hylocomiosum* in first year after the clearcut.

Five years after clearcut species count has raised and raspberry (*Rubus idaeus* L.) has the largest projective coverage but more than 10 % projective coverage has sheep's sorrel (*Rumex acetosella* L.), large-flowered hemp-nettle (*Galeopsis speciosa* Mill.), oval sedge (*Carex leporina* L.) and also common cow-wheat (*Melampyrum pratense* L.), small tufted-sedge (*Carex cespitosa* L.), un hairy wood-rush (*Luzula pilosa* L.). As ground cover plants get taller and form larger groups (see Fig. 1c) and needle touching point also raises, then increases average vertical height of registered vegetation.

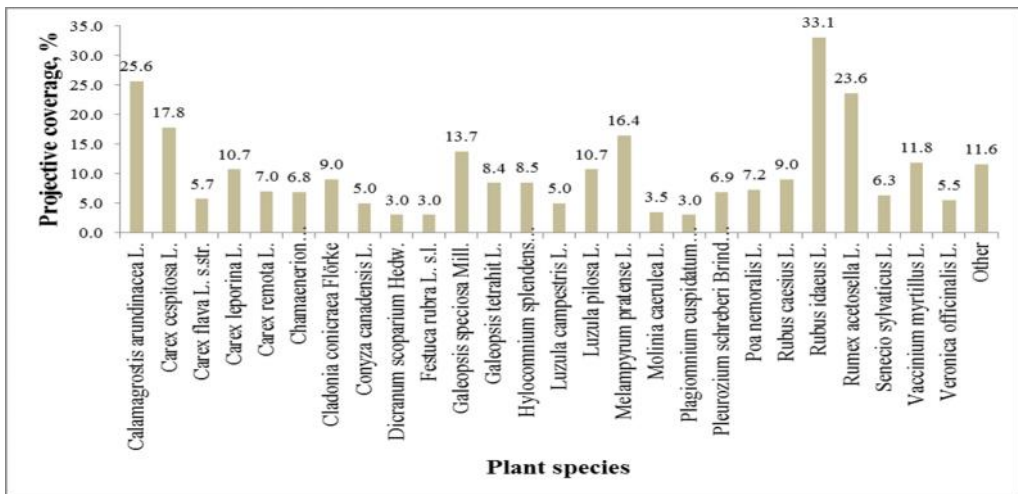


Figure 5. Projective cover of plants in a 5 years old *Pinetum hylocomiosum* young growth area.

Pykälä (2004) in South–West Finland established that the total and mean numbers of vascular plant species were almost double in clear-cut areas compared to mature forests. The biological diversity of species in this research compared to mature stand also is increasing: four species using point-square method and 17 species using Braun – Blanquet method appear as growth conditions improved and growth space increased. Shannon – Wiener index's values show that ground vegetation biological diversity has increased after the clear cut:  $H(s)$  in mature stand = 2.912, but in five years old clearing  $H(s) = 3.202$ . Ellenberg's ecological indicator values (Ellenberg, 1991) as light and nitrogen are also increasing: nitrogen value has increased the most - by 2.62 units (Fig. 6).

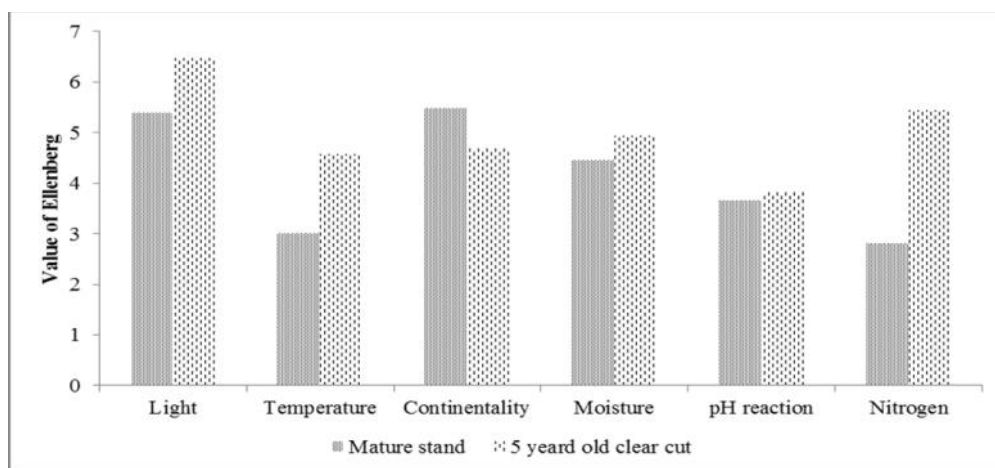


Figure 6. Ecological values of Ellenberg in a mature *Pinetum hylacomiosum* forest stand before and 5 years after the cutting

The most significant changes in individual species occurrence are between the second and third year's and Tschekanovsky coefficient value (0.19) is confirming that. Five years after clear cut ground vegetation has changed seriously: the Tschekanovsky's coefficient between the mature stand and five years old clearing is 0.18.

## CONCLUSIONS

After performing the clearcut there are significant changes in abundance of species of ground cover plants and in vertical structure of plant community. Till the second year after the cutting the total coverage of plants reduces. The most abundant are mosses. During the third year after clear cut there proceeds a rapid increase of weeds and decrease of mosses. The total species richness increases.

In the 4th and 5th year after the clearcut there increase the projective cover of *Monocotyledonae* plants (families *Graminaea* and *Cyperaceae*) forming higher vertical structure and overtaking the dominance from another groups. The dominance of this group reduces by development of young tree stand.

The results obtained and further research will be valuable supplement for practical forest inventory describing the characteristic ground cover vegetation in *Hylocomiosa* forest site type not only in mature forest age but during all forest rotation cycle.

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