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Variability of bryophytes and lichens on a forested coastal dune Tõotusemägi in Southwestern Estonia

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Abstract. Bryophytes and lichens are important in all dry land ecosystems due to their ability to colonize different substrates which are not suitable for vascular plants. They have an important role in vertebrates and invertebrate's food chain and function as a habitat for invertebrates. Nitrogen and carbon cycles in the forest depend greatly on the local bryophyte and lichen flora. The aim of present study was to investigate the frequency and variety of different species of bryophytes and lichens on the forested sand dune Tõotusemägi. The study was carried out on a 183 m long transect running on the western slope of the dune. Identification of bryophyte and lichen species was carried out and zonality of forest ground vegetation was demonstrated. Species were observed on the ground, on litter, on stumps and on trees. On the slope, 26 bryophyte species and 38 lichen species were registered. Dominating bryophyte species were *Pleurozium schreberi* (Brid.) Mitt., *Hylocomium splendens* (Hedw.) Schimp., *Polytrichum juniperinum* Hedw., *Polytrichum piliferum* Hedw, *Dicranum polysetum* Sw., *Dicranum scoparium* Hedw. Dominating lichen species were *Cladina rangiferina* (L.) Nyl., *Cladina arbuscula* (Wallr.) Hale & W. L. Culb., *Cladonia furcata* (Huds.) Schrad, *Cetraria islandica* (L.) Ach. Dominating species of epiphytic lichens were *Hypogymnia physodes* (l.) Nyl., *Parmelia sulcata* Taylor, *Pseudevernia furfuracea* (L.) Zopf, *Parmeliopsis ambigua* (Wulfen) Nyl. and *Imshaugia aleurites* (Ach.) S. L. F. Meyer. On the slope of the dune 12 different ground vegetation zones were distinguished. Bryophyte species characteristic for humid habitats and tolerant to shade were observed on foot of the dune. This may be caused by a stream flowing nearby which creates a more moist and nutrient rich habitat. The top area of the dune is open to direct UV radiation, therefore lichens and only some bryophyte species tolerant to dryness were observed.

Key words: costal dunes, dune forests, bryophytes, lichens.

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Introduction

Epiphytic bryophytes and lichens are important components of biological diversity in natural boreal and temperate forests (Söderström, 1988; Lesica *et al*., 1991; Longton, 1992; Esseen *et al*., 1997). Bryophytes provide a number of important ecological and social uses worldwide, for example, they play a significant role in carbon and nitrogen cycling (Glime, 2001; Turetsky, 2003). The results of Goulden and Crill (1997) showed that the moss-dominated ground vegetation of black spruce forests could account for up to 50% of the total forest photosynthesis. Bryophytes and lichens

function as habitat for invertebrates (Suren, 1991) and as seedbeds for forest plants (Glime, 2001). These nonlignified plants influence vegetative successional patterns following disturbance (Jonsson, 1993) and serve as bio-indicators of environmental change (Winner & Bewley, 1978; Gignac, 2001). On dunes bryophytes and lichens can act like pioneer plants; they trap and hold windblown sand in the foredune and help create conditions which encourage the establishment and growth of other plant communities such as woodland, scrub, heath and forest (Jonsson & Esseen, 1990; Andersson & Hytteborn, 1991; Gustafsson *et al*., 1992; Crites & Dale, 1998; Krys & Jonsson, 1999; Kimmerer, 2005). So far, however, diversity studies only rarely have been carried out on bryophytes (Lee & La Roi, 1979), lichens (Holien, 1997), or both (Wolf, 1993; Mucina *et al*., 2000; Grytnes *et al*., 2006).

Dunes represent an extremely complex and fragile habitat type. Vegetation is the key factor in dune stability and it is the vulnerability of dunes vegetation that makes the dunes sensitive to impact (NSW Coastline Management Manual, 1990). Fixed dunes contain important biodiversity both at the species and at the species community level, and they are considered as a priority habitat by the European habitat directive (Council Directive 92/43/EEC).

Maintenance of biodiversity is an integral part of the concept of "sustainable management", but human activity, like tourism and different outdoor activities, often are disturbing the basic equilibria, damaging the fragile vegetation and deteriorating the dune system. Külvik & Tambets (1998) emphasize the importance of dune forests to soil conservation, which in turn allows rare species to retain.

The purpose of this study was to describe and compare the richness of bryophyte and lichen species on a transect from foot to the top of the dune Tõotusemägi. This research should provide a slight insight into how variation of microenvironmental conditions, like soil pH and the location on the transect, influence the distribution of bryophyte and lichen species on the western slope of dune. The results of this research give us new knowledge about bryophytes and lichens diversity on dunes in Rannametsa area and results can be used as practical ecological background information for the elaboration of forest management policy.

Material and Methods

Study area

The study area is located in Luitemaa Nature Reserve (former Rannametsa-Soometsa Nature reserve) in Pärnu County in Southwest Estonia (Figure 1).

Luitemaa nature reserve has been created to protect the dunes formed by Lake Ancylus and Littorina Sea during the ice ages, the ecosystems on the dunes, coastal meadows and also rare and endangered species living in the area (Kiristaja & Timm, 2002).

In Luitemaa, there are two ancient dune chains. One of them is known as Võidu – Soometsa dune chain and the other as Rannametsa dune chain. Between the dunes lays a bog named Tolkuse. Pine stands with *Cladina*, *Vaccinium* and *Calluna* site types are dominant on Rannametsa dunes. The survey was conducted on Tõotusemägi, one of the highest dunes in Rannamtesa dune landscape. It is situated nearby Tallinn-Riga highway.

Fieldwork

Fieldwork was done in four days: June 19-20, 2004, October 10, 2004 and April 24, 2005. The 183 meters long transect runs on the western slope of Tõotusemägi. It

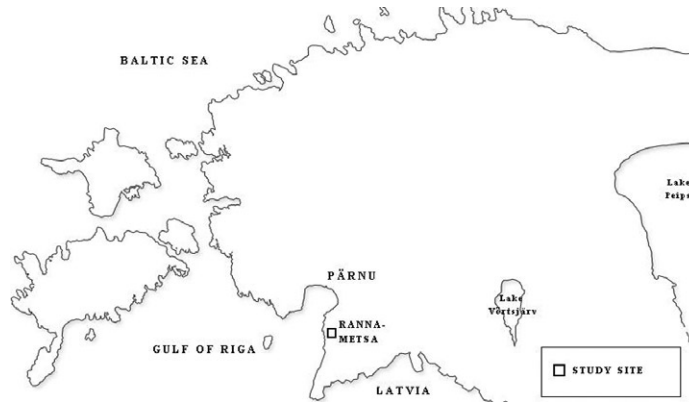


Figure 1. Location of the research area.
Joonis 1. Uurimisala paiknemine.

begins from the foot and reaches to the top of the dune. Transect begins about 6 meters from the stream flowing on the foot of the dune.

Bryophyte and lichen species were observed one meter to both sides of the transect from foot to top of the dune. On the study area samples of bryophytes and lichens were collected from different substrates: from the ground, from tree-trunks, from stumps and from litter and used for further identification of species. Zonality of forest ground vegetation was determined visually according to species variation. The survey was conducted simultaneously with general botanical analysis (Mandre *et al.*, 2006) and the zones were named after dominating vascular plant.

Bryophytes and lichens have no roots and only upper layer of the soil influences their functioning. In each zone, three randomly chosen sample points were established and soil samples from upper 2 cm layer (litter layer) were taken for pH analyses.

Laboratory work and data analysis

More than 200 individuals of bryophytes and lichens were collected from Tõotusemägi. The samples are preserved in the herbarium of Tallinn Botanic Garden. The species were identified in Tallinn Botanic Garden and Tallinn University by using dissecting and compound light microscopes.

For identification of bryophyte and lichen species three different manuals were used (Trass & Randlane, 1994; Ingerpuu & Vellak, 1998; Randlane & Saag, 2004)

For the identification of lichens, 3 different reagents were used:

1) 10% KOH hydrosol
2) $Na(ClO)_2$ saturated hydrosol
3) 5% $C_6H_4(NH_2)_2$ alcoholic solution

Using the reagents on the cortex, on the medulla or on the apothecia of lichen thallus evokes color reactions which expose the existence or the absence of different lichen substances (pigments, toxins) in the individuals being identified.

The pH of collected soil samples was measured in the laboratory of Estonian University of Life Sciences, Forest research Institute, Department of Ecophysiology. Soil pH was measured (n = 5 per sample) in a soil-water suspension (1:5) using a laboratory pH-meter (Mettler Toledo MP220). Regression analysis was made to find a

correlation between relative height and soil pH of the sampling site.

Correlations between number of different bryophyte and lichen species and the zones were calculated using correlation matrices. The normality of variables was checked by Lilliefors and Shapiro-Wilks tests. To normalize the variables the log-transformation was used. For correlations, software Statistica 7,0 was used, significance level $a = 0,05$ was accepted in all cases.

Results

Altogether 26 species of bryophytes and 38 species of lichens were registered on Tõotusemägi (Appendix 1). A clear zonality of forest ground vegetation was observed and 12 different zones of bryophytes and lichens were distinguished on the transect (Figure 2). The zones were named after dominating vascular plant species.

The number of registered bryophyte and lichen species varied between the zones. Correlation analyses revealed dependence between the number of lichen species and relative height of the zones ($r = 0,63$; $p = 0,028$), the number of lichen species increases in correlation to the height growth. Correlation showed no statistically reliable dependence between the number of bryophyte species and zones, therefore the bryophyte species richness seems not to be related to the relative height of the zone.

The soil pH was measured in each zone and regression analysis was made, but no significant dependence between the location of the sampling site and pH was found for the upper layers of soil ($R^2 = 0.432$).

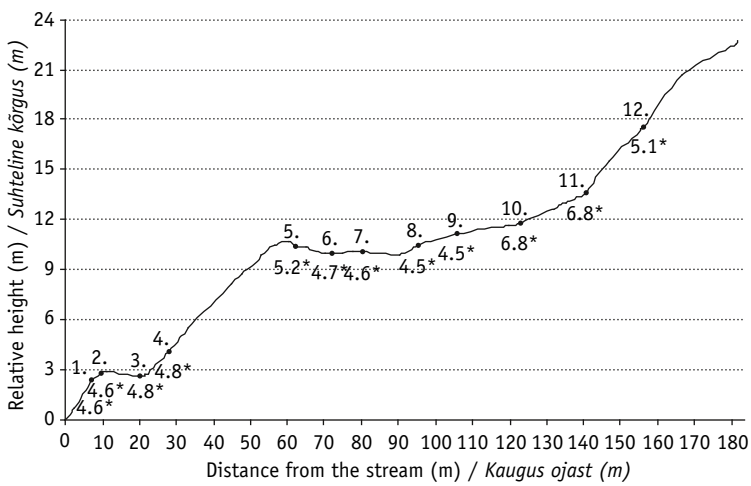


Figure 2. Zonality of bryophytes and lichens on western slope of dune Tõotusemägi. Zero point indicates the location of the stream on the foot of the dune. The number indicates the beginning of different bryophyte and lichen zones; * – the number shows mean value of soil pH in different bryophyte and lichen zones on the depth of 2 cm.

*Joonis 2. Sammalde ja samblike vööndilisus Tõotusemäe läänenõlval. Nullpunkt tähistab oja asukohta luite jalamil. Number tähistab erinevate sambla- ja samblikuvööndite algust; * – number tähistab kuni 2 cm sügavuse pinnasekihi pH keskmist väärtust erinevates sambla- ja samblikuvööndites.*

Dominating bryophyte species on the slope were *Hylocomium splendens* (Hedw.) Schimp. and *Pleurozium schreberi* (Brid.) Mitt. – registered in 6 zones, *Dicranum polysetum* Sw. and *Dicranum scoparium* Hedw. – registered in 4 zones. Dominating lichen species on the slope were *Cladina rangiferina* (L.) Nyl. – registered in 5 zones, *Cladina arbuscula* (Wallr.) Hale & W. L. Culb. and *Cladonia furcata* (Huds.) Schrad – registered in 4 zones, *Cetraria islandica* (L.) Ach. – registered in 3 zones. *Hypogymnia physodes* (L.) Nyl. – registered in 4 zones, *Parmelia sulcata* Taylor and *Pseudevernia furfuracea* (L.) Zopf – registered in 3 zones, *Imshaugia aleurites* (Ach.) S. L. F. Meyer and *Parmeliopsis ambigua* (Wulfen) Nyl. – registered in 3 zones, were the dominating species of epiphytic lichens registered.

Some bryophyte species (*Amblystegium serpens* (Hedw.) Schimp., *Aulacomnium palustre* (Hedw.) Schwaegr., *Bryum flaccidum* Brid., *Cephalosiella hampeana* (Nees) Schiffn., *Herzogiella seligeri* (Brid.) Iwats., *Lophocolea heterophylla* (Schrad.) Dum., *Plagiomnium cuspidatum* (Hedw.) T. Kop.) and some lichen species (*Cladina ciliata* (Stirt.) Trass, *Cladina tenuis* (Flörke) Ahti & M. J. Lai, *Cladonia phyllophora* Hoffm.) were registered only in 1 zone on the transect.

On the foot of the dune there was a stream. The ground was more humid and shady and more species of bryophytes were represented there than on the top area of the dune. Some of these species like *Aulacomnium palustre* (Hedw.) Schwaegr., *Eurhynchium praelongum* (Hedw.) Schimp., *H. seligeri*, *Rhytidiadelphus triquetrus* (Hedw.) Warnst., *P. cuspidatum*, *Plagiomnium undulatum* (Hedw.) T. Kop. and individuals of *Brachythecium* spp. were characteristic only to humid habitats. There were fewer trees on the top area of the dune than on the foot of the dune and the sites were more open to direct UV-radiation. The sites on the top area of the dune also endured under human influence. Mostly lichens (individuals of *Cetraria* spp., *Cladina* spp. and *Cladonia* spp.) and only some species of bryophytes that bear dryness and treading like *B. flaccidum*, *Pohlia nutans* (Hedw.) Lindb., *Polytrichum juniperinum* Hedw., *Polytrichum piliferum* Hedw. and *Racomitrium canescens* (Hedw.) Brid. were registered on these sites (Figure 3).

Zone 1. *Pteridium aquilinum*

The zone began 6 meters from the stream. Habitat was humid and the coverage of vascular plants was dense. Bryophyte species characteristic to humid habitats were registered. Mostly the individuals of *Brachytecium* spp., *Plagiotecium* spp., *R. triquetrus*, *P. undulatum*, *P. cuspidatum* were observed on the site. *A. serpens* was not registered on any other site on the transect.

No lichens were registered on the ground. The individuals of epiphytic lichens *Lecanora* spp. and *Loxospora elatina* were registered on the trunks of *Alnus incana*.

Zone 2. *Deschampsia flexuosa – Calamagostis arundinacea*

Dense coverage of vascular plants left a little room for bryophytes. Most of the species registered in this zone were the same as in Zone 1. The individuals of two species: *L. heterophylla* and *B. flaccidium* were not observed on any other site on the slope.

Zone 3. *Convallaria majalis*

Forest canopy was denser here. Coverage of bryophytes was dense, registered species were characteristic to humid habitats and tolerant to shade. Dominant species were *H. splendens*. Epiphytic individuals of *Lecanora* spp. and *Chaenotheca* spp. were registered on the trunks of *Pinus sylvestris*.

Zone 4. *Vaccinium myrtillus – Deschampsia flexuosa*

The coverage of bryophytes was dense. Dominating species were *H. splendens* and *P. schreberi*. Some assemblages of *D. polysetum* and *D. scoparium* were observed.

The individuals of epiphytic lichen species *Lepraria incana* (L.) Ach., *H. physodes*,

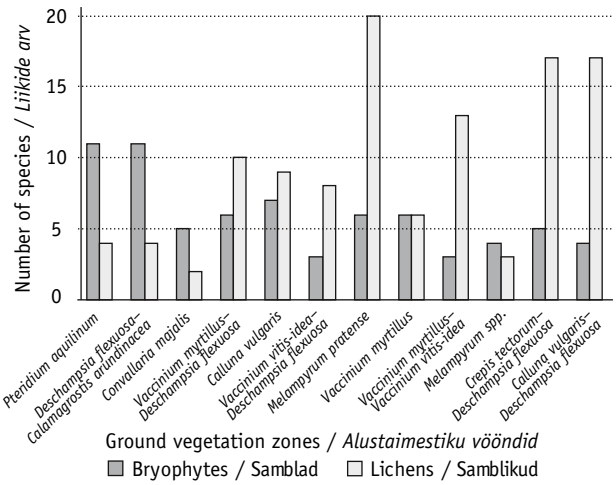


Figure 3. Number of bryophyte and lichen species in different forest ground vegetation zones.

Joonis 3. Sambla- ja samblikuliikide arvukus erinevates alustaimestiku vööndites.

P. furfuracea, *I. aleurites*, *P. sulcata* and *P. ambigua* were registered on *P. sylvestris*.

Zone 5. *Calluna vulgaris*

This zone was situated on a plateau, a plainer area on the slope. Forest canopy was sparse and the site was open to direct UV radiation. Bryophyte individuals which bear dryness were registered on the site: *Ceratodon purpureus* (Hedw.) Brid., *P. piliferum*, *P. nutans* and *D. scoparium*. The coverage of lichens was dense and the individuals of *C. arbuscula*, *C. rangiferina*, *Cladonia chlorophaea* (Flörke ex Sommerf.) Spreng., *Cladonia coniocraea* (Flörke) Spreng., *Cladonia cornuta* (L.) Hoffm., *Cladonia crispata* (Ach.) Flot., *C. furcata*, *Cladonia merochlorophaea* Asahina were registered.

Zone 6. *Vaccinium vitis-idea – Deschampsia flexuosa*

Forest canopy was denser here than described in Zone 5. Dominating species of bryophytes registered in the zone were *P. schreberi*, *D. polysetum* and *D. scoparium*. The coverage of lichens was much less dense compared to Zone 5. In addition to the species characterized in Zone 5, individuals of *Cladonia botrytes* (K. G. Hagen) Willd. and *Cladonia digitata* (L.) Hoffm. were registered. Individuals of epiphytic *H. physodes* were registered on the trunks of *P. sylvestris*.

Zone 7. *Melampyrum pratense*

Bryophyte species registered in this zone were the same as described in Zone 6. The coverage of lichens was sparse but numerous species were registered on different substrates. *Cladonia cenotea* (Ach.) Schaer., *C. phyllophora, Cladina mitis* (Sandst.) Hustich, *C. ciliata, C. islandica* and *Cetraria aculeata* (Schreb.) Fr. were observed in addition to the lichen species characterized in Zone 5 and Zone 6.

Zone 8. *Vaccinium myrtillus*

The coverage of bryophytes was dense and the dominating species registered were *H. splendens* and *P. schreberi*. An interesting finding was *Aulacomnium palustre* (Hedw.) Schwaegr., which is characteristic to more humid habitats. Some individuals of *Cladonia* spp. and *Cladina* spp. were observed.

Individuals of epiphytic *H. physodes* and *P. furfuracea* were registered on the trunks and branches of *P. sylvestris*.

Zone 9. *Vaccinium myrtillus – Vaccinium vitis-idea*

This zone was similar to Zone 8. Density of bryophytes was high. *P. schreberi*, *D. polysetum* and *D. scoparium* were the dominant bryophyte species in the zone. Lichen species registered were the same as characterized in Zone 8.

Zone 10. *Melampyrum* spp.

The coverage of bryophytes was dense. *H. splendens* and *P. schreberi* were the dominant bryophyte species. Individuals of *C. islandica*, *C. aculeata* were observed.

Zone 11. *Crepis tectorum – Deschampsia flexuosa*

This zone was situated on the last raise of the slope, near to the top of the dune. The forest canopy was sparse and the site was open to direct UV radiation. Some individuals of heat tolerant bryophytes were registered: *C. purpureus*, *P. nutans*, *D. polysetum*, *P. piliferum*. An individual of *Cephalosiella hampeana* (Nees) Schiffn. was documented.

The density of lichens coverage is high. Numerous species of *Cladonia* spp. and some species of *Cladina* spp. and *Cetraria* spp. were registered.

Zone 12. *Calluna vulgaris – Deschampsia flexuosa*

The zone was situated on the top area of the dune where the forest canopy is almost non-existent. Only some individuals of bryophytes were registered. The density of lichens coverage was high. The bryophyte and lichen species were the same as characterized in Zone 11.

Discussion and Conclusions

The age of dune and climatic conditions play an essential role in the formation of dune ecosystems, but the most important factor influencing the flora and the habitats of bryophytes and lichens on the slope of the dune is the structure of surrounding forest canopy. It creates a special microclimate for the sites and the individuals colonizing them. (Sulima & Coxon, 2001) The results of this research proved the occurrence of variety of site types and zonality along the slope. This may be caused by different topographic and edaphic conditions in the study area. The pH seems not to influence the distribution of bryophyte and lichen species. The height growth influences the distribution of lichen species, but does not seem to have an influence on bryophytes. Some of the zones were relatively narrow which may be caused by narrow changes in the structure of forest canopy affecting the amount of UV radiation reaching the forest ground and water runoff.

The results, received from the survey, could be used for geobotanical studies of comparison and for characterization of the structure of analogous dune forests as ecosystems.

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Appendix 1. Bryophytes and lichens registered on Tõotusemägi.
Lisa 1. *Tõotusemäel registreeritud samblikud ja samblad.*

Family / *Sugukond*	Species / *Liik*	Locality* / *Koht**
Lichens / *Samblikud*		
Arthoniaceae	*Arthonia radiata* (Pers.) Ach.	4
Cladoniaceae	*Cladina arbuscula* (Wallr.) Hale & W. L. Culb.	5-7; 9
	Cladina ciliata (Stirt.) Trass	7
	Cladina mitis (Sandst.) Hustich	7; 9; 11; 12
	Cladina portentosa (Dufour) Follmann	9
	Cladina rangiferina (L.) Nyl.	5-9
	Cladina tenuis (Flörke) Ahti & M. J. Lai	7
	Cladonia botrytes (K. G. Hagen) Willd.	6
	Cladonia cenotea (Ach.) Schaer.	7; 11; 12
	Cladonia chlorophaea (Flörke ex Sommerf.) Spreng.	5-7
	Cladonia coniocraea (Flörke) Spreng.	1; 5; 7; 9; 11; 12
	Cladonia cornuta (L.) Hoffm.	5; 7-9
	Cladonia crispata (Ach.) Flot.	5-7; 9; 11; 12
	Cladonia digitata (L.) Hoffm.	6; 9
	Cladonia fimbriata (L.) Fr.	11
	Cladonia floerkeana (Fr.) Sommerf.	11; 12
	Cladonia furcata (Huds.) Schrad	5-12
	Cladonia gracilis (turbinata) (Ach.) Ahti	7-9; 11; 12
	Cladonia merochlorophaea Asahina	5; 7; 11; 12
	Cladonia phyllophora Hoffm.	7
	Cladonia pyxidata (L.) Hoffm.	11; 12
Coniocybaceae	*Chaenotheca ferruginea* (Turner & Borrer) Mig.	2, 3
Lecanoraceae	*Lecanora carpinea* (L.) Vain.	1-3
	Lecanora expallens Ach.	3; 11, 12
	Lecanora pulicaris (Pers.) Ach.	1-3
	Lecidella elaeochroma (Ach.) M. Choisy	1
Lecideaceae	*Hypocenomyce anthracophila* (Nyl.) P. James & Gotth. Schneid.	11; 12
	Hypocenomyce scalaris (Ach.) M. Choisy	11; 12
Loxosporaceae	*Loxospora elatina* (Ach.) A. Massal.	4
Parmeliaceae	*Cetraria aculeata* (Schreb.) Fr.	7; 10-12
	Cetraria islandica (L.) Ach.	7; 9-12
	Hypogymnia physodes (L.) Nyl.	4; 6-9
	Imshaugia aleurites (Ach.) S. L. F. Meyer	4
	Parmelia sulcata Taylor	4
	Parmeliopsis ambigua (Wulfen) Nyl.	4; 7; 11; 12
	Pseudevernia furfuracea (L.) Zopf	4; 7-9
	Usnea hirta (L.) F. H. Wigg.	4; 11
Stereocaulaceae	*Lepraria incana* (L.) Ach.	2; 4; 7; 11; 12
Bryophytes / *Samblad*		
Amblystegiaceae	*Amblystegium serpens* (Hedw.) Schimp.	1
Aulacomniaceae	*Aulacomnium palustre* (Hedw.) Schwaegr.	1; 8
Brachytheciaceae	*Brachythecium albicans* (Hedw.) Schimp.	1; 3; 7
	Brachythecium oedipodium (Mitt.) Jaeg.	1-4; 7
	Brachythecium salebrosum (F.Web. & Mohr.) Schimp.	1; 3; 7
	Brachythecium velutinum (Hedw.) Schimp.	1-4; 7; 8
	Eurhynchium praelongum (Hedw.) Schimp.	2
Bryaceae	*Bryum flaccidum* Brid.	2
Cephaloziellaceae	*Cephaloziella hampeana* (Nees) Schiffn.	11
Dicranaceae	*Dicranum polysetum* Sw.	2-10
	Dicranum scoparium Hedw.	1-12
Ditrichaceae	*Ceratodon purpureus* (Hedw.) Brid	5; 11; 12
Geocalycaceae	*Lophocolea heterophylla* (Schrad.) Dum.	2
Grimmiaceae	*Racomitrium canescens* (Hedw.) Brid.	11
Hylocomiaceae	*Hylocomium splendens* (Hedw.) Schimp.	3; 4; 7; 10
	Pleurozium schreberi (Brid.) Mitt.	2; 4-10
	Rhytidiadelphus triquetrus (Hedw.) Warnst.	1
Hypnaceae	*Herzogiella seligeri* (Brid.) Iwats.	1
Hypnaceae	*Hypnium cupressiforme* Hedw.	1; 2

Family / *Sugukond*	Species / *Liik*	Locality* / *Koht**
Mielichhoferiaceae	*Pohlia nutans* (Hedw.) Lindb.	5; 11; 12
Plagiomniaceae	*Plagiomnium cuspidatum* (Hedw.) T.Kop.	1
	Plagiomnium undulatum (Hedw.) T.Kop.	1
Plagiotheciaceae	*Plagiothecium laetum* Schimp.	2; 3; 7
Polytrichaceae	*Polytrichum juniperinum* Hedw.	5
	Polytrichum piliferum Hedw.	2; 11; 12
Pottiaceae	*Tortula ruralis* (Hedw.) Gaertn. Et al.	12

* Indicates species locality on the transect, number of zones.
* *Näitab liigi paiknevust transektil, vööndi numbrit.*

Sammalde ja samblike varieeruvus Edela-Eesti luidetel Tõotusemäe näitel

Helen Kösta ja Mari Tilk

Kokkuvõte

Töö eesmärgiks oli selgitada erinevate sambla- ja samblikuliikide esinevused ning liigilise koosseisu varieeruvus Rannametsa luitestiku ühel kõrgeimal luitel – Tõotusemäel. Uuritava transekti kogupikkus oli 183 m, see paiknes luite läänenõlval. Transektil määrati erinevad sambla- ja samblikuliigid ning alustaimestu tsonaalsus. Erinevatest pinnasekihtidest võeti analüüse pH määramiseks.

Kihtides sügavusega kuni 2 cm statistilist sõltuvust prooviruudu suhtelise kõrguse ja mulla ülemiste kihtide pH vahel ei täheldatud, seega sammalde ja samblike vööndilisus nõlval ei olnud nähtavasti tingitud mulla pealmiste kihtide pH väärtusest.

Kokku registreeriti transektilt 26 samblaliiki ning 38 samblikuliiki. Sammaldest domineerisid harilik palusammal (*Pleurozium schreberi* (Brid.) Mitt.), harilik laanik (*Hylocomium splendens* (Hedw.) Schimp.) ning harilik (*Dicranum scoparium* Hedw.) ja lainjas kaksikhammas (*Dicranum polysetum* Sw.).

Domineerivad samblikuliigid olid harilik põdrasamblik (*Cladina rangiferina* (L.) Nyl.), mets-põdrasamblik (*Cladina arbuscula* (Wallr.) Hale & W. L. Culb.) ning harkjas porosamblik (*Cladonia furcata* (Huds.) Schrad). Epifüütsetest samblikest esinesid Eestis kõige sagedasemad lehtsamblikud; harilik hallsamblik (*Hypogymnia physodes* (L.) Nyl.) ja vagu-lapiksamblik (*Parmelia sulcata* Taylor), hall karesamblik (*Pseudevernia furfuracea* (L.) Zopf), kollane lagusamblik (*Parmeliopsis ambigua* (Wulfen) Nyl.) ja hall terasamblik (*Imshaugia aleurites* (Ach.) S. L. F. Meyer).

Luite läänenõlval registreeriti kokku 12 erinevat taimestiku vööndit, mida iseloomustavad erinevad valgus- ja niiskustingimused, substraadi iseärasused ning erinevate taimeliikide esinemine. Alumistes vööndites, kus niiskust on rohkem, domineerivad samblad, leidub vaid üksikuid samblikuliike, kõrgemates vööndites, kus puistu liituvus on väiksem, domineerivad kuivust taluvad samblikuliigid.

Registreeritud sambla- ja samblikuliigid olid enamjaolt luitemetsadele iseloomulikud, nende esinemine alal oli oodatav.

Saadud tulemusi võiks teatud määral üldistada ka teiste samalaadsete luidete kohta, kasutada geobotaanilistes võrdlusuuringutes ning luitemetsade kui ökosüsteemide struktuuri iseloomustamisel.

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