

UNDERSTANDING BRYOPHYTE ECOLOGICAL CHARACTERISTICS IN DECIDUOUS FORESTS

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16.10.2025
Jaunkalsnava

EPIPHYTE METAPOPOPULATIONS IN BOREO-NEMORAL FOREST LANDSCAPE

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16.10.2025

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Valsts izglītības
attīstības aģentūra

NACIONĀLAIS
ATTĪSTĪBAS
PLĀNS 2020



EIROPAS SAVI
Eiropas Reģionālā
attīstības fonds



Background

- Patch-tracking metapopulation model (Snäll u.c. 2003)
- Epiphytes: ideal model organisms
- In Latvia data about species distribution mostly one observation data
- Lacking knowledge about predictors in epiphyte distribution and dispersal in landscape scale
- Studies in other countries in many cases are not relevant to Latvia, because of different climate, forest management, development history, structures and vegetation
- Recommendations for nature conservation and sustainable forestry

Objectives

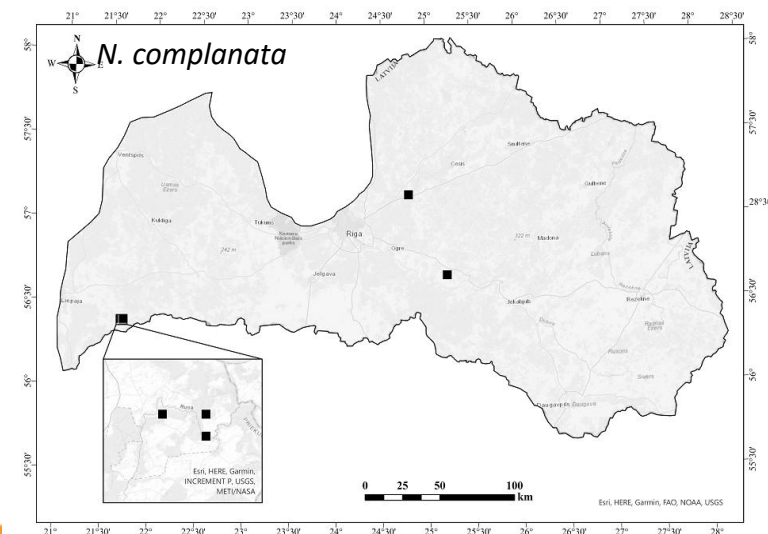
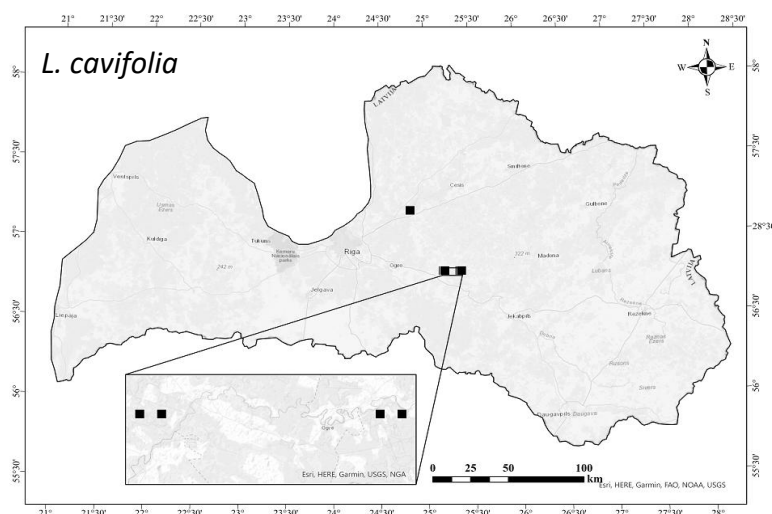
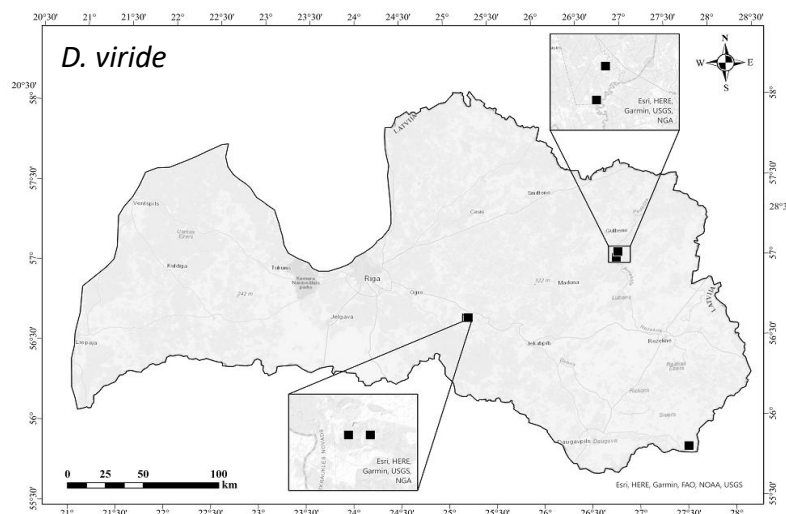
- 1) To characterize the main drivers in metapopulation existence in boreo-nemoral forest landscape;
- 2) To characterize rare epiphyte model species *Dicranum viride*, *Lejeunea cavifolia*, *Alleniella complanata* spatial patterns

I Epiphyte metapopulation drivers



I Epiphyte metapopulation drivers

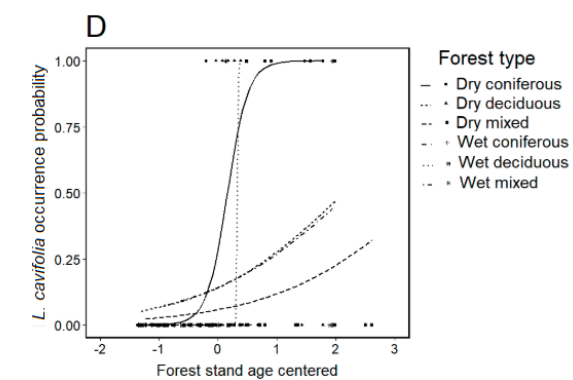
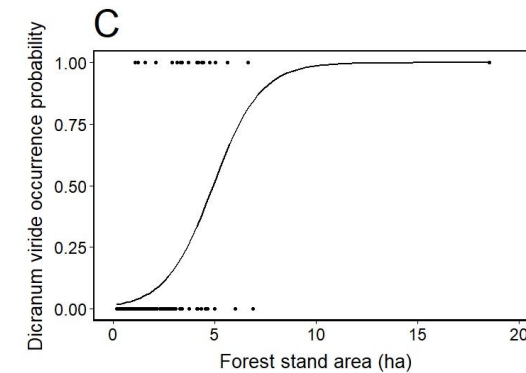
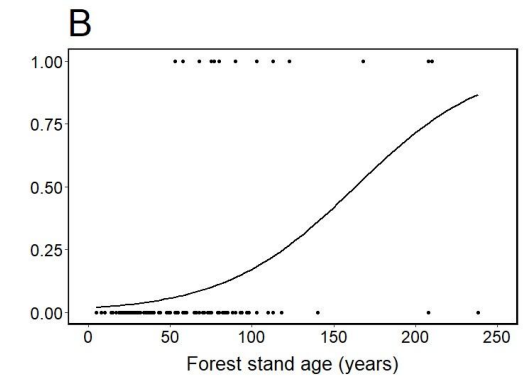
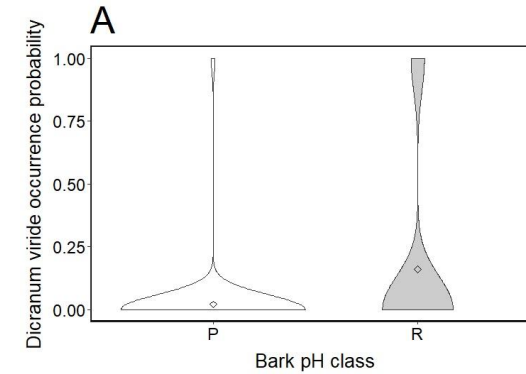
- Data from the Nature Conservation Agency in Latvia (Data from 2005 to 2020)
- We selected five concentration areas for each species Latvia (1x1km), with intensive past observations
- In total 30 plots (1x1 km), in each: 30 stands. Arc GIS pro version 2.7 (ArcGIS® software by ESRI)



I Epiphyte metapopulation drivers

GLM

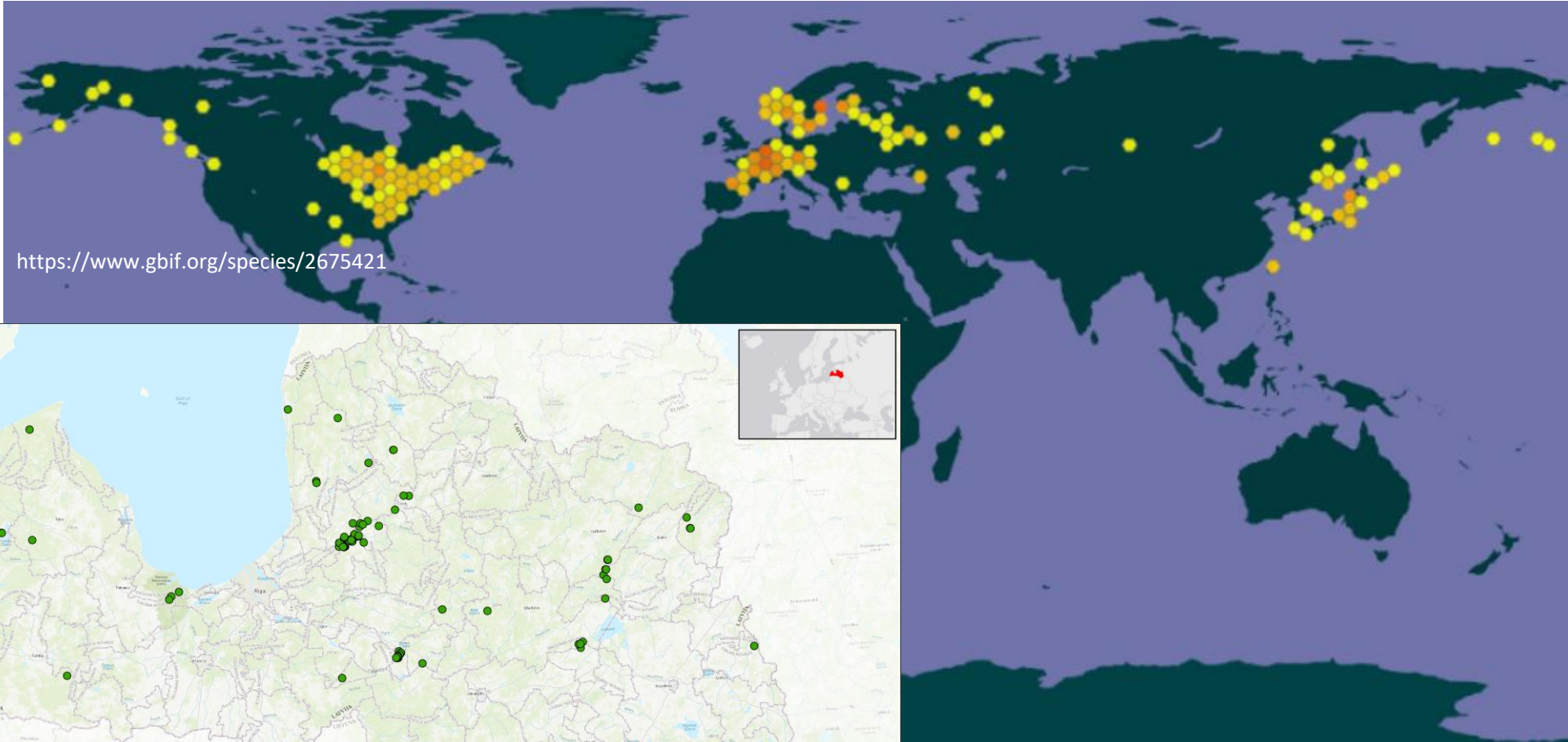
Response	Predictors	Statistics		
		R ²	Residual of deviance	P
<i>Dicranum viride</i>	Forest stand age	0.19	89.43	<0.01
	Forest stand area	0.25	67.29	<0.01
	Bark pH class	0.06	61.07	<0.01
<i>Lejeunea cavifolia</i>	Forest type	0.09	113.77	0.54
	Forest stand age	<0.01	96.23	<0.01
	Forest stand area	0.21	86.67	<0.01
	Heterogeneity	0.07	84.73	0.16
	Bark pH class	0.15	73.47	<0.01
	Forest type: Forest stand age	0.14	60.23	0.02
	Heterogeneity: Forest stand age	<0.01	58.90	0.25
<i>Neckera complanata</i>	Forest stand age	0.22	100.4	<0.01
	Bark pH class	0.05	93.82	0.01



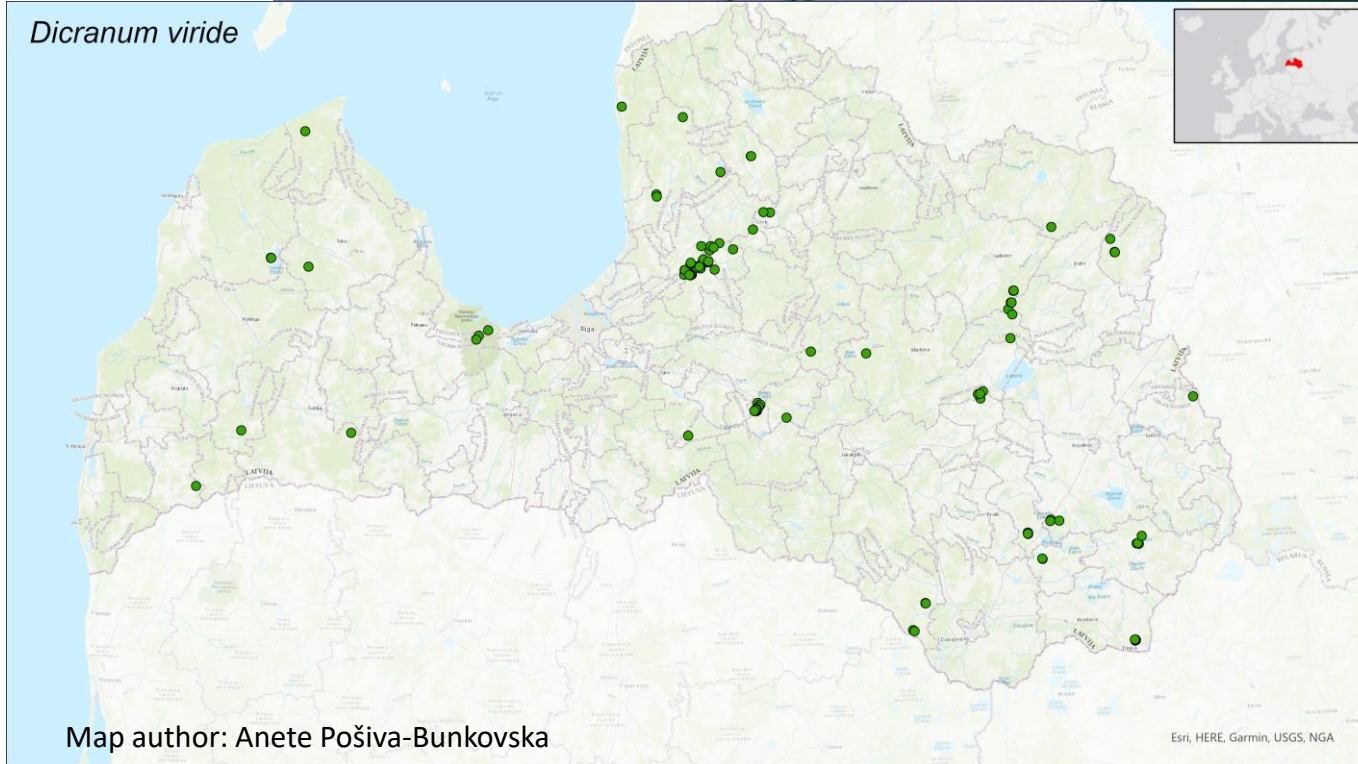
I Epiphyte metapopulation drivers

Conclusions

- Forest stand age and area are important drivers in rare epiphytic bryophyte occurrence in Latvian forest landscape
- Each of the studied epiphytic bryophyte model species have their own environmental demands
- The next step in future studies would be to apply species niche modeling approaches



Dicranum viride



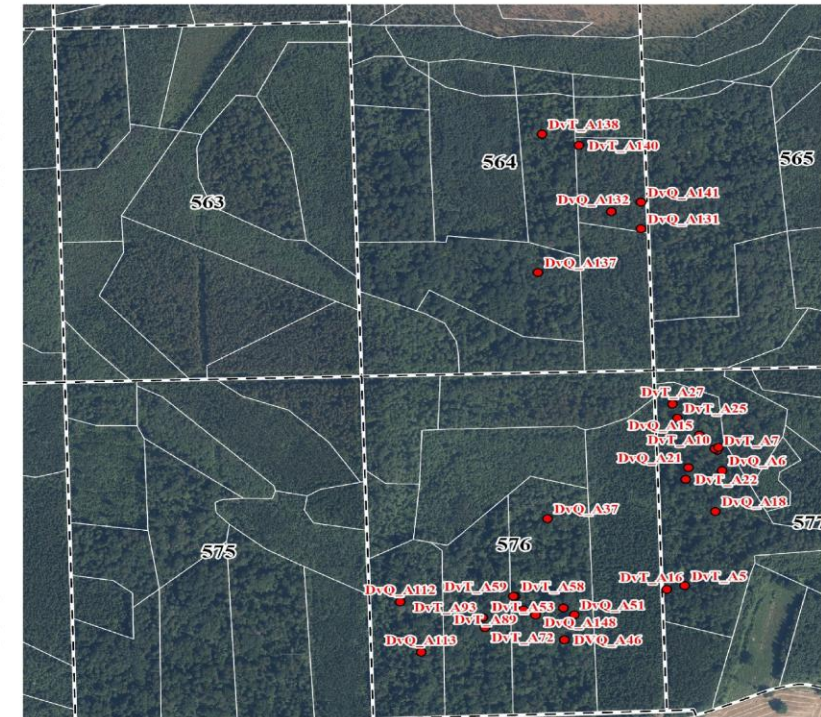
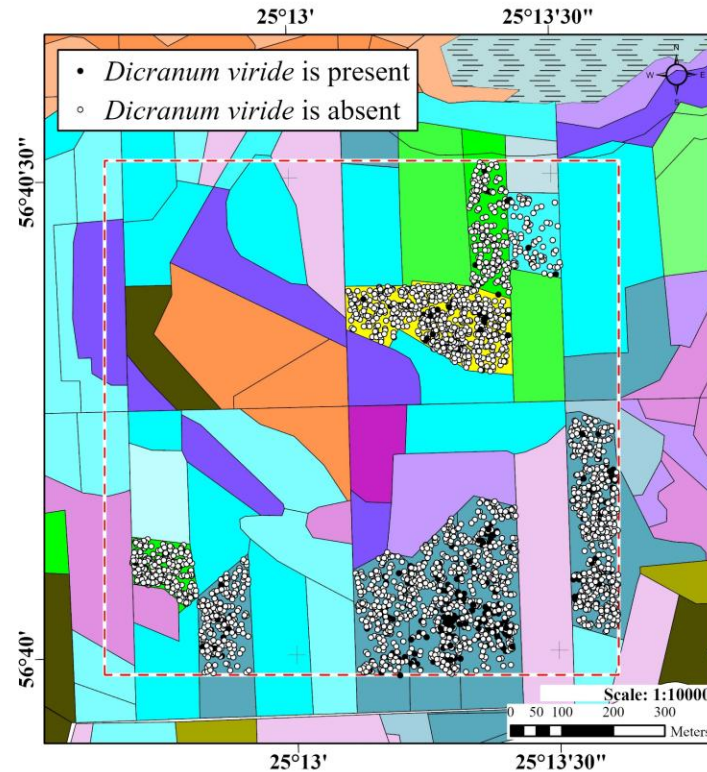
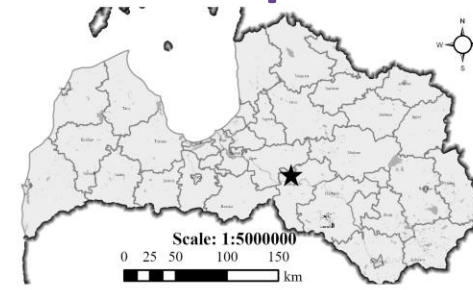
Reproduction in Latvia: only with leaf tips

Mostly in nemoral slope forests, oak forest

II Epiphyte model species spatial patterns



Legend
★ *Dicranum viride*



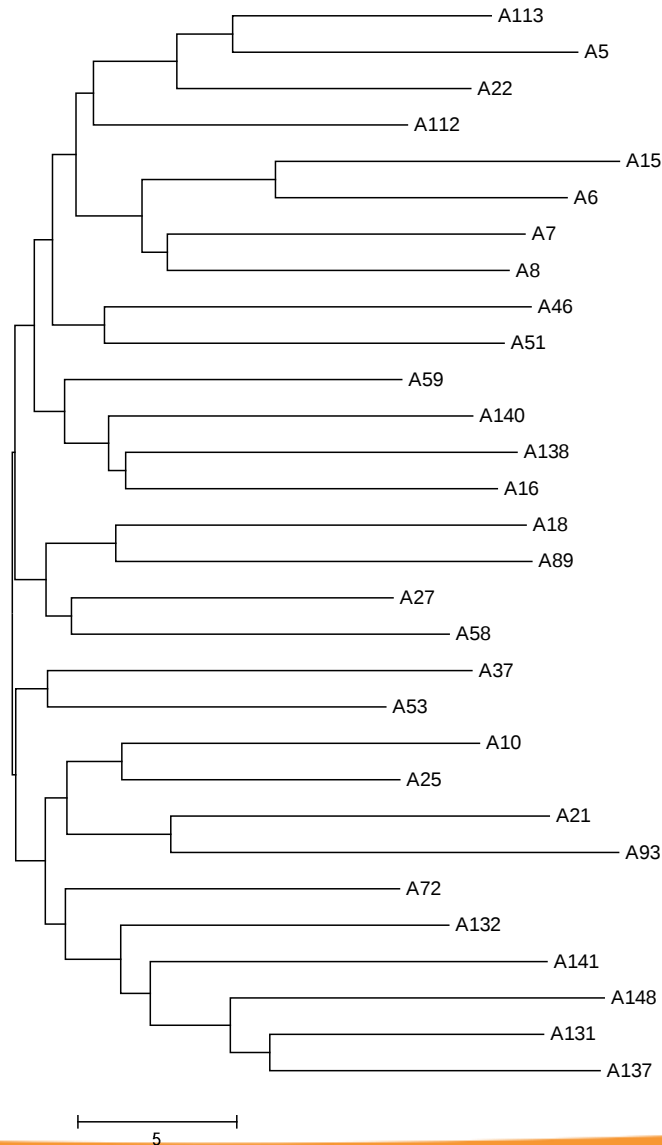
I Epiphyte model species spatial patterns



Genetic data collected from 7 forest stands, where *D. viride* was found (32 samples in one 1x1 km²). 3063 trees (287 with *D. viride*)

Doc

II Epiphyte model species spatial patterns



M11: Alignment Explorer (2023sunas1_viride.mas)

DataEditSearchAlignmentWebSequencerDisplayHelp

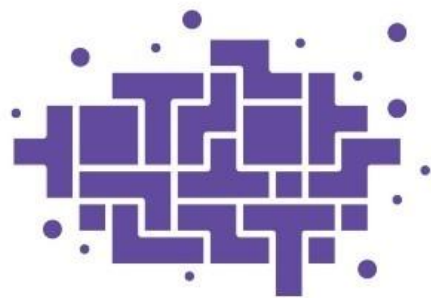
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Chloroplast DNA sequences

Conclusions

- *Dicranum viride* in Latvia is distributed in scattered populations that is highly associated with available habitat islands in fragmented landscape
- Spatial analysis shows clear trend of *D. viride* metapopulation aggregated structure in a studied forest landscape scale that may indicate about restricted dispersal abilities
- In more isolated suitable forest patches (patch level) *D. viride* metapopulations showed random structure that may indicate more recent species colonization, isolation from core areas or lack of suitable trees
- Molecular analysis indicates about *D. viride* dispersal limitation and genetic variability

- The project was funded from the postdoc project: «Epiphyte metapopulation dynamics in boreo-nemoral forest landscape», Nr. 1.1.1.2/VIAA/3/19/469
- Thanks is given to Stock Company “Latvia’s State Forests” for co-operation
- We are grateful to Nils Cronberg for discussions, to Inese Irbe and Edgars Nikolajevs for help in data collection and to Māris Nitcis for mapping help



FLPP

FUNDAMENTĀLO UN
LIETIŠKO PĒTĪJUMU
PROJEKTI

BRYOPHYTE SUCCESSIONAL PATTERNS IN DECIDUOUS FORESTS

5th INTERNATIONAL CONFERENCE Old-growth forests: policy
and practice October 16 - 17, 2025, Jaunkalsnava, Latvia Meža
pētīšanas stacija

Aim

- Characterize the bryophyte and lichen successional and spatial patterns along the deciduous forest chronosequence

Objectives

- 1) to compare bryophyte community** and functional trait similarities along forest chronosequence in relation to environment (**SP1**);
- 3) to characterize bryophyte model species** spatial structure along deciduous forest chronosequence (**SP3**);
- 4) to characterize the similarity in genetic structure** of selected bryophyte species populations along the forest chronosequence (**SP4**)

YOUNG FOREST STAND

SP1



Foto: Evita Oľehnoviča

MIDDLE-AGED FOREST STAND



5th INTERNATIONAL CONFERENCE Old-growth forests policy
October 16 - 17, 2025, Japinka snava, petišanas stacija

Foto: Evita Oľehnoviča

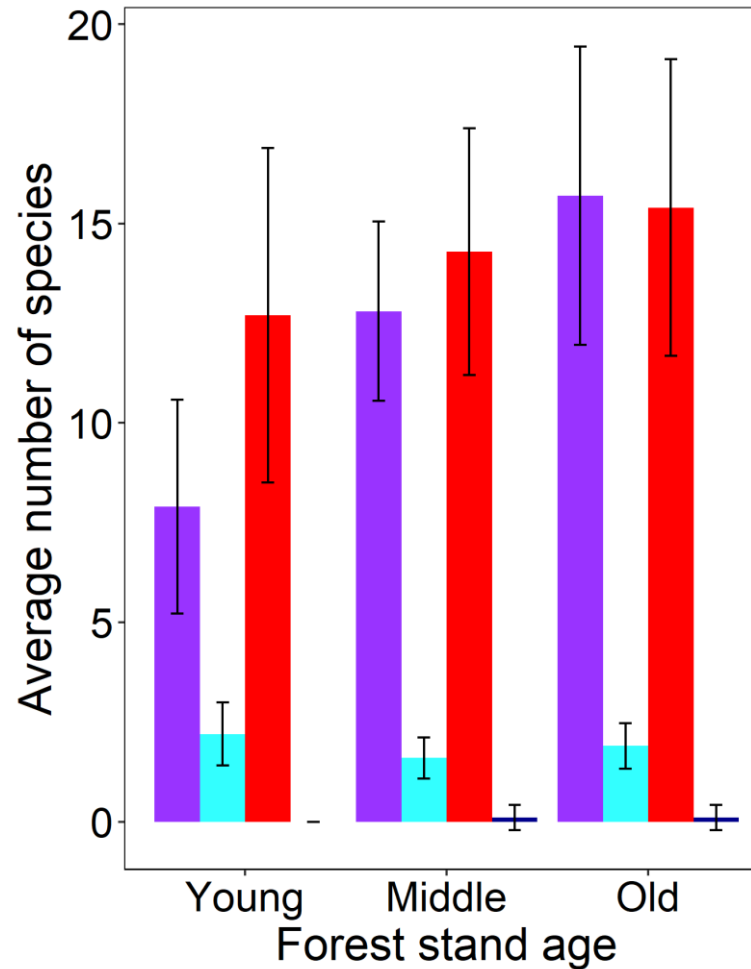
OLD FOREST STAND



Foto: Evita Oľehnoviča

Design: A. Kruglikova

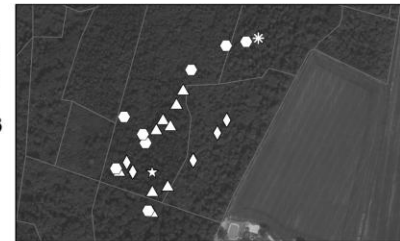
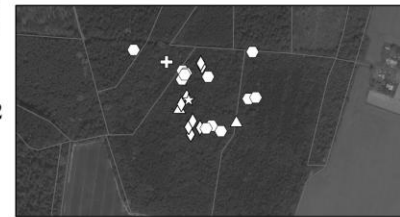
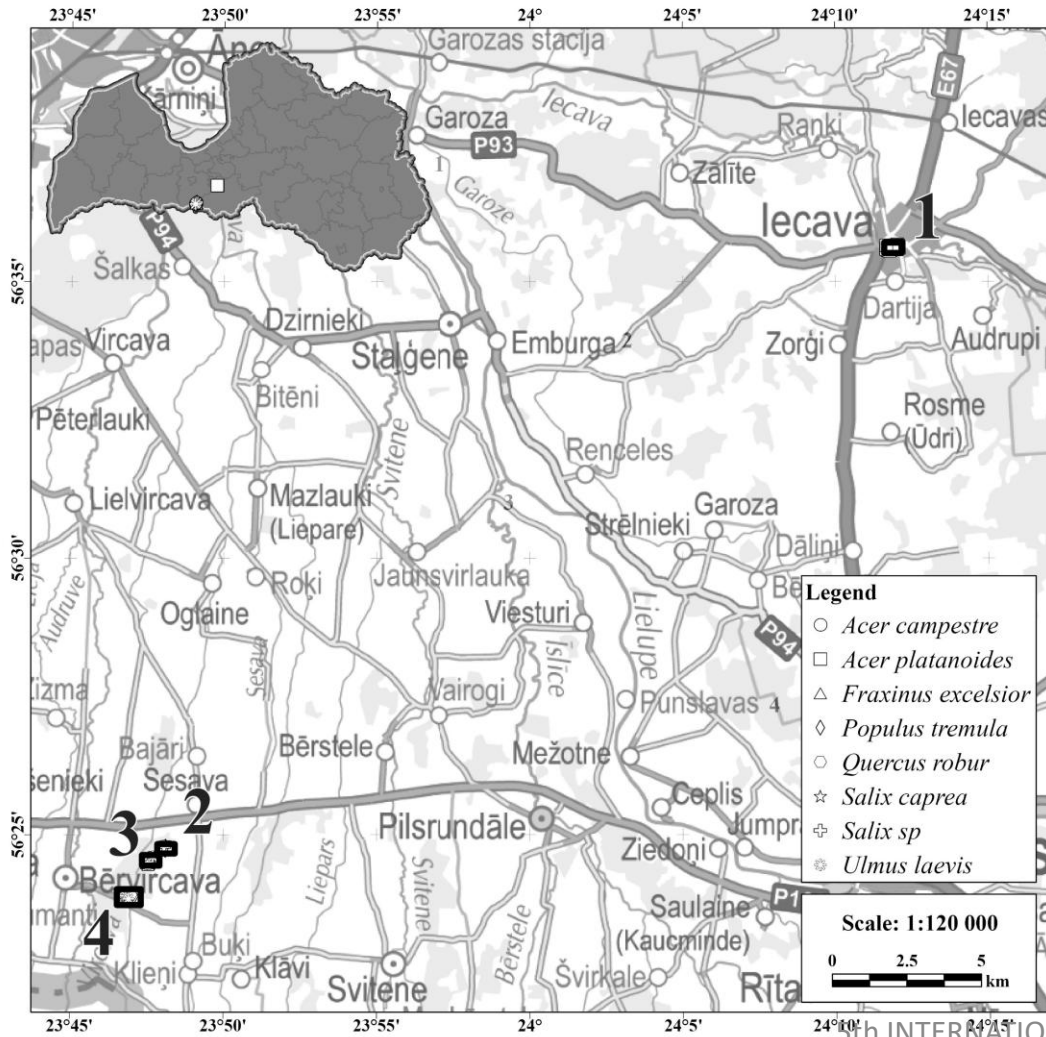
SP1 Black alder forests and bryophyte traits



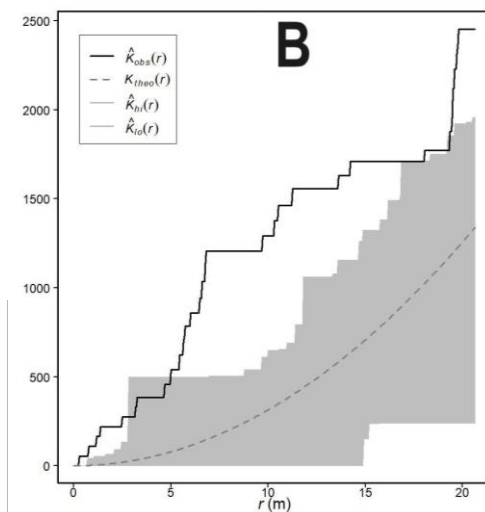
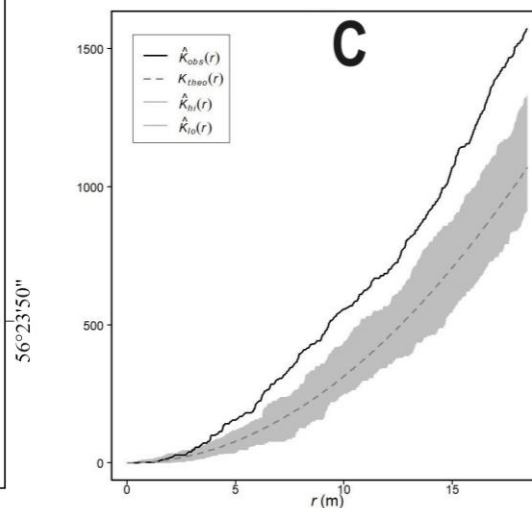
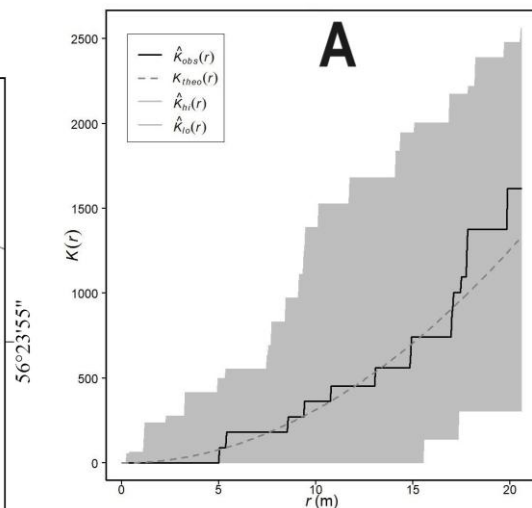
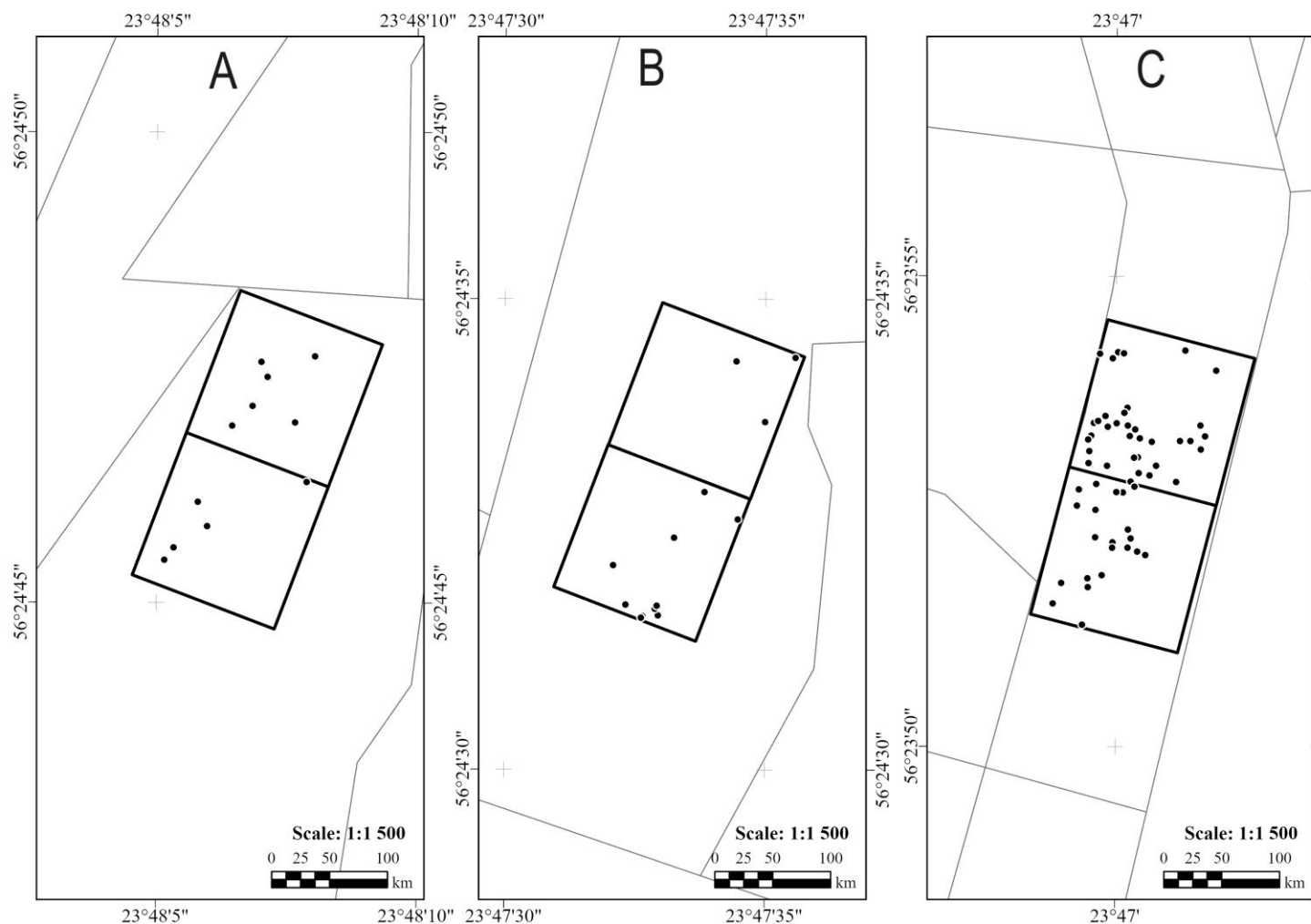
Forest species

- Largely restricted to closed forest
- May occur in forests, but prefers open land
- Occurs in forests as well as in open land
- Prefers forest edges and clearings

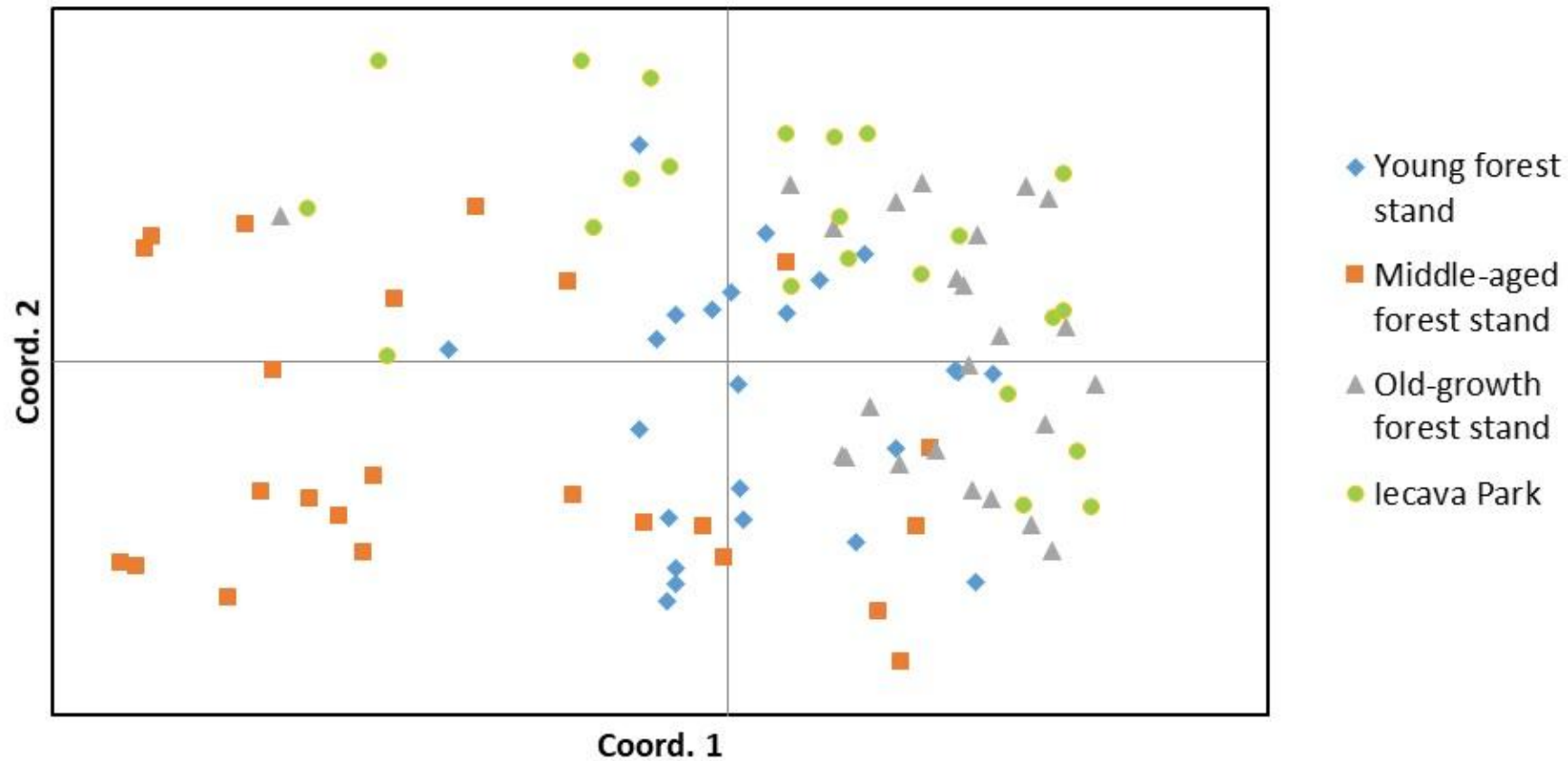
SP3, SP4 *Homalia trichomanoides* spatial structure and genetics



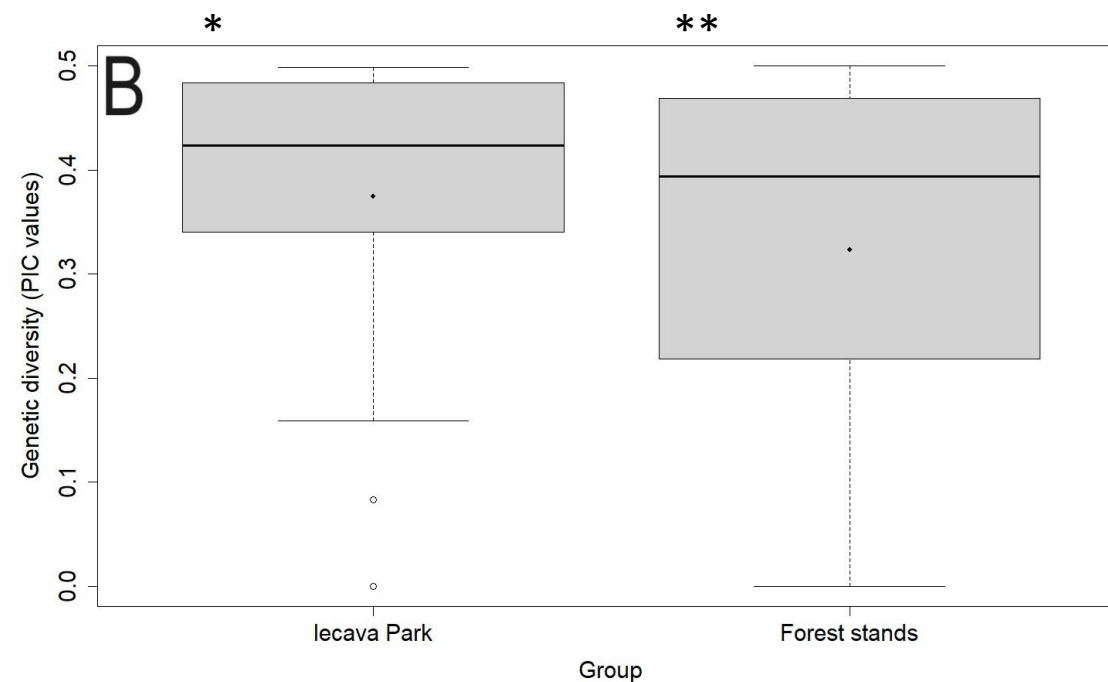
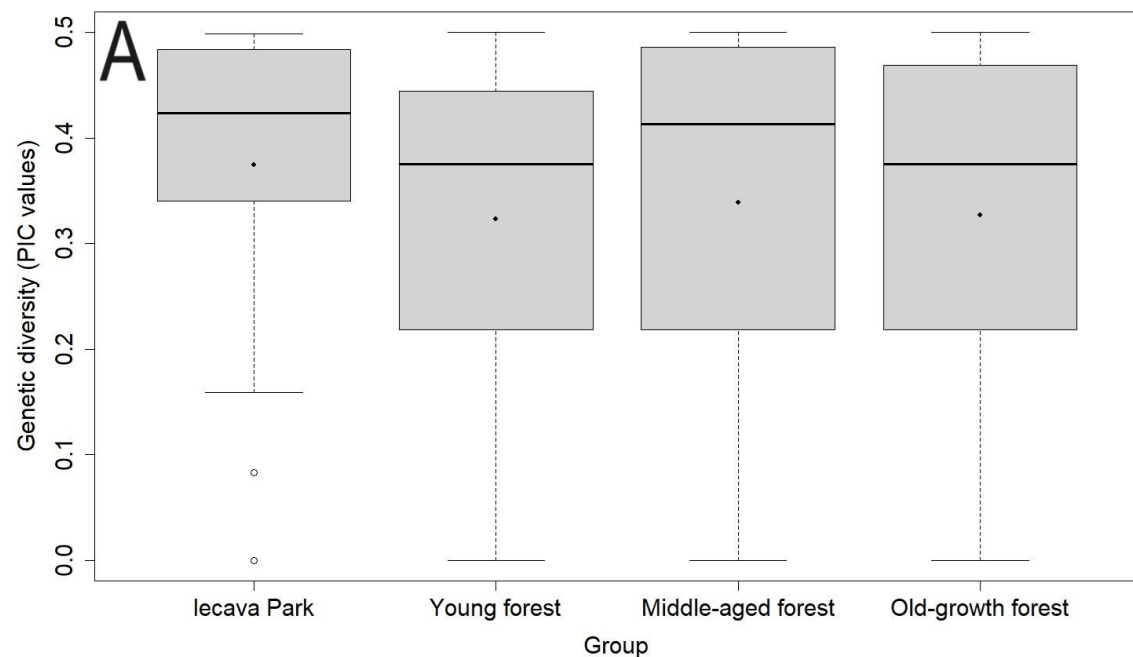
SP3, SP4 *Homalia trichomanoides* spatial structure and genetics



SP3, SP4 *Homalia trichomanoides* spatial structure and genetics



SP3, SP4 *Homalia trichomanoides* spatial structure and genetics



Conclusions

- The number of bryophyte taxa and their community composition is highly related to forest stand age
- Bryophyte preference to forest is important functional trait in black-alder forests
- The study shows the importance not only of forest stands, but also of urban habitats such as Iecava Park in the maintenance of the genetic diversity in populations of the old-growth forest bryophyte indicator species *Homalia trichomanoides* in a fragmented broad-leaved forest landscape

The study was supported by Fundamental and applied science research project of the Latvian Council of Science: “Bryophyte and lichen successional and spatial patterns in deciduous forests” (No. lzp-2020/1-0314).

