The effect of stand structure on different organism groups in mixed deciduous-coniferous forests in Hungary

Ódor[1], Péter; Márialigeti[1], Sára; Mag[1], Zsuzsa; Lengyel-Király[1], Ildikó; Tinya[2], Flóra

[1]Dept. of Plant Taxonomy and Ecology, L. Eötvös University, Hungary

[2]Dept. of Plant Pathology, Corvinus University of Budapest, Hungary

The aims

Potential explanatory variables:

Tree species composition:
- Tree species richness
- Proportion of tree species

Stand structure:
- Size distribution of trees
- Shrub layer
- Mature trees
- Deadwood

Light conditions
- Relative diffuse light (mean, heterogeneity)

Proportion of substrates:
- Open soil
- Litter
- Deadwood

Landscape variables:
- Proportion of landcover types (r=300 m)
- Heterogeneity of landcover types

Organism groups: (abundance, diversity, fuctional groups)

Birds

Bryophytes

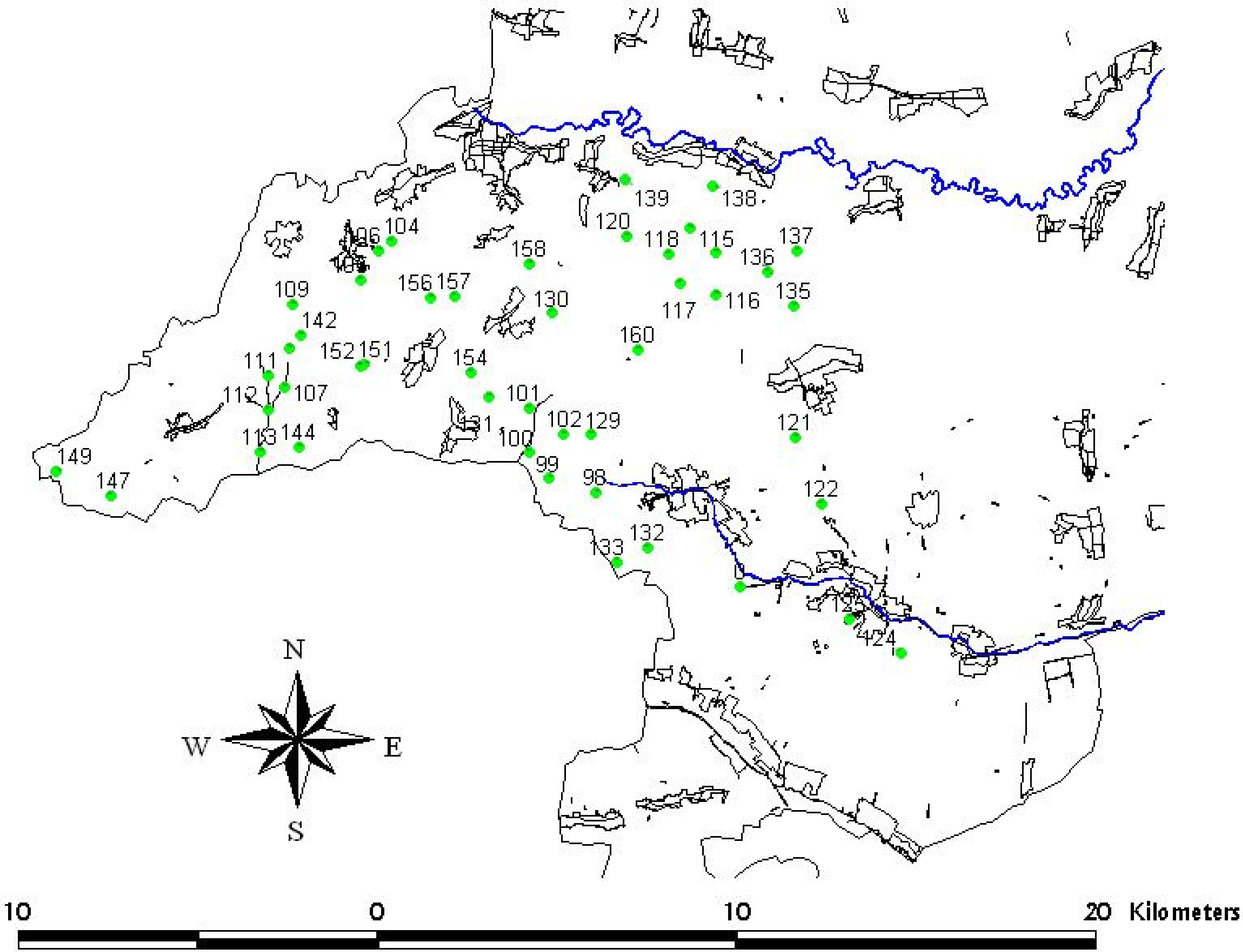
Herbs

Seedlings

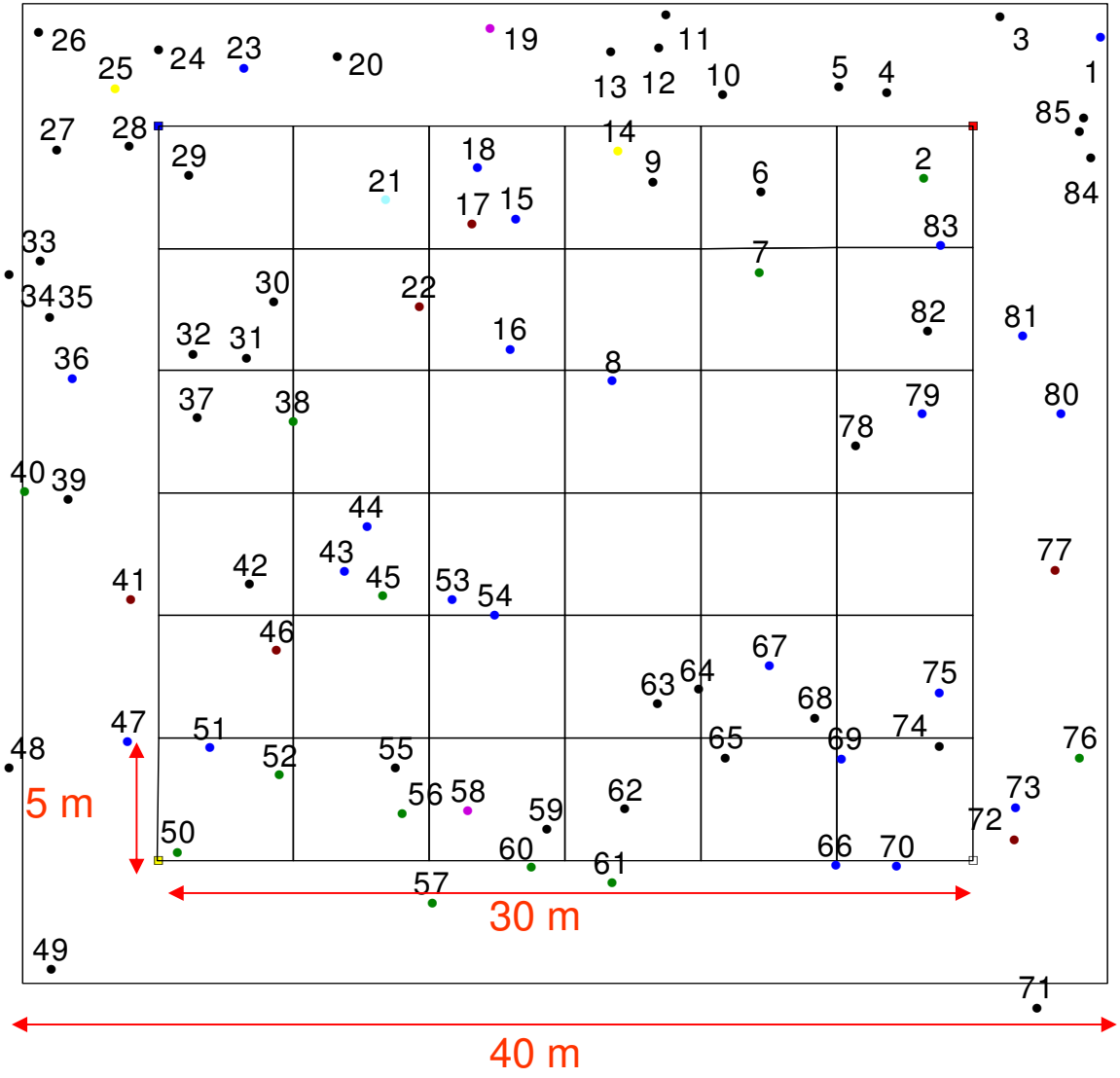
Saplings

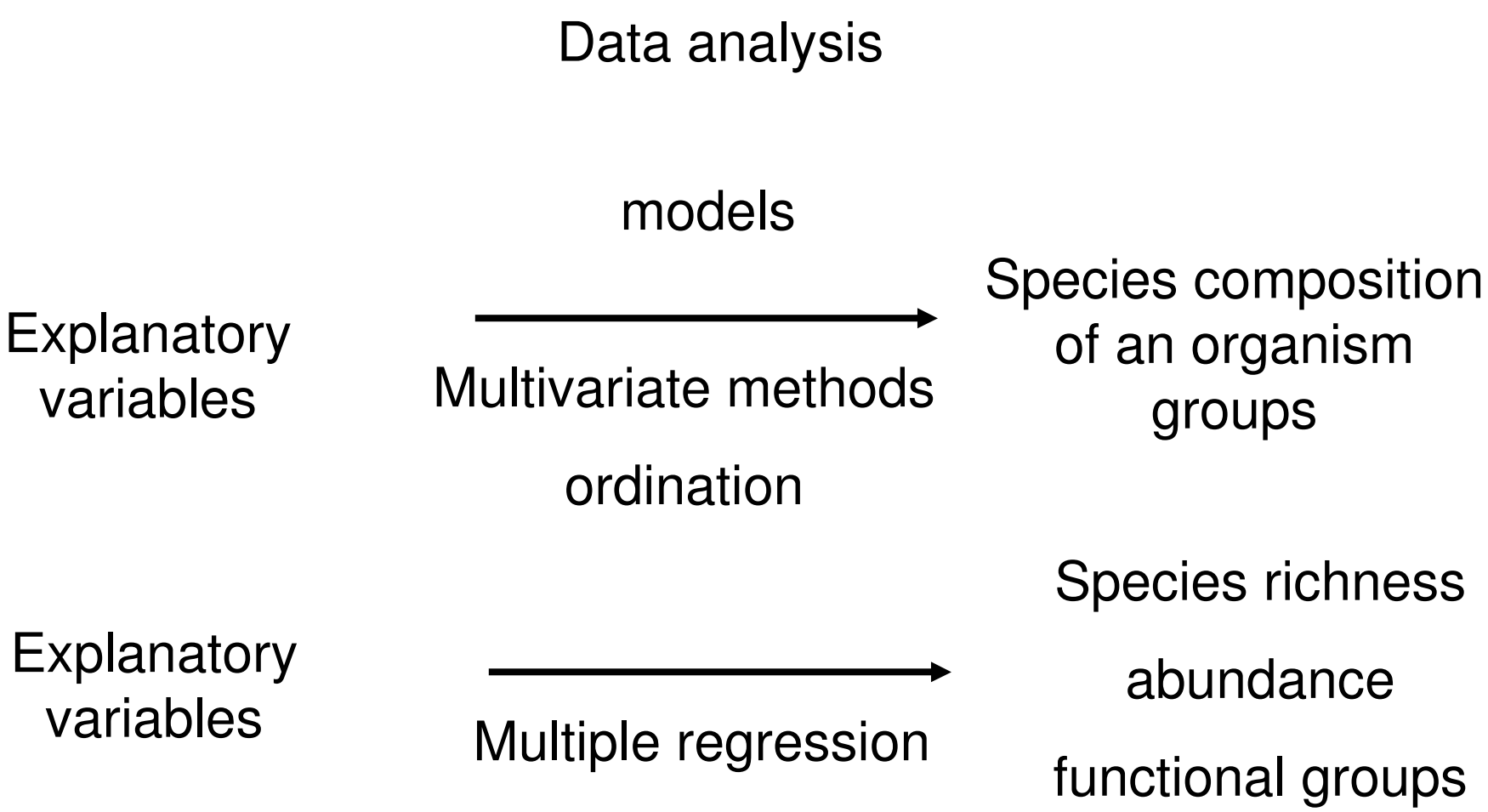
Study area:

Őrség National Park


139
138
120
118
115
137
104
158
136
156
157
109
130
117
116
135
142
160
152
151
111
154
112
107
101
131
102
129
121
113
144
100
149
99
147
98
122
132
133
124
N
W
E
S
10
0
10
20 Kilometers

Field survey

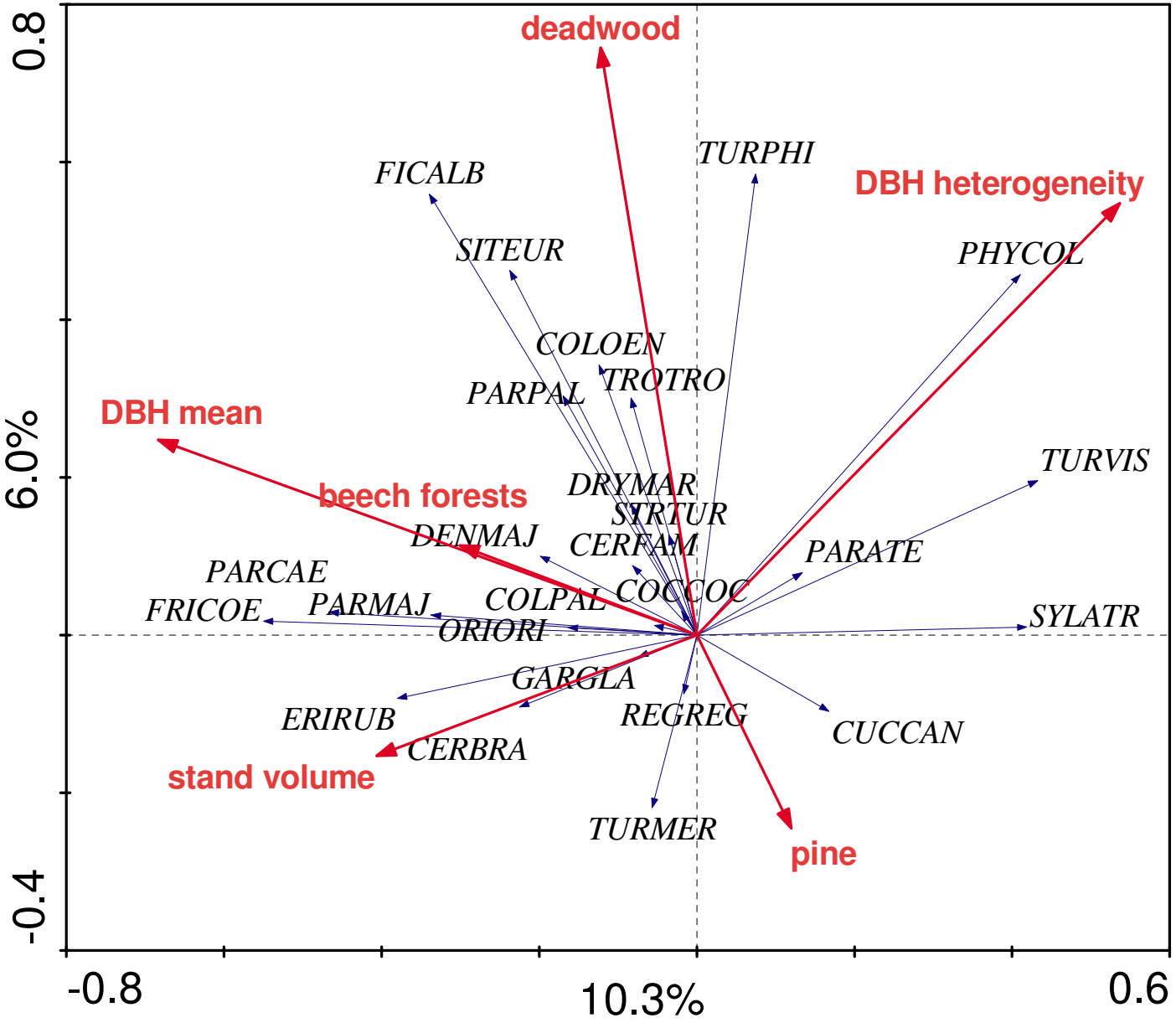


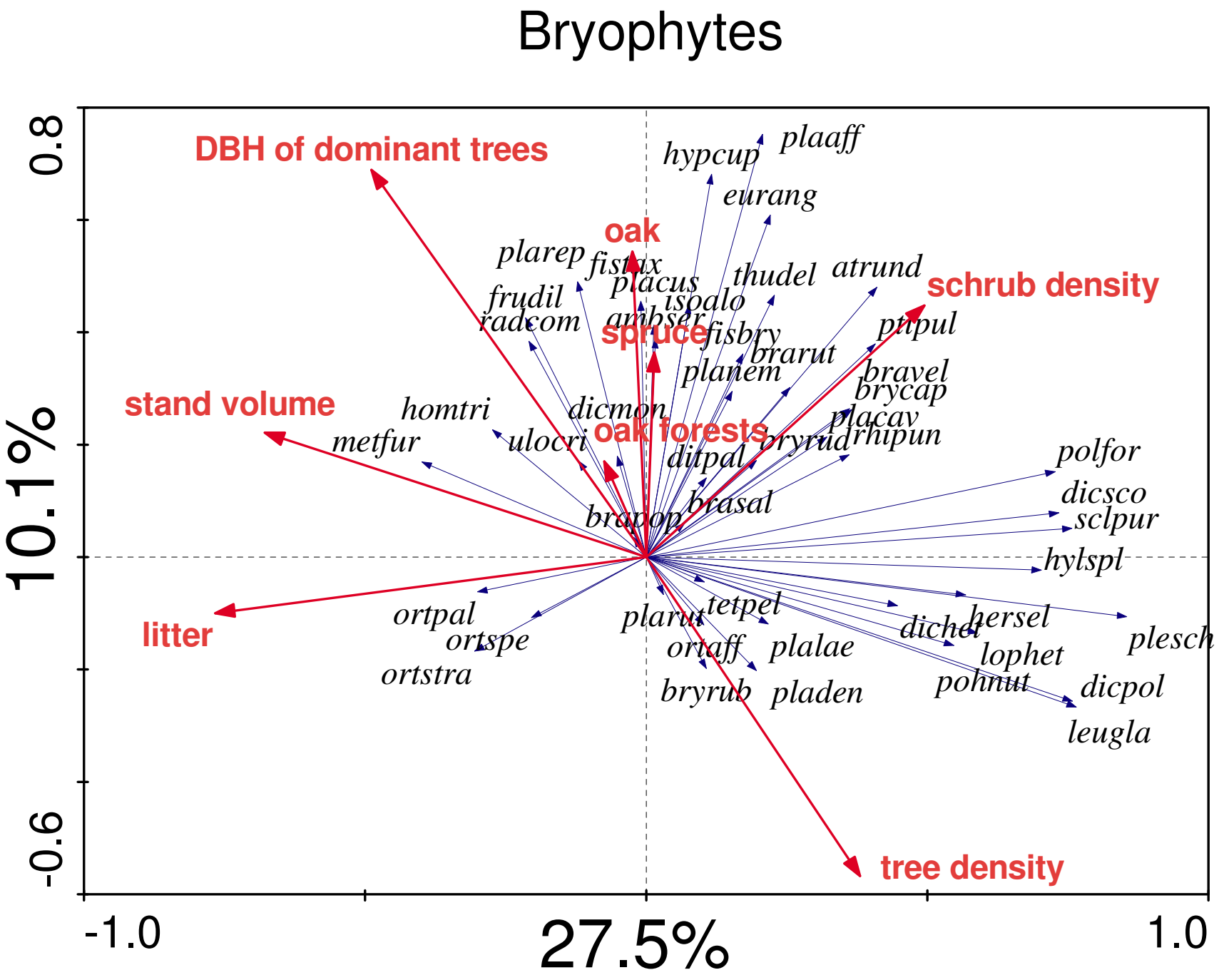

Data analysis
models
Explanatory variables
Multivariate methods
ordination
Species composition of an organism groups
Explanatory variables
Multiple regression
Species richness
abundance
functional groups

Species composition: direct ordination, redundancy analysis

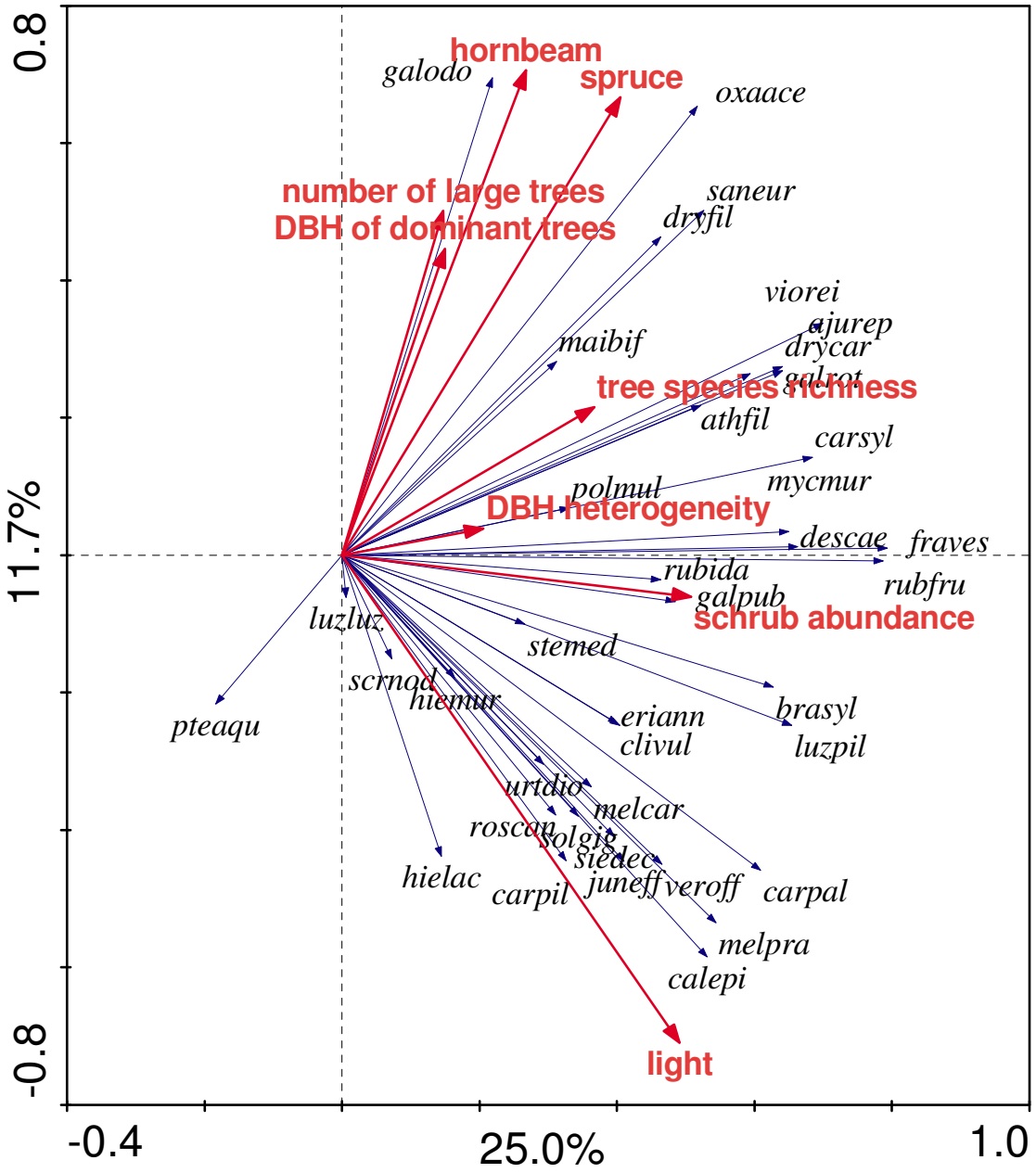
Organism group	Explained variance(%)
Birds	27
Bryophytes	56
Herbs	52
Seedlings	41
Saplings	54

Birds

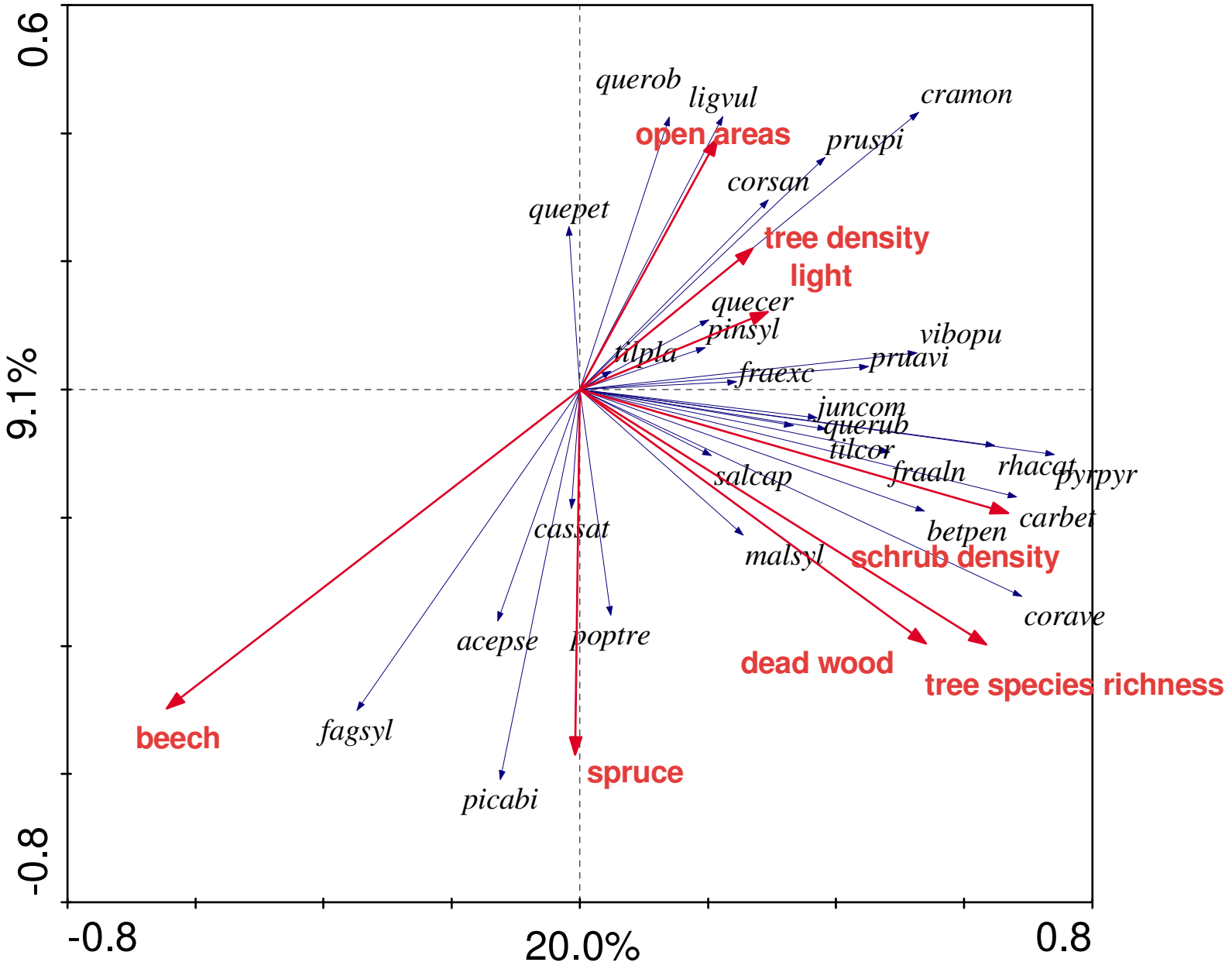

deadwood
TURPHI
FICALB
DBH heterogeneity
SITEUR
PHYCOL
COLOEN
TROTRO
PARPAL
DBH mean
TURVIS
DRYMAR
beech forests
STRTUR
DENMAJ
CERFAM
PARATE
PARCAE
COC COC
FRICOE
PARMAJ
COLPAL
SYLATR
ORIORI
GARGLA
ERIRUB
REGREG
CUCCAN
CERBRA
stand volume
TURMER
pine
0.8
6.0%
-0.4
-0.8
10.3%
0.6

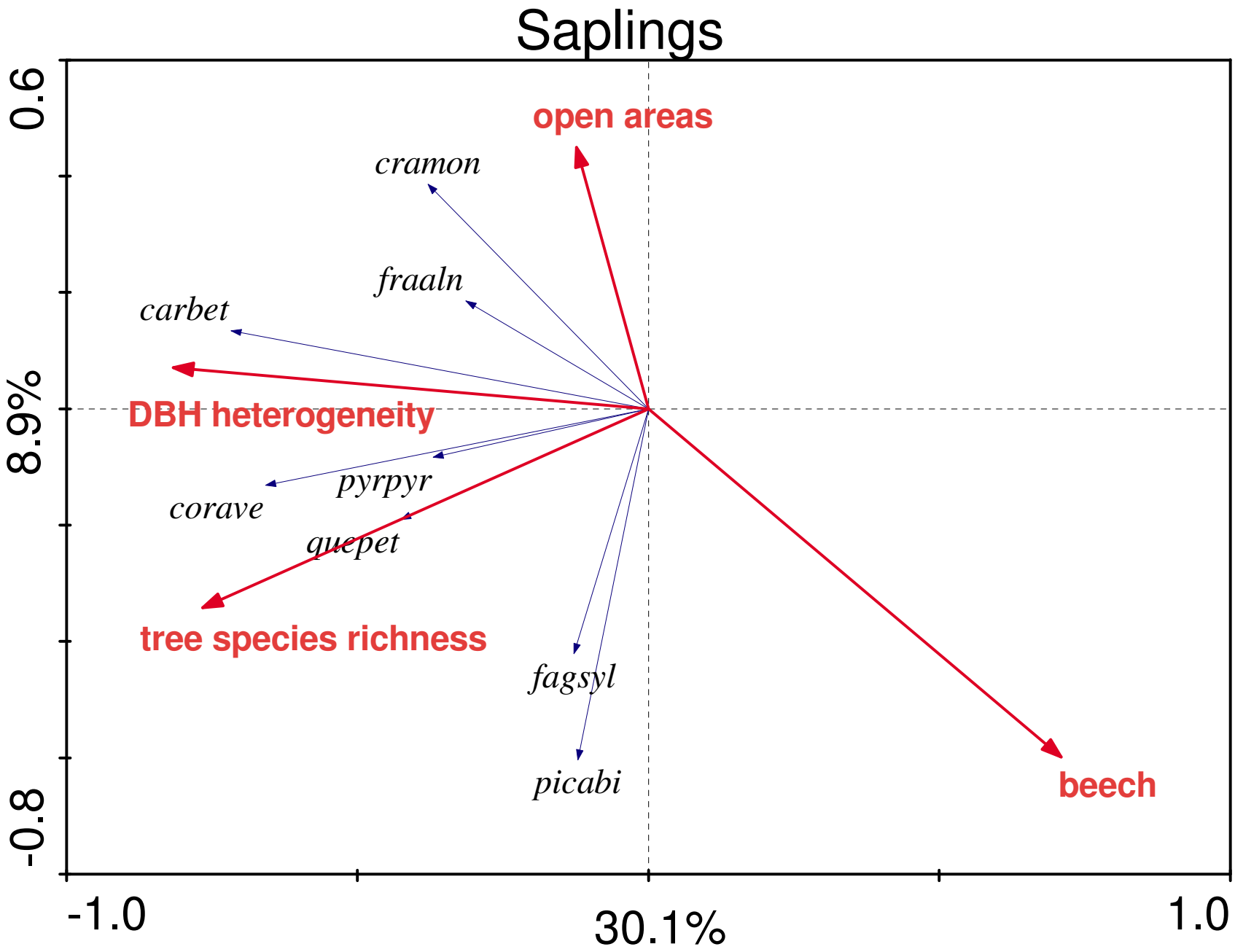

Bryophytes
DBH of dominant trees
oak
schrub density
spruce
stand volume
oak forests
litter
tree density
hypcup
plaaff
eurang
plarep
fistax
placus
thudel
atrund
frudil
isoalo
radcom
ambser
fisbry
ptipul
brarut
planem
bravel
brycap
placav
homtri
dicmon
metfur
ulocri
ditpal
oryrud
rhipun
polfor
dicsco
brasal
brapop
sclpur
hylspl
tetpel
ortpal
ortspe
plarut
dichet
hersel
plesch
ortaff
plalae
lophet
ortstra
pohnut
dicpol
bryrub
pladen
leugla
0.8
10.1%
-0.6
-1.0
27.5%
1.0

Herbs


0.8
11.7%
-0.8
-0.4
25.0%
1.0
hornbeam
spruce
galodo
oxaace
number of large trees
DBH of dominant trees
saneur
dryfil
viorei
ajurep
drycar
maibif
galrot
tree species richness
athfil
carsyl
mycmur
polmul
DBH heterogeneity
descae
fraves
rubida
rubfru
galpub
schrub abundance
luzluz
stemed
scrnod
hiemur
brasyl
pteaqu
eriann
clivul
luzpil
urtdio
melcar
roscan
solgig
siedec
hielac
carpil
juneff
veroff
carpal
melpra
calepi
light

Seedlings


0.6
9.1%
-0.8
-0.8
20.0%
0.8
querob
ligvul
cramon
open areas
pruspi
corsan
quepet
tree density
light
quecer
pinsyl
vibopu
tilpla
prunavi
fraexc
juncom
querub
tilcor
fraaln
rhacat
pyrpyr
salcap
carbet
betpen
cassat
malsyl
schrub density
corave
acepse
poptre
dead wood
tree species richness
beech
fagsyl
spruce
picabi


Saplings
0.6
8.9%
-0.8
-1.0
30.1%
1.0
open areas
cramon
fraaln
carbet
DBH heterogeneity
pyrpyr
corave
quepet
tree species richness
fagsyl
picabi
beech

Regression models predicting species richness

Organism groups	Birds	Bryophytes	Herbs	Seedlings	Saplings
Explained variance (R^2)	0.46	0.56	0.43	0.40	0.67
1. Variable (%)	Mean DBH (+, 15)	Schrub density (+, 24)	Light (+, 29)	Light (+, 26)	Tree species richness (+, 49)
2. Variable (%)	Hornbeam (+, 12)	Mixing tree species (+, 15)	Tree species richness (+, 13)	Tree species richness (+, 17)	Beech (-, 12)
3. Variable (%)	Herb cover (+, 12)	DBH heterogeneity (+, 13)	Spruce forests (+, 6)		Mean DBH (-, 6)
4. Variable (%)	Spruce forests (+, 6)	Litter cover (-, 8)			Tree density (-, 4)

Correlations between the organism groups according to abundance and species richness

species richness

	Birds	Bryophytes	Herbs	Seedlings	Saplings
Birds	**0.90*** **	**0.32^{ns}**	**0.37***	**0.18^{ns}**	**-0.02^{ns}**
Bryophytes	**0.27^{ns}**	**0.56*** **	**0.63*** **	**0.53*** **	**0.50****
Herbs	**0.35***	**0.55*** **	**0.85*** **	**0.79*** **	**0.54*** **
Seedlings	**0.58*** **	**0.51****	**0.39***	**0.36***	**0.53****
Saplings	**0.27^{ns}**	**0.29^{ns}**	**0.34***	**0.31^{ns}**	**0.53****

abundance

Abundance of large trees

Species composition and richness of birds and bryophytes

Shelterwood system: retention trees, increasing rotation period

Tree selection system: Saving mature trees

Tree species diversity

Key factor in species richness of all organism groups

It should be a main directive in all management system.

Tree size heterogeneity, shrub layer

Species richness of birds and bryophytes

Spatially fine scaled management: stem or group selection system

Deciduous litter cover

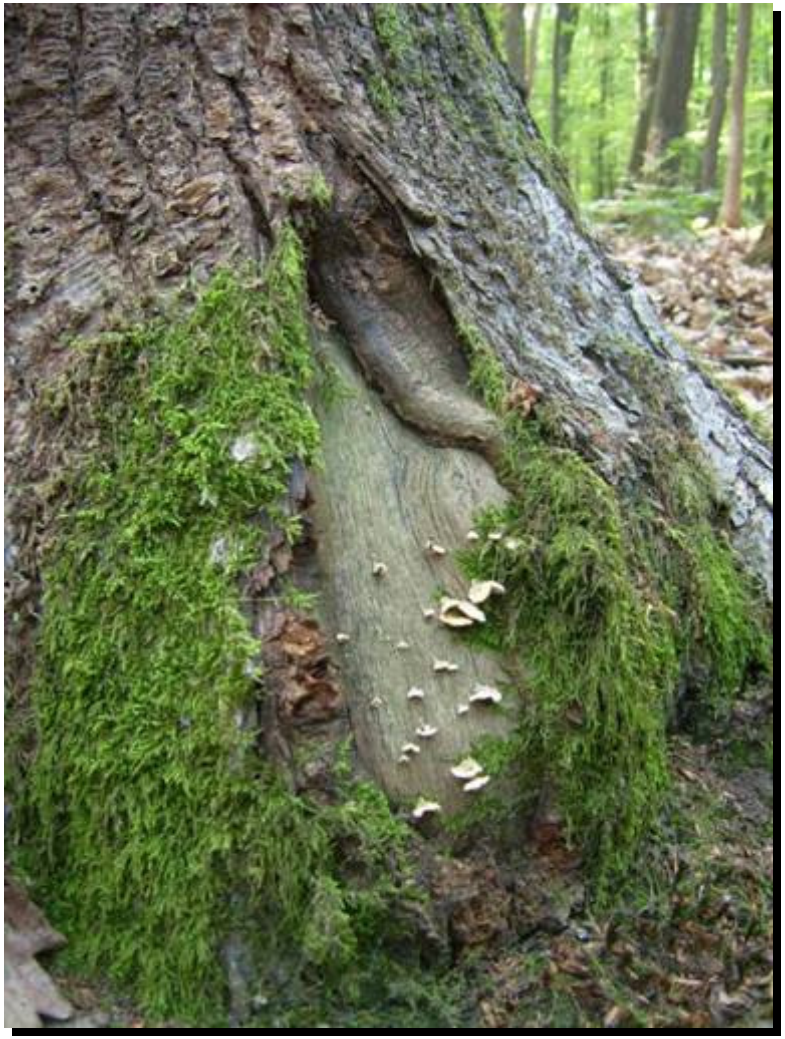
Inhibit the abundance of terricolous bryophytes

Light

The most important factor in the species composition and diversity of herbs and seedlings

Spatially fine scaled management: stem or group selection system

Oak proportion



Increase the cover and species richness of epiphytic bryophytes

Spruce proportion

Increase the diversity
of birds and herbs

Conclusions

Many community level variables of the organism groups can be predicted relatively well by simple variables of forest stands

Basic research: the relationships can generate hypotheses for experimental studies exploring causalities

Applied research: The relationships can help for the establishment of nature conservation and forest management strategies

Perspectives

Potential explanatory variables:

Tree species composition
Stand structure
Light
Substrates
Landscape variables
Forest history
Soil and litter properties
Microclimate

Organism groups:
(abundance, diversity, fuctional groups)

Birds
Bryophytes
Herbs
Seedlings
Saplings
Fungi
Lichens
Beetles
Spiders
Flies

Thank you for your attention!

Support: Hungarian Science Foundation (OTKA 68218, 79158), Őrség National Park Directorate, János Bolyai Scholarship