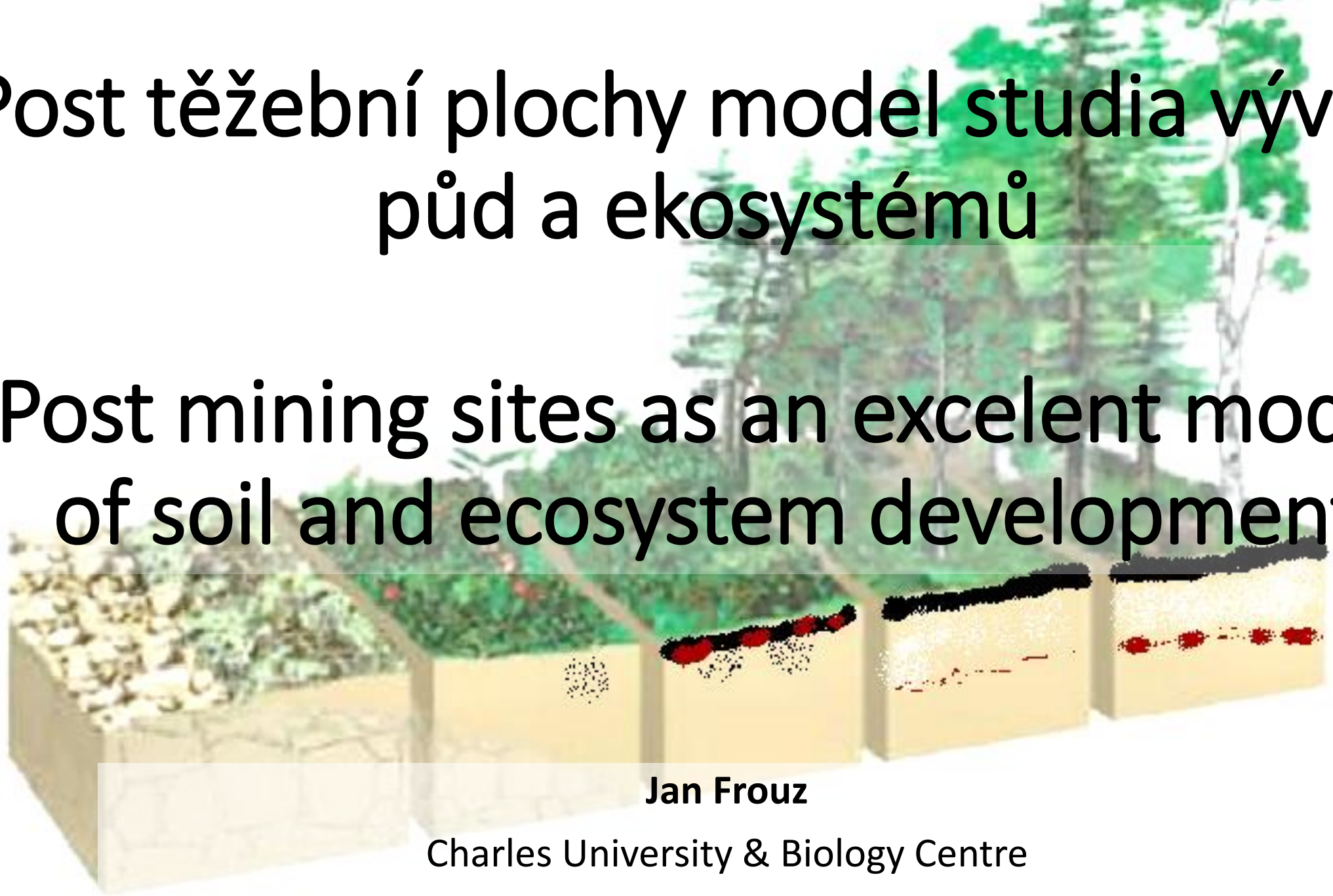
Post těžební plochy model studia vývoje půd a ekosystémů

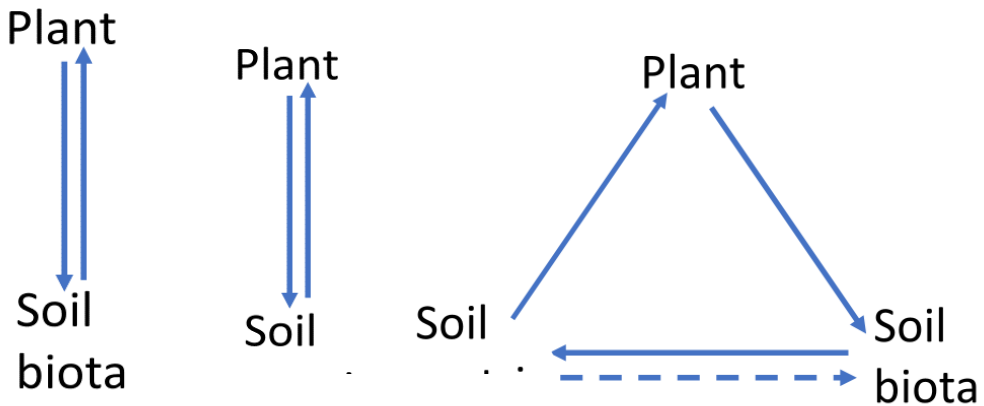
Post mining sites as an excelent model of soil and ecosystem development



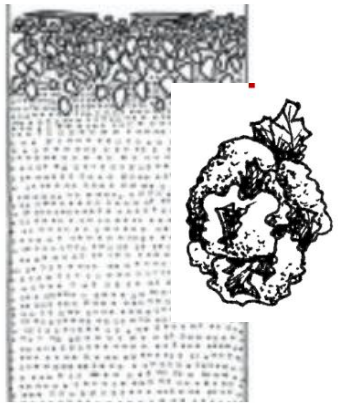
Jan Frouz

Charles University & Biology Centre

Czech Republic



Plants



Soil

Climate
Geology
Topography

Soil biota

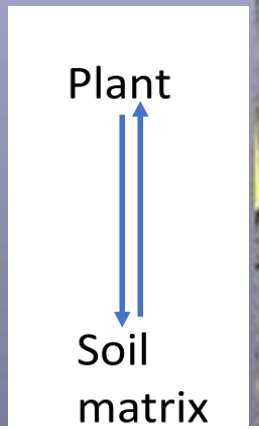
Post mining sites

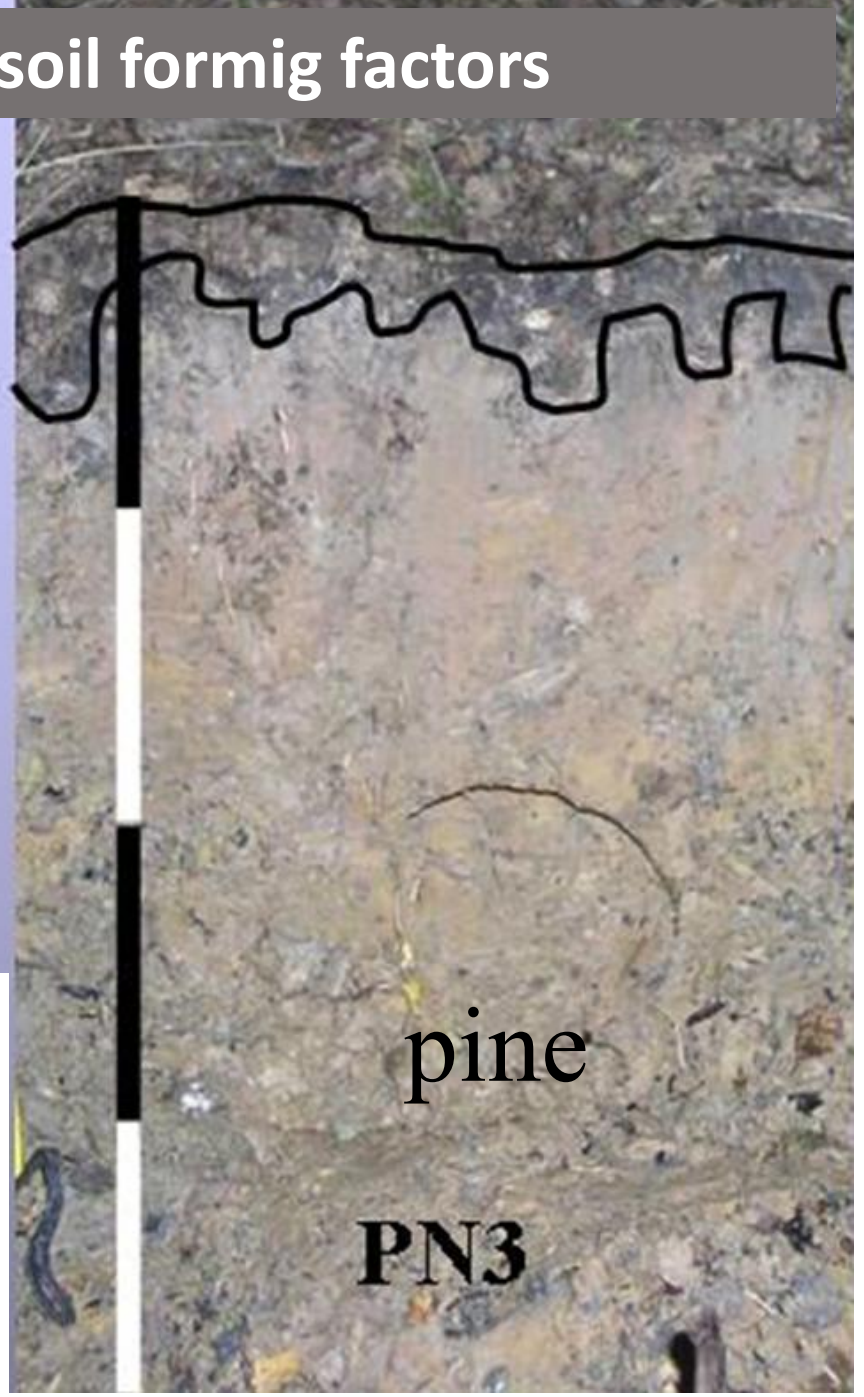
Sites with various combination of climate, soil forming substrate, vegetation and topography by site selection – one can keep study effect of these factors

Chronosequences – space to time substitution

Allow to do manipulation experiments which would be technically difficult or non ethical in other sites

Various combinations of soil formig factors

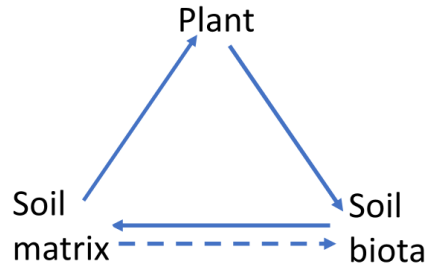


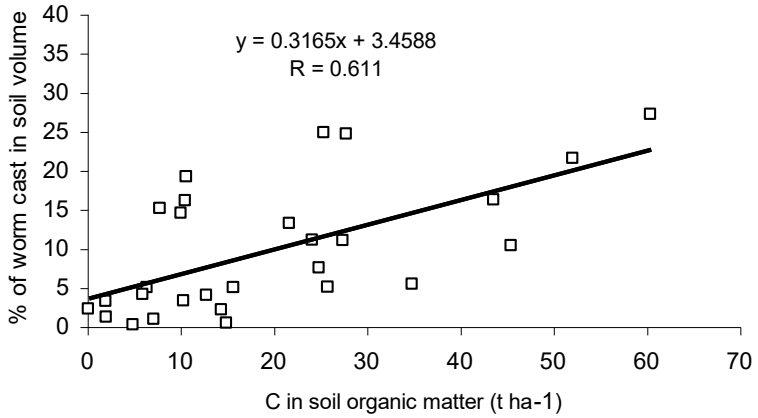


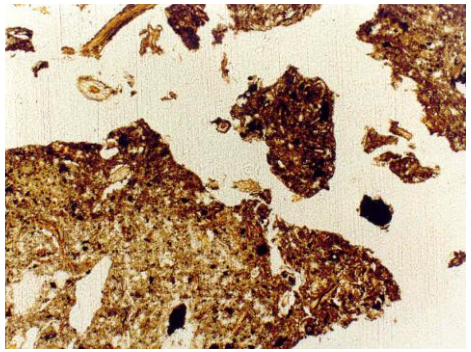
2 soils both 40 years old

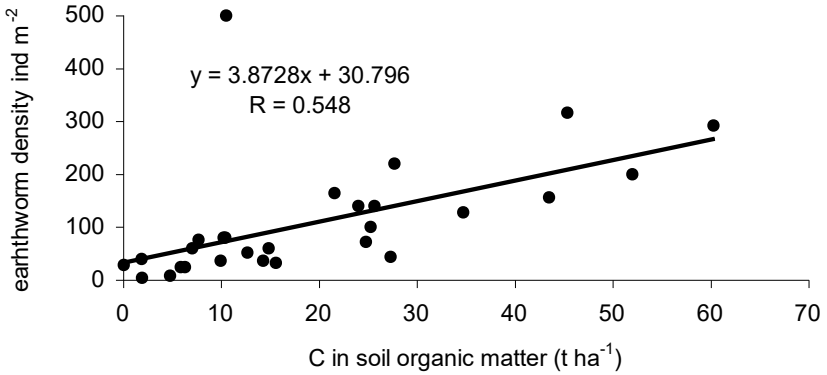
Developing on the same substrate

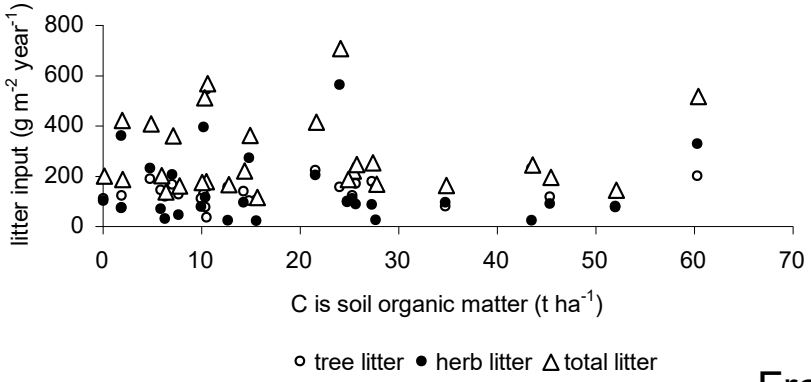
Located about 50m apart

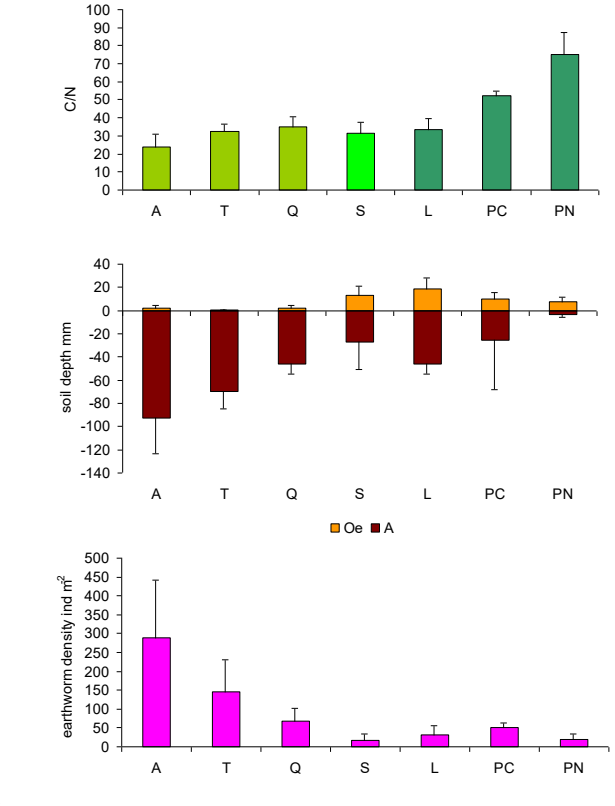


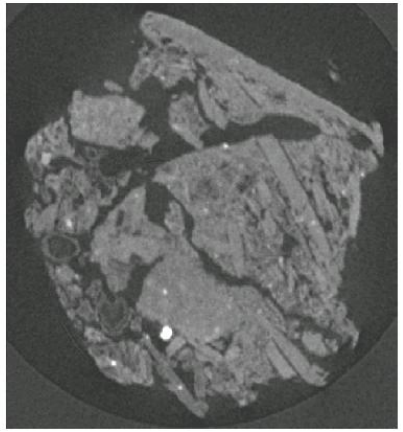


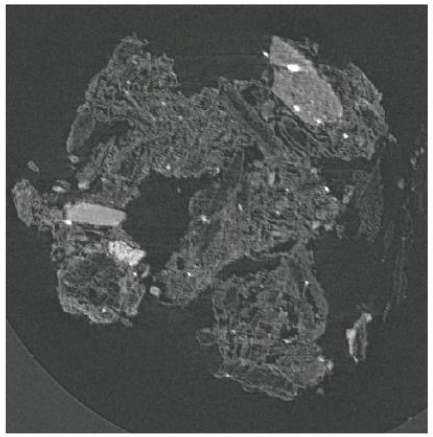




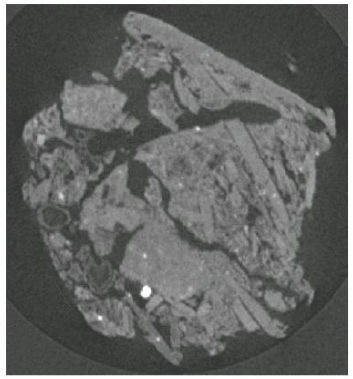


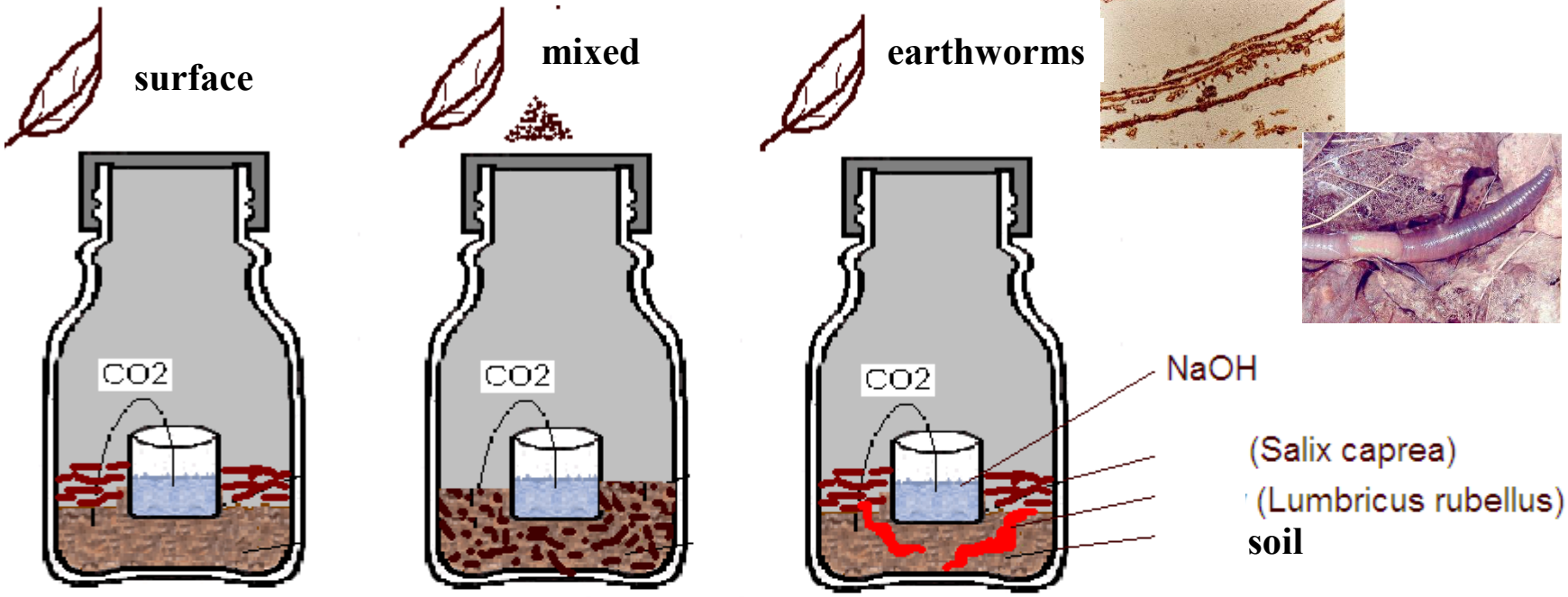


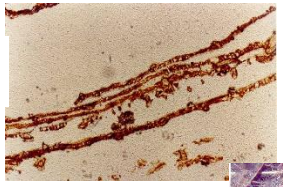


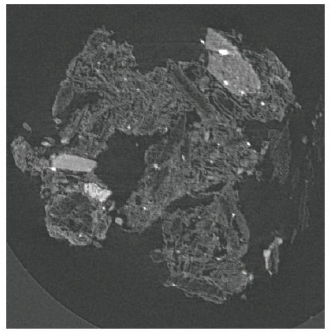


Frouz et al., 2009. Biogeochemistry 94(2): 111-121

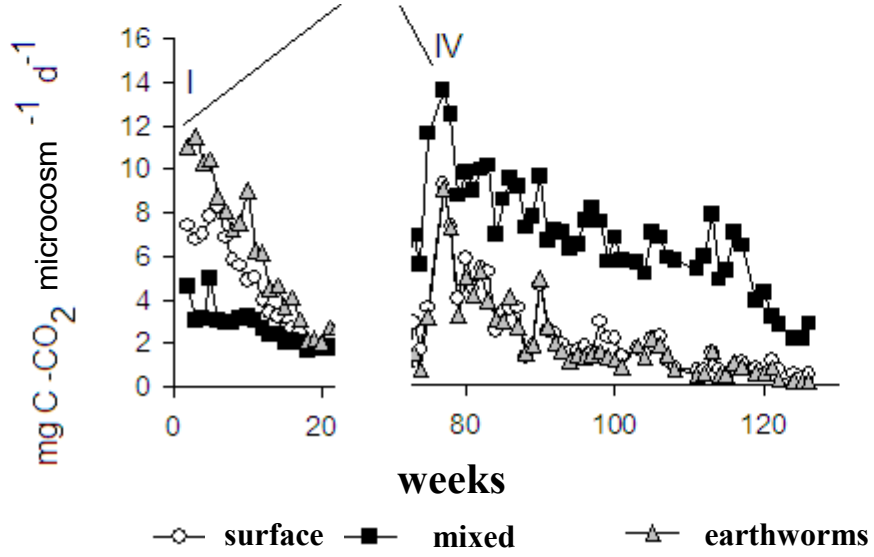


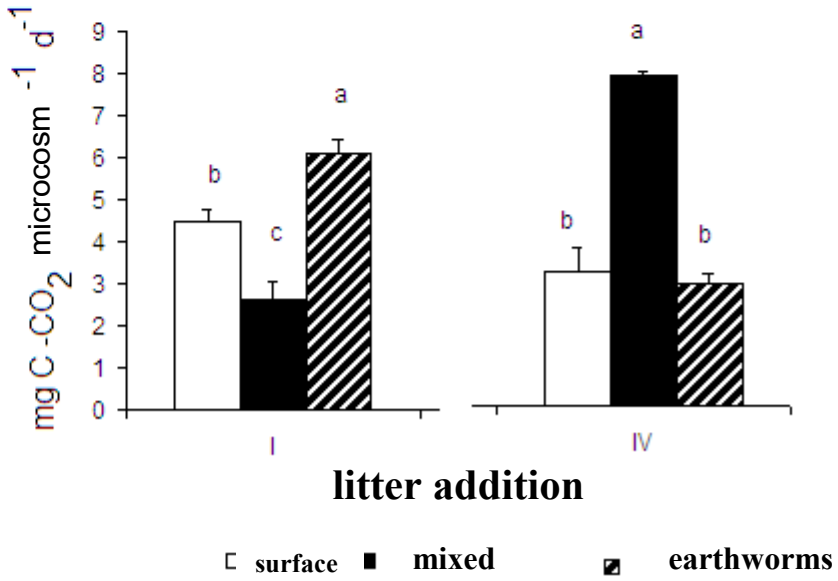




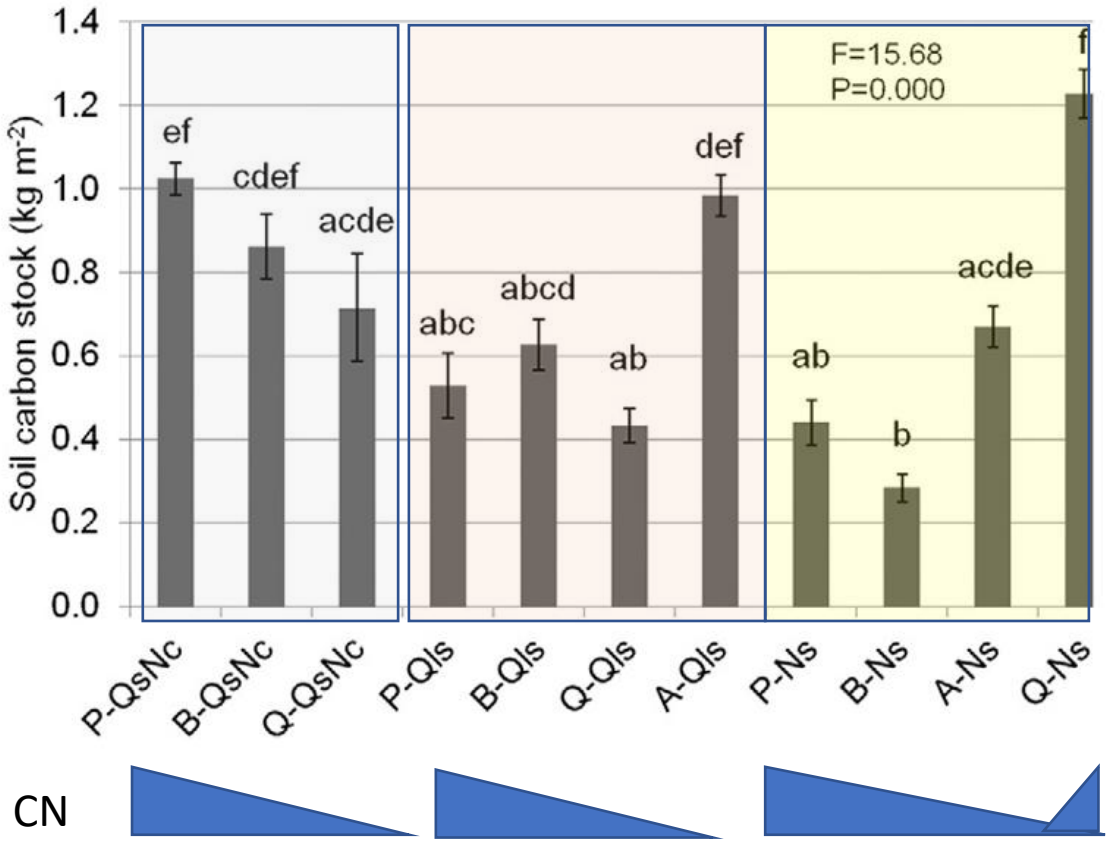


litter addition





Frouz et al., 2013 SBB



Geoderma 292 (2017) 9–16

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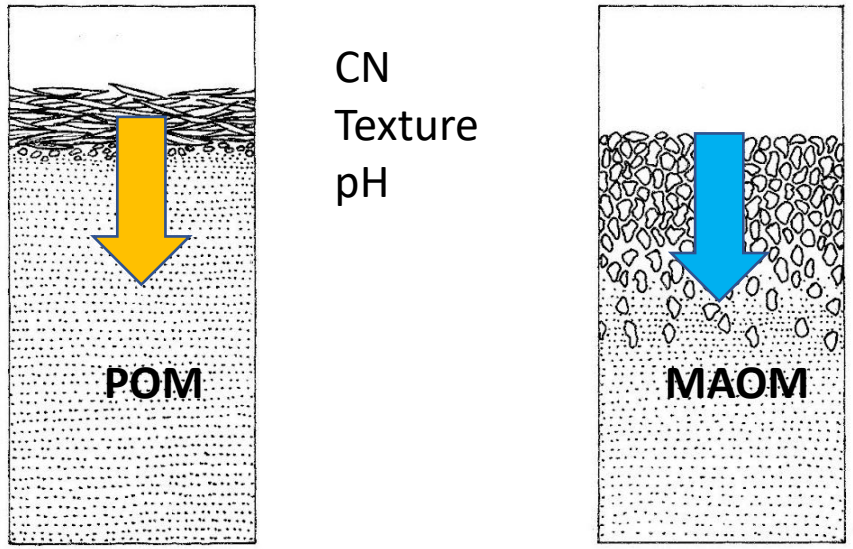
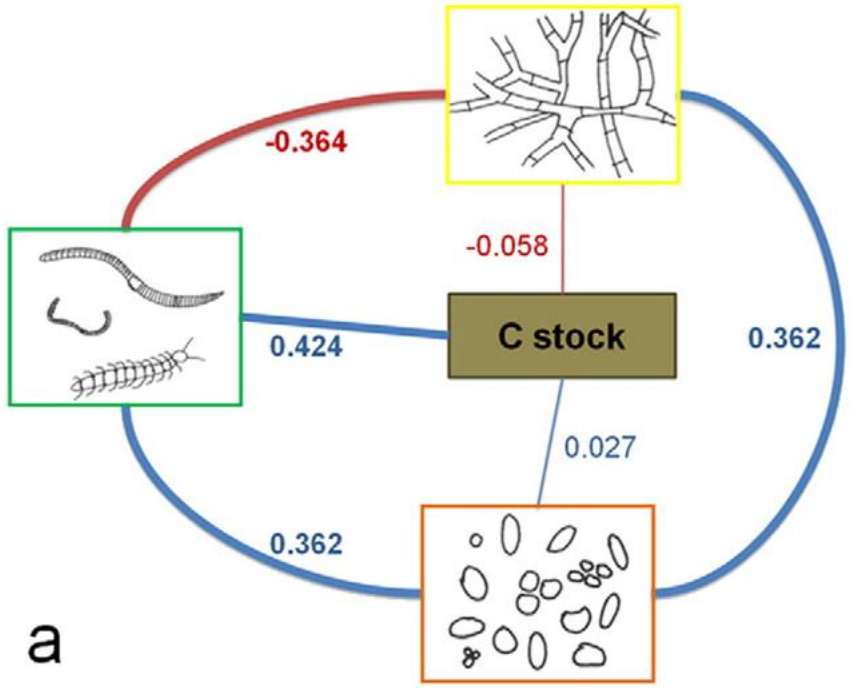
The effects of tree species and substrate on carbon sequestration and chemical and biological properties in reforested post-mining soils

Agnieszka Józefowska [a,*], Marcin Pietrzykowski [b], Bartłomiej Woś [b], Tomáš Cajthaml [c], Jan Frouz [c,d]

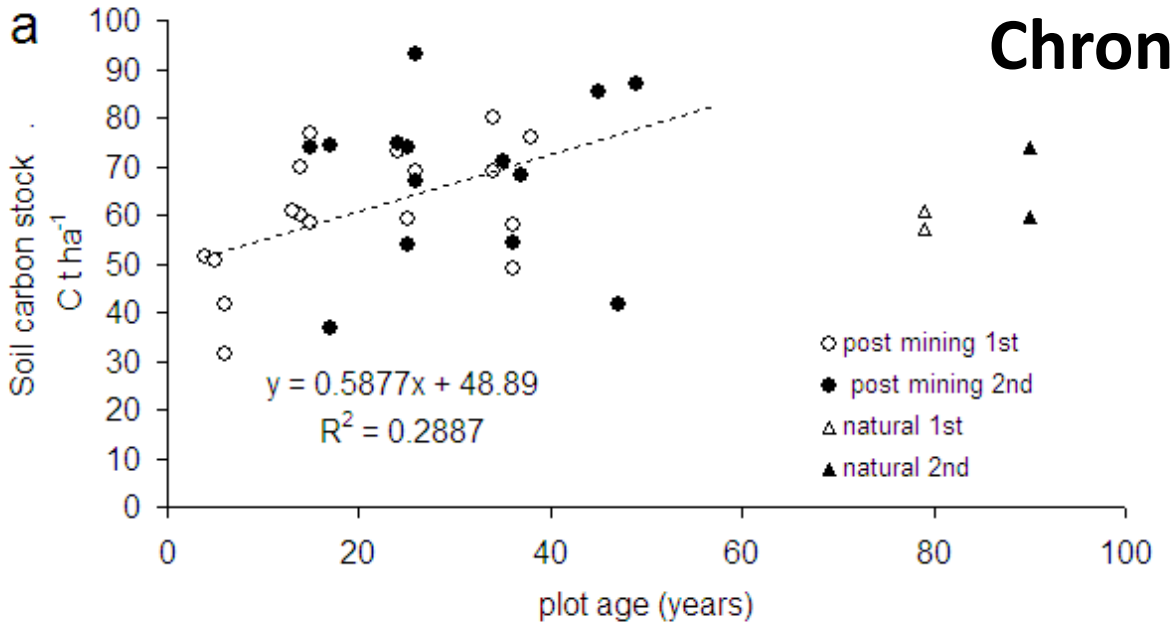
[a] Department of Soil Science and Soil Protection, Agriculture and Economy Faculty, University of Agriculture in Krakow, Al. Mickiewicza 21, 30-120 Krakow, Poland

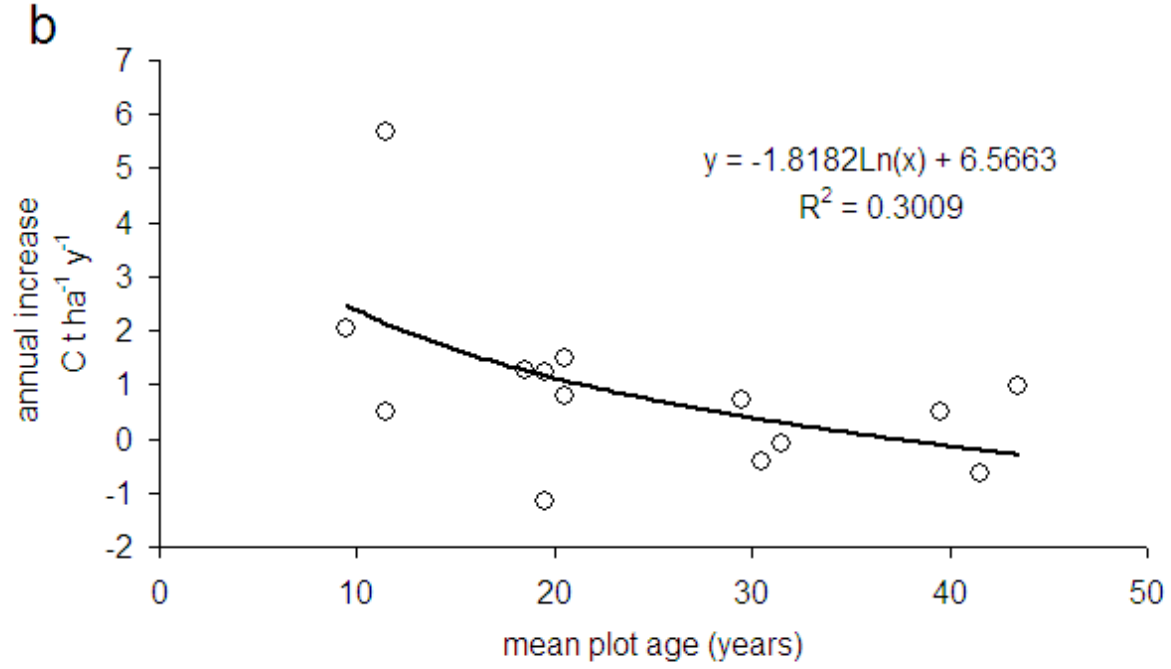


CN
Texture
pH



Chronosequences

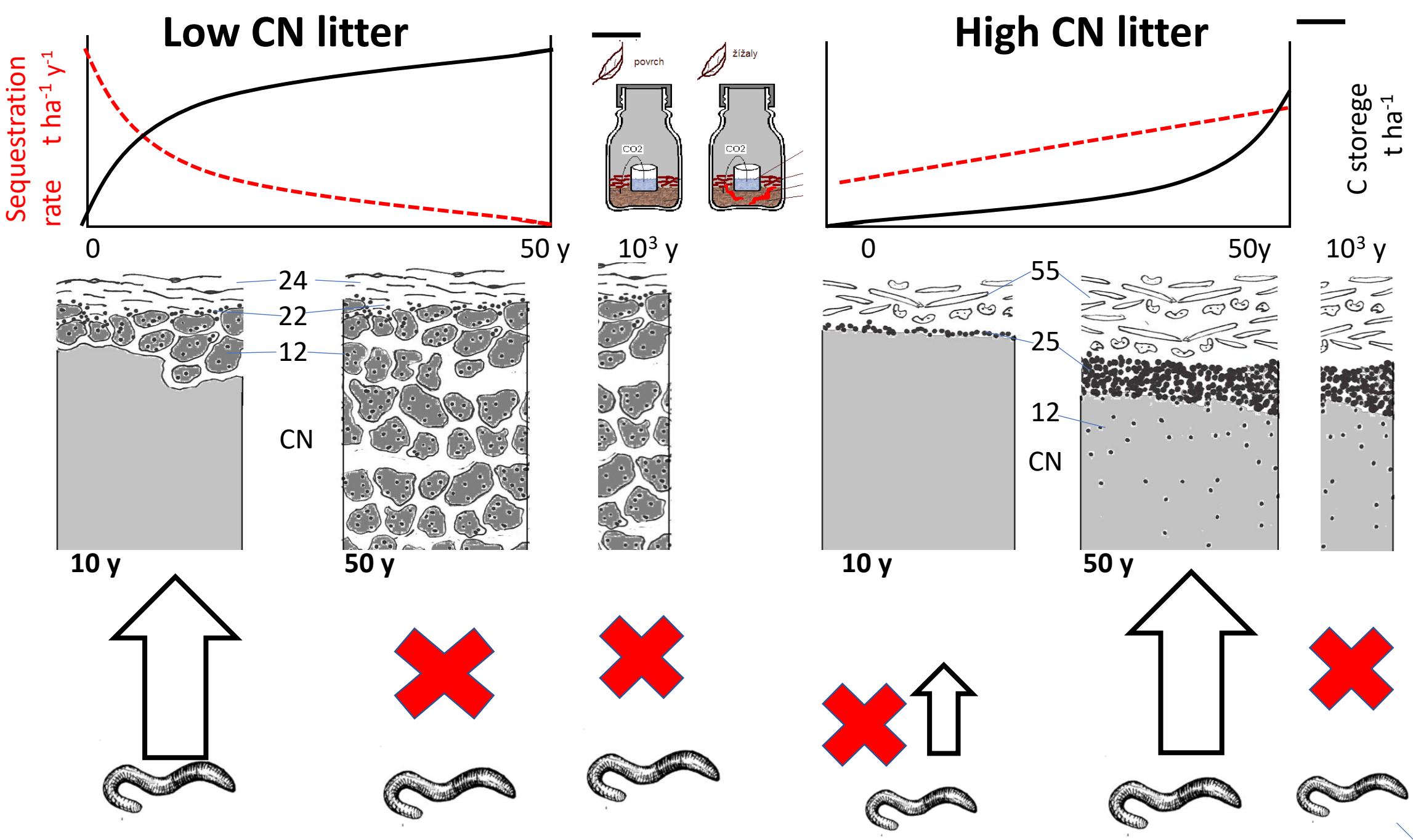




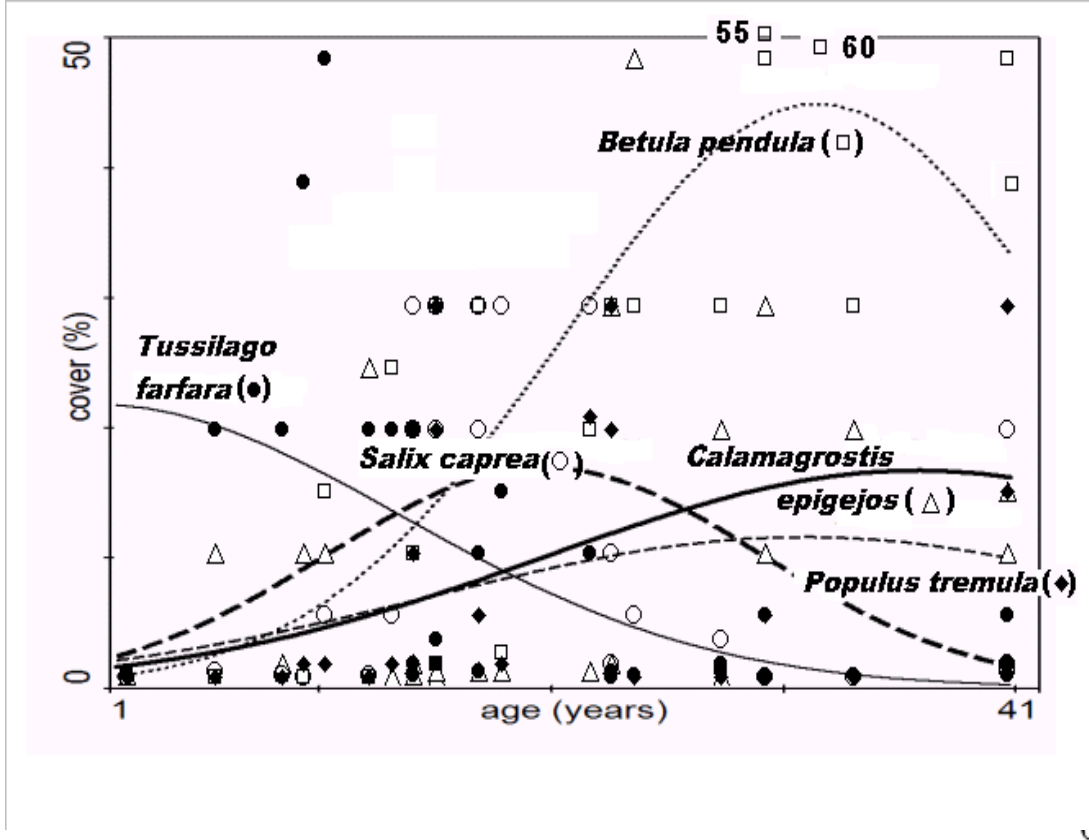
Carbon seqestration

Microstructure

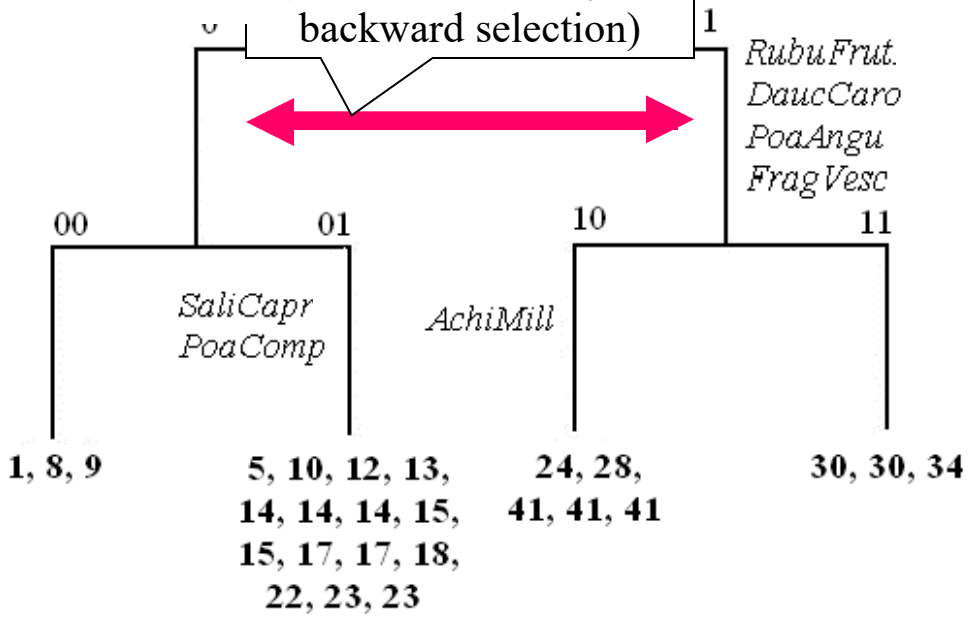
Earthwom efect on C storage

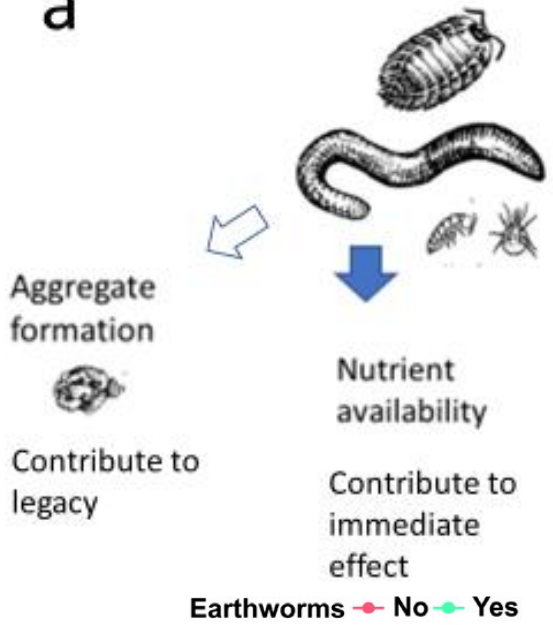


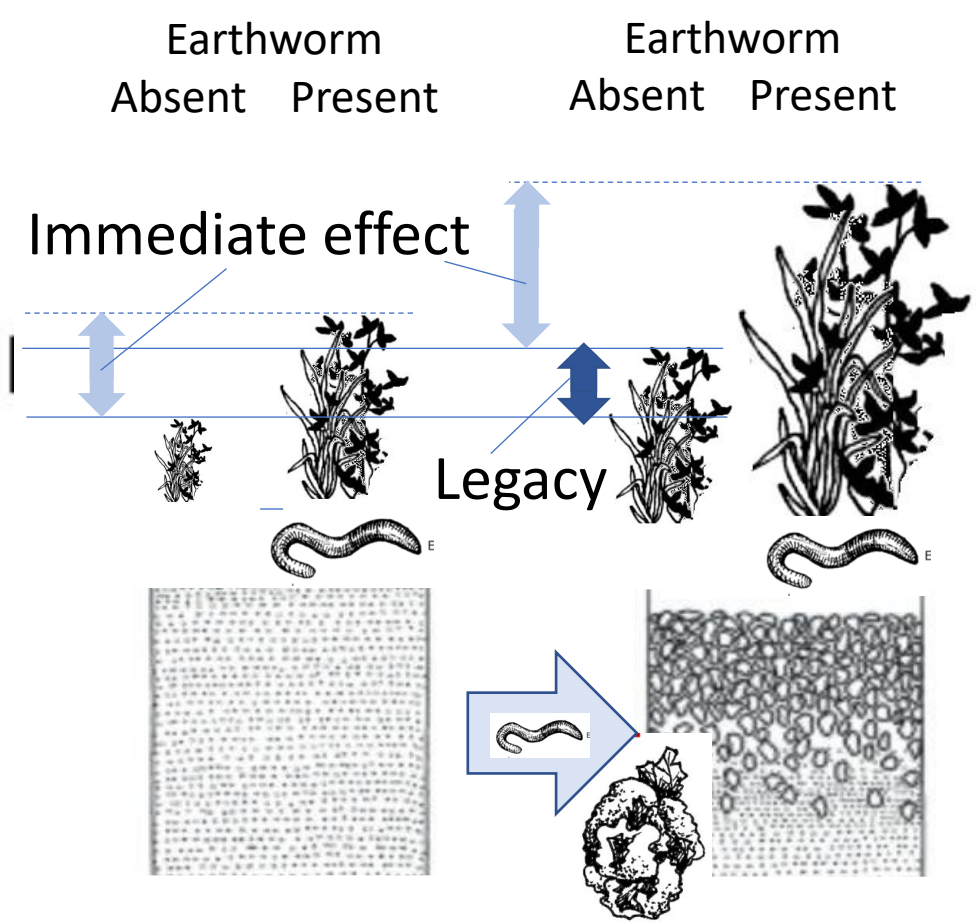
Plant community changes



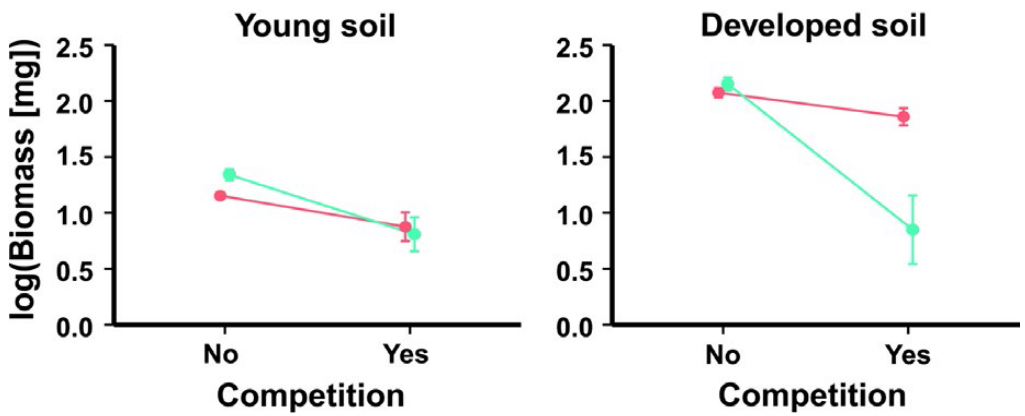
presence **humus layer** s strongest predictor of these groups (discriminant analysis, backward selection)







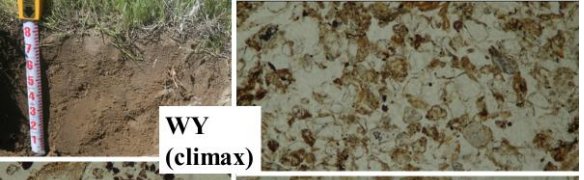
Earthworm effect on plants differ in soil which has been devoted by earthworms and in soil where fauna was for some time



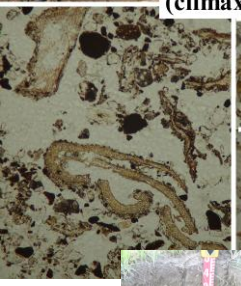
No earthworm legacy
Early succession

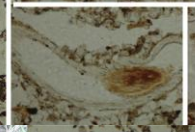
Earthworm legacy
Late succession

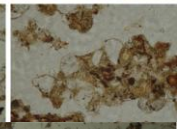
Mudrák, O., Frouz, J. 2018. Functional Ecology, 32: 626-635.



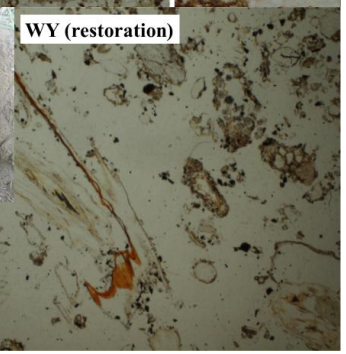
WY (climax)

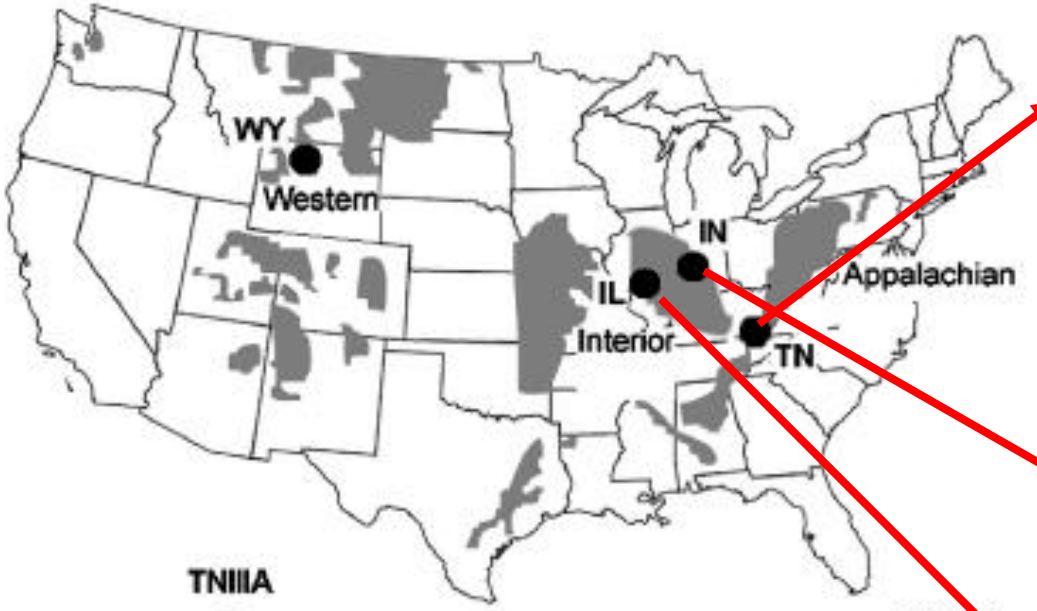


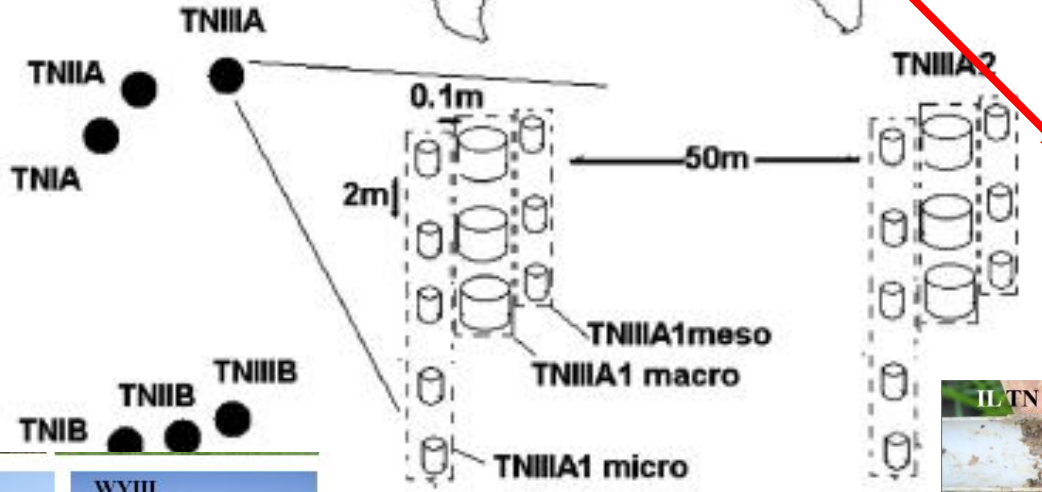


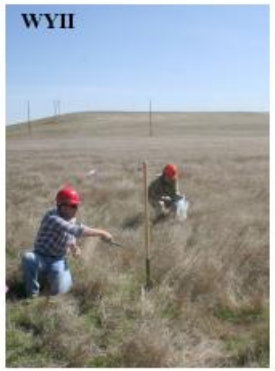


WY (restoration)

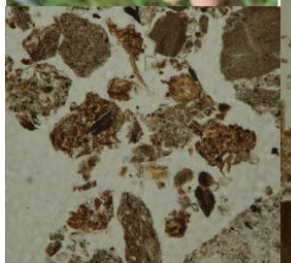


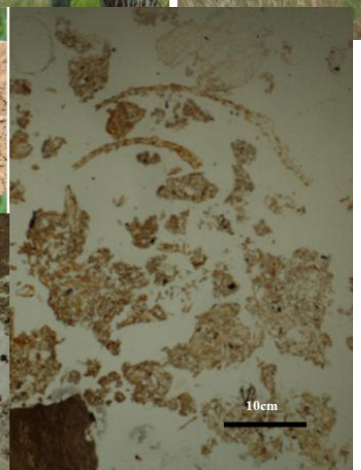


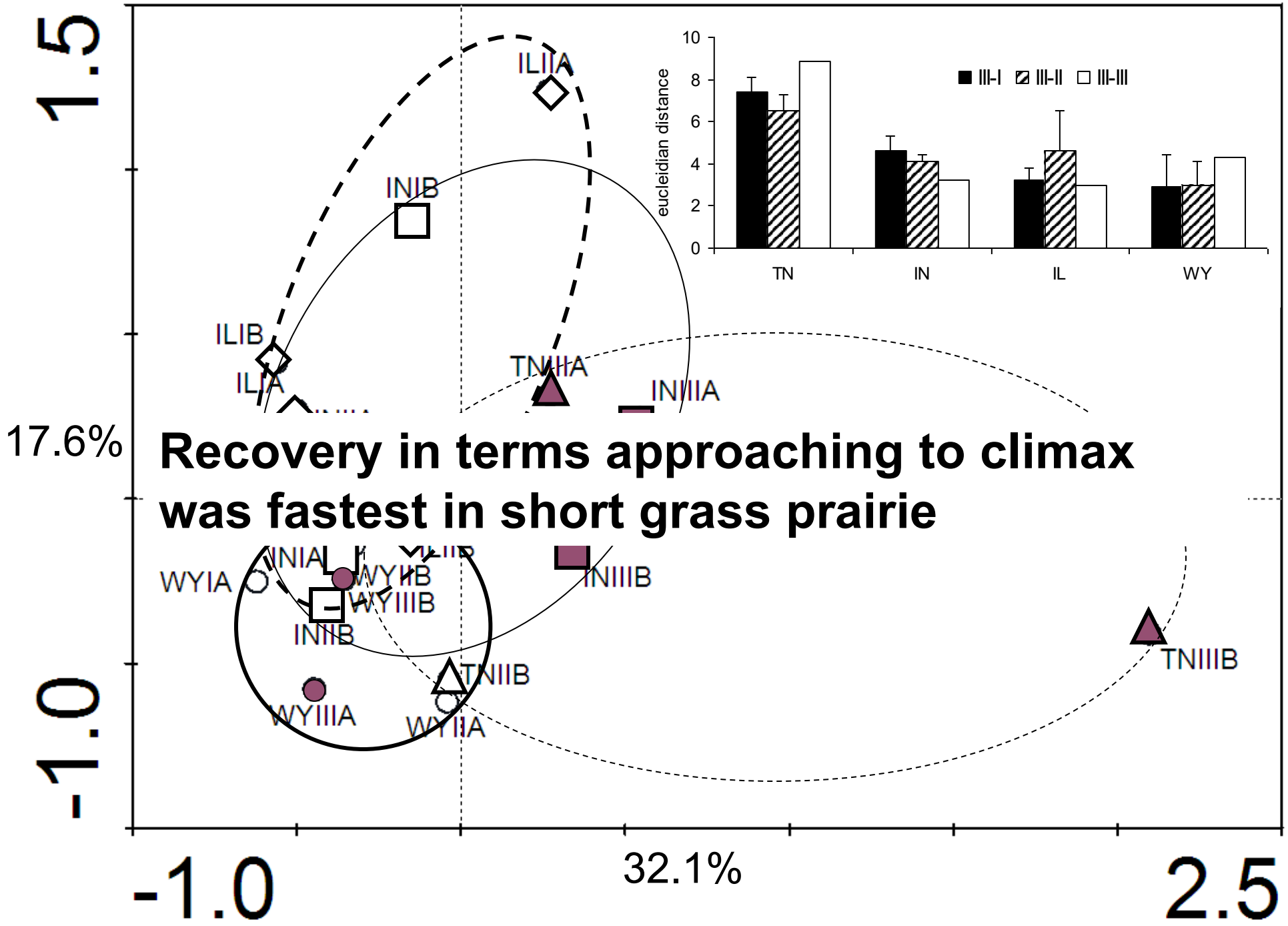




IL TN (restoration)

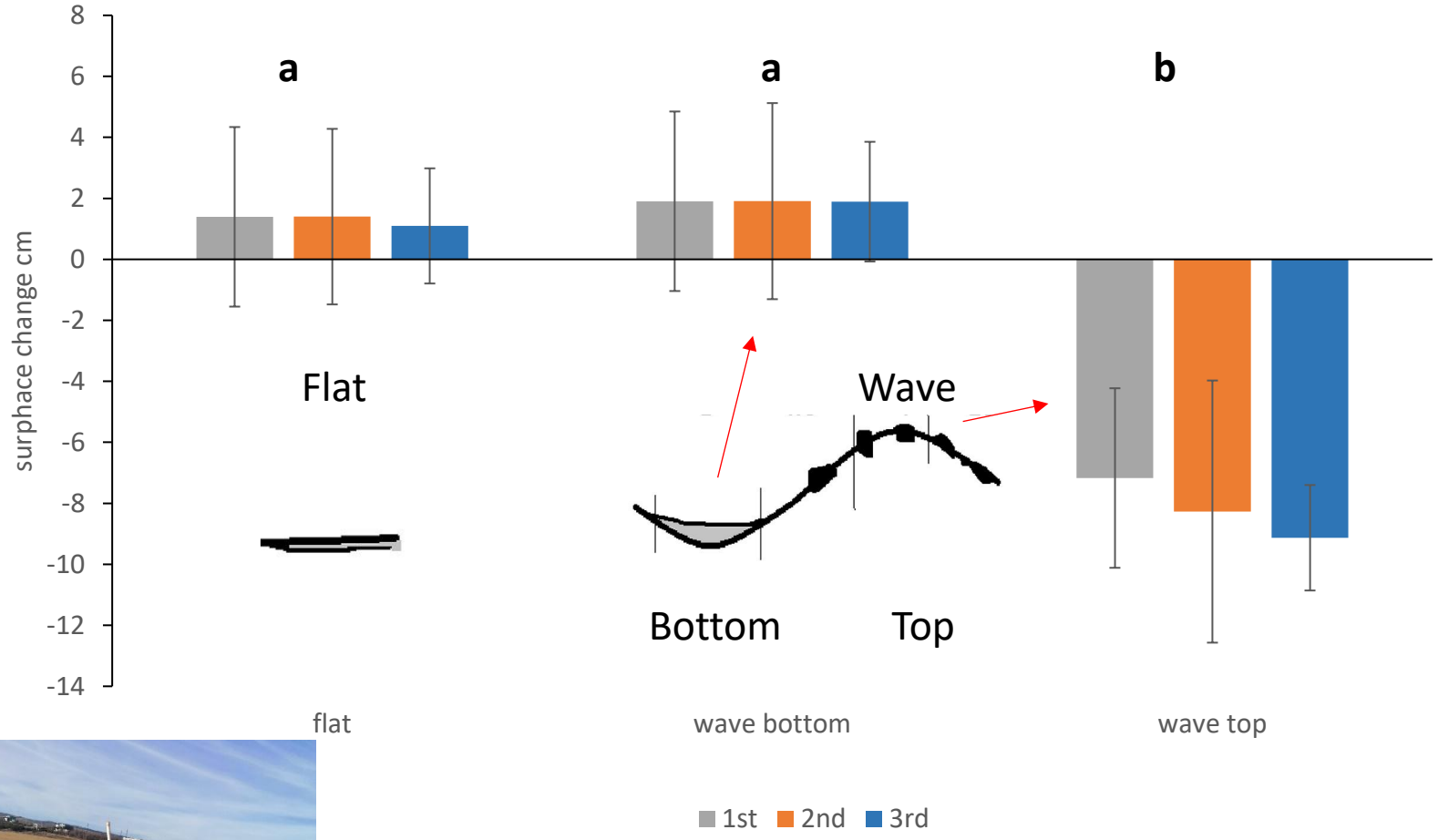






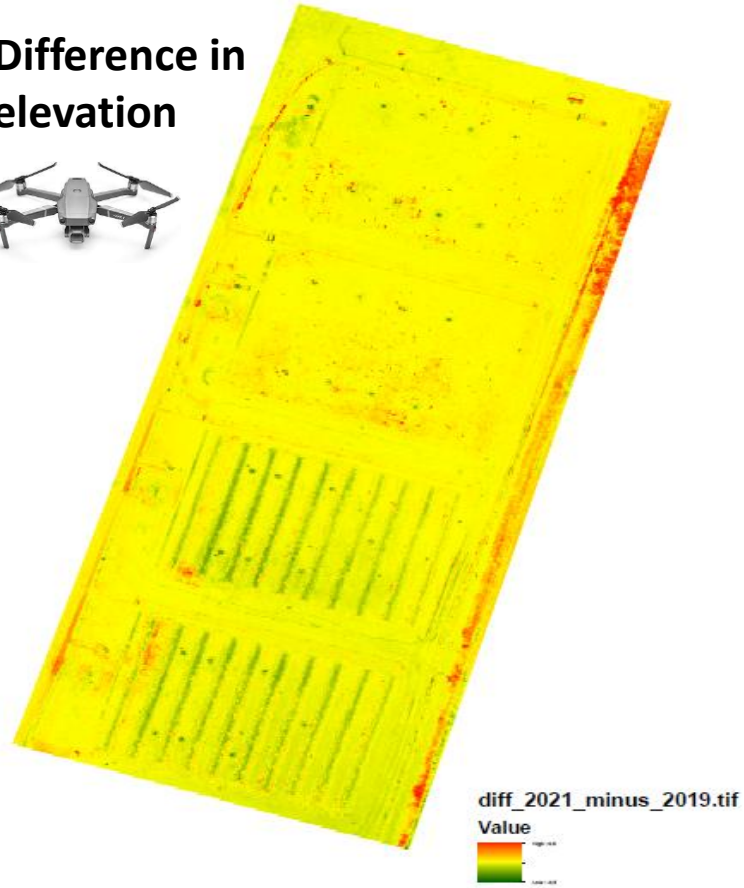
Recovery in terms approaching to climax was fastest in short grass prairie

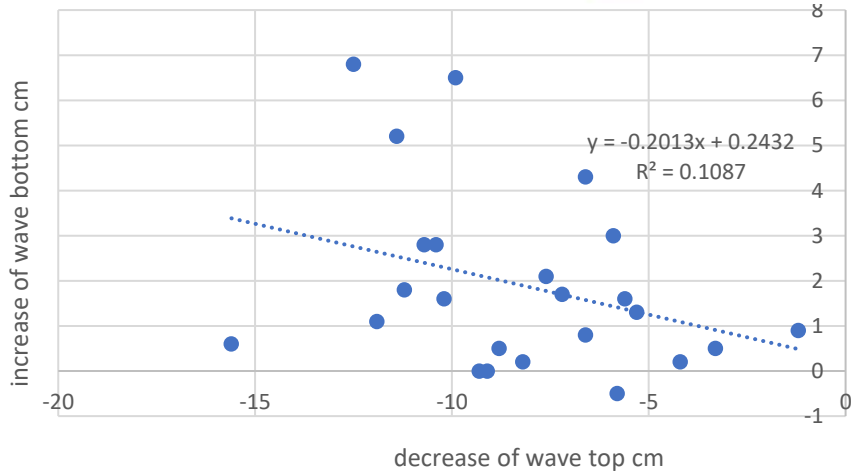
Manipulation experiments



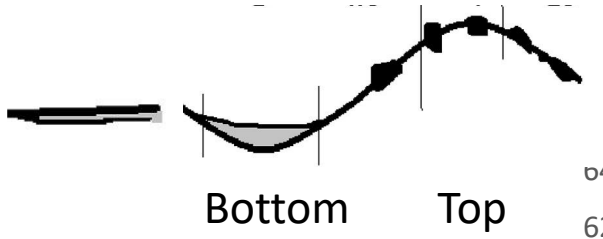
Surface change
Flat +1.4 cm Wave -3.2 cm ** (t test)
Soil loss
Flat 1.3 t ha^{-1} y^{-1} Wave 1.1 t ha^{-1} y^{-1} ns (t test)

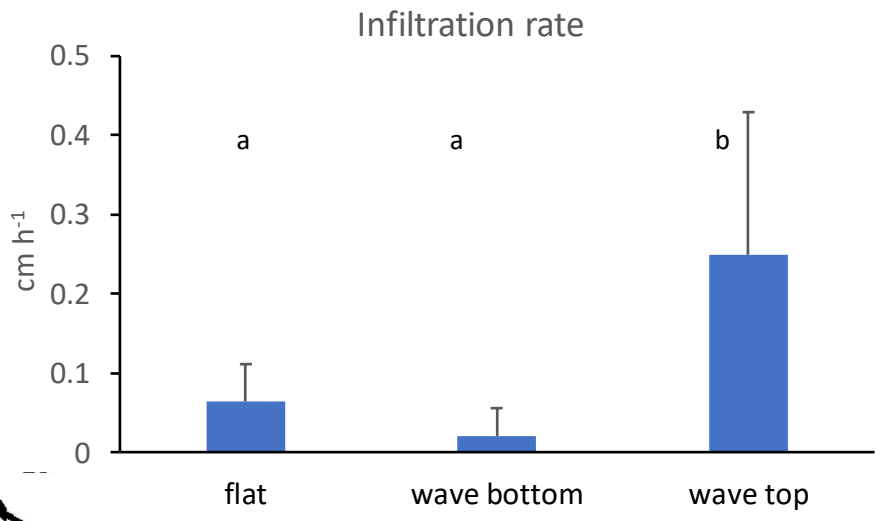
Difference in elevation

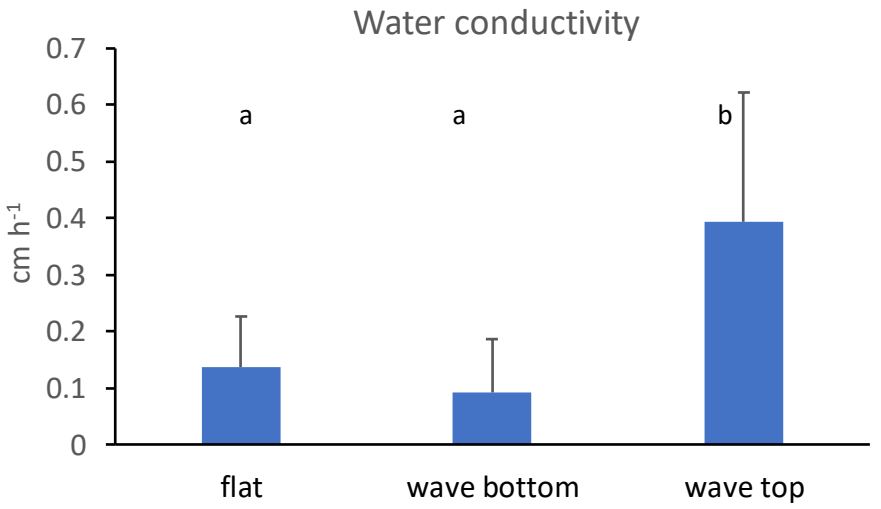


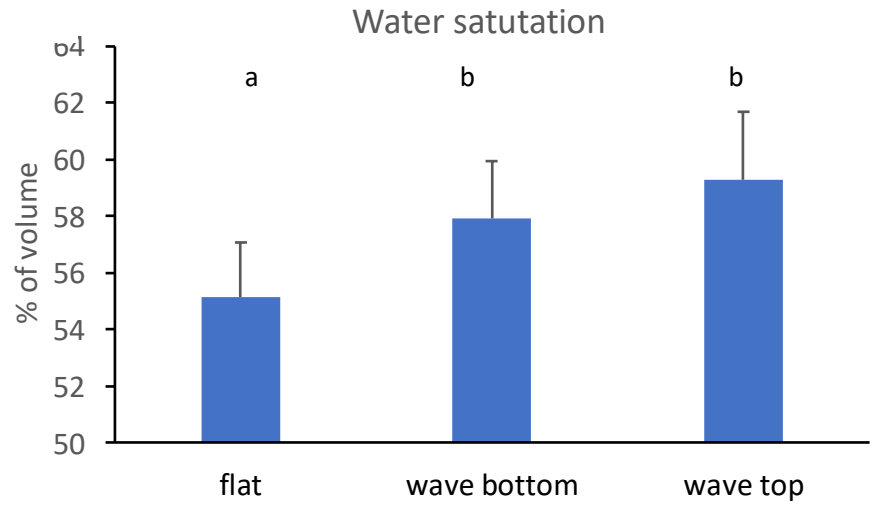


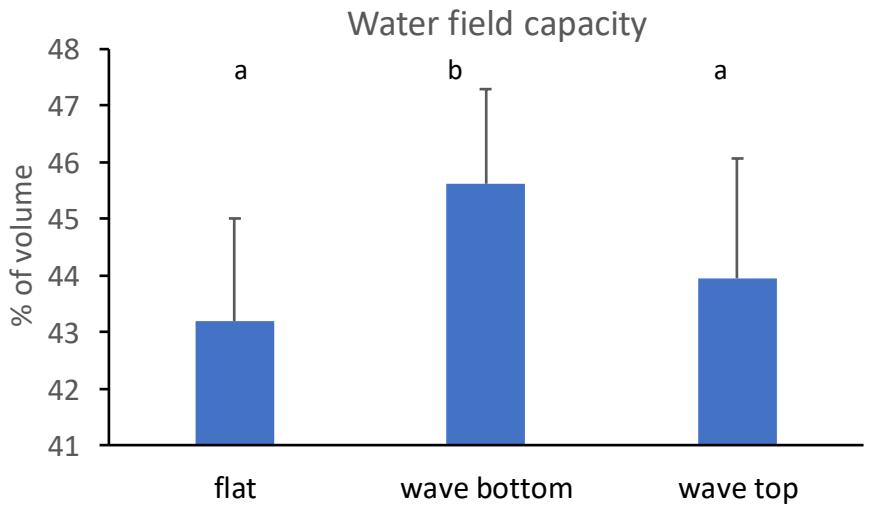
Infiltration and water retention





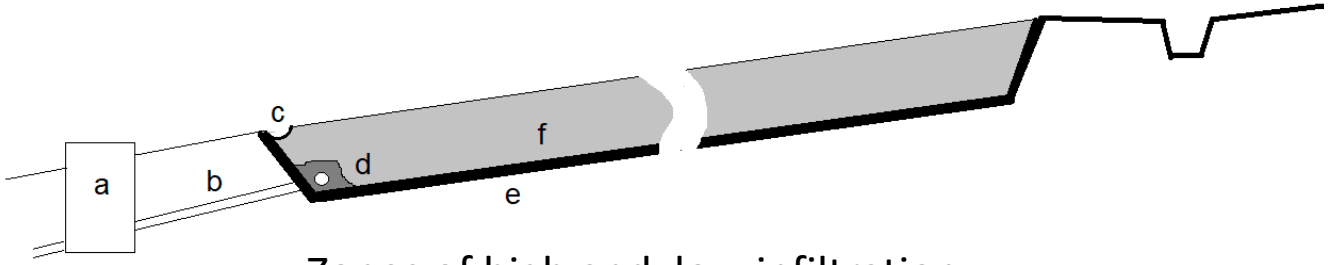






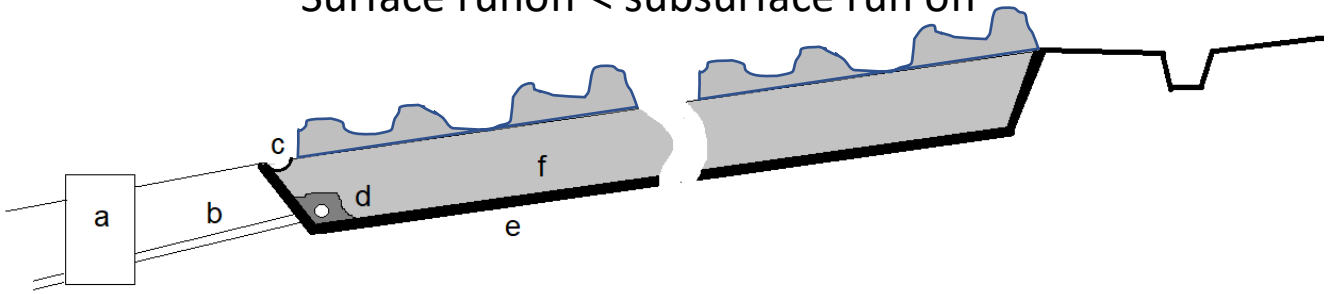
Homogenously low infiltration

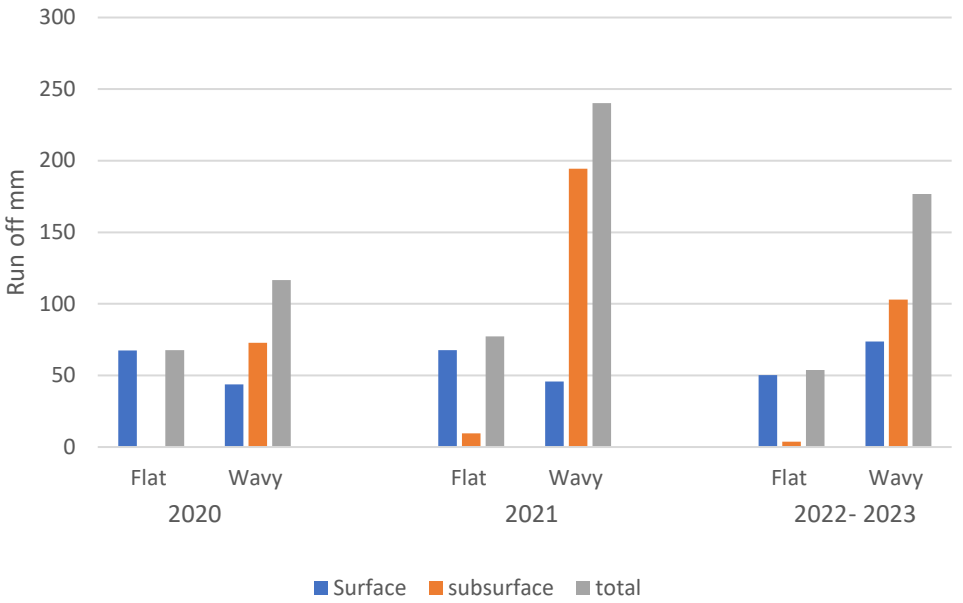
Surface runoff > subsurface run off

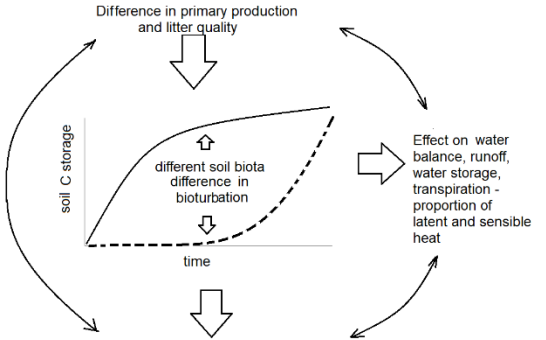


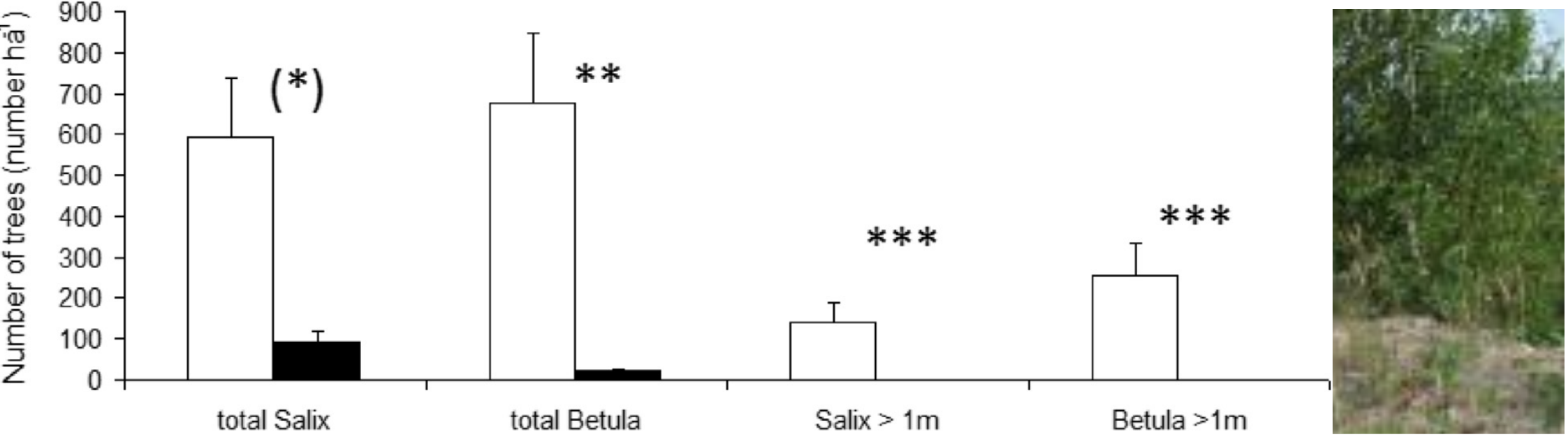
Zones of high and low infiltration

Surface runoff < subsurface run off

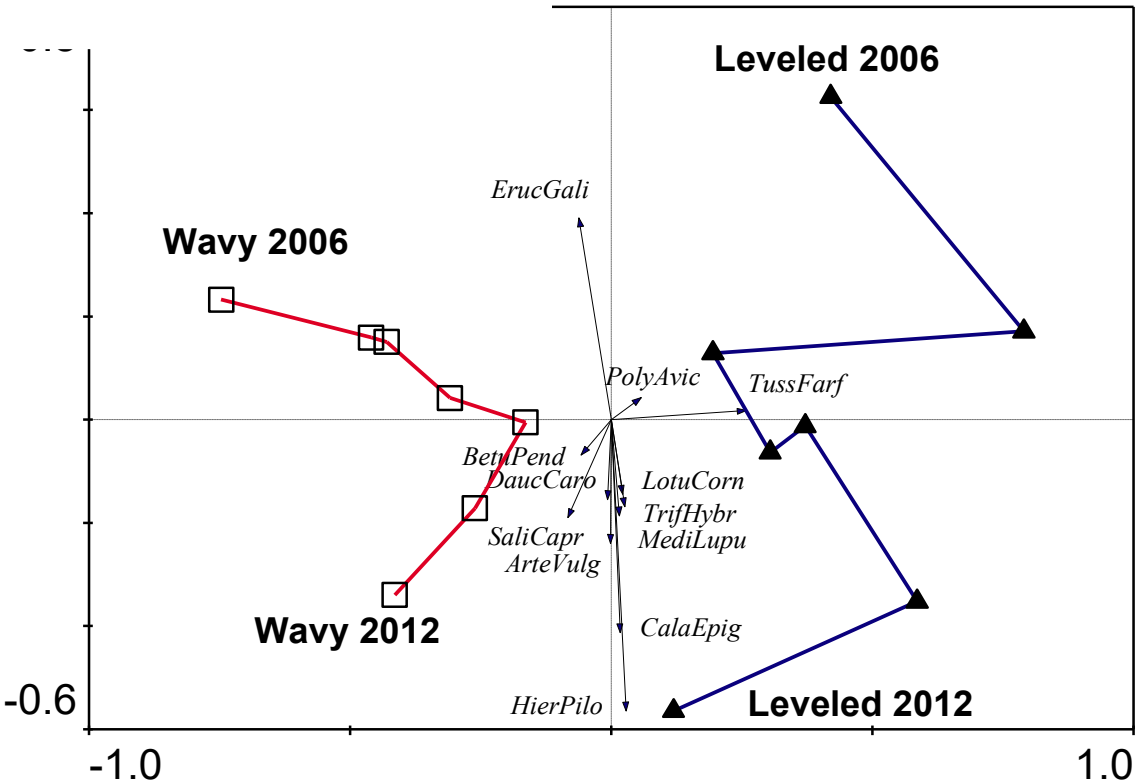


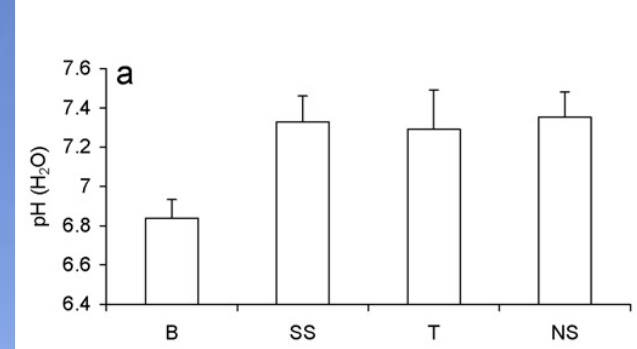


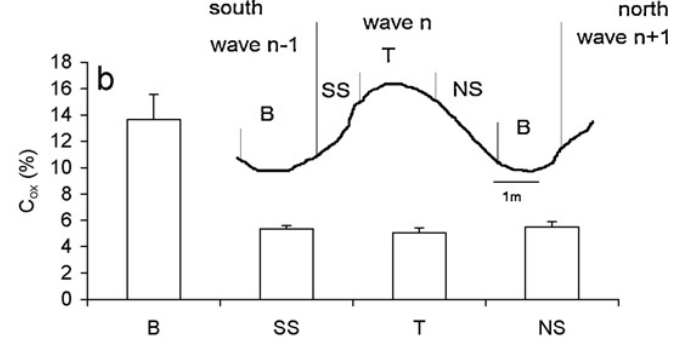


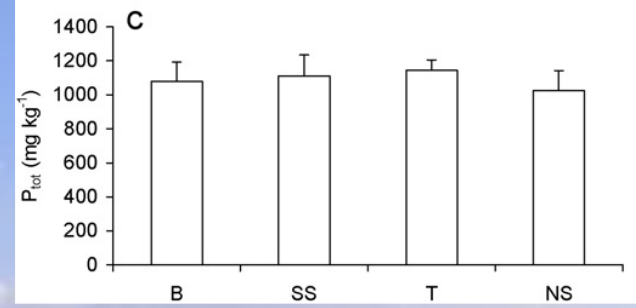

Number of trees (number ha-1)
900
800
700
600
500
400
300
200
100
0
(*)
**
***
***
total Salix
total Betula
Salix > 1m
Betula >1m

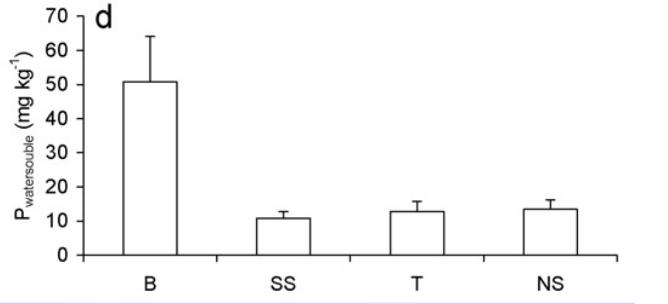

Waves
Leveled


Leveled 2006
ErucGali
Wavy 2006
PolyAvic
TussFarf
BetuPend
DaucCaro
LotuCorn
TrifHybr
SaliCapr
MediLupu
ArteVulg
Wavy 2012
CalaEpig
HierPilo
Leveled 2012
-0.6
-1.0
1.0

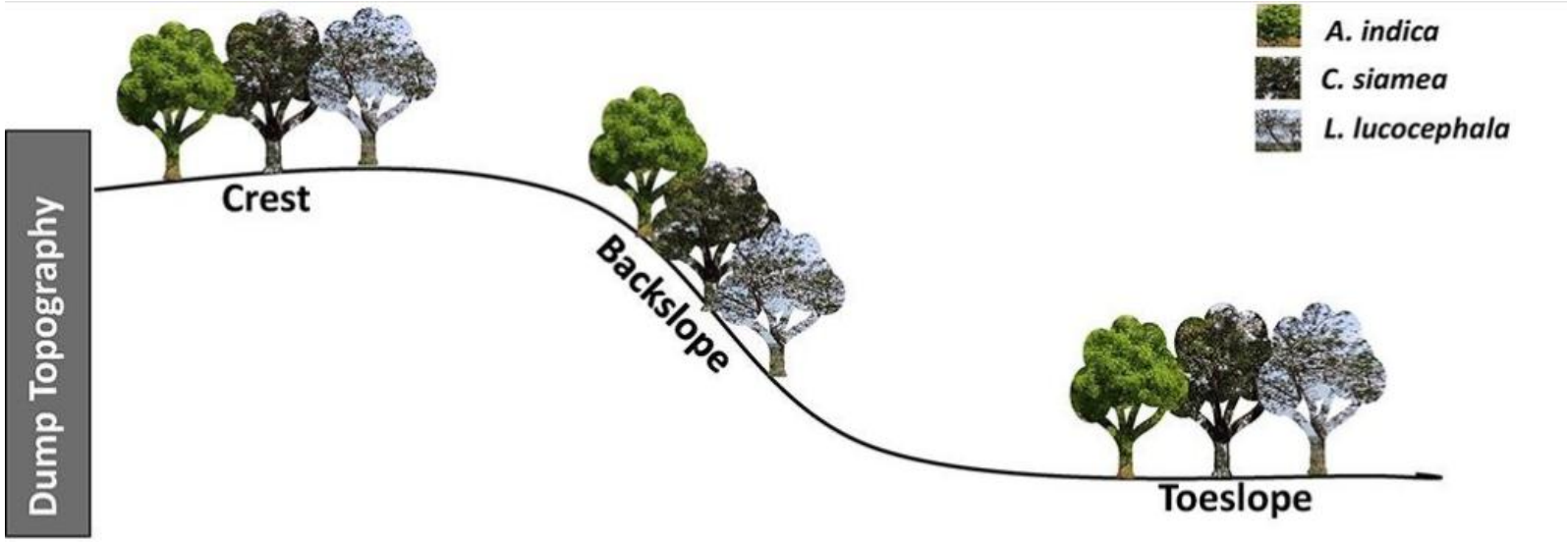

a
pH (H_2O)
7.6
7.4
7.2
7
6.8
6.6
6.4
B
SS
T
NS

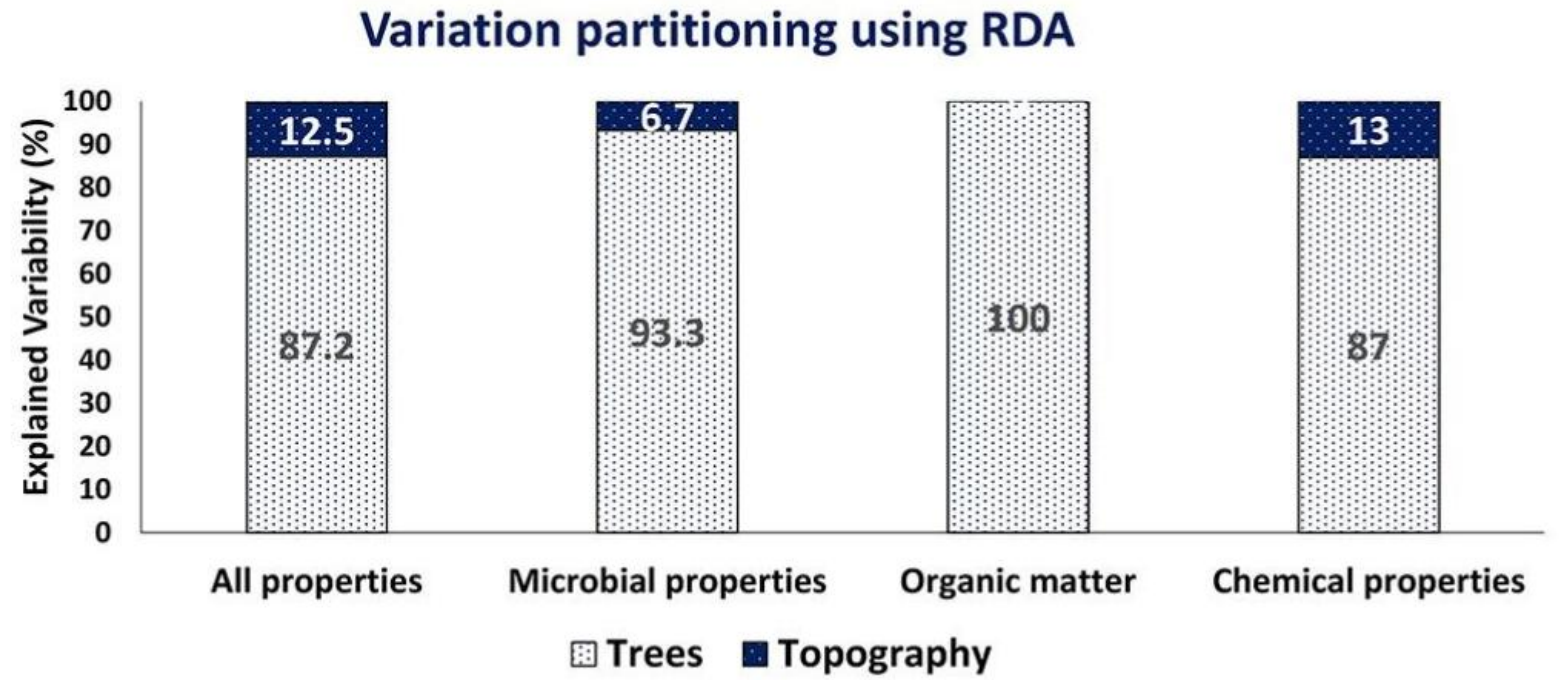

south
wave n-1
wave n
T
SS
NS
B
B
north
wave n+1
1m
b
C_{ox} (%)
18
16
14
12
10
8
6
4
2
0
B
SS
T
NS


c
P_{tot} (mg kg^{-1})
1400
1200
1000
800
600
400
200
0
B
SS
T
NS

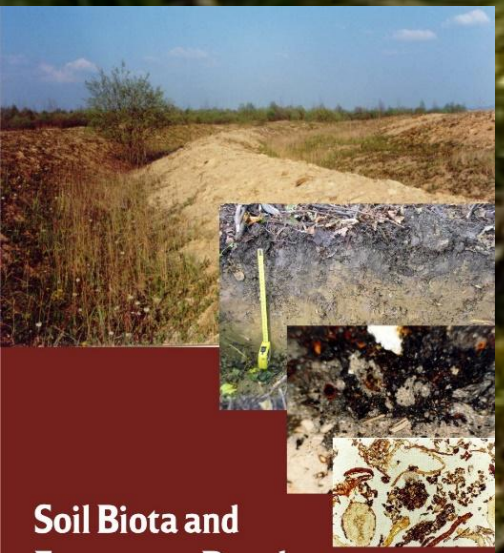

d
$P_{watersouble}$ (mg kg^{-1})
70
60
50
40
30
20
10
0
B
SS
T
NS

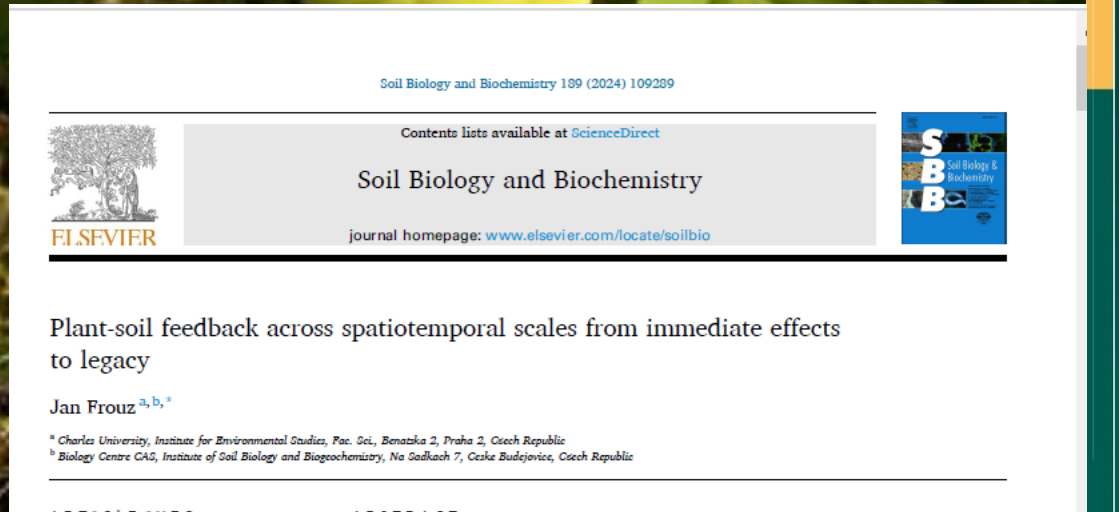
a
shrub & tree number
35
30
25
20
15
10
5
0
B
SS
T
NS
b
shrub & tree number
16
14
12
10
8
6
4
2
0
B
SS
T
NS
Salix
Populus


Dump Topography
Crest
Backslope
Toeslope
A. indica
C. siamea
L. lucocephala


Variation partitioning using RDA
Explained Variability (%)
100
90
80
70
60
50
40
30
20
10
0
12.5
87.2
6.7
93.3
100
13
87
All properties
Microbial properties
Organic matter
Chemical properties
Trees
Topography

Thank you for your attention

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Plant-soil feedback across spatiotemporal scales from immediate effects to legacy

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