Seened ja seente kaaslased mullas

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Tartu Ülikool
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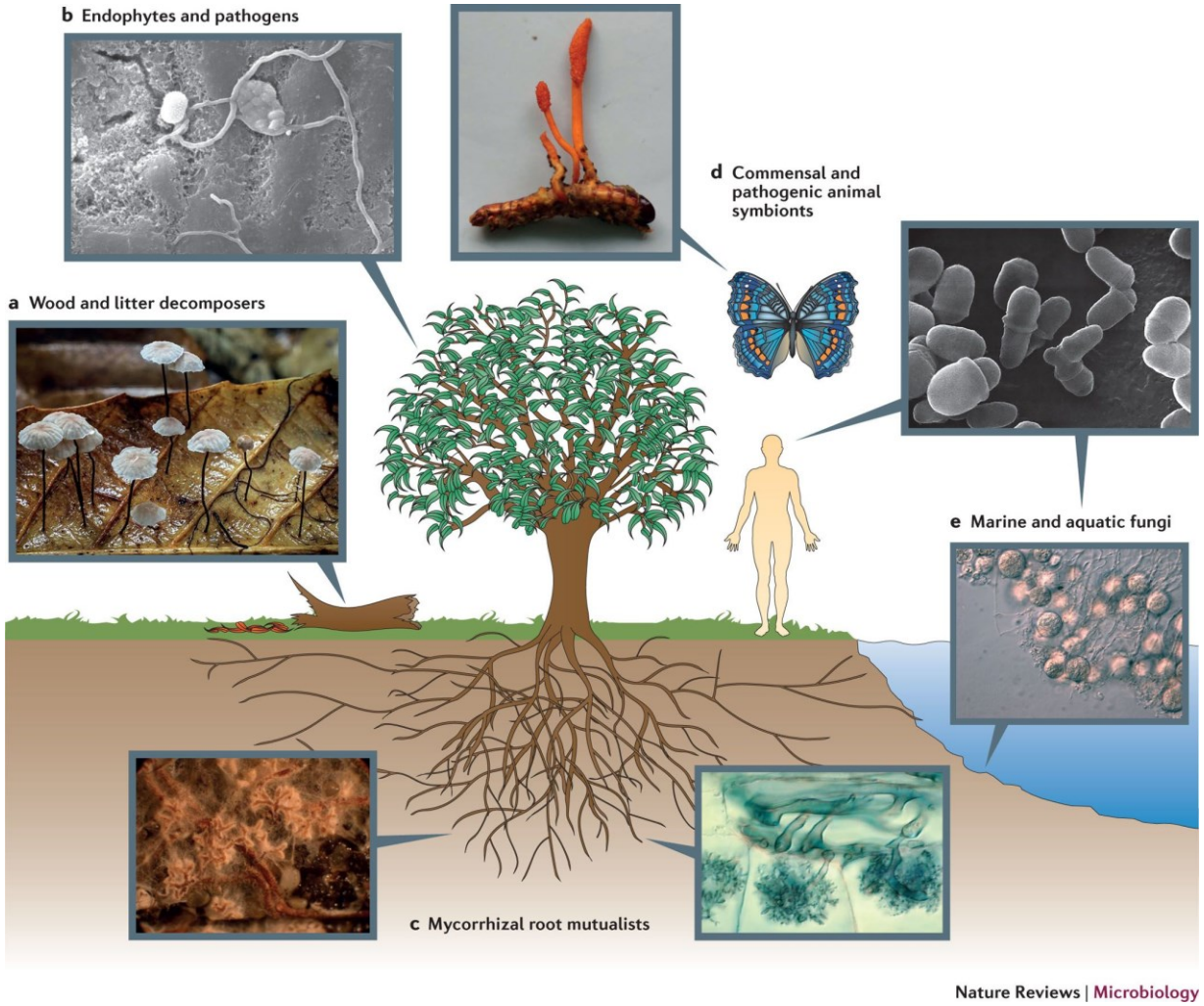
RIKKUS
MEIE JALGE ALL

KESKKONNAAMET

KESKKONNAMINISTEERIUM

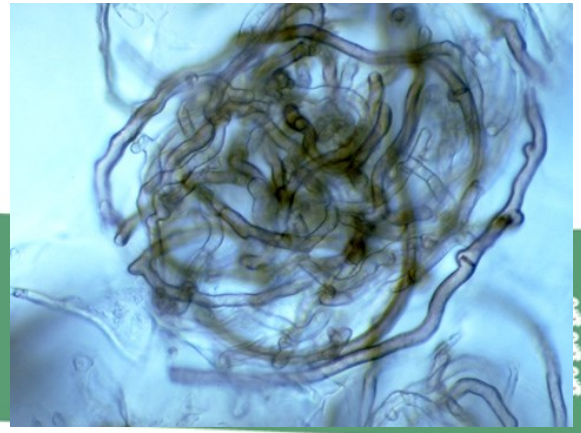


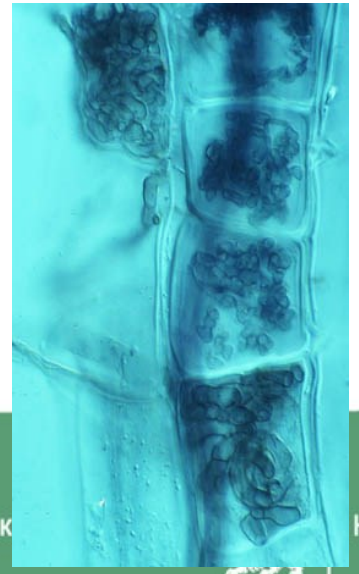
Peay et al. 2016

Ektomükoriisa

Orhidoidne mükoriisa

Erikoidne mükoriisa





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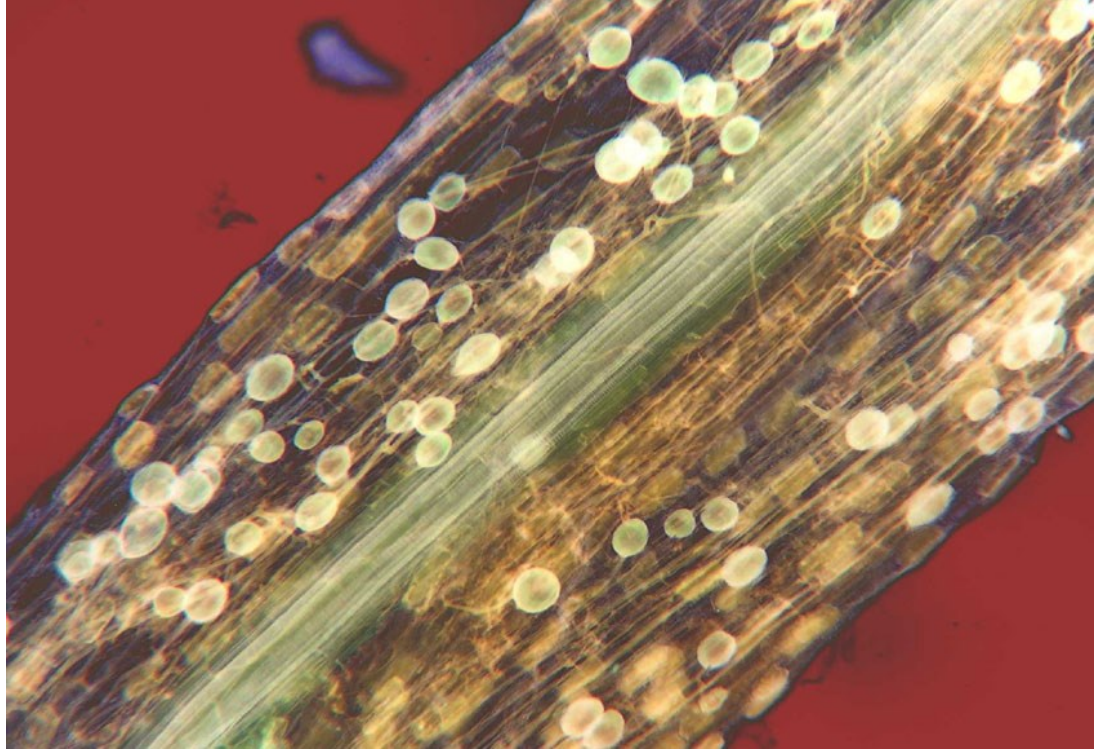
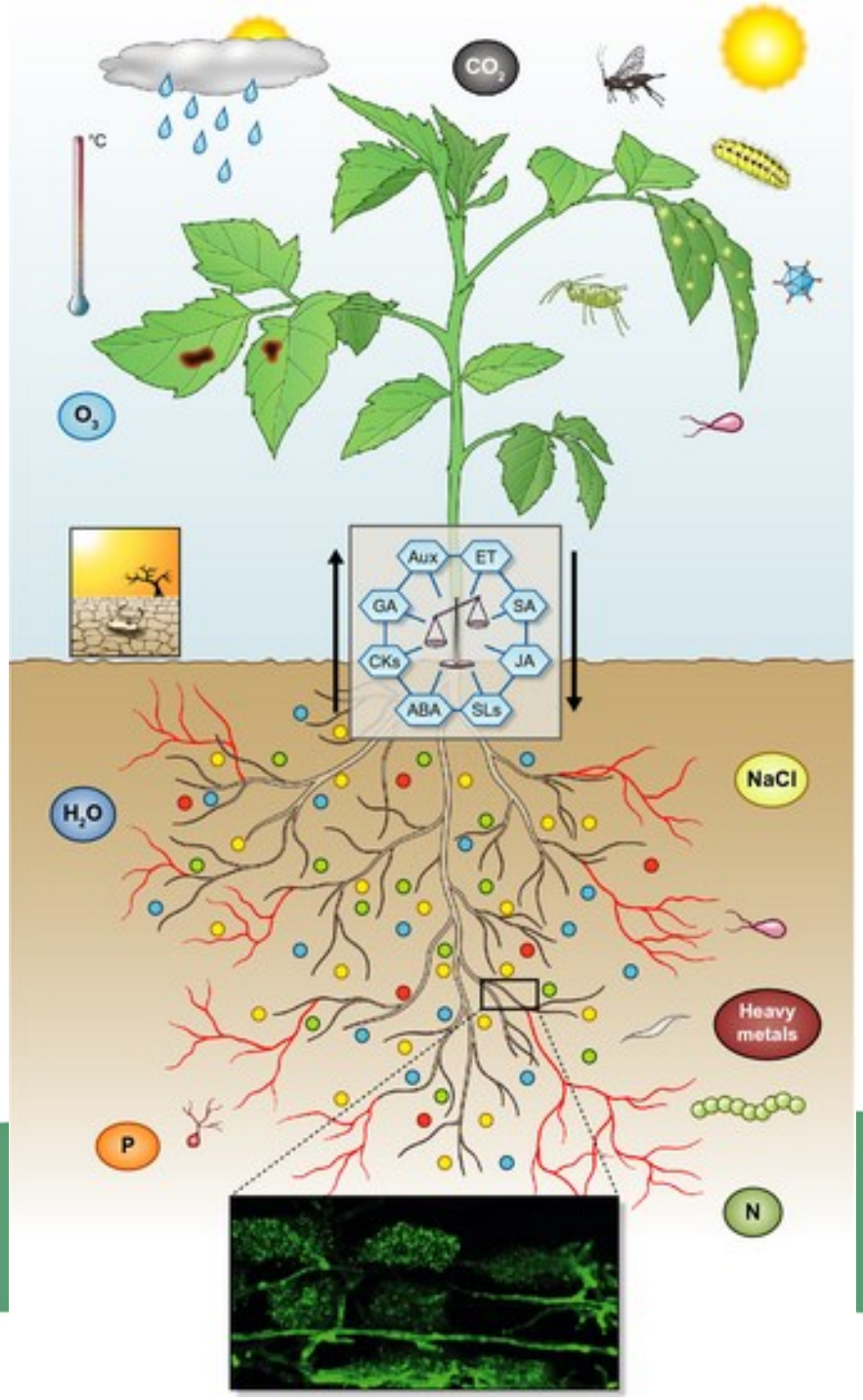


arbuskulaarne mükoriisa (AM):

juurtes vesiikulid

juurerakkude sees arbuskulid

juurte ümber mullas mütseel ja sellel eosed

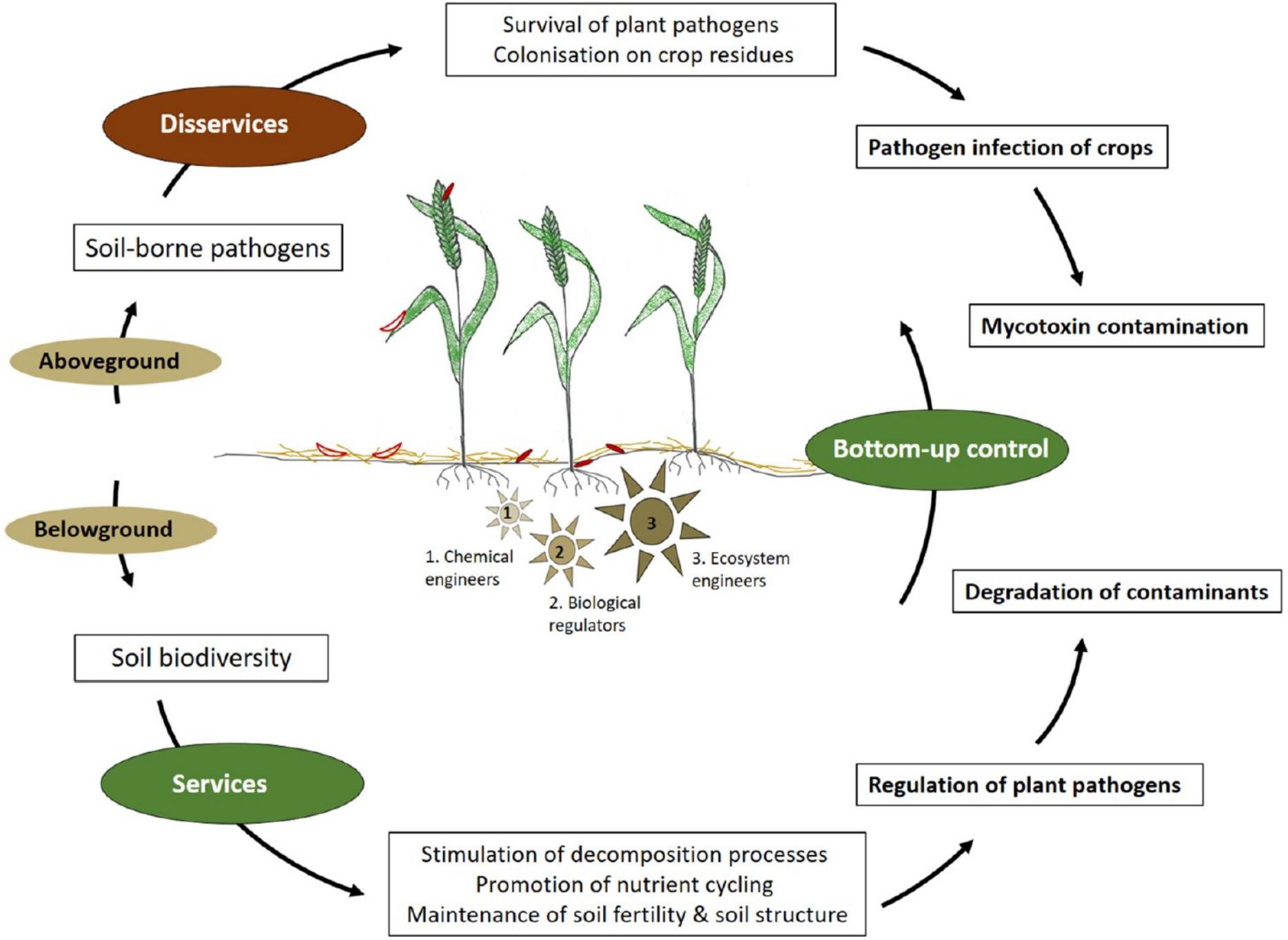


Arbuskulaar-mükoriissete seente peamised rollid:

- Taimede toitumine: P, N, mikroelemendid
- Kaitse biootilise stressi eest: maa-alused ja –pealsed patogeenid
- Kaitse abiootilise stressi eest: põud, soolsus, raskemetallid, jne
- Mulla struktuuri parandamine (vee-, toitainete sidumine)

Pozo et al. 2015, New Phytol. 205: 1431-1435

Mullaelustiku pakutavad ökosüsteemi teenused ja kahjud (disservices)



Plaas et al. 2019. Towards valuation of biodiversity in agricultural soils: A case for earthworms. *Ecological Economics* **159**: 291–300.

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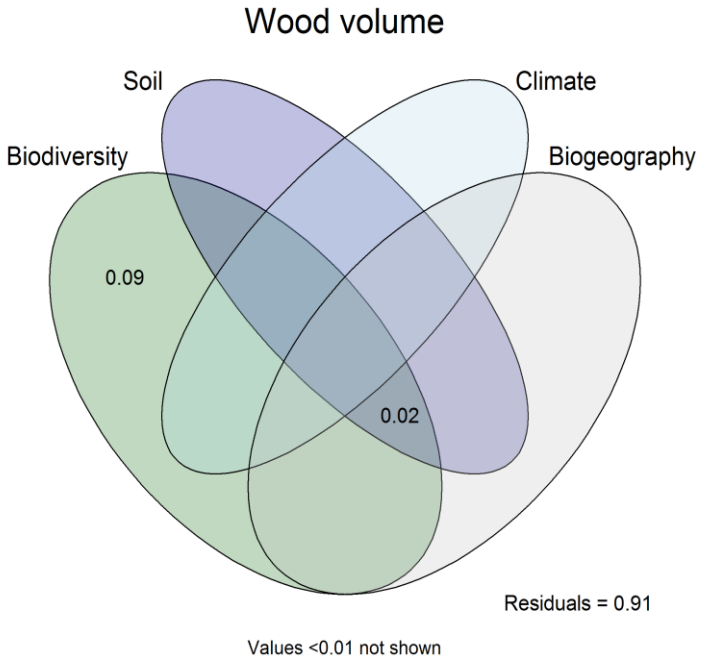
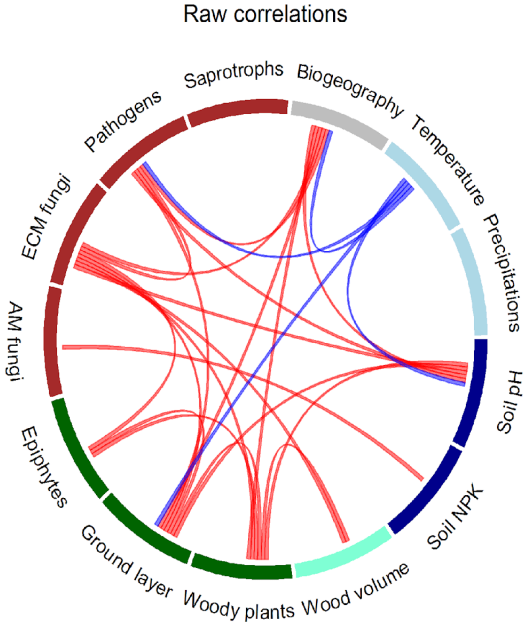


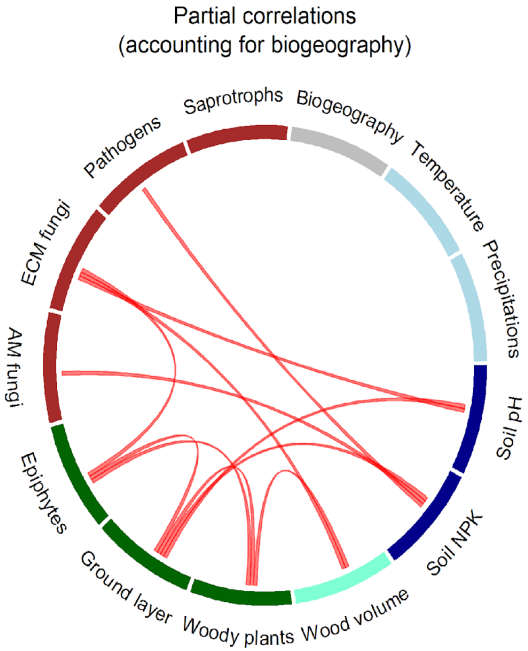
Puidu ruumala metsas on seotud elurikkusega ja selle päritoluga (biogeograafia)

- Elustiku rühmade omavahelised seosed
- Muld ja kliima (biogeograafiline ajalugu) seotud elurikkusega
- Ökoloogilised seosed taimede ja seenerühmade vahel

a



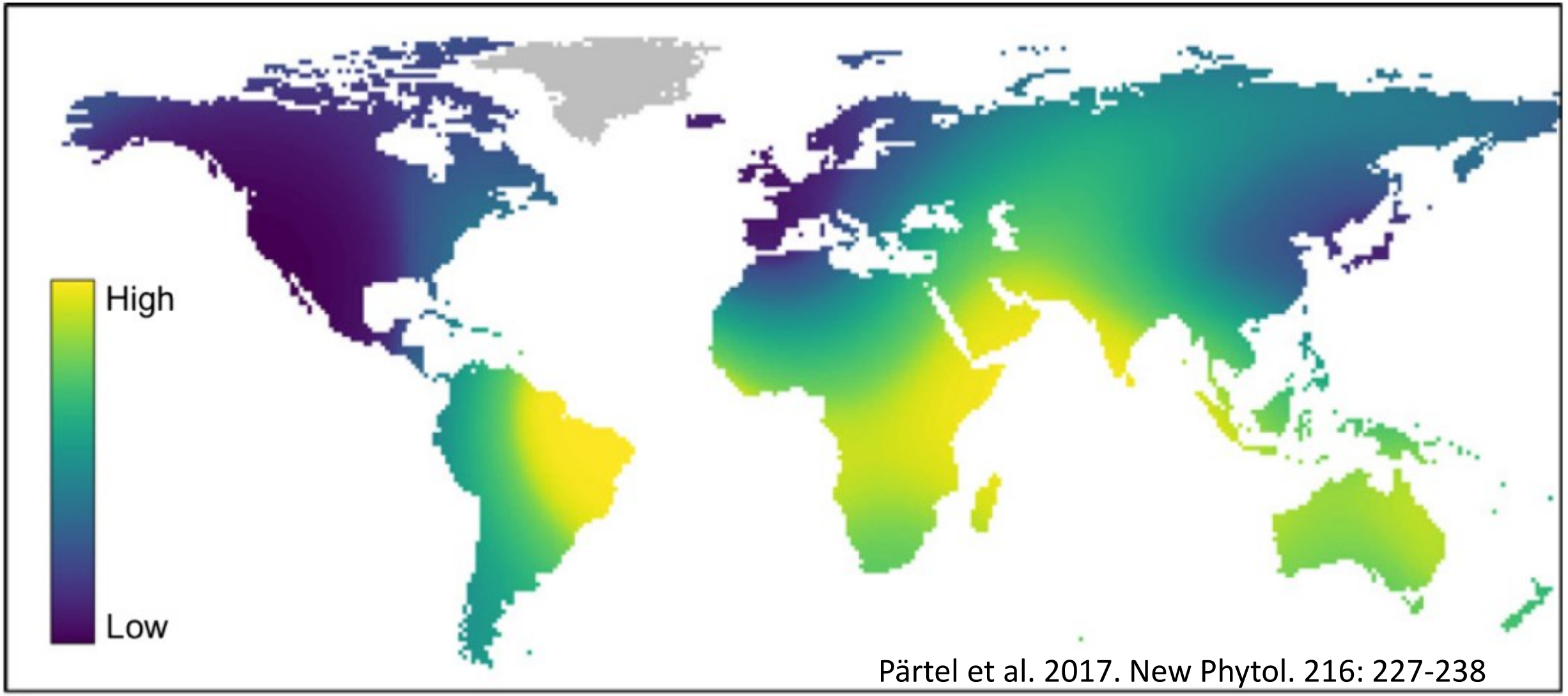
b



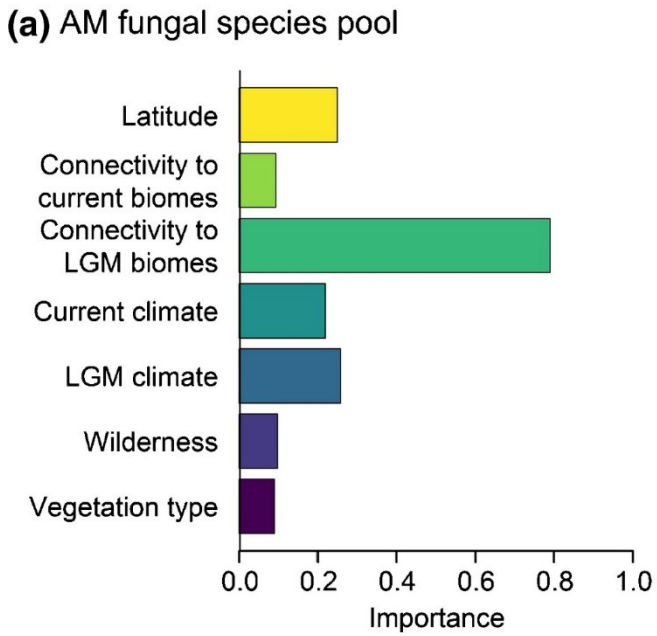
KESKKONNAAMET KESKKONNAMINISTEERIUM

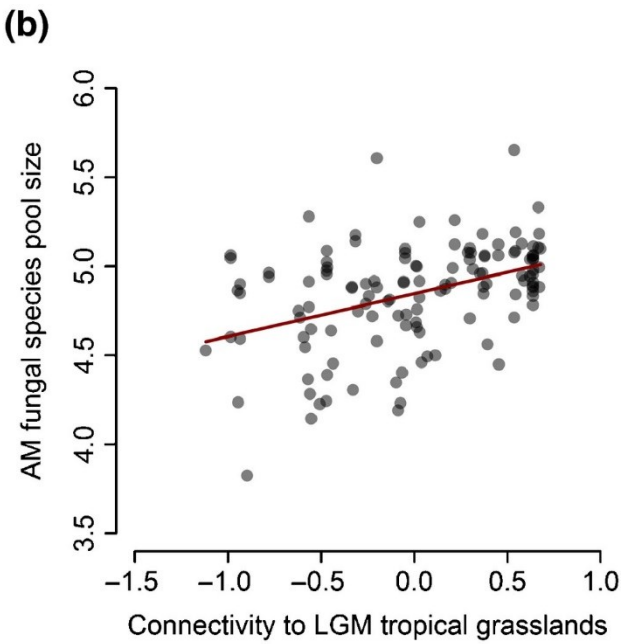
Noreika et al. 2019 Oikos, 10.1111/oik.06693

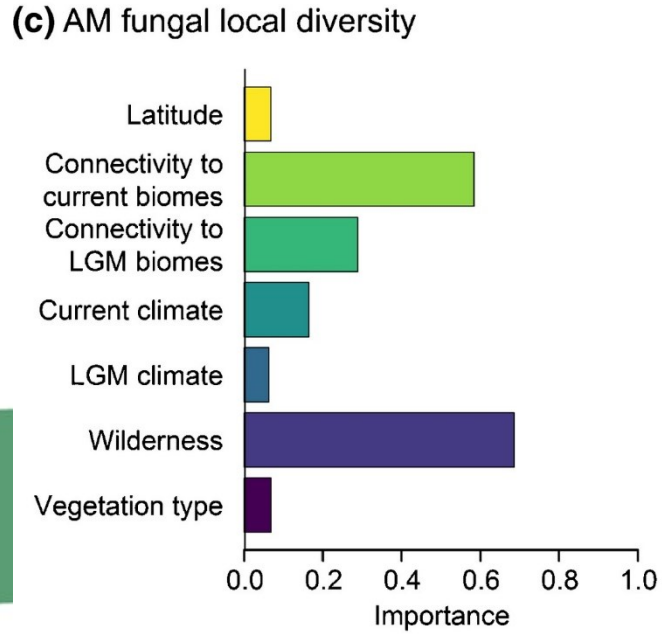
Krohmseente elurikkus

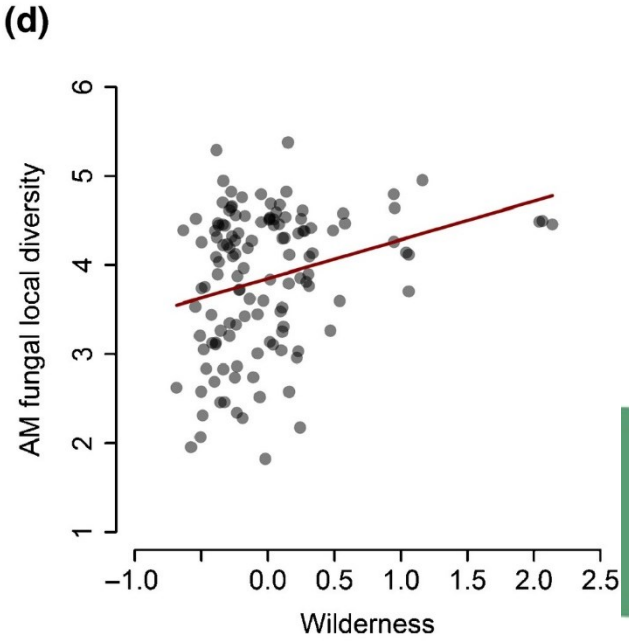


Pärtel et al. 2017. New Phytol. 216: 227-238





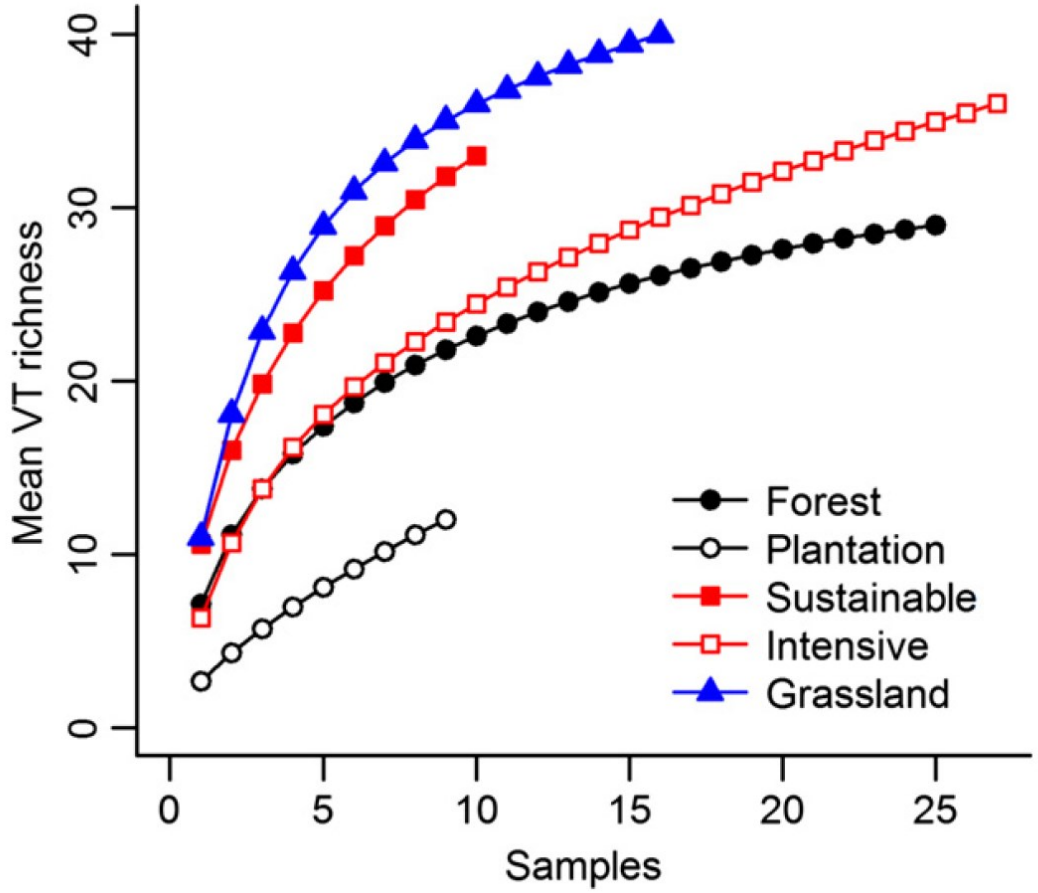




- **Liigifond** = ala potentsiaalselt asustada võivad liigid
- **Krohmseente liigifond** on peamiselt seotud viimase jääaja maksimumi aegsete bioomide levikuga (troopilised rohumaad) (=**ajaloolised mõjurid**)
- **Krohmseente elurikkus** on seotud praeguste bioomide ja looduslikkusega (=**tänapäevased mõjurid**)

KESKKONNAAMET KESKKONNAMINISTEERIUM

Pärtel et al. 2017. New Phytol. 216: 227-238



Niidud

Põllud

Metsad

Krohmseened Eestis

Niitudel ja mahepõldudel rikas mükoriisaseente elustik

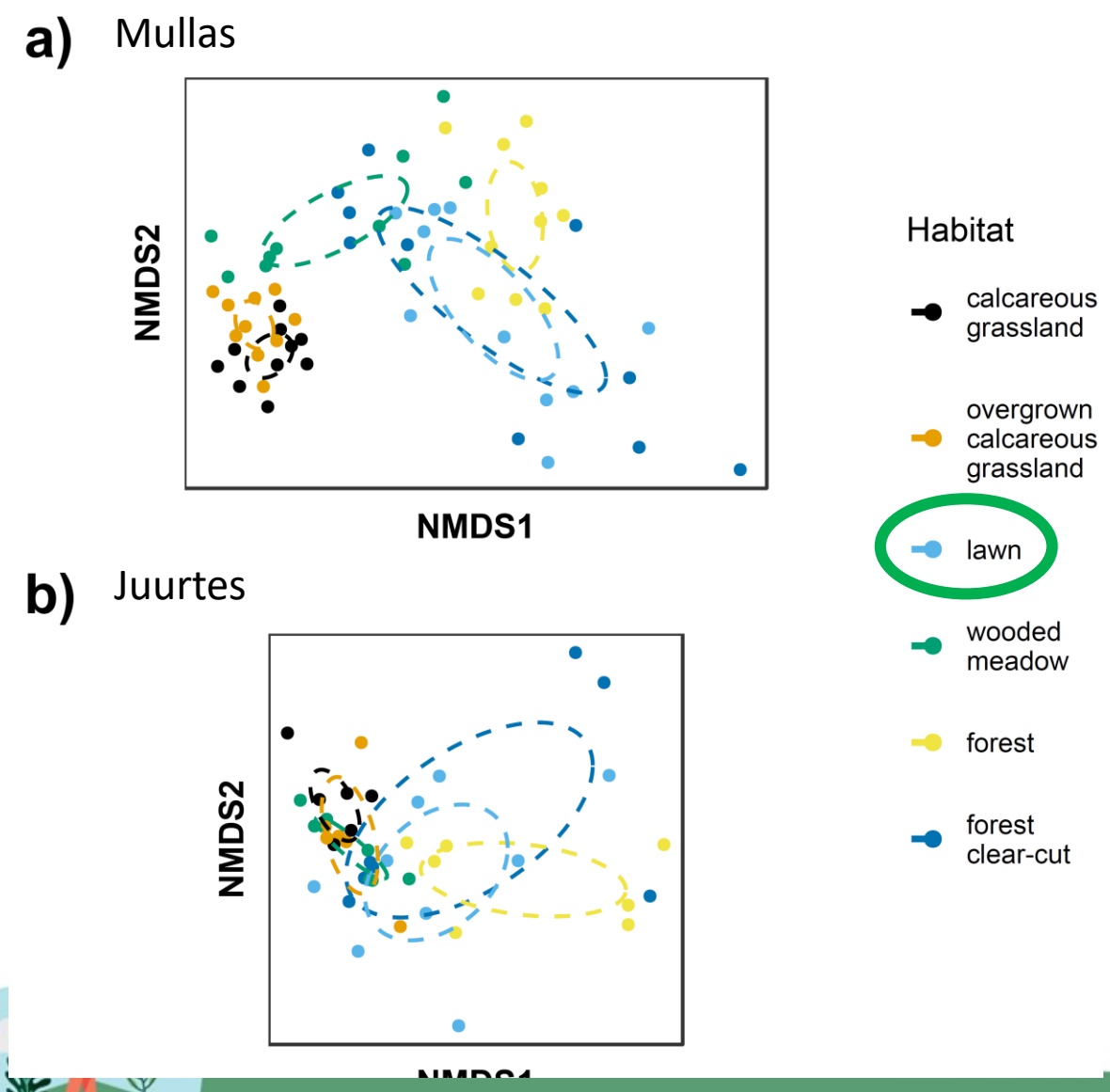
RIKKUS MEIE JALGE ALL

KESKKONNAAMET

KESKKONNAMINISTEERIUM

Moora *et al.* 2014, FEMS Microbiol Ecol 90: 609-621

Krohmseened Eestis



- AM seenekooslused on erinevad niitudel, metsas, puisniidul
- Metsa lageraie muudab AM seenekoosluse koosseisu
- **Õuemurus kasvab palju krohmseeni!**

Sepp et al. 2018 Mycorrhiza

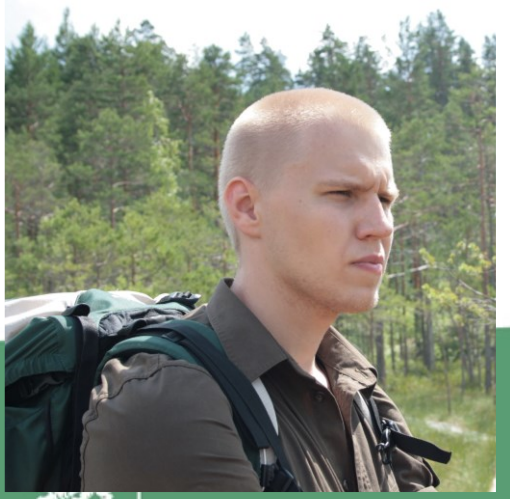
Tanel Vahter

Põllumajandus

Biodiversa3 projekt SoilMan

RIKKUS
MEIE JALGE ALL

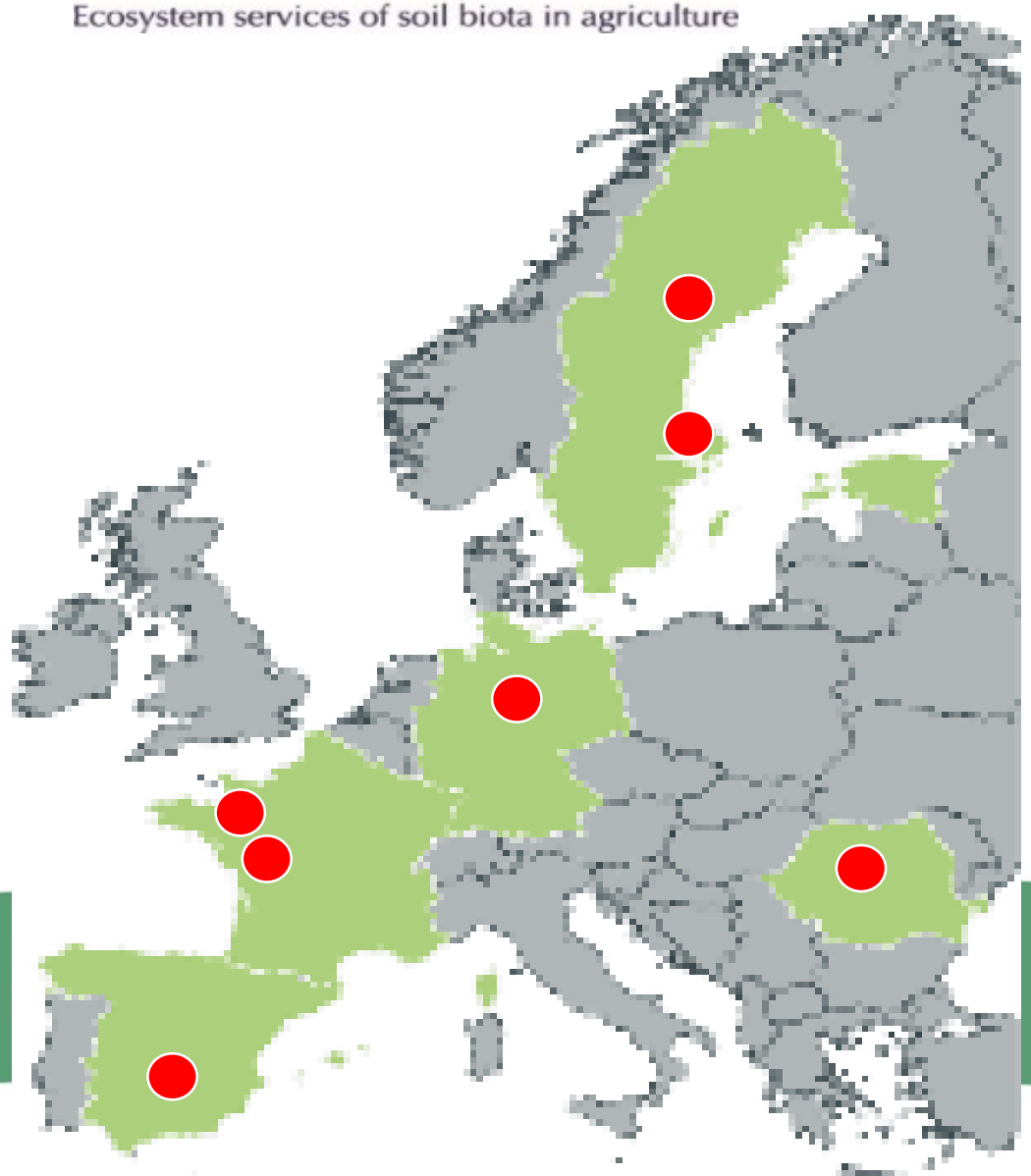
KESKKONNAAMET



Siim-Kaarel Sepp

SoilMan

Ecosystem services of soil biota in agriculture



Üle-Euroopaline uuring põllumuldadel

Fookus künnil:
- tavakünd
- vähendatud künd

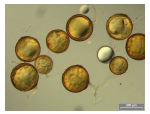
<u>Mullaelustik:</u>
- seened
- AM seened
- bakterid
- vihmaussid
- …

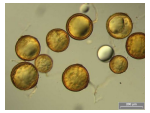
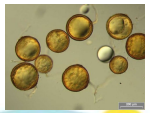
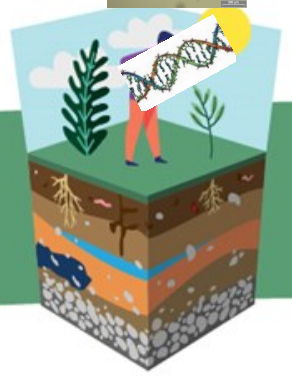
biodiversa

KESKKONNAMINISTEERIUM

Top 5 AM seent

= 4 Paraglomeraceae, Glomeraceae, Claroideoglomeraceae, Diversisporaceae

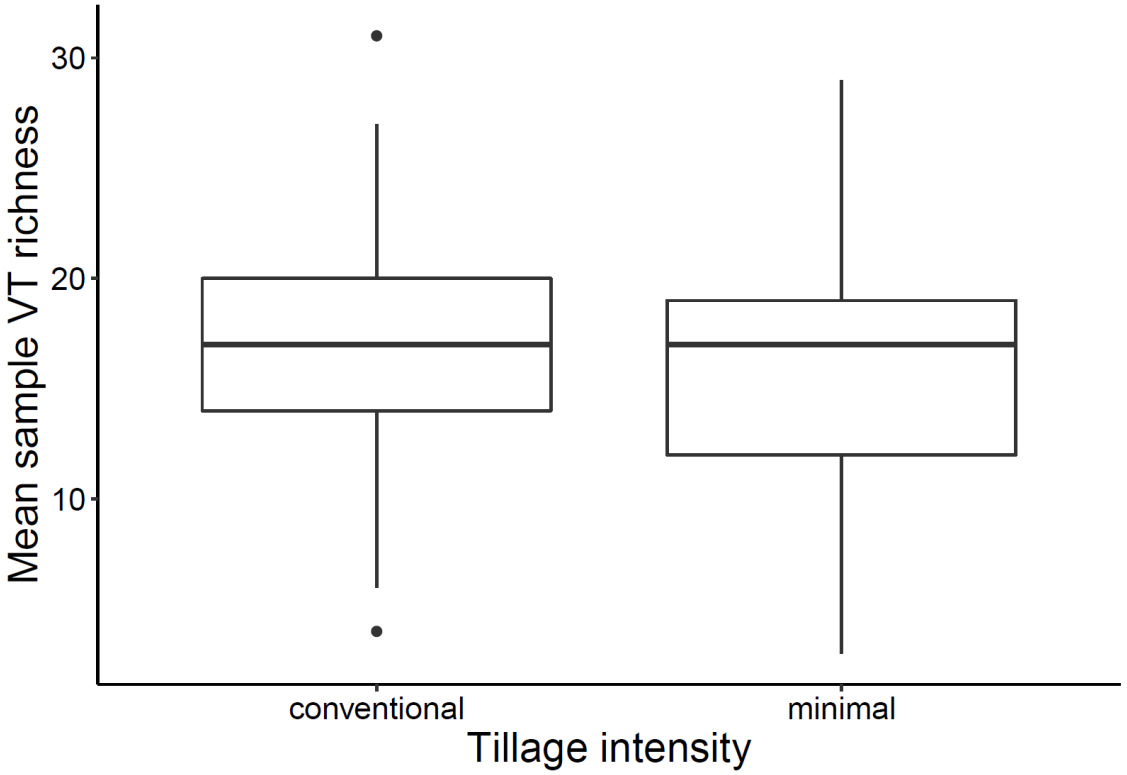


		DNA järjestuste osakaal	Proovide osakaal
VT281	Paraglomus laccatum	0,29	0,84
VT143	Glomus sp (DNA-based)	0,15	0,68
VT65	Glomus caledonium/geosporum	0,09	0,78
VT193	Claroideoglomus claroideum complex	0,08	0,64
VT306	Diversispora sp	0,06	0,72

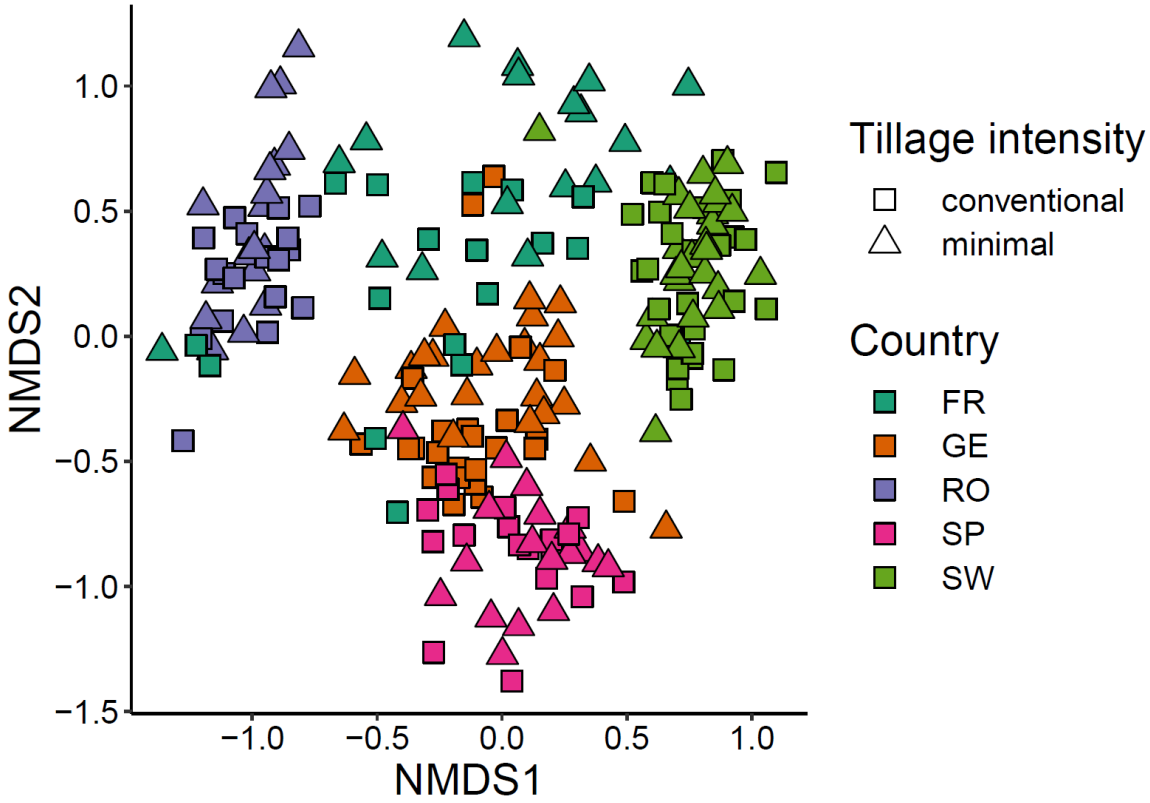
Vahter, Sepp, Öpik et al. (in prep.)

1. Künd ei mõjutanud AM seente elurikkust kõigi riikide võrdluses
2. AM seenekooslused erinesid riigiti



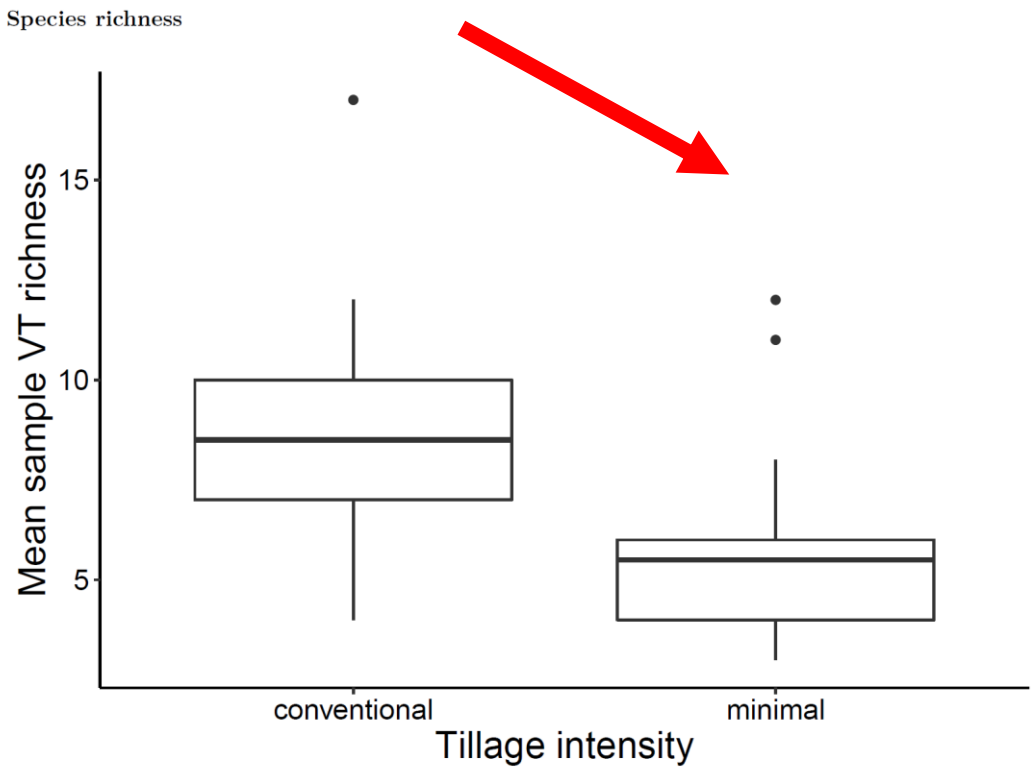
GLMM p = 0.048, effect size = −0.07, 95% CI [−0.13, 0]

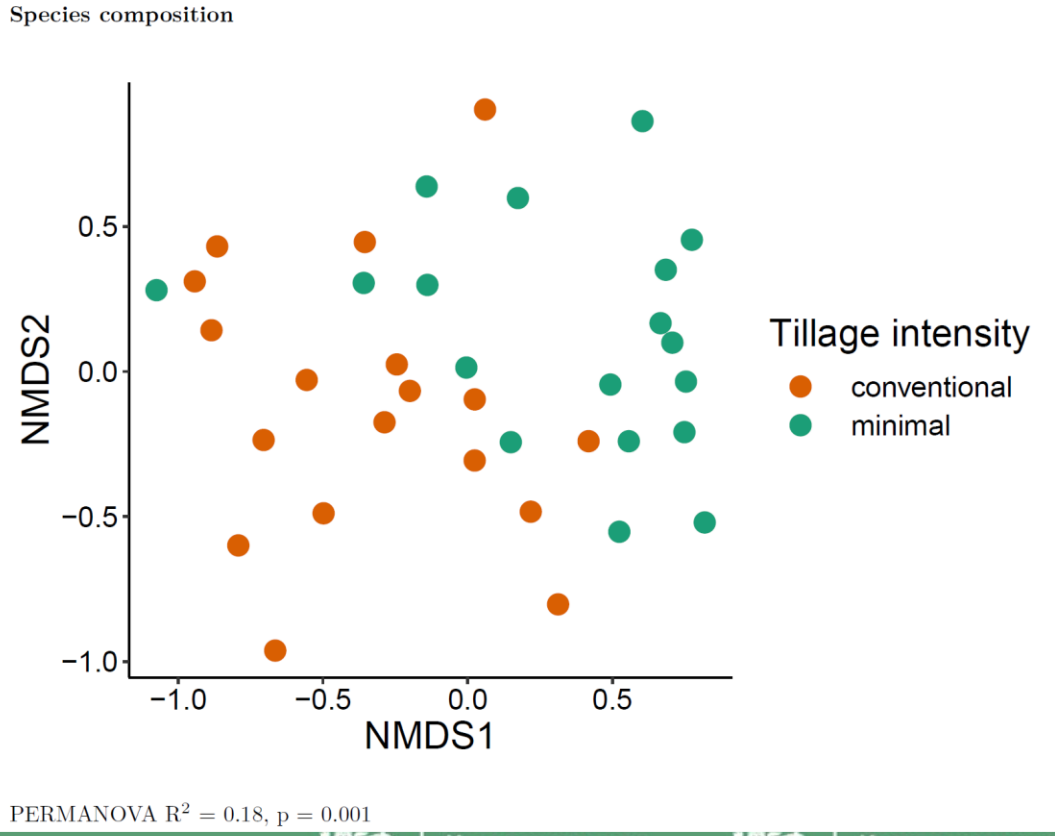
Species composition



Tillage intensity effect: PERMANOVA $R^2 = 0.02$, p = 0.001. Permutations restricted to replication within country.

Prantsusmaa

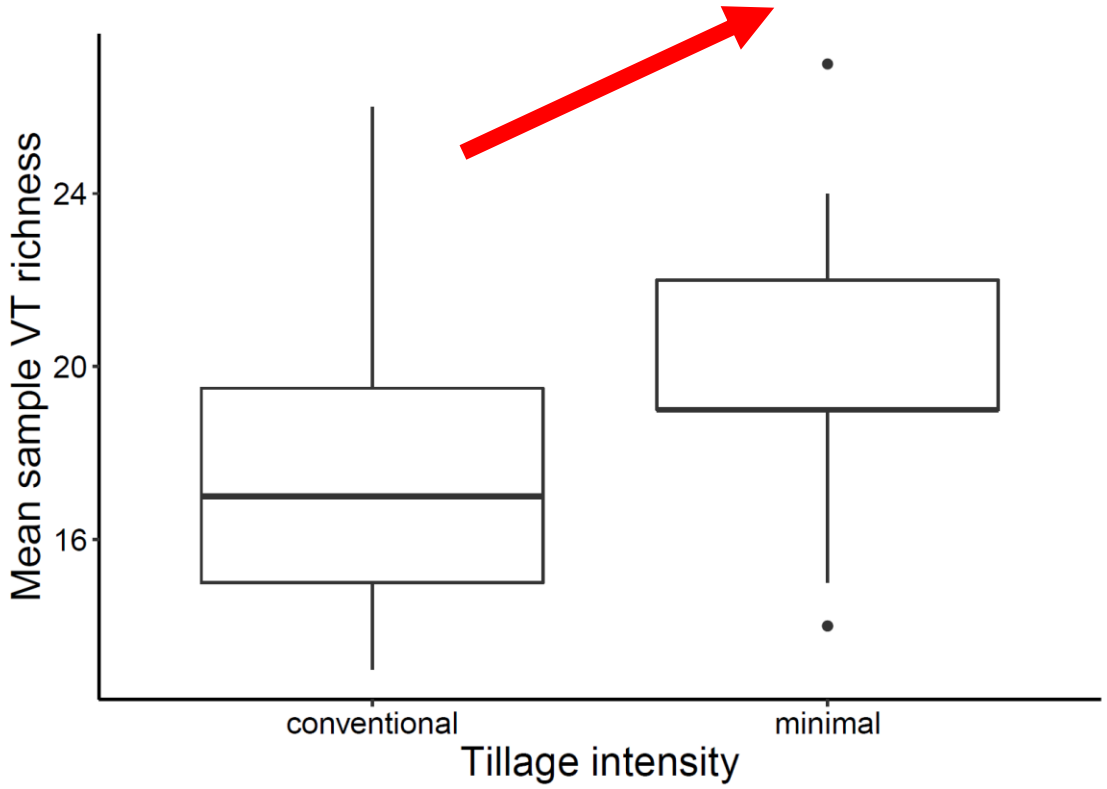




Vahter, Sepp, Öpik et al. (in prep.)

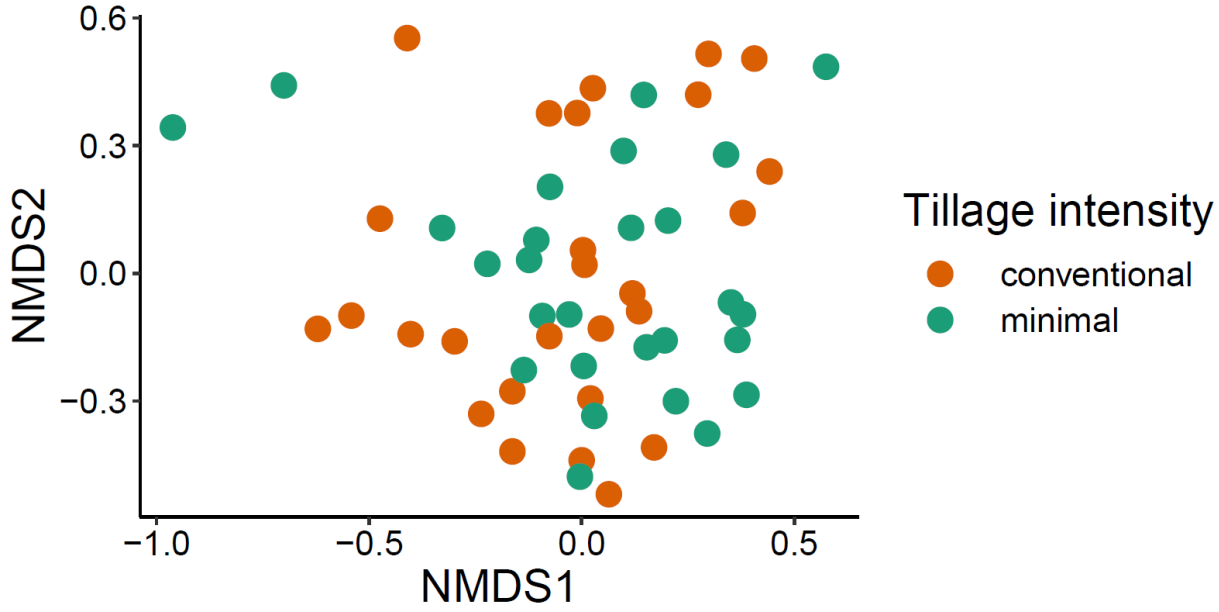
Rootsi

Species richness



GLMM p = 0.074, effect size = 0.11, 95% CI [−0.01, 0.23]

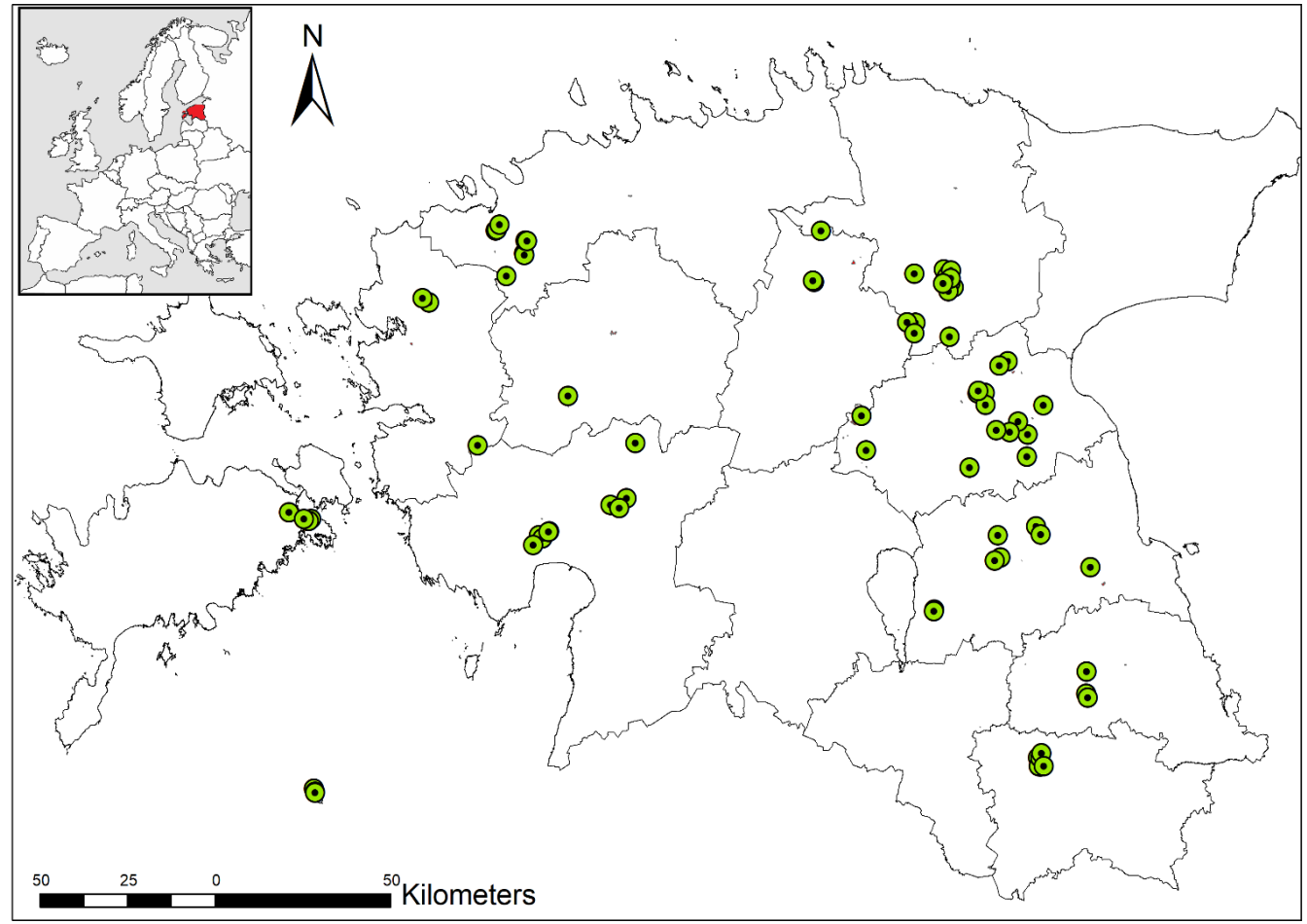
Species composition



PERMANOVA R^2 = 0.11, p = 0.001

Vahter, Sepp, Öpik et al. (in prep.)

Eesti põllud



Tanel Vahter

KESKKONNAAMET KESKKONNAMINISTEERIUM

Vahter et al. In prep.

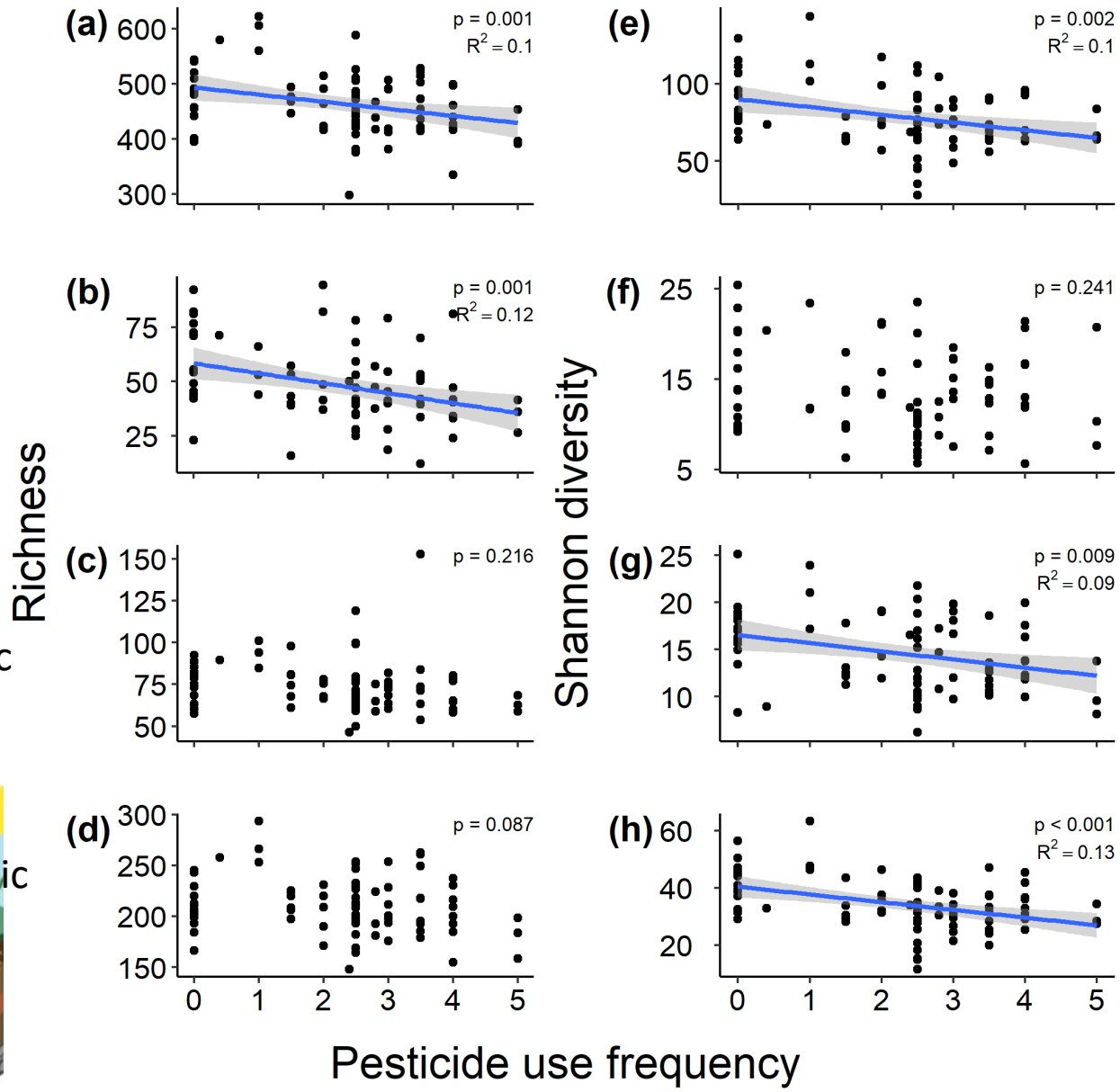
Taimekaitse-vahendite kasutus

All fungi

AMF

Pathogenic fungi

Saprotrophic fungi



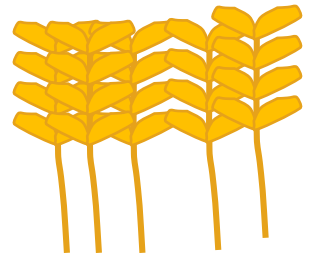
. Mõju seenerühmadele erinev

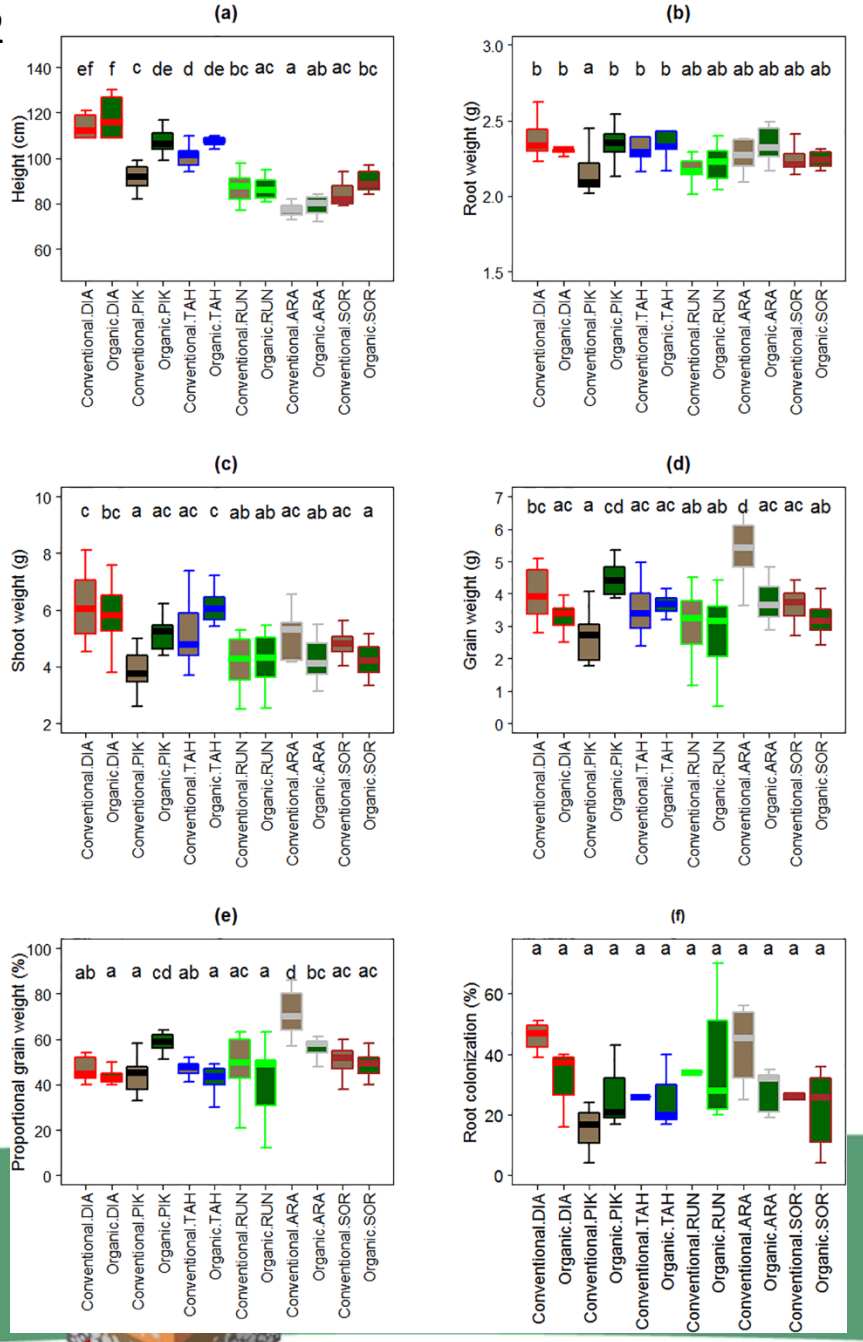
Vahter et al. In prep.

KESKKONNAAMET KESKKONNAMINISTEERIUM

Erivanuselised nisusordid (1929 - 2016) vs vastus AM seentele

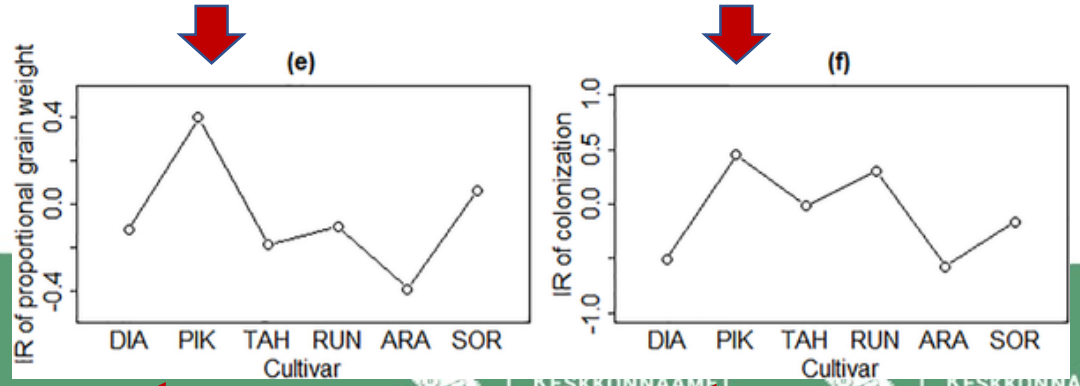
- 6 nisusorti
- Muld tava- ja mahepõllult
- Reageerivad AM seeneinokulatsioonile erinevalt (IR-inoculation response)
- **Enim reageeris Eesti sort Pikker (1959) = piirkondlik kohastumus???**





Sordi vanus

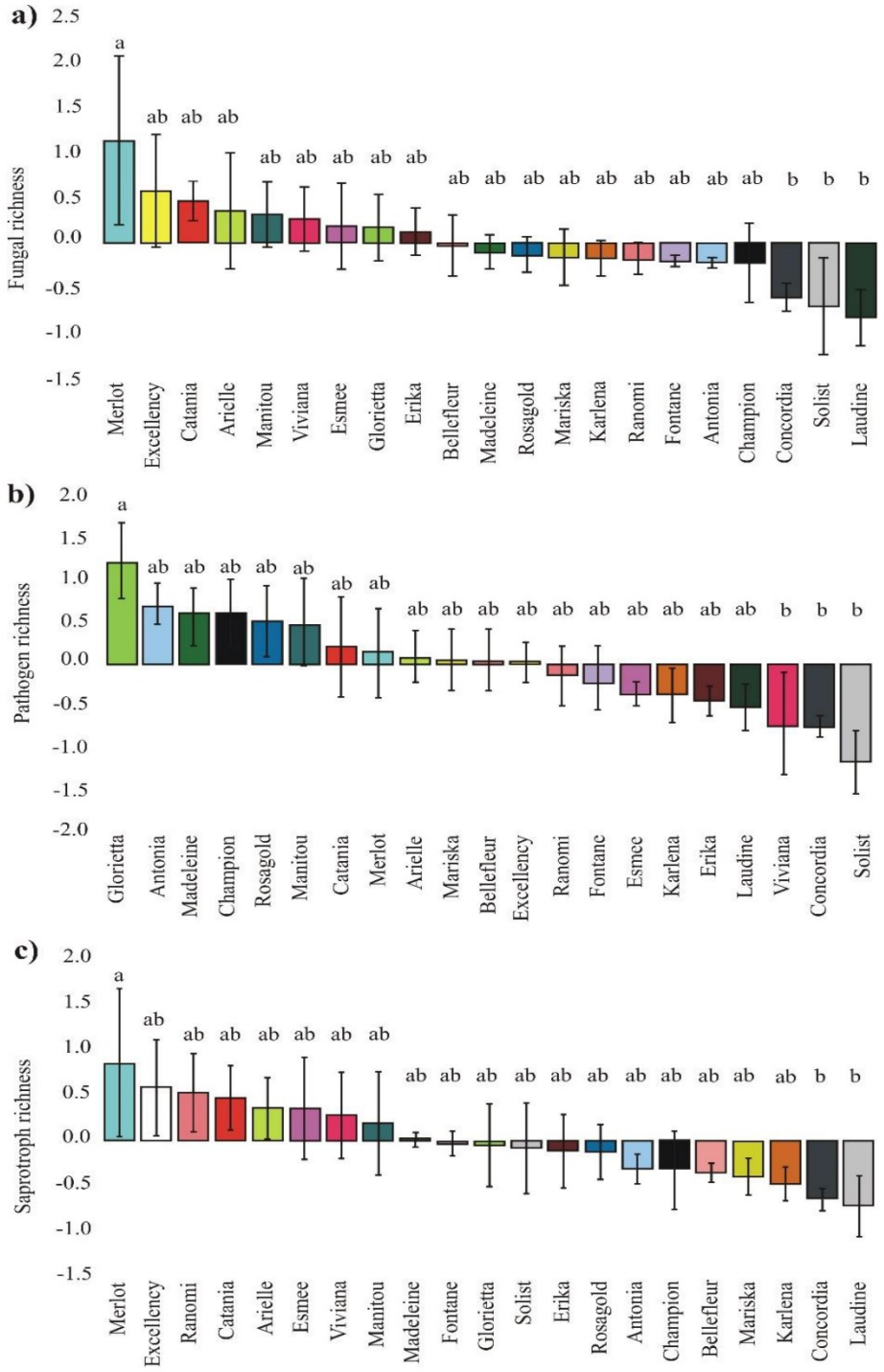
Sordi vanus



Sordi vanus

Sordi vanus

Garcia de Leon et al. 2000 Plos One



Kartulisordid vs seened juurtes

Sortidel seenerühmade elurikkus erineb :

- kõik seened
- patogeenid
- saprotroofid

Loit et al. 2020 Agronomy

Taimkatte taastamine

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KESKKONNAMINISTEERIUM

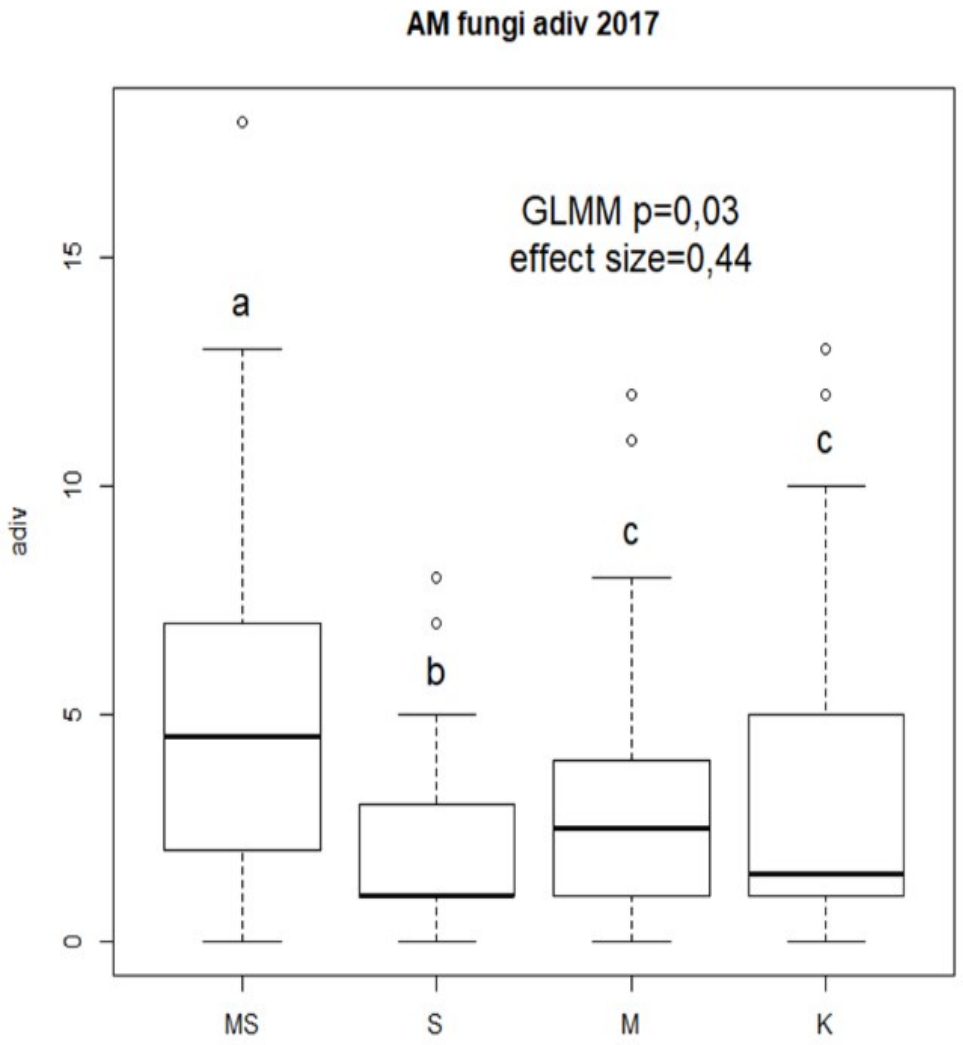
M – AM seente lisamine

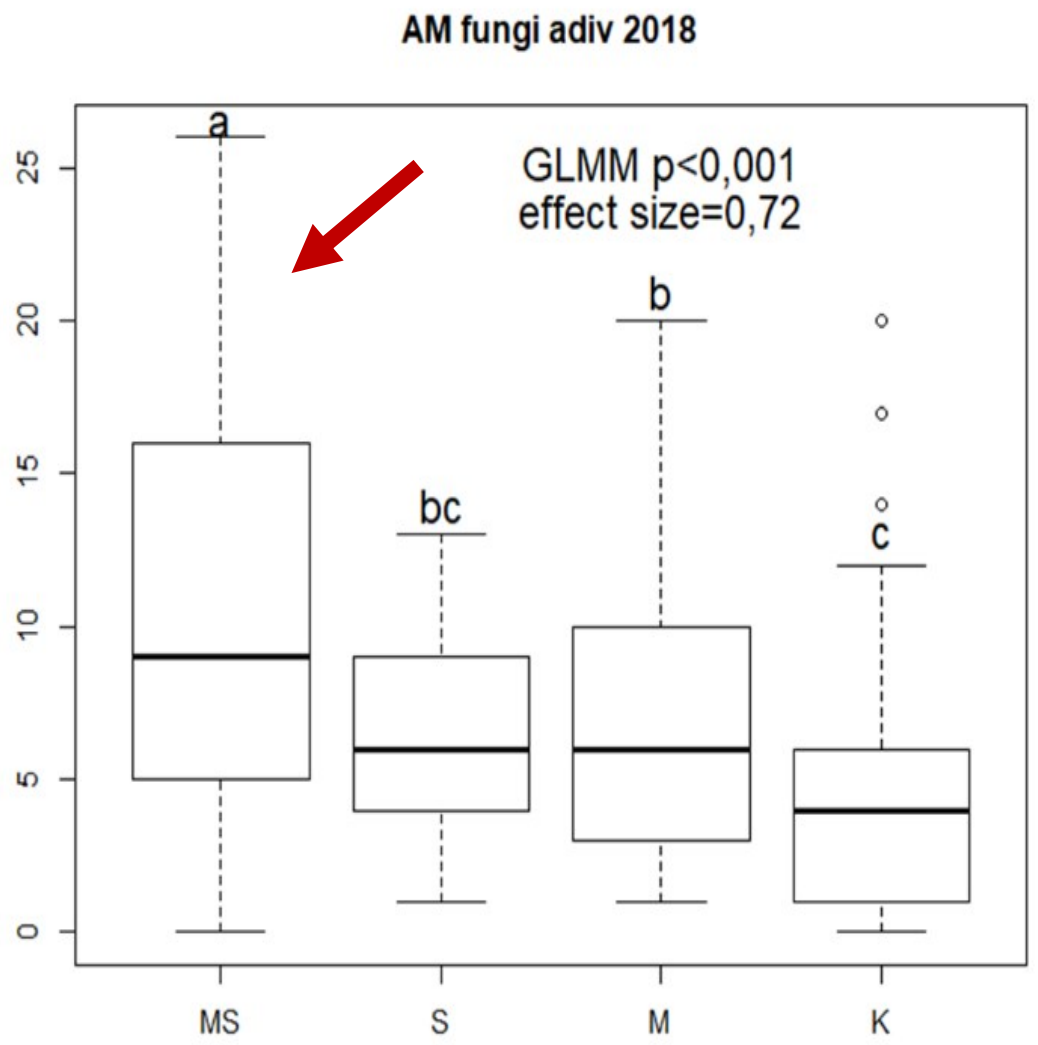
<u>MS – AM seened + seemned</u>

S – seemned

K – kontroll (ei lisata AM seeni ega seemneid)

AM seente elurikkus suurenes 2x





MS – AM seened + seemned

M – AM seemned

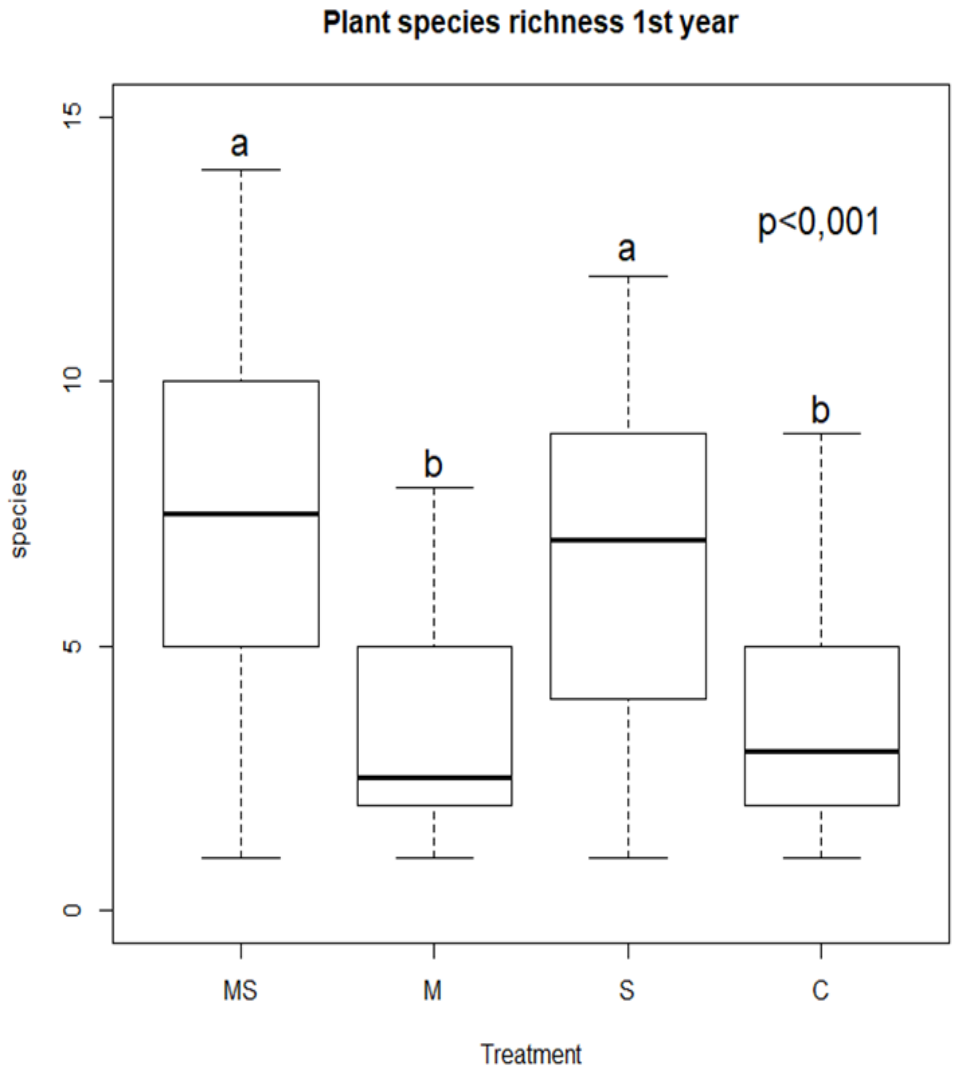
S – seemned

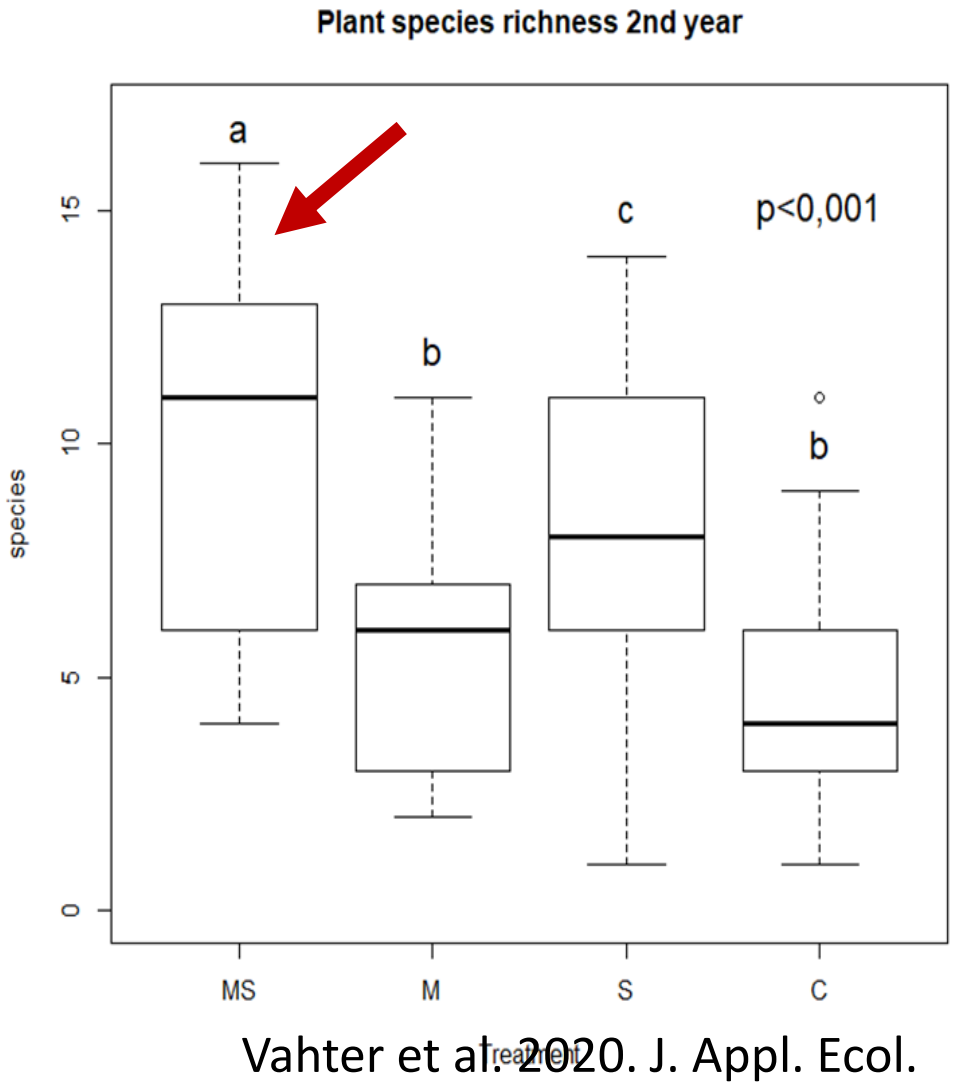
K – kontroll

Vahter et al. 2020. J. Appl. Ecol.

KESKKONNAMINISTEERIUM

Taimede liigirikkus suurenes >2x





MS – AM seened + seemned

M – AM seemned

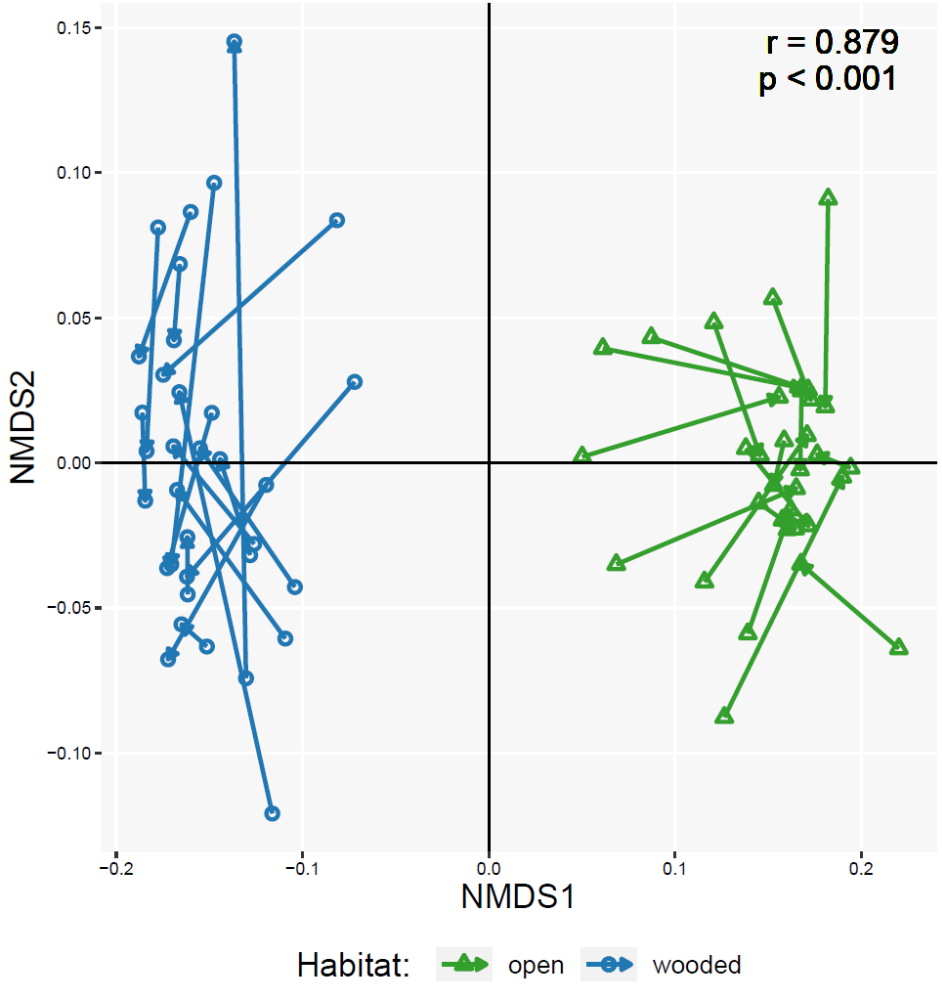
S – seemned

K – kontroll

Vahter et al. 2020. J. Appl. Ecol.

KESKKONNAMINISTEERIUM

Adding plant seeds and AMF: massive vegetation recovery



Taimede ja AM seente kooslused käivad puisniidul käsikäes:

Metsa- ja niidulaigud erinevad taimatte JA seenekoosluste poolest

Sepp et al. (2021) Ecosphere

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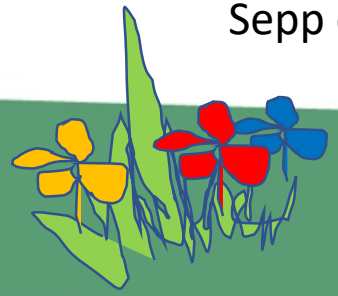
MEIE JALGE ALL



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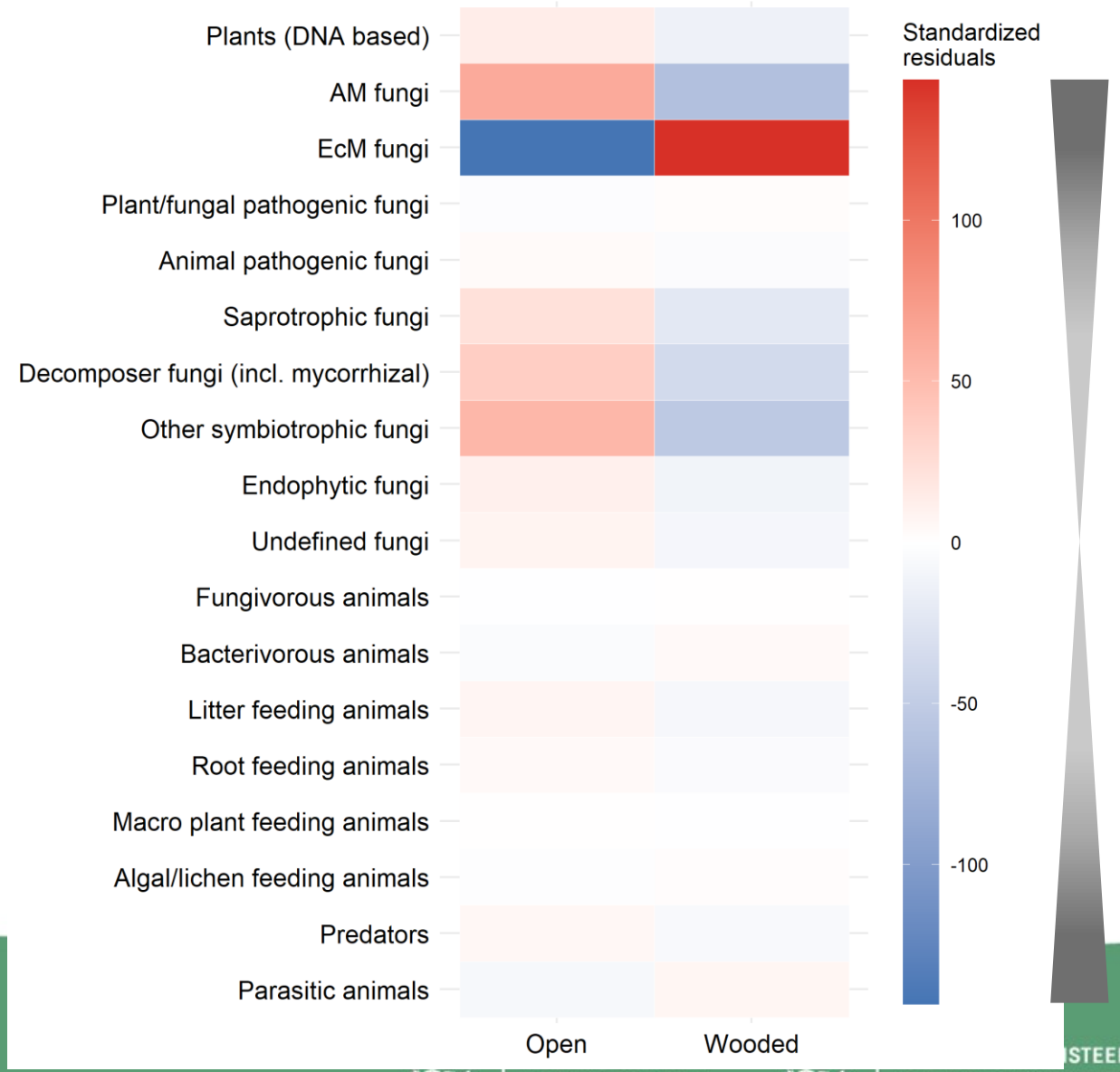
KESKKONNAMINISTEERIUM

Mükoriisaseened dirigeerivad mullaelustiku erinevusi metsa- ja niidulaikude vahel



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Sepp et al. (2021) Ecosphere, in press

Short Communication

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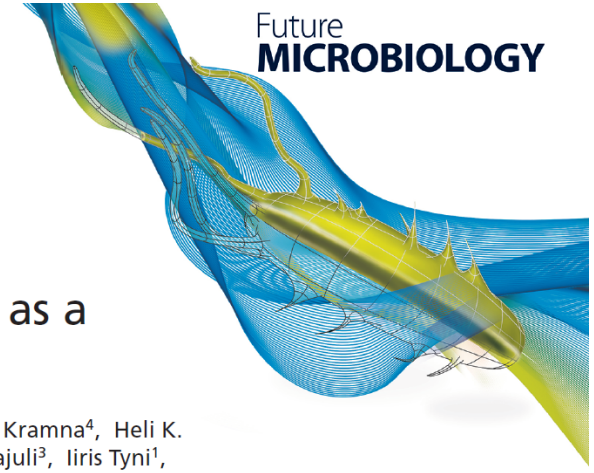

Future MICROBIOLOGY

Nature-derived microbiota exposure as a novel immunomodulatory approach

Noora Nurminen[1], Jake Lin[1,2], Mira Grönroos[3], Riikka Puhakka[3], Lenka Kramna[4], Heli K. Vari[3], Hanna Viskari[1,5], Sami Oikarinen[1], Marja Roslund[3], Anirudra Parajuli[3], Iiris Tyni[1], Ondrej Cinek[4], Olli Laitinen[1], Heikki Hyöty*[,1,6] & Aki Sinkkonen[3]

Näpud mulda!

Kontakt elusmullaga suurendab inimese mikrobioomi rikkust ja parandab immuunvastust

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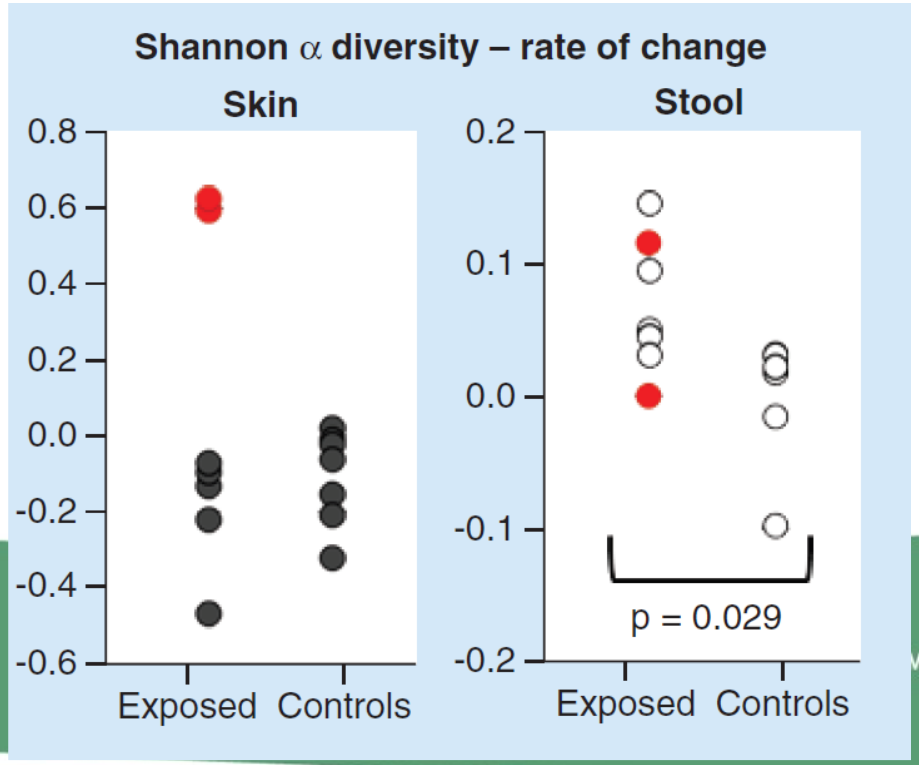

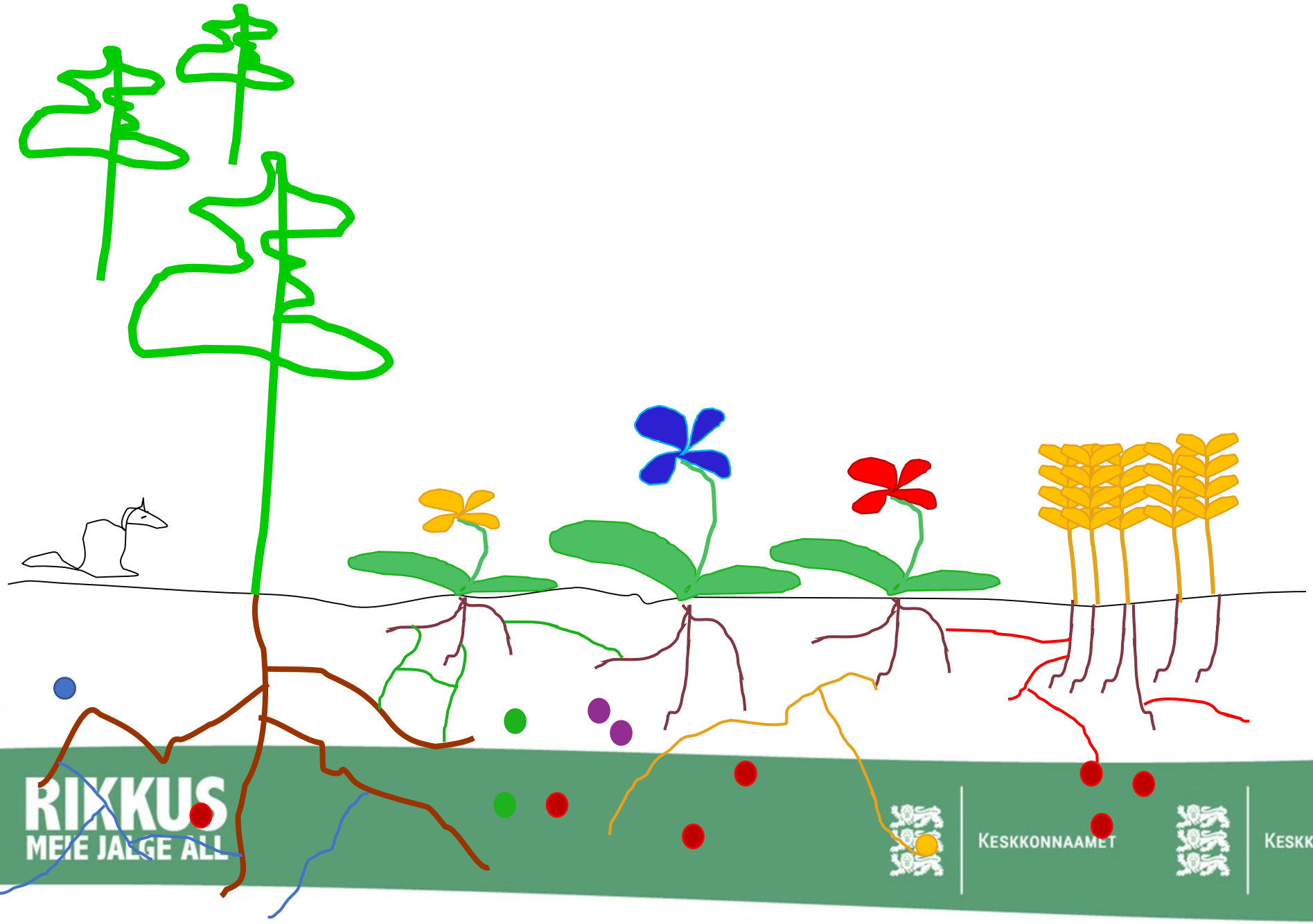

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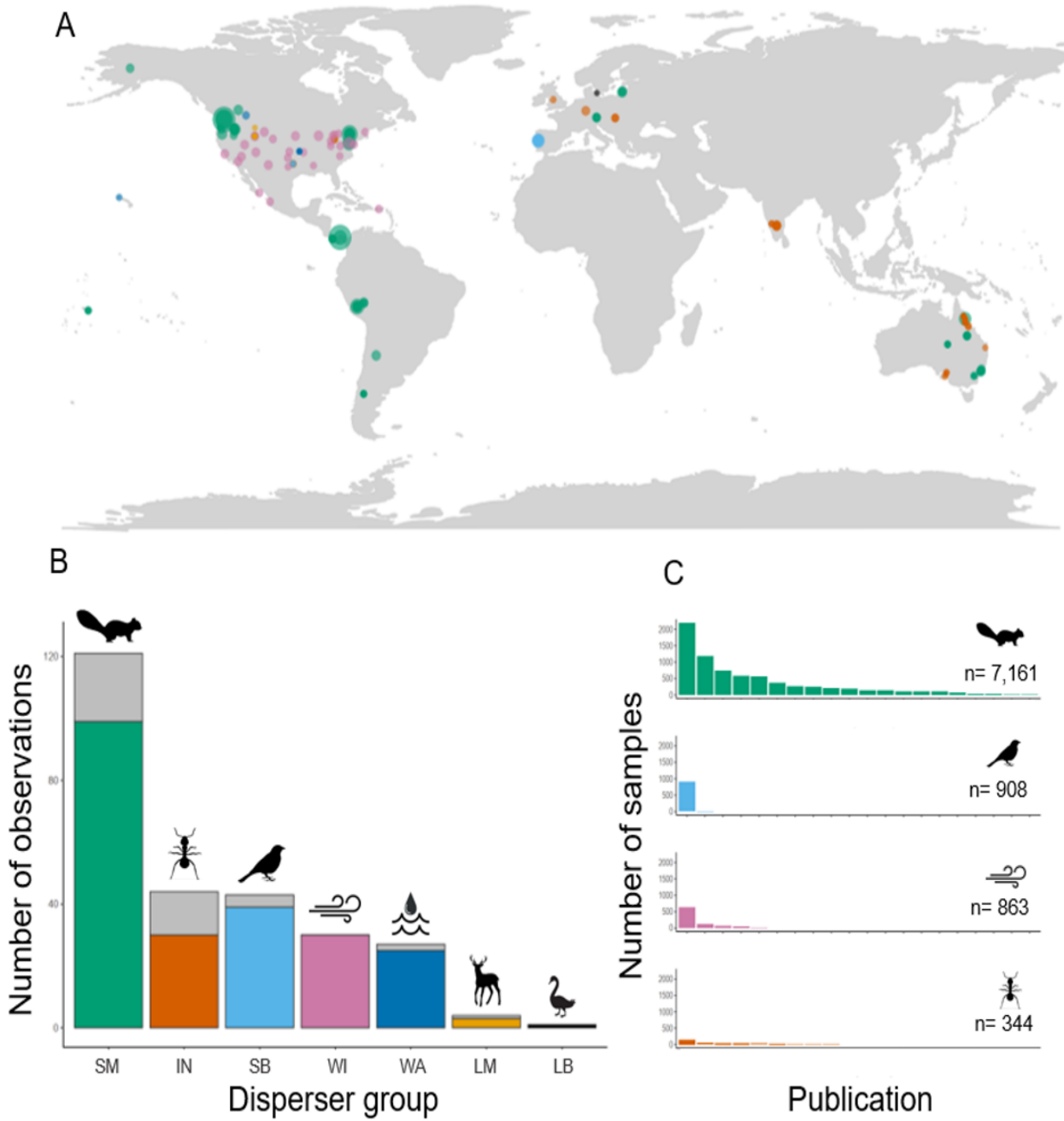
KESKKONNAMINISTEERIUM

How do AM fungi disperse? A global analysis



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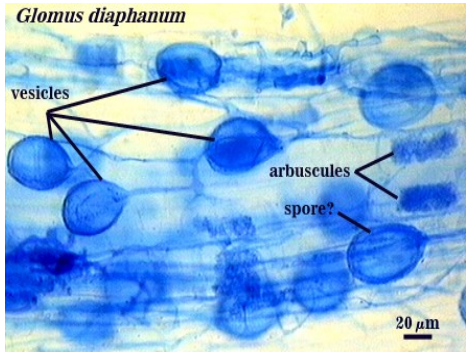
Paz et al. 2020 Micr Ecol (accepted)

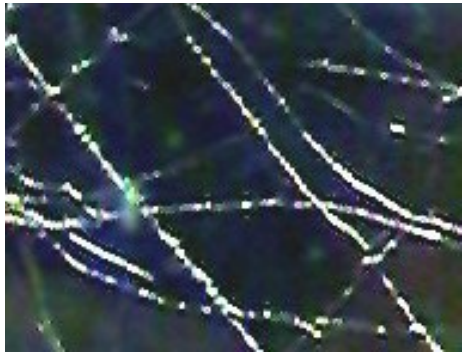
Propagules

Spores

Colonised roots



Mycelium



Vectors

Wind

Water

Animals

AMF arrival to a new patch

Garcia de Leon et al. 2016. Acta Oecol 77: 128-135

AMF arrival to a new patch

AMF and plants in trap boxes after 11 months:

- **30 AMF spp.**
- ruderal AMF: 30% spp, 70% sequences

- **30 plant spp.**
- ruderal plants: 30% of spp

- relation to distance from propagule source:
    - AMF: no
    - plants: yes

Garcia de Leon et al. 2016. Acta Oecol 77: 128-135