Ectomycorrhizal community in conifer stands on peat soils 12 years after wood ash treatment

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Experiments of forest fertilization with wood ash in Latvia

50 t ha^{-1}

5-20 t ha^{-1}

Researches established during EU project WOOD-EN-MAN
in 2002-2004

Experiments of forest fertilization with wood ash in Latvia

Objective of study

To investigate effect of wood ash fertilization on fine root mycorrhizal community of conifers 12 years after wood ash application.

Material and methods

Study site

- Experiment site - Vesetnieki, Forest research station, Jaunkalsnava
- Three mature conifer stands on deap peat soils

- Forest types:

Vacciniosa turf. mel. (A)

Myrtillosa turf. mel. (B)

Myrtillosa turf. mel. / Caricoso-phragmitosa (C)

Material and methods

Experimental design

Control groundwater well

Material and methods

Experimental design

Control 1

Control 2

Control 3

Control groundwater well

Material and methods

Root sampling

In summer, 2014 root sample were collected using soil borer (D = 12 cm, sampling depth – 0-20 cm)

63 soil samples – 27 from fertilized areas and 36 from control plots.

Material and methods

Root analysis

- Fine roots (>2mm in diameter) analysed
- Root sample was cut in 1cm fragments
- Number of ECM root tips per morphotype was assessed for 20 randomly choosed fragments

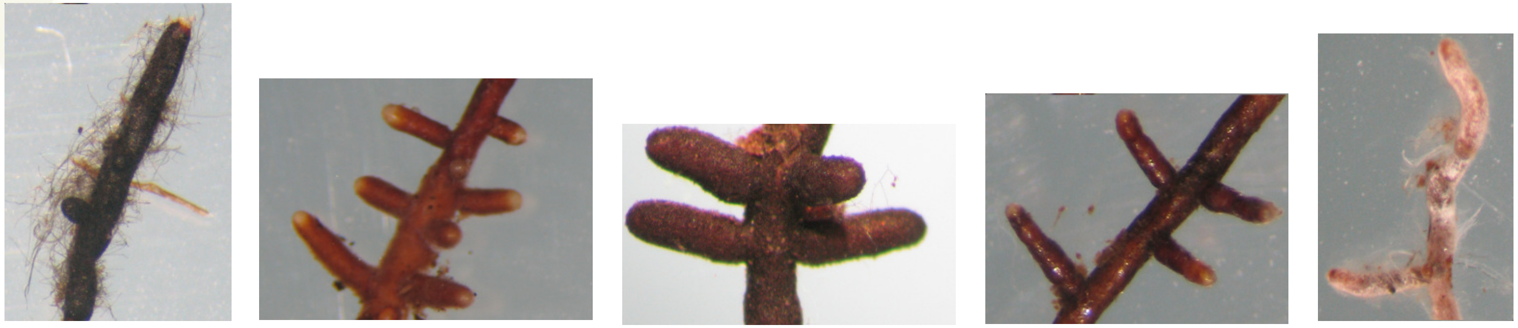


Photo: D. Kļaviņa

Material and methods

Root analysis

- 1 to 6 root tips from each morphotype from every sample plot were taken for species identification using molecular methods
- Phire Plant Direct PCR Kit was used.
- PCR amplification was performed with primer ITS1F and ITS4.
- Sequencing was performed by Macrogen Europe Inc.
- Raw sequence data were analysed using BioEdit and SeqMan software from DNASTAR package.
- Databases at GenBank and UNITE were used to determine the identity of sequences.

Material and methods

Background data

- Soil analysis

Samples collected in summer 2014, sampled in control and fertilized sites (0-10cm, 10-20cm, 20-40cm, 40-80cm).

- Tree growth rate

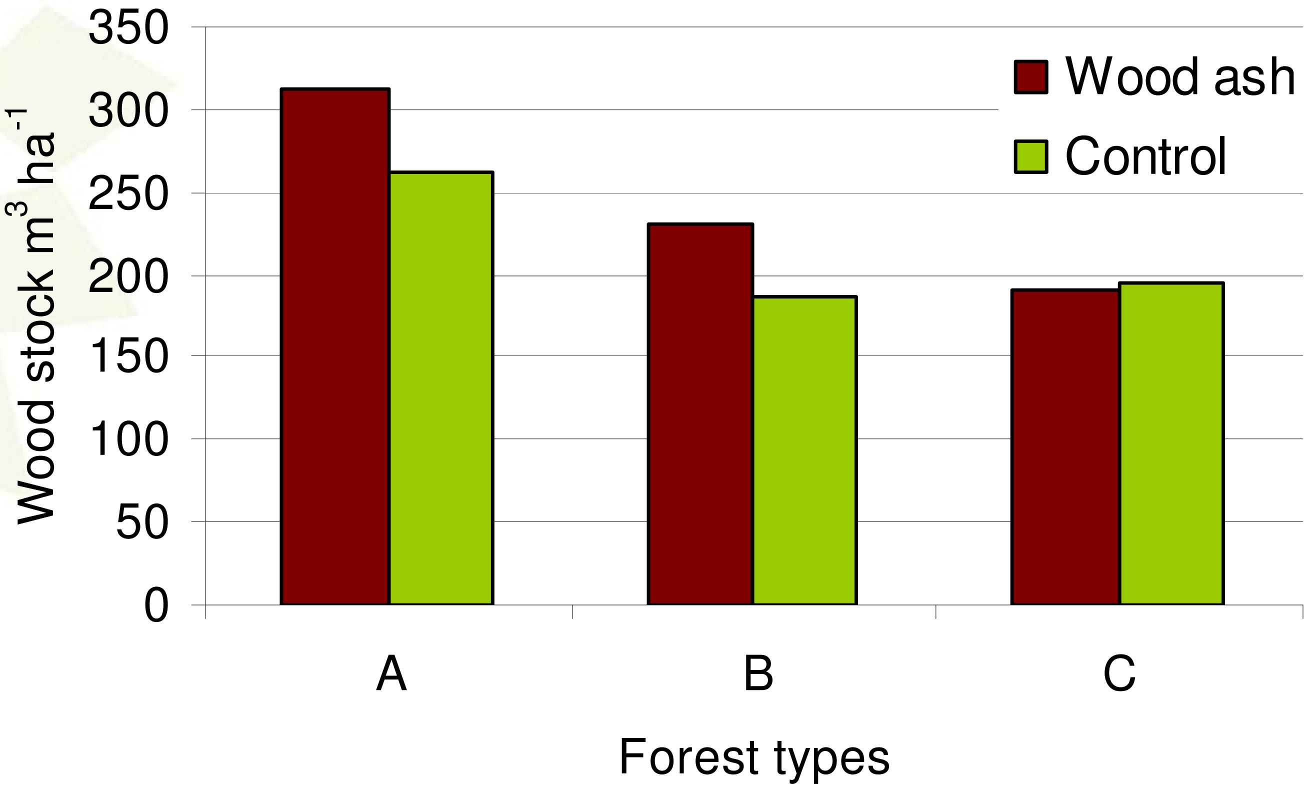
Soil analysis

Soil analysis

	Total		*Vacciniosa turf. mel.*		*Myrtillosa turf. mel.*		*Myrtillosa turf. mel. / Caricoso-phragmitosa*	
Parameters	**Ash**	**Control**	**Ash**	**Control**	**Ash**	**Control**	**Ash**	**Control**
pH (fresh samples in KCl)	7.1a	3.5b	7.6a*	3.3b	6.9a	3.1b	6.9a	4.0b
pH (sieved samples in H_20)	5.1 a	4.5 b	4.9a	4.3b	5.1a	4.3b	5.4a	4.8b
Relative moisture	10.2	10.4	9.8	9.9	9.7	9.1	11.6	11.6
N (Total, g/kg)	20.1 a	21.9 b	17.3	18.5	20.8	22.9	22.1	24.2
P (g/kg)	1.1 a	0.9 b	1.0	0.7	1.1	0.9	1.3a	1.0b
K (g/kg)	0.8	0.8	0.9	1.2	0.7	0.5	0.8	0.7
Ca (g/kg)	21.5 a	11.1 b	24.0 a	9.9b	19.6a	10.2b	20.8	12.9
Mg (g/kg)	1.4 a	1.0 b	1.4 a	1.0b	1.4a	0.8b	1.4	1.3

Different letter - significant differences ($p<0.05$)

Wood stock


350
300
250
200
150
100
50
0
Wood stock m^3 ha^{-1}
A
B
C
Forest types
Wood ash
Control

Results

Fine roots

	Vacciniosa turf. mel.		***Myrtillosa turf. mel.***		***Myrtillosa turf. mel. / Caricoso-phragmitosa***	
Parameters	**Ash**	**Control**	**Ash**	**Control**	**Ash**	**Control**
Biomass (kg / ha)	1498±214	1089±146	899±140	661±86	1284±315	998±166
Frequency (%) of viable fine roots	41.6%a (4076)	55.3%b (4345)	54.6%a (3745)	41.7%b (4492)	50.9%a (3419)	58.6%b (4725)

Different letter - significant differences ($p<0.05$)

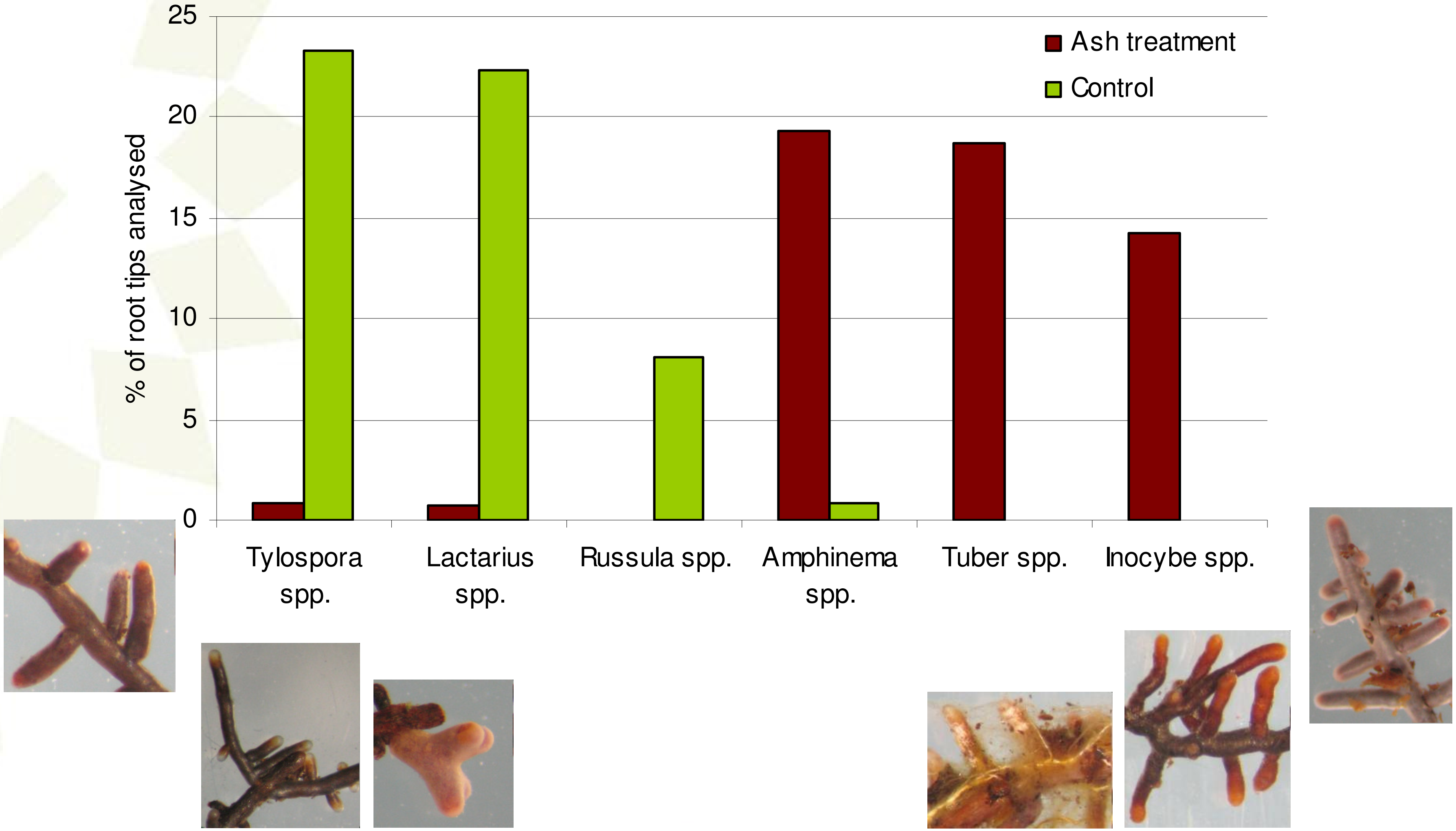
Results

ECM

	Ash	**Control**
Root tips morphotyped (No of morphotypes)	5350 (15)	7043 (15)
No of sequences	62	70
No of species	34 (23 singletons)	33 (22 singletons)
Shannon diversity index	2.2 (1.9 ... 2.7 per plot)	1.7 (0.9 ... 2.1 per plot)
Dominant species	*Amphinema byssoides* (17.0%) , *Tuber* cf. *anniae* (12.2%)	*Tylospora asterophora* (18.5%), *Lactarius tabidus* (20.3%)

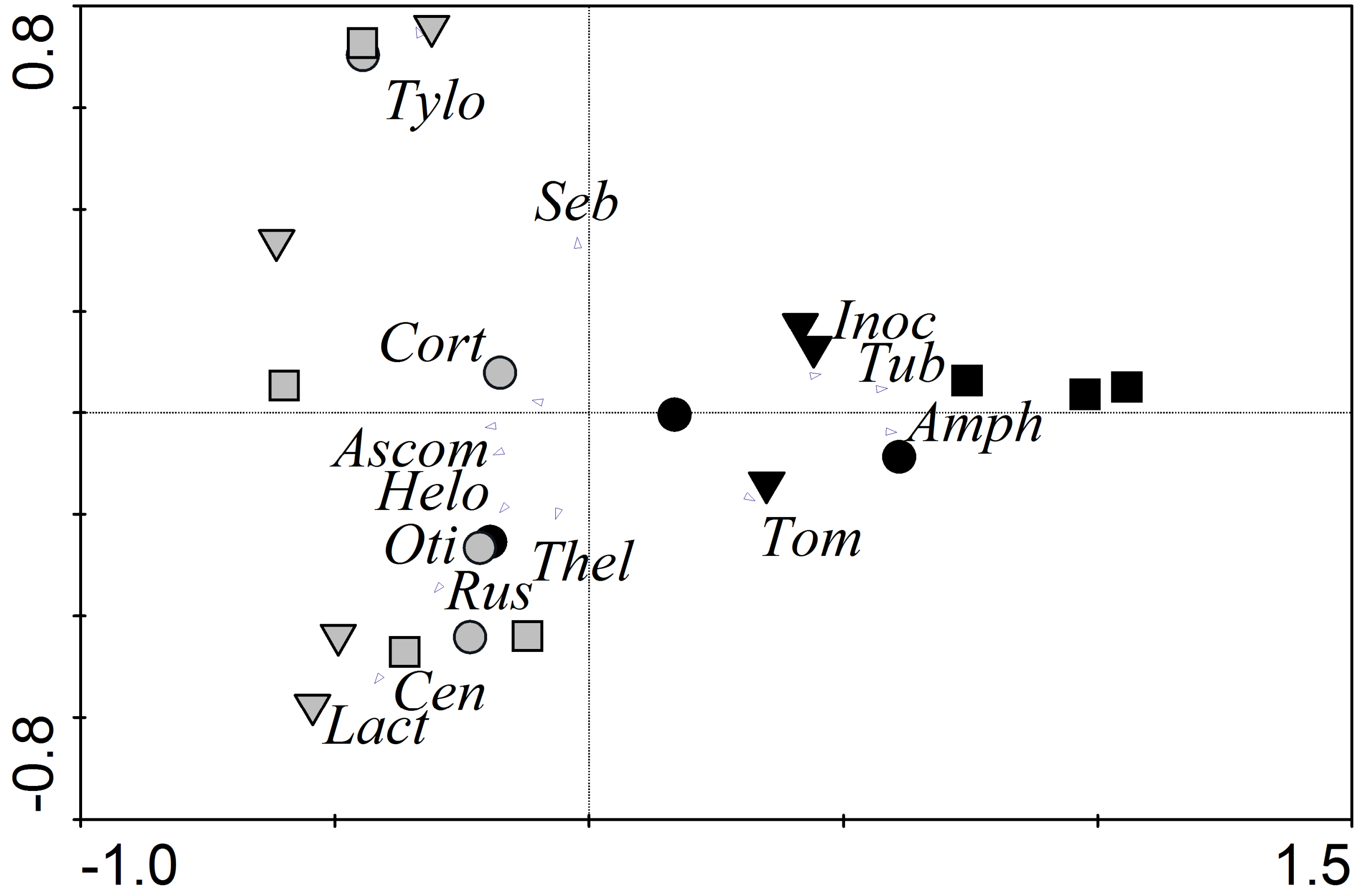
Results

ECM


% of root tips analysed
0
5
10
15
20
25
Ash treatment
Control
Tylospora spp.
Lactarius spp.
Russula spp.
Amphinema spp.
Tuber spp.
Inocybe spp.

Results

ECM



black – fertilized sample plots;
grey – control sample plots

circle – *Vacciniosa turf. mel.*;
square – *Myrtillosa turf. mel.*;
triangle – *Myrtillosa turf. mel. / Caricoso-phragmitosa*

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SILAVA

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SILAVA

METLA

SLU

ERAF
EIROPAS REĢIONĀLĀS
ATTĪSTĪBAS FONDS

EIROPAS SAVIENĪBA

IEGULDĪJUMS TAVĀ NĀKOTNĒ

NEFOM North European Forest Mycologists

Thank you for your attention!