Experiences and practices from COST actions

Scientific and aded values

Dr Jelena Lazarević

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme
of the European Union

Participation in COST actions improved scientific knowledge and work through:

- ✓ Meetings with scientists from different countries
- ✓ Excange of experinces and knowledge
- ✓ Improvement of techniques and skills in laboratory work
- ✓ Presentation and visibility of achieved scientific results....

...I have better results, which are more competetive (and visible)

- ✓ Improved international colaboration

Dr Jelena Lazarević

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- ✓ **FP1102: Determining Invasiveness and risk of Dothistroma (DIAROD) (2011-2015)**
  29 contries, Montenegro's participation (NNC): since 2013

- ✓ **FP1103: Fraxinus dieback in Europe: elaborating guidelines and strategies for sustainable management (FRAXBACK) (2012-2016)**
  39 countries were involved
  Montenegro's participation (NNC) since 2013

- ✓ **FP1305:Linking belowground biodiversity and ecosystem function in European forests (BioLink)** (2014-2018)
  33 countries were involved
  Montenegro's participation (NNC) since 2015

- ✓ **FP1401 - A global network of nurseries as early warning system against alien tree pests (Global Warning) (2015-2019)**
  39 countries were involved
  Montenegro's participation (NNC) since 2015

  - ➢ Domain FPS Forest, their products and services

- ✓ **CA17133 - Implementing nature based solutions for creating a resourceful circular city (2018-2022)**

COST Action networking tools

- ✓ MC meetings
- ✓ WG meetings & conferences
- ✓ Workshops & Training schools
- ✓ STSM
- ✓ Collaborative projects and publications

WG meetings & Conferences

Lazarević J.(2015): **Application of autochthonous fungi and forest soil for seedling mycorrhization - trials in Montenegro**, Soil Biological Communities and Aboveground Resilience, COST Action FP1305 BioLink: *Linking belowground biodiversity and ecosystem function in European forests,* Proceedings of the 3rd Annual Meeting, Rome, 17-19 November 2015, 54

Lazarević J., Keča N. (2016): **Basic physiological characteristics of *in vitro* cultures of ectomycorrhizal isolates from SE Montenegro**,The meeting of COST ActionFP1305 BioLink: Linking soil biodiversity and Ecosystem function in European forests "Belowground biodiversity and global change", Průhonice, Czech Republic, 24-26 October 2016.

Lazarević J., Menkis A. (2017): **Belowground fungal biodiversity associated with endemic *Pinus heldreichii* in high altitude Montenegrin forests**, 7th international Symposium on physiological processes in roots of woody plants -Woody root 7 jointly with Annual meeting of European network Cost Action FP1305 Biolink: Linking belowground biodiversity and ecosystem functions in European forests , June 26-29, 2017, Tartu, Estonia, Book of Abstracts, page 81.

Lazarević, J., Topalović, A., Menkis, A. (2018**)**: **Fungal biodiversity associated with fire-disturbed *Pinus heldreichii* forest soils in Montenegro**. Soil biodiversity and European woody agroecosystem FP1305 Biolink Cost Action Annual Meeting, Granada, 14-16 March, pp. 83-84. ISBN 978-88-97655-03-9

FP1305:Linking belowground biodiversity and ecosystem function in European forests (BioLink) (2014-2018)

Conference in Granada, March 2018

Training School on Molecular Detection and Population Genetics of Dothistroma Needle Blight Pathogens , 3- 7 March 2014, Uppsala, Sweden

DIAROD training workshop, trainers and partcipants, March 2014 - Sweden
Participant from MNE: Dr Jelena Lazarević, University of Montenegro, Biotechnical faculty

Lazarević J.(2015): **Dothistroma needle blight in different pine forests in Montenegro**, COST Action FP1102: Determining Invasiveness And Risk Of Dothistroma, DIAROD, **Management Committee meeting, workshop and final meeting**, 6 – 8 October 2015, Kraków, Poland

Lazarević J., Davydenko K. , Menkis A. (2018): **Dothistroma needle blight and other needle fungi of native conifers in Montenegro , The 15th International Phytotehnology Conference**, University of Novi Sad, 1-5 October 2015, Book of abstract, page 17., **invited speaker**

SHORT TIME SCIENTIFIC MISSIONS

FP1102: Determining Invasiveness And Risk Of Dothistroma (DIAROD)

COST-STSM-FP1102-16414 :
STSM Topic: **Learning molecular techniques to identify DNB in field samples**
Participant: Dr Jelena Lazarević, University of Montenegro, Biotechnical faculty
Host: Dr Hanna Milberg, Department of Forest Mycology and Plant Pathology, Swedish University of Agricultural Sciences, Uppsala, Sweden
Period: 08.03-30.04. 2014

COST-STSM-FP1102-26562:
STSM Topic: **Identification of DNB from field samples/occurrence of DNB at high altitude pine forests**
Participant: Dr Jelena Lazarević, University of Montenegro, Biotechnical faculty
Host: Dr Audrius Menkis, Department of Forest Mycology and Plant Pathology, SLU, Sweden
Period: 1.06-30.06.2015

FP1103: Fraxinus dieback in Europe: elaborating guidelines and strategies for sustainable management (FRAXBACK)

COST-STSM-FP1103-32332
STSM Topic: **Learning molecular techniques for genetical characterization and phylogeny of Ascomycetes-example of genus *Hymenoscyphus***
Participant: Dr Jelena Lazarević, University of Montenegro, Biotechnical faculty
Host: Dr Audrius Menkis, Department of Forest Mycology and Plant Pathology, SLU, Sweden

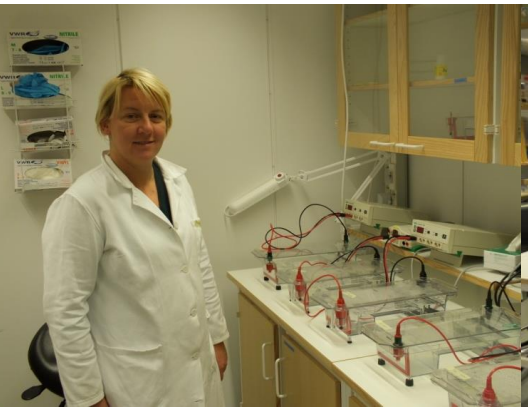
FP1305:Linking belowground biodiversity and ecosystem function in European forests (BioLink)

COST-STSM-ECOST-STSM-FP1305-150117-080732
STSM Topic**: Identification and genetic characterization of fungi from fire-disturbed forest soils with special reference to *Pinus heldreichii***
Participant: Dr Jelena Lazarević, University of Montenegro, Biotechnical faculty
Host: Dr Audrius Menkis, Department of Forest Mycology and Plant Pathology, SLU, Sweden

FP1401 - A global network of nurseries as early warning system against alien tree pests (Global Warning)

STSM reference number 41430
STSM Topic: **Invasive fungi in the phyllosphere of the principal tree species in Montenegro**
Participant: Dr Jelena Lazarević, University of Montenegro, Biotechnical faculty
Host: Dr Audrius Menkis, Department of Forest Mycology and Plant Pathology, SLU, Sweden

Department of Forest Mycology and Plant Pathology,
Swedish University of Agricultural Sciences, Uppsala, Sweden



University of Montenegro:

Biotechnical faculty

Historical Institute of Montenegro

Faculty of Tourism and Hotel management

National commercial entities :

- HM Durmitor, Žabljak
- The Old House, Podgorica
- Intertehna, Berane

International RTD entities :

University of Ljubljana - Biotechnical faculty (Slo)

Swedish Univ. of Agricultural Sciences - Dept. of Forest Mycology and Plant Pathology (S)

CNR, Institute for Technologies Applied to Cultural Heritage(I)

University of Basilicata (I)

- ✓ **Learning molecular techniques to identify DNB in field samples**
- ✓ **Identification of DNB from field samples: Occurrence of DNB at high altitude pine forests**

More than **350** samples from different pine forests from Montenegro were analyzed

•Looking for symptoms in pine forests under different ecological conditions

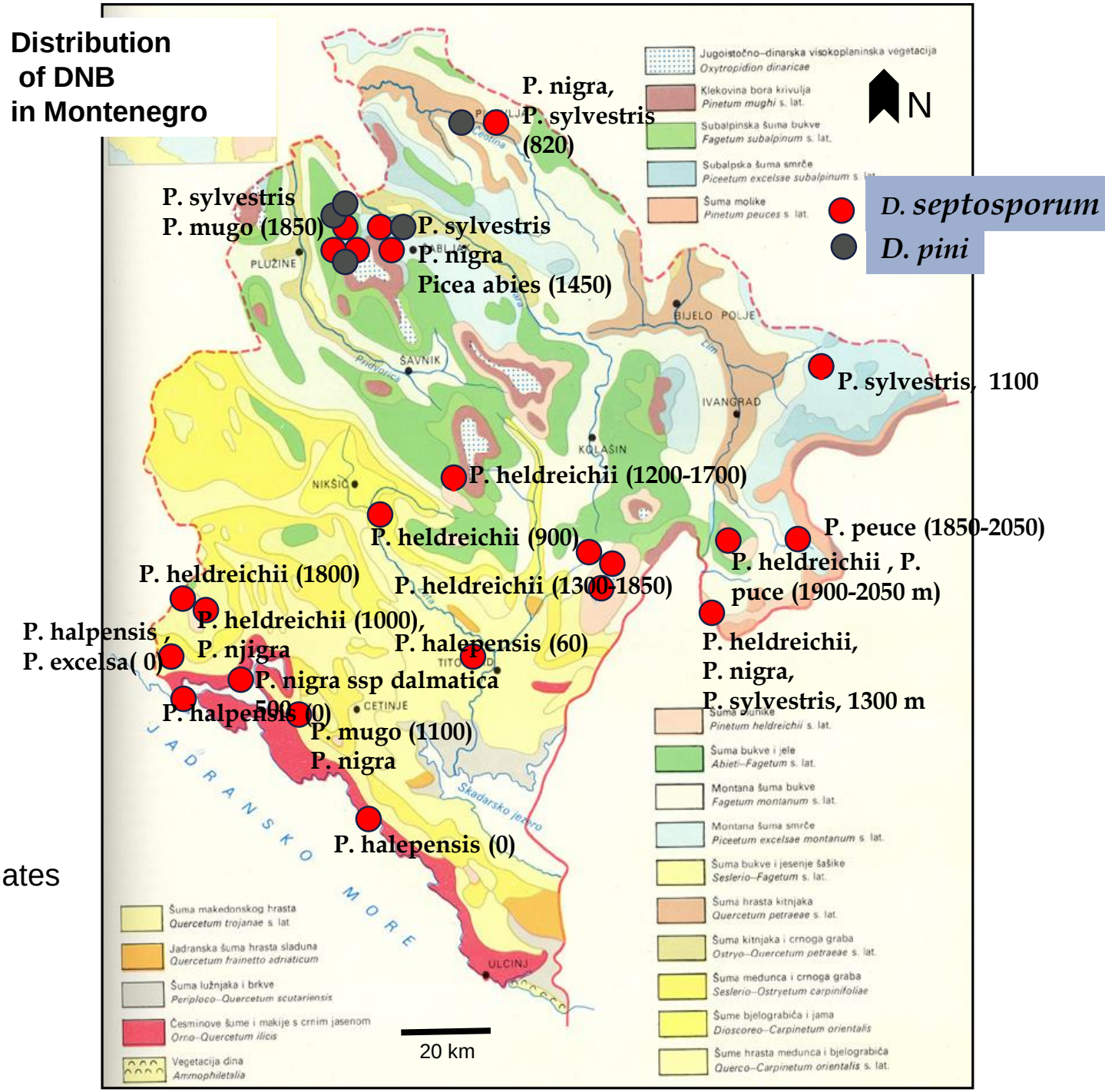
•symptoms were confirmed by molecular methods

- **PCR with species specific primers**

D. septosporum: **Dstub 2-F** & **Dstub2-R** (Ioos et al., 2010)

*D. pini***: Dptef-F** & **Dptef-R** (Ioos et al., 2010)

to determine wich species of *Dothistroma* is present in Montenegro



Results:

- 10 pines + spruce
- new hosts
- first records
- new Mt. areas/climates

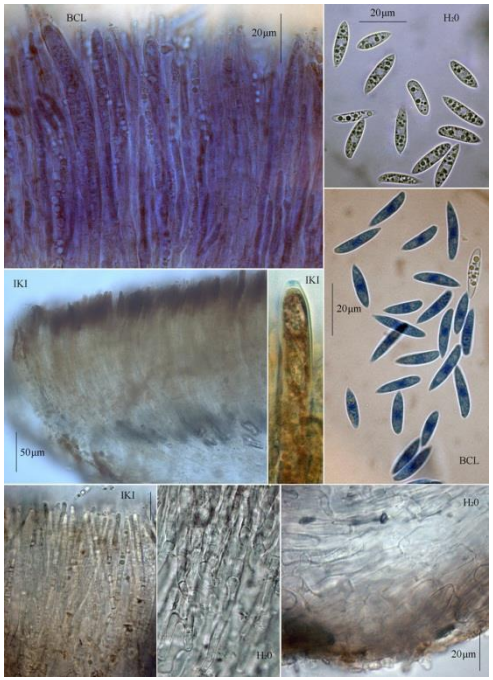
- *D. pini*... in Europe

STSM:Learning molecular techniques for genetical characterization and phylogeny of Ascomycetes-example of genus *Hymenoscyphus*

FP1103: Fraxinus dieback in Europe: elaborating guidelines and strategies for sustainable management (FRAXBACK)

- ✓ Molecular characterisation of different (10) *Hymenoscyphus* species from mycological collection (exicates) and from freshly collected material, with different molecular markers
- ✓ During FRAXBACK action, health status of *Fraxinus excelsior*, *F. angustifolia* and *F. ornus* were under observation, and estimated in different parts of Montnegro.

Photo B. Perić



H. fructigenus & H. rokebyensis

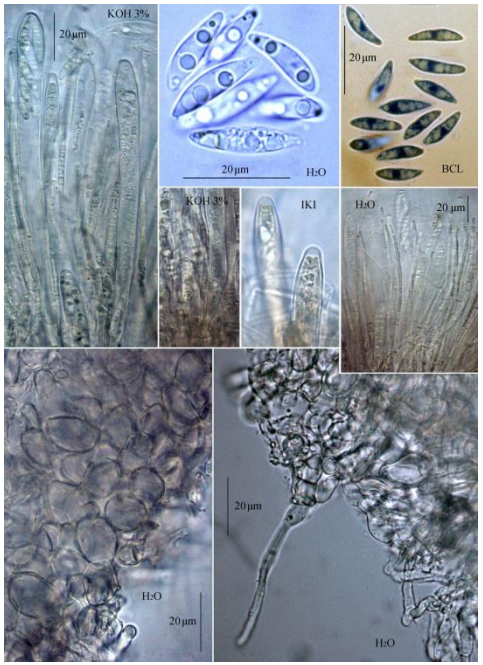


Photo B. Perić

FP1305:Linking belowground biodiversity and ecosystem function in European forests

STSM Topic: **Identification and genetic characterization of fungi from fire-disturbed forest soils with special reference to *Pinus heldreichii***

Fungal biodiversity associated with fire-disturbed *Pinus heldreichii* forest soils in Montenegro

Jelena Lazarević[1], Ana Topalović[1], Audrius Menkis[2]

UCG
Univerzitet Crne Gore

SLU

Forest fires are among the most devastating events in forest ecosystems

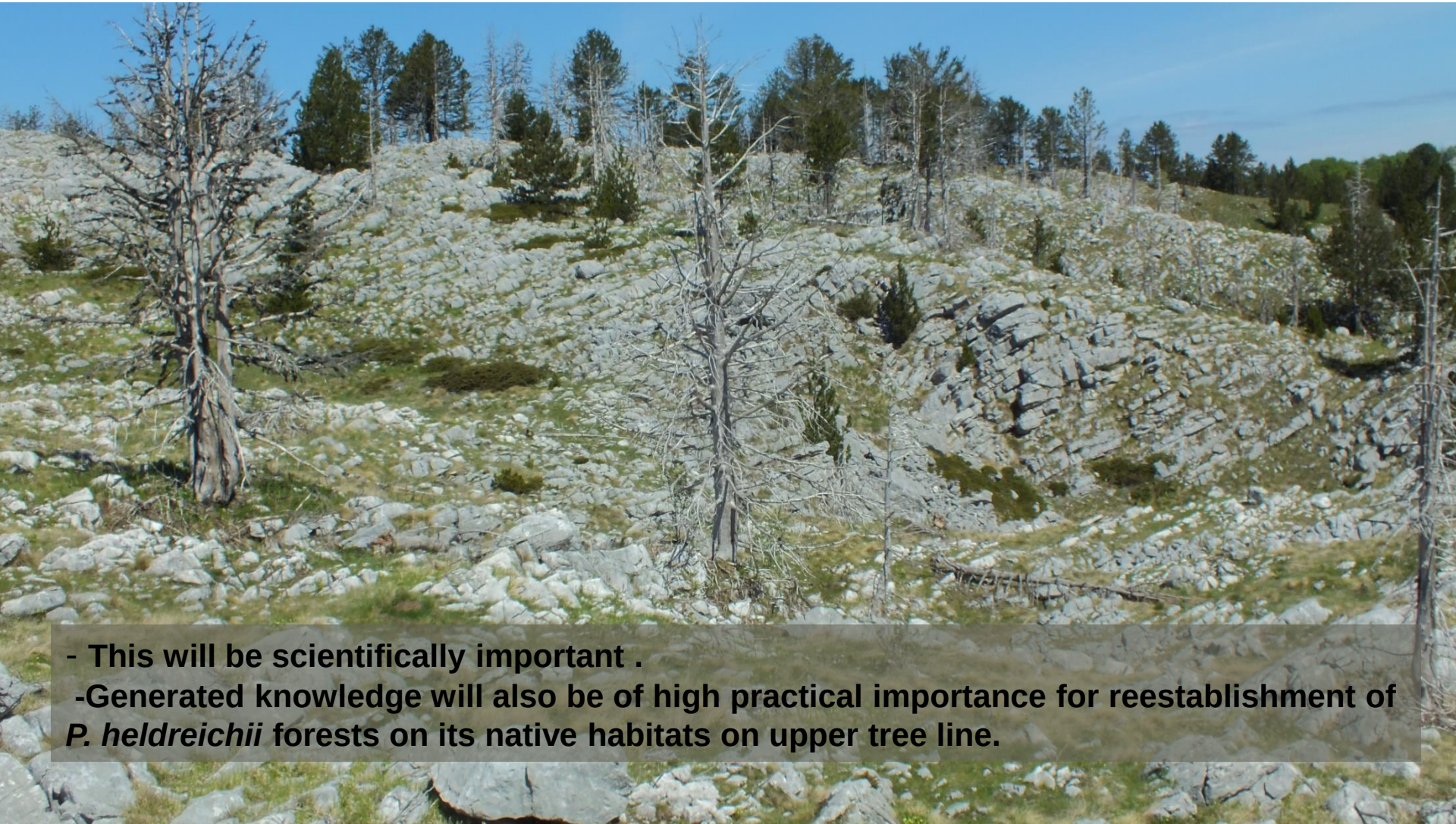
- **Forest fires are the major threat to forests of *P. heldreichii* in Montenegro.**
- **about 25 % of forest area covered by *P. heldreichii* in SE Montenegro were damaged by forest fires in the last 10-15 years.**
- 98% of all forest fires in MNE are caused by man


• (some other) forests need more than 70 years to recover after fire, while here ...

Little is known about the succession of soil fungi following a forest fire.

Aim of research :

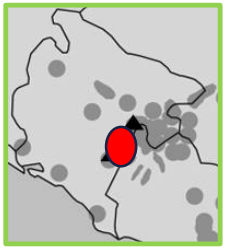
Getting knowledge on fungal succession, composition and structures of fungal communities in forest soils after the fire



- **This will be scientifically important .**
- **Generated knowledge will also be of high practical importance for reestablishment of *P. heldreichii* forests on its native habitats on upper tree line.**

Field_sampling : **June 2016**

Less than 1 year after fire



- **Stravče**– forest fire in **2015**
  - O- burned litter
  - A- soil (kalkomelanosol)
- **Hum Orahovski** –forest fire in **2014**
  - A-soil (kalkomelanosol)
- **Kastrat** –forest fire in **2012**
  - O- burned litter
  - A- soil (kalkomelanosol)
- **Treskavac** –forest fire in **2010**
  - O- burned litter
  - A- soil (kalkomelanosol)

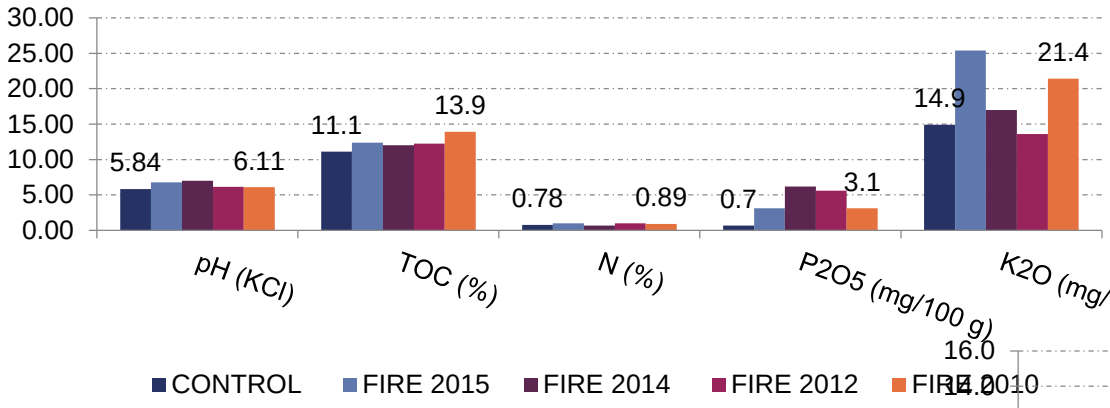
- Control (without fire) : **Kucka korita** - A- soil (kalkomelanosol)
  Sovrh –A-soil (regosol)

- Roots /plantlets from control sites

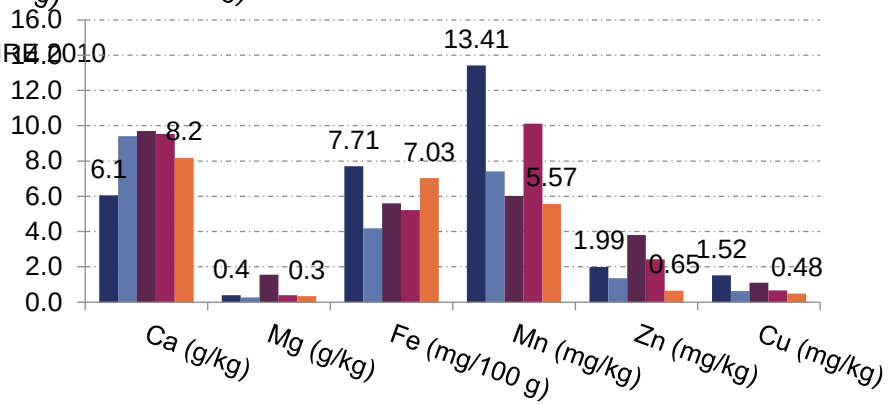
- 5 replicates per locality
(20-50 m between replicates)

Soil chemical characteristics- A horizont

pH, TOC, and primary macronutrients



secondary elements and microelements



2 years after fire

4 years after fire

6 years after fire

- **Direct isolation of genomic DNA from soil samples**

-CTAB extraction protocol (additional cleaning with Wizard DNA purification kit , PROMEGA

-**NucleoSpin Soil kit, Macherey-Nagel**

- **PCR amplification**

  gITS7 (8bpIDtag- G T G A R T C A T C G A R T C T T T G)
  ITS4 (8bpIDtag-TCCTCCGCTTATTGATATGC)
  (Ihrmark et al., 2012).

- **High-throughput PacBio sequencing**

for the purpose of fungal community studies, different samples were amplified with different **barcoded** fungal specific **primers**

Sequence analysis

SeqMan Pro version 12.0.0
BioEdit version 7.0.5.2

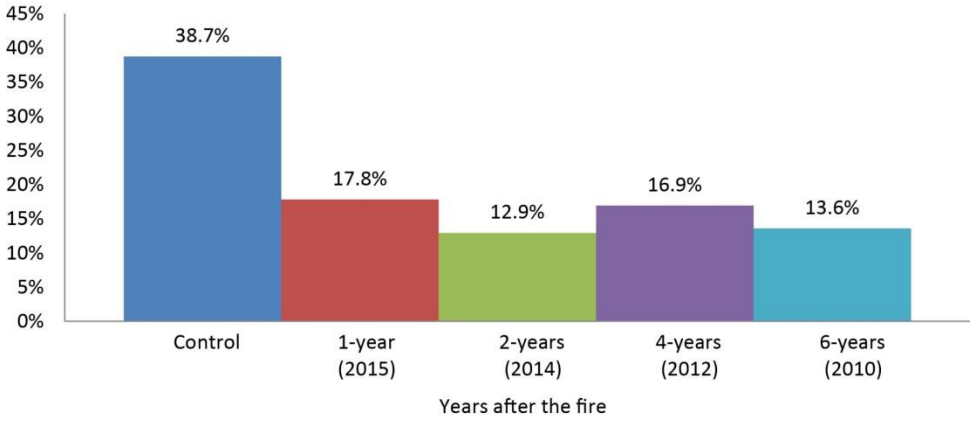
GenBank (https://blast.ncbi.nlm.nih.gov.)

The criteria for species identification:

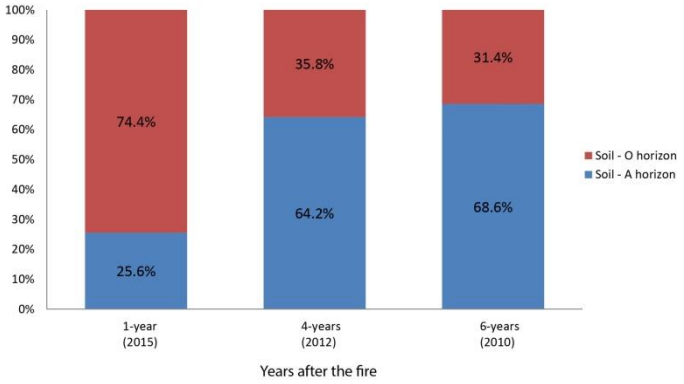
- sequence coverage >80%
- similarity to genus level 94-97%
- similarity to species level **98-100%**

- **Sequencing resulted in 10,105 high quality sequences**

Relative abundance of high-quality sequences



Distribution of high-quality sequences in soil horizons

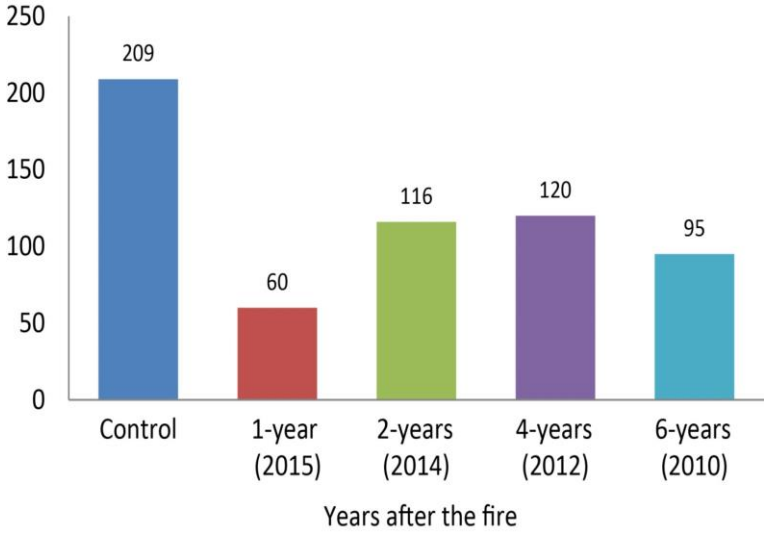


Fire results in the loss of biodiversity and shift in the fungal community structure.

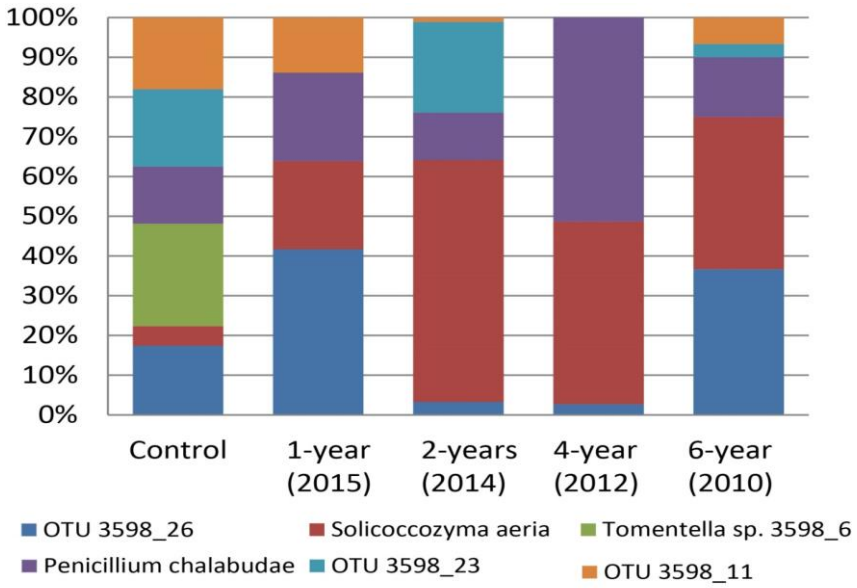
- Assembly showed the presence of **848** OTUs (at 98% similarity level)

- majority of dominant fungal species are unidentified
- majority of all fungal species are not identified at species (even genus) level

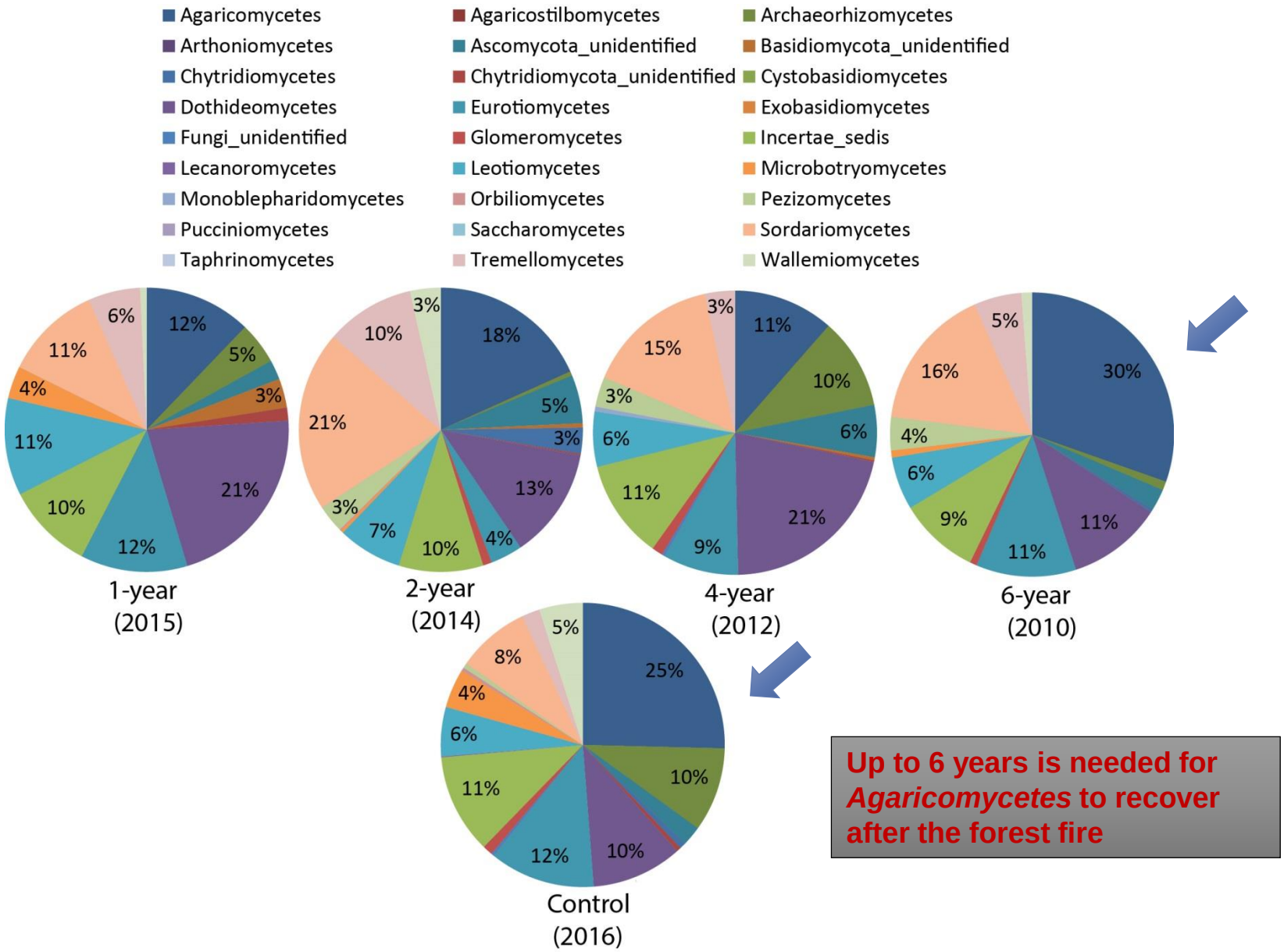
Richness of fungal OTUs in soil A-horizon



Abundance of the six most common OTUs in soil A-horizon

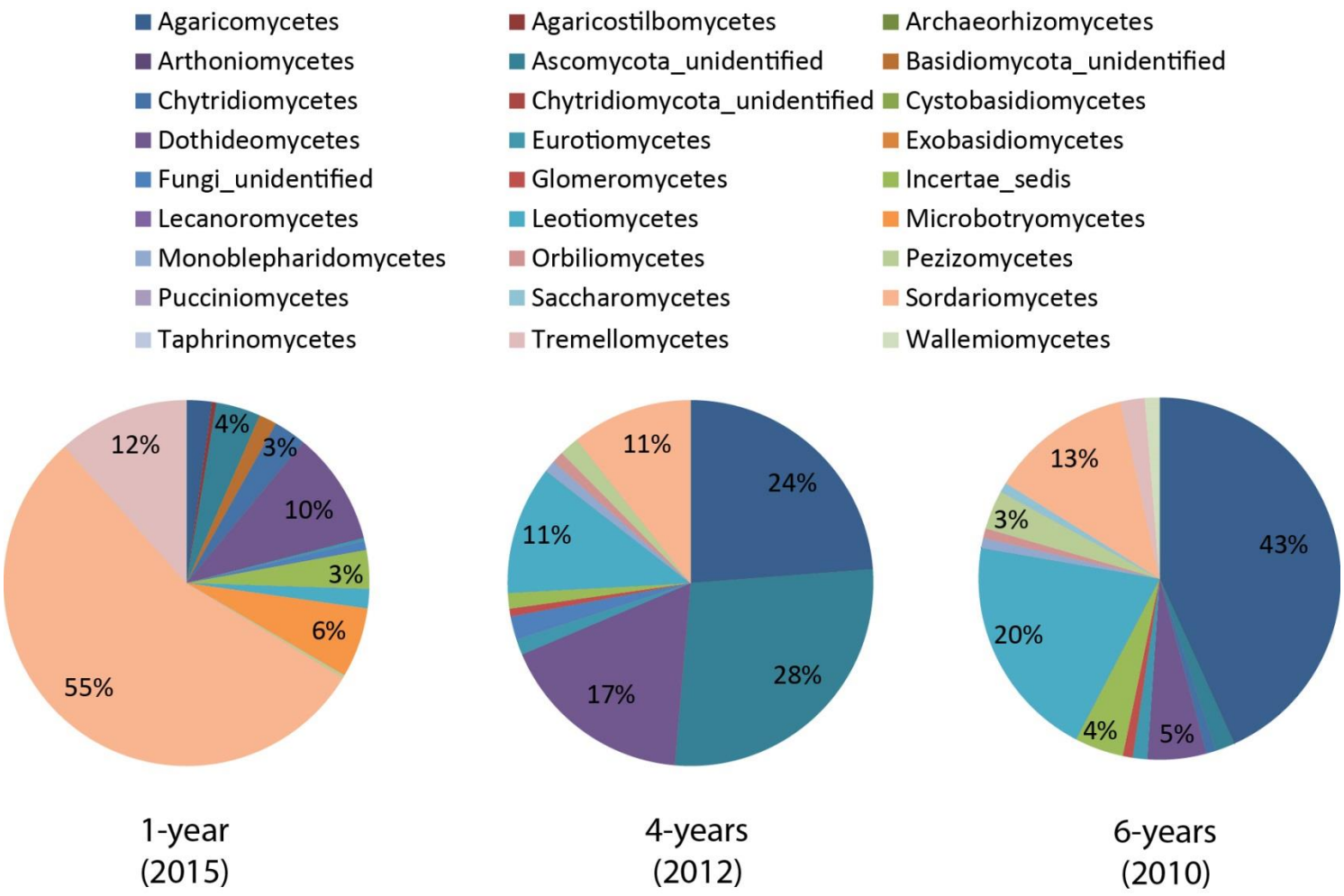


Composition of fungal community in soil A-horizon



Up to 6 years is needed for *Agaricomycetes* to recover after the forest fire

Composition of post-fire fungal community in O-burned litter layer



FP1401 - A global network of nurseries as early warning system against alien tree pests (Global Warning)

STSM Topic: **Invasive fungi in the phyllosphere of the principal tree species in Montenegro**

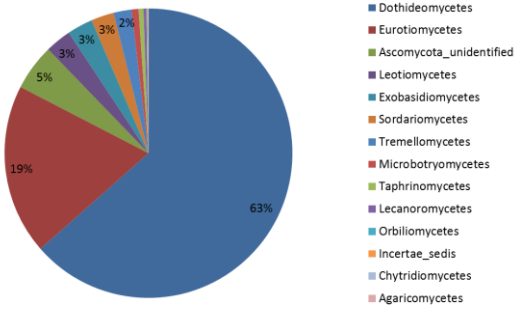
The aim of this study was to investigate fungi in healthy-looking needles and leaves of native tree pecies.

Widescale sampling:

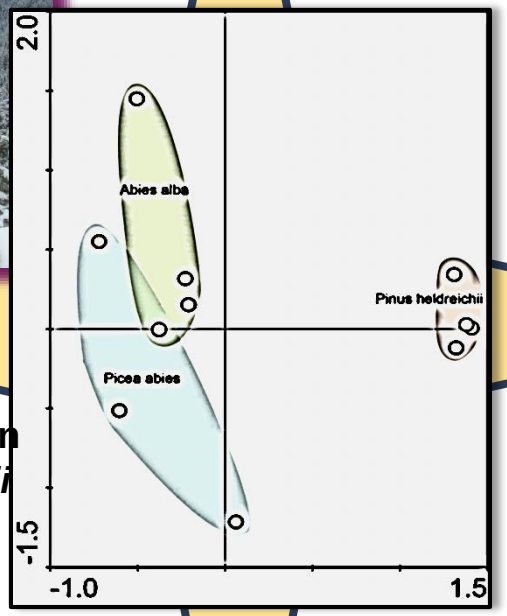
- ✓ 5 principal tree species: ***Fagus sylvatica***, ***Abies alba***, ***Picea abies***, ***Pinus heldreichii*** and ***Pinus peuce***
- ✓ 3 representative localities for each species
- ✓ 50 trees on each locality (50 m between)

P. peuce, Prokletije

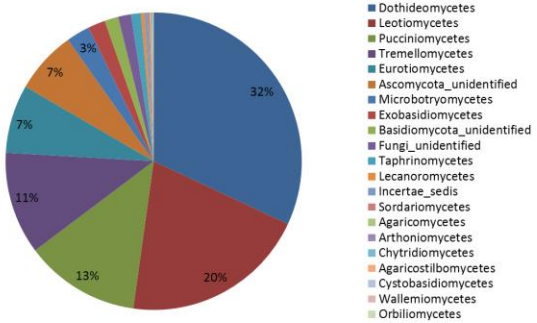
N



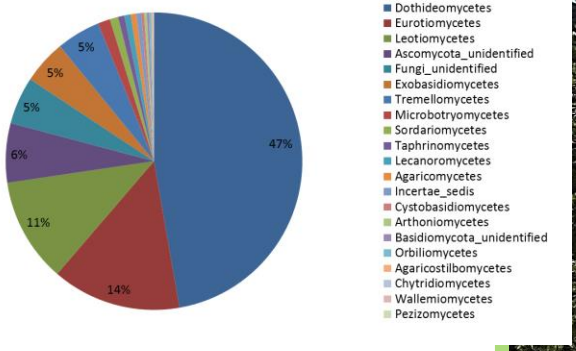
Composition of fungal community in needles of *Pinus heldreichii*



Ordination diagram of fungal communities in needles of *P- abies A- alba* and *P.heldreichii*



Composition of fungal community in needles of *Picea abies*

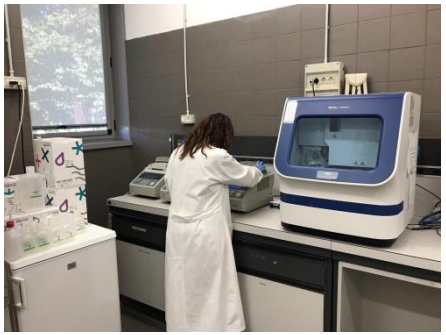


Composition of fungal community in needles of *Abies alba*

FP1202: Strengthening conservation: a key issue for adaptation of marginal/peripheral populations of forest trees to climate change in Europe (MaP-FGR)

COST-STSM-FP1202-32290
STSM Topic: **Learning molecular techniques for genetic characterization of forest tree populations- example of *Pinus heldreichii***

Participant: **Ivana Stojanović, M.Sc** , University of Montenegro, Biotechnical faculty
Host: **Giovanni Giuseppe Vendramin,** National Research Council, **Institute of Biosciences and BioResources**,Florence(IT),
Period: 01.03-31.03. 2016.



Lessons learned - what is important for successful STSM
(Message for young researchers)

- ✓ Y**ou** are **selecting** & **proposing** the **title** and the frame of your work, so explain it first to your possible host, and than to COST action coordinators (trough application form);
- ✓ It is not possible to stay always and persistently with your favorit themes from your master or PhD thesis, so **be flexible and open for new research topics**;
- ✓ **Responsible** and **dedicated work** is appreciated (in lab, but also in other cases), as well as reliable **comunication**;
- ✓ Sometimes, you will be asked, or you will need just to apply for already proposed call for STSM (Hosts are looking for applicants/ topis are alredy proposed – special tasks needed for the action);
- ✓ In other cases, you will be able to develop your own small project, which fits in general topic of the action.

Collaborative projects and publications

WG meeting:

- ✓ Presentation of the topic by R. Drenkhan (EE)
- ✓ Presentation about geodatabase by P. Vahalik, GIS expert (CZ)

Dothistroma interactive map:
http:// arcgis.mendelu.cz/monitoring/

- ✓ Disscussion abut criteria for creating database
- ✓ Presentations, discussions and comments from participants

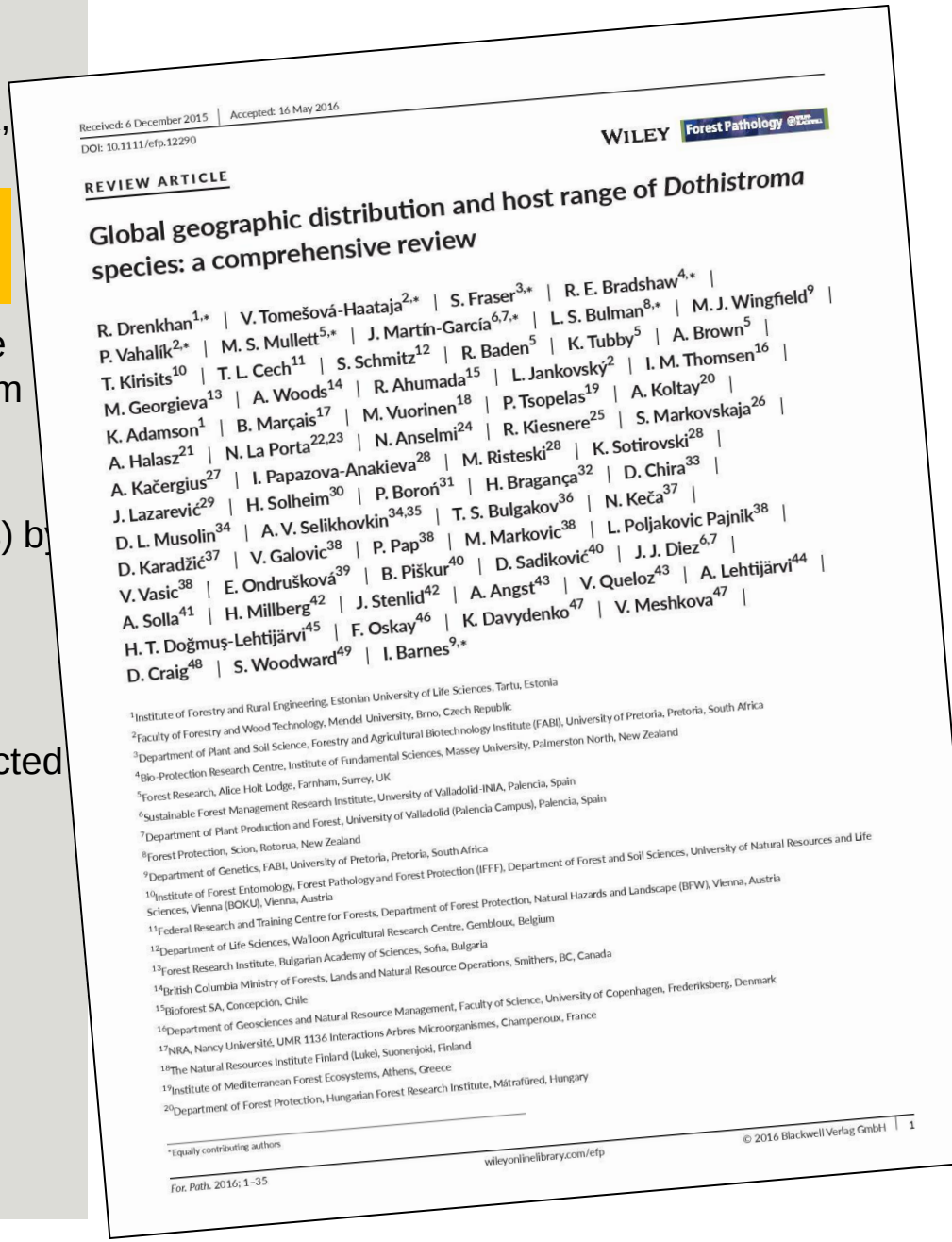
Participants sending reports and data (records) by e-mail (deadlines are defined)

New WG meeting(s).....

Meeting dedicating to publishing strategy (selcted participants),

- ✓ first draft were already prepared,
- ✓ we passed through all fragments/sections of work (for several publcations);
- ✓ tasks for further work were delegated.

Final drafts and manuscript for communication delivered via **e-mail**.



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WILEY Forest Pathology

REVIEW ARTICLE

Global geographic distribution and host range of *Dothistroma* species: a comprehensive review

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Global patterns in insects and fungi of dormant twigs of native and exotic congeneric tree species

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30 countries, 45 institutions

We performed a global study aimed at detection of potential insect pests and fungal pathogens on congeneric native and exotic woody plant species.

- ✓ Sampling was done simultaneously in **30 countries** around the world following a common sampling protocol.
- ✓ The plant species from genera ***Pinus***, ***Fagus*** and ***Quercus*** (Northern hemisphere) and ***Podocarpus***, ***Nothofagus*** and ***Eucalyptus*** Southern hemisphere).
- ✓ Sampling was done in January/February 2018 on the Northern hemisphere and in June/July 2018 on the Southern hemisphere, to respect seasonal phenomena.
- ✓ At each location twenty 50 cm long twigs were collected from each tree species and kept in containers with water at room temperature.
- ✓ Emerged insects were collected and identified to species or morphospecies level based on morphology and DNA barcoding of the mtDNA COI region.
- ✓ Fungal DNA was extracted from pooled buds, twig parts and needles for species identification using a metabarcoding approach based on the rDNA ITS region.
- ✓ Fungi were also isolated from collected material and cultivated...

Pairs from Montenegro:
Quercus robur *&* ***Quercus rubra*** (Loc. Podgorica)
Myrthus communis *&* ***Eucalyptus globulosus*** (loc. Podgorica and Bar)

Some ther collaborations, comes after COST conferences....

***with: Prof dr Stefano Grego*, World Agricultural Heritage Foundation**

*Introductory presentation**:***

Culture, Agriculture and Innovation for Sustainable Development

at **KATUN** PROJECT FINAL CONFERENCE: "*THE KATUNS PROJECT RESULTS AND FUTURE OF THE MONTENEGRIN KATUNS*" *THE KATUNS – HOW TO MOVE FOREWARD?*

A group of KATUN team members with guests on Mt. Durmitor, Sedlo, 28. September 2017

Application for Horizont 2020 project (call: : *SC5-21-2016-2017 TOPIC : Cultural heritage as a driver for sustainable growth Scope b) Heritage-led rural regeneration.*)

"**Maintenance of Mountain Heritage in Europe for Sustainable Use of its Natural Environment, for PROtection and Promotion of the Mountains' Cultural-Historical Traditions, for a VIable tourism, and for REsilience to Climate and Land Use Changes – PROVIRE**", with very active involvment of our team.

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