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LITHUANIAN RESEARCH CENTRE FOR AGRICULTURE AND FORESTRY

Project "Sustainable use of soil resources in the changing climate (SUCC)": Overview of activities by the Lithuanian team (LAMMC) in 2022.

Dr. Jelena Ankuda and Dr. Kęstutis Armolaitis

EEA (European Economic Area) Grants, Baltic Research Programme.

SUCC winter 2023 meeting, 03.02.2023.

Lithuanian team

- The PostDoc Dr. **Jelena Ankuda** acted as a Principal investigator (PI) on the Lithuanian side. **Her functions** in SUCC Project in 2022 were**:** project coordination and administration, project data analysis, and analyzing literature on the topic of the project, and planning and writing scientific and other publications.
- Dr. **Kęstutis Armolaitis** acted as a Co-Principal Investigator (Co-PI) and the Chief researcher. **His functions in 2022 were:** analyzing literature on the topic of the project, and planning and writing scientific publications.
- In SUCC project in 2022 the Lithuanian partner included 1 PhD student **Diana Sivojienė**. Her functions in SUCC Project in 2022 were: metagenomic data analysis, and analyzing literature on the topic of the project, and writing a scientific publications.

The following people participated in the project SUCC, but they were not formally employed in 2022:

- PhD student **Audrius Jakutis.** His functions were data analysis, analyzing literature on the topic of the project, and writing scientific publications.
- Dr. **Jūratė Aleinikovienė**. Her functions were analysis of data of soil microbiota biomass C and N, analyzing literature on the topic of the project, and writing scientific publications.
- Dr. **Donata Drapanauskaitė**. Her functions were analysis of data from performed chemical analyzes, analyzing literature on the topic of the project, and writing scientific publications.

Activities in 2022:

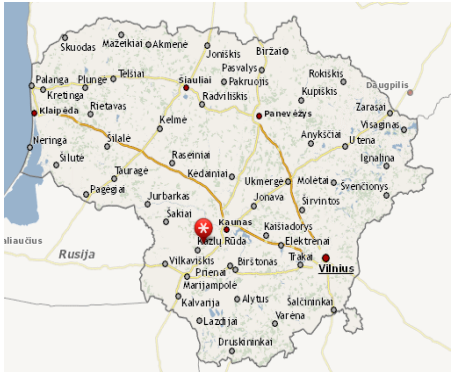
- In 2022 Lithuanian team with all SUCC participants participated in 1 online meeting to present their country's project activities and their future plans.

- Lithuanian participants actively communicated with each other and with project participants from other countries by e-mail, phone, or "in life".

- Frequent online meetings were also held between Lithuanian participants. Project activities were discussed, including scientific publications, and discussions were held regarding their improvement and addition, and data calculations necessary for writing the articles.

Activities in 2022

- Data part of Lithuanian Type III soil samples (Soil depth gradient), that were taken in Southwestern Lithuania, near Jūrė small town near Kazlų Rūda in Scots pine stand (Arenosol) was with the bioinformatics.
- Samples were collected from 3 soil profiles up to 2 m depth (0-5 cm; 10-15 cm; 20-25 cm; 50-55 cm; 100-105 cm; 150-155 cm and 195-200 cm).
- These and other data were analyzed and used for the writing of the scientific article "Soil microbiological parameters and soil organic carbon stocks in profile of forest Arenosol“.
- A draft of the article has been prepared, but the article has not yet been published.



Activities in 2022:

“Soil microbiological parameters and soil organic carbon stocks in profile of forest Arenosol“:

Results and Discussions:

- Soil chemical parameters (pH; SOC; STN; C:N ratio)
- Soil microbial biomass carbon and nitrogen
- Diversity of soil fungi along soil depth
- Correlation

Activities in 2022:

It was found that:

- 100947 (87.8%) sequences and 2369 (55.6%) OTUs were classified as Fungi.
- The highest number of reads for fungi and the OTUs of fungi were at the soil depth 100-105 cm.
- The most abundant phyla in all soil depths were *Ascomycota* (47.2%) and *Basidiomycota* (44.8%). The third most abundant phyla were *Mortierellomycota* or *Mucoromycota*.
- The relative abundance of *Ascomycota* was the highest in soil depth from 10-15 to 100-105 cm, meanwhile in the depths 0-5 cm, 150-155 cm, and 195-200 cm more abundant was *Basidiomycota*.

Our research showed that in Arenosol on Scots pine stand to the depth up to 2 meters it is possible to detect a relatively large number and diversity of soil fungi.

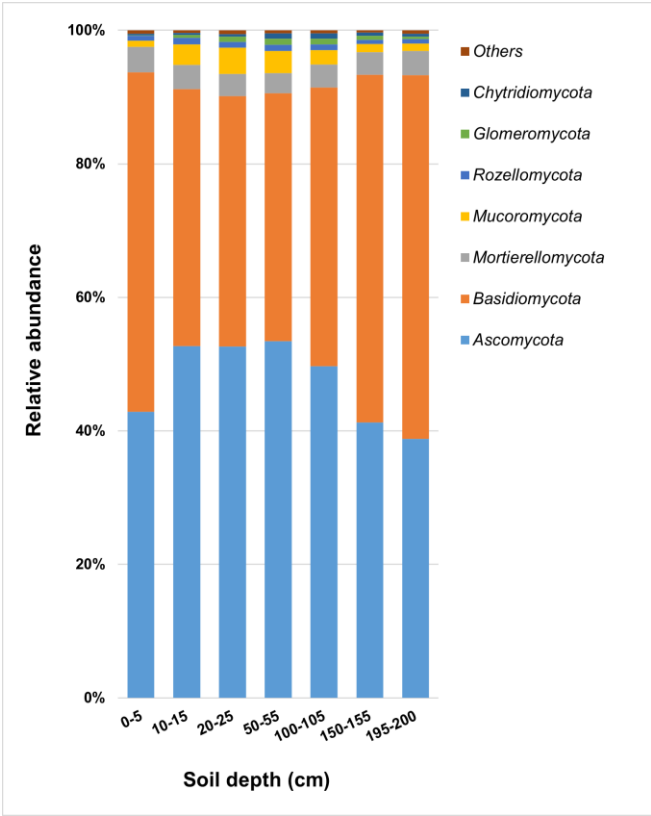


Figure 1. Relative abundance of most common fungal OTUs under the phylum level.

Activities in 2022 and the plans for 2023

We received some metagenomic data from an Estonian partner.

- Type I (North-to-South transects) and Type II (Land abandonment / afforestation chronosequence) soil samples metagenomic data were with the bioinformatics.
- We analyzed these data and started to write a second scientific article about soil microbiological and chemical parameters in different land use (Type II soil samples).
- Another part of metagenomic data (Lithuanian Type III (Luvisol) and additional Lithuanian soil samples) was withaut the bioinformatics.
- In 2022, Diana Sivojienė analyzed these data using the bioinformatics. In 2023, we plan to join in the process a new person who specializes in bioinformatics.
- Dr. Martin Maddison also sent us results of GHG emission concentrations at 25 Lithuanian plots in 2022. CO2 emission concentrations were measured and soil samples to determine emissions of N2O, CH4 were collected in 2021 at Type I, Type II, and Type III sites: forests and croplands, abandoned croplands, perennial grasslands, agroforestry land).

Activities in 2022:

Thanks to our Estonian partner, we are the co-authors of excellent scientific publication:

- 1. Tedersoo L., Mikryukov V., Zizka A., Bahram M., Hagh-Doust N., Anslan S., Prylutskyi O., Delgado-Baquerizo M., Maestre F. T., Pärn J., Öpik M., Moora M., Zobel M., Espenberg M., Mander Ü., Khalid A. N., Corrales A., Ahto A., Vasco-Palacios A. M., Saitta A., Rinaldi A. C., Verbeken A., Sulistyo B. P., Tamgnoue B., Furneaux B., Ritter C. D., Nyamukondiwa C., Sharp C., Marín C., Gohar D., Klavina D., Sharmah D., Dai D. Q., Nouhra E., Biersma E. M., Rähn E., Cameron E. K., De Crop E., Otsing E., Davydov E. A., Albornoz F. E., Brearley F. Q., Buegger F., Zahn G., Bonito G., Hiiesalu I., Barrio I. C., Heilmann-Clausen J., Ankuda J., Kupagme J. Y., Maciá-Vicente J. G., Fovo J. D., Geml J., Alatalo J. M., Alvarez-Manjarrez J., Põldmaa K., Runnel K., Adamson K., Bråthen K. A., Pritsch K., Tchan K. I., Armolaitis K., Hyde K. D., Newsham K. K., Panksep K., Lateef A. A., Tiirmann L., Hansson L., Lamit L. J., Saba M., Tuomi M., Gryzenhout M., Bauters M., Piepenbring M., Wijayawardene N., Yorou N. S., Kurina O., Mortimer P. E., Meidl P., Kohout P., Nilsson R. H., Puusepp R., Drenkhan R., Garibay-Orijel R., Godoy R., Alkahtani S., Rahimlou S., Dudov S. V., Põlme S., Ghosh S., Mundra S., Ahmed T., Netherway T., Henkel T. W., Roslin T., Nteziryayo V., Fedosov V. E., Onipchenko V. G., Yasanthika W. A. E., Lim Y. W., Soudzilovskaia N. A., Antonelli A., Kõljalg U., Abarenkov K. 2022. **Global patterns in endemicity and vulnerability of soil fungi.** ***Global Change Biology***, 28 (22): 6696–6710. IF – 13.211.

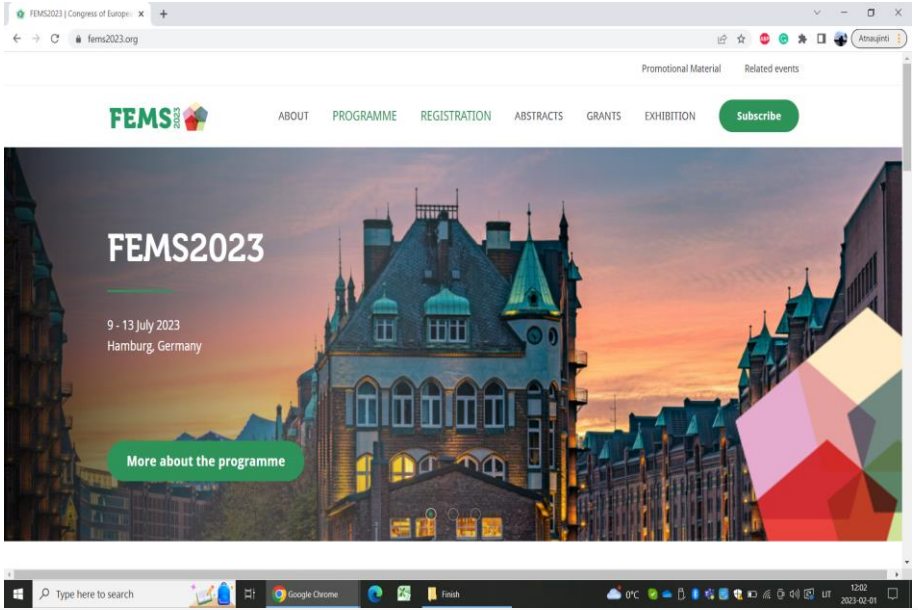
Activities in 2022 and 2023:

In 2023, we plan to participate with 2 poster presentations in **FEMS2023** (Federation of European Microbiological Societies) Congress, which will be 9-13 July in Hamburg (Germany). https://www.fems2023.org/

2 abstracts were prepared and sent:

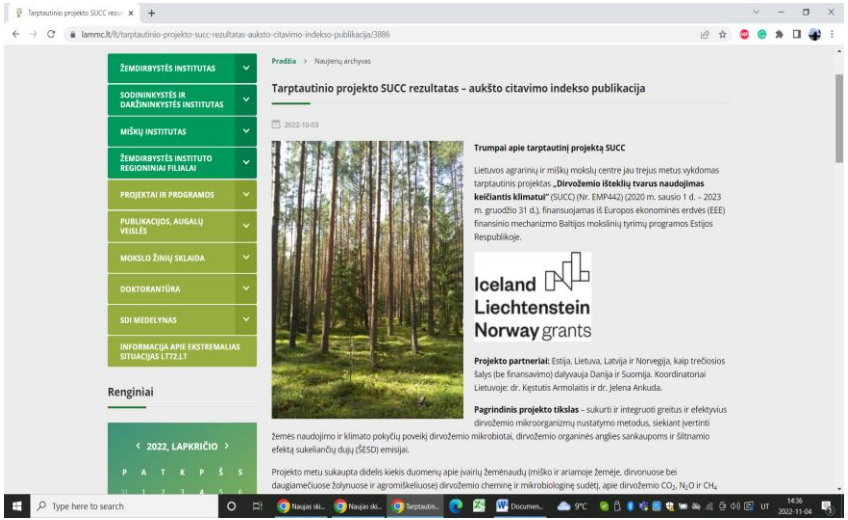
- ***Soil fungi and soil organic carbon stocks in Arenosol profile on Scots pine stand.***

- ***Influence of the afforestation process on soil fungi and soil organic carbon stocks in Arenosols.***



Activities in 2022:

- One article was written and published on the lammc.lt page and on the facebook.com page of Lithuanian Research Centre for Agriculture and Forestry (LAMMC). This article was about the SUCC project and the scientific article published together with the project partners (Tedersoo et al., 2022. Global patterns in endemicity and vulnerability of soil fungi. *Global Change Biology*, 28 (22): 6696–6710. IF – 13.211.) .



Plans for 2023:

- We plan to publish article "Soil microbiological parameters and soil organic carbon stocks in profile of forest Arenosol“ in "Forests" journal (IF – 3.282).

- We plan to finish a scientific article about soil microbiological and chemical parameters in different land use (“Soil bacteria and fungi related organic matter and nitrogen turnover in soils with different soil management practices”**?**) using data of Lithuanian Type II samples (Land abandonment / afforestation chronosequence). We plan to publish this article in a journal indexed in the *Clarivate Analytics Web of Science database* (with impact factor (IF)).

- We plan to prepare bioinformatics of the remaining metagenomic data and to write and publish 2 scientific articles.

- **Also, probably, the colleagues from all countries could write a common article using Type I data. It could be an article about changes of microorganism abundance, species composition, soil organic carbon concentrations, and other parameters in "North-to-South transects" in Scots pine (60 – 100-year-old) and silver birch (50 – 70-year-old) stands, and in perennial grasslands.**

Thank You for Your attention