Project "Sustainable use of soil resources in the changing climate (SUCC)". Overview of activities by Lithuanian team (LAMMC) in 2021.

Dr. Jelena Ankuda and Dr. Kęstutis Armolaitis

Online meeting, 2021.12.07.

Lithuanian team

- ✓ The PostDoc Dr. **Jelena Ankuda** acted as a Principal investigator (PI) on the Lithuanian side.

- ▪ **Her functions in 2021 were:** project coordination and administration, participation in field expeditions for soil sampling, data analysis and searching for literature on the topic of the project.

- ✓ Dr. **Kęstutis Armolaitis** acted as a Co-Principal Investigator (Co-PI) and the Chief researcher.

- ▪ He has studied the impact of different land-use (forest and afforested land, cropland, abandoned arable land and grassland) on soil chemical condition and sustainability, including carbon allocation in plants and carbon sequestration in soil for over 15 years. He continued his work in this field.

- ▪ **His functions in 2021 were:** search of soil sampling plots, participation in field expeditions for soil sampling, scientific consultations to PhD students, and other participants (Lithuanian partner), planning scientific publications and searching for literature on the topic of the project.

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✓ **PhD students:**

In our project in 2021 the Lithuanian partner included 2 PhD students:

▪ **Audrius Jakutis** is focused on restoration of soil fertility in croplands of different management regimes, especially from the perspective of soil microbiota.

His functions in 2021 were: participation in field expeditions for soil sampling, prepare the soil for chemical and metagenomic analysis, searching for literature on the topic of the project, and to go for an internship in Estonia to learn the protocols of molecular work, high-throughput sequencing analysis and the basics of bioinformatics.

▪ **Diana Sivojienė.** She studies successions of soil microbial communities in light textured soil using various organic fertilizers.

Her functions in 2021 were: participation in field expeditions for soil sampling, prepare the soil for chemical and metagenomic analysis, searching for literature on the topic of the project, and to go for an internship in Estonia to learn the protocols of molecular work, high-throughput sequencing analysis and the basics of bioinformatics.

Lithuanian team

✓ **Other participants:**

▪ Project junior researcher **Dr. Karolina Gvildienė.** She specialized on chemical analysis of soil, water and compost.

Her functions in 2021 were: perform chemical analyzes on soil samples and searching for literature on the topic of the project.

▪ Project senior researcher **Dr. Jūratė Aleinikovienė**. She is implementing soil organic carbon and mineral nitrogen analyses, estimating soil microbial biomass carbon and microbial biomass nitrogen content. She is measuring the potential of organic matter decomposition and determining the ecological sustainability of afforestation of former agricultural land.

Her functions in 2021 were: estimating of soil organic carbon and mineral nitrogen content, and soil microbial biomass carbon and microbial biomass nitrogen content in soil samples from Lithuanian sites; to go for an internship in Estonia to learn the protocols of molecular work and high-throughput sequencing analysis and the basics of bioinformatics, and searching for literature on the topic of the project.

Activities in 2021:

- In the second year of the project (2021), together with a colleague from Estonia dr. Martin Maddison, in various land uses CO_2 emission concentrations were measured at 25 plots, and soil samples were collected to determine emissions of other GHG (N_2O, CH_4) at the University of Tartu.

- Selected sites were of Type I, Type II and Type III: forests and croplands, abandoned croplands, perennial grasslands, agroforestry.
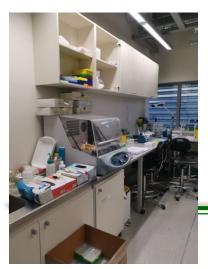
Activities in 2021:

- In the autumn, 42 samples were collected from 6 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) (Type III - Soil depth gradient).

- Locations of plots:

1. Norway spruce forest in Vaišvydava (11M plot of ICP Forests, Level II, Luvisol) – 3 pits;

2. Scots pine forest in Dubrava (former 6M plot of ICP Forests, Level II, Luvisol) – 3 pits.

- Chemical and microbiological analyzes of these soils samples were started.

- All these samples were prepared for the high-throughput sequencing analysis during an internship at Tartu university. High-throughput sequencing analysis was subsequently performed on the samples.

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Activities in 2021:

- In October, SUCC Lithuanian participants dr. Jūratė Aleinikovienė, Ph.D. students Diana Sivojienė and Audrius Jakutis did an internship at the Institute of Ecology and Earth Sciences of the University of Tartu.

- Trainees were introduced to the protocols of molecular work, high-throughput sequencing analysis, and the basics of bioinformatics.

- They learned methodology and performed deoxyribonucleic acid (DNA) extraction, polymerase chain reaction (PCR), and electrophoresis.

- In total of 117 Lithuanian soil samples were prepared for the high-throughput sequencing analysis.

- High-throughput sequencing analysis was subsequently performed on these samples.

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Activities in 2021:

In total 42 samples that belong to Type III, and 75 samples from 3 experiments were analyzed during the internship.

<u>Generalized schemes of experiments:</u>

◉ **I experiment:**
1. Cropland fertilized
2. Meadow
3. Mixed forest

◉ **II experiment:**
1. Clear cutting
2. Forest control (unfertilized)
3. Forest fertilized
4. Managed meadow

◉ **III experiment:**
1. Cropland unfertilized
2. Cropland fertilized
3. Cropland fertiliezed + biological product

▪ The sites were selected to evaluate the soil management (forest - fertilization and clear-cutting, meadow - meadow cutting and biomass removal; cropland - organic matter (biological implementation), mineral fertilization and biological product) sustainability on carbon balance / sequestration.

▪ It is expected to predict the soil management impact on soil carbon mineralization, stabilization, or accumulation according to the bacteria and fungi metagenomic analyses, bridging of soil bacteria and fungi functional potentials to carbohydrate or nitrogen metabolism.

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Activities in 2021:

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

◉ 1. Anslan S, Mikryukov V, Armolaitis K, Ankuda J, Lazdina D, Makovskis K, Vesterdal L, Schmidt IK, Tedersoo L. 2021. Highly comparable metabarcoding results from MGI-Tech and Illumina sequencing platforms. PeerJ 9:e12254. https://doi.org/10.7717/peerj.12254

◉ 2. Tedersoo, L., Mikryukov, V., Anslan, S. *et al.* The Global Soil Mycobiome consortium dataset for boosting fungal diversity research. *Fungal Diversity* (2021). https://doi.org/10.1007/s13225-021-00493-7

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Plans:

From Lithuanian partner at least two scientific articles could be foreseen:

- ❑ "Soil bacteria and fungi related organic matter and nitrogen turnover in soils with different soil management practices".

- ❑ The second article could be connected with Type III - Soil depth gradient.

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Thank You for Your attention