

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



LITHUANIAN
RESEARCH CENTRE
FOR AGRICULTURE
AND FORESTRY

Dr. Jelena Ankuda and Dr. Kęstutis Armolaitis

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

Online meeting, 2021.05.13.

Lithuanian team

- ✓ The PostDoc Dr. **Jelena Ankuda** acted as a Principal investigator (PI) on the Lithuanian side.
 - Her functions were: project coordination and administration, participation in a field expedition for soil sampling, determination of species diversity of plants, data analysis.
- ✓ 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. Kęstutis Armolaitis contributed to the coordination of the forestry side.
 - His functions were: search of soil sampling plots, participation in a field expedition for soil sampling, scientific consultations to PhD students and other junior researchers (Lithuanian partners).



Lithuanian team

✓ PhD students:

In our project in 2020 the Lithuanian partner included 3 PhD students who were already occupied with complementary research in 2019:

- **Audrius Jakutis** is focused on restoration of soil fertility in croplands of different management regimes, especially from the perspective of soil microbiota.
- **Vaiva Kazanavičiūtė (former surname Jurevičienė)** is specialized on the impact of land-use change and biomass use for climate change mitigation.
- **Donata Drapanauskaitė** is focused on the effect of chemical composition and structure of liming materials for neutralizing soil acidity. She tests the influence of soil pH and its regulators on the distribution of organic C in soil and C in plants. (She was PhD student till 2020.08.31. From 2020.12.17. she is Dr.).

Lithuanian team

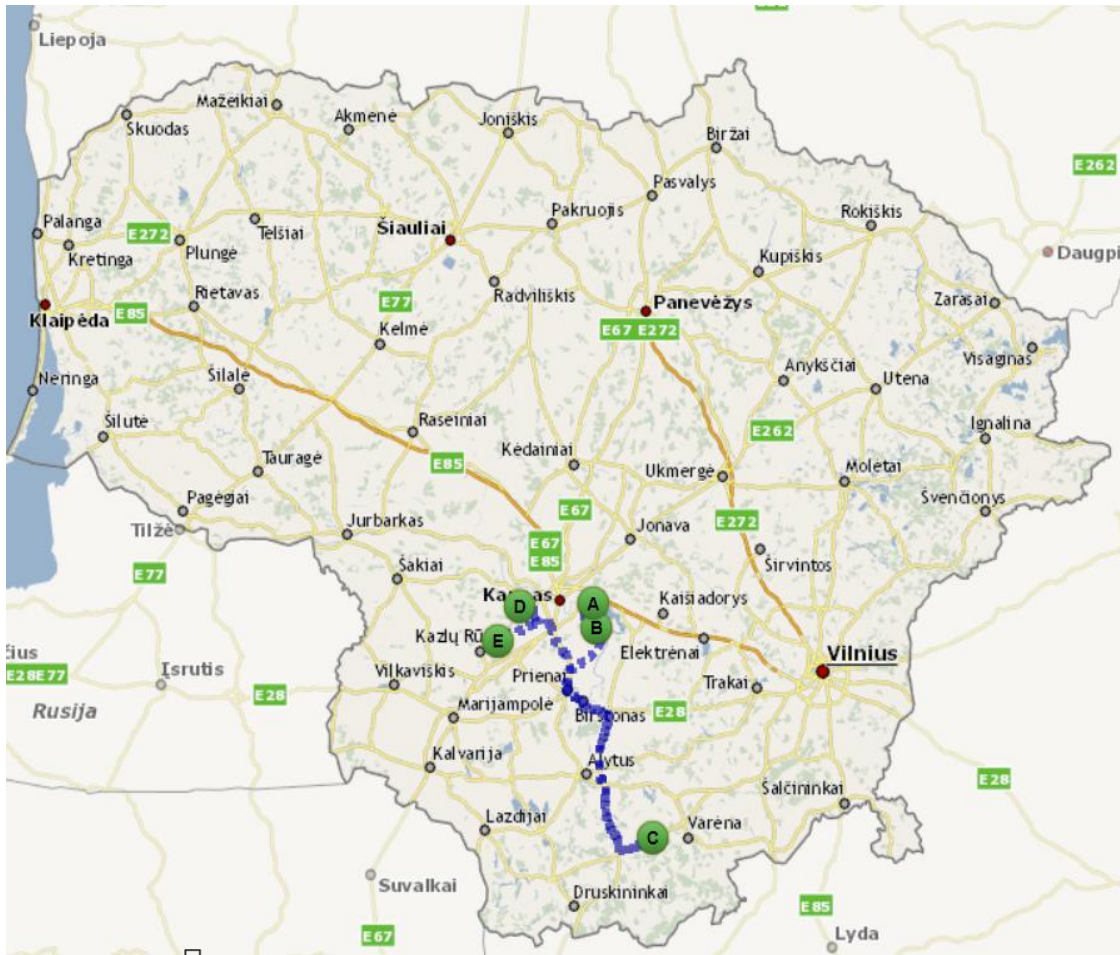
- ✓ **We planned to accept 2 PhD students in 2020.** We did it. We accepted 2 new doctoral students into the project:
 - **Diana Sivojienė.** She studies successions of soil microbial communities in light soil using various organic fertilizers.
 - **Valeriia Mishcherikova.** She is focused on the functional diversity of microbial communities in Scots pine (*Pinus sylvestris* L.) and Norway spruce (*Picea abies* (L.) H. Karst) forests in the process of climate change.

- ✓ **We employed one project junior researcher Dr. Jūratė Aleinikovienė.**

She has defended the PhD in 2009. Jūratė Aleinikovienė 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.

We sampled soil samples of:

- Type I - North-to-South transects.
- Type II - Land abandonment / afforestation chronosequence.
- Type III - Soil depth gradient.



Locations of sampling plots:

A – Žiegždriai (Type I and Type II)

B – Dubrava (Type I)

C – Perloja (Type I and Type II)

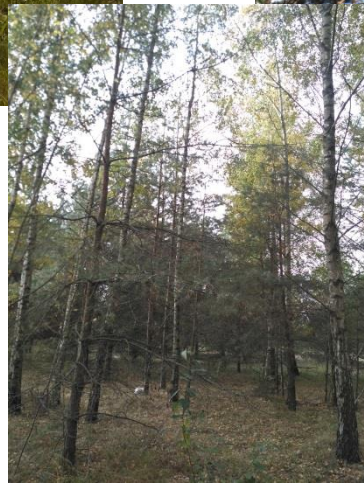
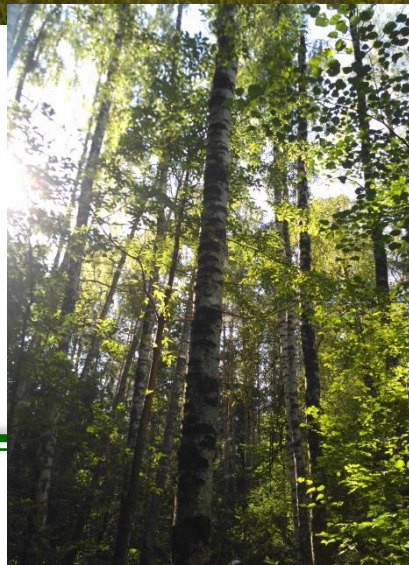
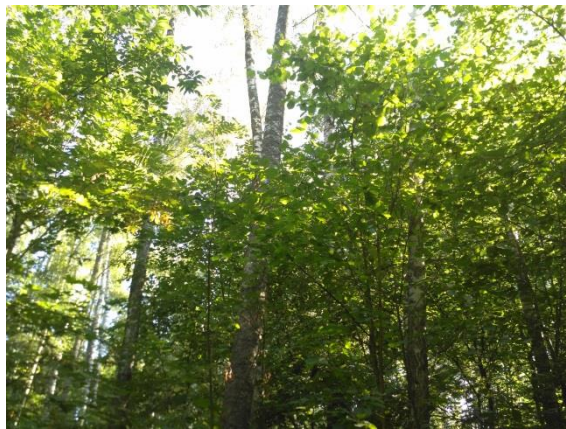
D – Near Kačerginė (Type I)

E – Jūrė small town near Kazlų Rūda
(Type I and Type III)

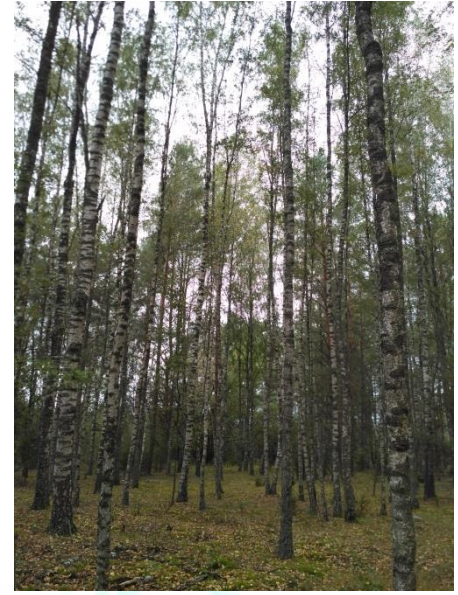
Dubrava (Type I)



Žiegždriai (Type I and Type II)



Perloja (Type I and Type II)



Near Kačerginė (Type I)



Jūrē small town near Kazlų Rūda (Type I and Type III)



Type I - North-to-South transects.

- ✓ In August and September, in total 20 soil samples from 15 plots in Lithuania were collected for the latitudinal gradient study of silver birch (*Betula pendula*) and Scots pine (*Pinus sylvestris*) forests and grasslands. Mainly these were Arenosols and Luvisols.

- ✓ Ecosystems:

- 1) Scots pine forest (5 plots) – 60 – 100-year-old
- 2) Silver birch forest (5 plots) – 48 – 68-year-old
- 3) Permanent grassland (5 plots)

- ✓ Depth of soil sampling: 0-5 cm

- ✓ Locations of plots:

- Dubrava (2020.08.11.)
- Žiegždriai (2020.08.13.)
- Perloja (2020.08.19.)
- Near Kačerginė (2020.08.27.)
- Jūrė small town near Kazlų Rūda (2020.09.05.)



Type II - Land abandonment/afforestation chronosequence

- ✓ In September and October, in total 15 samples from 14 plots in Lithuania were collected to assess abandonment / afforestation chronosequence. Mainly these were Arenosols and Luvisols.

- ✓ Ecosystems:

- 1) Croplands (2 plots)
- 2) Grasslands (2 plots)
- 3) Abandoned croplands=fallows (2 plots)
- 4) Coppicing grasslands (tree coverage 10-50%, height 2-6 m) (1 plot) 6-year-old
- 5) Coppice (tree coverage >80%, height >6 meters (1 plot) 20-year-old
- 6) Planted forest of deciduous trees (3 plots): silver birch (59-year-old), pedunculate oak (*Quercus robur*) (61-year-old), small-leaved linden (*Tilia cordata*) (61-year-old).
- 7) Planted conifers (2 plots): Scots pine (59-year-old) and Norway spruce (60-year-old).
- 8) „Mature forest“ (deciduous trees, preferably as natural as possible) (1 plot): silver birch - natural – mature (66-year-old).

- ✓ Depth of soil sampling: 0-10 cm

- ✓ Locations of plots:

- Perloja (2020.09.17.)
- Žiegždriai (2020.10.01.)

Type III – Soil depth gradient

- ✓ In October, in total 21 soil samples (3 pits, 7 depths) from 1 plot in Lithuania were collected for the soil depth gradient study in Scots pine forests (Arenosol).
- ✓ Ecosystem:
 - Scots pine forest – 60-year-old
- ✓ Sampling depth intervals:
 - 1) 0-5 cm,
 - 2) 10-15 cm,
 - 3) 20-25 cm,
 - 4) 50-55 cm,
 - 5) 100-105 cm,
 - 6) 150-155 cm,
 - 7) 195-200 cm.
- ✓ Location of plot:
 - Jūrē small town near Kazlų Rūda (2020.10.16. and 2020.10.22.) (3M plot of ICP Forests, Level II; Arenosols).
- ✓ In this plot we had extra measurement: sampling soil for bulk density analysis.

Activities by Lithuanian team (LAMMC)

- ✓ Determination of the taxonomic composition of plants, and plants percentage coverage at the soil sampling places.
- ✓ Ectomycorrhizal and ericoid mycorrhizal plants were also documented.



Activities by the Lithuanian team (LAMMC)

- ✓ Preparing soil samples (Type I, II and III) for chemical and microbiological analysis and sending part of these samples to Leho Tedersoo.
- ✓ Chemical analysis of soil samples (total SOC, total N, pH, etc.). It was started, but data was not entered and analyzed.
- ✓ In addition, soil organic carbon and mineral nitrogen content was estimated in soil samples from Lithuanian sites (site Type I and site Type II). In total 22 samples analyzed and in total 66 chemical analyses proceeded.
- ✓ In addition, soil microbial biomass carbon and microbial biomass nitrogen content were estimated in soil samples from Lithuanian sites (site Type I and site Type II). In total 22 samples analyzed and in total 132 microbial analyses proceeded.

Activities by Lithuanian team (LAMMC)

✓ Results were presented:

At the 3rd International Scientific Virtual Conference „AGROECOSYSTEM SUSTAINABILITY: Links between Carbon Sequestration in Soils, Food Security and Climate Change (AgroEco2020)“ during oral presentation „Land use change response on an allocation of organic carbon in the uppermost mineral soil layers“. Authors: Jūratė Aleinikovienė, Kęstutis Armolaitis, Jelena Ankuda, Audrius Jakutis, Diana Sivojienė, Valeriia Mishcherikova (2–3 December, 2020. <http://agroeco.vdu.lt/>).



CERTIFICATE

Hereby we confirm that

Jūratė Aleinikovienė, Kęstutis Armolaitis, Jelena
Ankuda, Audrius Jakutis, Diana Sivojienė,
Valeriia Mishcherikova

has participated at the International Scientific Virtual Conference
AgroEco2020
and has given an oral presentation

Land use change response on an allocation of organic carbon
in the uppermost mineral soil layers

Prof. Aušra Blinstrubienė
Chairperson of the International Scientific Conference Committee
Vytautas Magnus University Agriculture Academy

2-3 December, 2020 in Akademija,
Kaunas distr., Lithuania

MCMXXII
VYTAUTO DIDŽIOJO
UNIVERSITETAS

Activities by the Lithuanian team (LAMMC)

✓ Results were presented:

In the abstract, which was published in the abstracts book of 3rd International Scientific Virtual Conference „AGROECOSYSTEM SUSTAINABILITY: Links between Carbon Sequestration in Soils, Food Security and Climate Change (AgroEco2020)“. „Land use change response on an allocation of organic carbon in the uppermost mineral soil layers“. Authors: Jūratė Aleinikovienė, Kęstutis Armolaitis, Jelena Ankuda, Audrius Jakutis, Diana Sivojienė, Valeriia Mishcherikova (17 p.).

VYTAUTAS MAGNUS UNIVERSITY
AGRICULTURE ACADEMY



Agroecosystem Sustainability:
Links between Carbon Sequestration in Soils,
Food Security and Climate Change

INTERNATIONAL SCIENTIFIC VIRTUAL CONFERENCE

AgroEco2020
PROGRAMME AND ABSTRACTS



17

LAND USE CHANGE RESPONSE ON AN ALLOCATION OF ORGANIC CARBON IN MINERAL TOPSOIL

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Land-use change drives both the turnover of soil organic matter (SOM) and the changes in soil organic carbon (SOC) storage. Meanwhile, the objective of this study was to determine SOM allocation into the SOC and into the soil microbial biomass (SMB) along the land use change. Composite soil samples were collected from the mineral topsoil (in 0-10 cm of the depth) of cropland, abandoned agricultural land, managed and unmanaged grassland and adjacent middle-aged and premature forest stands of different tree species, mainly Scots pine (*Pinus sylvestris* L.) and silver birch (*Betula pendula* Roth). It was estimated, that mean allocation of decomposed SOM into the SOC was higher in the silver birch stands (22.0–4.2 mg C g⁻¹ of dry soil) and were significantly decreasing in Scots pine stands (10.1–14.4 mg C g⁻¹ DS) and cropland (9.8–13.7 mg C g⁻¹ DS). However, the SOC in abandoned agricultural land and in grassland was varying in relatively high extent, respectively, from 15.6 to 20.5 mg C g⁻¹ DS and from 15.0 to 23.5 mg C g⁻¹ DS and was higher than in cropland. There were estimated the significant link between the SOM allocation into the SMB and the vegetation composition in the land use change experimental sites. Thus, SMB carbon was significantly increasing mainly in the mineral topsoil of managed and unmanaged grassland (449–496 µg C g⁻¹ DS) and were by 1.6–2.3 folds higher than in cropland (217–280 µg C g⁻¹ DS) and 1.4–1.7 times higher than in the Scots pine stands (289–314 µg C g⁻¹ DS) This research work was carried out to obtain the results funded by the EEA Financial Mechanism Baltic Research Programme in Estonia.

Key words: soil, land-use change, organic matter, organic carbon, soil microbial biomass.



Activities by the Lithuanian team (LAMMC)

- ✓ Information about the project was prepared in Lithuanian and English and inserted in the website of Lithuanian Research Centre for Agriculture and Forestry lammc.lt:
https://www.lammc.lt/data/public/uploads/2020/09/succ_lt.pdf and
https://www.lammc.lt/data/public/uploads/2020/09/succ_en-1.pdf.

- ✓ Information about the project was inserted in the facebook.com page of Lithuanian Research Centre for Agriculture and Forestry:

https://www.facebook.com/permalink.php?story_fbid=4367816963233855&id=149047625110831
(2021.02.08.)

- ✓ Information about the project was presented during the online event "Living and Healthy Soil" („Gyvas ir sveikas dirvožemis“) (in Lithuanian). Oral presentation "The potential of Lithuanian soils to achieve climate neutrality" ("Lietuvos dirvožemių potencialas siekiant klimato neutralumo") (in Lithuanian). Authors: Kęstutis Armolaitis, Jūratė Aleinikovienė, Vaiva Kazanavičiūtė (December 4, 2020).

<https://www.lammc.lt/data/public/uploads/2020/11/seminaras-2020-12-04.pdf>).

Thank You for Your attention

