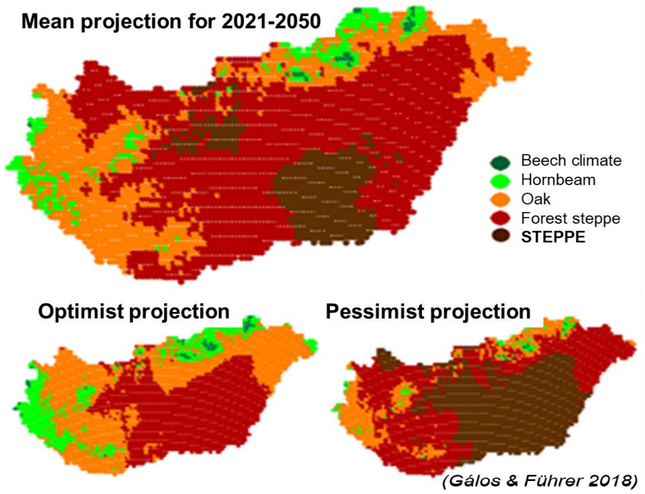
How can climate change modify the carbon stock of forest soils?

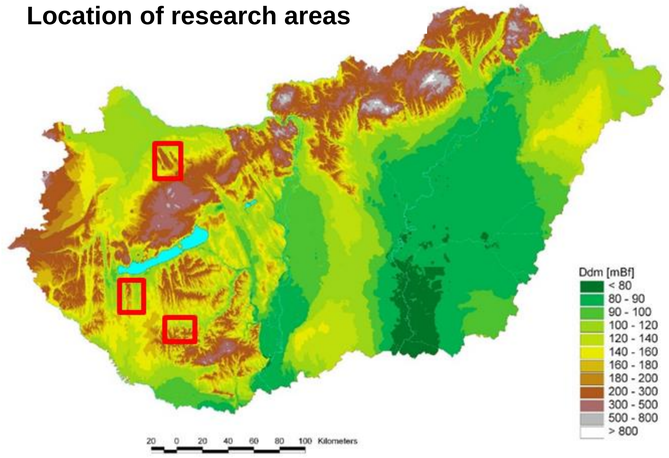
Adrienn HORVÁTH[1], Borbála GÁLOS[2], András BIDLÓ[1]
[1]*University of Sopron, Institute of Environmental and Earth Sciences, Department of Soil Site Survey, Sopron, Hungary*
[2]*University of Sopron, Institute of Environmental and Earth Sciences, Department of Ecology and Bioclimatology, Sopron, Hungary*
horvath.adrienn@uni-sopron.hu

Background: In Hungary, many forest types are at their 'lower distribution limit'. We expect to have huge magnitude effects of climate change in the Carpathian Basin. Due to changing site condtions, stands of Beech/Hornbeam climate are expected to replace with drought tolerant species. This afforestation may lead to change in carbon storage of forest soils. Our aim is to create a database and estimate the changes in the carbon stock of forest soils during the afforestations.

Shift of the forest-climate zones



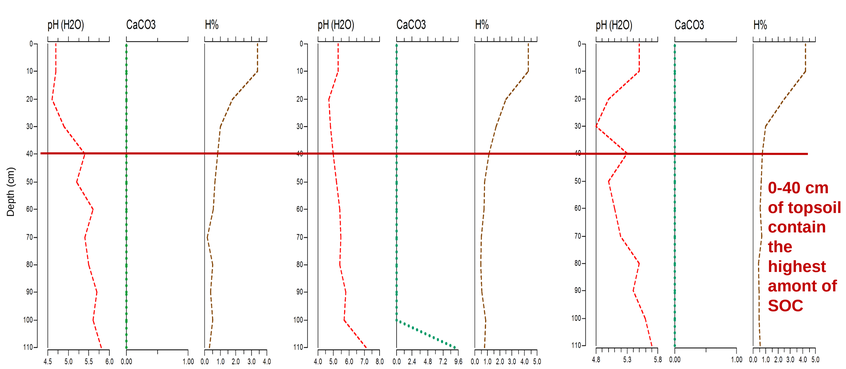
Location of research areas



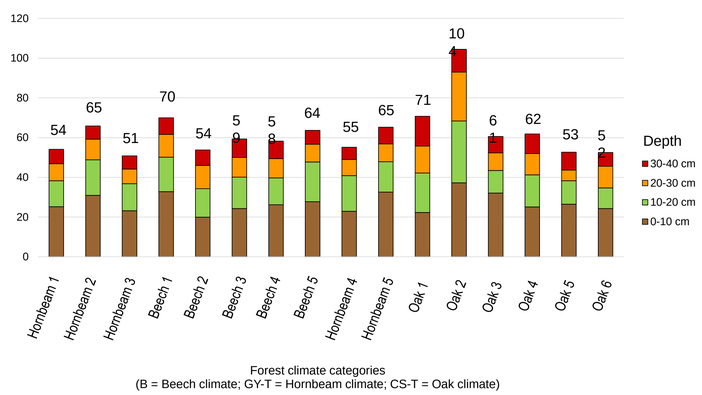
Identical bedrock (loess), loam, 150-250 m a.s.l., annual precipitation sum: 650-710 mm; annual temperature sum: 10-10.4 ° C. The average distance of the sampling points in a research area is ~ 1-2 km.

Sampling method

Hornbeam 1 — Beech 2 — Oak 3



SOC content of soil at 0-40 cm depth (C t/ha)



Forest climate categories
(B = Beech climate; GY-T = Hornbeam climate; CS-T = Oak climate)

The amount of SOC by forest climate categories

Depth (cm)	C t/ha			
	Beech climate	Hornbeam climate	Oak climate	Average
0-10 cm	26.21	27.82	27.07	27.09
10-20 cm	16.19	14.86	17.89	16.22
20-30 cm	10.35	8.69	13.03	10.57
30-40 cm	8.25	7.21	10.45	8.55
SOC on average by climate categories	60.99	58.61	68.44	

Discussion

During the evaluation, the amount of SOC was the highest in the topsoil layers. In summary, we found a larger amount (104 C t/ha) of SOC in the soil of stands, where sessile oak were the main stand-forming tree species. The amount of carbon was lower where turkey oak was dominant in sessile oak stands (70 C t/ha on average). To conclude, the SOC order in case of the stand-forming tree species: sessile oak (/hornbeam) > beech > Turkey oak. We detected that different forest utilization and tree species have an effect on the forest carbon as the litter as well (amount, composition). Our measurements are not representative of the whole stand, but the homogenous loess bedrock demonstrates the impact of different mixture forests on carbon stock. After all, vegetation depends on site conditions (e.g. moisture) and not vice versa. The effects of future climatic changes on soil carbon storage are difficult to predict. In the future, it would be important to expand the use of continuous forest cover farming modes.

References: Gálos B., Führer E. (2018): Climate projections for forestry in Hungary. DOI: 10.17164/EK.2018.003 **Acknowledgements:**. Speacial thanks to our colleagues who helped our work in any way.