SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

Study of soil characteristics in Sedelska river watershed

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Introduction

- Erosion has been identified as the world's greatest threat to soils.
- Due to the erosion processes the risk of landslides, greenhouse gas emissions and the loss of soil increases and organic carbon, food security and water quality decreases.
- Every year, the world's arable land decreases by more than 10 million hectares. Food losses due to erosion are significant.
- In Bulgaria, losses caused by soil erosion are high.
- Potential annual soil losses are greater than 40 t/ha on about 30% of the territory of the country. 7 to 10% of the total area of forest territories is affected by erosion to varying degrees.

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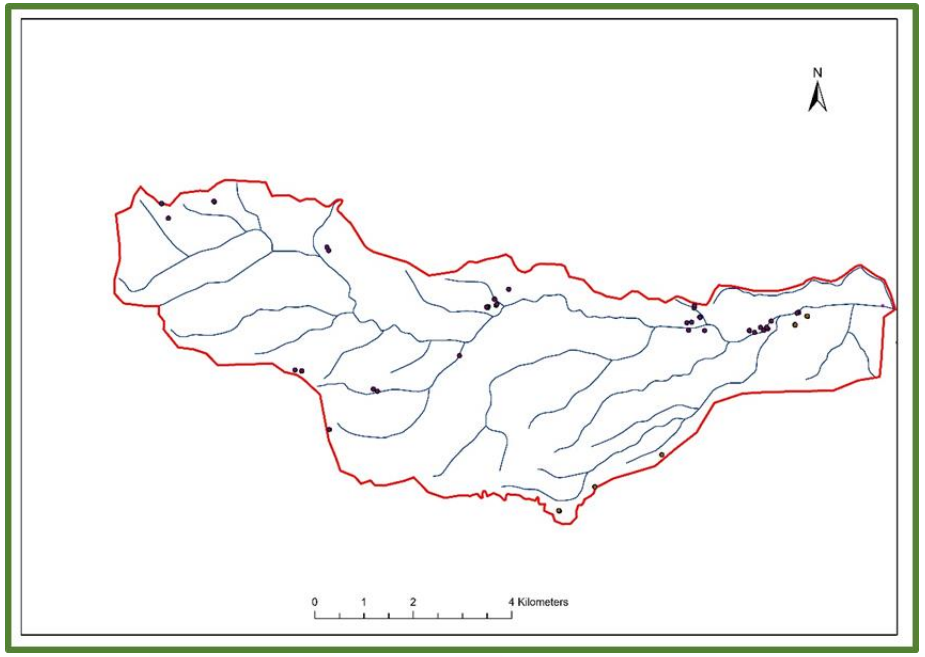
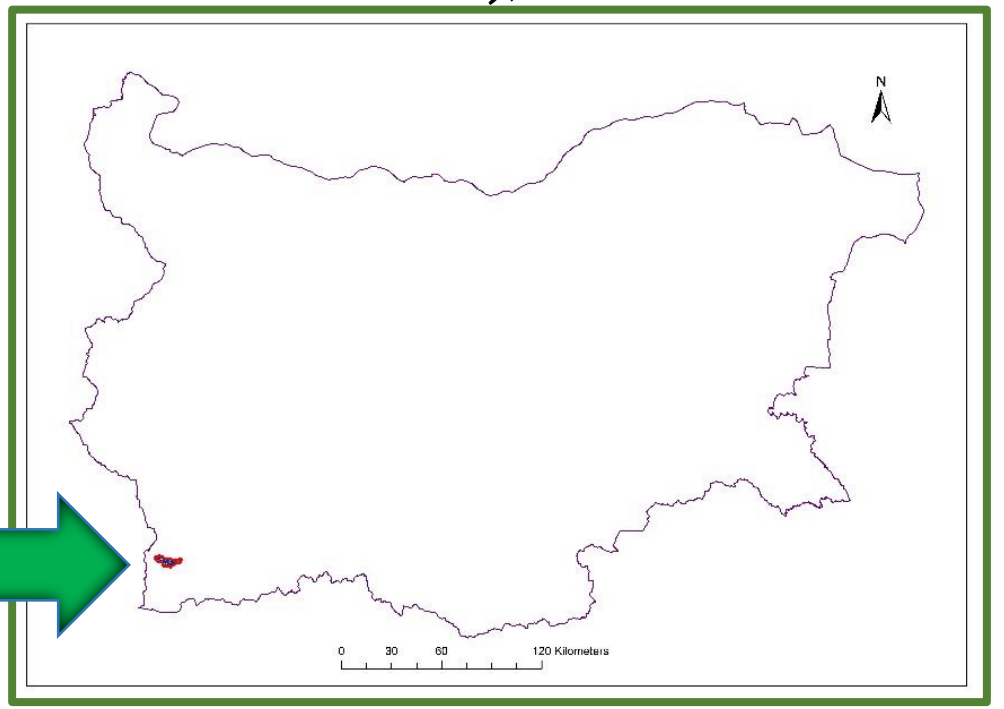
Subject of the study

- Soils developed on the right tributary (Sedelska river) of the Struma River with a torrential character (the Struma river flows into the Mediterranean sea);
- The catchment area is 50.2km^2;
- Length of the main stream is 18 km;
- Large-scale erosion control activities have been made;





Location of Sedelska river

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Objectives

- The main aim of the study was to analyze basic soil characteristics of soils forming under a different type of forest tree species (which were used for afforestation in the watershed of the Sedelska river) in order to determine which type of forest vegetation have better impact on the soil.

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METHODS AND MATERIALS

- Soil samples were taken from the surface layers (0-5 and 5-20 cm);
- The soil parameters that were investigated are soil pH $_{H2O}$, soil texture, org. C and total N.

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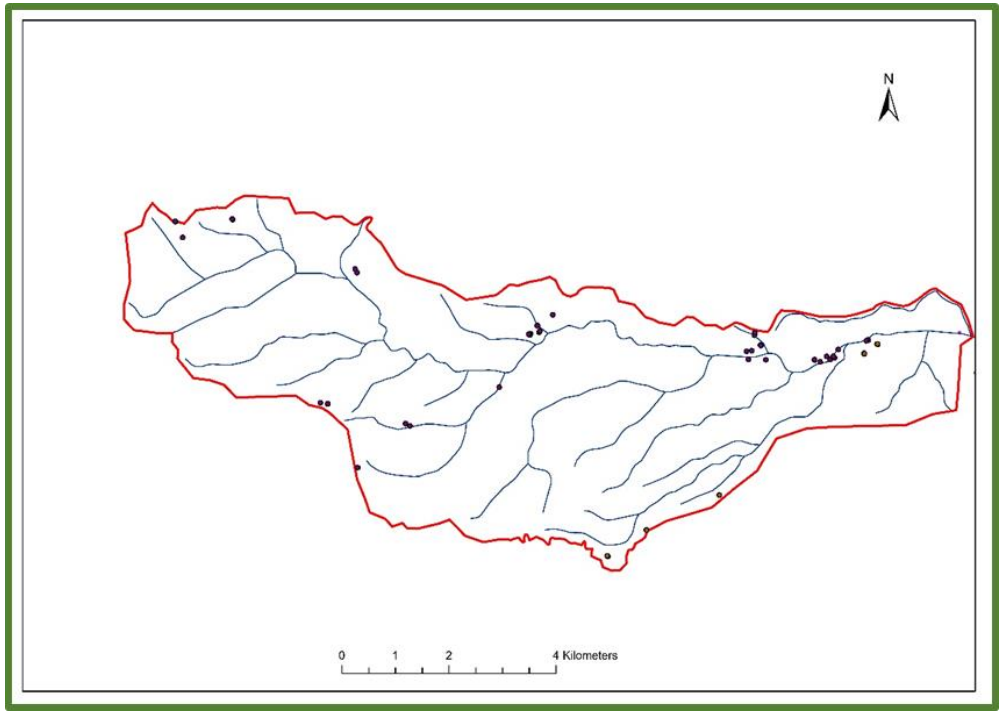
RESULTS AND DISCUSSION

A total of 32 soil profiles formed under the influence of Platanus orientalis, Quercus petraea, Quercus frainetto, Pinus sylvestris and Pinus nigra were studied. 69% of the studied soils were formed under Austrian (black) pine and Scots pine forest plantations – 12 soil profies in Austrian pine plantations and 10 in Scots pine plantations, which is why we focus on them.



Location of soil profiles in the study area

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RESULTS AND DISCUSSION

pH H2O in the studied soils

In soils forming under the influence of Austrian pine plantations:

litter layer – 4.7 to 5.4 very strongly to moderately acidic

For I layer – 5.4 to 6.2 medium to slightly acidic

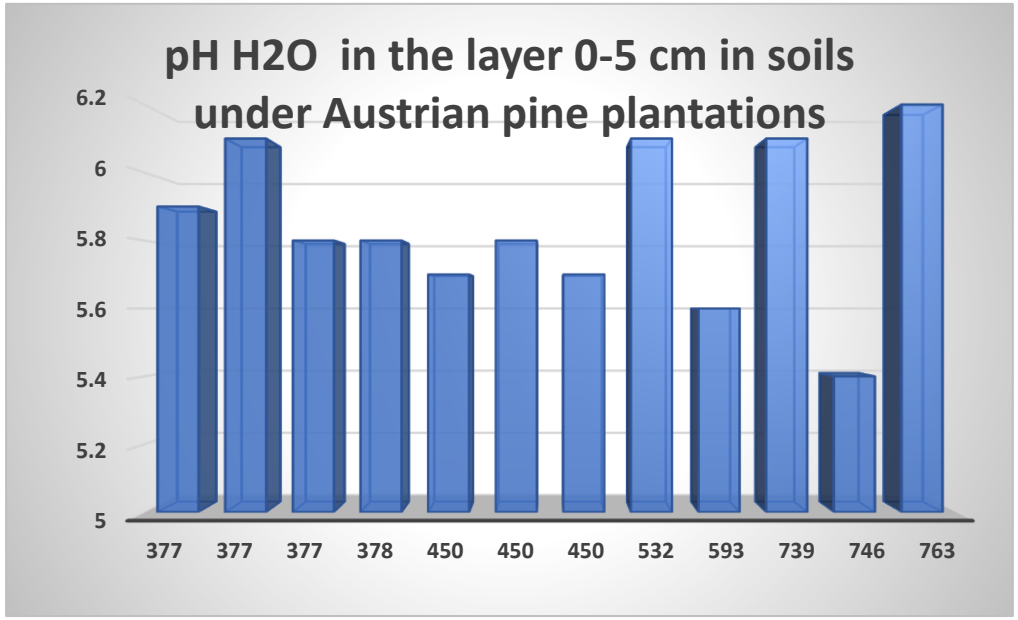
For II layer – 5.1 to 6.5 strongly to weakly acidic

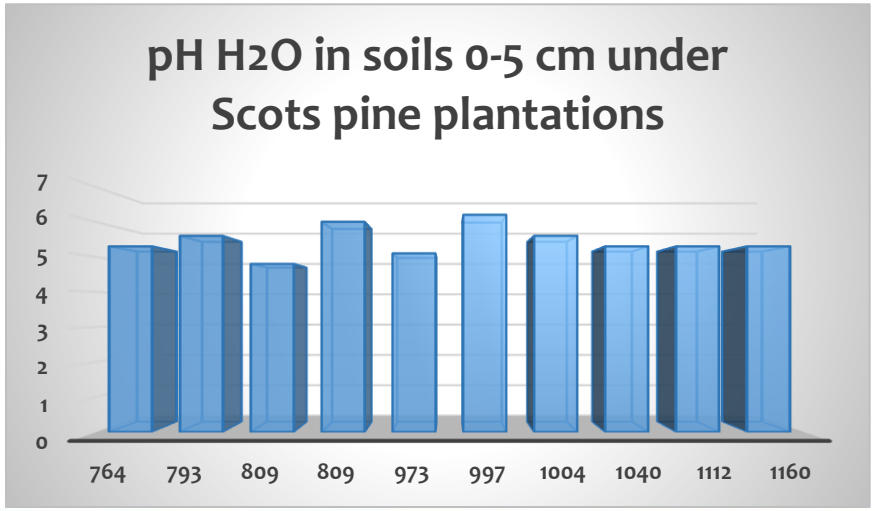
In soils forming under the influence of Scots pine plantations:

litter layer– 4.8 to 5.5 strongly to moderately acidic

For I layer – 4.8 to 6.0 strongly to moderately acidic

For II layer – 5.2 to 5.9 strongly to moderately acidic





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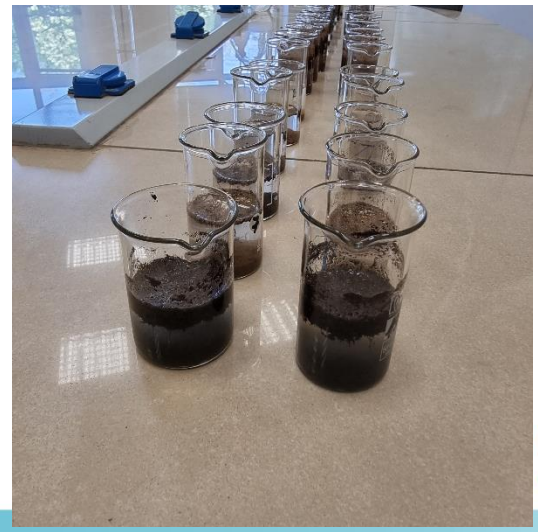
RESULTS AND DISCUSSION

Soil reaction has the most strong impact on soil forming process in the first 5 cm of the soil. For soils under Scots pine it is assessed as strongly acidic and most influential, and for soils under Austrian pine – medium acidic. So we can assume that Scots pine has more acidic influence compared to Austrian pine.

Soil acidity plays a crucial role for degradation processes of soils. The data obtained on the soil reaction show that both tree species have an acidifying effect on the soil, which is characteristic of coniferous species. Our study showed that the better tree specimen on the lower altitudes is Austrian pine.



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RESULTS AND DISCUSSION

Org. C in the studied soils

In soils forming under the influence of Austrian pine plantations:

Litter layer– 307 to 403 g/kg - **medium to high** stocked with org. C

For I layer - 4 to 11 g/kg - **very low to low**

For II layer - 2 to 4 g/kg **- very low**

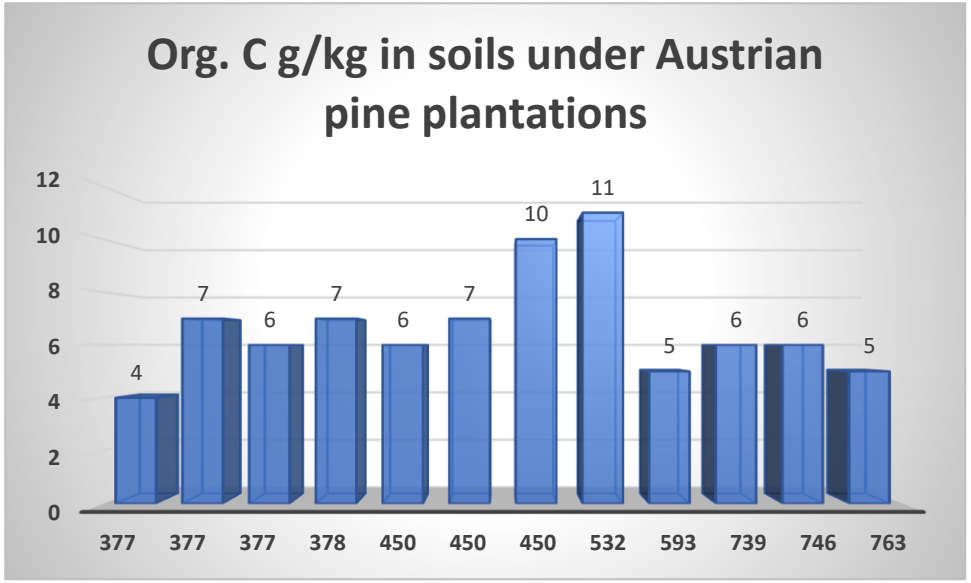
In soils forming under the influence of Scots pine plantations:

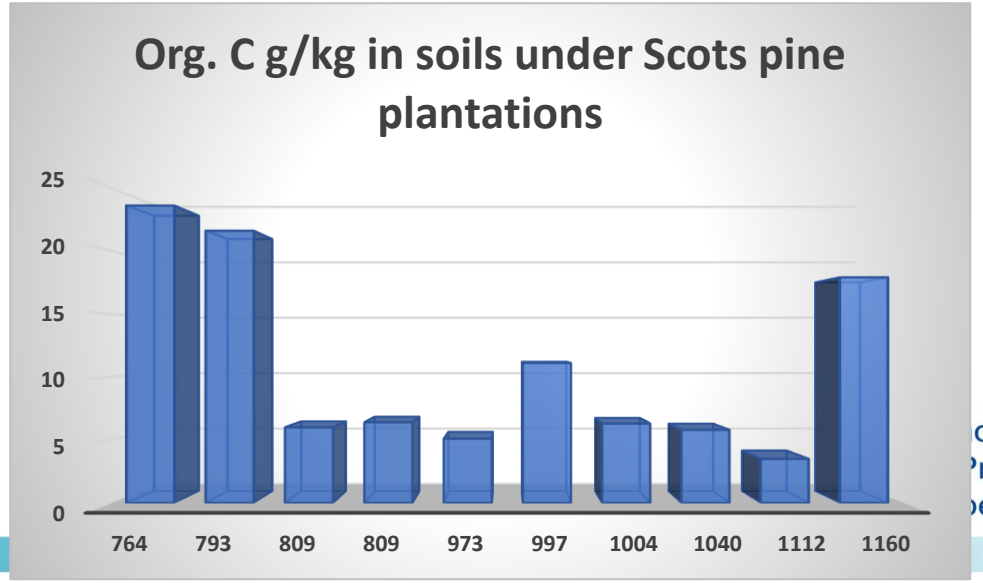
Litter layer – 277 to 412 g/kg - low to high stocked with org. C

For I layer - 4 to 24 g/kg - **very low to medium**

For II layer - from 1 to 20 g/kg - **very low to low**

It was established that soils on the lower altitudes (up to 800 m a.s.l.) which were developing under the influence of both Austrian and Scots pine plantations have been better stocked with org. C compared to those on the higher altitudes.





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RESULTS AND DISCUSSION

Total N in the studied soils

In soils forming under the influence of Austrian pine plantations:

I layer - 0.3 to 0.9 g/kg - **very low to low**

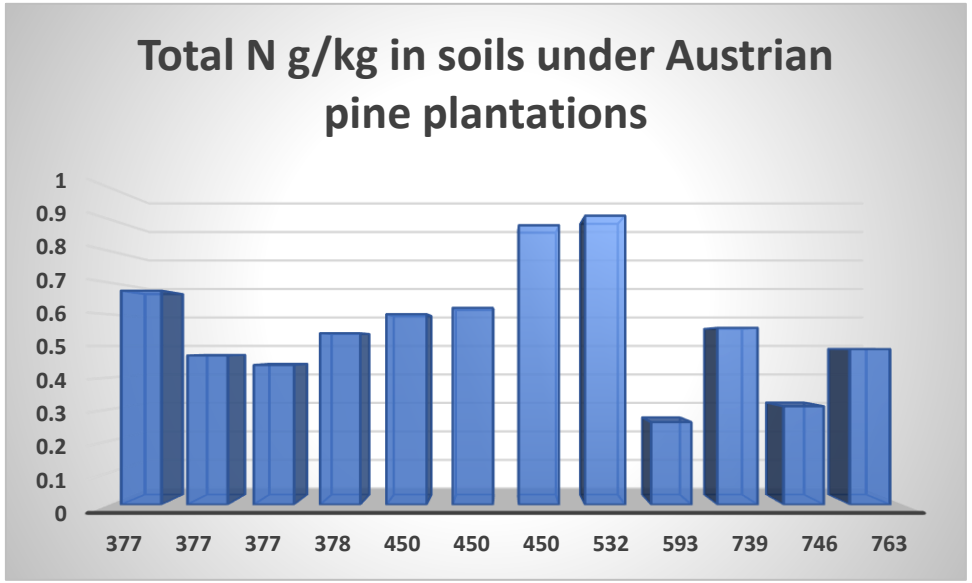
For II layer - 0.1 to 0.4 g/kg - **very low**

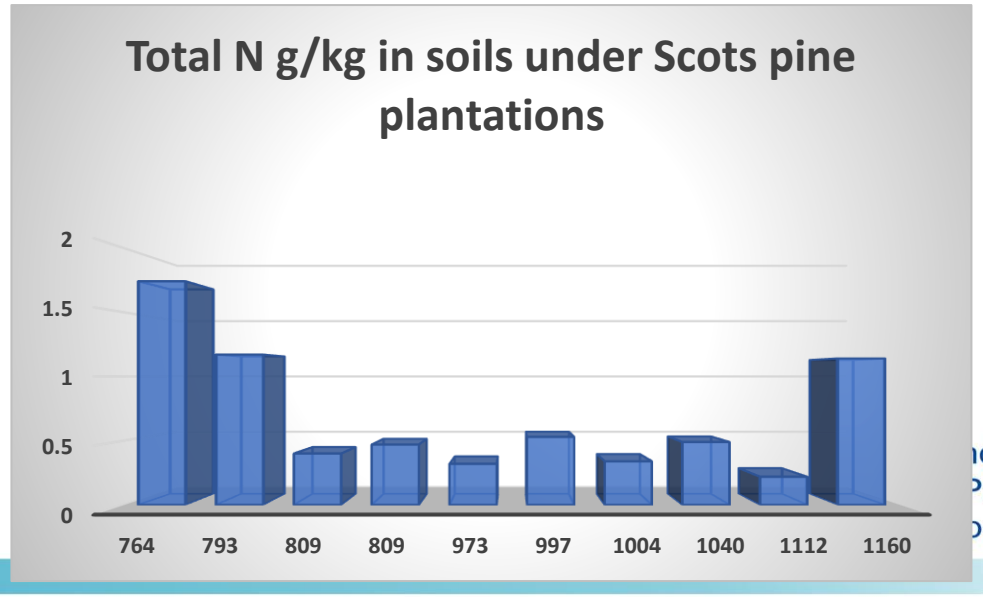
In soils forming under the influence of Scots pine plantations:

For I layer - 0.2 to 1.7 g/kg - **very low to medium**

For II layer - from 0.04 to 0.9 mg/kg - **very low to low**

The content of total nitrogen is assessed as very low in the soils developed under the both tree species. It also depend on the altitude. On the lower altitudes it was established that the content of total N is higher compared to the one on the higher altitudes.





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RESULTS AND DISCUSSION

Soil texture

Regarding the soil texture in the soil profiles for both types of forest plantations, the sand fraction predominates, followed by the silt fraction. The content of clay is low and is in the range of 4.01 to 16.45%. More clay was established in soils on lower altitudes. The soil texture in the first layer in the soils under Austrian pine plantations is assessed as sandy to loam, and in the soils under Scots pine - from sandy to sandy loam.

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RESULTS AND DISCUSSION

Soil depth

Soil profiles are assessed as very shallow to shallow. Soil depth in soils formed under the Scots pine plantations varied from 27 up to 40 cm and for soils under Austrian pine plantations from 29 up to 50 cm.

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Conclusion

- The selection of tree species in erosion control afforestation is a fundamental issue. In Bulgarian forestry, the practice is to afforest eroded areas mainly with *Pinus sylvestris* L. and *Pinus nigra* Arn., which successfully withstand the deteriorating soil and environmental conditions.
- The obtained results for the soil characteristics (acidic soil reaction, sandy soil texture, low content of org. C and total N) showed that the soil is easily susceptible to degradation processes.
- Some of the soil indicators (org. C and soil texture) have been improved over time, but the steep terrain and the high amount of precipitation in the area still pose a great risk for these soils.
- From the obtained data, we can assume that the afforestation with *Pinus nigra* has contributed positively to the better restoration of the soils on the lower altitudes and *Pinus sylvestris* on the higher altitudes.

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Thank you for your attention!

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