Chemical composition of *Fagus Sylvatica* annual rings affected by local industrial pollution in northern Romania (Baia Mare region)

Cosmin Ilie CUCIUREAN[1,2], Cristian Gheorghe SIDOR[1*]

1. National Institute for Research and Development in Forestry "Marin Drăcea", Voluntari, Romania
2. Doctoral School of Engineering Sciences, "Ștefan cel Mare" University from Suceava, Romania

This presentation participates in OSPP

Outstanding Student & PhD candidate Presentation contest

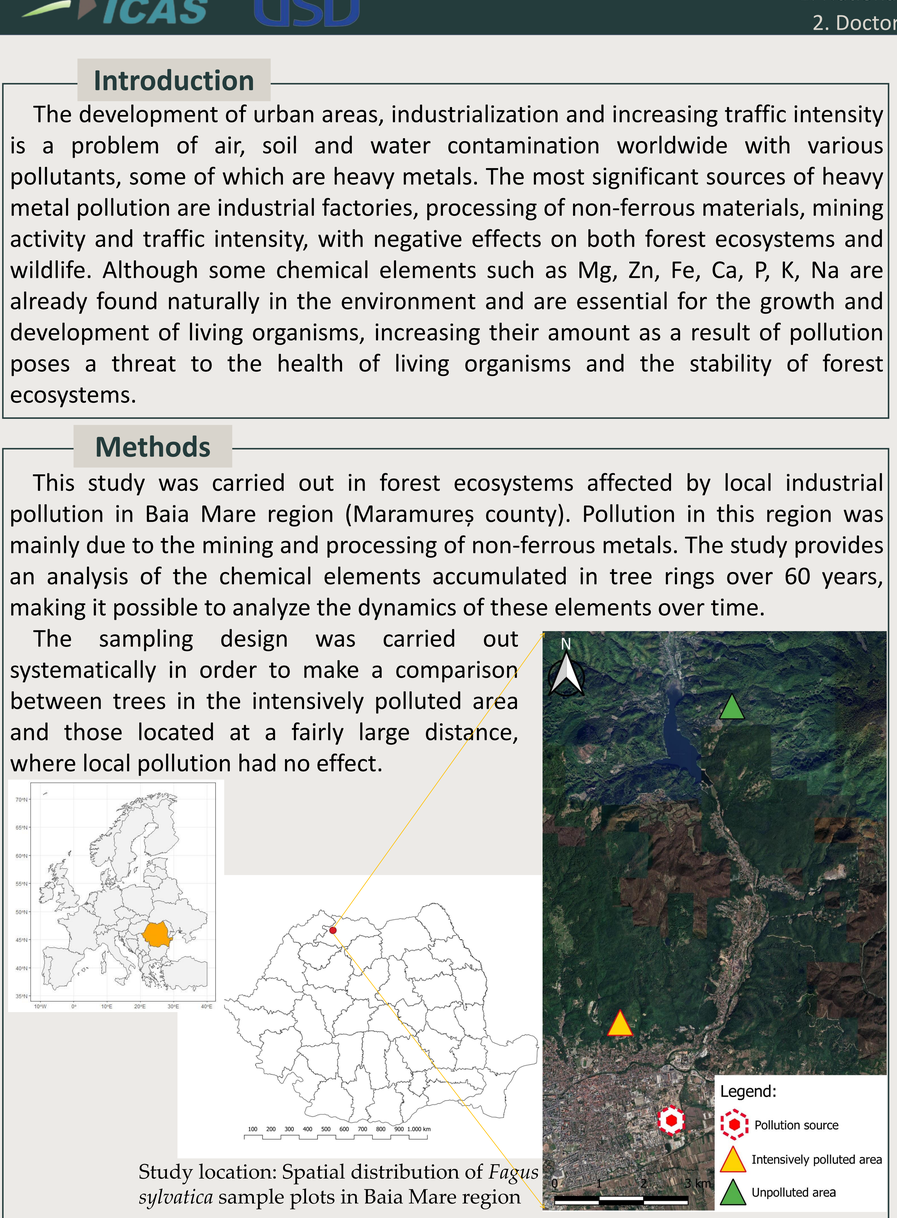
Introduction

The development of urban areas, industrialization and increasing traffic intensity is a problem of air, soil and water contamination worldwide with various pollutants, some of which are heavy metals. The most significant sources of heavy metal pollution are industrial factories, processing of non-ferrous materials, mining activity and traffic intensity, with negative effects on both forest ecosystems and wildlife. Although some chemical elements such as Mg, Zn, Fe, Ca, P, K, Na are already found naturally in the environment and are essential for the growth and development of living organisms, increasing their amount as a result of pollution poses a threat to the health of living organisms and the stability of forest ecosystems.

Methods

This study was carried out in forest ecosystems affected by local industrial pollution in Baia Mare region (Maramureș county). Pollution in this region was mainly due to the mining and processing of non-ferrous metals. The study provides an analysis of the chemical elements accumulated in tree rings over 60 years, making it possible to analyze the dynamics of these elements over time.

The sampling design was carried out systematically in order to make a comparison between trees in the intensively polluted area and those located at a fairly large distance, where local pollution had no effect.

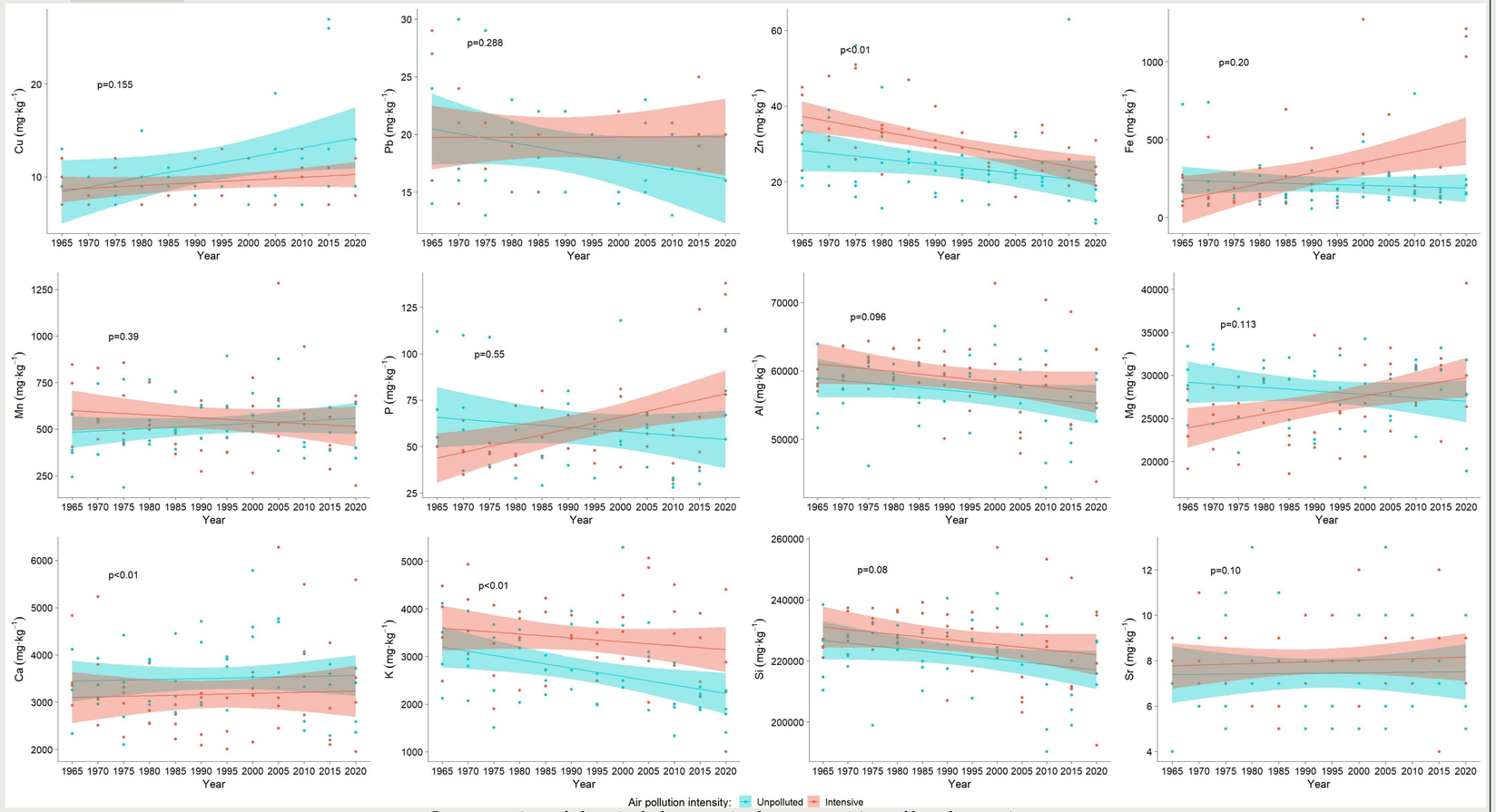


Study location: Spatial distribution of *Fagus sylvatica* sample plots in Baia Mare region

From each plot radial growth samples were taken from 4 trees for *Fagus sylvatica.* The growth samples were sectioned at 5-year intervals, from 2020 to 1961, with a total series length of 60 years. This was necessary in order to identify the elements accumulated by the growth rings both during the period of intense pollution and the period when industrial activity was significantly reduced.

The XRF (X-ray fluorescence) method was used to detect chemical elements in tree growth rings, samples were analyzed directly using Bruker X-ray fluorescence equipment, Tracer 5i.

Results



Concentration of chemical elements in the composition of beech tree rings

Conclusions

Significant differences were found at 95% confidence interval only for Zn, K and Ca concentrations.

Most mineral elements show stability or even a slight decrease in concentrations over time, indicated that they are essential for tree growth and development. However in some cases chemical elements such as Al, K, Si and Sr show high concentrations in the intensively polluted area.

For heavy metals most of them show higher concentrations in the intensively polluted area, but significant differences in relation to the degree of pollution impairment were found only for Zn. In both cases Zn shows a decrease in concentration over time.

In the case of Fe, an increase over time was observed in the intensively polluted area compared to the unpolluted area where Fe shows a slight decrease over time.

Acknowledgements

The researches were funded by the Ministry of Research and Innovation Romania, Nucleu Program, project number 19070104 "Impact of pollution on the structure, multiannual growth and accumulation of heavy metals in affected forest ecosystems" and CresPerfInst project (Contract 34 PFE/30.12.2021).

*Corresponding author: *cristi.sidor@yahoo.com*