SOILS FOR FUTURE UNDER GLOBAL CHALLENGES
SERBIAN SOCIETY OF SOIL SCIENCE
University of Belgrade, Faculty of Agriculture
Sokobanja, 21-24 September 2021
III International and XV National Congress
https://congress.sdpz.rs/

POLLUTION INDICES OF TRACE ELEMENTS IN SOILS OF PČINJA AND JABLANICA DISTRICTS

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INTRODUCTION

Increased soil pollution with various heavy metals is noticed in recent decades. Soil is one of the main recipients of heavy metals, so soil contamination is a significant environmental problem worldwide[1,3]. Therefore, it is very important to assess the risk caused by heavy metals to protect human health and the environment, as well as to control the impact of anthropogenic activities on the environment[2].

AIM

The main goal of this study was to assess the environmental and health risk of eleven heavy metals and metalloids (As, B, Cd, Cr, Cu, Hg, Mn, Mo, Ni, Pb, Zn) tested in the soil of Pčinja and Jablanica districts.

MATERIALS AND METHODS

In total, 152 samples were collected from agricultural land, from a depth of 30 cm. The concentration of the elements was measured by atomic absorption spectrometry and EPA 3051A :2007 method was used.

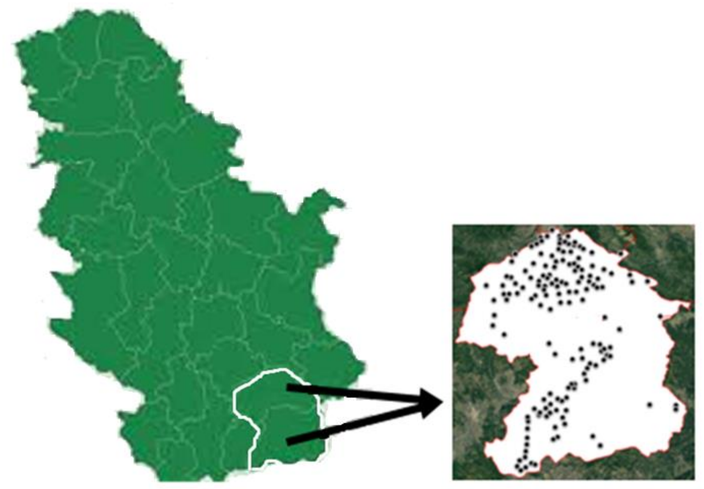

Fig.1. Studied area

ECOLOGICAL RISK ASSESSMENT

Five pollution indices were used to assess environmental risk: enrichment factor (EF), geoaccumulation index (I_{geo}), contamination factor (CF), pollution load index (PLI), and potential environmental risk index (RI).

Table.1. Potential risk index results

RI classes	100
RI < 150	71,7
150< RI < 300	28,3
300< RI < 600	0
RI > 600	0

Table.2. Pollution load index results

PLI classes	100
PLI < 1	97,4
1< PLI < 2	2,6
2 < PLI < 10	0
PLI > 10	0

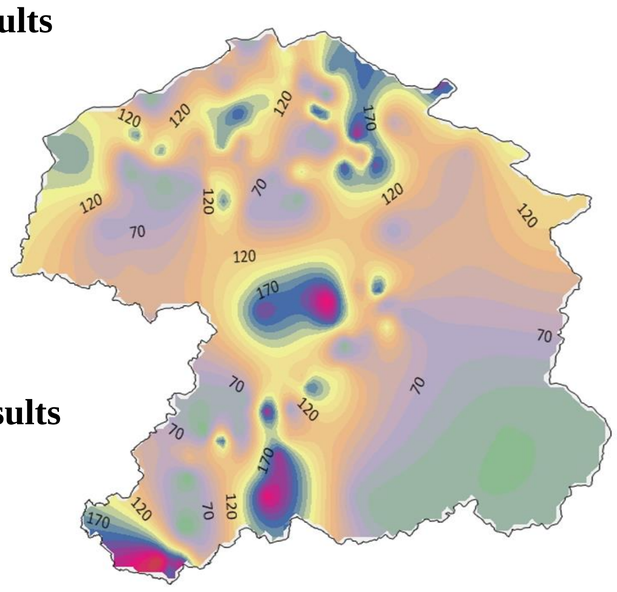

Fig.2. GIS map of RI

- The highest average EF values were obtained for Pb (moderate), Hg (significant) and As (very high).
- The highest average and maximum I_{geo} values were found for Pb, Hg and As.
- More than 70% of the samples had CF values for Cd and Hg between the limit and remediation values.
- For As, Cr, Cu, Ni, Pb and Zn the individual index of potential environmental risk is less than 40 - low environmental risk. Several samples posed significant environmental risk due to Cd and Hg.
- Most od the samples had PLI values less than one.

HEALTH RISK ASSESSMENT

Health risk was estimated with two risk models: non-carcinogenic and carcinogenic.

- For adults, there was no significant non-carcinogenic and carcinogenic risk throught exposure to studied soils.
- Examined soils did not represent carcinogenic risk for children.
- On the other hand, the same soils can cause non-carcirogenic problems for children.

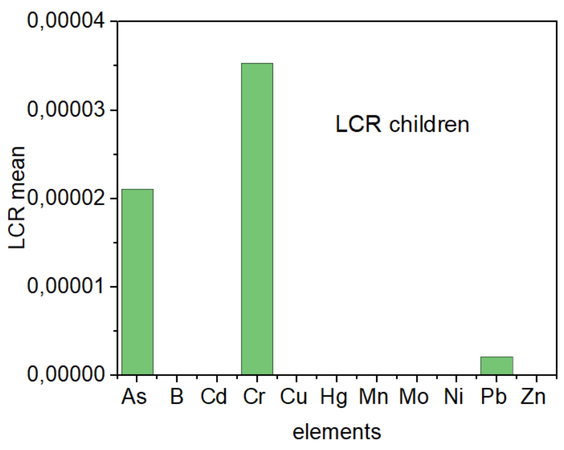

Fig.3. LCR results for children

Table.3. LCR results for adults

LCR classes	100
LCR < 1,0*10^{-6}	0
1,0*10^{-6}<LCR < 1,0*10^{-4}	96,7
LCR > 1,0*10^{-4}	3,3

Table.4. HI results for children

HI classes	100
HI < 1	14,5
HI > 1	85,5

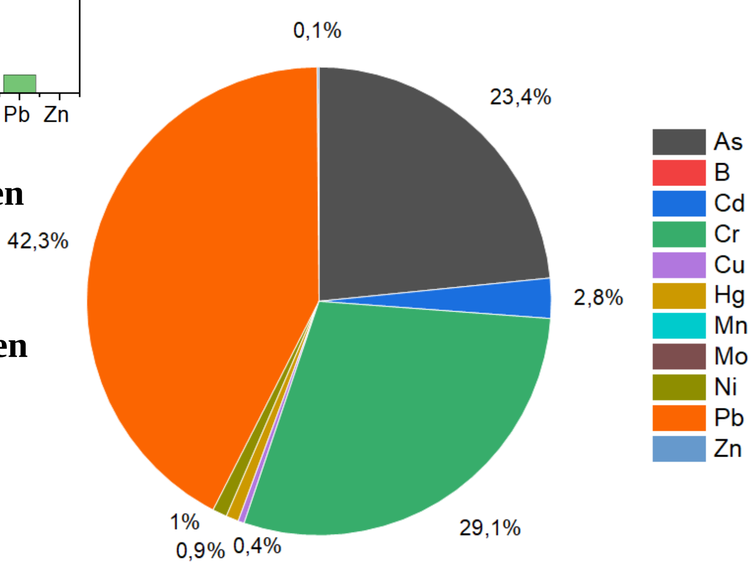

Fig.4. Pie chart for HI-adults

CONCLUSION

This study showed no significant risk of developing carcinogenic and non-carcinogenic diseases for adults, but there was some concern about non-carcinogenic risk for children. Increased average values of EF and I_{geo} indicated As, Pb and Hg pollution, while increased CF, PLI and RI values indicated Hg and Cd soil pollution.

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