

MOSS BAG BIOMONITORING OF AIR POLLUTION: URBAN VERSUS AGRICULTURAL SCENARIO

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CONTENT:

- 
- Air pollution issue

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- Moss bag biomonitoring

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- Urban area studies (Belgrade, Serbia)

- 
- Agricultural area studies (Serbia)

- 
- Final remarks: urban vs. agricultural scenario

Air pollution issue

No attention to agrichemical-originated
air pollution!!!



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Moss bag biomonitoring?!

- The overcoming of the issue requires: **1) continuously assessment of the environmental impact** and **2) concomitantly upgrade of regulations and policies** (EEA, 2017)

Urban areas → around 3% of the Earth`s surface



‘deserts’!!!



Agricultural areas $\rightarrow \approx 26\%$ of the Earth's surface



"There is no better indicator for the state of a species or a system, than that species or system itself."

Moss bag biomonitoring – brief history

- Goodman & Roberts, 1971...
- In Finland, the moss bag technique is nationally standardised (SFS 5794, Finnish Standards Association 1994)
- Ares et al. (2012). Review



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Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

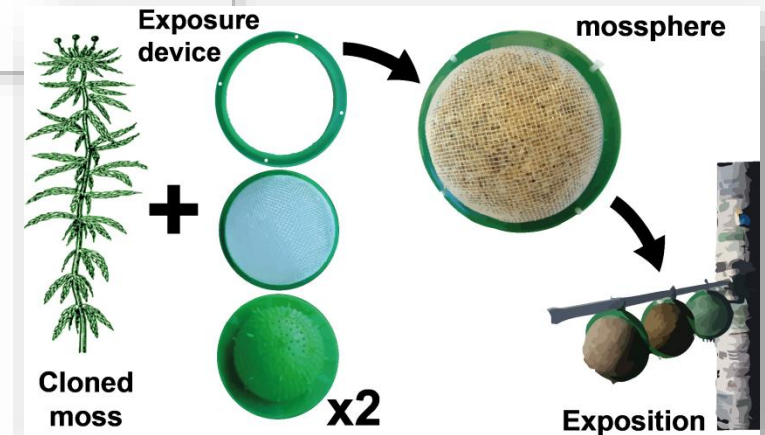


Review

Moss bag biomonitoring: A methodological review

A. Ares ^{a,*}, J.R. Aboal ^a, A. Carballeira ^a, S. Giordano ^b, P. Adamo ^c, J.A. Fernández ^a

- At international level, 'passive contaminant sensor device' (EP3076171-A1; WO2016156443-A1, Patent, 2016)



Moss bag biomonitoring – our research.



- Since 2005 until now...

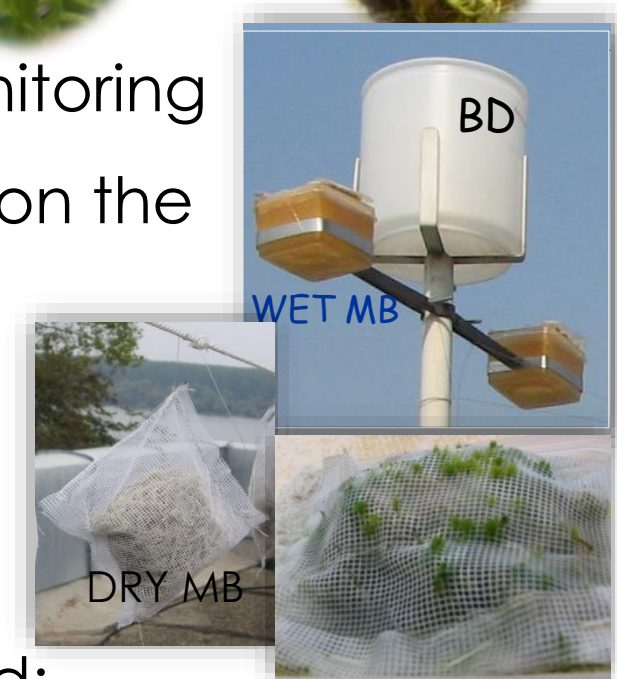
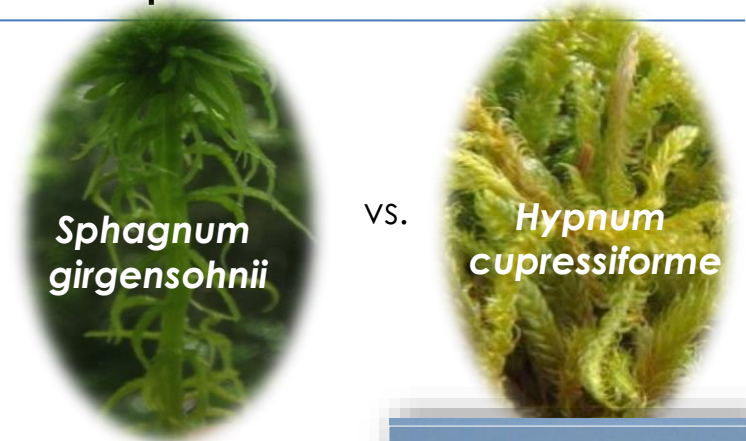
Analysis:

- Up to 50 elements were determined – potentially toxic major, minor and trace elements + rare earth elements (REEs)
- Moss samples were analysed by ICP-OES/ICP-MS, INAA



Moss bag biomonitoring – tested parameters

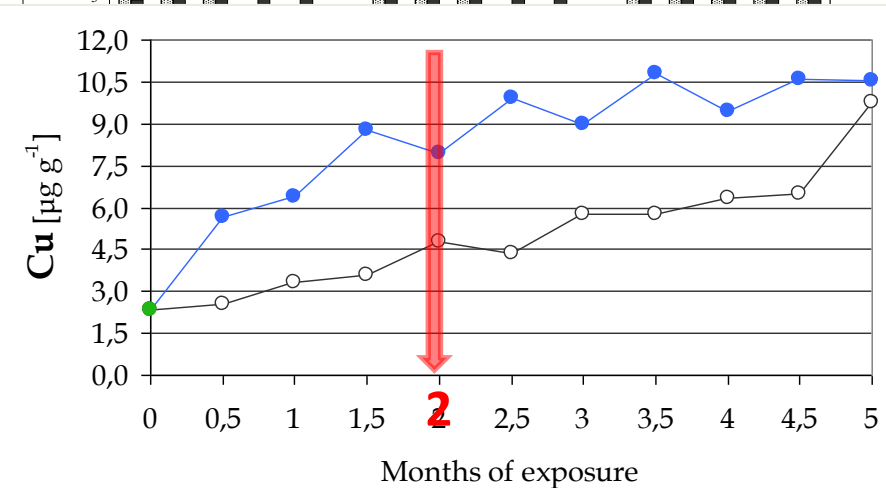
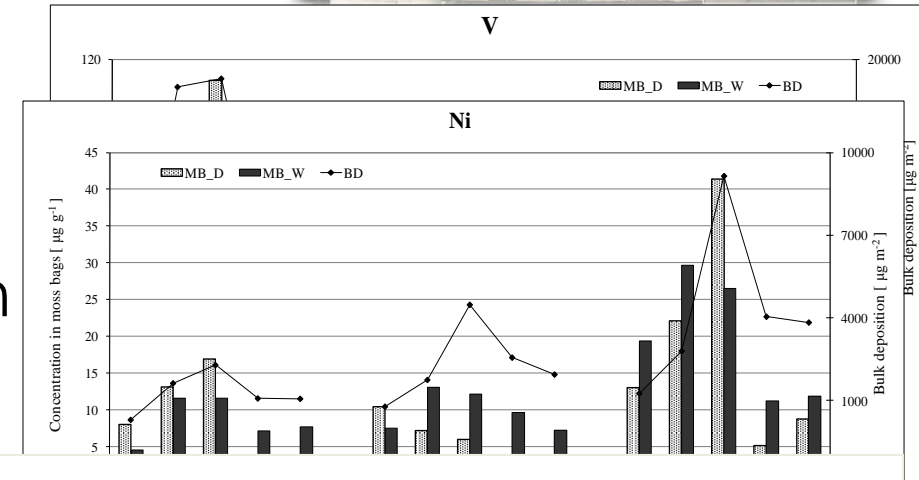
- Selection of the moss species
- Moss biomonitoring vs. regulatory monitoring
- Vitality of moss in bags and influence on the pollutant accumulation
- The optimal moss bag exposure period:
15 days up to 6 months



Our research: 2005–2009



- Dry vs. wet moss bags
- Moss bags vs. bulk deposition
- Moss bags vs. exposure time



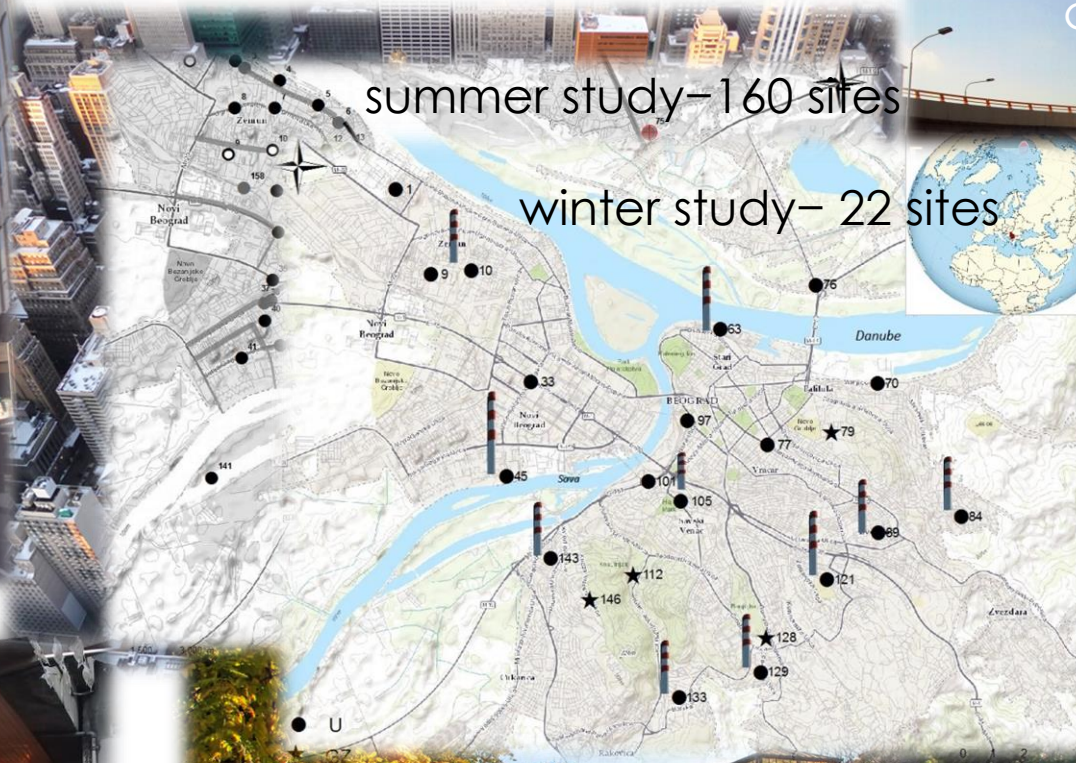
2011–2015: Moss bag biomonitoring in urban microenvironments and over the Belgrade city

street canyon

crossroad

summer study- 160 sites

winter study- 22 sites



city tunnel

airport



RESEARCH ARTICLE

Active moss biomonitoring of small-scale spatial distribution of airborne major and trace elements in the Belgrade urban area

Gordana Vuković · Mira Aničić Urošević ·
 Ivana Razumenić · Zoya Goryainova ·
 Marina Frontasyeva · Milica Tomašević ·
 Aleksandar Popović



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Moss bag biomonitoring of airborne toxic element decrease on a small scale: A street study in Belgrade, Serbia



Gordana Vuković^a, Mira Aničić Urošević^{a,*}, Sandra Škrivanj^b, Tijana Milićević^a, Dragoljub Dimitrijević^a,
 Milica Tomašević^a, Aleksandar Popović^b



The first survey of airborne trace elements at airport using moss bag technique

Gordana Vuković¹ · Mira Aničić Urošević¹ · Sandra Škrivanj² · Konstantin Vergel³ · Milica Tomašević¹ · Aleksandar Popović²

- Botanical garden study – background air pollution: moss trace element concentrations were markedly lower



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Urban background of air pollution: Evaluation through moss bag biomonitoring of trace elements in Botanical garden



CrossMark

Mira Aničić Urošević^{a,*}, Gordana Vuković^a, Petar Jovanović^b, Milorad Vujičić^c, Aneta Sabovljević^c, Marko Sabovljević^c, Milica Tomašević^a





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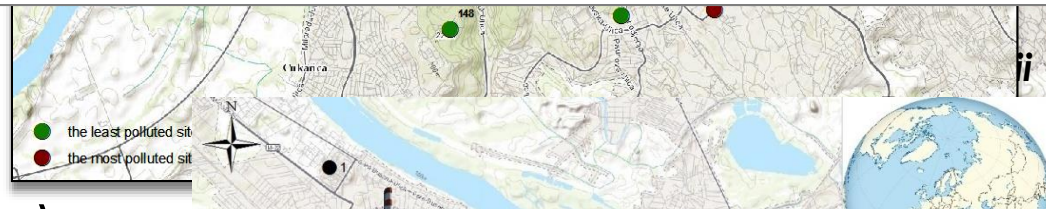
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Active moss biomonitoring for extensive screening of urban air pollution: Magnetic and chemical analyses



Gordana Vuković^a, Mira Aničić Urošević^{a,*}, Zoya Goryainova^b, Miodrag Pergal^c, Sandra Škrivanj^c,
Roeland Samson^d, Aleksandar Popović^c



Environ Sci Pollut Res
DOI 10.1007/s11356-015-5096-0



RESEARCH ARTICLE

Residential heating contribution to level of air pollutants (PAHs, major, trace, and rare earth elements): a moss bag case study

Gordana Vuković¹ · Mira Aničić Urošević¹ · Miodrag Pergal² · Milan Janković² ·
Zoya Goryainova³ · Milica Tomašević¹ · Aleksandar Popović²



2014-2017: Moss bag biomonitoring in agricultural (vineyard) area (Serbia)



conventional vineyard



organic vineyard



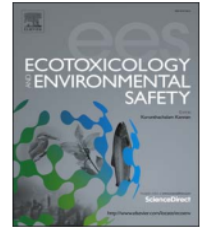
Conclusions



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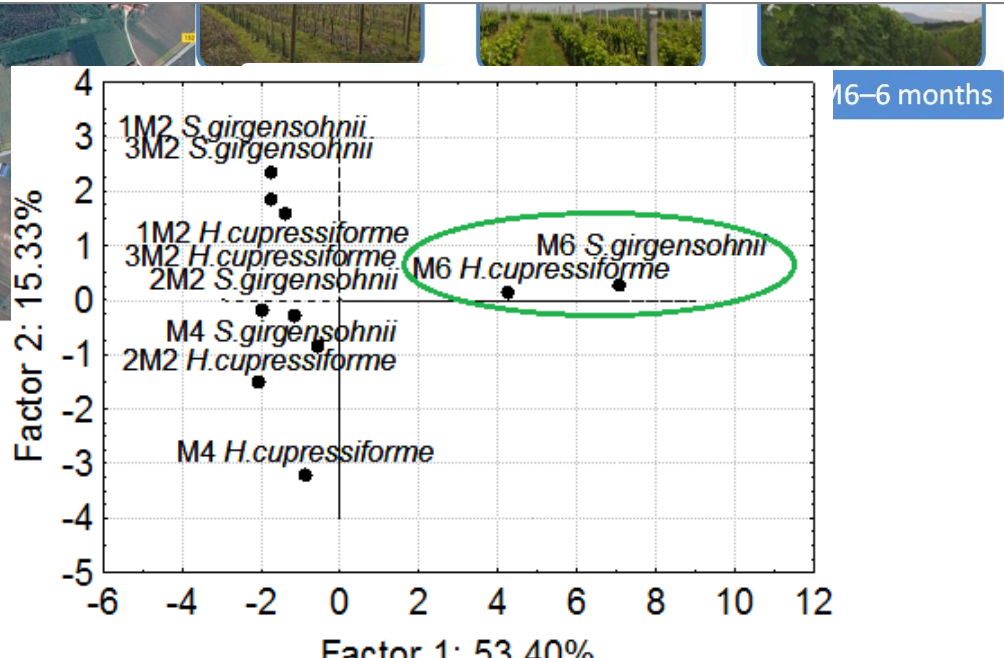
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Assessment of species-specific and temporal variations of major, trace and rare earth elements in vineyard ambient using moss bags



Tijana Milićević^a, Mira Aničić Urošević^{a,*}, Gordana Vuković^a, Sandra Škrivanj^b, Dubravka Relić^b, Marina V. Frontasyeva^c, Aleksandar Popović^b



Final remarks about moss bag biomonitoring

Urban area



Agricultural ambient



- Small-scale spatio-temporal differences in airborne element concentrations
- Moss bag exposition should be 2 months
- Both moss species *Sphagnum girgensohnii* and *Hypnum cupressiforme* can be used for biomonitoring, but not interchangeable, except for Cu, Cr and Sb
- *Sphagnum girgensohnii* is more sensitive to spatio-temporal changes in airborne element content
- Temporal differences in airborne element concentrations
- Moss bag exposition should be 6 months

Thank you for attention !!!



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