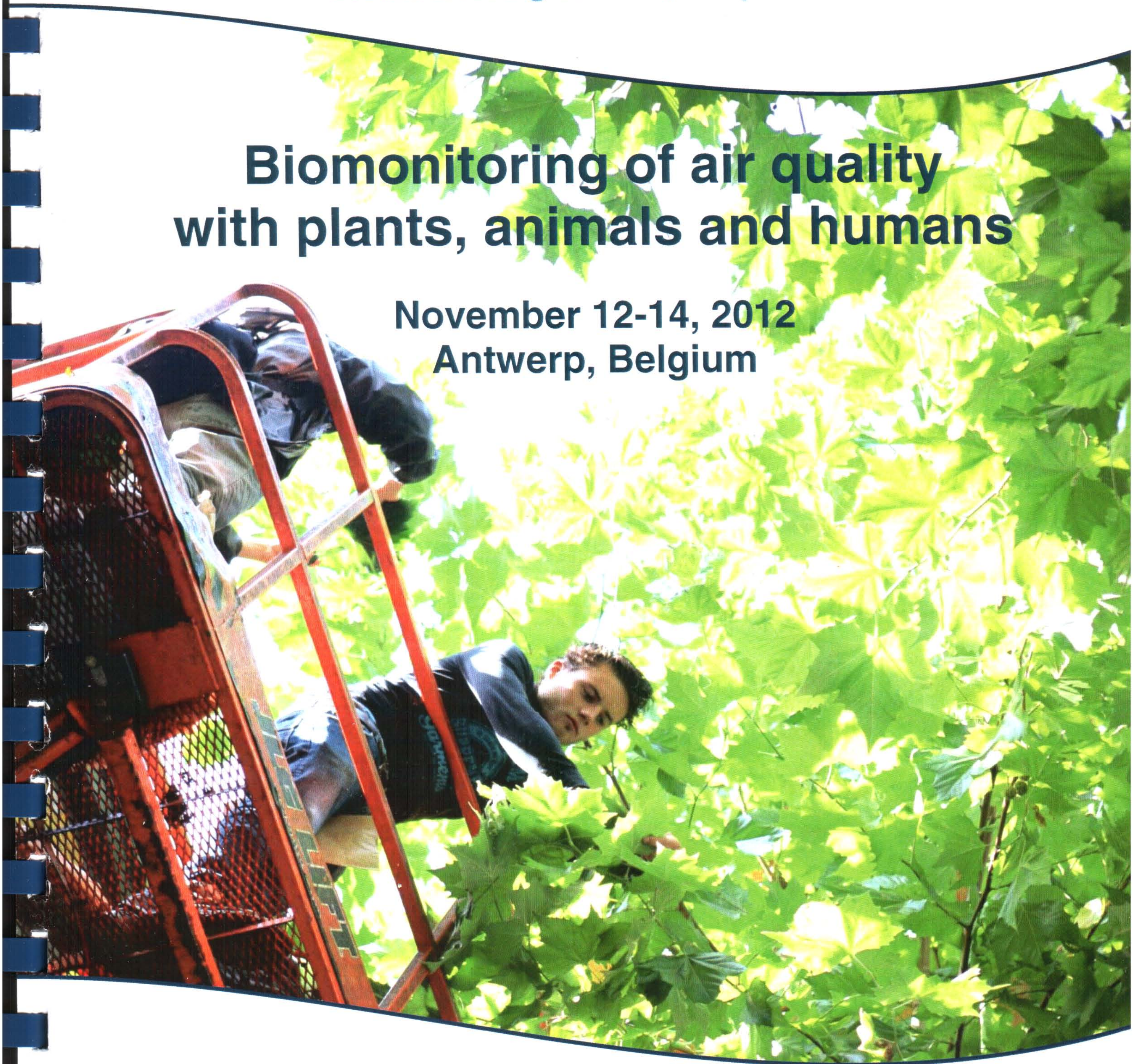
BIOMAQ

Biomonitoring of Air Quality 2012

Biomonitoring of air quality with plants, animals and humans

November 12-14, 2012
Antwerp, Belgium



IWT

Climaqs
Climate and Air Quality
Modelling for Policy Support

Universiteit Antwerpen

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Book of abstracts

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This conference is a joint organization of the Department of Bioscience Engineering, the Department of Biology and the Laboratory of Experimental Medicine and Pediatrics of the University of Antwerp, Belgium. It is organized in the framework of the CLIMAQS (Climate and Air Quality Modelling for Policy Support) project, carried out with the support of the Agency for Innovation by Science and Technology (IWT).

Program

November 12, 2012: Plant biomonitoring of air quality

8h45	*Registration*	
9h25	*Welcome*	
9h30	Invited speaker	**Plants as accumulating biomonitors** J. Neil CAPE
10h00	Oral 1	**Bioindication of troposheric ozone by native vegetation: the potential of *Viburnum lantana* for large-scale surveys** Elena GOTTARDINI, Antonella CRISTOFORI, Fabiana CRISTOFOLINI, Filippo BUSSOTTI & Marco FERRETTI
10h20	Oral 2	**The response of the foliar anti-oxidant system and stable isotopes of white willow to low-level air pollution** Tatiana WUYTACK, Hamada ABDELGAWAD, Jeroen STAELENS, Han ASARD, Pascal BOECKX, Kris VERHEYEN & Roeland SAMSON
10h40	*Coffee*	
11h00	Invited speaker	**Biomonitoring indoor air quality with higher plants** Damien CUNY & Marie-Amélie CUNY
11h30	Oral 3	**The secret light of plants: what can chlorophyll fluorescence tell us about air pollution stress of tree leaves?** Shari VAN WITTENBERGHE, Luis ALONSO, Jochem VERRELST, Jose MORENO & Roeland SAMSON
11h50	Oral 4	**Plant biomonitoring around waste incinerators** Chris VAN DIJK & Wim VAN DOORN
12h10	Oral 5	**Active moss biomonitoring of small scale inner city spatial distribution of ambient trace elements in Belgrade urban area** Mira ANIČIĆ UROŠEVIĆ, Gordana VUKOVIĆ, Ivana RAZUMENIĆ, Zoya GORYAINOVA, Marina FRONTASYEVA, Milica TOMAŠEVIĆ & Aleksandar POPOVIĆ
12h30	*Lunch & poster session*	
14h00	Invited speaker	**Environmental magnetism for air pollution monitoring** Leonardo SAGNOTTI
14h30	Oral 6	**Heavy metal content in *Nerium Oleander* and its relationships with heavy metals in inhalable atmospheric particles (PM $_{2.5}$) and in contaminated soils: Biomonitoring applications** Martín, A. MARTIN, S. VÁZQUEZ, M. GARCIA, C. ESPAÑOL, R. PINO & E. NAVARRO
14h50	Oral 7	**Biomagnetic monitoring of trees in urban environments** Karen WUYTS, Fatemeh KARDEL, Jelle HOFMAN & Roeland SAMSON
15h10	*Coffee*	
15h30	Invited speaker	**Deposited particles and particle fluxes through urban vegetation canopies monitored by magnetic susceptibility** Marcel LANGNER, Martin KULL & Agnes KONTN
16h00	Oral 8	**Lichen biomonitoring of air quality** Stefano LOPPI
16h30	Oral 9	**Are lichens suitable bioindicators of air pollutants originating from different waste management strategies?** Luca PAOLI, Anna GUTTOVÁ, Alice GRASSI, Daniela PROIETTI PANNUNZI,Anna LACKOVIČOVÁ, Dušan SENKO, Adelmo CORSINI, Valentina BIGAGLI, Juri VANNINI, Renato BENESPERI, Giovanni SARDELLA, Silvana MUNZI & Stefano LOPPI
19h00	*Conference dinner at 'De Groote Witte Arend'*	

Active moss biomonitoring of small scale inner city spatial distribution of ambient trace elements in Belgrade urban area

Mira ANIČIĆ UROŠEVIĆ[1,*], Gordana VUKOVIĆ[2], Ivana RAZUMENIĆ[2], Zoya GORYAINOVA[3], Marina FRONTASYEVA[3], Milica TOMAŠEVIĆ[1] & Aleksandar POPOVIĆ[2]

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Introduction

In urban environments, human exposure to air pollutants is significantly increased, especially near busy traffic streets, canyon streets, tunnels, etc. where urban topography and microclimate may additionally cause poor air conditions giving rise to pollution hotspots. Within these areas, pedestrians, cyclists, drivers and residents are likely to be exposed to pollutant concentrations exceeding current air quality standards (Vardoulakis *et al.*, 2003). The total number of air quality monitoring stations or sampling locations within a city is limited by practical constraints. However, biomonitoring can draw a reliable picture of pollution patterns in a much more cost effective way. Given their morphological and physiological characteristics, bryophytes have proved to be suitable biomonitors for trace element air pollution (Zechmeister *et al.*, 2003). Most research has been carried in the field of passive moss biomonitoring, but active biomonitoring, using moss as transplants, is of increasing interest in urban areas where naturally growing mosses are often absent. Also, in biomonitoring studies, spatial deposition patterns of trace elements are generally regarded as being horizontal only, while also vertical distributions are important, especially in the so called breathing zone of the urban areas. Thus, active moss biomonitoring study of trace element air pollution was performed in the Belgrade canyon streets and city tunnel in 2011 with the aim to evaluate possibility of using *Sphagnum girgensohnii* moss bags for investigation of the small scale vertical and horizontal distribution patterns of trace elements.

Material and methods

Moss bags preparation and exposure

Moss *Sphagnum girgensohnii* Rusow was collected at the end of May 2011 from a pristine wetland area located near Dubna, Russian Federation. This background area was chosen on the basis of results obtained previously (Aničić *et al.*, 2009a; 2009b). In the laboratory, the moss was carefully cleaned from soil particles and other foreign matter and air-dried. About 3 g of the moss was packed loosely in 10x10 cm bags of nylon net with 2-mm mesh size.

The experiment was performed in 5 street canyons and one tunnel situated in heavily traffic area of the Belgrade city (Serbia). In the canyon streets (M, KN, DJ, OV and KM), the moss bags were hung at heights of about 4, 8 and 16 m for 10 weeks, and also, for the same time (selected on basis previous study Aničić *et al.*, 2009), the moss bags were exposed in (IT), in front of (ET), and out of the tunnel (OT).

Analysis

After the exposure period, in the laboratory, approximately 0.4 g of moss were digested for 45 min in a microwave digester with 7 ml of 65% HNO_3 and 1 ml of 30% H_2O_2 at 200°C, and digested samples were diluted with distilled water to a total volume of 50 ml. The concentrations of 17 elements (Al, Ba, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Sr, V and Zn) in the moss bags were performed by inductively coupled plasma optical emission spectrometry (ICP-OES). Quality control was performed using the standard reference material lichen-336 (IAEA).

The data were processed using StatSoft STATISTICA 6.0. Basic statistics were performed, and significant differences were calculated at p< 0.05 level.

Results and discussion

Vertical element distribution in moss bags – street canyon experiment

Concentrations of the most elements were statistically higher ($p < 0.05$) in exposed moss than in background samples (initial element concentrations), indicating that the urban environment to which the moss bags were exposed was polluted by the elements in question (Fig. 1).

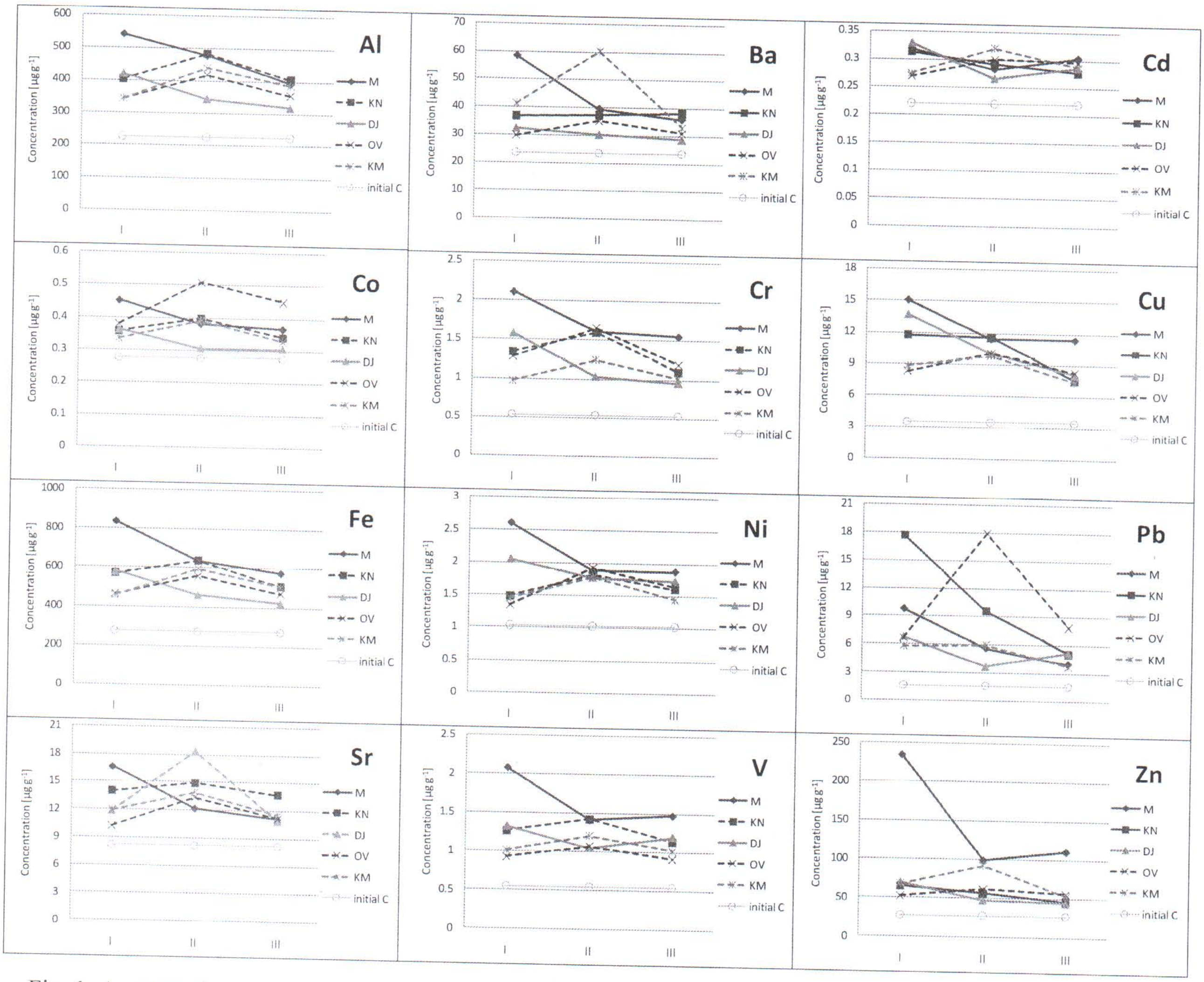

Fig. 1. Average element concentrations in moss bags exposed at three heights (I – 4 m; II – 8 m; III – 16 m) in 5 canyon streets (M, KN, DJ, OV and KM), and initial element concentrations in the unexposed moss

According to the results obtained, in all canyon streets, the vertical distribution patterns of the moss element concentrations (Al, Ba, Ca, Cr, Cu, Ni, Pb, Sr, V, Zn) showed statistically significant decrease from the first to the third heights of bags exposure (Fig. 1). However, in two canyon streets, the highest elemental concentration was determined in the moss exposed at the second height. This discrepancy could be explained by different direction of the primary air vortex in these streets, where the exposure sites were either placed on the leeward side or in the main air flow in the second positioned height. Thus, residents in some canyon streets may be exposed to higher air pollution than pedestrians.

Horizontal element distribution in moss bags – tunnel experiment

In the tunnel experiment, from inner to out of the tunnel, for Al, Ba, Cd, Co, Cr, Cu, Fe and Zn decreasing trend of concentrations in moss bags was obtained (Fig. 2). Otherwise, significantly higher concentration of the elements in moss bags was pronounced for the tunnel in comparison with the canyon street data.

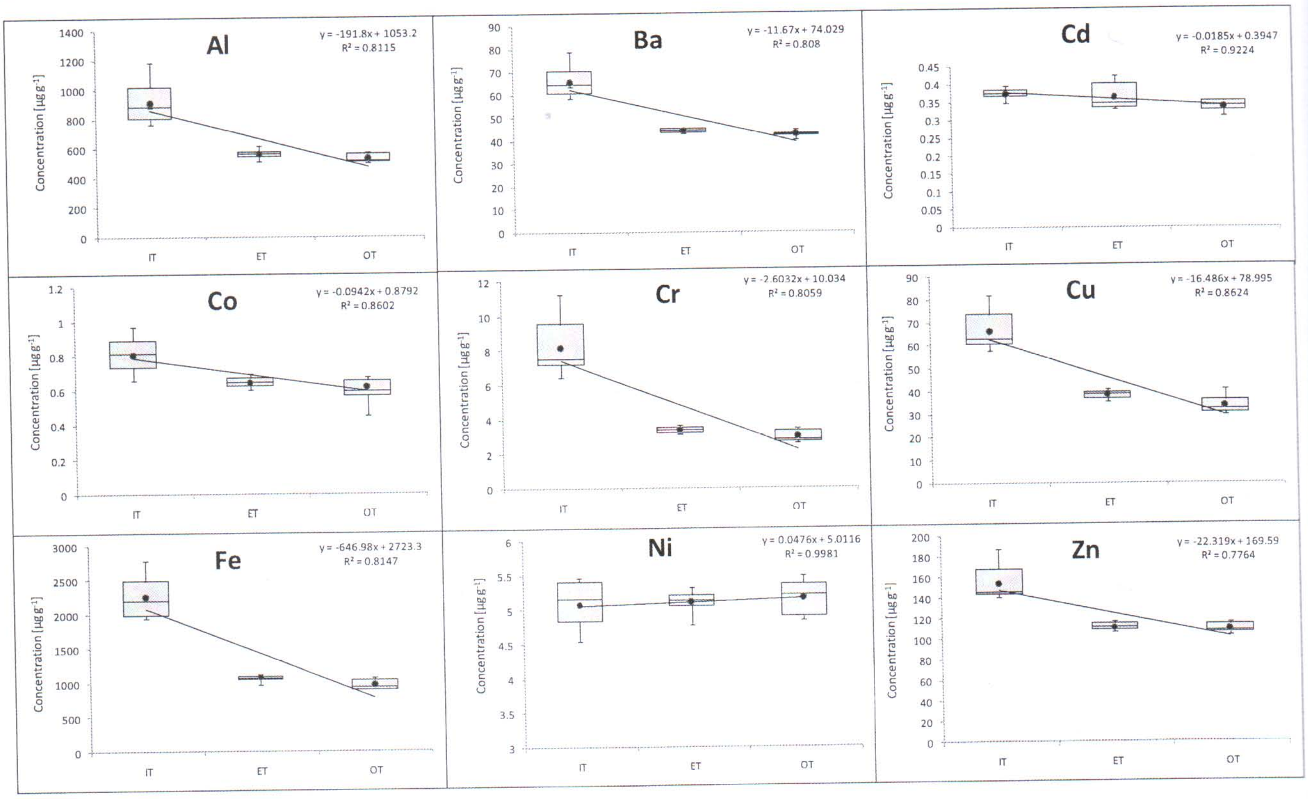

Fig. 2. Decreasing trend of element (Al, Ba, Cd, Co, Cr, Cu, Fe, Ni, Zn) concentration in moss bags exposed at three position: inside of tunnel (IT), entrance tunnel (ET), and out of tunnel (OT)

Conclusion

The results clearly indicate significant accumulation of the elements in exposed moss bags in Belgrade urban area. The vertical (from the first to the third heights of bags exposure in canyon streets) and horizontal (from inside to outside of the tunnel) distribution of the air element concentrations was obtained by moss bags. Thus, the use of *S. girgensohnii* moss bags could be a simple, sensitive and inexpensive way to monitor the small scale inner city spatial distribution of ambient trace element content.

References

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