6th Annual PGS Conference

27 January 2015

Institute for Environmental Studies

Benátská 2, Praha 2

Conference Abstracts

HOW ALGAL ORGANIC MATTER DIFFERS IN SPECIES AND GROWTH PHASE OF PHYTOPLANKTON

Magdalena BARESOVA[1,2], Martin PIVOKONSKY[1,2]
[1]Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Czech Republic
[2]Institute of Hydrodynamics, Academy of Sciences of the Czech Republic, Prague, Czech Republic
magdalena.baresova@gmail.cz

Keywords: Algal organic matter; molecular weight fractionation; protein content

INTRODUCTION

The study is aimed at the characterisation of algal organic matter (AOM) derived from the green alga *Chlamydomonas geitleri*, the diatom *Fragilaria crotonensis* and the cyanobacterium *Microcystis aeruginosa*. Metabolically produced extracellular organic matter (EOM), and also cellular organic matter (COM) deriving from the decay of phytoplankton cells, presents a significant component of natural organic matter in surface waters. In case of water reservoirs supplying drinking water plants, seasonally ocurring high concentrations of AOM may affect the performance of drinking water treatment and the quality of water (reduction in coagulation efficiency, membrane fouling, presursors of disinfection by-products, etc.) (Pivokonsky et al., 2006; Henderson et al., 2008).

In previous studies, it was demonstrated that a quantity and a chemical structure of AOM is species specific and varies with the age of the culture (Pivokonsky et al., 2006, 2014; Henderson et al., 2008). Studies ascertained that low molecular weights and non-proteinaceous AOM are more difficult to remove than the high and the proteinaceous ones, respectively (Bernhardt et al., 1985; Pivokonsky et al., 2012). It is obvious that the removal efficiency of AOM in water treatment is closely related to their composition; therefore, it is necessary to investigate the influence of the species and growth phase of the microorganism on the composition of AOM. The purpose of this study is therefore to characterize EOM/COM isolated from three of the most abundant species of phytoplankton considering drinking water treatment.

METHODS

The green alga *C. geitleri*, the diatom *F. crotonensis* and the cyanobacterium *M. aeruginosa* were cultivated in this study. Growth of the strains was monitored by cell counting and measuring optical density. Microorganisms' exudates (EOM) and COM were characterized in terms of the dissolved organic carbon concentration (DOC), protein and non-proteinaceous content (DOC_P and DOC_{NP}) and molecular weights (MW). Moreover, a division of EOM/COM into hydrophilic (HPI), hydrophobic (HPO) and transphilic (TPI) was carried out.

RESULTS AND DISCUSSION

The results show that HPI compounds dominate both EOM and COM of all the organisms. The HPI fractions constituted about 70 % of EOM at both exponential (EXP) and stationary (STAT) phases of the culture growths. In COM, HPI reaches even 90 % of DOC. The study confirms that the total amount of organics, and also the portion of proteins, increases as the cultures grow. The total DOC concentrations and the MW fractionations of protein (DOC_P) and non-proteinaceous (DOC_{NP}) matter in EOM–EXP, EOM–STAT and in COM are depicted in Fig. 1. The results of molecular fractionation demonstrate that the highest DOC portion of EOM, and also of COM, is contained in 10-30 kDa fraction of *C. geitleri* (91-100 %). Both EOM and COM of *F. crotonensis* and *M. aeruginosa* dominate with 3-10 kDa fractions (71-92 % and 38-78 %, respectively). *C. geitleri* and *F. crotonensis* show uniform MW composition, whereas *M. aeruginosa* exhibits broader MW diversity and a significant portion also in higher-MW fractions, particularly in >100 kDa (25 % and 22 % for EOM–STAT and COM, respectively). Compared to the protein content, the non-proteinaceous matter shows the same pattern for all the organisms. The largest portion of DOC is contained in 0-1 kDa fractions, which decreases with the age of culture with minimum in COM (51 % for *C. geitleri*, 47 % for *F. crotonensis* and 36 % for *M. aeruginosa*). On the contrary, the second largest non-proteinaceous fraction (>100 kDa) increases with the age of culture and reaches its maximum in COM (22 % for *C. geitleri*, 22 % for *F. crotonensis* and 35 % for *M. aeruginosa*).

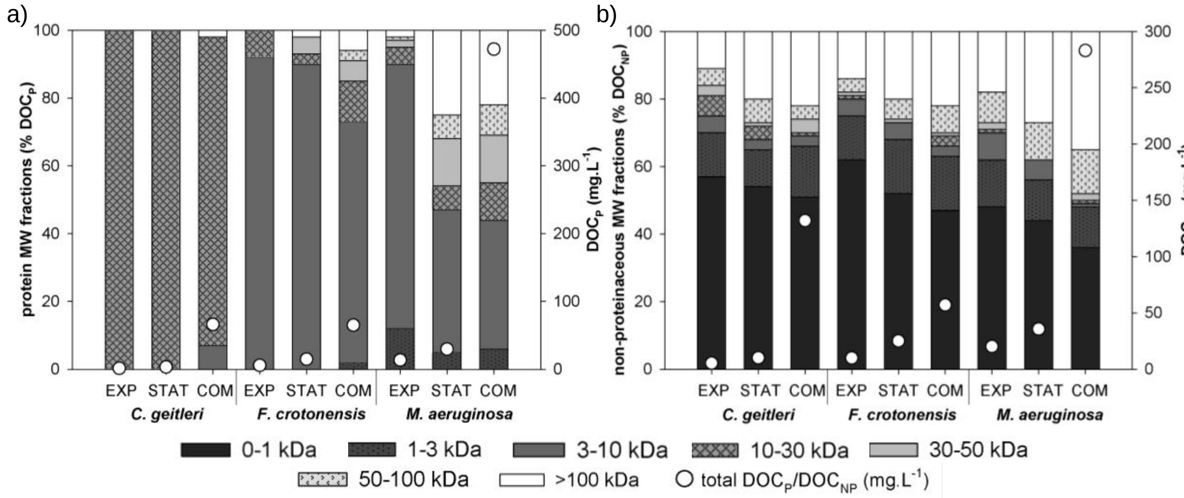


Fig. 1 Total DOC and MW fractionations of protein (a) and non-proteinaceous (b) content in EOM/COM.

CONCLUSIONS

The organic matter of all the observed microorganisms demonstrates several similarities, however, the composition and characteristics change with both the species and the growth phase.

ACKNOWLEDGEMENTS

The research project has been funded by the Czech Science Foundation under the project No. P105/11/0247.

REFERENCES

Bernhardt H., Hoyer O., Schell H., Lüsse B., 1985. Reaction mechanisms involved in the influence of algogenic organic matter on flocculation. *Z. Wasser. Abwass. For.* 18:18-30.

Henderson R.K., Baker A., Parsons S.A., Jefferson B., 2008. Characterisation of algogenic organic matter extracted from cyanobacteria, green algae and diatoms. *Wat. Res.* 42:3435-3445.

Pivokonsky M., Kloucek O., Pivokonska L., 2006. Evaluation of the production, composition and aluminum and iron complexation of algogenic organic matter. *Wat. Res.* 40:3045-3052.

Pivokonsky M., Safarikova J., Bubakova P., Pivokonska L., 2012. Coagulation of peptides and proteins produced by *Microcystis aeruginosa*: Interaction mechanisms and the effect of Fe-peptide/protein complexes formation. *Wat. Res.* 46:5583-5590.

Pivokonsky M., Safarikova J., Baresova M., Pivokonska L., Kopecka I., 2014. A comparison of the character of algal extracellular versus cellular organic matter produced by cyanobacterium, diatom and green alga. *Wat. Res.* 51:37-46.

Polycyclic aromatic hydrocarbons in size-segregated aerosol in Mladá Boleslav

Jan Bendl[1], Jan Hovorka[1], Jan Topinka[2]
[1] Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Benátská 2, 128 01, Praha 2,
[2] Department of Genetic Ecotoxicology, Institute of Experimental Medicine, Acad. Sci., Vídeňská 1083, Prague 4, 142 20, Czech Republic

Jan.Bendl@natur.cuni.cz

Keywords: Urban air, smog, aerosol mass size distribution, c-PAH

INTRODUCTION

Urban air pollution affects human well-being and causes premature deaths. One of the most dangerous pollutants from incomplete combustion are Polycyclic Aromatic Hydrocarbons (PAHs). Some of them are proven carcinogens like the Benzo(a)pyren. These PAHs are called carcinogenic PAHs (c-PAHs). The ability of PAHs to penetrate to organisms depends on aerosol particles. If PAHs are adsorbed to aerosol particles $PM_{2,5}$ and especially PM_1, they can easily come from lungs through capillaries directly to the blood and cause cancer or other disease. From this reason it is very useful to analyze PAHs from size-segregated aerosol. PAHs are in the air in two phases – in gas and particle phase. Distribution between these phases is dependent on the ambient temperature and vapor pressure of each PAH. PAHs with vapor pressure $<10^{-5}$ Pa are mostly bond to atmospheric aerosol and PAHs with vapor pressure $>10^{-5}$ Pa are mostly in the gas phase (Hovorka et al., 2012).

METHODS

Aerosol were sampled from 14th to 27th February 2013 in the central part of the city of Mladá Boleslav (50°25'32.661"N, 14°54'54.506"E) with High Volume Cascade Impactor BGI 900. This instrument separates aerosol into coarse fraction ($1<d_{ae}<10$ µm), upper accumulation ($0,5<d_{ae}<1$ µm), lower accumulation (0,17<dae<0,5 µm) and fine particles (<0,17um). First three fractions were sampled to polyurethane foam (PUF) and the fine fraction to the PTFE filers Pallflex TX40. Impactor was situated in the 3m height from the ground and aerosol was sampled for 23 hours every day.

Aerosol was analyzed for PAHs in the ALS Czech Republic s.r.o. laboratories (EN ISO CSN IEC 17025). PAHs were extracted from the PUF substrates and filters using dichlormethane. Extract were analyzed by the HPLC method with fluorometric detection (ISO 11338-2) (Hovorka et al., 2012).
These eight carcinogenic PAHs were analyzed: benzo[a]anthracene (B[a]A), chrysene (CHRY), benzo[b]fluorantene (B[b]F), benzo[k]fluorantene (B[k]F), benzo[a]pyrene (B[a]P), dibenzo[a,h]antracene (DB[ah]A), benzo[g,h,i]perylene (B[ghi]P), a indeno[1,2,3-cd]pyrene (I[cd]P).

RESULTS AND DISCUSSION

During the measurements was relatively sunny weather with the average temperature -2,3 °C. Minimum were -12.8 °C at 22th February and maximum 4.8 °C. Wind were calm with average 1,2 ms^{-1} so turbulent diffusion was dominant factor and air was well-mixed. Average concentration of sum of c-PAHs was 19,2 ngm^{-3} for the whole measured period. Concentrations of c-PAHs are in the table 1.

Table 1: Medians of c-PAHs concentration in size-segregated aerosol (ngm^{-3}) at Mladá Boleslav, from 14th do 27th February 2013

c-PAHs	1-10 µm	0.5-1 µm	0.17-0.5 µm	<0.17 µm	All fractions
B[a]A	0.61	1.34	0.51	0.16	2.69
CHRY	0.88	1.84	0.78	0.28	3.72
B[b]F	0.83	1.88	0.76	0.29	3.86
B[k]F	0.36	0.82	0.34	0.12	1.66
B[a]P	0.54	1.36	0.56	0.16	2.77
DB[ah]A	0.04	0.08	0.04	0.01	0.17
B[ghi]P	0.43	1.01	0.46	0.18	2.08
I[cd]P	0.41	0.98	0.43	0.16	2.02
∑ 8 k-PAU	4.14	9.37	3.86	1.33	19.15

B[a]P concentration in Mladá Boleslav was in average twenty times lower than in the similar winter time measurement in the Ostrava city at 2012 (Hovorka et al., 2012). Nevertheless, concentration was over the health limit of 1 ngm^{-3} except 19th. February 2013.

C-PAHs concentrations per aerosol mass in individual aerosol fractions ranged from 0,1 $mg.g^{-1}$ to 1 mgg^{-1}, but from 22th Ferbruary to 25th February 2013 concentration peaked up to 5 mgg^{-1} c-PAHs (fig. 1).

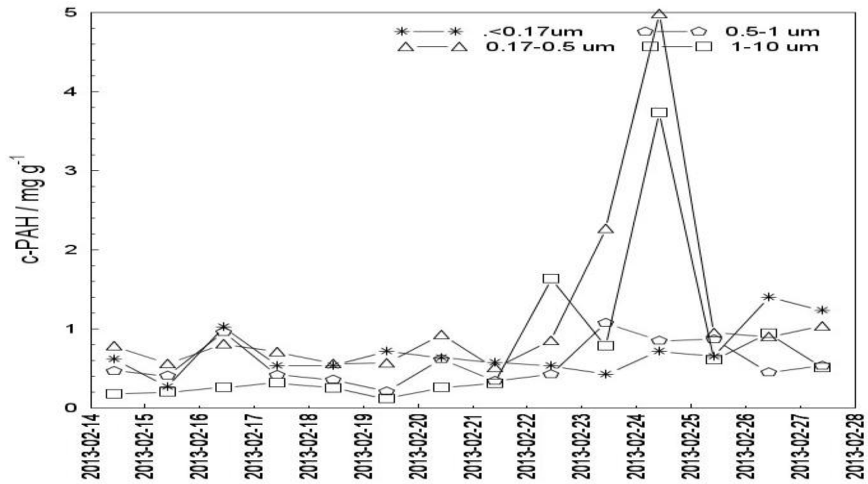


Fig. 1: C-PAHs concentration per aerosol mass ($mg.g^{-1}$) in Mladá Boleslav

CONCLUSIONS

Concentration dynamics of eight types of carcinogenic polycyclic aromatic hydrocarbons c-PAH in the organic extracts from size-segregated aerosol were studied. Aerosol samples were collected in Mladá Boleslav locality from the 14th to 27st February 2013. In the coarse fraction (1<dae<10 µm) was in avarage 4,14 ngm^{-3}, upper accumulation (0.5< dae<1 µm) 9,37 ngm^{-3}, and lower accumulation (0.17< dae<0.5 µm), and in ultrafine (dae<0.17 µm) 1,33 ngm^{-3}. C-PAH size distribution was always monomodal (peak 0.5-1 µm). Percentage of each c-PAH was: B[a]A 14; CHRY 20; B[b]F 20; B[k]F 9; B[a]P 15; DB[ah]A 1; B[ghi]P 11; I[cd]P 11 %. C-PAH concentrations in aerosol were high and ranged from 0,1 to 1 $mg.g^{-1}$ and for 5 days long period were concentrations from 1 to 5 $mg.g^{-1}$.

ACKNOWLEDGEMENTS

This study was supported by GA ČR (P503/12/G147).

REFERENCES

Bendl, J., Hovorka, J., Topinka, J. (2014): Velikostní distribuce k-PAU na lokalitě Mladá Boleslav v zimě 2013. Ochrana ovzduší 26 (1-2): 19-21

Hovorka, J., Topinka, J., Bendl, J., Baranová, A., Pokorná, P., Braniš, M. (2012): Podrobná charakterizace atmosférického aerosolu v lokalitě Ostrava - Radvanice v zimě 2012: Velikostní distribuce k-PAU. Ochrana ovzduší 24 (5): 40-43

Finlayson-Pitts, B. J., Pitts, J. N., Jr. (1999) Chemistry of the Upper and Lower Atmosphere: Theory, Experiments, and Applications. Academic Press, 436-547. ISBN-9780122570605.

Sonnefeld, W.J., Zoller, W.H., and May, W.E. (1983), Dynamic coupled column liquid chromatographic determination of ambient temperature vapor pressures of polynuclear aromatic hydrocarbons, Anal.Chem., 55, 275-280

Kamens R.M., Odum, R.J., and Fa, Z.H. (1995), Some observation on times to equilibrium for semi-volatile polycyclic aromatic hydrocarbons, Environ. Sci.Technol., 29, 43-50

International Agency for Research on Cancer and World Health Organization, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 92: Some Non-heterocyclic Polycyclic Aromatic Hydrocarbons and Some Related Exposures, (2010) Lyon.

Nielsen T. (1984), Reactivity of PAH towards nitrating species, Environ. Sci.Technol., 18, 157-163

Venkatamaran C. J. M, and Friedlander S. K. (1994), Size distribution of PAH and elemental carbon, Environ. Sci.Technol., 28, 563-572

LONG-TERM DEVELOPMENT IN CHEMISTRY AND COMPOSITION OF BENTHIC MACROINVERTEBRATE COMMUNITY IN ACIDIFIED MOUNTAIN STREAMS

Filip Beneš*, Evžen Stuchlík

Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Benátská 2, CZ-128 44, Prague, Czech Republic
* e-mail: BFilip@seznam.cz

Key words: acidification, benthic macroinvertebrates, recovery, mountain streams

INTRODUCTION

The most significant cause of anthropogenic acidification of surface waters in Central Europe was atmospheric deposition of sulphur and nitrogen oxides and partly of ammonia with the highest levels in 1970s and 1980s (Kopáček et al., 2001; Stuchlík et al., 2002). In the Czech Republic many of mountain streams with low neutralizing capacity were affected by anthropogenic acid deposition (Stuchlík et al., 1997; Veselý & Majer, 1998). The mobility of toxic metals, such as Al^{3+} ions, increases in low pH. Al^{3+} ions are toxic to several groups of benthic macroinvertebrates (Driscoll, 1985), which are used as good bioindicators for the assessment of the impact of acidification (e.g. Fjellheim & Raddum, 1990). Since 1990s many of acidified streams are recovering from acidification due to rapid decline in emissions of sulphur and nitrogen oxides (Kopáček et al., 2001). However, in some cases the hysteresis in chemical recovery has delayed biological recovery of streams from acidification (Kopáček et al., 2002) due to saturation of sulphur and nitrogen compounds in catchments. Hydrological conditions, such as flood (Feeley et al., 2012) or drought (Boulton, 2003), have often negative impacts on abundances and taxonomic richness of benthic macroinvertebrate community. On the other hand, clear-cut logging can sometimes have positive impact on composition of benthic macroinvertebrate community (Banks et al., 2007).

METHODS

Water samples for chemical analyses are filtered on-site through a 40 µm mesh-size polyamide filter. The macroinvertebrate samples are taken by a kicking technique (Frost et al., 1971) with a 500 µm mesh-size hand sieve from 6 different habitats for 30 seconds each, giving the adequate attention to all microhabitats. Collected macroinvertebrates are preserved with ca. 80% ethanol for further laboratory treatment. This is supplemented by qualitative sampling (collecting of larvae from stones and wood in the stream and collecting of adult individuals on the stream banks).

Measurements of pH and specific conductivity at 25°C (SC_{25}), measurements of alkalinity (ANC) by Gran titration, analyses of main ions (SO_4^{2-}, NO_3^-, Cl^-, F^-, H^+, Na^+, K^+, Ca^{2+}, Mg^{2+} and NH_4^+) by ion chromatography, spectrophotometric analyses of reactive aluminium (R-Al) and analyses of total organic carbon (TOC) on Shimadzu TOC analyzer are conducted at the Hydrobiological laboratory of Charles University located in the vicinity of the Blatná town. Benthic macroinvertebrate larvae are sorted and identified at least to the genus level or species level, if possible. Hydrological and meteorological data from almost every site are measured automatically.

RESULTS AND DISCUSSION

A study of development and changes in chemistry and composition of macroinvertebrate community in a strongly acidified mountain stream in the Brdy Mountains (the Czech Republic) was performed one decade after the first study. Significant decline in concentrations of SO_4^{2-} ions and reactive aluminium (R-Al) and other ions was detected over the period of 1999-2010. This fact refers to ongoing process of recovery from acidification of this stream, even though we did not detect any significant change in pH. Similar changes in water chemistry were recently detected in streams and lakes in the Bohemian Forest (the Czech Republic), too (Kopáček et al., 2013; Vrba et al., 2014). The fact of chemical recovery from acidification was supported with the occurrence of less acid-tolerant stonefly *Diura bicaudata* and caddisfly *Rhyacophila* sp. that indicates the first signs of biological recovery of the stream from acidification. Almost two-fold increase in taxonomic richness in 2010 compared to 1999 and quite significant increase of total organic carbon (TOC) over the period of 1999-2010 was observed. This can be partly attributed to the effect of logging (Banks et al., 2007).

CONCLUSION

Based on these and previously published results (Horecký et al., 2006, 2013; Hardekopf et al., 2008), we can expect similar development not only in the Brdy Mountains and in the Bohemian Forest, but also at other sites studied by our research group in the Czech Republic, such as the Jizera Mountains and the Slavkov Forest. In the future we can also expect a return of other less acid-tolerant taxa into strongly acidified streams at these study areas as the consequence of their recovery from acidification.

ACKNOWLEDGEMENTS

This research is supported by Czech participation in UNECE, ICP Waters and ICP IM projects and by the Czech Science Foundation – GACR grant No. P503-14-09231S, which coordinator is prof. Evžen Stuchlík.

REFERENCES

Banks, J.L., Li, J., Herlihy, A.T. (2007): Influence of clearcut logging, flow duration, and season on emergent aquatic insects in headwater streams of the Central Oregon Coast Range. Journal of the North American Benthological Society 26 (4), 620 – 632.

Boulton, A.J. (2003): Parallels and contrasts in the effects of drought on stream macroinvertebrate assemblages. Freshwater Biology 48, 1173 – 1185.

Driscoll, Ch.T. (1985): Aluminum in Acidic Surface Waters: Chemistry, Transport and Effects. Environmental Health Perspectives, vol. 63, 93 – 104.

Feeley, H.B., Davis, S., Bruen, M., Blacklocke, S., Kelly-Quinn, M. (2012): The impact of a catastrophic storm event on benthic macroinvertebrate communities in upland headwater streams and potential implications for ecological diversity and assessment of ecological status. Journal of Limnology 71 (2), 299 – 308.

Fjellheim, A., Raddum, G.G. (1990): Acid precipitation: Biological monitoring of streams and lakes. Science of The Total Environment 96, issues 1 – 2: 57 – 66.

Frost, S., Huni, A., Kershaw, W.E. (1971): Evaluation of kicking technique for sampling stream bottom fauna. Canadian Journal of Zoology 49, 167 – 173.

Hardekopf, D.W., Horecký, J., Kopáček, J., Stuchlík, E. (2008): Predicting long-term recovery of a strongly acidified stream using MAGIC and climate models (Litavka, Czech Republic). Hydrology and Earth System Science 12, 479 – 490.

Horecký, J., Stuchlík, E., Chvojka, P., Hardekopf, D.W., Mihaljevič, M., Špaček, J. (2006): Macroinvertebrate community and chemistry of the most atmospherically acidified streams in the Czech Republic. Water, Air, and Soil Pollution 173, 261 – 272.

Horecký, J., Rucki, J., Krám, P., Křeček, J., Bitušík, P., Špaček, J., Stuchlík, E. (2013): Differences in benthic macroinvertebrate structure of headwater streams with extreme hydrochemistry. Biologia 68/2, 303 – 313.

Kopáček, J., Veselý, J., Stuchlík, E. (2001): Sulphur and nitrogen fluxes and budgets in the Bohemian Forest and Tatra Mountains during the Industrial Revolution (1850-2000). Hydrology and Earth System Sciences 5 (3), 391 – 405.

Kopáček, J., Stuchlík, E., Veselý, J., Schaumburg, J., Anderson, I.C., Fott, J., Hejzlar, J., Vrba, J. (2002): Hysteresis in reversal of Central European mountain lakes from atmospheric acidification. Water, Air and Soil Pollution, Focus 2, 91 – 114.

Kopáček, J., Fluksová, H., Hejzlar, J., Kaňa, J., Porcal, P., Turek, J., Žaloudík, J. (2013): Chemistry of tributaries to Plešné and Čertovo lakes during 1998-2012. Silva Gabreta, vol. 19 (3), Vimperk, 105 – 137.

Stuchlík, E., Hořická, Z., Prchalová, M., Křeček, J., Barica, J. (1997): Hydrobiological investigation of three acidified reservoirs in the Jizera Mountains, the Czech Republic, during the summer stratification. Can. Tech. Rep. Fish. Aquat. Sci. 2155, 56 – 64.

Stuchlík, E., Appleby, P., Bitušík, P., Curtis, C., Fott, J., Kopáček, J., Pražáková, M., Rose, N., Strunecký, O., Wright, R.F. (2002): Reconstruction of long-term changes in lake water chemistry, zooplankton and benthos of a small acidified high-mountain lake: MAGIC modelling and palaeolimnological analysis. Water, Air and Soil Pollution, Focus 2, 127 – 138.

Veselý, J., Majer, V. (1998): Hydrogeochemical mapping of Czech freshwaters. Bulletin of Czech Geological Survey 73, 183 – 192.

Vrba, J., Kopáček, J., Fott, J., Nedbalová, L. (2014): Forest Die-Back Modified Plankton Recovery from Acidic Stress. AMBIO – A Journal of the Human Environment, vol. 43, No. 2, 207 – 217.

ECOLOGICAL TRAITS ACCOUNTING FOR BIRD SPECIES SENSITIVITY TO THE BLACK LOCUST INVASION

Jan Hanzelka[1], Jiří Reif[1]
[1]Institute for Environmental Studies, Faculty of Science, Charles University in Prague,
Benátská 2, 128 01 Prague 2, Czech Republic
jan.hanzelka@natur.cuni.cz

Keywords: forest birds, black locust, habitat specialization, life-history strategy

INTRODUCTION

Biological invasions rank among the top threats to biodiversity worldwide. Here we focused on the impact of the black locust (*Robinia pseudoacacia*) invasion on birds in the Czech Republic. We investigated the ecological traits of bird species occupying invasive black locust and native oak tree stands to reveal which of them are the strongest predictors of bird sensitivity to the black locust invasion. Specifically, we used habitat specialization and life-history strategy in our analysis. We predicted that the species more closely associated with the invaded stands will be habitat generalists and species with fast life history strategies.

METHODS

We performed a detailed mapping of bird occurrence on 15 plots located in the native oak stands and on 15 plots in the invaded stands. Birds were counted using simplified spot mapping technique (Bibby et al. 2000) during three visits in the peak breeding season from April to June. Species' habitat specialization was quantified using species specialization index (SSI, see Julliard et al. 2006) as a coefficient of variation of abundance of a given species across several habitat types. SSI of particular species recorded on our study plots was adopted from Reif et al. (2010). Species' life-history strategy was expressed as its position along a gradient from "K-selected" to "r-selected" species describing the slow-fast continuum. The values determining species' position along the gradient were extracted from Koleček & Reif (2011).
We expressed the relationship between birds and forest type using redundancy analysis (RDA). From this RDA, we extracted the species' scores for the first axis quantifying particular bird species' susceptibility to the black locust invasion. Subsequently we related the species scores to SSI and life-history strategy by the means of phylogenetic comparative analysis performed across species. We applied the phylogenetic generalized least-squares regression (PGLS) with model averaging based on Akaike's Information Criterion corrected for small sample sizes (AICc).

RESULTS AND DISCUSSION

The first axis of RDA explained 9.8 % of the variability in bird community composition. This part of variability in bird community structure accounted by the black locust invasion was statistically significant (pseudo-F = 3.04, $p < 0.01$) and provides evidence that the black locust invasion alters species composition in forest bird assemblages. The species most tightly associated with the oak stands were, for example, the Middle-spotted Woodpecker, the Black Woodpecker, the Wood Warbler or the Hawfinch. By contrast, the species such as the Chiffchaff, the Blackcap or the Song Thrush were those the most tightly associated with the black locust stands (Fig. 1).
In the next step, we explored the effects of the traits, i.e. SSI and life history strategy. From the five candidate models, only the model containing solely SSI received considerable support according to AICc. This best performing model explained 22 % of variation in birds' susceptibility to the black locust invasion. The models containing life history strategy showed lower performance. The effect of SSI was significantly negative: slope = -0.30, SE = 0.11, $t = -2.78$, $p = 0.011$. It means that species with the lowest SSI are mostly associated with black locust stands, whereas the species with the highest SSI are mostly associated with the oak stands (Fig. 2).
Lower abundance of habitat specialists in invaded stands could be the consequence of lack of some specific food types. It is possible that some insect species dependent on the plants supressed by the black locust can be missing in invaded habitat.

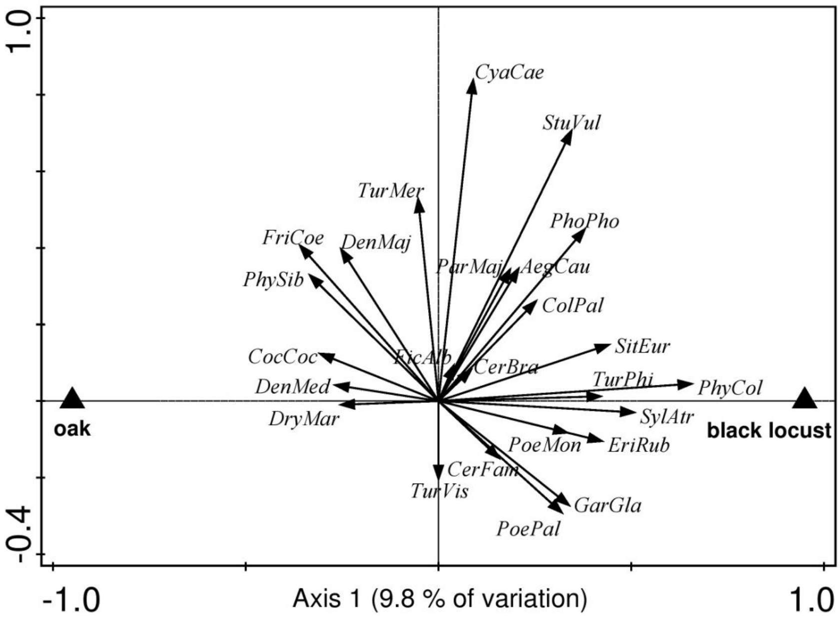


Fig.1 Redundancy analysis ordination plot showing the relation of the bird species to the forest type. Axis 1 expresses the bird species' association with the oak and the black locust stands. The positions of particular species can be thus viewed as indicator of species' susceptibility to the black locust invasion.

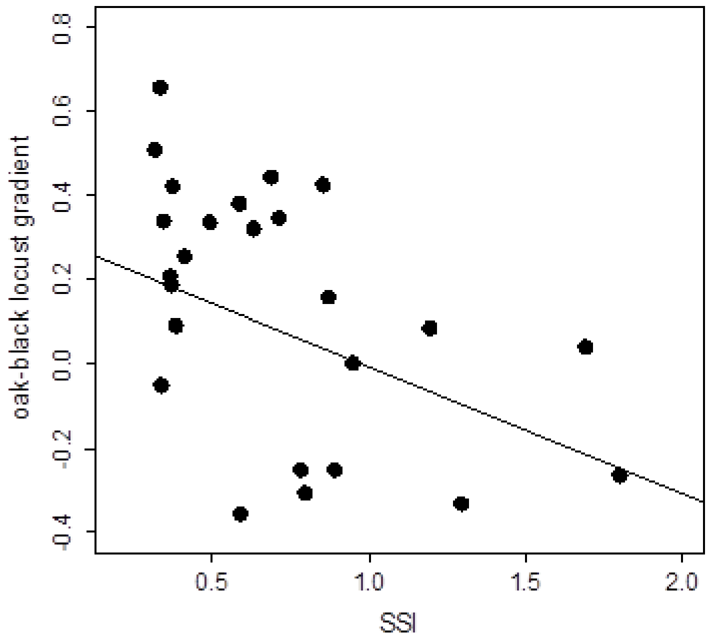


Fig. 2 The relationship between the bird species' position along the gradient from the native oak to the invaded black locust stands (see Fig. 1) and their habitat specialization (SSI)

CONCLUSIONS

Habitat specialists were strongly associated with the native oak stands, while habitat generalists were associated with the black locust stands. Our study implies that the spread of invasive plants may significantly contribute to the frequently reported replacement of specialist bird species by habitat generalists in local communities.

REFERENCES

Bibby CJ, Burgess ND, Hill DA & Mustoe SH. 2000. *Bird census techniques*. Academic Press, London.

Koleček J & Reif J. 2011. Differences between the predictors of abundance, trend and distribution as three measures of avian population change. *Acta Ornithol* 46:143–153.

Reif J, Jiguet F & Šťastný K. 2010. Habitat specialisation of birds in the Czech Republic: comparison of objective measures with expert opinion. *Bird Study* 52:197–212.

Influence of catchment characteristics on lake water chemistry in the Tatra Mountains (Slovakia)

Marie Hynštová, Evžen Stuchlík
Institute for Environmental Studies, Charles University in Prague, Benatska 2, CZ-12801 Prague 2, Czech Republic
marie.hynstova@natur.cuni.cz

Keywords: water chemistry, catchment, digital elevation model, recovery from acidification

INTRODUCTION

The study deals with catchments of the alpine lakes in the High Tatra Mountains (Slovakia). The lakes were subject of a long-term monitoring to detect chemical and biotic composition changes of lake water induced by acid atmospheric deposition and by its decline (e.g. Stuchlík et al. 1985, Fott et al. 1994, Stuchlík et al., 2002, Hořická et al. 2006, Kopáček et al. 2006, Stuchlík et al. 2006, Sacherová et al. 2006). The studied processes required a quantitative approach to describe the characteristics of the catchments. The concept of catchment influence on lake water quality is in agreement with findings of ongoing research. However, the definition and precision of lacking and estimated catchment parameters was not allowed without current technical and computing equipment because of the complexity of mountainous terrain.

METHODS

The key facility for studying relation between lake and its catchment was high resolution digital elevation model (2 × 2 m) of studied area. The morphological parameters (slope, altitude, aspect, real surface area) for 26 catchments were obtained by analysis of the digital elevation model using tools of geographic information system. The land cover was detected by aerial images. The catchment characteristics were correlated with water composition to response a different pace of recovering from acidification after the decline in acid deposition.

RESULTS AND DISCUSSION

One of the water quality indicators, sum of the base (Ca, Mg) cations, was positively correlated with the average slope of catchment that means the decrease in base cations leaching was pronounced in steeper catchments (Fig. 1). This pattern was observed only in southern hillside of the Tatra Mts range ($R^2 = 52$, $p < 0.01$), with exception of Malé Hincovo lake (empty circle). The decline of the lake water nitrate concentration was more advanced in a rock or moraine-rock type of catchment and with a lowering proportion of meadow and dwarf pine in catchment.

These results are not in contradiction with previous studies in this lake area, suggesting the role of type vegetation proportion and indirectly pool of soil in catchment as drivers of run-off composition (Kopáček et al. 2004).

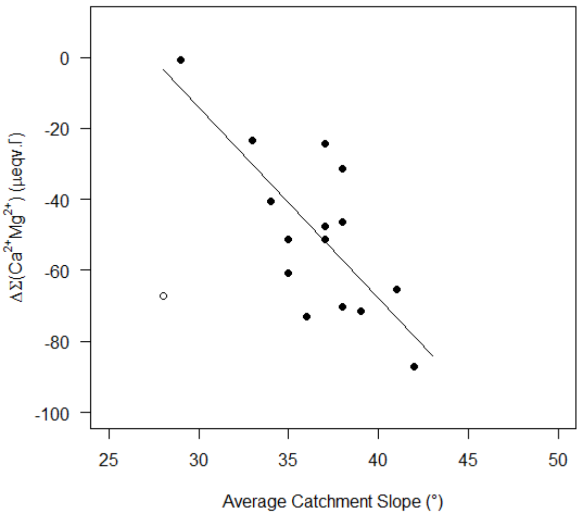


Fig. 1 The magnitude of change in sum of the Ca and Mg cations (1993-2006) and average slope of catchment.

CONCLUSIONS

This early results show the possibility of use the precisely derived catchment parameters from the digital elevation model in order to find out their effect on lake water chemistry in the process of recovery from acidification with a following prediction about the future change of lake communities with a focus on relict and rare species.

ACKNOWLEDGEMENTS

The project is supported by GAČR 14-09231S: Disentangling the effects of changing environmental chemistry and climate on biogeochemistry and biodiversity of natural alpine soils and waters.

REFERENCES

Fott J, Pražáková M, Stuchlík E & Stuchlíková Z. 1994. Acidification fo lakes in Šumava (Bohemia) and in the High Tatra Mountains (Slovakia). *Hydrobiologia*, *274*, 37–47.

Hořická Z, Stuchlík E, Hudec I, Černý M & Fott J. 2006. Acidification and the structure of crustacean zooplankton in mountain lakes: The Tatra Mountains (Slovakia, Poland). *Biologia*, *61*(S18), 121–134.

Kopáček J, Kaňa J, Šantrůčková H, Picek T & Stuchlík E. 2004. Chemical and biochemical characteristics of alpine soils in the tatra mountains and their correlation with lake water quality. *Water, Air, and Soil Pollution*, *153*, 307–327.

Kopáček J, Stuchlík E & Hardekopf D. 2006. Chemical composition of the Tatra Mountain lakes: Recovery from acidification. *Biologia*, *61*(S18), 21–33.

Sacherová V, Kršková R, Stuchlík E & Hořická Z. 2006. Long-term change of the littoral Cladocera in the Tatra Mountain lakes through a major acidification event. *Biologia*, *61*(18), 109–119.

Stuchlík E, Appleby P, Bitušík P, Curtis C, Fott J, Kopáček J, … Wright R. F. 2002. Reconstruction of long-term changes in lake water chemistry, zooplankton and benthos of a small, acidified high-mountain lake: MAGIC modellinf and palaeolimnological analysis. *Water, Air, and Soil Pollution*, *2*, 127–138.

Stuchlík E, Kopáček J, Fott J & Hořická Z. 2006. Chemical composition of the Tatra Mountain lakes: Response to acidification. *Biologia*, *61*(S18), 11–20.

Stuchlík E, Stuchlíková Z, Fott J, Růžička L & Vrba J. 1985. Vliv kyselých srážek na vody na území tatranského národního parku. *Zborník Prác O Tatranskom Národnom Parku*, *26*, 173–212.

CARBON DIOXIDE AND METHANE EMISSIONS FROM WOOD ANT NESTS

Veronika Jílková[1], Tomáš Picek[2], Jan Frouz[1,3]

[1] Institute for Environmental Studies, Charles University in Prague
[2] Faculty of Science, University of South Bohemia, České Budějovice
[3] Institute of Soil Biology, The Czech Academy of Sciences, České Budějovice

jilkova.veronika@gmail.com

Keywords: temperate forest, CH_4 oxidation, respiration, metabolic activity, microorganisms

INTRODUCTION

Wood ants build large, long-lasting nests which are known as hot spots of CO_2 production in forest ecosystems due to ant and microbial respiration (Domisch et al. 2006; Jílková & Frouz 2014; Risch et al. 2005). Temperate forest soils are important sinks of CH_4 (Smith et al. 2003). Wood ant nests have even more favorable conditions for CH_4 oxidation, such as good porosity and low moisture content (Adamsen & King 1993; Borken et al. 2006; Dutaur & Verchot 2007; Le Mer & Roger 2001). However, little is known about CH_4 flux and seasonal changes in CO_2 production in wood ant nests.

METHODS

The study was carried out in a temperate spruce forest on the southern slope of Kleť mountain in South Bohemia. Gas samples were taken eight times (at 1- to 2-month intervals) from July 2013 to May 2014 from static chambers inserted into the slope of six ant nests and to the surrounding forest floor. Gas concentration was then analyzed in a laboratory using gas chromatography.

RESULTS AND DISCUSSION

Ant nest mounds oxidized less CH_4 (-16±19 µg $CH_4 \cdot m^{-2} \cdot h^{-1}$) than the forest floor (-44±18µg $CH_4 \cdot m^{-2} \cdot h^{-1}$) (Fig. 1a). CH_4 flux did not show a strong seasonal pattern and was negative in ant nest mounds and forest soil even in winter when the soil was frozen. The only exception occurred in ant nest mounds in summer, when CH_4 oxidation was lower. Apparently, there are some conditions in ant nests that hinder CH_4 oxidation or promote CH_4 production. Such conditions could be higher content of monoterpenes contained in coniferous litter used for nest construction (Maurer et al. 2008) or anaerobic conditions which arise around easily decomposable organic matter (Flessa & Beese 1995).

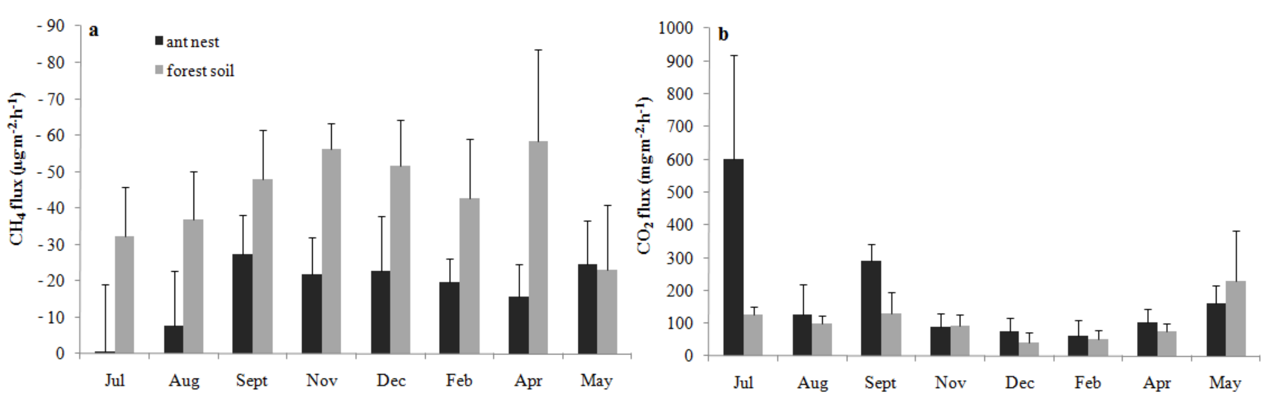


Fig. 1 Seasonal changes in CH_4 flux (a) and CO_2 flux (b) in wood ant nests and the surrounding soil.

Ant nests produced more CO_2 (189±204 μg $CO_2 \cdot m^{-2} \cdot h^{-1}$) than the forest floor (105±80 μg $CO_2 \cdot m^{-2} \cdot h^{-1}$) (Fig. 1b). The biggest difference in CO_2 flux occurred in July when it was almost six times higher in the ant nest mounds than in the forest floor. Ant nests clearly are hot spots of CO_2 production in forest ecosystems as mentioned earlier (Domisch et al. 2006; Jílková & Frouz 2014; Risch et al. 2005). The highest CO_2 production in July could be explained by higher numbers of ant workers occurring in ant nests in summer (Kwapich & Tschinkel 2013) and by higher activity of microorganisms which have enough nutrients and favorable temperature for the metabolic activity (Paul & Clark 1996).

CONCLUSIONS

Ant nest mounds do not significantly contribute to the CH_4 oxidation capacity of the forest soil. CO_2 production was higher in ant nest mounds than in the forest soil, especially in summer.

ACKNOWLEDGEMENTS

This study was supported by the Charles University in Prague, project GA UK No. 574213.

REFERENCES

Adamsen APS & King GM. 1993. Methane consumption in temperate and subarctic forest soils: rates, vertical zonation, and responses to water and nitrogen. *Appl. Environ. Microb.* 59:485-490.

Borken W, Davidson EA, Savage K, Sundquist ET & Steudler P. 2006. Effect of summer throughfall exclusion, summer drought, and winter snow cover on methane fluxes in a temperate forest soil. *Soil Biol. Biochem.* 38:1388-1395.

Domisch T, Finer L, Ohashi M, Risch AC, Sundström L, Niemelä P & Jurgensen MF. 2006. Contribution of red wood ant mounds to forest floor CO_2 efflux in boreal coniferous forests. *Soil Biol. Biochem.* 38:2425-2433.

Dutaur L & Verchot LV. 2007. A global inventory of the soil CH_4 sink. *Global Biogeochem. Cy.* 21:GB4013.

Flessa H & Beese F. 1995. Effects of sugarbeet residues on soil redox potential and nitrous oxide emission. *Soil Sci. Soc. Am. J.* 59:1044-1051.

Jílková V & Frouz J. 2014. Contribution of ant and microbial respiration to CO_2 emission from wood ant (*Formica polyctena*) nests. *Eur. J. Soil Biol.* 60:44-48.

Kwapich CL & Tschinkel WR. 2013. Demography, demand, death, and the seasonal allocation of labor in the Florida harvester ant (*Pogonomyrmex badius*). *Behav. Ecol. Sociobiol.* 67:2011–2027.

Le Mer J & Roger P. 2001. Production, oxidation, emission and consumption of methane by soils: A review. *Eur. J. Soil Biol.* 37:25-50.

Maurer D, Kolb S, Haumaier L & Borken W. 2008. Inhibition of atmospheric methane oxidation by monoterpenes in Norway spruce and European beech soils. *Soil Biol. Biochem.* 40:3014-3020.

Paul EA & Clark FE. 1996. *Soil Microbiology and Biochemistry*. Academic Press, San Diego.

Risch AC, Jürgensen MF, Page-Dumroese DS & Schütz M. 2005. The contribution of red wood ants to soil C and N pools and CO_2 emissions in subalpine forests. *Ecology* 86:419-430.

Smith KA, Ball T, Conen F, Dobbie KE, Massheder J & Rey A. 2003. Exchange of greenhouse gases between soil and atmosphere: interactions of soil physical factors and biological processes. *Eur. J. Soil Sci.* 54:779-791.

BEHAVIOUR OF ARTIFICIAL RADIONUCLIDES IN THE HYDROSPHERE

Eva Juranová[1,2], Eduard Hanslík[1]
[1] Department of Radioecology, T. G. Masaryk Water Research Institute, Public Research Institution, Podbabská 30, 160 00 Prague, Czech Republic,
[2] Faculty of Science, Institute for Environmental Studies, Charles University in Prague, Albertov 6, 128 43 Prague, Czech Republic.
eva_juranova@centrum.cz

Keywords: surface water, radioactive contamination, sediments, migration

INTRODUCTION

Artificial radionuclides, which are born in reactor during nuclear reactions, do not occur naturally in the environment (excluding tritium). They have been introduced into it by human activities, predominantly in the last century during atmospheric nuclear weapons tests and the Chernobyl accident. Nowadays, some of these radionuclides, namely caesium 137 (^{137}Cs) and strontium 90 (^{90}Sr), are still present in the water environment in low but measurable amounts (Maringer et al. 2009, Hanslík et al. 2013).

After the Fukushima nuclear accident in 2011, a great attention is focussed to the nuclear safety all over the world. It is not otherwise in the Czech Republic. Despite both Czech nuclear power plants are safe, as proved by stress tests, the nuclear safety concerns also a very improbable case of a severe accident, when radioactive material is released into surrounding environment. A proper estimation of radionuclide behaviour and transport in the water environment would be essential to ensure effective countermeasures.

In our study, we monitored and evaluated the residual contamination of hydrosphere, which represents a background of the accidental contamination. Experience with the old radioactive contamination indicate that sorption on solid particles plays a significant role in migration of radionuclides in the hydrosphere. That is why we focussed onto the characterization of the radionuclide sorption properties in components of hydrosphere, bottom sediments and suspended solids.

METHODS

To set the background conditions, the ^{90}Sr and ^{137}Cs activity concentrations were monitored in hydrosphere at four sites in the Vltava River catchment. The ^{137}Cs concentrations were analysed according to Standard ČSN ISO 10 703 (2008) using gamma-ray spectrometry. ^{90}Sr was determined in water using a standard method after radiochemical separation (Eaton et al. 2005). The evaluated data include also earlier collected results; the data set covers period 1990 (1994) – 2014. The temporal changes in the radionuclide concentrations were evaluated using an equation, adopted from a relationship suggested by Smith & Beresford (2005):

$$c = c_0 \cdot \left(\alpha \cdot e^{-\frac{\ln 2}{T_{eff1}} \cdot t} + (1-\alpha) \cdot e^{-\frac{\ln 2}{T_{eff2}} \cdot t} \right) \qquad (1)$$

where c is radionuclide activity concentration in surface water ($Bq \cdot l^{-1}$)
t time elapsed from the beginning of the monitoring (y),
c_0 activity concentration at the beginning of the observation ($Bq \cdot l^{-1}$),
α empirically determined constant,
T_{eff1}, T_{eff2} effective ecological half-lives of the radionuclide decline (y^{-1}).

To characterize sorption properties in the Vltava and Labe hydrosphere, series of batch experiments were conducted in the laboratory. To prepare the experimental batch, assortment of artificial radionuclides was added to surface water containing suspended solids or to a mixture of bottom sediment and water. After the sorption process reached a steady state, the solid phase was separated from the water and analysed using gammaspectrometry. Based on the analysis results, the distribution coefficients were calculated as a ratio of the radionuclide activity in the solid and water phase.

RESULTS AND DISCUSSION

As the collected data indicate, the effective rate of radionuclide decline changes during the monitoring interval. In the beginning of the observation, the radionuclide concentration is faster (has a shorter effective ecological half-life). Shortly after the contaminating event, fast removal of the radionuclide prevails, such as rapid wash out and run off the site. Later, slower processes become predominant, as most of the radionuclide is tightly bound in the environment and its removal is reluctant.

For both radionuclides, ^{90}Sr and ^{137}Cs, the removal process can be described with two effective ecological half-lives (include also the radiological decay of ^{90}Sr and ^{137}Cs): T_{eff1} is not higher than 3,0 years, T_{eff2} is between 8,1 to 17 years. Nowadays, the residual activity concentrations decrease slowly, which reflects the fact that the radionuclides are tightly fixed in the environment. On the other hand, the decrease is still faster than the radioactive decay itself, which means that the ecological processes are yet significant.

To estimate the radioactive contamination behaviour after a hypothetic recent nuclear accident, distribution coefficients were determined for sediment-surface water and suspended solids-surface water systems, sampled along the Vltava and Labe Rivers. Overall, the results were fluctuating in a wide range, depending on the sampling site and the tested radionuclide itself, too. The average value of the sediment- water distribution coefficient was decreasing in the sequence: $^{139}Ce > ^{134}Cs > ^{133}Ba > ^{241}Am > ^{60}Co > ^{85}Sr > ^{131}I$, in case of suspended solids-water system it was: $^{60}Co > ^{139}Ce > ^{241}Am > ^{133}Ba > ^{131}I > ^{134}Cs > ^{85}Sr$, but this order can vary slightly in particular sites. The evaluated distribution coefficients correspond well the data collected by International Atomic Energy Agency (2010) with respect to their natural variances.

CONCLUSIONS

The ^{137}Cs and ^{90}Sr residual contamination from global fallout and the Chernobyl accident is present in low amounts that are further decreasing at all monitored sites. The decline rate of these radionuclides has slowed down; nowadays, long-term processes of their removal from the water environment dominate. Slow sorption/desorption processes influence the activity decrease at present.

Under the simulated accidental conditions, the experimental results show that sorption onto solid phase is an important factor influencing fate of radioactive substances in hydrosphere, even in an early stage of a nuclear accident. The determined distribution coefficients should enable estimating of the radioactive contamination fate in the hydrosphere of the Vltava and Labe Rivers.

ACKNOWLEDGEMENTS

This work was prepared with the support of project VG20122015088 sponsored by the Czech Ministry of Interior.

REFERENCES

ČSN ISO 10703 (757630). 2008.. Jakost vod - Stanovení objemové aktivity radionuklidů - Metoda spektrometrie záření gama s vysokým rozlišením. ČNI.

Eaton AD, Clesceri LS, Rice EW, Greengerg AE. 2005. *Standard Methods for Examination of Water and Waste Water.* American Public Health Assotiation, Washington, DC.

Hanslík E, Marešová D, Juranová E. 2013. Radioactive Background in Hydrosphere prior to Planned Extension of Nuclear Power Plant. *International Journal of Nuclear Energy Science and Engineering.* 3: 47-55.

IAEA. 2010. *Handbook of parameter values for the prediction of radionuclide transfer in terrestrial and freshwater environments.* International Atomic Energy Agency, Vienna.

Maringer FJ, Gruber V, Hrachowitz M, Baumgartner A, Weilner S, Seidel C. 2009. Long-term monitoring of the Danube river-sampling techniques, radionuclide metrology and radioecological assessment. *Applied radiation and isotopes.* 67: 894-900..

Smith J, Beresford NA. 2005. *Chernobyl: Catastrophe and Consequences.* Chichester : Praxis Publishing Limited, 2005.

Impact of climatic change on bird populations

Michaela Koschová[1], Jiří Reif[12]
[1]*Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Benátská 2, 128 01 Praha 2, CZ*
[2]*Department of Zoology and Laboratory of Ornithology, Faculty of Science, Palacký University Olomouc, tř. Svobody 26, 771 46 Olomouc, CZ*
michaela.koschova@seznam.cz

Keywords: Birds, Climate change, Range shift, Ecological niche, Population trend

INTRODUCTION

Climate plays an important role in population changes of birds. Such changes result in the geographic range shift, which tell us about future assembly of ecological communities. Species ecological traits may explain a proportion of interspecific variability in range shifts. Based on relationship between current species distribution and climatic conditions we can model potential species range expected under given climatic conditions and therefore measure changes in distribution. We can expect shifts will be much larger in a future and we assume that for the conservation is important to know the bird's reaction on emerging climate changes to avoid the double pressure. Our aim is to know which traits are typical for species shifting their range further and which for species with smaller range shift.

METHODS

We counted potential shift in the breeding range for 298 bird species from A Climatic Atlas Of European Breeding birds (Huntley et al. 2007). By digitalizing we obtained the coordinates from which we estimated both area centres (current and future) and we counted the predicted range shift and its direction. Both we related to species ecological traits: habitat variables (niche, specialisation, position on humidity gradient), diet, migration strategy, life history, geographical position of the current range and relatedness to urban areas.

In the next step we included the magnitude of the shift between predictors. We related population trends of 106 species breeding in central Europe to the magnitude because we expect this area will undergo significant changes due to colonization and extinction induced by the climatic changes.

RESULTS AND DISCUSSION

The largest shift was recorded to the north direction whereas the smallest to north-west. Breeding habitat type showed as the strongest predictor for the potential range shift. Largest shift displayed forest and wetland species. Dietary niche proved to be significant after removing the influence of habitat.

Interaction of the magnitude of the shift and the distribution type proved to be significant to. That implies that species shifting the range most with the northern type of distribution have more negative trends in central European populations, than southern species.

Our results highlight the potential limitations because geographical position strongly limits the possibility of the range shift

REFERENCES

Huntley, B., R.E. Green, Y.C. Collingham and S.G. Willis. 2007. *A climatic Atlas of European Breeding Birds*. Lynx Editions, Barcelona, Spain.

URBAN AND SUBURBAN INTERMODAL FRACTION OF ATMOSPHERIC AEROSOL IN WINTER 2014

Jana Kozáková[1, 2], Jan Hovorka[1], Jaroslav Schwarz[2]
[1] Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Benátská 2, 128 01, Praha 2, Czech Republic
[2] Laboratory of Aerosols Chemistry and Physics, Institute of Chemical Process Fundamentals of the ASCR, v. v. i. Rozvojová 1/135, 165 02, Praha 6, Czech Republic
jana.kozakova@gmail.com

Keywords: Intermodal fraction, $PM_{2.5-1}$, Sioutas impactor

INTRODUCTION

Fine (PM_1) and coarse ($PM_{10-2.5}$) aerosols differ not only in size but also in the chemical composition, health effects, type of sources, and others. A dividing line between fine and coarse aerosol is not clearly defined. These fractions overlap in the aerodynamic particle size range 1-2.5 µm, also called the intermodal fraction. Sources of both coarse and fine aerosols contribute to the intermodal fraction to a different extent relating to different meteorological conditions and types of locations. According to several studies, the intermodal fraction highly correlated with coarse aerosol in dry areas during high wind speed episodes (Kegler et al. 2001, Claiborn et al. 2011). In contrast, other studies have shown higher or comparable correlation with fine aerosol (Geller et al. 2012, Jalava et al. 2006).

The aim of this study is to characterize the intermodal fraction in urban and suburban localities and estimate to what extent fine/coarse aerosol sources contribute to this fraction.

METHODS

The measuring campaign took place from 5.2.-7.3.2014 at an urban site (Ostrava Radvanice) and a suburban site (Plesná), Czech Republic. The urban site Radvanice is the residential area near a large industrial zone (southwest of the site) and traffic roads. The suburban site Plesná is the residential area situated on the northwestern outskirts of the Ostrava city. At both sites, we measured with various online and offline instruments. The results obtained daily using Personal Cascade Impactor Sampler (PCIS) are presented in this abstract.

RESULTS AND DISCUSION

The results from PCIS showed that the intermodal fraction represented 3 - 26% of the total PM_{10} in both sites. In contrast, PM_1 represented 64 - 93% and $PM_{10-2.5}$ 3 - 29% of the total PM_{10}. The Table 1 summarizes the statistic characterization of 24 hours concentrations from PCIS.

Table 1 The statistic characterization of 24 h concentrations from PCIS.

	Radvanice			Plesná		
	PM_1	$PM_{2.5-1}$	$PM_{10-2.5}$	PM_1	$PM_{2.5-1}$	$PM_{10-2.5}$
Average (µg/m^3)	40.4	3.5	5.1	31.9	2.9	2.4
Median (µg/m^3)	38.5	3.0	4.1	27.7	2.7	2.1
Min (µg/m^3)	14.3	1.7	2.2	9.1	0.7	0.6
Max (µg/m^3)	89.6	10.8	12.2	61.1	7.2	11.3
Standard deviation	16.6	2.1	2.7	15.8	1.9	2.2

The higher average concentrations of all three fractions were observed in Radvanice how we expected due to the large industrial source. $PM_{2.5-1}$ was associated with the coarse fraction in Radvanice and with fine and coarse fractions in Plesná.

Statistical dependence between the intermodal fraction and other monitored variables can be determined with Spearman correlation coefficients (Fig. 1).

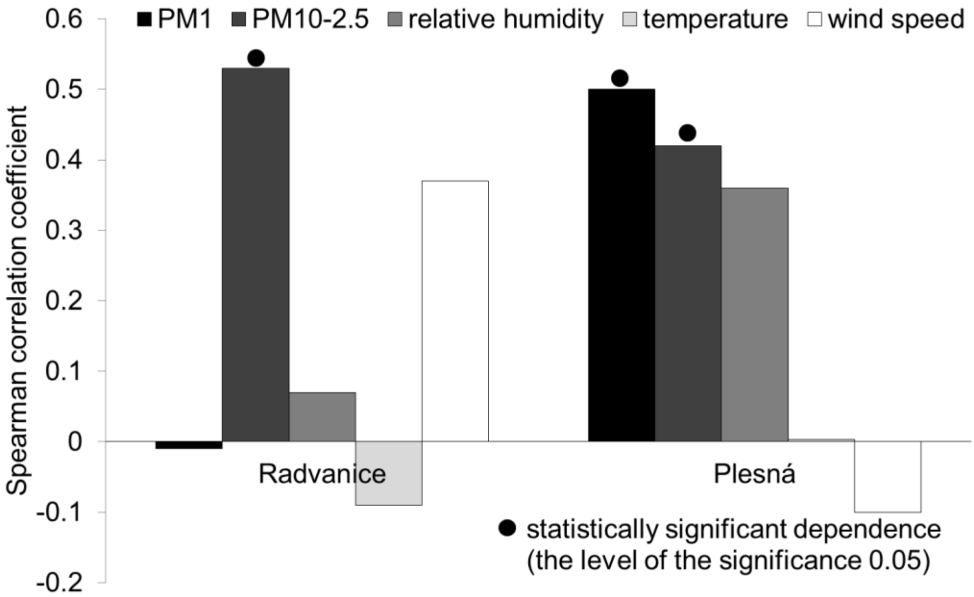


Fig. 1 Spearman correlation coefficients between $PM_{2.5-1}$ and other monitored variables.

A certain positive association was observed also between $PM_{2.5-1}$ and wind speed in Radvanice despite of the result of the test - not statistically significant dependence (p-value 0.06). During days with SW prevailing wind direction (from the industrial source) in Radvanice we observed higher wind speed (1.7 times) and lower PM_1 concentrations (1.6 times) than for days with other prevailing wind direction. It did not apply to the intermodal and coarse fraction (SW prevailing wind direction and higher wind speed - higher concentrations).

In-depth aerosol source identification of the intermodal fraction will be conducted with the help of ion chromatography (IC), inductively coupled plasma mass spectrometry (ICP-MS) and scanning electron microscopy (SEM) applied to aerosol samples.

ACKNOWLEDGEMENT

The project is supported by the Charles University Grant Agency (274213) and the Czech Grant Agency (P503/12/G147).

REFERENCES

Kegler, S.R., Wilson, W. E. and Marcus, A.H. 2001. PM 1, intermodal (PM2.5-1) mass, and the soil component of PM 2.5 in Phoenix, AZ, 1995-1996. *Aerosol Sci. Technol.* 35: 914-920

Claiborn, C.S., Finn, D., Larson, T.V. and Koenig, J.Q. 2011. Windblown dust contributes to high PM2.5 concentrations. J. *Air Waste Manage. Assoc.* 50: 1440-1445

Geller, G.D., Fine, P.M. and Sioutas, C. 2012. The Relationship between real-time and time-integrated coarse (2.5–10 μm), intermodal (1–2.5 μm), and fine (<2.5 μm) particulate matter in the Los Angeles basin. *J. Air Waste Manage. Assoc.* 54: 1029-1039

Jalava, P.I., Salonen, R.O., Halinen, A.I., Penttinen, P., Pennanen, A.S., Sillanpaa, M., Sandell, E., Hillamo, R., Hirvonen, M.-R. 2006. In vitro inflammatory and cytotoxic effects of size-segregated particulate samples collected during long-range transport of wildfire smoke to Helsinki., *Toxicology and Applied Pharmacology*. 215: 341-353

COMPARISON OF SUMMER AND WINTER SUBMICRON AEROSOL COMPOSITION STUDIED BY THE AEROSOL MASS SPECTROMETER

Lucie Kubelová [1,2], Petr Vodička[2], Jaroslav Schwarz[2], Vladimír Ždímal[2]
[1] Department of Environmental Studies, Faculty of Science, Charles University, Prague, Czech Republic,
[2] Laboratory of Aerosol Chemistry and Physics, ICPF, AS CR, Prague, Czech Republic
kubelova@icpf.cas.cz

Keywords: Atmospheric aerosol, Chemical composition, Aerosol Mass Spectrometer, PM1

INTRODUCTION

Aerosol particles are proven to affect climate change, visibility, and human health. To gain a better understanding of their origin and behavior, it is necessary to describe their chemical composition and number size distribution with a high time-resolution. In the Czech Republic or any of its neighboring countries except Germany, no results have been published from high time-resolution measurement of carbonaceous aerosol yet.

This abstract summarizes the results of two measurement campaigns conducted at a Prague background station Suchdol with focus on data from the compact-Time of Flight-Aerosol Mass Spectrometer (c-ToF-AMS). The data were collected during summer 2012 and winter 2013.

METHODS

The measurements were done at Prague Suchdol suburban site, which is located approximately six kilometers north west from the Prague city center. During the two measurement campaigns, we deployed the compact Time of Flight Aerosol Mass Spectrometer(c-ToF-AMS), field Organic Carbon/Elemental Carbon (OC/EC) analyzer and PM1 filter sampling analyzed by Ion Chromatography (IC). The c-ToF-AMS provided us with highly time resolved chemical composition and size distribution of aerosol particles (Drewnick 2005). The aerosol was analyzed with one minute time resolution. The vaporization and ionization occurred at 600°C and 70eV, respectively. To calculate air mass trajectories, we used the HYSPLIT model (Draxler & Hess 1998). Daily trends and wind roses were calculated using the OPENAIR software (Ropkins & Carslaw, 2012).

RESULTS AND DISCUSSION

To obtain correct mass concentration using the AMS, it is necessary to set correct Collection Efficiency (CE), i.e. the fraction of particles that are detected by the instrument from all particles introduced to the system. In order to determine an appropriate value of CE for our measurement, we compared AMS data with results from Ion Chromatography (IC). We found that for our summer and winter campaign the appropriate CEs were 0.29 and 0.35, respectively. This result was justified by further comparison of AMS data with data obtained by Scanning Mobility Particle Sizer (SMPS) and field OC/EC analyzer.

By comparison of the c-ToF-AMS data with the results of the HYSPLIT model, we found a clear inverse relation between the boundary layer thickness and the level of pollution. Furthermore, we selected episodes of significantly higher and lower pollution level from the whole measurement campaign and compared them with the air mass trajectories. Episodes of higher pollution were connected with arrival of continental air masses whereas episodes of lower pollution with arrival of marine air masses.

Next, we calculated the diurnal cycles and wind roses using the OpenAir Software. The diurnal cycles of total aerosol concentration measured by the c-ToF-AMS had maxima in the morning and minima in the afternoon. The maxima coincided with the morning traffic whereas the minima was caused mainly by the dilution effect of the boundary layer height. This trend applied to all species except sulphate. Sulphate showed two maxima in the afternoon which we explain as products of photochemical reactions and long range transport from upper parts of the atmosphere as the boundary layer increases.

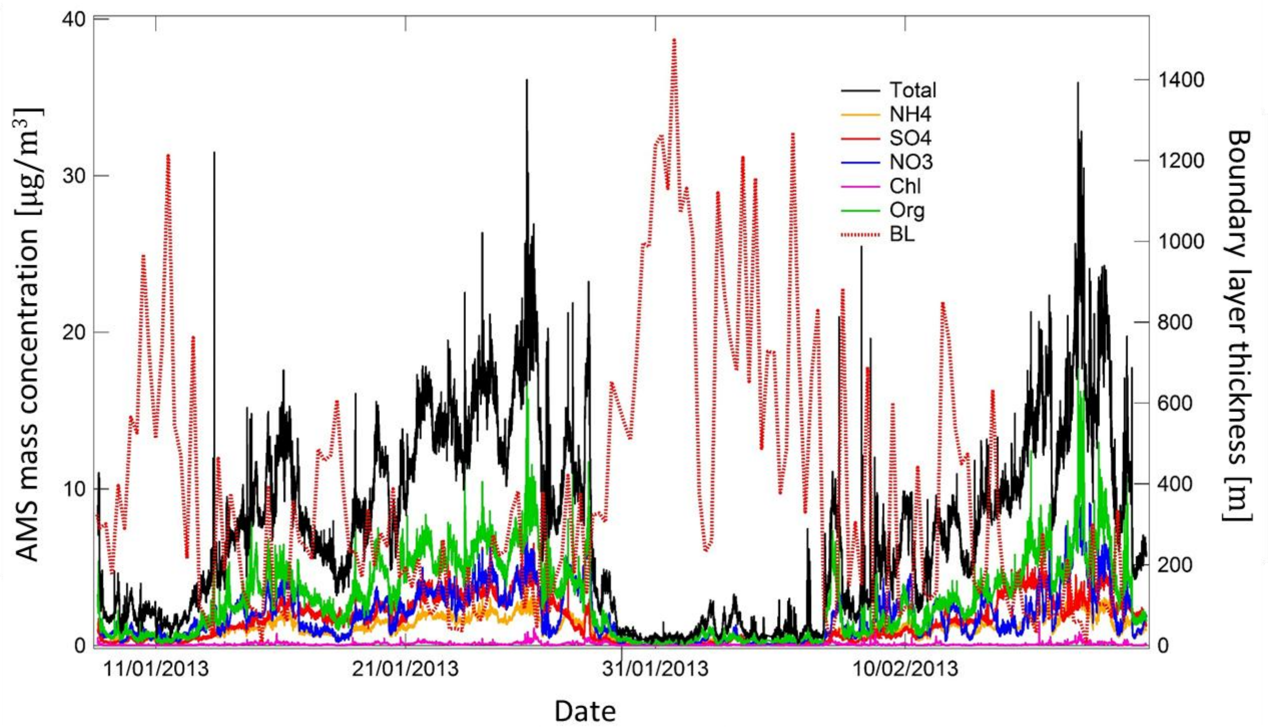


Fig.1 Time evolution of the main aerosol compounds measured and boundary layer.

We also carried out the analysis of organic fragments f43, f44, and f60, i.e. the ratio of particular mass to charge fragment versus the total organic mass. The values of f43 and f44 point to the oxidation state of the aerosol, whereas the value of f60 indicates the influence of biomass burning. We found that winter organic aerosol was influenced by biomass burning (unlike the summer one) and it was of local origin.

CONCLUSIONS

We analyzed data from summer and winter campaign measured by the c-ToF-AMS. The data were compared with results from the HYSPLIT model. We found a clear inverse relationship between total level of pollutants and the boundary level height. The episodes of low pollution were connected with arrival of maritime air masses and episodes of high pollution with arrival of continental air masses. Calculated daily cycles revealed influence of daily traffic, dilution effect and transport from upper parts of the atmosphere. The analysis of organic fragments revealed that winter organic aerosol was of local origin and strongly influenced by biomass burning compared to the summer organics.

ACKNOWLEDGEMENTS

The authors of this work gratefully appreciate financial support by the Czech Science Foundation under project No. CSF P209/11/1342.

REFERENCES

Draxler RR, Hess GD 1998. An overview of the HYSPLIT_4 modeling system of trajectories, dispersion, and deposition. *Aust Meteor Mag*, 47: 295-308.

Drewnick F, Hings S, DeCarlo PF, Jayne JT, Gonin M, Fuhrer K, Weimer S, Jimenez JL, Demerjian KL, Borrman S, Wornsnop DR 2005. A new time-of-flight aerosol mass spectrometer (TOF-AMS) - Instrument description and first field deployment, *Aerosol Sci Techno*, 39: 637-658.

Ropkins K, Carslaw D, 2012. openair - Data Analysis Tools for the Air Quality Community. *The R Journal*. 4: 20–29.

INTERACTION OF MICROBIAL COMMUNITY AND LITTER QUALITY AND ITS ROLE ON SOIL ORGANIC MATTER DECOMPOSITION

Jaroslav Kukla[1], Jan Frouz[1]
[1]Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Benátská 2, CZ12800 Praha, Czech Republic
jarda.kukla@email.cz

Keywords: decomposition, litter, microbial community, soil

INTRODUCTION

Litter decomposition, a major determinant of ecosystem functioning, is strongly influenced by the litter quality of different species. We aim to explore controls on litter decomposition dynamics and soil microbial community composition. Microbial biomass, microbial respiration, and litter leaf decomposition were quantified in chronosequences in post-mining sites located in the Sokolov brown-coal mining area.

METHODS

For study of decomposition we used Litterbag method which is widely used in decomposition studies. A large number of litterbags are installed at the start of the experiment and sampled periodically over time. The decomposition rates are determined from the mass loss of the newly shed litter included in the bag (Berg and McClaugherty, 2008). For quantification and composition of soil microbial community we used PLFA (phospholipid-derived fatty acids) method. PLFA analysis is a technique widely used for estimation of the total biomass and to observe broad changes in the soil microbial community (Frostegard and Baath, 1996). We also follow C-to-N ratio. For the measuring of soil respiration was used the ADC BioScientific LCi Analyser. In the soil samples we also used TOC (total organic carbon), HWC (hot water carbon) and fumigation methods.

RESULTS AND DISCUSSION

Three sampling of litterbags were done. Litterbags weight measurement was indicated and showed in Fig. 1. The results look like typical leaf litter decomposition rate (Zhang et al., 2008). For accurate results we need to wait for more sampling.

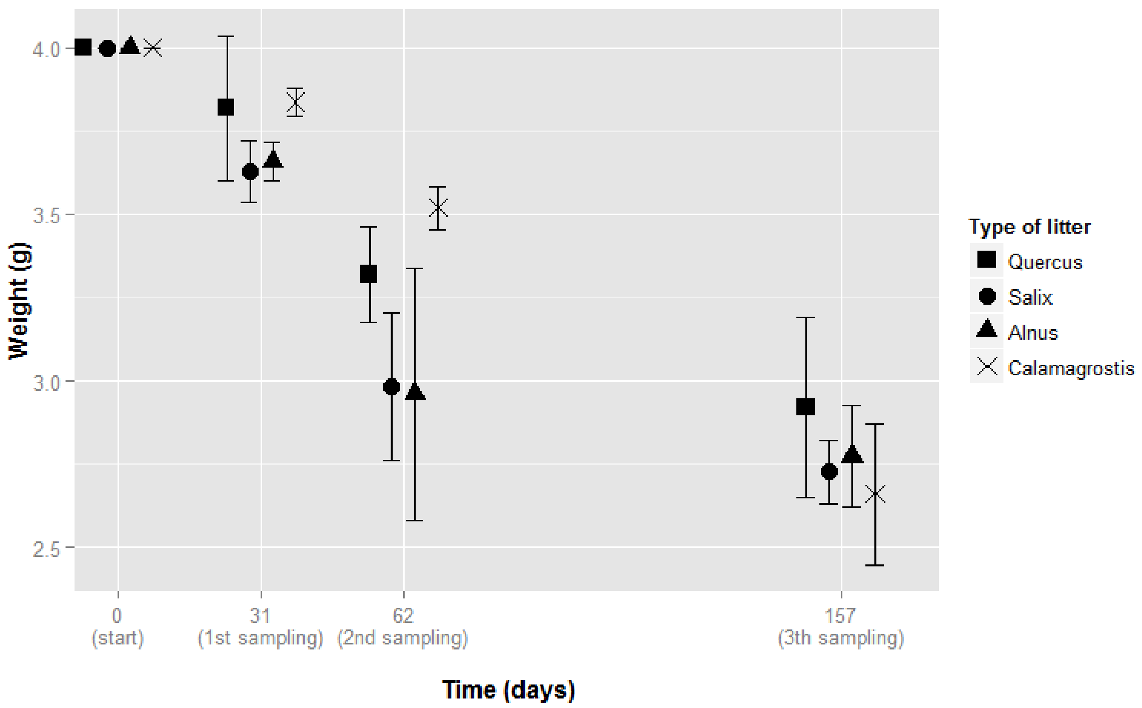


Fig. 1 Different types of leaf litter and its weight loss in time in the Sokolov area. All of these four types of samples were collected in the same day (31, 62, 157).

CONCLUSIONS

We started the experiment which is still going on and we suppose that it will have been finished in 24 months. During the experiment we collect samples. In this time we prepare samples for a chemical analysis and for analysis by GC-MS (Gas chromatography–mass spectrometry).

REFERENCES

Berg, B., and McClaugherty, C. (2008). Plant litter decomposition, humus formation, carbon sequestration (Berlin: Springer).

Frostegard, A., and Baath, E. (1996). The use of phospholipid fatty acid analysis to estimate bacterial and fungal biomass in soil. Biol. Fertil. Soils *22*, 59–65.

Zhang, D., Hui, D., Luo, Y., and Zhou, G. (2008). Rates of litter decomposition in terrestrial ecosystems: global patterns and controlling factors. J. Plant Ecol. *1*, 85–93.

SPATIAL ANALYSIS FOR ENVIRONMENTAL MAPPING OF ŠUMAVA NATIONAL PARK

Lemenkova P.[1]
[1]Charles University in Prague, Faculty of Science, Institute for Environmental Studies
pauline.lemenkova@gmail.com

Keywords: spatial analysis, remote sensing, Šumava National Park, GIS mapping

INTRODUCTION
The study area is Šumava National Park (ŠNP), the largest of the four national parks (68,064 hectares) located in the south-west of Czech Republic, on the border with Germany. Since 1990 it has been the protected Biospherical Reserve of UNESCO (Bilek et al. 1990). Being a unique mosaic of natural and secondary habitats of exceptional natural value of European-wide significance, the components of the ŠNP represent is the largest terrestrial significant part of the Natura 2000 network in Czech Republic and Germany. For instance, the fauna species of ŠNP include protected important examples, such as e.g. lynx, otter and peregrine (Bláha et al. 2013). The ŠNP is established as a special regime of environmental protection with unique biological communities that are the most precious objects of protection.
The area is represented by the vast wooded areas, mountain spruce and mixed forests of various ages, peat bogs, meadows biotops, moors and lakes. Altogether, they create a unique mosaic of biotopes, which encompass a variety of rare, endemic and endangered species, e.g. lynx, pearl mussel, owls, songbirds, etc (Jolecek et al. 1994; Semotanova 1998.). Geobotanically, the ŠNP belongs to the Bohemian Forest, which is split into two national parks, located in Czech Republic and in the adjacent Germany. It forms a unique protected forested area in Central Europe and one of the largest forested areas between the Atlantic Ocean and the Ural (Křenová and Hruska 2012). Geomorphologically, it covers Šumava plains, uplands Železnorudsko, Boubínská, Želnavskou, the Šumava mountains and Vltava furrow (Barešová & Hanusová 2010; Chabera 1998). However, some parts of the ŠNP experienced changes in the landscapes due to both natural climate changes and human impacts which is demonstrated in the undertaken modifications of the environmental zoning of the territory. Thus, since 1991 via 1995 and up to now, the zonation of ŠNP undergone changes, which resulted in the significant (almost double) decrease of Zone I (strictly conserved), slight increase of Zone II and increase of Zone III as well (Křenová and Hruska 2012). Some parts of ŠNP were previously deforested and used for agriculture since the last decades (mainly, from the middle of 20th century). Most of the fields and meadow areas have been abandoned. At the same time, many species are threatened by land-use changes (Bucharová et al. 2012). Other anthropogenic activities in Šumava area include treatments of mountain meadows and soils regularly practiced in the ŠNP: mowing, mulching and leaving fallow. The effects of such treatments includes significantly affected plant species diversity, shifts of dominance among certain species, decrease of the species richness (Maskova et al. 2009). Other triggers of ecosystems changes and ecological community dynamics include multi-year variation of climatic parameters and natural vegetation succession. For example, climate change increases the extinction probability of very small populations (Bucharová et al. 2012). As a result, the vegetation within the mountain ecosystems is gradually changing and degrading due both to anthropogenic effects and natural impacts. At the same time, the character of the rural landscape, strongly influenced by agricultural activity should be maintained in view of decreasing agricultural production. This question of environmentally sustainable management is highly important in the area of Šumava mountains (Cudlinová et al. 1999).

METHODS
The research aim was to analyse how the ecosystem landscapes located within the study area changed since 1991 until 2009 (18-year time span) using remote sensing data and GIS. The data include GIS layers in two forms: raster layers as Landsat TM images with 18-years interval (1991 and 2009), and vector thematic layers in ArcGIS shape-file format. The data were stored in a GIS project. Technically, the GIS project were generated in Quantum GIS (QGIS) software. Methodologically, the applied workflow used in this research included following steps: 1) Data capture, unpacking and storage. 2) Organizing GIS project. 3) Geo-referencing and re-projection. 4) Activating GDAL and GRASS remote sensing plugins. 5) Preliminary data processing. 6) Generating contour layers from DEM. 7) Colour composition from 3 Landsat TM bands. 8) Defining Region of Interest: raster mosaicing and clipping. 9) False colour composites (bands 4-3-2). 10)

Setting up parameters for classification. 11) Image classification using K-Means algorithm. 12) Pattern recognition. 13) Spatial analysis. The detailed illustrations of these steps are shown in the proposed presentation. The GIS analysis is used to test the importance of the natural and human-induced land used changes for survival of the important floristic locations in several case studies. Thus, landscape level predictors of commons (their location, size, borders) are evaluated using geospatial data: vector GIS layers and aerial images. The information received from these data includes digital model of the terrain (altitudes), vertical heterogeneity, slope, topographical related moisture index, heat load index and solar radiation index. The information on local geology and soil conditions (based on soil profiles), history of the colonization of the study area, and borders of land cadasters and private properties is taken from the auxiliary data. The land cover structure is calculated using Patch Analyst function embedded into the ArcGIS which is used to describe various aspects of landscape heterogeneity, habitat diversity and fragmentation.

RESULTS AND DISCUSSION

The outcomes are illustrated by two maps showing geographic distribution of land cover types within the study area in given time periods of 18-year time span. The results demonstrate visualization of the ecosystems in 1991 and 2009 showing dynamics of land cover types in the given time. The work demonstrated effective application of QGIS software combined with multi-source data (remote sensing and geoinformatics) for the purpose of environmental protection of precious areas of the Šumava National Park. The importance of the GIS and remote sensing (RS) data were successfully used for the environmental monitoring since 1970s (rapid development of Earth observation satellite systems and launch of the Landsat TM program). Therefore, the combination of remote sensing data and GIS tool for pattern recognition is proved to be effective tool for geo-botanical research, which is demonstrated in the current research.

CONCLUSIONS

The spatial analysis performed by means of QGIS in combination with remote sensing data (satellite images Landsat TM) for geobotanical studies. The spatio-temporal analysis was applied to raster images taken at 1991 and 2009. Built-in functions of the mathematical algorithms of QGIS enabled to process geospatial data and to derive information for geoecological modelling. The images classification was used to analyse changes in the ŠNP area that consist in different geobotanical land cover types. The results of spatial analysis demonstrated that structure, shape and configuration of landscapes in ŠNP changed since 1991.

ACKNOWLEDGEMENTS

The GIS data (thematic layers of ArcGIS .shp format) which were used in the current work have been generously provided by Dušan Ramportl from Charles University in Prague, Faculty of Science.

REFERENCES

Barešová M. and Hanusová Z. (2010). Zvláště chráněná území ČR - Národní parky - NP Šumava. Online: http://www.kct-tabor.cz/gymta/ChranenaUzemiCR/SumavaNP/index.htm

Bilek M., Kalal J., Bilek J. 1990. South Bohemia and Bohemian Forests information system (Spolek pro popularizaci jižních Čech). Šumava.

Bláha J., Romportl D. and Křenová Z. (2013) Can Natura 2000 mapping be used to zone the Šumava National Park? *European Journal of Environmental Sciences*, Vol. 3 (1), pp. 57–64.

Bucharová A., Brabec J., Münzbergová Z. 2012. Effect of land use and climate change on the future fate of populations of an endemic species in central Europe. *Biological Conservation* 145, 39–47.

Chabera S. 1998. Fyzický zeměpis jižních Čech. Přehled geologie, geomorfologie, horopisu a vodopisu. Jihočeská univerzita, České Budějovice. 139 s.

Cudlinova E., Lapka M., Bartos M. 1999. Problems of agriculture and landscape management as perceived by farmers of the Šumava Mountains (Czech Republic). *Landscape and Urban Planning* 46, 71-82s.

Jolecek M. et al. 1994. Ceska republika. Ucebnice zemepisu. Nakladatelstvi Ceske geograficke spolecnosti

Křenová Z. and Hruska J. (2012) Proper zonation – an essential tool for the future conservation of the Šumava National Park. *European Journal of Environmental Sciences*, 62 (2), No 1.

Maskova Z., Dolezal J., Kvet J., Zemek F. 2009. Long-term functioning of a species-rich mountain meadow under different management regimes. *Agriculture, Ecosystems and Environment* 132, 192–202.

Semotanova E. 1998. Historicka geografie Ceskych zemi. Historicky ustav, Praha, 293 s.

Aerosol particles concentration and size distribution in urban and suburban location

Cecilia Leoni[1], Jan Hovorka[1], Naděžda Ziková[1]

[1]Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Benatska-2, 12801 Prague

leonic@natur.cuni.cz

Keywords: Air pollution, Aerosol size distribution, Ultrafine particles, Industrial Plume

INTRODUCTION

Ostrava is one of the most polluted cities in the Czech Republic and it is considered an *hot spot* for air pollution in Europe (Sram *et al.,* 2013). In the residential district of Ostrava Radvanice and Bartovice the PM_{10} annual limits are often surpassed during winter: daily average concentration of 50 μgm^{-3} was exceeded 87, 116, 118, 148, 113, 109, 202 and 172 times, from 2013 to 2006, respectively (*CHMI*). In consequence of the alarming situation, investigation on air pollutants is needed. This presentation reports field campaign results on: (1) number and volume concentration, and (2) size distribution of particles and (3) relationship with meteorology. The aim of this work is the source identification of the particulate pollutants in Ostrava Radvanice and Bartovice district.

METHODS

A sampling campaign was carried out from the 5th of February to the 7th of March 2014. Ostrava Radvanice and Bartovice (S1) is located at the south-west of Ostrava near a large steel and iron factory (1.5 km distance). The factory is equipped with a sintering plant, three coke batteries, three operative blast furnaces, and four tandem furnaces.

5-minutes integration time particle concentration and size distribution were measured using SMPS model 3936L25 (TSI Inc., size range: 14-723 nm) and APS model 3321 (TSI Inc., size range 0.54-20 μm). The meteorological parameters, including wind speed and direction, were also registered (WindSonic M, Gill). Gaseous components were measured only in S1 with 5 minutes integration time (Horiba analyzers).

Aerosol particle concentration, size distribution and meteorological parameters were measured also in a suburban residential area, Plesná (S2) located at the north-east, 15 km far from Ostrava city centre, in the countryside.

RESULTS AND DISCUSSION

In S1 the average particle concentration in the lower submicrometer range (SMPS size range, with mobility diameter 14-723 nm) was $1.72\cdot10^4$ $\#cm^{-3}$. The average particle volume concentration in the upper submicrometer and in the supermicrometer range (APS size range, with aerodynamic diameter 0.5-20 μm) was 42 $\mu m^3\cdot cm^{-3}$. The dominant size fraction by volume is the coarse fraction from 5 to 20 μm. Both particle number and volume concentration are 3 times higher in S1 than in S2.

Peaks of CO and SO_2 were registered in S1 at the same time with peaks of ultrafine particles, with the size range of 30-40 nm, and of coarse particles (8 μm). The peaks of particle number, volume, SO_2 and CO were respectively 2.8, 4, 7, and 4 times higher than the *off-peak*. The peaks of pollutants are always related with south-western (180°-270°) wind direction and wind speed higher than 1 ms^{-1}.

The size distribution differs in the two sites (*Figure 1*). The fine particles number size distribution was often bimodal with a mode in the accumulation size range (>100 nm) overlapped by the Aitken mode at 30 nm. In S2 the size distribution was mainly unimodal, dominated by an accumulation mode in the size range 80-100 nm. On the contrary, the volume size distribution showed a similar shape in both locations, with bimodal peaks (0.5 and 8 μm).

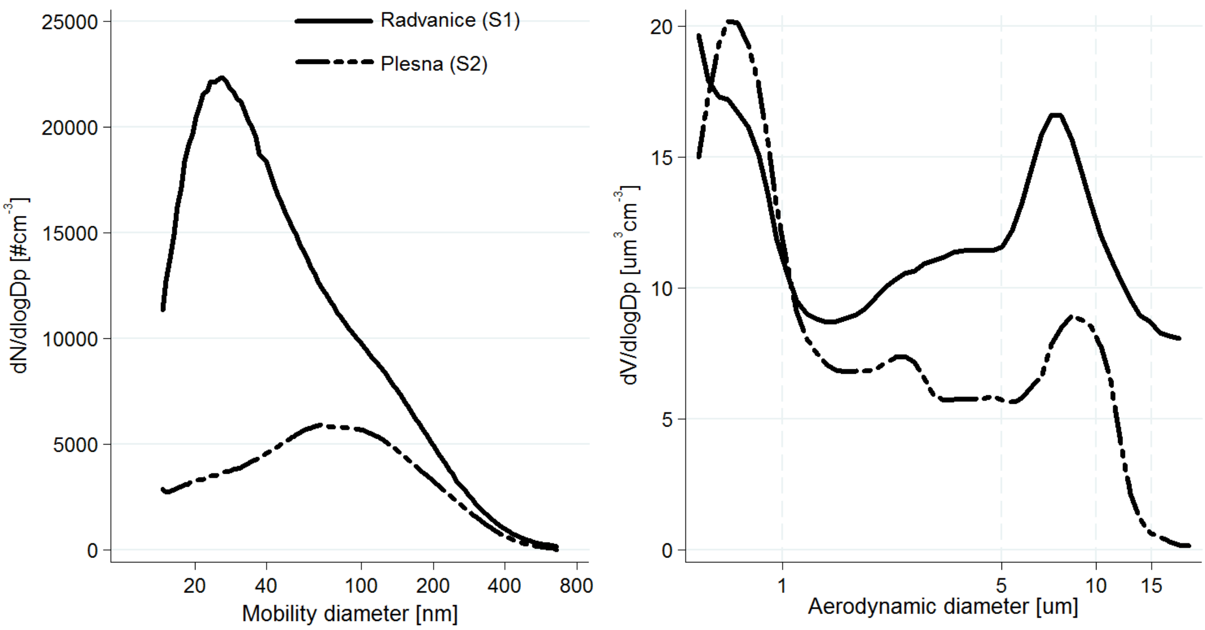


Fig. 1 Aerosol particle number size distribution (left) and volume size distribution (right).

CONCLUSIONS

In S1 the ultrafine particle higher concentration suggests the presence of a nearby source, which is not found in S2. The peaks are strongly wind direction dependent and associated with CO and SO_2, indicating the steelworks plume as the main source. Higher concentration of fine and ultrafine particles near steelworks are registered in previous studies (*Marris et al, 2012; Dall'Osto et al.,2008; Cheng et al., 2008; Moreno et al., 2004; Oravisjarvi et al., 2003*). Sintering process and raw iron production were found as the major sources of coarse $PM_{1.15\text{-}10}$ at the same location (*Pokorná et al., 2015*).

ACKNOWLEDGEMENTS

This work was supported by the Czech Grant Agency (P503/12/G147).

REFERENCES

Dall'Osto et al., 2008, A study of the size distributions and the chemical characterization of airborne particles in the vicinity of a large integrated steelworks, *Aerosol Science and Technology, 42:981–991.*

Marris et al., 2012, Fast changes in chemical composition and size distribution of fine particles during the near-field transport of industrial plumes, *Science of the Total Environment, 427-428, 126-138.*

Menad et al., 2006, Minimization methods for emissions generated from sinter strands: a review, *Journal of Cleaner Product, 14:740-7*

Moreno et al., 2004, Characterization of aerosol particulate matter from urban and industrial environments: examples from Cardiff and Port Talbot, South Wales, UK, *Science of the Total Environment, 334–35:337–346.*

Oravisjarvi K. et al., 2003, Source contributions to $PM_{2.5}$ particles in the urban air of a town situated close to a steel works, *Atmospheric Environment 37, 1013-1022.*

Sram et al., 2013, The European hot spot of B[a]P and $PM_{2.5}$ exposure-the Ostrava region, Czech Republic: health research results, *Hindawi Publishing Corporation, ISRN Public Health, volume 2013, Article ID 416701.*

Pokorná et al., 2015, Source apportionment of size resolved particulate matter at a European air pollution hot spot, *Science of the Total Environment*, 502, 172-183.

Composting for ex situ/on site decontamination of POPs contaminated soils

Ondřej Lhotský[1,2], Monika Stavělová[3], Petra Najmanová[2], Jana Janochová[4], Stefano Covino[4], Tomáš Cajthaml[1,4]
[1]FoS Charles University, [2]Dekonta,a.s., [3]AECOM CZ, [4]Institute of Microbiology of the AS CR
lhotsky@dekonta.cz

Keywords: composting, biodegradation, POPs, contaminated soil, compost substrate

INTRODUCTION

Composting is a process known from ancient times which is widely used nowadays for the stabilization of biodegradable municipal/agro-industrial wastes and the preparation of organic fertilizers. A number of different organic materials can be utilized as compost substrates. The microbial consortia that develop in the composting pile during the process are responsible for the breakdown of organic matter as well as for the degradation of more amenable environmental contaminants (petroleum-derived products, monoaromatics, organic solvents etc.) (US EPA 1998, McNabb et al. 1994). In recent years the degradation of more persistent organic pollutants (PAHs, PCBs and chlorinated pesticides) during composting treatments has been proved (Michael Jr. et al. 1995; Semple et al. 1995, Cajthaml et al. 2002; Šašek et al. 2003). In bioremediation practices, composting consists of mixing of polluted soils with typical compost substrates in order to achieve the decontamination/detoxification of such contaminated matrices. Although co-composting approaches have been already used for remediation at full scale (e.g. by the US Army for the treatment of TNT contaminated soils (US EPA 1997) in case of pollution with POPs there are still some limitations that needs to be overcome to make this an established technology. This presentation will focus mainly on the tests performed to optimize the composting of PAHs contaminated soils so that it could be used in practice.

METHODS

A first set of experiments was aimed at evaluating the suitability of various waste materials and mixtures for the co-composting of PAHs contaminated soils. Two different soils (1st ΣPAHs 370 mg kg-1, the highest concentration of pyrene and fluoranthene; 2nd ΣPAHs 6000 mg kg-1, the highest concentration of phenanthrene and anthracene) and 5 different organic waste mixtures were tested. The volume of each compost pile was approx. 0.75 m^3 and the ratio of soil to organic waste was 1:1 (w/w dry basis). Compost piles were aerated by re-digging the whole content of composters 4 times a year.

Since the beginning of the experiment, temperature in the piles' core, air quality and respiratory gases, were monitored continuously, while concentration of PAHs and microbial parameters (PLFA) were assessed during the thermophilic, cooling and maturation phase throughout a period of 2 years. When the concentrations of PAHs dropped significantly and composts were mature a battery of ecotoxicological and leachate tests was performed.

RESULTS AND DISCUSSION

The analyses proved that PAHs were degraded effectively during the composting process as their degradation in both soils varied from 95 to 98 % after 2 years (with more than 90 % of the initial PAHs content was degraded within the first year). Ecotoxicological tests suggested that no toxic metabolites were produced as there was no toxicity associated to the mature composts. According to our results, the composition of the organic waste does not play a substantial role on the extent of PAHs degradation if suitable humidity and carbon to nitrogen ratio are provided, although some differences in the rate of contaminants degradation were observed.

Next table shows composition of different compost mixtures. And the graphs below show the time development of the PAHs concentration in the compost mixtures. Only one of the prepared mixtures – compost II. did not show significant degradation of PAHs. This was due to the lack of the air in the mixture. Therefore samples of this mixture were not taken in the later phases of the test.

Ecotoxicological tests suggested that no toxic metabolites were produced as there was no toxicity associated to the mature composts.

Table 1: Composition of different compost mixtures

Compost :	I.		II.		III.		IV.		V.	
Character.	BRKO		Grass		Sludge		Chicken litter		Fruits and Vegetables	
C/N	14,0		14,0		26,0		28,5		29,7	
humidity (%)	51,7		62,4		53,8		28,8		37,6	
	component	% of dry matter	component	% of dry matter	component	% of dry matter	component	% of dry matter	component	% of dry matter
	Soil	50	Soil	50	Soil	50	Soil	50	Soil	50
	BRKO	40	Grass	50	Sludge	23	Woodchips	25	Grass	10
	Woodchips	10	x	x	Straw	8	Chicken litter	17	Straw	4
	x	x	x	x	Sawdust	5	Straw	8	fruits and vegetables	11
	x	x	x	x	horse manure	14	x	x	Woodchips	25

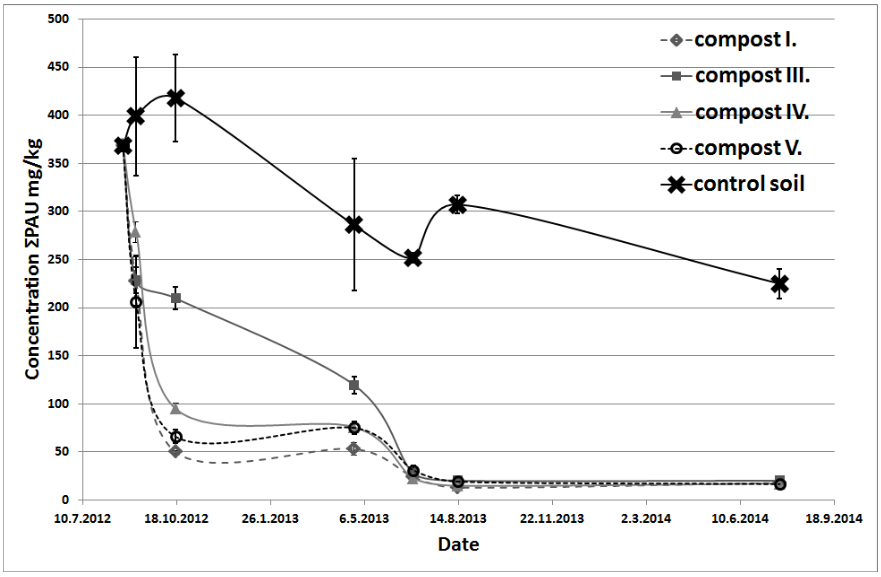


Fig. 1 Time development of the PAHs concentration in different compost mixtures in the 1st soil

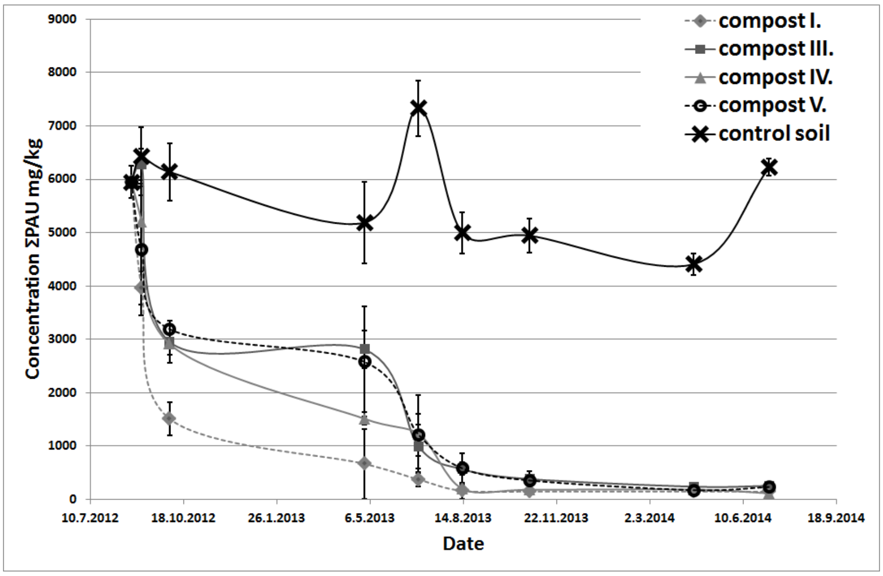


Fig. 2 Time development of the PAHs concentration in different compost mixtures in the 2nd soil

CONCLUSIONS

According to our results, the composition of the organic waste does not play a substantial role on the extent of PAHs degradation if suitable humidity and carbon to nitrogen ratio are provided, although some differences in the rate of contaminants degradation were observed.

ACKNOWLEDGEMENTS

The project was supported by the Technology agency of the Czech Republic (project No. TE01020218).

REFERENCES

Cajthaml T, Bhatt M., Šašek V, Matějů V 2002. Bioremediation of PAH-Contaminated Soil by Composting: A Case Study. *Folia Microbiol. (Prague)* 47(6): 696–700.

McNabb DH, Johnson RL, Guo I. 1994. Aggregation of Oil- and Brine-contaminated Soil to Enhance Bioremediation”. In *Hydrocarbon Bioremediation*, by R.E. Hinchee, B.C. Allenman, R.E. Hoeppel, and R.N. Miller, 296-302. Boca Raton, FL: Lewis Publishers.

Michel Jr. FC, Reddy CA, Forney LJ. 1995. Microbial Degradation and Humification of the Lawn Care Pesticide 2,4-dichlorophenoxyacetic Acid During the Composting of Yard Trimmings *Appl. Environ. Microbiol.* 61: 2566-2571.

Semple KT, Fermor TR. 1995. Composting Systems for the Bioremediation of Chlorophenol contaminated Land. In *Bioremediation of Recalcitrant Organics*, edited by R.E. Hinchee, D.B. Anderson, and R.E. Hoeppel, 93-100. Columbus, OH: Battelle Press.

Šašek, V, Bhatt M., Cajthaml T, Malachová K, Lednická D. 2003. Compost-Mediated Removal of Polycyclic Aromatic Hydrocarbons from Contaminated Soil. *Arch. Environ. Contam. Toxicol.* 44(3): 336–342.

United States Environmental Protection Agency. 1998. An Analysis of Composting as an Environmental Remediation Technology. In *Solid Waste and Emergency Response*; Ed.; EPA 530-R-98-008.

United States Environmental Protection Agency. 1997. Innovative Uses of Compost- Composting of Soils Contaminated by Explosives. In *Solid Waste and Emergency Response*; Ed.; EPA530-F-97-045.

DIET OF EURASIAN OTTER (*LUTRA LUTRA*) IN RELATION TO THE STOCKING OF RAINBOW TROUT (*ONCORHYNCHUS MYKISS*), BROWN TROUT (*SALMO TRUTTA* M. *FARIO*) AND GRAYLING (*THYMALLUS THYMALLUS*)

LYACH Roman[1]
[1]Institute for Environmental Studies, Faculty of Sciences, Charles University
[1]LyachR@seznam.cz

Keywords: *Lutra lutra*, hatchery – reared trout, spraint analysis, fish loss, daily food intake

INTRODUCTION

The Eurasian otter (*Lutra lutra*) is one of the most important piscivorous predators in the Czech Republic. Otters compete with humans for similar natural resources (fish) and are therefore considered a threat to fish farms, ponds and running waters stocked with hatchery-reared fish. With rising number of otters in the central Europe, conflicts between environmental protection and fishermen begin to escalate. Stocking and fish farms create perfect environment for fish-eating predators (including otters) and, together with decreased water contamination, lead to relatively high population densities of these predators that may even turn into local overgrowth (for example in pond-rich areas in south Bohemia, see Hlaváč and Toman 1995). While the great cormorant is considered the primary source of conflict in aquatic industry (Kranz 1995), otters can cause severe damage to fish populations on smaller streams, especially during rather cold winters when ponds and lakes freeze over. This study is quite unique in a way that it estimates predation on allochthon fish populations and therefore provides some insight on success of this stocking program while also gives information about predation of local native species. The aim of this study is to analyze otter diet during winter season and evaluate predation on local fish populations in Chotýšanka stream a few months after stocking brown trout yearlings, grayling yearlings and rainbow trout adults into the stream. We hypothesized that stocked trout and grayling will occur in diet of otter in non - negligible numbers.

METHODS

The study was carried out on Chotýšanka stream, situated in central Bohemia (Czech Republic), located approximately between cities Vlašim and Benešov. We examined one part of the stream, listed as Chotýšanka 1, located between pond Smikov and river Blanice. The stream is natural, rather shallow and narrow, with many meandering sections and variety of attached pools. Stream banks are of natural soil, surrounded by meadows (being cut once per year) or by forest and are easily accessible only during winter and rather overgrown by flora during summer. Although Chotýšanka is listed as typical trout water, natural conditions of the stream are rather poor and inappropriate for trout and grayling populations. Water is marginally slow, warm and eutrophic, mostly because of presence of large ponds above the stream. Therefore, trout and grayling stocking is rather questionable in this area. Diet composition was determined by spraint (faecal) analysis. Otter spraints were collected in winter season 2005/2006. Altogether we collected about 2 700 ml of spraints, which makes about 260 – 300 individual spraints. Collected spraints were soaked in a mixture of water and detergent (Jar) to separate individual bones from the remaining material and then washed through a 0.5 mm sieve and dried on direct sunlight. We separated all recognizable prey remains (fish diagnostic bones, scales, amphibian bones, crayfish exoskeleton remains) using a binocular loupe and a Petri dish. Fish species were identified to the lowest taxon possible based on morphological differences of diagnostic bones. We calculated Lt (*Longitudo totalis*) and weight of fish. We estimated total fish consumption by otters on the studied stream for the whole winter season (ninety days). We took three values – 0.75, 1, and 1.5 kg – as a daily food intake, covering the minimal, average and maximal daily food consumption by one adult otter (Kruuk 2006). Therefore, total estimated prey consumption of three otters during the winter season (ninety days) was calculated to be 202.5, 270 or 402.5 kg (depending on daily food intake). One of the main goals of this study was to estimate total predation on stocked fish during one winter period, calculating how many trout and grayling individuals otters remove from the stream by predation and what percentage of stocked fish remains there for fishermen.

RESULTS AND DISCUSSION

We found and identified a total of 1531 individual fish with total weight of 18 066 g. Fish was the most common prey item recovered in spraints, representing 83.75 % of the overall biomass. Amphibians (frogs from Rana family) represented 12.5 % of biomass and crayfish (*Astacus fluviatilis*) represented 3.75 % of biomass. We found no trace of birds, mammals or non – crayfish invertebrates in the spraints and no corpses in the studied area. Diet of otters composed of 12 fish taxa. The most important prey item was gudgeon (*Gobio gobio*) by both numbers and biomass. Chub (*Leuciscus cephalus*) was the second most important prey by numbers and biomass. Brown trout (*Salmo trutta* m. *fario*) was important only by numbers of fish consumed whereas inversely rainbow trout (*Oncorhynchus mykiss*) and common carp (*Cyprinus carpio*) were important only by biomass. We found no diagnostic bones or any other signs of grayling (*Thymallus thymallus*) in spraints. We calculated that fish made 83.75 % of total biomass in otter diet. Rainbow trout makes 10.90 % and brown trout 1.80 % of biomass.

In the past, otter predation on wild salmonids populations has been studied on several occasions. Otters may have a huge impact on salmonid populations by consuming large portion of the annual production of juvenile trout and salmon (up to 60 %, see Kruuk et. al. 1993). Carss et al. (1990) found out that otters prey upon Atlantic salmon during spawning season in rivers in Scotland. Otter predation on trout fish farms and trout stocked rivers had been proved before (Ludwig et. al. 2002). Mink predation can also heavily influence trout and salmon populations (Heggens and Borgstrom 1988). Trout predation may also depend on presence of local trout population as well as alternative fish prey. Hatchery – reared trout might be vulnerable to otter predation when stocked into a river with existing trout population and a lack of other easier – to – catch fish species (Jacobsen 2005). Unlike this study, otters in stream Chotýšanka preyed upon stocked trout even though there was clearly no native trout population. This may be because the stream is rather small, stocked fish are hatchery – reared and "naive" and other fish available are of smaller size. The main prey item was fish (almost 84 %). Such number is quite common for otters on small watercourses, streams and channels in moderate climate (Clavero et al. 2003). Alternative prey consisted of amphibians (frogs from Rana family) and crayfish, which is fairly common (Brzezinski et. al. 2006).

CONCLUSIONS

This study shows that otters can be important predators of newly stocked trout. Both trout and grayling stocking on stream Chotýšanka proved to be not so effective.

REFERENCES

BRZEZINSKI M., ROMANOWSKI J., KOPCZYNSKI L., KUROWICKA A. 2006. Habital and seasonal variations in diet of otters, *Lutra lutra*, in eastern Poland. *Folia Zool*. 55 (4), 337 – 348.

CARSS D. N., KRUUK H., CONROY J. W. H. 1990. Predation on adult Atlantic salmon, Salmo salar L., by otters, *Lutra lutra* within the River Dee system, Aberdeenshire, Scotland. *Journal of fish biology* 37, 935 – 944.

CLAVERO M., PRENDA J., DELIBES M. 2003. Trophic diversity of the otter (*Lutra lutra*) in temperate and Midterranien freshwater habitats. *Jour. Biogeogr*. 30, 761 – 769.

HEGGENES J., BORGSTROM R. 1988. Effect of mink, *Mustela vison*, predation on cohorts of Juvenile Atlantic salmon, *Salmo salar* L. and brown trout, *S. trutta* L., in three small streams. *Journal of fish biology* 33, 885 – 894.

HLAVÁČ V., TOMAN A. 1995. Otter Project in the Czech republic. In: REUTHER C., ROWE-ROWE D. 1993. Proceeding International Otter Colloqium Pietermaritzburg 1993. Habitat No. 11, Hankesbuttel, 86 – 88.

JACOBSEN L. 2005. Otter (*Lutra lutra*) predation on stocked brown trout (*Salmo trutta*) in two Danish lowland rivers. *Ecology of freshwater fish* 14, 59 – 68.

KRANZ A. 1995. On the ecology of otters (*Lutra lutra*) on central Europe. Doctoral dissertation, University of Agricultural science, Vienna.

KRUUK H. 2006. Otters: ecology, behaviour and conservation. Oxford University Press.

KRUUK H., CARSS D. N., CONROY J. W. H., DURBIN, I. 1993. Otter (*Lutra lutra*) numbers and fish productivity in rivers in north-east Scotland. *Symposium of the Zoological Society of London* 65, 171 – 191.

LUDWIG X. G., HOKKA V., SULKAVA R., YLONEN, H. 2002. Otter *Lutra lutra* predation on farmed and free-living salmonids in boreal freshwater habitats. *Wildlife ecology* 8, 193 – 199.

COMPARISON OF SOURCE APPORTIONMENT RESULTS FROM SUMMER AND WINTER MEASURING CAMPAIGN AT A PRAGUE – SUCHDOL SITE

Otakar Makeš[1,2], Petr Vodička[1], Jaroslav Schwarz[1]
[1]Institute of Chemical Process Fundamentals, AS CR, Prague, Czech Republic,
[2]Institute for Environmental Studies, Faculty of Science, Charles University in Prague
makes@icpf.cas.cz

Keywords: Atmospheric aerosols, AMS, Factor analysis

INTRODUCTION

Organic aerosol (OA) is the most abundant but still poorly characterized component of airborne particulate matter. This situation is even more complicated in large cities where many anthropogenic sources of primary organic aerosol (POA) are situated. In recent years, aerosol mass spectrometry has been increasingly applied to obtain highly time-resolved chemical composition of ambient aerosol. This is considerably important for clarification of organic aerosol life cycles and sources. Two measuring campaigns, which lasted about six weeks in summer 2012 and in winter 2013, were performed at suburban site Prague – Suchdol. Aerosol data were measured by Aerodyne compact time-of-flight aerosol mass spectrometer (AMS) which is able to characterize the size resolved chemical composition of non-refractory submicron (PM_1) fraction.

METHODS

Organic aerosol data were averaged to 30 min. intervals and analyzed by receptor modelling based on positive matrix factorization. Firstly, a set of factors is identified by unconstrained technique using Multi-linear engine (ME-2) (Paatero, 1999). Mass spectra of these factors correspond both to primary organic aerosol (POA) sources and secondary organic aerosol (SOA) sources. We distinguished various primary sources depending on season. In summer season we identified hydrocarbon-like organic aerosol (HOA) from traffic and OA emitted by and biomass burning (BBOA). In winter season we found two types of POA both connected with local heating. Wood burning (WBOA) and Coal burning (COAL) aerosols. POA portion was ranging from 10% to 20% of total organic aerosol in summer and from 10% to 40% in winter season. In both parts of the year SOA consists of two types of oxygenated organic aerosol varying in volatility and degree of oxidation. Semi-volatile oxygenated organic aerosol (SV-OOA) shows maximal concentration during the night and minima in the afternoon. Low-volatile oxygenated organic aerosol (LV-OOA) has an opposite daily pattern and is more oxidized then SV-OOA. Mass spectra of all detected POA factors were then put more precisely by ME-2 partially constrained technique: a-value approach (Canonaco, 2013).

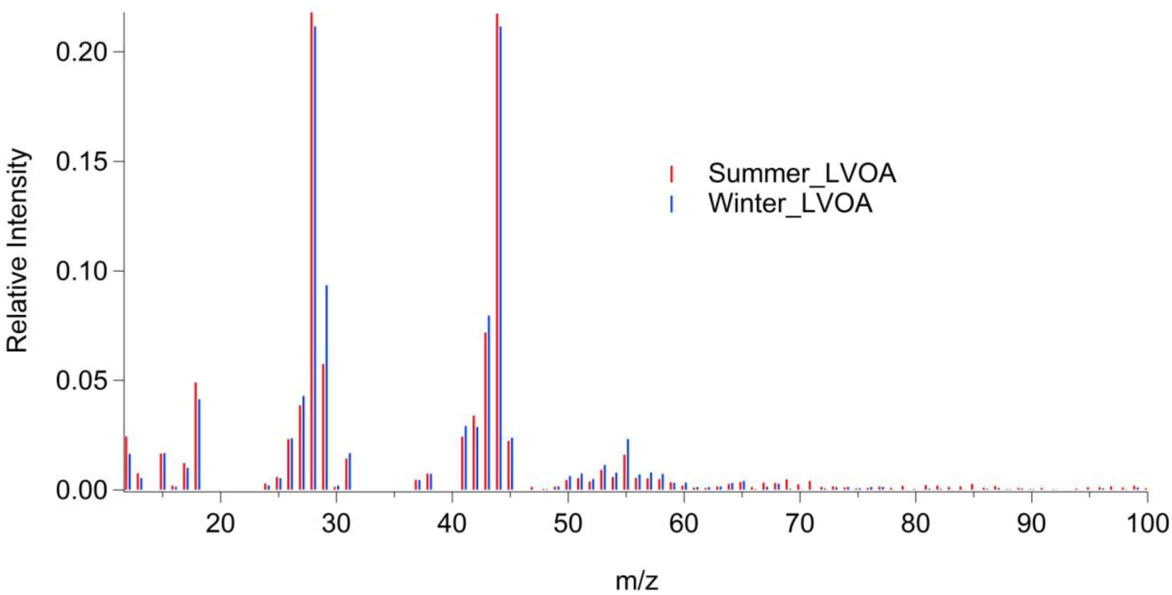


Fig. 1: Comparison of summer and winter LVOA mass spectra

RESULTS AND DISCUSSION

In both seasons ME-2 analysis resolves two POA sources and two SOA sources. The same SOA sources were identified in summer and winter. Pearson´s correlation coefficient R showed high degree of similarity ($R_{LVOAsummer, LVOAwinter}$ = 0.99, $R_{SVOA\ summer, SVOA\ winter}$ = 0.79). During winter season we were not able to resolve HOA factor clearly. We may assume that the low amount of HOA was included in COAL factor due to high similarity of HOA to COAL factor ($R_{HOA,COAL}$ = 0.81). Summer BBOA factor showed high similarity to WBOA factor ($R_{BBOA,WBOA}$ = 0.81).

ACKNOWLEDGEMENTS

This work was supported by the Czech Science Foundation under grant P209/11/1342.

REFERENCES

Canonaco, F., Crippa, M., Slowik, J. G., Baltensperger, U., and Prévôt, A. S. H.: Atmos. Meas. Tech., 6, 3649–3661, doi:10.5194/amt-6-3649-2013, 2013

Paatero, P. The multilinear engine – a table-driven least squares program for solving multilinear problems, including the n-way parallel factor analysis model. J Comput Graph Stat. 1999;8:854–888.

MICROHABITAT DETECTABLE DIFFERENCES AMONG SOIL FAUNA POPULATION IN SOKOLOV UNRECLAIMED POST MINING SITES: POTENTIAL OF FUNGAL BASED TERRESTRIAL FOOD WEB

Jabbar Moradi

Institute for Environmental Sciences, Faculty of Science, Charles University in Prague

Rojyar.moradi@gmail.com

Keywords: Unreclaimed sites, Fermentation layer, Soil fauna, F/B ratio, Soil food web

INTRODUCTION

Spontaneous primary succession is considered a low cost reclamation strategy in post mining sites. To further understand this process in last several years numerous studies have been done in Sokolov post mining discrete over unreclaimed sites dealing with different aspects of biological successions in the area. Rest on the previous studies we were interested to know whether there are some explainable patterns of diversity and population of soil Diptera and Coleoptera population under different vegetation coverages in unreclaimed sites.

METHODS

In 2012 a sampling have been conducted over the unreclaimed sites with different vegetation coverage (i.e. Bare, Grass and Woody coverage) and age (10, 18, 28, 55 years). Samples for extracting PLFA and chemical analysis has been taken at the same time (data in not completed yet).

RESULTS AND DISCUSSION

Highest diversity and population based on the results was mostly predicted by Grass coverage and age (Figure 1). Previous studies in the same site indicate over a clear difference using fermentation layer (Oe) among sites that is significantly in correlation with the coverage in the way that in Grass stage we have the thickest fermentation layer and highest levels of Fungal/Bacterial ratio in the soil. The high amount of organic matter in Oe layer as well as higher ratios of fungi/bacteria in the soil makes it reasonable to conclude that fungal based food web in Grass coverage system is connected with upper trophic levels namely micro and macro arthropods directly (as well as indirectly) comparing to bacterial based food web.

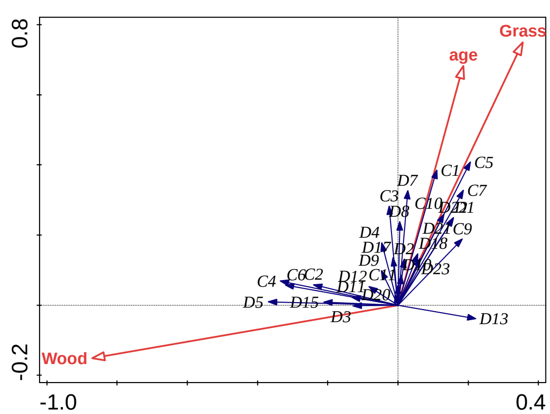


Fig 1. RDA analysis biplot showing the relationship between Coleoptera and Diptera with the environmental variables

This can lead to more energy transforming with less connections among trophic levels which is a sensible reason for higher population and diversity among coleopteran and dipteran soil fauna. Results as well shows that this stage is a temporary stage in the transition from bare to woody system during succession which itself is affected by the faunal activities in the soil.

CONCLUSION

According to a recently proposed hypothesis (Ponge, 2013), several lines of evidence point to a wider perspective for ecosystem selection with the involvement of humus form. Achieving the highest diversity and population seems not to be always the only destination for decision making because of the existence dynamic in the different levels of environment. The higher F/B ratio can be related to the superiority of Fungi and fungal based food web in relation to the higher diversity observed in the grass coverage. Testing the idea of fungal based preference in the presence of thick fermentation layer and its effects over population through laboratory and field experiments using C15 and N14 isotopes can be of great help with more understanding in this regard.

Identification of key factors during biodrying sewage sludge and digestate from biogas stations

Name: Vojtěch Pilnáček

Contact: Vojtech.Pilnacek@gmail.com

Introduction

It is no doubt, that literature author well known to most of waste management experts is Jan Neruda. All of them all the time speak the same "nerudian" question. „Where with him?". And waste is meant on this place. One of many ways of waste disposal is waste to energy. In this case lower calorific value plays title role. And here another in imaginative literature not so often asked question rises. „How to reach the best values of low calorific value?" One of methods is certainly biodrying.

Past work

Biodrying is process, which utilizes heat generated by aerobic decomposition of organic matter for substrate drying. Main agent of whole process is air artificially blasted to dried substrate. The air is firstly source of oxygen for aerobic decomposition processes, secondly it functions as medium for evaporated moisture transport. On the other hand it is simultaneously cooling medium and energy consumed negatively impacts energetic balance of the process. In past work we tried to find how to set the air supply to reach optimal drying performance.

In past work municipal solid waste was used as a substrate.

Methods

Waste was processed in model biodrying reactor. Two regimes of aeration were investigated: regime controlled by oxygen concentration (concentration between 16 and 20% was maintained) and regime controlled by temperature in upper layer of the reactor (temperature between 42°C a 45°C and oxygen concentration between 16 a 20% was maintained). Drying effectiveness was measured as change in substrate moisture and low calorific value.

Results

Table 1 - Values of moisture before and after the process

Run	Moisture before (%)	Moisture after upper layer (%)	Moisture after lower layer (%)	Desiccation upper layer (%)	Desiccation lower layer (%)
Temperature 1	41,28 ± 1,88	23,87 ± 3,20	13,74 ± 2,79	17,41	27,54
Temperature 2	43,64 ± 1,16	25,08 ± 0,65	22,87 ± 1,60	18,56	20,77
Oxygen 1	36,88 ± 1,61	37,82 ± 2,12	21,76 ± 0,65	-0,94	15,12
Oxygen 2	38,52 ± 1,26	15,81 ± 0,43	16,09 ± 0,80	22,71	22,43

Table 2 - Low calorific value before and after the process

Run	LCV before (MJ/t)	LCV after upper layer (MJ/t)	LCV after lower layer (MJ/t)	LCV change upper layer (%)	LCV change lower layer (%)
Temperature 1	9 077,12 ± 73,78	13 818,18 ± 344,23	15 415,33 ± 253,22	34,31	41,12
Temperature 2	9 835,66 ± 21,21	13 610,96 ± 772,26	14 817,38 ± 668,71	27,74	33,62
Oxygen 1	12 358,60 ± 219,74	11 314,05 ± 51,51	14 548,64 ± 95,82	-9,23	15,05
Oxygen 2	11 102,23 ± 123,71	14 982,44 ± 197,09	17 001,06 ± 180,99	25,90	34,70

LCV - Lower calorific value

Energetic balance of the process was reviewed as:

$$E = (\frac{H_{after\,upper} + H_{after\,lower}}{2} - H_{before}) \cdot m_{waste} - P \cdot t$$

Where: *E - energetic balance, $H_{after\ upper}$ - LCV after drying in upper layer, $H_{after\ lower}$ - LCV after drying in lower layer, H_{before} - LCV before drying, $m_{opd.}$ - waste mass, P - energy input of air supply, t - air supply operational time*

Table 3 Energetic balance of the process

Run	Air supply operational time (s)	Energy consumed (MJ)	LCV average before drying (MJ/t)	LCV average after drying (MJ/t)	Energetic balance (MJ)
Temperature 1	439338	28,12	9077	14617	138,07
Temperature 2	342441	21,92	9836	14214	122,14
Oxygen 1	64231	4,11	12359	12931	13,07
Oxygen 2	101854	6,52	11102	15992	140,17

Conclusions

- Under given conditions it was not possible to directly compare both regimes. Drying effectiveness does not depends only on aeration rate, but also on other factors (amount and composition of organic fraction, ambient air properties). Many yet in literature undiscovered questions rises: How is the process affected by amount and composition of the organic fraction? How is the process affected by ambient air characteristics?

- Energetic balance was every time positive. It seems that optimal is process controlled by oxygen concentration. Question is, in how many cases will be composition of dried waste suitable for this controlling regime.

Future work

In future work we want to have sewage sludge and digestate from biogas stations as a substrate. We want to answer some of questions defined by past work.

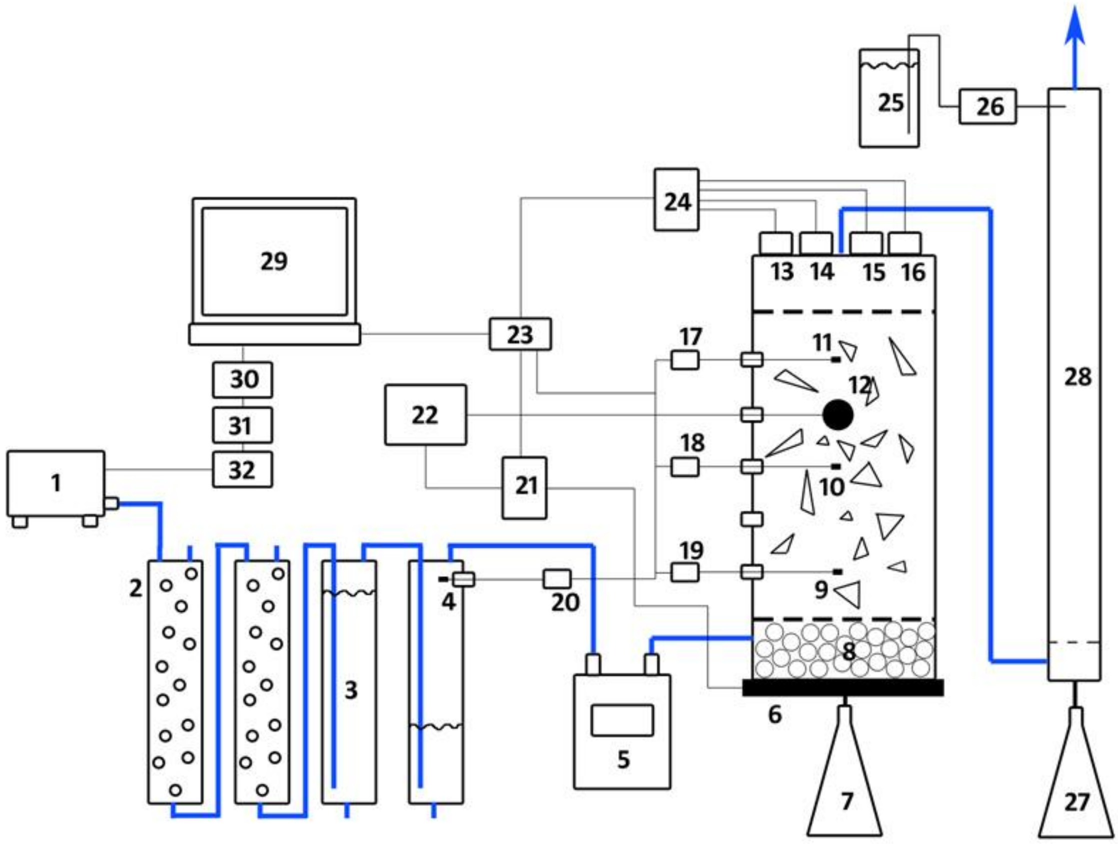
- How is the process affected by ambient air characteristics?

Simultaneously we define additional questions.

- How is the process affected by pH and C/N ratio?
- How is optimal amount of bulking agent to assure sufficient aeration?
- Quantification of microorganism groups participating on decomposition processes in phases of the process and find methods how to affect them.
- How are characteristics of produced fuel?
- How part has the biodrying effect on overall drying process?

For these purposes we will upgrade model biodrying reactor, for quantification of microorganisms groups Phospholipids fatty acids analysis (PLFA) will be used, for investigation of fuel characteristic combustion test will be performed and for investigation of biodrying effect chemical sterilization of dried substrate before and during the process will be utilized.

Picture 1 - Upgraded reactor scheme



1 - Air supply
2 - Plexiglass column with silicagel
3 - Plexiglass column with water
4 - Temperature and moisture sensor
5 - Flow meter
6 - Electronic balance
7 - Flask for leachate
8 - Drenage layer
9 - Temperature and moisture sensor
10 - Temperature and moisture sensor
11 - Temperature and moisture sensor
12 - Gas analyzator sond
13 - O2 sensor
14 - CO2 sensor
15 - VOC sensor
16 - NH3 sensor
17 - Convertor THT2
18 - Convertor THT2
19 - Convertor THT2
20 - Convertor THT2
21 - Convertor AD4
22 - Gas analyzator
23 - USB Convertor
24 - Convertor AD4
25 - Nutrient solution for biofilter
26 - Peristaltic pump
27 - Flask for condensate
28 - Biofilter
29 - Notebook
30 - I/O modul Quido 2/2
31 - Performance regulator
32 - Relay
- Air distribution
- Interconnection of electronic
- Hose for nutrient solution

Preliminary results on the status of snow leopard through camera trap technique in Annapurna, Nepal

Bikram Shrestha[1] and Pavel Kindlmann[2]
[1,2]Charles University, Prague, Czech Republic
bikramone@gmail.com

Keywords: Annapurna, Camera trapping, Himalayas, Snow leopard

INTRODUCTION

Snow leopard *(Panthera uncia)* is a critically endangered species, found in the mountains of Central Asia and widely but patchily distributed along the alpine and subalpine zones of Nepal's Himalaya. The snow leopards inhabit some of the world's most rugged landscape, exemplified by the Himalaya, where they prefer steep, rugged terrain well broken by cliffs, ridges, gullies and rocky outcrops (Schaller 1977; Jackson & Ahlborn 1989). Annapurna Conservation Area, a part of Nepal Himalaya, dominated by some of the world's tallest mountains, supports a significant proportion of Nepal's Snow Leopards estimated at 350–500 individuals (Jackson & Ahlborn 1990). A large portion of this lies within Mustang District covering c. 47% of the Annapurna Conservation Area (7,629km2) (NTNC 2008). Snow Leopards have been reported from the adjoining districts, Manang (Oli 1994) to the east and Dolpo (Jackson & Alhborn 1990) to the west, but little is known about the population in Mustang except for anecdotal accounts of livestock losses allegedly killed by this large feline. Our specific aim of the study was to determine the minimum number of snow leopards in Lower Mustang and Upper Mustang of Annapurna Conservation Area.

METHODS (FOR POSTER)

We have performed a pilot study, in which we used indirect sign method, that is, the SLIMS – the Snow Leopard Information Management System –in Lower Mustang in 2010 (one survey) and 2011 (two survey) to study snow leopard and its prey species. In 2011 (October-December), we used nine remotely triggered cameras (Bushnell and ScoutGuard passive infrared detector) to get a lower limit for leopard population size and to correlate this with presence sign abundance in Lower Mustang. Results from 2011 were published in the journal Threatened Taxa: at least 3 snow leopards were found in ca. 75 km^2 (Ale et al. 2014). During 2012-2013, we used three cameras in Lower Mustang during October to December. In 2012, we used 5 cameras in the Manang district over ca. 100 km^2 and 11 cameras in 2013 over 131km^2 during October to December. We located suitable camera-trap sites along high, well-defined and narrow ridgelines or valley bottoms at or immediately adjacent to frequently scent-sprayed rocks and scrapes (Jackson et al. 2006). In each location, we deployed one camera trap at a distance of 2-3 metres from the anticipated travel path of snow leopard. These camera traps were checked approximately every 12 to 15 days, and batteries were changed if necessary. We used pelage patterning, specifically spots on the flanks, dorsal surface of the tail, and on forehead to identify individual Snow Leopards. Abundance index was analysed based on indices of encounter snow leopard photographs (no. of capture events/per 100 trap nights).

RESULTS AND DISCUSSION

In Lower Mustang, we obtained a total of 42 pictures of snow leopards during nine capture events resulting in a capture success of 2.3 individuals per 100 traps nights in 2011, 77 pictures during 11 capture events resulting in a capture success of 3 individuals per 100 trap nights in 2012 and 14 pictures during five capture events resulting in a capture sucess of 4 individual per 100 trap nights in 2013. In Upper Manang, we obtained a total of 84 pictures of snow leopards during 8 capture events resulting in a capture success of 6 individual per 100 trap nights in 2012 and 105 pictures during 18 capture events resulting in a capture success of three individual per 100 trap nights in 2013 (Table 1). Lower Mustang (an area of ca. 75 km^2) supported a minimum of four adult snow leopards with one cub and Upper Manang (an area of ca. 131 km^2) supported three adult individuals with one cub during the period of observation. Jackson et al. (2006) reported 66 and 49 capture events (capture success 8.9 and 5.6 per 100 trap-nights) in two consecutive years of 2003 and 2004 in Hemis National Park in India. An indication that our camera locations and/or site set-up parameters were not ideal is the large number of false images (e.g., moving vegetation) and photos of non-targeted species such as livestock, birds, and other mammals. However, unlike survey by Jackson et al.(2006) in Hemis, our objective was simply to determine the minimum number of snow leopards in selected sites as pilot survey.

Table 1: 2011-2013 results of camera-traps in Annapurna

	Trapping effort (trap nights)	Images Total	Full	Partial	Non-target	False	Capture events	Individual SL identified
2011 results of camera-traps in Lower Mustang (cameras traps=9, camera location= 9, survey area= ca. 75 km2)								
TOTAL	400	42	19	23	779	26661	9	3 individuals (LM-SL1, LM-SL2, LM-SL3)
Per 100 trap nights		10.5	4.75	5.75	195	6665	2.3	
2012 results of camera-traps in Lower Mustang, (cameras traps=2, camera location=2, survey area= ca. 75 km2)								
TOTAL	140	77	41	36	262	2508	11	3 individuals with one cub (LM-SL1, LM-SL3 with cub, LM-SL4)
Per 100 trap nights		24	13	11	81	779	3	
2013 results of camera-traps in Lower Mustang, (cameras traps=2, camera location=2, survey area= ca. 75 km2)								
TOTAL	125	14	8	6	560	955	5	3 individuals (LM-SL1, LM-SL3, LM-SL4)
Per 100 trap nights		11	6	5	448	764	4	
2012 results of camera-traps in Upper Manang, (cameras traps=5, camera location=7, survey area= ca. 100 km2)								
TOTAL	140	84	46	38	79	67	8	
Per 100 trap nights		60	33	27	56	48	6	1 individual (UM-SL1)
2013 results of camera-traps in Upper Manang, (cameras traps=11, camera location= 11, survey area= ca. 131 km2)								
TOTAL	636	105	87	36	1378	34773	18	3 individuals with one cub (UM-SL1 with cub, UM-SL2, UM-SL3)
Per 100 trap nights		17	14	6	217	5467	3	

CONCLUSIONS

We conclude that our study sites Lower Mustang harbours at least four adult snow leopards and Upper Manang harbours at least three adult snow leopards. One female with one cub were captured in both study areas.

ACKNOWLEDGEMENTS

We thank National Trust for Nature Conservation (Nepal), Snow Leopard Conservancy (US), CzechGlobe-Global Change Research Center AS CR and Tshering Lama O'Gorman for supporting the field work.

REFERENCES

Ale, S.B., Shrestha B., & Jackson R.2014. On the status of Snow Leopard *Panthera uncia* (Schreber, 1775) in Annapurna, Nepal. *Journal of Threatened Taxa* 6(3): 5534–5543

Jackson R., Roe J. D., Wangchuk R. & Hunter D. O. 2006. Estimating Snow Leopard Population Abundance Using Photography and Capture– Recapture Techniques. *Wildlife Society Bulletin* 34, 772-781.

Jackson, R. & G. Ahlborn (1990). The role of protected areas in Nepal in maintaining viable population of Snow Leopards. *International Pedigree Book of Snow Leopard* 6: 51–69

Karanth, K.U. & Nichols J.D. 1998. Estimation of tiger densities in India using photographic captures and recaptures. *Ecology* 79(8): 2852– 2862

Oli, M.K. 1994. Snow Leopards and Blue Sheep in Nepal: Densities and predator-prey ratio. *Journal of Mammalogy* 75(4): 998–1004

NITROGEN AND PHOSPHORUS LEACHING FROM BIOMASS OF *CALAMAGROSTIS EPIGEJOS* DURING THE VEGETATION SEASON

Šimáčková Hana[1], Frouz Jan[1], Mudrák Ondřej[2]
[1] Institute for Environmental Studies, Faculty of Science, Charles University in Prague, CZ
[2] Institute of Botany, Academy of Science of the Czech Republic, CZ
hana.simackova@natur.cuni.cz

Keywords: Plant litter, Nitrogen, Phosphorus, Biomass, Post mining sites

INTRODUCTION

Decomposition of plant litter plays an important role in the formation of soil organic matter (Austin & Ballaré 2010). For understanding initial stages of litter decomposition was used a common aggressive tall grass *Calamagrostis epigejos* that usually grows in many disturbed habitats at succession stages. Enhanced availability of nitrogen from atmosphere deposition can accelerate the expansion of tall grasses (Holub et al. 2012). *C. epigejos* let in after senescence a large proportion of dead biomass standing for many months with limited contact with soil and microbial breakdown (Rebele & Lehmann 2001).

Lot of attention is still focused only in organic carbon accumulation and transformation but a little attention is dedicated to other nutrients. The aim of this study was to access the role of dead standing biomass on the leaching of nitrogen and phosphorus from plant aboveground biomass of *C. epigejos* and we observed losses nutrients from biomass during the whole vegetation season in two different old sites at the post-ming areas.

METHODS

The experiment was established in unreclaimed sites at heaps near Sokolov (CZ), where *C. epigeios* is a common grass at all succession stages (Frouz et al. 2008). It was used two sites: the first site was about 15 years old (young poor site) and the second site was 45 years old (old rich site). We collected plant biomass of *C. epigeios* every other month for one year. Plant biomass was categorize into the three pools: living, dead lying and dead standing biomass. The first part of initial litter was stored in a dark and dry place. The other part was placed in litterbags in the field exposition for 1 year buried in the soil or on the surface or hanging above soil surface.Total nitrogen concentration was determinated in biomass by combustion gas chromatography (Elemental Analyser 1108, Carbo Erba, Italy). Total phosphorus was analysed in mixed samples by mineralization with perchloric acid (Sommers & Nelson 1972) and determination of orthophosphate ions by acscorbic acid and ammonium molybdate (Watanabe & Olsen 1965).

RESULTS AND DISCUSSION

Results showed that the standing biomass led to faster leaching of nutrients while the most of dead biomass remained not decomposed. Losses of nitrogen were observed during vegetation season, but the greatest losses were immediately after senescence in august and consequent losses were slower. In young site was content of nitrogen in dead plant biomass closed to the lowest values in living plant biomass and it does not changed during vegetation season. It can indicate reabsorbtion of nitrogen from living biomass before senescence and preservation of nitrogen in dead standing biomass like in previous studies Holub et al. (2012). Table 1 shows significant differences between young and old sites in changes of phosphorus content in plant biomass. The retranslocation of phosphorus from living leaves to senescent leaves were observed especially at the end of vegetation season (Fig. 1) when the content of phosphorus in living biomass was close to values of dead biomass in the middle of the season at the old site. The ability to recycle of nutrient can play important role in biomass recovery at the beginning of the next growing season (Holub et al. 2012).

Table 1 Differences in content of phosphorus between young and old site shows results by factorial ANOVA. Significant results are indicated in intalics.

Effect	**DF**	**F-ratio**	***p-value***
Pool x Month	8	9,6	*0,000*
Site x Month	4	6,3	*0,000*
Pool x Site x Month	8	2,9	*0,011*

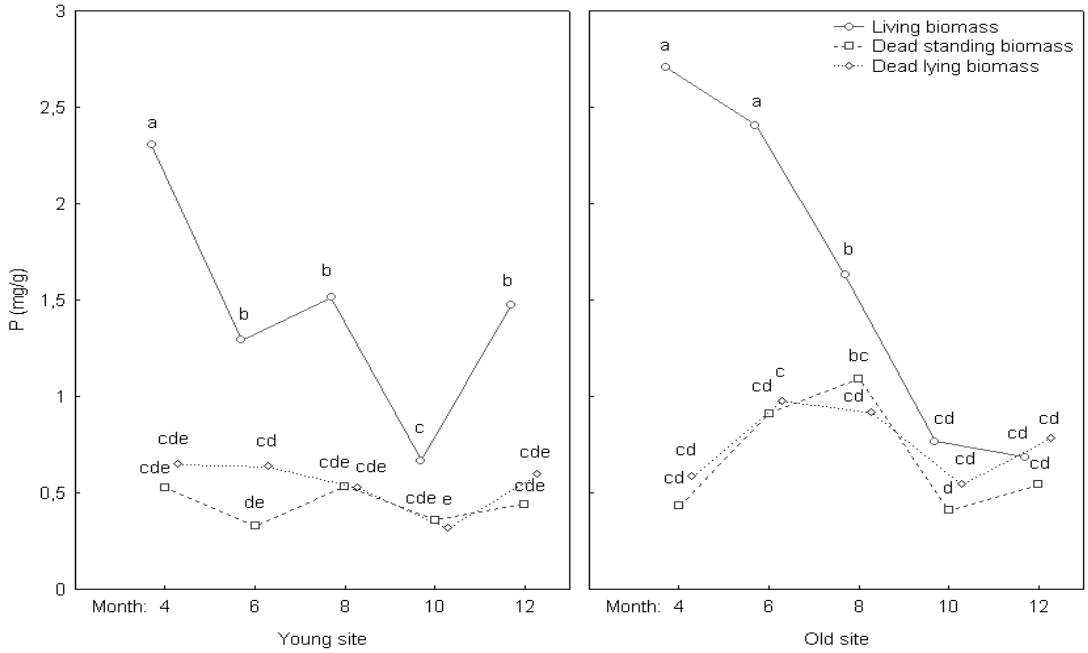


Fig. 1 Changes of phosphorus content in biomass of *Calamagrostis epigeios* during vegetation season at young and old site. Statistical homogenous group are marked by the same letter (ANOVA, LSD test, $P<0.05$).

CONCLUSIONS

We can conclude that the greatest losses of nutrients are subsequently before senescence of leaves and than leaching of nutrients are very slow.

ACKNOWLEDGEMENTS

This study was supported by the Charles University in Prague, and by the Czech Science Foundation Grant No. P504/12/1288).

REFERENCES

Austin AT & Ballaré CL 2010. Dual role of lignin in litter decomposition in terrestrial ecosystems. *Proc Natl Acad Sci* 107: 4618-4622.

Holub P, Tůma I, Záhora J &Fiala K 2012. Different nutrient use strategies of expansive grasses *Calamagrostis epigejos* and *Arrhenatherum elatius*. *Biologia* 67/4:673-680.

Rebele F & Lehmann C 2001. Biological flora of central Europe: *Calamagrostis epigeios* (L.) Roth. *Flora* 196:325-344.

Frouz J, Prach K, Pižl V, Háněl L, Starý J, Tajovský K, Materna J, Balík V, Kalčík J & Řehounková K 2008. Interactions between soil development, vegetation and soil fauna during spontaneous succesion in post mining sites. *Eur J Soil Biol* 44:109-121.

Sommers LE & Nelson DW 1972. Determination of total phosphorus in soils: a rapid perchloric acid digestion procedure. *Soil Sci Soc Am Pros* 29:902-904.

Watanabe FS & Olsen SR 1965. Test of ascorbic acid method for determining phosphorus in water and $NaHCO_3$ extracts from soils. *Soil Sci Soc Am Pro* 29:677-680.

DETERMINANTS OF ORCHID SPECIES DIVERSITY

Zuzana Štípková [1,2], Pavel Kindlmann [1,2]
[1]Global Change Research Centre, Czech Academy of Science, Bělidla 986/4a, 60300 Brno, Czech Republic, [2]Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Benátská 2, 12801 Prague 2, Czech Republic
zaza.zuza@seznam.cz

Keywords: connectivity, orchid, diversity

INTRODUCTION

Currently there are studies which suggest that the number of orchid species on islands is except their size and latitude also positively correlated with their connectivity on other islands. This may be due to the fact that higher locality connectivity means also higher colonization probability of a new species thanks to higher probability of species seed dispersal. This dependence could apply also in a smaller scale within a single continent or country, but this has not been tested so far (Schödelbauerová et al. 2009).
Probability of occurrence of a single orchid species on locality can be also affected by the history of locality (Janečková et al. 2006). On sites unaffected by human (by ploughing or fertilization) it is possible to expect a higher probability of occurrence of a single orchid species than on anthropogenic sites. The effect of anthropogenic influence can decline in time because the locality can return to natural state and can be recolonized from surrounding living populations again. The effect of these opposing opinions on the orchid occurrence is not known.
The aim of this study is to test the following hypotheses: 1) The probability of occurrence of a single terrestrial orchid species depend on connectivity of selected locality. 2) The probability of occurrence of a single terrestrial orchid species depend on history of selected locality.

METHODS

We used existing historical and recent databases of terrestrial orchid species occurrence on a selected area to determine historical localities of selected orchid species. We started with localities present in South Bohemia. At each of these localities we looked for orchid species and, if present, we counted their number. We also monitored vegetation cover (e. g. dominant species on the locality), adjusted exact GPS coordinates and too a photo.

RESULTS AND DISCUSSION

We have visited a total of 192 localities during the summer season of 2014. For specific numbers of visited localities of five most abundant species see Table 1. The numbers of living, dead and undiscovered localities are shown in Fig. 1.

Table 1 Number of visited localities of five most abundant species.

Dactylorhiza majalis	121
Epipactis helleborine	28
Epipactis palustris	6
Orchis morio	12
Platanthera bifolia	25

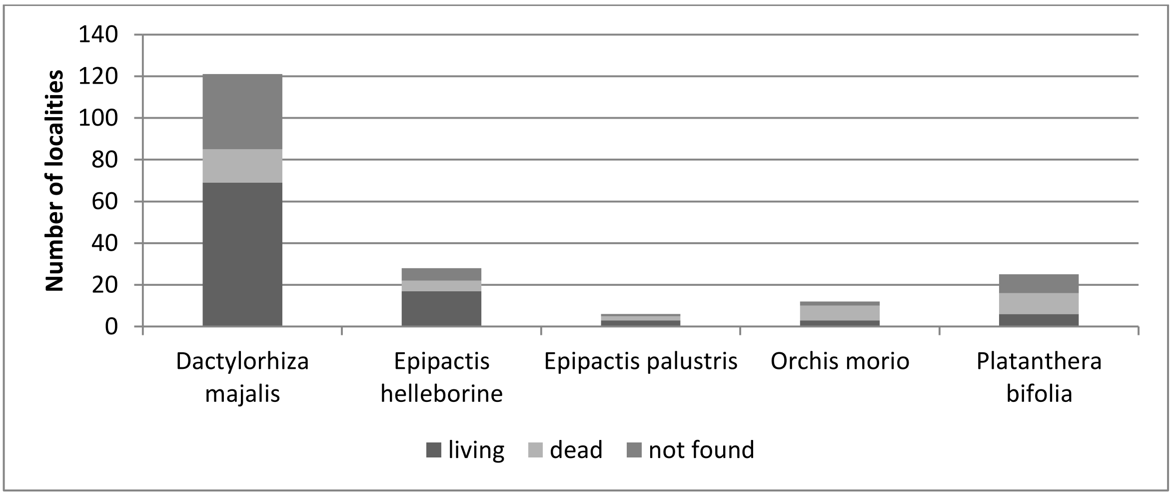


Fig. 1 Number of living, dead and undiscovered localities of 5 most abundant species.

From Fig. 1 it follows that the most abundant species in South Bohemia is *Dactylorhiza majalis*. The largest percentage of living localities was found for *D. majalis*, the lowest one for *Orchis morio* and *Epipactis palustris* (Fig. 1). It can be due to low demands on environmental conditions of *D. majalis* compared to other species.
We also analyzed: (1) the reasons of extinction of orchids in dead localities and reasons, why certain localities were not found, (2) number of new localities we found in 2014, (3) percentage of living localities, (4) numbers of new localities found in individual time intervals (before 1950, 1951-1999, 2000-2009, 2010-2013, 2014) and several other values.

CONCLUSIONS

The situation is not yet critical, but except of the commonest species like *D. majalis,* their fate should be closely monitored. E. g., one worrying result is that all historical localities of all species, except for *Dactylorhiza majalis*, are dead now. For further study to continue we need to collect more data on more species to evaluate our hypotheses.

ACKNOWLEDGEMENTS

Supported by grant No. 14-36098G of the GA CR.

REFERENCES

Janečková P, Wotavová K, Schödelbauerová I, Jersáková J, Kindlmann P 2006. Relative effects of management and environmental conditions on performance and survival of population of a terrestrial orchid, *Dactylorhiza majalis*. *Biol Conserv* 129: 40-49.

Schödelbauerová I, Roberts RL, Kindlmann P 2009. Size of protected areas is the main determinant of species diversity in orchids. *Biol Conserv* 142: 2329-2334.

THE EFFECT OF FUEL TYPE AND SPARK IGNITION ENGINE TECHNOLOGY ON CAR PARTICLE EMISSIONS IN THE CONTEXT OF URBAN AIR POLLUTION

Jitka Štolcpartová[1,2], Jan Topinka[2], Michal Vojtíšek[3]
[1]Institute for Environmental Studies, Charles University, [2]Institute of Experimental Medicine ASCR,
[3]Department of Automotive, Combustion Engine and Railway Engineering, Czech Technical University
jitkastolcpartova@seznam.cz

Keywords: nanoparticles, traffic, spark ignition engine, urban air pollution

INTRODUCTION

Internal combustion engines are often a dominant source of fine particles in urban air, which cause several times more premature deaths than traffic accidents (Yim & Barrett 2012; Caiazzo et al. 2013, EEA 2013).
The smallest particles, nanoparticles, are directly emitted by the engines in the vicinity of the roads, where people live.
Nanoparticles have short lifespan caused by aggregation into larger particles and dilution the air, their concentrations decrease to background level only several hundred meters from the road (Zhu et al. 2002). Therefore, the spatial distribution of these nanoparticles is highly heterogeneous depending on distance from the source, meteorological condition, etc.. Nanoparticle emissions are highly variable in dependence on internal combustion engine type, fuel, and current and prior engine operating conditions.
The work shows a difference in particle emissions between two cars with spark ignition (gasoline) engines using different engine technologies, a Skoda Fabia with a port injection 1.4-liter MPI engine, and a Ford Focus with a direct injection 1.0-liter EcoBoost engine.

METHODS

Two cars were used to measure the difference in emission between old engine technology represented by Skoda Fabia 1.4 MPI and new engine technology represented by Ford Focus EcoBoost 1.0 DISI. Cars were mounted on a dynamometer. Exhaust gases were diluted by constant volume sampler (set on $11m^3$/min). Diluted exhaust gases were then sampled on 47mm PTFE coated borosilicate glass filters (45l/min) and analyzed by exhaust engine particle counter (EEPS, TSI corporation) equipped with an additional diluter.
The cars were driven through Worldwide harmonized Light vehicles Test Procedure (WLTP), a global harmonized standard for determining the levels of pollutants, and Common Artemis Driving Cycles (CADC). CADC were driven through its three parts: Urban, Rural, Motorway 130. All tests were started with the engine at operating temperature.

PRELIMINARY RESULTS AND DISCUSSION

Particle number distributions of both cars are present in Fig. 1. Older engine technology MPI produced the vast majority of particles up to 20nm with peak around 8 nm. Larger particles were rare and constitute less than 15% of the total number concentration. DISI engine had its maximum of number concentration shift to smaller sizes, less than 12.5nm, with indistinguishable peak caused by instrument limitation. Larger particles formed 44% of total particles and had peak in 60nm in particle diameter.
Number concentration is higher in all measured fractions for DISI with lower difference up to 11 nm which had around two times higher concentrations than MPI, except for 6 nm (eleven times higher). Larger particles had from ten times to several orders of magnitude higher concentrations. This fact is confirmed by total particle mass per cycle showed in Table 1.
Addition of 15% ethanol by volume into gasoline influenced particles emissions of the engines conversely. MPI emissions were higher in opposite of DISI which decreased in comparison with pure gasoline. Adding 25% of butanol (either 1-butanol or isobutanol) by volume into gasoline has led to decrease of particle mass within both cars (not presented).

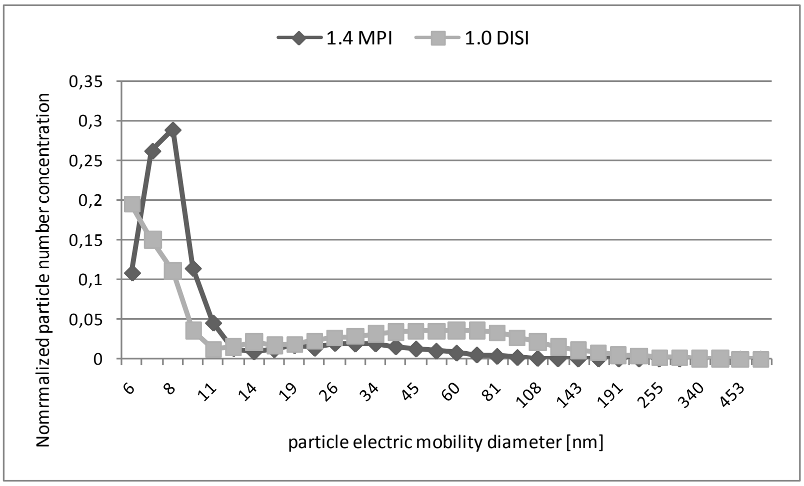


Fig. 1 Particles distribution during WLTP with hot engine, pure gasoline

Table 1 Particle mass produced during cycles [mg].

Fuel	Cycle	1.4 MPI	1.0 DISI
Pure gasoline	WLTP	6.83	25.86
	Artemis Urban	6.59	12.93
	Artemis Rural	9.76	25.86
	Artemis Motorway 130	16.35	74.91
Pure gasoline + 15% ethanol	WLTP	9.52	31.48
	Artemis Urban	9.27	21.47
	Artemis Rural	13.18	21.96
	Artemis Motorway 130	16.59	55.63

CONCLUSIONS

Newer direct injection technology (DISI) used in the Ford Focus EcoBoost, achieving lower CO_2 emissions due to higher thermal efficiency, had higher both mass and number particles concentrations in comparison with the “traditional” port injection technology used in the Škoda Fabia MPI. Younger gasoline car fleet could lead to worsen ambient air in places with dense traffic.

FUTURE

Future work would be focused on toxicological effects of particle emissions from gasoline and diesel (not presented) engines powered by different fuel types, including blends of biofuels.

ACKNOWLEDGEMENTS

The work was funded by the Czech Science Foundation, project BIOTOX - Mechanisms of toxicity of biofuel particulate emissions (13-01438S).

REFERENCES

Yim SHL & Barrett SRH. 2012. Public Health Impacts of Combustion Emissions in the United Kingdom. *Environ Sci Technol* 46(8): 4291–4296

Caiazzo F,Ashok A, Waitz IA, Yim SHL & Barrett SRH. 2013. Air pollution and early deaths in the United States. Part I: Quantifying the impact of major sectors in 2005. *Atmos Environ* 79: 198–208

EEA (European Environment Agency), Air quality in Europe – 2013 report. Online: http://www.eea.europa.eu/publications/air-quality-in-europe-2013 (accessed 3rd September 2014).

Zhu Y, William, Hinds C, Kim S & Sioutas C. 2002. Concentration and Size Distribution of Ultrafine Particles Near a Major Highway. *J Air Waste Manag Assoc*, 52(9), 1032-1042

Contribution of HNO_3 (g) to nitrogen deposition

Vojtěch Stráník[1,2]
[1]Institute for Environmental Studies, Faculty of Science, Charles University in Prague, Prague, Czech Republic
[2] Czech Hydrometeorological Institute, Prague 4–Komorany, Czech Republic

stranik@smistr.cz

Keywords: HNO_3, nitrogen deposition

INTRODUCTION

The accurate quantification of atmospheric deposition is very important for assessment of ambient air pollution impacts on ecosystems.
Atmospheric deposition of nitrogen, particularly the dry deposition, however, is likely to be underestimated due to unavailability of measurements of certain nitrogen species, such as HNO3(g) and NH3. It is known that HNO3 (g) may contribute significantly to the dry deposition of nitrogen even in regions with relatively low concentrations (Flechard et al. 2011).

METHODS

Atmospheric deposition of several different nitrogen species including HNO_3 (g) was calculated using Eulerian photochemical dispersion model CAMx based on emissions and weather data. Verification of outcome data was based on well-known and measured nitrogen species such as NO_3^- and NH_4^+.

RESULTS AND DISCUSSION

Results (Table 1) show that nitrogen deposition based on measured nitrogen species is underestimated. Real nitrogen deposition could be even two or three times bigger.

Table 1 Nitrogen deposition

Nitrogen species	annual deposition [$g.m^{-2}$]
based on CAMx model	
N/NH_3	1.6
N/HNO_3	1.0
N/PAN	0.007
N/HNO_2	0.001
measured deposition (Ostatnická 2009)	
dry (N/NO_X)	0.5
wet (N/NO_3^- and N/NH_4^+)	0.5 – 1.0

CONCLUSIONS

Preliminary comparison of measured and modeled wet deposition (N/NO3– and N/NH4+) indicated that modeled values were lower as compared to measured values, but more or less similar. Substitution of unmeasured nitrogen species by values modeled by CAMx seems to be a plausible way for approximation of total nitrogen deposition, and providing more realistic spatial pattern for further studies of likely nitrogen impacts on ecosystems. On the other hand real measurement is still irreplaceable.

ACKNOWLEDGEMENTS

I would like to acknowledge the grant NAZV QI112A168 (ForSoil) of the Czech Ministry for Agriculture for partial support of this contribution and the Czech Hydrometeorological Institute for providing data used in analysis.

REFERENCES

Flechard C.R., Nemitz E., Smith R I., Fowler D., Vermeulen A.T., Bleeker A., Erisman J.W., Simpson D., Zhang L., Tang Y.S., Sutton M.A. (2011): Dry deposition of reactive nitrogen to European ecosystems: a comparison of inferential models across the Nitro-Europe network. Atmospheric Chemistry and Physics 11, 2703–2728.

Ostatnická J., ed. (2009): Air Pollution in the Czech Republic in 2009. Prague, Czech Hydrometeorological Institute.

Epiphytic orchids: diversity and host-species relationship

Timsina B.[1,2], Rokaya M.B.[2,3], Shrestha B.[1], Bhattarai B.P.[4], Raskoti B.B.[5], Kindlmann P.[1,2], Münzbergová Z.[3,6]

[1] Institute for Environmental Studies, Faculty of Science, Charles University, Benatska 2, 128 01Prague,Czech Republic, [2] Department of Biodiversity Research, Global Change Research Centre (ASČR), Na sádkách 7, České Budějovice 37005, Czech Republic, [3] Institute of Botany, Academy of Sciences of the Czech Republic, Zamek 1, CZ-252 43 Průhonice, Czech Republic, [4]Birendra Multiple Campus, Tribhuvan University, Bharatpur, Chitwan, Nepal, [5] Institute of Botany, Chinese Academy of Sciences, Beijing, China, [6] Department of Botany, Faculty of Science, Charles University, Benatska2, 128 01 Prague, Czech Republic

binu.timsina@gmail.com

Keywords: Epiphytic orchids, diversity, distribution, species richness

INTRODUCTION

Factors influencing the distribution of epiphytic orchids are aspect, slope, altitude and characteristics of the individual host trees or shrubs (e.g., strata, height, evergreen/deciduous nature, bark surface, bark rugosity, bark water holding capacity, age, growth, bark pH, through fall, sunlight intensity) (O'Malley 2009, Adhikari and Fischer 2011).

Studies related to orchid species in Himalayan region, especially Nepal; focus mainly on taxonomy, phylogenetics, ecology, anatomy, ethnobotany and distribution pattern (e.g., Raskoti 2010, Subedi 2011, etc). However, there is no data, or any other information on orchids in factors influencing the distribution and composition of epiphytic orchids in Nepal. Thus, the aim of this study is to understand the factors driving epiphytic orchid diversity which would be useful for their effective conservation.

METHODS

The study was carried out in five different sites in Nepal: Annapurna region, Chitwan district, Upper Tamakoshi valley, The Shivapuri area, and Palpa district. In total, we sampled more than 23000 trees and shrubs individuals in different sites. Orchid and host species were counted by using walk transect method over the region to cover the maximum areas.

RESULTS AND DISCUSSION

We recorded 142 species of orchid growing on 192 host species in different regions. There were highest number of epiphytic orchid species in Annapurna (67 species) followed by Chitwan (64), Tamakoshi (50), Palpa (46) and Shivapuri (41). The total data showed a high correlation between number of orchid species and host individuals ($p < 0.05$, $R^2 = 0.879$) (Fig. 1).

The species richness of epiphytic orchid’s species was dependent on host individuals, different localities, and bark texture of host individuals (Table 1).

Fig. 1 The correlation between number of orchid species and host individuals in different study sites.

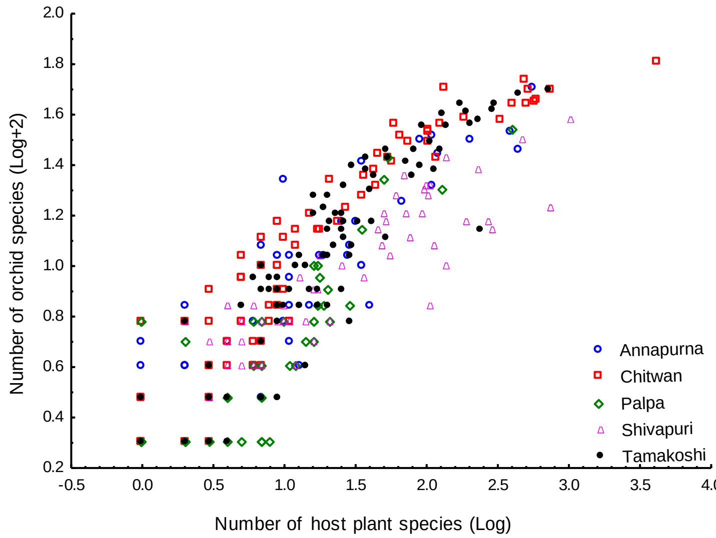


Table 1 Results of generalized linear model (glm) testing the effects of host individual, locality, host strata, bark texture, host habit and nature (evergreen/deciduous) on availability of epiphytic orchid. Significant p-values ($p \leq 0.05$) are bold.

	Df	Deviance	Resid. Df	Resid. Dev	F Value	Pr(F)	R^2
Host individuals (log)	1	5.75952	272	74.75576	26.39302	**<0.001**	0.0715
Locality	4	7.264898	268	67.49087	8.32285	**<0.001**	0.0902
Host strata	1	0.356266	267	67.1346	1.63259	0.202	-
Bark texture	1	1.495924	266	65.63868	6.85508	**0.009**	0.0186
Host habit	1	0.28085	265	65.35783	1.287	0.258	-
Nature (evergreen/deciduous)	1	0.11148	264	65.24635	0.51086	0.475	-

CONCLUSIONS

The number of epiphytic orchid species is directly proportional to the number of tree and shrub individuals in different localities. Bark texture of host species significantly influence the species richness of epiphytic orchids in Nepal.

ACKNOWLEDGEMENTS

The study was supported by GAČR 13-10850P and the grant No. CZ.1.05/1.1.00/02.0073 of the MSMT.

REFERENCES

Adhikari, YP and Fischer, A. 2011. Distribution pattern of the epiphytic orchid *Rhynchostylis retusa* under strong human influence in Kathmandu valley, Nepal. *Botanica Orientalis* 8: 90–99.

O'Malley, K. 2009. Patterns of abundance and diversity in epiphytic orchids on Parashorea malaanonan trees in Danum Valley, Sabah. *The Plymouth Student Scientist* **2**(2): 38-58.

Raskoti BB. 2010. *The orchids of Nepal*. Quality printers. Kathmandu, Nepal.

Subedi, A. 2011. *New species, pollinator interactions and pharmaceutical potential.* Ph.D. Dissertation, Leiden University.

Carbon sequestration in soils developing on landslides in the Flysch Carpathians

Olga Vindušková[1], Tomáš Pánek [2], Jan Frouz[1]
[1]Institute of Environmental Sciences, Faculty of Natural Sciences, Charles University, Czech Republic
[2]Department of Physical Geography and Geoecology, Faculty of Science, University of Ostrava, Czech Republic
olga.vinduskova@gmail.com

Keywords: soil organic matter, accumulation, phosphorus

INTRODUCTION

Accumulation of soil organic matter improves many soil properties and also leads to carbon sequestration (i.e., storage of CO_2)(Lal 2004). Therefore, processes affecting soil organic matter accumulation are of great interest to soil scientists.

Landslides located in one area – as well as sites after retreating glaciers or post-mining sites – represent useful study sites, because they develop on similar substrate under comparable climatic conditions and the age of the soils can be determined. After occurrence of landslide, the surface of fresh landslide scar contains low to zero amount of organic carbon. With time as carbon inputs from remnant patches of vegetation and new plant colonists enter the soil, soil organic matter accumulates (Walker and Shiels 2013).

In this study we focus on landslides in the Flysch Belt of the Outer Western Carpathians, especially in eastern Czech Republic and western Slovakia. The age of landslides was previously determined by radiocarbon dating of organic material obtained either directly from the landslide debris or, more frequently, from related lacustrine or fluvio-lacustrine sediments (Pánek et al. 2013). As the oldest site is older than 10 000 yrs and the youngest is only 5 years old, this chronosequence provides an unique opportunity to study soil carbon dynamics on a millenial timescale.

We hypothesize that the carbon sequestered in landslides is correlated with age, with the highest rates of accumulation found in the intermediate age of the site. We hypothesize that in the oldest sites, rate of carbon accumulation is limited by phosphorus availability.

REFERENCES

Lal R. 2004. Soil carbon sequestration to mitigate climate change. *Geoderma* 123:1-22

Pánek T, Smolková V, Hradecký J, Baroň I & Šilhán K. 2013. Holocene reactivations of catastrophic complex flow-like landslides in the Flysch Carpathians (Czech Republic/Slovakia). *Quaternary Res* 80:33-46.

Walker LR & Shiels AB. 2013. *Landslide Ecology*. Cambridge University Press, Cambridge.