Newsletter

2/2017

CzechGlobe

Global Change Research Institute CAS

CZECHGLOBE STILL REMAINS THE MARK OF EXCELLENT SCIENCE

It has just been 7 years since the CzechGlobe Center was established. We can say that the first 7 years of the Center have been successful despite the occurrence of some „typical childhood illnesses“. It seems as if lucky seven got even more highlighted by the recent announcement of the results of the call for the Excellent Research in Priority Axis 1 of the OP RDE, where our project „SustES - Adaptation Strategy for Sustainability of Ecosystem Services and Food Security in Adverse Natural Conditions“ ended second in the competition of 130 submitted project proposals, and along with 14 other projects it was selected for funding within the first phase of the selection. The 5-year-long project will significantly help fund the institution even after 2020, when a gradual decline in public funding for science and research is expected.

Also for these reasons, among other things, we are striving to ensure that our research activities reach beyond the border of the Czech Republic, or even Europe. In this context, in the past half-year, Ms. Ariel Jahner, a representative of the US Embassy in Prague, visited us twice during such a short period of time. Together with her we arranged a visit of Dr. Jeffrey Herrick from the American government agency called the US Environmental Protection Agency. His visit should contribute to the development of mutual cooperation between the two institutions. Similarly, a dinner held by a representative of the Ministry of Science, Technology and Space of the Israeli government could be equally promising for us in the future. It was an event attended by representatives of selected universities and scientific institutions, ours including.

From the CzechGlobe perspective, the event of the year was, of course, the autumn conference „Quo vaditis agriculture, forestry and society under Global Change?“, organized on the occasion of the 20th anniversary of the launch of intensive research on the issues of global change, carbon cycle and ecophysiology of plant production processes in the present GCRI. The conference is discussed in more detail inside this issue of the Newsletter. In addition to that, we have organized a number of project workshops and conferences.

What has become an “evergreen” in recent years is the fact that with approaching summer seasons, GCRI always gets massively publicized in the media. At that time of the year, we are often asked to comment on events related to extreme weather phenomena and explain their causes. Unfortunately, this year was particularly rich in natural disasters. Let’s mention the heat wave in southern Europe that culminated in a series of tragic forest fires or landslides related to the melting of the Alpine glacier. A chapter on its own was the hurricane season in the Caribbean, which has historically classified in the category of the most powerful and rainy hurricanes ever. For a long time it seemed that the Czech Republic — with the exception of South Moravia that has been suffering from serious droughts for several years in a row — will be more or less spared in this year‘s whims of weather. However, at the end of October the windstorm called Herwart swept over the Central Europe. Besides causing great damage to the energy industry, it caused troubles to foresters, whose already damaged stands by droughts and bark beetles were totally wasted estimating to almost three million cubic meters of damaged trees. The fact that drought is indeed a serious problem that needs to be resolved is also shown within the Government of the Czech Republic. The Government, at its last summer holiday session, discussed the draft called „The concept of protection against drought consequences on the territory of the Czech Republic“, which originated in response to the current occurrence of drought episodes. Just before this session of the Government, the Prime Minister of the Czech Republic, Bohuslav Sobotka, together with the representatives of the Ministry of the Environment and the Ministry of Agriculture, i.e. ministries submitting the draft of the concept, and representatives of the Agrarian Chamber visited CzechGlobe.

It was confirmed again that CzechGlobe is a recognized institution contributing to environmental policy making. Therefore we are pleased that after the Chamber of Deputies agreed on the adoption of the Paris Agreement in September, it was ratified on 4 November 2017, i.e. almost two years after it was signed. Thus, the Czech Republic — alongside more than 170 countries — can help maintain a sustainable state of the environment, at least by reducing greenhouse gas emissions. With an enormous delay, but better late than never! -mš-

Let us present the Department of Atmospheric Matter Fluxes and Long-range Transport

THE FOUNDATION OF THE NATIONAL ATMOSPHERIC OBSERVATORY IS A GOOD ENTERPRISE,

says prof. RNDr. Ivan Holoubek, CSc., the Head of the Department of Atmospheric Matter Fluxes and Long-range Transport in the Global Change Research Institute of the Czech Academy of Sciences. He studied Organic Chemistry at the Jan Evangelista Purkyně University (JEPU) in Brno (today's Masaryk University), where he also obtained his RNDr. degree in the field of Analytical Chemistry. He was awarded his CSc. degree at Charles University in Prague in the field of Ecology. In 1998 he was appointed Professor of Chemistry and Technology of Environmental Protection at Brno University of Technology. Since 1977 he has been working at the Faculty of Science, Masaryk University, where he served as the director of the Research Centre for Toxic Compounds in the Environment (RECETOX) from 1990 to 2013. Since 1991, he has been working as an expert for international organizations UNEP UN, World Bank, GEF, he has worked as an advisor to the Turkish government from 2013 to 2015 and at the national level he has worked for the Ministry of the Environment, Ministry of Agriculture, Ministry of Health and Ministry of Industry and Trade. Since November 2016 he has been working part-time for CzechGlobe as well. Within the UN he still continues to work in Turkey and Ukraine.

Your Department was originally under the Domain of Ecosystems Analysis and after you joined the Department it was included in the Domain of Climate Analysis and Modelling. What was the point of doing that?

As far as our new classification in the Domain of Climate Analysis and Modelling is concerned, it has its logic because the primary task of our Department is focused on the studies of atmospheric processes, long-range transport of substances and the like. We could, of course, have stayed in the original Domain of Ecosystems Analysis because the issue concerning the atmosphere is related to what is happening on the surface of the planet, and both atmospheric pollution and atmospheric processes have an impact on water, soil and living organisms. To put it simply, we could be in both the atmospheric domain as well as the ecosystem domain.

So, it seems pointless to ask you whether the research is related to global change or not, doesn't it?

As far as the connection between our research and the global change is concerned, I outlined it a bit at the conference „Quo vaditis?", which was organized by CzechGlobe two months ago. In my lecture I talked about the connections between the changes taking place on the planet and the possible chemical environmental pollution — which is another of the impacts of the expected changes. This is because many of the events that have happened on the planet over the past decades have many other consequences and connections. And whatever is happening, whether of a natural character — this can be a volcanic eruption, a forest fire or just the growth of vegetation itself, which is related to the occurrence of pollen in the air, or of an anthropogenic nature, which includes, in particular, combustion of fossil fuels, industrial mineral processing, etc., has its broader context. A typical example of the interconnection of air pollution and climate change can be the concentration of aerosols in the air affecting the amount of precipitation and the temperature balance of the Earth. So, the desired direction of our Department is definitely connected with global change. After all, the parameters we track can prove or disprove the various theories that exist around the issue of global change on the planet.

So how is the Department going to shape under your leadership?

In terms of shaping the Department, I have a bit different ideas from my predecessor. The activities of the Department are essentially connected with its unique infrastructure — the observatory, or the meteorological mast in Košetice. Although CzechGlobe uses the name Křešín near Pacov, I have already been cooperating with the Czech Hydrometeorological Institute for 30 years and I have always been going to „Košetice". So, the first step I took after I joined CzechGlobe was that together with the Czech Hydrometeorological Institute, the Research Center for Toxic Compounds in the Environment - RECETOX and the Institute of Chemical Process Fundamentals of the Czech Academy of Sciences, created the so-called National Atmospheric Observatory Košetice. I think it is a good enterprise which has combined two infrastructures of Czech Hydrometeorological Institute and CzechGlobe and has a wider national and international significance, since the infrastructure of all four institutions concerned is really unique. This corresponds with the trend that I have been trying to set throughout my whole life, which suggests that in order for things to make sense, it's good when one plus one equals more than two. So we agreed that the establishment of the observatory will interconnect the cooperating institutions even more. At this moment we are preparing a meeting of the director of CzechGlobe and the newly appointed director of the Czech Hydrometeorological Institute, where we will discuss other options of cooperation.

So what does the work of the Department consist in?

Our principal activity is associated with the data that we obtain thanks to the meteo-tower, i.e. we implement long-term environmental monitoring. We measure concentrations and fluxes of greenhouse gases and parameters that are related to their possible influences in the atmosphere. We also monitor pollutants such as aerosols, stratospheric ozone, CO and, newly, also mercury, whose monitoring is related to the Minamata Convention on Mercury. Sampling is basically automatic. Currently, we do not have any activities related to sampling outside of the automatic measurement analyzers, although we count with them in the future as well. Accordingly, our main task is data processing and its evaluation. This has been going on since the tower was launched, and so far we have been primarily focusing on validation of methods and debugging of various technical problems. We are now getting in the phase when we would actually like to use the obtained data, both for our own presentation, as well as for the comparison with the widespread data produced by the CHMI. Therefore there is a great potential for a number of joint projects and publications. There is, for example, an outline for cooperation with the tower in Tušimice, which is, on one hand, lower than ours, however, on the other hand, located in the industry-stressed area.

What are your core projects and cooperation?

I have already mentioned the most essential ones. These are new possibilities for cooperation with the Czech Hydrometeorological Institute, RECETOX Center and the Institute of Chemical Process Fundamentals within the National Observatory. Together, we are participating in the solution of the international project ACTRIS which consolidates the activities of scientists dealing primarily with the composition and characterization of atmospheric aerosols across Europe. By supporting this activity, the European Commission wants to contribute to more effective solution of social and environmental issues such as air quality, health, sustainability and climate change. All four workplaces of the National Observatory, in

addition to dealing with basic research in their field, also solve wider contexts and each contributes to the solution with their specific share. It is also worth mentioning that the so-called persistent organic pollutants have been observed in Košetice for more than 30 years, and some data sets are globally unique. Also, monitoring other substances that have started to be tracked under the ACTRIS project or CzechGlobe activities will represent relatively unique environmental information. Furthermore, the tower itself is highly unique and can be used for monitoring the processes associated with long-range transport of substances, with identification of sources of pollution, with a pollution gradient, and the like.

Another project is ERA-PLANET of the HORIZON 2020 programme. It is focused on long-term monitoring of changes on the planet. It is closely related to international conventions that deal with the protection of human health and the environment against mercury emissions and releases (the Minamata Convention) and with persistent organic pollutants (the Stockholm Convention). We contribute to the part of the project which focuses on the implementation of conventions and which is part of the global international planet observation system coordinated by the United Nations Environment Program (UNEP).

DEPARTMENT OF ATMOSPHERIC MATTER FLUXES AND LONG-RANGE TRANSPORT

The Department is integrated in the Domain of Climate Analysis and Modelling. Its activity is based on the provision and use of measurements conducted at the National Atmospheric Observatory in Košetice, which is a 250-meter-high tower with the appropriate infrastructure allowing — in addition to environmental monitoring, also multidisciplinary research focused on climate change and on the composition and quality of air.

Currently, the Department comprises of five scientists, one PhD student and two technicians.

What is the cooperation with the colleagues from CzechGlobe like?

As for the cooperation within CzechGlobe, I have been working with Professor Tříska for a long time, and already during the era of my predecessor the cooperation with the Department of Matters and Energy fluxes — which is related to our contribution to solving the atmospheric part of the Integrated Carbon Observation System (ICOS) project — started to develop. Our cooperation with other teams is still in its infancy. It is perhaps also due to the fact that I am away more often than not, which is related to a number of national and international activities which I had been part of and which I cannot easily back out of. Our collaboration with other departments rather consists in getting to know each other because my primary task after my appointment in CzechGlobe was mainly to consolidate and finish building up the Department. I think we have been successful doing that, because there were two of us at the beginning and today there are eight of us. Since they are all young people, I think I will first help them stand on their own feet and then continue to further develop the Department. In order to kick-start internal cooperation within CzechGlobe, I am planning to start organizing joint seminars next year to be able to show each other what possibilities we have, because I think that many colleagues are not familiar with what I had been doing in the past and what we could focus on together in the future.

CONFERENCE "QUO VADITIS AGRICULTURE, FORESTRY AND SOCIETY UNDER GLOBAL CHANGE

This year GCRI marks its 20th anniversary of intensive research on the issues of global change, the carbon cycle and the ecophysiology of plant production processes. On this occasion, GCRI organized an international conference entitled „Quo Vaditis Agriculture, Forestry and Society under Global Change?" in the Beskids on the days of 2nd, 3rd and 4th October 2017. From the thematic point of view the conference covered all aspects of GC research undertaken at the CzechGlobe Center. These topics also correspond to the current social calls being solved and supported at the level of ERA (European Research Area). The three-day programme of the conference attended by more than 100 participants from 15 countries – many of whom were at the origin of our institution, was divided into three thematic sections, i.e. agriculture, forestry and the GC social dimension sections. The programme also included an excursion to the Ecosystem Station at Bílý Kříž, which is the oldest and key experimental workstation of the GCRI.

Within the expert sections, the following topics were addressed:

The agricultural section put on lectures focused on GC impacts on production and non-production functions of agriculture and lectures on adaptive measures, especially issues regarding the improvement of water management and carbon storage in the soil. The section was introduced by an invited lecture of dr. Václavík (Helmholz Center for Environmental Research, Germany) on possible negative links between the development of agricultural production, intensification and biodiversity. Other lectures focused on the different parts of agricultural ecosystems such as soil (improved infiltration and retention capacity through friendly tillage technologies, influence of conditions on soil respiration) or plants (influence of the interaction of environmental factors on climate change impacts on agricultural crops) up to the studies at the level of ecosystems or regions (water balance modeling, methods of energy flux assessment, utilization of remote sensing methods).

The section concerned with forestry started with a series of three invited lectures (prof. Ceulemans – University of Antwerp, Belgium; prof. Godbold – BOKU Wien, Austria and dr. Schwärzel – United Nations University, Germany). Individual conference contributions addressed the influence of changing growth conditions, such as temperature increase, nitrogen deposition, increased CO_2 concentration, or acid rains on tree growth and the development of forest ecosystem. What was also presented, were actual results of the influence of extreme synoptic situations associated with GC, such as the occurrence of tornadoes in the regions of Central Europe. A number of contributions proposed the application of new methodological approaches that can be used for monitoring changes in forest stand structure, for monitoring the emission of greenhouse gases and their quantification as well as for restoration of damaged forest stands. The discussion showed the need for comprehensive and long-term study of plants and ecosystems or the need to interconnect individual experimental techniques with quality modeling of processes at ecosystems level.

The GC social dimension section presented various aspects of GC. One of the most important aspects was the society's attitude towards the climate change. Attitudes create perception and reactions of both individuals and the whole society to climate change. Another important aspect is the economy of climate change and ecosystem services. The contributions focused on the social consequences of the environmental GC, the role of payments for ecosystem services, or the analysis of the costs and benefits of adaptation actions. Climate change will affect cities as places where most people live. Several contributions focused on the adaptation to climate change in cities and obstacles and opportunities for successful adaptation. Other important topics discussed were the role of carbon forestry, environmental pollution and biodiversity when adapting and mitigating global environmental changes.

SCIENTISTS ARE WARNING – AFTER 25 YEARS AGAIN

GOT OUR ATTENTION

In 1992, a group of scientists associated within the "Union of Concerned Scientists" published an article entitled "World Scientists' Warning to Humanity". The manifesto, which briefly sums up global trends related to sustainability, was supported by more than 1700 independent scientists, including most Nobel Prize winners. The scientists have pointed out that humans were on a collision course with the natural world and that there is an urgent need for inevitable changes to remedy this situation. The main issue was the need to stabilize the global population. After 25 years, at the time of the 23rd Climate Conference in Bonn, BioScience journal published a similar call. It has been supported by more than 15,000 scientists, which has significantly increased the importance of this new call.

Although the authors do not present any new scientific findings, they summarize the progress that humanity has achieved over this period. The article summarizes 9 key global sustainability indicators.

Researchers are witnessing a rapid and continuing decline in chlorofluorocarbons emission, a rapid decline in birth rates in many areas of the world thanks to the investment in women's education, a promising decline in deforestation rates in some parts of the world, and a rapid increase in the capacity of renewable energy sources combined with a reduction in extreme poverty and hunger. At the same time, however, they point to the fact that in most other areas the warning did not get across properly and the situation continues to deteriorate. Despite many findings that humanity has acquired in the context of sustainability over the last 25 years, the greenhouse gas emissions or dead zones in the oceans have been rising gradually and the decline in biodiversity has been continuing at an accelerated rate. At the conclusion of the call, the scientists state that the time to reverse humanity's collision course with natural world is rapidly shortening, and it is inevitable for people to realize the connection of their everyday lives and the resulting consequences for the planet Earth. -aa-

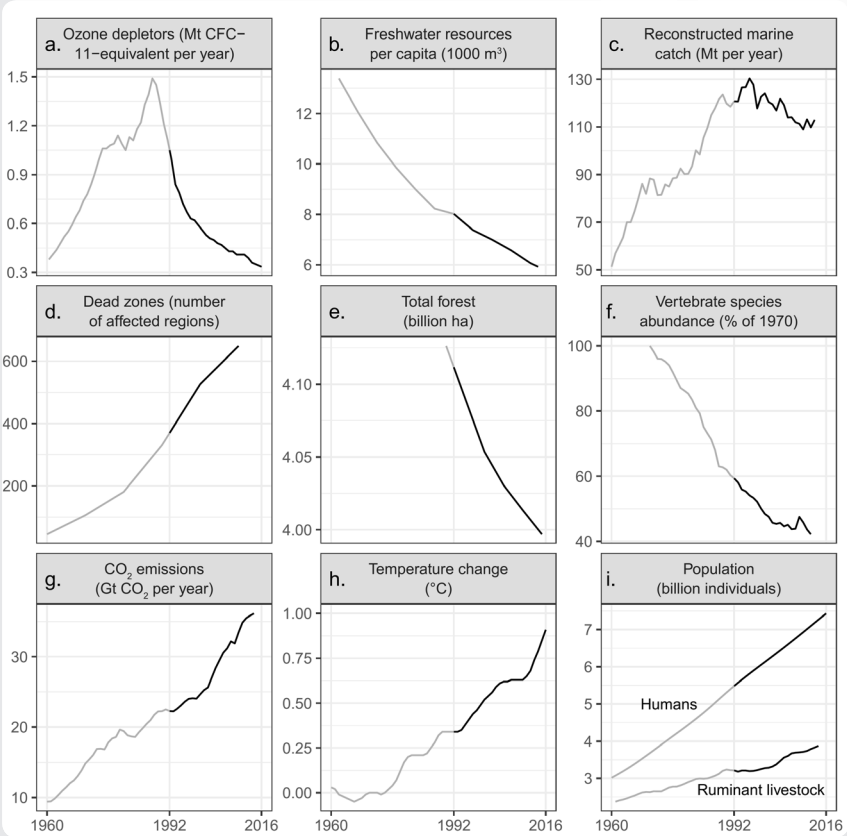

Fig. 1: Continuation of trends since the publication of the first call in 1992, i.e. for the period from 1960 to 2016. (a) emission of chlorofluorocarbon that depletes the ozone layer; (b) drinking water sources per person; (c) marine catch; (d) the occurrence of dead zones in the oceans; (e) forest areas; (f) the number of vertebrate species; (g) carbon dioxide emissions; h) change in global temperature; (i) the population and the state of the ruminant livestock.

Reference: Rippley et al. 2017, BioScience. https://academic.oup.com/bioscience/advance-article/doi/10.1093/biosci/bix125/4605229

WHAT´S NEW

Prime Minister Sobotka in CzechGlobe

On 21st July 2017 Bohuslav Sobotka, the Prime Minister of the Czech Republic, together with the representatives of the Ministry of the Environment, the Ministry of Agriculture and the Agrarian Chamber of the Czech Republic, visited GCRI. The discussions with scientists concerned mainly the impacts of climate change on the Czech Republic. On the subject of adaptation of agriculture to climate changes, the Prime Minister emphasized the need for a plan that would be created based on scientific findings.

Meeting of the DriDanube project

From 4th to 6th October 2017, GCRI organized the second working meeting of the DriDanube Project (Drought Risk in the Danube Region) in Brno. Besides the agenda related to the implementation and management of the project, the meeting programme also included training courses focused on the topic of Implementation of widespread monitoring network of drought impact with the help of respondents, as well as on work with a web portal of the project including different types of maps and functionalities.

Visit of the Chairwoman of the Czech Academy of Sciences

On 17th October 2017, the Chairwoman of CAS, prof. Eva Zažímalová, together with the vice-chairman of CAS, Dr. Zdeněk Havlas, visited GCRI. This was one of the introductory visits of their tour of CAS institutes which they have undertaken since they were appointed to their posts in the spring of 2017. In addition to the Brno headquarters, they also visited some of the detached experimental workplaces during their full-day tour. It included the atmospheric station in Křešín near Pacov, the Domanínek research station in Bystřice nad Pernštejnem and the airborne laboratory at the airport in Brno Tuřany.

Meeting with the respondents of Intersucho.cz portal

On 14th November 2017, GCRI together with Mendel University and Agrarian Chamber of the Czech Republic organized a discussion conference called „Monitoring and Evaluation of Agricultural Drought Impacts in the Czech Republic - encounter with the practical experts of Intersucho.cz portal". Most of the 140 participants were respondents who have been monitoring the impacts and course of drought in the surface layer of the soil on weekly basis. For these respondents a block of expert lectures was prepared.

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In this issue of the CzechGlobe newsletter we are coming up with a novelty. Starting this year, an appendix dedicated to interesting results achieved in the past year will become part of the winter issue of the newsletter published at the end of the year.

The appendix to issue 2/2017 is dedicated to interesting publications of PhD students and postdocs across various expert sections.

Fischer, M., Kelley, A. M., Ward, E. J., Boone, J. D., Ashley, E. M., Domec, J.-C., Williamson, J. C., King, J. S. A critical analysis of species selection and high vs. low-input silviculture on establishment success and early productivity of model short-rotation wood-energy cropping systems. *Biomass & Bioenergy* 2017, 98 (1): 214-224. ISSN 0961-9534.

The study Fischer et al. (2017) is focused on the topic of short rotation woody crops (SRWC) for bioenergy purposes. Most of the research on SRWC has been dedicated to the genera Populus and Salix. These species generally require relatively high-input culture, including intensive weed competition control, which increases costs and environmental externalities. Widespread native early successional species, characterized by high productivity and good coppicing ability, may be better adapted to local environmental stresses and therefore could offer alternative low-input bioenergy production systems. To test this concept, we established a three-year experiment comparing a widely-used hybrid poplar (Populus nigra × P. maximowiczii, clone 'NM6') to two native species, American sycamore (Platanus occidentalis L.) and tuliptree (Liriodendron tulipifera L.) grown under contrasting weed and pest control at a coastal plain site in eastern North Carolina, USA. Mean cumulative aboveground wood production was significantly greater in sycamore, with yields of 46.6 Mg ha^{-1} under high-inputs and 32.7 Mg ha^{-1} under low-input culture, which rivaled the high-input NM6 yield of 32.9 Mg ha^{-1}. NM6 under low-input management provided noncompetitive yield of 6.2 Mg ha^{-1}. Poor performance in all traits was found for tuliptree, with a maximum yield of 1.2 Mg ha^{-1}, suggesting this native species is a poor choice for SRWC. Sycamore clearly showed superiority in survival, biomass increment, weed resistance, treatment convergence, and within-stand uniformity. Highlighted by the capability of sycamore to be grown with very little inputs (also on highly eroded clayey soils as the authors proved in another study), these are all important characteristics for bioenergy feedstock crop species, leading to reliable establishment and efficient biomass production. We conclude that careful species selection beyond the conventionally used genera may enhance reliability and decrease negative environmental impacts of the bioenergy biomass production sector.

McGloin, R., **Šigut, L.**, Havránková, K., Dušek, J., Pavelka, M., Sedlák, P. Energy balance closure at a variety of ecosystems in Central Europe with contrasting topographies. *Agricultural and Forest Meteorology* 2017, 248: 418-431, ISSN 0168-1923.

Study focuses on energy exchange between the atmosphere and selected ecosystems that are part of the Czech, European and global network of ecosystem stations for carbon monitoring. Scientific studies often focus more on CO_2 exchange and the influence of micrometeorological parameters on the plant production. However, the heat released by a surface can also tell us a lot about the vegetation responses to actual environmental conditions. The available sun radiation transformed to heat can be released as a flux of sensible or latent heat. We can experience the sensible heat through the increase in air temperature while the latent heat is carried by the water molecules that used it for evaporation. Thus, especially observation of latent heat flux allows us to answer questions about plant water management. From the methodical point of view, another important topic that is connected with energy fluxes is the so called energy balance closure and it was also the main theme of the article. This approach assumes that the amount of available energy during the year is equal to the sum of latent and sensible heat. Due to the high precision of available energy measurements, the generally observed energy flux underestimation is accounted to the uncertainties of energy flux measurements by eddy covariance method. The publication results helped to confirm the high quality of eddy covariance measurements (energy balance closure in the range 70 – 80%) and also to pinpoint the conditions under which the method reliability decreases. The work demonstrated the dependence of energy balance closure on the atmospheric stratification when the highest degree of closure occurred in moderately unstable conditions. Detailed data analysis of the location with the lowest closure fraction showed that complex topography to the south of the eddy covariance tower was influencing the airflow and resulted in poor energy balance closure results.

Juráň, S., Pallozi, E., Guidolotti, G., Fares, S., Šigut, L., Calfapietra, C., Alivernini, A., Savi, F., Večeřová, K., Křůmal, K., Večeřa, Z., Urban, O. Fluxes of biogenic volatile organic compounds above temperate Norway spruce forest of the Czech Republic. *Agricultural and Forest Meteorology* 2017, 232: 500-513. ISSN 0168-1923.

Fluxes of volatile organic compounds were modelled and measured at Bílý Kříž experimental station in 2014 by using eddy-covariance technique coupled with PTR-TOF-MS 8000 mass spectrometer, which is able to capture the whole spectrum of gases in 10 Hz resolution. Together with information about wind movement it is possible to get precise direction of the flux of all the compounds. Spruce forest was recognized to emit monoterpenes (up to 2.03 nmol m^{-2} s^{-1}) and isoprene together with 2-methyl-3-buten-2-ol (up to 1.6 nmol m^{-2} s^{-1}). The last compound came as a surprise as it was the first time when it was measured in Norway spruce forest. Diurnal patterns of modelled monoterpene fluxes by MEGAN model were in accordance with the measured fluxes. More precise results were achieved when emission factors for separate sunny and shaded needles were applied. The loss of carbon due to volatile organic compound emission was calculated and related to the carbon assimilated by photosynthesis; the daily average was 0.3% with maxima peeking up to 1.5%. Published results contribute to better understanding of volatile organic compounds (take part in tropospheric ozone and aerosols formation) fluxes from forest ecosystems of Central Europe.

Machacova K, Maier M, Svobodova K, Lang F, Urban O Cryptogamic stem covers may contribute to nitrous oxide consumption by mature beech trees. *Scientific Reports* 2017, 7, 13243,DOI: 10.1038/s41598-017-13781-7.

Czech-German research team from the Global Change Research Institute CAS and the University of Freiburg has revealed that trees might consume nitrous oxide (N_2O) from the atmosphere. Their results were published in Scientific Reports belonging to the Nature publishing group in October 2017. N_2O is an important greenhouse gas contributing to global climate change. It is naturally produced and metabolized in soils and can be also exchanged with the atmosphere. The gas exchange at the soil surface can occur in both directions – as emission of N_2O into the atmosphere, but also as N_2O uptake from the atmosphere. Even though trees are known to emit N_2O into the atmosphere, they have so far been overlooked in N_2O inventories of forest ecosystems. The authors measured and quantified natural fluxes of N_2O from stems of mature European beech trees (Fagus sylvatica), which represent native and widely distributed deciduous tree species in temperate forests of Central Europe. The article shows for the first time that stems of beech trees may act as a substantial sink of N_2O from the atmosphere under conditions of soils consuming N_2O. Consistent consumption of N_2O by all stems investigated is a novel finding in contrast to current studies presenting trees as N_2O emitters only. To understand these fluxes, researchers collected samples of photoautotrophic organisms associated with beech bark (so called "cryptogamic stem covers" as lichens, mosses and algae) and measured their capacity to exchange N_2O with the atmosphere under laboratory conditions. All these organisms were net N_2O sinks at full rehydration and temperature of 25 °C. The consumption rates were comparable to stem consumption rates measured under field conditions of mountain forests. The results presented in the article highlight that cryptogamic stem covers could be a relevant sink of N_2O in European beech forests.

Emmer, A. Geomorphologically effective floods from moraine-dammed lakes in the Cordillera Blanca, Peru. *Quaternary Science Reviews* 2017, 177, Dec: 220-234. ISSN 0277-3791.

Glacial lake outburst floods (GLOFs) originating in moraine-dammed lakes — specific low-frequency, high magnitude events resulting from failure or overtopping of the lake dam, tied with the retreating glaciers — represent a significant geomorphological process as well as a threat for local communities in the Cordillera Blanca, Peru (thousands of fatalities documented). To better face them, these processes need to be investigated and understood in the broader context of ongoing changes. The main objective of this work was to provide a revised and comprehensive overview of geomorphologically effective floods in the area of interest, using various documentary data sources, verified by analysis of remotely sensed images (1948-2013) and enhanced by original field data. Verified events (n = 28; 4 not mentioned before) are analyzed from the perspective of spatiotemporal distribution (1725 - present), pre-flood conditions, causes, mechanisms and geomorphological impacts as well as socioeconomical consequences, revealing certain patterns, ties to the ongoing geoenvironmental change, and similar features. GLOFs are further classified according to their magnitude: 5 extreme events, 8 major events and 15 minor events are distinguished, referring to the quantified geomorphological and socioeconomical impacts. Selected moraine dams and flood deposits are dated using lichenometric dating. Special attention is given to moraine dam breaches - the most frequent type of water release with the most significant consequences. Finally, a general schematic model of lake formation, growth and post-flood evolution reflecting initial topographical setting and glacier retreat is introduced and the utilization of the obtained results is outlined.

Segečová, A., Červený, J., Roitsch, T. Stress Response Monitoring of Photoautotrophic Higher Plant Suspension Cultures by Fluorescence Imaging for High-Throughput Toxic Compound Screening. *Journal of Environmental Protection and Ecology* 2017, 8 (6): 678-692. ISSN 1311-5065.

Chlorophyll fluorescence measurement is commonly used to detect different types of stress in plants. In recent years, this method has expanded by the option of a visual imaging of a fluorescence signal. However, the plant body is often complexly structured or composed of several different cellular structures that may complicate the measurement of fluorescence or result in an uneven distribution of the fluorescence signal. Therefore, we focused on the study of plant cell cultures - cells growing freely in nutrient medium. This is actually a kind of miniaturization of a leaf to a cellular level. These cells contain chloroplasts, so they make it possible to use chlorophyll fluorescence to detect stress and form a homogeneous biomass, which simplifies both the application of the stressor - in our case the herbicide - and fluorescence response measurements. These tests can be performed in microplates, allowing you to test a large number of samples on a small area. In addition, the reduction of the leaf to one cell type accelerates the penetration of the toxicant to the cells, which reduces the time required to detect stress and the concentration needed to trigger the response.
We tested the effect of the DCMU herbicide concentration range on the response of chlorophyll fluorescence of the autotrophic cell culture of the tomato in a 96-well microtiter microplate. We found that, using a chosen combination of imaging fluorescence method and cell culture, we are able to (a) detect the negative effect of the herbicide on the photosynthesis efficiency at even low concentrations; (b) differentiate response to individual concentrations; (c) detect stress in a short time after DCMU administration; (d) reduce undesirable response variability; (e) detect negative effects pre-symptomatically.
Our preliminary results indicate the potential of our experimental approach as a rapid pre-screening method for testing toxicity and / or as an additional method to standard whole plant toxicity tests. In the future, we are going to focus on the validation of this method for more groups of toxic substances.