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 included.

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,
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). 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 Trtika 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.

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 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.
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.

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.


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 abovegroundwood 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 coverage, 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.


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 CO₂ 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.


Fluxes of volatile organic compounds were modelled and measured at Bílý Kríž 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 monoterpane 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 peaking 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.
Czech-German research team from the Global Change Research Institute CAS and the University of Freiburg has revealed that trees might consume nitrous oxide (\(\text{N}_2\text{O}\)) from the atmosphere. Their results were published in Scientific Reports belonging to the Nature publishing group in October 2017. \(\text{N}_2\text{O}\) 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 \(\text{N}_2\text{O}\) into the atmosphere, but also as \(\text{N}_2\text{O}\) uptake from the atmosphere. Even though trees are known to emit \(\text{N}_2\text{O}\) into the atmosphere, they have so far been overlooked in \(\text{N}_2\text{O}\) inventories of forest ecosystems. The authors measured and quantified natural fluxes of \(\text{N}_2\text{O}\) 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 \(\text{N}_2\text{O}\) from the atmosphere under conditions of soils consuming \(\text{N}_2\text{O}\). Consistent consumption of \(\text{N}_2\text{O}\) by all stems investigated is a novel finding in contrast to current studies presenting trees as \(\text{N}_2\text{O}\) 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 \(\text{N}_2\text{O}\) with the atmosphere under laboratory conditions. All these organisms were net \(\text{N}_2\text{O}\) 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 \(\text{N}_2\text{O}\) in European beech forests.

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