

# Newsletter

2/2014



## THINGS ARE GOOD



After four hectic years of building and developing the research infrastructure of the Centre of Excellence CzechGlobe, the time of a relative relaxation has finally come. The period which for the key scientific personnel has been associated with the implementation of monitoring indicators and specification of instrumentation for their purchases through tenders, was exchanged with the time they can fully devote to scientific work again.

Now they have the ideal conditions - the infrastructure is ready and the scientific teams are stabilized. It seems that all of this fits together and allows them, in addition to standard acquisition and solution of projects, to engage in contractual research as well. It is noticeable, for example, with the Laboratory of Metabolomics, which is already nearly used to its full capacities thanks to the contractual research they are doing. The Remote Sensing Laboratory is fully equipped and apart from its own assignments it committed to within grants, it can provide the services of the Airborne Laboratory through open-access. The contractual research is being successfully carried

out also by the Department of Climate Modeling, which helps energy companies find solutions for processing meteorological data. Such solutions make it possible to increase the efficiency of the use of solar and wind power stations.

As for successful grants, we must highlight the first HORIZON 2020 programme project, which was acquired by the Division of the Human Dimensions of Global Change Impacts with its project ESMEALDA. This team, as well as the Department of Climate Change Impacts on Agroecosystems, managed to acquire also a project of Norwegian Funds.

The past six months since the Opening Ceremony of the CzechGlobe Centre have been associated with organizing workshops and summer schools - mostly under the umbrella of the Education for Competitiveness Operational Programme (ECOP). A project that can be considered highly successful is the HyDaP project, which was completed in September by its final conference. During the two years of its implementation the team was able to hold 7 international workshops and 5 discussion panels. These events provided

mostly PhD students with the opportunity to practically get acquainted with the latest technologies in airborne remote sensing and showed them how to use such technologies in the investigation of ecosystems, water, soil, etc. Other projects provided summer schools focused on systems biology, biology of plant stress, ecophysiological measurements and the management of projects in science and research.

The time has also come for us to be able to begin pursuing things that had to stand aside a little in the past. These include glass domes at Bílý Kříž. After 17 years of operation, they were greatly marked by the ravages of time and had to undergo a general reconstruction. Nevertheless, even compared to new and modern cultivation chambers in Domanínek they are still considered a unique experimental facility. They were them that helped us open the doors of prestigious „scientific clubs“ dealing with impact experiments. It is also owing to this fact, that the more senior research staff considers the experimental station at Bílý Kříž a matter of the heart.

The conclusion of this year was also very significant because the OP R&DI project CzechGlobe underwent the evaluation by an international committee. At the same time, the institution has been preparing for the regular international evaluation of the departments of the Academy of Sciences, which will be held next year. Although we will not be introduced to the project evaluation results until the early 2015, we already have to agree with the words the chairman of the evaluation committee said in his final evaluation speech. Namely „the work we have carried out in a relatively short period of time is enormous, but to reach the imaginary Mt. Everest of science we still have to climb a great deal of the steep path. So far we have managed to build up a base camp and climbed up into the first high-altitude camp ... „With the year ending, we just wish we got a bit higher on our way in 2015!

-mš-

**WE ARE INTRODUCING THE DEPARTMENT OF CLIMATE CHANGE IMPACTS ON AGROSYSTEMS**

**ARE WE FACING A HIGHER RISK OF EPISODES OF DROUGHT**



says Doc. Mgr. Ing. Miroslav Trnka, Ph.D., the head of the Department of Climate Change Impacts on Agrosystems. He graduated from the Faculty of Agronomy, Mendel University in Brno, where he completed his PhD studies in the subject field of Applied Landscape Ecology. He still works for Mendel University as a university teacher at the Department of Agrosystems and Bioclimatology. Besides that, Mr. Trnka completed his Master's degree at the Faculty of Law, Masaryk University in Brno, where he focused on the issue of standards for the protection of nature and the atmosphere. Since 2010, he has been working at the CzechGlobe Centre whose formation he has been involved in since its very beginning.

As far as the CzechGlobe structure is concerned, you are a completely new department focusing on climatology, which was not a much investigated subject in the original ISBE (Institute of Systems Biology and Ecology). When did you start considering a closer interconnection and cooperation?

We, at Mendel University, where part of the team actually comes from, had known about ISBE for a long time, and had, in fact, cooperated with some of the institution's staff for many years. When the CzechGlobe project was conceived, prof. Marek approached prof. Žalud from Mendel University and prof. Brázdil from Masaryk University in order to ask them whether they would be interested in taking part in the formation of a conceptually new institution. Of course we were interested. We felt that this was an opportunity to systemically connect agriculture, forestry, substance fluxes, climatology and hydrology - the fields that belong together - within a single institution. And we believed it was necessary if the analysis of the climate change impact is to be done in an interdisciplinary way. In addition, it seemed that the idea of the Centre is truly targeted at ensuring the conditions for long-term cooperation between the disciplines and we felt that this idea could work. We still believe that our new institution has the potential to shift the level of the climate change issues to a new, and hopefully a higher level.

The name of the department implies that you are broad in scope – you collect data, perform physiological measurements, model ... Can you describe in more detail what is it that you deal with?

We sometimes jokingly say that we are kind of a climatological CzechGlobe on a small scale, because we also strive to understand how systems work. Therefore we work with models a lot, and from the very beginning we have tried to compare them with experimental data which we either obtained from other experiments or bought. In the course of time, we found out that we need to be able to measure the data ourselves in order to know where errors may occur, how big they can be or how various measurement methods can differ. Then we can better decide which data and from which database is worth buying. We are trying to get most data from ongoing experiments, because it is an effective way to maximize the data use. I.e. for other purposes than it was originally collected for. Sometimes, however, the data is not available, so we cannot do without our own experiments. And that is why CzechGlobe is so amazing - partly because of the equipment that is available here, but mainly because of the people. You can come up to colleagues from other teams and departments with a proposal for an experiment, and not only do they not tell you to go fly a kite, but they will come up with their own ideas about what else

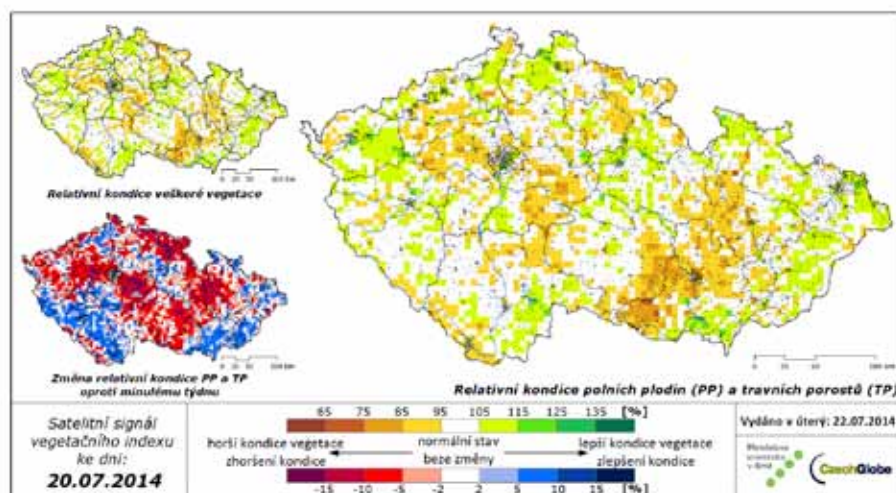
could be done. So, in the end, we create things that are very interesting, and on top of that, it happens very quickly. Consequently, it does not happen or at least should not happen very often, that somebody else will carry out a project aimed at a specific topic before we manage to write a successful project proposal and start the measurements ourselves.

**So it seems that the cooperation between the CzechGlobe teams does work, doesn't it?**

We feel so, and I do not think that it is just thanks to the CzechGlobe hospitality towards guests, as most of our department is not physically based directly in the Běláidla street. On the contrary, we have been feeling like a part of the family for a long time and are very happy to come here to consult new ideas and projects. Generally, the atmosphere here is very relaxing which gives us the energy to go on. It is kind of opposite to what we experience with other partners in terms of various administrative matters and project demands.

**This year, the prestigious journal Nature - Climate Change published the results of your study whose outcomes were ranked among beneficial results of the Czech agricultural research for global food security by the Ministry of Agriculture. What is the study about?**

The impact of the study is perhaps, to some extent, a bit overestimated. We were simply the first people who specifically pointed out to something that seemed to us to be clear. However, the literature had quite neglected it, or if you like, had forgotten it completely. The thing is, that in the field of agronomy, potential impacts need to be addressed comprehensively and factors that, at first sight, can be considered banal or obvious should not be omitted. Together with colleagues from several countries within the project called Joint Programming Initiative, we wondered where the risks for future food production lie. We chose wheat because it is the world's main food exported and Europe is the largest producer of it. We found out that the current analyses of the impact of climate change on agriculture miss the identification of the impact of various phenomena of inclement weather. And they are not only climatic extremes, these phenomena also include, for example, the occurrence of higher temperatures in sensitive periods for wheat, droughts, late frosts, black frosts in winter and also, what we observed in the CR this year, that due to persistent rains, people were unable to access the sites with necessary machinery during the critical moment for the production (the time of sowing or harvesting). These factors had been neglected in existing studies because it is difficult to model and quantify their importance for the yield. Instead, physiological models saying how wheat grows in the conditions given and how it will grow in the future climate are used. For example, with an increase in average temperature by 2 °C, Europe, according to these models, is



going to make profit on that - in the upcoming decades the wheat yields will be higher on average. However, these models do not completely correlate with reality, because they do not include a number of factors that might jeopardize the production. Therefore, we began to wonder how often such unfavorable extremes may occur in the current climatic conditions. That was the core of our study – we were investigating whether the likelihood of adverse events is going to decrease or increase. One of the innovations is that we did not deal with just one single phenomenon but with about eleven phenomena in various combinations, for which we determined their cumulative probability. Naturally, we are still working on it, because we have just touched on the subject. There are many more pitfalls and risks, and so far we have only covered the most important events for selected locations in Europe. The study shows that it may be wrong to settle for the conclusion that the climate change does not impact food security in Europe much. What can happen is that while the average yields will rise, local differences will be dramatic. For example, this year seemed to be catastrophically bad at first, then it turned out that, for example, oilseed rape yields are record-breaking, but when the whole season is evaluated, the year ends up being average which is due to the fact that part of the harvest was not harvested, or if you like, was harvested but in a significantly worse quality. And all these circumstances came together in a single year on such a small area as the Czech Republic. **You examined 11 different phenomena, but as far as I know, and also considering the InterSucho project, you mainly deal with drought. Is that so?**

What we are engaged in is the agriculture, which covers a large part of the area of the Czech Republic and Europe, and it is, in fact, the principal consumer of water in Europe. Therefore water management and water economy in the landscape has always been a key question for us. I and my colleagues from our department have been dealing with it for over 15 years so far. In the long term, we monitor changes and trends in soil moisture in the Czech Republic and we deal with soil deficiency and its impact on vegetation. The first results of our analyses, which were also presented by the National Climate Program of the CR, revealed that the water balance is going to change and that there is a greater risk of drought episodes in the future. Our recent studies have shown that soil moisture in the last 50 years, during the critical periods from April to June, has been decreasing – resources of water in soil have been falling systematically. The InterSucho project helped us carry out the vision and create a system that will monitor soil water content in such a resolution that it is practically applicable, but at the same time, that the data could be used for strategic studies and that the system could also deal with future climate conditions. Consequently a website was created ([www.intersucho.cz](http://www.intersucho.cz)) to weekly monitor the whole country in terms of occurrence and potential impacts of drought. This activity can be directly used in agricultural

## DEPARTMENT OF CLIMATE CHANGE IMPACTS ON AGROSYSTEMS

The Department of Climate Change Impacts on Agrosystems belongs, in terms of the CzechGlobe structure, to the Division of Climate Analyses and Modelling. The department deals with the assessment of climate change impacts on

agroecosystems, both the impacts on the cultivation of major field crops as well as on new types of cultures. It also seeks to propose and test adaptation measures helping to mitigate the effects of the climate change or to accelerate the positive impacts.



practice and is also welcomed by the Agricultural Chamber of the Czech Republic, which we cooperate with. Such monitoring and information is vital for farmers who are then able to make a responsible decision during the critical period.

Frankly, we consider drought in the CR more significant than it might be, for example, in the Mediterranean, despite the fact that the European project policy and subsidy policy are framed very differently. The Central European agriculture, Czech particularly, is adapted to relatively evenly distributed rainfall and has no additional sources of water - neither large bodies of water nor rivers or large underground water resources. We are almost entirely dependent on rainfall, and any change in the hydrological cycle in the Czech Republic becomes evident. In our opinion, the vulnerability of Czech agriculture is extreme and there are very few areas under irrigation. At the same time we are struggling with soil degradation. These soils have a reduced ability to retain water. So far, we even do not know what the current water reserves in the soil are and how the situation is going to develop in the future. This is a deadly mix for farmers and it is also very disadvantageous in terms of competition, because, for example, German farmers are not just better informed, they are also more confident in terms of rainfall thanks to prevailing climatic conditions.

### **Do your results lead to any adaptation measures?**

In connection with landscape, the word landscape resilience is widely used- i.e. flexibility and resistance, which is, when considering all of the above mentioned risks, relatively high, but it is necessary to be aware of the fact that the risk is going to increase over time. In the upcoming decades, southern Moravia is not going to become the second Sahara, of course. It may, however, and quite likely it will, be susceptible to significant

moisture deficits within the season, to damage to permanent crops such as vineyards and orchards, and even to yield fluctuations leading to liquidation for individual farmers. These threats are very real.

Adaptation, unlike mitigation, cannot be centrally controlled through legislation, diversification is therefore important, i.e. not to rely on individual crops, as we do now, but to focus on higher value-added production in the landscape. We must get back to the things that we left behind, and adjust the crops to that. Great potential is in cultivation, genetics and in existing technologies. Again, it's about science producing practically useful results. This is where I see a problem - in the system of science funding, in distinguishing what basic and applied research is. For instance, our InterSucho project is a typical example. We started with basic research and came to applicable results. The grant support system does distinguish between the basic and applied research, but it is hard to find the boundary, which is not there, in fact. And it is drought actually (monitoring and search for adaptation measures) that serves as an example of basic research which can provide a piece of applicable information. However, no private company is going to finance a research monitoring drought because the adaptation is local and the development and operation of such a system would be unprofitable for a single company. The impacts and benefits of the system are tied to specific entities, where each entity has different priorities. It is therefore impossible to directly commercially exploit a thing as drought monitoring. On the other hand people in practice expect science to deliver such information, since it is obvious that such a system can actually be technically implemented.

# WERE THE PROGNOSSES OF THE CLUB OF ROME RIGHT?

**GOT OUR ATTENTION**

G. Turner

The Club of Rome is an independent organization of scientists founded in 1968. As its name suggests, their main idea is that in order to avoid the destiny of the Roman Empire, it is necessary to change the current global development. In 1972 their book „The Limits to Growth“, which highlighted the unsustainability of continuing growth in the consumption of natural resources and energy, earned worldwide attention. Through the total of 12 analyzed scenarios in the global model World3, they identified that the overshoot of environmental capacity and subsequent collapse could be avoided only if considerable changes in social behavior were made and if technological progress overtook the environmental degradation and resource depletion. These conclusions were perceived as too pessimistic and relatively quickly after the book was published they were criticized primarily by economists. Although the criticism was mostly technically and scientifically inaccurate or based on scenarios not corresponding with “BAU - Business As Usual”, it is generally accepted today that the forecasts of the Club of Rome were not right in the end. An Australian scientist Graham Turner in his work examined in detail how the original scenarios of the Club of Rome have reflected reality so far (**Fig. 1**).

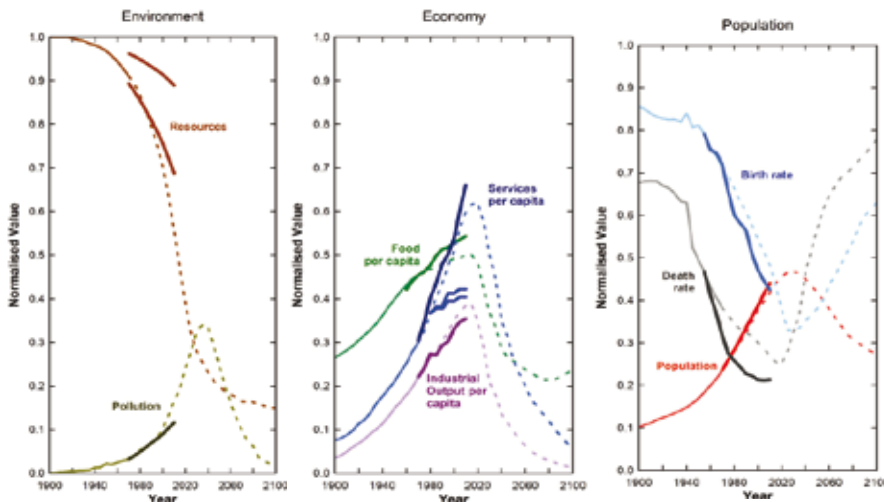
The results show that the evolution of the modeled BAU scenarios, i.e. such where no substantial changes in population and economic growth occur, have reflected reality in

most of the parameters monitored quite well so far. Therefore, one cannot yet say that the forecasts of the Club of Rome failed to be right. On the contrary, this work points out that the current economic problems manifesting in the global financial crisis, as well as problems with oil production at the global level, may be the first signs of a deviation from the economy functioning „as usual“. What is particularly crucial for the further global development is the oil production, which now powers 95% of all transportation, and any significant impact on the oil extraction would be reflected in a decline in economic activity. Current analyses suggest that we are currently in the period of maximum extraction of conventional oil, i.e. the cheapest and energetically most convenient.

One of the conclusions of this study is that the global downturn is potentially possible. And in many respects, it could be experienced much sooner than most people think. However, if the world economies get over their current problems and economic growth is kick-started in the upcoming years, it will be possible to argue that the Club of Rome and its prognoses were fortunately wrong.

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Citace: Turner, G. (2014) 'Is Global Collapse Imminent?', *MSSI Research Paper No. 4, Melbourne Sustainable Society Institute, The University of Melbourne.*



**Fig. 1:** The standard scenario of „Business As Usual“ (BAU) according to the publication of the Club of Rome called *The Limits to Growth* (dashed lines) in comparison with the reality of the following 40 years, i.e. from 1970 to 2010 (solid lines). The compared variables are: global pollution and the fraction of non-renewable resources remaining (a), industrial production, food and services (blue - the upper curve shows electricity, the middle curve shows literacy rates for adults and the lower curve shows the literacy rates for youths), all calculated per capita (b), development of population, birth-rate and death-rate (c).

# WHAT'S NEW

## Professor Baldocchi's visit

In July, prof. Dennis Baldocchi, one of the world's most renowned experts in the field of biometeorology and ecosystem ecology, from the University of Berkeley was staying at the GCRC on a working visit. During his one-week-long visit, not only did he present lectures but he also devoted his time to expert discussions with young scientists, PhD students and technicians. He was eager to provide his listeners with useful advice based on his own experimental experience. When visiting ecosystem stations and the atmospheric station in Křešín, he was both surprised and pleased at the excellence of the equipment at the research facilities as well as at the work of scientists and technicians.

## Open science

From 6th to 10th October 2014, within the scope of a regular event organized by the AS CR called „Open Science“, a biology course for secondary school teachers was held at the GCRC. The course offered a series of lectures accompanied by practical tutorials across biology disciplines. The lectures will serve the participants as a resource of new knowledge for the preparation of pilot lessons as well as for innovations in their teaching. The course was attended by twenty secondary school teachers from across the Czech Republic. The GCRC provided, among other things, laboratories with the necessary equipment.

## Science and Technology Week

From 1st to 15th November 2014, the AS CR organized a national event called the Science and Technology Week. This year the GCRC got actively involved by participating in the presentation of science in the shopping mall Vaňkovka, by the Day of open doors in the laboratories of the P.G. Jarvis Pavilion in Brno and, in the week from 10th to 14th November, by a series of popular science lectures for the general public at the Brno Observatory.

## How Brno breathes

On 10th November 2014, a project of regional cooperation for measuring CO<sub>2</sub> exchange between the city and the atmosphere was launched at the Brno Observatory with the attendance of the President of the AS CR, prof. Drahoš.

## Czech-Icelandic workshop

From 20th to 21st November 2014 in Prague, the GCRC organized a Czech-Icelandic workshop called „Ecosystem services and sustainable development: integrating experiences from different regions and scales“. This bilateral workshop introduced the participants to the experience with the application and implementation of a framework for ecosystem services primarily in the Czech Republic and Iceland, but also in neighboring countries and regions.

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