

# Newsletter

1/2019



## THE GLOBAL CHANGE THEME IS GAINING SOCIAL IMPORTANCE

The *silly season*, or as we call it the *cucumber time*, in journalists' jargon refers to a period when there is nothing much to write about, at least from the newsworthy perspective. From the viewpoint of CzechGlobe, the first six months of 2019 were definitely not a *silly season* at all. On the contrary, these months were loaded with events that are worth writing about, at least briefly.

The year started very powerfully for the colleagues from the Remote Sensing Department who had the honorable duty to organize the 11<sup>th</sup> workshop of Imaging Spectroscopy held under the auspices of the Special Interest Group for Imaging Spectroscopy in Brno SIG IS of the European Association of Remote Sensing Laboratories (EARSel), associating more than 250 workplaces from both academic and corporate environment. The main topics of this year's workshop were hyperspectral imaging from pilotless drones, interpretation of chlorophyll fluorescence signal in the context of FLEX satellite mission and the fusion of hyperspectral data with lidar and thermal data.

The activity which was presented in the media and received great public response was an activity of the Department of Climate Change Impacts on Agrosystems which, together with the Czech Hydrometeorological Institute, decided to expand its network by taking on phenological observers. 63 of them were successfully integrated and involved in active observation. Nature lovers can thus help and share their observations of watching trees and plants during regular walks in the countryside or even in their gardens. This concept of engaging the public in nature observation and data collection for scientific purposes is currently being developed in the world as the so-called citizen science.

After all, the fact that people are not indifferent to nature and the environment was evidenced by this spring's closely watched

climate change (CC) event consisting in a global student strike organized on the occasion of the Earth Day. Students supported by a part of the scientific community demonstrated for climate protection and for respecting the



commitments pledged by the states in the ratification of the Paris Agreement. It is apparent that the threat that CC poses to humanity leaves hardly anybody indifferent, and there is hope that mankind will be able to face CC and thus avert irreversible changes on the planet. Our politicians are also aware of this, and in connection with the most common manifestation of CC in our country - drought, they have begun to listen to scientists and people who suffer from the effects of drought the most - farmers, foresters, but also representatives of municipalities threatened with a lack of drinking water. Through the established National coalitions against drought they are beginning to adopt adaptation strategies and measures. A specialized conference entitled Water - Drought accompanied by an exhibition of the same name was held at the Parliament, Chamber of Deputies of the Czech Republic in March, and CzechGlobe contributed significantly to both events. In May, also with our participation, the exhibition called Water and Civilization, arched over by the Ministry of the Environment, was held at Kampa in Prague. The exhibition of photographs with accompanying expert texts introduced the general public to all aspects related to water, from the fundamental influence of water to the rise and extinction of civilizations, through its physical

and chemical properties up to the critical importance of water for today's world, level of agriculture, etc.

The warning of scientists against the threats of drought again turned out not to be just flogging a dead horse. Even though, from the perspective of a layman, it didn't seem like it at all in the winter, climatologists had already predicted that we would be expecting another of the dry years in a row, i.e. the fifth year in the last six years. Even the popular folk saying *that things are never so bad they can't be made worse* came true, i.e. the drought hit us already in early spring. The unusually dry and even warm April predicted disastrous crop results for the farmers, but literally at the eleventh hour rainy and cold weather came again and in at least some areas, it warded off the worst fears.

At the beginning of May, the United Nations Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) published an assessment report on the state of world ecosystems. According to the report, one of whose main authors was also prof. Kindlmann from CzechGlobe, the planet Earth is currently facing the sixth mass extinction where about a million species are endangered to die out. The specificity of the current massive decline in biodiversity is its rapid progression and the fact that it is demonstrably linked to human activities. Biodiversity is discussed with prof. Kindlmann in an interview inside this newsletter issue.

Finally, an event on a different note we can be rightly proud of. GCRI CAS became a member of the Climate Innovation Community of the European Institute of Innovation and Technology (EIT Climate-KIC), where, within the V4 countries, we are going to arch over research in the field of smart agriculture aimed at low-carbon management and increasing resilience in the conditions of CC and help transfer research results into practice. -mš-

## Introducing the Department of Biodiversity Research

# WE WILL HAVE TO SUBSTITUTE CHASING MONEY FOR PURSUING SURVIVAL OF NATURE,



says prof. RNDr. Pavel Kindlmann, DrSc., Head of the Department of Biodiversity Research at the GCRI. He graduated from the Faculty of Mathematics and Physics of Charles University in Prague, where he studied an individual study plan focusing on the topic of Modelling Population Dynamics of Insect Pests. Since 1980 until today, he has been working within the Czech Academy of Sciences. At first, he worked for the Entomological Institute, and then he transferred to the Institute of Landscape Ecology of the today's GCRI. From 2001 to 2008 he worked part-time at the Faculty of Biology at University of South Bohemia, and since 2009 he has been teaching as a full professor at the Institute for Environmental Studies of the Faculty of Science, Charles University. He is engaged in population and metapopulation dynamics, evolution of life strategies, prediction of

frequency and biological control of pests, landscape connectivity and nature conservation. He uses insect pests and their predators, terrestrial orchids, or large mammals as the main model groups. For many years, he worked alternatively at the University of East Anglia, Norwich, UK, at the Université de Rennes, Rennes, at the Institut National Agronomique Paris-Grignon, Paris, France, at the University of Yamagata, Tsuruoka, Japan, and at the University of Tennessee, Knoxville, USA. He is a member of the World Commission on Protected Areas, IUCN, Species Survival Commission, IUCN, In Situ Conservation Committee, IUCN, Orchid Specialist Group, IUCN, Policy Committee, European Section, Society for Conservation Biology. He is one of the leading authors of a report on biodiversity on Earth, created by the United Nations Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the founding director of the European Orchid Conservation Center. He is the editor-in-chief of the international journal called European Journal of Environmental Sciences, published in the Web of Science, and an editor of several other impact journals (Frontiers in Ecology and Evolution, Journal of Applied Entomology, etc.).

### How does a mathematician become a biologist and one of the most significant experts in biodiversity?

As a child, I lived in the country and I stayed outdoors in the countryside with my friends a lot. At the age of 15, I started horse-riding. However, as I have been good at maths since I was a child, I went to study the FMP at Charles University after I had finished grammar school. Nevertheless, after the first year of studies, I realized (probably because of my childhood in the country and among horses) that I would have been more interested in something more practical. A friend of mine introduced me to Ivo Hodek, an entomologist who was engaged in researching the relationships between ladybugs and aphids. Aphids were considered to be pests, and scientists expected ladybugs to help them with the biological protection of crops, i.e. that they will substantially reduce aphids. Ivo Hodek needed a mathematician for his research to calculate it all. Succinctly speaking, with the help of mathematical models, I was supposed to predict how many ladybugs will be needed to reduce the number of aphids, so that no crop damages arise. I used differential equations to model the population dynamics of pests and their natural enemies. When I, later on, met my future wife, she was engaged in growing and conserving orchids. Together we began to map the occurrence of orchids in South Bohemia and to save their so far surviving habitats. It was mainly by mowing these habitats after seeding of orchids - without mowing, the orchids would be oppressed by other, aggressive plants in a few years. Well, all of this logically

led towards my interests in biodiversity and nature conservation.



### Biodiversity is now a very frequently used term. There are reports saying that up to a million species can die out in the future. Is it really that serious?

Extinction of species is dealt with in a report compiled by a scientific team called the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). The report was published in early May this year. There were a total of 145 selected experts, who had more than 300 specialists at hand for individual taxa or parts of the world. They all worked under the auspices of the UN for three years. I was fortunate enough to participate in this team as one of the leading authors of the fourth of the six chapters.

Our team was inspired by the highly respected Intergovernmental Panel on Climate Change, whose members, through its studies and forecasts in recent years, have been able to bring global warming to the spotlight of public debate. According to our report, the unprecedented extinction of species and the destruction of ecosystems is in terms of the future of mankind similar to climate change and it deserves comparable attention. In accordance with our report, it is really up to one million animal and plant species that are in danger of extinction. As Bob Watson, chairman of IPBES says, people have long thought that preserving species diversity protects only nature itself, but our studies clearly point out at the relationship between biodiversity, nature and, at the same time, provision of food and drinking water in both rich and poor countries. Another prominent ecologist, Richard Pearson, says: "Many species would probably eventually get adapted to climate change but they do not know how to do it. Populations are already very small and they are losing their genetic diversity, landscapes are fragmented and plants and animals cannot find new suitable natural environments. So we are facing a great threat."

The current species extinction rate (i.e. biodiversity reduction) is totally unprecedented, unique and irreversible, and is referred to as the beginning of the sixth mass extinction in the history of planet Earth. For example, one new international study shows that every year the volume of insects equivalent to 2.5% of its current amount disappears. If this trend continued at the same pace, in 100 years a single bee would not be heard buzzing or a single beetle would not hide under a stone on the surface of planet Earth.

### I see, but is biodiversity fundamentally important to humans in any way?

For example, pollinators are disappearing. And we need insects to pollinate our crops. When there are no pollinators, most crops will not be able to yield. Sufficiency of pollinators therefore has a significant impact on our future crops. Or take pharmacies: 70% of the drugs used to treat cancer today are of natural origin or originate in nature. Every year, we are discovering that another species can be somehow helpful for us. And we never know in advance what it will be. And if our foolishness makes it extinct, it is our bad luck. When you crash your car, you can take it to the mechanic and have it repaired. But no one will fix a species again, it will never be recreated.

### What are the causes of this drastic loss of species?

Our report ranks five major causes of annihilation. The most important is the change in the use of land and seas and the associated destruction



of natural habitats. The human footprint on the planet has been growing so fast that it is destroying and crowding out other forms of life. Over the past 50 years, the human population has doubled, the world economy has strengthened four times, international trade ten times. Human civilization has taken three quarters of all land, especially for the needs of agriculture that feeds on the growing and ever richer population. At the expense of forests and unique ecosystems, a few species of cattle and monoculture crops are spreading across the planet, causing erosion and soil depletion. Also the area occupied by cities is growing rapidly, three quarters of rivers and lakes are used for agricultural purposes, humans do not intervene in only 3% of sea areas.

The second most important factor in destroying nature is, according to the study, the direct use of animals and plants, especially industrial fishing, which threatens fish populations. Climate change is ranked as the third „infestant“, followed by an increasing amount of waste and the spread of invasive species due to the interconnection of the world.



#### What is the specific role of global change in this process?

Our report states that when the temperature rises by 1.5 - 2°C, the majority of populations of terrestrial species will be heavily shrunk. In particular, 5% of terrestrial plants and animals will be threatened by extinction if the temperature rises by 2°C. To name a specific example, let's get back to pollinators. In order for the pollination to be successful, the period when the pollinator is active must coincide at least roughly with the period when our crop is blooming. However, when global warming occurs, for example, each species can react differently to it. Therefore, the flower can miss the pollinator: the pollinator either will be active before flowering or after flowering of the plant, and pollination will not be carried out.

#### Of all of that, what is essential in terms of our Czech conditions?

At our scale, the main threat to biodiversity is the loss of natural habitats - i.e. locations where natural processes are left without human intervention. At these sites, species that would not be able to survive in our cultural landscape, can survive. They are surviving in small quantities because these habitats are relatively small. If we reduce them even more, these species will not survive at

## DEPARTMENT OF BIODIVERSITY RESEARCH

In terms of the CzechGlobe structure, The Department of Biodiversity Research is incorporated in the Domain of Ecosystems Analyses. It carries out basic research in fields including evolution ecology (in particular the evolution of life strategies), population dynamics (especially predator-prey and plant-pollinator systems), and stability of ecological communities using theoretical, experimental and field approaches, particularly in the context of current climate changes. The results of this

research are applied in the protection of biodiversity, nature conservation, and biological control of pests. At present, the main model groups are terrestrial orchids, aphids, aphidophagous insects and large mammals. Besides the Czech Republic, the department conducts field research also in e.g. Nepal, Bolivia, Colombia and Papua New Guinea.

At present, the department has nine researchers, three PhD students and a technician.

all. Therefore, we are calling for maintaining these habitats to be kept as large as possible, because it is evidenced that the larger the area, the more species can survive there.

In the Czech Republic, the most significant such areas are the non-intervention zones in the Šumava mountains. It is right here where we are very concerned that the administration of the Šumava NP continuously ignores our scientific arguments during the process of running a new zonation planning project that is currently in progress, and plays into the hands of economic and political interests when trying to win support of local municipalities. In that way, it neglects the main reason why the National Park exists - conservation of nature and efforts to preserve the local rare species and communities. This will almost inevitably lead to the destruction of some of the rarest habitats in the Šumava mountains - such as the moors around the village of Horská Kvilda or a system of meadows at the village of Zhůří. But that would be a much longer story.

#### Can you name any other factors negatively affecting plants and animals in the Czech Republic?

Another major factor is our large-scale industrial agriculture. I.e. growing crops on large fields where only a few species survive, being able to adapt to the constant human intervention and the amount of chemicals we spray here. This is related to the loss of all kinds of groves and balks between the fields that occurred during the consolidation of the land within the period of collectivisation after 1948. All these small enclaves were once a refuge for many species that now have nowhere to hide from human activities.

Unfortunately, however, I must state that the number of species has been disappearing as a result of these human activities in the agricultural landscape already since 1948, so today - while further intensifying the agriculture - we are more or less just observing the decline in the numbers of surviving species. Nevertheless that is wrong as well.

#### In your biodiversity research, you focus on a wide range of species - according to what criterion do you choose the studied species?

My own research is far from being limited to the Šumava mountains - it is just a tiny stone in a mosaic. In fact, my professional focus is rooted in my youth - both in being lucky enough to have met my future wife, who introduced me to orchids, as well as having met excellent experts on aphids and ladybugs, Ivo Hodek, Jaroslav Holman and especially my lifelong co-worker Tony Dixon, who have been my best teachers.

Research on large mammals results from my love for the mountains. This love also brought me to Nepal. Here I met Khadga Basnet, who was working on the mentioned large mammals. I am still working with his former students and other scientists, who I met during my stays in Nepal - now it is mainly Bikram Shrestha, who monitors the endangered snow leopard.



#### What significant and interesting projects are you addressing at the moment?

We are trying to find factors that determine the species diversity of orchids in the Czech Republic, in the tropics and on the world's islands: the Mediterranean, the Caribbean and the Pacific Ocean Islands. All of this requires great international cooperation, which I have been succeeding to maintain. In the virgin tropical forests of southern Colombia we are preparing a scientific research station. We are going to focus primarily on monitoring orchids here, but the station will also be available to scientists dealing with other groups of organisms.

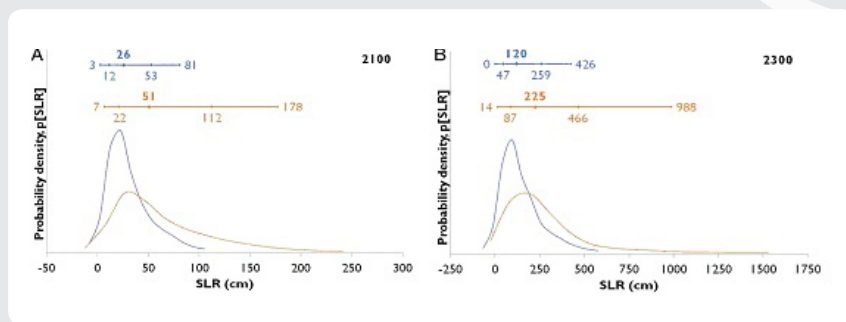
## SEA LEVEL WILL RISE MUCH FASTER

GOT OUR ATTENTION

It might seem that the rising sea level due to the increase in the temperature of the atmosphere and the oceans is a side issue. However, a significant rise in sea level would directly or indirectly affect the lives of hundreds of millions of inhabitants on our planet, primarily in coastal areas. Although the IPCC's last report considered the rise of the sea-level by about one meter by the end of the century as the worst-case scenario, this number is no longer valid today. A new study by a team of scientists led by Jonathan Bamber of the University of Bristol was based on an expert estimate and published in the prestigious journal PNAS and it shows that this "worst-case" scenario is likely to double.

In May this year, a concentration of CO<sub>2</sub> exceeding 415 ppm was recorded at Mauna Loa station, bringing the carbon dioxide concentration to its highest level in at least 3 million years. When the CO<sub>2</sub> value was last as high, the global temperature rose by up to 2–3°C and the sea level was 10 to 20 meters higher. Of course, it would take several centuries to reach a similar state of climate, but there is enough evidence showing that the processes of melting large ice complexes are already accelerating today.

In the May issue of PNAS journal, Jérémie Mouginot with the team, showed that, compared to the 1980s, ice in Greenland melts up to 6 times faster today. A week later,



**Fig. 1:** Probability distribution function of ocean growth for the temperature scenario up to 2100 (A) and 2300 (B) with lower (blue) and higher (orange) temperature increase. The horizontal scale shows the growth of the sea level in cm for the 5th, 17th, 50th, 83rd and 95th percentile values.

the journal *Geophysical Research Letters* published the work of Andrew Shepherd's team demonstrating similar development on the other pole. Using the data from satellite radar altimetry, they found that ice in the western part of Antarctica is decreasing 5 times faster than in the early 1990s. In some places, glaciers have thinned by more than 120 meters over this period and the zone of dynamic imbalance is expanding inland. There is also a destabilization of the eastern part of Antarctica, which, according to original forecasts, was supposed to remain largely untouched till at least the end of the century.

This accelerating trend suggests that they are the worse forecasts of climate models that will be fulfilled, but it is also more in line with the knowledge of sea levels in warmer periods in the past. The work of Jonathan Bamber used a combination of the subject field experts' speculations and Monte Carlo simulations to estimate the sea-level growth. While the scenario of higher increase in temperature still envisages the most likely increase in sea levels of about

50 cm by the end of the century, there is also considerable possibility predicting the increase in the sea level by 150 to 200 cm by the end of the century, and by more than 5 meters by 2300. Authors of the publication noticed that paradoxically thanks to the new findings, uncertainty about the possible development of ice melting has increased, upwards though. As glaciologists gain a better overview on the dynamic relationship of ice melting in relation to air and warmer oceans, the prognoses are closer to those of palaeoclimatology. The problem is that as soon as these processes kick-start, it will not be possible to reverse them anyhow in the coming centuries. -aa-

#### References:

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 Shepherd et al. 2019, *Geophysical Research Letters*. <https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2019GL082182>  
 Mouginot et al. 2019, PNAS. <https://www.pnas.org/content/116/19/9239>

## WHAT'S NEW

### Foundation of Czech consortium of the DANUBIUS infrastructure

On 26<sup>th</sup> April 2019, representatives of GCRI CAS – CzechGlobe and the South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses CENAKVA attached to the University of South Bohemia in České Budějovice signed an agreement on the establishment of the Czech ESFRI consortium of the Research Infrastructure DANUBIUS. The consortium will provide interdisciplinary collaboration between the two leading research infrastructures in the research of river and marine ecosystems.

### Opening of an Ecosystem Station in Vietnam

On 9<sup>th</sup> May 2019, with the presence of the representatives of the Global Change Research Institute CAS – CzechGlobe, Vietnam National University of Ho Chi Minh City and the representative of the Embassy of the Czech Republic in Vietnam, the Ecosystem station for long-term and accurate monitoring of energy and greenhouse gas fluxes between the atmosphere and the ecosystem was solemnly put into operation. The station is the result of three-year-long mutual cooperation declared by the joint memorandum of both institutions.

### DriDanube final conference

From 6<sup>th</sup> till 8<sup>th</sup> May 2019, the Danube Drought Conference was held in Vienna. It was the final DriDanube project conference (Drought Risk in the Danube Region). The conference introduced the results of the project, focused on sharing knowledge and experience and promoting greater interconnection between the political, scientific and public sectors in the battle against drought. At the conference, the representatives of CzechGlobe, one of the main recipients of the project, presented a joint network of reporters in the DriDanube partner countries established within the project.

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