

Interview with prof. Ing. Pavel Pech, CSc., professor at the Czech University of Life Sciences Prague

Will world conflicts in the future be over water rather than oil and land? Why is he more afraid of genes than climate change? And is it better to build dams and large water reservoirs, or establish ponds, wetlands, and pools? What is his opinion on artificial intelligence? These are just some of the topics that I discussed with prof. Ing. Pavel Pech, CSc., long-time head of the Department of Water Resources and Environmental Modeling at the Czech University of Life Sciences (CULS). "I'm from Hnojárna,"* he says about himself with a smile, and it does not sound pejorative at all – after all, he is the founder of the Faculty of Environmental Sciences at CULS in Prague.

Professor, during our recent meeting you told me that you have been teaching at CULS for 33 years. However, you yourself graduated from CTU. What do you think about the current relationship between these two institutions? Do they compete, or rather cooperate?

Considering that I graduated from the Faculty of Civil Engineering in the field of Water Management and Water Structures, I am a technical person. In 2004, at the Department of Water Resources and Environmental Modeling, we accredited the Environmental Modelling study programme, which could be considered as a potential competitor of the Faculty of Civil Engineering at CTU in Prague. But in fact, the representatives of the Faculty of Civil Engineering actually teach in this programme. After the establishment of the Faculty of Environmental Sciences and the subsequent accreditation of the doctoral, habilitation, and professorship programme in Environmental Modelling, representatives of water management from CTU became members of the Field of Study Board. For some time then, I was a member of the Field of Study Board of Environmental Engineering at the Faculty of Civil Engineering. The current head of the department, Prof. Martin Hanel, continues to be a member of this Field of Study Board, who further deepens cooperation with the Faculty of Civil Engineering, for example in organizing joint conferences. Teachers from the Faculty of Civil Engineering regularly participate in the defence of bachelor's, master's and doctoral theses, as well as chairpersons and members of state commissions. Therefore, in my opinion, cooperation with the Faculty of Civil Engineering in the field of water management is positive and correct.

You spoke about the Faculty of Environmental Sciences, which you helped to establish. When was that and what preceded its establishment?

In 2003, when I was acting as Vice-Dean for Education at the Faculty of Forestry, as a member of the landscape-ecological part, I participated in the renaming of the faculty to the Faculty of Forestry and Environment. Later, the university began to think about a greater involvement of the university in the field of the environment by creating an institute or a new faculty. The result was that in April 2007, CULS Rector, Prof. Jan Hron, entrusted me as the guarantor of the establishment of the new Faculty of Environmental Sciences, and then Dean of the Faculty of Forestry and Environment, Prof. Vilém Podrázský, with the establishment of the Faculty of Forestry and Wood Sciences. After about two months of intensive work, with the help of the Department of Water Resources and Environmental Modeling, it was possible to prepare all the documents for the establishment of the new faculty. I would like to highlight at least one name, Dr. Jiří Pavlášek, who helped a lot and later, after the establishment of the Faculty, mainly participated in the consolidation of the education part, including the subsequent preparation of the accreditation of the bachelor's field of Water

Management. At the field meeting of the Accreditation Commission in Pavlov on 18–20th June 2007, the division of the Faculty of Forestry and the Environment and the establishment of the Faculty of Forestry and Wood Sciences and the Faculty of Environmental Sciences from 1st July 2007 were approved. The staff of the landscape and ecology departments moved from the original faculty to the newly created faculty; The Accreditation Commission of the Ministry of Education, Youth and Sports also agreed to the transfer of three bachelor's, four master's, four doctoral fields of study, as well as one habilitation and three habilitation and professor's fields of study. Subsequently, the Rector appointed me to the position of "Person entrusted with the management of the Faculty of Environment Sciences" until the regular Dean elections, which took place in December 2007. Between 1st July and 6th December 2007, I was arranging the functional mechanisms for the Faculty with the authorized management. It was interesting that less than two months passed from the decision to the approval of the Faculty establishment.

At the master's and doctoral programme, you offer over ten professional subjects, including studies in English. Do you have a lot of international students at your university?

Currently, I guarantee eleven subjects – five in the bachelor's, four in the master's, and two in the doctoral programme, of which three subjects are taught in English. During the academic year, approximately 20 to 25 students take part in English subjects. Around 1,500 foreign students study at CULS every year.

Could you please compare the construction of dams around the world with our country? Where do you see the differences in these conditions, for example, when compared to Austria or Poland?

Compared to other European countries, the construction of dams in our country was at a similar level in the 20th century. I am not an expert in the design or construction of dams; however, I can see that the current situation in this area is not good. Let me give you one example. After the floods in Moravia and Poland in 1997, both countries began to address the situation by considering the construction of a dam. Nové Heřmínovy in the Czech Republic, and Ratiboř in Poland. Both dams should be used for flood protection – on the Polish side it was supposed to be a dry polder for a period of five years, which should be converted into a classic water dam holding 180 million m³ of water, and on the Czech side the new dam was supposed to capture around 14 million m³ of water, of which 3.5 million m³ would be used for drinking purposes. On the Czech side, a zoning decision for the construction of the dam was approved in June 2023. The construction should begin in 2027 and the dam should be completed in 2032. Although considerations about the construction of dams started at the same time, the Polish side already opened the waterworks in 2020, which, by the way, was designed to hold ten times more water.

From the above case, a different approach to the planning, approval, and construction of dams is clear. It should be noted that for a quick and successful solution to water management issues related to climate change, water management issues should be included in the responsibility of one ministry; or, given the importance of the issue, it deserves its own ministry. Currently, in our country, water management issues are integrated into two ministries, which by their very nature have different priorities in this area.



Photo: Hřivinec P. 2011

Do you think that Czech natural conditions allow the construction of such dams? And if a new dam were to be built, would it be possible to get enough water to fill it?

Natural conditions certainly allow the construction of other necessary dams, which is evidenced by the plans mainly coming from the Ministry of Agriculture. In my opinion, climate change will force some dams to be built. My previous answer shows my rather pessimistic view of their implementation in our country. A comparison of the length of building permits in different countries was recently published in the press, and the Czech Republic is in about 160th place in the world, even behind countries such as Congo or Rwanda. In order to ensure (not only) enough drinking water, but also water for agriculture and to maintain sufficient flows in the rivers in the near future, it will be necessary to significantly speed up and make the decision-making and implementation more efficient. The approval and construction of dams on some Czech rivers will have to happen, hopefully as soon as possible, because a dam will not be built in a year or five years and climate change will not wait. And to your question about enough water to fill them. According to experts on hydrology, the total volume of precipitation does not change significantly over the years – even in times of climate change – but their intensity and time distribution throughout the year do. One example regarding getting enough water to fill a new dam; if you take only the flow of $0.3 \text{ m}^3/\text{s}$ from the total flow on the river, it would take about five months to fill Nové Heřmínovy dam.

Do you think it is better to focus on the construction of large water reservoirs, or rather build or restore ponds, pools, and wetlands?

Personally, I would not prioritize any of the listed measures. However, it will be necessary to focus on building these structures in parallel – each of them has its own importance. Various studies show that semi-natural measures only help with the water balance by about eight to ten per cent, so it will be necessary to proceed with the construction of both smaller and larger dams, which are often wrongly perceived negatively by the public. Regarding, for example, ponds and wetlands, they do not help the water balance much with their usable volumes. They may have problems in the near future due to the increasing amount of water vapour. I would not say that it is better to focus on building bigger dams, but it will be necessary for maintaining “water comfort”. There are already places in the Czech Republic that have great difficulties in securing sufficient water during dry periods. So far, it has been “forgotten” that the use of groundwater is an inseparable part of the strategy to ensure sufficient water in times of climate change. The advantage of groundwater is that there are no evapotranspiration losses. From the balance of drinking water used, it follows that 50 per cent of the Czech Republic is actually groundwater, which gradually leads to a reduction in its reserves. Therefore, artificial infiltration should also be implemented, which can be a suitable source of water in the dry season. Artificial infiltration began to be used to enrich groundwater supplies at the beginning of the 20th century. This is also where the history of the Káraný waterworks begins, built according to a project of one of

the classics in the field of groundwater, Adolf Thiem, in 1919. An artificial infiltration system has been operating in Káraný since 1968, but its further use is very sporadic in our country. A number of scientists have been dealing with this issue within grants, including practical applications. In projects related to groundwater, I rather concentrated on the efficient use of so-called “actual wells”, because in many cases the constructed networks of underground wells are used by water management companies, and as long as a sufficient amount of water is pumped from the wells for treatment, the companies do not care about their condition. The clogging (aging) of wells and a noticeable drop in abundance then leads to their complete depreciation, while timely intervention can maintain the well’s productivity at a sufficient level for many decades.

It seems to me that much of the information that the media is flooding us with on an almost daily basis regarding climate change is already approaching the spread of an alarmist message. Do you believe that the current situation is already irreversible?

Much information from the media about climate change is currently rather one-sided and presented in a pessimistic or even depressing manner. If people get information presented in this way from the media, it can cause a certain kind of apathy, depression and resulting psychological problems in many of them, which we also know from the recent covid pandemic. This massive and often one-sided information “massage” can be taken as a “mediocracy”, i.e., the government of the media, with a huge influence on human thinking and the actions of human society. It would probably be more reasonable to try to inform as truthfully as possible in the press, taking into account the different opinions on the matter, mention the uncertainties in connection with climate change, and point out that there are real ways out of this critical situation and ways of adapting to the given situation. Nowadays, it is clear that climate change is happening; however, it is necessary to take into account other opinions when explaining it, for example, that the opposite process to what is happening now, i.e., cooling, can theoretically occur. These theories are also presented by scientists from reliable sources, for example the recent reports from NASA. If we take into account that the theory of global warming works, there are a number of options in the field of water management to effectively respond to this change – be it semi-natural measures, building reservoirs, connecting water management (water supply) systems and so on; however, it is necessary to implement these measures in the foreseeable future, and not as was presented in the case of Nové Heřmínovy dam.

During our meeting, I was very interested in your mention that you fear gene manipulation more than climate change. Could you please explain this to our readers?

Let me clarify. If climate change continues, I am also concerned about the consequences, especially in terms of sufficient water availability in various parts of the world. From places with catastrophic situation with water resources, masses of people will head towards places where there is still enough water. It will not be a matter of millions of people, but tens to hundreds of millions. These shifts will cause the steep fall of advanced civilizations.

Going back to the concern about genes. Firstly, these are genetically modified crops, in which the hereditary DNA material is changed using gene technologies, and although most scientists assure the safety of the mentioned procedures, many of them have more cautious opinions in assessing their harmlessness; according to them, possible negative effects on humans may manifest themselves only after decades or even in the following generations. Secondly, and this is even more serious, is the direct intervention in the organism’s genome using modern DNA technologies involving the introduction of foreign genes into the organism. For example, in 2018, in China, they used revolutionary new genetic methods of altering a human embryo. After this intervention, twins were born who had genetically altered DNA. At the current level of knowledge, it is not possible to reliably demonstrate how gene manipulations can interfere with life and how it will continue to affect it.

We talked about the technicized era, as well as the very rapid development of artificial intelligence. What is your opinion about it and how do your students perceive it?

The rapid development and application of artificial intelligence brings great expectations, but also concerns. It is clear that artificial intelligence (AI) is already beneficial in a number of areas and in different fields. As an older person, I remember well the sci-fi movie “The Terminator”, which could gradually become a reality. In this film, a pessimistic scenario is shown with the use of artificial intelligence, which at a certain point discovers that it no longer needs humans for its existence – it can learn, make decisions, change, adapt, and so on. To ensure fulfilment of Isaac Asimov’s three well-known laws of robotics (AI can be substituted for the word “robot”) – “1) A robot must not injure a person or, through inaction, allow a person to be harmed; 2) A robot must obey orders given to it by humans, except where such orders would be contrary to the first law; 3) A robot must protect its own existence if such protection does not conflict with the first or second law” – becomes unrealizable, due to its nature and origin. From the occasional debates with students, it appears that they do not have a problem with the use of AI, and most of them have no concerns about the future. I learned from a faculty colleague that one of the students used AI to write a bachelor’s thesis, but at the current level of AI it was easily identified and the student failed the thesis. However, AI is in its early stages of development and it is moving forward very quickly. It is necessary to prepare well for its effects in the future.

Do you think there is a risk of water wars in addition to other world conflicts in the future?

I remember that years ago, the former Chief of the General Staff of the Army of the Czech Republic said in an interview that future military conflicts are not expected to be about oil, but will be related to battles over water and its resources. This issue is presented very well in the three-part Norwegian documentary “The Future of Water”, and I recommend watching it for those interested in water management issues. The author of the document is Prof. Terje Tvedt from the Universities of Bergen and Oslo. He travelled all continents and created an excellent documentary about water and its problems and outlined possible solutions. The individual parts have apt names: “Rulers of Water”, “New Uncertainty”, “Age of Water”. The war for water resources in the past is shown using the example of the Republic of South Africa. In 1986, it signed a water supply agreement with Lesotho and participated in the construction of a large dam. In 1998, there was a threat of a coup in Lesotho and a refusal to supply water to the Republic of South Africa. Its president at the time, Nelson Mandela, ordered a direct air strike, which solved Lesotho’s water supply problem. Other potential water resource fights threaten Africa, such as the Nile. Sudan and Ethiopia have built huge dams with China’s help, thereby disrupting the stability of the Nile water supply system in, for example, Egypt. With ongoing climate change, the situation is intensifying and there is a threat of explosive conflict between countries dependent on the Nile water. Another example are the war conflicts in Asia. In the Himalayas, at altitudes of around 6,000 m above sea level, a secret war has been going on for more than twenty years over the sources of water from the Himalayan glaciers, called the “Battle in the Skies”. This conflict between India and Pakistan is all the more dangerous because they are nuclear powers, and its escalation threatens severe consequences.

And this is just a small sample of the ongoing war over water resources. It is necessary to prepare for the fact that if climate change continues at the pace that we can observe now, then, in my opinion, there is a high risk of significantly larger military clashes over water resources.

Regarding the lack of water, how would you deal with very dry areas in South Moravia or Rakovník district, for example? In comparison with the world, you told me that the Chinese, for example, are able to conduct water through open channels and underground to very distant places, within hundreds to thousands of kilometres.

First, a note on China and its water management issues. The south of China has plenty of fresh water, but its northern part has only twenty per cent of the fresh water available in the whole country, even though it contains two-thirds of China's arable land. China has been dealing with this issue since the 1950s. The total length of tunnels and open channels currently being built or planned to transfer water from the south to the north will reach 20,000 kilometres when completed. For example, in 2014, China opened a channel to transfer 54 billion m³ of water. The commissioning of the canal brought the unexpected effect of a significant increase in the groundwater level in some places. At the same time, China is building the world's longest water tunnel to transfer water from the Three Gorges to Beijing. The entire transport network measures 1,400 kilometres, which is a gigantic, even megalomaniacal construction, which of course we cannot compete with.

Now for the first part of your question. Our society must deal with the lack of water in South Moravia, Rakovník district in Polabí, and in the foothills of the Ore Mountains in the shortest possible time. The individual Povodí State Enterprises have already prepared or are preparing solutions with the construction of the necessary dams, and at the same time the connection of water supply systems is prepared or planned. We have a very good example from the past that it is possible to build such structures. For example, in 1972, a 51-kilometre-long tunnel was completed – the longest water transfer tunnel in Central Europe – leading from the Želivka reservoir to Prague. The water from Želivka supplies drinking water not only to Prague, but also Beroun, the surroundings of Kladno, and partly the Vysočina region. I will return to the situation in our country. "Mediocracy" should do away with climate scaremongering and concentrate on the vital water issues and their solution in the period of climate change, so that instead of lookout towers, cycle lanes, electromobility and many other "necessary" things, it puts pressure on public opinion and, above all, on political representation. There must be accelerated strategic decision-making and the implementation of necessary water management structures and measures because we all know that without water there is no life. And I will add that larger water management structures will not be built in this country in five, ten, or even twenty years, although if there is will, it can be done in significantly shorter time.

Finally, I want to talk about your students again, Professor. You have been teaching for 33 years, so you certainly have the opportunity to compare the level and knowledge of those today compared to three decades ago. You mentioned that the number of students in both water management and environmental modelling continues to decrease. How do you explain that?

If I compare my studies and today's teaching, there is quite a big difference, not in the content of, for example, hydraulics that I teach, but in what today's students are capable of, but also willing to learn. Allow me a small note that also clarifies my experience of more than 30 years of teaching, and nowadays a decline in the quality of teaching can also be observed, which is logical. About 20 years ago, as Vice-Dean for Education, I attended a seminar held in connection with the preparation of the state "matriculation" exams. At this seminar, neuropathologist Dr. František Koukolík gave a lecture, and his excellent presentation showed that over the course of generations, 12 to 14 per cent of the population year had the prerequisites to successfully complete university studies. At that time, he said in his lecture that 60 to 70 per cent of the population year goes to university to study and this amount of students has an effect on the quality of students, but is naturally also reflected in the quality of the teaching process (I apologize for possible inaccuracies in the quotation from this lecture). Now a specific example from my experience. When asked about their knowledge of Archimedes' law, many students – and it is not a small number – are unable to interpret it correctly, even after completing the hydraulics subject. During one of my visits to my wife's mother (she is more than 80 years old, comes from a farm, and after finishing primary school, she worked in the forest all her working life) I tried to jokingly ask if she knew Archimedes' law. And the result – not only did she tell me the whole thing correctly, but she even explained it. And finally, to the last part of the question. After the accreditation of the Environmental Modelling programme, between eight

and fourteen students from various fields of study at Faculty, but also from other faculties and even from Charles University, studied it every year. The level of these graduates was excellent. The evidence is their application in practice, at the Faculty, in the institutes of the Academy of Sciences (Institute of Hydrodynamics, Institute of Thermomechanics), in the company DHI, a. s., but also in TGM WR1, and graduates have also applied abroad – in Germany, Great Britain, etc. Subsequently, there was a gradual decrease in interest in this field, and the interest of students in the bachelor's field of Water Management and the master's field of Water in the Landscape is also decreasing. My explanation for this is that once students find out that they should study technical field of study and with it mathematics, physics, hydraulics, hydrology and other technical subjects, they prefer to take the easier route to get university education. And so, at the end of the interview, I will add one more statement – in the near future, there will be a shortage of university-educated water managers in the Czech Republic.

Professor, thank you very much for the pleasant meeting and for the time you devoted to our interview.

Mgr. Zuzana Řehořová

Prof. Ing. Pavel Pech, CSc.

Prof. Ing. Pavel Pech, CSc., born on 31st January 1955 in Beroun, graduated in Water Management and Water Structures at the Faculty of Civil Engineering of the Czech Technical University in Prague. After graduating in 1979, he joined Vodní zdroje, state enterprise, where he worked on issues related to well hydraulics. In his doctoral thesis at the Department of Health Engineering of the Czech Technical University, he also dealt with the issue of hydrodynamic tests on wells, the creation and evaluation of additional resistances in the well and its immediate surroundings. He defended his thesis in 1985. He then moved to the Institute of Hydrodynamics – then the Czechoslovak Academy of Sciences – and dealt with the issue of oscillatory flow in the cardiovascular system in the Department of Biomechanics, and later with numerical modelling of flow in reservoirs in the Department of Hydrology. In 1990, he started working at the Czech Agricultural University, later the Czech University of Life Sciences in Prague (CULS). In 1995, he obtained his habilitation in the field of Hydroinformatics, and in 2005 he was appointed professor in the field of Agricultural and Forestry Hydrology. At CULS, he started his teaching carrier with practical lessons in Hydraulics and Small Water Courses. He currently teaches the subjects of Hydraulics, Surface and Groundwater Hydraulics, Groundwater Hydraulics, and also Hydraulics and Groundwater Hydraulics in English. He participated in and later led a number of practically focused grants issued by the Ministry of Agriculture, the Ministry of the Interior, and the Technology Agency of the Czech Republic (TA CR). Recently, he has led TA CR grants focused on the sustainable use of groundwater reserves in the Czech Republic and the introduction of new well cleaning technologies; for example, a well cleaning device using ultrasound was developed within the TA CR project in cooperation with the German company SONIC Technologies GmbH, which is now successfully used by the company VODNÍ ZDROJE, a. s.



*Translator's note:

"Hnojárna" – a pejorative term (from Czech "hnůj" – manure) used for CULS, as it was previously called "University of Agriculture").

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