

# KEEPING OUR HEADS ABOVE WATER

**P**rof. Zbigniew Kundzewicz from the PAS Institute of Agricultural and Forest Environment in Poznań talks about the negative impact of climate change on our lives and what we can do to save ourselves.

**ACADEMIA: What does climate change mean for the average Pole?**

**ZBIGNIEW KUNDZEWICZ:** It is already affecting the average Pole. Hardly anyone is aware of the fact that high temperatures are the main natural phenomenon responsible for killing Poles. A study conducted on this very issue at my Institute showed that in the years in which heat waves were particularly severe,

there were more than 1,000 additional deaths in Poland's ten major cities, whereas in Europe overall the figure reached 70,000 in 2003. Two factors contributed to this: high air temperatures, including at night, and the effect of the urban heat island – sun-heated roofs, sidewalks and streets gave off heat at night. Typically there are less deaths in Poland in the summer months than in the winter. However, record high



temperatures turn everything upside down. In the coming decades, hot summers will become more frequent in Europe, occurring nearly every year. In addition, societies are aging, and people aged 65+ can't tolerate heat. In the summer of 2003 France saw a record number of deaths in Paris, with many of its elderly, sick and lonely residents dying. The health minister resigned because he underestimated the threat. Meanwhile, many of these deaths could have been prevented by taking simple preventive steps, such as trying to ensure that the elderly stay hydrated (seniors don't always feel thirsty, and this is the first step to dehydration).

**Global warming is inevitably causing the glaciers to melt. How will rising sea levels affect Poland?**

One can see with a naked eye that the mountain glaciers are shrinking. The melting of the Greenland and Antarctic ice sheets is responsible for half of the sea level rise, which is approximately 3mm per year on average. The other half is caused by rising water temperatures, which increases the water volume.

Poland is very sensitive to a rise in sea level. Even a small rise increases the probability of storm surges and backwater floods, which happened in the past and continue to happen, except that in this case even a few centimeters can lead to a significant increase of the frequency of storm surges.

A sea level rise of 4 meters will cause the Hel Peninsula to become a small island, the Żuławy region will simply disappear, and part of the Vistula valley will become flooded. This gloomy scenario, however, will not happen any time soon. Certainly not in the 21st century.

**Couldn't we protect ourselves against flooding the way the Dutch have?**

The Netherlands are located in a depression, and this is a bit different. In 1953, 2,000 people lost their lives in the Netherlands as a result of a great storm surge. Since then the government has invested enormous resources in protecting the country against flooding. It takes protection against floods much more seriously than other countries. The embankment on the sea side is the strongest construction of this type in the world, as it must withstand 10,000-year water (meaning exceeded once every 10,000 years, on average, so the annual probability of exceeding is 0.01%).

Also inland, on seemingly irrelevant brooks, there are protective structures built to protect against 125-year flood, which is more than many countries have on large rivers, where 100-year protective structures are considered to be really good. In the Netherlands, all protective structures are built to protect against 125-year flood, followed by 250, 400, 1250, and 4000 years, depending on the area.

So we can certainly learn from the Dutch, but it will not help us save Hel, because even the Dutch will not come up with a solution to this problem. I have been to the Netherlands many times, visiting Scheveningen near The Hague, where the beach is not as attractive as our beaches on the Baltic Sea. The embankment is extremely high, but for the people living there it is a serious matter.

**So it is the lowest areas, like the Baltic coast, Żuławy or the Vistula valley that are most at risk. Is the rest of the country safe for now?**

If the sea level increases by 40 meters, a large part of Poland will be flooded. The melting of the entire Greenland ice sheet would increase the sea level by 7.36 m, and the melting of the entire Antarctic ice sheet by 58.3 m. With significant warming, the high-

er areas will probably become islands, and in the long term, ultimately submerged islands.

In addition to the destructive pressure of rising sea waters, there are other types of floods. River floods, such as the floods of 1997 and in 2010 in Poland, are gaining momentum. More and more problems are caused by “urban floods” and “flash floods” caused by intense rain, which are too much for the sewage system to handle. Until recently, these were very rare, and now they occur in many cities, including Warsaw.

There are several reasons for this. Increasingly dense urban construction takes away ground space, which means that the water can't freely seep into the ground. Intense rain is becoming even more intense.

#### How are they related to global warming?

According to the laws of physics, warmer atmosphere can hold more water vapor, which increases the chances of intensive and more frequent rainfall. Prof. Tadeusz Niedźwiedz, a climatologist from the

#### When temperatures rise, we don't need to heat our homes, so we burn less fossil fuel. Shouldn't climate warming therefore decrease the consumption of coal and oil, and consequently lead to lower greenhouse gas production?

But in the summer we increasingly need air conditioning, which is more expensive and effectively cancels out the positive aspects of using less heating during winter. Air conditioning, which is good for adapting to climate change, is terrible when it comes to preventing it – power generation produces carbon dioxide emissions, contributing to global warming. But it is becoming more widespread and I'm afraid there is no escape from it, also for Poland.

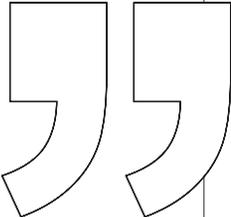
#### We keep coming back to climate, talking about droughts and rainfall, but how can global warming effect the fauna and flora?

The academic answer to this question is that all living creatures seek out the right climate for themselves, including humans, so there is a threat of climate migrations. Species of flora and fauna change location, migrating north and to higher elevations. We are observing thermophilic species moving to new habitats. One example of this is the moth known as the Horse-chestnut leaf miner (*Cameraria ohridella*) originating in the Lake Ohrid area on the Balkan Peninsula, where the climate is warmer than in our country. But for years now this insect has been attacking chestnut trees in Poland, causing leaves to prematurely wither and fall. Also, unwanted species posing a direct risk to humans, such as ticks, have been clearly extending their range, appearing in places they never have before, including the far north areas of Scandinavia.

There are significant changes to biological systems, including phenological changes of plants, such as accelerated blooming or fruit ripening, as well as fauna activity, like the appearance of butterflies, or the migrating times of birds.

The growing season has extended, affecting the timings of crops and agricultural practices. The course of the weather observed in recent years in Poland, the result of climate change, has contributed to crop yield variability, as well as the emergence of new threats to crops from pests, diseases and weeds. In Poland, as in all of Europe, agriculture is subject to increasing climatic risks. We are afraid that unfavorable climatic conditions will continue for decades, increasing the variability of yields from year to year.

I once reviewed a study on truffles, whose future in the south of Europe is very uncertain. About 70% of the French production of truffles comes from cultivations, meaning you buy a grafted seedling that you need to water in order for it to grow. During a drought year, there isn't enough water. Each sector needs water. The only way is to ration it, but it still will not be enough for everyone, so truffle cultivation may begin



Record high temperatures will turn everything upside down. In the coming decades, hot summers will become frequent in Europe, occurring nearly every year. Societies are aging, and older people tolerate heat poorly.

University of Silesia, clearly observed an increase in the occurrence of atmospheric circulation systems, which are associated with the risk of intense rainfall. It's true that rainfall projections are quite uncertain, and different models say different things, generally suggesting that humid locations will become even more humid (northern Europe – Sweden, Norway, Finland), and dry areas will become even drier (southern Europe – Spain, Portugal, Italy, southern France, Greece). And drier weather means more forest fires.

The year 2003, which I already mentioned as a record year for deadly heat waves in Europe, was also extremely dry, to the extent that nuclear power plants had to be shut down because there was not enough water for cooling.

## PROF. ZBIGNIEW KUNDZEWICZ



JAKUB OSTAŁOWSKI

### Prof. Zbigniew Kundzewicz, PhD, DSc

is a hydrologist and climatologist. His work deals with system hydrology, the relations between climate and water resources, hydrometeorological extremes (especially intense rain events, floods and heat waves), as well as issues of global adaptation to changes and sustainable development. He has been involved in numerous scientific studies of the Intergovernmental Panel on Climate Change (IPCC).

to dwindle. This will give a chance to other countries with sufficient water supply. We have already seen an example of this in the successful introduction of truffles in England. How about Poland? The truffle does not like frost, but who knows?

### Who is to blame for climate change?

Almost all climatologists and everyone at the Katowice conference agree with the conclusion that anthropogenic greenhouse gas emissions are most responsible for the current global warming. The atmospheric concentration of carbon dioxide increases every year. There haven't been any Major annual fluctuations since the measurements began. The fuel crisis of the early 1970s did somewhat slow down the growth rate, but the level of concentrations continued to rise. Politicians from many countries gather every year at the climate summit, debating on how to reduce emissions. There is a lot of talk, but no effective action. The atmospheric concentration of greenhouse gases is gradually increasing.

Poland's economy is based on coal, of which we have a lot, but I'm not sure we can say that "we have coal reserves for 200 years" because it may soon become the most expensive energy source in Europe.

### Perhaps the government should consider nuclear or renewable energy?

In my opinion, renewable energy has enormous potential in Poland. We're talking about energy taken from biomass, as well as geothermal, wind and solar energy. Although in Poland the sun does not shine as often and as intensely as it does in the south of Europe, the amount of solar radiation reaching the Earth's surface at our latitude should be utilized. Even Norway has introduced photovoltaic systems. There is still a lot to do in terms of improving energy efficiency. We should look for negawatts of energy saved, not just megawatts of energy produced.

I think we should take a look at Germany's energy policy. They are definitely moving away from nuclear energy, and gradually from coal energy. That only leaves renewable energy.

### What can we do individually to produce less carbon dioxide?

We should try to reduce our "carbon footprint" as much as possible, reducing our energy consumption, which in most of Poland comes from the combustion of coal, oil and gas. Both direct consumption (the heating system, domestic electricity consumption, vehicle fuel consumption), as well as for manufacturing and transporting goods that we consume and use.

I think that we should look at coal consumption in more broad terms, taking into account many aspects, such as energy, employment, health, environment and climate. Historically, coal, "black gold," was a valuable resource for Poland, but it is also one of the causes of smog. According to the European Environment Agency, every year about 48,000 people in Poland die prematurely due to poor air quality.

Taking steps to mitigate climate change will therefore also contribute to reducing smog, because smog is caused by the burning of coal, which at the same time increases the atmospheric concentration of carbon dioxide, which in turn leads to global warming. We need a strong public campaign to reduce smog and carbon emissions. It should be strong enough to encourage drivers to start using public transport instead. If the weather is nice, we should cycle or walk to school, work or to the store. If we leave the car and walk instead, it will be better for the environment, for the climate, and for our health. Not to mention for our wallets, as it will not cost us anything.

Reducing the emission of pollutants from old, inefficient furnaces, in which all kinds of things are burned, would significantly improve air quality. Many cities in Poland subsidize the replacement of old furnaces with newer generation ones. A campaign has been launched promoting green energy through subsidizing home photovoltaic systems. These are steps in the right direction and I hope they will continue.

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