

MANAGING WATER RESOURCES WISELY

Poland is among the countries that are facing water stress, although we largely remain accustomed to having water always there when we need it. Should we take this unrestricted access for granted?



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Water is indispensable – we use it every day and when it goes scarce the quality of life deteriorates rapidly. But in Poland, we rarely think about water. We just turn on the faucet, and there it is. We are not forced to walk many miles or wait in long lines to access public water sources. Nor do we have to choose between buying water or spending money on other things. It is simply there. We are

convinced that this situation will continue forever. After all, it has remained unchanged for centuries...

However, many people living in Poland found out how illusory that belief was in 2018 and 2019, when most of the country was hit by drought. In 2019, over 350 municipalities announced restrictions on the use of tap water. In Skierniewice, a town of 50,000, there was no water for about two weeks. Likewise, inhabitants of other regions in Poland soon experienced the effects of drought, above all in the form of rising food prices. Drought takes the greatest toll in agriculture, but it also affects other sectors of the economy. The total costs of drought in 2018 were estimated at more than 2.6 billion zlotys, including around 1.55 billion zlotys in losses in agriculture, with the remaining losses being reported in other sectors. This translated into 0.13% of Poland's GDP. We have yet to estimate the losses suffered by Poland's economy in 2019, but we can expect that the level was similar.

Unfortunately, we may assume with a high degree of probability that similar situations will recur in coming years. Paradoxically, at the same time, we must also be prepared to face a growing flood risk. Human-induced climate change, both current and projected, already impacts very strongly on the management of water resources, affecting above all the amount and distribution of precipitation and therefore the availability of water – globally, regionally, as well as locally. As the greenhouse effect grows stronger, the changes in the management of water resources and the related threats will be even greater. We should already start preparing now.

Drought and flood

Climate change affects in a broad and significant way all climatic factors: the length of the growing season and average temperatures in specific seasons and months, the amount and distribution of precipitation, the number of snow cover days, the frequency of extreme weather events, and so on. Some of these have a significant impact on the management of water resources. The most dangerous consequence facing Poland, it seems, will involve changing amounts and distribution of precipitation and the attendant higher risk of droughts as well as floods.

This stems from several factors, above all the low level of average annual precipitation in Poland – around 600 mm, varying from less than 500 mm in central Poland to nearly 800 mm on the coast and over 1,000 mm in the Tatra Mountains. Meteoric water (from precipitation) is the main source supplying the system of surface waters in Poland, while the water reaching the country from abroad through rivers accounts for just 3%. Another significant problem resulted from the water policy that was pursued almost throughout the whole of the second half of the 20th



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The Vistula River in Warsaw with an extremely low water level



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century, when water management was mainly focused on draining wetlands to convert them into agricultural land. In effect, thousands of hectares of wetlands and swamps were destroyed, boglands were drained, mid-field ponds were covered over, and many watercourses were channeled. Consequently, instead of supporting the retention of excess water in the landscape, measures were taken that accelerated water runoff and outflow into the Baltic. Then, just when it appeared that the approach was about to change, Poland was hit by a wave of major floods in 1997, 2009, and 2010, and consequently priority was given to the construction of hydraulic structures and the acceleration of the water drainage, instead of the regulation of water relations and the storage of excess water.

Overall, insufficient measures aimed at halting human-induced climate change will further augment the threats to the stability of water resource management, especially given the projected changes in the amount, distribution, and intensity of precipitation as well as growth in average air temperature. This process has continued since 1991. Since that time:

- the number of days with daily precipitation ≥ 10 mm has risen by ten days per decade, and the number of days ≥ 20 mm has risen by four days per decade;
- the number of days with precipitation ≥ 30 mm has risen by over three days per decade;
- the number of days with precipitation of 50 mm has risen by two days per decade.

From the perspective of flood safety, the growth in the frequency of catastrophic precipitation of ≥ 70 mm per day is alarming (observations in recent years indicate there are an average of four such days a year in Poland). Such precipitation causes local surface flooding and flash floods, which affects in particular urban areas (due to large areas of impervious surfaces) and mountain areas. The absence of a system facilitating the retention of excess meteoric water also means increased risk of drought. When rainfall is heavy, surface runoff into watercourses is greater than in the case of moderate precipitation, and so less water ends up percolating down to replenish groundwater.

Temperature

Average temperatures in Poland have been on the rise for several decades, and such changes are observed especially in late winter and in spring. Since the mid-20th century, average annual temperatures in most areas of Poland have risen at a rate of around 0.2°C per decade. Currently, the average temperature in Poland is over 1°C higher than it was in the mid-20th century. This means increased evaporation, so less water is retained in the ground and infiltrates into the deeper soil layers.

As we have noted above, while drought poses the greatest threat to agricultural production, it may also lead to significant problems in other sectors of the

economy. Many of Poland's coal-fired power-generating units are cooled with water that comes from rivers, and if the level of water in rivers drops significantly, this may necessitate curbing or even halting the production of electricity. Since demand for electricity currently peaks in the summer, having to curb electricity production in this period may have catastrophic consequences for the entire economy.

Tourism is another sector that is worth analyzing in the context of drought. It is commonly believed that the consequences of climate change, i.e. increased temperatures and longer periods without precipitation, will boost Poland's attractiveness in the context of the development of tourism and the leisure industry. However, such analyses do not factor in the fact that such new conditions will be conducive to cyanobacterial and algal blooms, including ones caused by species that produce substances toxic to people. Another danger on the Baltic coast beaches will be the growing risk of infection with the bacteria *Vibrio vulnificus*, especially when the sea water temperature exceeds 20°C . It is estimated the around 25% of those infected with this bacteria die, and this rate grows to 50% when the infection worsens into sepsis, or systemic inflammatory response syndrome. Most patients die within 48 hours of contracting sepsis. In 2019, Germany reported five cases of *Vibrio vulnificus* infection in the Baltic Sea, and one of the patients died.

Priorities

Because climate change entails such a wide array of negative consequences, halting this process is one of the greatest challenges facing humanity. Unfortunately, despite the signing of the United Nations Framework Convention on Climate Change (UNFCCC) 28 years ago and despite the intensive international negotiations that have continued since then, the world is still far from stabilizing the amount of greenhouse gases in the atmosphere, which are seen as the main cause of this adverse trend. Because effective adaptation measures will not be possible unless we stop the growth in the concentrations of greenhouse gases, reducing their emissions should nevertheless be seen as a priority in climate policy.

Likewise, action must be taken to reduce the scope of the negative consequences in the short term. The most important of these measures should involve bolstering Poland's resistance to drought. To make this happen, we need to change the existing paradigm of the management of water resources, in which engineering and technical measures are prioritized as the most effective. This is because climate change is only one of the causes of the ongoing environmental crisis that must be taken into account in the implementation of reforms. Other very important measures include ensuring that the action being taken will effectively



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The Vistula River in Warsaw experiencing a high water level

protect biodiversity, strengthen the natural environment, and support the achievement of the good ecological status of water. Therefore, we should implement measures whose negative impact on the natural environment is as low as possible. In this case, these are measures that support natural water retention: restoration of wetlands, marshlands, and boglands and their unconditional protection; restoration and protection of mid-field and forest ponds and lakes; the revitalization of watercourses; measures supporting water retention in both forest and agricultural soils; the protection of mid-field shelterbelts, and so on. All solutions should support the retention of water where it falls and slow down its runoff into the sea.

The potential of natural water storage in Poland is estimated at around 35 billion cubic meters – nearly nine times more than the capacity of all man-made storage reservoirs currently in use. In addition, the potential of soil retention is estimated at almost 3 billion cubic meters.

Preventing the consequences of agricultural drought by increasing local water retention should be seen as the most desirable measure, because it not only remains the least expensive of all available methods but also improves soil fertility and productivity. After the implementation of new measures, artificial storage should be limited to the areas where methods harnessing the natural storage potential have failed to bring about sufficient effects and it is necessary to store additional amounts of water. Small installations should be preferred, because large reservoirs not only fail to prevent drought but also have a huge negative impact on the environment.

The growing risk of drought makes it necessary to adapt Polish agriculture so as to minimize the risk of losses. This will mean inevitable growth in irrigated surfaces. The overriding rule should be to use water from surface water resources for irrigation and apply drip irrigation. The priority should be on the method

known as deficit irrigation, which involves frequent irrigation with small amounts of water only when soil moisture dips below the level of moisture at which crop yields start to decrease. Although this method translates into overall crop yields that are somewhat lower than those obtained by maintaining adequate soil moisture, the value of such crop yields is optimal in relation to the cost of water used for irrigation.

Other methods that should be taken into consideration in the context of protection against drought include alley cropping, which involves planting crops in alleys between rows of trees, which shade the ground and store meteoric water. Other important methods include the use of organic fertilizers, because soils rich in humus are more drought-resistant.

A growing risk of deficits should also motivate us to conserve water and use it more efficiently. In the face of the growing risk of water deficits in Poland, we should introduce a norm mandating installations that use gray water in new buildings, for example for flushing toilets. Also, we should consider introducing progressive water rates, with water prices increasing significantly when monthly or daily use exceeds a certain level. In cities, storing precipitation water on the site where it falls should be the norm, and this should be done for example through the construction of local storage reservoirs and rain gardens, the replacement of impervious concrete surfaces with more permeable ones, and so on. Rainwater tanks should be made mandatory for large parking lots with permanent paved surfaces.

These are only some of the measures that may and should be implemented in Poland to reduce the risk of losses resulting from water deficits. The work of the Intergovernmental Panel on Climate Change shows that the negative consequences of climate change are making themselves evident faster than we thought four or five years ago, so the implementation of such measures in Poland is becoming a very urgent task.

Further reading:

<http://klimada.mos.gov.pl/en/climate-change-in-poland/>

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