Long-term sustainability of the landscape in new climatic conditions

D Kubeckova¹ and S Krocova²

¹VSB-Technical University of Ostrava, Faculty of Civil Engineering, L. Podeste, 1875, 708 33 Ostrava-Poruba, Czech Republic
²VSB-Technical University of Ostrava, Faculty of Safety Engineering, Lumirova 13, 1875, 703 00 Ostrava-Vyskovice, Czech Republic

Email: darja.kubeckova@vsb.cz

Abstract. The long-term sustainability of the landscape and its natural environment must be the decisive task of the public administration and, in the wider concept, of every citizen. In new climatic conditions, this need has intensified. The following article suggests in a basic scope whether the above-mentioned task can be accomplished, and what means of solution should be used.

1. Introduction
The natural environment is a very sensitive system. It has its own proper balance, which maintains the living conditions of flora, fauna and human populations at the same time. However, over time, the given conditions may change due to a number of natural or anthropogenic causes. Currently, one of the stages of a periodic change is under way. The world is undergoing a climate change that can affect not only the function of the natural environment itself, but also significantly change the living conditions of people on the planet as a whole. Its intensity is not known, but it can already be assumed from external manifestations, and in many cases it can be proven that it is most manifest in the environment of aquatic ecosystems [1, 2].

Depending on its intensity, a number of so-called negative phenomena will occur that the current human population will have to address urgently. The solution can take many forms and dimensions, depending on the type of solution in question and the maturity of the human society of a particular world region. The common denominator of all solutions, covering the overall concept, must be the activity of the public administration or the local authority. Its main task must always be to preserve the long-term sustainability of the landscape in a state in which the individual steps of partial solutions are supposed to take place continuously and the concerned concept is cemented into an organic whole. However, the solutions must not be segmented but must result from an overall risk analysis and the specific real threats to the country or its region. Current scientific knowledge in the field of performing risk analysis enables the state administration to select solutions that correspond to the real threat, cover its scope and intensity, while taking into account the technical and economic options of the solution. The following article suggests in a basic scope how to approach the issue dealing with the problems of long-term sustainability of the landscape in new climatic conditions.

2. Threats to the natural environment and aquatic ecosystems under new climatic conditions
The stability of natural conditions is one of the basic incentives for planning and addressing the long-term sustainability of territorial units. In the basic parameters, it determines the usefulness of a particular area for agricultural, forest-based or civil industrial activities. However, it is not a fixed
factor, but often a highly variable quantity depending on the use of the territory for different human needs and activities. Basically, land used by the human population can be divided into the following categories and characteristics: agricultural and forestry management, civic needs of the housing stock, land for industrial and technical activities, and land with special protection of aquatic ecosystems and sources of raw materials.

Each of the above-mentioned and other activities inherently brings not only positive features, but also natural or anthropogenic threats and consequences [3]. Their characteristics are based on the intensity of the burden on the natural landscape with environmental and especially anthropogenic influences. Their extent differs depending on the type of the landscape, its resistance to ecological burdens and the possibilities for its elimination in real time.

2.1. Natural environment almost undisturbed by human activity
These are, as a rule, areas in countries and regions that have not been built up, or areas with minimum ecological burdens resulting from human activities. In the real environment, these burdens are represented by the following buildings and structures with minimum negative impacts on the original characteristics of the natural environment (as: rural and recreational buildings and regional sports facilities, agricultural and forestry buildings, construction of transport infrastructure, and structures and construction complexes of technical infrastructure).

However, these facilities and land developments are not entirely immune to the occurrence of extraordinary events and the long-term disturbance on the sustainability of the natural environment. It always depends on how it is conceived by the public and controlled by the public administration. However, the optimization of the relationships mentioned in the following chapter has the potential for satisfactory development.

2.2. Industrial and intensively burdened landscape
Ensuring long-term sustainability and an acceptable natural environment in an industrial and intensively burdened landscape is significantly more complicated both from an ecological and a prognostic point of view. Since the second half of the last century, the area with the above-mentioned characteristics has increased. According to the forecasts of the UN and other scientific workplaces dealing with the demographic development of mankind, it is clear that in the 21st century, most of humanity will be concentrated in these localities.

Negative phenomena and threats to the natural environment will be based primarily on the following primary subjects and facilities: insufficiently treated urban and industrial water as far as substances are concerned, long-term reduction in the volume of flowing water in containers, increasing load of accumulated surface water with substances, the assumed lower infiltration of rainfall and snowfall into the water-bearing layers of the soil leading to a significant change in the quality and quantity of groundwater in most regions affected by climate change, significant enlargement of the area of large cities and the number of industrial areas and logistics areas, and significant expansion of transport infrastructure construction and increase in negative impacts with respect to maintaining the natural environment of the world’s regions. These and other negative phenomena will be the major environmental threat of the 21st century. If the risk is not solved or if it is underestimated, potential negative threats will be deepened up to the critical point phase. Whether this threat occurs and to what extent will depend on a number of factors. One of the key ones, however, will be the activity of the public administration within the territory. It has irreplaceable means and authority to reduce or at least substantially eliminate most of the risks [4].

3. Public administration and its potential for reducing risks in the industrial landscape
In most countries of the world, the public administration is the state administration and self-government. Its role and function in the real life of citizens and legal entities is absolutely irreplaceable. One comes into contact with both systems throughout one’s whole life. In some areas of territorialisation, basic needs and decision-making requirements are integrally increasing. These areas clearly include the industrial landscape and its technical infrastructure and protection of the aquatic ecosystems of the region in question. By its very nature, a number of operational and security threats
and emergencies arise in the industrial landscape [5]. These events can have a different threat dimension and duration if they actually occur. Given that the activities of the state administration and decision-making, as opposed to the activity of natural persons, can be carried out only on the basis of the authorization by law, the public administration has at its disposal the tools resulting from the following figure 1 under the conditions of, for example, the Czech Republic.

![Figure 1. Sequence of legislative regulations in the Czech Republic.](image)

The figure 1 shows the effect of the international treaties and EC directives on the drafting of laws, the Government Regulations and decrees in the drafting of legislative regulations of the Czech Republic. Their importance significantly increased after the Czech Republic joined the European Union, which included, among other things, the obligation to implement these supranational standards in the legislation of the individual countries. Under this configuration of law, the public administration must carry out its activities. For example, in the field of control and protection of aquatic ecosystems, “Water management authorities of regions and municipalities with extended powers” have the primary responsibility for the performance of the state administration. In the industrial landscape, irrespective of the specific local incorporation of the state administration in the legislative environment of the country concerned, water management authorities must focus their attention especially on the following areas of managing surface and groundwater and their long-term sustainability in the natural physical state: extraction of surface and groundwater by legal and natural persons, passive and active protection of aquatic ecosystems against contamination from industrial activities of individual subjects, keeping an overview of the old ecological burdens and their gradual elimination, reduction of water consumption for energy purposes in river basins endangered by hydrological drought, elaboration of studies and crisis scenarios for solving situations in increasing the consequences of hydrological drought, and control of public administration crisis plans and plans for crisis preparedness of entities in the water management sector and their possible updating in the light of new scientific knowledge of threats.

The optimal operation of water management authorities is the primary basis leading to the long-term sustainability of the natural environment in the industrial landscape. The outputs of this activity are not only discussed at the water management level, but they are a prerequisite for the development of the territorial units of the regions in all the countries of the world. It is necessary to realize that without water there is no life on Earth. This fact is generally known to everyone, from small children to specialists in various fields of human activity. Despite this common knowledge, however, it is not
considered in practice. In forthcoming potential crisis situations caused by climate change and its impacts on aquatic ecosystems predominantly in the inhabited areas of the world’s regions, there is no longer a timeframe for underestimating the global risk in question.

While scientific knowledge and states’ technical capabilities do not have the full potential to solve this dangerous situation, they can, at least, mitigate it to a large extent by adopting preventive countermeasures [5]. The ways and means of responding to emerging environments are, to a fundamental extent, clear from the following subchapter of the article.

4. Means to increase the long-term sustainability of the natural environment in the countryside
Ensuring long-term sustainability of the natural landscape and the natural environment is a complex task. Often, in the attempt to achieve it, interventions were carried out in the past, which did not solve the situation but, on the contrary, often significantly worsened it. In particular, this concerns the construction of land amelioration structures with the aim of eliminating flooded land or amelioration of the various types of recipients in order to reduce the period of floods and their consequences. As an illustrative case, both interventions had their immediate effect, but they demonstrably failed in the complex of maintaining a natural balance between immediate effect and long-term benefits.

To reduce the above-mentioned and any additional risks of failure, the options and benefits should be based on the model shown in figure 2 and figure 3 below.

![Figure 2. Sequence of legislative regulations in the Czech Republic [6].](image1)

![Figure 3. Sequence of legislative regulations in the Czech Republic [7].](image2)
Even with an optimal risk analysis process, the impossibility of an ideal solution and the resulting uncertainty rate must always be taken into account. It is quite probable that at least the number of sources of danger can be attained by the analysis. The diagram shows that when this risk management technique is used correctly by the public administration, it is possible to maximize the strengths of decision-making and, on the contrary, to overcome the weaknesses and the resulting risks. However, in order to make the decision as optimal as possible, it is always necessary to take into account the actual state of the landscape, its resistance and further vulnerability when underestimating the implementation of corrective measures.

With this technique of assessing operational safety risks and the adoption of alternative follow-up measures, the operators of the technical infrastructure of each country should also operate outside the public administration. Only their synergy has the prerequisites for achieving a real positive result in landscape protection. At the present time there is no longer room for theoretical considerations, but there must be a combination of theory and work. One of the ways to achieve this commitment is given in the article.

5. Conclusion
Both authors of the article deal with the issue on a long-term basis. Since the beginning of their professional careers, in their lectures for students at universities, they have been instilling knowledge about the unity of nature and the need to respect natural laws in human action. The incoming new generation of scientists and technicians will, among other things, have the task of rectifying a number of past mistakes in decision making. How to achieve this goal is indicated in the basic, significantly reduced scope in this article.

Acknowledgments
This work was supported by the research project V120152019049 “RESILIENCE 2015: Dynamic Resilience Evaluation of Interrelated Critical Infrastructure Subsystems”, supported by the Ministry of the Interior of the Czech Republic in the years 2015-2019 and project “Development project 2017”, supported by the Ministry of the Interior of the Czech Republic in the years 2016-2018.

References
[1] Castany G 1978 Effects of drought on groundwater. Vulnerability of water dry layers. Bulletin du B R G M Section III 3
[2] Drought Management Plan Report Including Agricultural Drought Indicators and Climate Changes Aspects. Water Scarcity and Drought Expert network 2008 European Commission http://ec.europa.eu/environment/water/quality/pdf.dmp_report.pdf
[3] Krocova S 2017 Industrial Lanscape in the Period Drought. Inz.Miner. 39 39-32
[4] Adamec V, Malěrová L and Adamec M 2016 How to assess teritory vulnerability Sci. for Popul. Protect. 1 35-40
[5] Rehak D, Hrdina P, Senovsky M and Dvorak J 2011 Case Study on the Spatial Development Impact Assessment Tool Applied in the Spatial Development Environmental Security Assesment Communications 13 32-36
[6] Prochazkova D and Riha J 2004 Crisis management (Czech Republic: Prague)
[7] Collective of Auhors 2007 Perception of Security in a Territory (Czech Republic:University of Pardubice)