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WATER MANAGEMENT FOR SUSTAINABLE GROWTH STRATEGIES

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The aim of this document is to present a synthesis of water sustainability issues as the basic role in the sustainable growth strategies in many countries. Water crisis and extreme weather conditions have been identified by the World Economic Forum community as two of the top ten global risks. This is hardly surprising, considering the devastating impacts of having too little water, or too much. While water's immediate impacts are often local, water security is now recognized as the systemic global risk. Each development has its own limiting parameters. In the latest decades, we have recognized the term ‚blue and green water'. Blue water availability is a limiting factor for the green water. Due to the changes and processes in the country, as climatic, economic or socio-economic ones, fundamental factor for sustainable development is to secure water supply. Soil water and its availability for crop production during the growing season appear to be a problem. Surface water resources created for the additional irrigation in the pastures are now used for other purposes such as energy or industry. It is therefore important for water sustainability in the countries to increase the water resources protection.

Keywords: water management, sustainability, agricultural crop, limits, drought

Introduction

In the past 40 years the world has lost about 30% of its arable land due to the erosion and pollution. It can lead potentially to disastrous consequences as global demand for food. Since 1970, the world population has rapidly risen from the initial number 3,706 billion to the recent number of humans estimated to 7.4 billion people.

Economic development and population growth are linked in generalised ways. Economic progress generates resources that can be used to improve human knowledge and health. These improvements, along with associated social changes, reduce both fertility and mortality rates of human beings. On the other hand, high rates of population growth that belong to surpluses available for economic and social development can hinder the improvements in education and health. In the past, the intensification of agriculture and the production of higher yields helped nations to cope with the increasing population pressures on the available land (World Commission on Environment and Development, 1987).

Water systems are creating complex conjunctions of physical, social, economic and political factors. Conjunctions contain also risks and uncertainties. Their complexity with hydrological events is defined by a mixture of natural aridity, flood vulnerability and high inter- and intra-annual rainfall variability, with the last being the most complex. Vulnerability of water resources increases the investment (in information, institutions and infrastructure) required for water security (Grey, 2007).

It is necessary in the present time to evaluate the climate changes and their influence on the balance among population, water demand and water availability. We need to consider the entire suite of socially valued water uses and how the accessibility of water across those uses is eligible to change. Water is valuable not only for domestic uses, but also for its role in supporting the aquatic ecosystems and environmental amenities, including recreational opportunities, and as a factor of production in irrigated agriculture, hydropower production, and other industrial uses (Young, 2005). Our global economy needs to grow continually, to be capable of providing food for growing world population adequately. Water is crucial for the future growth. However, it can also become the significant limiting factor for development. Businesses in water-scarce areas are already at risk. Investors are increasingly taking water supply into consideration during their decision-making processes (UNEP, 2011). Drought is the biggest threat of the present climate changes. Impact of drought is global. Blue water availability is a limiting factor for the future development. The concept is closely related to the sustainability, but with more emphasis on the growth and on the mitigating climate change. Drought is widely comprehended as the major long-term challenge to sustainability (Bowen, 2011).

The green economy is defined as an economy that results in reducing environmental risks and ecological scarcities and hence tries to create conditions for sustainable development without degrading the environment. It is narrowly related to ecological economics, although it has a more politically applied focus (Sabha, 2015). Over 65 countries in the world have pounced on green economy and related strategies. About 50 of them are taking steps to develop national green economy plans (Lynn, 2014). Green growth is about to make growth processes resource-efficient, cleaner and more resilient without necessarily slowing them. Direct contribution to the economic growth can protect the environment because the environment as the natural capital is an input into the production. Environmental conservation can involve increased inputs of natural capital and thus contribute to an enhancement in income (Hallegate, 2012).

Given today's approach to water management, there is so much growth that can be covered with water resources. Gains in efficiency and productivity in water management and utilization can reduce risks and enable higher levels of sustainable growth. How far-reaching do those gains have to be? And can we make a difference in a timely enough manner by understanding that the path for sustainable growth requires more than green solutions – that is also requires the blue ones? (UNEP, 2012). Countries with smaller economic development are located in the regions which have the most droughts and drastic seasonal changes in precipitation and evaporation. They also tend to face the rapid population growth. A daily rising population is thus competing for scarce water resources (Falkenmark, 1992).

Water is often wasted because it is under-priced. Direct and indirect subsidies (especially for agricultural use) are still common in both developed and developing countries. If we remove such subsidies and allow water prices to cover production costs, we can provide encouragement for water protection. Also for the investments which are needed to spread more

beneficial technologies (Postel, 1996). More and more governments, businesses and communities around the world are starting to focus on managing ecosystems holistically, in recognition of many connections within and between them. This same approach goes for the intersection of water, food and energy; actions within one industry have direct impacts on the other ones (Kyung-Jin Min, 2014). Research results have estimated that the wide range of ecosystem services that fresh water provides are collectively valued at more than US$ 7 trillion per year. In so many countries, water is the cheapest material that people pay for. Fresh water flows over and under our lands in rivers and stays in lakes before it eventually empties into the oceans. Everyone knows that rain allows plants to grow. However, not so well known is that the plants in landscape and forests also give some of the water they use back into the water cycle over direct evapotranspiration to make rain (Renzetti, 2002).

The Korean government with the Water and Green Growth initiative are prepared to develop a new global solution. The first concept was introduced during the 6th World Water Forum in Marseille, France in 2012. The idea has gone through various discussions and has developed at different levels and platforms since then. This is the opportunity to let the world know that water is the key factor to environmentally sound and socially inclusive economic development (Kyung-Jin Min, 2014).

Material and methods

One of the fundamental tasks for governments at present is to ensure the economic growth. To ensure a higher increase of production, we obviously need more raw materials and natural resources. However, the global water constantly balances and thus the water resources are limited. The resources used for human beings are reduced because people use water bodies as receiving water.

Media keep us updated about decreasing quality of water resources and about the completely devastated rivers and lakes.

Why was the name of green growth adopted? May we really change our approach to the natural resources conservation, to increasing expenses for natural resources and improve attitudes of nearby residents to nature exploitation and protection? We will try to analyse these issues.

Green growth

The term 'green growth' (Figure 1) has appeared after overcoming the problems of the financial and economic crisis that peaked in 2008. An important impulse for starting the policy of green growth in Slovakia was the adoption of the "Declaration for green growth" at OECD Ministerial Council Meeting in June 2009.

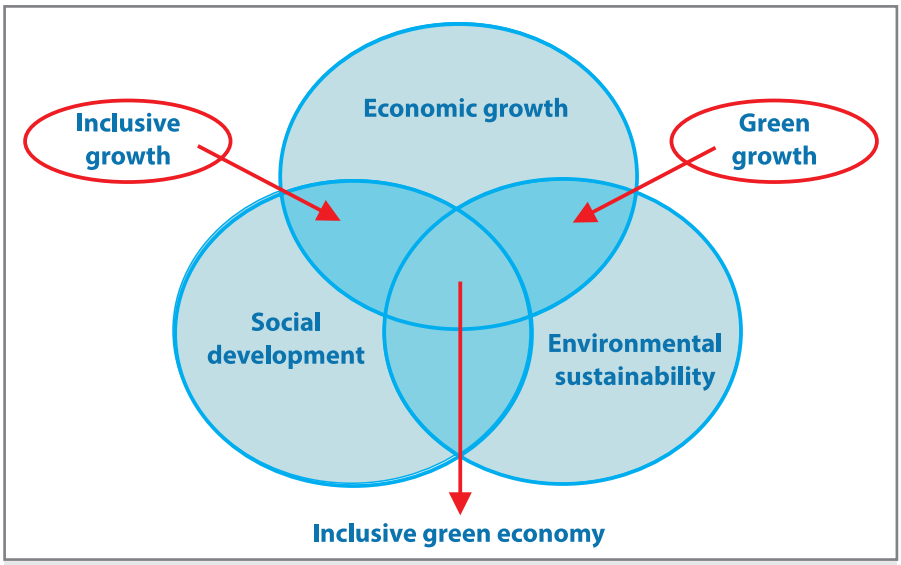

Figure 1 Global context of Green Growth
Source: Poverty-Environment Partnership, 2012

The financial crisis from 2007 to 2008, also well known as the Global Financial Crisis and 2008 financial crisis, is considered by many economists to have been the worst financial crisis since the Great Depression of the 1930s (Reuters, 2009).

A way out of the economic crisis sought the unconventional application of economic principles, as well as natural resources. Green growth therefore creates new sources of the growth through incentives for greater efficiency in utilization of the natural resources and natural assets. It discovers new opportunities for innovation spurred by policies and framework conditions that allow using the new ways of creating the value and addressing the environmental problems, allow creation of new markets by encouraging demands for green technologies, goods and services; allow boosting the confidence of investors through greater predictability and continuity for governments to deal with main environmental issues and also securing more balanced macroeconomic conditions, supporting reduction of prices volatility of resources and finally enable supporting fiscal consolidation – Figure 1 (Poverty-Environment Partnership, 2012).

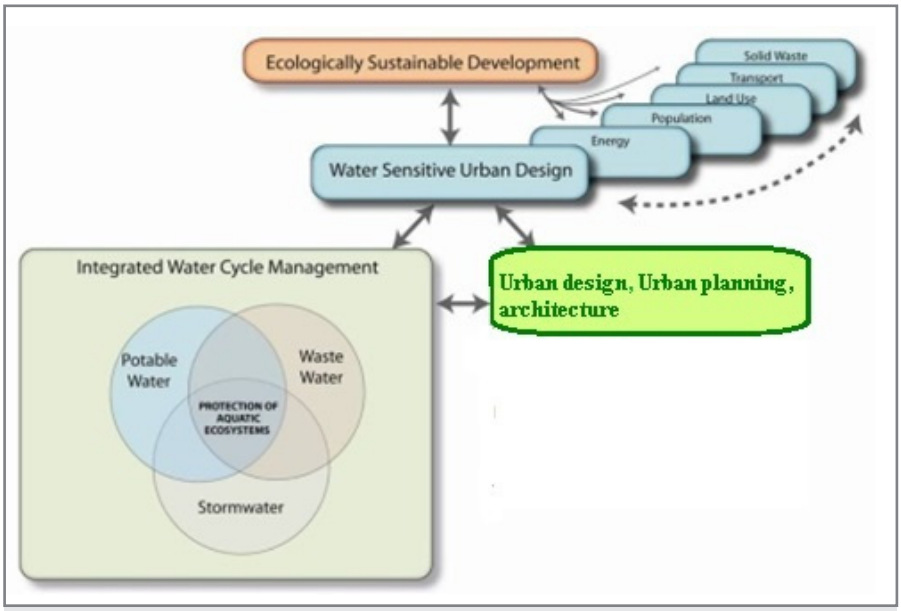

Figure 2 Water cycle management and sustainable development of towns
Source: after Steffen, 2015

The goal of the green growth is to increase human wealth by supporting the effective natural resources use and economic activities that represent a sustainable benefit for the society.

'Reaching these objectives will inevitably call for putting innovations into practice and understanding and appreciating the value of the natural capital' (UNESCO, 2006).

The Slovak Republic belongs to those OECD member countries which have developed their own national green growth indicators. First of the OECD countries to introduce their own indicators was the Netherlands, followed by the Czech Republic and South Korea (Slovak Environment Agency, 2014).

The selected indicators characterise Slovakia's initial position as seen from the perspective of the green growth and these indicators are going to be used as a measuring tool before taking any further steps. They are going to be taken in the process of the strategy implementation and for complex assessment of the future trend of the Slovak economy. The present set of green growth indicators consists of 32 individual indicators that are relevant to the conditions in Slovakia. Four of them represent national indicators which describe the voluntary instruments for the environmental strategy (Slovak Environment Agency, 2014).

The Nexus: water – energy – food security

We have increasingly recognized that water, energy and food security are inseparably linked. The interconnectedness of these sectors in space and time means that the solutions to the problems in one sector, in most cases, cannot be longer found without impacts on one or more of the other sectors. A nexus approaches integrating management and governance across the sectors and scales and hence can support the transition to the green economy by reducing the negative economic, social and environmental externalities, increasing overall efficiency of resource utilization, and providing additional benefits such as strengthening the focus on human rights in connection to water and food. Rural-urban interaction in intensively urbanising world and many valuable chains further underscore the importance of the intersectoral approach (Postel, 1996).

Agricultural sector is responsible for 87% of total global water consumption. In Asia it represents about 86% of total annual water usage, compared with 49% in North and Central America and 38% in Europe. Rice growing, in particular, is a large consumer of water: it takes about 5000 litres of water to produce 1 kg of rice. Compared with other crops, rice production is less efficient in the way of a water use. Wheat, for example, consumes 4,000 m^3/ha, while rice consumes 7,650 m^3/ha (Eurostat, 2015).When societal water demands are high in relation to water availability, water is seen as scarce.

Climate change together with fluctuation of temporal and spatial variability of water resources are natural factors that, when combined with the pressures of economic growth and major population change, make the sustainable development of our water resources a challenge – Figure 2 (Steffen, 2015).

By promoting green growth based on the sustainable management and use of natural resources, countries are able to generate sustainable and inclusive economic growth and job creation. The private sector should be a force for economic growth and employment and contribute to sustainable and inclusive development. Both the international and national framework for green growth should be strengthened, and policy coherence for trade, agriculture, environment, energy, climate and development must be enhanced. Green growth will focus on the sustainable food production, access to energy and water and integrated climate efforts (Steffen, 2015).

Over the last decade, water has also been increasingly used for the production of the first-generation bio fuels. The production of bio fuels affects water resources in two ways: directly through water usage for irrigation and the industrial processes of feedstock conversion; and indirectly by increasing water loss through evapotranspiration that would otherwise be available as runoff and groundwater recharge (Ringler, 2012).

Water use and availability directly affect economic growth with growing water scarcity, limiting desirability or potential for investments. To assess this latter linkage, water scarcity increases its effects on a country's economic growth. We need to know how much the water productivity improvements can reduce water overutilization and thus sustain economic growth. Alternative development pathways must be developed and assessed at various levels of economic growth. The well-known critical ratio or water stress index (the ratio of water usage to internal renewable water resources) can be used to identify the developmental outcomes that put both population and economic development at risk from water stress. High critical ratios (values above 40%) significantly influence water stress, as we can see at figure 3 (Ringler, 2012).

The European Commission published its 2020 strategy for sustainable growth in year 2014. It was a set of initiatives that has replaced the Lisbon strategy. The 2020 strategy sets five targets that should be achieved within the next decade in order to meet Europe's energy and climate goals. The Environment Council discussed the EU 2020 Strategy on the 15th of March 2010.

The Ministers welcomed the strategy and the fact that the environment and climate change objectives were one of its priorities. Some delegations wish for these elements to be strengthened in the strategy. Delegations highlighted the added value in the terms of growth and jobs that could be derived from all of the aspects of environmental protection.

Many of them underlined resource efficiency and sustainability as they are crucial to

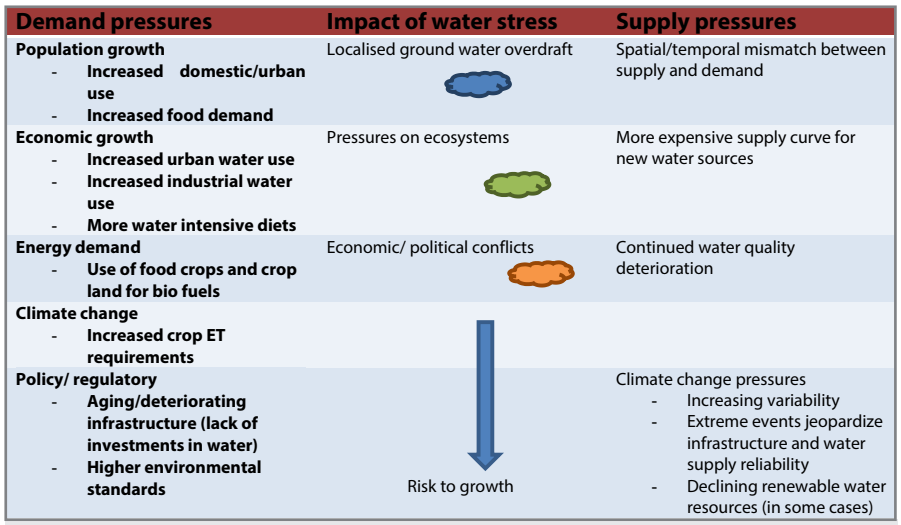

Figure 3 Supply and demand pressures on water availability and use
Source: Ringler, 2012

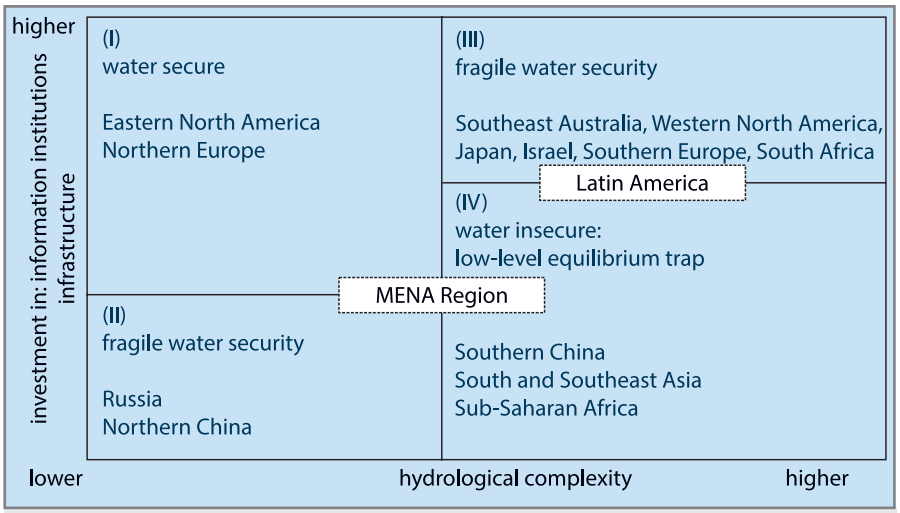

Figure 4 Water security around the world
Source: Grey, 2013

reach the EU's climate targets but also to improve its competitiveness and ensure energy security. Ministers agreed that integrating environmental concerns into other policies would be the best way of achieving the targets while acknowledging the importance of market tools and full use of financial cohesion instruments and regional policy (The EU's 2020 Strategy).

Water Sensitive Urban Design (WSUD) is a holistic approach to the planning and design of the urban development that aims to minimise impacts on the natural water cycle and protect the health of aquatic ecosystems. It promotes the integration of rain-water, ground water supply and wastewater management at the development scale.

Water stress

At present, there is published information about the water scarcity and water stress on the global scale, as well as in the individual countries. The global data generate from average values of water resources and its utilization. The local information comes from current observations and real conditions in the landscape. Figure 4 shows the global evaluation of water security and countries in Southern Europe are selected for fragile water security.

The global balance in the long term observation is favourable. This balance, however, has got one major problem. The amount of useable resources is not specified. More and more countries have problems with the quality of surface water or ground water and some resources are completely destroyed. Nowadays, there are a lot of problems of water resources both for the population and for the agricultural production. Balance of water resources in the country, region or city is often the crucial information for the assessment of the opportunities for economic and social growth. The landscape, its structure, and its surface dramatically change in the agriculturally used parts during the year, mainly due to the impact of water cycle on the evapotranspiration.

The key role played by freshwater in the biomass production process and therefore in food production as well, implies that risks to water security arise not only from scarcity of liquid water (blue water), but also from scarcity of infiltrated rain water in the soil (green water), which limits the potentials of food production (Falkenmark, 2013).

In the year 2015, many areas of Europe were monitored during the long period without rainfall and high temperatures. Farmers and gardeners were desperately looking for ways to save their yield in periods without precipitation and tried to use the available solutions. Cities and towns also struggled with the lack of water and many of them proceeded to the restrictions on the use of water in the city.

Central Europe heat waves / dry season / extreme events

Immense heat waves were avoiding Central Europe but it is only a matter of a short time when they will also affect our region. The current heat wave in summer 2015 was accompanied not only by high temperatures but also by an extreme drought.

Since June, 2015, there have been just some rare sporadic rainfall events in the several places in the southern Slovakia. This, in the combination with high temperatures leads to more rapid drying of the land and thus causing serious problems. Several areas in Slovakia had to face the problems with water supply and last summer there were reported more than 1400 fires till October, 2015. Based on the analysis of the current unfavourable situation in Slovakia, it shows that this summer drought might bring even more serious inconveniences than particularly severe droughts in 2012, 2011, 2007 and 2003. It is even possible that the catastrophic drought in 1947 might repeat.

Climatologists warn against the constant occurrence of more and more extreme weather and drier and warmer years, which are mainly a result of decades of global warming. However, almost nobody pays proper attention to these alerts. Therefore, we appeal to all politicians to act responsibly. (We should act locally, think globally.) We believe that the support of the Slovak Government provided to the automotive industry should take into the consideration the risks associated with the effects of the climate changes. Adaptation of measures to climate changes should not therefore remain just on the paper and should not have only a declarative character. It's not just us, just our country, who wants to live, but the future generations as well (Ač, 2015).

We have managed to reach the interaction of our urban landscape with the natural environment in a way that leads to the social, economic and environmental risks arising from the extreme conditions.

The farmers are trying to respond to the drought by using different kinds of irrigation. However, the irrigation may be just a short-term solution to these problems. In the longer lasting droughts, abnormally high consumption of water indicates that the water reservoirs will not be able to store enough water. In the long dry season, they are not just plants in the landscape which suffer, but also water resources. Far more sustainable

Table 1 Total yields in selected years in t/ha (Source: SLOVSTAT, SPPK)

	1990	1993	1995	2000	2005	2010	2013	2014	2015
Corn for grain	3.56	4.62	4.90	3.04	6.97	5.53	7.33	5.07	4.98
Potato	14.12	18.15	11.07	15.47	15.77	11.45	20.62	18.15	24.38
Sunflower	1.94	2.01	1.73	1.70	2.14	1.81	2.66	2.33	2.41
Sugar beet	30.82	34.31	34.27	30.37	52.16	54.52	61.04	56.29	51.49

solution is to plan land resistance to drought – the ability to withstand drought periods. In principle, the methodology of the sustainability of water resources and the landscape sustainability should be applied. It is important to plan in the landscape such water consumption for crops grown in the area that may still ensure the water resources in rivers and reservoirs. Groundwater must be primarily intended to ensure the supply of drinking water.

Problems with the drought are mainly significant for agricultural production. To analyse the yield of the essential crops cultivated in Slovakia, we should take into the consideration two possibilities of how to solve it. On one hand we should reduce crop production, on the other hand reduce water consumption. Decrease of the average yield of crops during the drought season in the last 20 years is really significant. If we compare today's yields with the yields from the period around 1990, the yields from the current dry season are still high. According to the information of SPPK (9 November, 2015), the average yield of corn for grain in 2015 was 4.98 tonnes per hectare (t/ha), sunflower 2.41 t/ha, sugar beet 51.49 t/ha and potatoes 24.38 t/ha (http://slovak.statistics.sk/wps/portal/).

Although the year 2015 was extremely dry and the agriculture consumes the soil water even more than in the past, it still highly exceeded the yields form the period of 1990s. The result is an extraordinary drop of groundwater levels. The drought had an impact on insufficient supply of drinking water for population, despite the fact that the heat ended.

Conclusion

Water starts its existence as rainfall, later creates streams and rivers, forms lakes and finally turns into the oceans. The similar processes exist in the economy, too. The flow of activities of an individual person and people enables the existence of life in villages, towns, countries, and finally the economic security of the societies worldwide.

Water and its circulation are firmly connected due to its never ending recovery and ability to readapt. We have to explore the processes in nature in the scientific way to discover and gain opportunities for economic development in the point of view of the sustainability of water resources and human development.

We all need to help to protect our water resources. We must continue to educate as many people, corporations and government leaders about the importance of conserving fresh water, as possible. Countries have prepared plans for agricultural development without sufficient knowledge of the water resources. Similarly, they have adopted water management plans without more proper knowledge of the needs of agriculture. They have processed the development plans for cities without a precise balance of all types of waters in urbanized areas. However, all the plans are considered to be sustainable. The integration of those plans will help in the future use of water resources and to the country as a whole.

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