CHALLENGES FOR THE DEVELOPMENT OF LOWLAND RIVERS ECOSYSTEM SERVICES IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT GOALS

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Abstract
In 2015, the United Nations General Assembly adopted a resolution for sustainable development – the 2030 Agenda. It sets 17 Sustainable Development Goals to reduce global poverty and encourage sustainable international development. Governments worldwide have adopted sustainable development goals for water quality improvement and the revitalization of freshwater ecosystems. They have set ambitious targets for improving water quality by reducing pollution, removing landfills, reducing releases of hazardous chemicals and materials, and protecting and restoring water-related ecosystems, including mountains, forests, wetlands, rivers, and lakes. It is an opportunity to change the degradation of the environment for decades or even centuries and focus seriously on the recovery of the environment. The aim of this study is to analyze the opportunities provided by the ecosystem services of the Svete River at the Jelgava municipal level in the context of the United Nations 17 sustainable development goals. The created matrix offers a deeper understanding of the role of ecosystem services at the local authority level and provides a framework for the further development of ecosystem services. The results of this pilot study can be used as a basis for the development of ecosystem services in municipalities with lowlands.
Key words: Ecosystem services, water quality, ecosystem health, sustainable hydrology.

Introduction

The implementation of sustainable development in Latvia started in early 1990 when the initial national environmental policy was formed, aware of the need to reconcile sustainable economic and social processes with ecological protection needs. In 2002, the guidelines for sustainable development in Latvia were approved, based on the 1992 United Nations (UN) Declaration of the Conference on Sustainable Development. Following the review of the EU Sustainable Development Strategy in 2006, the planning process for the sustainable development of Latvia was based on the UN launch, in which citizens expressed their vision on what Latvia should be in all sustainability dimensions in 2030 (United Nations, 2015).

Latvia's Sustainable Development Strategy until 2030 sets out a spatial development perspective to preserve Latvia's specific natural and cultural heritage, its inherent and unique landscapes. Ecosystem services are part of natural capital. Natural capital shall be allocated to renewable resources, non-renewable resources and ecosystems in services.

Ecosystem services are services such as 'ecological processes that provide and meet the needs of human existence'; services such as the 'benefits that people get from nature' services as 'ecology components directly used to ensure human well-being' (Adukia, 2017; Fisher &Turner, 2008).

The aim of this study is to analyze the opportunities provided by the ecosystem services of the Svete River at the Jelgava municipality level in the context of the UN 17 Sustainable Development Goals (SDG).

Materials and Methods

The Svete River has been chosen as a pilot area because the ecosystem services of the Svete River catchment area in the Jelgava region represent all ecosystem service groups according to Common International Classification of Ecosystem Services (CICES). The Svete River is a water drain of national importance, which according to the Civil Law, is a public river. It is a tributary of the left bank of the Lielupe. The total length of the Svete River is 123 km, of which 75 km are located in the territory of Latvia (Figure 1) and 65.4 km in the Jelgava region, but 48 km – in Lithuania.

In the first reaches of Svete River, on the left bank, there are primary forests, but on the right bank is the city of Jelgava. In this part, the Svete River flows through the nature park 'Svete floodplain', which is part of the Natura2000 network of protected areas. The low areas of the floodplain are delimited from the Svete River by polder dams. The central part of the Svete River mostly flows through intensively managed agricultural areas. Hydroelectric power plants (HPPs) and water reservoirs have been built in three places upstream of Svete River.

This study takes the same approach CICE, and it is a hierarchically formed classification system that categorizes ecosystem services into three main categories: 1) supply services, 2) environmental and support services, 3) cultural services.

The assessment of ecosystem services has been carried out in determining the practical value of ecosystem services: 1) biophysical assessment (the structure and functions of the ecosystem); 2) social

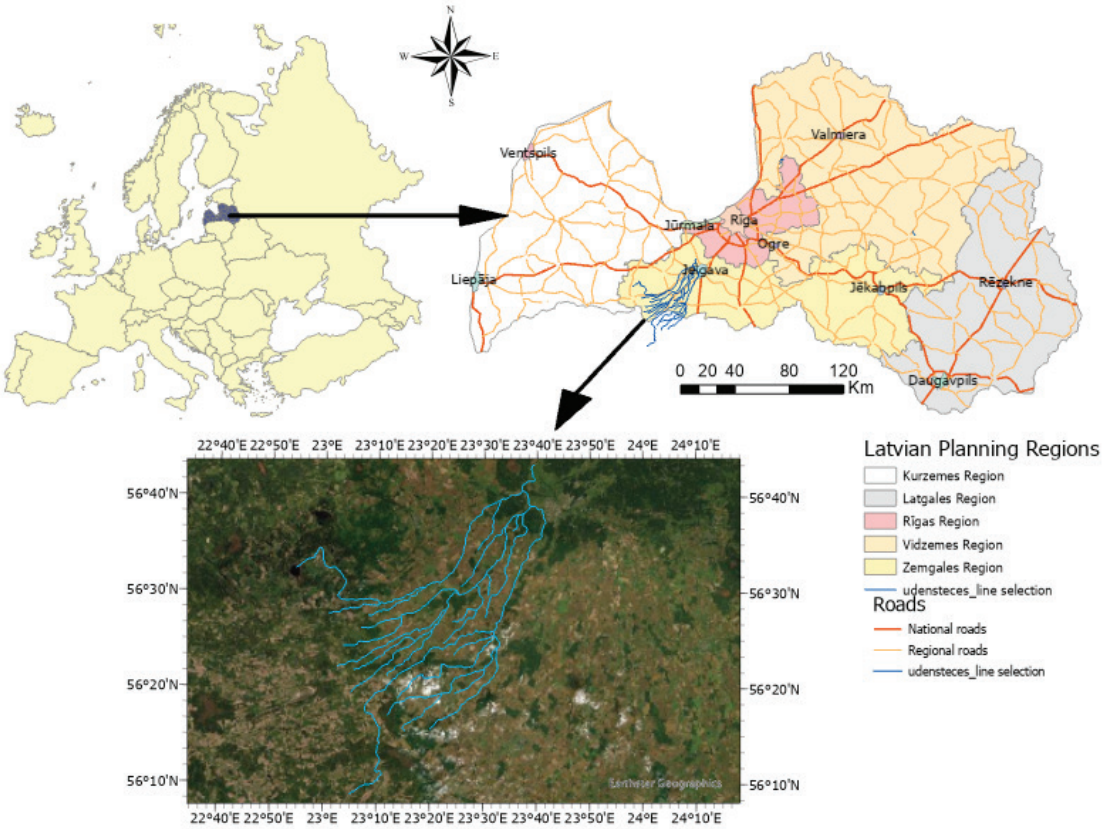

Figure 1. The analysed Svete River catchment area (created by K. Siltumens).

assessment (clarifying ecosystem services of relevance to society); 3) economic assessment.

The values of ecosystem services are allocated to the use-value, the importance accorded by a person, to use nature to meet their needs, to ensure their existence; and fair value arising from the assumption that nature has a 'right of its own' to 'its own existence', regardless of whether people benefit from it.

In this study, ecosystem services were analysed in the context of SDG. A set of ecosystem services for the Svete River was identified for each purpose, geared towards achieving the specific objective.

Results and Discussion

Sustainability is the transmission of the environment we live in to future generations without compromising future generations' living standards and opportunities. Social sustainability is a responsible treatment of people in various contexts but is mainly related to including all sections of society. Environmental sustainability – responsible action to the environment and diversity, focusing primarily on preserving the environment. In turn, economic sustainability is a responsible action from a financial point of view. Economic failure cannot be sustainable.

17 SDG is a new global environmental understanding of economic transformation and sustainable development through responsible consumption and production patterns and clean and affordable energy. It is becoming clear that climate policy, sustainable development and poverty reduction are inextricably linked (United Nations, 2015).

In this study, ecosystem services in the pilot area are identified and analysed in the context of the UN 17 SDG (Figure 2).

SDG-1 Water is an essential resource that affects economic and social systems and is critical in transferring substances and energy. According to United Nations data (Barnaby, 2009), 80% of all jobs worldwide depend on sustainably managed water resources and water-related services, including sanitation and sewage services. The objective falls within the supply, environment, aid, and cultural services. The river provides a safe buffer zone for flood control and drought prevention while at the same time reducing vulnerability to extreme environmental and climate events. The river can give a small niche of its tourism business. Tourism, hotel business, cultural monuments, manor, spas, guest houses, walking trails, restaurants, cafeterias, intact wild landscapes provide everyone with mental recreation and well-being the benefits of ecosystem services and hydro and substantial water resources and sustainable energy generation opportunities.

SDG-2 The objective falls into supply and environment and support services. Crop production in the Svete River catchment is higher in the drained soil. Irrigation options are available during drought. The drainage of forest areas increases the productivity of forests and wood quality. The Svete River provides food production, boosting agricultural productivity and the income of small food producers. Everyone can supply themselves with berries, mushrooms, wild fish, cancers and herbs. By focusing on more sustainable strategies for implementing agricultural policy, water use efficiency can be increased by using water from the river. On the other hand, intensified agricultural activity may increase nitrogen, phosphorus and toxic substances in the river (Boyd & Banzhaf, 2007) contradicting SDG-14.

SDG-3 Includes the category of environmental and support and cultural services. Safe and clean drinking water is essential for the well-being of society, whether it is used for household, food or leisure purposes. Providing people with clean and healthy water can improve their quality of life. The Svete River offers the opportunity to relax and promotes relaxation in coastal areas. Water tourism, recreation by the water, SPA area, plants, physical enjoyment of the landscape, walks, swimming, sunbathing, sports activities on the coast improve people's mental and physical health and ensure human well-being. With predictable water storage capacity for drinking water and recreational activities, the sustainable development of lakes and reservoirs is essential to reduce water-related diseases, deaths and water pollution and pollution-related diseases. However, the lack of a sanitation system outlined sources from agricultural remarks and the primary sources of high-level amenities in rivers, lakes, and reservoirs (Craun, Calderon, & Kreuns, 2005). To achieve improvements in health care systems, obtaining a quality water resource is recommended.

SDG-4 The Svete River provides environmental education as well as education for sustainable development. Everyone involved in education has the opportunity to change the world to reduce the threats posed by climate change, biodiversity loss and over-consumption. However, water pollution can cause health problems for young children and be a significant barrier to obtaining proper education in the absence of children (Adukia, 2017). Good quality education can contribute to an active future in biodiversity conservation and waste management with higher knowledge, attitudes and skills of trained students.

SDG-5 Women play a vital role in providing, managing, and protecting water resources.

Women and girls are considered 'water carriers' in the world. According to a UNICEF study (WHO & UNICEF, 2014), women spend at least 16 million hours each day collecting drinking water. It significantly reduces the time spent on productive work and learning, which in many places leads to a broader gender gap (Jayachandran, 2015). Higher gender equality means better education for girls and women, leading to a greater understanding of environmental protection, which benefits ecosystems (Adukia, 2017). The objective falls into supply, environment and support, and cultural services.

SDG-6 Safe drinking water and sanitation are recognized as fundamental human rights, as these

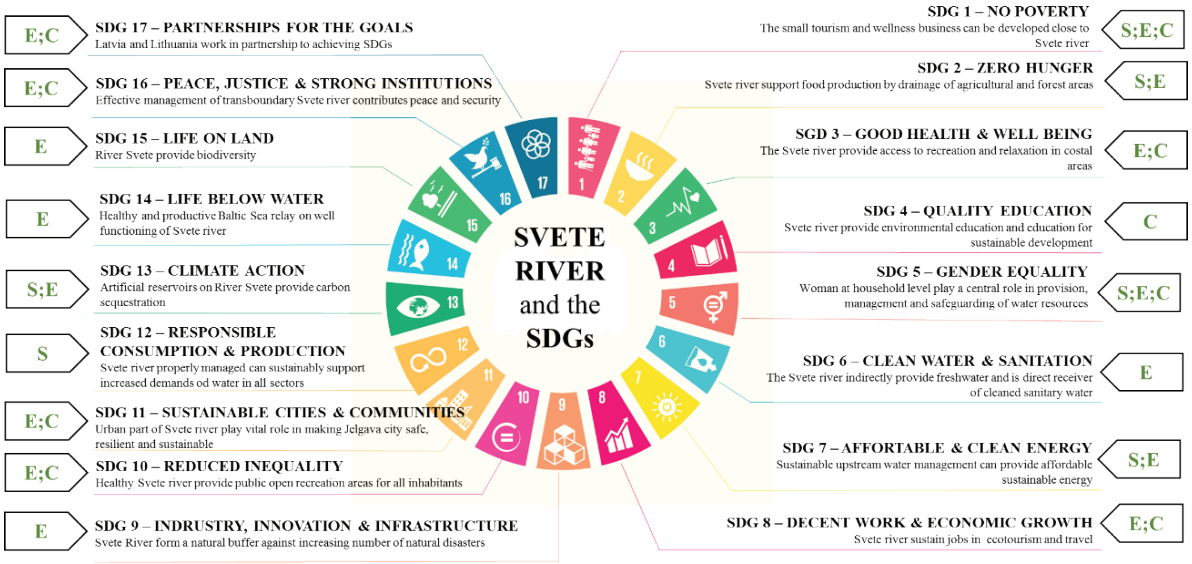

Figure 2. SDG analysis by Svete River catchment ecosystem services (Supply services (S); Environmental and support services (E); Cultural services (C)) (created by I. Grinfelde).

factors are essential to ensure a healthy lifestyle and are necessary for each person's self-assurance. However, without active action today, in 2030, the world will not be able to guarantee everyone access to clean and safe drinking water and sanitation (United nations, 2015; WHO, 2019). Data from the World Health Organization (WHO, 2019) shows that 14 people die daily from stomach diseases caused by polluted water in the world. The Svete River is a direct provider of freshwater and sanitary water receivers. The objective falls into the category of environmental and support services.

SDG-7 The objective is Renewable energy, where sustainable water management provides sustainable energy. The goal falls into the category of supply and environment and support services.

The main objectives of the target are to extend renewable energy into energy consumption, ensure access to stable, affordable, sustainable and modern energy as well as to promote a sustainable and inclusive economy. Thus, the operation of hydropower plants makes a significant contribution to achieving this goal.

SDG-8 The objective can promote sustainable tourism and the sustainable use of recreational reservoir services. Tourism, hotel business, cultural monuments, manors, spas, guest houses, walking trails, restaurants, cafes, untouched wild landscapes provide an opportunity to develop tourism for anyone and anywhere. Creating opportunities for people's well-being and mental recovery provides decent jobs. The objective falls into environmental and support services and cultural services.

SDG-9 The Svete River forms a natural buffer zone against the growing number of natural disasters and reduces pollution. Reconstruction and renewal of environmentally friendly agricultural drainage systems are required, including ecologically friendly elements, such as installing two-stage drainage ditch systems and creating sedimentation ponds or pools in them. Cascade can also reduce nutrient accumulation. As a result, the run-off of nutrients (nitrogen and phosphorus) from the fields to the waters is diminished; the development of eutrophication in the water body decreases. The objective falls into the category of environmental and support services.

SDG-10 The aim is to reduce inequality. A healthy Svete River provides public recreation areas for all residents. The 48 km long Svete River flows through the Republic of Lithuania. Lithuania's impact on river waters accounts for 50% of its pollution. To improve water quality, transnational cooperation with Lithuanians is needed. There are relatively slow-flowing rivers in Zemgale. The groundwater level is relatively high, filtration in intensive agricultural conditions is fast enough; therefore, a relatively large amount of nutrients enters the water.

Lithuania is more involved in the meandering of straightened rivers – making them winding, reducing the release of nutrients into the sea – the longer the water path has to be measured, the better it is purified. As it is an expensive measure, the emphasis in Latvia is more on changing agricultural measures, such as installing two-stage drainage ditches, sedimentation ponds or pools in them. During the reconstruction, shallow ponds are installed in the ditches, where nutrients settle down, aquatic plants grow very actively, thus removing nutrients. Due to such a pond, the water is already cleaner. Cascade can also reduce nutrient accumulation. Ideally, a combination of all measures could be used. The objective falls into the category of environmental and support services and cultural services.

SDG-11 Goal - sustainable cities and communities. Part of the Svete River makes Jelgava safe, durable and sustainable. Disaster preparedness and resilience, resilience to future weather challenges, and importance to prevention and preparedness are vital. It is in the interest of every municipality to develop, be safe for the population, have a clean environment, good transport, housing, green areas, cultural heritage, it is friendly and convenient for both living and working. The Svete River ensures the ecology of the city and the adaptation of wildlife to the human environment. The city can also play its part by improving the water cycle and restoring groundwater through urban planning solutions ('green roofs', rainwater harvesting, cleaning and restoration of old riverbeds), all of which ensure a safe and sustainable city. The objective falls into the category of environmental and support services and cultural services.

SDG-12 Objective – Responsible consumption and production. Proper management of the Svete River can sustainably ensure high water requirements in all sectors. The purpose falls into the category of supply services.

In the face of global resource scarcity, the biggest challenge for producers and consumers is to take a 'do more with less effort'. The EU has implemented a wide range of policies and initiatives to achieve sustainable consumption and production. In the EU Green Course context, particularly the new Circular Economic Action Plan, a Sustainable Products Policy Legislative Initiative was announced to make products suitable for a climate-neutral and resource-efficient circular economy. By promoting healthy use and production in the 'circular economy', sustainable development aims to minimize the negative impact of mass production on the environment and human health (Griggs *et al*., 2017).

SDG-13 Purpose – Protection of the planet. The artificial water reservoirs created on the Svete River ensure carbon sequestration. Freshwater reservoirs

and climate change have a dual relationship (Berga, 2016). Hydropower reservoirs are a central renewable energy resource that helps mitigate climate change (Boehlert *et al*., 2007).

Rivers and water bodies are primary regulators of the carbon cycle and climate change (Tarnvik *et al*., 2009; Williamson *et al*., 2009). They play a crucial role in preventing extreme climatic events, such as floods or melting snow and glaciers (Schallenberg *et al*., 2013). The threats posed by climate change lead to natural disasters such as drought, extreme weather, etc. The objective falls into supply, environment, and support services.

SDG-14 Purpose – life underwater. Healthy Svete River ensures healthy Baltic Sea. Objective 14.1, which aims to protect marine ecosystems, is essential to prevent and reduce land-based activities. Each freshwater stream with a higher concentration of pollutants in the coastal area makes it challenging to reach 14.1. the objectives of "preventing and significantly reducing all forms of marine pollution, to achieve a healthy life under seawater, priority should be given to improving water quality from inland water systems. However, the possible trade-off between sea fishing and freshwater fishing should be considered. In addition, the objectives of Article 14.4 should be addressed as well as 14.6. to avoid overfishing and illegal fishing, which can lead to shortages of marine fish and put more pressure on freshwater fish in rivers and lakes. The objective falls into the category of environmental and support services and cultural services.

SDG-15 The Svete River provides biodiversity. The Svete River flows downstream through the Natura 2000 area. Svete floodplains are a significant European and Latvian territory for waterfowl during spring migration when more than 20,000 individuals gather in the floodplain territory simultaneously. There are corncrakes, long-necked eagles, the great eagle, little eagle, black stork, snake eagle, etc. 45 specially protected bird species have been discovered in the Svete floodplain. The high dams of the Svete polders are suitable for leisurely rest, nature and bird watching, from which the immediate and distant surroundings can be well seen.

Inland water bodies and terrestrial ecosystems play a critical role in many complex biogeochemical cycles, such as the carbon cycle, the water, the nitrogen and the nutrient cycle (Chapin *et al*., 1995; Schimel, 1995).

Goal 15.8 focuses on preventing and controlling invasive species to be implemented in both inland water and terrestrial ecosystems, as the life cycle of many species includes both ecosystems (Pejchar & Mooney, 2009).

The objective falls into the category of environmental and support services and cultural services.

SDG-16 Practical cross-border cooperation between neighbouring countries on river management contributes to safety and stability. The Svete River ensures people's inner and spiritual harmony. Peace in the world begins with peace in oneself and the family. Everyone can find countless examples of hatred person's nationality, gender, sexual orientation, religion or simply different views. Teaching and learning inner peace is an achievable goal in working with yourself and others. Being in nature and working with your shadow sides is a simple and effective way to develop inner peace. Strengthening internal peace should be the outcome of any education: to provide the market with the human resources and consumers it needs and build a better society and living environment. New threats to peace are also linked to global climate change and natural disasters, which may require the relocation of large numbers of people and lead to violent conflicts due to limited natural resources. In the frame of foreseeable unpredictability, more attention should be paid to the provision of peace education. And each of us can help learn peace and non-violence through our example and initiative.

The objective falls into the category of environmental and support services and cultural services.

SDG-17 Partnership to achieve goals. Recently, international conflicts over freshwater resources, especially regarding hydroelectric dams (Gleick & Heberger, 2014; Gleick, 2014) have occurred. The construction of new hydropower plants can lead to significant changes in the river's lower reaches, thus creating potential conflicts between different regions (Barnaby, 2009). Therefore, a good partnership between other countries is needed for these areas to be comprehensively managed. The objective falls into the category of environmental and support services and cultural services.

Conclusions

Water quality, a healthy ecosystem, and the restoration of biodiversity will benefit freshwater ecosystems and downstream users, including fast-growing cities and marine life in coastal areas and oceans.

The world is still experiencing a deterioration in water quality, especially from nutrients such as phosphorus and nitrogen. The main requirement is to eliminate three primary sources of pollution: the discharge of untreated wastewater from industrial and urban sources; reduction of agricultural fertilizers entering rivers, lakes and groundwater; and the deposition of nitrogen-containing compounds in the atmosphere by burning fossil fuels.

Progress is happening. However, to achieve our goals, we need to accelerate, increase and see improvement in other countries and regions. Our

efforts could be particularly successful if we turn wastewater into a source of reused water, energy, fertilizer and other valuable materials.

In addition to wastewater, one of the biggest challenges is pollution from agriculture. Precision agriculture will help, where the right amount of fertilizer is applied precisely where needed. More innovative and more environmentally friendly ways of water treatment will help. With the 2030 Agenda for Sustainable Development, the international community is convinced to solve global problems together.

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