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University's multi-scale initiatives for redefining city development

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Abstract

Purpose – The purpose of this paper is to present the varied roles played by the University of Łódź (UL) in maintaining and restoring the natural capital of a city as a driver for sustainable city development. The higher education institution can be perceived as visionary, originator and executor of natural capital projects.

Design/methodology/approach – The paper analyses three cases performed by the Faculty of Biology and Environmental Protection, UL, in the city of Łódź. The activities are based on different scales ranging from city-wide to local, e.g. river and green infrastructure, and which vary in character from policy planning to implementation.

Findings – Natural capital projects influence city development on different levels: by the initiation of legal protection, by the implementation of rehabilitation concepts for rivers and by influencing the strategic documents for mid-term and long-term urban development.

Originality/value – The university has the potential for multidisciplinary engagement in the development of urban sustainability. In large-scale projects, academics play a more conceptual role, in capacity building and knowledge transfer, while in local-scale implementations, their role includes innovation, know-how and technology transfer. Moreover, it may act as a reinforcement hub, by safeguarding and strengthening the natural capital of the city.

Keywords Sustainable development, Natural capital, City, Ecohydrology, Ecological networks, University of Łódź

Paper type Case study



Introduction

The role played by traditional forms of research and training in the dissemination of knowledge and skills at universities is changing, insofar that academic institutions are broadening their response to the problems faced by local communities (Bodorkos and Pataki, 2009), through collaboration with external entities (Stefanovic, 2008). One particular challenge addressed by higher education institutions over the past decade has been that of building capacity for sustainable development (Hansen and Lehmann, 2006). However, cities and regions in Poland have arguably yet to take full advantage of the potential of the universities located in their areas (Kwiek, 2012). Mutual benefits can be garnered by universities acting in partnership with the city and the region, by serving as sources of professional, well-educated staff capable of contributing innovative solutions (Lehmann *et al.*, 2009; Benneworth *et al.*, 2010; Doman'ski, 2011). In this regard, universities should, and can, significantly contribute to the implementation of sustainable development in cities and societies.

The University of Łódź (UL) is one of the largest universities in Poland, one of whose mission aims is to be actively involved in the innovative development of the City of Łódź and its region within central Poland. Hence, UL is continually seeking initiatives which address the economic and social challenges faced by the inhabitants of Łódź and the surrounding region. As one such initiative is the sustainable development of the city (Misja i Strategia UŁ, 2009), it is equally important to strengthen the third pillar of sustainable development, the natural capital of the city.

Another important element of the UL's strategy is to join forces with the market environment, i.e. business, central and local government institutions and non-governmental organisations (NGOs), to initiate joint projects to develop and promote both the City of Łódź and its region (Misja i Strategia UŁ, 2009). These activities demand cooperation for the sustainable development of the city, including the preservation of natural capital.

The UL plays a significant role in these initiatives, supporting the city authorities in making the best use of the natural capital of the city as a driver for its sustainable development. The activities are undertaken at different scales from city-wide to local, e.g. river and green infrastructure, with the UL playing various roles, depending on which it can be perceived as visionary, originator or executor of natural capital projects. The aim of the paper is to analyse the role of higher education in maintaining and restoring the natural capital of the City of Łódź, to improve its development. The analysis will include three examples of cases carried out by the Faculty of Biology and Environmental Protection, UL.

The history of natural capital in Łódź

Łódź is a relatively young city located in central Poland. At the beginning of the nineteenth century, the city grew through the intensive expansion of the textile industry, which was facilitated by the exploitation of local natural resources, especially the abundant water in the area and the extensive forests of Łódź (Trzcinka and Drzazga, 2003). This expansion resulted in considerable human impact, changing the natural capital: river valleys were developed, wetlands were dried, pools and ponds levelled and natural watercourses canalised. Eighteen rivers flow through the city today, mostly regulated in open- or closed-system channels (Ratajczyk and Wolan'ska-Kamin'ska, 2012). As Łódź is located on the watershed divide between the Vistula and Oder rivers, a number of small rivers begin within the city or flow through it. Due to its significant slopes, for a city situated in the lowland area of central Poland, and the low permeability of its sealed surfaces, stormwater retention in the landscape is extremely low, resulting in periodical flooding and urban drought (Wagner and Breil, 2013). Together with the urbanisation process, the original forest ecosystems have

undergone substantial change. Large areas have been deforested, with forest cover declining from 76 per cent at the end of the nineteenth century to 30 per cent in the second decade of the twentieth century (Diehl, 1997). During this period, the north-eastern administrative city limits were extended to enclose 1,200 hectares of forest (Trzcinka and Drzazga, 2003). It took only a century or so for the city to expand more than tenfold. Currently, the city covers nearly 293 km² (Statistical Office in Łódź, 2014): built-up and urban areas cover 47 per cent of the city, forests and wooded areas 10 per cent and water only covers 0.5 per cent. Nevertheless, despite these significant anthropogenic transformations, enclaves of biodiversity associated with the river valleys have survived within the city limits. These are composed of communities important across Europe: riparian and hornbeam forests, fresh grasslands and riverside communities (Ratajczyk and Wolan'ska-Kamin'ska, 2012).

The role of the natural capital in the development of the city has also changed over time. In the nineteenth century, its natural resources, the waterways and forests, allowed the small town to become a major manufacturing and textile centre in Central and Eastern Europe (Trzcinka and Drzazga, 2003). The depression of the 1930s and the economic transformations in Eastern and Central Europe in the 1980s destroyed the city's textile industry. Since then, Łódź has faced several social challenges, with unemployment being a major factor. The population of the city is steadily falling, as inhabitants look for better job opportunities and higher quality of life elsewhere. The quality of life is also falling due to low natural capital and the unsustainable infrastructure of an emptying city. Therefore, Łódź is once again looking to its natural resources, its rivers and green spaces, to act as drivers of the sustainable economic development of the city and to revitalise its past heritage (Wagner *et al.*, 2011). In this regard, the natural capital of the city must constitute a multifunctional space combining water retention and landscaping functions with the protection of biodiversity, as well as providing a healthy living environment.

The role of the University of Łódź in integrating natural capital within city development

Within the past two decades, the UL has instigated several successful initiatives to redefine development of the city by strengthening the role of natural capital. This paper presents the three most substantial initiatives which have reached the level of implementation or have been awarded formal status in the strategic documentation of the city.

The Blue-Green Network – a city-wide initiative

Sustainability planning on the city-wide scale was addressed by the Blue-Green Network (BGN) concept (Figure 1; Zalewski *et al.*, 2012, Zalewski, 2015).

Vision. The BGN concept extends the idea of a green belt around the city by connecting existing city river systems into one functional network, together with systems that have been rehabilitated. BGN-based planning uses the Ecohydrology approach (Zalewski, 2015), which considers on the one hand, the interrelations within the catchment as a template for water and nutrient dynamics, and on the other hand, biological processes ranging from ecological succession and biological productivity to nutrient circulation by the microbial loop. These interrelationships are all incorporated in BGN planning to enable natural system management (Zalewski and Wagner, 2005; Wagner and Breil, 2013).

The BGN approach organises the Łódź area to make use of its natural capital and serve as a basis for several ecosystem services: stormwater retention and purification, improvement of the urban microclimate and its flexible adaptation to global climate change (Zalewski *et al.*, 2012), improvement in the health of the inhabitants (Kupryœ-Lipin'ska *et al.*, 2014), improvement of environmental quality in the urban space and the reduction of its management costs, providing conditions for sustainable public transport as well as supporting the revitalisation of historical and cultural heritage. Finally, they improve the

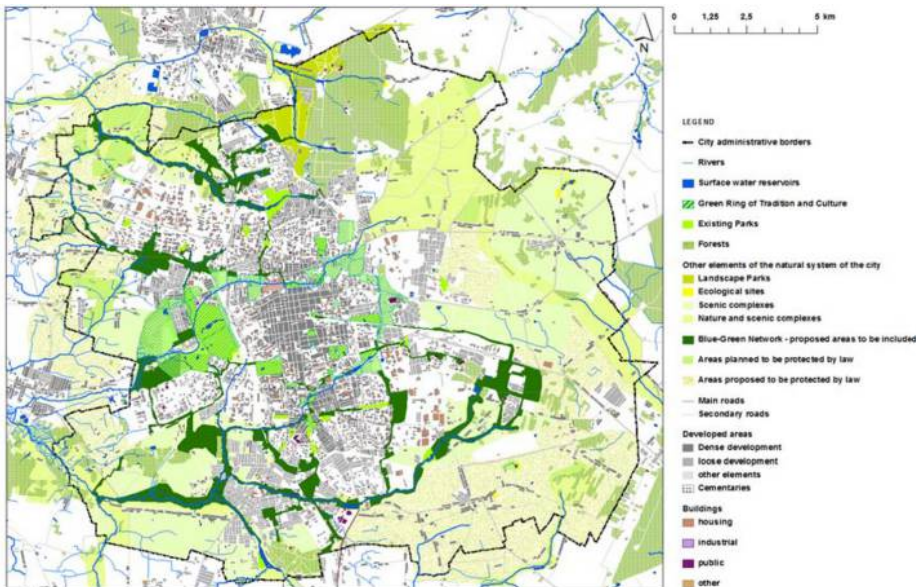


Figure 1.
BGN concept
(Zalewski *et al.*, 2012)
adapted to a Study of
Determinants and
Directions for Spatial
Development for the
City of Łódź in 2010

aesthetics and the quality of life within the city to attract business, thus stimulating economic development.

Initiation. The vision of the BGN was developed within an EU FP6 funded project named SWITCH (Sustainable Water management Improves Tomorrow's Cities' Health; Integrated Project, GOCE018530: 2006-2011). The project was initiated by UL researchers and was implemented jointly with the City of Łódź Office. The goal of the project was to construct more sustainable water resources in the cities of the future and demonstrate new approaches in 12 demonstration cities around the world, Łódź being one of them. The Łódź approach incorporates a more sustainable form of city development based on the use of water as the key factor for sustainability. A complex small urban river rehabilitation activity was used as the basis of a demonstration project (Wagner and Zalewski, 2009) which represented the starting point for the development of rehabilitation strategies for all 18 of the small urban rivers of Łódź (Zalewski *et al.*, 2007). The connection of the river valleys with the green areas of Łódź and the green belt around the city led directly to the formulation of the BGN concept (Zalewski *et al.*, 2012, Zalewski, 2015).

Implementation. One of the activities within the SWITCH project was the establishment of a Learning Alliance (LA) multi-stakeholder platform launched with the twin purposes of exchanging knowledge and experience, and defining common goals for water management in the city (Wagner *et al.*, 2011). It is also a platform to discuss the often-contradictory aims, aspirations and expectations of particular institutions, as well as the barriers that hamper their achievement. The initial core group of six stakeholders, representing the city water and environment and strategic planning sectors, soon expanded to more than 60, representing over 25 areas in science, public administration, NGOs and practitioners in various sectors related to water.

In 2008, regular meetings and communication among the LA participants resulted in a vision for the water resources of the city but also underlined the importance of integrated spatial planning in their sustainability. While the development of a Study of Determinants

Table I.
“The Green Jewels of
Łódź”: phases of
implementation

Name of the area	Form of protection	Year of assignment
Łąki na Modrzewiu (1)	Ecological site	2008
Międzyrzecze Bzury i Łagiewniczanki (2), Stawy w Nowosolnej (3), Łąka w Wiączyniu (4), Stawy w Mileszkach (5), MokradŁa przy Pomorskiej (6), Jezioro Wiskitno (7), MokradŁa Brzozy (9), Międzyrzecze SokoŁówki i Brzozy (10)	Ecological site	2009
Ruda Willowa (8)	Nature and scenic complex	
Dolina dolnej Wrzącej (11), Olsy na Żabien´cu (12), Majerowskie Pole (13), Olsy nad Nerem (14), Majerowskie BŁota (17)	Ecological site	2010
Sucha dolina w Moskulach (15), Dolina SokoŁówki (16), Międzyrzecze Neru i Dobrzyńki (18), z´ródŁa Neru (19), Dolina Górnego Neru (20), Dolina Miazgi (23), Stoki Dąbrowy (24), Dolina górnej Augustówki i Olechówki (25), Pradolina Łódki (26), Korytarz CheŁmy-Łagiewniki (27), Dorzecze SokoŁówki (28), Dolina Jasien´ca (30)	Nature and scenic complex	
Feliksins´ski Ols (21), Bagno Popielarnia (22), Olsy nad AnioŁówką (29), Chocianowickie MokradŁa (31)	Protected landscape area	Not approved
	Ecological site	Not approved

Note: The numbers correspond to [Figure 2](#)

and Directions for Spatial Development for the City of Łódź ([City of Łódź Office, 2010](#)) was progressing, two additions jointly formulated by the LA were accepted and included into the document in 2009, these proposing, among other things, inclusion of the BGN Concept as an integral part of the development project. Currently, a new Study of Determinants and Directions for Spatial Development for the City of Łódź is being developed. Interest in the BGN concept has been growing steadily during the production of the document, as demonstrated by intensive public and expert consultations, with the participation of UL staff.

Two years later, the BGN Concept become a part of the Integrated Development Strategy for Łódź 2020+ established by the [City of Łódź Office \(2012\)](#). Since 2013, the city office has implemented a comprehensive strategic management system, comprising separate sectoral policies which contribute to the overarching realisation of the strategy. The policies set development guidelines for particular areas of urban activity and translate the main strategy into specific activities. The sectoral policies are time-correlated with the strategy, allowing the costs of executing specific goals to be estimated, and the results to be identified, monitored and evaluated. The management of water and the natural environment has been included in the Municipal Management and Environmental Protection Policy adopted in 2013 ([Wagner et al., 2014](#)).

Green Jewels of Łódź – a “stepping stones” initiative

Vision. UL botanists proposed a collaborative project with the city administration to preserve the most valuable natural areas within the Łódź administrative area. The initial concept was developed in 2007, based on previous research conducted in 1997-1999 ([Kurowski and Andrzejewski, 2003](#)).

Initiation. In December 2008, a group consisting of UL staff, the Urban Green Council, members of the Polish Town Planner Society and Wzniesienia Łódzkie Landscape Park

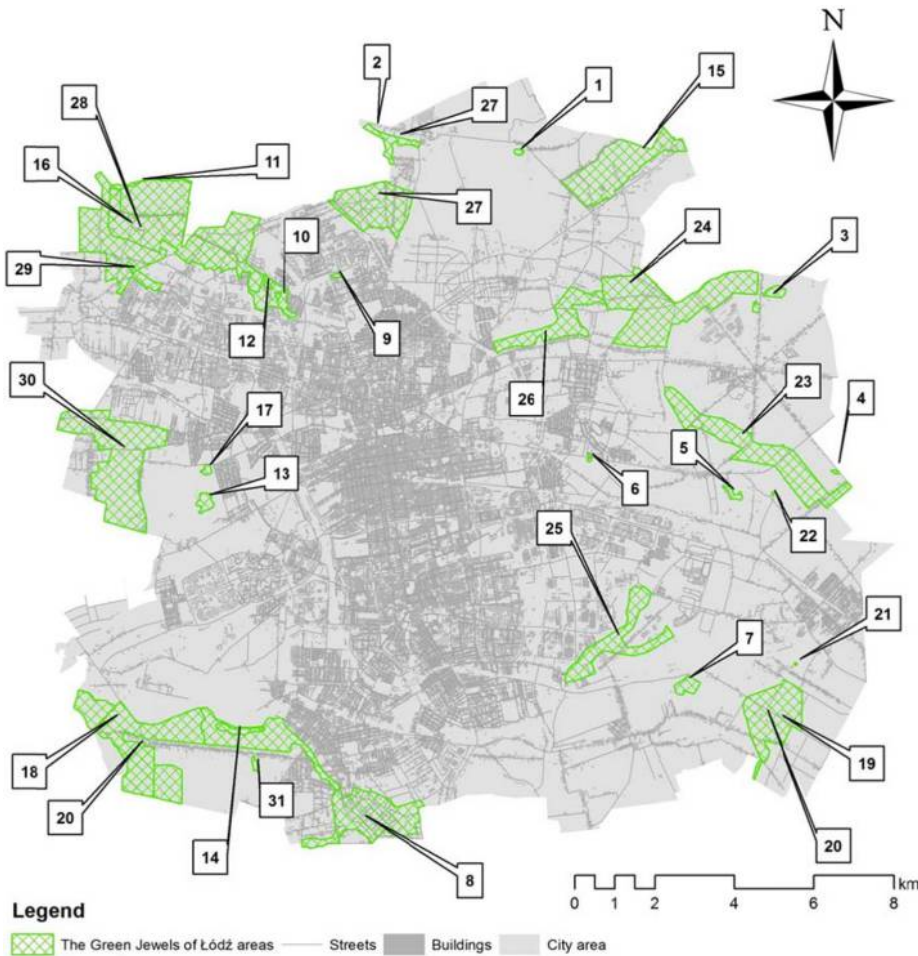


Figure 2.
The status of
implementation of
“The Green Jewels of
Łódź” concept

workers was established for the improvement of the natural capital of Łódź. Thirty-one areas were earmarked for protection as Protected Landscape Areas (PLAs) (8), Natural and Scenic Complexes (NSCs) (5) or Ecological Sites (ESTs) (18). The results were submitted to the Urban Planning Centre in an elaborated form, “Geobotanical inventory and improvement of not yet protected, valuable natural areas within the administrative boundaries of Łódź”, which laid the foundations for adopting a natural basis for the further study of conditions and directions for the spatial development of Łódź (Kurowski *et al.*, 2009).

Implementation. The project was implemented in three steps (Table I). One ecological area was designated in 2008, nine protected areas were added in 2009 and another nine in 2010 (Ratajczyk *et al.*, 2010). Four ESTs and all proposed PLAs have yet to be approved (numbers 20 to 31 on Figure 2). In certain cases, the same area is covered by different forms of legal protection.

The UL initiative has led to the designation of 14 ESTs, with a total area of 113.84 ha, and five NSCs, of 957.99 hectares, within the city limits. This represents a significant step in the

protection of the natural capital of Łódź, as until this time, only two nature reserves and a fragment of a landscape park existed.

River-scale action – stormwater retention, river restoration, recreation

Vision. Rivers are important elements of the Łódź landscape. They were not only one of the reasons for the development of the city, but now may also be key to the revitalisation of the city and the improvement of its sustainability based on blue and green infrastructure (Wagner and Zalewski, 2009; Krauze and Wagner, 2014). The rehabilitation of a river provides a multifunctional space for stormwater retention, air and water purification, biodiversity conservation, climate change adaptation and reconnection of the urban natural system, as well as the provision of facilities such as recreational and sport areas and alternative transport corridors. Rehabilitation provides space for research and innovation, expertise and educational space for higher and post-doc education, awareness raising and training, all of which contribute to empowered decision-making and foster inter-institutional cooperation for better water management. The process also triggers several bottom-up initiatives, including the implementation of best management practices in new investments, linking and focusing NGOs and the actions of individual city inhabitants.

Initiation. The activities developed by the Department of Applied Ecology, UL, focused first on one of the city's 18 rivers, the Sokołówka, which served as a demonstration site for the Ecohydrology approach as part of the SWITCH project (Wagner and Zalewski, 2009; Wagner and Breil, 2013). SWITCH has received strong support from both the city authorities and its inhabitants. The project was made possible by joint application for LIFE+ EU funding by the University and the Łódź city administration. The intended destination of the funding was the rehabilitation of the cascade of recreational reservoirs on the Bzura river as part of the "Ecohydrologic rehabilitation of recreational reservoirs 'Arturówek' (Łódź) as a model approach to rehabilitation of urban reservoirs" project (EH-REK) LIFE08 ENV/PL/000517, which took place from 2010 to 2015 (Jurczak *et al.*, 2012, 2015; www.arturowek.pl).

Implementation. In both projects, attempts were made to harmonise the existing hydrotechnical infrastructure of the river and the cascades of the reservoirs located along their runs with the natural capital and functionality of their ecosystems. The main goal was to increase the potential of the rivers to absorb increased water and pollutant fluxes from the urban catchments, without compromising their quality, appearance and recreational potential.

On the Sokołówka river, the activities were mainly related to the design and construction of several small reservoirs providing different and multiple ecohydrological functions (Figure 3). The two upper reservoirs act as detention ponds, mitigating high flows from the upper, developed river catchment, and increasing the sedimentation of transported solids. The Sequential Sedimentation Biofiltration System located below them protects the downstream recreational reservoirs from remaining stormwater pollution with a sequence of physical, biogeochemical and biological processes (Zalewski *et al.*, 2012). The two reservoirs located the furthest downstream were constructed mainly for recreation purposes; however, their construction also allows for the enhanced absorption of the dissolved pollution by phytoremediation, supports biodiversity and increases water retention in the landscape. The final part of the project was the elaboration of conceptual plans for the rehabilitation of part a river bed and river valley to create Sokołówka Park, whose full implementation is anticipated within the next two years.

Most of the activities on the Sokołówka river were integrated with earlier activities undertaken by the City of Łódź office. The "Annex to the assumptions of the general river project: reservoirs", prepared in 1999, was used by the City of Łódź Department of Municipal

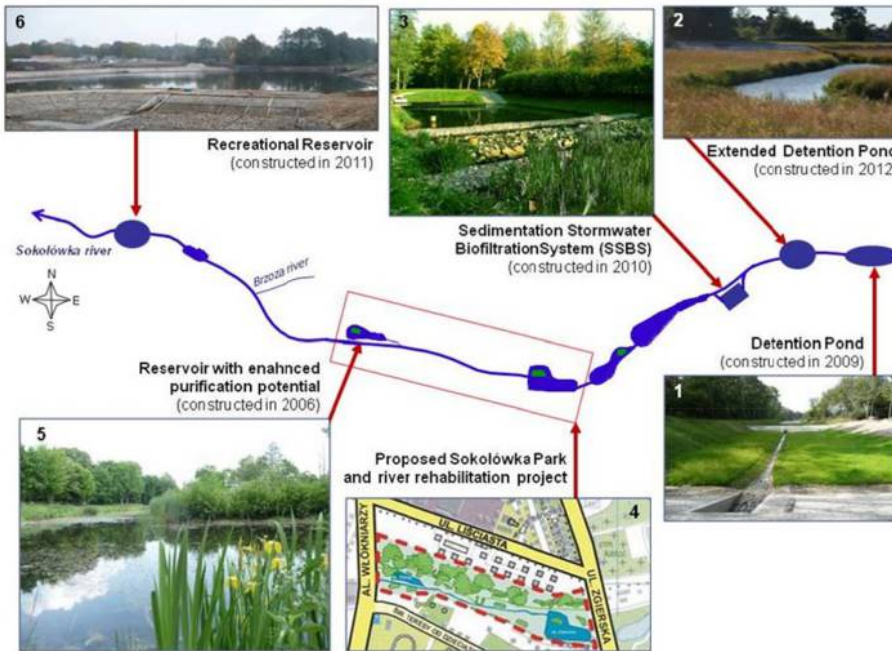


Figure 3. Demonstration project on the Sokolówka River developed within the EU SWITCH project

Services to establish a small retention programme for Łódź in 2001. This programme is being implemented via projects that include not only rivers but also their valleys, drainage basins and local communities. The “Small retention” project generated a need for research and scientific expertise to support the development of innovative concepts and solutions, thus allowing joint application for EU projects between the city authorities and researchers. Successful implementations, as well as the establishment of the LA multi-stakeholder platform within SWITCH, strengthened the relationships and trust between researchers and authorities, as well as within the water sector in Łódź, and provided solid ground for further cooperation. The LIFE+ Bzura River rehabilitation project on the Arturówek reservoirs mentioned earlier is one such example. Several successful implementations based on the upscaling of the SWITCH experiences in urban Ecohydrology were applied, leading to substantial improvement of the water quality in the river and the cascade of its recreational reservoirs (Figure 4). It resulted in the elimination of toxic cyanobacterial blooms and improvements in the ecological quality of the system, as well as the ecological safety and value of the area for its inhabitants (Jurczak *et al.*, 2015).

Discussion

Academic centres play highly diversified roles in the sustainable development of cities, acting not only as initiators of projects but also their executors. At the implementation stage, universities act as partners, working with other entities.

Cooperation between city authorities and universities focuses mainly on economic development and the construction of a knowledge-based society (Benneworth *et al.*, 2010; Penco, 2015). Recently, these initiatives have reoriented more towards the engagement of employers in the development of higher education programmes responding to the needs of

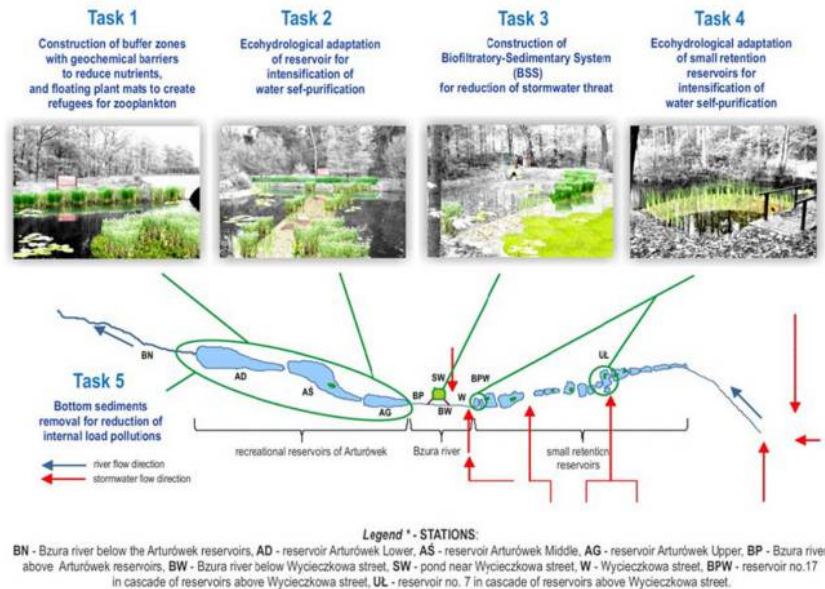


Figure 4.
Ecohydrological solutions applied for the rehabilitation of the recreational reservoirs on the Bzura River

the labour market. They also serve as a response to the objectives of such EU programmes as POWER (Operational Program: Knowledge, Education, Development – www.power.gov.pl). In the literature, however, little is written about the cooperation between higher education institutions and cities in promoting sustainable development by nature conservation and the shaping of urban space based on natural capital.

The UL has been actively involved in such activities for many years. Since the middle of the twentieth century, UL researchers have been committed to such nature conservation activities as the establishment of legal protection of well-preserved natural areas of Łódź (Kurowski *et al.*, 2009). Recently, the range of these activities has been extended and linked to the international agenda of the UN via participation in the UNESCO International Hydrological Programme, particularly its research and application dimensions (Zalewski, 2015). Although the outcomes of the case studies analysed herein serve natural capital, they primarily benefit society by providing better living conditions and safeguarding ecosystem services, such as regulating, supporting and cultural functions (Gómez-Baggethun *et al.*, 2013). They successfully support and stimulate other research topics, such as those focused on the economic value of natural capital (ecosystem services), which has been successfully developed by the Faculty of Economics and Sociology, UL, and implemented by the Sendzimir Foundation (Giergiczny and Kronenberg, 2014; Kronenberg, 2015).

By providing knowledge, research and experience, the UL may be seen as a local innovation and development hub (Hansen and Lehmann, 2006) that significantly contributes to intelligent use of the city's capital. Moreover, as the presented initiatives enhance natural capital, higher education institutions may act not only as development centres but also as reinforcement hubs, strengthening already existing assets.

According to Kwiek (2012), Polish universities should be more involved in local politics and development, although some changes can be observed, as demonstrated by initiatives undertaken by the UL. These projects confirm the growing involvement of universities in urban spatial development (D'Auria, 2001). However, these initiatives cannot be

implemented unilaterally. Effective cooperation between higher education institutions and the city is only possible with the accessible approach of local authorities who are willing to exploit the potential of the university. Fortunately, this cooperation is taking place (Benneworth and Hospers, 2007).

Cooperation between the university and the city brings mutual profit (Hansen and Lehmann, 2006). The universities gain a local training ground for the research and implementation of their ideas, while the city itself and society benefit through innovations and knowledge-based problem solving. These benefits extend into the areas of spatial development and the implementation of natural capital-based sustainable development within spatial planning. These initiatives are reinforced by the effective involvement of higher education institutions operating in large urban centres, and also allowing the preservation of their natural capital (Kistowski, 2013).

Conclusions

Academic centres may play highly diversified roles in the sustainable development of the city, acting not only as initiators of projects but also as their advisors and executors. At the implementation stage, universities may act as an active partner, working with other entities and linking the everyday practice of the local administration to the wider context of international sustainability trends and goals, as well as to up-to-date research.

The precise nature of university engagement in building sustainability depends, to a large extent, on the character of the project and its scale. In large-scale projects, university workers play a more conceptual role associated with capacity building and knowledge transfer, whilst at the local-scale implementations, the role includes innovation, know-how and technology transfer, and they make a significant contribution to implementation.

The presented sustainability projects developed by the Faculty of Biology and Environmental Protection, UL, have influenced the development of Łódź on different levels:

- by the legal protection of the most valuable natural remnants within the area of the city;
- by the implementation of two river rehabilitation concepts together with the city authorities; and
- by influencing the design of strategic documents for city development in the mid-term (2020+) and long-term (Study of Determinants and Directions for Spatial Development for the City of Łódź).

Higher education institutions can be perceived not only as development and innovation hubs but may act as reinforcement centres by safeguarding and strengthening the natural capital of the city.

The concept of “The Green Jewels of Łódź” was developed by the Department of Geobotany and Plant Ecology, Faculty of Environmental Protection of the UL, with cooperation with the Botanical Garden, the City Forest Office, the Polish Town Planners Society, the Wzniesienia Łódzkie Landscape Park, and was financed by the City of Łódź Office.

The Sokołówka River Restoration Project was developed and implemented within the EU Project SWITCH (6 FP, 018530), POIG.01.01.02-10-106/09-04 “Innovative resources and effective methods of safety improvement and durability of buildings and transport infrastructure in the sustainable development” (financed from the European Regional Development Fund as part of the Innovative Economy Operational Programme), and in cooperation with the City of Łódź Office represented by the Department of Municipal Services, within a “Small retention programme for Lodz”, established in 2001.

The project "Ecohydrological rehabilitation of Arturowek recreational reservoirs (Łódź) as a model approach to the rehabilitation of urban reservoirs" (EH-REK; LIFE08 ENV/PL/000517) was carried out by the Department of Applied Ecology of the UL in cooperation with Łódzka Spółka Infrastrukturalna and the City of Łódź Office represented by the Municipal Sports and Recreation Center. The project is financed from the European Commission, the National Fund for Environmental Protection and Water Management, co-financed from the Regional Fund for Environmental Protection and Water Management in Łódź and project beneficiaries' own contribution.

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