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Closer to Nature – Closer to Mankind

On Poland's surface waters restoration program.

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One of the tasks commissioned by the "Wody Polskie" National Water Holding as part of the ongoing second update of Poland's river basin management plans involves developing a National Surface Waters Restoration Program. The program has been drafted by the firm Multiconsult Polska, with a team of experts led by Ilona Biedroń. The preparatory work on the project lasted from September 2019 until February 2020.

Program objectives

The need for surface waters restoration is directly enshrined in the EU's Framework Water Directive (FWD) and the Marine Strategy Framework Directive. These documents require EU Member States to take measures for the protection of inland surface waters (rivers and lakes), transitional waters (coastal lakes), coastal waters and groundwater. The directives oblige the Member States to either achieve or maintain at least "good" environmental status of their rivers, lakes, transitional and coastal waters by 2015, and of their marine waters by 2020 at the latest (allowing for these two deadlines to be maximally extended to 2027).

Good environmental status not only denotes good quality of sea, river and lake waters but above all signifies their rich biological diversity and desirable morphology that allows for these waters to perform natural environmental functions such as those needed for river self-purification. Environmental monitoring data indicate, however, that the environmental status of some 90% of the so-called updated Surface Water Bodies (SWB) in Poland is less than "good." Restoration measures aim to help achieve the environmental objectives for surface waters and water-dependent natural areas by the prescribed deadlines. The program's overriding objective is to identify priority areas and the accompanying measures that should be first put in place, due to environmental and economic considerations and in accordance with the package of surface water body restoration measures proposed for the country at large.

Poland's National Surface Waters Restoration Program, which intends to achieve at least "good" status of waters using its developed planning tools and outlined river restoration measures, contributes to the attainment of goals associated with the protection of water resources – the goals identified in the updated river basin management plans and in the national marine waters protection program. An improved physiochemical status of waters may produce significant benefits such as reduced scale of maintenance works (associated with ongoing river upkeep, involving for example mowing of plants or removal of bottom deposits) and water treatment for the needs of the population and the economy. Restoration is expected to enhance a river basin's retention capacity, i.e. its ability to retain precipitation and thaw water, and to restore the natural water circulation patterns in the basin. This will help both mitigate the risk of flooding and reduce the consequences of drought, which may prove useful in adaptation to climate change. The resulting enhanced natural assets and increased attractiveness of water bodies for the development of tourism and recreation represent a certain added value of water restoration and improved environmental status.

Good status of water bodies

Restoration of rivers, lakes, coastal and transitional waters aims to protect water ecosystems, whose natural richness allows them to perform natural functions that are essential for the environment, for building its resilience to various pressures such as pollution or climate change, and for satisfying human needs. A river with "good" environmental status is characterized by rich biodiversity due to such factors as significant flow variability and morphological variations of the river bottom caused by natural erosion, sediment transport and deposition (in the form of sandbars, islets, etc.) A lake with "good" status, in turn, may see its coastline evolve as a result of wave action and growth of coastline vegetation. In the case of marine waters, a coastal zone with "good" status is one where the continuity of sediment transport along the shore is guaranteed, as is the possibility for the natural development of beaches and the shoreline. All these features of natural waters do allow for their economic use, despite certain limitations involved. According to Poland's National Surface Waters restoration Program, the environmental functions of surface waters are on par with the economic functions, while restoration is a modern tool for water management that helps optimize the benefits for nature, society and the economy.

Main program assumptions

Restoration of surface waters involves a set of complementary measures aimed to restore or strengthen

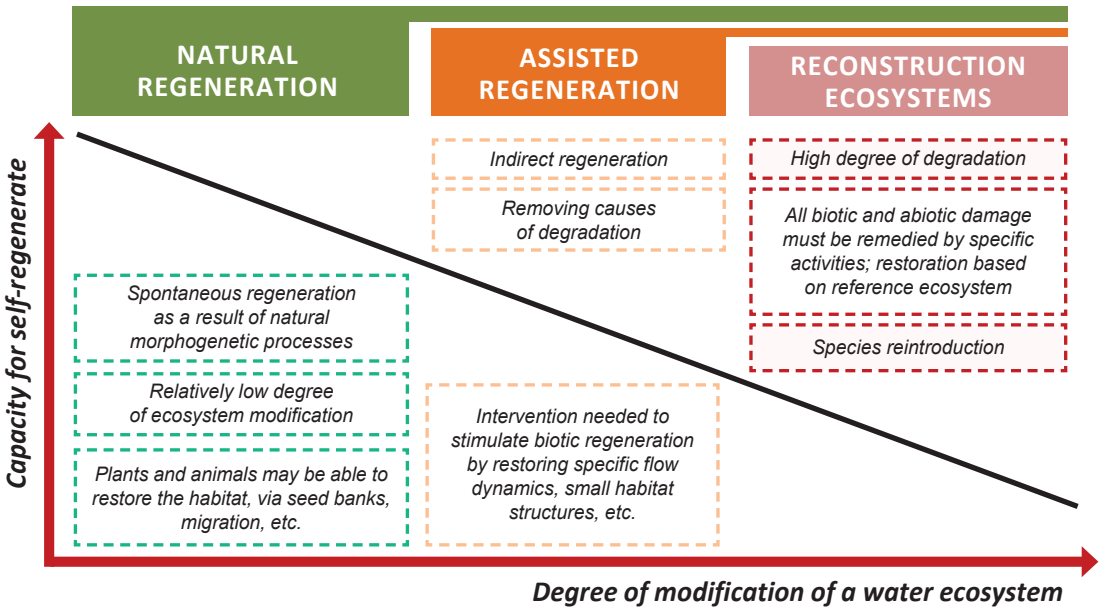

Fig. 1
Regeneration ability of a water ecosystem depending on the degree of its modification

SOURCE: NATIONAL SURFACE WATERS RESTORATION PROGRAM

the natural features of water ecosystems. It encompasses recreating hydromorphological diversity, restoring continuity of waterways (needed by aquatic organisms, and for a free flow of water and sediment transport) by making such barriers as dams, barrages and weirs navigable, and restoring other natural environmental processes in water and water-dependent ecosystems. Restoration of individual water bodies also forms part of river basin restoration, which plays an important role in increasing the resilience of ecosystems to droughts and floods and involves recreating wetlands, reducing surface imperviousness and restoring natural water circulation patterns in the river basin. As a rule, such measures foster natural water retention and help improve water quality, increase ecosystem resilience through more effective adaptation to environmental (and climate) changes, and ensure the provision of ecosystem services.

Surface water restoration efforts should be understood as encompassing:

- restoration proper, which involves restoring an ecosystem that has been transformed by mankind to a state that is close to natural by reinstituting original processes and structures;
- so-called revitalization, which means either recreating (in natural ecosystems) or creating (in artificial water sections) relevant ecological functions in a given ecosystem that will not necessarily bring the ecosystem back to its original state from before the anthropogenic changes, but which will nevertheless boost its biodiversity and resilience.

These goals may be attained by undertaking specific actions in order to foster natural processes, by refraining from taking any action (in which case restoration occurs as a result of spontaneous natural processes), or by modifying the ways in which specific activities, e.g. those associated with day-to-day water maintenance, are performed.

Based on the degree of transformation of a water ecosystem and its capacity for self-regeneration, restoration measures may include three main types of efforts (Fig. 1):

- natural regeneration – in slightly transformed water ecosystems, the condition of habitats will improve as a result of self-regeneration of their hydromorphological and biotic elements;
- assisted regeneration – which comprises natural regeneration augmented by carefully planned measures undertaken as part of day-to-day water maintenance, including good water maintenance practices that support natural hydromorphological and environmental processes;
- system reconstruction – which refers to assisted regeneration together with additional technological measures that alter the existing hydromorphological or ecological conditions which may lead to ecosystem degradation, and foster biodiversity.

The conceptual work concluded that the National Surface Waters Restoration Program needs to fulfill certain conditions, namely it should be:

- effective, i.e. it should lead to the attainment of the environmental objectives set for waters and protected areas; not cause damage to the existing valuable environmental assets; help restore system functionality, i.e. processes and structures, and their mutual connectivity and continuity; make the ecosystems more resilient to extreme phenomena and disturbances, and reduce the vulnerability of ecosystems to other types of pressure;

- rational, i.e. it should first and foremost employ cost-effective methods that are rooted in natural processes;
- sustainable, i.e. to the greatest possible extent it should ensure self-regeneration in the future;
- adaptative, i.e. it should allow for modifications and improvements in response to actual monitoring results;
- prosocial, i.e. as much as possible it should engage local communities and individuals in the planning and implementation of restoration measures, taking into account their expertise as well as the needs and challenges arising from the use of the environment.

Methodology overview

The project used multi-criteria analysis to prioritize restoration needs, thereby identifying Areas Requiring Restoration (ARRs). Given the specific characteristics of various types of surface water bodies (i.e. river, lake, coastal and transitional waters), multi-criteria analyses were performed separately for each type. For instance, in the case of rivers, all of Poland's 3116 surface water bodies were analyzed based on the following parallel criteria:

> Restoration of surface waters involves a set of complementary measures aimed to restore or strengthen the natural features of water ecosystems.

- migratory navigability for diadromous fish (living both in saline and fresh water) and protected anadromous fish;
- the potential to achieve "good" ecological status or "good" ecological potential;
- environmental objectives for water-dependent protected areas;
- biological navigability of river bodies linked to lake bodies requiring restoration;
- other needs associated with water management or societal needs.

As a result, an index value was ascribed to individual water bodies to indicate how much, and how urgently, they are in need of restoration. Ultimately, 91% of Poland's river water bodies were categorized as requiring remedial measures.

Furthermore, the potential success and the benefits of restoration were analyzed. To this end, a forecast was made of the potential improvement in the index reflecting the river's hydromorphological status (HIR – Hydromorphological River Index). This method facilitates an objective assessment of the river's natural state and the degree of its anthropogenic transformation. By comparing the index's actual value (before river restoration) with the value attained post-restoration (determined on the basis of simulations factoring in the scope of specific restoration measures), we obtained a measure reflecting the need for restoration and the anticipated gains.

In a similar procedure, lake, transitional and coastal water bodies were identified as ARRs – areas requiring urgent implementation of restoration measures. The process was based on an analysis of information on the pressure and changes within the surface water body and their catchment areas which have a significant bearing on the deterioration of the water condition. These analyses applied indicators relevant for a given type of water body in order to assess their hydromorphological and biological elements.

Topical scope

Importantly, in addition to the list of Areas Requiring Restoration (ARRs) and their prioritization, the National Surface Waters Restoration Program posits a list of necessary measures allowing each of the water bodies analyzed to achieve at least good ecological status (for those bodies designated as "natural") or good ecological potential (for those designated as "artificial or heavily modified"). To this end, a separate list of restoration measures was developed for each water body type, which comprised the following sets of activities:

U – modified works performed as part of water maintenance needed to achieve the restoration effect,
D – additional measures performed as part of regular water management,
T – technical measures,
Z – measures in the river basin,
P – supplementary measures, including legislative arrangements and prohibitions.

Whether individual sets of activities will be performed depends on the degree of modification of a given water ecosystem as well as on the spatial and economic constraints arising from the characteristics of a given water body (Fig. 2).

The National Surface Waters Restoration Program also comprises:

- an analysis of legal and administrative arrangements regarding implementation options for the listed restoration measures;
- pilot study reports, comprising 17 river bodies, five lake bodies, one transitional and one coastal water body, and one dammed reservoir;
- an analysis of unit costs of individual restoration measures, and of aggregate costs of all measures in the given surface water bodies.

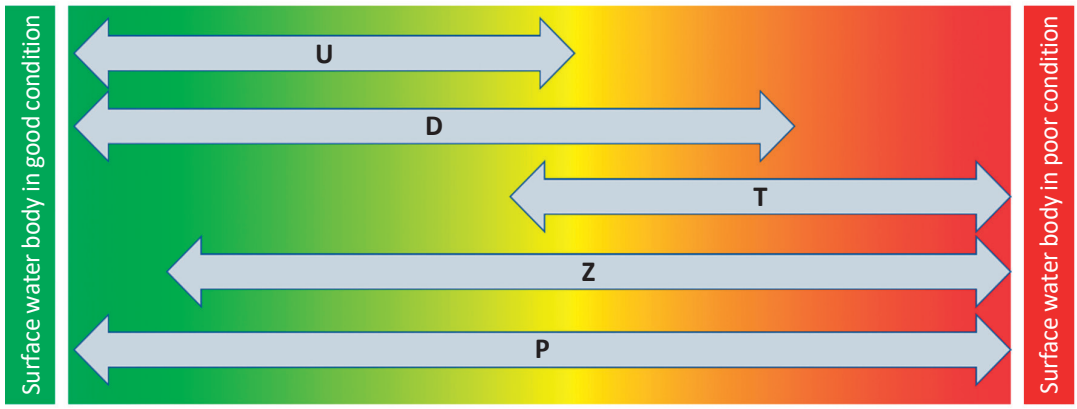

Fig. 2
Scope of application of restoration measures, depending on the condition of a surface water body

SOURCE: NATIONAL SURFACE WATERS RESTORATION PROGRAM

The above analyses and forecasts led to a preliminary and tentative valuation of river restoration in Poland, allowing for a broad margin of uncertainty. According to the adopted valuation assumptions, the aggregate cost totaled approx. PLN 3.5 billion, which corresponds to about PLN 1 million per surface water body. Although this ballpark figure is very likely underestimated, it makes it possible to rank restoration among the costs of water management measures and investment projects in Poland. If we assume that the valuation methodology developed as part of the National Surface Waters Restoration Program produces a result that is understated by a factor of two, the restoration costs spread over several years should still not pose too heavy a burden for the state budget and are not incomparably higher than the costs of other nationwide programs. In many cases, restoration measures helping to reduce the costs of maintenance works thanks to their modernization (such as sectional mowing of water vegetation, which has a similar hydraulic effect as complete vegetation mowing in long river sections) may even generate some savings.

In addition, an over 360-page *Manual of Good Practices in Surface Waters Restoration* forms an integral part of the national program. It is a summary of practical knowledge on how to identify needs and set restoration goals, plan and implement measures, and monitor their effects. It outlines the methods for assessing the hydromorphological status of waters, and describes in detail the required field research and analyses of available data in terms of technical requirements and solutions, applicability, implementation costs, potential benefits and possible risks regarding both environmental and economic impacts. Furthermore, individual activities are illustrated with examples of applications, mostly of the facilities that have already been completed. Sources of additional information are also suggested, such as titles of publications, studies and projects, website addresses, etc. Some practical examples highlight such issues as choosing the restoration strategy, setting direct objectives and selecting adequate methods and measures.

Awaiting final decisions

The restoration measures proposed in the National Surface Waters Restoration Program require each surface water body to be analyzed individually, taking account both local and overall determinants of a given area. For this reason, specific measures focusing on spatial location and technical scope were proposed for those priority areas which have already been fully diagnosed in detail and are ready for implementation. The measures intended for the remaining areas are as yet tentative proposals which call for further analyses that will need to factor in the provisions of other strategic documents. Final decisions about the planned restoration measures and their implementation schedule will be made when the second update of the water management plans is completed. We can already state, however, that the launch of the national program will not only significantly improve the ecological status of waters but will also help optimize their multifaceted use and enable society to derive tangible benefits from water ecosystems with good ecological status.

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Further reading:

Żelazo J., Popek Z., *Podstawy renaturyzacji rzek* [Introduction to River Restoration]. Warsaw 2014.

Szoszkiewicz K., Jusik S., Adynkiewicz-Piragas M., Gebler D., Achtenberg K., Radecki-Pawlik A., Okruszko T., Giełczewski M., Pietruczuk K., Przesmycki M., Nawrocki P., *Podręcznik oceny wód płynących w oparciu o Hydromorfologiczny Indeks Rzeczny* [Handbook for the Evaluation of Flowing Waters based on the Hydromophological River Index]. Warsaw 2017.