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Principles for water resources management in

Natura 2000 areas located in river valleys

Warsaw, July 2005

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Principles for water resources management of Natura 2000 areas in river valleys

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Foreword

The publication which we have the pleasure of presenting to you is the effect of a project realized by two Polish NGOs—the Polish Committee of the Global Water Partnership (GWP Poland and WWF Poland. The impulse for work on this joint endeavor was a seminar organized by both of these organizations, 'The Natura 2000 Program—A Chance or a Threat for River Valleys?', which took place in June 2003. The discussion, whose participants included representatives of the water resources management and nature science communities, showed that reconciling economic and flood safety needs with nature conservation requirements in the Nature 2000 areas is difficult and complex, but possible.

Work on the project, which was endowed with the patronage of the Secretary of State in the Ministry of the Environment responsible for water management, was executed in two stages. In the first, two independent papers concerning river valleys were prepared—one devoted to nature conservation; and the other, to water resources management. The next stage encompassed discussion and preparation of a joint position concerning the principles which should be in force in the Nature 2000 river valley areas. As could be predicted, work on the first stage was completed quickly and without any great difficulty. The second stage, on the other hand, lasted considerably longer than initially predicted. Agreement on positions required many working-group meetings, during which much time was devoted to explanations and discussions concerning terminology; indeed, the key challenge turned out to be finding a common language.

The realization of the *Principles for water resources management in Natura 2000 areas located in river valleys* project involved several dozen people. We warmly thank not only those whom we mention on the inside front cover, but also all who took active part in the working-group meetings and seminars; for without their involvement, we would not have been able to bring our work to completion. We also thank the Ministry of the Environment for their contribution to the content, as well as financial support of the project.

We shall leave assessment of the final effect, in the form of the present *Principles*…, to our readers. We realize that this is not an absolutely perfect product, that some statements contained herein could still raise doubts. The aim of the work undertaken was not, however, to formulate judgments which would be accepted without reservation by all parties interested in water resources management and nature conservation (if such a thing were even possible!). Our task was to make an attempt at meeting each other halfway and seeking a common language for the two communities in a concrete matter of interest to both parties. The usefulness of and need to continue similar work is obvious.

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1 Introduction

For many years now, water resources have been assigned a role as one of the main factors in the progress of civilization—in particular, the development of industry, agriculture, and transport. The unquestioned effects of such an approach were the construction of waterways, the development of hydroelectric power, increased acreage of farmland, construction of water supply systems to provide the population with water. Unfortunately, these operations, aiming to satisfy constantly growing human needs, were often undertaken without taking proper account of the need to protect water resources and the associated ecosystems, which represent one of the basic elements of the orderly conditions necessary for the survival and further development of humanity. As a report published in March 2005 by Millennium Ecosystem Assessment states[1], in the last 50 years, degradation of ecosystems and reduction of biodiversity have progressed faster than ever in the entire history of humanity. On a global scale, it is estimated that during this time, ca. 60% of ecosystem services underwent degradation. The danger that these processes will continue represents one of the most serious threats to the achievement of the UN Millennium Development Goals.

These tendencies have not passed over our country—though already in 1965, Julian Lambor in his classic textbook *Podstawy i zasady gospodarki wodnej* [*Foundations and Principles of Water Management*] wrote:

> *If water management is to yield a proper solution—not only in the technical sense, but also in agreement with the requirements outlined by the laws of nature—which at the same time guarantees the wisdom and stability of water management solutions, it must develop in close coherence with nature conservation. There is reason to predict that in a short time, matters pertaining to nature conservation will find themselves at the center of interest in the most civilized countries…*

Prophetic words, clearly signaling the possibility of conflicts occurring in water resource management, but at the same time obligating us to search for compromise solutions permitting achievement of the objectives of sustainable and balanced development, whose essence is economic development in conjunction with a rational use of natural resources which will not cause irreversible losses in future generations' capacity to benefit from them.

Over the years, a clear change in the approach to water resource management has taken place. At the International Conference on Water and the Environment (Dublin, 1992), preceding the UN Earth Summit in Rio de Janeiro, water was described as a 'finite and vulnerable resource, essential to sustain life, development and the environment'[2]. On the other hand, the 2000/60/EC Directive establishing a framework for the Community's activities in the area of water policy—the so-called Water Framework Directive, which is the most important Community legal act

[1] Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC. (http://www.maweb.org/en/Products.aspx?)

[2] . UN/WWAP (United Nations/World Water Assessment Programme). 2003. *UN World Water Development Report: Water for People, Water for Life.* Paris, New York and Oxford, UNESCO (United Nations Educational, Scientific and Cultural Organization) and Berghahn Books.

designating the framework of water policy—introduced an equally unambiguous definition: 'Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such'[3].

The consequence of adopting these strategic definitions is the establishment of water management priorities which subject this area to sustainable development principles, which in turn enforce a change in water resource management principles and techniques. The place of an objective oriented towards usage and provision of water for the satisfaction of various human needs has been taken by an objective of balanced usage and protection not only of water itself, but also of aquatic and water-dependent ecosystems.

In this interpretation, the foundation for water resources management is considered to be an integrated approach, based in the natural, social and economic properties of water resources and the environment associated with them. This assumption implies a principle of water management in the catchment- and river-basin borders, which has found clear confirmation both in EU legislation and in Polish water law. The concepts of Integrated River Basin Management (IRBM), which accompany the Water Framework Directive, create a foundation for making strategic decisions concerning water which are based on complete information about both the socio-economic and the environmental aspects of water management, and which fully assess all needs and are made with the participation of all interested parties.

2 Aim and scope of publication

The designation of Natura 2000 areas in Poland, as well as the perspective of managing network sites according to plans oriented towards preservation or improvement of favorable environmental conditions, has produced lively discussion among many professional communities, as well as central and local government institutions at different levels, and NGOs. The initiative of the Polish Committee of the Global Water Partnership, as well as WWF Poland, supported by the patronage of the Secretary of State at the Ministry of the Environment, had the aim of attempting to bring together two communities—nature scientists and water resources management specialists—around problems in management of Natura 2000 river valley areas. For the two years of the project's duration, discussions were carried out concerning the possibilities for reconciling habitat and species requirements with the social and economic objectives facing water management. The present publication represents the fruit of collaborative work by water management specialists and nature scientists—the effect of many meetings, seminars, working-group discussions—in which, beyond questions of content, much time was devoted to mutual learning and searching for a common language. The basis for the *Principles* is represented by three sub-papers[4], commissioned and prepared by specialists; but the final document could not

[3] Directive 60/2000/EC.

[4] Dąbkowski S., Badowski A. 2004. *Zasady gospodarowania na obszarach Natura 2000 w dolinach rzecznych—uwarunkowania gospodarki wodne* [*Management Principles for Natura 2000 River Valley Areas—Conditions for Water Resources Management*], Warsaw, manuscript.
Chylarecki P., Kucharczyk M. 2004. *Przyrodnicze uwarunkowania wdrażania sieci Natura 2000 na obszarach dolin rzecznych* [*Natural Conditions for Implementation of the Natura 2000 Network in River Valley Areas*], Warsaw, manuscript.

have been produced without several hundred hours of community service work on the part of persons united around GWP – Poland and WWF - Poland.

During work on the *Principles*, the Ministry of the Environment published the 7-volume *Poradniki ochrony siedlisk i gatunków Natura 2000—podręcznik metodyczny* [*Handbooks on Natura 2000 Habitat and Species Protection—A Methodological Text*], which in a very detailed manner not only describe the distribution and characteristics of individual environment types, as well as of plant and animal species protected in the intent of the Birds and Habitats Directives; but also mention the threats to them, as well as giving recommendations concerning methods of protection. Such detailed instructions, also prepared for species and habitats associated with river valleys, are meant to be guidelines for the management and protection plans which are to be prepared for individual Natura 2000 sites.

The present publication does not contain such detailed guidelines, because that was not its aim. Thus, we have opted not to discuss in detail rivers differing in size (large, small), water courses of differing slope (lowland, mountain), valleys differing in water supply source (fluviogenic, topogenic), processes taking place in them (peat creation and silt deposits), etc. The aim of the *Principles* is to diagnose possible conflict situations at the boundary between water resources management and nature conservation, and indicate ways to resolve potential conflicts at valley sites in the Natura 2000 network. Thus, aside from the legal basis for the functioning of the Natura 2000 network and a general definition of river valley species and habitat needs, we have focused on those social and economic tasks of water management which could represent an obstacle or hindrance to achievement of nature conservation objectives. Or, to put it differently—tasks of water management whose realization could be threatened by realization of nature conservation objectives. Aside from recommendations concerning individual water management tasks, we have also formulated proposals for systems solutions which could make management of Natura 2000 river valley areas more effective.

The dissemination of the *Principles* among persons and institutions responsible for water management and for management of Natura 2000 areas, and among NGOs and academic communities, as well as the preparation of detailed guidelines for water management at valley sites, will contribute to effective management of those river valleys which are to be found in the Natura 2000 network.

3 Legal basis of the Natura 2000 network.

3.1 European Union Regulations

In the Maastricht Treaty, the European Community undertook to ‘promote] measures at international level to deal with regional or world-wide environmental problems’. In the Treaty of Amsterdam, the principle of sustainable development is described as one of the objectives of the Community. In a European Commission communiqué from 1998, supported by the European

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Ślubowska A., Świerkosz K. 2004. *Doświadczenia krajów UE w zarządzaniu obszarami Natura 2000 w dolinach rzecznych* [*Experiences of EU Countries in Management of Natura 2000 River Valley Areas*], Warsaw, manuscript.

Council position, there is discussion of including environmental protection in Community policy. This undertaking is included in the legal acts regulating EU sector policies concerning, among other things, power supply, agriculture, industry, fisheries and transportation. European Union institutions are absolutely obligated to include matters of environmental protection in all of their policies. The Community environmental protection policy is oriented towards achieving objectives both in the sphere of rational natural resource use, and in the area of environmental quality. The Member States are required to realize these objectives.

In joining the European Union, Poland undertook to fulfill the provisions of the Maastricht Treatyby treating environmental matters on a par with other matters. We read there, among other things:

> *The Community shall have as its task, by establishing a common market and an economic and monetary union and by implementing the common policies or activities referred to in Articles 3 and 3a, to promote throughout the Community a harmonious and balanced development of economic activities, sustainable and non-inflationary growth respecting the environment, a high level of employment and of social protection, the raising of the standard of living and quality of life, and economic and social cohesion and solidarity among Member States.*

The Natura 2000 network is one of the fundamental endeavors in the area of space management, oriented towards environmental protection, being realized within the European Union. Its legal basis is represented by two Union directives:

79/409/EEC of 2 April 1979 on the conservation of wild birds (the so-called Birds Directive)

92/43/EEC of 21 May 1992 on the conservation of natural habitats as well as wild fauna and flora (the so-called Habitats Directive).

These directives referring to nature conservation—and concretely, to protection of birds, other animals, plants and habitats of importance on a European scale—are presently the most important Community legal acts concerning protection of biodiversity on our continent. In Article 2 of the Habitats Directive, the main objective of these activities is described as: ‘ensuring bio-diversity through the conservation of natural habitats and of wild flora and fauna in the European territory of the Member States’.

This objective expresses a general orientation indicating the necessity of complex actions supported by appropriate legal regulations of member countries. The creation and functioning of the Natura 2000 network represents an integral part of the concept of sustainable development, which in Polish law has been given the status of a constitutional norm[5].

The Habitats Directive gives the functioning of the Natura 2000 network the character of integrated endeavors carried out on a continental scale:

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[5] Article 5 of the Constitution of the Republic of Poland**:** ‘*The Republic of Poland shall safeguard the independence and integrity of its territory and ensure the freedoms and rights of persons and citizens, the security of the citizens, safeguard the national heritage and shall ensure the protection of the natural environment pursuant to the principles of sustainable development.*’

> *A coherent European ecological network of special areas of conservation shall be set up under the title Natura 2000. This network […] shall enable the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range.* (Art. 3(1))

This is supplemented by the introduction to the Directive, which considers that:

> *… the main aim of this Directive [is] to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements …,*

also drawing attention to the fact that:

> *… maintenance of such biodiversity may in certain cases require the maintenance, or indeed the encouragement, of human activities.*

Among the areas in the Natura 2000 network, of special significance are river valleys. The natural features of valleys are universally known—a wealth of habitats as well as plants and animals, especially birds, as well as their essential role as ecological corridors. But at the same time, river valleys have for centuries represented an area of particularly vigorous human activity, with the aim of utilizing water resources to achieve various social and economic objectives. Economic activity and settlement in river valleys also require a variety of actions associated with flood protection.

The Habitats Directive obligates member countries to effectively protect endangered species and habitats in the areas comprising the Natura 2000 network. The fulfillment of these requirements could turn out not to be coherent with the traditionally-conceived approach to river valley water management. However, in exceptional circumstances and situations, the Directive (Art. 6(4)) permits actions which negatively impact natural environment status in protected areas. This may take place only when three conditions are fulfilled simultaneously: the endeavor is justified by 'imperative reasons of overriding public interest', no alternative solutions exist to achieve this same objective, and all measures necessary will be taken to compensate losses occurring in the natural environment. In connection with EU membership obligations, water management in Poland is faced with objectives oriented towards meeting of social, economic and environmental needs. Action to protect river valley waters and ecosystems (to ensure protection of water-dependent species and habitats) is becoming one of the fundamental tasks of water management, aside from flood protection and water supply for the population. The Natura 2000 network, it is worth emphasizing, is a mechanism not only for nature conservation, but also for improvement of the human environment—of quality of life.

3.2 Regulations of national law

In Poland, the Water Law Act of 18 July 2001 formulates detailed objectives for water management in the following manner:

Water resource management serves to meet the needs of the population and the economy, as well as to protect waters and habitats associated with these resources, in particular in the area of:

1) *Supplying an appropriate quantity and quality of water for the population*

2) *Protecting water resources from pollution as well as from improper or excessive exploitation*
3) *Maintaining or improving the status of aquatic and water-dependent ecosystems*
4) *Providing flood and drought protection*
5) *Supplying water for agricultural and industrial purposes*
6) *Meeting needs associated with tourism, sports and recreation*
7) *Creation of conditions for utilization of water for electrical power, transportation and fisheries.*

The amendment to the Water Law Act passed in June 2005 supplements these tasks, indicating as appropriate '*action in accordance with the public interest, without permitting avoidable deterioration in the ecological functions of waters, as well as of land ecosystems and wetlands directly dependent on them*'. This modification of the provisions of the law is to serve the purpose of transferring the principles of the Water Framework Directive to Polish water law.

The necessity, resulting from the sustainable -development strategy, of protecting aquatic and water-dependent species and habitats, represents one of the essential objectives of water management. In Poland, the importance of this protection is justified by the natural features of the country, which stand out positively in comparison with those of other countries in Europe.

Over 60% of the territory of Poland is utilized for agriculture (including: 76% arable land, 22% green areas). Woods occupy 28% of the country; and aquatic ecosystems, about 3%. The combined length of rivers and streams works out to a total of about 98 000 km. Many aquatic and wetland areas have not undergone any significant transformation and remain in good condition. In Poland, the existence of over 33 000 animal species, 11 000 plant species and 5 000 species of fungi has been confirmed. The most valuable areas from the natural environment standpoint are the 23 national parks (over 3 000 km^2) and 1 354 nature reserves (nearly 1 500 km^2). Besides these, 120 landscape parks and 490 protected landscape areas have been set up; other forms of protection include natural monuments (including nearly 27 000 trees with monument status), lands utilized for ecological purposes, documentary positions and natural landscape complexes, as well as species protection of plants, animals and fungi. Protection of this natural wealth is provided for by national law.

Union directives are requirements addressed to Member States; and the accession treaties obligate these states to introduce the principles contained in the directives into their respective national laws. In the area under discussion here, the fundamental act of national law is the Law on Nature Conservation of 16 April 2004. It regulates the 'big picture' of nature conservation issues; it also contains provisions concerning the designation and functioning of the Natura 2000 network, following from the Birds and Habitats Directives. In introducing this new form of nature conservation, the law mentions '*Natura 2000 areas*', a network which is to encompass *Special Protection Areas* (SPAs)—sites designated for protection of wild bird species; and *Special Areas of Conservation* (SACs), designated for protection of wild plant and animal habitats. An individual SPA or SAC may include some or all of an area covered by various forms of nature conservation, or of an area not covered by any of these forms.

In an area classified as an element of the Natura 2000 network, the protection provided encompasses plant and animal species, as well as their habitats, mentioned in the appendices to both of the aforementioned directives, not—as in a national park or nature preserve—all elements of nature. According to the Habitats Directive, protective actions within Natura 2000 areas will be initiated '*taking account of economic, social, cultural and regional requirements*'.

Natura 2000 areas are designated by decree of the minister responsible for environmental affairs. Via the same route, the minister designates the manner and scope of preparation of an initial draft for a protection plan for these areas[6] as well as instituting a 20-year protection plan for each area. The minister is obligated to coordinate the functioning of Natura 2000 areas. According to Union integration provisions (accession treaty, directives), the minister is obligated to draft a list of Natura 2000 areas and present it to the European Commission. Designation of a Natura 2000 area, changing of its boundaries, or elimination of the area requires, among other things, agreement with the minister responsible for agricultural affairs and the minister responsible for water management affairs. The drafted plan for protection of Natura 2000 sites—utilizing plans appropriate to the location of national parks, nature preserves and landscape parks, as well as plans for forest management—is drawn up by the person supervising that area, within 5 years of its designation, in agreement with the municipal councils appropriate to the given location.

On the basis of this drafted plan, by decree of the minister responsible for environmental affairs, a 20-year protection plan for the concrete area is ratified, containing:

- A description and assessment of existing and potential internal and external hazards, as well as designation of ways of eliminating or mitigating these hazards and the associated damage
- A description of the conditions for preservation or restoration of proper habitat and species status
- A list of protection tasks, with a description of the manner of their performance, type, scope and localization, for a period of time in accordance with the needs at hand
- A description of the scope of natural environment monitoring
- A description of the boundaries of the Natura 2000 area.

The assumption of the Natura 2000 network is to reconcile economic activity and nature conservation in the protected areas. This means non-impedance of economic activity and agreement to the realization of endeavors in various sectors, with the proviso that the overall objective be achieved of non-deterioration of habitat and species status, as well as compliance with the provisions of the protection plans adopted for the specific area. There is a principle that these provisions cannot infringe on property law or on the competency areas of local administration in the given area, and they are supposed to be based on voluntary consent of the area's users to the limitations associated with the provisions. The Law on Nature Conservation contains clauses on the necessity of analyzing alternative solutions for economic activity and investment which could create a hazard for the object of protection in the Natura 2000 areas. In the law, also indicated was the necessity of compensatory actions which the investor must undertake to maintain the integrity and proper functioning of the Natura 2000 network. On the

[6] Decree of Minister of the Environment of 30 March 2005 on the manner and scope of preparation of the draft for a Natura 2000 area protection plan (Journal of Laws 61 item 549)

other hand, the Law provides for the possibility of paying financial compensation to owners and possessors of areas for limitations on their activity in Natura 2000 areas.

The fundamental characteristic of the Natura 2000 network, differentiating this form of nature conservation from other forms, is the considerably fuller inclusion of the network into the sustainable development strategy. This characteristic is expressed in the assumption of a targeted balance between economic activity and nature conservation—which, in comparison with the rigors for strict nature reserves s, means a relaxation of the protective requirements; and on the other hand, a rejection of the concept of '*fighting with nature*'. Many sectors of the national economy participate in usage of the valleys of rivers utilized for economic purposes, and this circumstance expands the space of dialogue and negotiation for the establishment of an optimal concept for space management.

4 Species and habitat protection requirements for Natura 2000 sites

The objective of area protection conducted within the Natura 2000 network is to preserve or create a **proper conservation status**[7] for the species and habitats which the given area has been designated to protect. In reference to habitats, favorable conservation status is defined as a situation in which the following conditions are fulfilled:

- The natural range of the habitat and the areas it covers are not decreasing
- The specific structures and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future
- The conservation status of species typical for specific habitat is favorable[8]. (ten przypis nalezy zlikwidowac, a dalsze odpowidnio przenumerowac – JK)

In reference to species, favorable conservation status can be defined as follows:

- Population is not decreasing on the continous basis (tutaj nie ma przypisu – JK) The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future
- There is, and probably will continue to be, a sufficiently large habitat to maintain its viable[9] populations on a long-term basis[10] Ten przypis nalezy zlikwidowac – wszystkie dalsze przenumerować - JK)

4.1 Flow regime

Ensuring a favorable conservation status for Natura 2000 areas in river valleys is inseparably linked to maintenance or recreation of the flow regime which gave rise to the present wealth of fauna and flora in these areas. The reference system here is the river's hydrological regime as defined for a period comprising the last few decades, in conditions preceding implementation of

[7] Such a formulation is used in the Law on Nature Conservation (from 16 April 2004); to more fully convey the essence of the issue, it would be better to use, following the spirit of the Habitats Directive, the formulation **favorable conservation status**.

[8] 92/43/EEC of 21 May 1992 Habitats Directive, Art. 1(e).

[9] Able to recreate itself, stable

[10] 92/43/EEC of 21 May 1992 Habitats Directive, Art. 1(i).

any heavy hydrotechnical development. These reference characteristics, often described as the 'natural flow regime' in the literature, take into account not only absolute values, but also—above all—measures of variability in the river's key hydrological parameters. For the natural dynamics of the system represented by a river valley are one of the key factors determining its natural features. For the river valley's spontaneously-formed dynamics, together with its dynamic flow regime, remain in a mutually interdependent relationship with the specific physico-chemical properties of water (temperature, oxygenation, etc.), as well as with the continuity of the river channel and valley essential for protected species and habitats,

Habitats and species characteristic of river valleys were subject to evolutionary formation in the conditions of specific, reproducible patterns in time-space differentiation of river flow. As such, they are not only adapted to the toleration of a wide amplitude in water levels, but indeed require the maintenance of a specific flow variability scheme for their long-term preservation. Large flood waves are the main factor which shapes the river channel and its movements, which are requisite for endless renewal of river bank and river bed ecosystems subject to constant change (succession, seasonal rhythm, fluctuation, degeneration and regeneration). They are also a factor in the formation of the conditions of the river bed in gravel-bearing streams and rivers with a fast current (admixture of debris, washing away of small fractions), which in turn decide the conditions for the spawning season and growth of juvenile rheophilic fish. Flood flows provide connectivity between the river channel and water reservoirs in the floodplain depressions , The inundated areas themselves represent a place of reproduction for numerous fish, amphibians and insects. An array of river-related organisms (e.g. fish or insects) treat growth in flow volume as a stimulus for spawning, hatching or seasonal migrations. Similarly, periodic drying out of the valley and low river flows are often necessary for the development of plants and stabilization of pioneer communities of species which colonize new areas during the flood period[11].

For river valley ecosystems, flow volume and water levels which change significantly over time represent an integral element of their functioning, essential for their existence. Both the limited rises in water level and the low water levels characteristic of the annual hydrological cycle, and occasional large flood waves and hydrological droughts, are an indispensible component in the long-term preservation of river ecosystem integrity. If they do not occur, river ecosystems are subject to degradation, on account of which their biological diversity is decreased and—equally importantly—their ability to fulfill service functions with respect to the society[12] is conspicuously handicapped, as is their ability to adapt to changing climatic conditions. This degradation leads to a cascade of disturbances in the functioning of other ecosystems, whose effects can accumulate for decades before their social costs are fully revealed.

11 More information in the publication Chylarecki P., Kucharczyk M. 2004. *Przyrodnicze uwarunkowania wdrażania sieci Natura 2000 na obszarach dolin rzecznych* [*Natural Conditions for Implementation of the Natura 2000 Network in River Valley Areas*]. Manuscipt, GWP Poland, WWF Poland.

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A flow regime of dynamics approximating the natual one can be determined on the basis of a representative series of daily river water levels or flow volumes, in conditions devoid of significant influences from the manner of water use or hydrotechnical development of the river .[13]. It is of key significance for the long-term existence of three main categories of habitats in low-lying valleys of large rivers in Poland which are protected as Natura 2000 areas—both river chanel habitats, floodplain forests and wet meadows in the flodplain terraces are critically dependent on episodes of increased flow volume. Sand islands and sand bars in the river channel , which sustain the existence of at least dozen animals indicated as high-priority species in the Birds and Habitats Directives, are built primarily during the larger flood events typical of early spring. In natural hydrological conditions, newly-built islands start to appear at the beginning of May, i.e. at the time when the characteristic species of protected birds associated with this habitat begin their egg-laying season. Full exposition of sand bars and shallows, which provide the rich feeding grounds necessary for the nourishment of juvenile protected birds, occurs during the natural low water-level periods characteristic for the second half of June and for July.

The majority of the naturally valuable fragments of low-lying river valley areas are characterized by regular (annual or almost annual), relatively long-lasting, early spring inundations of extensive fragments of the flood plain terrace, which are not only the norm there, but also an essential condition for the subsistence of habitats and species key to the Natura 2000 network. For many of the meadow bird species protected in Natura 2000 areas, the longer or deeper their potential nesting grounds in flood plain terraces remain inundated in the early spring, the greater is their number which will establish there their nests. The spring inundation is so important because shallowly-inundated fragments of meadows represent the place of development for a wealth of invertebrate fauna, chiefly insect larvae, which in turn represent a staple food for many valuable birds. The slow, systematic receding of the early spring inundation shifts the shallow zone, gradually giving birds access to successive rich feeding-grounds which appear as the water level drops. In the case of amphibians and several fish species, areas with shallow early-spring inundation represent a place for reproduction and egg-laying. Slow recession of water levels allows for the birth of tadpoles or frys and their transmission into the deeper parts of inundation. Too rapid a drop in water level represents a factor contributing to mass mortality in the early developmental stages of amphibians and fish reproducing in the shallows.

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13 Key parameters characterizing the hydrological regime of a river, defined on a series of 24-hour water level or flow volume measurements, include measures of:
– volume/level
– frequency
– duration
– reproducibility/predictability of occurrence in the yearly cycle
– speed of alternation.
Precise definitions of concrete parameters may differ, dependent on needs. However, it is worthwhile to draw attention to the standard set of 33 parameters serving the purpose of a synthetic characteristic profile, as well as of an assessment of the degree of change in a hydrological regime—IHA (Indicators of Hydrologic Alternation); Richter et al. 1996, Richter et al. 1997, Poff et al. 1997, Richter et al. 1998); it is used successfully in many states of the USA, as well as in an array of other countries, with the support of universally available software (see www.freshwaters.org).

In natural hydrological conditions (i.e. those not subject to significant antropoghenic pressure), still in June, after the basic recession of inundations, the groundwater table is sufficiently high that the wet soil continues to enable birds to obtain food in the moister, lower-lying meadow regions, on the edges of the deeper old river beds and ground surface depressions. Another factor deciding on the quality of breeding-habitat for valuable birds nesting on flood plain areas in meadows and pastures is the lack or limited extent of winter inundations. The natural hydrological characteristics of flood plain areas in Poland's lowland river valleys coincide with these requirements, which—particularly in conjunction with the spring floods— creates an optimal breeding environment on riverside meadows for an array of bird species protected as part of the Natura 2000 network.

The task of maintaining a significantly dynamic flow regime is not always in agreement with social and economic water management objectives, which include, among other things, utilization of water resources for human needs—while preserving the proper status of these resources—as well as flood protection. The effect of this has been the formation of a policy described by convention as '*flow equalization*', consisting of reducing high flows and supplementing low flows.

Though in the conditions proper to Poland's rivers, 'absolute' equalization of flow is 'physically' impossible, the traditional concept of water management has contained a task of maintaining so-called '*minimum flows*' '—minima which are meant to ensure proper conditions for nature conservation, water quality maintenance, fishing and tourist purposes. In reference to the needs of habitats and species, according to what was written in the beginning of this chapter, the minimum environmental flow values in Natura 2000 areas should also take into account the occurrence of substantial variations in the river dynamics. In this area, one can utilize papers published in 1996 concerning the manner of determining minimum environmental flow values according to the environmental criteria[14].

The Water Framework Directive introduces maintaining a '*good water status*' ' as a primary objective of water management. This objective includes the task of conserving variation in river flows on account of ecosystem conservation needs. Such an orientation imposes a different from the traditionally accepted interpretation of 'minimum flow' —which should be understood not as a constant minimum value, but as a need of paying special attention to the sequence (cycle) of river flows , which while it represents a transformation of the natural regime of the river, is carried out with a limitation on the degree of variation in this natural flow regime—preserving

[14] Tyszewski S, Okruszko T, Pusłowska D. 'Propozycja metodyki określania sposobu wykorzystania zasobów wodnych zlewni o szczególnych walorach przyrodniczych na przykładzie Górnej Narwi i Supraśli' ['A Proposed Methodology for Determining the Manner of Utilization of Catchment Area Water Resources of Particular Natural Value, on the Example of the Upper Narew and Supraśla']. 7th Nationwide Academic and Technical Seminar 'Conservation of Water Quality and Resources—Principles for Rational Water Management', Zakopane, 1996.
Okruszko T., Tyszewski S., Pusłowska D. 'Gospodarowanie zasobami wodnymi Górnej Narwi' ['*Water Resource Management in the Upper Narew*']. Zeszyty Prob. Post. Nauk Rol., 428, Warsaw, 1996.

flood and low river flows to such extent as not to cause negative consequences for the river environment and the associated ecosystems. [15].

Subjecting water management to the objectives expressed in the Water Framework Directive should remove one of the chief sources of the conflicts indicated above. Such an orientation in water management will also support maintenance of the dynamic structure of habitats—limiting interference in the natural processes essential to these habitats.

4.2 Extensive usage

Large, extensively-used meadows and pasturelands located on river-valley flood plain terraces form one of the most valuable habitat categories in Central European conditions. The long-term existence of these habitats is dependent not only on special water conditions (discussed above), but also—above all—on the traditional, extensive system of agricultural usage of these areas. Both excessive intensification of that usage , and too far-advanced reduction of its intensity, as well as complete abandonment of agricultural usage , lead to a rapid loss of the high natural value of wet meadows and pastures .

In the case of meadows, indicators of a optimal level of utilization include:

- Regular hay-mowing including hay removing from a meadow,
- Late date of first harvest (at least 10 June),
- Differentiation of harvest date on neighboring land parcels,
- Minimization of fertilizer use,
- Conservation of varied surface contour,
- No supplementary sowing of high-yield species or varieties of grasses,
- llow livestock density and use of local breeds,,
- No reforestation.

With regard to pastures, the essential factors are:

- Low livestock density, not exceeding 1.0 LU[16]/ha, especially where soil quality is poor,
- Late starting date for pasturing (beginning of May, optimally after the 20th)
- Total length of pasturing in one year at a level approx. 200 LU x days/ha, (up to 300–400 LU x days/ha on richer soils, or once every few years on poorer soils.
- Free-range pasturing, or in large pasturing areas
- No fertilizer use
- No supplementary sowing of high-yield varieties and species of grasses.

Generally, the aforementioned set of factors corresponds to the current manner of land utilization in many areas located between flood levees and in non-embanked river valleys in lowland areas of Poland.

[15] Such a pro-ecological view is discussed in a handbook entitled *Obliczanie przepływu nienaruszalnego* [*Calculation of Minimum Flow Volume*] (Witowski, Filipkowski, Gromiec, 2004), which was deliberated upon in the forum of the Ministry of the Environment, unfortunately without legislative consequences.

[16] LU—Livestock Unit—A conventional unit corresponding (for the purposes of the present publication) to an animal of 500 kg body mass, or many animals of combined body mass 500 kg. For example: 1 breeding cow or heifer = 1 LU; heifer or young bull aged 0.5-1.0 year = 0.3 LU, adult horse = 1.2 LU.

4.3 Habitat dynamics

A third factor of key significance for conservation of biological features in river valleys are their natural dynamics. Habitats characteristic of valleys have the character, by and large, of transitory habitats which are part of continua of spontaneous successive transformations. Individual habitats, with the passing of time, on the one hand, are transformed into others; on the other hand, they continually regenerate themselves in different places. As a result, valleys are a place where a mosaic character of habitats, i.e. coexistence in a small area of a large number of different habitats , is particularly well-expressed. In a broader perspective, this mosaic of valley habitats arranges itself, as a rule, in recurring spatial patterns, reflecting successive continua linking individual habitats and representing various stages of their ecological age. Obviously, the basic factor determining renewal of these habitat continua is the spontaneous dynamics of the river channel , formed by the natural river flow regime. An enormously important consequence of this type of river-valley habitats is the fact that the conservation of specific , spatially-limited habitat patches is simply ineffective, because in large measure, they undergo spontaneous transformations which are impossible to impede. The only possible form of conservation for these unique, dynamic ecological systems is conservation of the processes which condition theses natural dynamics, carried out in a relatively large-scale area (river course segments). This boils down to conservation of flow volume variation as a fundamental factor driving and forming these phenomena, as well as to non-interference in the natural processes —especially in such processes as erosion, sedimentation and sediments transport.

The dynamic nature and mosaic distribution pattern of floodplain forest and bush habitats or meadow complexes are relatively well-described and embedded into general awareness of people engaged in farming in river-valley areas. However, it is worthwhile to emphasize a similar aspect of the genesis and functioning of two other factors determining the natural features of Natura 2000 valley areas: riverine sand islands, and land contours in the flood plain terraces.

Riverine sand islands, populated with sparse pioneer vegetation, are in and of themselves a habitat being protected according to the Habitats Directive; but above all, they are a biotope for an array of valuable birds mentioned in the Birds Directive. Islands in the early stages of vegetation succession, while attractive to birds, are nonetheless an ephemeral habitat, subject to rapid transformations—being washed out, or covered by willow undergrowth. In natural conditions, the continuity of this habitat is possible only thanks to continuous deposition of successive sand bars and islands by the current of the free-flowing river, in the nearer or further vicinity of old or washed-out islands. Vegetation succession is sometimes also impeded by flood waves which deposit successive layers of sediments on existing islands. However, it should be remembered that the protection of sand islands, as well as the associated habitats and species (as well as protection of the entire system of riverine shallows and sand bars, with their characteristic fauna, including valuable fish species) is possible only on a broader geographic scale, and on the condition of maintaining the natural processes which govern their renewal.

The high biological value of many flood terrace meadows is a derivative not only of extensive use or of regular inundation, but also of well-developed land surface patterns. . As a rule, the

flood plain terraces formed by historic changes in the river channel patterns , represents a mosaic of elevations and shallower or deeper depressions, often arranged in characteristic stripes. Land elevation differences not infrequently reach 2 m, and determines the enormous variety in duration of inundation of specific fragments of the land surface. While this does make mechanization and intensification of hay-harvesting more difficult, it does represent a basic factor forming a strong heterogeneity in aquatic conditions, which is of key significance for the wealth of vegetation communities, as well as of fauna, including meadow birds.

5 Implementation of social and economic water management tasks in Natura 2000 river valley areas

The environmental objectives concerning surface waters defined in the EU Water Framework Directive determine water management measures, which should concentrate on achieving/maintaining favorable biological, physico-chemical and morphological water status, as well as favorable status of aquatic and water-dependent ecosystems.

The water management tasks described by the law and dictated by social and economic postulates include water supply, sewage treatment and removal, improvement of agricultural production (irrigation and drainage), inland water transport, hydroelectric power development, development of aquatic recreation and tourism, water pollution control , and flood/drought protection. Implementation of these tasks is often at odds with the environmental objectives of water mangement. In assessing ways of satisfying management objectives, we must always look at them in a broader context, i.e. against the background of economically-justified needs and in a perspective including several different alternatives. For example, prospects for hydroelectric power development need to be made dependent not only on the power value of the water resources in our possession, but above all, on the size of the demand for electrical power, bearing in mind the various possibilities for its satisfaction (hydroelectric, heat, wind, etc.). Beyond this, we always need to take into account possibilities for implementing mechanisms to increase power production efficiency , and limit energy demand. Multi-alternative analyses must be conducted within the framework of the so-called strategic of environmental impact in accordance with Directive 2001/42/EC, as well as within environmental impact assessments in accordance with Directive 85/337/EEC and with the regulations of the national Law on Environmental Protection of 27 April.

An issue often ignored in the decision-making process concerning investments is the division of costs and benefits. Often, the costs of an investment are borne by taxpayers as a whole, while the benefits become the privilege of a narrow interest group, or of one sector. The principle introduced by the Water Framework Directive, that ‘the one who benefits, pays’, should become the standard, and the parties responsible for compliance should be the water authorities.

Decisions concerning investment endeavors in Natura 2000 valley areas have additional limitations. In the intent of the Law on Environmental Protection, as well as the Habitats Directive and the European Commission guidelines contained in the publication *Assessment of plans and projects significantly affecting Natura 2000 sites, Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC,* permission for the

localization of an investment which will adversely affect a favorable protection status can take place only if three conditions are fulfilled simultaneously:

- The assumed objective cannot be achieved in any other manner not harmful to protected species and habitats;
- The investment is justified by overriding public interest[17];
- Losses to the natural environment will be compensated by placing another area under protection (corresponding in range and quality—species, habitats—to the area which is losing favorable conservation status).

In the following chapters are presented the most important water management endeavors with which we may have to deal with at Natura 2000 sites located in river valleys, together with an indication of their justification in terms of social and economic needs, negative impacts on protected species and habitats, as well as recommendations aimed at eliminating or minimizing these impacts.

5.1 Storage reservoirs and barrages

5.1.1 Social and economic justification

These structures raise particular controversy on account of the extent of their impact on species and habitats in Natura 2000 refuges. The greatest threat for Natura 2000 areas in river valleys is transformation of water course flow downstream from a reservoir. We must state clearly here that there is no water storage without transformation of the flow regime. Analysis can only apply to the scope and magnitude of these transformations, as well as to determination of whether a given reservoir really impacts water levels and flow in the region of specific habitats. However, if we accept the idea of water storage , then we must also agree to the transformation of the flow process for a certain length of the given river. Nevertheless, transformation of the hydrological regime cannot negatively impact species and habitats in Natura 2000 areas.

The task of water barrages is not so much water storage as water impoundment for shipping, hydroelectric power development or water supply improvement purposes.

Generally, the objectives of building storage reservoirs and barrages include water supply for the population, industry and agriculture, flood protection, improvement of shipping conditions, production of electricity at the hydroelectric power plants associated with the reservoirs or barrages in question, development of aquatic tourism and recreation or, finally, development of fisheries. Fish ponds should also be seen as a particular form of storage reservoirs. Normally, storage reservoirs and barrages fulfill at least a few of the above-mentioned functions simultaneously. In the hydrological conditions of some regions in Poland, in light of great flow variability, water storage in reservoirs is practiced; these reservoirs, becoming multi-functional

[17] Decrees of the European Court of Justice preclude predominance of the economic factor over that of nature conservation, e.g. the decision in case no. C-355/90, *Commission v. Spain* of 1993 (*Santona Marshes*). Acquisition of workplaces or development of tourism and recreation in association with realization and exploitation of large investments fits into the concept of 'overriding public interest'—see ECJ verdicts on http://www.curia.eu.int.

elements of water supply systems, have the task of preventing water deficits harmful to water users.

On the other hand, such storage reservoirs are often utilized to reduce the magnitude of flood flow, thereby mitigating flood risk. Despite the fact that local actions on flood terraces to mitigate flood damage, as well as non-structural measures undertaken in the river valley and catchment area leading to a reduction in flood wave size, are in the long run very beneficial, people still consider storage reservoirs to be an essential element of the flood protection system, emphasizing their role in protection of human life and property. However, at the same time, we must not forget that no engineering structures can ensure absolute flood protection; thus, we must avoid creating a false feeling of safety among the population. We must always take into account the hazards resulting from the risk of breakdown in structural flood protection measures . A pro-ecological approach to flood protection should not be interpreted as a categorical exclusion of 'hydrotechnical development'. Opinions on mitigating flood damage by expanding small-scale storage and setting up polders are correct—these means of protection bring measurable effects, especially in the case of small and medium-size flood flows. It should be remembered, however, that there exists such a category of catastrophic flood flows in the face of which all protective solutions, both structural and non-structural, are helpless.

5.1.2 Negative impact on Natura 2000 species and habitats

Permanent flooding of part of the valley

It is particularly harmful to Natura 2000 valley areas, especially in the case of large reservoirs occupying many square kilometers of a previously unembanked valley, or one embanked only to a slight degree. Shallow storage reservoirs sometimes represent a good environment for the occurrence of a wealth of avifauna, but as a rule, this fauna is comprised of less valuable species (of lower protection priority) than those which populate a given segment of natural valley before inundation.

While in the case of storage reservoirs, their negative impact via inundation concerns rather shorter segments of rivers, the impact of barrages built for shipping purposes can apply to very long fragments of valleys, and negatively impact the particularly valuable habitats and species of wide lowland valleys. However, the risk resulting from inundation of part of a valley does not apply to small barrages build for purposes of regulating the steep-slope rivers.

Elimination or modification of spring flood flows

Elimination of spring flood flows , or significant reduction of their volume, results from the basic function of the most of reservoirs—to accumulate excess water for various purposes.

A possibility of interrupting connectivity between the river channel and flood plain areas could also result from lowering of the river bed downstream of the reservoir or barrages , as a result of erosion induced by stoppage of sedimentation transport , inherent in the accumulation of water by means of the reservoir or barrages . In the case of flow discharges which in the past were overflowing river banks, now the entire flow remains in the eroded river channel.

Elimination of end-of-summer and autumn low flows

The negative impact of equalizing river flows , as well as of eliminating low flows , is presented in detail in Ch. 3.[18]

Groundwater table changes

A rise in the groundwater table in the vicinity of a reservoir negatively impacts xerothermic habitats and species (those favoring a dry environment); a drop in this level as a result of river bed erosion downstream of the reservoir or barrages, impacts negatively , those favoring a wet environment.

Changes in water temperature in the impact zone of the reservoir or barrages

Water temperature is one of the fundamental factors in reproduction and growth of aquatic fauna, especially fish. In the summer, a rise in river temperature in the backwater zone stagnophilic reservoirs, or downstream—if water is discharged downstream via surface spillway —can effectively eliminate cold-water fish from the reservoir. A rise in water temperature downstream of the reservoirs or barrages can also be a factor eliminating some types of habitats (e.g. *Ranunculus* complexes). On the other hand, bottom outlet facilities cause a drop in river termperature downstream of the reservoir in the summer, and a rise in the winter, which can lead to disturbances in the ecosystem, e.g. by changing the fauna and flora species composition.

Interruption of river channel and valley continuity

If a fish ladder is not present, or if it is not functioning properly, building a dam or barrage introduces a new element to the environment which, for many organisms migrating along the river, represents an impassable barrier. It can lead to the division of a population into two smallers ones, unable to function in a sustainable manner. The most typical effect of interrupting corridor continuity is that rheophilic fish are cut off from their spawning, feeding and wintering grounds, which originally occurred in that segment of the river which has now found itself on the upstream side of the reservoir.

Changes in river bed structure

Stoppage of sediment transport results in erosion of material from the river channel downstream of the dam or barrage. This can lead to changes in river bed structure, e.g. complete washing out of gravel, all the way down to solid rock.

5.1.3 Recommendations

The fundamental recommendation is to study all of the possibilities for reducing water demands which were mentioned in general at the beginning of this chapter, and/or alternative methods of satisfying them.

Revision of operating rules

[18] See also: Chylarecki P., Kucharczyk M. 2004. *Przyrodnicze uwarunkowania wdrażania sieci Natura 2000 na obszarach dolin rzecznych* [*Natural Conditions for Implementation of the Natura 2000 Network in River Valley Areas*]. Manuscript, GWP Poland, WWF Poland

Revision of the so-called reservoir operating rules (more precisely: storage volume control schemes) should be undertaken in the direction of recreating a flow regime downstream of the reservoirs which is in agreement with the needs of aquatic and water-dependent ecosystems. The question is whether it is possible to carry out such a revision. Generally, the answer to this question is positive—revision is not only possible , but often absolutely advisable. However, it is necessary to precisely define its purpose and scope in enough detail to be able to translate the requirements of the natural environment into a storage control scheme, into a system of requirements concerning reservoir outflows, correlated with the randomly-variable inflow from the upstream part of the catchment area. To assess whether this revision is possible for a specific reservoir, individual analysis is necessary. The flow regime favorable to the specific species and habitats which are the object of protection in the Natura 2000 locations should be precisely described—giving the exact frequency and extent of inundation. Very useful here is an approach oriented towards recreation of a specific part of the natural variability in hydrological parameters (the RVA (Range Of Variability) approach[19]). It is necessary to check whether such an inundation scheme is possible to effectuate, and whether a specific reservoir can contribute in an essential manner to the formation of the required flow regime in an area of habitats which are at a significant distance downstream from the reservoir being analyzed. The change of operating rules must be conducted in accordance with clauses in Polish and European Union environmental protection law concerning environmental impact assessments. Revision of operating rules for existing reservoirs, in conjunction with implementation of flexible flow management systems, could be one of the effective tools for achieving the basic objective of the Water Framework Directive—attainment of a favorable ecological status for surface waters.

Flood protection

Flood protection objectives should be achieved primarily via actions (measures) undertaken on a catchment-area scale, with the aim of mitigating surface runoff intensity—among other things, reforestation, transformation of arable lands into green areas, water storage in the existing agricultural and forest drainage systems, limitation of impermeable surfaces—restraint of the tendency to change surfaces which can absorb water into impermeable surfaces; protection and recreation of wetlands appropriate agrotechnical operations (e.g. plowing along contour lines, leaving unplowed stubble over the winter season, creating buffer zones from permanent vegetation along rivers). Another group are actions to increase valley storage : removal of flood dikes where there is no development to be protected, removal of those dikes which protect no one and nothing, preservation of natural river segments and flood plain areas and renaturalizing those which have been transformed. Resettlement from areas at risk should also be counted among the alternative solutions, especially if the costs of resettlement and their scale would be approximately the same as for resettlement associated with building a reservoir. As far as structural measures are concerned, then significantly more advantageous from the viewpoint of protecting Natura 2000 river bank areas are dry reservoirs and flood retention polders, because

[19] See Richter *et al.* 1998. 'A spatial assessment of hydrologic alternation within a river network'. *Regul. Rivers: Res. Mgmt* 14:329-340.

they do not lead to permanent inundation of an area, and do not change the entire flow regime (their impact is short-term and applies to the largest floods only).

In assessing flood protection alternatives , we must be guided by the primacy of protecting human life, conduct effectiveness analyses for long-term time frames, and take into account the risk of unreliability and breakdowns, especially in the context of global climate changes.

The postulate of transferring all valuables to so-called 'safe places' is unrealistic. In the historic process of social development, cities were located in areas near rivers, which were utilized as a transportation routes, or as protection against the enemy. At the same time, especially during the industrialization period, intensive inroads were made into flood plain areas. There were various reasons for this: often recognition of the magnitude of the risk was lacking, sometimes the danger was taken lightly, or awareness of it was lacking. Presently, it is unrealistic to completely abandon utilization of areas at risk, but it is definitely necessary to restrict their usage (and here, there is a particular role for spatial management plans). Although many structures have already been built in these areas (some of which would be worth tearing down)—it is necessary to avoid locating new structures there, which represent a hazard to the environment and are associated with serious danger to persons and property, causing also problems for rescue operations in a flood event situation.

Water supply for the population, industry and agriculture

In the case of a water supply task impacting on a Natura 2000 area, in first order of priority among the proposed alternatives should be mentioned: limitation of water use , closure of water circulation systems, implementation of water-saving technologies, as well as reduction of losse in water supply systems (e.g. urban water supply systems). In actions taken to reduce water use , of particular significance is proper application of economic instruments.

In some cases, an alternative to a water-storing structure (e.g. the barrage) could be a bottom intake or an infiltration intake of groundwater (limited by considerations of resource protection and preservation). An alternative applicable to a river in the Natura 2000 could be an intake from an unprotected river. In making the decision to supply water by building a storage reservoir, attention should be paid to the sensitivity of such a solution to external factors, e.g. reservoir eutrophication or water shortage pursuant to lack of precipitation and extended drought.

Aquatic tourism, sports and recreation

Proper management of existing natural and artificial reservoirs often permits pressure from aquatic tourism, sports and recreation to be relieved. The need for swimming space is being effectively met by the more and more widespread 'aquaparks'. An alternative to storage reservoirs located in the river channel could be swimming spaces located outside the river channel and using only a small portion of river flow. However, in this case as well, this objective cannot impinge upon the favorable status of habitats and/or species in a Natura 2000 area. We must also remember the tourist and recreational values of undeveloped river valleys.

Power production and inland navigation

The hydroelectric potential of Poland indicates that hydroelectric power plants will never have any significant share even among renewable energy sources, which, for example, is reflected in Poland's Energy Policy until 2025. Nevertheless, very often electrical power production represents an additional function of a storage reservoir. Every time a power plant is planned for a particular location, even on existing barrages and dams, it should be assessed from the viewpoint of impact on the fish species listed in Appendix II of the Habitats Directive. All hydroelectric endeavors, both large and small hydroelectric power plants, should guarantee minimum evironmental flows (presently, these flows are often effectuated through the hydroelectric plant turbines!), as well as protection of fish and other organisms from injury and death in the turbines. One way to effectively achieve these objectives is to build the power plant outside of the river channel , with water transported to the power station via a derivative canal, and secure the turbine water intake and outlet with screens of a size adapted to the species and size of fish which they are to protect.

Similar to that of hydroelectric power is the situation of inland navigation, which at the moment, with the exception of fragments of the Odra River, has a minimal share in transport of goods in our country. Analysis of the possibilities for development of shipping should take into account total costs (among others, building and maintenance of water routes, loading and unloading infrastructure, environmental costs), as well as the seasonality of water transport (freezing, low water levels which cannot always be augmented). As an alternative to large depth navigation units , requiring river regulation work on a large scale and augmentation of flow, we must consider transport units adapted to the hydrological conditions of Polish rivers.

Fisheries

As far as fisheries are concerned, an alternative to storage reservoirs are, above all, ponds built outside the river channel , which are much more productive. The demand for fish can also be satisfied by catching fish in a natural river (with no impoundments) , all the more so that the range of species occurring in such a river is much more attractive from the consumer's standpoint.

A general recommendation whose objective is to minimize the impact of the already-existing structures that control free flow of rivers, including on fish and lamprey populations, concerns facilities enabling them to migrate both upstream and downstream. In constructing fish ladders, one must take into account all of the species of fish and lampreys which they will serve. A ladder can be considered effective when it can be found by at least 95% of fish migrating upstream, and the delay in migration caused by the necessity of discovering the entrance to the ladder and making their way through does not exceed a few dozen hours. Construction of fish ladders must be taken into account in investment costs; the necessity of maintaining their proper functioning and monitoring their effectiveness, on the other hand, must be included in operational costs. Fish ladder operation and maintenance must be assigned to the operator of the barrage, dam and/or reservoir.

In finishing these recommendations, we must emphasize that in making decisions concerning the building of storage reservoirs and barrages , we must also bear in mind the uncertainty of

economic forecasts, as well as various development scenarios. The fact that forecasts concerning water demand up until now have often been too high, remains exceedingly important. Likewise, forecasts from the 1990s of growing power demand in Poland have turned out to be wrong—despite over 10 years of economic growth, annual electrical power usage has practically not grown, and Poland still has considerable power reserves[20]. Another factor, aside from economic forecast uncertainty, which we must bear in mind with such investments as storage reservoirs, are global climatic changes and the resulting increased probability of occurrence of extreme events—both floods and droughts. The general principle should be to locate reservoirs only in the upper portions of a catchment area.

In relation to existing barrages at risk for erosion, we must always consider the variant of its modernization , letting the river sediments debris through the barrage (obviously, if this is possible, i.e. the sediments are able to reach the barrage) as well as artificial filling the river channel with sediments downstream of the barrage. [21].

For complete analysis of the need of a storage reservoir, hydrological investigations are always performed from the viewpoint of water resource variability, both within individual years and on a scale of many years (the occurrence of wet, average and dry years). In addition, for larger catchment areas, we must aim to assess the possibility of changes in hydrological conditions as a result of climate change. A significant warming could lead to milder winters and reduction of snow cover retention, which would consequently mean a limitation of spring inundations which are of particular significance for maintenance of proper natural conditions. These comments lead to the conclusion that the opinion concerning the influence of a specific reservoir on habitats and species protected in a Natura 2000 area should be formulated individually, without hasty transference of assessments from other locations characterized by sometimes completely different parameters, dimensions and extent of impact.

5.2 River and stream training

5.2.1 Social and economic justification

The necessity of undertaking training works in river and stream channels is generally justified by needs of flood control, protection of water intakes for population and the economic purposes, needs to maintain water depth essential for inland shipping, as well as protection of the river or stream channel and banks against erosion. Protection against erosion is of particularly great significance in the densely-populated valleys of rivers and streams in mountain and foothill areas. We could also add that river training structures often improve the working conditions of water intakes, but they are not always absolutely essential to their functioning. In the case of small lowland rivers, training works serve chiefly to maintain their draining function with respect to adjacent land amelioration schemes.

[20] Hille E. 2001. 'Ogólne uwarunkowania gospodarki energetycznej w Polsce: Implikacje dla oceny wariantów' ['General Conditions for Power Management in Poland: Implications for Assessment of Variants'] (App. 7 to *Studium kompleksowego rozwiązania problemów stopnia Włocławek: Prognoza skutków społeczno-ekonomicznych i środowiskowych* [*Study of a Complex Solution to the Problems of Włocławek Locks: Forecast of Social, Econcomic and Environmental Effects*], Manuscript, WWF Poland, Warsaw)

[21] Such a solution is used successfully on the Iffezheim locks in the Upper Rhine cascade.

Regardless of real needs, the obligation to regulate water levels is placed on water owners by the Water Law Act in art. 26 pt. 3[22]. The provisions of art. 67 show that '*regulation of natural water channels , so-called river training, serving purposes of flood protection and improvement of water usage conditions*', consists of, among other things, '*forming of the longitudinal e and e cross-section profiles of river channel, as well as of the horizontal pattern t of the natural water channel '*. If this formation is understood as straightening of a river, changing its slope by construction of a series of water impounding structures , changing the river channel bed into a canal with concrete walls, then reconciling the above obligation with the requirement of '*maintaining good e water status*' (Water Framework Directive) is unrealistic. The law should clearly designate conditions which must be fulfilled in carrying out river training works. It should also redefine such an ambiguous formulation as '*proper technical status of natural river channels '*, used in the aforementioned art. 26.

However, the greatest doubts are associated with adaptation of rivers to inland shipping. The answer to these fears is given by analysis of shipping demands, as well as economic analyses of prospects for development of water transport, which make it rather improbable that a large-scale program for expansion of navigation routes on Poland's rivers will be undertaken.

In reference to mountain rivers and streams, the following publication will certainly be helpful in the subject matter of the present chapter: *Zasady dobrej praktyki w utrzymaniu rzek i potoków górskich* [*Best Practices for Maintenance of Mountain Rivers and Streams*], accepted by the Minister of the Environment on 9 May 2005, prepared by a team of academics and practitioners from Kraków[23].

5.2.2 Negative impact on Natura 2000 species and habitats

Modification of river dynamics (change of flow conditions)

River training works almost always lead to acceleration of runoff and concentration of the river channel. Aside from changes in the river channel itself (e.g. increased depth, increased water velocity), they impact adjacent flood plain areas—e.g. shortening the time of inundation, eliminating the 'cleansing' element of the flood wave essential to maintain the open character of some habitats and preserve the dynamics of the system as a whole.

Simplification of habitat structure in the river channel and bank zone

River training (structures, deepening and changing the cross-section of river channel) causes changes in the structure of a water course: it shortens the length of meanders, eliminates the multi-channel and spreading character of the river channel. It leads to the disappearance of such structures as islands, sand bars and steep slopes, which in turn leads to the disappearance of an array of habitats, or to the withdrawal of species associated with these structures.

[22] 'Among the obligations of the owner of inland surface waters is: […] 3) regulation of water level or flow volume in natural rivers as well as canals, in accordance with the possibilities resulting from the water management structures located in these waters, as well as from hydrological conditions…

[23] Bojarski A., Jeleński J., Jelonek M.; Litewka T.; Wyżga B., Zalewski J. 2005. *Zasady dobrej praktyki w utrzymaniu rzek i potoków górskich* [*Best Practices for Maintenance of Mountain Rivers and Streams*]. Manuscript. Kraków.

Lowering of groundwater table

In some cases, erosion of regulated rivers causes their incision by more than 2 m depth. This leads to a complete break in connectivity between river channel and its bank zone as well as with the flood plain terrace.

Break in river channel continuity

Development of steeply-sloped rivers by means of small barrages or troughs creates barriers to migration of fish and other organisms. It also disturbed sediment transport processes.

5.2.3 Recommendations

The solutions proposed in earlier chapters relative to building storage reservoirs and barrages also apply with regard to river training works.. Decisions concerning the undertaking of river training works should take into account the sustainability of the solutions adopted and the expenses necessary to maintain the training structures.

Flood protection

In the case of river and stream regulationon account of flood protection needs, it must be recommended that every time, an analysis be performed of the investment in the context of flood safety in the entire catchment area. The questions to be answered include what the scale of the threat is (at risk could be human life or valuable infrastructure); whether acceleration of runoff in a given segment of the river will not cause a growth in flood phenomena downstream or worsen the situation by superposition of flood flows in the main river with flood flows originating from tributaries. Additional question is what scale of river training is essential – for example, one short groin can effectively divert the current from the base of the levee and there is no need to carry out training works on a larger segment of the river or close one of the river channels).

Protection against erosion

A fundamental alternative solution related to river training works intended for erosion prevention is to buy out land directly adjacent to the river. Another alternatives are exchange of that land for land located at some distance from the river channelbed, or financial compensation of endangered land owners, which often turns out to be much cheaper than structural operations such as bank reinforcement. Quite aside from the benefits to the natural environment, such alternatives are of sustainable character and, over a longer time frame, usually turn out to be cheaper than a constant ‘battle with erosion’. Mitigation of erosion can be achieved by appropriate bank management—installation and maintenance of permanent belts of herbaceous vegetation, as well as trees and bushes—and transformation of arable lands into permanent, extensively-used meadows and pasture lands. Securing of banks from access by farm animals, elimination of gravel excavation from river channels and elimination of common practices involving use of river channels as cication and logging trails, are only few examples which do not require huge expenditures and are ‘nature-friendly’ methods of preventing river channel erosion.

Small barrages securing existing structures (bridges, roads, buildings) against erosion should be constructed in the form of artificial rapids which do not represent barriers for fish and other organisms. Existing small barrages should be kept open, either by few dozen centimeters' high indentions in the sill to concentrate the flow, or by exchanging them for stone rapids in the case of higher barrages. This reduces costs, because it eliminates the necessity of building and maintaining fish ladders. A particular problem are small barrages built to control transport of sediments , which not only represent a barrier to the migration of organisms along water courses, but change the water course morphology downstream in an essential manner. Everywhere possible, they should be removed (obviously in stages), or at least modernized in such a way as to restore water course continuity and partly transport of sediments. The details of technical solutions concerning building of new structures and modernization of existing ones on the mountaineous water courses, as well as conditions for their removal, can be taken from the *Zasady dobrej praktyki w utrzymaniu rzek i potoków górskich* [*Best Practices for Maintenance of Mountain Rivers and Streams*] cited earlier.

An important recommendation concerning Natura 2000 river valley areas is renaturalization. On many valuable river segments, there exist river training structures which no longer fulfill any function (e.g. the river has lost significance for inland shipping, or as a result of horizontal migration of the river, there is no longer any risk of the levee being washed out). Their removal or non-renovation can in a superb manner provide variety in valley structure and improve habitat conditions, or increase the range of occurrence of species for whose protection a conservation site has been created. The same effects can be brought by specific actions aimed at recreating the natural features of degraded valleys (e.g. restoration of the meandering character of the river, recreation of deepwater-rapid sequences, abandonment of intensive agricultural usage of the flood plain terrace). Each time, the decision to remove a structure or take renaturalization action must be preceded by the same kind of procedure as in the case of a decision to erect new structures—including an environmental impact assessment.

5.3 Flood-control levees

5.3.1 Social and economic justification

Earth structures protecting adjacent areas from inundation during flood periods are called flood control levees or embankments. With the aid of flood levees, we protect cities, industrial centers, housing developments and villages, as well as transport routes and arable lands. Levees are constructed as continuous systems and are attached to high banks. In lowland areas, they represent a fundamental means of flood protection in every country of the world; in Poland, they began to be built already in the mid-13th century.

Among the virtues of flood control levees are their simplicity of construction, relatively low costs, and direct effectiveness. Their deficiency is the necessity of constant monitoring and maintenance, as well as relatively high risk of failure.

5.3.2 Negative impact on Natura 2000 species and habitats

Modification of river dynamics (change of flow conditions)

Levees cause a narrowing of the flood cross-section of the river, which causes an acceleration of flow velocity and builts-uip erosion processes in the river channel. In addition, cutting off the extensive flood plain areas causes a reduction of valley retention and an increase in the flood flow velocities. It can also cause a rise in flood water levels in the area between the levees, at the same time eliminating supply of water to the old river channels, so important for many Natura 2000 species and habitats.

Simplification of habitat structure in the river channel and bank zone

An essential flaw of flood levees are the difficulties they cause in regulation of water relationships in areas lying beyond the levees—the peculiar character of levees consists of cutting off a part of the valley from natural flood flows , as well as cutting the river off the natural inflow from small streams and from sub-surface inflow. Depending on the type of water supply to the valley and the operational effectiveness of the pumping system to drain water from the area behind the levees, building levees can cause a drop in water tables beyond the levees, or the opposite phenomenon—a constant inundation of some areas. Thus, aside from changes in water course and bank zone structure, similar to those which are the result of regulatory work, levees cause drying out of a part of the valley and degradation of breeding habitats, as well as withdrawal of the species associated with them.

5.3.3 Recommendations

Because levees are just one of many different ways to prevent floods, all comments and recommendations concerning flood protection appearing elsewhere in this publication are applicable here—especially the necessity of a catchment-area (basin) approach. In the present situation, deciding to protect some area by flood levees , we must consider in detail all reasons for and against their building (instead of building new parallel levees, it is often sufficient to limit ourselves to use of ring levees to locally protect intensively-used areas). The new approach in flood protection inclines us to revise the existing levees and abandon maintenance of those levees which do not protect persons or property, and negatively impact Natura 2000 areas. In applying economic accounting and charging a portion of of levee maintenance costs to the owners of the area under protection, it could turn out that dismantling levees protecting arable lands of low quality is in every way a rational solution[24]. Another solution which reconciles flood protection objectives with habitat and species protection objectives is to transform the area outside the levee into a flood polder. In such case, we need to ensure flow control in the polder beneficial from the viewpoint of habitats and species protected within the Natura 2000 network, i.e. inundating it in accordance with the natural flood cycle and at the water level appropriate for the given period.

Improvement of the status of valley habitats can be achieved by changing the manner of valley usage or limitation of its intensity. The possibility of financial compensation in the form of premiums for implementation of an agro-environmental program on a farm is particularly

[24] Dąbkowski S, Badowski A.. 2004. *Zasady gospodarowania na obszarach Natura 2000 w dolinach rzecznych - uwarunkowania gospodarki wodnej* '[*Principles for Management in Natura 2000 River Valley Areas—Conditions for Water Management*]. Manuscript, GWP Poland, WWF Poland

attractive in Natura 2000 areas—these premiums are increased by 20% relative to the base amount.

A solution which would reconcile the significance of extensive usage of grasslands for Natura 2000 sites with their flood protection function could be to implement a 'valley retention' package. Farmers could receive premiums in exchange for their agreement to periodic inundation of their lands located in the valley. At the same time, extensifikation of agriculture in areas immediately adjacent to a river is with all certainty beneficial in the long-term perspective of protecting water from diffuse pollution of agricultural origin.

5.4 Valley land reclamation (irrigation and drainage) systems

5.4.1 Social and economic justification

River valleys, on account of the soil features in their area, have always represented, in the past and now, a land particularly suitable for raising crops. Trying to inrease productivity, an essential role is played by the river, and the natural consequence of this fact are human attempts to magnify this impact. The task of land reclamation and drainage systems is to improve soil and water conditions in such a way as to obtain optimal conditions for agricultural development. In Poland, these systems are most often grassland areas. In particular, the operations of land reclamation systems lead to the elimination of surface inundation, rapid drainage of winter waters, and maintenance of the water table at a depth enabling proper aeration of the soil profile.

Properly operated –land reclamation systems lead to a manifold increase in agricultural productivity. We should not be surprised that in case of intensive agricultural development , this changes the river valley environment. Under such situation, important threats can occur to the natural environment, to habitats and the animal and plant species resident in them. At the other end of the spectrum are land reclamation systems whose use in agriculture is being discontinued. Many expert opinions concerning the operation of such degradated systems emphasize that often they exhibit predominance of drainage over irrigation functions, caused by devastation of hydraulic structures , as well as by long-term abandonment of water-impounding facilities, what in consequence leads in many areas to significant degradation of soil habitats. Separate comments must be formulated regarding the relationships between land reclamation systems and flood protection. Art. 70 of the Water Law Act states that agricultural drainage '*consists of […] protection of arable lands from flooding*', and art. 71 categorizes flood protection structures as '*fundamental water drainage*' facilities. Inclusion of flood safety measures in drainage contributes in large measure to the training of small water courses, often consisting of transformation of the river channel into a straightened canal of geometrically regular cross-section, with massive reinforcements of the river bottom and its banks. Such undertakings are commonly justified by the need to ensure floodwater runoff, but not infrequently, massive reinforcements are introduced unnecessarily in the meadow and forest

areas. These methods of flood protection do not find any justification and are not in accordance with the Water Law Act, as confirmed by the provisions of art. 63[25]:

> *In designing, executing and maintaining water management facilities, we must be guided by the principles of sustainable development, in particular, of preserving favorable status for waters and their characteristic biocenoses, as well as the need to preserve existing topography and biological relationships in the aquatic environment and in wetlands.*

This text of the law clearly resembles the formulations of the Water Framework Directive.

5.4.2 Negative impact on Natura 2000 species and habitats

Drying out of wetlands

Green pasture lands provided land reclamation infrastructure are an example of those naturally valuable areas which have been formed by human action. They are valuable for protection of species and habitats only on the condition of retaining water relationships which enable the occurrence of wet meadows. The danger is a drop in the water table, and in some situations, a break in their natural connectivity with surface waters, rapid drainage of flood waters, lack of possibilities for accumulating water in sluice ponds during dry periods, and mineralization of peat subsoil as a result of drying[26].

Change in the manner of usage

Favorable species and habitat protection status in grassland lands provided with land reclamation facilities can be maintained only on the condition of preserving its extensive usage. Thus, the danger is, on the one hand, intensification of usage—high pastured livestock density (>1.0–1.5 LU/ha), pasturing in small areas, intensive fertilization of hay-growing meadows and pastures, supplementary sowing of high-yield species and varieties of grasses, early start of pasturing and early harvesting, simultaneous harvesting of large surface areas; and on the other hand, abandonment of usage, thereby permitting secondary vegetation succession. Obviously, another danger is transformation of grassland areas into arable lands, as well as forestation of those areas.

5.4.3 Recommendations

We must consider resistance concerning land reclamation infrastructure built in the Natura 2000 network areas as justified, if these investments were to be implemented according to technologies proper to areas of intensive meadow or agricultural utilization. For areas under nature conservation, more appropriate are land reclamation techniques used in the forested areas. These techniques prefer pro-ecological—sometimes superficially very primitive—solutions in management of forest water courses and lakes, as well as wetland areas, oriented

[25] The text of art. 63 is cited in accordance with the amended version of the Water Law.

[26] An additional negative effect of peat mineralization is washing out of biogenes and eutrophication of surface waters downstream of the drained valley.

towards securing of local and naturally-formed water conditions whose preservation is essential to the existence of habitats to be protected.

Natura 2000 valley areas which have not been provided with irrigation and drainage facilities until now must be kept in their present state. In the areas already provided with land reclamation infrastructure, the basic principle should be an individual approach, dependent on local hydrological and habitat conditions, as well as pressure of farmers on the usage of existing technical infrastructure. As a general principle, in the case of areas abandoned by farmers, we must assume an aim to restore the former natural water relationships in the valley; at the same time we should support extensive usage of drainage systems in a case where farmers are interested in pasturing or in meadows harvesting. . The first of these recommendations can be effectuated via renaturalization operations, by permitting canals and ditches to become overgrown and shallow, initiating and accelerating bank erosion processes on straightened fragments of water courses, as well as by regulating water level and runoff by proper operation of gates in the small water impounding structures. In a case where there are no regulated weirs we must consider building them.

Another solution associated with maintenance of the present extensive agricultural usage is an issue much more complicated, associated with ensuring the economic effectiveness of such actions, as well as with maintaining and utilizing structural facilities in the condition ensuring proper soil moisture in the valley. In a case where these actions do not work, and in a situation where pasturing or harvesting has been abandoned, it is necessary to restore them by way of the specified protection operations, e.g. in areas with strong tendencies toward secondary succession, every few years we must cleanse the area of bushes that have appeared, as well as limit the development of reed areas.

5.5 River valley maintenance works

5.5.1 Social and economic justification

River valley maintenance works are associated both with maintaining and operating structural water management facilities (e.g. pumping stations, levees, reservoirs, canals), and with maintaining the river channel together with the area bounded by flood control levees in a condition ensuring safe passage of a flow which does not create flood risk. Maintenance works are oriented above all towards preserving the present status of the river and encompasses, among others local developments, such as protection of river banks, carried out at the express intervention of local governments and land owners; as well as protection of technical infrastructure (roads, power, gas and telecommunications networks, etc.).

Maintenance works, justified, above all, by flood protection needs, frequently encompass works aimed at concentrating and deepening the main course of a river, eliminating bends, meanders, branching in the river channel, as well as removal of trees and bushes from the area between the levees. All of these actions pose the danger of eradicating flora and fauna habitats formed there.

This type of maintenance works in water management has been used all over the world, although in Natura 2000 areas, it requires determination of its essential extent and intensity. For example, so-called 'cleansing' of river channels should be limited to places at risk for formation of ice jams, which cause water impoundmentss and in an essential manner increase the degree of flood risk. In the case of particularly valuable natural habitats (e.g. floodplain forest located between flood levees), an alternative solution permitting conservation of favorable habitat status and improvement of flood safety is, for example, widening of the area between levees.

In the context of maintenance works, particular attention should be paid to the river channels and the areas between levees, as well as riverbanks and water bodies turned into illegal waste dumps—with abandoned vehicle wrecks, worn-out household appliances, old tools, etc. Such devastation of the river and lake environment is not only a hazard to the natural environment, but also impedes runoff and has a negative impact on water quality.

We have high hopes for a consensus in this area, in conjunction with the process of implementing the European Union Water Framework Directive. Its main objective of '*maintaining favorable water status*' places special emphasis on conservation of natural aquatic environment, increases the importance of nature conservation, and calls for greater caution in conducting water management maintenance works in river valleys.

5.5.2 Negative impact on Natura 2000 species and habitats

Simplification of river channel and bank structure

Such a superficially minor intervention as removal of tree trunks from the river channel eliminates shelter for many animal species, changes feeding conditions andsimplifies the bank line. In turn, cutting down trees and bushes growing on the river bank, which are home to many invertebrates, limits the feeding base for aquatic organisms.

Change in thermal conditions

Removal of trees growing on river banks eliminates shade, which leads to a significant rise in water temperature, sometimes above the survival treshold for some fish species. This is particularly true in shallow mountain and foothill streams.

Limitation of habitat and species range

Cutting down trees growing on river banks and in the floodplain destroys one of the high-priority habitats protected by the Habitats Directive, which is a shelter for many animal species.

5.5.3 Recommendations

The above-mentioned river valley maintenance works in Natura 2000 areas must be limited to the essential minimum. Trees and other flow obstacles in the river channel can be removed in those justified cases where they could actually cause ice jams and increase flood hazard to persons or property.

Removal of trees must be preceded by hydrological analyses which should answer the question of the measure in which the trees represent a factor impeding runoff of water and ice, as well as

whether this creates a flood hazard. The extent of the removal should be limited to the minimum. A line of trees should be left on the bank of the water course (also on account of the trees' role in protecting the river banks against erosion). An exception would be removal of trees growing in acidic habitats, with the aim of improving the protection status of habitats and species sensitive to low-pH water.

Maintenance works should always be conducted outside of the reproductive season of birds and other animals. Destruction of the river channel and its banks during conducting the maintenance work must be avoided.

6 Recommended systems solutions

6.1 Reinforcement of river basin management

Proper water resource management, including conservation or restoration of favorable ecological status for habitats dependent on surface and ground waters, requires administration to be established on the scale of the entire catchment area. Institutions responsible for water management, drainage, spatial management and environmental protection, active in central and local government structures within specific administrative boundaries (municipalities, counties, provinces), are not in a position to resolve problems associated with water management which should be carried out within the boundaries of hydrographic regions (river basins, river catchments). For this reason, the Water Framework Directive emphasizes the importance of river basin planning and water resource management. The operational boundaries of regional water management boards indicate that in Poland, actions aiming towards water management adapted to the catchment area have already been undertaken. Despite these changes, an array of responsibilities concerning water management still remains in the hands of central and local governments operating within administrative rather than hydrographic boundaries.

Change in this area would certainly contribute to more effective implementation of various tasks associated with water resource management on a catchment-area scale. Such integrated water management represents one of the basic elements enabling the improvement in water status which is the principal goal of the WFD.

On account of the fact that water status, in light of new water policy, is described not only by chemical and physical parameters, but also by ecological parameters, a stronger emphasis on environmental aspects of water management than heretofore becomes a necessity. This will definitely require retraining and hiring of additional personnel at institutions responsible for water resource management. Bearing in mind the directions and requirements of the new water policy, it will become indispensable to hire personnel at these institutions well educated in the areas of biology and environmental protection. Retraining and hiring additional personnel shall permit the avoidance of many potential conflicts associated with water management in Natura 2000 areas—wetlands, river valleys, etc.—in which proper functioning of habitats and species depends to large degree on water relationships.

Preparation of personnel to manage the Natura 2000 network represents one of the essential conditions for efficient functioning of the network of protected areas. The scope of the training programs cannot, obviously, be limited only to issues directly connected to conservation of natural features in the Natura 2000 network, but should also, beyond this, include the entire spectrum of environmental protection and water management aspects, including issues of flood management as well as management of natural disaster situations.

Implementation of integrated water resource management plans for each river basin, together with a transfer of full ownership rights and 'water authority' to river basin (presently: water region) management boards, are a condition for achievement of the environmental objectives of water management, as well as for effective species and habitat protection in Natura 2000 river valley areas.

6.2 Integrated water resources management

The integrated water resource management conducted within the bounds of a catchment area, required by the Water Framework Directive, represents the basis for implementation in water management of the principles of sustainable development. In this regard, the present status of the Polish water management system, together with its institutional and organizational solutions, represents one of the most serious obstacles to the achievement of the environmental objectives of water management. In light of the Polish law, there are five government agencies presently responsible for water resource management. Additionally, there is no (??-JK) clear division of functions between water owners and the relevant water management agencies. While they do have an influence on the scope and conditions of water usage, the regional water management boards (RZGW) nonetheless do not possess authorization to issue water-law permits, which remain in the competency area of administrative institutions—county administrators and provincial governors. The boundaries of the competency areas for individual institutions managing water resources (river basin area, water region, province, county, municipality, National Park) significantly impede effective management within hydrographic boundaries. Additionally, the RZGWs do not possess legal competency in reference to a significant portion of inland waters. Smaller water courses, as well as a significant fraction of water management infrastructure, are administrated by the boards of land reclamation and water management , which are subject to provincial government authorities. On the other hand, it is the president of the National Water Management Board, together with the directors of the RZGWs, who is responsible for implementation of the Water Framework Directive in Poland.

The multitude of institutions responsible for the process of water management, in conjunction with different planning documents (which are being prepared within administrative rather than catchment-area boundaries), leads to conflict often due just to the poorly defined scope of operations and competency areas of individual institutions. The proper functioning of the Natura 2000 network in river valleys, which requires, among other things, the very concrete actions indicated in the previous chapters—and especially, precise water management—will represent an additional element complicating the water resources management process. Without putting the present water management decision-making structure and principles in order, it could become

exceedingly difficult to take into account different requirements of water management and to ensure at the same time the proper functioning of Natura 2000 areas.

In order to achieve the objectives of the Water Framework Directive, as well as, indirectly, ensure the effective functioning of the Natura 2000 network in river valleys, it is becoming necessary to define, in a transparent manner, the competency areas of the individual agencies responsible for water management. This purpose could be served by granting full water ownership rights and administrative decision-making authority to the river basin management boards.

6.3 Integration of plans and programs

For proper management of water resources and of the associated natural environment, it is exceedingly important to prepare in advance and integrate plans and projects to be implemented in various regions, prepared by various professional communities and different interest groups.Different aspects of economic utilizatin of water, water transport, power production and conservation of river valley features will always accompany the various projects and programs being initiated. Such different, often mutually exclusive economic and environmental expectations do not always have to be a source of conflict. Early ‘confrontation’ of plans with the assumptions of sustainable water management on the scale of an entire basin can lead to exclusion or else adaptation of some elements of regional plans due to water management conditions in the river basin. It is integration of local plans and adaptation of ‘regional’ expectations to the plan for water management in the entire river basin which must become everyday practice at institutions responsible for water management and environmental protection.

Implementation of local projects whose scope of investment remains within the boundaries of a muncipality or county can result in changes in water relationships, and even water parameters themselves, in areas located in another part of the river basin. Lack of integration of the local spatial development plans with river basin management plans can result, for example, in deterioration of ecological status in another fragment of river basin. For this reason, practical application of the principle of not permitting deterioration of the present ecological status in areas of high natural value, as well as of the principle of compensating losses in the natural environment, has a chance of success only if there is an appropriate linkage of local spatial development plans with river basin plans, of which registers of protected areas (including Natura 2000 areas) are an inseparable element.

The present multitude of planning documents, as well as the unclear links and lack of hierarchy among them, make transparent and efficient water resource management impossible. It is becoming necessary to implement top-down limitations in spatial development plans for floodplain and wetland areas, as well as for those with limited access to water resources. Plans prepared for the entire river basins must take into account water needs of water-dependent natural habitats and species, and cannot lead to deterioration of their favorable protection status in Natura 2000 areas. During the preparation of integrated plans for water resources management

within the boundaries of a river basin, all long-term governmental, sectoraland regional programsin any way affecting water resources - must be subject to verification.

6.4 Monitoring and information flow

The functioning of the Natura 2000 network, together with protective activities being carried out, as well as their relationship with water management, must be the subject of constant monitoring. Within the scope of data collected, aside from information referring to water resources and water relationships, we must include data referring to the status of habitats, number and structure of populations, as well conditions for existence of species under protection. The scope and frequency of information exchange between the institution managing the area under protection and the river basin management board (RZGW) should be precisely designated via an appropriate decree from the Minister of the Environment.

Endeavors associated with investment, production and exploitation activity which could influence the status of Natura 2000 areas—and in particular, of rare fauna and flora species and habitats,must be thoroughly analyzed by the RZGWs and by services managing Natura 2000 areas, already at the planning stage, with an eye to their potential impact on the environment. Depending on the degree of environmental impact determined, alternative plans must be prepared (in case it is determined that they will have a significant impact on Natura 2000 sites) or, where the implementation of the endeavors in question is unavoidable, compensatory actions must be proposed (in accordance with the procedure following from Art. 6(4) of the Habitats Directive. This will require not only close cooperation, but also good information flow between the institutions responsible for nature conservation and those responsible for water management. In Natura 2000 network areas located in river valleys, constant monitoring of the operation of hydraulic structures is required—not only of those used by water managers or administrators, but also those utilized by water users. The purpose of that monitoring is to identify that water management facilities' and hydraulic structures' that impact water relationships in specific catchment areas, important for protected species and habitats. These data should be supplemented with data obtained by state services—meteorological and hydrological, as well as hydrogeological—in the course of the everyday activities following from their statutory obligations. After preliminary processing and verification, monitoring results should be transmitted to the managers of individual Natura 2000 network areas. Even in the case of planned renovation (repair) work on hydraulic structures, which could temporarily have a negative influence on the status of habitats and species, this work must be reported to and consulted with the institution managing the Natura 2000 area. For this reason, it would be recommended to create a coherent information exchange and analysis system, as well as guarantee its efficient use by trained personnel at institutions involved in environmental protection and water management. This would make it possible, already at the planning stage (and not only later at the construction stage of the investment), to take into account the environmental needs of the given catchment area and its associated water-dependent habitats and species.

Development and maintenance of databases should be subject to coordination, to ensure compatibility of records with the software being used. This compatibility is a condition for effective information exchange, and is necessary for efficient transfer of data to the 'central' database, which should be located at the river basin management office.

6.5 Communication and community participation

Ensuring appropriate community participation in the decision-making process is necessary in both the planning and the implementation phase of both nature conservation and water management tasks. The majority of conflicts associated with watermanagement in river valleys result from different expectations of individual interest groups, and from ignoring of the significance of community participation in decision-making. Water management in Natura 2000 areas, on account of their nationwide significance and international obligations following the European Union accession treaty and directives, as well as on account of links with many aspects of the economy, can be effectively carried out only by obtaining public acceptance of the objectives and methods of conservation. Conservation of natural features in many areas requires active involvement of local communities in protective operations. In the case where nature conservation is carried out 'by the people for the people', the chances of habitat and species preservation are very good. In a case where protective considerations require implementation of limitations on usage in given areas, conflict situations arise. The situation is similar to that of water management—investments which meet with community resistance have negligible chances of implementation. Thus, it is exceedingly important to maintain good community communication already at the stage of programming and planning of actions, both in nature conservation and in water management.

The Natura 2000 network, despite popular opinion, is not a restrictive form of environmental protection requiring implementation of any significant changes in the previous manner of utilization of a given area. The principle for the functioning of this network is, above all, 'not to permit deterioration of the present status', as well as to support (among others financially) the carrying out of management to improve the status of habitats and species at risk. However, ineffective popularization of the operational principles of the Natura 2000 network, as well as the fact that it is a new form of nature conservation, previously unknown in Poland, have contributed, already at the stage of designating the areas, to a negative attitude on the part of many communities. In order to clarify these misunderstandings, a nationwide information campaign in this area is needed.

In order to achieve a compromise among the many, often opposing interests of various communities or sectors, it is necessary to 'socialize' the decision-making process. This can take place in the form of community negotiations and discussions, as well as inclusion of community representatives in decision-making bodies. The function of such bodies can be fulfilled by river basin councils created on the French model. In this context, we must consider the possibility of legislative changes which would enable a true representation in these councils of the interests of various water users (including those involved in the management of Natura 2000 areas), as well as the granting such councils with decision-making and not just advisory authority.

6.6 International cooperation, cross-border issues

The borders of Poland, for the majority of their length, run along lines which are topographically characteristic—along the Baltic coast, along the Odra River, the Nysa Łużycka River and the Bug River, along the main peaks of the Sudety Mountains and the Carpathians. Natural environment relationships permeate these lines, which makes it necessary to implement nature conservation in cross-border (transboundary) and international terms. These circumstances take on particular significance for the Natura 2000 network and areas located in the valleys of international border rivers.

Management of nature conservation and implementation of conservation tasks in transboundary areas must not only take into account the natural characteristics of the environment in areas on both sides of the border, but also differences in the legal regulations of the neighboring countries. The functioning of the Natura 2000 network is controlled by the guidelines of European Union directives, and coordination of its implementation in the Community Member States is regulated by commonly-recognized legal norms. A different situation arises when the area on the other side of the border belongs to a state which is not a member of the Community. This takes place in reference to the border along the Bug River with Belarus and Ukraine (the Bug valley is an element of the Natura 2000 network). The universally-acknowledged appropriateness of nature conservation at an international forum should become a basis for cooperation among States belonging to various groups, and transboundary problems should be resolved in reliance on universally-accepted principles expressed in documents from international conferences devoted to conservation of the natural environment (Rio de Janeiro, Dublin, Johannesburg), as well as on relevant conventions and other documents of the United Nations. The inclusion of these principles in relevant international agreements should represent the legal basis for implementation of the objectives of the Natura 2000 network in areas such as the Bug River valley.

It could be suggested that we introduce clauses into these agreements, concerning the need to protect habitats, with an indication of concrete species proper to the areas of the States encompassed by a specific agreement, in anticipation of joint conservation activity planning.

Another forum for international cooperation in the Natura 2000 network should be academic contacts, conferences, seminars and symposia, as well as exchange of information and experiences in specialized publications. The availability of foreign literature should be increased by translating selected publications.

7 Conclusions

This document, having the character of a compromise among various interests, shows that the interests of water management can be reconciled with those of nature conservation in Natura 2000 river valley areas. Without doubt, there exists a need to continue work on principles of functioning for the Natura 2000 network, as well as to search for solutions which will permit achievement of both nature conservation and water management objectives, in accordance with the principles of sustainable and balanced development.

Further activity in this area should be manifested in, among other things:

- Formulation of legal acts associated with the Natura 2000 network in a more precise manner, transfer of the principles of European Union law to national legislation, as well as care taken to ensure that the specific character of Poland's natural conditions finds its rightful place and reflection in Union regulations;
- Collection of experiences from the environmental protection reinforcement process, including from execution of nature conservation tasks in the Natura 2000 network; and, on the basis of these experiences, continued reform and fine-tuning of legal regulations, as well as improvement of management organizations and institutions;
- Preparation of detailed guidelines, norms and instructions concerning both natural environment issues and management, economic, investment and technical issues;
- Preparation, on the model of the [*Poradniki ochrony siedlisk i gatunków Natura 2000*] *Handbooks on Natura 2000 Habitat and Species Protection*, of a detailed methodology concerning principles for water management in Natura 2000 areas;
- Undertaking complex studies and academic papers, with particular attention paid to methodology for analyses and assessments, to definition and selection of criteria, and to algorithms and calculation procedures as tools for formulation of decisions;
- Further involvement of technical specialists in nature conservation and environmental management decision-making processes; and of nature scientists, in water resources management, especially in investment endeavors;
- Inclusion of nature conservation and expansion of its scope in course syllabi at institutions of higher learning in technical fields and in economics, as well as further implementation of elements of technical knowledge at institutions of higher learning in the area of natural sciences.

Coordination of the tasks mentioned above will be possible only through cooperation between water management specialists and nature conservation experts. Close collaboration of services and forces responsible for water management and nature conservation should also apply to all their joint efforts to obtain Union's financial support for protection activities in river valley areas selected for the Natura 2000 network.

Implementation of the Water Framework Directive and principles regulating the functioning of the Natura 2000 network in river valleys is a joint task for the Polish water management and nature conservation services for the next few years.

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