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## Management of water resources in rural areas: the Polish approach

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**Abstract:** The Water Framework Directive (WFD), whose basic aim was to create a legal background for water bodies' protection, undoubtedly affects all economic sectors. Being a specific and distinctly different water user, agriculture will have the greatest share in the implementation of WFD out of all sectors of national economy. This results from its special character (60% of the country area used by agriculture), large volume of water consumed by evapotranspiration, diffuse pollution etc. Implementation of WFD will call for undertaking of many activities to restrict an unfavourable impact of agriculture on water resources and water related ecosystems. It is assumed that agriculture should also protect water resources. Accomplishment of this task imposes significant changes in the land use of river basins. Water management can be an essential factor deciding about the sustainable development of rural areas and biological diversity of agricultural landscape. Actions undertaken so far to implement the WFD are mainly limited to the protection of water quality from agricultural pollution. It is also necessary to undertake implementation of other aims of WFD. This refers especially to the provision of good hydromorphological status of water bodies, protection of water related ecosystems and effective water use.

Key words: *agriculture, rural areas, Water Framework Directive, water resources, wetlands*

### INTRODUCTION

According to the Polish Water Act (Water..., 2001) some surface waters are distinguished for their significance for agriculture. Ownership duties in respect to these waters (small rivers, irrigation canals and ditches) are performed by speakers (*Marszałek*) of the voivodships and care of the waters is within the responsibility of voivodship (province) boards of reclamation (irrigation and drainage) and water facilities. The rest of water bodies (bigger rivers and canals) are managed by the Regional Water Boards. At present over 36% of agricultural lands (i.e. 18% of the total area of the country) are equipped with various reclamation (irrigation and drainage) facilities (Table 1).

**Table 1.** Basic reclamation infrastructure

Item	Unit	Number of units
A. Areas equipped with draining systems	thous. ha	6 690
– covered drainage (arable lands)	thous. ha	4 725
– ditches (grasslands)	thous. ha	1 965
B. Rivers and channels used for the needs of agriculture		
– non-regulated rivers of a bottom width > 2.0 m	km	24 796
– regulated rivers and channels	km	49 588
– streams and ditches of a bottom width < 2.0 m	km	283 746
C. Irrigated croplands 1991/ 2002		
– total irrigated area	thous. ha	481 / 101
– irrigation of arable lands and orchards	thous. ha	62 / 5
D. Water reservoirs		
– number		185
– retention capacity	mln m <sup>3</sup>	170

The present methods of counteracting droughts and floods are based mainly on technical measures like construction of water reservoirs, flood embankments, draining systems etc. In many cases the obtained economic effects have not been satisfactory and resulted in environmental losses. It is necessary to look for other methods of improving the structure of water balance.

The prospective fulfilment of water demands and evaluation of natural resources enforce the search for new, more nature-friendly methods of water management also including small rivers and ditches. These views are reflected in the Water Framework Directive which has established the framework for common water policy. Implementation of the WFD requires undertaking many activities in rural areas (Water..., 2003). It is necessary to change the management of agricultural water resources. It might involve activities leading to the enlargement of potential retention capacities of small river catchments.

Some actions to protect water resources in rural areas have been undertaken in Poland with a variable success. In most cases the rationale for these actions is to protect surface water quality. Actions aimed at protecting quantity and retaining water resources are undertaken to a lesser extent. There are some projects, undertaken for purposes of wetland flora and fauna protection which have a positive effect on water balance.

This paper presents basic actions associated with implementation of the Water Framework Directive in rural areas. Legal, organisational and financial conditions determining the maintenance of agricultural water resources in a good ecological status are described.

## AGRICULTURAL WATER RESOURCES

Reclamation infrastructure is very rich. It comprises, in particular, over 70 000 km of rivers and channels included in the so-called basic reclamations. Moreover, 280 000 km of small streams and ditches are managed by owners of reclaimed grounds. Noteworthy, at present some 100 000 hectares are irrigated while several years ago irrigation involved the area of 500 000 hectares (MIODUSZEWSKI, 2003).

Small area of irrigated grounds does not mean little water consumption. Plant production and forestry are the greatest water consumers. Riverine outflow equals less than 30% of precipitation. More than 40% of precipitation is used by rainfed agriculture and 25 by forestry (MIODUSZEWSKI, 2006).

Actually, over 5% of riverine flow is taken up by industry and municipalities. Most of this water, however, in a form of more or less treated sewage returns to the water cycle in contrast to the water taken up by vegetation, which is as a whole turned into water vapour.

It is clearly seen that agriculture and water demands of plants in general (including forests) play a significant role in water cycling in nature. Therefore the agriculture water resources are a key factor in implementation of the Water Framework Directive.

## CONDITIONS FOR IMPLEMENTATION OF THE WFD IN RURAL AREAS

The Water Framework Directive contains a list of actions necessary to achieve its goals. Basic actions pertaining to agriculture and water resources in rural areas include:

- preventing water pollution from agricultural diffuse sources,
- protection of drinking water and ground water aquifers,
- securing adequate hydromorphological status of waters (good ecological status of surface waters),
- protection of water-related ecosystems,
- promotion of effective and sustainable water use -as regards both irrigated and non-irrigated crops,
- providing the return of water services.

The Water Framework Directive (WFD), whose basic aim, as it is shown above, was to create a legal background for the surface and ground water protection, undoubtedly affects all economic sectors like agriculture, industry, transport, tourist infrastructure, rural and municipal sewage treatment plants. Implementation of the WFD will call for undertaking many activities to restrict an unfavourable impact of the economy on water resources and water related ecosystems (Directive..., 2000; Kodeks..., 2002; Ustawa..., 2001).

Being a specific and distinctly different water user, agriculture will have the greatest share in the implementation of the WFD out of all sectors of national economy. It comes out of its spatial character (60% of the country area used by agriculture), large volume of water consumed for evapotranspiration, diffuse and dispersed pollution, regulation of water relations (irrigation and drainage) in large areas including these of special natural value (for example the area under Natura 2000). During the III World Water Forum in Kyoto it was underlined (MIODUSZEWSKI, 2003) that water management in agriculture is largely responsible for the status of the natural environment and for providing food for increasing number of people. There is a reasonable fear of the shortage of water to produce appropriate amount of food on the global scale. It seems that this fear does not pertain to Europe. Nevertheless, access to water may soon become a barrier restricting agricultural production in European countries including Poland. Limited water resources and their poor quality may also exert unfavourable impact on natural environment.

The accomplishment of these tasks requires agriculture to assume some duties and observe restrictions.

Application of basic agro-technical principles from the Code of Good Agricultural Practices (Kodeks..., 2002) is thought necessary to restrict diffuse pollution. One should understand that the farmer who applies good agricultural practices fulfils the requirements of releasing permissible loads of pollutants.

In areas particularly important for the protection of the quality and amount of water resources it might be necessary to issue some additional restriction of agricultural use. It applies e.g. to buffer zones of surface and ground water intakes. Some restrictions may also be issued in river valleys (flood control) and in wetlands (water related ecosystems).

Plans for the protection of water resources may require purchasing some grounds e.g. for the restoration of a meandering river channel in order to obtain good hydromorphological system, for constructing polders to control floods or for protecting particularly valuable wetlands (conservation).

Separate question is to provide, according to the WFD, an effective and sustainable water use. The latter refers to exploitation of draining and systems irrigation and maintenance of streams – receivers of water from drainage systems. Rich reclamation infrastructure offers many possibilities of water management for agriculture purposes, taking into account the necessity of protecting the quality and amount of water resources. Basic activity in the light of nature protection should aim at restricting rapid water outflow from both objects equipped with draining ditches (grasslands) and draining objects (arable lands).

## WATER-RELATED ECOSYSTEMS – PRESENT STATUS AND THREATS

The notion of “water-related ecosystems” has been taken from the Water Framework Directive of EU and has not been clearly defined so far. It is commonly understood as a synonym of “wetlands”, “hydrogenic sites” or “wet areas”. Wetlands mean the areas overgrown by hygrophilous vegetation or covered by surface deposits accumulated by water (peat, mud, alluvia).

Wetland areas in a broad sense occupy 4 345 400 hectares, i.e., around 14% of the country area. It is estimated that 15% of the total wetland area (both natural and transformed) is covered by forests and shrub communities. The remaining part is occupied mainly by grasslands and also sometimes by croplands.

Over 80% of wetlands, including hydrogenic forest sites, have been drained in order to intensify forest and agricultural production. Lack of data does not allow to evaluate the transformation of all wetlands, their utilisation and preserved natural values. Detailed inventory was performed only for peatlands (Table 2). The data presented demonstrate that only roughly 9% of peatlands preserved their natural or close to the natural status.

**Table 2.** Utilisation of peatlands (www.gridw.pl/raport)

Land use	Area	
	thousand ha	Percent
Natural peatlands	12.0	8.8
Meadow utilisation	960.0	70.7
Forests	120.0	8.8
Former peatlands (with surroundings)	150.0	11.0
Protected peatlands	6.1	0.4
Exploited peatlands (peat digging)	2.5	0.2
Total	1 358.6	100.0

Only on 25% of drained wetlands there is a potential possibility of irrigation with the so-called subirrigation i.e. through the maintenance of a high water table in draining ditches during the growing period. Now, irrigation is carried out only on 100 000 hectares (Table 1), i.e. on 5% of the drained areas. Lack of irrigation poses a threat to both natural environment and water balance of the catchment. Spring waters are drawn down very fast, increasing the risk of floods and resulting in water deficits in the summer time.

The principle of legal protection of water-related ecosystems was first clearly formulated in the new Water Act of 2001 within the adaptation of Polish legal regulations to the Framework Water Directive of EU. It should be underlined, however, that various actions to stop wetland draining had been undertaken before

by the ecological NGOs. Withholding in 1984 of further drainage of the valuable anastomosing Narew River valley, which was planned to be turned into intensive meadow and pasture area could serve as an example of such actions. In 1998 the Committee for Reclamation and Engineering of Agricultural Environment of the Polish Academy of Sciences postulated protection of drained and agriculturally used hydrogenic sites. The Committee underlined the necessity of restricting fast water outflow from such sites. Unfortunately, these postulates have not been implemented.

Fundamental legal acts regulating actions aimed at wetland protection are the Environmental Protection Act and Nature Protection Act. Both do not deal directly with water-related ecosystems but create possibilities to protect them. The Environmental Protection Act obliges every investor to prepare the environmental impact assessment. This is also obligatory in the case of constructing drainage-irrigation systems. The Nature Protection Act formulates the principles of legal protection of valuable areas, including wetlands.

Polish accession to the European Union poses a threat to wetlands but also creates some chances of increasing the extent of protective measures. The threats stem from the enlargement of farm sizes and intensification of agriculture. The cases of liquidation of protected wetlands on private grounds (new big farms) are already known. The chance for wetlands lies in abandoning agricultural use of grounds difficult for cultivation. They might be legally protected.

Environmental protection is included in the formulated plans of rural development, agro-environmental programmes and in the implemented code of good agricultural practice. The documents pay considerable attention to the protection of water quality in rural areas but practically neglect the problem of protection and restitution of wetlands. Also they do not involve the question of appropriate water management of irrigation-drainage systems in grasslands situated in wetlands. It seems that protection of wetlands in the agricultural landscape should find appropriate solution in further reformulation of these documents.

Protection of wetlands is a part of the programme Natura 2000. Areas designated for legal protection encompass river valleys, peatlands and other water-related ecosystems. The programme involves 11% of country area.

Twenty-three most valuable areas covering in total 314 527 hectares (Table 3) were given the highest protective status of national parks.

Mainly forest habitats (60.7%) are protected but waters (7.2%) and water-related sites (12.1%) are present in practically every national park. Three national parks (Biebrza National Park, Narew National Park, Warta River-Mouth National Park) were, however, established chiefly for the protection of valuable wetlands.

Wetlands are included in other forms of legal protection. Two large landscape parks of an area of several thousand square kilometres (Landscape Park of the Narew Valley and Landscape Park of the Lower Odra) are situated in river valleys.

**Table 3.** Habitat types in national parks

Habitat	Area	
	ha	%
Forests	190 730	60.7
Agricultural lands	43 823	13.9
Waters	22 749	7.2
Lands of ecological use (wetlands)	37 927	12.1
Other	19 298	6.1
Total	314 527	100.0

There are many (several thousand) small protected areas in Poland, sometimes of an area of several dozen to several hundred hectares. They are mainly natural reserves and the so-called plots of ecological use. At least half of these objects was created to protect aquatic ecosystems or hydrogenic sites. They diversify agricultural landscape and play positive role in water cycling within small river catchments.

In spite of past destruction, there are still many valuable wetlands which are not legally protected. A part of them can be found in areas abandoned by agriculture but some are situated on grounds, where an intensive development of agriculture is being observed. There is a reasonable apprehension that a part of these sites might get liquidated.

It looks that from the point of view of WFD and other nature protection acts including the program Natura 2000 it is not possible to maintain an intensive agriculture use on the majority of grassland areas. The level of agriculture and the method of land use should be adjusted to the nature value of river valley. The economic side of such agriculture is a difficult problem to solve.

#### SMALL WATER RETENTION DEVELOPMENT PROGRAMME

To improve water balance in rural areas, the Minister of Agriculture in cooperation with the Minister of Environment established in 1995 a programme for the development of small water retention. The programme involves a whole set of actions aimed at increasing retention capacity of small river catchments dominated by agricultural use. Actions associated with the protection of water-related areas fell into the agreed priority directions. Such directions include:

- reconstruction, modernisation and construction of water structures in the existing drainage systems in order to increase the water level in streams and ditches, to use water for agricultural irrigation (groundwater level management), to slow down the outflow of surface waters and to protect peat soils,

- improvement and modernisation of draining-irrigating systems to implement the results of ecological surveys in order to preserve biological equilibrium of these biotopes,
- construction of water structures on streams to elevate ground water level in the surroundings,
- retention of spring, snow-melt and rain waters in ponds, water holes and terrain depressions.

Some tasks of the small retention programme are similar to those of WFD. Especially in the field of wetland protection (water related ecosystems), small river revitalization (good ecological state of surface water) etc.

Data presented in Table 4 show that the programme and its implementation focused on technical solutions consisting mainly in construction of small water reservoirs and in construction of hydraulic structures (weirs). Protection of wetlands that would include the improvement of water management in drained hydrogenic sites was realised with much less intensity.

**Table 4.** The accomplishment of the small retention programme (mean annual values from 1997–2003)

Item	Number of objects		Capacity (retention)		Investment costs	
	items	%	10 <sup>6</sup> m <sup>3</sup>	%	10 <sup>6</sup> EURO	%
Lake water lifting	30	7.4	11.0	62.3	0.52	3.8
Water reservoirs	84	20.7	3.3	18.9	7.42	54.8
Fishponds	107	26.5	2.2	12.7	1.35	10.0
Weirs on rivers and channels	110	27.5	0.7	4.2	3.45	25.4
Weirs on small streams and draining ditches	53	13.1	0.1	0.4	0.17	1.3
Other	21	5.1	0.2	1.5	0.62	4.7
Total	405	100	17.5	100	13.53	100

Most weirs listed in Table 4 were associated with the improvement of water conditions in river valleys and so they pertain to water-related ecosystems. Remarkable was a small number of such constructions in ditches which proves little care paid to the improvement of ecological status of hydrogenic sites and underestimation of their role as the regulators of water relations. Noteworthy were also numerous fishponds. They were mostly dug out in the terrain depressions or in river valleys. Construction of a fishpond was often combined with peat digging and removal and thus with the destruction of the originally existing hydrogenic site.

It seems that, in spite of some imperfections, the programme for the development of small retention plays a positive role in improving the structure of water balance in rural areas. A part of financial aid is directed to the improvement of wa-

ter relations in wetlands. Therefore the programme of small retention can be recognized as some way for implementation of WFD in rural areas, besides that many of the undertakings are more connected with economical use of water and less with the protection of water resources.

## THE ROLE OF COMMON AGRICULTURAL POLICY (CAP) IN IMPLEMENTATION OF THE WFD IN RURAL AREAS

Implementation of the WFD has been initiated in Poland. Various actions (including planning) are being undertaken by regional boards of water management and coordinated by the Ministry of Environment. Agricultural problems, with the exception of diffuse pollution, are considered to a small extent. On the other hand, water management is underrepresented in plans of rural development (part of CAP) prepared in the Ministry of Agriculture and Rural Development (Sector..., 2003).

The first stage of official implementation of the WFD in rural area was focused on activities that should limit diffuse pollution from agricultural sources. That resulted from the necessity of implementing the so-called Nitrate Directive. Areas sensitive to nitrate pollution were delineated and principles of land use on these areas were elaborated (Order of Directors of the Regional Boards of Water Management).

Sector Operational Programme “Restructuring and modernisation of food sector and development of rural areas” for years 2004–2006 has been prepared. The priority “supporting changes and adaptation in agriculture” includes an activity entitled: “management of agricultural water resources”. That part of operational programme is aimed at:

- better utilisation of productive means (e.g. fertilisers),
- improving yield stability and quality,
- improving the effectiveness of agro-technical measures,
- protecting croplands against floods.

Activities planned under the heading: “management of agricultural water resources” continues former technical activities directed to more effective agricultural utilisation of soils. In this context, detailed studies are necessary to elaborate methods for realisation of planned works which would agree with the principles of the WFD and would not disturb the functions of areas encompassed in Natura 2000.

Implementation of the Code of Good Agricultural Practices (Kodeks..., 2002) and establishment of agro-environmental programmes are important actions in view of water management and protection of water resources. The Code contains important declarations on implementation (dissemination) of appropriate agro-technical methods, which would decrease pollutant emissions and improve the quality of surface and ground waters. It does not, however, consider water man-

agement in irrigation-drainage systems as a method applied to restrict pollutant flux. There are no rules on proper exploitation of these systems in view of water resources protection and resulting from the necessity of restricting mineralisation and degradation of organic soils, which is a basic requirement of the WFD.

Much hope for implementation of proper methods of water management seems to be associated with the agro-environmental programmes. The present proposals in that matter involve seven agro-environmental packages (Sector..., 2003 – [www.mos.gov.pl](http://www.mos.gov.pl)), including two which to some extent refer to water quality protection, namely:

- protection of soils and waters: using aftercrops to increase plant coverage of soils in the autumn-winter period,
- buffer zones: formation of 2–5 m wide belts of grassland at the border between croplands and surface water bodies in order to limit negative impacts and protect sensitive sites.

Both packages may be implemented only in priority zones established within voivodships. So, the scope and aims of agro-environmental programmes in their present version do not involve the problems of water resource protection. They also do not consider any activity within the scope of water management which might largely be decisive for natural values of agricultural and forested areas (e.g. wetland protection).

## CONCLUSIONS

All analyses and considerations indicate that changes in agricultural utilisation of river catchments are necessary if we want to have rivers of good ecological status with clean water.

Water Framework Directive does not refer directly to water demands of agriculture (irrigation, drainage) as it does not consider other water users. Directive in many points refer to waters “significant for agriculture”. One of the most difficult problems arising from the WFD is the assessment of ecological status of surface waters, whose ownership is executed by the Speaker (Marszałek) of the voivodship. These are usually small streams of a great total length where it is difficult to distinguish between natural and artificial or highly modified sections.

A separate problem is constituted by the need of implementation of comprehensive water management within the confines of small catchment basins dominated by agriculture. Water demands of agriculture based, e.g., on atmospheric deposition should be an important element of the whole water management in the catchment including both quantitative and qualitative aspect of water balance.

Actions undertaken so far to implement the WFD are mainly limited to the protection of water quality against agricultural pollution. It is an important issue, whose consideration should be continued and in many cases intensified and ex-

tended (to include e.g. the protection of alimentation areas). However, it is also necessary to undertake implementation of other aims of the WFD. This refers especially to the provision of good hydromorphological status of surface waters, protection of water related ecosystems and effective water use.

The presently elaborated Operational Programme of the Development of Rural Areas for the years 2007–2013 should help in implementing the WFD in rural areas. According to recommendations of the European Union the programme predicts rewarding farmers for difficulties associated with the implementation of the WFD. Water issues should also be considered in agro-environmental programmes. Noteworthy, documents of the EU strongly underline that programmes for rural development should, at least partly, be coordinated at the catchment level and combined with the programmes of land management there, which should enforce close cooperation between institutions responsible for rural development with those managing water resources.

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## STRESZCZENIE

**Gospodarowanie zasobami wodnymi na obszarach wiejskich w Polsce**

Słowa kluczowe: *mokradła, obszary wiejskie, Ramowa Dyrektywa Wodna, rolnictwo, zasoby wodne*

Jednym z trudniejszych do rozwiązania problemów, wynikających z postanowień Ramowej Dyrektywy, jest ocena stanu ekologicznego wód powierzchniowych, w stosunku do których prawa właścicielskie reprezentuje marszałek województwa. Są to małe ciekie, lecz o bardzo dużej sumarycznej długości, gdzie bardzo trudne jest rozróżnienie, na ile są one wodami sztucznymi lub silnie zmodyfikowanymi. Równie ważnym zagadnieniem jest ustalenie sposobu wdrażania kompleksowej zlewniowej gospodarki wodnej w granicach niewielkich zlewni, w której dominują potrzeby rolnicze. Potrzeby wodne rolnictwa, w tym również bazującego na opadach atmosferycznych, powinny być ważnym elementem całościowej gospodarki wodnej w zlewni, obejmując zarówno jakościową, jak i ilościową stronę bilansu wodnego. Podejmowane dotychczas działania w zakresie wdrażania RDW ograniczają się głównie do ochrony jakości wód przed zanieczyszczeniami rolniczymi. Jest to ważne zagadnienie, którego realizacja powinna być kontynuowana, a w wielu przypadkach intensyfikowana i rozszerzana (np. ochrona obszarów zasilania wód podziemnych). Konieczne jest jednak podjęcie również działań nad wdrożeniem pozostałych celów RDW. Dotyczy to szczególnie zapewnienia dobrego stanu hydromorfologicznego cieków, ochrony ekosystemów od wód zależnych, efektywnego korzystania z wody. Istotną rolę we wdrażaniu RDW na obszarach wiejskich powinien odgrywać opracowywany obecnie Program operacyjny rozwoju obszarów wiejskich na lata 2007–2013. Zgodnie z zaleceniami Unii Europejskiej, w programie tym przewiduje się odpłatności dla rolników za utrudnienia wynikłe przy wdrażaniu RDW. Problematyka wodna może być również uwzględniana w programach rolnośrodowiskowych. Programy rozwoju obszarów wiejskich będą musiały być, przynajmniej częściowo, koordynowane na poziomie dorzeczy oraz połączone z planami zarządzania obszarami dorzeczy, wymuszając ścisły związek między odpowiednimi instytucjami odpowiedzialnymi za rozwój obszarów wiejskich oraz instytucjami zarządzającymi zasobami wodnymi.

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