

## Lithuanian wetlands database: the tool for bird monitoring and conservation in Lithuanian wetlands

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A countrywide inventory of important wetlands was constructed in Lithuania in 1996-1999. Over 80 wetlands (total area c130 000 ha) were investigated. The Ramsar methodology was used as the basis of the inventory's structure. Results of the inventory have revealed that more than 30 Lithuanian wetlands meet the Ramsar criteria qualifying them as of international importance. The wetlands investigated during this survey support the majority of many species of Lithuanian breeding birds, including many that are rare and endangered. Internationally important concentrations of numerous bird species have been recorded in these sites. A high priority of the program was to provide to the regional and local authorities responsible for nature management all necessary information concerning the key wetlands and their birds. Consequently, a new Lithuanian Wetlands Database (WDB) had to be created. It includes the following:

1. Data on important wetlands in each region or district.
2. Data on species and communities in each important wetland.
3. Land use and conservation recommendations at the species or community level.
4. Data visualisation (maps at several levels: from national to local and down to individual wetland).

Replicates of the WDB were forwarded to the organizations responsible for conservation of wetlands in all districts/regions. The WDB permits responses to be made to all matters arising related to wetlands. It will serve as an important tool for further monitoring of bird populations in Lithuanian wetlands and for the formation of new databases of important transfrontier wetlands (those shared by several countries).

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### 1. Introduction

Lithuania contains rich wetland resources. Mires and bogs of all types cover about 5% of the whole country. Large mire complexes comprise almost virgin natural areas that have never been used for agriculture or forestry, the kind of natural habitat that was many years ago in Western Europe. In Lithuania

there are 2834 lakes larger than 0.5 ha in area. There are 400 man-made wetlands larger than 5 ha and over 10 000 smaller ponds and reservoirs. Among 758 rivers (longer than 10 km) and numerous streams there are many unregulated or moderately modified rivers with naturally flooded land. The total length of the unregulated natural rivers and streams is c17 000 km. The preservation of areas of such extraordinary biological richness is

particularly important for many breeding species of birds. In particular, the coastal wetlands (part of the Eastern Atlantic Flyway) are extremely important sites for migratory and wintering populations of waterfowl.

Many important wetlands in Lithuania are at least partly protected, the total protected area now comprising *c*12% of the country. Most preserved areas were originally established when all the land belonged to the State. The recent political and economic changes in Lithuania have during recent years resulted in intensified forestry and in privatisation or re-privatisation of land. Numerous existing wetlands may be turned into private property. In such circumstances it was necessary to compile rapidly the inventory of important wetlands, particularly those areas meeting the criteria of the Ramsar convention. Lithuania joined the Ramsar convention in 1993, 5 key wetlands being designated as Ramsar sites: the Čepkeliai, Kamanos, Viešvile and Žuvintas Strict Nature Reserves and the Nemunas River Delta Regional Park (overall total area *c*50 000 ha). However, most key wetlands lacked detailed habitat and biological community information. The first country-wide inventory of all the important wetlands was compiled in 1996-1999 (Balčiauskas & Švažas 1998), the project being supported by Migratory Birds of Western Palearctic (OMPO). The project objectives were:

- To perform the inventory of the key wetlands, using the Ramsar criteria and classification.
- To produce detailed maps of each important wetland, by plotting important elements of each site.
- To develop the WDB to provide a rele-

vant tool for regional and local decision-makers responsible for wetlands management and to form the basis of further monitoring of wetlands and their fauna and flora.

## 2. Study Area and Methods

More than 80 wetlands (total area *c*130 000 ha) were investigated in 1996-1999. The designated wetlands are comprised of the following wetland types:

1. Mire complexes.
2. Bogs and marshes of all types.
3. Peat-lands.
4. Wet forests.
5. Large shallow lakes.
6. Stretches of river possessing natural floodplain.
7. Natural wet meadows and swamps.
8. Coastal wetlands adjacent to seasonally flooded meadows.
9. Large fishponds and man-made reservoirs.

Intensive field surveys (land-, aerial- and boat-based) were performed in all selected wetlands. The Ramsar datasheet and methodology were used as the basis of the inventory structure. The Ramsar criteria were used to designate wetlands of the international importance. All valuable wetland elements were recorded and plotted on maps. A principal objective of this inventory was to survey breeding and migratory populations of birds.

The Lithuanian WDB was intended primarily as a tool for regional and local decision-makers and to form the basis of further monitoring of important wetlands, their fauna and flora. It is designed to handle spatially oriented data. The data comprises information on rare and com-

mon species (although the main emphasis is on birds); the WDB's ability to cope with taxonomic arrangement enables even newly described species to be added. The WDB is compatible with the Lithuanian Biodiversity Database, created by the project group 'Ecological diversity of Lithuania' (Balčiauskas & Budrys 1997) and it includes the species composition and distribution of certain wetlands or districts. Much additional information on species, wetlands and other localities is also contained in the WDB. The WDB was designed under DBMS Paradox for DOS, and includes the mapping module DMAP for DOS (by Alan J. Morton, U.K.).

### 3. Results and Discussion

The results of field surveys performed in 1996-1999 have identified more than 30 Lithuanian wetlands that meet the Ramsar criteria applicable to wetlands of international importance (Švažas *et al.* 1999). Wetlands investigated during this inventory support the majority of many Lithuanian breeding bird species. These wetland areas hold between 70-100% of the total estimated Lithuanian breeding population (see Kurlavičius & Raudonikis 1999) of Black-throated Diver *Gavia arctica*, Greylag Goose *Anser anser*, Shelduck *Tadorna tadorna*, White-tailed Eagle *Haliaeetus albicilla*, Short-toed Eagle *Circaetus gallicus*, Avocet *Recurvirostra avosetta*, Golden Plover *Pluvialis apricaria*, Dunlin *Calidris alpina*, Ruff *Philomachus pugnax*, Great Snipe *Gallinago media*, Black-tailed Godwit *Limosa limosa*, Wood Sandpiper *Tringa glareola*, Short-eared Owl *Asio*

*flammeus*, Aquatic Warbler *Acrocephalus paludicola*, Bearded Tit *Panurus biarmicus* and Great Grey Shrike *Lanius excubitor*. They also support more than 50% of the total Lithuanian population of Black-necked Grebe *Podiceps nigricollis*, Gadwall *Anas strepera*, Pintail *Anas acuta*, Shoveler *Anas clypeata*, Ferruginous Duck *Aythya nyroca*, Red-breasted Merganser *Mergus serrator*, Crane *Grus grus*, Little Tern *Sterna albifrons* and Eagle Owl *Bubo bubo* (Tab. 1). The Nemunas River Delta Regional Park is the most important large-scale nesting centre of waterbird species in Lithuania (Švažas *et al.* 1999, Raudonikis & Kurlavičius 2000). This territory supports the majority of the Lithuanian breeding population of Greylag Goose, Shoveler, Dunlin, Ruff, Black-tailed Godwit, Great Snipe and Little Gull *Larus minutus*. It is the only breeding site of Avocet in Lithuania.

The available data on the population trends of certain species indicate a decline in numbers of Gadwall, Shoveler, Ferruginous Duck, Dunlin, Ruff, Curlew *Numenius arquata* and Black-tailed Godwit in the wetlands covered during this survey. In 1996-1999 these species were not recorded in numerous former breeding grounds. The decline of breeding populations was caused primarily by the increased eutrophication and encroachment of the most important habitats (Žalakevičius *et al.* 1995). The lack of suitable breeding habitats is the main reason of the recent decline of breeding populations of Little Tern and Aquatic Warbler. A rapid increase in numbers of breeding Greylag Geese was recorded in many sites. During the last 20 years this species has become re-established as a

breeding species in Lithuania due both to a partial introduction and to a natural influx of birds from adjacent breeding grounds. A high increase in numbers is characteristic of Goosander (*Mergus merganser*), which has recorded in the last decade a rapid range expansion in Lithuania and the other countries of the Eastern Baltic. During the same period, Avocet has also expanded its breeding range, recently forming a new breeding site in the Nemunas river delta area. Small increases in the breeding populations of Bittern *Botaurus stellaris*, Honey Buzzard *Pernis apivorus*, Montagu's Harrier *Circus pygargus*, White-tailed Eagle, Crane and Short-eared Owl were recorded in most wetlands covered in 1996-1999, while the population trends of other analysed species during the last decade have been stable.

The designated and potential Ramsar sites are particularly valuable breeding grounds for many rare, vulnerable and endangered bird species. 40 bird species included in the Lithuanian Red Data Book breed or possibly breed in the Nemunas river delta area and 30 species in the Čepkeliai mire complex. Both wetlands support the largest number of endangered and vulnerable bird species in Lithuania. Several other key wetlands are also distinguished by a very high diversity of protected bird species. Five bird species included in the IUCN Red List of Threatened Animals (Lesser White-fronted Goose *Anser erythropus*, Ferruginous Duck, Steller's Eider *Polysticta stelleri*, Spotted Eagle *Aquila clanga* and Aquatic Warbler) were recorded in 14 wetlands covered during this survey. The main breeding area of Ferruginous Duck is located in southwest and central Lithuania

(Lakes Obelija, Metelys, Žuvintas and Žaltytis and the Kauno Marios reservoir). The great majority of Aquatic Warblers breed in wet meadows bordering the eastern coast of the Curonian Lagoon. Up to 200 breeding territories of this species have been recorded in this site during recent years, though high annual fluctuations in numbers of breeding birds are characteristic of this species. Floodplains surrounding the Nemunas river delta are the key stopover sites for Lesser White-fronted Goose in Lithuania. Only single migratory Spotted Eagles in recent years have been recorded in the Nemunas river delta area and in a few inland sites. The marine Palanga site is the only key wintering area of Steller's Eider in Lithuania, up to 2300 birds being recorded. Breeding territories of Corncrake *Crex crex* were recorded in many wetlands investigated in 1996-1999.

The results of this survey have confirmed the huge importance of Lithuanian coastal wetlands for migratory and wintering populations of waterfowl. Internationally important concentrations (exceeding the 1% Ramsar threshold) of 24 waterbird species have been recorded in these sites (Švažas 1996, Švažas *et al.* 1998). The Nemunas river delta area is among the most important staging sites for migratory populations of Whooper Swan *Cygnus cygnus*, Bewick's Swan *Cygnus columbianus bewickii*, White-fronted Goose *Anser albifrons* and Pochard *Aythya ferina* in Europe (Švažas *et al.* 1997, 1998). Large concentrations of Cormorant *Phalacrocorax carbo*, Bewick's Swan, Whooper Swan, Greylag Goose, White-fronted Goose, Bean Goose *Anser fabalis*, Pintail, Goldeneye *Bucephala clangula*, Goosander and Little Gull, exceeding the

1% Ramsar threshold, have been recorded in the northern part of the Curonian lagoon and in the adjacent wet meadows. This brackish lagoon is also the key wintering resort of the wintering population of Goosander, supporting up to 15% of the whole NW Europe population (Švažas *et al.* 1994, Scott & Rose 1996). The shallow inshore marine waters at the coast of Palanga town are among the most important wintering areas of the globally threatened population of Steller's Eider in Europe (Nygard *et al.* 1995). Marine waters along the coast of the Curonian Spit regularly support important concentrations of divers, Great Crested Grebe *Podiceps cristatus*, Velvet Scoter *Melanitta fusca* and Long-tailed Duck *Clangula hyemalis* (Švažas 1993, Vaitkus 1999). Several Lithuanian inland wetlands hold internationally important staging concentrations of waterbirds. The most important are the large shallow lakes of southern and south-west Lithuania. They are the principal staging sites of Great Crested Grebe and Coot *Fulica atra* in Lithuania (Stanevičius 1999). These wetlands regularly support staging flocks of Bean Goose and Crane exceeding the Ramsar 1% threshold. Certain large fishpond complexes are important staging areas of White-fronted Goose and Bean Goose in eastern Lithuania. Furthermore, large peat-lands regularly support important concentrations of Crane (up to 2-4% of the whole NW Europe population) (Raudonikis & Kurlavičius 2000).

All data collected and analysed during this countrywide survey (including all the characteristics of important wetlands in each region or district, distributions of rare species of fauna and flora, recommendations including land use and conserva-

tion measures, maps of all levels) were compiled and mapped in the Wetlands Database. Replicates of the newly established database have been distributed to the organisations responsible for the conservation of wetlands in many districts and regions; the WDB will serve as an important tool for wetland management and protection.

The general scope of the WDB is:

1. Accumulation of structured information on wetlands at a national level.
2. Maintenance of regional and district databases.
3. Provision a management tool and information system for local decision-makers.

The WDB comprises several structural parts:

1. Data concerning species and communities, including their distribution and abundance.
2. Data on wetlands.
3. Additional information on species, communities, habitats and wetlands (including their main threats, the status of certain species in Lithuania and in other countries and data on species biology and ecology.).
4. A compendium of special recommendations concerning management and conservation of wetlands, sites, or species.
5. A compendium of general recommendations at the species or community level, including land use practices and management and conservation measures.
6. Data visualisation (mapping and plotting at several levels, from the national to local and down to selected wetlands).

A simplified relational structure of the

WDB and how its elements are interconnected is provided in Fig. 1. The end-user interface is made as simple as possible to allow WDB users in all Lithuanian municipalities and districts to use it without special training. The WDB provides the possibility of managing data without having to depend on a mass of instructional tables, forms or reports. The end-user interface consists of menus and dialogue boxes.

The WDB lacks GIS-functionality, because it is not a tool for land-use planning. However, the Lithuanian Ministry of Environment will establish special GIS systems for this purpose. The WDB includes several levels of spatial representation, from national down to local level (Figs. 2-5). Starting at national level, the WDB represents a map of all wetlands

included into the database (Fig. 2a); it also shows the location of the selected wetland (Fig. 2b) and displays species distribution with dots that indicate the sites with species records (Fig. 2c):

At the administrative district level, the WDB represents a map of the selected district showing the location of each important wetland in the district (Fig. 3a), the location of the selected wetland (Fig. 3b) and sites with records of rare species of fauna and flora in district wetlands (Fig. 3c).

At a wetland (local) level the territorial representation is restricted to a schematic diagram of the selected wetland (including boundaries of the area, district or state borders, main roads, position of the nearest settlements, lakes, rivers and other water bodies) (Fig. 4a). The same infor-

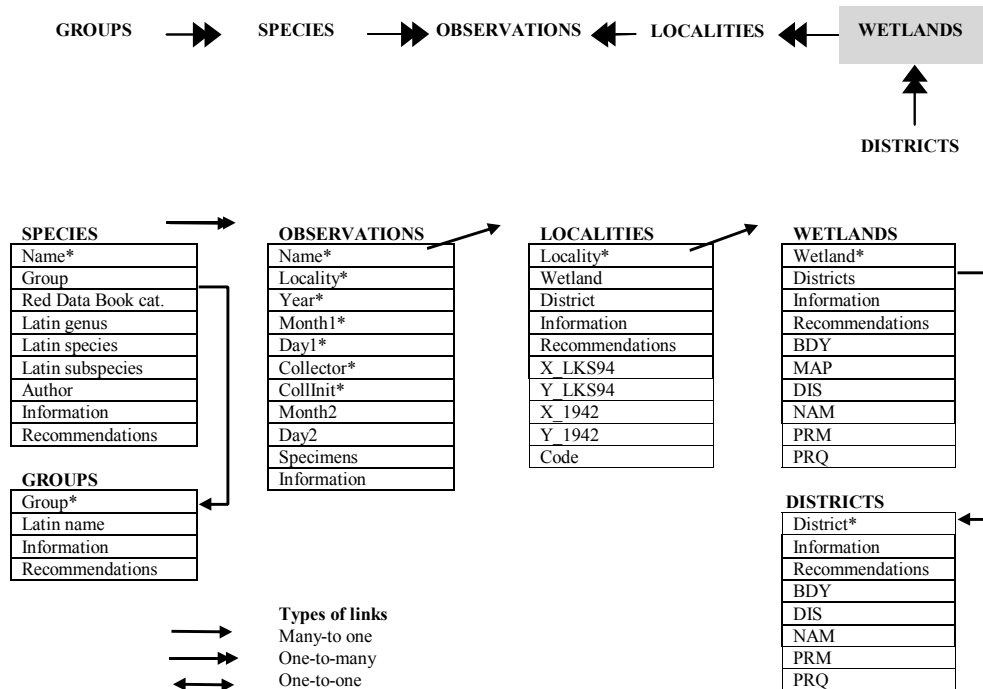


Figure 1. The structure of data files of the Wetland Database. The links between data fields of these files are shown as arrows.



Figure 2. The Territorial output of the WDB at a national level, representing: a. The map of important Lithuanian wetlands. b. Location of the selected wetland (the Nemunas River Delta). c. Distribution of one species in Lithuania.

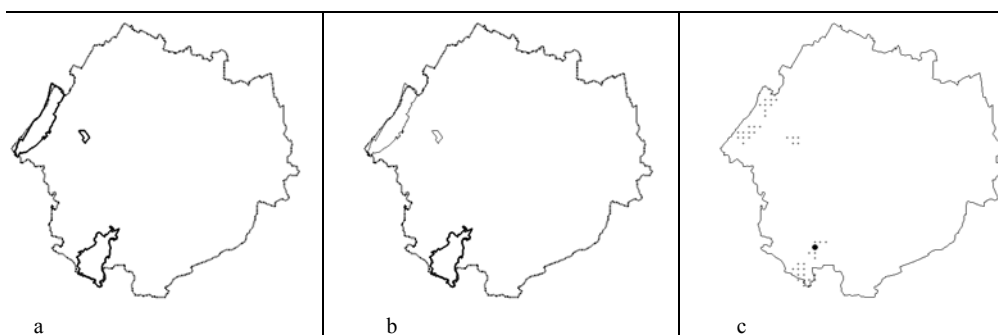


Figure 3. Territorial output of the WDB at a district level, representing: a. Location of all the important wetlands in one administrative district. b. Location of the selected wetland in the district. c. Localities of all survey points in important wetlands of the district, the selected point being indicated as black dot.

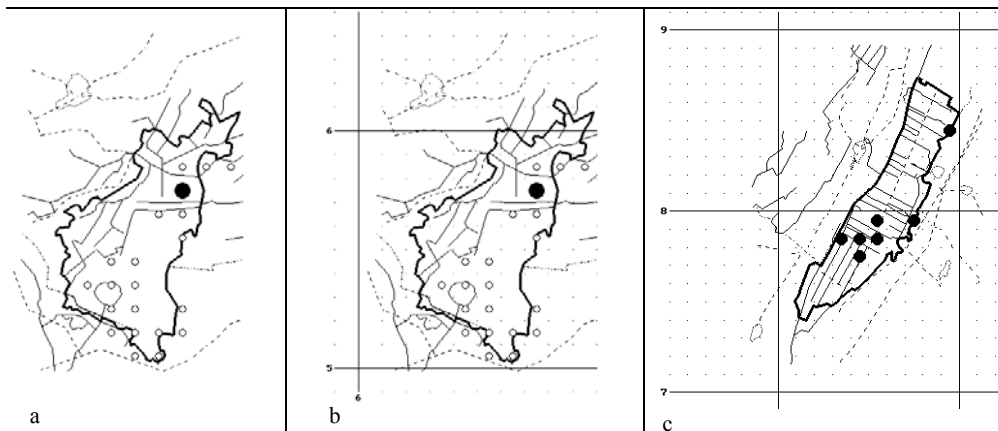


Figure 4. Territorial output of the WDB at a local or wetland level, representing: a. Location of all survey points in the wetland (unfilled, or empty dots), location of the selected locality (solid, or black dot), boundaries of the area (thick solid line), district or state borders (thin dot-dash line), main roads (thin dash line), nearest settlements (thin dot line), water bodies (thin solid line). b. The same output using the 10x10km grid coordinate system (lines) and the 1x1 km grid (dots). c. Distribution of one selected species in a particular wetland.

mation can be presented with coordinate gridlines representing 10×10 km squares and dots 1×1 km squares (Fig. 4b). At this level, the position of survey points (or localities) is represented on the scheme by unfilled dots; the position of the selected locality is emphasized as a solid (black) dot. On the schematic diagram of species distribution at a wetland level, solid (black) dots represent localities where the species has been recorded (Fig. 4c). This information is mapped directly from the database tables.

The territorial approach in the Wetland Database is realised according to the following scheme: District→Wetland→Locality→Observation. There are several possibilities for the end-user at every link of this chain, including:

1. General information; *e.g.* the size of wetlands in the district, the habitat structure of the selected wetland, species composition in selected sites.
2. Recommendations concerning wetlands management and conservation.
3. Input of new data or information.
4. Editing the existing data and information.
5. The list of the elements involved; *e.g.* the list of species in a selected wetland.
6. Context-specific help system.
7. The map output, implemented in the first two levels.

The species approach is formed according to the following scheme: Species Group→Species. At the species level there are several choices: 'species in districts', 'species in wetlands' and 'species in certain sites'. It is possible to work only with species included in the Lithuanian Red Data Book. The possibilities for the end-user at every link of this chain are almost the same as in the previous scheme.

The lowest level of information in the WDB are observations, including both territorial and species approaches. The observation is defined as a unique combination of place, species, time and observer. Starting from the observation, the biodiversity estimation is performed in the same way as at other levels, species lists being annotated with locality, wetland and district information. Estimation is calculated as the Hill's diversity numbers  $N_1$ ,  $N_2$  and  $N_3$ , Shannon's diversity indices with base of  $e$  or 2, and Simpson's evenness index (see Ludwig & Reynolds 1988).

It is expected that through use of the WDB, results from the wetlands inventory program will provide direction and support for the most effective and forthcoming practical implementation of recommendations concerning the protection and subsequent management of important Lithuanian wetlands during the period of national economic transition. The newly created WDB can form the structural basis of further monitoring of Lithuanian wetlands and their fauna and flora. At present it includes all the available data on the essential elements of important wetlands (particularly on birds), collected during field surveys performed in 1996-1999 and compiled from the published sources. The data in the WDB on species, communities, wetlands and the resultant recommendations may in future be supplemented, edited or deleted, according to subsequent studies. All future data on the included wetlands or species will be incorporated into the WDB. Researchers from universities or research institutes, the staff of National and Regional Parks and municipal ecologists will add new data into databases at district or local level for transfer



into the national WDB functioning in the Institute of Ecology.

The Lithuanian Wetlands Database will be also used for the formation of a new Regional Database of Important Transfrontier Wetlands. The inventory of important wetlands shared by Lithuania with Belarus and with Russia will be implemented in 2001-2002. All data collected during this international program will be compiled and mapped in a special database whose structure is based on the WDB.

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