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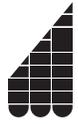
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Wetland Identification and Protection: North American and European Policy
Perspectives
Michigan State University Agricultural Experiment Station and Cooperative Extension
Service
Research Report
Gerhardus Schultink, Richard van Vliet, Resource Development
Issued October 1997
52 pages

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Michigan Agricultural
Experiment Station
Michigan State University

Wetland Identification and Protection: North American and European Policy Perspectives



October 1997 ■ Research Report 554

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Wetland Identification and Protection: North American and European Policy Perspectives¹

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Foreword

This research report is part of an effort to assist Michigan units of government in identifying wetlands, their functions, perceived public values and critical roles in contributing to the quality of life (QoL) of its residents. Comparative perspectives and approaches to wetland identification and preservation are useful in developing guidelines for local governments, which, under Michigan legislation, are faced with a delegated mandate to protect wetlands of 5 acres or less.

At the core of this issue is the conversion of rural space, including wetlands, resulting from new settlement patterns. Increasingly, Michigan's citizens, elected officials, planning professionals and scientists are expressing concerns about the impacts of urbanization (expansion of residential, commercial, transportation and industrial land uses) on open space, resulting in a rapid conversion of prime farmlands, wetlands and woodlands, and environmental degradation. Estimates indicate that land use conversions have exceeded 200 acres per day in the mid-1990s. According to Rusk (1996), during the 1960-90 period, Michigan urbanized growth areas (with population increases ranging from 40 to 90 percent) have expanded at a rate 1.9 to 2.6 times faster than population

growth, signifying a decreasing density of settlement patterns. The conversion rate is even higher for the relatively stagnant urban growth areas (2 to 17 percent population increases for the 30-year period), where a decline of socioeconomic conditions is marked by a "suburban flight" with rapid land conversion and population growth ratios of 6.9 to 27. In part, this is caused by an urban planning policy that lacks incentives to revitalize residential, commercial and industrial land uses of core urban areas. This has resulted in a decline of the urban service infrastructure, including a loss of quality in educational, medical, recreational, cultural and retailing functions, and an increase in crime rates.

Most notably, the population of older central cities has declined. Detroit, for instance, lost 821,000 persons in the 1950-90 period. Though a significant number of these population losses may be attributed to out-of-state migration in the '80s, this population movement illustrates the statewide process of urban to suburban migration, with land development ratios of up to 27 acres of rural land replacing one acre of urban land use.

For Michigan's rural areas, the USDA (1994) estimates that the total land area in farms declined from

17,562,000 acres in 1900 to 10,700,000 acres in 1994, or almost 40 percent. This trend is associated with an increase in land prices from \$33 per acre to \$1,212, a decline in the number of farms from 203,261 to 52,000, and an increase in average farm size from 86 to 206 acres.

Increasingly, environmental impacts associated with these land use conversions are becoming a significant concern in urbanizing and rural regions alike. Impacts vary from overextraction of groundwater resources by residential wells, groundwater contamination by nitrates and phosphates from private septic systems, and contaminated runoff caused by pesticide and fertilizer applications on golf courses and residential lawns, to contamination from industrial and commercial acreage and toxic substances from poorly designed landfills. In addition, land conversion reduces groundwater recharge rates, increases surface water runoff and flood risks, reduces open space and ecosystem habitat, and limits opportunities for recreation and tourism.

In light of these concerns, the beneficial functions of wetlands, with their ability to reduce and mitigate these impacts, are receiving increasingly international recognition. The identification of these functions and

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the public policies enacted to protect and enhance these functions in international settings are the focus of this comparative review. Wetland protection policies and strategies are also compared.

Acknowledgments

The authors wish to thank the various individuals and institutions that have graciously provided references and shared professional perspectives and insights. We especially appreci-

ate the comments and suggestions from Kenneth Verburg, Delbert Mokma and Eckhart Dersch and the editorial assistance from Leslie Johnson at MSU.

Summary

This report presents a comparative literature review of wetland protection policies of the United States and several European nations. The Netherlands, Germany, the United Kingdom, Denmark, Norway, Sweden and Finland were selected because they represent regions with similar economic development impacts on the natural environment. Of these countries, the Netherlands, Germany and the United Kingdom exemplify the most significant population pressures.

In defining wetlands, European nations use the International Ramsar Convention definition. The U.S., in contrast, uses slightly different definitions originating from various federal agencies: the U.S. departments of the Interior and Agriculture, and the Environmental Protection Agency.

The United States lacks a *comprehensive national wetland policy* addressing specific wetland preservation goals, time-based planning objectives, evaluation measures and performance standards. Rather, wetland policy is somewhat fragmented by agency objective and regulatory initiative and by the optional delegation of protection measures to the states. For instance, the National Wetlands Priority Conservation Plan largely provides guidelines for wetland identification and mapping. Various wetland protection policies, laws and regulations represent the functional emphasis of U.S. policy measures. Examples include the establishment of the Wildlife Refuge System (preservation of waterfowl sanctuaries), and the Rivers and Harbor Act (maintain navigation by regulating dredging and filling), and the Water Pollution Control Act and

its Amendments of 1972 (later called the Clean Water Act, emphasizing pollution control measures).

Many states rely on federal protection measures. A few state governments have chosen to self-regulate wetlands by adopting federal wetland protection measures, as is the case with Michigan's adoption of the Wetland Protection Act in 1979, later replaced by the Natural Resources and Environmental Protection Act. In Michigan, local governments are permitted to enact more specific wetland protection measures in the form of local ordinances. More recent amendments make this more difficult, however, because of the requirement to complete a wetland inventory as a basis for adopting wetland ordinances.

In spite of existing preservation policies, wetland acreage continues to decline in the U.S. and Europe. U.S. wetland conversions are expected to continue at a rate of 290,000 to 450,000 acres (117,408 to 182,186 ha.) annually. In Europe, the Netherlands represents a nation with a long, hierarchical land use planning history. Here, four planning documents are relevant to wetland protection. The Nature Policy Plan (Ministry of Agriculture, Nature Management and Fisheries) is the most significant. Its goal is to reverse the fragmentation of nature areas by establishing a National Ecological Network with wetlands representing mostly the "core areas". Ecosystem habitat protection is identified as the principal reason for wetland protection. As a result of these policies, the destruction of existing Dutch wetlands has almost been halted. For

the remaining wetlands, problems such as fragmentation, pollution and eutrophication have yet to be resolved.

One unique aspect of Dutch wetland preservation policies is that new wetlands were created in areas reclaimed from portions of the Zuiderzee, a former tidal basin of the North Sea, and along some coastal areas. This includes the nature preserve "Oostvaardersplassen", about 13,000 acres in the most recently reclaimed Flevoland Polder, designated as a national biosphere preserve. In addition, discussions are taking place to take considerable lowland acreage out of agricultural production by raising the groundwater table and even inundating some polders reclaimed from inland lakes during the past three centuries. This last initiative reflects changed priorities in the EC and the Netherlands, where agricultural overproduction and its environmental impacts, combined with increasing awareness of the public values of wetlands, have started to reshape environmental policy.

Most other northwestern European countries preserve wetlands through nature and wildlife habitat protection measures. Norway and Finland have a Wetland Conservation Plan and River Protection acts, respectively. The efficacy of these measures seems unknown. In Denmark, the Danish Nature Protection Act is according to the Danish Bird Protection Association, adequate to meet its protection objectives. In most European countries, except for the less populated Scandinavian countries, wetlands suffer from increasing eutrophication and pollution.

Introduction

Wetland ecosystems, inland as well as coastal, are a landscape element that drew special attention in the late 1960s (Williams, 1990). This included the recognition that wetlands perform several important societal and environmental functions. Wetlands support many species during their life cycle, ranging from fish spawning to migratory birds' feeding and breeding habitat. They also protect shores from erosion through storm abatement, prevent flooding by increasing storage capacity and containing runoff, and are critical in recharging aquifers. In addition, wetlands enhance water quality by recycling nutrients and storing (toxic) chemicals.

Despite these widely established public values, wetlands are globally a highly threatened ecosystem. Europe has lost most of its natural wetlands and the U.S. more than 50 percent since early European settlement (Mitch and Gosselink, 1993). The rate of wetland conversion has decreased but continues.

In northwestern European countries and the U.S., attempts have been made to protect wetlands from uncontrolled development. The judicial systems and the perceived importance of public vs. private rights, responsibilities and values in the Old and the New World are somewhat different and lead to different policies, laws and regulations. In the U.S., for example, national and state-level laws aim to protect wetlands for various functional reasons, while optional development controls may be exercised at the local level. In the Netherlands, with its centralized policy framework, national preservation and restoration measures are emphasized. Policies and laws on both sides of the Atlantic may represent similar goals, but they differ in enforcement strategy, efficacy, and national and regional priorities. For example, one country may emphasize habitat or biodiversity protection, while another focuses on flood protection.

These differences make it difficult to measure the success of preservation policies. This is exacerbated by the differences in legal systems and emphasis on property rights, which plays a significant role. In the U.S., private land ownership historically involves property rights that includes a "bundle of rights" (Barlowe, 1972), including mineral and water rights, development rights, transfer rights by lease, mortgage or sale—with or without deed restrictions—or the provision of easements. Here, fee simple ownership of land entitles the owner to the most complete set of rights where use *may* include rights to exploit (emphasize short-term economic gain), degrade (exceed long-term use capacity) or even destroy the land by permanently altering its future economic or public use capacity. Although this right is the most complete and the broadest private property right yet developed, it is yet *exclusive* and not *absolute*. Ownership rights are always subject to limitations and conditions as promulgated by federal, state or local jurisdictions reflecting societal interests and values. Especially in the U.S., that difference in judicial interpretation of these formalized public interests, in the form of land use policies, laws and regulations, varies significantly by jurisdiction and over time. For instance, the perceived need and willingness to implement effective land use controls such as zoning and wetland ordinances at the *local* level and their *practical* implementation vary greatly.

As such, public land use controls for wetland protection are more difficult to exercise in the federal U.S. system than in European countries characterized by centralized and nationally consistent public policies. In the U.S., this especially influences nature conservation policy options because 74 percent of all wetlands in the contiguous 48 states are controlled by private landowners (USDI, 1990).

This comparative research addresses two primary world regions: Europe and the United States. The European countries of the Netherlands,

Germany, Denmark, Norway, Sweden, Finland and the United Kingdom were chosen because they experience a degree of economic development pressure on wetland resources similar to that in the United States. Also, legislation of the European Union (E.U.) is discussed because all European nations included, except for Norway, are members.

Michigan serves as an example of state wetland legislation but does not necessarily represent the other states, which mostly rely on federal policies. Because Michigan, with its freshwater ecosystems, has no marine and estuarine (tidal) wetlands, policies on marine coastal zone management were not included.

This research represents a comparative literature review of the most readily available sources. In addition, personal interviews were conducted with specialists from the several countries and state agencies.

Defining wetlands

During the past 20 years, a number of interested parties in the U.S. have challenged the principles and definitions used in federal wetland regulations. In part, this reduced the credibility of national and state regulatory practices, including methods of wetland characterization, delineation and functional evaluation. Though these issues are perceived as critical in many countries, no parallel to this challenge is evident in European countries.

The term "wetland" as a collective definition distinguishing it from terrestrial ecosystems has been used to replace the term "swamp" in the latter part of this century. The global extent of wetlands is estimated to be from 7 million to 8 million km² (Mitch, 1994). Though international definitions vary, basic similarity exists in temporary or permanent waterlogging and peat-forming capacities due to an impermeable layer of clay. Differences are found in features such as salinity, hydrology, climate and successional stage

(Williams, 1990). The term “wetland” is usually synonymous with several wetland ecosystems, such as marshes, (raised) bogs, mires, fens, swamps, carrs and schwingmoor. The term “mire” is more often used in Europe instead of peatland (National Science Foundation, 1995). When comparing wetland policies among countries, it is important to compare the practical implications of the scientific definitions in use.

International

During the Ramsar Convention of 1971 (IUCN, 1993), wetlands were identified as “*areas of marshes, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine the depth of which at low-tide does not exceed six meters*”. Subsequently, most countries adopted this definition in their wetland identification and preservation efforts. In addition, the convention provides that wetlands may incorporate riparian and coastal zones adjacent to the wetland area, estuarine waters, and islands or bodies of marine water deeper than 6 meters at low tide lying within these wetlands. The convention’s definition covers a wide range of ecosystem types, from rivers to coastal areas and even coral reefs.

National

The United States and the state of Michigan

According to the Conservation Foundation (1990), in the U.S. alone, more than 50 different non-regulatory definitions are in use. Because of the wide variety of landscape features (hydrology, sediment and climatic conditions), the composition and wetland functions are perceived as most important. All those regional definitions (marshes, fens, bogs, wet meadows, potholes, bottomlands, moor, etc.) fall under the common denominator of “wetlands” at the present.

In 1972, amendments to the Federal Water Pollution Control Act

(later called the Clean Water Act [CWA] gave the U.S. Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA) authority to regulate uses in areas with potential pollution impacts on water quality. This included 15 percent of the total wetland acreage. Between 1972 and 1977, judicial authority broadened considerably and created a need for a regulatory definition of all wetlands in the United States. This definition was finalized in 1977 and upheld until 1985, when the Food Security Act (FSA), via the U.S. Department of Agriculture (USDA) established a separate regulatory definition used concurrently with the USACEs definition.

Given the need for greater national uniformity in the delineation and identification of wetlands, the USACE issued a national delineation manual in 1987 (USACE, 1987). After this, the USACE collaborated with the U.S. Department of the Interior’s Fish and Wildlife Service (FWS), the EPA and the USDA in preparing a revised manual, released in 1989. These revisions were not implemented because the manual was strongly criticized by various individuals and special interest groups as being *excessively inclusive*. In their opinion, land that should not be defined as wetland was regulated under these provisions, strongly restricting future development. For instance, 80 percent of Louisiana would be protected from development (Davis, 1991). In 1991, the Bush administration attempted to create a revised manual, which also was not implemented because of criticism that too many wetlands were *excluded* from regulatory control. Estimates indicated that from 30 to 80 percent of wetlands now classified as such would have lost protected status in some regions (*Engineering News Record*, 1991) because inundation or saturation requirements were increased from 7 to 14 days (National Science Foundation, 1995 and Silverberg, 1993).

As a result, three definitions are used currently in the United States: the USACE 1977 definition, the

Natural Resources Conservation Service (NRCS) definition in the Food Security Acts (FSA) of 1985 and the FWS 1979 definition (Cowardin *et al.*, 1979). The USACE and the FSA definition have direct regulatory significance through implementation of the CWA and the FSA. The FWS definition is also significant because it captures the perspective of a federal agency that interacts with regulatory agencies, comments on permits, and is charged with reporting to the U.S. Congress on the status of the nation’s wetlands and serves as the basis for national assessment and mapping of wetlands (National Academy of Sciences, 1995).

U.S. Environmental Protection Agency and U.S. Army Corps of Engineers.

The federal regulation used by the U.S. Army Corps of Engineers for implementing a dredge and fill permit system required by section 404 of the 1977 Clean Water Amendments define wetlands as:

Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

U.S. Department of Agriculture

In the Food Security Act (1985), the following definition is used:

The term “wetland,” except when such a term is part of the term “converted wetland”, means land that:

- A. *Has a predominance of hydric soils;*
- B. *Is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions; and*
- C. *Under normal circumstances does support a prevalence of such vegetation.*

For purposes of this Act and any other Act, this term will not include lands in Alaska identified as having high potential

for agricultural development which have a predominance of permafrost soils.

U.S. Fish and Wildlife Service

The non-regulatory definition that the FWS uses defines wetlands in the following way:

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes, (2) the substrate is predominantly undrained hydric soil, and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year (Cowardin et al., 1979).

Reference definition

Besides these official definitions, the National Research Council's Committee on the Characterization of Wetlands³ developed a reference definition in 1995. This scientific definition (see also Figure 1) falls outside the mandate of any particular federal

agency, policy or regulation. It states:

A wetland is an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. The minimum essential characteristics of a wetland are recurrent, sustained inundation or saturation at or near the surface and the presence of physical, chemical and biological features reflective of recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physiochemical, biotic or anthropogenic factors have removed them or prevented their development (National Academy of Sciences, 1995).

Michigan

According to part 303 of Michigan's Natural Resources and Environmental Protection Act (1994), which replaced the Goemaere-Anderson Wetland Protection Act, a wetland is:

Land characterized by the presence of water at a frequency and duration sufficient to support and that under normal circumstances does support wetland veg-

etation or aquatic life and is commonly referred to as a bog, swamp or marsh and is any of the following:

(i) Contiguous to the Great Lakes or Lake St. Clair, an inland lake or pond, or a river or stream.

(ii) Not contiguous to the Great Lakes, an inland lake or a pond, or a river or stream; and **more than 5 acres** in size; except this subdivision shall not be of effect, except for the purpose of inventorying, in counties of less than 100,000 population, until the department certifies to the commission of natural resources it has substantially completed its inventory of wetlands in that county.

(iii) Not contiguous to the Great Lakes, an inland lake or pond, or a river or stream; and **5 acres or less** in size if the department determines that protection of the area is essential to the preservation of the natural resources of the state from pollution, impairment or destruction and the department has so notified the owner; except this subdivision may be utilized regardless of wetland size in a county in which subdivision (ii) is of no effect; except for the purpose of inventorying at the time.

³ The National Research Council is an organization founded by the National Academy of Sciences in 1916.

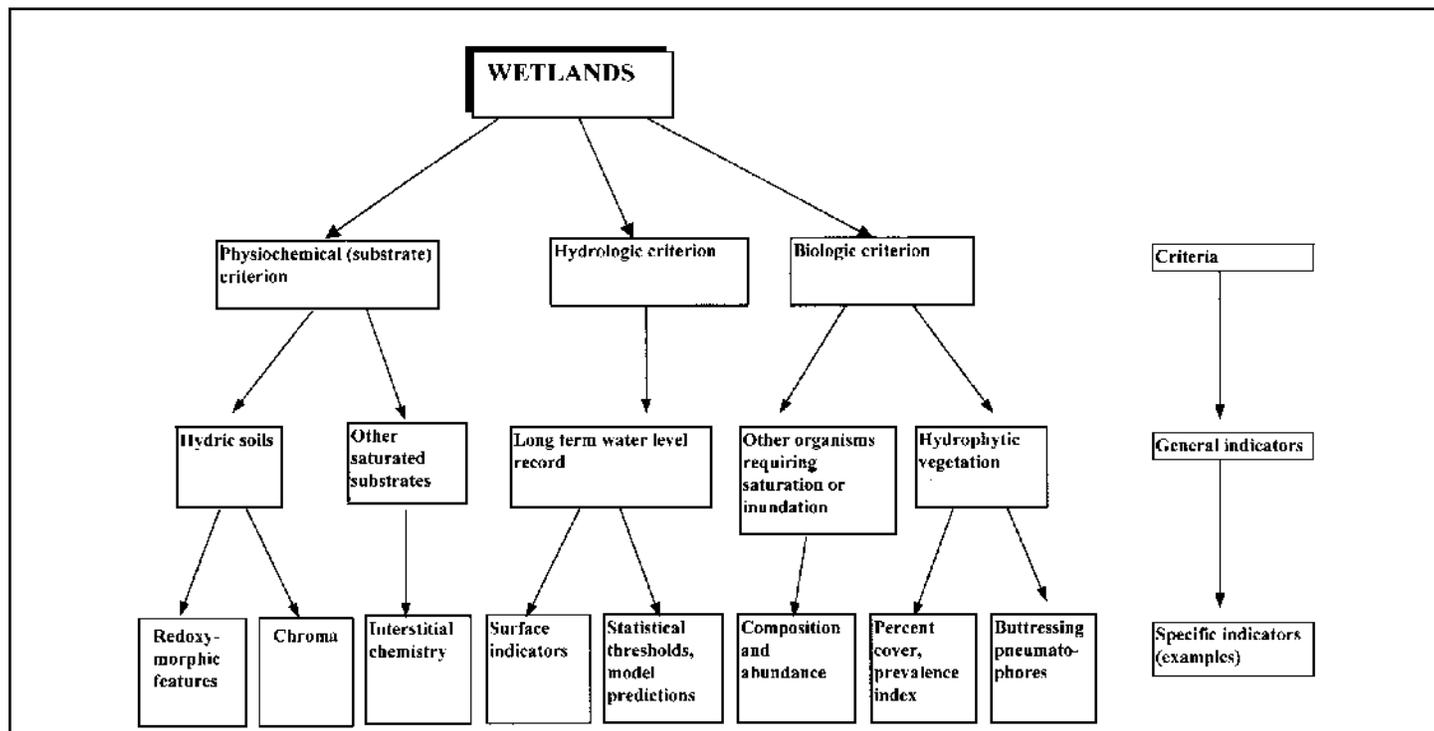


Figure 1. Diagram of relationship between the reference definition, criteria, general indicators and specific indicators for wetlands (source: National Science Foundation, 1995).

Canada

In Canada, the term “wetland” has been defined and used by various national and provincial agencies. The freshwater edges of lakes and rivers, inland marshes, swamps, sloughs and peatlands, the marine waters of estuaries and the tidal ocean shorezone are all identified as including wetlands. Following the Ramsar convention, Canadian wetlands meet national or provincial criteria related to the presence of soil and flora adapted to wet environments as well as the occurrence of waters that are generally restricted to a maximum depth of 2 meters.

In Canada, wetlands are defined as:

...land having the water table at, near or above the wetland surface or which is saturated for a long enough period to promote wetland aquatic processes as indicated by hydric soils, hydrophytic vegetation, and various kinds of biological activity which are adapted to the wet environment (Mitsch and Gosselink, 1993).

Europe

The Netherlands, the UK, Finland, Germany, Sweden, Denmark and Norway

In all these countries, the Ramsar wetland definition is used.

Wetland functions and values

Wetlands represent one of the most important landscape elements in preserving environmental quality. This includes protecting surface and groundwater quality and quantity; reducing loss of biological diversity and surface water runoff, thereby assisting in flood protection; and providing erosion and sedimentation control. Increasingly, citizens are becoming aware of the importance of wetlands in protecting public and private interests by preserving or enhancing property values, protecting the environment and preserving recreational opportunities. In Michigan, for instance, wetlands are

of great importance in replenishing the groundwater supplies of shallow aquifers in rural areas and improving the water quality of residential wells by recycling and storing chemicals introduced by agricultural land use (e.g., nitrates, phosphates and pesticides) and runoff from residential properties.

Wetlands may be viewed as one of the most productive environments in the world, covering about 4 percent of the planet. They provide tremendous economic benefits to people through their production of fisheries resources, the maintenance of water tables for agriculture, timber production, water storage and reduction of natural impacts such as watershed flooding and shoreline erosion. According to Environment Canada (1997), wetlands have been estimated to provide over \$10 billion a year in benefits to Canadian society. Wetlands' ecological functions and values include being sinks for natural contaminants, heavy metals and other pollutants; enhancing water purification; and providing popular recreational and hunting areas worldwide. In particular, wetlands include critical habitats for countless mammal, bird, reptile, amphibian, fish and invertebrate species. Especially in the industrialized world, many of these species are threatened with extinction.

The productivity and functional capacity of wetlands depend on their ecological quality. However, wetlands are among the most threatened habitats in the world because of drainage, eutrophication, land reclamation, pollution and incompatible land uses.

Wetland acreage losses in the conterminous U.S. and Michigan between the early settlement days and the National Wetlands Inventory in the mid-1980s (Dahl, 1990) are estimated to be 53 percent and 50 percent, respectively. Though most of the early losses can be attributed to the conversion of wetlands to agricultural use, more recent losses—especially since the 1950s—are mainly caused by conversion to residential, commercial and transportation uses.

Drainage of wetlands for agricultural uses has significantly decreased since the 1970s as a result of the enactment of federal wetland protection measures and incentives in recent farm bills (Food Security Acts) such as the Conservation Reserve and Swampbuster programs.

The emphasis of this report is on wetland preservation policies and associated legislation. But because legislation aims to preserve publicly recognized values, this chapter discusses the most important functions and values. “Functions” generally refer to ecological processes, whereas “values” connote an anthropogenic orientation in monetary terms (Benhart and Margin, 1994). Most wetland values were not explicitly recognized in the past, but currently, most functions are more realistically valued and acknowledged by our society. More specifically, the contributions of the various wetlands function to the overall quality of life are increasingly recognized, especially in suburban and rural areas most affected by the environmental impacts. This in itself is very significant because most legal protection generally results from recognized societal values (Mitsch and Gosselink, 1993). In the view of many in the professional and scientific communities, however, much needs yet to be accomplished to raise public understanding and awareness.

Williams (1990) identified four broad categories of wetland functions:

1. Physical functions: flood mitigation, coastal protection, sediment trapping and climatic functions.
2. Chemical functions: pollution trapping, removal of toxic residues and waste processing.
3. Biological functions: productivity and provider of habitats.
4. Socioeconomic functions: food production (fish, fowl and fauna) and recreational and aesthetic benefits that are difficult to quantify.

Because the public understanding of these functions varies, they are valued differently by society. In general, values can be divided in three main

categories: socioeconomic, hydrological/biochemical and ecosystem functions. All are not exclusive—many values fall into more than one category. The most important values are discussed below.

Socioeconomic values

Assessing the “real” public “values” of wetlands is one of the valuation challenges in resource economics. “Value”, in the context of assessing wetland resources, has a different meaning to different users and specialists. To the general public, it may represent recreational opportunities such as hunting, fishing, boating or wildlife observation. To an ecologist, the value of a marsh may be its significance as critical breeding habitat. To a land use specialist or resource manager, it may be shoreline stabilization, sediment retention, flood control and groundwater recharge. All these values are based on important use functions of wetlands, frequently well documented in the form of empirical evidence and scientific theories, and sometimes reflecting public perceptions and preferences based on personal experience, knowledge or private interest perspectives.

In this context, it is important to emphasize the fundamental purpose of impact assessment of land use alternatives on the sustained production capacity of our renewable resources. It necessarily represents the broader, long-term *public interests* of multiple generations rather than the short-term monetary gains of narrowly defined *private interests*.

Placing an economic value on the loss of natural resources or expressing public preferences associated with impacts of policy changes or project alternatives on the natural environment is an objective of environmental valuation and resource economics. As such, it represents a fundamental distinction from other disciplines—attempting to reflect the functionality or public utility in economic terms. This economic value is a measure of the extent to which a user is willing to forego one set of

alternative goods and services to obtain or maintain a particular set of goods and services, such as those represented by a wetland. This concept is typically referred to as the *willingness to pay* (WTP) and reflects a welfare measure or desire to maintain a habitat in its original, undisturbed functional or unpolluted state.

Economic theory and federal laws and regulations have progressed to address the challenges of economic valuation and public policy analysis. In the U.S., environmental valuation has its origin in the River and Harbor Act of 1902, requiring a systematic assessment of project benefits and costs to commerce. Lipton *et al.* (1995) list other milestones of this legislative history:

- The Flood Control Act of 1936.
- The national thrust to broaden valuation by including intangibles and concerns of the environmental movement in the ‘50s and ‘60s.
- The National Environmental Policy Act (NEPA) of 1969, with its systematic impact assessment requirements.
- The Clean Air Act of 1970.
- The Clean Water Act of 1972.
- The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, including natural resource damage assessment.
- Executive Order 12291 of 1981 on Regulatory Impact Analysis.
- The Oil Pollution Act of 1990.

With regard to mandates associated with coastal and marine resource management and public policy, the following legislation is specifically relevant:

- Section 404 of the Clean Water Act, which addresses the wetland permitting process necessary to convert wetlands for development. It charges the U.S. Army Corps of Engineers to assess public and private benefits and costs and, specifically, to take into account environmental values.

- Section 319 of the Clean Water Act, which establishes a national program on non-point pollution control.
- Section 6217b of the Coastal Zone Act Reauthorization Amendments of 1990, which requires that states with coastal management programs develop a Coastal Nonpoint Pollution Control Program for approval by the EPA and NOAA.
- The National Environmental Policy Act (NEPA), requiring federal agencies to assess environmental impacts of proposed legislation and “other major federal actions significantly affecting the quality of the human environment.” Subsequently, this authority has been extended to include any (partially) government-funded actions, even carried out by the private sector, requiring an Environmental Impact Assessment (EIS). Though cost-benefit analysis is discussed under the NEPA, it is not required. When a cost-benefit analysis is conducted, discussion of the relationship between the analysis and the unquantifiable environmental impacts, values and amenities is mandatory.
- The Magnuson Fishery Conservation and Management Act of 1976 and its amendments, requiring the preparation of fishery management plans under federal jurisdiction by fisheries management councils. This act requires cost-benefit analysis under the regulatory impact review component of the plan. To assist in this process, the National Marine Fisheries Service, under the auspices of NOAA and the Department of Commerce, provides guidance.
- The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), which mandates the preparation of regulations to assess natural resources damage from oil spills or hazardous substances to

compensate society for losses incurred prior to the full restoration of the natural resources.

- The Oil Pollution Act (OPA) of 1990, which specifically mandates regulations for the assessment of damages from oil spills. Both CERCLA and OPA require the development of a systematic damage claim by which the values of lost resources and service flows, pending full restoration, are to be included. This may also include the value of wildlife and the existence value that society attaches to a natural habitat or wilderness area. These acts are rather comprehensive in identifying valuation methods and the range and types of values that may be included.
- The Coastal Zone Management Act of 1972, which identifies coastal resource uses subject to management that may require benefit-cost analysis. These include the siting of major facilities such as energy, commercial and industrial development, transportation and recreation.
- The Marine Protection, Research and Sanctuaries Act of 1972 (as amended), which requires assessment of socioeconomic benefits derived from sanctuary designation, in combination with an EIS, and fisheries management guidelines and pollution regulations.
- The National Estuary Program (NEP), established under sections 317 and 320 of the Water Quality Act of 1987 (amended to the Clean Water Act), which directs the development of comprehensive conservation and management plans (CCMPs), which are critically dependent on the valuation of estuarine functions and services.

Valuation of socioeconomic benefits may be based on the real market price of goods and services produced by wetlands or, alternatively, on the so-called non-market goods and services and non-use value, such as aesthetic considerations. The first cate-

gory is represented by socioeconomic benefits such as food production (fish, fowl and fauna) and other animal products harvested. Another example is forested wetlands as a source of fiber with high harvest volumes due to high productivity rates—e.g., bottomland hardwood in the southeastern part of the United States. The second category, non-market goods and services, represents other societal benefits of wetlands not formally “traded” in the marketplace, such as flood protection, erosion and sedimentation control, preservation of biodiversity and the provision of recreational opportunities.

In assessing negative project impacts or cost, opportunity cost—representing (short-term) benefits foregone by not developing or exploiting wetlands—may be considered as well. Examples of these costs may include protection measures preventing use of bogs for cranberry production or other forms of agriculture in reclaimed (drained) wetlands with excellent soils for certain specialty crops due to high organic soil content, acidity or nutrient supply. Historically, drained wetland soils have typically contributed disproportionately more to the regional economy than higher situated mineral soils.

Another important example is the use of wetlands as a source of peat, a clean-burning fuel source with a relatively high caloric value. Peat production is concentrated in countries with vast deposits. These include Russia, with 89 percent of the world production total; Ireland, with 6.2 percent; and Finland, with 3.4 percent (Williams, 1990, and Mitsch and Gosselink, 1993). Peat mining in lowland areas of the Netherlands and northern Germany has created wetland resources with unique ecosystems, permitting various stages of wetland succession and habitat formation varying from floating bogs to forested wetlands. The mining of peat as a non-renewable energy source, however, typically destroys more unique wetland habitat than it creates. This is especially significant when it involves the destruction of

elevated bogs, an oligotrophic ecosystem that, by its unique nature and limited acreage worldwide, is a scarcer ecosystem than lowland bogs, which are (increasingly) subject to eutrophication.

Recreational and aesthetic benefits are also non-market socioeconomic values. If hunting is seen as a form of recreation, hunter expenditures may be counted as revenues to the local community and as a contingent value of wetlands. Aesthetic values are more difficult to quantify, however, because of the inevitable subjectivity. Here contingent values may be based on the public’s willingness to pay to have these values preserved.

Non-market goods and services provided by wetlands have traditionally been considered secondary in importance to the economic value of quantifiable market products. However, as more scientific knowledge and public understanding have emerged on the functional benefits of wetland protection, societal willingness to endorse preservation policies has increased.

Hydrological and biochemical values

Hydrologic values, because they represent significant aspects of the quality of life, may be viewed as part of socioeconomic values and, therefore, considered very important.

Wetlands in low-lying areas have an important water storage and peak-flow retention function, especially during severe rainstorms and during high water levels in the spring characterized by high soil moisture balances because of low evapotranspiration rates, high precipitation and melting snow. As illustrated in Figure 2, reducing peak runoff reduces flood risk.

In 1977, the Carter administration acknowledged this risk, specifically, by issuing an executive order to protect floodplains (see p. 17, Wetland protection policies). The accompanying statement indicated that the federal government had invested \$ 10 billion between 1936 and 1977 to reduce flood hazards. Despite these

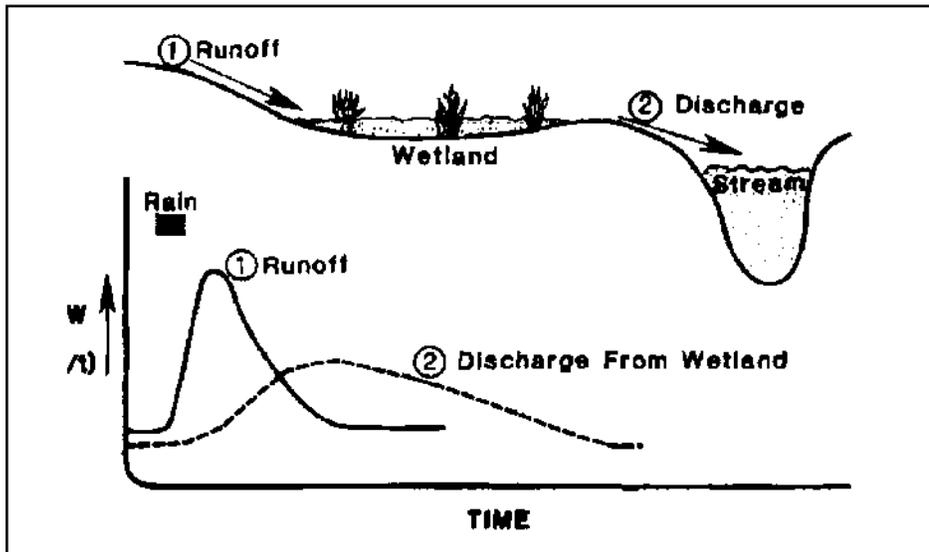


Figure 2. The general effect of wetlands on stream flow (Source: Mitsch and Gosselink, 1993).

efforts, annual losses from floods continued to increase (Environmental Law Institute, 1993). In 1975, U.S. flood damage was estimated at \$3 billion to \$4 billion.

Development in floodplains that reduces water storage increases flood risks. In general, the function of flood abatement seems undervalued—floodplain development is the most significant cause of wetland destruction (Darnay, 1994). Coastal wetlands can absorb most of the destructive power of storm surges. A 30-meter wetland buffer is enough to dissipate most wave energy, and at the same time, wetland vegetation, with its complex root systems, protects against erosion (Mitsch and Gosselink, 1993; Kusler, 1983; Williams, 1990).

Wetlands also perform an important function in maintaining water quality by recycling and accumulating nutrients, trapping sediments and transforming a variety of toxic chemical substances (National Science Foundation, 1995; Mitsch and Gosselink, 1993; Kusler, 1983; Williams, 1990). A study by Houck and Rolland (1995) indicated that a loss of 50 percent of America's remaining wetlands would result in increased sewage treatment plant expenditures of up to \$75 billion just to remove nitrogen. A Swedish study concluded that the benefits of using

land for wastewater treatment are greater than the value of the same land used for agricultural production (Benhart and Margin, 1994).

Ecosystem values

Globally, biodiversity is threatened. Present estimates indicate that one to six plant and animal species become extinct per day. According to Darnay (1994), this number will increase to one species per hour by the year 2000. Increasingly, biodiversity is recognized as an important socioeconomic value.

The presence of wetlands is highly correlated with biodiversity. Wetlands represent a fertile breeding habitat for many species of flora and fauna, and many plants exist only within wetland ecosystems. Scientists estimate that 150 bird species and 200 fish species depend entirely on wetland ecosystems (Berhart and Margin, 1994). Of the 97 species that became extinct since 1600, approximately one-third were wetland birds. Of the species vulnerable to extinction, 16 percent are wetland birds (Buisson, 1994). Many of Europe's most threatened species rely on wetlands for their survival, including 20 of Europe's most threatened birds. A quarter of the most threatened and most vulnerable plants are concentrated in wetland habitat (Institute for European

Environmental Policy, 1991). Coastal wetlands are used as nursery ground for many fish species that feed on wetland-dependent food. Nearly two-thirds of the U.S. commercial and saltwater fish catch probably depends on the coastal estuaries and their wetlands (Williams, 1990).

The most well-known wetland function is providing wintering and breeding grounds to migratory birds. Scholars have discovered a strong correlation between the diminution of numbers of migratory birds and the reduction of wetlands through drainage and cultivation. The breeding and wintering areas of migratory birds are linked by several flyways, such as the Palearctic flyway in Europe (see p. 26, European Union). The presence of small stopover wetlands along these flyways is crucial to the survival of migratory birds (IEEP, 1991), which, according to a Fish and Wildlife Service inventory, include more than 23.3 million birds (Williams, 1990). The Waddenzee, with almost half a million waders present, is a coastal wetland between the Netherlands, Germany and Denmark that is also of major significance for migratory birds (Williams, 1990). Some wetland waterfowl in the Netherlands are known to represent 20 to 77 percent of the total breeding population of western and central Europe (Ministry of LNV, 1990)

Global wetlands

Only wetlands of the selected countries are chosen for this comparative research. To present a contextual review, however, the global situation is also briefly discussed. This discussion includes aspects of international legislation because of its significant influence on wetland protection in the selected countries.

History

Several studies have estimated the global extent of wetlands. Estimates range from 5.25 million to 8.5 million square kilometers. Globally, wetland ecosystems (including rice paddies),

at an estimated 7 to 8 million square kilometers, account for 6 percent of the land area (Mitsch, 1994; OECD, 1992).

As mentioned earlier, the total acreage of wetlands declined dramatically during the past decades. Wetlands are considered to be among the most threatened ecosystems of all environmental resources. In Europe, except for Scandinavia, natural wetlands have vanished almost completely.

A significant proportion of the world's wetland ecosystems is peat-forming. Peatlands in the developed countries have been altered by two main processes: conversion to agricultural or forestry use, and mining of peat for energy and horticulture (IUCN, 1992). Peatlands in their natural condition impose restrictions on intensified agricultural utilization because of the high water table and the physical-chemical characteristics of the organic profile. Historically, peat has been cut in limited quantities to satisfy the energy needs of many isolated communities. Since the turn of the century, however, the use of peat on an industrial scale for power generation and district heating plants has expanded considerably. Fuel peat production worldwide nearly doubled between 1950 and 1980, from 47 million tons to 90 million tons (IUCN, 1992). For example, 90 percent of the peat cut in Finland is used to generate power. Estimates show that, on a global scale, 50 percent of the wetlands that once existed have been lost (IUCN, 1991).

Trends in wetland areas

Despite the increased recognition around the world of the importance of wetlands, their destruction continues (Mitsch, 1994). Contributing to the currently lower rate of wetland losses in the industrialized world is the fact that most sites that were readily accessible and could be reclaimed at a lower cost have already been lost. In the developed world, the network of protected areas covers only small portions of the total

wetland area. Outside such parks and reserves, wetlands continue to decline (IUCN, 1991).

International protection of wetlands

Ramsar Convention (1971)

The Convention on Wetlands of International Importance, also known as the Ramsar Convention – named after the city in Iran—was adopted in 1971 through the cooperation of 18 nations. The convention is an intergovernmental treaty that provides the framework for international cooperation in conserving the world's wetland habitats.

All E.U. states and the United States are contracting parties of the Ramsar convention. At present, there are 96 contracting parties to the convention with 858 wetland sites, totaling nearly 55 million hectares, designated for inclusion in the Ramsar List of Wetlands of International Importance. Western Europe has 53 percent (408) of all Ramsar sites and North America has the greatest total area (14,894,800 hectares) designated under the Ramsar Convention (Wetland International, 1996). Convention parties formally recognized that wetlands are essential for hydrological and ecological processes, the rich flora and fauna and support of human activities. The convention's objectives focus on stemming the loss of wetlands and ensuring their conservation and sustainable wise use for future generations. The treaty is unique in its focus on a particular ecosystem and provides the framework for the international protection of wetlands as habitats for migratory fauna, for the benefit of human populations. Countries that have ratified the agreement commit themselves to "wise use" of all areas that constitute wetlands. It recommends the creation of nature reserves to conserve wetlands and waterfowl.

The Ramsar Convention Bureau fosters cooperation among countries by promoting wetland conservation, recognizing that many wetland

systems either cross or are affected by international water systems. It also recognizes that migratory fauna management requires international cooperation. Hence, international action is required to promote the establishment and maintenance of an international network of protected wetland areas to ensure the conservation of critical functions and values. These objectives are enhanced by the promotion of sound national land use planning practices based on environmental carrying capacity. Contracting parties to the convention undertake to respect four main obligations:

- Designation of at least one wetland for inclusion in the List of Wetlands of International Importance.
- Promotion of the wise use of wetlands within their nation, particularly through the implementation of wetland conservation and management policies.
- Consultation with other contracting parties about implementing the obligations arising under the convention, particularly for those wetlands shared between nations.
- Establishment of protected wetland areas throughout their nation.

One of the doctrines of the convention was the establishment in 1990 of the Ramsar Wise Use Principles, complementing global sustainable development goals. In industrialized and developing countries alike, land use impacts on wetlands are frequently incompatible with the objective of sustaining ecosystem functions. These principles address this issue by calling on the contracting parties to:

- Establish and implement national wetland conservation policies.
- Undertake review and revision of the legislative and governmental infrastructure to promote wetland conservation.
- Undertake wetland inventories for wetland management.
- Promote wetland research.

- Establish protected wetland reserves.
- Promote public education and awareness of wetland values and conservation.

Wetlands of International

Importance are selected on the basis of ecological, botanical, zoological, hydrological, fisheries and human use criteria. Sites can be nominated because they represent rare or unusual wetland types in a biogeographical region. Sites of international importance that are subject to potential changes in ecological character due to technological developments, pollution or other human interference are listed in the "Montreux Record", an international "early warning" list maintained as part of the Ramsar Database. The record was established by recommendation 4.8 of the 1990 Montreux conference to identify priority sites for positive national and international conservation attention. The Montreux Record is reviewed regularly by the convention's Scientific and Technical Review Panel (Ramsar Convention Bureau, 1997).

World Heritage Convention (UNESCO, 1972)

The full name is the Convention for the Protection of the World Cultural and Natural Heritage. Its objective is to protect natural and cultural areas of outstanding value. These areas are selected by the World Heritage Committee and make up the World Heritage List or, for seriously threatened sites, the List of World Heritage in Danger. Each contracting party is obliged to take all possible measures to protect the sites included in these lists.

Bonn Convention (1979)

The Convention on the Conservation of Migratory Species of Wild Animals arose from one of the recommendations of the action plan adopted at the UN Conference on the Human Environment in Stockholm in 1972. Article III states *that parties that are range* [areas that a migratory

species inhabits] *states of a migratory species listed in the appendix shall endeavor to conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction* (Bonn Convention, 1979).

United Nations Conference on Environment and Development

The main objective of the Convention on Biological Diversity is to conserve biological diversity and its sustainable use of components of that biodiversity. Article 6a of the treaty states that: *countries will develop national strategies, plans, or programs for the conservation, and sustainable exploitation of the biodiversity* (UNCED, 1992).

International criteria for wetland classification and designation

International criteria for wetland classification are identified in the Ramsar Convention. Sites are designated on the Ramsar list on the basis of their international importance in ecology, botany, zoology, limnology or hydrology. The Ramsar criteria are classified into three groups (Wetlands International, 1996):

Criteria for representative or unique wetlands.

A wetland should be considered internationally important if:

1. *It is a particularly good representative example of a natural or near-natural wetland characteristic of the appropriate biogeographical region.*
2. *It is a particularly good representative example of a natural or near-natural wetland common to more than one biogeographical region.*
3. *It is a particularly good representative example of a wetland that plays a substantial hydrological, biological or ecological role in the natural functioning of a major river basin or coastal system, especially where it is located in a trans-border position.*

4. *It is an example of a specific type of wetland rare or unusual in the appropriate biogeographical region.*

General criteria based on plants or animals.

A wetland should be considered internationally important if:

1. *It supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant or animal, or an appreciable number of individuals of any one or more of these species.*
2. *It is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna.*
3. *It is of special value as the habitat of plants or animals at a critical stage of their biological cycle.*
4. *It is of special value for one or more endemic plant or animal species or communities.*

Specific criteria based on the waterfowl.

A wetland should be considered internationally important if:

1. *It regularly supports 20,000 or more waterfowl.*
2. *It regularly supports substantial numbers of individuals from particular groups of waterfowls indicative of wetland values, productivity or diversity.*
3. *Where data on populations are available, it regularly supports 1 percent of the individuals in a population of one species or subspecies of waterfowl.*

These criteria led to the Ramsar classification (Figure 3).

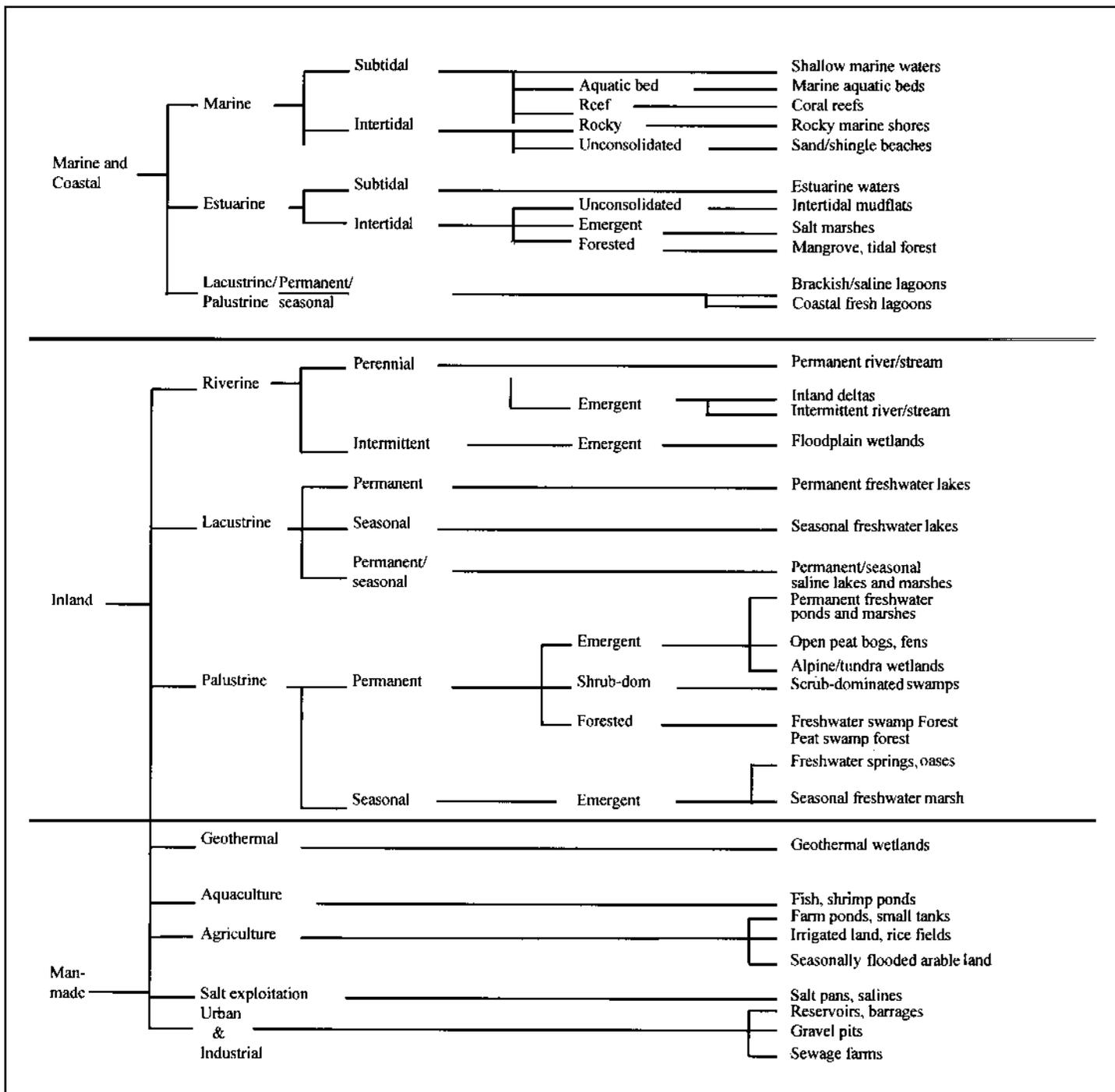


Figure 3. Wetland classification used by the Ramsar Convention Bureau (Scott and Jones, 1995)

Wetlands in the United States

History

By means of the Swamp Acts between 1849 and 1860, the U.S. Congress gave 64 million acres (26.32 million hectares) of wetlands to 15 states, urging reclamation and sale. The president of the American Health Association declared in 1876: "The state cannot afford to be indifferent to the presence of swamps which check production, limit population, and reduce the standard of health and vigor." The land area that currently comprises the U.S. contained in 1780 almost 392 million acres (158.70 million ha) of wetlands, of which 221 million acres (or 89.5 million ha) were in the lower 48 states. In the 1980s, in the conterminous U.S., 104 million acres (42.1 million ha) of wetlands remained. Alaska has the vast majority of wetland acreage (Dahl, 1990). Since European settlement, the United States has lost 53 percent of all its wetlands (Cwikiel, 1992). California lost 91 percent and Alaska less than 1 percent (Dahl, 1990).

Conversion to agriculture accounted for 87 percent of the estimated 13.8 million acres of wetlands lost in the mid-1950s to mid-1970s period (Heimlich, 1989). The rate of conversion between 1954 and 1974 was about 500,000 acres annually. Between the mid-1970s and the 1980s, the loss was 290,000 acres per year (Dahl, 1991) and from 1987 to 1991, 105,000 acres per year (Danielson and Leitch, 1996). Conversions to agricultural use dropped to 54 percent. According to Darnay (1994), commercial development is the main cause of wetland destruction since 1985, accounting for more than 50 percent.

Trends in wetland areas

Predicting the future is difficult, but trends are evident (Tiner, 1984). A growing population increases development pressure. In addition, population is shifting from the industrialized Northeastern and North Central

states to the Southeast and Southwest, which increases development pressures on wetlands in these regions. The National Planning Association estimated that 80 percent of the nation's population growth during the 1980-2000 period would occur in the South and the West. The top 10 states in projected population increases are California, Florida, Texas, Arizona, North Carolina, Georgia, Washington, Colorado, Virginia and Tennessee (USDI, 1989).

Especially in the Western states, competition for water increases between agricultural and non-agricultural users and reduces ecosystem availability. Suburban expansion means more acreage per household. The pressure to drain wetlands will continue to increase. The Fish and Wildlife Service estimated in 1989 that wetland losses were still continuing at a level as high as 450,000 acres annually (USDI, 1989) and will result in an additional 4,250,000 acres loss by the year 2000 (USDI, 1990).

Michigan

Michigan, situated in the heart of the Great Lakes Basin, is surrounded by freshwater. Like most of the other northern states, it is a product of glacial action, followed by the modifying influences of water, wind and revegetation. The interior is dotted with lakes and drained by major river systems (Michigan Society of Planning Officials, 1995).

Before European settlement, Michigan had a wide variety of habitats, largely forested in the Upper Peninsula and the northern half of the Lower Peninsula. The southwest was covered with oak savannas and prairies (MSPO, 1995). Almost one-third was wetland (Michigan DNR, 1988). In fact, wetlands attracted immigrants into the region in the 1600s because of the abundance of fur-bearing species that relied on wetlands. As soon as Michigan was ceded to the United States by Britain after the Revolutionary War, immigrants began to move into southern Michigan and clear land for farming.

With the completion of the Erie Canal from New York to Lake Erie in 1816, a rush of settlers entered the state. In 1810, Michigan had 4,762 residents; by 1840, mainly to drainage for agriculture, that figure had increased to 180,628 (MSPO, 1995). Michigan has lost about 50 percent of its wetland acreage since early settlement (MSPO, 1995, MDNR, 1988). This includes uses for horticultural crops and for specialty crops such as blueberries. Michigan farmers are being encouraged to cultivate cranberries by horticulture marketing experts. In addition, cranberry growers from southeastern Massachusetts are lured to Michigan (Goodenough, 1995). Urban sprawl, however, constitutes the most significant threat to wetlands. Though the population is barely rising, more space per capita is being used to house Michigianians (MSPO, 1995).

Wetland protection in the United States

Legal system

The U.S. national government delegates many powers and responsibilities to the individual states. In certain areas of public policy, state governments have a high degree of autonomy, as do local governments such as county and municipal governments (cities, boroughs, townships and villages). This autonomy is a direct result of the colonial history and dates back to the early 17th century English settlements, which experienced an acute localization of authority by scattered settlers. Counties were soon created as the basic unit of local government. In New England, seven towns were created shortly after the arrival of the first settlers and the town became the sole unit of local government. Consequently, local government gained a high degree of autonomy, which explains the current mistrust of distant central political power (Wood, 1996). This "home rule" principle is still quite prevalent.

A different legal issue in wetland protection is the broader debate over

the protection of private property rights. It is more difficult to regulate private land use in the U.S. than in European nations. A primary reason is that there is no consensus about the proper reach of government and public authority (Reilly, 1996). In history, from the beginnings of European settlement of the North American continent, land-hungry immigrants arrived with one paramount goal: finding a piece of secure property. They also imported the feudal English common-law system (Farm Foundation, 1985) with a differentiated bundle of property rights. Private ownership was defined as the right to possess, to use, to manage, to benefit, to be secure and to alienate. This represents an *exclusive* rather than an *absolute right*. The latter disregards the interest of others in the exercise of ownership (Farm Foundation, 1985). The only rights retained by government were taxation rights, the right to acquire the land by eminent domain and compensation, and the right to *regulate the use of land*.

Even at present, national property rights movements, backed by provisions of the fifth amendment to the Constitution, have found powerful champions in the U.S. Congress. This is exemplified by the practical inclusion of development rights as part of private property rights and the compensation requirements as a result of the public "taking" right. According to a major ruling in 1992 (*Lucas vs. South Carolina*), the U.S. Supreme Court decided that regulations denying "economically viable use of land" require due compensation no matter how great the public interest involved. The "taking" issue is one of the dilemmas of valuing and protecting wetlands. In contrast, development rights are not inherently part of private rights in European countries, and therefore public land use restrictions limiting "highest and best use" of private property do not have to be compensated.

According to a 1994 study by the National Association of Home Builders, the value of private property is very dependent on its immediate

surroundings. Favorable regulations that limit the expansion of incompatible land uses and thereby prevent the reduction of private property values are not directly compensated by beneficiaries. In essence, land use restrictions designed to improve or restore environmental quality may be viewed as a taking under the fifth amendment of the U.S. Constitution (Reilly, 1996). As part of the Bill of Rights, the "just compensation clause" is lodged in the fifth amendment protecting property owners against uncompensated government seizure of property for the public good. It states that "*private property shall not be taken for public use without just compensation*". With the industrialization of America, government found it necessary to impose regulations to protect the public's health and safety. In 1922, Justice Holmes decided that if a regulation goes too far, it would be recognized as a taking. In U.S. Claims Court, Judge Smith awarded \$64 million plus interest to property owners injured by environmental regulations (Brookes, 1991).

Despite the "taking" issue, the constitutional hurdle remains high for property owners. First, owners are not automatically entitled to the most profitable use of their land. Local zoning, nuisance or wetland ordinances restricting the type and nature of development are examples of use limitations. Second, diminutions of value caused by government regulations are uniformly tolerated. Third, virtually all public interests to be served by environmental laws are legitimate in the context of the constitution. Last, such laws are usually found to substantially advance the public interest.

The impact of the property rights movement caused several states to adopt legislation to protect property rights. The first is the "Takings Impact Assessment" analogue on the environmental impact assessment (EIS). In 1988, the Reagan Administration issued Executive Order 12630, which requires state agencies to evaluate most

government action to determine whether such action could result in a taking of private property. The second is compensation bills that require states to pay property owners when regulations decrease the property market value by a certain percentage.

Wetland protection policies

The first action taken to protect wetlands was by the Carter administration in 1977 with the issuance of two executive orders that established wetland protection as official federal policy. The first, Executive Order 11988 on Floodplain Management, established federal policy for the protection of floodplains. It directed agencies to revise procedures and consider the impact on floodplains and to avoid direct or indirect support of floodplain development if alternatives existed. The second, Executive Order 11990 on the Protection of Wetlands, required that all federal agencies minimize the destruction, loss or degradation of wetlands. In addition, the preservation and enhancement of natural and beneficial values of wetlands became part of an agency's responsibilities. Both executive orders applied to all property owned by the federal government.

No net loss

In 1987, a National Wetlands Policy Forum was convened to investigate the status of wetland management in the United States. The forum formulated as its major objective to achieve no overall net loss of the nation's remaining wetlands. This meant that if, for economic or political reasons, wetlands were destroyed, replacement was required by restoration or construction. This concept became a cornerstone of wetland conservation in the United States (Mitsch and Gosselink, 1993). In 1988, the Bush administration embraced this concept as a national goal. In response to this goal, a "no net loss" Wetland Action Plan was prepared by the U.S. Fish and Wildlife Service. This action plan draws on existing legislative authorities, regulations, and directives to

focus and emphasize wetland conservation activities toward the goal of eliminating the net loss of wetlands (USFWS, 1990).

National Wildlife Refuge System

The well-being of wildlife depends on vital habitat. Besides regulating land, the federal government also acquires and manages wildlife habitat for wildlife conservation. The first attempt to create a systematic program of wildlife refuge acquisition was for migrating birds by means of the Migratory Bird Treaty Act of 1913. The success of this act was limited, and the Migratory Bird Conservation Act was passed in 1929 (Bean, 1977). Funding for refuge acquisition was obtained from the sale of duck stamps to hunters.

Federal laws

The United States does not have a formalized national wetland protection law. Rather, measures of protection are provided through laws that address other purposes (Mitsch and Gosselink, 1993). Wetlands are managed primarily under regulations related to land use and water quality.

Swamp Land Act of 1850

This act enabled states with considerable acreage of land that was "wet and unfit for cultivation" to reclaim and develop the land. It stated that land should be transferred from federal to state ownership to permit drainage of swamplands. In total, about 64 million acres (25.9 million ha) were granted to the states; half the land was considered suitable for farming (National Science Foundation, 1995).

River and Harbor Act of 1899

The River and Harbor Act (RHA) mandated the U.S. Army Corps of Engineers (USACE) to maintain navigation with the responsibility to regulate dredging and filling of "navigable waters." Subsequently, the courts gave the USACE authority to review fill permits of submerged land resulting in potential ecological damage. This resulted in the legal protection status of wetlands. Section 13 of the

RHA, which makes it unlawful to discharge refuse into navigable waters without a permit, is superseded by the permit authority of section 402 and 405 of the Clean Water Act. Today, however, it still may be used for enforcement purposes (Goodenough, 1995).

Water Bank Act of 1970

The U.S. Department of Agriculture's Water Bank Program for Wetlands Preservation offers landowners of important migratory waterfowl nesting and breeding areas 10-year renewable agreements. In return for an annual fee, the landowners agree "not to drain, burn, fill, or otherwise destroy the wetland character or to use such areas for agricultural purposes" (Bean, 1977; Gosselink, 1990).

The Clean Water Act of 1972

Section 404 of the CWA is the primary vehicle for wetland protection and regulation. It is somewhat controversial because wetlands are not specifically mentioned. It provides authority to the Army Corps of Engineers to establish a permit system to regulate the dredging and filling of materials in all "waters" of the United States. Initially, this was limited to navigable waters, but after two court decisions (*Natural Resources Defense Council v. Callaway* and *United States v. Riverside Bayview Homes*), wetlands were explicitly included (Zinn and Copeland, 1996). As a result, the following waterways are included:

- *All interstate waters, including interstate wetlands.*
- *All other waters, such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce.*
- *All impoundments of water that fit these definitions.*
- *Tributaries of any defined waters.*
- *The territorial seas.*

- *Wetlands adjacent to waters, other than adjacent to other wetlands.*

Furthermore, the EPA, to which the secretary of the army provides the permit review guidelines, controls which areas may be listed as suitable disposal sites and can prohibit certain materials from being discharged at an approved site on certain grounds. Permits expire at the end of five years (NWSTC, 1993).

Section 404(f)(1) provides the following statutory exemptions for permit application requirements:

- *Normal farming, silviculture or ranching activities such as plowing, seeding, minor drainage and harvesting.*
- *Maintenance of structures such as dikes, dams, levees, breakwaters, causeways and bridge abutments.*
- *Construction or maintenance of farm ponds or irrigation or drainage ditches.*
- *Construction of temporary sedimentation basins on construction sites.*
- *Farm or forest roads, or temporary roads for moving mining equipment, under the condition that best management practices are met and the water is neither impaired nor permanently changed.*
- *Actions authorized by an approved state regulatory program.*

However, these exemptions are subject to the "recapture" provision of 404(f)(2), which requires a permit if a discharge changes the use of water, impairs its flow or circulation, or reduces the reach of the water. This provides a balance between the exemptions and the recapture provision so that only routine activities with relatively minor water quality impacts are exempt.

Embodied in the CWA's statement of policies is Congress' intent to encourage state implementation of, among others, the federal 404 permit program (Environmental Law Institute, 1993). The 104th Congress indicated that environmental protection was best left to individual states and suggested that state government,

being closer to the people, was more democratic (Goodenough, 1995). Until now, only Michigan (see p. 20, Michigan laws) and New Jersey have received authorization to administer the 404 program. Oregon is about to be the next (Goodenough, 1995).

Endangered Species Act of 1973

This act protects threatened species throughout the country. The Endangered Species Act (ESA) plays a substantive role in § 404 permitting of the CWA. Section 7 of the ESA prohibits all federal actions, including permit approvals, that would jeopardize listed endangered species or adversely modify habitats critical to their survival (Houck and Rolland, 1995).

Food Security Act (FSA) of 1985

The FSA, sometimes also referred to as the "farm bill", includes two provisions that are of special importance for wetland protection, namely the Swampbuster provisions and the Wetland Reserve Program.

Swampbuster

The Swampbuster provisions address general wetland preservation objectives and identify the presence of wetlands on the basis of three physical wetland features: wetland-type soils, wetland plants and water. Because normal agricultural and silvicultural activities were exempted from section 404 permit requirements, allowing farm wetland drainage and in commercial forests, these Swampbuster provisions were provided as a part of the 1985 Food Security Act. They deny federal subsidies to any farm owner who knowingly converts wetlands to farmland after the effective date of the act. Swampbuster enforcement is a two-step process (Zinn and Copeland, 1996). The Natural Resource Conservation Service (NRCS) determines first whether swampbusting has occurred. If so, the landowner is referred to the agencies administering farm benefit programs, which then render a decision on benefit denial.

Wetland Reserve Program

The Wetland Reserve Program was enacted in the 1990 farm bill. It is a voluntary program entitling landowners to receive payments for restoring cropland converted from former wetland and protecting those wetlands (NRCS, 1996). The Wetland Reserve Program (WRP) is authorized by the Food Security Act of 1985 and was amended in the 1990 farm bill. The restoration cost-share can be up to 75 percent and additional economic return is possible. In this process, landowners are offered the appraised agricultural market value of their land in exchange for signing a permanent easement and restoring the land to wetland status. Easements for 30 years may also be offered for 50 percent of the appraised value. So far, the USDA has sought only permanent easements (Zinn, 1994).

Tax Reform Act of 1986

This act reduced the fiscal benefits of drainage by eliminating tax expensing of wetland drainage costs not in compliance with the Swampbuster provision. Gains on sales of converted wetlands are treated as ordinary income rather than as capital gains and, therefore, taxed at a higher rate (Leitch, 1992).

Emergency Wetlands Resources Act of 1986

The U.S. Congress concluded that wetlands are nationally significant resources that contribute to the economy, food supply, water supply and quality, flood control, and fish, wildlife and plant resources. This 1986 act was enacted to promote the conservation of wetlands by intensifying cooperative efforts among private interests and local, state and federal governments for the conservation, management and/or acquisition of wetlands (USDI, 1989). Under the act, the USDI was directed by Congress to develop a National Wetlands Priority Conservation Plan. This plan identifies the locations and types of wetlands and interests in wetlands that should receive priority attention for wetland acquisition projects by federal and state agencies

using Land and Water Conservation Fund appropriations. The primary purpose of the plan is to assist decision-makers in focusing their acquisition efforts on the more important, scarce and vulnerable wetlands in the nation (USDI, 1989).

Planning and zoning

State and local natural resource management dates back to the 1800s, when park, wildlife and forestry programs were established for lands in the public domain. Control of the private use of land was possible only by outright acquisition. It was not until the 1920s that states authorized local units of governments to adopt zoning and subdivision regulations. In practice, however, lack of effective local control and demand for land close to urban centers resulted in construction within floodplains and destruction of wetlands (Kusler, 1980).

Rural land use planning is often undertaken principally for economic development with limited emphasis on resource protection. Though a significant number of federal programs have an indirect impact on land use decision making (137 federal programs in 1979—such as the Department of Housing and Urban Development [HUD] with its urban revitalization programs and USDA/NRCS with well intended efforts to preserve prime farmland, etc.), land use planning remains largely the domain of local government. Though some states' programs assumed some responsibilities after WWII, specifically in the 1970s, most states—including Michigan—re-delegated planning authority to the local level in the 1980-90 period. Oregon and New Jersey are notable exemptions because of their adoption of state-wide planning strategies and growth management policies. The federal role is mostly limited to providing funding for city and regional planning activities (Held and Visser, 1984), with specific allocations to public housing assistance (HUD), transportation and economic development (U.S. Department of Commerce, Economic Development Administration).

The implications of this “laissez-faire” policy are significant. Demand for indiscriminate conversion of open space, including prime agricultural land and wetlands, primarily for residential use, has exploded since World War II. This suburban sprawl is associated with a disinvestment in urban areas. As pointed out by Richmond (1997), during the 1980-90 period, the U.S. poverty rate in urban areas increased by 40 percent while the area associated with this poverty rate increased by 54 percent. On the basis of current and projected trends, Michigan’s population increase over the 1980-2010 period is projected to translate into a tenfold residential area increase! Clearly, these trends are associated with erosion of the local tax base of the inner cities and a declining service infrastructure.

Nationally, land conversion for urban development, at current rates, is largely (80 percent) associated with single family residential use. The pull factors of urban sprawl include a higher quality of life with lower crime rates, better educational and recreational opportunities, increasing property values, comparatively low tax rates/house value and improved environmental quality.

Public investments associated with this development are not only costly and inefficient but they also effectively *subsidize* urban sprawl by providing the necessary capital expenditures and services, such as police and fire protection and infrastructural expansion. In reality, residential taxation rates are insufficient to cover the costs of infrastructural development and maintenance. Most of these costs are born by non-residential uses and, to some extent, by people outside local jurisdictions. Buchell (1997), in discussing the fiscal impacts of sprawl, indicates that in South Carolina, public investments needed to accommodate current growth patterns are directed primarily to road construction (50 percent). The remainder is distributed among education (20 percent), health services (15 percent), commerce (5 percent), environment (3 percent), and recreation

and culture (2 percent). He states that this public investment, coupled with graduated tax abatements over a 33-year period to attract new industries in an attempt to generate employment opportunities, is clearly not directly borne by the principal recipients of these benefits—suburban residents. This shortfall in revenues associated with uncontrolled growth will have to be offset by increases in taxes on fuel, real estate and sales, toll roads and parking fees.

Michigan

Michigan laws

Clean Water Act

As mentioned above, Michigan is one of the two states authorized to administer the federal 404 permit program of the CWA. In 1977, the Michigan Department of Natural Resources (MDNR) and the U.S. Army Corps of Engineers signed a Memorandum of Understanding (MOU, 1977) stating that “*a considerable portion of the duplication which necessarily results from processing permit applications independently can be eliminated if application processing is done in a joint matter*”. This MOU refers both to permits under the River and Harbor Act of 1899 and the Clean Water Act.

In 1984, a Memorandum of Agreement (MOA, 1984) between Michigan and the USACE delegated administrative authority for the section 404 program. In it, the corps also waived its right to review MDNR permits. Two exceptions were made. The first, for major discharges into areas that could affect existing or proposed Detroit District COE (Chief of Engineer) projects, and second, for discharges that may affect navigation in navigable waters of the U.S. “*All waters within the state of Michigan shall be regulated by MDNR other than those waters which are presently used, or are susceptible to use in their natural condition or by reasonable improvement as a means to transport interstate or foreign commerce shoreward to their ordinary high water mark, including wetlands adjacent thereto*”. Under these

provisions, the EPA retains review authority.

Two laws primarily are used to regulate Michigan’s waters and wetlands as provided under CWA’s section 404: the Natural Resources and Environmental Protection Act and the Inland Lakes and Streams Act. The other laws are ancillary state statutes that partly overlap Michigan’s wetland jurisdiction (Goodenough, 1995).

Natural Resources and Environmental Protection Act of 1994

Part 303 of the Natural Resources and Environmental Protection Act of 1994 (NREPA) replaced the Wetland Protection Act (Act 203) of 1979, in effect since 1980. The act prohibits draining, dredging or filling of regulated wetlands without a permit from the MDNR. Because of the broad definition of wetlands, the amount of wetlands regulated by the NREPA is considerable. The NREPA covers all wetlands contiguous to the Great Lakes or Lake St. Clair, an inland lake or pond, or a river or stream; and wetlands not contiguous to the Great Lakes or Lake St. Clair, an inland lake or pond, or a river or stream that are 5 acres (2.02 ha) or larger.

“Contiguous to the Great Lakes” includes every wetland within 1,000 feet of those lakes; or those located within 500 feet of an inland lake, river, pond or stream. Wetlands of any size in counties of fewer than 100,000 population are not covered by the NREPA wetland provision until the MDNR has conducted an inventory (Sadewasser, 1996). Wetlands contiguous and smaller than 5 acres can be protected under the NREPA if the MDNR designates them as “essential” (Michigan Compiled Laws Annotated, 324.303). State protection does not depend on the completion of a wetland inventory (Sadewasser, 1996).

To designate a wetland as “essential”, one or more of the following criteria have to be met:

- a. It supports state or federal endangered or threatened plants, fish or

wildlife appearing on a list specified in section 36505.

- b. It represents what the department has identified as a rare or unique ecosystem.
- c. It supports plants or animals of an identified regional importance.
- d. It provides groundwater recharge documented by a public agency.

A local unit of government in Michigan is allowed to protect contiguous or not contiguous wetlands that are smaller than 5 acres and meet the wetland protection provision of the NREPA. For wetlands between 5 and 2 acres, local governments have to comply with state regulation by using the same definition and completing an inventory. In 1995, 22 local governments had wetland protection ordinances (MDEQ*, 1995).

If a local unit of government of Michigan has adopted a wetland ordinance for a site smaller than 2 acres, a development permit cannot be denied unless the site meets one of the following criteria:

- a. The site supports state or federal endangered or threatened plants, fish or wildlife appearing on a list specified in section 36505.
- b. The site represents what is identified as a locally rare or unique ecosystem.
- c. The site supports plants or animals of an identified local importance.
- d. The site provides groundwater recharge documented by a public agency.
- e. The site provides flood and storm control by the hydrologic absorption and storage capacity of the wetland.
- f. The site provides wildlife habitat by providing breeding, nesting or feeding grounds or cover for forms of wildlife, waterfowl—including migratory waterfowl—and rare, threatened or endangered wildlife species

- g. The site provides protection of subsurface water resources and provision of valuable watersheds and of recharging groundwater supplies.
- h. The site provides pollution treatment by serving as a biological and chemical oxidation basin.
- i. The site provides erosion control by serving as a sedimentation area and filtering basin, absorbing silt and organic matter.
- j. The site provides sources of nutrients in water food cycles and nursery grounds and sanctuaries for fish.

Potential wetland protection options in Michigan are summarized on the following page (Fig. 4).

Part 301 of the NREPA replaced the **Inland Lakes and Stream Act of 1972** (MCLA, 324.301). The Inland Lakes and Streams Act (ILSA) generally extends jurisdiction to any “natural or artificial lake, pond or impoundment, river, stream, or creek ... or any other body of water which has .. evidence of a continued flow or continued occurrence of water, including the St. Marys, St. Clair and Detroit Rivers.” However, surface areas of less than 5 acres, the Great Lakes and Lake St. Clair are excluded from regulation under ILSA (Goodenough, 1995). Prohibited activities include dredging or filling bottomland, setting up constructions or making canals to connect with an inland lake or stream (ILSA, 1972).

Part 361 of the NREPA also replaced the **Farmland and Open Space Preservation Act of 1974** (MCLA, 324.361). “This Act provides for farmland development rights agreements and open space development rights easements;...” Through the act, a “state or local governing body” can buy the development rights of a landowner for a period not less than 10 years by means of a development rights agreement or easement. Open lands that could be considered for an agreement or easement are areas “approved by the local governing body, the preservation of which area in its pre-

sent condition would conserve natural or scenic resources, including: the promotion of the conservation of soils, wetlands and beaches...” As a practical matter, landowners may file an application to have land placed under the act in return for a reduction of tax liabilities. Early termination of such an agreement is subject to government review and approval and results in a (partial) restitution of the accumulated benefits.

Floodplain Regulatory Act of 1968

This act (Act 167) assesses the location and extent of floodplains, streambeds and stream discharge for the state’s watercourses to prevent dangerous flooding events. Permits are required to alter a floodplain.

Part 17 of the NREPA is the former **Michigan Environmental Protection Act of 1970** The Michigan Environmental Protection Act (MEPA). The MEPA prohibits any conduct that is likely to pollute, impair or destroy a lake, stream, wetland or other natural resources of the state. Exemptions are made if investigation shows that there are no less harmful feasible and prudent alternatives and the “conduct is consistent with the promotion of the public health, safety and welfare in light of the state’s paramount concern for the protection of its natural resources from pollution, impairment or destruction”.

Soil Erosion and Sedimentation Control Act of 1972

This act (Act 347) is designed to protect the waters of the state from sedimentation caused by soil erosion. Permits are required for earth changes that disturb one or more acres of land or that are within 500 feet (150 m) of a lake or stream, or for alterations of the stream. Plowing, tilling, mining and logging are permitted under the act.

State Zoning Enabling Acts

The state can convey authority to local units through acts of the state legislature. Such powers take two forms, *mandating* and *enabling*. A

* In October 1995, the Department of Environmental Quality (DEQ) was separated from the MDNR. The DEQ is now responsible for regulatory wetland compliance issues.

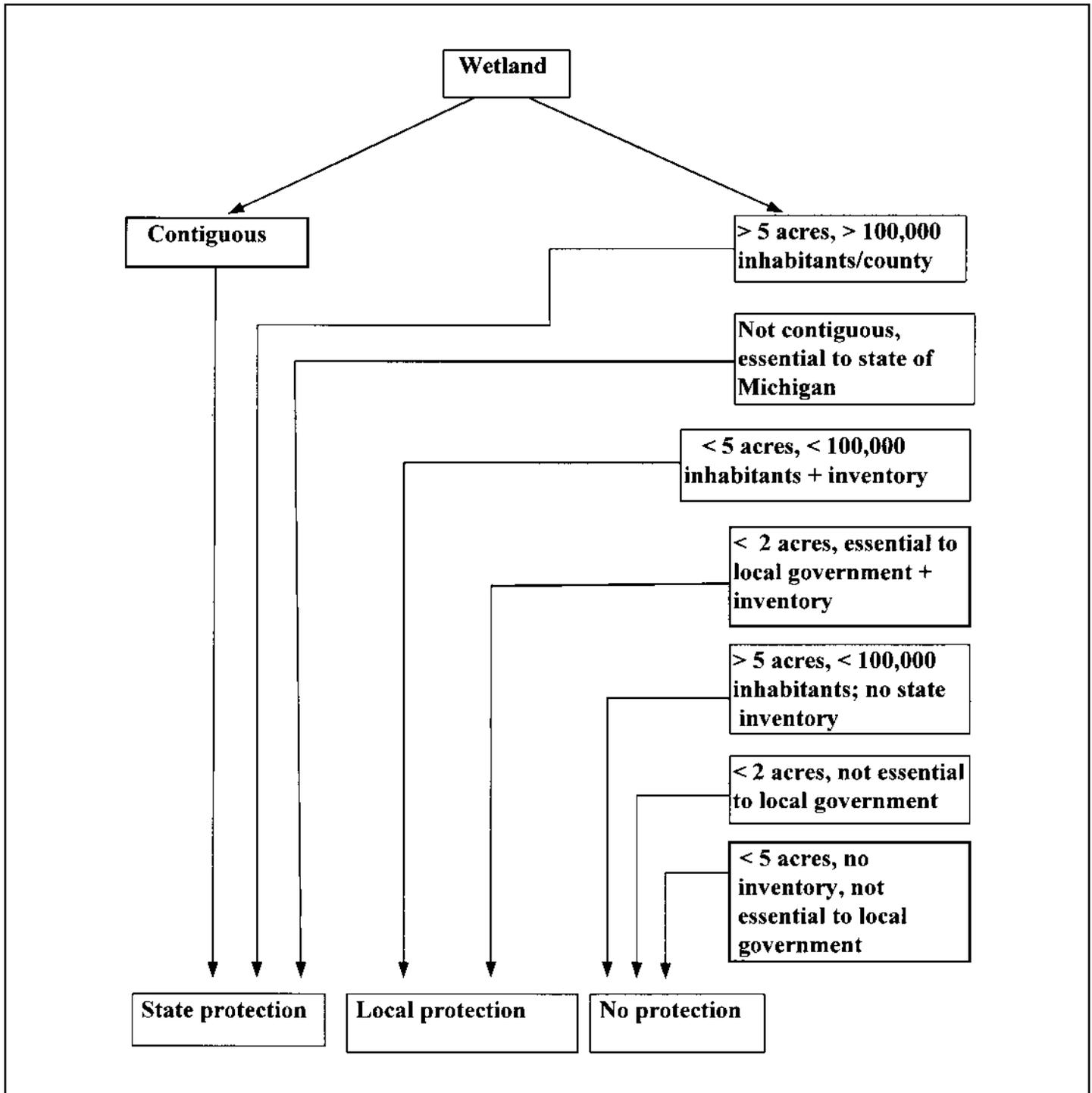


Figure 5. Diagram of conditions for potential wetland protection in Michigan. Numbers represent wetland size and county population.

mandating statute directs a township board to exercise certain powers and may vary from very detailed instructions, as in the laws governing uniform accounting and budgeting procedures, to broad grants of power, as for the responsibility to provide for the general health and welfare of the public.

Enabling or permissive statutes do not require local units to act but allow local officials to do so if they so desire. Once a township board votes to use the power, the enabling statutes often prescribe how the township should proceed in carrying out the functions. For instance, state law does not require a township

board to adopt a zoning ordinance. But if it does, it must give proper public notice and create a zoning board of so many members and a board of zoning appeals (VerBurg, 1990).

Michigan has three zoning enabling acts for three types of local government.

The first is the **City or Village Zoning Act of 1921**. This act provides a legal basis for ordinances that regulate “the use of land and structures, the height, the area, the size, and location of buildings ... the light and ventilation of those buildings”. The density of population can also be regulated by ordinance and the designation of the use of certain state-licensed residential facilities.

The second, the **County Rural Zoning Enabling Act of 1943**, and the third, the **Township Rural Zoning Act of 1943**, serve the same purpose. The basis and considerations of both zoning ordinances are:

“The zoning ordinance shall be based upon a plan designed to promote the public health, safety and general welfare, to encourage the use of lands in accordance with their character and adaptability, and to limit the improper use of land, to conserve natural resources and energy, to meet the needs of the state’s citizens for food, fiber and other natural resources, places of residence, recreation, industry, trade, service and other uses of land, to insure that uses of land shall be situated in appropriate locations and relationships, to avoid the overcrowding of population [to provide adequate light and air] to lessen congestion on the public roads and streets, to reduce hazards to life and property, to facilitate adequate provision for a system of transportation, sewage disposal, safe and adequate water supply, education, recreation and other public needs, and to conserve the expenditure of funds for public improvements and services to conform with the most advantageous uses of land, resources and properties”.*

Local regulations: land use planning and zoning

Planning is accomplished by the development of a land use master plan and its implementation through local ordinances and regulations for zoning, subdivisions, housing, nuisance conditions, etc. As specifically authorized under the zoning acts, local authorities such as municipalities and townships may adopt zoning

ordinances. In open space preservation and wetland protection issues, *township* actions are the most relevant, especially when bordering urbanizing regions.

The development of local government in the U.S. derives directly from the United Kingdom. The English *shire*, which was the unit for judicial administration and law enforcement, was the predecessor of the American *county*. The English *parish*, which was the unit for the maintenance of the established church, charities and local roads, became the American *town* or *township*. The English *borough*, a thickly populated area that had received a charter from the king to engage in business as well as governmental enterprises, was the prototype of the American *municipality*. There are distinctive differences in various parts of the country. In the South, the plantation system was adapted not to the town but to the county. In New England (northeastern states), the town is the principal unit of local government (Zimmerman, 1978).

Michigan local governments are patterned after the town meeting system of New England. Most counties have 36 townships, each generally comprising a 6-by 6-mile area. In the 19th century, these two forms of local government became inadequate for urban settlements where people needed more local services and required a government with stronger regulatory powers. The legislature provided for the establishment of city governments separated from the township governments. Villages are an intermediate level of government with most of the special powers of cities, but they remain part of the townships in which they are located. At present, Michigan has 83 counties, 1,241 townships, 271 cities and 263 villages (Legislative Council, 1995).

Local regulations pertaining to land use development and controls are implemented in the form of land use master plans and ordinances such as zoning, wetland protection, nuisance, woodland protection, etc. Zoning is widely used to protect

sensitive areas, such as groundwater recharge areas and wetlands at the local level through the regulation of development type and density. Its effectiveness in this regard is continually debated.

Section 8 of Michigan’s former Wetland Protection Act (WPA) allows a municipality to provide by ordinance for more stringent definition and regulation of wetlands than is provided by state law. A municipality must notify the MDNR before adopting a wetland ordinance to execute an agreement providing, in part, that the MDNR will not issue a wetland permit if a municipality has denied a permit under its ordinance (Zimmermann, 1992). In 1991, three dozen municipalities had adopted wetland ordinances, mostly as a part of their zoning ordinances. This authority is supplemental to the existing authority of a municipality to enact zoning ordinances under the County, Township, City and Village Zoning Enabling Acts (MDNR, 1988).

Many local units of government in Michigan were creating local wetland protection ordinances that were in general more restrictive and extended authority over more wetlands than the state and federal statutes. The former WPA was amended in 1993, however, to restrict the ability of municipalities to adopt wetland ordinances. In the current section 30308 of the NREPA, municipalities were given until June 18, 1994, to conduct a local wetland inventory and file copies of wetland ordinances with the MDNR if the ordinances were to remain effective (NREPA, 1994). Also, new ordinances require an inventory.

* Extra phrase of the Township Rural Zoning Act of 1943.

Criteria and classification of wetlands of the United States

The criteria of wetlands in the United States are covered by the definitions mentioned on page 7 (United States and the state of Michigan). The classification of wetlands was implemented by the Fish and Wildlife Service in 1979 (Cowardin, 1979). This is very important because landowners are able to recognize if their land is defined as a wetland and thus protected from development without a permit. The classification is divided into five major systems: marine, estuarine, riverine, lacustrine and palustrine (Figure 5). The definitions of these terms are:

A **marine system** consists of the open ocean overlying the continental shelf and its associated high-energy coastline.

The **estuarine system** consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed or sporadic access to the open ocean and in which ocean water is at least occasionally diluted by freshwater runoff from the land.

The **riverine system** includes all wetlands contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 percent.

The **lacustrine system** includes wetlands with all of the following characteristics: situated in a topographic depression or a dammed river channel; lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent areal coverage; and total area exceeds 8 ha. If less than 8 ha, they

are included in the lacustrine system if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary or if the water depth in the deepest part of the basin exceeds 2 meters at low water.

The **palustrine system** includes all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent. It also includes wetlands lacking such vegetation but with all of the following characteristics: area less than 8 ha; active wave-formed or bedrock shoreline features lacking; water depth in the deepest part of basin less than 2 m at low water; and salinity due to ocean derived salts less than 0.5 percent.

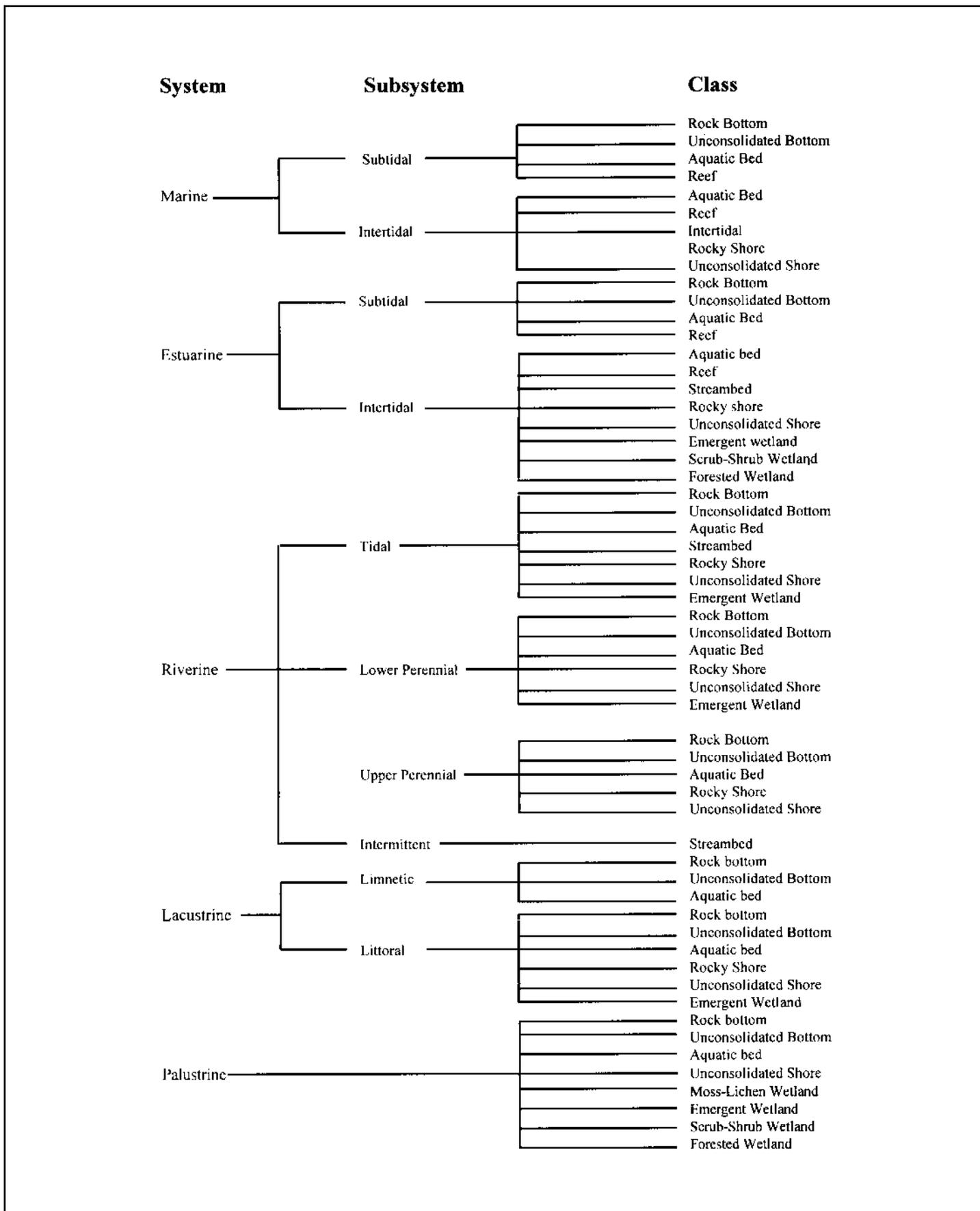


Figure 5. Classification hierarchy of wetlands and deepwater habitats, showing system, subsystems and classes. The palustrine system does not include deepwater habitats. (Cowardin et al., 1979.)

Europe

History

It is estimated that two-thirds of all wetlands in Europe have vanished since the beginning of the century (E.U., 1995). The main causes were land reclamation, building of hydroelectric dams in rivers and peat extraction. In the 1970s and 1980s, guaranteed (subsidized) high grain prices proved an important incentive for converting low pastures into farmland, as was the draining of wetlands subsidized by the national authorities. Power plants and dam construction alone led to a loss of 13,000 natural floodplains in the Rhine watershed (E.U., 1995). In addition, the total river forests area of the Rhine declined dramatically. Of the 40,000 ha in 1830, only 8,500 ha remained (E.U., 1995). All these factors caused increased peak runoff, downstream velocity and the flood risk of numerous cities.

These changes, combined with high snowmelt conditions in the winters of 1994 and 1995, caused the Rhine and Meuse rivers to flood several cities in Germany, Belgium and the Netherlands (Aarden, 1996). These circumstances are similar to the major floods along the Mississippi River basin in the 1990s.

Trends in wetland areas

The future of Europe's wetlands is not bright. Many pressures now threatening wildlife habitat show little signs of abating, while the total area of natural and semi-natural habitats continues to diminish (Table 1,

[IEEP, 1991]). The total wetland area is also still declining and will be for some time in the future (E.U., 1995). eutrophication, groundwater extraction and acid rain are considered to be main threats. Global warming is likely to affect the distribution of many sensitive species (IEEP, 1991). Because of the confinement of those species to relatively small, mostly isolated areas, it has become difficult for terrestrial species to migrate using natural pathways.

Although all member nations are signatories to the Ramsar Convention, the legal protection of wetlands is still limited to the functional aspect of water quality. Even important wetlands are protected only because they offer a habitat for endangered species. Other benefits are rarely specifically identified.

Wetland protection in Europe

European wetland protection policies have emerged over the past 20 years and are specifically designed to protect sensitive ecosystems of international significance. They reflect pan-European initiatives and more recent directives by the European Union.

Pan-European

Bern Convention (1979)

The official name is the Convention on the Conservation of European Wildlife and Natural Habitats. The Bern Convention originated from the Council of Europe. "The aims of this Convention are to conserve wild flora and fauna and

their natural habitats, especially those species and habitats whose conservation requires the cooperation of several states, and to promote such cooperation. Particular emphasis is given to endangered and vulnerable species, including endangered and vulnerable migratory species" (Council of Europe, 1979).

The Ramsar and Bern conventions, albeit important, are not legally binding. In contrast, the following E.U. directives are.

European Union

E.U. Directive on the Conservation of Wild Birds.

This directive was adapted in 1981 and imposes strict legal obligations on European Union member states to maintain populations of naturally occurring wild birds at levels corresponding to ecological requirements, to regulate trade in birds, to limit hunting to a sustainable exploitation, and to prohibit certain methods of capture and killing. Article 1 applies to the conservation of birds, their eggs, nests and habitat. Articles 3 and 4 are meant to protect habitats. Article 3 states: "Member States shall take the requisite measures to preserve, maintain or re-establish a sufficient diversity and area of habitats for all the species of birds referred to in Article 1".

Article 4 adds special protection measures to conserve the habitats of threatened bird species through the designation of Special Protection Areas (SPAs), as listed in Annex 1 (EEC, 1979). Bird habitat selection criteria are:

- Species extinction danger.
- Habitat change vulnerability.
- Species rarity due to population size or restricted local distribution.
- Habitat uniqueness.

Article 4.2 states that similar measures shall be taken for regularly occurring migratory species not listed in Annex 1 and shall pay particular attention to the protection of wetlands and particularly to wetlands of international importance (EEC, 1979).

Table 1. Areas of important wetlands in several countries of the European Union.

Country	Coastal wetlands (ha)	Inland wetlands (ha)
Netherlands	404,335	391,134
United Kingdom	372,000	518,713
Germany	680,881	427,424
France	381,280	800,627
Italy	165,070	107,742
Denmark	885,142	64,399

Source: IEEP, 1991

E.U. Habitat Directive

In this directive, the particular set of environmental conditions on which an organism or group of interdependent organisms depends is defined as a habitat. Its main goal is to promote maintenance of biodiversity by the conservation of fauna, flora and natural habitats of E.U. importance. The fundamental purpose of this directive is to establish a network of protected Special Areas of Conservation (SACs) throughout the community designed to maintain both the distribution and the abundance of threatened species and habitats, both terrestrial and marine. Wetlands are an important part of this network, especially for creating steppingstones for migratory birds along their flyways (Figure 6). The network of proposed SACs, called *Natura 2000*, will include SPAs of the Bird Directive. Criteria for selection include priority habitats (see page 27, Criteria and classification of wetlands of Europe) and species identified in the annexes (EEC, 1992).

Urban Waste Water Treatment Directive

This directive sets out rules for the collection, treatment and discharge of urban and industrial wastewater. It aims to protect the environment from the adverse effects of such discharges while requiring treatment of all significant discharges. Distinction is made between discharges in sensitive and less sensitive areas. Discharges may require more stringent treatment, such as nutrient removal (EEC, 1991).

Criteria and classification of wetlands of Europe

In 1985, the Corine program (Coordination of Information on the Environment) was established as an experimental project. It was subsequently extended to provide a permanent information network to assist the European Environment Agency.

Corine has three main objectives:

1. To gather information on the state of the environment for use in priority community applications.

2. To coordinate national initiatives taken by member states, and to improve information at the international level.

3. To ensure the consistency of nomenclatures, definitions, etc., as well as creating the conditions necessary to compare data (E.U., 1996).

Corine includes projects on the preservation of quality of air, soil, water, land cover types and biotopes, and reduction of coastal erosion. The biotopes project aims to "identify and describe biotopes of major importance for nature conservation in Europe" (Hughes, 1995). Its sites of major importance for nature conservation are defined as: "An area of land or a body of water which forms an ecological unit of community significance for nature conservation, regardless of whether this area is formally protected by legislation".

Sites included in the Corine biotopes inventory must satisfy the following criteria:

- Presence of vulnerable species of plants or animals.
- Presence of vulnerable habitats.
- Richness of the site for a taxonomic group (e.g. birds, mammals, dragonflies, orchids).
- Richness of the site or phytosociological units (Wageningen Agricultural University, 1996).

It recommends inclusion of all the sites that:

- Contain 1 percent or more of the E.C. population of a vulnerable species.
- Are among the 100 most important sites for such species in the E.C.
- Are among the five most important sites for a species in a region of the E.C. (WAU, 1996)

The habitat directive uses the Corine classification of habitats (Fig. 7) to identify protected habitat by designation of SACs. These include the SACs of the Bird Directive. In total, 167 habitats are listed in Corine, of which 45 have priority status (EEC, 1992). Wetlands are an integral part of these ecosystems.

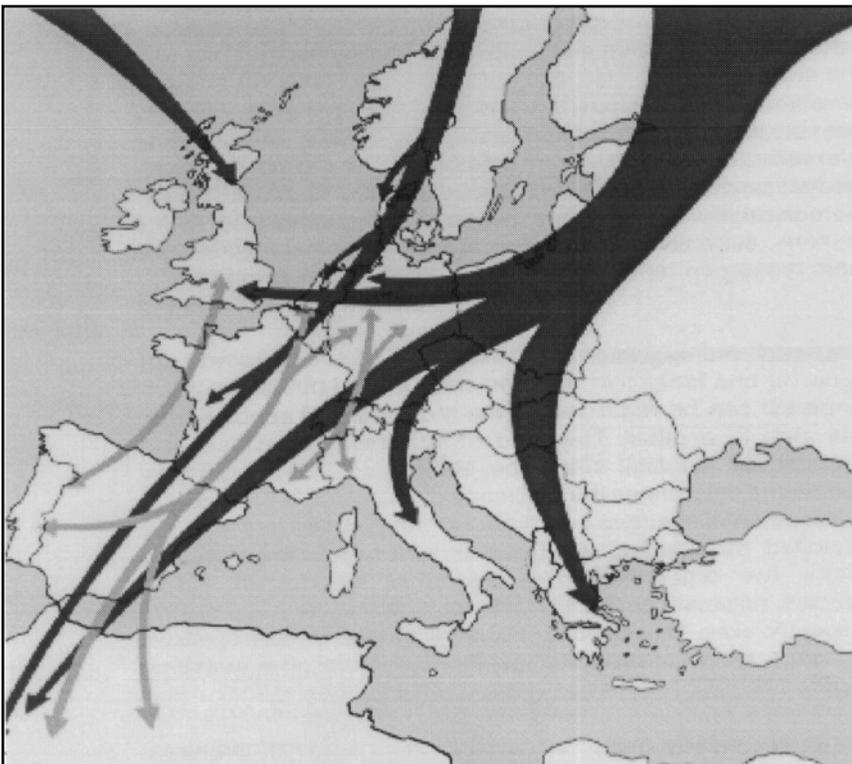


Figure 6. Routes of migratory birds in Europe.

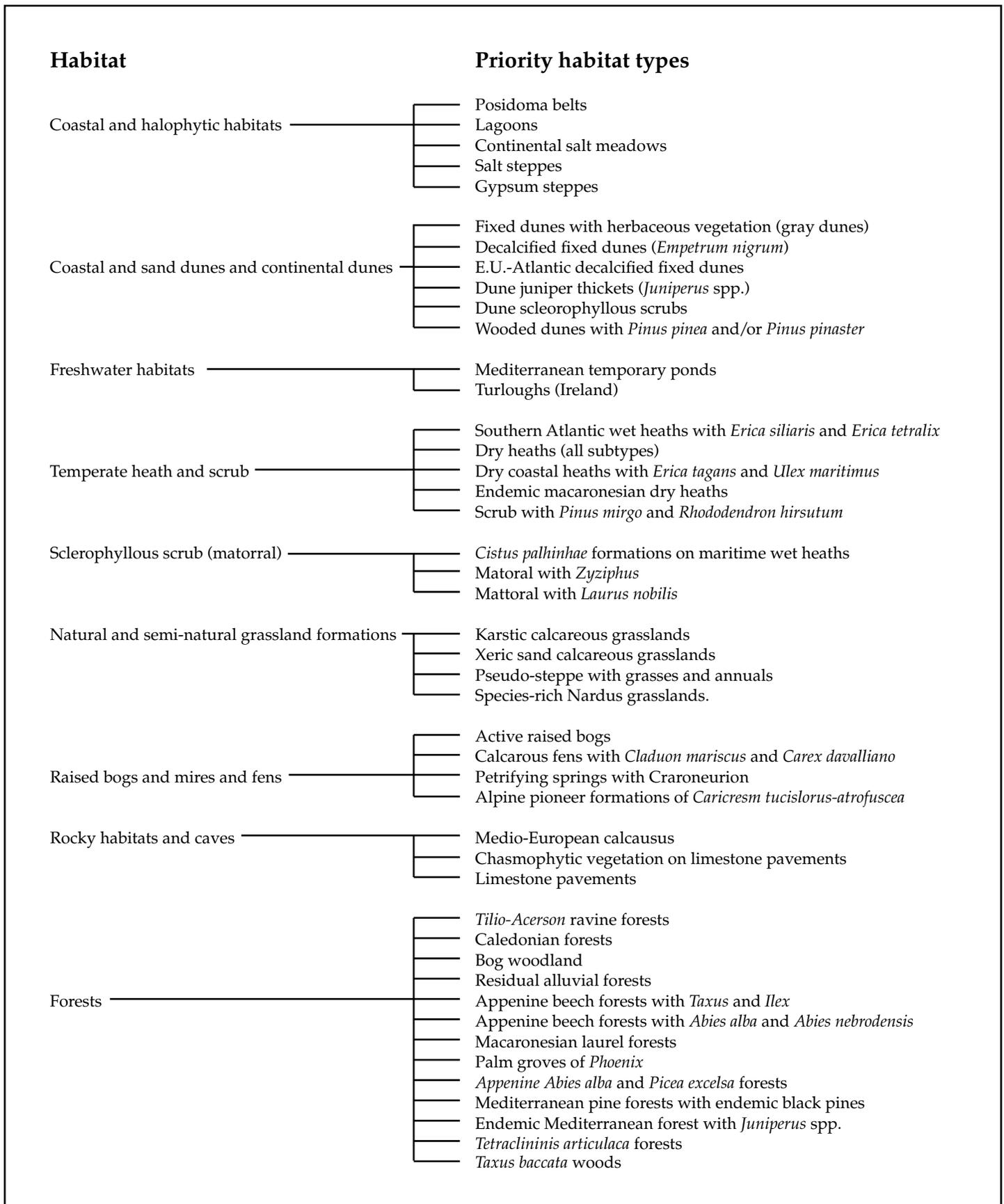


Figure 7. Natural habitat types of community interest whose conservation requires the designation of special areas of conservation listed in Annex 1 of the habitat directive. Habitat types that do not have the priority status are not included (Corine, 1989).

The Netherlands

History

A large part of the Netherlands is a river delta. Though a part of the country is situated above sea level, the major part (60 percent) is below sea level (Saeijs, 1989). For example, the western part has an elevation varying between slightly above to 5 m (16 feet) below mean sea level (MSL) (TNO, 1989). Of the territory of the Netherlands, situated at the estuaries of the Rhine, Meuse and Scheldt rivers, two-thirds consists of wetlands (Schilstra, 1996). Since the rise of the ocean level from prehistoric times to the present (Fig. 8), inhabitants of the low-lying areas in the western part of the country regularly had to fight against the water. The present country is largely the result of this struggle, representing the balance of successes and failures (TNO, 1989).

From the year 1200, the Dutch empoldered (reclaimed land from water) large acreages of wetlands for many purposes. In the 16th century, technological innovation made windmills much more effective. This boosted the number of drained inland lakes and formed polders (areas with artificially maintained low groundwater tables). Between 1595 and 1635, 23,400 ha were reclaimed in the western parts of Holland (Williams, 1990). In the 1800s, wind power proved to be insufficient to combat seepage through some embankments.

Steam power was introduced during the industrial revolution, and three steam engines proved to be enough to drain the Haarlemmermeer (a lake bed of 18,000 ha) between 1845 and 1852. In the 20th century, the rate of land reclamation was still accelerating. From 1927 to 1968, various projects reclaimed a combined total 205,000 ha.

Later in the 20th century, it was not the reclamation activities that threatened wetlands but "*ruilverkaveling*", agricultural parcel consolidation and improvement. The

object was to create economies of scale for farmers and market gardeners (Baldock, 1984). Especially after World War II, parcel consolidation and land improvement was the main cause of draining. Its main goal was to create food self-sufficiency in the post-World War II period by consolidating scattered plots into compact farm holdings with improved infrastructure, drainage and production efficiencies.

In 1960, a change in national policy called for an end to wetland reclamation with the goal of bringing remaining areas under protection. Reclamation of heathlands and marshes, in contrast to bogs, stopped. The turbary rights and most of the reclamation rights of bogs were in the hands of private companies. It took the government until the early 1970s to obtain ownership for the remaining 8,000 ha of bogs (Beusekom, 1990).

In total, as much as 7,000 km² of wetlands have been reclaimed or drained (TNO, 1989). Only 36 percent remain (OECD, 1995). The government estimates that 27 percent (995,125 ha) of the Dutch territory is wetlands (Ministry of Agriculture, Nature Management and Fisheries or LNV, 1996).

Trends in wetland areas

The Netherlands, the most densely populated country in Europe with 407 inhabitants per km² (OECD 1995), is used intensely. In 1993, 64 percent of the total area was used for agriculture, with natural areas representing a mere 4 percent (Tempel and Osieck, 1994). The direct destruction of wetlands has more or less been halted, though land use impacts continue to degrade natural areas (Osieck, 1996). Other causes for environmental degradation include:

- Declining natural habitat areas.



Figure 8. The Netherlands in the years 800, 1500 and 1900 AD.

- High degree of fragmentation of habitat.
- Use impacts such as eutrophication, lowered water tables and disturbance (Ministry of LNV, 1990).

Pollution from heavy metals in manure, fertilizers and micropollutants causes serious problems and is difficult to resolve (TNO, 1989; Ministry of LNV, 1990). Groundwater, in particular, is threatened by excessive manure applications—nitrates leach easily through soil, contaminating the relatively high groundwater tables. In addition, excessive groundwater extraction lowers groundwater tables of nature preserves while concentrating pollutants (Ministry of LNV, 1995^c).

Wetland protection in the Netherlands

Legal system

The Netherlands is a unitary monarchy in which the national government (with the largely ceremonial role of the queen) executes all government functions. The subnational units, provinces and *gemeentes* (local governments comprising municipalities with their surrounding rural areas), administer matters within their jurisdictions with powers mandated and delegated by the national authority.

Property rights

At the beginning of the 19th century, private ownership was considered to be inviolable. It was “the most comprehensive right a man can enjoy”, although excluding mineral rights. However, the law also includes restrictions on the use of property to the effect that its use may not conflict with laws and regulations and may not interfere with the rights of the public or other citizens. Equal compensation under the law is emphasized (Lambers, 1996). Laws and regulations may limit property rights, especially when land use is subject to a local “*structuurplan*” (land use structure plan) or “*bestemmingsplan*” (land use allocation or designation plan). Normally, these plans may authorize already existing land uses but may restrict certain management practices. In the case of a public taking, the owner receives compensation based on current prop-

erty market price. In addition, financial compensation may be given for loss of derived income based on previous use. However, compensatory payments for the loss of *development* rights are not a legal issue in the Netherlands (Held & Visser, 1984).

In addition to land use rights, the distribution of land ownership also affects comparative environmental policy. In the Netherlands, two-thirds of the natural areas are in public ownership and managed for the public benefit. Public land as a whole accounts for 5 percent of the total land area (in 1977), compared with 32 percent in the United States in 1987 (Held & Visser, 1984; Darnay, 1994).

Water administration

Water administration in the Netherlands is one of the earliest still existing forms of government administration. Starting in the Middle Ages, polders and watersheds were combined to form water management districts administered by district water management boards (“*waterschappen*”). These elected water boards still administer inland water bodies, streams and polder hydrological units. In the past, elected councils used to represent farmland owners and were dominated by narrow agricultural interests, such as drainage. However, current law permits *any* resident in a particular water management district to participate in board elections. This results in a broader representation of community interests, including nature and wetland conservation objectives. These interests are reflected in the decisions and management practices of water boards (Ministry of LNV, 1996).

Though supervised by provincial authorities, municipalities and water boards operate with a high degree of independence. However, the national government decides on such matters as water quality and distribution (TNO, 1989). This is important because wetlands are very vulnerable to water supply and quality. This arrangement provides assurances that national wetland preservation and management objectives prevail in local decision making.

Laws

Nature Conservation Act

Just as in the United States, laws in the Netherlands do not specifically address wetland preservation objectives. Rather, they reflect nature policy with an emphasis on the management and preservation of ecosystems. Objectives include the preservation of biodiversity and the development of complete ecosystems—wetlands as integrated components of river, coastal zone and forest ecosystems (Ministry of LNV, 1996).

To this end, the Nature conservation Act (NBW) aims to protect ecosystem habitat in general and is the most important and effective policy instrument. Implementation strategies include land purchase, land designation and ownership transfer to government nature organizations by providing “state nature monument” status. Sometimes land is purchased by private nature conservation organizations with financial assistance from the government and “nature monuments” are formed (Ministry of LNV, 1985). By 1991, the total surface owned by the National Forest Service was 180,192 ha, of which 79,000 ha were managed as state nature reserves. The total surface owned by private nature conservation organizations was 135,834 hectares (Tempel and Osieck, 1994). Designation under the NBW has three legal consequences (Tonnaer, 1994):

1. It introduces a system of licensing to regulate all potentially damaging activities.
2. It permits the secretary of the ministry of LNV to set up a management plan with the consent of the owner.
3. It results in the prohibition of certain activities in these nature reserves.

In addition, the NBW includes also another important policy instrument, conservation easements (see p. 31, National planning policies).

Physical Planning Act

This act can designate national parks with a size of at least 1,000 ha (2,500 acres). These areas have special natural or landscape values and a special animal and plant biodiversity (Tonnaer, 1994). Designating areas is possible only with the consent of the owner of the area. This limits the importance for nature conservation purposes (Held and Visser, 1984).

The framework for public planning is laid down in the Physical Planning Act, which makes references to governmental planning agencies, different categories of plans, the legal powers of planning authorities and regulations for compensating citizens negatively affected by public planning measures (Cammen, 1984). It also authorizes provinces to prepare provincial land use structure plans ("streekplannen") and municipalities to adopt Land Use Allocation Plans ("bestemmingsplannen") and includes the obligation to set up similar plans for their rural areas (Held and Visser, 1984). The provincial planning process involves the preparation and implementation of national planning policy and outlines land allocation guidelines for municipalities (see page 32, Regional and local planning and zoning in the Netherlands). The act provides significant central authority because it provides national and provincial governments with review power and the potential to instruct local authorities to change land use plans (Cammen, 1984).

National planning policies

In the Netherlands, no explicit wetland policy exists. Because the country is densely populated, with virtually every square meter of land use designated, land use planning is critical. As part of this land use policy, Dutch nature management has been outlined in the '90s in four public land use planning and policy documents (Romijn, 1995).

The first is the Nature Policy Plan (NBP), developed by the Ministry of Agriculture, Nature Management and Fisheries (LNV). Its objective is to halt natural area deterioration. The

legal basis for the NBP is provided in the Nature Conservation Act. Since 1950, almost 500 of the 1,400 higher plant species declined in numbers and 70 have become extinct. In the same period, the number of species of breeding birds has fallen by a third (Ministry of LNV, 1990). This plan is the most important nature conservation initiative in the Netherlands and resulted in the National Ecological Network (NEN). The NEN (see appendix 2) is of paramount importance to develop sustainable conservation practices and restore and develop ecological values. The ecological network consists of core areas and nature development areas connected by ecological corridors.

Core areas are areas with existing ecological values of (inter)national importance. Here, policy aims to safeguard and increase existing ecological values. Negative development is counteracted.

Nature development areas represent opportunities for the development of ecological values of (inter)national importance. These areas may receive some initial human intervention, but ecological development is encouraged.

Ecological corridors connect core areas and nature development areas, thereby improving the migratory pathways and distribution of plant and animal species. This increases the opportunity for populations to colonize new habitats and also compensates, in part, for area fragmentation.

Buffer zones are created around nature areas to achieve and maintain the desired ecological values. For example, local hydrological buffer zones may be created around core wetland areas vulnerable to desiccation.

Two implementation measures are used for the NEN: land purchases and conservation easements. Since 1975, and before the establishment of the NEN when the government brought out the "*Relatienota*", farmers, owners or users could already obtain subsidies to promote ecological farming. The same incentive is used for NEN purposes (Bouwer and Leroy, 1995).

Conservation easements are differentiated on the basis of three functional areas:

- *Management areas*, where future agricultural use is planned but minor management adjustments may be considered because of the presence of *inherent natural and landscape values*, such as a wide range of rare plant and bird species (Bouwer and Leroy, 1995).
- *Reservation areas*, designated to maintain high quality nature conservation values. In these areas, the objective is to buy out farmers because any form of long-term agricultural use is found to be incompatible. To facilitate future land purchases by the "Bureau Beheer Landbouwgrond" (BBL, or Bureau of Agricultural Land Management) and the intermediate modification of current management practices, farmers may sign use agreements with the BBL and receive compensatory payments to promote less input-intensive farm management. Compensation is based on the difference in economic returns resulting from current and alternative ecological management practices. In return, the BBL obtains land purchase rights and obligations.
- *Problem areas*. The European Union originated this specific policy. Problem areas typically do not represent nature conservation needs *per se* but are designated by the E.U. if natural conditions, such as high ground water tables, make agricultural production difficult but it is still desirable to deter urbanization or to maintain rural landscapes. Compensation is relatively low, compared with the previous two conservation easements.

Eighteen wetland areas have been designated in the Netherlands under the Ramsar Convention, covering a total of 320,217 hectares—32 percent of all Dutch wetlands. Of the 674,908 hectares without this status, 20,765 ha

(3 percent), are protected under the Nature Conservation Act. A significant part of the remaining wetlands is included in the National Ecological Network (Ministry of LNV, 1996).

The second land use planning and policy document is the National Environmental Policy Plan (NMP) of the Ministry of Housing, Physical Planning and Environment (Ministry of VROM). Whereas the nature policy plan is largely area-oriented, the NMP is more general and deals with the reduction and prevention of pollution (Ministry of LNV, 1990). It specifies target groups (traffic, industry, agriculture, etc.) and management problem themes (desiccation, acidification, eutrophication, etc.). The NMP aims for ... *an environmental quality in which the ecological functions assigned to ecosystems can be met ...* (Ministry of LNV, 1990; Ministry of VROM, 1989).

The theme of desiccation is of great importance to the Dutch wetlands. Peatlands for example, suffer from irreversible desiccation consequences due to mineralization and decay of soil structure. In collaboration with the Ministry of Agriculture and the Ministry of Water Management, efforts have been undertaken to deal with desiccation. The goal is to reduce it by 25 percent compared with the 1985 level (Ministry of LNV, 1995^c).

The third document is the *Fourth Policy Document on Physical Planning Extra* (VINEX), also by VROM. Herein, spatial planning preferences are identified. In a densely populated country with many competing land use needs, proactive land use planning is needed. The hierarchical structure in the Netherlands is one in which the central government identifies general land use goals and objectives. Provinces and municipalities, in coordination with the central government, carry out actual implementation. In this plan, four policy *koersen* (policy directives or action plans) are identified, portrayed in map form as different colors (Bouwer and Leroy, 1995):

- a. The first directive (mapped in yellow) represents all intensive forms of agriculture.
- b. The second directive (brown) is almost identical but is associated with less intensive agricultural management practices. In both directives, nature conservation is spatially segregated from agriculture and nature development.
- c. The third directive (blue) represents areas with no potential for economically viable agriculture. Here, long-term goals are nature management and open air recreation.
- d. The fourth and final directive (green) emphasizes predominantly ecological preservation. Here, every management function adapts to nature development goals and sustainable land use practices to preserve nature values.

The last and fourth planning document is the *Third National Policy Document on Water Management* by the Ministry of Transport, Public Works and Water Management (V and W). It promotes rules for the management of water systems to fulfill ecological functions. The policy can be summarized as: "*To have and maintain a safe and habitable country as the prior condition and to develop and maintain healthy water systems which guarantee sustained use*" (Department of V&W, 1991).

It recognizes the problems of water pollution (nutrient loads, heavy metals, etc.) and dehydration and specifies target objectives to tackle these problems with multiple strategies. This means that policy is carried out simultaneously with regard to related issues and objectives. It is expected that a multiple strategy or systems approach will result in higher overall public benefits that exceed the sum of the benefits of the subcomponent policy objectives.

Regional and local planning and zoning in the Netherlands

As mentioned above, provincial structure plans connect national strategic planning and the executive allocation plan of municipalities. The provincial structure plans can be characterized as a policy program containing a broad outline of regional policy goals, administrative and financial implementation instruments, and broad design of structural physical elements.

Local authorities are required to prepare allocation plans (*bestemmingsplannen*) for new development and conservation in rural areas. They are considered the cornerstone of Dutch planning law. It is the only plan that has direct legal consequences for local inhabitants. The allocation plan is restrictive in nature: it is primarily designed to prevent undesirable forms of development or urban renewal (Cammen, 1984). Development is permitted in accordance with the allocation plan. The provinces designate nature areas in their regional structure plans and in compliance with national nature development policy. Although it does not occur often, municipalities are entitled to designate nature areas if in compliance with national and regional nature policies (de Roo, 1996).

National park De Weerribben

De Weerribben is a national park that covers 3,500 hectares. It is a remnant of a former vast, low peat mining area together with the nearby nature reserves "De Wieden" (Ministry of LNV, 1991). Peat mining took place in this area beginning in the Middle Ages and stopped in 1956 when other fuels became price competitive. Dried peat was used as an effective fuel in people's homes. Long, narrow strips of water remained where peat was removed.

The area is, therefore, greatly affected by human activities, which, in fact, have been advantageous for

nature development. Without intervention, the area, through natural succession, would have developed into one large swamp forest within 20 to 30 years and the unique character of the low peatland would have been lost. Instead, the Weerribben has a varied landscape of open water ponds, floating mats of vegetation in former peat holes, and quaking bogs, reed marshes, wet meadows, shrubby marshes and woodlands. A great diversity of vegetation exists in the Weerribben. For example, dark sedge, a threatened species throughout Europe, occurs in the transition zone between the quaking bog and drier, unfertilized pastures. Also, fauna is abundant and the presence of pike means that water in the Weerribben has become relatively clean.

Traditional agricultural practices have been retained to ensure maintenance of the characteristics of the area. They include reedcutting, woodland coppicing, haymaking, grazing, and the dredging of ditches and waterways. A declining market and increased labor and management costs made state subsidies necessary to enable local inhabitants to continue their traditional activities. Efforts continue to keep eutrophic water from penetrating nearby canals.

The Weerribben ecosystem is still threatened. During the past decades, its nature conservation values have decreased. Because of agricultural rationalization, wooded banks, important ecological corridors, have been reduced and "improvements" of watercourses hamper fish migration routes. Farming activities in the area surrounding the Weerribben also cause an outflow of groundwater affecting the quaking bog vegetation in dry summers. Compensating river water is eutrophic and hampers maintenance of the mesotrophic and oligotrophic conditions essential for the diversity of the peat and aquatic vegetation complexes (Ministry of LNV, 1996^a). At the moment, the Weerribben is an "ecological island" in a "sea" of ecologically degraded landscape. Wetland "De Wieden" is nearby and has an ecosystem linkage

with the Weerribben. With the NEN, the provincial authorities are creating ecological corridors between the two core areas. Spatial segregation of intensive agriculture and natural areas is planned so both can coexist in their future development. Farmers in the area are provided with financial incentives to relocate; remaining farmers are supported and encouraged to find additional income-generating activities such as tourism and recreation (Ministry of LNV, 1996^a).

Criteria and classification of wetlands in the Netherlands

The Dutch government gives the highest priority to protecting biodiversity, transboundary (European) nature protection policies and the protection of several key ecosystems, including wetlands (Ministry of LNV, 1996^b). The fact that a quarter of all threatened and most vulnerable plants in the Netherlands rely on wetlands for their survival (IEEP, 1991) underlines the importance of wetland ecosystems for preserving biodiversity. In addition, the Netherlands is also a contracting party to the Biodiversity Convention in Rio. Following its ratification, a Biodiversity Action Plan was developed. In the context of European nature conservation, the Dutch government promoted the need for a European ecological network.

Safeguarding biodiversity is the main objective of Dutch nature policy. That is why 657 species from 10 taxonomic groups have been selected as *target species*. This selection is based on an assessment of international significance and on a national ("red") list of threatened and endangered species. But biodiversity can be maintained only if target species' habitats are maintained or restored. As mentioned on pg. 31, in National planning policies, the NEN was developed to restore those habitats (Ministry of LNV, 1995a).

The NEN provides a methodical

approach to identify a comprehensive set of 132 *nature target types* (Ministry of LNV, 1995^a). Each of the 132 units in this classification specifies an ecological objective in terms of biotic and abiotic components at a particular scale. These 132 nature target types have been identified to reverse the loss of species in the Netherlands and are chosen to support a maximum number of these species. Selection quality criteria include *diversity* (ecosystems and species), *naturalness* of ecosystems and *characteristicness* (Ministry of LNV, 1995^a). The classification of wetlands is a part of the 132 nature target types. A separate wetland classification in the Netherlands does not exist. The classification goal is not to identify certain ecosystems but to develop a practical "toolbox" for planning, management and policy evaluation (Ministry of LNV, 1995^{a-b}).

The number of *nature target types* is a result of nine *physic-geographical regions* in the country with four *main management strategy groups* that differ in the degree of human interference. This results in 36 different management areas. Areas are further subdivided, where possible. This permits up to 132 different nature target types (Table 2). Because completely natural units do not exist in the Netherlands as a result of human influences, the first main grouping is defined as *almost-natural units*. These are areas of at least 1,000 ha, which habitat must develop without outside interference and by means of large-scale natural processes. The second main group is the *attended-natural units*. These areas are also of considerable size. The difference is that these areas require more initial management inputs, such as the reintroduction of some target species. Some areas may also need management, such as grazing, on a regular basis. The third main group is called *semi-natural units*. Small-scale promotion of certain succession stadia and associated target species are the central focus. If possibilities for large-scale processes are absent or there is a danger that small, isolated populations of target species will disappear, this group is of critical importance.

Table 2. Number of target types by physic-geographic region and main group.

Physic-geographic region*	Main Groups (management strategies)				Total
	1	2	3	4	
Hilly land	1	2	12	2	17
Higher sandy grounds	2	3	19	2	26
River area	-	2	12	2	16
Peatland	1	3	10	2	16
Sea clay area	-	3	13	2	18
Dunes	1	1	16	2	20
Closed sea-arms	-	3	8	1	12
Tidal area	2	2	2	-	6
North Sea	1	-	-	-	11
Total	8	19	92	13	132

* These are not official translations

The fourth group is *multifunctional units*. These area units constitute a compromise with other functions such as recreation, agriculture and forestry, mostly detrimental for the development of natural values. For some target species, however, human influences are needed and important.

For biodiversity in general, ecological and socioeconomic criteria have been developed to select and prioritize ecosystems (Ministry of LNV, 1996).

The ecological criteria are:

- *The ecosystem should contribute to biodiversity, which is measured on the basis of species richness, vulnerability, extent of being threatened and/or uniqueness.*
- *The ecosystem should be a global common -- i.e., an ecosystem or species of major common international responsibility.*
- *There should be a measure of interdependence between the ecosystem abroad and the national ecosystem (Ministry of LNV, 1996).*

The socioeconomic criteria are:

- *The Netherlands is involved in the damage done to the ecosystem.*
- *There should be a possibility for the export or propagation of the specific Dutch knowledge and expertise in the field.*
- *There should be a possibility to link up with local socioeconomic measures, as well as with planning and environmental measures.*
- *The measures taken should have an effect locally and have the best possible concrete results for nature (Ministry of LNV, 1996).*

Among others, wetlands (in connection with migratory birds) are ecosystems that are given priority for the 1996-2000 period. Besides the common values associated with wetlands, they represent international responsibilities because of their transboundary significance. Many wetlands are an important link in the Western Palearctic flyway, which extends from Siberia to South Africa (see Figure 6).

United Kingdom

History

Large areas of the eastern United Kingdom are close to or below sea level and are comparable to the polder areas of the Netherlands. Since the Middle Ages, large areas of coastal wetlands were enpoldered and half of the original area has disappeared (E.U., 1995). Major drainage systems in the past 200 years have lowered the water table so that bog, mire and marsh soils have been converted into "more valuable" agricultural land (Penning-Rowsell, 1986). Between the middle of the 19th century and 1978, about 84 percent of lowland raised bog in Britain was lost through afforestation, agricultural reclamation and commercial peat cutting (Gosselink, 1990). The rest was severely damaged by burning and draining so that of the peatlands, only 6 percent (6,200 ha) remains. Swamps were destroyed at a rate of 4,000 to 8,000 ha per year in the 1970s (E.U., 1995). Wetlands did not receive attention in Britain until the 1980s when the increasing rarity of wetlands became evident. As a result, the U.K. has brought under the protection of the Ramsar Convention 91 sites with a total area of 387,000 hectares.

Trends in wetland areas

Of the 91 sites, 11 are suffering from adverse effects or are likely to change ecologically. These concerns are eutrophication, acidification and groundwater pollution, none of which is considered serious (Department of Environment, 1996).

Wetland protection in the United Kingdom

Legal system

The responsibility to declare and manage the network of national nature reserves is exercised by the Nature Conservancy Council (NCC).

This is an independent council funded through the Department of the Environment that designates and protects Sites of Special Scientific Interest (SSSI). SSSIs are all sites of national or international importance under national legislation (Department of the Environment, 1994). Development proposals in or likely to affect an SSSI must be subject to special scrutiny. If development is planned in an SSSI (and around the SSSI up to 2000 m for wetlands), the planning authorities must consult the NCC as soon as possible for advice. Sites can also be designated as SPAs and SACs according to implemented E.U. legislation such as the habitat and bird directives (see Table 3). These designations are not mutually exclusive—a site can have more than one designation and receive added protection.

Laws

Wildlife and Countryside Act, 1981

This act strengthened the protection of SSSIs, a concept that was introduced in its predecessor of 1949. The notification of a site as an SSSI is the mainstay of habitat protection in the U.K. (Fairhead, 1996). The act also permits the designation of a site as a National Nature Reserve (NNR). Both designations are meant for sites of national importance based on flora and fauna, geological or physiological features.

Minerals Planning Act, 1981

In this act, the long-term development planning for a local authority's area for mires is determined by the inclusion of peat as a mineral. Local plans must specify where mineral extraction—in this case, peat—may take place. The government policy is that peat extraction may take place only as long as the environmental damage is minimized. For NNRs and SSSIs, more specific and more restrictive control is used. Nature conservation is not an explicit criterion taken into consideration when assessing whether planning permission for mineral extraction should be given. Only because environmental impact assessment is obligatory since 1988, and as a result of an E.U. directive, review safeguards are now included by the introduction of the mire conservation perspective (Heathwaite, 1993).

A national strategy for mire conservation is lacking, however, because each peat extraction application is dealt with at the local level (Heathwaite, 1993).

Land Drainage Act, 1994

This act mandates local authorities, when acting as drainage bodies, to further the conservation of wildlife when making decisions relating to land drainage and flood defense. It brings the environmental duties of local authorities into line with the National Rivers Authority (NRA)

and the Internal Drainage Boards (IDBs), which operate in the United Kingdom and Wales. The act also empowers ministers to intervene to prevent drainage activities that are likely to damage nature conservation interests of national and international importance.

Conservation (Natural Habitats, etc.) Regulations, 1994

This act formally transposes the requirements of the EC Habitats Directive into national law. The terms used are identical to those in the European habitat and bird directives.

The Planning and Compensation Act, 1991

This act improves the ability of local planning authorities to safeguard conservation and area amenities by strengthening planning enforcement and development controls. It also requires structure, local and unitary development plans to include policies on the conservation of the natural beauty and amenity of the land.

Wetland restoration criteria in the United Kingdom

As early as 1901, the ecological role and scientific importance of mires were acknowledged in Europe. According to Heathwaite (1993), ethical, aesthetic and economic aspects

Table 3. Classification of nature reserves in the United Kingdom.

Importance	Site Designation	UK Statutory Designation
Sites of international importance	Ramsar Sites	SSSI
	Special Protection Areas	SSSI, SPA
	Special Areas of Conservation	SSSI, SAC
Sites of national importance	National Nature Reserves	SSSI
	Sites of Special Scientific Interest	SSSI
Sites of regional/local importance	Local Nature Reserves (LNRs)	LNR
	Non-statutory Nature Reserves	-
	Sites of Important for Nature Conservation	

Source: Department of the Environment, 1994.

should be also taken into account with a distinction between conservation need and conservation worth (Table 4). Permanent conservability should be assessed according to the following criteria, which apply not only to Britain but also to other western European countries (Heathwaite, 1993):

Table 4. Mire conservation criteria (from Heathwaite, 1993).

<p>Conservation need is based on:</p> <ul style="list-style-type: none"> • scientific interest • ecological equilibrium • ethical motives • aesthetic aspects • economic effects <p>Conservation potential and success are controlled by:</p> <ul style="list-style-type: none"> • hydrology • chemistry • biology <p>Conservation worth depends on:</p> <ul style="list-style-type: none"> • naturalness • threatened status • irreplaceability • diversity • variety • completeness • representativeness
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Germany

History

As in many countries, wetlands were considered wastelands. As early as 1765, when the King of Prussia issued a reclamation edict, all "wastelands" in Prussia were declared to be the property of the state (property rights were not effective yet.) The objective was to force their cultivation and encourage creation of new settlements. Also, large areas of peatland were used as fuel sources and drained for agricultural purposes. Because of these activities, 95 percent of all fens and 58 percent of raised bogs have disappeared in Germany (Terkamp, 1992).

Trends in wetland areas

Because of a lack of systematic monitoring by the German federal authorities, only current trends can be described. It is unknown how wetlands with adverse effects relate to the stable wetlands with unchanged ecological features*.

The main threats correlate with the high density of people and intensive agriculture. Disruptions caused by recreational activities, road traffic and disturbances by military flight operations are examples. The federal government considers property rights, traditional uses and a high variety of different interests as the most important causes of the ecological degradation observed in many wetlands (Federal Ministry for the Environment, 1995).

Wetland protection

Legal system

Germany is a federal nation in which the constitution determines the rights of the various legislative bodies in Germany's federal structure. In most cases, federal environmental law supersedes *Länder* (states') laws. Framework legislation related to nature conservation, landscape pro-

tection and water management can be enacted at the federal level. However, more specific regulation of nature areas remains the domain of the *Länder* (OECD, 1993).

Laws

Nature Conservation Act

In Germany, the federal Nature Conservation Act provides for six kinds of protected areas, defines their purposes and very broadly defines prohibitions. None of these provisions is directly applicable by the German federal government because the act represents the framework for adoption of complementary legal provisions by the various *Länder*. The *Länder* have an obligation to consult the federal ministry only when national parks are designated. These *Länder* have, thus, a large degree of autonomy in the legislative implementation of this framework and full freedom with regard to the modalities of its implementation (OECD, 1993).

Policy program

In 1991, the nature conservation authorities of the federation and of the federal *Länder* represented in the *Länder* Panel on Nature Conservation (LANA) adopted a basis policy with common approaches to solutions and development perspectives for nature conservation measures in Germany. They state that natural and near-natural wetlands, in addition to other habitat types, should be given top priority for conservation and protection against any detrimental changes. They are considered to be *core areas* of German nature conservation. The program also states, in principle, that wetlands should be restored, their quality improved and areas extended, and that adequately sized biotopes should be developed by networking existing biotopes. The last has the highest priority. It is the intention to develop these principles further to shape a national wetland policy (Federal Ministry for the Environment, 1995).

* The German national report for the sixth meeting of the Ramsar Convention excluded the internationally important wetlands without adverse effects. This makes a comparative judgment about the German situation impossible.

Planning

Section 2 of the Nature Conservation Act deals with landscape planning. Nature conservation planning is included as part of the landscape planning process. It takes place at three levels:

1. The *program*, mandated by the federal Nature Conservation Act (Article 5), developed for the territory of a *Land* as a whole.
2. The *master plans* for parts of a *Land*.
3. The *landscape plan*, a tool of local planning.

Article 7 of the NCA is directly applicable only when the natural situation requires transboundary planning and where cooperation is necessary to avoid hampering the aims of national conservation.

Level one is a framework that every *Land* can use accordingly to its interpretation. Only some *Länder* have integrated the program in their general planning process. The federal government does not guide the content of the second level, the master plans. The result is that the content and character of general conservation planning have been left to the decision of the *Länder*. Level three is a nature conservation plan at the local level. The plan consists of an inventory of the situation of the natural environment and an outline of the goals and measures needed to achieve future goals.

Zoning

Federal and *Länder* conservation legislation offers the possibility to designate core areas as nature reserves and buffer zones as landscape reserves. Such reserves have been designated in several national parks as a result of national park management rather than wetland management objectives.

Sweden

History

During the 1900s, many of Sweden's rivers and lakes have been used to generate power. Today, 72 percent of all economically viable hydroelectric reservoirs fed by lakes and rivers are used for this purpose, representing 16 percent of the total power generated (Löfroth, 1991).

From about 1850, extensive drainage was performed to acquire new land for agriculture (Mitsch, 1994). In total, about 600,000 hectares of peatland were converted to agricultural use. Such drainage is no longer practiced. Forestry ditching, however, is still going on to some extent. Swedish forestry practices accounted for draining more than 1.5 million hectares.

Sweden still has large areas of wetlands. The main type is wet forest (30 percent), which accounts for about 5 million hectares. The total area of open mires is about 3.6 million hectares. Together with the wet forest, they constitute more than 90 percent of the total wetland area in Sweden (SEPA, 1996).

Trends in wetland areas

Ramsar sites in Sweden have not been changed adversely. According to SEPA (1995), the sites are in stable condition.

Wetland protection in Sweden

Laws

No overall national wetland policy exists in Sweden, except for a national plan to conserve mires. Within this plan, 345 sites totaling 210,000 hectares are set aside as nature reserves (SEPA, 1995).

The drainage of areas always required permits in Sweden (Mitsch, 1994)—first, according to the Ditching Act, which was succeeded by the Water Act of 1918. The new Water Act of 1983 is based on the same principle that land improve-

ment benefits or advantages of a drainage project must exceed the costs or disadvantages of opposing private and public interests. Nature Conservation became a public interest in the early 1980s. This led to a new paragraph in The Nature Conservation Act in 1986 requiring a permit for draining. Another paragraph in the Nature Conservation Act states that the government can define regions in which land drainage is prohibited. These two paragraphs give the public authorities the means to prevent valuable wetlands from being drained. In 1995, all drainage activities were prohibited within Ramsar sites (SEPA, 1995).

Acts of great importance to landowners are the Agricultural Management Act and the Forest Conservation Act. Both identify rules indicating that agriculture and forestry should be managed with great concern for nature preservation.

Indirectly, the Swedish Environmental Protection Act (EPA) can also play an important role. If there is a risk of pollution, a drainage permit can be denied. This act applies to point source pollution in particular but not to diffuse pollution sources such as nutrients or heavy metals resulting from normal agricultural or forestry management practices. In 1985, a new paragraph was added to the EPA giving the government the ability to declare certain areas of land or water an environmental protection zone if it is deemed especially sensitive to pollution.

Sweden provides an incentive to create new wetlands. Subsidies may be given for the restoration or creation of wetlands on the condition that grain acreage is reduced.

Denmark

History

Since the beginning of the 18th century, the area of Danish wetlands has been drastically reduced because of land reclamation and drainage. The main purpose was to increase agricultural production. Many small rivers and watercourses have also been channelized or culverted. Since then, 50 to 70 percent of all wet inland biotopes have disappeared (SEPA, 1991), a total 162,000 ha. In the 1970s, swamps were destroyed at a rate of 2,400 ha per year (E.U., 1995). The remaining wetlands have deteriorated because of eutrophication, caused principally by nitrogen and phosphorus. As a consequence, the amount of submerged vegetation has diminished because of the diminished light penetration. During the past decade, however, the reduction in wetland area has been stopped. About 885,000 hectares of wetlands remain, of which 732,000 hectares are covered by the Ramsar Convention. Most of the area is the Waddensea and coastal shallow marine waters (Ministry of Environment, 1996). Inland wetlands do not include large areas.

Trends in wetland areas

The main wetland problems in Denmark are eutrophication because of discharge of nutrients from adjacent agricultural areas (Ministry of Environment, 1996) and excessive hunting pressure (Danish Society for the Conservation of Nature as quoted by Flinstid, 1996). Overall, the Danish society is satisfied with the wetland policy, especially the Nature Conservation Act, protecting all small water bodies.

Wetland protection in Denmark

Legal system

In Denmark, legislative authority for nature conservation is centralized, but the National Forest and Nature Protection Agency of the Ministry of

the Environment has no authority over individual conservation orders, such as easements (IUCN, 1991).

Denmark is divided into 25 conservation districts, each of which has an independent special conservation board chaired by a local judge. This board is authorized to implement individual conservation orders. The local communities, the national conservation authorities and the Danish Nature Conservation Society (NGO) can make proposals for these orders to the board. The individual conservation orders are sometimes regarded as a taking and can be appealed to the main conservation board in Copenhagen.

Laws

In Denmark, the national wetland policy is covered by an integrated and comprehensive set of nature protection and environmental laws, which also complies with article 6 of the Convention on Biological Diversity. Restoration of wetlands is a part of wetland policy (E.U., 1995).

Nature Protection Act of 1978 (amended in 1992)

General protection for larger wetlands (public watercourses, private watercourses broader than 1.5 meters, bogs and moors larger than 5,000 square meters [0.5 ha], salt marshes and salt meadows larger than 3 ha, heath more than 5 ha) is given by the Nature Protection Act of 1978. Under the provisions of this act, all changes in the wetlands are subject to the permission of the county councils. Without permission, it is illegal for private or public landowners to change their wetlands by drainage, such as channeling watercourses. Any license application in contradiction with nature protection objectives may be rejected without any compensation to the landowner. Decisions made by these councils can be appealed to the National Forest and Nature Protection Agency by nature conservation associations or anyone directly affected by the decisions. Thus far, the authorities have been very restrictive. There has hardly been an occasion when permission

has been given for projects that could destroy protected wetlands of significance. State financial support from the Ministry of Agriculture for draining was terminated in 1982.

A number of important wetlands are covered by specific conservation schemes or wildlife management provisions, which give detailed rules for land use, public access, hunting, etc., within the protected areas. In these cases, the landowner has normally received financial compensation for the restrictions on land use.

The government also presented a "Strategy on Marginal Lands," an important objective of which is to restore part of the former degraded wetlands. The preliminary aim was to rehabilitate 20,000 ha over a period of 10 to 20 years. By 1995, 1,300 hectares had been reestablished as wetlands. The Ministry of Environment and Energy has launched a national policy plan to restore 30,000 ha of former wetlands during the next 30 years.

The Act on the Structure of Agriculture

This act implements the E.U.'s "set aside" policy by providing financial support to encourage a more ecologically adapted agricultural land use. Designation as a Ramsar site is a qualifying criterion for obtaining this financial support.

The Raw Materials Act

In 1990, a new ministerial order came into force under this act. This order banned all exploitation of submerged rocks, stones and boulders within the borders of Ramsar and E.U.-designated bird protection sites. Also, another order of 1995 prohibits the prospecting and extracting of raw materials from these sites. Permission for existing activities will be phased out over 10 years.

In 1989, the Danish parliament adopted the Nature Management Act. The goal of this act (among others) is to improve or preserve conditions for wild flora and fauna. The act also implements the strategy on marginal lands and provides the legal background for the use of

public funds for nature management. These funds are used largely to restore wetlands.

The Hunting and Wildlife Management Act

The revised Hunting and Wildlife Management Act of 1994 establishes wildlife reserves to safeguard wildlife. These reserves within Ramsar and E.U. bird protection areas are an important legal instrument in site-related wildlife conservation measures. Several provisions are based on zoning to regulate hunting and other recreational activities over time and space.

Action Plan for the Aquatic Environment

In 1987, this action plan was adopted by the Danish parliament to reduce the amount of nitrogen and phosphorus discharge into the environment by 50 percent and 80 percent, respectively, by 1993. These discharges from farmland, industry and urban areas during the past decades have caused extensive eutrophication. By 1994, a significant reduction from urban and industrial areas had been achieved. Nitrogen from farmland still causes problems, however. Restoration of wetlands in Denmark is seen as a way to reduce the amount of nutrients in an economical way.

Action Plan to extend the Wildlife and Nature Reserve Network in Denmark

Denmark's environmental NGOs proposed an extension of the network of protected areas for waterbirds by the establishment of more than 50 new wildlife and nature reserves in Ramsar sites and E.U. bird protection areas. The National Forest and Nature Agency later developed the implementation plan. It encompasses the creation of hunting—and disturbance-free core zones surrounded by buffer zones or management areas. The core zones should, where possible, include water areas and adjacent transition zones of bird habitats.

In contrast to the Kushiro Recommendations (a Ramsar conference), Denmark did not find it necessary to develop specific management plans for all listed sites as a general procedure because most human activities in wetlands are regulated by Danish nature and environment protection legislation as well as physical planning legislation.

Planning

The national planning system and its implementation are responsibilities of the national government with the assistance of regional and local authorities. The systematic planning for nature conservation is integrated into the physical planning system.

The National Forest and Nature Protection Agency performs two functions related to local physical planning. First, the agency sets out guidelines that county councils should consider in preparing their plans (IUCN, 1991). These guidelines may also address small sites not covered by general protection measures.

Second, plans adopted by the councils have to be approved by the Ministry of Environment, and the agency advises the minister on the acceptability of the plan from a conservation point of view. Once approved, the plan is binding. If there are elements that are against general wetland protection as defined in the Nature Conservation Act, little can be done. The authorization to proceed to action has to be obtained from the county council and may be appealed; but the plan is binding for the administration. In that case, all that can be done is to negotiate alternative implementation actions (IUCN, 1991).

Norway

Trends in wetland areas

The wetlands in Norway have not been a subject of significant adverse changes. Some sites are affected by development that took place before the areas were designated as legally protected areas and Ramsar sites, and eutrophication resulting from agricultural runoff may cause changes. Long-range transboundary air pollution in the form of acid precipitation is also a cause of adverse effects on Norwegian wetlands (Ministry of Environment, 1996^a).

Wetland protection

Legal system

Management of protected areas in Norway, including Ramsar sites, has been delegated to the regional (county) environment departments. General provisions for protection are laid down in the Nature Protection Act. Use and management of the individual site are handled by royal decree (Ministry of Environment, 1996^a). Individual management plans are to be developed for all protected areas. Guidelines are developed and management plans are set up accordingly.

Laws

Norway's Ministry of Environment includes a department responsible for the conservation of natural and cultural heritage. Two laws govern nature conservation: the Nature Conservation Act and the Wildlife Act.

Nature Conservation Act

The Nature Conservation Act of 1970, amended in 1990, aims to ensure that natural resource management acknowledges the interdependence of humans and nature. This act protects all Ramsar sites. The government has the primary responsibility for establishing protected areas, but the Ministry of Environment makes decisions in matters of temporary protection.

Wildlife Act

The goal of the Wildlife Act of 1981, amended in 1993, is to ensure that all wildlife and wildlife habitat are managed in ways that maintain overall productivity and biodiversity. It lays down the protection principle that all animals are protected unless hunting is explicitly permitted.

Within this framework, areas could be designated as (OECD, 1993):

- National parks.
This includes intact or virtually intact areas and regions of natural beauty or particular interest. In principle, designation is only for public land, but private land may be incorporated into a national park if it is contiguous to the public land. Unless the economic loss is significant, this classification does not involve any financial compensation.
- Nature reserves.
This includes intact or virtually intact areas of special habitats of significant scientific or educational interest. These areas may receive general protection or may be protected with a specific use designation in mind (wetland reserve, bird sanctuary, etc.). In that case, the state compensates landowners. Ramsar sites are primarily protected in the form of nature reserves.
- Protected landscape areas.
This includes natural landscapes preserved for their beauty or other characteristics. Authorization is granted by the county governor.
- Special areas:
Special areas are designated by the county executive board. These areas can be protected by measures that limit certain property rights, such as building rights, in return for compensation.

Planning

Planning and Building Act of 1985

The Planning and Building Act can enable the integration of nature conservation concerns with physical planning at the municipal and regional levels. This act facilitates the coordination of state, county and municipal activities and provides a basis for decisions on the use and protection of the environment and economic development. The act provides for four levels of planning: development planning, municipal planning, county planning and national planning. Municipal planning is concerned with specific physical planning issues and is generally the most important. Municipalities make binding planning decisions, but in the event of objections from the county, neighboring municipalities or state institutions relating to the proposed plans, the Ministry of the Environment assumes authority.

The act also provides for public participation in the decision-making process and for environmental impact assessments for major projects to ensure that the effects on the environment and natural resources are analyzed and considered before the projects are approved.

Wetland conservation plan

Norway developed wetland conservation plans as early as 1970, even before the Ramsar Convention. Regional thematic conservation plans for wetlands and important seabird colonies are most relevant for wetland conservation. Such plans are also developed for forests. Each county had completed its plan by 1995.

Finland

History

Finland has been called the land of thousands of lakes. It has 33,522 km² of inland waters representing 9.9 percent of the total area of the country. There are 56,010 lakes larger than 1 hectare and 187,888 lakes and ponds larger than 500 square meters (Finnish Environment Institute, 1996^a). The amount of various peatlands was originally exceptionally high, about 110,000 km². Raised bogs are dominant in the south and mires in the north (Finnish Environment Institute, 1996^b). In the European and global context, the existence of mires and many shallow water bodies and the extensive shoreline stress the importance of these Finnish wetland biotopes.

Currently, about 5.5 million hectares have been drained for forestry and agriculture. Finland had 11 Ramsar sites but recently added 50 others (Finnish Forest and Park Service, 1996).

Trends in wetland areas

Finland's coastal wetlands are vulnerable to oil pollution from coastal navigation. Also the spread of the American mink (*Mustela vison*) is seen as a threat to the wetlands in the future (FFPS, 1996). Climatic changes, pollution and other chemical damages are still considered minor threats. eutrophication of both freshwater and marine areas is changing the aquatic and coastal habitats. Also, a decline in habitats caused by construction activities, especially in the more densely populated south, is a threat. The total length of all lakeshores in Finland is 140,000 km. Most of these shores are privately owned, and ownership includes the right to build on the land, including shores. That is also the main use that is threatening the shores. For the whole country, 32 percent of the shoreline was used for residential development, especially second homes. At present there are some 400,000 "holiday" houses in

Finland, of which most lie along a shore. This number is still rising, with an average of about 6,400 summer cottages added annually. Only 5 percent of all lakeshores are legally protected (Finnish Environment Institute, 1996^b).

Wetland protection in Finland

Laws

Nature Conservation Act of 1923

This act was enacted to protect endangered species, mainly birds. Habitats were not protected, however. The proposed new Nature Protection Act of 1996 contains nine nature types to be protected, including marshes and sandy shores. The nine habitats are not to be changed in such a way that their specific characteristics would be lost (Finnish Environment Institute, 1996^b).

Finland became a member of the E.U. in 1995 and is busy implementing E.U. legislation (Habitat and Birds Directive) on preserves and wildlife protection in the Nature Conservation Act.

The Water Act of 1961

This is the most extensive act of Finnish legislation. Its core consists of provisions on altering, polluting and damming prohibitions. The act can also be used for conservation (FFPS, 1996).

The Act on the Protection of Rapids of 1987

This act preserves 53 water systems or parts of water systems. Up to 60 percent of the Kiiminkijoki watershed consists of wetlands.

River protection acts

Finland has two special acts for river protection. Both are river-specific. They are the 1983 Act on the Special Protection of the Ounasjoki River and the 1991 Act on the Special Protection of the Kyrönjoki River.

Discussion and conclusions

Discussion

The discrepancy of the legal definition of “wetlands” has raised scientific and political concerns. In the U.S., it is the temporary saturation requirement and the depth and duration of flooding, which varies by wetland type and year (Mitsch and Gosselink, 1993). A wetland may not *always* be wet. A functional wetland is one in which some parts are wet all year long, some are wet only part of the year and some patches may be dry some years. These dry patches are needed to support ecosystem functions (Alper, 1992). Second, wetlands are often at the margins between deep water and terrestrial uplands and may be considered to be mere extensions of ecosystems, whereas others see properties in wetlands not contained in either upland or deepwater systems (Mitsch and Gosselink, 1993). Third, wetland species range from facultative (wet and dry) or obligate (wet or dry) adaptations, which makes it difficult to use them as wetland indicators (Mitsch and Gosselink, 1993). In U.S. wetlands south of San Diego, for example, several endangered species are present only in certain years. Fourth, wetland size, ranging from small (a few hectares) to hundreds of square kilometers, is an important criterion in conservation policy.

Conservation efforts in Europe and the U.S. have focused on sites of international importance. These sites, though small in number and large in size, have mostly been protected successfully. However, this resulted in neglect of equally important sites, and the insidious loss of smaller, dispersed sites (IUCN, 1991). Although these sites may be of little importance individually, together they constitute a wetland resource of major local, national and often international significance.

Research undertaken by Yale University, simulating loss of small wetlands in Maine, showed that if 62

percent of the total wetlands were destroyed – representing only 19 percent of the total state’s wetland area – the average inter-wetland distance would increase by 67 percent. This would mean that, instead of 90 percent, only 54 percent of the landscape would be within the maximum migration distance (estimated at 1,000 meters) of terrestrial and aquatic-breeding amphibians. A spatially structured demographic model revealed that local populations of turtles, small birds and small mammals, stable under conditions of no wetland loss, faced a significant risk of extinction after the destruction of small wetlands (Gibbs, 1993). The National Science Foundation (1995) concluded that the same could happen with birds because many waterfowl are sensitive not only to area reductions but also to patch size, wetland density and proximity to other wetlands.

The same notion of *ecosystem connectivity and migratory pathways* is the basis of the development of the National Ecological Network in the Netherlands (Appendix 2). In Michigan, the protection of a patchwork of larger and smaller wetlands connecting core ecosystems—areas of national, state and local significance—could be the major objective of an integrated wetland policy. This policy initiative would comprise a set of coordinated actions at the state and local levels by means of conducting targeted wetland inventories and the implementation of wetland preservation ordinances enacted to ensure protection of wetland of less than 5 acres. The ultimate goal of this wetland conservation policy would be to ensure sustained, coordinated wetland management statewide, thereby preserving the integrity and viability of one of Michigan’s most important natural resources. This would not only assist in maintaining a sustained revenue flow from tourism and recreation activity but also add to the economic vitality of the agricultural and forestry sectors and preserve and enhance the quality of life of Michigan’s citizens.

The Ramsar definition is very broad and includes areas within wetlands that do not meet the criteria themselves. But it excludes wet or periodically flooded lowland pastures and areas of reclaimed marsh where the water table is permanently high—within 20 cm of the surface (Baldock, 1984). The Ramsar definition also does not include vegetation or soil characteristics and extends wetland to a water depth of 6 meters or more, beyond the depth requirements of wetlands in the U.S. and Canada. However, this definition makes it possible to include a wider variety of habitats, such as river ecosystems and coral reefs. The intent of the Ramsar definition was to include all wetland habitat of migratory water birds, inclusive of manmade wetlands such as reservoirs and seasonally flooded agricultural land, and marine water areas less than 6 meters deep at low tide. Because the Ramsar definition is increasingly providing the basis for national and international inventories, this definition is the most important definition (Scott and Jones, 1995).

In contrast with the Ramsar classification, the European Corine classification system relies more on vegetation characteristics (E.U., 1995).

The USACE definition includes inundation and saturation requirements as a prime determinant of wetlands, while including soil and vegetation characteristics. An area has to exhibit all three attributes to be classified a wetland (Conservation Foundation, 1990). This reference definition implies that wetlands cannot be supported on non-soil or non-hydric substrates. The specific reference to vegetation provides another difficulty. Some wetland vegetation includes only algae and mosses (National Science Foundation, 1995).

The definition used by Michigan is similar to the USACE definition because EPA regulations require that state wetlands permits comply with the requirements of the CWA. The Michigan definition has a practical extension, however. The Michigan Department of Environmental

Quality (DEQ) does not regulate isolated wetlands of less than 5 acres and wetlands of any size in counties with population below 100,000 (Goodenough, 1995). This 5-acre criterion in counties with fewer than 100,000 inhabitants is solely politically motivated. Bennett (1996) indicates that the 5-acre limit was chosen arbitrarily, reflecting the expectation of the state legislature that wetlands in counties with larger populations are under greater development pressure. It may be concluded that the intent was not to regulate every small wetland in the state (Sadewasser, 1996; Bennett, 1996).

Without a statewide inventory, non-contiguous wetlands of any size in counties of less than 100,000 population are not covered by the state's wetland protection provisions. Since the implementation of the water protection act in 1980, no such statewide inventory has yet been completed.

The new amendments in the NREPA prove to be very crucial in local, voluntary wetland protection of wetlands of less than 5 acres because an expensive inventory is required for the adoption of a wetland ordinance. According to the national business institute (NBI, 1995), this amendment was to reduce the number of municipalities that have valid wetland ordinances from approximately 40 to approximately five. According to the DEQ, the legislature wanted all existing local ordinances to expire unless they came into compliance with the amendments (Sadewasser, 1996). The Michigan United Conservation Clubs stated that development interests resulted in the local government's obligation to conduct these expensive wetland inventories (Moore, 1996). Of the 83 counties in Michigan, only four have wetland inventories. The implication for 22 existing local ordinances is uncertain.

The Food Security Act wetland definition emphasizes the importance of hydric soil as a critical indicator. This implies that wetlands cannot exist where hydric soils are not present, which is not the case. Its definition

emphasizes primarily agricultural land use. Regarding the presence of vascular plants, the same problem arises as in the USACE definition. The arbitrary exclusion of Alaskan wetlands is not based on scientific distinctions (National Science Foundation, 1995).

The FWS definition reflects a more scientific perspective and is broader than the USACE definition. The presence of one of the three attributes—water, vegetation or soil—is adequate for wetland classification (Conservation Foundation, 1990). Referring to terrestrial and aquatic systems, the FWS definition introduces a complication. Wetlands are not always transitional, either geographically or functionally. Furthermore, *transition* is not the characteristic of wetlands alone. The coupling to non-soil environments, however, is a special strength of this definition (National Science Foundation, 1995). Also, according to this definition, an area might be appropriately classified as a wetland even though it may lack appropriate soils or vegetation at the time a particular survey is conducted (Mattingly, 1994). It includes non-vegetated areas such as mudflats, gravel beach, rocky shore and sandbar (Leidy, 1992).

Critics in the U.S. argue that regulators have overreached their mandate by exerting jurisdiction over drier areas that either should not be defined as wetlands or at least should not be afforded the same degree of regulatory protection as wetter wetlands. Some politicians, landowners and agency officials advocate the "duck test" to assess whether a particular area is a wetland: if a duck lands in it and splashes, the area must be a wetland (Leidy, 1992). This, however, would declassify as much as 75 percent of wetlands currently protected by the Clean Water Act in some regions (Alper, 1992). Besides that, 35 percent of waterfowl species observed in wetlands with a seasonal hydrology were also recorded using two or more different seasonal wetland habitat types. It is, therefore, a misperception that wildlife requires

wetlands with standing water for most life cycle stages (Leidy, 1992).

Of all societal values of wetland protection, the function of biodiversity habitat preservation seems paramount. Drained wetlands, such as reclaimed land, may represent high special agricultural production values and sources of biomass for fuel and fiber. However, these benefits are not sustainable and therefore not necessarily desirable (Williams, 1990).

If a low priority wetland is filled, an equal amount of similar wetland has to be created elsewhere, according to the federal "no net loss" policy. This policy has not succeeded on a large scale yet, and it may be impossible to recreate a functional wetland at all (Alper, 1992). A study for the South Florida Water District found that for every 14,058 acres (5,691 ha) lost, only half as many acres of wetlands were restored, and most were poorly designed and maintained (Darnay, 1994). In addition, it is very difficult to establish a relative replacement value. Must the same ecosystem replace a bottomland hardwood forest or can a substitute suffice? (Mattingly, 1994). Considering eastern Europe and Russia, the National Research Council (NRC) stated, however, that restoration projects, even when completely successful, are far more cost effective in the short term than postponed for several decades (Hamilton, 1992).

Food and Security Act

Between 1985 and 1990, only 26 producers had federal agricultural benefits withheld because of the Swampbuster program. And the wetland reserve program applied only to 5 percent of 2,000 foreclosed farms, encompassing just 260,000 acres (105,260 ha) (Steinhart, 1990). Darnay (1994), however, credited the Swampbuster program for reducing farmland conversions from 335 acres a day to 79 acres a day (135.6 ha and 32 ha, respectively) between 1987 and 1991.

The Clean Water Act

The permit system under section 404 of the CWA does not include small wetlands. Dredging and filling of small wetlands is allowed throughout the country. Planting, harvesting, draining and plowing of wetlands are not covered by section 404. The program has limited power to reduce wetland losses. Cumulative effects are implicated in such impacts as increased flooding along adjacent waterways (Mattingly, 1994).

The reason for delegating administration of section 404 of the CWA to the states was to streamline the permitting process and provide greater public accessibility. In Michigan, public participation in permit review has increased. However, section 404 provides more access to third parties and special interest groups by wider distribution of public notices.

Local judicial intervention can undermine the effectiveness of state programs. In 1995, the MDNR lost a vital issue in the *Hugett v. MDNR* case. Here, the plaintiff purchased a 325-acre (131 ha) peat bog parcel and applied for a permit to fill it with sand. The EPA and FWS brought out adverse comments. An additional permit was requested to establish a cranberry farm. The MDNR granted removal of 30,000 cubic yards of peat from an 86-acre (35 ha) area. The establishment of a cranberry farm was denied, however because of EPA objections. In court, Mr. Hugett claimed that the cranberry proposal was exempt under the (former) WPA. An employee of the Michigan Department of Agriculture (MDA) testified on his behalf that the department's policy included the resolution that no permit was required under the WPA for the establishment of cranberry facilities in wetlands. The MDNR stated the opposite, emphasizing that the state's mandate included compliance with the requirements of the (federal) CWA. Under this act, more stringent requirements are allowed but the state may not impose any less stringent requirements. Section 404 (f)(1) of the CWA specifically exempts per-

mitting requirements for discharges from normal on-going farming. This exemption, however, does not apply to non-wetland conversion.

Michigan has no counterpart to the federal regulations that serve to clarify the regulatory exemptions and no body of state to interpret the exemptions. Of the five administrative rules in the WPA (Definitions, Permit Applications, Permits, Wetland Determinations and Mitigation), none specifically explains to an applicant what activities are exempt from regulation. As a result, the court gave greater weight to the MDA's than to the MDNR's testimony because it included the only exemption policy. The EPA was powerless in this case because it can not override the state CWA. The EPA action remaining was to withdraw the entire program from Michigan, a punishment that did not fit the crime (Goodenough, 1995).

Endangered Species Act

The ESA is widely respected by the court rulings. If a wetland site supports endangered species, development is jeopardized—at the very least, project plans may be modifications. Section 7 of the ESA provides safeguards in environmental law, in addition to the 404 program (Houck and Rolland, 1995).

The combined regulatory provisions make U.S. wetland policy rather complex. Instead of developing one comprehensive wetland protection law, Congress added provisions to various laws primarily concerned with related environmental protection issues such as water pollution, agricultural production, fish and wildlife habitat, and federal agricultural programs. This has resulted in a confusing array of definitions, prohibitions and policies applicable to activities in or concerning wetlands (Environmental Law Institute, 1993).

Long-term, state—let alone federal—land use planning is not popular in the U.S. According to Diamonds and Noonan (1996), it is viewed as foreign and even totalitarian. Unplanned land use development patterns with uncontrolled environmental

consequences result from the lack of comprehensive land use planning and development strategies at the state and local levels.

Europe

In Europe, awareness about wetlands loss and measures for their protection largely have not had the same legislative support as in the United States. As suggested by Williams (1990), this may be the result of the lack of a politically powerful hunting lobby. In general, environmental matters were slower in taking hold across the continent, let alone matters of importance to rural areas such as mire, bogs, etc. Food production and self-sufficiency were the goals of rural policy since WWII. The long period of human habitation did not instill a public "wilderness ethic" because little natural habitat remains. The most significant public policy initiative in European wetland protection is the bird and habitat directives. According to the IEEP (1991), certain member nations are too slow to implement policy measures, including the designation of nature areas.

The Netherlands

The direct destruction of wetland habitat has been halted in the Netherlands. However, the quality of the remaining wetlands is exposed to increased pressure by human activities such as recreation and fisheries (shellfish). Also the dehydration of wetland soils due to draining of adjacent lowland is still a big problem. Additional land use pressures are emerging, including commercial development of offshore locations and inland lakes not yet reclaimed. This includes development of a second national airport (Osieck, 1996).

Wetland policy in the Netherlands is far from comprehensive. Although several limited policy initiatives exist, full-scale implementation has not yet occurred. Furthermore:

- Policies do not represent the fact that wetlands are one ecosystem. An integration of all relevant policy contexts—nature

conservation, physical planning, agricultural development, environment management, etc.—is lacking.

- Policies have yet to be developed for specific user groups.
- Ecological borders of wetland ecosystems do not coincide with political/administrative jurisdictions, such as provinces, municipalities and regional water boards, complicating coherent wetland policy formulation.
- Formulated policies reflect different scales (E.U., national, province and municipality) and lack consistency and coordinated implementation.
- Current policy does not include all wetlands (Romijn, 1995).

Policy directives of the Ministry of Environment and the Ministry of Agriculture are, though similar, not complementary. For instance, the green directive only partially overlaps with the National Ecological Network (Bouwer and Leroy, 1995).

The Ministry of Agriculture expects that, without policy changes, most goals of the Nature Policy Plan will not be met. Environmental and nature preservation policies have to be complementary. A report was published last year in an attempt to harmonize the two policies and identify common goals (Ministry of LNV, 1995). Research findings predict that over the next 50 years, the National Ecological Network will improve national biodiversity by 15 to 20 percent, at a cost of 0.003 percent of the GNP (Sijtsma, 1995).

The conservation easements used for the NEN have a positive effect on natural values. Several plant and animal species are returning. On the other hand, because of the principle of voluntary participation, fragmentation is still occurring. Areas where normal agricultural management practices take place (Bouwer and Leroy, 1995) surround areas with conservation easements.

Conclusions

Wetlands provide extremely important biophysical and socioeconomic functions that contribute significantly to the various quality-of-life dimensions of urban and rural inhabitants. These functions include, among others, improvement of groundwater availability and quality, nutrient recycling, retention of sediment and toxic substances, flood control, biodiversity preservation—including essential habitat for many endangered species—and the provision of many recreational opportunities, including fishing and hunting. However, for many countries, habitat and biodiversity preservation appears to be the main reasons for wetland conservation. Globally and on the North American and European continents, wetland loss continues, albeit in the latter two at reduced rates.

The fact that globally the estimated rate of species extinction ranges from one to six species per day and is expected to increase to one species per hour by the year 2000 (Darnay, 1994) may convince even skeptics that global wetland protection remains critically important.

Many countries included in this report have national wetland definitions and classification systems that are difficult to equate. Because many nations ratified the Ramsar Convention, this definition may be perceived as the most significant, globally. As with many international treaties, the Ramsar Convention has no legal implementation consequences for the contracting parties. Therefore, its effectiveness and impact are limited. This is especially evident in the slow rate in designating Ramsar sites.

Wetland protection in all countries discussed above is mainly based on habitat and biodiversity protection. The U.S., although representing a more comprehensive legislative approach towards wetland identification, classification and protection, relies on a patchwork of policies and laws. Six federal agencies and departments have administrative authority related to wetland policy,

in some cases supplemented by delegated state and local authority. This may be viewed as a disadvantage in comprehensive wetland protection. On the other hand, wetlands are surrounded by a potentially multilayered protection mechanism, although not equally effective. In relative terms, U.S. wetland protection policies are more comprehensive than those of any other country. Policies have considerably slowed wetland destruction, but the national "no net loss" goal has not yet been achieved. With an annual wetland conversion rate between 300,000 and 450,000 acres (121,457 and 121,450 ha), new action should be considered to protect this fragile ecosystem resource.

State wetland protection is very

important because the federal 404 program may exclude smaller wetlands. The efficacy of Michigan's wetland protection is uncertain, however. The state protection (of wetlands greater than 5 acres) does not depend on the existence of an inventory, while a poorly drafted local zoning ordinance may, in effect, hamper local protection. In the 16 years after implementation of the Michigan Wetland Protection Act, local wetland inventories are rarely made. The cost of wetland inventories is simply too high for most local units of government and is, therefore, an impediment to establishing local wetland ordinances.

European wetland policy is based mainly on biodiversity. If used

correctly, the habitat and bird directives could be effective. But here, also, the protective designation is happening too slowly. With almost no natural wetlands left, the European countries should accelerate designation of nature areas.

In the Netherlands, protection policy is mainly reserved to the Ministry of Agriculture, which is faced with the apparently contradictory mandates of wetland protection and agricultural development. However, the implementation of the NEN continues according to plan.

The Scandinavian countries appear to be the only ones where wetlands are not under imminent threat. This is due, in part, to low population pressures.

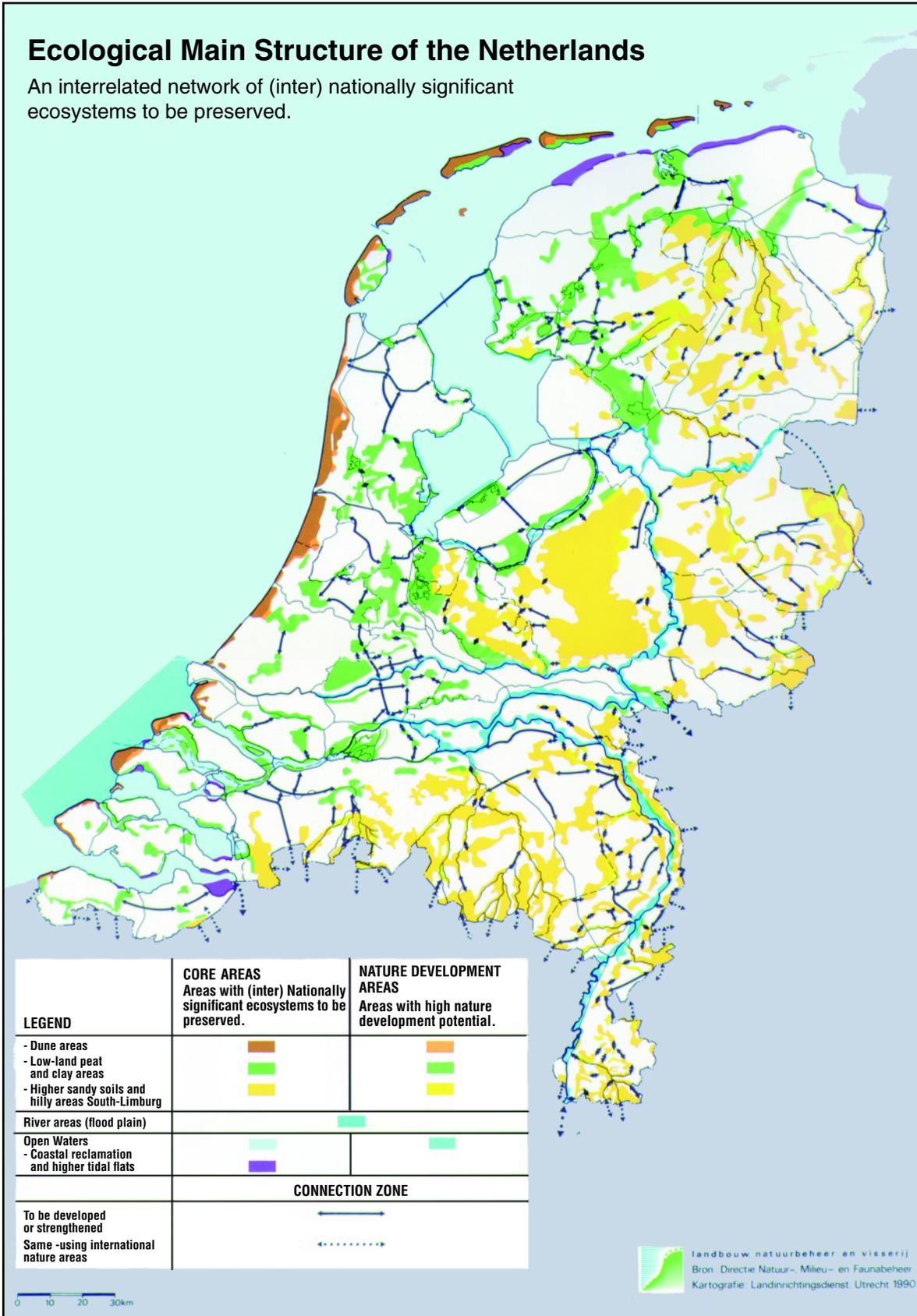
Appendix 1

Local units of government in the State of Michigan with local wetland ordinances. Last inventory by the Department of Environmental Quality of Michigan was conducted in March 1995.

County	Name	Received (m-d-y)
Allegan	Clyde Township	7-6-94
Antrim	Forest Zhome Township	8-23-94
Grand Traverse	Whitewater Township	6-24-94
Ingham	Meridian, Charter Township of	7-27-94
Oakland	Waterford Charter Township	9-14-94
Oakland	Addison Township	9-15-94
Oakland	White Lake Township	1-20-94
Oakland	Orchard Lake Village	8-16-94
Oakland	Auburn Hills, City of	8-18-94
Oakland	Oakland, Charter Township of	8-16-94
Oakland	Independence, Charter Township of	8-18-94
Oakland	Brandon, Charter Township of	8-23-94
Oakland	Bloomfield Township	8-11-94
Oakland	Milford, Charter Township of	5-9-94
Oakland	Orion, Charter Township of	8-8-94
Oakland	Oxford, Charter Township of	8-5-94
Oakland	West Bloomfield Charter Township	8-10-94
Oakland	Wixom, City of	3-14-94
Oakland	Novi, City of	8-31-94
Oakland	Rochester Hills, City of	6-8-94
Washtenaw	Ann Arbor, City of	11-7-95
Wayne	Gross Ile, Township of	11-9-95

Appendix 2*

National ecological network of the Netherlands



* Translated from the original Dutch version.

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