ONTARIO'S PROGRAM FOR WETLAND INVENTORY, MANAGEMENT AND RESEARCH

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ABSTRACT

Ontario's program for wetland inventory and evaluation was initiated in 1983; the largest numbers of wetlands were evaluated in 1984 and 1985. Wetland evaluation has continued through 1986-1988 and additional wetlands will be assessed where required. To date, 1982 wetlands totalling 390,000 ha have been evaluated. Of those evaluated in 1983-87, 418 (230,000 ha) are in Classes I and II and considered provincially significant. Regionally significant or Class III wetlands account for a further 366 wetlands (43,000 ha) and the remainder, 1027 (98,000 ha) fall into Classes IV to VII. Quality control for wetland evaluation takes the form of training courses for field staff and review of wetland evaluations by regional and Wildlife Branch staff. Periodic review of the provincial wetland data base will allow update of information on wetlands, particularly those at risk from degradation or loss. The inventory is of little use unless managers and the public have access to it. In order to provide easy access to the wetland data, we are entering wetland evaluation data in the province into microcomputer systems. Also, we have prepared a provincial report describing 152 Class I to III wetlands assessed in the first two years of the program. Another document outlining information on wetlands assessed in 1985 is currently in preparation. A number of research projects have helped explore the wetland data base and enhance our knowledge of regional variation among wetlands. The wetland data base has revealed the relatively high species diversity of Class I to III wetlands as compared to those of lower rank. We have described the major characteristics of Ontario's predominant, but little known wetland type— the forest swamp. More recent work has analyzed the physical and biological attributes of the important Great Lakes' coastal wetlands.

INTRODUCTION

The dwindling numbers of wetlands in southern Ontario led to the development of the provincial wetlands program. Public interest groups, notably the Federation of Ontario Naturalists, Ontario Federation of Anglers and Hunters and Ducks Unlimited, contributed to the program, led the way in many areas and helped turn wetlands into a high profile issue. The basis for all wetland conservation is a good inventory and assessment of wetland resources. This paper looks at Ontario's wetland evaluation program, its technical basis, its accomplishments and its future. Specifically, six different aspects are discussed:

- development of a wetland evaluation system;
- the numbers of wetlands and area evaluated;
- quality control of wetland evaluations;
- developing and using the provincial wetland data base;
- wetland research; and
- publicizing Ontario's significant wetlands.

THE STARTING POINT: WETLAND LOSS

The decline of wetland resources in Ontario prompted the Government of Ontario to initiate steps towards a wetland management policy in 1980. The first major components of this initiative centred on a cooperative federal-provincial mapping inventory of the wetland resource and on development of an evaluation system. The inventory was completed by Environment Canada for all of southern Ontario (Snell 1987).

Estimates of wetland loss in Ontario vary (Cox 1972; Bardecki 1984; Snell 1987). Between two thirds and three quarters of wetlands south of the Precambrian Shield have been lost. Most extreme is southwestern Ontario where overall 90 percent, and in places 100 percent, of the original wetlands have disappeared. Areas along western Lake Ontario and in eastern Ontario have lost as much as 80 percent of their wetlands. Recent (1967-82) trends are not encouraging either (Snell 1987). Of the remaining southern Ontario wetlands, 5.2 percent were lost from 1967-1982. The natural reclamation of abandoned converted wetlands, particularly in central and eastern Ontario, reduced the net loss to 1.8 percent. Kent County experienced a 26 percent loss during 1967-82.

THE EVALUATION SYSTEM

Development of a wetland evaluation system was initiated in 1980 by the Ontario Ministry of Natural Resources and the Lands Directorate and Canadian Wildlife Service of Environment Canada (Glooschenko 1983). A number of consultants were retained to work on various aspects of the system. Preliminary versions of the Wetland Evaluation System were tested during 1981, 1982 and 1983 (Collins and Maltby 1984). Revisions were made to address some of the weaknesses uncovered in field testing and subsequent statistical analyses. The current version (Ontario Ministry of

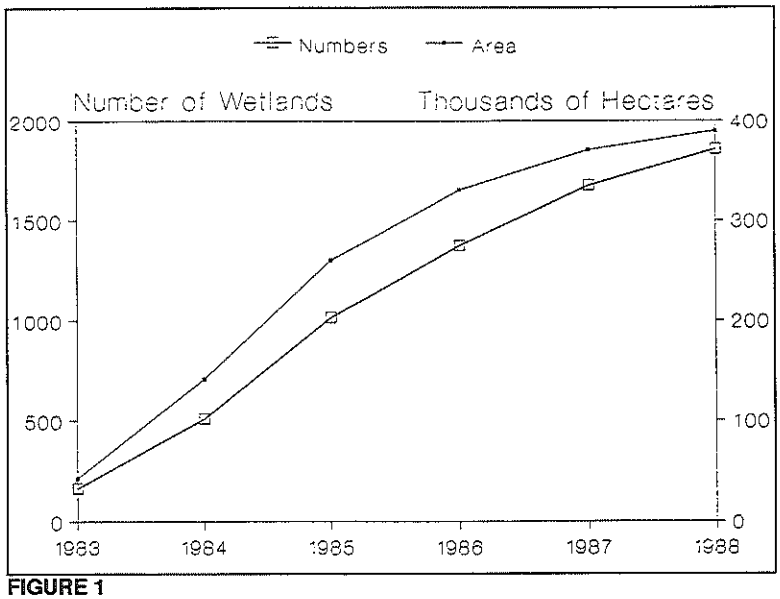

FIGURE 1
The numbers of wetlands and total wetland area evaluated from 1983-1988.

Natural Resources and Environment Canada 1984) has been in use for four complete field seasons. Evaluations done in 1983-84 have been revised using the second edition of the manual.

The goal of the evaluation system is to rank wetlands so that management is appropriate to their relative value. The evaluation system quantifies wetland values in a manner which permits comparison of wetlands. In this way, it may be used as a basis for making informed land use decisions. The primary use of the system, therefore, is as a planning tool to aid the implementation of government policy. Ultimately, the evaluation system ranks wetlands into seven distinct classes, Class I being the highest or most valuable and Class VII being the lowest ranked.

The system classifies wetland values into four distinct components: biological, social, hydrological and special features. Each component has a maximum of 250 points and each is weighted equally in the decision regarding the final ranking of a wetland.

The biological component of the system measures values related to biological productivity and diversity. Productivity is related to climate, soils, wetland type, site type and nutrient status while diversity depends on the number of wetland types, vegetation communities, surrounding habitats, connections with other wetlands, interspersion and open water. Social value, as measured by the evaluation, relates to resource products, recreational activities, aesthetics, education, ownership and accessibility. A wetland's hydrological value derives from its importance for stabilizing stream flows, improving water quality and controlling erosion. Special features consist of the occurrence of rare or endangered species, bird nesting colonies, winter wildlife habitat, waterfowl habitat, fish habitat, unusual geological features and an assessment of the rarity of each wetland type.

GETTING THE BASIC DATA: WETLAND EVALUATION RESULTS

An ambitious program of wetland inventory and evaluation began in earnest in 1983, initially for three years and subsequently extended through 1988 (Fig. 1). Evaluations were carried out by the Ontario Ministry of Natural Resources, conservation authorities and, during 1982-1983, Environment Canada.

To date, 1982 wetlands have been evaluated, totalling almost 390,000 ha (Fig. 1). Figure 1 shows the numbers of wetlands and total area evaluated during the years the program has been operating.

Evaluation in 1983 employed the first edition of the manual and 165 wetlands (approximately 40,000 ha) were evaluated that year (Fig. 1). In 1984, another 350 wetlands (about 100,000 ha) were assessed. The year 1985 was big for wetland evaluation and the first year the second edition of the manual was used. A total of 567 wetlands (120,000 ha) were assessed by the Ministry of Natural Resources and the conservation authorities. With the majority of the more significant wetlands evaluated by the end of 1985, fewer wetlands were assessed in later years. The years 1986, 1987 and 1988 saw 380, 365 and 155 wetlands evaluated, respectively.

Wetland evaluation will continue as needed. Some districts have completed all inventories and others require more fieldwork. The implementation of the Conservation Lands Tax Reduction Program will likely create a need for wetland evaluation as some landowners will wish to have their wetlands evaluated. This program provides tax rebates of up to 100 percent to owners of Class I to III wetlands and other heritage lands provided the owners agree to maintain the natural values of their land.

Of wetlands evaluated 1983-1987, about 230,000 ha of wetlands (62 percent) are classified as provincially significant (i.e. Class I and II); 43 000 ha (12 percent) are regionally significant (Class III); and the remaining 97,000 ha (26 percent) fall into Classes IV to VII (Fig. 2).

Looking at the numbers of wetlands by wetland class (Fig. 2) the picture is somewhat different. Twenty-three percent (i.e. 418 wetlands) are in Classes I and II, 366 or 20 percent fall in Class III and 1027 or 57 percent are in Classes IV to VII. The differences in the distributions among the seven classes for numbers of wetlands and area (Fig. 2) result from the different average sizes of wetlands in the different classes.

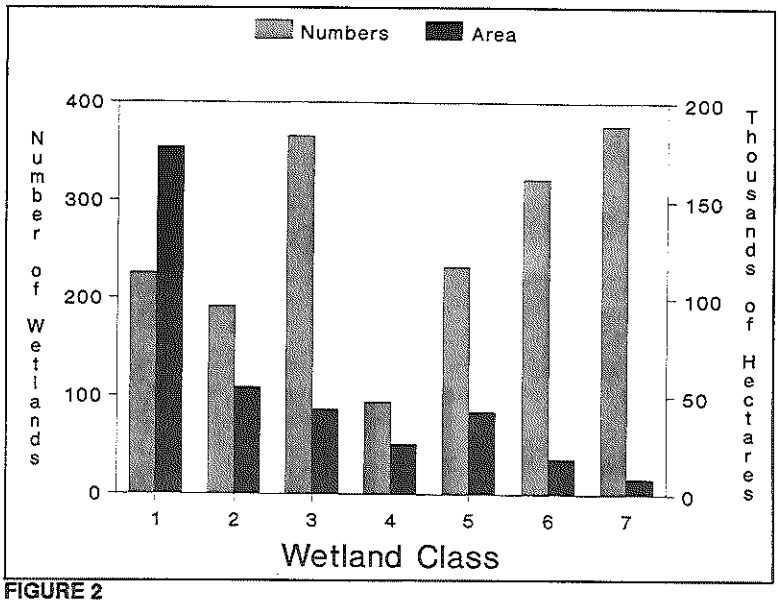

FIGURE 2
Wetland numbers and area in each wetland class. Numbers shown are for all wetlands assessed 1983-1987.

A number of Class I and II wetlands are extremely large, for example Long Point wetland complex is 17,000 ha and Luther Marsh is 4000 ha. Not all Class I and II wetlands are large; Kettle Creek Woods, a Class I wetland in Aylmer District, is only 25 ha in size. Nevertheless, on average Class I and II wetlands are larger and indeed, large size contributes to a wetland's score (Ontario Ministry of Natural Resources and Environment Canada 1984) and is highly correlated with total score (Scheifele and Mulamootil 1987). Wetlands in classes IV to VII tend to be smaller than others, but many exceptions exist.

The Ministry will be noting the status of wetlands already evaluated. New information can alter a wetland's rank and land use change and natural processes, such as lake level fluctuations, can significantly modify a wetland's size and structure.

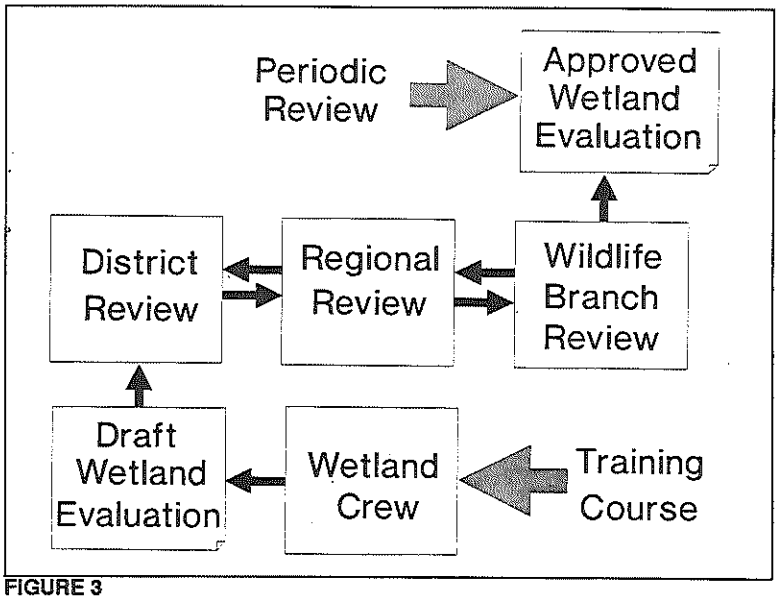

FIGURE 3
The wetland evaluation approval process.

QUALITY CONTROL

Wetland evaluation must provide a consistent assessment of the value of a wetland. To ensure this consistency, the Ministry of Natural Resources developed a system of checks on both the competence of wetland evaluators and the accuracy of each wetland evaluation (Fig. 3).

All wetland evaluators must either take the wetland evaluation course offered by the Ministry of Natural Resources or be trained by an experienced wetland evaluator who has taken the course. The two-to-three day wetland course includes classroom time giving the fundamentals of the evaluation method. The attendees then split into teams and each independently conducts a wetland evaluation in the field. Instructors give advice on the interpretation of the manual. The students then do the background work on maps and other sources of information, write up the evaluation and calculate the wetland's scores and classification. A 'post-

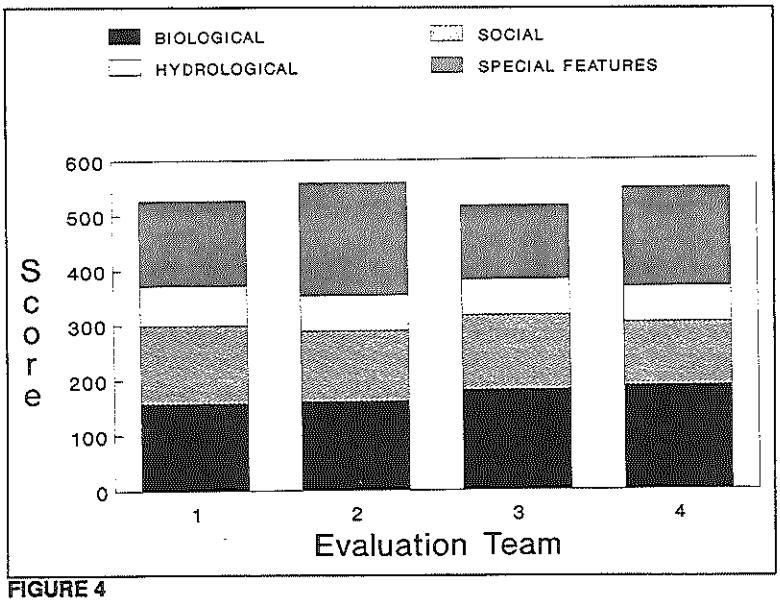

FIGURE 4
Wetland scores for Wolverton Swamp calculated independently by four different evaluation teams.

mortem' identifies the causes of any differences among the different teams.

Wetland evaluations done by district staff, conservation authorities and consultants are reviewed by the district office and then forwarded to regional office (Fig. 3). Here they undergo another review and are then passed on to Wildlife Branch of the Ministry of Natural Resources for the final review. At the Wildlife Branch a thorough review occurs and suggested changes are sent to the regions and districts. When the District, Region and Wildlife Branch agree on the final assessment, the wetland evaluation is given final approval.

Procedures for changing wetland evaluations are also in place. New information about particular wetlands often becomes available, such as the occurrence of provincially significant plant and animal species. This often results in an increase in the wetland's rank. For example, subsequent to the completion of the Haldimand-Norfolk Natural Areas Inventory (Gartshore *et al.* 1987), the wetland evaluations for wetlands in the Regional Municipality of Haldimand-Norfolk were revised to include the additional rare species discovered by Gartshore *et al.* (1987). Because of this a number of wetlands increased their rank.

To document the consistency of wetland evaluations done by different wetland evaluators, a replication study was undertaken. Four wetlands were selected, one of each major wetland type: marsh, swamp, bog and fen. These were also selected to represent the four administrative regions of the Ministry of Natural Resources in southern Ontario, Southwestern, Central, Eastern and Algonquin. The wetlands selected were White Lake Fen, Wolverton Swamp, Nanticoke Creek Marsh and Wolford Bog. Three or four experienced teams of evaluators conducted separate evaluations for each wetland.

Analysis of the results of this 'experiment' are not yet complete but preliminary results show that the overall scores determined by different wetland evaluators show similarity (Glooschenko *et al.* 1988a). Figure 4 shows the results for Wolverton Swamp, indicating that, where appropriate background information is available, scores for the individual components may vary somewhat but the total score changes rather little.

THE WETLAND DATA BASE

Wetland evaluations contain standard assessments of standard attributes. These type of data are ideal for computerization and entry into data base management software. A computerized wetland data base, possibly linked to geographic information system software, would be a powerful tool for both management and for research (Fig. 5).

Having such a data base increases the ability of scientists and managers to ask 'what if' questions and quickly provide comprehensive comparative information that would be unavailable using regular

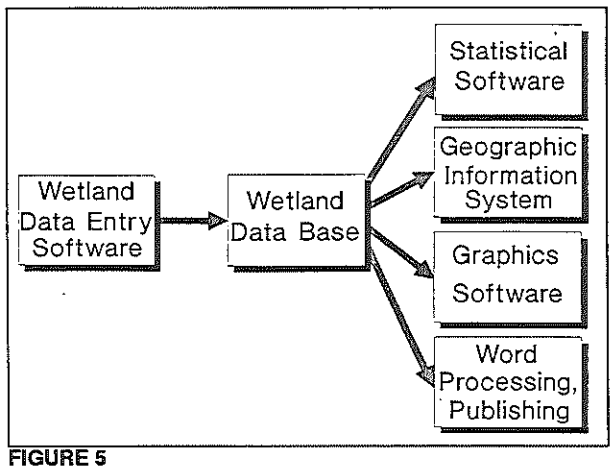

FIGURE 5
Potential software components of a comprehensive wetland database system.

'paper' data bases. Even in its present form, the wetland data base has provided the basis for a number of studies outlined later.

Computer programs to facilitate the entry of wetland data were written at the Ministry of Natural Resources for three microcomputer models: IBM compatible MS-DOS machines, the Apple IIe and the Digital Equipment Pro 350 and 380. Approximately two thirds of all wetland data have now been entered on one of these machines. Data can be transferred between the three different formats. Work in the next few years will lead to the development of a computerized wetland data base using data base management software.

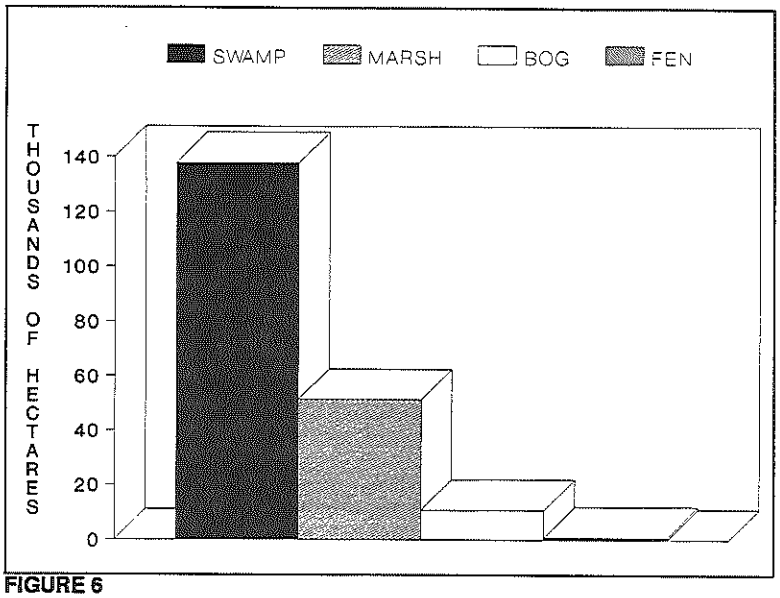

FIGURE 6
Total area in each wetland type for a sample of 1000 wetlands.

RESEARCH: BACKING UP MANAGEMENT

Effective management of wetlands requires the support of incisive research. Consequently, research projects have examined a number of important issues regarding wetlands. One of these has already been discussed, the study of replicability of the evaluation method. Others have examined the values of Ontario's forest swamps, the diversity of coastal wetlands along the Great Lakes and the occurrence of provincially significant bird species.

Ontario's wetlands are made up of swamps, marshes, bogs and fens. In a sample of 1000 wetlands totalling 200,844 ha, 68.6 percent of the area was swamp habitat, 25.6 percent marsh, 5.4 percent bog and 0.4 percent fen (Fig. 6). Most wetlands are made up of a mixture of the wetland types, most often swamp and marsh.

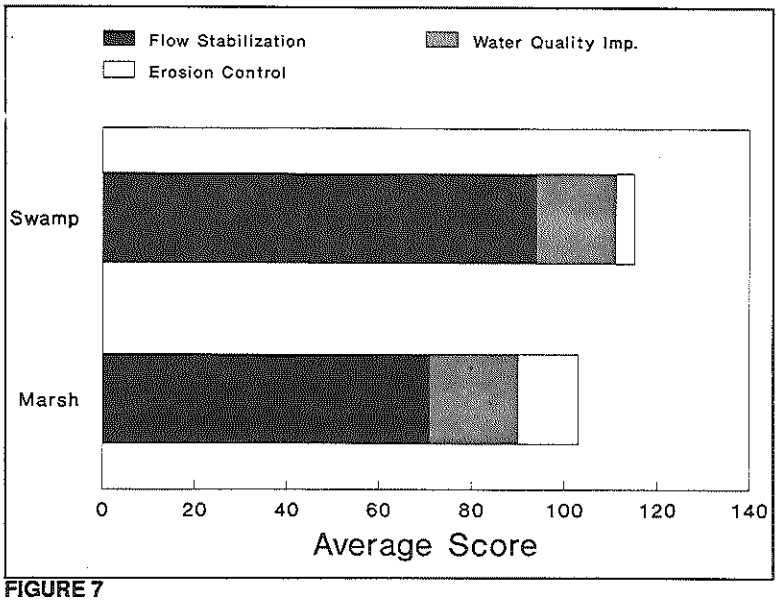

FIGURE 7
Average hydrological scores for swamps and marshes (modified from Glooschenko *et al.* 1987).

Clearly, the most common wetland type in southern Ontario wetlands is swamp (Fig. 6). Much of this habitat is forest swamp. Red Maple, Black Ash, Silver Maple and White Cedar are the common canopy species. Some tangible values of these forested swamps were uncovered in a review of empirical studies of a number of swamps and analysis of data from the provincial data base (Glooschenko *et al.* 1987).

Many swamps are on palustrine sites and consequently score relatively highly for the flow stabilization portion of the hydrological component (Fig. 7). Empirical studies of several Ontario swamps document their importance in these functions (Glooschenko *et al.* 1987). Marshes, on the other hand, score significantly higher in scores for water quality improvement and erosion control (Fig. 7).

Swamp habitats support a different assemblage of rare species than other wetland types. Rare trees and shrubs, such as *Nyssa sylvatica*, *Quercus*

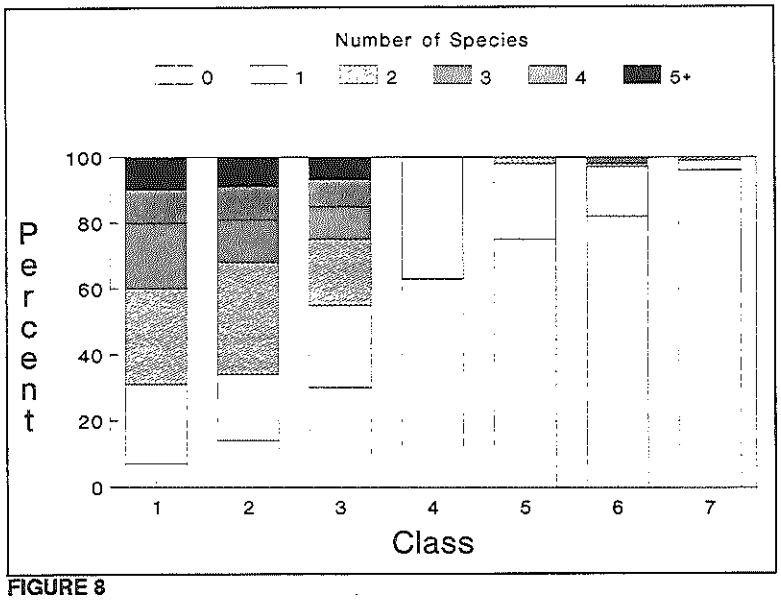

FIGURE 8
The number of provincially significant bird species occurring in the seven wetland classes (from Glooschenko *et al.* 1988a).

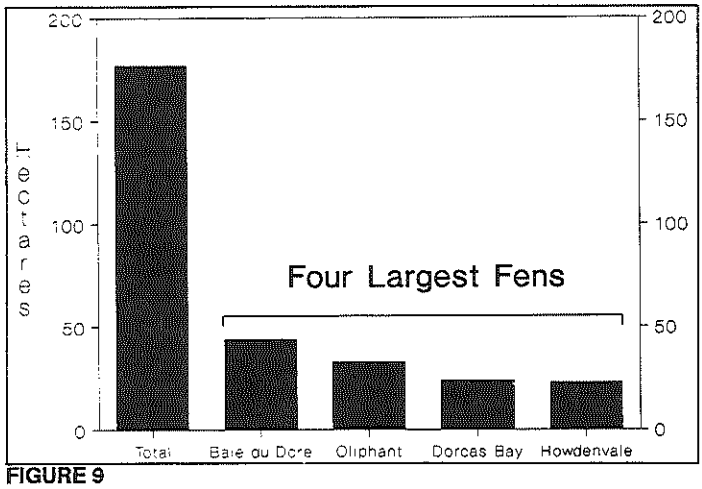

FIGURE 9
The total area of Great Lakes shoreline fen habitat and the fen area of the four largest shoreline fens.

palustris and *Viburnum recognitum* almost by definition occur more frequently in swamps. Vertebrate species also exhibit preferences. In a sample of wetlands either predominantly marsh or swamp, the Four-toed Salamander, Southern Bog Lemming, Eastern Fox Snake and Eastern Hog-nosed Snake occurred much more frequently in swamps (Glooschenko *et al.* 1987).

The presence of rare or provincially significant plant and animal species is a major influence on wetland classification. Provincially significant bird species are by far the most frequently recorded species. Glooschenko *et al.* (1988a) documented the occurrence of provincially significant bird species at 622 wetlands in southern Ontario. Forty-three species were included among that sample. Black Tern, Northern Harrier and Marsh Wren account for nearly half of all occurrences.

That research showed that Class I-III wetlands are quite similar in having consistently higher numbers of provincially significant bird species present while Class IV to VII wetlands in general had few such species (Fig. 8). In fact, the average number of provincially significant bird species in Class I to III wetlands was statistically different from the number in Classes IV to VII.

Recent work also analyzed the physical and biological attributes of the critical Great Lakes' coastal wetlands (Glooschenko *et al.* submitted). Attention is focussed on these wetland habitats under the joint U.S./Canadian initiative to develop a Classification and Inventory of Great Lakes Aquatic Habitats as well as non-governmental efforts to protect coastal habitats (see Smith 1987).

Little comprehensive, broad-scale analysis of the characteristics of Great Lakes coastal wetlands exists for the Canadian side of the lakes. The provincial wetland data base makes this possible for the first time. Coastal wetlands show a predominance of marsh vegetation, contrasting the dominance of swamp in inland wetlands. Bogs are exceedingly rare; only two wetlands among 160 coastal wetlands contained any bog habitat.

As Figure 6 makes quite clear, fen is the most uncommon of southern Ontario's wetland types (also see Reddoch 1984). Even more uncommon are shoreline fens along the Great Lakes. Of the 49,000 ha of coastal wetlands evaluated, only 177 ha are fen habitat (Fig. 9). Furthermore, 124 of those hectares are in four large fens on the Bruce Peninsula (Fig. 9). Portions of two of these are protected by the Federation of Ontario Naturalists' nature reserves. One other is the subject of an effort to preserve the habitat.

Wetlands along Lakes Erie and Ontario, particularly the latter, are often in sheltered bays or behind barrier beaches. Those along Lake Huron and Georgian Bay are more often exposed to the open lake and wave action. The protected locations and more southern location contribute to the predomin-

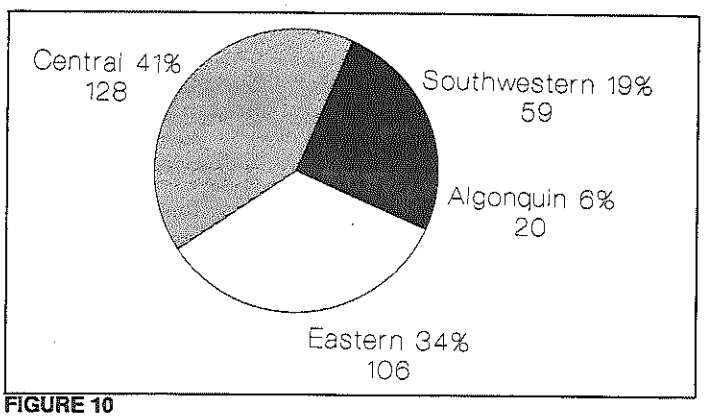

FIGURE 10
The numbers of wetlands from each MNR administration region to be included in the second wetlands report.

ance of organic soils and high levels of dissolved solids in wetlands on Lakes Erie and Ontario. A greater percentage of swamp and fen habitat in Lake Huron and Georgian Bay wetlands as well as larger palustrine components contribute to a greater complexity of vegetation.

THE INTERIM REPORT AND BEYOND: RAISING PUBLIC AWARENESS

The public at large does not generally appreciate the many tangible environmental, economic and social values of wetlands. Thus, efforts are underway to publicize the importance of high ranking wetlands. These will dovetail with procedures to raise landowner awareness as part of the Conservation Land Tax Reduction Program and will also provide a better basis for implementing wetlands planning policy statement.

Provincially and Regionally Significant Wetlands of Southern Ontario — Interim Report 1987 (Glooschenko *et al.* 1988b), issued early in 1988, describes the biological, hydrological, social and special features values of 152 Class I to III wetlands; these were evaluated in the earlier years of the evaluation program, 1983-84. This document was well received and is making information on the most significant wetlands immediately available to planners and policy-makers, municipalities, landowners and conservationists.

But there are, in total, 784 Class I to III wetlands according to our present knowledge. A second report outlining information on approximately 300 wetlands assessed in 1985 is in preparation (Fig. 10). Work on that report is approaching the halfway mark. At least one more report would be necessary to describe the remainder of over 350 Class I to III wetlands evaluated between 1986 and the present.

Wetlands of Canada, a book just released by the National Wetland Working Group (1988), features a chapter on the "Wetlands of Eastern Temperate Canada" (Glooschenko and Grondin 1988), which includes all of southern Ontario's wetlands. Much of the information in this chapter is drawn from the Ontario wetland data base. The vast wetlands of boreal Canada, including those of northern Ontario, are profiled in another chapter, "Wetlands of Boreal Canada" (Zoltai *et al.* 1988). This text will, no doubt, be used by educators to explain wetland functions and promote their values.

CONCLUSION

The pace of wetland evaluation has been fast. Probably no other broad scale resource mapping and analysis has been realized in such a short time frame. It is the basis for government initiatives like the wetlands planning policy statement and the Conservation Lands Tax Reduction Program. The information base is impressive and offers new knowledge with which to better understand and protect our wetland resources. And yet wetlands are not static; neither can the inventory remain so. The state of our wetlands must continually be monitored and wetland evaluations updated.

The great effort expended on wetland evaluation is indicative of the commitment of the Ontario Government to wetland conservation. That commitment depends on the support of the citizens and voluntary organizations concerned about wetlands. The momentum built during the wetland evaluation program must continue in order that we may conserve the significant wetlands now identified.

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