CANADA'S THREATENED ATLANTIC COASTAL PLAIN
WETLANDS: HABITAT CHARACTERISTICS AND
CONSERVATION CONCERNS

I.C. WISHEU and P.A. KEDDY
Biology Department, University of Ottawa, Ontario, Canada, K1N 6N5

SUMMARY

Canada’s coastal plain vegetation, which includes 22 nationally or globally significant plant taxa, occurs only in southwestern Nova Scotia and in the Georgian Bay area of Ontario. The species occur primarily in sheltered, infertile wetlands and/or on lakeshores exposed to seasonal flooding or wave wash. Coastal plain plants seem well suited to such areas as they have many characteristics of stress tolerant plants. They appear to be restricted to these habitat types by competitively superior plants which occupy more fertile and less disturbed shorelines. The rarity of these species is therefore due to limited habitat, so conservation strategies should emphasize the preservation of remaining habitat and the maintenance of existing levels of infertility, flooding and exposure to waves.

1. INTRODUCTION

1.1 Flora status and Range

Atlantic coastal plain species occur in low lying areas along the eastern seaboard of North America and are particularly abundant in moist or wet habitats (1). Their range extends from the Gulf of Mexico to New England, with disjunct populations occurring in the Great Lakes Basin and in Southern Nova Scotia. Throughout this range, habitat destruction or alteration is reducing population sizes and at least 22 members of the flora are of either global or national significance (1,2).

1.2 Disjunct Canadian Populations

In Canada, populations of coastal plain species are found in only two provinces. In Ontario, the flora occurs only in the south, along lakeshores near Lake Huron (3, Figure 1). There are 23 different coastal plain taxa in this region, 6 of which are nationally significant (2,3). In Nova Scotia, coastal plain plants are more abundant (4,5, Figure 2) with larger population sizes and greater diversity. There are at least 18 nationally or globally significant members of the flora in Nova Scotia, including one endemic (*Euthamia galetorum*) (2).

2. HABITAT CHARACTERISTICS

2.1 Sand and Gravel Lakeshores

One kind of wetland in which coastal plain species are found, has gently sloping sand and gravel lakeshores that experience frequent floods or that are exposed to wind and wave disturbance (6, Figure 3). These disturbances prevent shrubs from invading the shorelines and keep soil fertility low (1,7). Coastal plain lakeshores are infertile, as is evident from measures of soil nutrients (8), from the low levels of standing crop that occur (6,9) and from the abundance of carnivorous plants (4,6,9), a group of species which indicate infertility (10). Members of the coastal plain flora that occur along lakeshores include *Euthamia*
Figure 1. The distribution of Atlantic coastal plain species in Ontario. After Keddy and Sharp, 1989 (3).

Figure 2. Atlantic coastal plain. Medway River systems. After W.

*galetorum, Rhexia virginica rosea.* In Ontario, most known on gravel lakeshores.

2.2 Peat and Grassy Swales

A second kind of coastal plain vegetation occurs in swales or bogs (Figure 4). It consists of herbaceous and carnivorous plants (10).
Figure 2. Atlantic coastal plain species in Nova Scotia are most abundant along the Tusket and Medway River systems. After Wisheu et al. (submitted) and Hill and Keddy (accepted) (4,5)

galetorum, Rhedia virginica, Lachnanthes carolina, Sabatia kennedyana and Coreopsis rosea. In Ontario, most known occurrences of coastal plain vegetation are from sand and gravel lakeshores.

2.2 Peat and Grassy Swales

A second kind of coastal plain habitat are sheltered peaty areas, either lakeshores, grassy swales or bogs (Figure 4). These are infertile areas, as indicated by the presence of carnivorous plants (10). Infertility appears to be maintained by periodic flooding, but fire
and/or muskrat grazing may also act to remove organic matter (11). Coastal plain species that occur in peaty or grassy regions include *Drosera filiformis*, *Scirpus longii*, and *Lophiola aurea*. The last species also occurs along open lakeshores.

3. THE COASTAL PLAIN FLORA

3.1 Stress tolerance

Members of the coastal plain flora seem to be especially suited to the infertile and frequently flooded habitats in which they occur. Most of the species are small plants and they often grow as rosettes—a shape and size that make them resilient to wave wash (12). Also, their adaptations for slow growth rates and their evergreen or carnivorous habits facilitate survival during long periods of submergence or in nutrient-poor soil (6). Species with these same characteristics have previously been classified as stress tolerators (13,14).

3.2 Low competitive abilities

Coastal plain species occur on infertile substrate, but transplant experiments in Ontario have indicated that they need not be restricted to such areas (15,16). When transferred to fertile soil, both *Xyris diffinimus* and *Rhexia virginica* grew larger. Coastal plain plants are able to grow in fertile areas, but they are restricted from doing so apparently because they are unable to co-exist with competitively superior species which normally inhabit fertile regions. In a recent screening of the competitive abilities of 44 different wetland plants, coastal plain species and the species with which they co-occur were found to have very low competitive abilities (17,18).

4. CONSERVATION CONCERNS

4.1 Eutrophication

If eutrophication were to increase the fertility of coastal plain habitat, then competitively superior species that normally occupy fertile sites would invade and outcompete the smaller, slower growing coastal plain plants. This invasion by dominant non-native species following eutrophication has already been observed in coastal plain wetlands in the New Jersey Pine Barrens (19). Agricultural and residential development has enriched the wetlands, and there has been an increase in nutrient-demanding, competitively dominant non-native species and a decrease in carnivorous and native coastal plain plants (19, Table 1).

**TABLE 1**

Numbers of plant species in pristine and enriched Atlantic coastal plain wetlands in the Pine Barrens, New Jersey. From Ehrenfeld, 1983 (19)

<table>
<thead>
<tr>
<th></th>
<th>No. of species</th>
<th>% carnivorous</th>
<th>% non-native</th>
<th>% nutrient-demanding, woody</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pristine site</td>
<td>26</td>
<td>12</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Enriched site</td>
<td>72¹</td>
<td>0</td>
<td>96</td>
<td>12</td>
</tr>
</tbody>
</table>

¹ Actual count was 73. One species was unidentifiable as to being native or non-native.

Figure 3. Wilsons lake, an example of Atlantic coastal plain.

Figure 4. A large population of Muskrat.
Coastal plain species such as Zostera marina, Scirpus maritimus, and Juncus roemerianus are small plants and are well suited to the infertile and nutrient-poor habitat. They are also resilient to wave wash (12). Some species are herbivorous or carnivorous, but many are detritivorous and feed on nutrient-poor soil (6). Species such as Z. marina and S. maritimus are considered stress tolerators (13,14).

Plant experiments in Ontario (5,16) have shown that species such as S. maritimus and J. roemerianus can tolerate a wide range of salinities, including those of the fresh-water marshes. When transferred to saltwater environments, they grow slower but are able to survive and reproduce. Coastal plain plants are often referred to as "fugitive" species because they are so resilient and can regenerate rapidly from even the smallest fragment of plant material.

Coastal plain wetlands in the

<table>
<thead>
<tr>
<th>% nutrient-demanding, woody</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>12</td>
</tr>
</tbody>
</table>

This table shows the percentage of nutrient-demanding woody species in coastal plain wetlands. The values range from 0 to 12, indicating varying degrees of nutrient demand.

Figure 3. Wilsons lake, a sand and gravel lakeshore in the Tusket River system, supports large populations of Atlantic coastal plain plants. (Reprinted with permission from Wisheu and Keddy 1989 (6)).

Figure 4. A large population of Lophiola aurea occurs in a peat bog at Fancy Lake, Nova Scotia.
4.2 Water stabilization
In both Ontario and in Nova Scotia, coastal plain habitat is often maintained by exposure
to wind and waves or by fluctuating water levels. Waves and high water periods wash out
organic matter and kill invading shrubs, which would eventually outcompete the rare
coastal plain plants (7,16). Low water periods allow the flora to regenerate from seed, a
phenomenon that is critical in Ontario and New Jersey (20,21), but of lesser importance in
Nova Scotia (22). The strong relationship between large fluctuations in water levels and the
occurrence of coastal plain plants has been documented repeatedly (1,5). It can be predicted
then, that either eutrophication or the stabilization of water levels would further decrease the
already endangered populations of Atlantic coastal plain species.

REFERENCES
2   G.W. Argus and K.M. Pryer, Rare Vascular Plants in Canada, Our Natural Heritage, Canadian
3   C.J. Keddy and M.J. Sharp, Atlantic Coastal Plain Flora Conservation in Ontario, Natural
5   N.M. Hill and P.A. Keddy, accepted for publication, Ecology.
10  T.J. Givnish, in: E.B. Abrahamson (Ed), Plant-Animal Interactions, McGraw-Hill, New York,
11  N.M. Hill and M. Johansson, submitted for publication.
18  I.C. Wisheu and P.A. Keddy, accepted for publication, Biol. Conserv.
21  K.A. McCarthy, Spatial and Temporal Distributions of Species in Two Intermittent Ponds in

PROTECTING ALVARS: PARTS EQUAL THE WHOLE

J.W. BELCHER and P.A. KEDDY
Department of Biology, University of Western Ontario,
London, Ontario, Canada, N6A 5B7

SUMMARY
Alvars, which consist of a limited global distribution, are protected status. The flora, species, and
vegetation patterns of these systems are species, and vegetation patterns are

1. INTRODUCTION
Protection not only of primary goal of many conservation on National Parks and
ecosystems exist in isolated patches. Our research focuses on
the conservation status of the 4 alvars based on species

2. ALVAR VEGETATION
2.1 Definition
An alvar is an area with vegetation (3,4), ranging from
a forest of mixed forest where the area is
naturally maintained by

2.2 Distribution
Alvars have a limited distribution in the Eastern United States, and occur in New York (6) and
New Jersey. Three alvars are known as cedar glades. A fourth alvar occurs in Ontario (Fig. 1) in three
Peninsula region near Lake that
