

1991

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Knepper, D. A.; Wright, J. B.; and Musselman, L. J., "The Phytogeographical Significance of Some Rare Plants at Back Bay" (1991). *III. Flora. 2.*
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The Phytogeographical Significance of Some Rare Plants at Back Bay

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Abstract: The Back Bay region has long been recognized for its many species which reach either their northern or southern limits there. The eminent Harvard botanist M.L. Fernald collected extensively in the Back Bay region during the late 1930's and early 1940's. He postulated the Back Bay area provided a unique opportunity for the migration of fresh and brackish water species through a series of interconnected or neighboring marshes and pools. His collections document the presence of several species which we now consider extirpated.

Of especial interest are genera with vicarious species pairs, that is, one area of overlap between wide-ranging species and southern species is at Back Bay. We present information on two such pairs: *Lilaeopsis carolinensis* (southern) and *Lilaeopsis chinensis* (wide-ranging); and *Lippia nodiflora* (southern) and *Lippia lanceolata* (wide-ranging). In addition we discuss species which reach their northern or southern limits at Back Bay. Examples include: *Limosella subulata* (Scrophulariaceae), a northern species which apparently has been extirpated, and *Juncus megacephalus* (Juncaceae), an endemic of the southeastern United States which is abundant near its northern limit at Back Bay.

Introduction

In 1856 the range of the second edition of *Gray's Manual of Botany* was extended to include all of Virginia (Fernald, 1950). This seemingly trivial event led to some of the most intense botanical exploration of the state by the irrepressible Harvard botanist, Merritt Lyndon Fernald.

The majority of Fernald's fieldwork in Virginia was focused on the coastal plain of the southeastern portion of the state. The flora of this botanically rich and interesting area was described by Fernald (1937) as follows:

... the species making up the indigenous flora of the coastal plain in southeastern Virginia are by no means of uniform occurrence. Many are almost ubiquitous types. . . . The majority, however, are restricted in occurrence, their restrictions varying from local abundance in one or few small areas to single tiny colonies or individuals. In other words, a considerable proportion of the flora has the characteristics of either a relic-flora, left over but not dominating in an area from which it has largely been destroyed, or a pioneering flora which has not succeeded in competition with more aggressive and dominating species.

The botanical uniqueness of the area is further supported by the fact that the City of Virginia Beach (formerly Princess Anne County) has 15 plant species which are found nowhere else in the state (Harvill et al, 1986). This is the highest number of species known from only one county in Virginia, the second highest being nine, from

Lee County. Of the 15 species known in Virginia only from the City of Virginia Beach, at least six of these are currently found, or were historically collected from Back Bay: *Eleocharis radicans* (Poir.) Kunth., *Lilaeopsis carolinensis* C. & R., *Arenaria lanuginosa* (Michx.) Rohrbach, *Limosella subulata* Ives, *Physalis viscosa* L., and *Lippia nodiflora* (L.) Michaux.

This paper discusses some general geographic patterns and the significance of some rare plants of Back Bay.

Materials and Methods

This paper heavily relies on the work of Fernald (1937 and 1940) as it applies to the Back Bay region. The phytogeographical history of the Atlantic coastal plain follows the recent work by Delcourt and Delcourt (1981; 1986). The present status of many of these uncommon plants stems from a current inventory of the Back Bay region by the second author (Wright, these proceedings).

Study Area

Back Bay is located in the southeastern corner of the City of Virginia Beach. For the purposes of this paper, the "Back Bay region" refers to the maximum Back Bay land acquisition boundary recently proposed by the U.S. Fish and Wildlife Service (U.S. Department of the Interior, USF&WS, 1989). This same report gives a helpful summary of the climate, geology, topography, and soils of the region.

Regional Phytogeographical Patterns

Recent studies on the flora of southeastern Virginia's coastal plain have emphasized that it is a region where many boreal and austral plant species are at the extreme limits of their ranges (Frost and Musselman, 1987; Wright et al, 1990). This same pattern holds true for the Back Bay region, and was recognized by Fernald over 50 years ago (Fernald, 1937). Table 1 lists some rare plants of Back Bay which can be generally classified as northern or southern elements.

Because of the number of novelties found in the Back Bay region and the unique environmental conditions, Fernald had a keen interest in the phytogeography of Back Bay. He stated that the more characteristic Back Bay plants are

...intolerant of much salinity in the waters and confine themselves to the fresh to but slightly brackish reaches of streams, pools, and inlets. This group is, then, of peculiar interest, since the plants have apparently mostly attained their present habitats and extreme isolation in the past, at periods when they could migrate from river to river along fresh or brackish (not strongly saline) shores. (Fernald, 1940)

One of these fresh to brackish tidal plants of northern distribution is *Limosella subulata*. Figure 1 shows the range of this species (adapted from Pennell, 1935). It was historically reported from the Back Bay region (Fernald, 1935), however, recent attempts to locate it by the authors have been fruitless. Increased water turbidity may be to blame, for Fernald (1940) states the "water of shallow Back Bay was so very clear that we could see the white sandy bottom only a few feet below, except where *Potamogeton bupleuroides*, *Vallisneria americana* and other aquatics made solid growth." Any recent visitor to Back Bay knows that Fernald's (1940) description of the water quality is sorely dated (see Norman and Southwick, these proceedings).

Juncus megacephalus is an endemic rush of fresh to brackish estuaries of the southeastern United States (see Figure 2) and is found near its northernmost limit at Back Bay (Fernald, 1940; Harvill et al, 1986). Fernald (1940) often cited this species in his discussions of the flora of fresh tidal estuaries and shores. He described it as

...not a plant of the saline outer coast but rather of the fresh to barely brackish inner margin of the coast, sometimes in fresh inland habitats. With great stretches of fresh to slightly brackish inner shore, now extending from below Cape Henry to Cape Fear and, formerly, doubtless more continuously to Florida, it has been able to follow more or less without interruption its most favorable habitats; but it does not follow north along the saline outer coast. (Fernald, 1940)

The genus *Lilaeopsis* is represented at Back Bay by two species: *Lilaeopsis chinensis* and *L. carolinensis*. *Lilaeopsis chinensis* is found all along the Atlantic coast of North America, and at Back Bay is often associated with *Spartina cynosuroides* on firm, exposed mud. *Lilaeopsis carolinensis*, however, "has its chief center on the lower reaches of La Plata River in temperate eastern South America, but with four remote stations known in North America: near New Orleans; shallow water near Myrtle Beach, South Carolina; an unidentified station (presumably near Wilmington), North Carolina; and this pond on Long Island [Back Bay]" (Fernald, 1940; see Figure 3). Since Fernald's time, more stations for *L. carolinensis* have been found along the Gulf and Atlantic coastal plains between New Orleans and Back Bay (Ludwig, personal communication). Unlike *L. chinensis*, *L. carolinensis* is found in more protected coves on unconsolidated peat flats often in association with *Triglochin striata*.

Lippia is another genus which is represented at Back Bay by two species: *Lippia lanceolata* and *Lippia nodiflora*. The former species is known from Florida to southern California, north to southern New Jersey and the Great Lakes region. The latter is known from Florida to Texas and north to southeastern Virginia (Fernald, 1950). As stated before, in Virginia *Lippia nodiflora* is known only from the City of Virginia Beach (Harvill et al, 1986).

Although there does seem to be a convergence of northern and southern elements at Back Bay, this is an oversimplification of the phytogeographical patterns for the coastal plain of southeastern Virginia. Fernald (1937) gives a more detailed discussion based on his extensive fieldwork and divides the flora into seven general phytogeographical categories.

Fernald hypothesized that the predominance of pan-tropical and warm-temperate species at Back Bay was a result of a "very ancient dispersal." Recent paleobotanical work, however, indicates that during the Wisconsinian glaciation (mid-Pleistocene epoch), Virginia was dominated by boreal vegetation (Delcourt and Delcourt, 1981; Delcourt and Delcourt, 1986). This condition existed until the early Holocene when the Laurentide ice sheet retreated north out of the Great Lakes basin. The accompanying rise in temperature, sea-level, and other geomorphic changes led to the migration of warm-temperate taxa north, and the retreat of boreal taxa northward and to the higher elevations of Virginia (Delcourt and Delcourt, 1981; Delcourt and Delcourt, 1986; Woodward and Ruska, 1986). If this were the case, then perhaps the North American stations of *Lilaeopsis carolinensis* represent a relatively recent migration.

It should not be inferred, however, that the northern and southern elements found at Back Bay migrated as two distinct groups. The individual species of any flora surely differ in their rates of dispersal, temperature limitations, salinity tolerance, etc.

Of the factors which affect the range of a species, climate is considered to be of chief importance because it not only imposes physiological limitations on plants, but also influences soil development (Good, 1964). It is more than mere coincidence that many of the austral Back Bay species have ranges which closely parallel the mean minimum annual temperature zones as mapped by Cathey (1990). For example, the range of *Lippia nodiflora* closely matches the southeastern portion of zone 8 which has a mean annual minimum temperature of 10-20 F (see Figure 4).

Phytogeographical Significance

Whether the rare plants of Back Bay are representatives of a relic distribution or are the result of recent migration is still subject to debate. This should not, however, detract from the significance of the Back Bay region being the extreme limit (either north or south) of many rare plants' range. Mayr (1963) states that

The most distinct isolates of a species are nearly always situated along the periphery of the species range. . . . They are almost invariably a source of disagreement among taxonomists, some of whom consider them 'still' subspecies, others 'already' species.

The variability of Back Bay's vegetation is nicely documented in the writings of Fernald (1935; 1937; 1940; 1941; 1950). His knowledge of the flora and keen powers of observation led to the addition of many subspecies and varieties considered "new to Virginia."

Many of the species listed in Table 1 are not considered rare throughout their ranges (eg. *Cladium jamaicense*). These plants are given special consideration in Virginia because they are uncommon in the state. The presence of these species, in addition to the true rarities, make the vegetation of the Back Bay region a unique component of the state flora (Harvill et al, 1986; Ludwig et al, these proceedings).

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Table 1: Some Rare Plants of Back Bay

Rare Back Bay Plants with Northern Affinities

- Sparganium androcladium* (Engelm.) Morong
- Potamogeton perfoliatus* var *bupleuroides* (Fernald) Farwell
- Cyperus engelmannii* Steud.
- Eleocharis halophila* Fernald & Brack.
- Limosella subulata* Ives

Rare Back Bay Plants with Southern Affinities

- Lycopodium appressum* (Chapm.) Lloyd & Underw.
- Bulbostylis ciliatifolia* (Ell.) Clark
- Cladium jamaicense* Crantz
- Cyperus haspan* L.
- Dichromena colorata* (L.) Hitchcock
- Tillandsia usneoides* L.
- Juncus abortivus* Chapman
- Juncus megacephalus* M.A. Curtis
- Calopogon pallidus* Chapman
- Quercus incana* Bartram
- Arenaria lanuginosa* (Michx.) Rohrback
- Paronychia riparia* Chapman
- Lilaeopsis carolinensis* C. & R.
- Sabatia brachiata* Ell.
- Lippia nodiflora* (L.) Michaux
- Verbena scabra* Vahl
- Physalis viscosa* ssp. *maritima* (M.A. Curtis) Waterfall
- Bacopa monnieri* (L.) Pennell
- Aster racemosus* Ell.
- Erigeron vernus* (L.) T. & G.
- Heterotheca gossypina* (Michx.) Shinnery
- Iva imbricata* Walter



Figure 1. Range of *Limosella subulata* (Pennell, 1935)



Figure 2. Range of *Juncus megacephalus* (Fernald, 1940)



Figure 3. Range of *Lilaeopsis carolinensis* (Fernald, 1940)