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ECOLOGICAL STUDIES IN THE BAYS AND OTHER WATERWAYS NEAR LITTLE EGG INLET AND IN THE OCEAN IN THE VICINITY OF THE PROPOSED SITE FOR THE ATLANTIC GENERATING STATION, NEW JERSEY

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VOLUME THREE

A QUANTITATIVE STUDY OF THE VEGETATION NEAR THE GREAT BAY BOULEVARD, TUCKERTON, NEW JERSEY

by

James D. Montgomery and Mark R. Newcomb

For

PUBLIC SERVICE ELECTRIC AND GAS COMPANY

Ichthyological Associates, Inc.
August 1975

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A QUANTITATIVE STUDY OF THE VEGETATION NEAR THE GREAT BAY BOULEVARD, TUCKERTON, NEW JERSEY

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Introduction

In 1971, Ichthyological Associates, Inc. began ecological studies for Public Service Electric and Gas Company to evaluate effects of the proposed offshore nuclear generating station. A study of the birds and mammals on Great Bay Boulevard was begun during the summer of 1972 (Thomas and Milstein 1973: 169-197). An initial survey of the vegetation was conducted in October and November, 1973 (Pokras and Pokras 1974). A quantitative study of the vegetation began in the spring of 1974 and ended in October.

The proposed transmission corridor extends from the plant site off Little Egg Inlet to the southern terminus of Great Bay Boulevard; along Great Bay Boulevard to an area north of Willis Creek; and then northwest to a switching station, 10.5 miles northwest of the plant site. The pipe-type cable circuits will be buried under Great Bay Boulevard and to the easterly side of this road. Placement of the five circuits will cause disruption of vegetation on the easterly 15-20 ft strip; the Boulevard and the strip will be restored.

Great Bay Boulevard is located in Little Egg Harbor Township, Ocean County, N. J., at 74° 20' W and 39° 35' N. The Boulevard begins at Route 9 in Tuckerton and extends for 6.8 miles. The road was

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constructed in 1931-32 by the State of New Jersey, but is now maintained by the Township (Ocean County Engineer's Office, personal communication). The Boulevard is on a peninsula separating Great Bay to the west and Little Egg Harbor to the east.

Starting on the upland, the road travels for approximately 1 mile through a residential area, then through the extensive Tuckerton marsh, where it crosses several creeks. The roadway is built on sand fill above the level of the marsh, with the bridges on fill mounds well above the marsh.

The purpose of this investigation is to describe the flora and vegetation within the 100-ft right-of-way of Great Bay Boulevard, from Atlantic Avenue about 1.2 miles south of Tuckerton, to the end of the road.

The most important factor limiting plant species in salt marshes is elevation (Kerwin and Pedigo 1971, Ranwell 1972), which influences frequency and duration of tidal flooding, and to some degree, salinity. The true salt marsh typically occurs between the level of twice-daily tidal inundation and the elevation where flooding occurs only a few times a year during spring or storm tides (Ranwell 1972). Between these two conditions, the plants display a zonation related to tolerance to flooding and salinity. Other factors also play a role. For example, Spartina alterniflora has a high requirement for iron (Adams 1963). Flooding by fresh water during storms may be related to seed germination in this species (Ranwell 1972). At the upper edge of the marsh, light becomes limiting where shrubs and trees shade the marsh grasses.

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In recent years there have been several studies in New Jersey, dealing with various aspects of salt marsh vegetation, and the general literature is extensive (Ranwell 1972). Spartina alterniflora, S. patens, and Distichlis spicata predominate in the marsh proper. S. alterniflora occurs at the outer edge of the marsh in nearly pure stands (Martin 1959, Good 1965, Robichaud and Buell 1973). A tall form of this species occurs principally along creek banks and ditches, and a short form grows on the low marsh surface (Good 1965, Durand and Nadeau 1972, Squiers and Good 1974). Different growth forms have been interpreted as an ecological response (Durand and Nadeau 1972, Blum 1968). S. patens and D. spicata occur at higher levels of the marsh than S. alterniflora, and vary in importance in different areas. Martin (1959) reported Distichlis in higher areas than S. patens, but Durand and Nadeau (1972) found the two species mixed together. Other marsh plants are found mixed with these grasses, but are usually of minor importance. Iva frutescens and Juncus gerardi are found at still higher elevations in salt marshes.

Most investigations have been limited to the marsh proper and only mention is made of the marsh border. Baccharis halimifolia and I. frutescens border some salt marshes (Martin 1959, Rosenwinckel 1964, Good 1965). Brackish and fresh-water marshes border other salt marshes as at Island Beach and are dominated by Typha latifolia, Hibiscus palustris, Thelypteris palustris, Rhus toxicodendron, and Baccharis halimifolia (Martin 1959). Phragmites communis borders parts of the marsh at Cheesequake (Rosenwinckel 1964) and is the dominant plant in the marshes at Hackensack Meadows (Sipple 1971-72). This present

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investigation concerns an area where the disturbance from construction of Great Bay Boulevard over the marsh has changed the elevation and substrate, and extended the upland marsh border on a long narrow strip into the marsh. This creates an ecotone community where diversity is often high (see Odum 1971 for discussion).

Summary

1. This investigation describes the flora and vegetation in the right-of-way of Great Bay Boulevard, Tuckerton, N. J.

2. The flora included 198 species of vascular plants and included plants typical of salt marshes as well as species of the Pine Barrens and Middle District.

3. Introduced species comprised 26% of the flora; these tended to occur near the road edge in sandy soil.

4. The largest number of species, especially of woody plants, was found in Section One, nearest the mainland.

5. Tree borings indicated that the oldest trees and largest shrubs were nearly 30 years old, only 10 years less than the date of construction of Great Bay Boulevard.

6. Euphorbia polygonifolia, considered rare in New Jersey, was collected on the beach north of Big Thorofare Channel, on the west side of Great Bay Boulevard.

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7. Quadrat data indicated that the distribution of plant species was correlated with distance from the edge of the road and with elevation above mean low water.

8. Upland species tend to be correlated with distance from the edge of the road, while species typical of salt marshes tend to be correlated with elevation.

9. An indication of seasonal aspect of the vegetation was obtained by resampling in September, quadrats originally sampled in the spring; data for identification of species and cover values were most satisfactory in the late summer.

10. The Chi-square test of association from contingency tables was used to aid in describing species associations.

11. No discrete communities were found; rather an overlapping series of zones was described.

a. Roadside vegetation occurred on sandy soils, with grasses such as Panicum virgatum dominant.

b. Tall shrubs occurred from 3 to 8 ft from the road. Myrica pensylvanica was the dominant shrub, with other shrubs and small trees occurring on sandy soil with complete litter covering.

c. Baccharis halimifolia dominates a zone beyond Myrica at elevations of 3.8 to 4.5 ft; the vegetation is more open than in the tall shrub zone, and more herbs are present.

d. Spartina patens and Iva frutescens occur either together or separately at elevations of 3.5 to 4.5 ft. Soils have more fine sand and more bare soil occurs in this zone.

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e. The open marsh at elevations below 3.5 ft is dominated by Spartina alterniflora which grows on soils high in clay and organic matter.

f. Phragmites communis dominates sandy soils at moderate elevations. There was a positive correlation between Phragmites and trash.

12. Spartina alterniflora has been shown to be the most productive species in the marsh and has been transplanted or seeded into marsh areas for revegetation.

13. Myrica and Baccharis are important shrub species for birds and occur at higher elevations.

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Materials and Methods

Floristic Survey

A weekly survey was begun in late July to determine the plant species present on Great Bay Boulevard. All previously unrecorded plants and plants not identifiable in the field were brought to the laboratory for identification and drying. A collection of all species was made. The permanent voucher collection was placed in the Chrysler Herbarium of Rutgers University, New Brunswick, N. J., and a reference collection retained at the Ichthyological Associates' laboratory in Absecon. Note was made of each species of woody plant (trees, shrubs, and woody vines) in each section as to relative abundance and any special features of location (such as occurring only on fill). Identifications were made by using Gleason and Cronquist (1963) and Fernald (1950); Hitchcock and Chase (1950) was used for grasses. Some identifications were confirmed by comparison with specimens in the Chrysler Herbarium, Rutgers University. Nomenclature for scientific names follows Gleason and Cronquist (1963).

Since many species have multiple common names, scientific names are used throughout the report. Selected common names are given in Table 1.

Ages of Trees

Estimates of the ages of trees and large shrubs were made using an increment borer. This device removes a small (3/16 inch) radial

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core from the tree trunk without damaging the tree. Aging gives some idea of past history of vegetation and time of replacement (see Smith 1966 for discussion). Ages of trees were determined to the nearest year where the core reached or closely approached the center of the tree. In some cases, exact ages could not be determined because of irregularities in the rings or broken cores. Where the core did not approach the tree center, a minimum estimated age was determined. Ages are, in any case, subject to some variation (Smith 1966).

Selected trees or large shrubs of four species on Great Bay Boulevard were aged: Baccharis halimifolia (Groundsel-tree), Juniperus virginiana (red cedar), Myrica pensylvanica (bayberry), and Prunus serotina (black cherry). Borings on large trees were made at breast height, and on smaller trees and shrubs at a height of 1 to 2 ft above the base. The cores were stored in soda straws and the number of growth rings was counted in the laboratory using a binocular dissecting scope.

Location of Transects

Great Bay Boulevard was arbitrarily divided by the five bridges into six sections (Fig. 1). In addition, the full length of the Boulevard was surveyed into 100-ft intervals by Fellows, Read, and Weber, Inc. These intervals are designated in hundreds of feet plus feet; thus, 116 + 25 indicates 116 ft x 100 plus 25 ft, or 11,625 ft, from the north end of the Boulevard at Tuckerton. The sections were as follows: Section One from Atlantis Avenue to Big Thorofare, 74 + 0 to 134 + 0; Section Two from Big Thorofare to Little Thorofare, 134 + 0

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to 176 + 0; Section Three from Little Thorofare to Jimmy's Creek, 176 + 0 to 203 +0; Section Four from Jimmy's Creek to Big Sheepshead Creek, 203 + 0 to 269 + 0; Section Five from Big Sheepshead Creek to Little Sheepshead Creek, 269 + 0 to 317 + 50; and Section Six from Little Sheepshead Creek to the end of the road beyond the Rutgers Marine Laboratory, 317 + 50 to 360 + 0 (Fig. 1).

Within each section, 10 possible transect lines on each side of the road (20 total) were randomly selected by drawing numbers. Because the vegetation was disturbed when elevations were taken at even hundred foot intervals, it was decided to use points 25 ft on each side of each 100-ft point (designated as 105 + 25 or 105 + 75, for example). The order in which these transects were to be done was also determined randomly.

Initially, data were collected on six transects in each section. Species area curves were used to determine when an adequate area had been sampled (Smith 1966). Cain (1938) suggested that the minimum number of samples be at the point on the curve where an increase in area of 10% causes an increase of 10% in the number of species. Cain and Castro (1959) indicated that sampling was adequate at the point where the species area curve flattens out. Based on the species area curves for each section, eight transects were sampled in Section One, seven transects in Section Two and Section Four, and six were adequate in Sections Three, Five, and Six.

Each transect was begun at the edge of the road, and ended with the 50-ft stake at the limit of the right-of-way. Elevation data to 0.01 ft were taken (after the vegetation study) at each foot along the transect by Fellows, Read, and Weber, Inc.

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Quadrat Methods

One-foot square quadrats were established along the transect line on an even foot mark from the center line of the right-of-way; thus, the first quadrat began at the foot mark nearest the road-edge where vegetation occurred, and the last quadrat ended at the 50-ft mark. Alternate quadrats were studied as recommended by Smith (1966), and were numbered consecutively.

The following data were collected in each quadrat:

1. Number of plants of each species rooted in the quadrat.

2. Basal area of each species rooted in the quadrat as percent of quadrat area.

3. Average height of each species rooted.

4. Percent cover; i.e. the proportion of the projected area of the quadrat overlapped by the foliage of each plant species.

5. Percent cover and height of species not rooted in but overhanging the quadrat.

6. A map of the location of each plant rooted in the quadrat.

7. Percent of basal area of the quadrat covered by litter (dead leaves, twigs, branches, fruits, etc.), bare soil, water, and trash (material not of natural origin such as wood, cans, bottles, paper, etc.).

The number of plants was counted as stems for most species where a simple stem occurred at the surface of the ground. Plants which have several stems from the base such as certain grasses were counted as clumps (Cain and Castro 1959). Plants with a basal rosette of leaves

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were also measured as clumps. Percentage values for cover and basal area were estimated using the Trepp Scale (Table 2) suggested by Phillips (1959).

Soil samples were collected in quadrats 1, 5, 10, 15, and where present, 20. Samples from one line east and west in each section were analyzed for organic content and particle size. Samples were oven dried at 110 C for 24 hours, weighed, and dried in a muffle furnace at 500 C for 24 hours. The weight loss represented organic material lost by ignition. The remaining organic-free soil was then sorted using sieves of gravel (2.0 mm), sand (0.25 mm), and fine sand (0.05 mm) sizes in a mechanical shaker. The weight obtained for each size class represented the percent of the mineral soil in each size class.

Data Analysis

Frequency, mean percent cover, mean basal area, and density were calculated from the quadrat data for each species according to Phillips (1959), Cain and Castro (1959), and Shimwell (1971). Frequency refers to the number of samples in which a species occurs relative to the total number of samples and indicates the chance of recording a given species in a quadrat. Mean percent cover and basal area are indices of dominance and reflect the numbers and relative size of individuals of a species. Density refers to the calculated number of individuals per unit area as opposed to abundance, in which numbers are estimated (Cain and Castro 1959).

Correlations were made between the vegetation, soils, and elevation to determine the community structure. These correlations are discussed as they are used.

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Results

Floristic Survey

The 198 species found in the Great Bay Boulevard right-of-way comprise three divisions and 48 families of vascular plants (Table 1). The largest family, Gramineae (grass family) contained 42 species; other large families were Compositae (daisy family), 30 species; Leguminosae (bean family) and Rosaceae (rose family), 14 species each; and Chenopoidaceae (goosefoot family), 11 species. Twenty one families were each represented by a single species. The largest genera were Panicum (gramineae), 8 species; Cyperus (Cyperaceae), 5 species; Polygonum (Polygonaceae), 5 species; Solidago (Compositae), 5 species; Eragrostis (Gramineae) 4 species; Lespediza (Leguminosae), 4 species; and Prunus (Rosaceae), 4 species.

The most recent comprehensive study of the geographical and ecological relationships of the southern New Jersey flora is that of Stone (1911). He divided the flora into elements from the Pine Barrens, Middle District, Coastal Strip, Cape May District, and Maritime District. The ecological relationships of the plants of Great Bay Boulevard are indicated in Table 1 , and generally follow Stone (1911).

The Maritime District includes plants of salt marshes and beaches. Forty-one species (20.7% of the total) from Great Bay Boulevard were considered typical Maritime District plants, including 25 typical salt marsh plants, 15 beach or salt marsh border plants, and 1 salt-water plant. Ten species (5.1 %) were considered typical Pine Barren plants, plus 41 species (20.7%) common to the Pine Barrens and Middle District. Twenty-seven additional species (13.6%) were typical of the Middle District, an area of coastal plain south of the fall line and north of the Pine Barrens. Twenty-six species (13.1%) from Great Bay Boulevard are Coastal Strip Plants.

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Fifty-two species are introduced to the survey area (26.3% of the total flora) and are indicated by asterisk in Table 1 . Many of these species are confined to the disturbed area at the edge of the road, and others, while native to the region, are clearly introduced to the study area via the disturbance of Great Bay Boulevard. Examples of such species are Panicum spp., Achillea millefolium, Eupatorium spp., Lespediza virginica, L. capitata, and Fragaria virginiana. Eragrostis curvula is an introduced species first discovered in New Jersey by D. E. Fairbrothers in 1955. It was found growing along the Garden State Parkway near the Mullica River, where it had been planted. By 1959 it was reported from three counties and at least 2 miles from the Garden State Parkway (Fairbrothers 1960). Its location on Great Bay Boulevard is approximately 4 miles from the Parkway.

A group of species was found exclusively in a fresh-water marsh on the west side of Great Bay Boulevard, just south of Atlantis Avenue; these were Bidens cernua, Cyperus erythrorhizos, Erianthus giganteus (on spoil heap), Impatiens biflora, Lemma minor, Ludwigia alterniflora, Lycopus amplectens, Polygonum punctatun, Thelypteris palustris, Verbena hastata, and Vernonia noveboracensis. Other plants abundant in this marsh but not restricted to it were Hibiscus palustris, Echinochloa walteri, Panicum dichotomiflorum, and Rosa palustris. Robina pseudoacacia, Helianthus annuus, and Sicyos angulatus were found only on fill at the south edge of this marsh, along with several other "weed species".

Forty-three species of woody plants were encountered (Table 3). Section One had the most species, 40, followed by Section Two, Four, and Six, with 15 in each. Twenty-one species were found only in Section

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One; no species was restricted to any other section. Eight species were found in all six sections. Of these, B. halimifolia, I. frutescens, M. pensylvanica, and Parthenocissus vitacea were common to abundant in all sections (Table 3).

Results of tree agings are given in Table 4. Groundsel trees (Baccharis) were 10 to 12 years old at near maximum size. The other species, red cedar (Juniperus), bayberry (Myrica), and black cherry (Prunus) had maximum ages near 30 years.

Species New to New Jersey

Digitaria ciliaris is reported here for the first time from New Jersey. This species is a native of Asia (F. W. Gould, personal communication).

Endangered Species

Euphorbia polygonifolia is the only species from Great Bay Boulevard considered rare by Fairbrothers and Hough (1973). It was noted by these authors as a beach plant with a spotty distribution in New Jersey. Known locations included Cape May and Monmouth Counties. It was rare because of habitat destruction. It occurred on the beach north of Big Thorofare Channel, on the west side of Great Bay Boulevard.

Transect and Quadrat Studies

The locations and dates of sampling for the transect lines are given in Table 5. Forty transect lines were run, comprising a total of 751 quadrats (Fig. 1). The species area curves used to determine the number of transects per section are shown in Fig. 2.

The frequency of the 89 species encountered in quadrats is shown in Table 6. S. alterniflora was the most frequently encountered species overall and in all sections except Section One and Two. I. frutescens was the

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most frequently occurring species in these sections and second overall. The first five are all typical salt marsh species (Table 1). As expected (Shimwell 1971), there are more species with low frequency.

Frequency is given in Table 7 for species rooted in quadrats, as opposed to those listed as occurring (Table 6), which includes overhanging and rooted plants. S. alterniflora is again the most frequent species, with S. patens, I. frutescens, and Solidago sempervirens in descending order of frequency. Baccharis had a much lower frequency of rooted compared to cover values. It is an important cover species. M. pensylvanica and R. copallina had similar reductions in frequency of rooted compared to cover values.

Based on these frequency data and on observations, 17 species were selected for study to determine vegetation relationships. The data for these species was tabulated in two ways: distance from the edge of Great Bay Boulevard and elevation above mean low water (datum, 1929), using the elevations taken by Fellows, Read, and Weber, Inc. The mean tidal range is 3.7 ft for Little Egg Inlet, 3.4 ft for Seven Islands in Great Bay, 3.3 ft for Big Thorofare, and 2.4 ft at Tuckerton Creek in Little Egg Harbor (Thomas et al. 1972). Means for each species for all quadrats at a given distance or at a given elevation are given in Tables 8 to 15 . The frequency for the 17 species is compared to distance from the road edge (Table 8) and with elevation (Table 9). Percent cover, basal area, and density data are compared with distance and elevation (Tables 10-15).

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Near the edge of the road, Panicum virgatum (switchgrass) had the highest value for frequency, percent cover, basal area and density, and was important to a distance of 5 to 7 ft from the road edge. Other grasses, including Festuca rubra, also had high values in this zone adjacent to the road (see Table 14). P. virgatum was only weakly correlated with elevations, but had importance above a 4.3-ft elevation. The lowest elevation at which Panicum was found was 3.3 ft

M. pensylvanica (bayberry) replaced P. virgatum as the dominant species between 3 and 7 ft from the road edge and remained dominant to about 9 ft. Other woody plants, R. copallina and Prunus serotina, also had their highest values in this distance range, as did the herb, Solidago tenuifolia. M. pensylvanica dominated at elevations of 4.3 to above 5.5 ft.

Baccharis halimifolia (groundsel-tree) dominated from 11 to about 19 ft from the road and at elevations of 3.8 to 4.5 ft.

S. patens (salt hay) was important at elevations of 3.3 to 4.5 ft. Plants were encountered in quadrats from 1.2 ft to 4.8 ft above mean low water (plus two quadrats at more than 7 ft). S. patens was encountered at various distances from the road and was more correlated with elevation.

Solidago sempervirens (seaside goldenrod) had essentially the same elevation range as S. patens and was also scattered in distance from the road.

I. frutescens (marsh elder) was the dominant shrub species below 4.3 ft and occurred at the lowest elevation of any shrub species, 1.4

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ft. This species occurred at a wide variety of distances from the road (from 1 to 37 ft) but was most important at distances of 11 to 33 ft. Its distribution was more controlled by elevation-related factors than distance-related ones. Atriplex patula and D. spicata (salt grass) occurred over this same general range, but were never dominant in frequency, cover, or density values at any distance or elevation.

S. alterniflora (salt marsh cord grass) occurred in the marsh end of most transects. It occurred at elevations from 0.4 to 4.5 ft and was dominant in quadrats below 3.5 ft. Elevation was most important in its distribution.

Salicornia europaea (glasswort) was never high in frequency or cover values, but occurred in the same elevation range as S. alterniflora.

P. communis (reed) occurred over a wide variety of distance quadrats. This species tended to form dense stands that excluded most other species. An exception was Teucrium canadense (wood sage), which frequently occurred in Phragmites stands. P. communis usually had either very high values along a transect or did not occur at all. To illustrate this, data from one transect line in Section Two and one in Section Four are shown in Table 16 . Except in quadrats adjacent to the road where other grass species (P. virgatum and F. rubra) dominated, Phragmites dominated both transect lines to the exclusion of virtually all other plants. Phragmites occurred at elevations of 1.5 to more than 7 ft, but in most cases occurred above 4 ft. Typically, the dense stands of Phragmites along Great Bay Boulevard occur on sandy fill and in trash heaps, as, for example, opposite Rand's Marina in Section Four

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(Transect 238 + 25 E in Table 16 is from this area). Phragmites seems to have had the same invasive role on the Hackensack Meadows (Sipple 1971-72) and Rosenwinckel (1964) reported it from the brackish edges of Cheesequake marsh.

Results for average percent litter, bare soil, trash, and water in quadrats are compared to distance from the edge of the road in Table 17 and to elevation in Table 18. Litter predominated in all but the points most distant from the road edge and lowest elevations. The first quadrat (nearest the Boulevard) had a higher frequency of bare soil than quadrats farther from the road. Thus, first quadrats contained some bare soil in 27 of 40 cases (67.5%), compared with 12 (30.0%) second quadrats, and 10 (25%) third quadrats. Some of these quadrats were also occupied by large grass clumps which accounted for a substantial portion of the total basal area; this was not counted as litter, although such clumps contained much dead as well as living material. P. virgatum and Andropogon sp. are examples of such clump grasses.

Litter percentages were high in the shrub zone, where this zone was well developed. This was shown, for example, in the data for Section One. The mean percent bare soil for all transects in Section One was zero for points 6, 7, and 8, and less than 5% for points 5 and 9. The same applied in Section Six.

Litter percentages dropped off at lower elevations in the marsh, where bare soil predominated at elevations below 2.75 ft. Tidal action removes much of the larger organic material, leaving bare soil, which was mostly clay (Table 20). Organisms mix material into the soil in this area also, giving it a high organic content.

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Trash was distributed irregularly; some transect lines had high percentages and some had virtually none. Trash (generally bottles, cans, and paper) occurred near the road edge and in quadrats 13 to 18 (elevations 2.25 to 3.0 ft). The latter represented the inner marsh edge, where high tides washed in floating debris such as wood and plastic.

The presence of water along a transect depended on the tide level at the time the transect was investigated. Standing water occurred as high as 4.0 ft, and predominated below 2.5 ft above mean low water. When water was absent at low tide, bare soil (mud and peat) was exposed. Ditches with elevations below 1 ft (or even below mean low water) were encountered on some transect lines and were water-filled at all times.

Results of soil analysis are given in Table 19 . These results are summarized by points (distance from road) in Table 20 . Soils in points 1 and 5 had low organic content (less than 10%) and high percentages of gravel and sand. Soils from points 15 to 20 contained more organic material and more clay-sized particles. There was little difference between east and west sides of the Boulevard.

Discussion

Correlation of Vegetation with Physical Factors

The data presented above indicate that on Great Bay Boulevard there are overlapping zones of dominant plant species correlated with the distance from the edge of the road and elevation. Near the roadway, where elevation is higher and the soil sandy, distance from the road edge is more important. The true marsh vegetation is controlled more

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by elevation. Five species showing this replacement with distance from the edge of the road and with elevation above mean low water are shown in Figs. 3 and 4, respectively.

These data illustrate that zonation of salt marsh species depends on elevation, and factors associated with elevation (salinity, inundation times). The construction of Great Bay Boulevard has superimposed a series of species from the salt marsh-upland interface on the marsh proper. Typical salt marsh species such as S. alterniflora, S. patens, D. spicata, and I. frutescens tend to be distributed along a lower elevation gradient. Upland and border species, such as P. virgatum, M. pensylvanica, R. copallina, and F. rubra are more correlated with distance from the edge of the road. Marsh border species such as B. halimifolia, and S. sempervirens are correlated with both distance from the road and elevation to a certain extent. Soils are sandy at the edge of the road and into the shrub (Myrica) zone, and then are more typical marsh soils at lower elevation quadrats (Tables 17 and 18).

Introduced species were found in the floristic survey most frequently along or near the edge of the road. To see if the quadrat data supported this hypothesis, data for all introduced species encountered in quadrats was listed by distance from the edge of the road (Table 21). Twenty species were encountered in quadrats, and averaged 8 to 9 ft from the road edge. If Lonicera japonica, an introduced woody vine abundant throughout the shrub zone in Section One, is subtracted from these data, the results show even more clearly the tendency for introduced species to occur in the first few quadrats (Table 21). In fact, 12

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of the 19 introduced species occur only within the first seven quadrats (13 ft), and represent 62.8% of all introduced species except Lonicera.

Data were collected from five transects in Section One and two transects in Section Two by M. A. Pokras and M. L. Pokras in the spring of 1974 as a preliminary part of the study of Great Bay Boulevard vegetation. These data were not included in our analysis because the early collection date made identification of species difficult and many plants had not fully matured. The data collected by Pokras and Pokras were compared with our data to indicate seasonal differences (Table 22).

In general, frequency data were similar. The major difference occurred in grasses, which were not identified to species in the early study because of immaturity. Considerable difference existed in cover data. We reported higher cover in 33 cases, lower in 8 cases, and equal cover in 5. This represented seasonal difference; species such as Prunus serotina, I. frutescens, B. halimifolia, S. sempervirens, and the Spartina sp. do not produce leaves until later than the Pokras and Pokras samples were taken, and do not reach full development (flowering and fruiting) until mid to late summer. Density data were not greatly different, indicating similarity in sampling. Some differences did occur in percentage of basal area for litter, trash, and bare soil. These might be due to seasonal changes, but are inconsistent in pattern and thus probably due to sampling differences in using the Trepp Scale.

Species Associations

Associations between species can be tested for randomness using the Chi-square test ($P \leq .01$) in two-species contingency tables

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(Shimwell 1971, Greig-Smith 1964). This method was used for studies of salt marsh associations by Adams (1963). Certain species were tested by pairs (Tables 23 and 24) to determine whether their association could be explained by chance alone or to some other factor, indicating a positive or negative association (i.e., whether they occurred together more frequently or more rarely than expected).

The results show no clearly defined groups of species, but a gradation along the transect lines from P. virgatum, to R. copallina and M. pensylvanica, to B. halimifolia and S. patens, to I. frutescens, S. europaea, and S. alterniflora. For example, Baccharis shows positive association with S. patens, random distribution with I. frutescens and negative association with S. alterniflora. S. sempervirens shows positive association with Baccharis and S. patens, but also with Iva; this species apparently crosses between several zones. These data were helpful in establishing the vegetation zones discussed below.

Plant Zonation

Overlapping zones of plants rather than discrete plant communities exist on Great Bay Boulevard. This gradient is due to the combination of elevation and the changes wrought by the construction of Great Bay Boulevard more than 40 years ago. These zones are described below. Two transect cross-sections are shown in Figs. 5 and 6 .

Roadside Vegetation

This zone occurs on the sandy fill within 3 to 10 ft of the edge of the road. Dominant plants are P. virgatum and F. rubra, with

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Rumex acetosella, Plantago lanceolata, S. tenuifolia, and various "weed" species frequently present. This zone occurs in nearly all Sections (Fig. 5 and 6) but varies from 1 ft to more than 10 ft wide, depending on the extent of roadside fill. Trash is abundant and is positively associated with P. virgatum (Table 24).

Tall Shrub Zone

Shrubs extend 3 to 8 ft from the roadside vegetation into the marsh, to elevations of less than 4 ft. There are several important shrub species and they in turn tend to be zoned. Nearest the road, tall shrubs and small trees which are predominately upland species occur. M. pensylvanica, R. copallina, P. serotina, and J. virginiana are the main trees and shrubs. The vegetation is dense with woody vines such as Smilax glauca, S. rotundifolia, P vitacea, and Rhus toxicodendron tying the vegetation together. Few herbaceous species are present. Myrica averaged 4 ft high with a maximum of 10 ft; Prunus trees were up to 20 ft tall. Oldest Myrica, Juniperus, and Prunus are approximately 30 years old, indicating that this zone was established soon after Boulevard construction. Soils are sandy but with more organic content than in the roadside zone, and the ground surface is completely covered by litter. This part of the shrub zone is present throughout Sections One, Two, and Six, and most of Section Four, but is absent in parts of Sections Three and Five. These differences are largely due to the low elevations of the roadside in Sections Three and Five (Table 5). This shrub zone is used extensively by breeding and migratory birds according to the data of Pokras and Pokras (1974) and our observations.

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Baccharis halimifolia Zone

The tall shrub zone grades into a more open zone dominated by B. halimifolia. Elevation averages 3.8 to 4.5 ft but the soil is still predominately sandy, and litter values remain high. S. sempervirens, S. patens, and D. spicata frequently occur under the Baccharis. Atriplex patula is also common. Baccharis plants are 4 to 8 ft tall.

Spartina patens-Iva frutescens Zone

At elevations of about 4.5 ft above MLW, I. frutescens replaces Baccharis as the predominant shrub species. Iva provides even less cover than Baccharis. Herbaceous species are always present, and may provide more cover than Iva. S. patens may occur in nearly pure stands or in various mixtures with Iva, D. spicata or other herbaceous species. There is frequently some bare soil as well as litter, and soils are higher in organic content and percent fine sand and clay than in the zones discussed above.

Spartina alterniflora Zone

The lowest elevations, below 3.5 ft,are usually dominated by Spartina alterniflora. It frequently forms dense pure stands although other herbs such as S. europaea, S. bigelovii, and Limonium nashii may also be present. Two forms of S. alterniflora are present, with the tall form limited to ditch and creek banks. Soils are high in organic content and composed largely of fine sand and clay. The soil surface is usually exposed, since litter is carried away by the tides that inundate this zone regularly.

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Phragmites communis Zone

As discussed above, in the study area, Phragmites communis tends to form dense nearly pure stands on high elevation sandy soils and can be recognized as a separate zone. A positive association exists between the presence of Phragmites and the occurrence of trash (Table 24).

Productivity and Replanting

Considerable data are available in the literature concerning the productivity of salt marshes. A useful summary is provided by Keefe (1972). In New Jersey, studies have been made by Good (1965) for Cape May County, Durand and Nadeau (1972) for Nacote Creek marsh, Atlantic County, and Squiers and Good (1974) for the Great Bay Boulevard marsh near the Rutgers Marine Laboratory. S. alterniflora had the highest productivity of any species in these studies. S. patens and D. spicata had lower values. The importance of S. alterniflora productivity lies in the organic material contributed by this species to estuarine food chains (de la Cruz 1973). The difference between this species and S. patens and D. spicata lies in two factors according to Blum (1968): the area covered by each species, and the way in which mechanical breakdown affects each. S. alterniflora breaks up when the above ground stems and leaves die, and these parts are transported into the soil by organisms or carried into the estuary by tides. S. patens tends to dry in place and form a dense mat which decays very slowly (Blum 1968). Thus, S. alterniflora is the species which should be considered for marsh replanting.

Several studies have shown that S. alterniflora can be transplanted or seeded into marsh areas for revegetation (Stalter 1973, Woodhouse,

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Seneca, and Broome 1972). If proper transplanting and soil conditions are maintained, an area can be covered within 2 years from replanting. This seems practical for areas at lower elevation along Great Bay Boulevard. At higher elevations and in sandier soils, it should be practical to replant shrub species such as Baccharis and Myrica which now occupy similar sites. This would prevent less desirable Phragmites and weed species from invading this zone.

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Table 1. Plant taxa collected on Great Bay Boulevard, 1974. Taxa are arranged by divisions; within divisions by families (alphabetical order) and within families by genera (alphabetical order). E.R. indicates ecological relationship of the species, mostly after Stone (1911), using the following abbreviations: c = coastal strip, m = middle district, p = pine barrens, s = salt marsh (maritime) district, * = introduced to area, unmarked = widespread native species.

Taxon	Common Name	E.R.	Coll. No.	Date
POLYPODIOPHYTA				
POLYPODIACEAE				
Pteridium aquilinum (L.) Kuhn var. latiusculum (Desv.) Und.	bracken	m, p	74-199	14 Aug.
Thelypteris palustris Schott	marsh fern		74-272	5 Sept.
PINOPHYTA				
CUPRESSACEAE				
Juniperus virginiana L.	red cedar	m	74-300	11 Sept.
PINACEAE				
Pinus echinata Mill.	short-leaf pine	m, p	74-299	11 Sept.
Pinus rigida Mill.	pitch pine	p	74-326	18 Sept.
MAGNOLIOPHYTA - DICOTYLEDONEAE				
ACERACEAE				
Acer rubrum L.	red maple	p	74-323	18 Sept.
AMARANTHACEAE				
Amaranthus hybridus L.	prince's feather	*	74-314	11 Sept.
ANACARDIACEAE				
Rhus copallinum L.	winged sumac	m	74-193	14 Aug.
Rhus toxicodendron L.	poison ivy	m	74-231	22 Aug.
AQUIFOLIACEAE				
Ilex verticellata (L.) Gray	winterberry	m, p	74-331	18 Sept.
BALSAMINACEAE				
Impatiens biflora Walt.	touch-me-not	m	74-235	28 Aug.
BETULACEAE				
Betula populifolia Marsh	grey birch	p	74-296	11 Sept.
CAPRIFOLIACEAE				
Lonicera japonica Thunb.	Japanese honeysuckle	*	74-196	14 Aug.
Sambucus canadensis L.	elderberry	m	74-352	4 Oct.
Viburnum dentatum L.	arrowwood	m	74-216	22 Aug.
CARYOPHYLLACEAE				
Dianthus armeria L.	Deptford pink	*	74-213	22 Aug.
Saponaria officinalis L.	bouncing bet	*	74-158	1 Aug.
Silene cucubalis Wibel.	bladder campion	*	74-238	28 Aug.
Spergularia marina (L.) Griseb.	sand spurrey	s	74-177	21 Aug.

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Table 1 . (cont.)

Taxon	Common Name	E.R.	Coll. No.	Date
CHENOPODIACEAE				
Atriplex arenaria Nutt.	-	s, c	74-322	11 Sept.
Atriplex patula L.	orache	s	74-148	29 July
Bassia hirsuta (L.) Aschers.	-	s*	74-321	11 Sept.
Chenopodium album L.	lamb's quarters	*	74-161	1 Aug.
Chenopodium ambrosioides L.	Mexican tea	*	74-319	11 Sept.
Salicornia bigelovii Torr.	glasswort	s	74-192	14 Aug.
Salicornia europaea L.	glasswort	s	74-261	3 Sept.
Salicornia virginica L.	glasswort	s	74-191	14 Aug.
Salsola kali L.	saltwort	s	74-162	1 Aug.
Sueda linearis (Ell.) Moa.	sea-blite	s	74-342	26 Sept.
Sueda maritima (L.) Dum.	sea-blite	s	74-320	11 Sept.
COMPOSITAE				
Achillea millefolium L.	yarrow		74-144	26 July
Ambrosia artemisiifolia L.	ragweed		74-250	28 Aug.
Artemisia stelleriana Besser	wormwood	*	74-346	26 Sept.
Aster dumosus L.	aster	m	74-312	11 Sept.
Aster tenuifolius L.	aster	m, p	74-254	29 Aug.
Baccharis halimifolia L.	groundsel-tree	s, c	74-334	18 Sept.
Bidens cernua L.	beggar's ticks		74-266	5 Sept.
Bidens polylepis Blake	beggar's ticks	*	74-285	5 Sept.
Chrysopsis mariana (L.) Ell.	golden aster	m, p	74-279	5 Sept.
Circium vulgare (Savi) Tenore	thistle	*	74-198	14 Aug.
Conyza canadensis (L.) Cronq.	horseweed		74-185	14 Aug.
Erechtites hieracifolia (L.) Raf.	fireweed		74-309	11 Sept.
Eupatorium album L.	thoroughwort	p	74-142	26 July
Eupatorium hyssopifolium L.	thoroughwort	m, p	74-194	14 Aug.
Eupatorium rotundifolium L.	thoroughwort	m, p	74-236	28 Aug.
Gnaphalium obtusifolium L.	Sudweed	m, p	74-186	14 Aug.
Helianthus annuus L.	sunflower	*	74-340	26 Sept.
Hieracium gronovii L.	hawkweed	m, p	74-277	5 Sept.
Hypochaeris radicata L.	cat's ear	*	74-143	26 July
Iva frutescens L.	marsh elder	s	74-165	6 Aug.
Lactuca canadensis L.	wild lettuce	m	74-187	14 Aug.
Lactuca serriola L.	prickly lettuce	*	74-156	1 Aug.
Pluchea pupurascens (Sw.) D.C.	marsh fleabane	s	74-268	5 Sept.
Solidago canadensis L. var. scabra (Muhl.) T. & G.	goldenrod	m	74-315	11 Sept.
Solidago nemoralis Ait.	goldenrod	m, p	74-281	5 Sept.
Solidago odora Ait.	sweet goldenrod	m, p	74-278	5 Sept.
Solidago sempervirens L.	seaside goldenrod	s	74-335	18 Sept.
Solidago tenuifolia Pursh.	goldenrod	m, p	74-280	5 Sept.
Vernonia noveboracensis (L.) Michx.	ironweed	m	74-274	5 Sept.
Xanthium strumarium L.	cocklebur	s	74-290	5 Sept.
CONVOLVULACEAE				
Convolvulus sepium L.	morning glory	m	74-147	29 July
Cuscuta compacta Juss.	dodder	m, p	74-188	14 Aug.

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Table 1 . (cont.)

Taxon	Common Name	E.R.	Coll. No.	Date
CRUCIFERAE				
Cakile edentula (Bigel.) Hook.	sea rocket	s	74-160	1 Aug.
Lepidium virginicum L.	peppergrass		74-145A	26 July
CUCURBITACEAE				
Sicyos angulatus L.	bur cucumber		74-339	26 Sept.
EUPHORBIACEAE				
Euphorbia cyperissias L.	cypress spurge	*	74-327	18 Sept.
Euphorbia polygonifolia L.	seaside spurge	s	74-264	3 Sept.
FAGACEAE				
Quercus falcata Michx.	southern red oak	m	74-303	11 Sept.
Quercus illicifolia Wang.	scrub-oak	p	74-247	28 Aug.
Quercus phellos L.	willow oak	m	74-212	22 Aug.
HYPERICACEAE				
Hypericum densiflorum Pursh	St. John's wort	p	74-313	11 Sept.
Hypericum gentianoides (L.) BSP.	St. John's wort	m, p	74-225	22 Aug.
JUGLANDACEAE				
Carya tomentosa (Poir.) Nutt.	mockernut		74-324	18 Sept.
Juglans nigra L.	black walnut		74-336	18 Sept.
LABIATAE				
Lycopus rubellus Moench.	bugleweed	m, p	74-276	5 Sept.
Teucrium canadense L.	wood sage	s	74-149	31 July
Trichostema dichotomum L.	blue curls	m, p	74-237	28 Aug.
LAURACEAE				
Sassafras albidum (Nutt.) Nees	sassafras	m, p	74-166	6 Aug.
LEGUMINOSAE				
Baptisia tinctoria (L.) R. Br.	wild indigo	m, p	74-224	22 Aug.
Cassia nictitans L.	wild sensitive plant	m	74-145	26 July
Desmodium dillenii Darl.	tickseed	m	74-245	28 Aug.
Lathyrus latifolius L.	sweet pea	*	74-329	18 Sept.
Lespediza capitata Michx.	bush-clover	m	74-282	5 Sept.
Lespediza cuneata (Dumont) G. Don.	bush-clover	*	74-283	5 Sept.
Lespediza repens (L.) Bart.	bush-clover	m, p	74-205	22 Aug.
Lespediza virginica (L.) Britt.	bush-clover	m	74-284	5 Sept.
Melilotus alba Desr.	white sweet clover	*	74-197	14 Aug.
Robinia pseudoacacia L.	black locust	*	74-328	26 Sept.
Strophostyles helveola (L.) Ell.	wild bean	c	74-152	1 Aug.
Trifolium pratense L.	red clover	*	74-289	5 Sept.
Trifolium repens L.	white clover	*	74-221	22 Aug.
Wisteria frutescens (L.) Poir.	wisteria	*	74-328	18 Sept.
MALVACEAE				
Hibiscus palustris L.	marsh mallow	c	74-232	22 Aug.
Kosteletzkya virginica (L.) Presl.	Kosteletzky's mallow	s, c	74-189	14 Aug.

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Table 1 . (cont.)

Taxon	Common Name	E.R.	Coll. No.	Date
MORACEAE				
Morus alba L.	white mulberry	*	74-182	21 Aug.
MYRICACEAE				
Myrica asplenifolia L.	sweet-fern	m, p	74-203	19 Aug.
Myrica pensylvanica Loisel.	bayberry	c	74-141	26 July
NYSSACEAE				
Nyssa sylvatica Marsh.	sour gum	m, p	74-325	18 Sept.
ONADRACEAE				
Ludwigia alternifolia L.	-	m, p	74-269	5 Sept.
Oenothera biennis L.	evening primrose	m	74-157	1 Aug.
OXALIDACEAE				
Oxalis dillenii Jacq.	sorrel		74-316	11 Sept.
PHYTOLACCACEAE				
Phytolacca americana L.	pokeweed		74-159	1 Aug.
PLANTAGINACEAE				
Plantago aristata Michx.	buckhorn	*	74-344	26 Sept.
Plantago lanceolata L.	plantain	*	74-208	22 Aug.
Plantago major L.	plantain	*	74-220	22 Aug.
PLUMBAGINACEAE				
Limonium nashii Small	sea-lavender	s	74-190	14 Aug.
POLYGONACEAE				
Polygonella articulata (L.) Meissn.	-	s, m, p	74-333	18 Sept.
Polygonum aviculare L.	knotweed		74-210	22 Aug.
Polygonum convolvulus L.	black bindweed	*	74-317	11 Sept.
Polygonum erectum L.	knotweed		74-233	22 Aug.
Polygonum pensylvanicum L.	smartweed		74-179	7 Aug.
Polygonum punctatum Ell.	knotweed	m	74-234	28 Aug.
Rumex acetosella L.	red sorrel	*	74-151	31 July
Rumex crispus L.	dock	*	74-217	22 Aug.
ROSACEAE				
Amelenchier canadensis (L.) Medic.	shad-bush	m, p	74-295	11 Sept.
Aronia melanocarpa (Michx.) Ell.	chokeberry	m, p	74-243	28 Aug.
Fragaria virginiana Duchesne	strawberry	m, c	74-347	27 Sept.
Potentilla canadensis L.	potentilla	m	74-305	11 Sept.
Prunus maritima Marsh.	beach-plum	s	74-184	7 Aug.
Prunus persica (L.) Patsch.	peach	*	74-183	7 Aug.
Prunus serotina Ehrh.	black cherry	m	74-297	11 Sept.
Prunus virginiana L.	choke cherry		74-241	28 Aug.
Pyrus malus L.	apple	*	74-311	11 Sept.
Rosa multiflora Thunb.	multiflora rose	*	74-255	29 Aug.
Rosa palustris Marsh.	swamp rose	m, c	74-275	5 Sept.
Rubus cuneifolius Pursh	sand blackberry	m, p	74-211	22 Aug.
Rubus flagellaris L.	dewberry	m, p	74-215	22 Aug.
Rubus laciniatus Willd.	bramble	*	74-246	28 Aug.

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Table 1 . (cont.)

Taxon	Common Name	E.R.	Coll. No.	Date
RUBIACEAE				
Diodia teres Walt.	buttonweed	m, p	74-206	22 Aug.
SCROPHULARIACEAE				
Gerardia maritima Raf.	gerardia	s	74-249	28 Aug.
Linaria canadensis (L.) Dum.	toadflax	m, p	74-201	16 Aug.
Linaria vulgaris Hill.	butter-and-eggs	*	74-229	22 Aug.
Verbascum thapsis L.	moth mullein	*	74-228	22 Aug.
SIMAROUBACEAE				
Ailanthus altissima (Mill) Swingle	tree-of-heaven	*	74-330	18 Sept.
SOLANACEAE				
Solanum nigrum L.	black nightshade		74-318	11 Sept.
ULMACEAE				
Celtis occidentalis L.	hackberry	c	74-240	28 Aug.
UMBELLIFERAE				
Daucus carota L.	Queen Anne's lace	*	74-214	22 Aug.
VERBENACEAE				
Verbena hastata L.	vervain	m	74-219	22 Aug.
VITACEAE				
Parthenocissus vitacea (Knerr.) Hitchc.	virginia creeper	m	74-146	29 July
Vitis aestivalis Michx.	grape	m	74-200	14 Aug.
MAGNOLIOPHYTA - MONOCOTYLEDONEAE				
CYPERACEAE				
Carex albolutescens Schw.	sedge	m, p	74-204	21 Aug.
Cyperus erythrorhizos Muhl.	-		74-267	5 Sept.
Cyperus filicinus Vahl.	sedge	s	74-226	28 Aug.
Cyperus filiculmis Vahl.	sedge		74-168	6 Aug.
Cyperus retrorsus Chapm.	sedge	p	74-227	22 Aug.
Cyperus strigosus L.	sedge		74-218	22 Aug.
Fimbristylis autumnalis (L.) R. & S.	-	m, p	74-353	7 Oct.
Scirpus americanus Pers.	bulrush	s, m, p	74-153	1 Aug.
Scirpus robustus Pursh.	bulrush	s	74-251	28 Aug.
GRAMINEAE				
Agropyron repens (L.) Beauv.	quackgrass	*	74-252	28 Aug.
Agrostis tenuis Sibth.	-	*	74-172	7 Aug.
Ammophila breviligulata Fern	dunegrass	s	74-180	21 Aug.
Andropogon scoparius Michx.	little bluestem	s, m, p	74-308	11 Sept.
Andropogon virginicus L.	broomsedge	m, p	74-304	11 Sept.
Aristida dichotoma Michx.	-	m, p	74-345	26 Sept.
Bromus japonicus Thumb.	brome-grass	*	74-170	6 Aug.
Bromus tectorum L.	downy chess	*	74-230	22 Aug.
Cenchrus tribuloides L.	sandbur	s	74-307	11 Sept.
Dactylis glomerata L.	orchard grass	*	74-341	26 Sept.

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Table 1 . (cont.)

Taxon	Common Name	E.R.	Coll. No.	Date
GRAMINEAE (cont.)				
Danthonia spicata (L.) Beauv.	oat-grass	m, p	74-348	30 Sept.
Digitaria ciliaris (Retz.) Koel.	crabgrass	*	74-263	3 Sept.
Digitaria sauguinalis (L.) Scop.	crabgrass	*	74-207	22 Aug.
Distichlis spicata (L.) Greene	salt grass	s	74-262	3 Sept.
Echinochloa microstachya (Weig.)Rydb.	barnyard grass		74-287	5 Sept.
Echinochloa walteri (Pursh) Nash	-	s	74-286	5 Sept.
Eleusine indica (L.) Gaertn.	goosegrass	*	74-253	28 Aug.
Elymus virginicus L.	wild rye	s, c	74-155	1 Aug.
Eragrostis cilianensis (All.) Link.	love-grass	*	74-288	5 Sept.
Eragrostis curvula (Schrad) Nees	weeping love-grass	*	74-172	7 Aug.
Eragrostis pilosa (L.) Beauv.	love-grass	*	74-222	21 Aug.
Eragrostis spectabilis (Pursh) Steud.	purple love-grass	s	74-169	6 Aug.
Erianthus giganteus (Walt.) Muhl.	plumegrass	p, c	74-273	5 Sept.
Festuca myuros L.	-	*	74-294	9 Sept.
Festuca rubra L.	red fescue	s	74-173	7 Aug.
Panicum clandestinum L.	-		74-302	11 Sept.
Panicum commonsianum Ashe?	panic-grass	p	74-298	11 Sept.
Panicum dichotomiflorum Michx.	panic-grass	s, m	74-248	28 Aug.
Panicum lanuginosum Ell. var. lindheimeri (Nash) Fern.	panic-grass	m, p, c	74-202	19 Aug.
Panicum meridionale Ashe	-	p	74-355	7 Oct.
Panicum nitidum Lam.	panic-grass		74-150	31 July
Panicum scoparium Lam.	panic-grass	c	74-195	14 Aug.
Panicum virgatum L.	switch-grass	m, p, c	74-176	21 Aug.
Paspalum laeve Michx.	-	c	74-242	28 Aug.
Paspalum setaceum Michx.	-	m, p	74-209	22 Aug.
Phragmites communis Trin.	reed	s	74-310	11 Sept.
Poa compressa L.	bluegrass	*	74-171	7 Aug.
Sorghastrum nutans (L.) Nash	Indian grass	m	74-358	1 Nov.
Spartina alterniflora Loisel.	marsh-grass	s	74-260	3 Sept.
Spartina cynosuroides (L.) Roth	cordgrass	s	74-181	21 Aug.
Spartina patens (Ait.) Muhl.	salt hay	s	74-174	7 Aug.
Triodia flava (L.) Smyth	red-top	c	74-239	28 Aug.
JUNCACEAE				
Juncus gerardi Loisel.	black-grass	s	74-154	1 Aug.
LEMNACEAE				
Lemna minor L.	duckweed		74-271	5 Sept.
LILIACEAE				
Allium vineale L.	wild garlic	*	74-301	11 Sept.
Asparagus officinalis L.	asparagus	*	74-244	28 Aug.
Smilax glauca Walt.	greenbrier	m, p	74-167	6 Aug.
Smilax rotundifolia L.	greenbrier	m, p	74-291	5 Sept.
POTAMOGETONACEAE				
Ruppia maritima L.	ditchweed	s	74-256	29 Aug.

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Table 2 . Trepp Scale values for cover and basal area.

Percent Cover	Value	Average Value
less than 1.0	x	0.5%
1.0 - 9.9	1	5.0%
10.0 - 24.9	2	17.5%
25.0 - 49.9	3	37.5%
50.0 - 74.9	4	62.5%
75.0 - 100.0	5	87.5%

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Table 3 . Location and abundance of woody plant species on Great Bay Boulevard.

a = abundant, likely to be seen at any point on section
c = common; either scattered through section or many plants in a small area
r = rare; few plants in section
1 = one plant only observed
b = occurs only on bridge fill at end of section
* = introduced (not native to area)

Species	Sections					
	1	2	3	4	5	6
Acer rubrum	c	-	-	-	-	-
Ailanthus altissima	r*	-	-	-	-	-
Amelanchier canadensis	r	-	-	-	-	-
Aronia melanocarpa	r	-	-	-	-	-
Baccharis halimifolia	a	a	a	a	a	a
Betula populifolia	r	-	-	-	-	-
Carya tomentosa	r	-	-	-	-	-
Celtis occidentalis	r	-	-	-	-	rb
Ilex verticellata	r	-	-	-	-	-
Iva frutescens	a	a	a	a	a	a
Juglans nigra	-	-	-	lb	lb	-
Juniperus virginiana	c	c	c	c	-	cb
Lonicera japonica	c*	-	-	-	-	c*
Morus alba	r*	-	-	-	-	-
Myrica asplenifolia	r	-	rb	-	-	-
Myrica pensylvanica	a	a	c	a	c	a
Nyssa sylvatica	c	-	-	-	-	-
Parthenocissus vitacea	a	c	c	c	cb	c
Pinus echinata	1	-	-	-	-	-
Pinus rigida	r	-	-	-	-	-
Prunus maritima	r	-	-	-	-	-
Prunus persica	r*	-	-	1*	-	lb*
Prunus serotina	a	rb	rb	rb	rb	c
Prunus virginiana	r	-	-	-	-	-
Pyrus malus	r*	rb*	-	-	lb*	-
Quercus falcata	r	-	-	-	-	-
Quercus illicifolia	r	-	-	-	-	-
Quercus phellos	r	-	-	-	-	-
Rhus copallinum	a	a	c	cb	cb	c
Rhus toxicodendron	a	c	rb	c	rb	a
Robinia pseudoacacia	r*	-	-	-	-	-
Rosa multiflora	r*	-	-	r*	-	-
Rosa palustris	r	-	-	-	rb	-
Rubus cuneifolius	a	c	-	rb	-	-
Rubus flagellaris	c	r	rb	cb	cb	c
Rubus laciniatus	-	lb*	-	-	rb*	rb*
Sambucus canadensis	1	-	-	-	-	-
Sassafras albidum	a	c	rb	r	-	-
Smilax glauca	c	c	-	r	-	rb
Smilax rotundifolia	c	rb	-	-	-	-
Viburnum dentatum	c	-	-	-	-	-
Vitis aestivalis	r	-	-	-	-	r
Wisteria floribunda	r*	-	-	-	-	-
number 43 species	40	15	11	15	12	15
species limited to Section	21	0	0	0	0	0

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Table 4 . Ages of trees from Great Bay Boulevard.

Species	Point	Diameter (in)*	Age (years)**
Baccharis halimifolia	330 + 50	3.0*	12
	331 + 50	3.0*	11+
	334 + 75	3.3*	11 ± 1
	332 + 0	2.3*	11
	350+	3.0*	10+
	350+	3.7*	10+
	192 + 0	2.6*	9+
	273 + 50	2.1*	6 ± 2
Juniperus virginiana	116 + 25	6.4	31 ± 2
	116 + 50	4.4	26 ± 3
	116 + 50	6.5	21+
Myrica pensylvanica	350+	4.3*	29 ± 2
	Br. 4	8.4	27+
	Br. 2	4.2	22+
	350+	3.9*	20
	Br. 2	2.9	19 ± 1
	332 + 50	3.0*	17 ± 2
	334 + 75	3.5*	15 ± 1
	350 + 25	5.1*	14+
	350+	3.6*	13+
Prunus serotina	116 + 0	8.3	30+
	116 + 75	6.0	29 ± 1
	Br. 2	2.9	19 ± 1

* diameters marked taken 1-2 ft above base of trunk; others taken at breast height.
** ages marked + indicates minimum age (center not present in core); ages marked ± indicates a range because of uncertainty in counting rings.

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Table 5 Locations, dates of sampling, and elevation data for transect lines on Great Bay Boulevard. Elevations are based on USC and GS Datum of 1929. For description of location system see text.

Transect no.	Date Sampled	Elevations Road	Max.	Min.	50 ft.
Section 1					
83 + 25 W	7 Oct.	8.59	8.61	6.13	6.21
89 + 25 E	3 Oct.	6.04	6.12	1.50	1.58
104 + 75 E	30 Sept. - 1 Oct.	6.37	6.51	2.96	2.96
110 + 75 W	4 Oct.	6.55	6.66	0.28	0.28
111 + 75 W	7-8 Oct.	5.70	5.71	1.43	-
116 + 25 E	1-2 Oct.	5.37	5.62	2.12	2.12
116 + 75 E	8-9 Oct.	5.54	5.83	2.45	2.45
123 + 75 W	14 Oct.	5.35	5.35	1.43	1.56
Section 2					
145 + 75 E	17 Oct.	4.60	4.75	2.43	2.43
146 + 75 E	23-29 July	5.04	5.37	-0.38	2.61
147 + 25 W	30-31 July	5.04	5.37	-0.38	2.61
149 + 75 E	31 July - 2 Aug.	4.45	4.79	1.00	2.01
151 + 75 W	5-6 Aug.	5.11	5.55	-0.57	2.10
154 + 75 W	6 Aug.*	5.12	5.16	-0.05	2.33
162 + 25 E	6 Aug.	4.42	4.55	1.78	1.78
Section 3					
177 + 25 W	19 Aug.	4.59	4.80	1.21	3.00
183 + 25 E	8 Aug.	4.17	4.17	2.46	2.52
185 + 25 W	9 Aug.	4.41	4.41	2.97	3.00
186 + 75 E	13-16 Aug.	4.44	4.44	0.99	2.77
191 + 75 W	13 Aug.	4.90	4.90	3.17	3.96
194 + 25 E	19 Aug.	4.72	4.72	2.18	2.71
Section 4					
210 + 75 E	20 Aug.	5.02	5.53	1.45	1.45
212 + 25 W	26-27 Aug.	4.41	4.41	3.05	-
221 + 75 E	15 Oct.	5.19	5.23	2.74	2.74
238 + 25 E	26 Aug.	5.03	5.15	4.24	4.29
240 + 25 E	27 Aug.	5.22	5.54	4.98	4.98
242 + 25 W	29 Aug.	4.26	4.57	1.70	1.85
253 + 25 W	22 Aug.	4.19	4.19	2.18	2.49
Section 5					
277 + 25 W	17 Sept.	4.30	4.30	2.43	3.02
281 + 25 W	10-12 Sept.	4.00	4.21	2.56	2.60
289 + 25 E	3 Sept.	3.97	3.97	2.60	2.60
290 + 25 E	12-13 Sept.	3.83	3.83	2.79	2.89
298 + 25 W	6-9 Sept.	4.23	4.23	3.09	3.09
310 + 25 E	9-10 Sept.	7.38	7.41	2.66	2.85
Section 6					
324 + 25 W	27 Sept.	6.70	6.73	1.50	1.50
328 + 25 E	19 Sept.	4.86	4.86	1.95	2.00
340 + 25 E	25 Sept.	4.70	4.70	1.20	1.20
340 + 25 W	23 Sept.	4.76	4.76	2.91	2.92
348 + 25 E	23-24 Sept.	5.19	5.19	2.71	2.76
250 + 25 W	24-25 Sept.	5.21	5.53	2.45	2.45

* Transect line completed by M.A. Pokras and M.L. Pokras, 9-14 May, revised by J.D. Montgomery and M.R. Newcomb.

Table 6 . Frequency of plant species occurring in quadrats on Great Bay Boulevard.

	Section 1		Section 2		Section 3		Section 4		Section 5		Section 6		Total	
	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%
Spartina alterniflora	31	20.1	32	26.0	66	58.4	52	42.3	59	50.0	44	36.7	284	37.8
Iva frutescens	35	22.7	41	33.3	24	21.2	21	17.0	42	35.6	24	20.0	187	24.9
Spartina patens	17	11.0	13	10.6	46	40.7	28	22.8	39	33.0	30	25.0	173	23.0
Solidago sempervirens	35	26.6	24	19.5	27	23.9	29	23.6	6	5.1	24	20.0	145	19.3
Baccharis halimifolia	40	26.0	20	16.3	20	17.7	17	13.8	12	10.2	28	23.3	137	18.2
Panicum virgatum	41	22.7	20	16.3	14	12.4	35	28.5	4	3.4	17	14.2	131	17.4
Myrica pensylvanica	8	5.2	39	31.7	16	14.2	22	17.9	-	-	22	18.3	107	14.2
Phragmites communis	6	3.9	23	18.7	-	-	22	17.9	24	20.3	7	5.8	82	10.9
Atriplex patula	28	18.2	16	13.0	-	-	6	4.9	2	1.7	13	10.8	65	8.7
Salicornia europaea	8	5.2	8	6.5	5	4.4	5	4.1	28	23.7	10	8.3	64	8.5
Distichlis spicata	25	16.2	5	4.1	11	9.7	1	0.8	15	12.7	3	2.5	60	8.0
Lonicera japonica	46	29.9	-	-	-	-	-	-	-	-	11	9.2	57	7.6
Parthenocissus vitacea	7	4.5	25	20.3	-	-	4	3.3	-	-	14	11.7	50	6.7
Rhus copallina	26	16.9	16	13.0	2	1.8	-	-	-	-	-	-	44	5.9
Solidago tenuifolia	24	15.6	16	13.0	-	-	-	-	-	-	-	-	40	5.3
Convolvulus sepium	6	3.9	16	13.0	-	-	13	10.6	-	-	-	-	35	4.7
Rumex acetosella	24	15.6	1	0.8	-	-	2	1.6	-	-	-	-	27	3.6
Teucrium canadense	4	2.6	9	7.3	-	-	8	6.5	1	0.8	4	3.3	26	3.5
Rubus cuneifolius	10	6.5	16	13.0	-	-	-	-	-	-	-	-	26	3.5
Prunus serotina	19	12.3	6	4.9	-	-	-	-	-	-	-	-	25	3.3
Smilax glauca	19	12.3	3	2.4	-	-	-	-	-	-	-	-	22	2.9
Festuca myuros	18	11.7	-	-	-	-	-	-	3	2.5	-	-	21	2.8
Festuca rubra	6	3.9	-	-	2	1.8	8	6.5	3	2.5	1	0.8	20	2.7
Phytolacca decandra	2	1.3	1	0.8	-	-	9	7.3	1	0.8	6	5.0	19	2.5
Lepidium virginicum	7	4.5	5	4.1	1	0.9	-	-	1	0.8	3	2.5	17	2.3
Rubus flagellaris	13	8.4	4	3.3	-	-	-	-	-	-	-	-	17	2.3
Carex albolutescens	15	9.7	-	-	-	-	1	0.8	-	-	-	-	16	2.1
Plantago lanceolata	8	5.2	1	0.8	-	-	2	1.6	3	2.5	2	1.7	16	2.1
Juniperus virginiana	13	8.4	2	1.6	-	-	-	-	-	-	-	-	15	2.0
Rhus toxicodendron	10	6.5	4	3.3	-	-	-	-	1	0.8	-	-	15	2.0
Achillea millefolium	6	3.9	2	1.6	-	-	-	-	1	0.8	5	4.2	14	1.9
Strophostyles helveola	2	1.3	2	1.6	4	3.5	1	0.8	-	-	5	4.2	14	1.9
Bromus tectorum	6	3.9	3	2.4	-	-	4	3.3	-	-	-	-	13	1.7
Danthonia spicata	10	6.5	2	1.6	-	-	1	0.8	-	-	-	-	13	1.7
Eupatorium album	13	8.4	-	-	-	-	-	-	-	-	-	-	13	1.7
Sueda marina	-	-	-	-	-	-	-	-	3	2.5	8	6.7	11	1.5
Poa compressa	6	3.9	4	3.3	-	-	-	-	-	-	-	-	10	1.3
Polygonum pensylvanicum	-	-	-	-	-	-	4	3.3	6	5.1	-	-	10	1.3
Andropogon virginicus	9	5.8	-	-	-	-	-	-	-	-	-	-	9	1.2
Digitaria sanguinalis	6	3.9	-	-	-	-	-	-	3	2.5	-	-	9	1.2
Polygonella articulata	8	5.2	-	-	-	-	-	-	-	-	-	-	8	1.1
Oenothera biennis	1	0.6	-	-	-	-	2	1.6	-	-	4	3.3	7	0.9
Andropogon scoparius	3	1.9	-	-	-	-	3	2.4	-	-	-	-	6	0.8
Conyza canadensis	5	3.2	-	-	-	-	-	-	1	0.8	-	-	6	0.8
Elymus virginicus	2	1.3	3	2.4	-	-	1	0.8	-	-	-	-	6	0.8

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Table 6 . (cont.)

	Section 1		Section 2		Section 3		Section 4		Section 5		Section 6		Total	
	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%
Eupatorium hyssopifolium	-	-	3	2.4	3	2.7	-	-	-	-	-	-	6	0.8
Juncus gerardi	1	0.6	-	-	-	-	-	-	5	4.2	-	-	6	0.8
Panicum meridionale	5	3.2	-	-	-	-	-	-	-	-	-	-	5	0.7
Cyperus erythrorhizos	-	-	-	-	-	-	-	-	-	-	4	3.3	4	0.5
Eragrostis spectabilis	2	1.3	-	-	1	0.9	1	0.8	-	-	-	-	4	0.5
Fragaria virginiana	-	-	-	-	-	-	-	-	-	-	4	3.3	4	0.5
Lactuca serriola	-	-	-	-	-	-	4	3.3	-	-	-	-	4	0.5
Polygonum convolvulus	-	-	-	-	-	-	-	-	-	-	4	3.3	4	0.5
Smilax rotundifolia	4	2.6	-	-	-	-	-	-	-	-	-	-	4	0.5
Cakile edentula	-	-	-	-	-	-	-	-	-	-	3	2.5	3	0.4
Cassia nictitans	-	-	-	-	-	-	-	-	-	-	3	2.5	3	0.4
Cyperus filicinus	1	0.6	1	0.6	-	-	-	-	1	0.8	-	-	3	0.4
Lespediza capitata	3	1.9	-	-	-	-	-	-	-	-	-	-	3	0.4
Limonium nashii	-	-	-	-	-	-	-	-	1	0.8	2	1.7	3	0.4
Prunus persica	-	-	-	-	-	-	3	2.4	-	-	-	-	3	0.4
Salicornia bigelovii	-	-	-	-	-	-	-	-	2	1.7	1	0.8	3	0.4
Sassafras albidum	-	-	3	2.4	-	-	-	-	-	-	-	-	3	0.4
Spergularia marina	-	-	-	-	-	-	-	-	3	2.5	-	-	3	0.4
Sueda linearis	3	1.9	-	-	-	-	-	-	-	-	-	-	3	0.4
Aristida dichotoma	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Eragrostis curvula	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Fragrostis pilosa	-	-	-	-	-	-	-	-	2	1.7	-	-	2	0.3
Gnaphalium uligiosum	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Linaria canadensis	1	0.6	1	0.6	-	-	-	-	-	-	-	-	2	0.3
Panicum lanuginosum	-	-	1	0.6	1	0.9	-	-	-	-	-	-	2	0.3
Panicum nitidum	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Panicum scoparium	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Prunus virginiana	-	-	2	1.6	-	-	-	-	-	-	-	-	2	0.3
Rumex crispus	-	-	-	-	-	-	-	-	-	-	2	1.7	2	0.3
Spartina cynosuroides	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Trifolium repens	-	-	-	-	-	-	-	-	2	1.7	-	-	2	0.3
Composite A	1	0.6	1	0.6	-	-	-	-	-	-	-	-	2	0.3
Asparagus officinalis	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Aster linariifolius	-	-	-	-	-	-	-	-	-	-	1	0.8	1	0.1
Bassia hirsuta	-	-	-	-	-	-	-	-	-	-	1	0.8	1	0.1
Cyperus retrorsus	-	-	-	-	-	-	1	0.8	-	-	-	-	1	0.1
Dactylis glomerata	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Dianthus armeria	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Eleusine indica	-	-	-	-	-	-	-	-	1	0.8	-	-	1	0.1
Hieracium gronovii	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Lespediza cuneata	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Polygonum aviculare	-	-	-	-	-	-	-	-	1	0.8	-	-	1	0.1
Polygonum erectum	-	-	-	-	-	-	1	0.8	-	-	-	-	1	0.1
Sambucus canadensis	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1

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Table 7 . Frequency of plant species rooted in quadrats on Great Bay Boulevard.

Species	Section 1		Section 2		Section 3		Section 4		Section 5		Section 6		Total	
	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%
Spartina alterniflora	28	18.2	29	23.6	62	54.9	50	40.7	58	49.2	38	31.7	265	35.3
Spartina patens	11	7.1	9	7.3	42	37.2	25	20.3	31	26.3	28	23.3	146	19.4
Iva frutescens	15	9.7	22	17.9	12	10.6	12	9.8	33	30.0	5	4.2	99	13.2
Solidago sempervirens	21	13.6	18	14.6	19	16.8	19	15.4	6	5.1	13	10.8	96	12.8
Panicum virgatum	25	16.2	12	9.8	12	10.6	20	16.3	2	1.7	11	9.2	82	10.9
Salicornia europaea	7	4.5	7	5.7	5	4.4	3	2.4	27	22.9	10	8.3	59	7.9
Phragmites communis	1	0.6	17	13.8	-	-	19	15.4	16	13.6	3	2.5	56	7.5
Distichlis spicata	19	12.3	1	0.8	9	8.0	1	0.8	13	11.0	2	1.7	45	6.0
Myrica pensylvanica	4	2.6	16	13.0	9	7.9	7	5.7	-	-	8	6.7	44	5.8
Atriplex patula	19	12.3	10	8.1	-	-	3	2.4	1	0.8	5	4.2	38	5.1
Lonicera japonica	32	20.8	-	-	-	-	-	-	-	-	5	4.2	37	4.9
Baccharis halimifolia	9	5.8	5	4.0	4	3.5	4	3.3	4	3.4	7	5.8	33	4.4
Solidago tenuifolia	17	11.0	12	9.8	-	-	-	-	-	-	-	-	29	3.9
Festuca rubra	6	3.9	-	-	2	1.8	7	5.7	3	2.5	1	0.8	19	2.5
Teucrium canadense	3	1.9	8	6.5	-	-	6	4.9	-	-	2	1.7	19	2.5
Festuca myuros	13	8.4	-	-	-	-	-	-	3	2.5	-	-	16	2.1
Plantago lanceolata	7	4.5	1	0.8	-	-	2	1.6	2	1.7	2	1.7	14	1.9
Rumex acetosella	11	7.1	1	0.8	-	-	2	1.6	-	-	-	-	14	1.9
Smilax glauca	12	7.8	1	0.8	-	-	-	-	-	-	-	-	13	1.7
Danthonia spicata	9	5.8	2	1.6	-	-	1	0.8	-	-	-	-	12	1.6
Lepidium virginicum	3	1.9	5	4.1	1	0.9	-	-	1	0.8	2	1.7	12	1.6
Parthenocissus vitacea	2	1.3	9	7.3	-	-	1	0.8	-	-	-	-	12	1.6
Rhus copallina	11	7.1	-	-	1	0.9	-	-	-	-	-	-	12	1.6
Carex albolutescens	10	6.5	-	-	-	-	1	0.8	-	-	-	-	11	1.5
Achilla millefolium	5	3.2	2	1.6	-	-	-	-	-	-	3	2.5	10	1.3
Bromus tectorum	4	2.6	3	2.4	-	-	3	2.4	-	-	-	-	10	1.3
Convolvulus sepium	5	3.2	3	2.4	-	-	2	1.6	-	-	-	-	10	1.3
Juniperus virginiana	9	5.8	1	0.8	-	-	-	-	-	-	-	-	10	1.3
Poa compressa	6	3.9	4	3.3	-	-	-	-	-	-	-	-	10	1.3
Digitaria sanguinalis	6	3.9	-	-	-	-	-	-	3	2.5	-	-	9	1.2
Rubus cuneifolius	7	4.5	2	1.6	-	-	-	-	-	-	-	-	9	1.2
Sueda marina	-	-	-	-	-	-	-	-	3	2.5	6	5.0	9	1.2
Eupatorium album	8	5.2	-	-	-	-	-	-	-	-	-	-	8	1.1
Rubus flagellaris	5	3.2	3	2.4	-	-	-	-	-	-	-	-	8	1.1
Phytolacca decandra	-	-	-	-	-	-	6	4.9	-	-	1	0.8	7	0.9
Polygonella articulata	7	4.5	-	-	-	-	-	-	-	-	-	-	7	0.9
Polygonum pensylvanicum	-	-	-	-	-	-	4	3.3	3	2.5	-	-	7	0.9
Prunus serotina	6	3.9	1	0.8	-	-	-	-	-	-	-	-	7	0.9
Conyza canadensis	5	3.2	-	-	-	-	-	-	1	0.8	-	-	6	0.8
Oenothera biennis	1	0.6	-	-	-	-	1	0.8	-	-	4	3.3	6	0.8
Rhus toxicodendron	5	3.2	1	0.8	-	-	-	-	-	-	-	-	6	0.8
Strophostyles helveola	1	0.6	1	0.8	2	1.8	1	0.8	-	-	1	0.8	6	0.8
Andropogon virginicus	5	3.2	-	-	-	-	-	-	-	-	-	-	5	0.7
Elymus virginicus	1	0.6	3	2.4	-	-	1	0.8	-	-	-	-	5	0.7

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Table 7 . (cont.)

	Section 1		Section 2		Section 3		Section 4		Section 5		Section 6		Total	
	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%	# quadrats	%
Juncus gerardi	-	-	-	-	-	-	-	-	5	4.2	-	-	5	0.7
Cyperus erythrorhizos	-	-	-	-	-	-	-	-	-	-	4	3.3	4	0.5
Fragaria virginiana	-	-	-	-	-	-	-	-	-	-	4	3.3	4	0.5
Panicum meridionale	4	2.6	-	-	-	-	-	-	-	-	-	-	4	0.5
Eupatorium hyssopifolium	-	-	2	1.6	1	0.9	-	-	1	0.8	2	1.7	3	0.4
Limonium nashii	-	-	-	-	-	-	-	-	-	-	-	-	3	0.4
Smilax rotundifolia	3	1.9	-	-	-	-	-	-	3	2.5	-	-	3	0.4
Spergularia marina	-	-	-	-	-	-	-	-	-	-	-	-	3	0.4
Andropogon scoparius	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Aristida dichotoma	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Cassia nictitans	-	-	-	-	-	-	-	-	-	-	2	1.7	2	0.3
Cyperus filicinus	1	0.6	-	-	-	-	-	-	1	0.8	-	-	2	0.3
Eragrostis pilosa	-	-	-	-	-	-	-	-	2	1.7	-	-	2	0.3
Eragrostis spectabilis	1	0.6	-	-	1	0.9	-	-	-	-	-	-	2	0.3
Lespediza capitata	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Linaria canadensis	1	0.6	1	0.8	-	-	-	-	-	-	-	-	2	0.3
Panicum nitidum	2	0.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Salicornia bigelovii	-	-	-	-	-	-	-	-	1	0.8	1	0.8	2	0.3
Sueda linearis	2	1.3	-	-	-	-	-	-	-	-	-	-	2	0.3
Trifolium repens	-	-	-	-	-	-	-	-	2	1.7	-	-	2	0.3
Composite A	1	0.6	1	0.8	-	-	-	-	-	-	-	-	2	0.3
Asparagus officinalis	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Aster linariifolius	-	-	-	-	-	-	-	-	-	-	1	0.8	1	0.1
Cakile edentula	-	-	-	-	-	-	-	-	-	-	1	0.8	1	0.1
Cyperus remorsus	-	-	-	-	-	-	1	0.8	-	-	-	-	1	0.1
Dianthus armeria	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Eleusine indica	-	-	-	-	-	-	-	-	1	0.8	-	-	1	0.1
Eragrostis curvula	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Hieracium gronovii	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Lactuca serriola	-	-	-	-	-	-	1	0.8	-	-	-	-	1	0.1
Lespediza cuneata	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1
Panicum lanuginosum	-	-	1	0.8	-	-	-	-	-	-	-	-	1	0.1
Polygonum aviculare	-	-	-	-	-	-	-	-	1	0.8	-	-	1	0.1
Polygonum convolvulus	-	-	-	-	-	-	-	-	-	-	1	0.8	1	0.1
Polygonum erectum	-	-	-	-	-	-	1	0.8	-	-	-	-	1	0.1
Prunus virginiana	-	-	1	0.8	-	-	-	-	-	-	-	-	1	0.1
Rumex crispus	-	-	-	-	-	-	-	-	-	-	1	0.8	1	0.1
Spartina cynosuroides	1	0.6	-	-	-	-	-	-	-	-	-	-	1	0.1

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Table 8 . Comparison of frequency of occurrance with distance from edge of road for 17 plant species from Great Bay Boulevard.

Ft from edge of road	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	>38
Species																				
Panicum virgatum	80.0	70.0	47.5	30.0	27.5	12.5	15.0	7.5	7.5	7.5	7.5	5.0	2.5	5.0	-	-	-	-	-	-
Festuca rubra	15.0	7.5	5.0	2.5	2.5	5.0	2.5	2.5	5.0	-	-	-	-	-	-	-	-	-	-	-
Solidago tenuifolia	15.0	10.0	10.0	12.5	12.5	10.0	5.0	10.0	7.5	2.5	-	-	-	-	5.0	-	-	-	-	-
Rhus copallina	10.0	12.5	15.0	7.5	17.5	17.5	7.5	7.5	10.0	2.5	2.5	-	-	-	-	-	-	-	-	-
Myrica pensylvanica	32.5	35.0	47.5	42.5	35.0	32.5	12.5	15.0	7.5	5.0	2.5	-	-	-	-	-	-	-	-	-
Spartina patens	22.5	27.5	30.0	32.5	32.5	30.0	27.5	27.5	22.5	32.5	32.5	22.5	25.0	15.0	5.0	12.5	12.8	15.8	11.5	-
Prunus serotina	2.5	7.5	7.5	7.5	7.5	12.5	5.0	2.5	2.5	2.5	2.5	2.5	-	-	-	-	-	-	-	-
Phragmites communis	-	2.5	10.0	12.5	12.5	15.0	15.0	12.5	12.5	12.5	12.5	15.0	12.5	12.5	10.0	10.0	10.3	13.2	7.7	-
Lonicera japonica	10.0	12.5	15.0	12.5	12.5	12.5	12.5	10.0	10.0	10.0	10.0	7.5	-	-	-	-	-	-	-	-
Solidago sempervirens	42.5	30.0	15.0	20.0	12.5	25.0	25.0	35.0	22.5	32.5	32.5	17.5	12.5	12.5	10.0	7.5	2.6	5.3	3.8	-
Baccharis halimifolia	12.5	25.0	17.5	17.5	22.5	35.0	40.0	32.5	32.5	25.0	25.0	12.5	7.5	7.5	10.0	10.0	5.1	5.3	-	-
Atriplex patula	-	-	2.5	-	10.0	7.5	7.5	7.5	17.5	20.0	15.0	12.5	17.5	10.0	5.0	7.5	10.3	10.5	3.8	-
Teucrium canadense	2.5	2.5	5.0	5.0	2.5	2.5	10.0	10.0	5.0	7.5	5.0	2.5	2.5	-	-	-	-	-	-	-
Distichlis spicata	-	2.5	2.5	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0	10.0	12.5	17.5	12.5	7.5	10.3	10.5	7.7	-
Iva frutescens	12.5	7.5	7.5	12.5	22.5	30.0	30.0	30.0	30.0	35.0	35.0	42.5	40.0	32.5	25.0	25.0	25.6	15.8	15.4	-
Spartina alterniflora	-	2.5	-	5.0	12.5	17.5	30.0	25.0	35.0	35.0	42.5	55.0	60.0	57.5	60.0	57.5	61.5	76.3	69.2	78.9
Salicornia europaea	-	2.5	2.5	2.5	5.0	10.0	10.0	10.0	5.0	-	2.5	12.5	20.0	12.5	10.0	15.0	10.3	15.8	23.1	-
Number of quadrats	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	39	38	26	19

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Table 9 . Comparison of frequency of occurrance with elevation above mean low water (USC and GS, 1929) for 17 plant species from Great Bay Boulevard.

elevation (ft)	>7.5	7.25-7.5	7.0-7.25	6.75-7.0	6.5-6.75	6.25-6.5	6.0-6.25	5.75-6.0	5.5-5.75	5.25-5.5	5.0-5.25	4.75-5.0	4.5-4.75	4.25-4.5	4.0-4.25	3.75-4.0	3.5-3.75	3.25-3.5	3.0-3.25	2.75-3.0	2.5-2.75	2.25-2.5	2.0-2.25	1.75-2.0	1.5-1.75	1.25-1.5	1.0-1.25	<1.0
Panicum virgatum	75.0	33.3	40.0	33.3	60.0	50.0	45.5	66.7	21.4	25.0	56.4	48.6	40.0	42.9	11.3	5.8	2.0	1.9	-	-	-	-	-	-	-	-	-	-
Rhus copallina	100.0	33.3	20.0	33.3	20.0	25.0	27.3	33.3	14.3	14.3	10.3	0.2	11.1	4.8	3.8	2.9	-	-	-	-	-	-	-	-	-	-	-	-
Solidago tenuifolia	-	-	-	-	30.0	8.3	18.2	33.3	14.3	10.7	10.3	8.6	17.8	14.3	3.8	5.8	-	-	-	-	-	-	-	-	-	-	-	-
Prunus serotina	-	-	20.0	-	-	8.3	-	16.7	21.4	14.3	7.7	8.6	4.4	4.8	7.5	1.4	-	-	-	-	-	-	-	-	-	-	-	-
Myrica pensylvanica	-	-	-	-	50.0	8.3	-	16.7	21.4	39.3	38.5	42.9	37.8	38.1	17.0	8.7	2.0	7.7	1.2	1.4	2.7	-	-	-	-	-	-	-
Phragmites communis	-	-	80.0	66.7	10.0	-	9.1	-	-	21.4	15.4	25.7	13.3	26.2	5.7	11.6	6.0	7.7	7.3	4.3	13.5	4.8	11.8	12.5	-	-	-	-
Festuca rubra	-	-	-	-	-	-	-	-	-	10.7	5.1	14.3	6.7	-	7.5	2.9	-	-	-	-	-	-	-	-	-	-	-	-
Lonicera japonica	-	-	-	-	40.0	41.7	18.2	66.7	64.3	14.3	10.3	8.6	6.7	7.1	11.3	8.7	5.9	38.5	-	-	-	-	-	-	-	-	-	-
Teucrium canadense	-	-	-	-	-	-	-	16.7	14.3	3.6	7.7	-	6.7	21.4	5.7	2.9	2.0	-	1.2	-	-	-	-	-	-	-	-	-
Solidago sempervirens	-	33.3	-	-	10.0	-	9.1	-	28.6	25.0	33.3	28.6	33.3	33.3	35.8	33.3	25.5	21.2	9.8	1.4	10.8	-	-	-	-	-	-	-
Baccharis halimifolia	-	-	20.0	33.3	20.0	8.3	-	-	7.1	3.6	15.4	22.9	26.7	35.7	50.9	40.6	25.5	17.3	7.3	5.7	5.4	-	-	-	-	-	-	-
Spartina patens	-	-	40.0	-	-	-	-	-	-	-	-	8.6	31.1	26.2	62.3	55.1	41.2	34.6	19.5	8.6	10.8	19.0	11.8	-	-	-	25.0	-
Iva frutescens	-	-	-	-	-	-	-	-	-	3.6	-	5.7	4.4	11.9	34.0	53.6	64.7	46.2	22.0	15.7	45.9	38.1	29.4	12.5	20.0	28.6	25.0	-
Distichlis spicata	-	-	-	-	-	-	-	-	-	-	-	-	2.2	2.4	13.2	11.6	15.7	25.0	12.2	7.1	5.4	9.5	5.9	12.5	10.0	-	-	-
Atriplex patula	-	-	-	-	-	-	-	16.7	-	7.1	2.6	2.9	6.7	7.1	17.0	10.1	13.7	9.6	9.8	4.3	29.7	14.3	5.9	-	-	-	-	-
Salicornia europaea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	2.9	17.6	7.7	15.9	15.7	24.3	28.6	17.6	12.5	-	14.3	-	6.7
Spartina alterniflora	-	-	-	-	-	-	-	-	-	-	-	-	2.2	4.8	1.9	27.5	62.7	63.5	72.0	67.1	75.7	81.0	82.4	87.5	90.0	85.7	50.0	26.7
Number of quadrats	4	3	5	3	10	12	11	6	14	28	39	35	45	42	58	69	51	52	82	70	37	21	17	8	10	7	4	15

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Table 10 . Comparison of percent cover with distance from edge of road for 17 plant species from Great Bay Boulevard.

Ft. from edge of road	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35
Species																		
Panicum virgatum	24.7	17.4	13.9	8.1	5.8	3.2	2.6	2.6	2.2	2.0	2.3	2.2	1.0	0.2	-	-	-	-
Festuca rubra	6.6	1.3	0.5	0.9	0.1	0.2	1.8	0.8	0.5	-	-	-	-	-	-	-	-	-
Solidago tenuifolia	2.6	0.4	0.6	0.8	0.8	0.4	0.2	0.4	0.2	0.0	-	-	-	-	-	-	-	-
Rhus copallina	3.3	7.3	8.9	4.4	5.9	4.5	2.2	1.9	3.2	0.4	0.1	-	-	-	-	-	-	-
Myrica pensylvanica	16.2	22.3	27.7	25.2	20.4	15.8	9.9	7.8	3.7	0.2	0.1	-	-	-	-	-	-	-
Spartina patens	5.2	9.2	11.8	10.4	7.8	5.0	7.4	0.9	6.3	7.7	10.5	6.8	2.7	2.2	0.2	1.1	5.6	4.8
Prunus serotina	0.1	0.6	3.2	4.7	4.7	6.1	3.1	1.8	1.8	1.8	1.3	0.4	-	-	-	-	-	-
Phragmites communis	-	0.1	1.9	3.3	6.0	6.8	6.0	6.8	6.2	5.4	4.6	4.3	4.8	4.6	5.6	6.1	4.0	3.9
Lonicera japonica	2.3	3.6	3.8	1.8	2.6	3.5	3.9	3.1	2.2	1.7	1.2	0.6	-	0.1	0.4	0.1	-	-
Solidago sempervirens	5.1	3.8	4.7	2.5	1.9	8.0	5.6	4.3	6.3	3.3	5.0	1.6	3.4	2.8	1.9	0.3	0.4	0.8
Baccharis halimifolia	4.1	8.4	7.1	8.3	11.8	16.9	19.4	20.5	14.9	12.1	10.5	7.0	3.0	4.7	4.4	3.8	2.0	0.0
Atriplex patula	-	-	1.0	0.2	0.4	1.2	0.7	3.2	2.7	3.4	2.2	1.3	3.2	1.2	0.2	1.0	0.7	0.4
Teucrium canadense	0.1	0.1	0.2	0.2	0.4	0.3	1.0	1.1	1.6	0.3	0.2	0.4	0.1	-	-	-	-	-
Distichlis spicata	-	0.0	0.1	0.3	0.3	0.2	1.8	3.2	4.0	1.4	3.8	1.1	2.4	2.6	1.2	2.1	0.7	1.0
Iva frutescens	0.2	1.7	0.5	4.0	8.2	7.8	7.3	5.2	4.4	6.8	10.0	13.0	15.0	13.3	6.5	4.0	4.6	3.3
Spartina alterniflora	-	0.1	-	0.6	1.8	2.7	5.8	7.7	10.6	11.3	10.3	17.9	20.2	22.3	24.7	21.4	16.6	21.4
Salicornia europaea	-	0.5	0.0	0.1	0.4	0.9	0.6	0.9	0.1	0.9	0.1	1.2	1.2	0.5	0.4	2.1	0.5	0.6

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Table 11. Comparison of average percent cover with elevation above mean low water (USC & GS, 1929) for 17 plant species from Great Bay Boulevard.

elevation (ft)	>7.5	7.25-7.5	7.0-7.25	6.75-7.0	6.5-6.75	6.25-6.5	6.0-6.25	5.75-6.0	5.5-5.75	5.25-5.5	5.0-5.25	4.75-5.0	4.5-4.75	4.25-4.5	4.0-4.25	3.75-4.0	3.5-3.75	3.25-3.5	3.0-3.25	2.75-3.0	2.5-2.75	2.25-2.5	2.0-2.25	1.75-2.0	1.5-1.75	1.25-1.5	1.0-1.25	<1.0
Panicum virgatum	5.8	0.2	0.3	1.7	3.8	4.6	8.2	25.9	1.6	16.1	22.1	16.2	9.2	18.2	3.3	0.2	0.3	0.1	-	-	-	-	-	-	-	-	-	-
Rhus copallina	57.5	20.8	7.5	20.8	12.5	13.5	10.7	12.5	4.8	5.7	2.0	8.4	4.7	2.5	0.1	1.0	-	-	-	-	-	-	-	-	-	-	-	-
Solidago tenuifolia	-	-	-	-	1.5	0.4	2.0	5.8	0.7	0.5	0.5	0.4	2.2	0.6	0.1	0.7	-	-	-	-	-	-	-	-	-	-	-	-
Prunus serotina	-	-	1.0	-	-	1.5	-	6.2	11.6	5.7	4.3	7.5	2.8	2.2	4.8	1.3	-	-	-	-	-	-	-	-	-	-	-	-
Myrica pensylvanica	-	-	-	-	41.2	7.3	-	14.6	15.2	24.5	25.9	18.5	22.0	20.9	9.3	1.8	1.7	3.5	7.6	1.2	0.1	-	-	-	-	-	-	-
Phragmites communis	-	-	46.0	50.0	8.8	-	3.4	-	-	9.7	11.5	15.1	4.6	10.4	1.9	1.9	0.5	2.4	2.9	2.0	1.4	0.8	1.1	0.6	-	-	-	-
Festuca rubra	-	-	-	-	-	-	-	-	-	0.5	0.2	2.8	1.3	-	0.7	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Lonicera japonica	-	-	-	-	8.5	5.2	1.6	10.8	20.1	3.2	3.8	3.4	1.6	4.0	2.3	1.7	0.5	0.4	-	-	-	-	-	-	-	-	-	-
Teucrium canadense	-	-	-	-	-	-	-	0.1	0.4	0.2	0.4	-	0.5	1.7	1.8	0.1	0.3	-	0.1	-	-	-	-	-	-	-	-	-
Solidago sempervirens	-	-	-	-	5.0	-	0.5	-	12.9	2.0	6.8	6.0	8.4	4.9	5.9	5.7	4.8	6.6	1.6	0.1	0.3	-	-	-	-	-	-	-
Baccharis halimifolia	-	-	-	1.7	6.2	0.8	1.6	-	-	0.0	2.1	3.9	14.4	17.0	20.1	25.4	12.7	11.4	1.7	2.1	2.7	-	-	-	-	-	-	-
Spartina patens	-	-	7.5	-	-	-	-	-	-	0.7	2.6	3.2	4.9	1.9	15.2	13.4	7.3	9.6	3.2	2.6	3.0	2.0	0.0	-	-	-	-	-
Iva frutescens	-	0.2	-	-	-	-	-	-	-	0.2	-	0.2	1.2	0.8	4.8	11.8	20.5	13.2	6.7	3.5	15.9	19.2	8.7	2.2	2.2	5.0	4.4	-
Distichlis spicata	-	-	-	-	-	-	-	-	-	-	-	-	0.1	1.5	4.5	2.2	2.1	3.3	0.9	2.5	1.1	0.9	0.3	4.7	0.5	-	-	-
Atriplex patula	-	-	-	-	-	-	-	6.2	-	0.8	0.1	0.1	1.1	0.7	2.0	2.4	1.5	1.9	0.9	1.0	4.8	0.7	0.3	-	-	-	-	-
Salicornia europaea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.1	1.2	0.5	0.7	2.0	1.6	1.4	1.6	0.6	-	0.7	-	0.3
Spartina alterniflora	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.1	5.6	16.4	17.1	23.3	27.4	22.2	25.5	35.3	26.9	25.8	22.5	2.5	9.0
Number of quadrats	4	3	5	3	10	12	11	6	14	28	39	35	45	42	53	69	51	52	82	70	37	21	17	8	10	7	4	15

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Table 12 . Correlation of basal area with distance from edge of road for important woody plants and herbs from Great Bay Boulevard. Each number represents the mean of percent cover of basal area for all plants at a given distance from edge of road. Blanks indicate no rooted plants of this species at this distance.

Distance (ft)	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37
Woody Plants																			
Rhus copallina	-	0.1	0.3	0.1	0.1	0.1	-	-	0.1	0.0	-	-	-	-	-	-	-	-	-
Myrica pensylvanica	0.3	0.6	0.7	0.4	0.4	0.3	0.1	0.0	-	-	0.0	-	-	-	-	-	-	-	-
Prunus serotina	0.0	0.0	-	-	0.4	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-
Baccharis halimifolia	0.1	0.2	0.0	0.2	0.2	0.0	0.5	0.0	0.5	0.5	0.1	0.1	-	0.4	0.0	0.0	-	-	-
Iva frutescens	0.1	0.0	0.0	0.2	0.6	0.8	0.4	0.1	0.3	0.2	1.2	0.5	0.5	0.3	0.4	0.1	0.4	0.4	0.0
Lonicera japonica	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	-	0.0	0.0	-	-	-	-
Herbs																			
Panicum virgatum	10.6	4.9	4.6	3.0	1.2	0.4	0.4	0.4	0.9	0.2	0.0	2.2	-	0.0	-	-	-	-	-
Festuca rubra	2.2	1.2	0.4	0.2	-	0.1	0.4	0.1	0.1	-	-	-	-	-	-	-	-	-	-
Solidago tenuifolia	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.1	-	-	-	-	-	0.0	-	-	-	-
Teucrium canadense	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	-	-	-	-	-	-	-
Phragmites communis	-	-	0.0	0.0	0.3	0.3	0.2	0.2	0.3	0.0	0.0	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.0
Solidago sempervireus	0.5	0.1	0.5	0.2	0.2	0.8	0.3	0.4	0.2	0.2	0.5	0.2	0.2	0.0	0.1	0.0	0.1	0.0	-
Distichlis spicata	-	-	0.0	0.0	0.0	0.0	0.1	1.1	1.2	0.2	0.7	0.2	0.2	1.2	0.0	0.4	0.0	0.4	0.0
Spartina patens	2.1	2.4	7.5	6.2	5.0	2.8	5.8	0.3	3.3	4.5	7.4	2.9	0.5	0.2	0.1	0.1	1.9	3.4	1.7
Spartina alterniflora	0.4	-	0.0	0.1	0.3	0.6	0.6	1.1	2.0	2.1	2.0	4.7	3.6	4.4	5.3	4.2	3.6	6.0	4.2
Atriplex patula	-	-	0.0	-	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Salicornia europaea	-	0.0	0.0	-	0.0	0.1	0.1	0.1	0.0	-	.0	0.6	0.4	0.1	0.1	0.1	0.1	0.1	0.1

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Table 13 . Comparison of average basal area with elevation above mean low water (USC & GS, 1929) for 17 woody plants and herbs from Great Bay Boulevard. Basal are is given in in^2/ft^2. Species marked are measured as clumps; others measured as individual stems.

elevation (ft)	>7.5	7.25-7.5	7.0-7.25	6.75-7.0	6.5-6.75	6.25-6.5	6.0-6.25	5.75-6.0	5.5-5.75	5.25-5.5	5.0-5.25	4.75-5.0	4.5-4.75	4.25-4.5	4.0-4.25	3.75-4.0	3.5-3.75	3.25-3.5	3.0-3.25	2.75-3.0	2.5-2.75	2.25-2.5	2.0-2.25	1.75-2.0	1.5-1.75	1.25-1.5	1.0-1.25	<1.0
Woody plants																												
Rhus copallina	0.4	-	1.4	-	-	0.6	0.7	0.1	0.6	0.1	0.0	0.4	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lonicera japonica	-	-	-	-	0.2	0.1	0.1	0.2	0.3	0.1	0.2	0.1	0.0	0.1	0.1	0.1	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Prunus serotina	-	-	0.1	-	-	0.1	-	-	0.5	0.3	-	0.7	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Myrica pensylvanica	-	-	-	-	1.5	0.1	-	0.1	0.6	0.8	0.8	0.1	1.1	0.5	0.0	0.0	0.1	0.0	-	-	-	-	-	-	-	-	-	-
Baccharis halimifolia	-	-	-	-	-	0.1	-	-	-	-	0.0	0.0	0.2	0.9	0.6	0.7	0.2	0.4	-	0.0	0.2	-	-	-	-	-	-	-
Iva frutescens	-	-	-	-	-	-	-	-	-	-	-	0.0	-	0.2	0.9	1.5	1.1	0.4	0.3	0.6	1.0	0.1	0.1	3.2	-	0.1	-	-
Herbs																												
Panicum virgatum*	1.8	-	-	-	1.5	2.8	2.0	14.4	2.3	4.3	7.9	6.2	5.1	12.2	1.6	0.0	0.1	0.0	-	-	-	-	-	-	-	-	-	-
Festuca rubra*	-	-	-	-	-	-	-	-	-	0.3	0.4	2.6	0.3	-	2.2	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Solidago tenuifolia	-	-	-	-	0.1	0.1	1.3	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Phragmites communis	-	-	2.9	4.8	0.7	-	-	-	-	-	0.1	0.1	0.1	0.6	0.0	0.1	0.0	0.0	0.1	0.2	0.0	-	0.0	0.1	-	-	-	-
Teucrium canadense	-	-	-	-	-	-	-	-	0.1	-	0.0	-	-	0.2	0.2	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-
Solidago sempervirens	-	0.2	-	-	-	-	-	-	0.6	0.0	0.4	0.8	0.4	0.8	0.3	0.5	0.5	0.8	0.3	0.0	0.1	-	-	-	-	-	-	-
Atriplex patula	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.0	-	-	-	-	-
Spartina patens*	-	-	1.6	-	-	-	-	-	-	-	-	1.4	4.3	1.6	13.1	13.7	6.5	10.2	2.6	1.7	2.7	1.3	-	-	-	-	-	-
Distichlis spicata	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	2.2	0.4	0.2	1.8	0.1	1.2	0.2	0.1	0.0	3.2	-	-	-	-
Spartina alterniflora	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	0.5	1.3	4.5	4.8	8.6	9.8	6.4	5.6	13.6	3.9	10.5	7.7	0.4	2.7
Salicornia europaea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.0	0.3	0.1	0.1	0.5	0.3	0.2	0.1	0.1	-	-	-	0.0
Number of quadrats	4	3	5	3	10	12	11	6	14	28	39	35	45	42	53	69	51	52	82	70	37	21	17	8	10	7	2	15

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Table 14 . Density (stems per ft^2) for woody plants, grasses and herbs from Great Bay Boulevard, compared with distance from edge of road.

distance ft	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	>38
Woody plants																				
Rhus copallina	-	0.1	0.1	0.1	0.1	0.1	-	-	0.1	0.0	-	-	-	-	-	-	-	-	-	-
Myrica pensylvanica	0.2	0.8	0.9	0.7	0.3	0.2	0.1	0.0	-	0.5	0.1	-	-	-	-	-	-	-	-	-
Prunus serotina	0.1	0.1	-	-	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lonicera japonica	0.1	0.2	1.5	0.1	0.3	0.2	0.1	0.2	0.1	0.2	0.2	-	-	0.0	0.0	-	-	-	-	-
Baccharis halimifolia	0.1	0.3	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	-	0.1	0.0	0.0	-	-	-	-
Iva frutescens	0.2	0.8	0.1	0.1	0.9	2.1	3.4	1.4	1.1	0.7	1.6	1.1	1.3	1.0	0.7	0.1	0.4	0.1	0.4	-
Grasses																				
Panicum virgatum[c]	1.2	0.6	0.4	0.2	0.2	0.1	0.1	0.1	0.0	0.1	0.2	0.1	-	0.0	-	-	-	-	-	-
Festuca rubra[c]	0.4	0.4	0.1	0.1	-	0.2	0.2	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-
Phragmites communis	-	-	0.1	0.0	0.8	0.4	0.3	0.5	0.4	0.2	0.1	0.3	0.3	0.3	0.3	0.4	0.4	0.6	0.3	-
Spartina patens[c]	1.2	0.8	0.6	0.8	0.6	0.3	0.7	0.3	0.4	0.3	0.4	0.5	0.5	0.5	0.1	0.2	0.2	0.6	0.1	-
Distichlis spicata[a]	-	0.3	0.3	0.7	0.7	0.6	0.9	1.1	2.4	0.7	2.5	0.8	2.6	1.9	1.3	0.7	0.3	2.2	0.2	-
Spartina alterniflora	-	-	-	0.2	0.6	1.5	1.7	3.7	4.6	6.3	7.8	12.6	14.0	15.0	16.9	17.4	16.4	23.8	22.2	45.5
Other grasses	2.2	7.6	4.2	1.5	1.0	0.3	1.1	1.7	2.4	1.2	0.2	0.0	0.1	-	0.6	0.2	0.1	0.0	0.1	-
Herbs																				
Solidago tenuifolia	0.8	0.4	0.4	0.2	0.3	0.1	0.1	0.0	0.1	-	-	-	-	-	-	-	-	-	-	-
Teucrium canadense	0.0	0.1	0.0	0.3	0.1	0.1	0.3	0.2	0.6	0.1	0.1	0.2	-	-	-	-	-	-	-	-
Solidago sempervirens	1.2	0.6	0.9	0.4	0.2	0.8	0.3	0.9	0.5	0.3	0.9	0.3	0.5	0.1	0.4	0.2	0.2	0.0	-	-
Atriplex patula	-	-	0.0	-	0.0	0.1	0.0	0.3	0.5	0.2	0.5	0.1	0.4	0.1	0.1	0.1	0.1	0.2	0.1	-
Salicornia europaea	-	0.8	0.0	-	0.3	0.3	0.8	0.9	0.1	-	0.0	3.2	0.9	0.5	0.4	0.7	0.5	0.3	0.3	-
Other herbs	2.7	3.0	1.8	1.5	1.0	0.6	0.8	0.6	0.5	0.2	0.2	0.2	-	0.1	0.2	0.2	0.1	0.3	0.2	-

a number of Distichlis stems estimated in two cases

c grasses counted as clumps rather than individual stems

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Table 15. Density (stems per ft^2) for woody plants, grasses, and herbs from Great Bay Boulevard, for different elevations.

elevation (ft)	>7.5	7.25-7.5	7.0-7.25	6.75-7.0	6.5-6.75	6.25-6.5	6.0-6.25	5.75-6.0	5.5-5.75	5.25-5.5	5.0-5.25	4.75-5.0	4.5-4.75	4.25-4.5	4.0-4.25	3.75-4.0	3.5-3.75	3.25-3.5	3.0-3.25	2.75-3.0	2.5-2.75	2.25-2.5	2.0-2.25	1.75-2.0	1.5-1.75	1.25-1.5	1.0-1.25	<1.0
Woody plants																												
Rhus copallina	0.5	-	0.4	-	-	0.1	0.2	0.2	0.2	0.0	0.1	0.1	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Myrica pensylvanica	-	-	-	-	0.5	0.2	-	0.2	1.4	0.9	0.5	0.1	0.8	0.2	0.0	0.3	0.0	0.1	-	-	-	-	-	-	-	-	-	-
Prunus serotina	-	-	0.2	-	-	0.2	-	-	0.1	0.1	0.1	0.1	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lonicera japonica	-	-	-	-	0.3	0.2	0.2	0.3	1.0	0.2	0.2	0.2	0.0	0.2	0.1	0.1	0.0	0.1	-	-	-	-	-	-	-	-	-	-
Baccharis halimifolia	-	-	-	-	-	0.4	-	-	-	-	0.0	0.2	0.0	0.5	0.1	0.1	0.1	0.1	-	0.0	0.0	-	-	-	-	-	-	-
Iva frutescens	-	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1	2.7	1.7	3.1	2.2	0.6	0.4	1.0	0.4	0.2	-	-	1.0	-	-
Grasses																												
Panicum virgatum[c]	1.0	-	-	-	0.5	0.4	0.2	0.7	0.4	0.5	0.5	0.5	0.4	0.6	0.1	0.0	0.0	0.1	-	-	-	-	-	-	-	-	-	-
Festuca rubra[c]	-	-	-	-	-	-	-	-	-	0.5	0.2	0.5	0.2	-	0.2	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Phragmites communis	-	-	4.2	3.3	1.2	-	-	-	-	1.1	0.6	0.5	0.3	0.5	0.0	0.1	0.2	0.1	0.3	0.3	0.1	-	0.1	0.4	-	-	-	-
Spartina patens[c]	-	-	0.8	-	-	-	-	-	-	-	-	0.5	0.4	0.5	1.3	1.2	0.6	0.7	0.3	0.2	0.1	0.6	-	-	-	-	-	-
Distichlis spicata[a]	-	-	-	-	-	0.9	-	-	-	-	-	-	-	1.6	1.9	1.6	1.8	2.4	0.7	0.8	0.8	0.3	0.1	9.9	-	-	-	-
Spartina alterniflora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	4.2	10.4	11.3	18.7	29.5	18.3	20.9	23.4	11.1	15.3	18.1	3.0	8.0
Other grasses	4.0	56.3	9.4	-	0.2	2.2	0.4	0.5	5.9	4.3	6.4	2.1	3.5	0.2	0.2	0.0	0.0	-	-	0.0	-	-	-	-	-	-	-	-
Herbs																												
Solidago tenuifolia	-	-	-	-	0.2	0.1	0.4	1.0	0.2	0.2	0.2	0.3	0.7	0.4	0.0	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Teucrium canadense	-	-	-	-	-	-	-	-	0.2	-	0.1	0.0	-	0.8	0.6	0.1	0.2	-	-	-	-	-	-	-	-	-	-	-
Solidago sempervirens	-	2.0	-	-	-	-	-	-	0.5	0.1	0.9	0.5	0.8	1.3	0.3	0.7	0.9	1.0	0.2	0.0	0.2	-	-	-	-	-	-	-
Atriplex patula	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	0.3	0.6	0.1	0.2	-	-	-	-	-	-	-	-	-	-	-
Salicornia europaea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.1	1.3	0.6	0.2	2.3	1.0	1.8	0.3	0.6	-	-	-	1.0
Other herbs	0.5	2.0	2.2	0.3	3.9	3.8	4.9	5.5	3.5	2.3	0.8	1.0	0.5	1.6	0.5	0.3	0.2	0.1	0.2	0.1	0.2	-	-	-	-	-	-	-

a number of Distichlis stems estimated in two cases

c grasses counted as clumps rather than individual stems

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Table 16. Data on percent cover (Trepp Scale) and density (stems per ft^2) for Phragmites communis and other species in two transect lines from Great Bay Boulevard.

162 + 25 E (Section 2)

ft from road edge		1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	mean
elevation above mlw		4.46	4.34	4.46	4.36	4.46	4.38	4.08	4.64	4.38	3.76	3.20	3.15	3.12	3.05	2.95	2.78	2.74	2.20	3.67
Phragmites communis	% c	-	-	2	2	5	5	5	5	5	5	4	4	4	3	3	3	2	2	49.7
	d	-	-	1	-	6	4	1	3	4	5	2	4	8	4	4	11	-	-	3.1
Teucrium canadense	% c	1	1	1	1	2	1	2	2	-	-	-	-	-	-	-	-	-	-	4.3
	d	1	3	1	9	5	2	2	-	-	-	-	-	-	-	-	-	-	-	1.3
Other grass sp.	% c	5	4	4	3	1	-	-	-	-	-	-	-	-	-	-	2	-	2	16.1
	d	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3	0.4
Other herb sp.	% c	x	-	3	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-	3.4
	d	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	5	-	-	0.5
Woody plant sp.	% c	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	0.8
	d	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	0.2

238 + 25 E (Section 4)

ft from road edge		1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	mean
elevation above mlw		4.97	4.97	4.88	4.96	5.06	5.14	5.14	5.01	4.91	4.90	4.90	4.92	4.90	5.04	4.72	4.56	4.46	4.28	4.87
Phragmites communis	% c	-	-	2	5	3	5	4	5	4	5	5	5	5	5	5	5	4	3	64.2
	d	-	-	-	1	3	5	6	3	3	3	3	4	2	3	-	4	4	3	2.6
Other grass sp.	% c	4	5	5	3	4	1	-	-	-	-	-	-	-	-	-	-	-	-	19.0
	d	4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6
Herb sp.	% c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Woody plant sp.	% c	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0

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Table 17 . Data for mean percent basal area for litter, bare soil, trash, and water for all quadrats at a given distance from edge of road. Number of quadrats used is given in Table 8 .

Distance (ft)	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	38
Litter	68.0	78.1	71.0	71.8	71.6	73.2	71.2	73.0	73.5	58.7	66.1	58.3	56.5	46.7	42.8	47.2	46.8	34.0	34.5	14.7
Bare soil	16.2	6.7	7.9	8.9	11.7	13.2	11.7	16.2	13.4	16.3	17.0	18.2	20.7	20.3	20.4	20.4	17.3	25.3	31.0	41.5
Trash	3.0	2.8	4.9	5.2	3.2	1.9	0.6	1.1	1.8	1.5	2.4	0.4	3.9	4.9	4.1	2.6	4.0	5.0	2.7	0.2
Water	-	-	-	-	-	-	-	-	-	-	2.9	7.9	14.5	20.8	21.4	21.5	21.9	20.6	19.2	38.3

Table 18 . Data for mean percent basal area for litter, bare soil, trash, and water for quadrats at a given elevation above mean low water (USC & GS Datum 1929). Number of quadrats at each elevation is given in Table 9 .

Elevation (ft)	>7.5	7.25 - 7.5	7.0- 7.25	6.75- 7.0	6.5- 6.75	6.25- 6.5	6.0- 6.25	5.75- 6.0	5.5- 5.75	5.25- 5.5	5.0- 5.25	4.75- 5.0	4.5- 4.75	4.25- 4.5	4.0- 4.25	3.75- 4.0	3.5- 3.75	3.25- 3.5	3.0- 3.25	2.75- 3.0	2.5- 2.75	2.25- 2.5	2.0- 2.25	1.75- 2.0	1.5- 1.75	1.25- 1.5	1.0- 1.25	<1.0
Litter	62.5	51.7	82.5	87.5	78.0	39.4	45.5	79.2	80.4	61.6	73.3	76.2	78.9	76.1	69.2	72.8	68.5	70.2	65.4	47.1	47.5	23.7	17.4	20.3	10.2	6.5	1.2	1.5
Bare soil	35.0	51.7	8.5	-	15.5	49.8	41.4	0.8	7.3	9.3	5.3	11.1	4.6	5.7	11.7	8.0	16.7	16.5	16.8	20.8	29.3	35.0	38.1	60.0	60.5	55.4	-	5.3
Trash	-	7.5	3.5	1.7	1.2	-	3.0	0.8	0.7	18.3	7.8	2.5	3.4	8.0	1.8	1.5	1.2	0.5	1.7	2.2	2.1	5.0	0.6	0.6	1.0	0.7	-	4.2
Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	2.9	-	3.7	17.9	10.5	36.3	36.0	13.8	19.2	25.7	87.5	78.3

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Table 19 . Organic content and particle size analysis of soils from Great Bay Boulevard.

Point	Quadrat	% Organic	% Mineral	% of Mineral: % Gravel >2.0mm	% Sand 2.0-0.25	% Fine Sand 0.05-0.25	% Clay <0.05
110 + 75	(1)	2.8	97.2	9.8	69.2	18.7	2.4
W	(5)	1.5	98.5	38.7	44.2	13.5	3.6
	(10)	4.2	95.8	19.9	64.3	12.3	3.5
	(15)	17.4	82.6	0.0	12.5	47.5	40.0
116 + 75	(1)	4.8	95.2	7.9	70.2	20.0	2.0
E	(5)	3.3	96.7	20.7	60.9	15.5	3.0
	(10)	36.4	63.6	0.3	3.6	45.5	50.6
	(15)	22.7	77.3	0.0	0.7	71.9	27.4
147 + 25	(1)	1.8	98.2	26.6	54.7	13.4	5.3
W	(5)	18.3	81.7	11.4	61.9	22.2	4.6
	(10)	19.7	80.3	0.0	19.5	55.3	25.2
	(18)	8.6	91.4	0.0	1.5	68.0	30.6
149 + 75	(1)	4.1	95.9	37.9	51.6	8.2	0.0
E	(5)	7.8	92.2	11.9	68.0	17.7	2.4
	(10)	21.9	78.1	0.0	19.9	57.7	22.4
	(15)	2.3	97.7	2.7	64.6	26.8	5.9
186 + 75	(1)	1.3	98.7	17.2	64.1	12.5	6.2
E	(5)	12.4	87.6	2.7	68.6	22.6	6.1
	(10)	7.0	93.0	7.6	32.2	33.0	27.2
	(15)	36.6	63.4	0.6	2.4	54.4	42.7
191 + 75	(1)	4.5	95.5	15.6	65.7	15.8	2.9
W	(5)	2.2	97.8	25.6	64.9	8.1	1.3
	(10)	33.5	66.5	3.8	54.7	31.3	10.2
	(15)	33.5	66.5	0.0	11.5	59.8	28.8
210 + 75	(1)	7.0	93.0	7.2	75.2	16.2	1.4
E	(5)	19.0	81.0	11.4	66.6	19.5	2.5
	(10)	23.1	76.9	0.1	23.4	47.8	28.7
	(15)	64.9	35.1	0.0	2.2	23.8	74.0
242 + 25	(1)	9.2	90.8	0.4	21.4	43.6	34.6
W	(5)	7.3	92.7	0.0	10.2	59.5	30.4
	(10)	14.0	86.0	6.4	28.5	46.3	18.9
	(15)	11.3	88.7	10.0	61.1	18.4	10.6
289 + 25	(1)	11.3	88.7	27.7	54.1	14.1	4.1
E	(5)	6.0	94.0	15.3	68.9	10.3	5.5
	(10)	1.6	98.4	12.5	78.0	7.5	2.0
	(15)	37.4	62.6	0.5	11.5	50.0	37.9
	(20)	32 6	67.4	0.2	11.9	47.9	40.0
298 + 25	(1)	6.1	93.9	18.4	70.7	9.5	1.4
W	(5)	7.9	92.1	4.9	80.5	11.5	3.1
	(10)	9.2	90.8	1.4	83.6	12.4	2.5
	(15)	6.4	93.6	15.1	71.5	10.0	3.4

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Table 19. (cont.)

Point	Quadrat	% Organic	% Mineral	% of Mineral			
				% Gravel >2.0mm	% Sand 2.0-0.25	% Fine Sand 0.05-0.25	% Clay <0.05
324 + 25 W	(1)	4.0	96.0	14.4	58.2	20.9	6.5
	(5)	2.6	97.4	37.8	47.9	11.4	2.9
	(10)	1.8	98.2	70.9	24.2	4.2	0.7
	(15)	20.0	80.0	0.4	22.1	41.9	35.6
	(20)	23.4	76.6	0.2	1.7	37.5	60.6
328 + 25 E	(1)	6.5	93.5	17.9	63.2	16.3	2.6
	(5)	4.7	95.3	9.6	55.3	31.0	4.1
	(10)	3.5	96.5	12.8	62.8	22.5	2.0
	(15)	10.3	89.7	5.8	34.3	52.6	7.4
	(20)	44.7	55.3	0.0	10.3	66.6	23.1

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Table 20 . Summary by points for organic content and particle size of soils from Great Bay Boulevard.

Total for	n	% Organic	% Mineral	% of Mineral			
				Gravel	Sand	Fine Sand	Clay
all (1)	12	5.2	94.8	16.8	59.8	17.4	5.8
all (5)	12	7.8	93.2	15.8	58.2	20.2	5.8
all (10)	12	14.6	85.4	11.4	41.2	31.4	16.2
all (15-20)	15	24.3	75.7	2.4	21.6	44.8	31.1
all (1)E	6	5.8	94.2	19.3	63.1	14.6	2.7
all (1)W	6	4.7	95.3	14.2	56.6	20.3	8.8
all (5)E	6	8.9	91.1	11.9	64.7	19.4	3.9
all (5)W	6	6.6	93.4	19.7	51.6	21.0	7.6
all (10)E	6	15.6	84.4	5.6	36.6	35.7	22.2
all (10)W	6	13.7	86.3	17.1	45.8	27.0	10.2
all (15-20)E	8	31.4	68.6	1.2	17.2	49.3	32.3
all (15-20)W	7	17.2	82.8	3.7	26.0	40.4	29.9

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Table 21 . Quadrat locations for introduced plant species from Great Bay Boulevard.

Species	Number of Quadrats	Range	Mean
Lonicera japonica	57	1-16	5.39
Rumex acetosella	27	1-7	3.19
Festuca myuros	21	1-13	4.84
Plantago lanceolata	16	1-4	1.88
Bromus tectorum	13	1-16	5.85
Poa compressa	10	1-5	2.70
Digitaria sanguinalis	9	1-6	2.67
Lactuca serriola	4	11-17	14.75
Polygonum convolvulus	4	1-4	2.50
Prunus persica	3	13-15	14.00
Eragrostis curvula	2	4-5	4.50
Eragrostis pilosa	2	1-2	1.50
Rumex crispus	2	1-2	1.50
Trifolium repens	2	2-3	2.50
Asparagus officinalis	1	12	12.00
Bassia hirsuta	1	13	13.00
Dactylis glomerata	1	1	1.00
Dianthus armeria	1	2	2.00
Eleusine indica	1	1	1.00
Lespediza cuneata	1	2	2.00
Total 19 sp.	178		4.52
Mean without Lonicera	121		4.10

Table 22 . Comparison of data collected by M. A. Pokras and M. L. Pokras, March-April, 1974 (P & P) with data collected on the same transect lines by J.D. Montgomery and M.R. Newcomb, September, 1974 (M & N). F = frequency C = mean percent cover D = mean density in stems per ft^2

Transect	89 + 25 E						104 + 75 E						110 + 75 W						116 + 25 E					
	P & P			M & N			P & P			M & N			P & P			M & N			P & P			M & N		
	F	C	D	F	C	D	F	C	D	F	C	D	F	C	D	F	C	D	F	C	D	F	C	D
Woody plants																								
Rhus copallina	-	-	-	-	-	-	52.6	17.5	0.4	52.6	22.2	0.3	-	-	-	10.5	1.2	0.1	-	-	-	-	-	-
Myrica pensylvanica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.3	13.0	2.2	31.6	19.3	1.4
Lonicera japonica	-	-	-	-	-	-	21.1	4.1	0.3	36.8	6.2	0.2	-	-	-	-	-	-	-	-	-	10.5	0.5	0.0
Prunus serotina	-	-	-	-	-	-	-	-	-	5.2	0.9	0.1	-	-	-	-	-	-	10.5	0.5	0.0	10.5	6.6	0.1
Juniperus virginiana	-	-	-	-	-	-	-	-	-	-	-	-	20.0	12.1	0.0	20.0	9.7	0.0	-	-	-	-	-	-
Baccharis halimifolia	16.7	5.1	0.1	33.3	11.0	0.1	-	-	-	5.2	0.9	0.3	-	-	-	-	-	-	26.3	6.7	0.1	36.8	13.3	0.1
Iva frutescens	5.6	2.1	0.4	11.1	3.8	0.4	21.1	9.1	0.1	15.8	6.2	0.1	10.5	0.5	0.0	15.8	5.8	0.0	26.3	5.4	0.2	42.1	18.4	1.4
Herbs																								
Rumex acetosella	38.9	3.1	5.8	38.9	2.6	4.8	21.1	0.8	1.2	21.1	1.1	0.8	-	-	-	15.8	0.5	0.6	-	-	-	-	-	-
Solidago sempervirens	16.7	0.3	0.3	16.7	0.6	0.2	26.3	4.3	0.7	52.6	17.8	1.1	31.6	1.1	1.2	36.8	8.9	1.2	10.5	0.3	0.5	42.1	6.0	1.1
Grasses																								
Panicum virgatum	33.3	11.2	0.3	50.0	15.3	0.6	-	-	-	57.9	4.0	0.4	-	-	-	31.6	1.3	0.3	-	-	-	5.3	0.0	0.1
Festuca myuros	-	-	-	27.8	2.9	0.6	-	-	-	21.1	1.5	0.2	-	-	-	15.0	2.5	0.5	-	-	-	10.5	1.2	0.2
Andropogon scoparius	-	-	-	-	-	-	-	-	-	15.8	6.2	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Phragmites communis	5.6	0.3	0.0	33.3	2.8	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Distichlis spicata	-	-	-	5.5	0.0	0.2	5.2	0.0	0.2	26.3	3.0	2.5	-	-	-	-	-	-	10.5	0.3	0.0	36.8	12.4	16.5
Spartina patens	27.8	8.5	0.2	33.3	8.5	1.0	5.2	0.0	0.1	-	-	-	10.5	0.5	0.0	-	-	-	21.1	6.2	0.2	15.8	1.2	0.2
Spartina alterniflora	16.7	2.2	1.8	33.3	6.2	4.9	5.2	0.3	0.0	10.5	1.2	0.2	31.6	15.8	5.9	42.1	12.9	6.4	5.3	0.0	0.3	10.5	1.2	0.7
Other grass*	61.1	5.6	64.7	27.8	8.2	1.2	84.2	6.7	15.0	42.1	3.3	1.1	63.2	3.8	54.1	52.6	3.8	14.4	63.2	4.8	11.9	26.3	3.2	2.5
Litter (Basal Area)		75.7			54.9			84.9			84.9			49.2			40.0			77.2			79.9	
Soil (Basal Area)		16.1			26.4			9.6			5.3			46.9			57.5			15.2			12.2	
Trash (Basal Area)		2.4			0.6			1.4			1.1			1.4			2.0			1.2			1.1	

* The category other grass in P & P includes data for unidentified grass species, including some listed separately for M & N; in M & N includes the following species: Aristida dichotoma, Bromus tectorum, Dactylis glomerata, Digitaria sanguinalis, Elymus virginicus, Eragrostis curvula, Festuca rubra, Poa compressa.

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Table 23 . Chi-square contingency table values for association or random distribution of species-pairs on Great Bay Boulevard. Associations are given in Table 24 . Blank pairs were not tested.

Panicum virgatum											
44.78	Rhus copallina										
30.00	15.43	Myrica pensylvanica									
26.57	6.60	28.15	Solidago tenuifolia								
20.86		1.47	1.83	Solidago sempervirens							
0.07		1.96	3.55	20.84	Baccharis halimifolia						
				15.81	57.37	Spartina patens					
						0.01	Distichlis spicata				
38.19		18.16		16.41	5.88	31.71	60.17	Iva frutescens			
84.94				41.43	43.64	0.57	0.01	19.75	Spartina alterniflora		
								29.90	41.26	Salicornia europaea	
											Phragmites communis
16.31					0.09				15.29		17.02 trash

Table 24 . Positive and negative association and random distribution for certain species-pairs on Great Bay Boulevard. + indicates positive association, - negative association, 0 random distribution. Blank pairs were not tested.

Panicum virgatum											
+	Rhus copallina										
+	+	Myrica pensylvanica									
+	o	+	Solidago tenuifolia								
+		o	o	Solidago sempervirens							
o		o	o	+	Baccharis halimifolia						
				+	+	Spartina patens					
						o	Distichlis spicata				
-		-		+	o	+	+	Iva frutescens			
-				-	-	o	o	+	Spartina alterniflora		
								+	+	Salicornia europaea	
											Phragmites communis
+					o				+		+ trash

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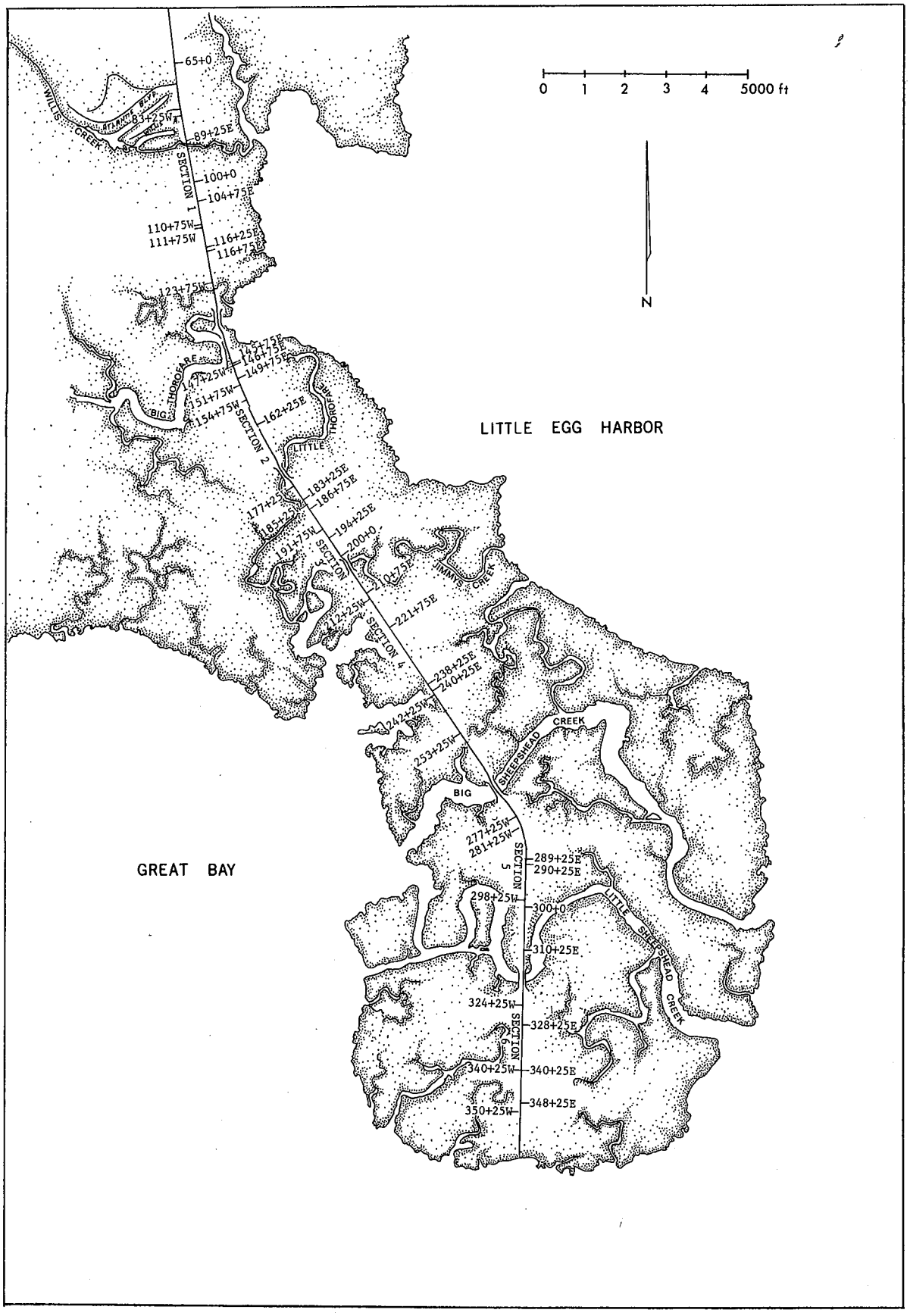

Figure 1. Tuckerton marsh and Great Bay Boulevard, showing location of Sections and transect lines.

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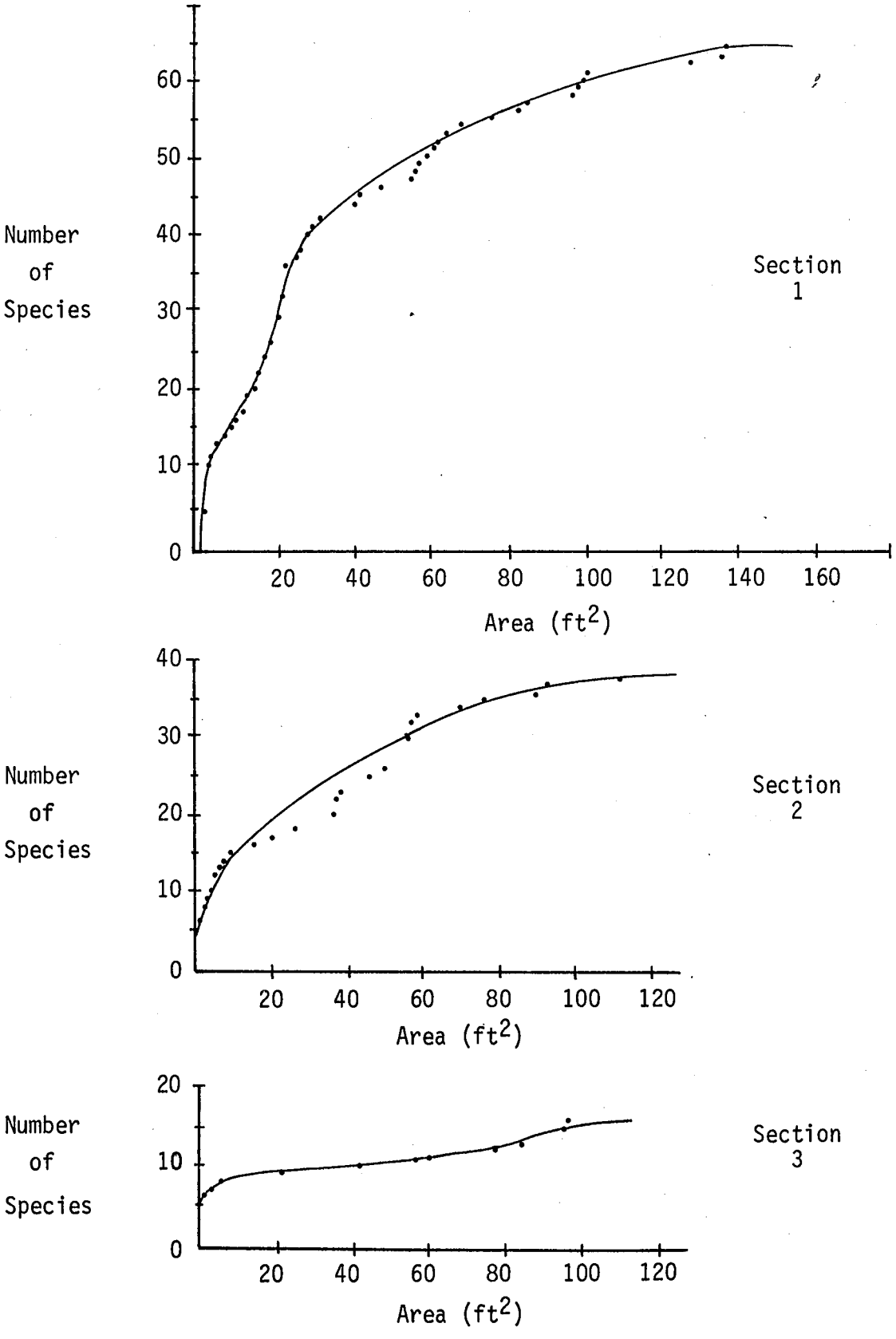

Figure 2. Species area curves for each section.

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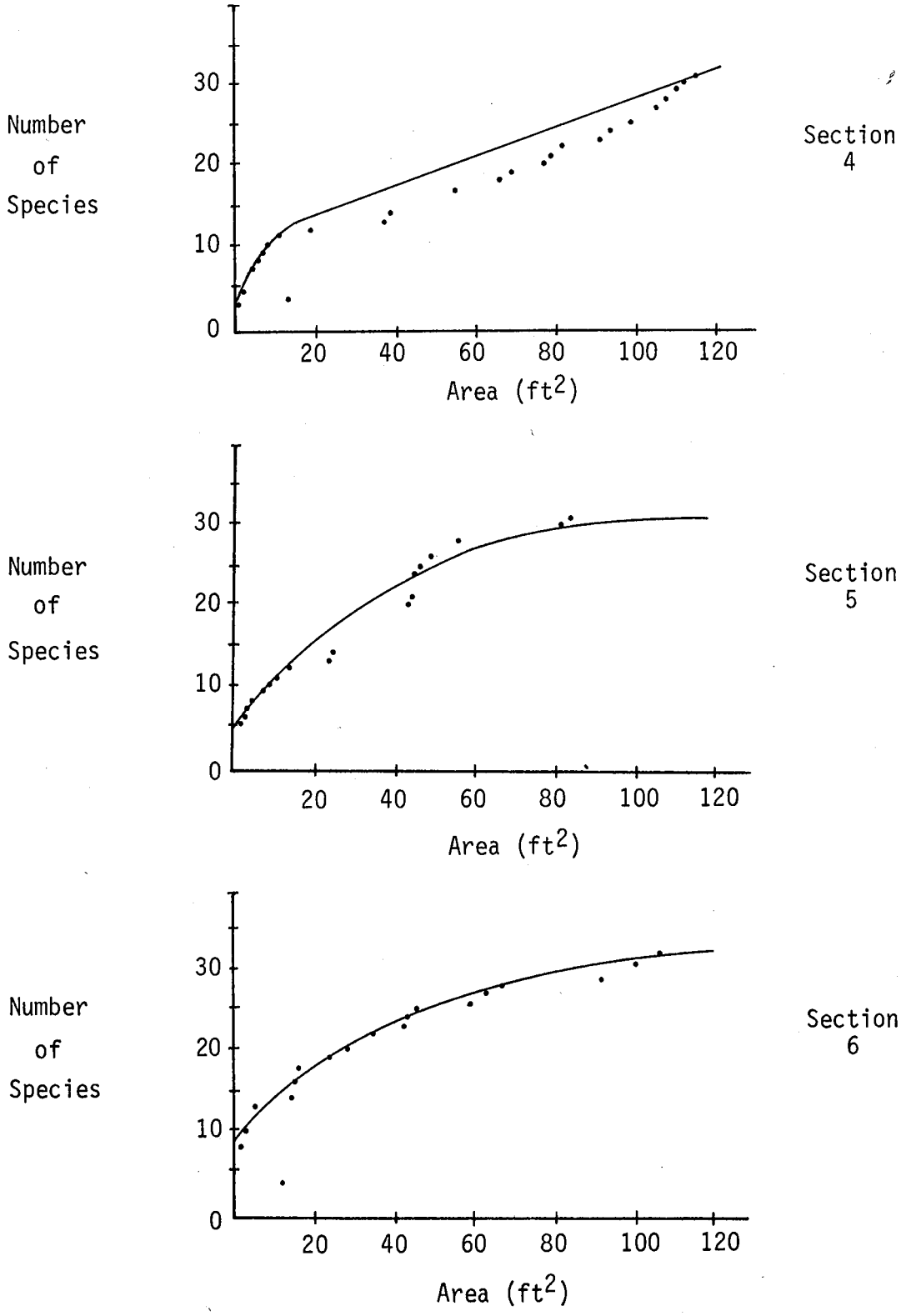

Figure 2 . (cont.)

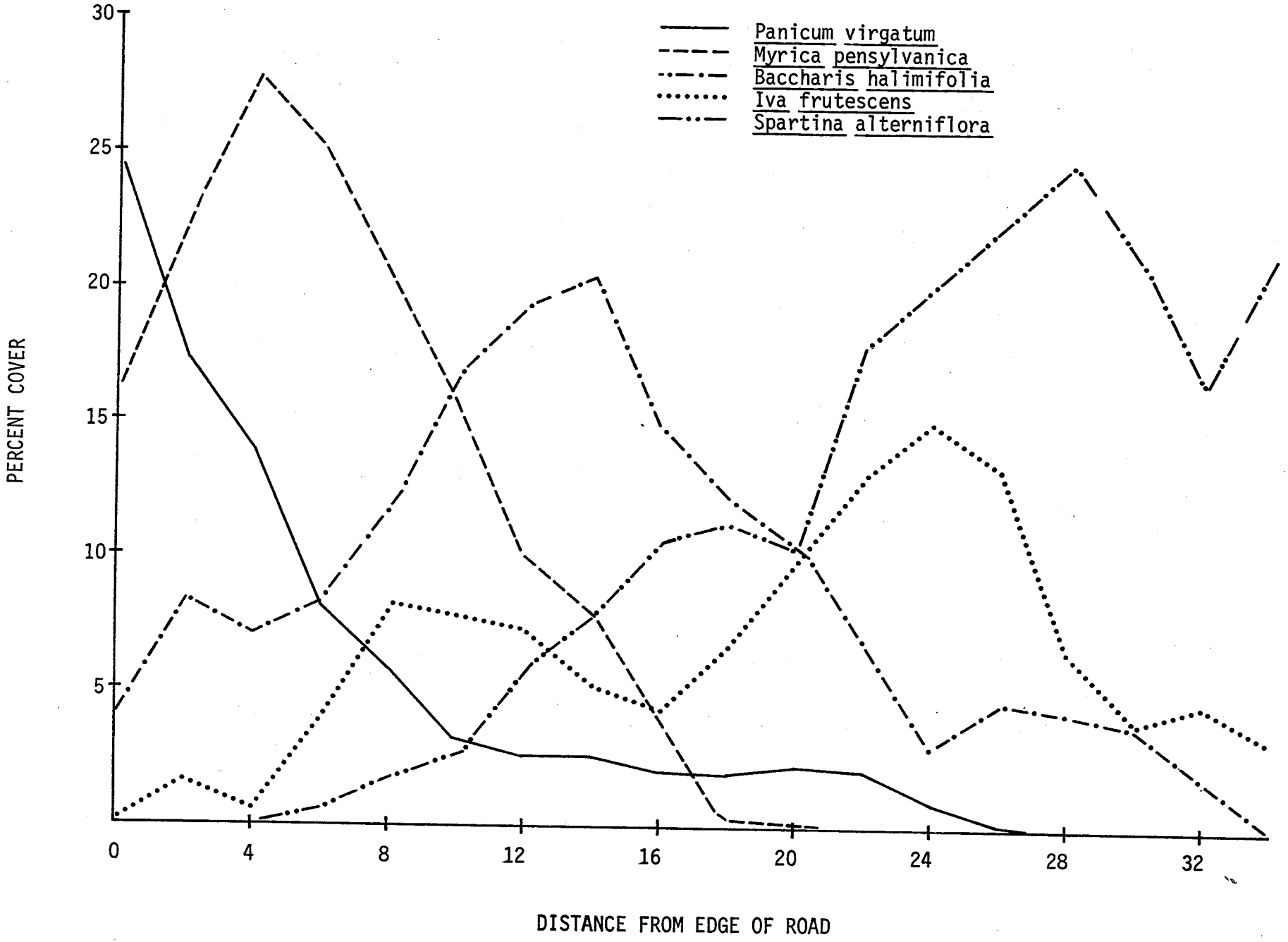

Figure 3. Percent cover in relation to distance from edge of road for five plant species from Great Bay Boulevard.

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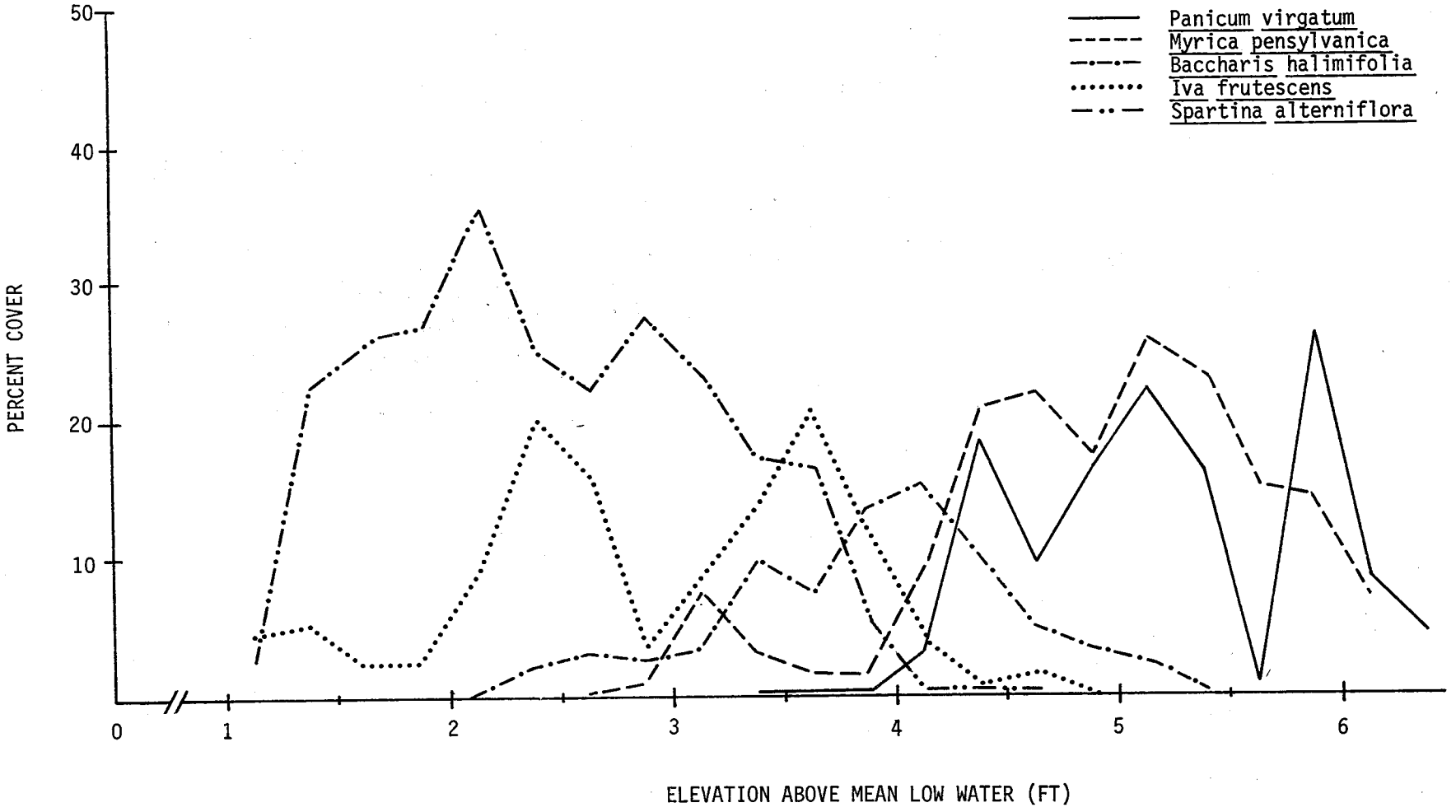

Figure 4 . Change in percent cover with elevation above mean low water (datum USC & GS 1929) for five species from Great Bay Boulevard .

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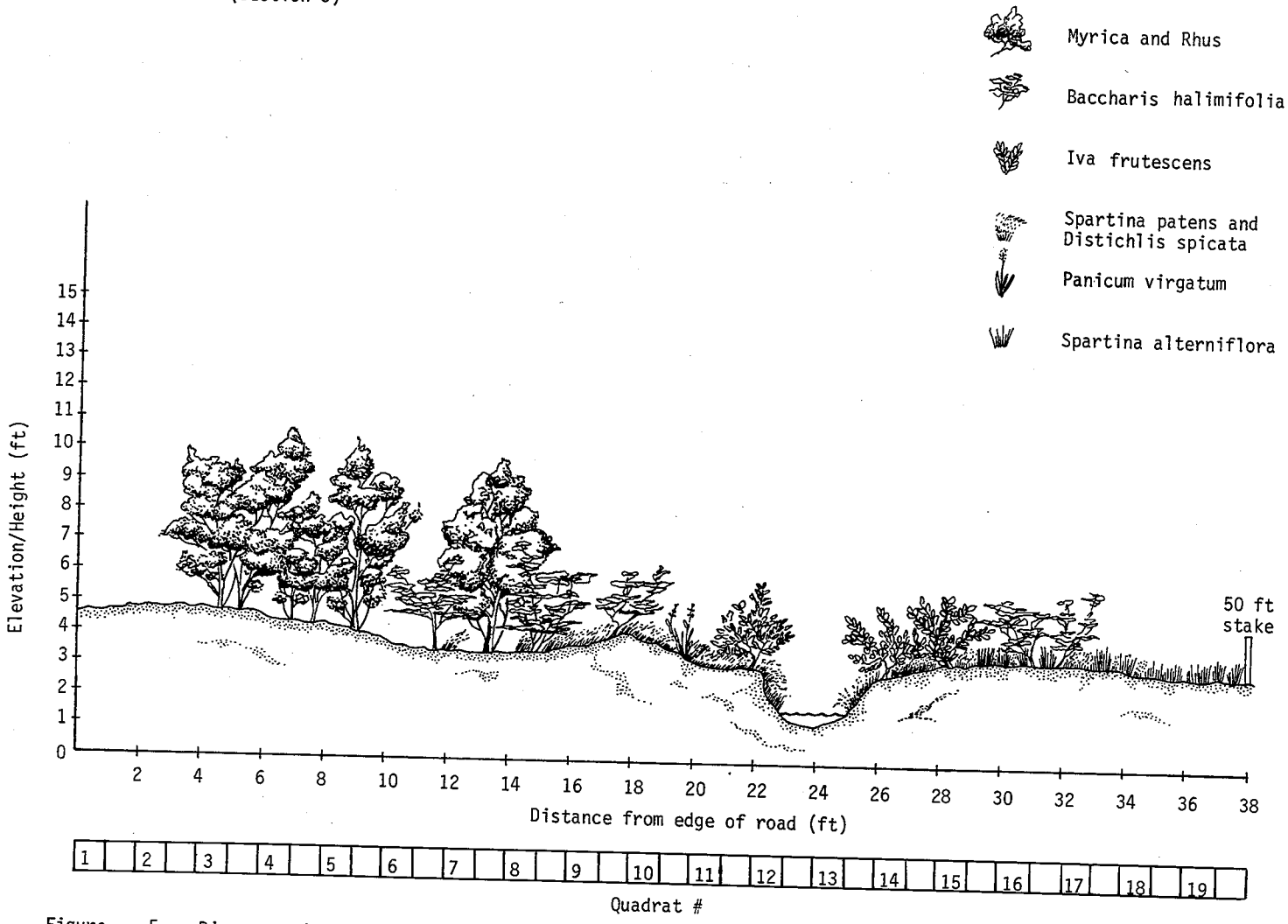

Figure 5 . Diagrammatic cross-section of transect at 177 + 25 W (Section 3), a transect with typical shrub zone.

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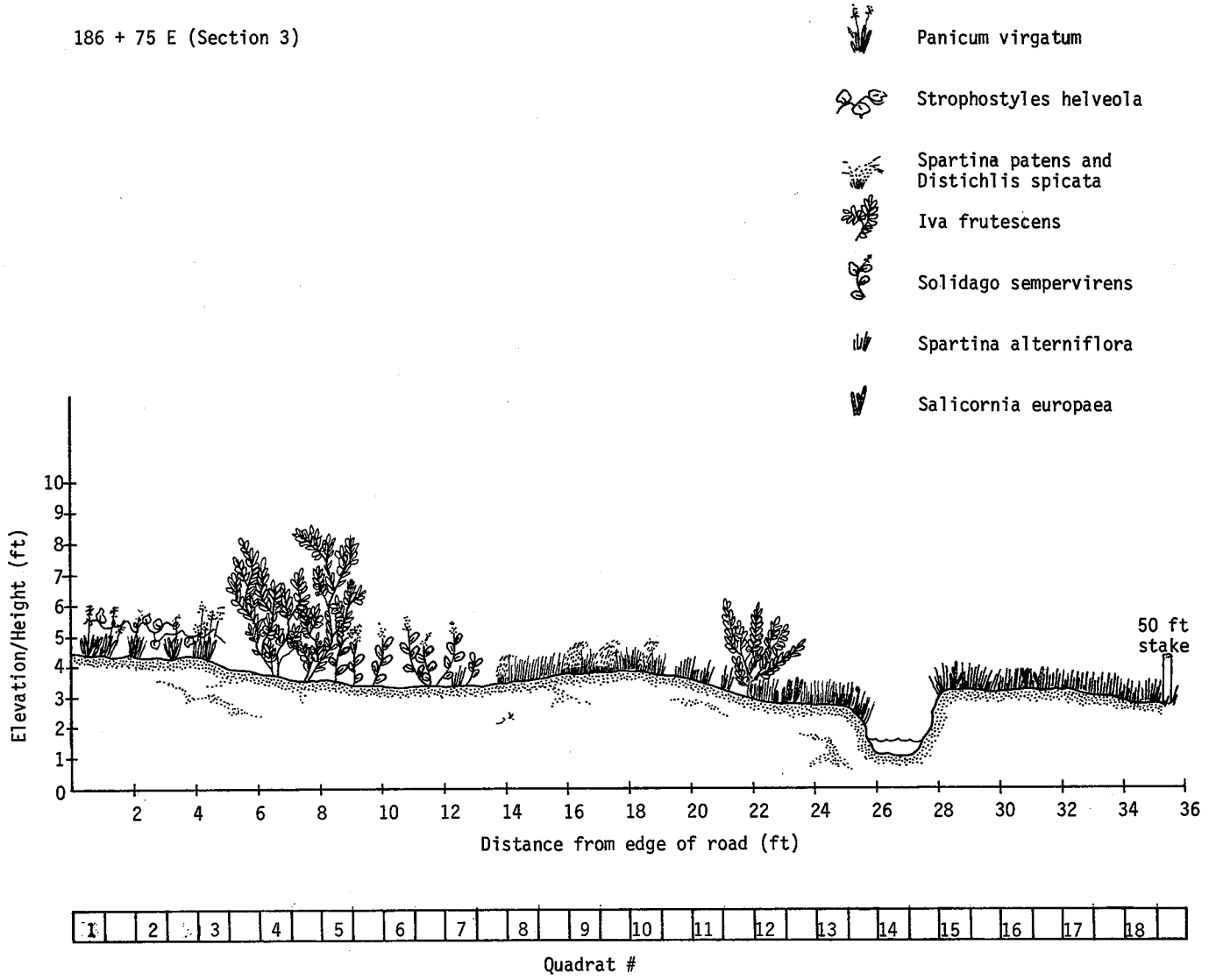

Figure 6 . Diagrammatic cross-section of transect at 186 + 75 E (Section 3), a transect with relatively little shrub zone.

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