

BARRIER ISLAND ECOLOGY

I. Objectives:

1. Examine changes in community composition along an environmental gradient (an ecotone), with particular emphasis on patterns of change in plant dominance and diversity.
2. Learn vegetational sampling techniques appropriate for examining patterns along a defined gradient.
3. Examine general characteristics of barrier island communities (sand dune and salt marsh) and the factors regulating their composition.

II. Introduction:

Ecologists often are interested in changes in distribution and abundance that occur along an environmental gradient (termed an ecotone). Such environmental gradients are an important part of almost all habitats and may range from the barely detectable changes in humidity a centipede experiences as it moves from under a leaf to an exposed surface to the dramatic differences apparent between upland and submerged habitats (swamps, lakes, etc.).

Along our coast in North Carolina, obvious examples of environmental gradients can be seen in both sand dune and salt marsh habitats on barrier islands. In sand dunes, the foredune area (facing the ocean) experiences salt spray blown from the ocean, high winds, and blowing and shifting sands. The dune crest has a similar environment, though the degree of sand shifting and salt spray may be less than seaward areas. However, the habitats behind the dune, including the backdune and dune swale regions, experience more protected conditions. These areas usually have relatively stabilized substrates (except during major storms), minimal direct salt spray under non-storm conditions, and often may have freshwater available relatively near the surface (especially the dune swale).

For most terrestrial plants, these environmental changes present a gradient of relatively harsh conditions on the foredune to more hospitable circumstances behind the dune crest. One would expect a parallel gradient in community composition.

The salt marsh also represents a gradient of environmental conditions, in this case based primarily on the time a given area is submerged by salt water. Since water-logged soils and salt water can be harmful to many higher plants, one might expect changes in plant dominance and abundance as one moves from high ground into those portions of the salt marsh that are inundated on a daily basis.

III. Methodology:

A. Sand Dune Community

The types of plants in each area and their relative abundance will be sampled using quadrats laid along a transect from the foredune to the dune swale, working in groups of four students each. We will use percent cover as a measure of abundance and resource use by the various plants. Percent cover is one of several techniques useful for sampling vegetation and is particularly applicable when one is studying organisms with modular growth or if one is interested in how different species use the space resource rather than simply numerical abundance.

You will use a quadrat that has two sets of five lines that intersect at right angles forming 25 intersection points. Percent cover will be determined by recording the species of plant that lies under each intersection point (or “bare space” if no plants occur under a point). The percent cover for a plant in that quadrat is then determined by the number of points where it is recorded divided by 25.

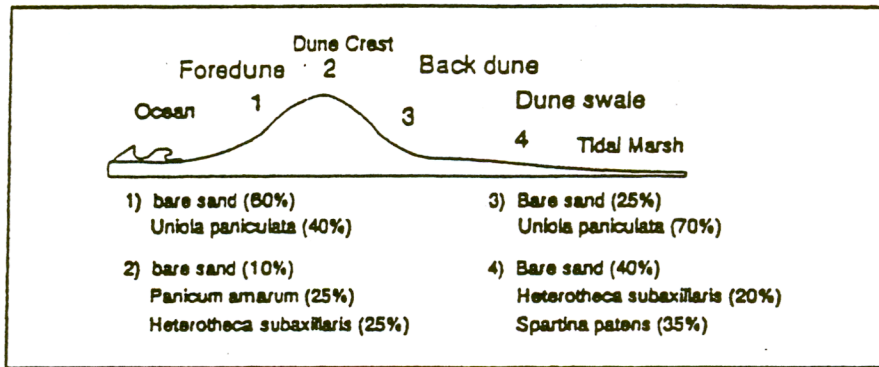
The exact manner in which these transects will be placed and the quadrat sampling performed will be demonstrated by the instructor. All work will be completed in groups of four and the data entered onto the data sheets provided. When the class returns to the laboratory at the end of the field trip, the data from the individual groups will be combined into class data. The laboratory assignment will be on the combined class data.

B. Salt Marsh Community

Characteristics of salt marsh plants and zonation within the salt marsh community will be described by the instructor in the field.

IV. **Laboratory Assignment:**

1. In a table, list the plant species found at each sampling area and their average percent cover for the class as a whole. Be sure to list all species observed by the class (not just your group), use the average percent cover for all groups at that area, and don't forget to average in zero's when computing your percent cover.
2. In order to observe how the dominant members of the plant community change along the dune ecotone, diagram a dune profile for the class data in which you indicate which species dominates at each of the sampling areas. For this profile, draw a cross-section of the dune system indicating the sampling areas. Indicate which species covered more than 10% of the space sampled (include bare space when it occurred more than 10% of the time). An example, using invented data, is given below:



3. Using a chi-square test, determine whether the total number of species is significantly different between the sampling areas. To do this, construct a table that lists the total number of plant species observed by the class in each of the sampling areas (if you have four sampling areas, your table will have four columns, each indicating the total number of species observed in the area). You can then compute the chi-square statistic as we have done before, using the average of the four numbers as the expected value.
4. Answer the following questions:
 - a) Explain why there was (or was not) a difference in the number of species between the sampling areas. If there was a difference, which areas had the highest number of species?
 - b) Why did our sampling technique measure relative abundance rather than absolute density? How would you measure absolute density of these dune plants?
 - c) From your data, which plants are probably most tolerant of salt and sand movement and which are least tolerant?

Characteristic Plant Species of the Sand Dunes and Tidal Marsh

Note the habitat and other pertinent information concerning each of the following plants.

Common Name	Scientific Name	Habitat	Comments
1. Goldenrod	<i>Solidago sempervirens</i>	_____	_____
2. Sea rocket	<i>Cakile harperi</i>	_____	_____
3. Black needlerush	<i>Juncus roemerianus</i>	_____	_____
4. Sea oats	<i>Uniola paniculata</i>	_____	_____
5. Salt marsh aster	<i>Aster tenuifolius</i>	_____	_____
6. Dune spurge	<i>Euphorbia polygonifolia</i>	_____	_____
7. Sea ox-eye	<i>Borrchia frutescens</i>	_____	_____
8. Amer. beachgrass	<i>Ammophila breviligulata</i>	_____	_____
9. Saltmeadow cordgrass	<i>Spartina patens</i>	_____	_____
10. Smooth cordgrass	<i>Spartina alterniflora</i>	_____	_____
11. Sea lavender	<i>Limonium carolinianum</i>	_____	_____
12. Cactus	<i>Opuntia drummondii</i>	_____	_____
13. Broomsedge	<i>Andropogon virginicus</i>	_____	_____
14. Sea elder	<i>Iva imbricata</i>	_____	_____

15. Marsh elder

Iva frutescens

16. Panic grass

Panicum amarum

17. Camphorweed

Heterotheca subaxillaris

18. Wax myrtle

Myrica cerifera

19. Glasswort

Salicornia virginica

20. Paronychia

Paronychia riparia

21. Evening primrose

Oenothera humifusa

22. Suaeda

Suaeda linearis

23. Pennywort

Hydrocotyle bonariensis

24. Sandspurs

Cenchrus tribuloides

25. Diodia

Diodia teres

26. Catbrier

Smilax bona-nox

27. Beach pea

Strophostyles helvola

28. Yucca

Yucca aloifolia

29. Yaupon

Ilex vomitoria

30. _____

31. _____

32. _____

Sand Dune and Salt Marsh Ecology

Group members: _____

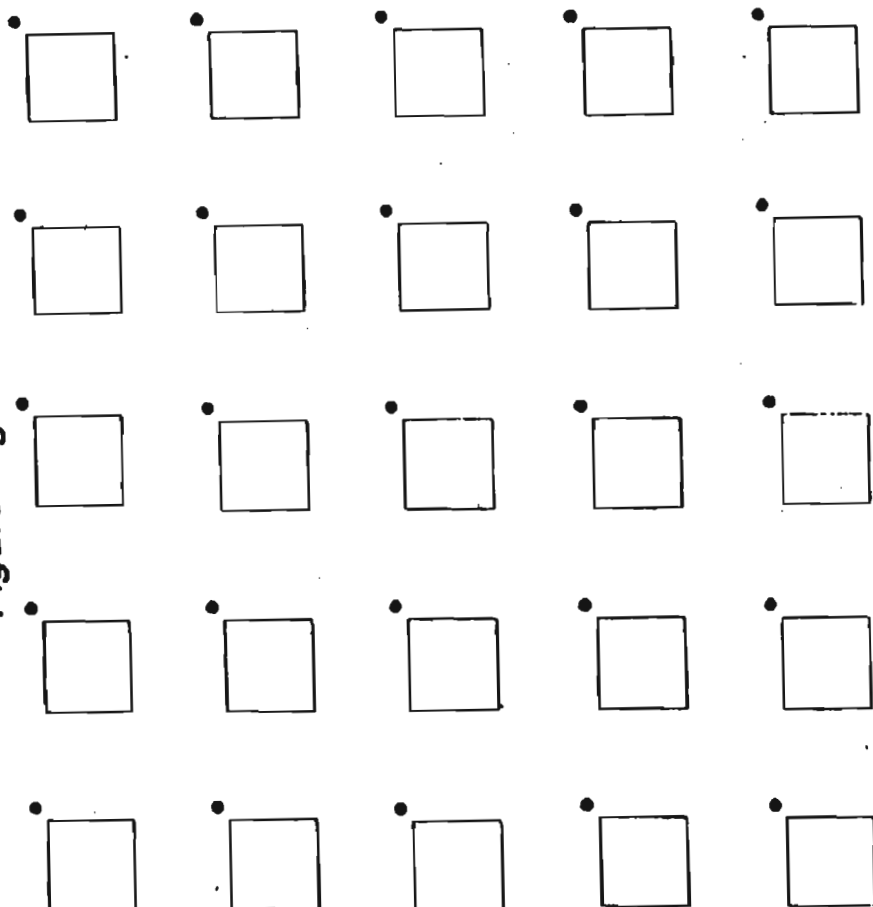
Date: _____

Location: _____

Sheet _____ of _____

Data Sheet

Figure Eight Island



Ocean

Sound

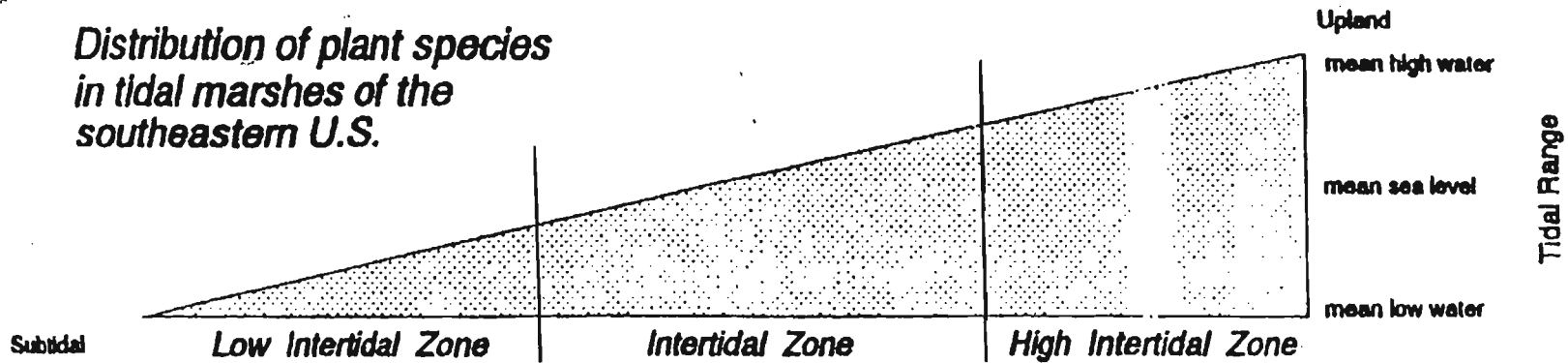
Wrightsville Beach

Species

1. Goldenrod *Solidago sempervirens*
2. Sea rocket *Cakile harperi*
3. Sea oats *Uniola paniculata*
4. Dune spurge *Euphorbia polygonifolia*
5. Amer. beachgrass *Ammophila breviligulata*
6. Saltmeadow cordgrass *Spartina patens*
7. Cactus *Opuntia drummondii*
8. Broomsedge *Andropogon virginicus*
9. Sea elder *Iva imbricata*
10. Panic grass *Panicum amarum*
11. Camphorweed *Heterotheca subaxillaris*
12. Wax myrtle *Myrica cerifera*
13. Paronychia *Paronychia riparia*
14. Evening primrose *Oenothera humifusa*
15. Pennywort *Hydrocotyle bonariensis*
16. Sandspurs *Cenchrus tribuloides*
17. Diodia *Diodia teres*
18. Catbrier *Smilax bona-nox*
19. Beach pea *Strophostyles helvola*
20. Yucca *Yucca aloifolia*
21. Yaupon *Ilex vomitoria*
22. _____
23. _____
24. _____

Sand Dune and Salt Marsh Ecology

*Distribution of plant species
in tidal marshes of the
southeastern U.S.*



Tidal Marsh Species

1. Black needlerush *Juncus roemerianus*
2. Salt marsh aster *Aster tenuifolius*
3. Sea ox-eye *Borrchia frutescens*
4. Smooth cordgrass *Spartina alterniflora*
5. Sea lavender *Limonium carolinianum*
6. Saltmeadow cordgrass *Spartina patens*
7. Glasswort *Salicornia virginica*
8. Marsh elder *Iva frutescens*
9. Seaside goldenrod *Solidago sempervirens*
10. Suaeda *Suada linearis*
11. _____
12. _____
13. _____
14. _____

Locate each of the species at left along the intertidal zone diagrammed above. Note the presence of animals and animal signs as well as algae and other lower plants.

Notes: