BIOTIC SUCCESSION IN A COASTAL SALT MARSH

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It is often possible to work out the probable successional relations of an area by a careful study of the zonal communities within that area, and the salt marsh lends itself especially well to such a study because the gradual transition from one zone to another is apparent to even the casual observer.

Grand Isle is a small island off the coast of Louisiana whose size is about 1 by 7 miles. Down the middle of the island there is a rather definite tree line which roughly divides the sand dune or Gulf side on the south from the marsh or back bay side on the north. The marshes of Grand Isle make up a large portion of the island and form a characteristic border along the back bay. This so-called "wet prairie" is also typical of a great body of marshland common in the Gulf Coastal region.

This study was conducted through the months of June and July, 1939, with intensive work on the marsh just back of the Louisiana State University Field Laboratory and observations on the marshes of numerous surrounding small islands. Stations were selected in each of the type communities and weekly checks were made. On each trip to the marsh the animals in representative quadrats were counted, height of the water table recorded, surrounding vegetation swept for insects, and pH and temperature were taken whenever possible. The soil layers with their contents were also studied in each area.

The water table was quite variable. On June 15 the marsh was inundated owing to an excessive wind from the south coincident with the high tide. This caused an unusual amount of water to be sent into the back bay which spread out over the marsh as backwash. On July 11 a similar backwash occurred, but was less extensive than the first.

The soil is typical of the marshland soils in general. As in all soils where inundation is frequent and drainage poor, the mineral matter mingles with the roots tending to form a silty soil rather like clay in nature. The surface material is accordingly more or less compact, impermeable and plastic. It is bluish gray in color, often mottled with iron stains and may be underlain with fibrous peat containing hydrogen sulfide.

The first community beyond the open water is the SPARTINA-LITTORINA community. This portion of the marsh is covered by water a greater part of the time. Here the dominant plant is the salt cane, *Spartina alterniflora*, which forms nearly pure stands. Associated with this in small numbers is the glasswort, *Batis maritima*. Occasional sprouts of honey mangrove, *Avicennia nitida*, are seen. The predominant animal in this region is the common periwinkle, *Littorina irrorata*, which is always found in the wetter parts of the marsh. *Littorina* seems to respond to the frequent inundation of the marsh by climbing up onto the marsh grasses; whether or not this is a tidal rhythm is yet doubtful. Another familiar marsh snail, characteristic though less abundant, is *Neritina reclivata*. One of the commonest inhabitants of this community is the horse mussel, *Modiolus demissus*, but is often overlooked because it burrows in the soil. It is thought that all of these animals feed on algae.

The second marsh community is the DISTICHLIS-LITTORINA community in which the salt cane gives way to the salt marsh grass, *Distichlis*

spicata, while the periwinkle remains the predominant animal. Another glasswort, *Salicornia sp.*, appears as does another common marsh snail, *Melampus coffeus*. The horse mussel and *Neritina* are both present in this community in practically the same numbers as in the first.

The mid-seral community is the DISTICHLIS-MELAMPUS community. Here the salt marsh grass is distinctly the dominant plant although the two glassworts are also present. *Melampus* is the predominant animal here; we also find *Littorina* present in considerable numbers. *Modiolus* is present, though less abundant; we find the fiddler crab, *Uca mordax*, for the first time in this community. It is here that the greatest abundance of insects are found, although the groups present are essentially the same as in the preceding communities. This portion of the marsh is usually covered by from one-fourth to one-half inch of water.

A zonal community which appears in the marsh just back of the laboratory and just next to the tree line is the *BATIS-UCA MORDAX* community which appears to be an intermediate successional stage beween the *Distichlis-Melampus* community and the *Baccharis-Iva* associes of Penfound and Hathaway. Here the ground is relatively dry most of the time; the glassworts are the dominant plants. In fact, they are the only plants present here. The fiddler crabs are definitely the predominant animals. *Uca mordax* is the most common with *U. pugnax* and *U. pugilator* ranking next. According to Rathbun, 1918, these crabs feed on algae.

Perhaps the most striking and interesting of all marsh communities is the honey mangrove community. Mangrove is an evergreen shrub having terete aerial roots and often reaching a height of 25 feet. It is adapted to live in areas of soft, mucky, poorly aerated bottoms. Mangrove readily invades the lower areas of the marsh as is evidenced by the presence of small sprouts in the *Spartina-Littorina* community next the open bay.

Since mangrove usually appears in a stage after *Spartina* and *Distichlis*, it seems that a certain amount of humus is needed in the soil if it is to survive. In the younger stands where it ranged from 4 to 6 feet in height there was an abundance of *Spartina* present beneath it; in the older stands where the mangrove was from 15 to 20 feet in height and formed a forest wall at the water's edge, there was no grass present beneath it at all until towards the center of the island, where the mangrove was only about 4 feet high. Here *Spartina* was again found and as the mangrove stopped, the typical marsh grasses became more abundant, gradually giving way to the marsh proper at the center of the island. Several islands were visited where the mangrove was of medium height, thick and scrubby. Here the drier-marsh plants such as elder, sea-oxeye and groundsel tree were found growing in great tangled masses at the water's edge among the mangrove roots. These plants were especially well developed. Since Penfound and Hathaway, 1938, found that a *Baccharis-Iva* associes normally follows *Avicennia*, this latter community appears to be an intermediate successional stage between *Avicennia* and what these authors term a *Baccharis-Iva* associes.

The animals in the mangrove community are characteristic. The fiddler crabs are the predominant ones, with *Uca mordax* and *U. pugnax* most abundant. The marsh crabs *Sesarma cinerea* and *S. reticulata* are also numerous; the mud crabs *Eurytium* and *Panopeus* are present in considerable numbers at the edge of the water. *Melampus* is always present and *Littorina* is usually found in small numbers.

SUCCESSION

The open bay is, of course, free from plants as are the deeper lagoons of the marsh except for a few algae. Salt cane readily invades the lower

areas, and as these early invaders take root and grow, they build up the surrounding marsh by catching and holding debris which is washed in by the tides. This slowly forms an uplifted region where other plants such as *Distichlis* and *Avicennia* may gain a foothold. In the case of the mangrove it is particularly evident that as the marsh is built up, the higher communities are definitely advancing over the lower. Not only is there a gradation of mangrove away from the water's edge, but there is abundant migration of its seedlings into the grass communities. This fact is further substantiated when we find a considerable mass of partially decomposed roots of the marsh grasses even under the densest stands of honey mangrove (Penfound and Hathaway, 1938). As the mangrove builds the land up to a still higher level, such plants as the marsh elder and groundsel tree are able to come in on somewhat drier soil. In time these plants take precedence over the mangrove which succeeds in killing itself out by building up a set of edaphic conditions under which it cannot survive. The same is true of the *Baccharis-Iva* associes as it gives way to the climax live oak, *Quercus virginiana.*

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