

Trudeau, Philip (1979). "Ecology of Barrier Beaches in South Central Maine (Popham State Park, Reid State Park, and Small Point Beach)".

In an attempt to determine the interactions between plants and coastal processes in Maine, the vegetation, climate, salt spray, ground water, edaphic characteristics, sand source, barrier migration, sea level trends, erosion, overwash, and aeolian sand transport were studied at Popham Beach State Park, Reid State Park, and Small Pt. Beach.

Five dune plant communities were subjectively designated and then analyzed quantitatively. With dominant species ranked in order of importance, the plant communities are: foredune (*Cackile edentula*, *Ammophila breviligulata*, and *Salsola Kali*), dunegrass (*Ammophila breviligulata*, *Lathyrus japonicus*, and *Rubus idaeus*), beach-heather-lichen (*Hudsonia tomentosa* and *Cladonia* spp.), dune shrub (*Myrica pensylvanica*, *Rubus idaeus*, *Spirea tomentosa*, *Rosa virginiana* and *Rhus radicans*), and dune forest (*Pinus rigida*, *Populus tremuloides*, *Betula papyrifera*, *Picea rubens* and *Alnus rugosa*). Compared to other East coast beach systems, *Picea rubens*, *Picea glauca* and *Abies balsamea* are distinctive to the dune forest, while the high diversity and cover of *Caledonia* lichens is more similar to British than American dunes. Average basal area in two dune forests was 28.78 m²/ha. Low marsh standing crop peaked in mid-September, and summer production for 1976 and 1977 was 680 +/- 29 g/m² and 634 +/- 28 g/m², respectively.

Varying with topography and distance from the beach, salt was measured in the air and the espalier tree formation seen on the dunes. Under one barrier, the winter table was found to be consistently level and when it was within 0.5m of the surface, the vegetation was distinctive compared to higher and drier sites. No ground water analyzed under dunes or swales was saline enough to affect the vegetation on the site.

Along a transect from the beach inland, pH was neutral (7.1) seaward of the foredune and more acidic on inland sites (4.15 to 5.15). Soil organic matter was found to be low in the foredune, dunegrass and beach-heather-lichen communities, and increased in the shrub and dune forest. Cation exchange capacity and exchangeable cations (potassium, magnesium, calcium, and sodium) fluctuated rather consistently with the organic matter.

Three lines of evidence were developed to determine whether an inland embayment and a local river supplied sand to the beaches under study: (1) a coring analysis showed relative beach stability; (2) a sieving analysis revealed a decreasing mean and improved sand sorting from the embayment to the coast; and (3) a Fourier analysis of sand grain shape showed a consistent ratio of grain shapes from the embayment down the river and onto one of the beaches.

Three processes or results of coastal processes - overwash, erosion and aeolian sand transport - were monitored along the foredune. Out of 36 profiles examined on three beaches, forty-seven percent experienced overwash as a result of the 1/78 and 2/78 nor'easters, with a mean maximum overwash deposition of 21.4 +/- 7.3 cm. As a result of these same storms, 72% of all beach transects showed some erosion, 14% remain unaffected and 14% prograded. Mean erosion for all 36 profiles was -4.1 +/- 0.7m, and these differences between beaches were significant.

Aeolian sand transport into the foredunes was an active process. Mean sand accretion per stake was 12.9 +/- 1.7 cm for a 1 1/2 years time interval. No significant differences were found between beaches, but significant differences were revealed between regions of the foredune(aeolian ramp, foredune ridge and foredune back slope). In a comparison of sand transport between different measurements dates, seven intervals revealed three groups of statistically significant "seasonal groupings" (in order of increasing sand transport": "summer," "late spring-early summer," and "fall-winter-spring"). During these "seasons", higher wind speeds from a local airport were also significantly different. Therefore, as expected, more sand was transported in seasons with higher wind speeds.