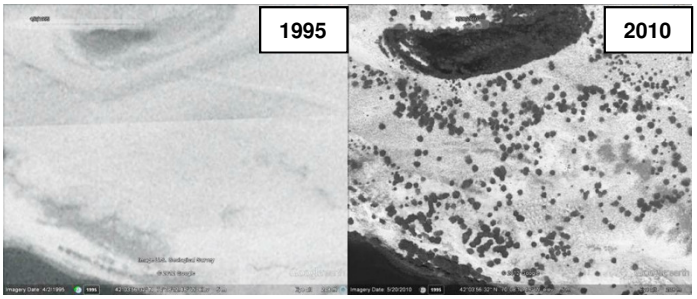
Dune Grassland Monitoring

Background

Coastal dunes make up roughly one third of the Cape Cod National Seashore (CACO), covering approximately 8,500 acres from Chatham to Provincetown. Dunes predominate on barrier beach and spits, along the coastal margins of the Atlantic Ocean and Cape Cod Bay, and across the northern tip of the Cape Cod peninsula – an area known as the Province Lands. CACOs dune areas began forming soon after glacial retreat as sediments eroded from the outwash plain and were re-deposited by long shore currents. Although mature forest eventually became established in many places, it was largely removed by Europeans settlers for building materials and to clear land for agriculture and livestock grazing. Thus, the present-day dune grasslands of CACO are a product of both newly formed coastal landforms and land-use history.

Long-Term Monitoring

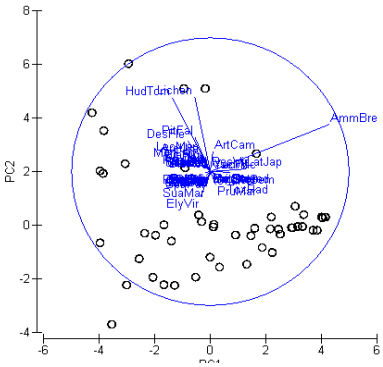
While numerous studies on CACO dune vegetation have been conducted in the past, they have been very limited in scope and the survey methods were not designed for long-term monitoring. Most importantly, most studies were conducted before the advent of GPS technology. As such, it would be extremely difficult to resample any of the original sites. To reliably monitor how the system evolves through time and responds to environmental influences, a standard, repeatable protocol is necessary.



Succession of dune grassland to shrubland/woodland habitat between 1995 and 2010.

Management Applications

Long term monitoring of dune grassland vegetation provides valuable information on the stability of the landscape, resilience to environmental forcing factors (such as storms), and rates of vegetation succession (conversion to forested habitat).



Principal Components Analysis of species composition in dune grassland plots. Plots (black circles) that are close to each other have more similar plant communities while plots distant from each other have disparate communities (not related to geographic distance). The blue lines indicate the species that contribute most to dissimilarities (e.g., AmmBre = beachgrass, HudTom = wooley beach heather; these important species increase during primary succession, then decrease during secondary succession to woodlands and forests)

Status and Trends

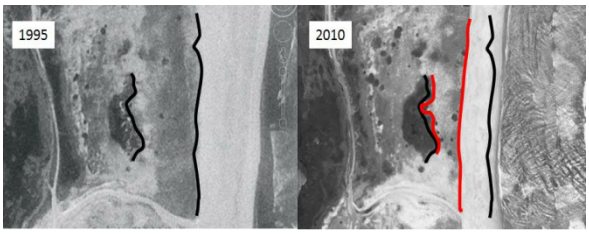
Ground-level vegetation monitoring was implemented in 2006 and 2011. The largest changes occurred where salt marsh encroachment or bluff erosion occurred. Analysis of aerial photography between 1995 and 2010 shows dramatic increases in woody vegetation, especially in beachgrass-dominated dunes of the Province Lands.

In addition to changes in sea level and erosion, there are a number of other important environmental factors influencing dune grasslands. These include desiccation from low soil moisture and high temperatures, nutrient-poor, acid substrate, salt spray, sand blasting and burial, and wind (mechanical stress).

Table showing the presence (P)/absence (A) of selected dune grassland plant species in monitoring plots between 2006 and 2011.

Species	Common name	2006	2011
Bromus tectorum	cheatgrass (exotic)	P	A
Quercus ilicifolia	scrub oak	P	A
Rumex acetosella	sheep sorrel (exotic)	P	A
Salicornia virginica	glasswort (salt marsh)	A	P
Spartina alterniflora	cordgrass (salt marsh)	A	P
Xanthonium strumarium	cocklebur	A	P
Yucca filamentosa	Yucca	A	P

Severe salt-spray damage, as evidenced by the brown needles, to a pitch pine near the coastal bluff. Note the small stature of the tree, which develops as a result of wind and salt stress



"Squeezing" of dune grassland habitat by coastal wetland transgression (west) and coastal erosion (east) on a CACO barrier spit. Black lines indicate east and west boundaries of dune grassland in 1995; red lines indicate boundaries in 2010.

Vegetation monitoring will be repeated every 5-6 years in an effort to build a long-term dataset for this ecosystem and further clarify impacts to vegetation extent and successional processes.

More Information

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