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COASTAL ADAPTATION ANALYSIS

BioMap2 Components
Core Habitat: **N/A**
Critical Natural Landscape: **Coastal Adaptation Analysis**

COASTAL HABITATS: BEACHES, DUNES, AND ESTUARIES

Massachusetts has approximately 1,500 miles of coastline, more than any other New England state except Maine. The coast supports a tremendous diversity of wildlife habitat, numerous rare species, and intact coastal and estuarine ecosystems of global significance such as those at Plum Island, Sandy Neck, and on outer Cape Cod.

Beaches and dunes are highly dynamic habitats that are continuously reshaped by wind and water. A wide variety of rare and common animal species use these habitats, including habitat specialists such as the Least Tern, Piping Plover, and American Oystercatcher. Beaches serve as foraging areas for vast numbers of migratory shorebirds, and provide habitat for Gray Seals, tiger beetles, and numerous other species. Dunes provide important nesting habitat for Diamondback Terrapins, and are used by several rare insect species. Barrier beach ecosystems include a mosaic of open areas, woodlands, shrublands, and small wetlands.

Estuaries contain a mix of important habitats. Salt marshes and associated tidal flats comprise some of the most productive ecosystems on earth. The salt-tolerant vegetation of the salt marsh community provides the basis of complex food chains in both estuarine and marine environments. Subtle differences in elevation provide a diversity of habitats including low marsh, high marsh, subtidal and intertidal flats, and tidal creeks. Brackish and freshwater tidal marshes and swamps, along with coastal salt ponds, also occur along the Massachusetts coast and provide critically important habitats.

Many animals use the abundant resources of salt marshes, tidal flats, and other estuarine systems including migrating and overwintering waterfowl and shorebirds, such as Snowy Egrets, and habitat specialists such as the Saltmarsh Sharp-tailed Sparrow. Estuaries provide wintering areas for Black Ducks and other species, and staging areas used by species such as Greater Yellowlegs in preparation for migration.

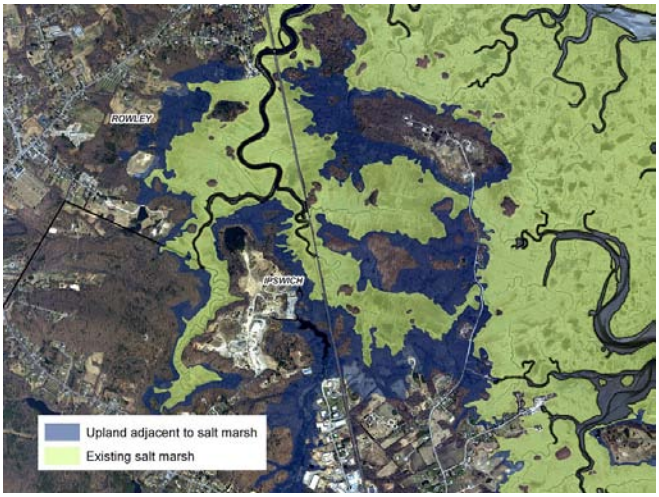

Figure 1: *BioMap2* coastal adaptation analysis

These rich ecosystems not only support numerous rare and common species, but also absorb storm surges, thus protecting inland infrastructure (roads, houses, and other property) as well as fresh groundwater supplies.

Coastal ecosystems face several significant threats. Ongoing development can result in destruction and fragmentation of coastal ecosystems and contributes pollutants that significantly diminish the health of estuarine ecosystems. Coastal habitats are also particularly vulnerable to the potential impacts of climate change. Sea-level rise in coming decades is expected to inundate low-lying salt and brackish marshes, while increased storm intensity is likely to erode beach and dune systems. Increased storm intensities and rapid sea-level rise in combination with the elimination of natural dynamics by jetties, seawalls, and other structures may undermine the ecological function of many coastal ecosystems.

The Massachusetts Natural Heritage & Endangered Species Program and The Nature Conservancy's Massachusetts Program developed *BioMap2* in 2010 as a conservation plan to protect the state's biodiversity. *BioMap2* is designed to guide strategic biodiversity conservation in Massachusetts over the next decade by focusing land protection and stewardship on the areas that are most critical for ensuring the long-term

persistence of rare and other native species and their habitats, exemplary natural communities, and a diversity of ecosystems.

COMPONENTS OF *BIOMAP2*: ***BioMap2*** **Core Habitat** identifies specific areas necessary to promote the long-term persistence of rare species, other Species of Conservation Concern, exemplary natural communities, and intact ecosystems. ***BioMap2*** **Critical Natural Landscape** was created to identify and prioritize intact landscapes in Massachusetts that are better able to support ecological processes and disturbance regimes, and a wide array of species and habitats over long time frames. *BioMap2* uses specific data and sophisticated mapping and analysis tools to spatially define each of these components, calling on the latest research and understanding of species biology, conservation biology, and landscape ecology.

COASTAL ADAPTATION TO SEA LEVEL RISE: The coastal habitats of Massachusetts are particularly vulnerable to potential sea-level rise in the next century, which many estimates suggest is likely to exceed one meter. Therefore, in addition to prioritizing current coastal habitats, the creators of *BioMap2* examined the landward side of salt marshes to determine where these habitats might move to as sea levels rise. Undeveloped lands adjacent to and up to one and a half meters above existing salt marshes were identified, and included as Critical Natural Landscapes with high potential to support inland migration of salt marsh and other coastal habitats over the coming century.

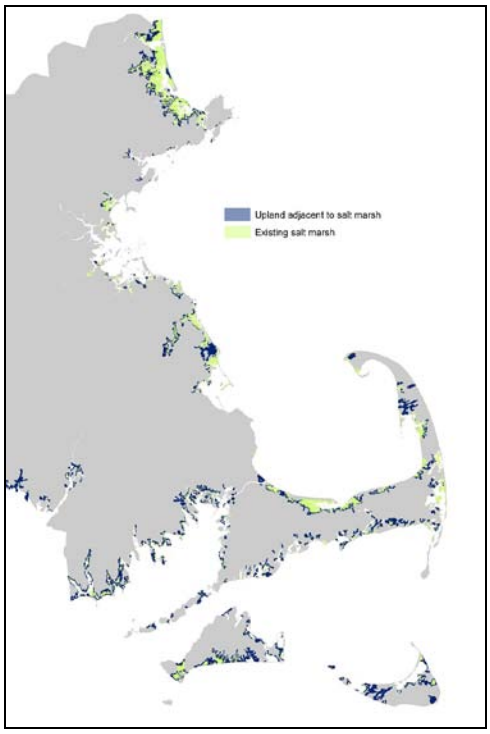

Figure 2: *BioMap2* Coastal Adaptation Analysis results

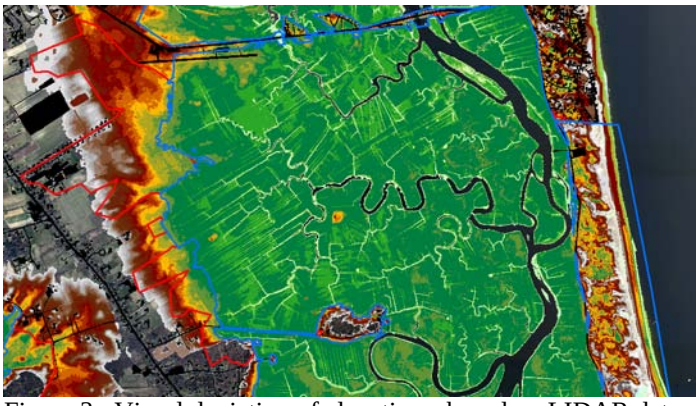
Figure 3: Visual depiction of elevations, based on LIDAR data, of salt marsh and adjacent upland areas in northern Massachusetts

ACHIEVING STRATEGIC CONSERVATION WITH *BioMap2*: In *BioMap2*, the Core Habitat and Critical Natural Landscape are complementary and overlapping, and were delineated based on separate criteria. Each represents a different scale of biodiversity in Massachusetts, yet the protection of both is important to conserve the full suite of biodiversity in the state.

Natural, low-lying areas adjacent to existing salt marsh have a high likelihood of developing into salt marsh or other important coastal habitat in the future if current sea level rise predictions hold. Estimates vary on the extent of the potential rise of sea level, but one and one half meters is a somewhat conservative target. Land protection of undeveloped areas within this zone would be a prudent measure to bar against the potential future loss of salt marsh habitat upon which so many species—rare and otherwise—depend. Restoration efforts in parts of coastal Massachusetts are already underway to restore salt and brackish water habitats that were cut off from regular inundation by manmade barriers. Lessons learned at these restoration sites could be applied to future changes in coastal habitats in the event of sea level rise.

Both land protection and stewardship may be necessary to protect the biodiversity represented by the *BioMap2* Coastal Adaptation areas. Land protection may be a good first step, but the removal or alteration of manmade structures along the Massachusetts coast may also be necessary to help restore the natural dynamics of a coastal ecosystem. Artificially hardened shorelines alter the natural erosion and deposition patterns of sand that are necessary for the maintenance of beaches and dunes. Obstructions such as levees and undersized culverts impede the movement of salt water into salt bays and marshes. Only through the combination of land protection and stewardship can high quality coastal ecosystems be maintained in Massachusetts in the foreseeable future.