

# Opportunities and Constraints to Restoring Naturally-Functioning Landforms and Biota on Intensively-Developed Barrier Islands

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## The issue

Environmentally-damaging actions associated with development of the coastal zone include: 1) eliminating dunes to facilitate construction; 2) grading dunes flat to facilitate access and create recreation space; 3) eliminating beach habitat by mechanically cleaning natural beach litter; and 4) retaining a fixed shoreline position with static protection structures (bulkheads, seawalls), causing truncation or loss of beach and dune as erosion proceeds. Most recreational beaches are graded into "slabs of sand" and raked (Figure 1A). The beaches may be capped by a dune (Figure 1B), but the dune is often low, narrow, linear, and designed as a dike to reduce wave attack and flooding. Fences, placed on the landward and seaward sides, restrict natural sand movement and dune evolution.

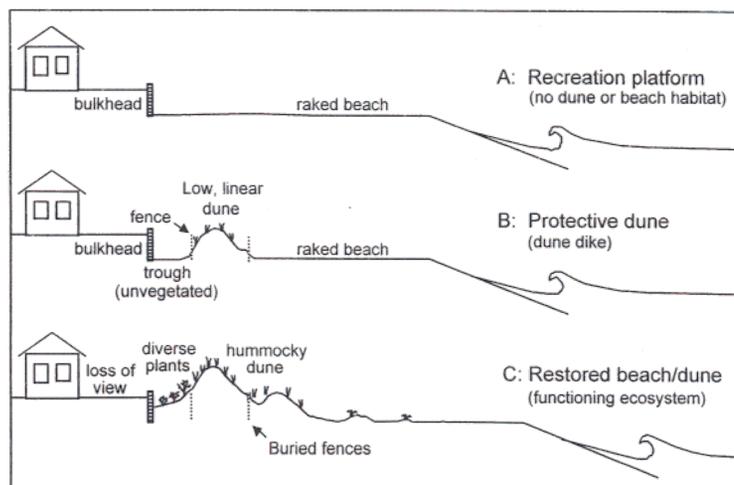


Figure 1. Characteristics of nourished beaches managed as recreation platforms (Profile A), with protective dunes (Profile B) and with restored dunes (Profile C).

Nature has been so degraded in many beach towns that residents and visitors now view natural beach litter lines, incipient vegetation, beach fauna, and even dunes as undesirable features. Many visitors have lost appreciation for the natural coastal environments that have been destroyed by development. Natural coastal preserves cannot provide a nature experience for the large numbers of tourists because these preserves are often inaccessible or there are restrictions on intensity of their use. It is becoming increasingly important to retain or restore nature within locations of human habitation to remind residents and visitors of their environmental heritage, enrich the tourism experience and encourage nature-protective behavior. Solutions for accommodating nature in developed areas are different from natural areas in that shorelines must have both natural and human-use value. Not only must the lost natural environments be restored, the significance and value of the natural features and the human role in their restoration and maintenance must be identified (Nordstrom 2000).

## **The opportunity**

Large-scale beach nourishment operations in developed municipalities now make it feasible to restore large, naturally functioning dunes in many locations where they did not exist (e.g. Figure 1C), but the full potential of this sediment resource will not be realized without a multi-objective management approach that addresses habitat improvement and nature based tourism in addition to the traditional goals of protection from erosion and flooding and provision of recreation space. The approach to management must build on and add to the practices observed in the best of the existing local programs, so restoration of natural characteristics will be seen as realistic and achievable and will be adopted by other municipalities. Restoration efforts for developed coasts must also acknowledge that buildings and support infrastructure will limit availability of space on the landward side, and the wide environmental gradients that characterize natural coasts may not be achievable. To survive, the restored habitats may require active human inputs and may evolve according to a trajectory that differs from natural systems.

The dunes at Ocean City, NJ provide an example of an achievable restoration outcome in nourished areas, where space and competing interests of residents must be considered. The dune at Ocean City was initiated when the municipality placed sand-trapping fences on a beach widened in a 1992 nourishment operation and planted the flat beach with only American beach grass. Six years later, the dunes evolved to heights exceeding 2.5 m above backbeach elevation, and 13 new vegetation species appeared. Suspension of raking and driving on the recreation beach (to protect nesting sites of piping plovers) resulted in formation of incipient dunes at litter lines that grew into more sizeable foredunes that merged with the protective dune to form a dune field similar to the one that would occur on a naturally-evolving beach. The result was a conversion of the landscape from the situation depicted in Figure 1A to the situation depicted in Figure 1C. The seaward portion of the dune is dynamic, and it provides a visible example of the cycles of growth and destruction that characterize natural coastal environments. The landward crest retains its integrity as a protection structure, and the narrow backdune evolves into a stable vegetated environment. The cross shore zonation of vegetation is similar to that of a natural dune, but the vegetation types are distributed across a narrower space than on a natural coast.

Restored dune environments like the one depicted in Figure 1C will be eroded as wave erosion continues. Sand-trapping fences and vegetation plantings can be used to rebuild dunes for a while, but inevitably, beach nourishment may be required to maintain the integrity of a healthy, well-vegetated backdune. A significant new aspect of restoration in developed areas is that the restored dune landscape (not just the recreation beach or the development) must be considered a resource that qualifies for protection using beach nourishment.

Acceptance of dunes in New Jersey has evolved slowly and has relied on aggressive actions of a few key people and programs. There is still a sizeable and often highly vocal component of the population that opposes dune construction because dunes block views of the ocean from residences, but many other stakeholders think that the dunes are an aesthetic improvement because they restore a degree of natural beauty. Preference for

natural landscapes can change as experiences are improved and people are enlightened as a result of incremental improvements in nature quality (Arler 2000). Some residents even allow the dune to migrate onto their properties and become directly involved in stewardship of nature. Involving property owners in restoration can expand the space over which natural environments can evolve to the zone landward of the bulkhead depicted in Figure 1, but dune migration into this zone may place their land within a regulated dune zone and limit their future land-use options.

### **The compromises and the work ahead**

Managing natural environments in developed areas as evolving semi-natural systems will require acceptance of evolutionary trajectories that are different from those expected in natural and presently-developed systems and will involve changes in attitudes, goals and practices by most stakeholders. Contemporary debate about environmentally-sustainable societies is too often characterized by confrontation between anthropocentric and biocentric perspectives. Common ground must be sought and meaningful dialogue must occur between competing interests, and environmental debates need to be expressed in non-absolutist terms that will permit compromise, flexibility and pluralism of values with more pragmatic and policy based approaches to human-nature relationships (Grizzle 1994; Naveh, 1998; Barrett and Grizzle 1999; Minter and Manning (1999); Table 1 identifies some of the compromises that may be required in maximizing restoration goals. Table 2 identifies a selected number of representative research questions related to biological research needs concerning values and uses for coastal dunes in developed areas and human actions that may have to be suspended or expanded. The rationale for these summary statements will be presented in greater detail for discussion at the symposium.

### **References**

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- Naveh, Z., 1998. Ecological and cultural landscape restoration and the cultural evolution towards a post-industrial symbiosis between human society and nature. *Restoration Ecol.*, 6: 135-143.
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Table 1. Actions taken to enhance natural value of beach and dune on developed shores.

**Municipal managers**

- Establish no rake segments (alongshore) and zones (cross shore).
- Remove cultural litter manually in these areas.
- Avoid mechanical grading except for emergency operations.
- Minimize vehicle use on backbeach (including municipal workers).
- Minimize extent of sand fences (initial ridge, blowouts).
- Change expectations of tourists and residents by education and involvement.

**Developers/Property owners**

- Tolerate or accommodate natural processes or vegetation.
- Leave space for natural environments.
- Do not demarcate seaward property line using barriers.
- Adopt a sense of coastal heritage and appreciation for natural value.
- Provide a compatible coastal landscape image.

**Scientists**

- Consider humans an intrinsic component in landscape evolution.
- Define reference and target states and the significance of naturalness.
- Adapt research to include smaller temporal and spatial scales.
- Be responsive to research needs of property owners and municipal managers.
- Initiate two-way advisory process and bottom-up approach to management.

**Environmental advocates and regulators**

- De-emphasize preserving static environmental inventory.
  - Accept alternative natural trajectory.
  - Emphasize habitat restoration in target-species programs.
  - Use stakeholder preferences to develop restoration goals.
  - Avoid restrictions that penalize environmentally-friendly actions.
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Table 2. Sample questions for evaluating research issues concerning restoration of beaches and dunes in developed areas. Modified from Nordstrom (2000).

- How much can the environmental gradient be compressed and still provide natural values?
  - How do biota differ on raked and unraked beaches and restored and unrestored beaches?
  - Which species should be the objectives of special management efforts in restored areas?
  - How should the minimum critical size of a sand dune ecosystem be determined?
  - Which species can be accommodated on the stable portions of dunes, and which require dune mobility?
  - To what extent is mobile sand necessary to accommodate exclusively coastal species?
  - What kinds of habitats do (or can) dunes on private properties provide?
  - How can natural environments on private properties be enhanced?
  - Which species thrive in these environments and can benefit from intensive care of responsible residents?
  - Under what conditions should exotic vegetation be accepted?
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