STANDARD FOR DUNE STABILIZATION

Definition

Controlling surface movement of sand dunes or shifting sand by vegetative or mechanical means.

Purpose

To reduce wind erosion and the encroachment of shifting sands, to provide a barrier against tide water, and to make the areas useful for other purposes.

Water Quality Enhancement

Reduces wind erosion, sand movement by storms and tides and facilitates dune building at ocean, bay frontal and back bay areas.

Where Applicable

Along ocean and bay shorelines where blowing sands and storm waters may cause erosion damage. Stay at least one hundred feet (horizontal distance) from mean high tide water line (MHT).

Methods and Materials

Sand dunes naturally form on barrier islands, shorelines exposed directly to the ocean, and inland sand deposits. The source of this wind born sand is the ocean or its bays. These parallel ridges of sand form perpendicular to prevailing winds and grow toward its source of sand. Periodic storm events and human activity continually alter their development and original configuration. Once developed the sand dunes provide protection from moderate storms and tides. The existence and maintenance of vegetation on dunes provides a network of root and foliage which holds unconsolidated sand in place. American beachgrass is the dominant, naturally occurring, vegetation of the frontal dunes of New Jersey. When beachgrass is established with structural resources and other dune species, a formidable well anchored storm barrier is established.

1. VEGETATION

   A. Materials: The foliage of most sand dune species filters sand from the wind. The reduction of wind velocity near the dune's surface by vegetation allows sand to be deposited. The root mass of these plant species of the sand dunes are typically deep and extensive, anchoring the dunes to their foundation. When possible certified cultivars, which have been tested on similar sites, should be utilized.

   B.

      1. To promote biodiversity species planting is preferred however, cultivar releases recommended for NJ sand dunes; all listed were released by the USDA, Natural Resources Conservation Service Cape May Plant Material Center, located in Swainton, NJ. a.
         'Cape` **American Beachgrass** (*Ammophila breviligulata*)
         b. 'Atlantic` **Coastal Panicgrass** (*Panicum amarum var. amarulum*)
         c. 'Avalon` **Saltmeadow Cordgrass** (*Spartina patens*)
         d. 'Wildwood` **Bayberry** (*Myrica pensylvanica*)
         e. 'Ocean View` **Beach Plum** (*Prunus maritima*)

2. Non-Cultivar releases suitable for NJ sand dunes
    a. **Switchgrass** (*Panicum virgatum*)
    b. **Bitter Panicgrass** (*Panicum amarum*)
    c. **Seashore Little Bluestem** (*Schizachyrium scoparium* var. *litoris*)
    d. **Seaside Goldenrod** (*Solidago sempervirens*)
    e. **Eastern Red Cedar** (*Juniperus virginiana*)

C. Establishment: Online information concerning dune stabilization may be found at the uSDA-NRCS Plant Materials Center (PMC) website: http://plant-materials.nrcs.usda.gov/njpmc/

1. American Beachgrass - Beachgrass is successionally classified as a pioneering type species; it is the hardiest species **capable of surviving the harsh environmental conditions of the frontal dunes**. For initially stabilizing a dune system, this species is the most reliable and commercially available option. Once established it rapidly spreads by a rhizomatous root system, developing a soil binding network of inter-woven roots.

    Planting Dates: October 15 to April 1; under non frozen soil conditions

    Planting Unit: a minimum of two stems (culms) per hole

    Method: hand placement, or use of a vegetable or tree planter

    Size: 16 to 18 inch long stems, > ¼ inch in diameter

    Depth: approximately 8 inches deep (≥ 7" but ≤ 9" is acceptable)

    Spacing : severe sites = 12" X 12"
    normal sites = 18" X 18"
    stable sites = 24" X 24"

    Notes:
    - Plant ≥ 100 feet of horizontal distance from the mean high tide water line to ensure success
    - Plant a minimum of 10 parallel rows; stagger (off-set) rows to maximize protection
    - Firm soil around plants to eliminate air pockets
    - If utilizing dredged fill allow salts to leach out before planting and allow rains to compact sands.

2. Coastal Panicgrass - This warm season bunch-like grass is a post stabilization species **thriving from the crest of the frontal dune to inland sites.** It is the only dune stabilization species which has been directly seeded on to the sand dunes successfully. Potted plants and stem divisions can also be successfully established on these severe sites. The annual foliage emerges from a deep fibrous perennial root system with short lateral rhizomes. This species can be successfully planted with or over seeded into stands of American beachgrass. The same plant and seed establishment techniques outlined below, also pertain to Switchgrass, Seashore Little Bluestem, and Seaside Goldenrod.

    Seeding Dates: over seeding: April 1 to May 1
    dormant seeding: November 1 to April 15
    planting plugs or transplants: April 1 to May 15

    Planting Unit: single bare-root or containerized seedling or division; 12 - 18 inches tall

    Seeding rate: 8 to 12 Lbs. of Pure Live Seed (PLS) per acre

Depth: plants: 2 inches deeper than the nursery depth
seed: drilled 1½ to 2½ inches deep

Method plants: hand placed, or use a vegetable or tree planter
seed: hand or mechanically operated drill or seeder

Spacing: plants: 4' X 4'
seed: 3' to 10' row spacing

3) Saltmeadow Cordgrass - Although typically associated with tidal salt marshes, this cordgrass also naturally occurs in the **secondary and back dune areas,** predominantly inhabiting inter-dune troughs and low blow-out areas. It is dominate in these micro-sites since most other sand dune species can not tolerate wet to saturated soil conditions. The trailing rhizomes of saltmeadow cordgrass are slender, but form dense mats near the surface. It is vegetatively established on normal sites using freshly harvested stems (culms) or containerized plants on severe locations.

Planting Date: May 1 to June 15

Planting Unit: 3 to 5 live stems placed bare-root or containerized

Depth: 2 inches below the nursery grown depth

Method: hand placed, or vegetable planter

Size: > 12 inches

Spacing: 18 to 36 inches depending on the severity of the planting site

Note: Utilize this species in low elevation sites of sand dunes which are frequently inundated.

4. Shrubs and Trees - Medium sized shrubs and small trees naturally **dominate the back dune** zone of New Jersey's barrier islands. The shrubs begin to **co-inhabit the mid secondary dunes**. Once extensive stands of bayberry, beach plum, pitch pine and other woody species covered these islands where houses now stand. The shrub species which are well adapted to the dune ecosystem are capable of either layering or root suckering.

The trees and shrubs of the sand dunes have deep tap root systems for supplying adequate moisture and nutrients. Each species utilized for back dune stabilization has its own unique attributes. **Beach plum** has a colorful bloom in spring which yields a tasty succulent cherry like fruit. **Bayberry** roots have nodules which enable it to fix atmospheric nitrogen similar to legumes; it also produces aromatic fruit and leaves. The **junipers** which are adapted to sand dunes provide the visual appeal of evergreens in the back dunes.

The major function of tree and shrub vegetation on sand dunes is still the permanent solid structural stabilization. All of trees and shrubs of the sand dunes produce viable seed, but intentional establishment occurs using bare-rooted or potted seedlings.

Planting Date: March 15 to April 15; unless soil is frozen

Planting Unit: 1/0 or 2/0 bare-root seedlings or containerized transplants

Depth: 2 inches below the nursery grown depth

Method: hand placement or using a tree planter

Size: > 12 inches tall

Spacing: 4 to 6 feet apart; off-set (stagger) rows for maximum protection

Note: to ensure establishment (first 2 years) all competing vegetation must be removed from within 2 feet of each plant; it is important not fertilize the surrounding vegetation which will potentially out-compete the tree or shrub

C. Maintenance

1. Fertilizer

Date: May through July; no sooner than 30 days after planting

Rate: $\leq$ 50 lbs. of nitrogen (N) per acre < 25 lbs. of phosphorus (P) and 25 lbs. potassium (K) per acre

Frequency:

- Apply N for the first two years after planting, then as needed to maintain stem density and plant health.
- Single or split applications are acceptable if not applied before May 1 or after July 30. Split applications must be at least 30 days apart.
- It is only necessary to apply (P) and (K) in alternate years.

Recommended Formulations:

- 10-10-10, 20-10-10, 15-10-10, etc. are acceptable as long as the maximum rates per nutrient are not exceeded.
- Time release fertilizers are encouraged that will provide the target amounts of the primary nutrients per acre.

Notes: Fertilize dune grass planting by mechanical or broadcast application, except where woody species are planted. Only apply fertilizer within the drip line of shrubs and trees. Not following this procedure will result in excessive herbaceous growth, which will out compete newly established trees and shrubs. Where woody plants are established, fertilizer may be broadcast applied.

2. Replanting

- Like a chain, a dune system is no stronger than its weakest link. Uniform, unbroken dune lines are essential to the protection a system can provide.

- Uncontrollable events (i.e. Storms, construction, etc.) may damage sand dunes. If such damage occurs between October and April replant within a month. If the damage is experienced from May to September, utilize the outlined sand fencing or excavation procedures listed below, then plant during the recommended establishment period.

D. Dune Crossing Areas

Where foot or vehicular traffic is expected over dunes, it is recommended a curvilinear path be constructed to direct traffic. These paths can be constructed with boards or be of a gravel base and should be bordered by sand fence to funnel the traffic to and from the beach.

2. SANDFENCING:

A quick and effective way to build temporary sand dunes is with the use of sand fencing (standard snow fence). Utilizing lines of fencing and wooden posts, orientated parallel to the beach approximately 140 feet (horizontal distance) from mean high tide. A source of sand is necessary for this technique to be effective, but it is not limited by time of establishment.

A. Materials

1. Fencing
   - Standard 4 ft. slatted wood snow fencing; wood must be decay free.
   - Polyvinyl fencing material with 50% porosity may be used as an alternative.
   - Four wire ties (> 12 ga.) must be used to secure fencing to each post.

2. Posts
   - Wooden posts must be > 6½ ft. long, with a minimum diameter of 3 inches; typical length ranges from 7 to 8 ft.
   - The posts should be made from black locust, eastern red cedar, Atlantic white cedar, or other species of similar durability and strength.
   - Space posts 10 ft. apart, and set them > 3 feet deep.

B. Technique

1. Position - orientation of fence line is parallel to waterline of the beach, at least 140 feet (horizontal distance) from mean high tide (see figure 2).

2. Height - with adequate sand sources, dune elevations can be increased annually by at least four foot increments (approximately the maximum height of the fencing, this can be increased with vegetation). The maximum dune height which is attainable will range from 12 to 15 feet, but is greatly influenced by prevailing wind velocities and sand grain size.

3. Installation - weave fencing in front of and behind alternating posts to attain maximum strength.

4. Number of Rows - When the distance to the MHT water line is 100 feet or more, 2 parallel rows spaced 30 to 40 feet apart are ideal; but single rows with 30 foot perpendicular spurs, spaced 40 feet apart are also acceptable if there is less than 100 feet from the MHT and a protective dune is desired. A zigzag pattern may also be considered. Where there is less than _50__ feet from the MHT it may not be feasible to build dunes.

5. Replacement - sand will typically fill fencing to ¾ of its total height at a maximum; upon reaching maximum fence capacity, additional lines of fence can be added until maximum planned dune height is reached; replace damaged fencing and posts within one month of storm damage to maintain a contiguous dune line.

C. Comments

1. This method is more expensive per lineal foot than building dunes with vegetation alone, but less expensive than using earth moving machinery to construct dunes.

2. Although dune height can be increased faster, it is limited by the fence height and ability to continually add more lines of fencing.

3. Planting parallel rows of vegetation on either side of fences is usually more effective than either vegetation or fencing techniques alone.

4. When complementing fencing with vegetation, do not plant closer than ten feet and no further than 15 feet from the fence lines. Vegetative strips should be about 20 feet wide (see figure 2-2 & 2-3).

3. MECHANICAL EXCAVATION

A With the use of various earth moving machines temporary, excavated sand dunes are quickly created.

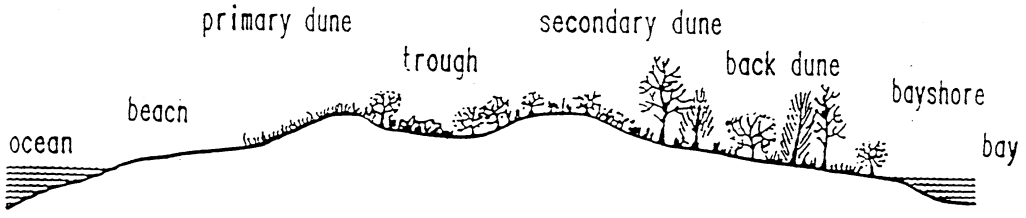
B. Since time is required for settling and cohesion to occur, such dunes are often short lived and only provide minimal protection to the public and private resources behind them.

C. This method is often useful in the repair of storm damaged sand dunes during the fall and winter months. Any blow-out areas can be quickly filled.

D. Front-end loaders of all sizes can be used. Various grading machines are also useful.

E. Pumped sand from off shore dredging can be shaped and positioned with machinery.

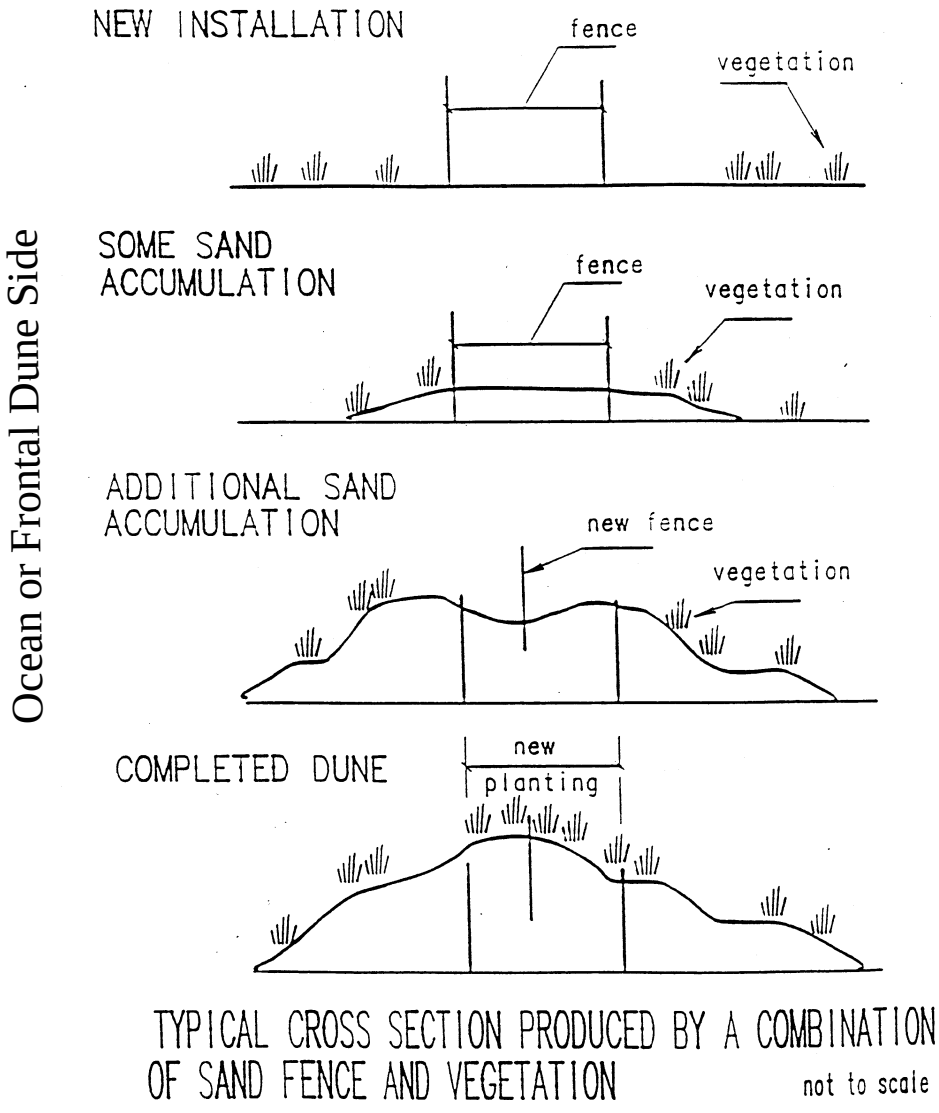
Figure 2-1



TYPICAL BARRIER ISLAND CROSS SECTION

Figure 2-2

Figure 2 -3



TYPICAL CROSS SECTION PRODUCED BY A COMBINATION OF SAND FENCE AND VEGETATION not to scale

Source: USDA