HOW TO BUILD AND SAVE BEACHES AND DUNES

John A. Jagschitz
and
Robert C. Wakefield

Plant and Soil Science

UNIVERSITY OF RHODE ISLAND
MARINE EXTENSION SERIES NUMBER
AGRICULTURAL EXPERIMENT STATION PUBLICATION

HOW TO BUILD AND SAVE BEACHES AND DUNES:

Preserving the Shoreline with Fencing and Beachgrass

John A. Jagschitz
Assistant Professor of Plant and Soil Science
and
Robert C. Wakefield
Professor of Plant and Soil Science

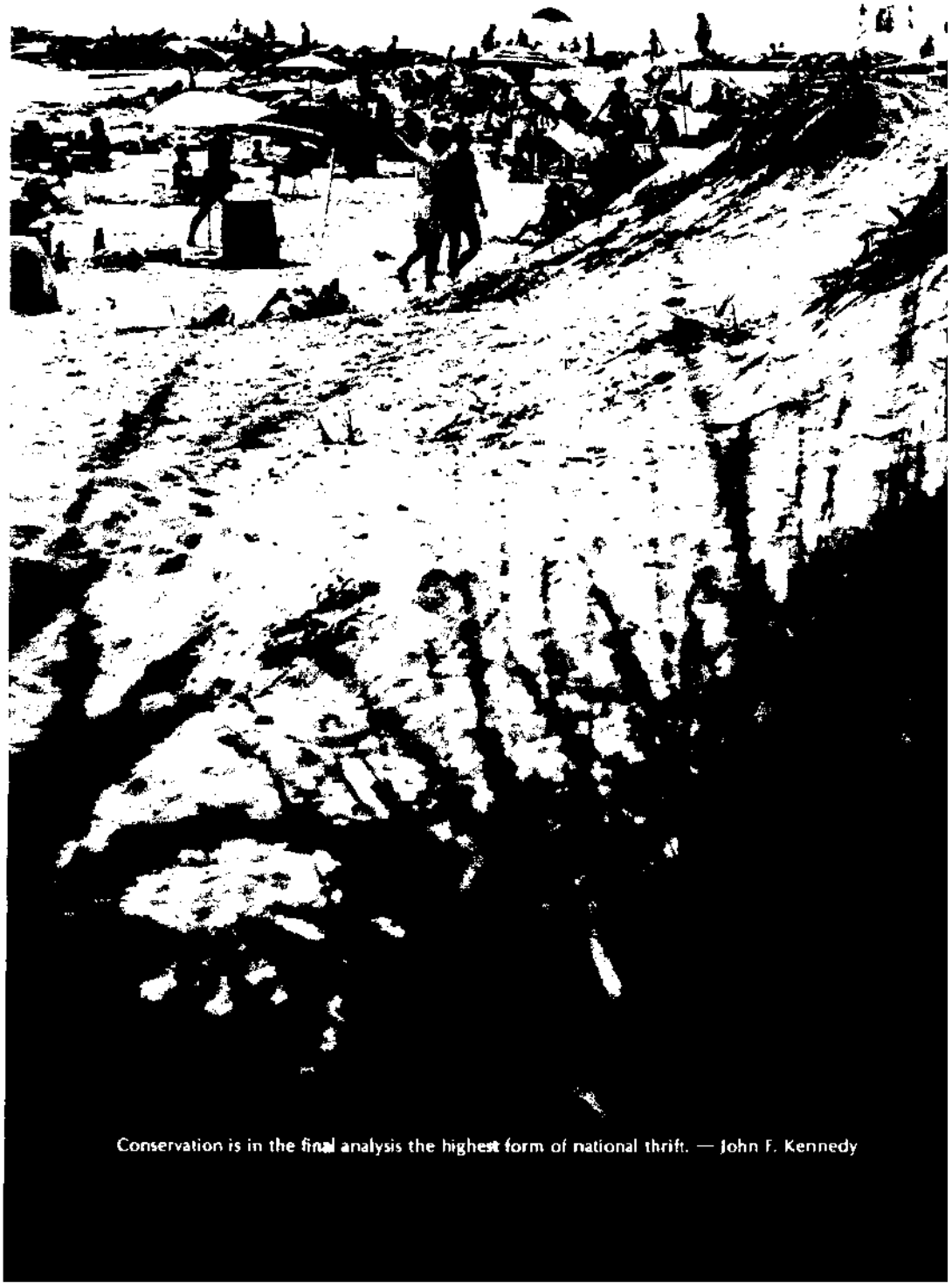
Bulletin 408 is contribution 1407 of the Rhode Island Agricultural Experiment Station, Kingston. Project funds also are from Title 1, Higher Education Act of 1965, United States Office of Education.

COLLEGE OF RESOURCE DEVELOPMENT
UNIVERSITY OF RHODE ISLAND
KINGSTON, RHODE ISLAND

OCTOBER, 1971

Additional copies may be obtained from the Rhode Island Agricultural Experiment Station, Woodward Hall, University of Rhode Island, Kingston, Rhode Island 02881.
Photos are by Robert J. Izzo, *University photographer.*

TABLE OF CONTENTS



Conservation is in the final analysis the highest form of national thrift. — John F. Kennedy

THE EVER-VULNERABLE SANDY SHORELINE

From Maine to North Carolina and along the Great Lakes — the areas where this handbook can be best used — the nation has thousands of miles of beautiful sandy shoreline. This serves man in obvious ways: it provides him recreation — swimming, fishing, boating, and beautiful scenery to view — and, with improved transportation, an appealing place to live year-round. Through the ages, it has been a center for commerce and industry too. Today, surveys show that the demand for its use will continue to rise.

Not so obvious is the role the shoreline plays as a protective barrier. It not only shields inland areas from the ravages of storms, but from day-to-day erosion by wind and water, which is an unending process.

In this destructive process, wind and water can eat away *unprotected* sandy areas. Headlands and banks are undercut and recede. Beaches and dunes are damaged and destroyed. Sand is washed or blown inland or into coastal ponds. Besides destroying the shoreline, the sand may pollute both ponds and harbors, cover roads, and encroach upon homes and other properties. Thus, only with adequate protection, can both man's creations and the shoreline itself, which are ever-vulnerable to destruction by these natural means, be preserved.

PROTECTION: AN INDIVIDUAL OR GROUP EFFORT?

Halting the destruction of the shore by winds and waves is the object of some governmental projects. But most of these are largely left for the future and involve the construction of rock revetments, rip-rap and concrete walls and the extensive use of sand fill to raise and widen beaches.

Such protective measures are too costly for individuals, or possibly even the separate states, to undertake. Until conditions warrant extensive federal aid, individual property owners and local communities must assume the responsibility of protecting their own lands.

But meanwhile, what can the individual beach owner do for his own protection? Some owners whose land lacks the natural protection of bedrock, boulder cover, or a dense blanket of vegetation have built walls, bulkheads or revetments. Such structures, even on a small-scale, are costly, requiring exact specifications that only can be provided by professional engineers. Moreover, the finished structure itself must be protected against erosion, and its effect on the adjacent shoreline must be considered.

As an inexpensive means to protect his beach, the individual owner can erect simple structures, such as snow fences and can use vegetation to build and save sand dunes, nature's extremely effective barriers against the ravages of the sea. This handbook has been written to explain how this can be done.

BEACH AND DUNE BUILDING

Why, When and Where?

Beaches, if they are of adequate size and shape, can protect the shoreline by holding back the sea and dissipating the energy of waves. The sand dunes on such beaches are among nature's most effective barriers against the action of waves, tides and winds. Besides offering protection they serve as stockpiles of sand which, by wave action, help replenish the sand on the beach. Homes and other structures behind them are usually well protected and, at least, partially protected during storms which destroy the dunes. In fact, if beaches and dunes are damaged or destroyed, it may be more economical to rebuild and stabilize them than to do without them. If dunes are needed for immediate protection, the sand can be moved by bulldozer, truck or dredge and placed in dune-like piles. But a less expensive, although slower, method is to trap and collect wind-borne sand by using snow fencing, brush or beachgrass.

The easiest place to build your own dunes is on beaches with a large supply of small sand particles. The presence of fresh sand deposits around clumps of grass or other obstructions is good evidence that the kind and quantity of sand needed for natural dune building is available.

Dunes should be constructed in front of property to be protected and across areas where sand has been blown or washed away. They should be built above the high tide line and on slopes that face the ocean. In some areas, in less than a year, dunes four feet high or more may be built through the use of fencing, while in other places this growth might take several years. After dunes are constructed they should be stabilized by vegetation to prevent them from being blown or washed away.

Building with Brush

Brush and discarded Christmas trees can be used to trap sand and build dunes. These materials can simply be piled or spread where dunes are desired. A porous pile is more effective than a solid pile and also requires less material. Brush piles hold sand very well, since little sand is lost due to shifting winds. Piles about four feet high should make a good start for dune building. When the original pile is buried, additional material can be layed on the surface to make the dune larger.

Brush and discarded Christmas trees can be used most efficiently by placing them in a fence-like structure. The material can be fastened to horizontal "rails" which are attached to posts. Or the pieces can be placed side-by-side in an upright position, like vertical fencing, and then partly buried in the sand. The butt ends should be placed in a trench about two feet deep and firmly packed in place.

For extensive use of such materials to build dunes, the brush and discarded Christmas trees, as well as the labor, must be readily available at a reasonable cost. One objection to the use of brush is that it appears unsightly until buried by sand, and picnickers may negate dune building efforts by using the brush and trees for firewood.

To make a sand dune, either snow fencing can be erected, as pictured at right, or brush and old Christmas trees can be substituted for the fencing. Note the thick beachgrass behind the fencing which also can build dunes as well as stabilize them.

Building with Fences

Standard wooden snow fencing is ideal for collecting wind-blown sand for building dunes. It may also be used to trap sand before it encroaches upon parking lots, roads, ponds and valuable property. This picket-type fencing is readily available, can be handled easily and can be erected in a short time. There has also been some degree of success with fabric fencing of varying porosity. Fencing should be placed facing both the wind and sand supply to trap the most sand.

In general, fences erected parallel to the shoreline do an adequate job. But, fences can be placed at right angles to the shoreline to trap sand that blows up and down the beach.

Two designs are suggested for parallel fencing. Either two lines of fencing can be spaced about 20 feet apart with a crossover fence placed every 50 feet, or a single line of fencing can be made with spurs, each 15 feet long, extending at right angles from the main line every 50 feet. On long stretches of beach a single line of fence alone has proved very successful and economical.

Iron pipes, at least one inch in diameter, or wooden posts can be used to hold up the fencing. These should be spaced about 10 feet apart and driven well into the sand to keep the fence from sagging or collapsing.

As the fences are buried, additional ones can be erected to make the dune larger. Once the desired dune height is obtained and the fences become buried the dune must be stabilized with vegetation or it may erode away. Many dunes that have taken years to build have been lost in months, weeks or even days because they were not stabilized.

Building with Vegetation

Natural dunes along the shore are formed and protected from erosion by vegetation. Foliage holds sand in place and traps wind-borne sand. As sand accumulates, the vegetation grows up through it. With sustained deposits and vegetative growth, dunes grow larger and remain stable.

Thus, all dunes and sandy areas should be protected with a blanket of vegetation. This makes them more resistant to wind and water erosion and prevents them from encroaching upon other property. Unprotected areas will easily erode and can lead to the loss of an entire dune or beach area.

The best vegetation for use from the state of Maine to North Carolina and in the Great Lakes area is American beachgrass (*Ammophila breviligulata* Fernald). Establishing and maintaining it is simple and relatively inexpensive. This perennial, native grass can tolerate sand blasting and deposition, strong winds, salt spray, occasional flooding, and droughty, infertile sand. Beachgrass spreads by growing underground stems which form new plants for added protection. It can accumulate up to four feet of sand in a year's time. Where this much sand or less is needed, beachgrass could be used instead of fencing for dune building. In such cases, it would also provide an immediate stabilizing cover. Beachgrass should be planted in strips parallel to the shoreline. The width of strips might vary from 15 to 100 feet depending on the amount of sand available for dune building. Recent work has shown that beachgrass planted least densely at the outer edges has formed more gently sloping dunes.

American beadgrass (*Amphicarpa bravifolia* Fernald) grows in bunches containing many culms (stems) that can reach a height of three feet. The seedhead noticeable here as a spike-like panicle, becomes visible about mid-July.

BEACHGRASS FOR BEACH AND DUNE SAVING

How and When Beachgrass Grows

American beachgrass usually starts to green-up and grow along the beaches in late March and becomes dormant by late fall. It grows in bunches containing many culms (stems) that may reach a height of two to three feet. Many new culms appear from beneath the sand in early spring. These come from the nodes at the base of older plants or from rhizomes (underground stems) that have spread beneath the sand for several feet.

Beachgrass produces seed in a spike-like panicle (cluster) about 10 inches long usually visible in late July or early August. By mid-September the panicle is on a stalk about three feet high and has changed from green to light brown in color. Most of the seed is shed in the fall, but the empty panicle may still be evident the following year.

The best and quickest way to establish beachgrass on dunes or active, sandy areas is to transplant mature culms. In nature, beachgrass usually gets its start in new areas from pieces of stems or rhizomes that have blown or washed into the area. Very few new plants in active areas come from seed. Seedlings easily dry out and die or are sand-blasted, buried or blown away. Only where sand is stable and remains moist might seed produce sufficient beachgrass cover for stabilization after a season's growth.

Obtaining Beachgrass

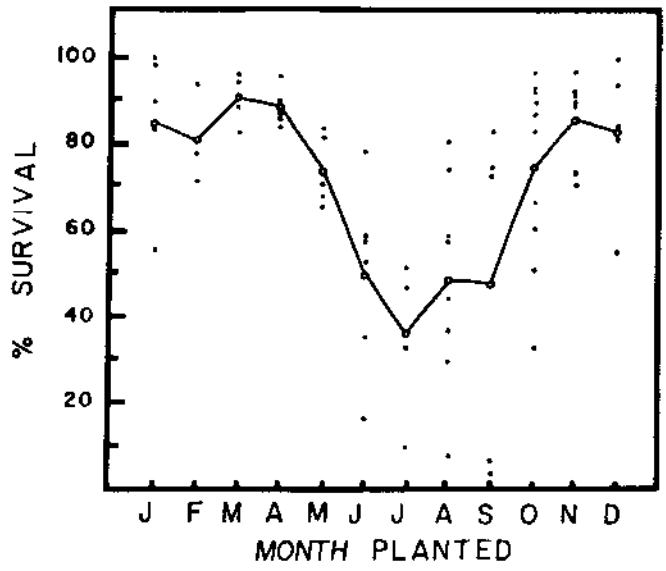
Beachgrass culms can be bought from commercial growers or taken by thinning native stands. The commercial price for 3000 culms ranges from $30 to $75 (1971) depending on the quantity ordered. About 3000 culms are enough to stabilize an area of about 2000 square feet. Some commercial sources for beachgrass are listed by The Soil Conservation Service, Cape May Courthouse, New Jersey 08210. A few sources include Coastal Stabilization Nursery, P.O. Drawer 987, New Bern, North Carolina 28560; Church's Nursery, Old Shore Road (Erma), R.F.D. 1, Cape May, New Jersey 08204; and Moore's Sod Farms, P.O. Box 281, Berlin, Maryland 21811.

A handy and inexpensive way of obtaining culms is to thin out native stands. But this should only be done with permission of the landowner. Beachgrass on public lands could be managed and supervised to make culms available to area residents. With culms more accessible, shore owners might more readily initiate beachgrass plantings.

In thinning, culms are pulled or dug from the sand. But a sufficient number of plants is left to prevent erosion. Culms can only be safely taken from back dunes or protected areas. They should not be removed from frontal dunes or areas that require maximum protection.

Areas to be thinned could be fertilized a year or two in advance in order to double or triple the number of culms available and to make them healthier, bigger and easier to plant. After thinning an area, it should be fertilized to encourage protective regrowth and to increase culm production for future harvests.

Shown here is one beachgrass "plant" containing several culms, or stems. They are usually planted about 18 inches apart to stabilize dunes.



The best time to plant beachgrass is from October through April. Note the poor survival when planted from June through September.

Handling Beachgrass Culms

The best time to collect and plant beachgrass culms for the best survival is from mid-October through April. At this time the sand is moist, temperatures cool, and most culms dormant. Summer plantings are not recommended, although at that time the rate of survival may be improved by watering.

Culms from commercial growers are usually ready for transplanting, while those from thinning operations require some preparation. Clumps of beachgrass, when pulled or dug from the sand, contain many individual culms. These clumps should be shaken free of sand and separated into divisions of three or fewer live culms. Dead culms, dead blades and underground stems that can interfere with planting should be removed. Roots usually are not evident, but will develop from basal nodes after planting. The culms may be clipped to a length of about 18 inches from the base to reduce bulk and make planting easier.

All culms should be kept cool and moist and planted as soon as possible. The basal portion, where new growth will develop, must be protected from drying out. This can be done by packing the culms tightly or by covering the basal portions with moist burlap or sand. Small numbers of culms can be handled efficiently by packing them in a pail containing a few inches of water.

Planting Culms

Areas are best stabilized by establishing beachgrass on the entire section. Planting should be started on the windward side of the area and progress to the leeward. To stabilize most areas, groups of three culms are planted in holes spaced 18 inches apart. The holes should be staggered to get maximum erosion control.

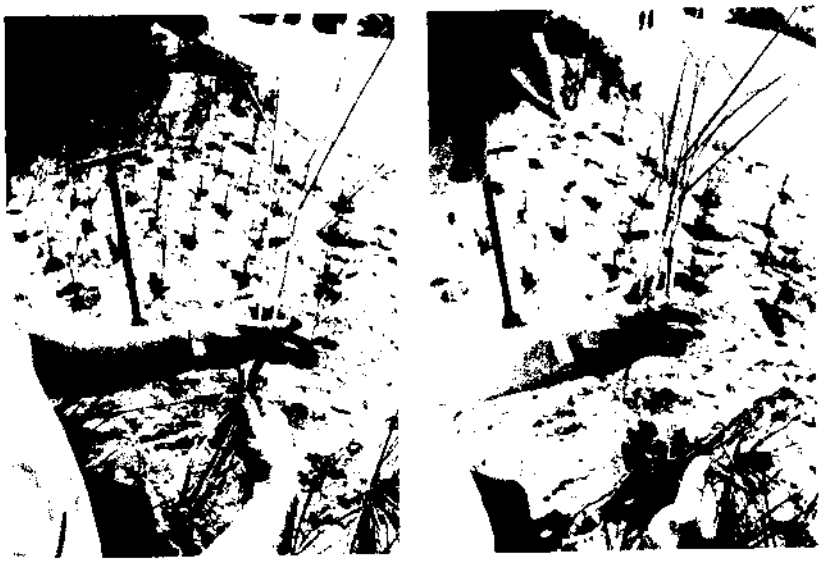
Closer spacing (12 inches) is necessary on active dunes or steep slopes or in narrow strip plantings. On stable areas spacing 24 inches may be sufficient. The number of holes per 1000 square feet for 12-, 18-, and 24-inch spacings is 1155, 515 and 290 respectively; the number of culms needed is three times the number of holes.

Beachgrass can be planted by hand in holes made with a dibble, tilling spade or tree planting tool. The base of each culm must be planted seven to nine inches deep because surface sand layers often become dry in the summer. Planting the culms at this depth also will help prevent them from being blown out. The culms should be firmly packed in order to anchor them and to eliminate air spaces around the culm bases which might dry them out.

Extensive plantings can be done more economically and faster by using a mechanical planter. Up to two acres a day can be planted with the use of a tractor, transplanter and a crew of six to seven men. Such machine methods are widely used at several of the national seashore and wildlife refuge areas.

Fertilizing Beachgrass

Usually sand lacks sufficient plant food for optimum beachgrass growth. Adding fertilizer, which costs about a dollar per 1000 square feet, can



First step (left) in planting beachgrass is to dig or pull bunches of culms (stems) from back dunes or protected areas. If these will not be planted immediately protect the basal portions from drying out by covering them with moist burlap or sand or pack them in buckets containing a few inches of water. Separate them into smaller bunches of three or fewer culms and next (right) remove dead culms, dead blades and underground stems.

Plant the culms (left) seven to nine inches deep from the base. Place clumps of three culms about 18 inches apart, starting from the windward and working toward the leeward side of the planting area. Finally (right) pack the sand around each plant by stamping the sand with your foot.

double or triple its growth. New plantings and thin stands especially should be fertilized. They will grow better and faster and form a dense, protective cover. Fertilizing beachgrass also will encourage its spread into unprotected areas.

Fertilizer should be applied in April or May to obtain the best response. It can be applied all at once or half can be applied immediately and the remainder in July. Plantings done from June through September should be fertilized immediately afterward. Those planted after September should be fertilized in April. On small areas, fertilizer can easily be broadcast by hand. Ground machinery, planting machine attachments or helicopters can be used more efficiently on larger areas.

Inorganic fertilizers, high in nitrogen, are the most effective and least expensive to use. Granular ones such as 10-10-10, 15-10-10, 20-10-5 or 30-10-0 are satisfactory. (The percentage of nitrogen is indicated by the first figure.) An annual application of two to three pounds of nitrogen per 1000 square feet should be made for two years. After this, fertilize at half this rate when necessary to maintain a good stand.

A special fertilizer, MagAmp K (7-40-6), has been used with some success at planting time. It is placed in the bottom of the planting hole at a rate of about 0.8 ounce per hole. This fertilizer is costly but is effective for two or three years. After this, broadcast fertilizers should be used to maintain a good stand.

MAINTENANCE: KEY TO SUCCESS

Beach and dune building and saving measures must be maintained if they are to succeed. In the past, many have been allowed to deteriorate, wasting money and resulting in total loss of protection. Deterioration can be caused by storms, weathering, misuse, neglect or vandalism. Property owners and communities must continually be on the alert to prevent damage and make immediate repairs.

Fencing materials used to build sand dunes should be repaired promptly when damaged. If not, dunes that have been built will quickly blow away. Beachgrass should be maintained to provide a complete, dense cover. If the stand becomes weak or thin, it should be fertilized. If any portion of the cover is lost or destroyed it should be replanted immediately. If not, wind will erode the sand and blow out plants along the edge. If allowed to continue, the eroded area will become larger, until eventually all plant cover may be destroyed and the sand blown or washed away.

People are the chief cause of beachgrass destruction. Pedestrian and vehicular traffic, which tramples and kills beachgrass, should be restricted to designated areas. Walks, roads and parking areas should be provided to prevent breaks in plant cover that can lead to erosion. Destruction of dunes and beachgrass should be avoided during the construction of homes and buildings. Sand exposed after construction should promptly be planted in beachgrass.

A COMMUNITY EFFORT

The planting of beachgrass and use of fencing materials for shore protection is best accomplished on a community basis. Such a desirable and rela-

A route to the water, but can another be found? The footpath is creating a blow-out in the dune, which is the first step in the erosion process. Note the fence, which needs repair. The planting of beachgrass and the care of fences can be worthwhile community projects for civic groups, especially on public beaches.

tively inexpensive project may be of interest to community leaders, civic groups and other organizations interested in conservation.

Some towns and interested groups in some states have organized successful beachgrass planting operations and placed brush along the shore to encourage dune building. Some states, however, have been more active and shown greater interest than others.

With energetic and enthusiastic organization by civic and community leaders, old and young alike could be inspired to share in such a deserving project. In this way much of an ever-valuable natural resource, the shoreline, could be protected and conserved for the future.

USEFUL READING

1. Augustine, M. T. and W. C. Sharp. 1969. Effect of several fertilizer treatments on the production of American beachgrass culms. *Agronomy Journal* Vol. 61, No. 1: 43-45.
2. Brown, R. L. 1948. Permanent coastal dune stabilization with grasses and legumes. *Journal of Soil and Water Conservation* Vol. 3, No. 2: 69-74.
3. Davis, J.H. 1957. Dune formation and stabilization by vegetation. *Technical Memorandum No. 101.* U.S. Army Corps of Engineers, Beach Erosion Board, Washington, D.C.
4. Hafenrichter, A. L. 1967. Tying down sand dunes. *U.S.D.A. Yearbook of Agriculture:* 317-321.
5. Hawk, V. B. and W. C. Sharp. 1967. Sand dune stabilization along the North Atlantic coast. *Journal of Soil and Water Conservation* Vol. 22, No. 4: 143-146.
6. Jagschitz, J. A. and R. S. Bell. 1966. Restoration and retention of coastal dunes with fences and vegetation. *Bulletin 382.* R.I. Agricultural Experiment Station, Kingston, R.I.
7. Jagschitz, J. A. and R. S. Bell. 1966. American beachgrass (establishment-fertilization-seeding). *Bulletin 383.* R.I. Agricultural Experiment Station, Kingston, R.I.
8. Savage, R.P. and W. W. Woodhouse, Jr. 1968. Creation and stabilization of coastal barrier dunes. *Reprint 3-69.* U.S. Army Coastal Engineering Research Center, Washington, D.C.
9. Steiner, W. W. 1967. Sand fortresses tame Atlantic surf. *U.S.D.A. Yearbook of Agriculture:* 330-332.
10. Stoesz, A. D. and Brown, R. L. 1957. Stabilizing sand dunes. *U.S.D.A. Yearbook of Agriculture:* 321-326.
11. Stratton, A. C. 1957. Beach erosion control in the Cape Hatteras national recreational area. *Shore and Beach* Vol. 25: 4-8.
12. U.S. Army Corps of Engineers. 1950. South shore, State of Rhode Island, beach erosion control study. *House Document No. 490,* 81st Congress, 2nd Session. Government Printing Office, Washington, D.C.
13. U.S. Army Corps of Engineers. 1958. South Kingstown and Westerly, Rhode Island, beach erosion control study. *House Document No. 30,* 86th Congress, 1st Session. Government Printing Office, Washington, D.C.
14. U.S. Army Corps of Engineers. 1961. Shore protection planning and design. *Technical Report No. 4.* Beach Erosion Board, Washington, D.C.
15. U.S. Army Corps of Engineers. 1964. Hurricane survey report of Rhode Island coastal and tidal areas. *House Document No. 145,* 89th Congress, 1st Session. Government Printing Office, Washington, D.C.
16. U.S. Department of Agriculture, Soil Conservation Service, 1963 . Building planting and maintaining coastal sand dunes. *Conservation Information No. 32.* Beltsville, Maryland.
17. Woodhouse, W. W., Jr. and R. E. Hanes. 1966. Dune stabilization with vegetation on the outer banks of North Carolina. *Technical Memorandum No. 22.* U.S. Army Coastal Engineering Research Center, Washington, D.C.
18. Zak, J.M. 1967. Controlling drifting sand dunes on Cape Cod. *Bulletin 563.* Mass. Agricultural Experiment Station, Amherst, Mass.