

# Building Coastal Dunes with Sea Oats and Surrogate Wrack<sup>1</sup>

Natalie Hooton, Debbie Miller, Mack Thetford, and Sean Claypool<sup>2</sup>

Increasing stresses on our beaches and coastal dunes cause changes to occur too quickly or too frequently for natural processes to repair. Recovery of these damaged areas requires the development and use of more effective restoration strategies. Coastal grasses have long been recognized as the biological engineers of our dunes. These plants build dunes by capturing and stabilizing moving sand. To promote growth of new dunes or to repair damaged dunes, perennial grasses, such as sea oats (*Uniola paniculata*) are often planted after dunes have been eroded, fragmented, or destroyed. Survival of transplanted, nursery grown sea oats is variable, and growth can be slow. Additions of commercial fertilizers and the addition of water-absorbing gels are often recommended to increase survival and speed growth of transplants, but these products are not always effective and can be expensive. More effective, cheaper restoration alternatives are needed (Hooton 2014).

Wrack, defined as beach litter consisting of “algae, grasses, driftwood, fruits, seeds, and carrion, along with cultural litter” that accumulates at the high tide line (wrack line) or after storms is an important resource to wildlife and provides many benefits to the development of beach dunes (Behbehani and Croker 1982; Orr et al. 2005; Dugan et al. 2003; Nordstrom et al. 2011) (Figure 1). Wrack has a rough surface that allows it to catch seeds of dune plants and sand as they blow in the wind, promoting sand accumulation. Trapped seeds commonly germinate and grow with the help

of wrack (Figure 2). As wrack ages, it supplies nutrients, protection, and moisture that assist plant survival and growth. Seagrasses in wrack act as a nitrogen source for coastal dune plants, while brown algae, also found in wrack, can be an important supplier of nitrogen and phosphorus to plants (Williams and Feagin 2010). For these reasons, wrack serves an important role in shoreline ecology and should be left in place. However, the Florida Fish and Wildlife Conservation Commission (<http://myfwc.com/wildlifehabitats/managed/sea-turtles/beach-activities/beach-cleaning-guidelines>) allows mechanical cleaning of beaches during certain times of the year. Discarding wrack collected during mechanical beach cleanings wastes a valuable resource. Instead of disposing of wrack collected during beach cleaning, it may be feasible to place wrack near native dune plants to enhance growth of dune vegetation. Alternatively, an organic substance like wheat straw may provide similar benefits. The potential of using organic substances similar to wrack to enhance growth of dune vegetation was recently tested on Florida beaches with the use of wheat straw as a surrogate wrack. We applied a layer of wheat straw to restoration planting sites to determine the feasibility of using wrack and or similar cost-effective organic substances in coastal dune revegetation/restoration projects to (1) increase transplant survival, (2) accelerate the growth of coastal dune plants, and (3) enhance dune building through sand accumulation. We expected

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2. Natalie Hooton, biologist and ecologist, Environmental Services Greater Pittsburgh Area; Debbie Miller, professor, Department of Wildlife Ecology and Conservation; Mack Thetford, associate professor, Department of Environmental Horticulture; and Sean Claypool, senior field technician, UF/IFAS West Florida Research and Education Center, Milton, FL 32583.

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increases in survival and growth of planted sea oats and increases in sand accumulation.



Figure 1. Newly deposited wrack on Pensacola beach.  
Credits: Mack Thetford, UF/IFAS



Figure 2. Wrack partially buried by sand accumulation.  
Credits: Mack Thetford, UF/IFAS

## Sea Oats Planting and Surrogate Wrack (Wheat Straw) Placement

Six planting sites were located on sand flats parallel to the Gulf on Perdido Key, Florida. Plugs of sea oats spaced approximately 1 foot apart were planted in the spring (Figure 3). Sea oats were planted two weeks before surrogate wrack (wheat straw) was applied; however, the delay in applying surrogate wrack was not by design and may not be necessary. At each site, five bales of wheat straw were placed on half of the sea oats planting; the remaining half of the sea oats planting remained bare. The wheat straw (surrogate wrack) layer measured approximately 8 inches in depth (Figure 4).



Figure 3. Sea oats planting with and without surrogate wrack (wheat straw) at one of 6 research sites on Perdido Key, FL.  
Credits: Natalie Hooten



Figure 4. Surrogate wrack (wheat straw) placed around sea oats at approximately 8 inches deep two weeks after planting.  
Credits: Natalie Hooten

## Plant Growth

We found that survival of spring-planted sea oats was greater than 97% and was the same with or without surrogate wrack (wheat straw) (Hooten 2014). However, when planting in the summer or in drier years survival may be greater with surrogate wrack than without because of the water-holding capacity of the wrack. Just six months after planting, all measures of plant growth (shoot height, shoot number, and the weight of aboveground standing plant material) were significantly greater for sea oats planted with surrogate wrack (wheat straw) than without surrogate wrack. Greater lateral spread of underground stems resulted in significantly greater plant width with surrogate wrack than without. Two years after planting, growth of leaves and shoots remained greater with surrogate wrack than without surrogate wrack (Figure 5). Surrogate wrack also resulted in more plants maturing to flowering size in year two. The number of flowering shoots was greater with surrogate wrack than without (Figures 6 and 7) two years after planting.

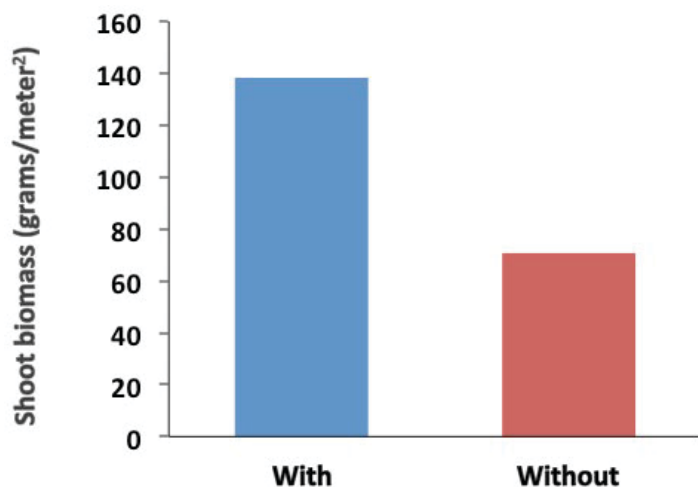


Figure 5. Shoot biomass (g/m<sup>2</sup>) of *Uniola paniculata* (sea oats) two years after planting with and without surrogate wrack.  
Credits: Debbie Miller, UF/IFAS

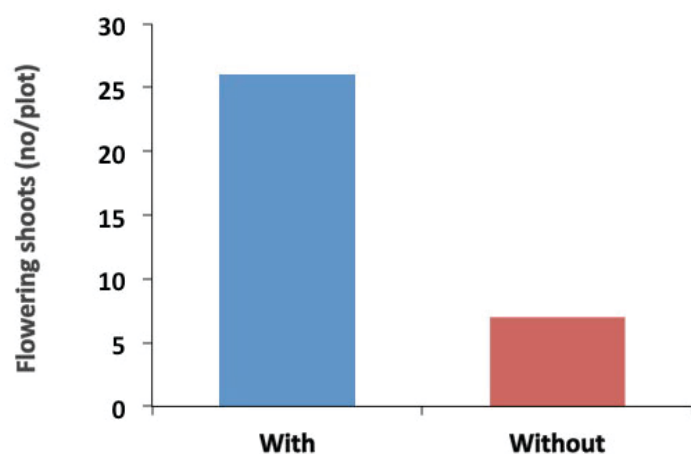


Figure 6. Number of flowering shoots of *Uniola paniculata* (sea oats) per plot with and without surrogate wrack two years after planting.  
Credits: Debbie Miller, UF/IFAS

## Sand Accumulation

Both planting of sea oats and the presence of surrogate wrack increased sand accumulation. Sand did not accumulate where plants were not present. The dune built by the planting reached about 1.5 feet above the surrounding sand (no plants) two years after planting (Figures 7 and 8). Sand accumulation (created dune height) was notably greater with surrogate wrack than without wrack, even after eight months. Two years after planting, the section of the created dune with both sea oats and surrogate wrack had accumulated more sand than the section where sea oats were planted without surrogate wrack (Figures 7 and 8).

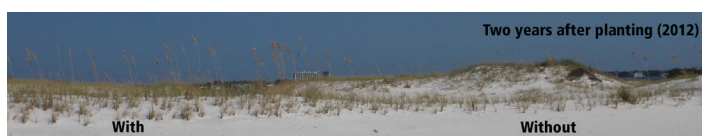


Figure 7. Sand accumulation and presence of sea oats flowering shoots two years after planting with and without surrogate wrack.  
Credits: Sean Claypool, UF/IFAS

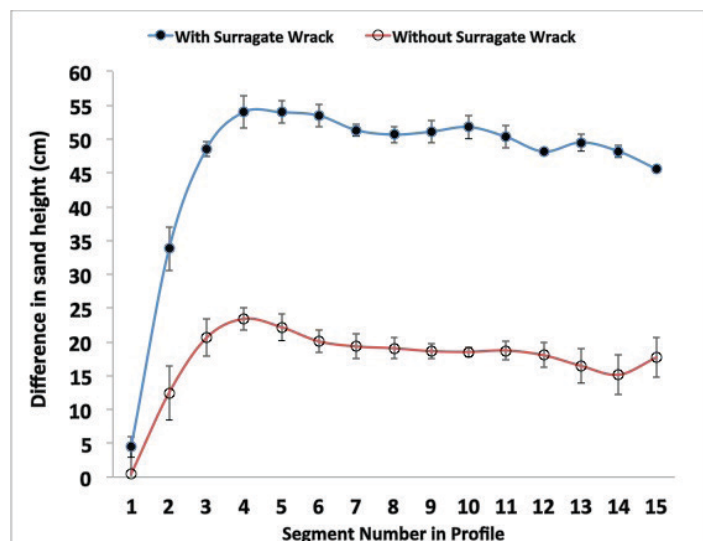


Figure 8. Relative sand height ( $\pm 1$  standard error,  $n=6$ ) (cm) 2 years after planting (May 2010 - August 2012) by 60 cm segments across *Uniola paniculata* (sea oats) plantings with surrogate wrack (8 inches of wheat straw mulch) or without surrogate wrack; segment 1 was outside the plot area and represents bare sand with no sea oats.  
Credits: Debbie Miller, UF/IFAS

## Why do we think surrogate wrack increases plant growth and dune growth?

- Surrogate wrack may capture and hold precipitation near the surface and increase available moisture.
- Increased moisture may contribute to increased growth of sea oats with surrogate wrack.
- Increased nutrients from the surrogate wrack may also contribute to increased growth of sea oats.

## Implications for Dune Restoration

- Surrogate wrack such as wheat straw can potentially benefit coastal dune restoration by increasing the rate of growth of dune grasses such as sea oats.
- Surrogate wrack used with sea oats improves sand accumulation in addition to the spread of sea oats by lateral growth of underground stems. This demonstrates that surrogate wrack and potentially natural wrack collected from beach cleaning could be used to assist dune building.
- Surrogate wrack can be used to decrease the time to first flowering for transplanted sea oats. Greater flowering of sea oats would provide a food source for wildlife and improve the spread of sea oats by seed/seedlings.



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