

**Progress Report to the Willapa National Wildlife Refuge
RESTORATION OF COASTAL DUNES FOR SNOWY PLOVER AT
LEADBETTER POINT WILLAPA NATIONAL WILDLIFE REFUGE:
EFFECT OF HERBICIDE ON NONNATIVE DUNE GRASS CONTROL.
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Introduction:

The endangered Snowy Plover nests in dunes that have minimal coverage by dune grass. The western foredunes of Leadbetter Point. Willapa National Wildlife Refuge is covered by three species of dune/beach grass: native dunegrass (*Elymus mollis*), European beachgrass (*Ammophila arenaria*) and American (*Ammophila brevigulata*). The latter two are considered to be aggressive and inhibit the nesting of Snowy Plover. Six herbicide treatments were used by the Willapa National Wildlife Refuge in the fall of 2004 to control dune grass in preparation of the sites for oyster shell covering, preferred by the Snowy Plover for nesting. WSU Long Beach conducted pre and post-treatment monitoring of the site to evaluate treatment efficacy. This report documents those findings.

Methods:

Six different herbicide/mechanical treatments were used to prepare the beach grass on the foredunes along the Western tip of the Long Beach Peninsula for nesting sites of Snowy Plover (Table 1, Figure 1, and Photos 1 & 2). Plant density (by number), stem density and percent surface area data were collected from each of the different treatment types—pre (10/20/04) and post treatment (1/5/06). Herbicides were applied at 60 gpa spray volume in September/October 2004. Bulldozing and disking occurred in January of 2005. All areas were sprayed again with Habitat/Hasten with a tractor-mounted boom in September 2005, but this later treatment did not affect stem counts across the plots. Within each plot, data was collected using a 0.25 meter quadrat randomly dropped every 50 meters along a 400 meter transect. Transect locations were noted with GPS. .

Table 1. Treatment location and types			
Location area and size	Herbicide	Bulldoze	Disk
NE 5 acres	Habitat 6 pt/acre	Yes	Yes on west; No on east
N mid 3 acre	Habitat 6 pt/acre	No	Yes
NW 4 acre	Roundup Pro 10%	No	Yes
N Ridge 2.5 ac	Roundup Pro 10%	No	No
S Ridge 1.6 ac	Habitat 6 pt/acre	No	No
S Ridge 1.4 ac	Habitat 4 pt/acre	No	No

Results and Discussion: Statistical inferences are difficult since the treatments were not truly replicated. However, nonparametric analysis of the pseudo-replications and a general overview of the means indicate four major findings (Table 2, 3 & 4).

1) For the herbicide treatments in the non-bulldozed non-disked foredunes, 10% Rodeo was better than 4 or 6 pt/ac of Habitat.

2) For the un-bulldozed disked sites 10% Rodeo was similar to 6 pt/ac Habitat.

3) Habitat followed by bulldozing and disking was less effective than Habitat followed by just disking.

4) The native and European dune grass species were the most susceptible to herbicide treatments. Overall, 10% Rodeo or 6 pt/ac Habitat plus disking or 10% Rodeo alone cleaned up dune grass sites adequately for use in Snowy Plover restoration. Use of Habitat earlier in the season when the plants were actively growing may have resulted in better efficacy than in October after the plant growth had ceased.

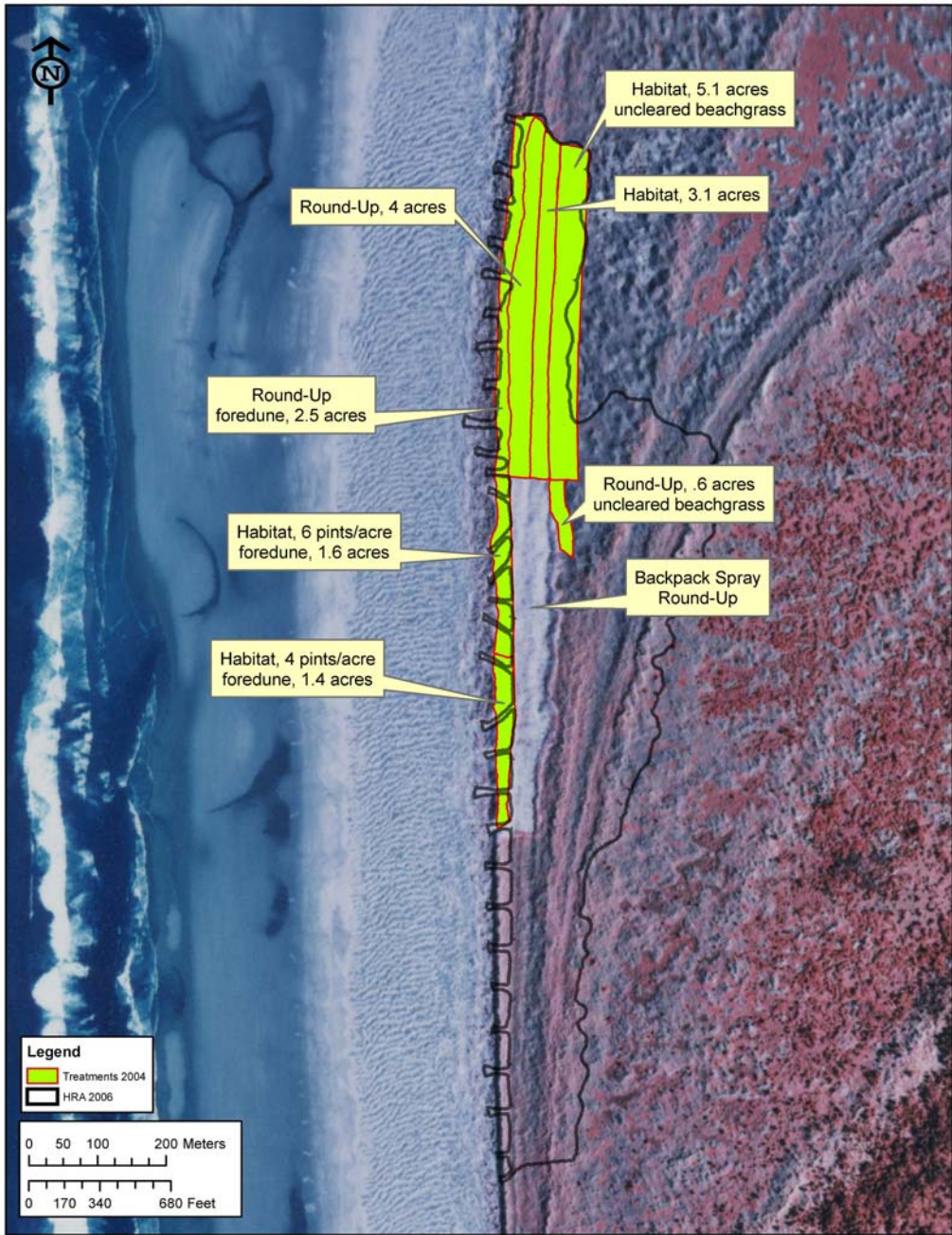




Table 2. Effect of herbicide treatment on dune grass control and percent cover (means \pm standard error; mean separation within columns by Duncan's Multiple range test @5%)			
Treatment	% cover pre-treatment	% cover 12 mat	% reduction in coverage
Habitat 6 pt/a + BD + Disk	55 \pm 11	21 \pm 6 cd	46 \pm 14
Habitat 6 pt/a + no BD + Disk	21 \pm 6	2 \pm 1 d	32 \pm 61
Rodeo10% no BD +Disk	10 \pm 3	0.5 \pm 0.3 d	82 \pm 16
Rodeo10% no BD + no Disk	19 \pm 5	0.7 \pm 0.4 d	84 \pm 12
Habitat 6 pt/a + no BD + no Disk	37 \pm 12	25 \pm 14 c	31 \pm 46
Habitat 4 pt/a + no BD + no Disk	62 \pm 21	56 \pm 18 b	16 \pm 16
Control	80 \pm 4	80 \pm 4 a	-3 \pm 1

BD=bulldozing, Disk=disking

Table 3. Effect of herbicide treatment on dune grass plant density by species (means)

Treatment	Number of plants/ 0.25m ²					
	Pre-treatment			14 months Post-treatment		
	Amer.	Eur.	Native	Amer.	Eur.	Native
Habitat 6 pt/a + BD + Disk	8	0	0	4.8	0	0
Habitat 6 pt/a + no BD + Disk	4	0	1.1	0.9	0	0
Rodeo10% no BD +Disk	1.9	0	0	0.3	0	0
Rodeo 10% no BD + no Disk	2.8	0.1	0.4	1.1	0	0
Habitat 6 pt/a + no BD + no Disk	3	0	1	1.7	0	0
Habitat 4 pt/a + no BD + no Disk	1.8	0	1	2.8	0	0
Control	6.7	1.5	0.4	4.2	4.4	0.3

BD=bulldoze, Disk=disking

Table 4. Effect of herbicide treatment on dune grass stem density by species (means)

Treatment	Number of stems/ 0.25m ²					
	Pre-treatment			14 months Post-treatment		
	Amer.	Eur.	Native	Amer.	Eur.	Native
Habitat 6 pt/a + BD + Disk	17.8	0	0	8.5	0	0
Habitat 6 pt/a + no BD + Disk	10.3	0	5.5	2.2	0	0
Rodeo 10% no BD +Disk	8.5	0	0	0.2	0	0
Rodeo 10% no BD + no Disk	9.8	3.25	2.1	1.1	0	0
Habitat 6 pt/a + no BD + no Disk	14.7	0	3.7	26.7	0	0
Habitat 4 pt/a + no BD + no Disk	23	0	7.5	39.5	0	0
Control	22.9	4.3	0.9	13.3	16.1	1.1

BD=bulldoze, Disk=disking

Table 5. Effect of herbicide treatment on change in dune grass stem density by species (means)						
Treatment	Change in stem density (pre-14 month post treatment)/ 0.25m ²					
	Number of plant			Stem density		
	Amer.	Eur.	Native	Amer.	Eur.	Native
Habitat 6 pt/a + BD + Disk	-3.2	0	0	-9.3	0	0
Habitat 6 pt/a + no BD + Disk	-3.1	0	-1.5	-8.1	0	-5.5
Rodeo 10% no BD +Disk	-1.6	0	0	-8.2	0	0
Rodeo 10% no BD + no Disk	-1.6	0.1	-0.3	-8.7	-3.2	-2.1
Habitat 6 pt/a + no BD + no Disk	-1.2	0	-1	12	0	-3.7
Habitat 4 pt/a + no BD + no Disk	1	0	-1	16.5	0	-7.5
Control	-2.6	2.65	-0.1	-10.4	11.3	-0.2