Introduction of *Sidalcea hendersonii* to Dean Creek ACEC, Coos Bay District BLM

Final Report

Andrea S. Thorpe
Institute for Applied Ecology

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PREFACE

This report is the result of an agreement between the Institute for Applied Ecology (IAE) and the USDI Bureau of Land Management. IAE is a non-profit organization dedicated to natural resource conservation, research, and education. Our aim is to provide a service to public and private agencies and individuals by developing and communicating information on ecosystems, species, and effective management strategies and by conducting research, monitoring, and experiments. IAE offers educational opportunities through 3-4 month internships. Our current activities are concentrated on rare and endangered plants and invasive species.

Questions regarding this report or IAE should be directed to:

Andrea S. Thorpe, *Conservation Research Program Director*
Institute for Applied Ecology
PO Box 2855
Corvallis, Oregon 97339-2855
phone: 541-753-3099, ext. 401
fax: 541-753-3098
email: andrea@appliedeco.org

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Cover photographs: *Sidalcea hendersonii* flowers from introduced plants at Yellow Flag at Dean Creek ACEC. Except where noted, all photos by Andrea S. Thorpe.

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INTRODUCTION

Henderson's checkermallow (*Sidalcea hendersonii*; Figure 1) is a perennial forb in the Malvaceae family. This species was historically found in at least ten sites in Oregon (Figure 2); it currently occurs naturally on Cox Island in the Siuslaw Estuary near Reedsport and at two sites near Warrenton. Including the relatively numerous *S. hendersonii* populations in Washington and British Columbia and a recently discovered population in Alaska, there are believed to be fewer than 100 total populations. Many of these occur on unprotected, private land (Gisler and Love 2005). Due to the low number of populations and continued decline of population sizes, *S. hendersonii* has been listed as a Species of Concern by the USFWS and designated a List 1 (taxa threatened with extinction or presumed to be extinct throughout their entire range), G3 (globally rare, uncommon or threatened, but not immediately imperiled), S1 (critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation) taxon by the Oregon Natural Heritage Information Center (ORNHIC 2007).

Sidalcea hendersonii's range extends farther north than any of the other 23 *Sidalcea* species in North America. Although it resembles *S. candida* and *S. oregana*, *S. hendersonii* is distinguished by glabrous foliage, smooth carpels, and the purplish hue to its stems and the tips of its calyx lobes. Like several other *Sidalcea* species, *S. hendersonii* is gynodioecious. The maintenance of gynodioecy results from the parasitization of seeds in bisexual plants by two species or Curculionid beetles (Marshall and Ganders 2001). Flowering occurs from June through September. Flowers are pollinated by several different insects, including species of *Bombus* (bumblebee), *Apis* (honeybee), and *Vanessa* (brush-footed butterfly).

It has generally been thought that *S. hendersonii* occurs in *Deschampsia caespitosa*-dominated estuarine habitats. However, Gisler

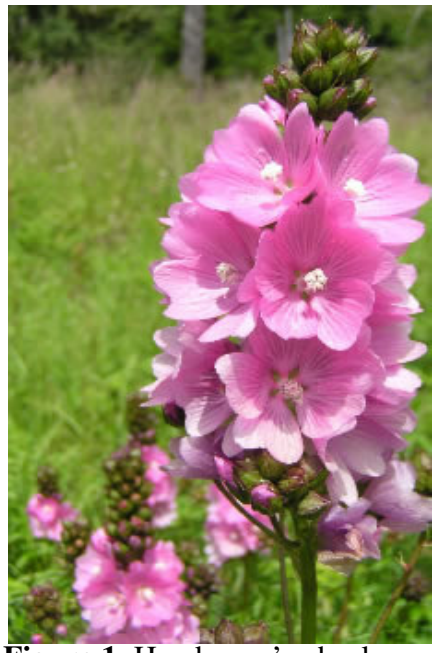

Figure 1. Henderson's checkermallow (*Sidalcea hendersonii*). Photo by Melanie Gisler.

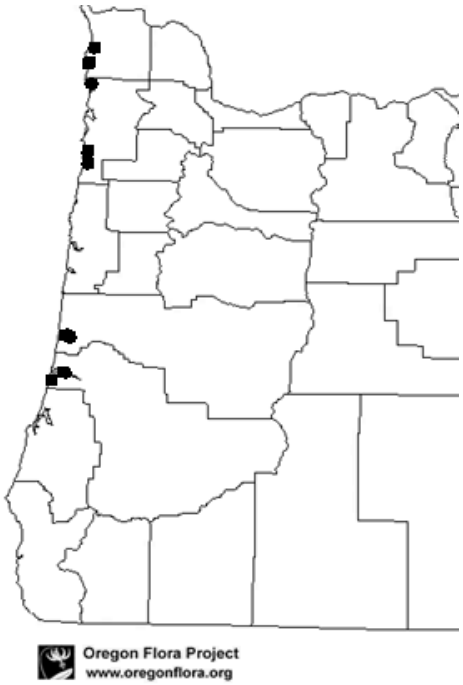

Figure 2. Historical distribution of *Sidalcea hendersonii* in Oregon; map from the Oregon Flora Project.

and Gisler (2005) found that *D. caespitosa* was a minor component of sites currently supporting *S. hendersonii* in Oregon and Washington. In a study of three populations in Washington and three in Oregon that bracket the species' former range along the northern Oregon coast, the top seven indicators of suitable habitat were (in order of importance) 1. *Potentilla pacifica,* 2. *Juncus balticus,* 3. *Angelica lucida,* 4. *Achillea millefolium,* 5. *Galium aparine,* 6. *Deschampsia caespitosa* and 7. *Hordeum brachyantherum*. In the Siuslaw Estuary in Oregon, other important indicator species included *Agrostis exarata*, *Erechtites minima*, *Festuca rubra* var. *littoralis*, *Grindelia integrifolia*, *Heracleum lanatum*, *Solidago canadensis*, and *Vicia gigantea*.

In 2005, the Institute for Applied Ecology planted approximately 300 *S. hendersonii* in the Siletz Bay Refuge and at three sites in the Umpqua River Estuary (Blacks Island, Goose Island, and Butler Creek Ranch; Gisler 2006). When the Siletz Bay Refuge was revisited in July 2006, 87 out of 120 transplants were relocated (73% survival). Goose and Blacks Islands were revisited in June 2008. Informal surveys located 30 out of 70 plants at Goose Island (43% survival) and 37 out of 50 plants at Blacks Island (74% survival). Because transplanted individuals were not intensively searched for, these survival rates represent potential underestimates of the actual survival rates. If these populations are to persist, continued reintroductions and augmentations are important because inbreeding in small populations of *S. hendersonii* has been correlated with reductions in seed production, germination, survival, and flowering (Marshall and Ganders 2001).

The objective of this project was to establish a new population of *S. hendersonii* at Dean Creek ACEC (Coos Bay District BLM). This multi-year project included two reintroduction events. In 2009, our goal was to build upon previous efforts at Umpqua River Estuary, Siletz Bay Refuge, and Spruce Reach Island by planting an additional 250 plants at Dean Creek ACEC. Outplantings at Bandon Marsh National Wildlife Refuge occurred concurrently to this project and are discussed in Appendix B.

PROPAGATION METHODS AND RESULTS

2007 - 2008 propagation

The seed used for the 2008 outplanting was collected in 2003 from Cox Island in Lane County, Oregon. Seed had been stored at room temperature. During the first phase of 2007 seed germination we used the protocol described in Gisler (2006) on a limited number of seeds. Optimal germination requirements for the seed of a species can vary between populations, the year the seed was produced, or the length of time the seed was in storage. Since few seeds germinated using previously successful techniques, we initiated a second phase of seed germination to test modified protocols over a 9-week period in early 2008.

All *Sidalcea hendersonii* seeds were removed from their dried fruits by forcing them through a 1.981 mm soil sieve. Each seed was scarified by making a small incision on the back of the seed coat. On 12 December 2007, we put 600 seeds into small pots (1" x 1" x 1") filled with EB Stone seedling starter soil. Seeds were pressed into the soil to just below the surface. The soil was moistened and the pots were cold stratified at 4^{o}C in continuous dark for two weeks. Pots were then transferred to the west greenhouse complex at Oregon State University where temperature was maintained at 21^{o}C during the day and 13^{o}C at night with 14 hours a day of artificial light provided by a Sun System

3 - 400 HPS bulb. Seeds began to germinate after two weeks. After four weeks, 42 seeds (8%) had germinated; the remaining seeds were abandoned. After germinating, seeds were transplanted into Anderson pots (2" x 2" x 10") with Gardener's Gold potting soil. Plants were watered every 2 - 3 days and fertilized once a week with Miracle Grow.

Through experience with other *Sidalcea* species, we found that germination success increased with longer cold stratification periods (up to 8 weeks). Phase II seeds were cleaned and scarified as in the phase I protocol, after which they were mixed with moistened vermiculite and put into Ziploc bags. These bags were placed into cold stratification at 4°C in continuous dark; after three weeks one bag was removed, its contents were spread over the soil in a large tray, and the tray was placed in a room with a 25°C day / 15°C night temperature cycle and 8 hour day / 16 hour night lighting cycle. One bag was removed each week through week 9 in order to determine the optimal cold stratification length for maximal seed germination.

A total of 82 plants were produced during using the two germination methods described above. We repotted all seedlings into gallon containers in spring 2008. The plants were grown in the greenhouse until September 2008, and then transferred outside to harden off several weeks prior to outplanting. Based on the germination success of seed collected and germinated in late 2008 (below), we hypothesize that the seed collected in 2003 was old and stored improperly and had therefore lost a significant amount of its viability.

2008 - 2009 propagation

Sidalcea hendersonii seed was collected from Cox Island in August 2008 with support of Nature Conservancy staff. Approximately 10% of every inflorescence was stripped of its fruits, which were put into paper bags. There was active seed predation by weevils, as evidenced by the large number that crawled out of the paper bags. The inflorescence material was later spread out to dry and sprinkled with diatomaceous earth to control the weevils. Once dry, the inflorescence material was crushed using a "boat" (similar to a mortar and pestle lined with rough fabric); the chaff was separated from the seed using a vacuum-driven system that sorted material based on weight. This process resulted in 132 grams of fairly clean seed (>5,000 seeds).

Seeds were scarified before planting in late 2008 using a box and a brick both lined with medium-grit sandpaper. Many of the unviable seeds were demolished during this process; potentially viable seeds had visible scratching on their seed coats. We used two different methods to stratify the seeds. Nine hundred eighty firm seeds were selected out of this mixture and sown a seed-length into water-saturated soil in plug trays. Trays were wrapped in black plastic to maintain their moisture during cold stratification. An unknown quantity of seeds that were not separated from the inflorescence material and non-viable seeds were thinly scattered over saturated soil in sixteen 4" square pots. We scattered a thin layer (<1/2") of perlite over the soil and seeds and wrapped the pots in plastic for the duration of the cold stratification. Cold stratification for both trays and pots lasted six weeks, after which they were unwrapped and moved into a room at the Oregon State University's west greenhouse complex where the temperature was maintained at 21°C during the day and 13°C at night with 14 hours a day of artificial light provided by a Sun System 3 - 400 HPS bulb.

Several seeds had germinated before the trays were unwrapped in January 2009. The soil in the trays was kept moist by misting three times per week. Germination started immediately and primarily occurred in the first two weeks after the trays were pulled out of cold stratification. After five and a half weeks, 289 seeds had germinated (29.5%) and most of the seedlings had put on 1 - 2 post-cotyledon leaves. Germination in the pots occurred similarly to the trays. After five and a half weeks, approximately 120 seedlings had germinated.

All seedlings were repotted into gallon containers in early February 2009. A total of, 394 *S. hendersonii* seedlings survived and put on new leaves as of February 24th, 2009. These plants were grown in the greenhouse until September 2009, when they were moved outside to harden off before outplanting (see below).

SIDALCEA HENDERSONII OUTPLANTING AND RESULTS

Outplanting of *S. hendersonii* occurred at four areas within Dean Creek ACEC in 2008 and 2009. A total of 306 individuals were planted at 13 transects and points (Table 1). In July 2009 and 2010, we monitored the survival and reproductive status of outplanted individuals. In general, *S. hendersonii* were planted at 1 meter intervals (starting at 0.5m), 0.5 meters to either side of each transect (Table 1, Appendix B). If a planting position was particularly unsuitable for *S. hendersonii* due to trees, shrubs, dense *Iris pseudacorus*, or hydrology, then that position was abandoned. The ends of all transects were marked with rebar spray painted pink. Planting involved digging a hole large enough for a gallon pot-sized rootball to fit into, breaking up the rootball to promote root growth, and packing dirt firmly into the hole around and on top of the rootball.

Spruce Reach Island.

In 2008, we established two transects adjacent to Spruce Reach Island, on the edge of the channel separating the island from the mainland (Table 1, Appendix A). Both transects supported native and invasive species including *Anaphalis margaritacea* (pearly everlasting; native), *Potentilla pacifica* (=*Argentina egedii* ssp. *egedii,* pacific silverweed; native), *Juncus balticus* (Baltic rush; native), *Angelica lucida* (seacoast angelica; native), *Lythrum salicaria* (purple loosestrife; invasive), and *Phalaris arundinacea* (reed canarygrass; invasive). On October 28, 2008, 11 seedlings were planted along the 5 meter transect established on the south side of the island (Figure 3) and 21 seedlings were planted along the 10 meter transect on the northwest side of the island (Figure 4).

We observe high survival for plants on Spruce Reach Island (90% North, 82% South; Table 2). The second year of planting, survival at the north transect remained high (86%), but decreased to only 27% at the south transect. Mortality at the south transect was due to severe bank erosion. This erosion appeared to be associated with work to the adjacent culvert and bridge. In 2009, all surviving plants flowered. In 2010, half of the plants in each transect flowered. Reproductive output of the flowering plants increased from 2009 to 2010 on the north transect, but decreased on the south transect (Table 3).

Table 1. Outplanting information for Dean Creek ACEC. See Appendix A for aerial photos of outplanting areas.

Outplanting area	Transect ID	Transect length (m)	# of plants	Plant locations	Lat/Longs (WGS84)
Yellow Flag	Transect 1 (N)	13	26	Start at 0.5m and continue every 1m on both sides of tape	43.695364N 124.027991W
	Transect 2 (S)	13	24	Start at 0.5m and continue every 1m on both sides of tape, no plants @ 4.5N or 7.5S	43.695283N 124.027990W
	Circle 3 (W)	NA	9	8 plants in circle around center point @ N, NE, E, SE, S, SW, W, NW, each 1m from center; 9th plant in center	43.695337N 124.027966W
	Circle 4 (Middle)	NA	9	8 plants in circle around center point @ N, NE, E, SE, S, SW, W, NW, each 1m from center; 9th plant in center	43.695347N 124.027916W
	Circle 5 (E)	NA	9	8 plants in circle around center point @ N, NE, E, SE, S, SW, W, NW, each 1m from center; 9th plant in center	43.695338N 124.027842W
Spruce Reach Island	Transect 1 (N)	10	21	E side of tape: plants @ 0.5, 1.0, 1.5, 2.5, and every meter to 9.5; W side of tape: as above except no plant @ 2.5m	43.696981N 124.016316W
	Transect 2 (S)	5	11	N side of tape: plants @ 0.5m and every meter to 4.5m; S side of tape: plants @ 0 and every meter to 5m	43.696204N 124.016626W
Slough	Transect 1 (SE)	32	55	Plants every meter, 0.5-1.0m from both sides of tape; no plants @ either side of 16m; no plants on E side of tape from 24-32m	43.693448N 124.030763W
	Transect 2 (NE)	16	27	0-6m: 1 plant every meter on tape; 7-16m: plant every meter on both sides of tape, 0.5-1.0m away	43.695283N 124.030955W
	Transect 3 (NW)	25	52	Plants 0.5-1.0m away from tape every meter and on both sides	43.695062N 124.031460W
	Transect 4 (SW)	32	39	0-3m plants on E side only, 4-8m plants on both sides, 9-11m no plants either side, 12-17m plants on both sides, 18-32m plants on E side only; all plants 0.5-1.0m away from tape	43.693312N 124.030922W
Owl	Transect 1	9	15	1 plant located on tape @ 0-3m and 5m, plants located on both sides of tape @ 4m and 6-9m	43.693096N 124.045772W
	Circle 2	NA	9	8 plants in circle around center point @ N, NE, E, SE, S, SW, W, NW, each 1m from center; 9th plant in center	43.693071N 124.045461W

Table 2. Number of *S. hendersonii* planted and surviving in each year.

			Monitoring Year							
			2009				2010			
Area	Transect	# Planted	# Veg.	# Flow.	#	*(%)* Total	# Veg.	# Flow.	#	*(%)* Total
2008 Planting										
Spruce Reach Island										
	North	21	0	19	19	*(90%)*	6	12	18	*(86%)*
	South	11	0	9	9	*(82%)*	1	2	3	*(27%)*
Yellow-flag										
	North	26	0	25	25	*(96%)*	1	19	20	*(77%)*
	South	24	0	24	24	(100%)	3	18	21	*(88%)*
2009 Planting										
Owl										
	Circle	8	-	-	-	-	0	0		0
	Transect	15	-	-	-	-	2	0	2	*(13%)*
Slough										
	Transect 1	55	-	-	-	-	0	0		0
	Transect 2	27	-	-	-	-	0	0		0
	Transect 3	52	-	-	-	-	0	0		0
	Transect 4	39	-	-	-	-	0	0		0
Yellow-flag										
	Circle-Middle	8	-	-	-	-	0	6	6	*(75%)*
	Circle-West	8	-	-	-	-	0	8	8	*(100%)*
	Circle-East	8	-	-	-	-	2	5	7	*(88%)*

Table 3. Average number of stems and racemes stem^{-1} of flowering *S. hendersonii*.

	Monitoring Year			
	2009		2010	
Site	Stems	Racemes stem^{-1}	Stems	Racemes stem^{-1}
2008 Planting				
Spruce Reach Island				
North	5.2	16.5	7.3	20.8
South	7.2	21.6	1.5	12.0
Yellow-flag				
North	6.0	26.8	10.1	63.5
South	7.0	30.6	10.6	35.2
2009 Planting				
Yellow-flag				
Circle-Middle	-	-	5.0	12.2
Circle-West	-	-	4.1	18.9
Circle-East	-	-	2.0	3.6

Yellow Flag

Yellow Flag is located in a tidally inundated wetland adjacent to Spruce Reach Island. Similar to the other transects, several indicator species, including *P. pacifica*, *J. balticus*, and *A. lucida* were present. However, this site was dominated by yellow flag iris (*Iris pseudacorus*) and willows (*Salix* species). *Iris pseudacorus* was treated with herbicides in July 2008; however, its rhizomes were densely clustered immediately beneath the soil surface and still appeared healthy at the time of planting. The vegetation at each transect was pruned back with a weedwhacker, pruners, and a machete prior to planting.

On October 28, 2008, two 13 meter transects were established at Yellow Flag, along which 26 and 24 seedlings were planted (Figure 5). In 2009, 98% of these plants survived, all of which flowered. Survival decreased in 2010 to 82%, on average between the two plots, with the majority flowering (Table 2). In 2010, each flowering plant produced an average of 10 flowering stems per plant with an average of 35.2 (south) or 63.5 (north) racemes per stem (Table 3).

In 2009, we planted an additional 27 plants between the 2008 transects (Appendix A). Instead of planting individuals along transects, three points were chosen (Table 1). At each point, eight plants were planted one meter from the point at the cardinal and intercardinal directions. The ninth plant was planted at the center of the circle. The center of each circle was monumented with a fiberglass post spray-painted pink. In 2010, survival in these ranged from 75%-100% (Table 2), with the majority of the plants flowering. The average number of flowering stems per plant and racemes per stem varied significantly between plots (Table 3). The lowest flowering effort was in the east plot, which also had the highest cover of *I. pseudocorus*.

While not as dense as prior to herbicide treatment, *I. pseudacorus* was observed at Yellow Flag in 2009 and 2010. Without repeated herbicide applications, this plant will reinvade the areas now occupied by *S. hendersonii* and is likely to negatively impact these introduced plants.

Slough transects

Four transects were established along the slough off of the Umpqua River (Table 1, Appendix A). Planting areas were selected due to their relatively high cover of *Potentilla pacifica* and *Juncus balticus*. Transects ranged in length from 16 to 32 meters. Both ends of each transect were marked with fiberglass posts spray-painted pink. Plants were spaced 0.5 to 1.0 meters away from and on both sides of the transect at one meter intervals except where noted in Table 1. A total of 173 plants were planted at the four transects.

In 2010, the two southern transects could not be relocated. The north transects were relocated, but no plants were found (Table 2). The habitat appeared to have shifted to a wetter habitat type, with much higher cover of *Juncus* spp. and very low cover of *P. pacifica*.

Owl

The Owl outplanting area contained enough suitable habitat to establish one transect and one point. Both outplanting sites were situated adjacent to a different slough off of the Umpqua River (Appendix A). The transect was 15 meters long and had 15 plants planted along it. The point planting was constructed the same way as the points at Yellow Flag (see above). All *S. hendersonii* seedlings were planted as in 2008 (see above).

In 2010, we could not find the plot marker nor any plants at the circular plot. Two percent of the plants on the transect survived; all were vegetative (Table 2). It appeared that elk had been using the area of the plot and transect as a travel corridor, and likely led to the loss of plants at this site.

CONCLUSIONS

The population of *S. hendersonii* at Dean Creek ACEC now represents the second largest population in Oregon. Habitat at Yellow Flag, on the Spruce Reach Island Transect, and at the Owl area appears suitable to support populations of *S. hendersonii*. However, invasive weeds pose a threat to introduced plants in both areas, particularly *I. pseudocarus* at the Yellow Flag site. In 2010, the lowest reproductive effort by *S. hendersonii* was observed in areas with the highest infestations of *I. pseudocarus*. Thus, although this site has the potential to support a significant population of *S. hendersonii*, its success will depend on regular treatment of *I. pseudocarus* and other invasive weeds. The North Spruce Reach Island Transect appears to have suitable habitat for *S. hendersonii*, but is a relatively small area and likely can not support additional plants. Although the habitat at the Owl area appears suitable for this species, success will likely require fencing the plants to minimize herbivory and trampling by elk.

The work at Dean Creek ACEC has resulted in the additional benefit of providing momentum for additional *S. hendersonii* introductions; in 2009, IAE introduced almost 300 plants to the Bandon Marsh National Wildlife Refuge (Table 1) and in May 2010, approximately 80 plants were planted at Cox Island to supplement the naturally occurring population. We recommend that future coastal restoration efforts consider including *S. hendersonii* in their planting designs. As described in Gisler and Gisler (2005), we found high survival in mid-level marsh habitat characterized by the presence of at least three of the following indicator species: *Potentilla pacifica*, *Juncus balticus, Angelica lucida, Achillea millefolium, Galium aparine, Deschampsia caespitosa*, *Hordeum brachyantherum*, *Agrostis exarata*, and *Erechtites minima.* We also recommend additional augmentations of the introduced populations, including the Siletz Bay Refuge, Blacks Island, Goose Island, and Bandon Marsh; it has been suggested that 100 is the minimum number of plants to form a viable population and most of these population are currently below that number.

Figure 3. South planting area on Spruce Reach Island. Note pink-tipped rebar marking transect end.

Figure 4. North planting area on Spruce Reach Island. Note pink-tipped rebar marking transect end.

Figure 5. Reintroduction transects at the Yellow Flag outplanting area. Note pink-tipped rebar in left picture indicating the beginning of the transect.

Figure 6. Reintroduction transects along the Slough.

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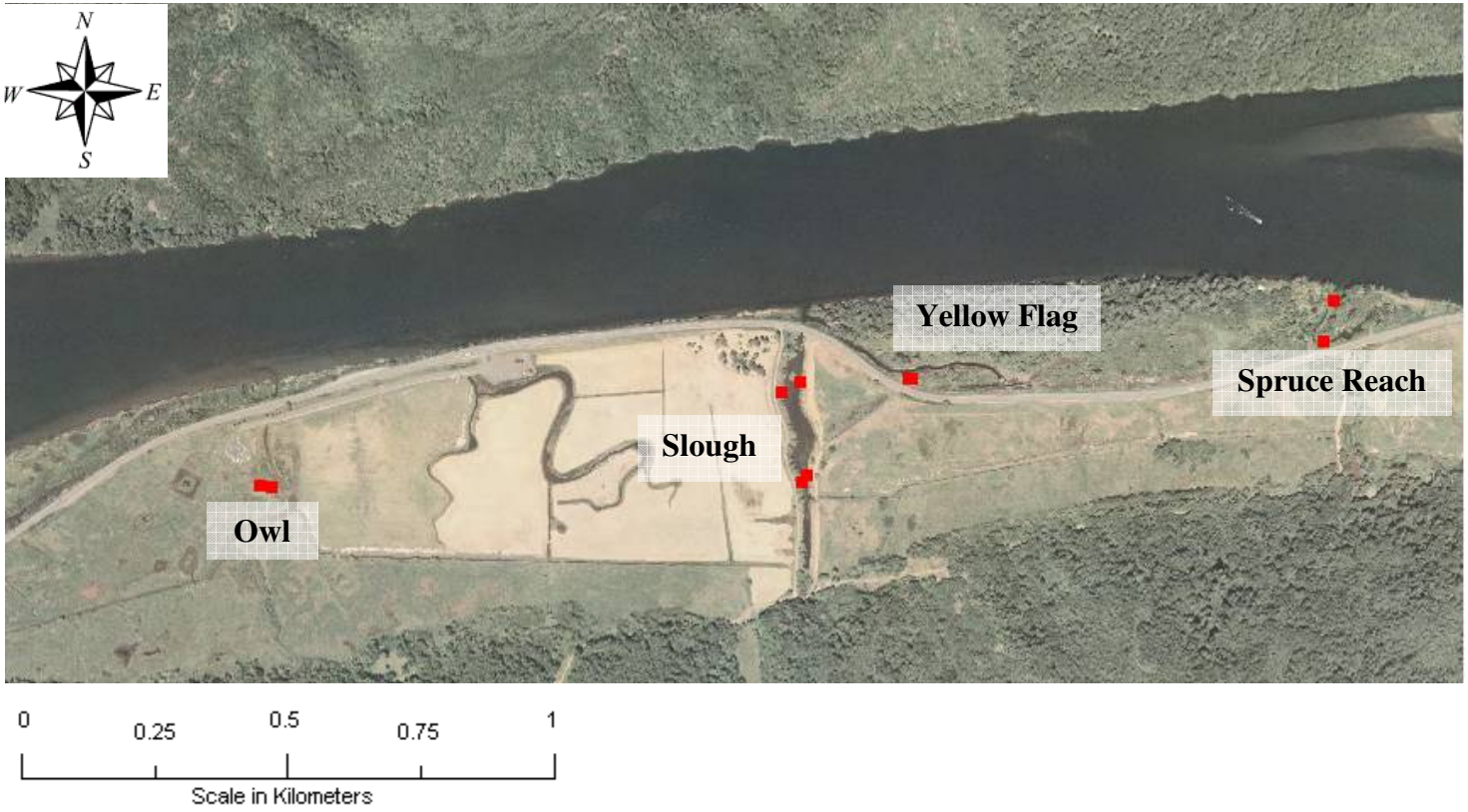
APPENDIX A. AERIAL PHOTOGRAPHS OF REINTRODUCTION SITES AT DEAN CREEK ACEC AND BANDON MARSH NATIONAL WILDLIFE REFUGE



Dean Creek ACEC planting areas. For more information about the sites, see Table 1. Road adjacent to river is Umpqua Highway (State Route 38). Pullout for elk viewing area (between Owl and Slough) is approximately 3.7 miles east of Reedsport (Highway 101).

Owl planting area at Dean Creek ACEC. In 2009, 15 plants were planted along Transect 1 and 9 plants were planted at the Circle plot, hear numbered "2". See Table 1 for more information.

Slough planting area at Dean Creek ACEC. In 2009, 55 plants were planted at Transect 1, 27 at Transect 2, 52 at Transect 3, and 39 at Transect 4. See Table 1 for more information.

Yellow Flag planting area at Dean Creek ACEC. In 2008, 26 plants were planted along Transect 1 and 24 were planted along Transect 2. In 2009, 9 plants were planted at each of Points 3, 4, and 5. See Table 1 for more information.

Spruce Reach Island planting area at Dean Creek ACEC. In 2008, 21 plants were planted along Transect 1 and 11 plants were planted along Transect 2. See Table 1 for more information.

APPENDIX B. OUTPLANTING AT BANDON MARSH NATIONAL WILDLIFE REFUGE.

Outplanting at Bandon Marsh National Wildlife Refuge occurred concurrently with the 2009 introductions at Dean Creek ACEC. This project was jointly funded by IAE and the Native Plant Society of Oregon, which support of the US Fish and Wildlife Service. Information is included here to provide a comparison with outplanting success between sites.

Seed collection and grow-out

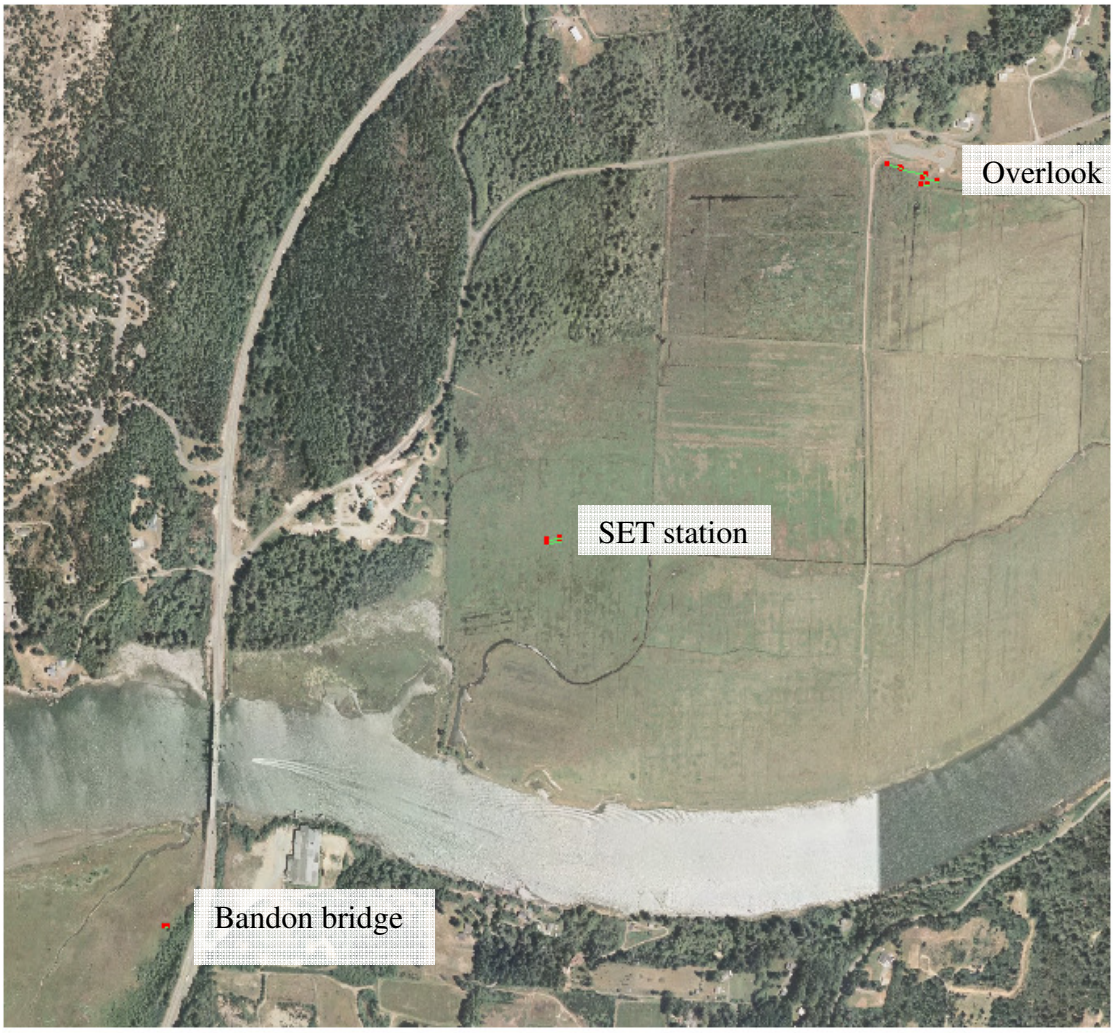
Sidalcea hendersonii seed was collected from Cox Island in the Siuslaw Estuary in October 2008. Seed was scarified, cold stratified, and germinated in early 2009. Seedlings were planted in gallon-sized pots in February 2008 and were grown at the Oregon State University west greenhouse complex until September 2009. Plants were placed outside to harden off for approximately two weeks before outplanting.

Sidalcea hendersonii outplanting

297 plants were outplanted in three areas at Bandon Marsh National Wildlife Refuge on October 22 and 23, 2009. Plants were placed along transects in order to facilitate relocation and monitoring. All plants were watered within 1 hour of planting. Brief surveys in 2010 found that 50 – 75% of outplanted *S. hendersonii* survived at the Overlook transects. Survival at this site appeared to be limited primarily by intense competition with *Potentilla pacifica*, *Agrostis exarata*, *Juncus balticus,* and *Holcus lanatus*.

Table 4. Outplanting information for \ Bandon Marsh National Wildlife Refuge.

Outplanting area	Transect ID	Transect length (m)	# of plants	Plant locations	Lat/Longs (WGS84)
Overlook	Transect 1	25	49	Plants every meter, 1m from tape on both sides	43.15724806N 124.3803984W
	Transect 2	50	102	Plants every meter, 1m from tape on both sides; no plants @ 13S, 12N, or 10N	43.15717581N 124.3800781W
	Transect 3	25	51	Plants every meter, 1m from tape on both sides; no plant @ 7N	43.15700674N 124.3792228W
	Transect 4	12	22	Plants every meter, 1m from tape on both sides; no plants at 12N, 12S, or 11N	43.15696064N 124.3794484W
SET station	Transect 5	22	24	Plants every 2 meters, 1m from tape on both sides	43.15081629N 124.3876388W
	Transect 6	22	25	Plants every 2 meters, 1m from tape on both sides, 1 extra plant b/t transects 5&6	43.15084269N 124.3879226W
Bandon Bridge	Transect 7	10	24	Plants every meter, 1m from tape on both sides (some closer to 0.5m away), extra plants on line @ 7m and 6.7m	43.1442049N 124.3964401W



Sidalcea hendersonii introduction areas at Bandon Marsh National Widlife Refuge.

Site Name	Transect #	# of plants	Length of Transect (m)
Overlook	1,2,3,4	49, 102, 51, 22	25m, 50m, 25m, 12m
SET station	5,6	24, 25	22m, 22m
Bandon Bridge	7	24	10m

Overlook planting area at Bandon Marsh National Wildlife Refuge. In 2009, 49 plants were planted along Transect 1, 102 along Transect 2, 51 along Transect 3, and 22 along Transect 4. See Table 1 for more information.

SET station planting area at Bandon Marsh National Wildlife Refuge. In 2009, 24 plants were planted along Transect 5 and 25 were planted along Transect 6. See Table 1 for more information.

Bandon Bridge planting area at Bandon Marsh National Wildlife Refuge. In 2009, 24 plants were planted along Transect 7. See Table 1 for more information.