Upland restoration monitoring at the Williamson River Delta- First year results

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Introduction

Upland areas at the Williamson River Delta Preserve were historically dominated by grasses and shrubs (Christy 1996), but they were converted for agricultural production along with the delta's wetlands by the 1940's. On the Tulana portion of the property, approximately 400 acres of uplands have not been farmed since 1996 and are part of a long-term restoration project to restore ecological processes on the delta (David Evans and Associates 2005).

Site preparation in upland restoration sites were initiated in 2005, and native grasses were planted in 2009-2010. This report describes results from the first year of post-planting monitoring and documents the upland restoration efforts completed to date.

Methods

Project history

Following the cessation of farming in 1996, the uplands on Tulana (i.e. the portions of Riverbend, Searchlight, Strip, and Campfields at or above 4143 ft.) were colonized by an assortment of exotic species dominated by mustards (*Sisymbrium altissimum*, *Descurainia* spp.), prickly lettuce (*Lactuca serriola*), Canada thistle (*Cirsium arvense*), and cheatgrass (*Bromus tectorum*).

Upland restoration planning efforts outlined site preparation options to reduce the weed seed bank (Elseroad and Stevens 2005) and potential native species planting lists (Elseroad 2005). Site preparation began in spring 2005 and consisted of prescribed burning following by planting barley as a cover crop to control weeds. Prescribed burning followed by barley planting was repeated in 2006-2008. Native grass planting was planned to occur following the fall 2008 prescribed burn, but was delayed due to inadequate weather conditions. In June 2009, herbicides were applied to control the broadleaf weeds that established the previous winter and spring, and in October 2009, a prescribed burn was used to prepare the fields for planting.

Native grasses were drill seeded with a Truax range drill in fall 2009 and spring 2010 at the following rates (Figure 1):

Field	Seeding date	Species planted*	Seeding rate (lbs/acre)	Acres planted
Riverbend	Oct-Nov 2009	42% basin wildrye, 58% Idaho fescue	12.9	60
Searchlight	Oct-Nov 2009	38% basin wildrye, 62% Idaho fescue	12.5	25.7
Strip	Oct-Nov 2009	55% basin wildrye, 27% Nuttall's alkaligrass ,18% squirreltail	11.6	47
Campfields	April 2010	56% basin wildrye, 26% Nuttall's alkaligrass , 17% squirreltail	12.6	36.8
			Total	**170**

*Seed sources: basin wildrye (*Leymus cinereus*) and Idaho fescue (*Festuca idahoensis*)- hand collected in Upper Klamath Basin and increased by BFI Native Seeds; squirreltail (*Elymus elymoides*) and Nuttall's alkaligrass (*Puccinellia nuttalliana*) purchased from Granite Seed

The total area planted was considerably smaller than what was originally planned (170 vs. 400 acres; Figure 1) due to difficulties implementing the prescribed burns at elevations lower than 4143 ft., because at those elevations the vegetation was denser and did not carry fire easily. As a result, the area planted in 2009-2010 was mainly at 4144 ft. and above.

Post-planting weed control consisted of applying broadleaf herbicides in March and May 2010 to control mustards and other weed species, followed by mowing in August and September to reduce the additional weed growth that occurred over the summer. Future management actions will include continued weed control and planting of native forbs and shrubs.

Monitoring methods

Upland restoration monitoring consisted of sampling 25 $1m^2$ plots in each of the four former agricultural fields that were seeded with native grasses (Figure 1). Plot locations were randomly selected prior to sampling using Hawth's tools in ArcMap. Plot locations are intended to be re-randomized each year that monitoring occurs, which will allow a larger percentage of the area to be sampled over time.

In each plot, data collected included the density of each seeded species and the aerial cover of all plant species and ground surface type (bare ground or litter). Percent cover of all species greater than 1% was recorded to the nearest percentage. For species with cover less than 1%, cover classes of 0.5%, 0.25%, and 0.1% were used. Plant cover was estimated separately for each species; therefore plant cover totaled over 100% when species overlapped one another. Nomenclature followed Hitchcock and Cronquist's (1973) Flora of the Pacific Northwest, and species names were updated following USDA (2010). Data were collected from June 6-8, 2010 by Adrien Elseroad.

Results

Native grass establishment

Native grass seedling density ranged from 6-23 plants/m^2, with the greatest establishment occurring in Campfields (Figure 2). The abundance of each seeded species corresponded to their proportion in the seed mix, i.e. the species seeded at higher rates established at higher rates (Figure 3).

Plot cover

Plot cover in all fields was dominated by bare ground, which ranged from 47-73% (Table 1). The most abundant plant species were cheatgrass (*Bromus tectorum*), a non-native annual grass, and herb sophia (*Descurainia sophia*), a non-native annual mustard. Average cover of seeded species was low, ranging from 0.06-3%, and was highest for basin wildrye in Campfields (Table 1).

Discussion

Native grass seeding in the upland restoration sites was successful in establishing all the species that were planted. While native grass cover was low in the first growing season following planting, cover can be expected to increase substantially in the next few years. Initial native grass densities appear high enough to sustain the seedling mortality that typically occurs following establishment, particularly for the species that were seeded at the highest rates (i.e. basin wildrye and Idaho fescue). For example, even if basin wildrye densities dropped to 1 plant/m^2, dense stands of this species would still develop, as mature plants are very large and can occupy most of a square meter.

Management recommendations

1. **Continue weed control efforts**
   Initial weed control efforts appeared successful in maintaining sufficient bare ground for native grass establishment. Weed control efforts should continue for several years to reduce competition with established seedlings and the forbs and shrubs that will be planted in restoration sites in future years.

2. **Continue annual monitoring for at least two more years**
   Monitoring the success of seeding and weed control efforts provides important information that can guide future management actions in upland restoration sites.

Literature cited

David Evans and Associates, Inc. 2005. Final Environmental Impact Statement, Williamson River Delta Restoration Project. Prepared for the Natural Resources Conservation Service and The Nature Conservancy. 300 pp.

Elseroad, A. 2005. Upland restoration plant species lists for the Williamson River Delta Preserve. Unpublished report. The Nature Conservancy.

Elseroad, A. and C. Stevens. 2005. Upland Restoration at the Williamson River Delta Preserve: Tasks and Timelines. Unpublished report. The Nature Conservancy.

Figure 1.

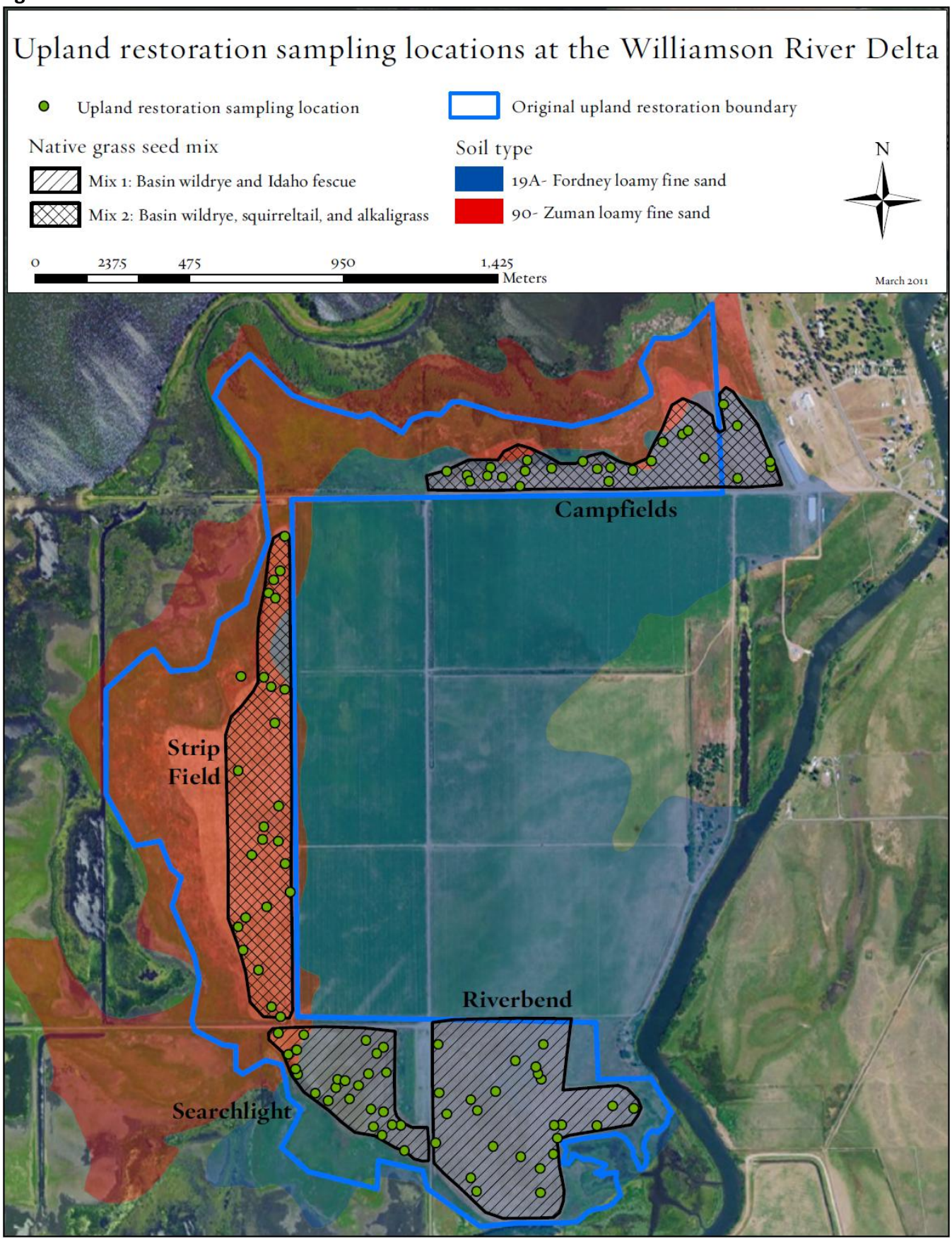
Upland restoration sampling locations at the Williamson River Delta
Upland restoration sampling location
Original upland restoration boundary
Native grass seed mix
Mix 1: Basin wildrye and Idaho fescue
Mix 2: Basin wildrye, squirreltail, and alkaligrass
Soil type
19A- Fordney loamy fine sand
90- Zuman loamy fine sand
N
0
2375
475
950
1,425
Meters
March 2011
Campfields
Strip Field
Riverbend
Searchlight

Figure 2. Density of all seeded native grasses in upland restoration monitoring plots on Tulana at the Williamson River Delta in 2010. Values are means ± SE (n=25).

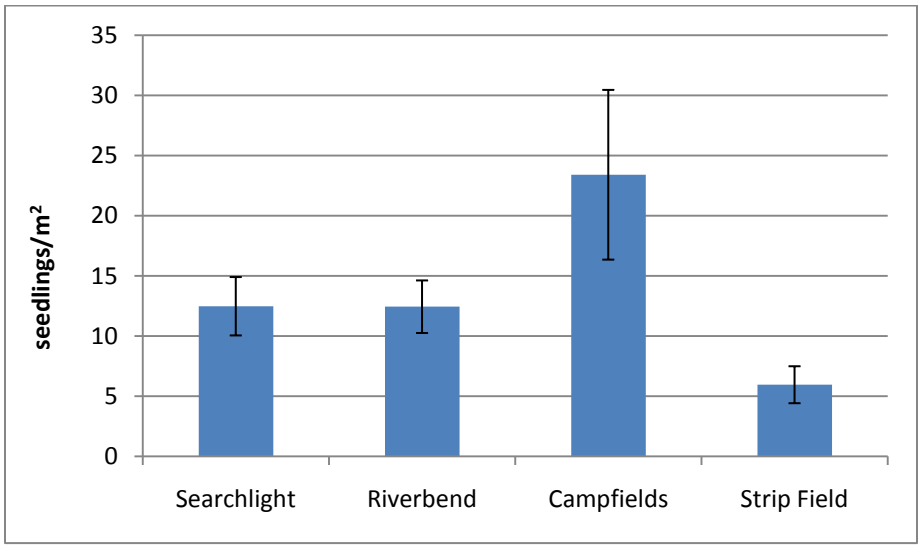

Figure 3. Density of each seeded native grass species in upland restoration monitoring plots on Tulana at the Williamson River Delta in 2010. Values are means ± SE (n=25).

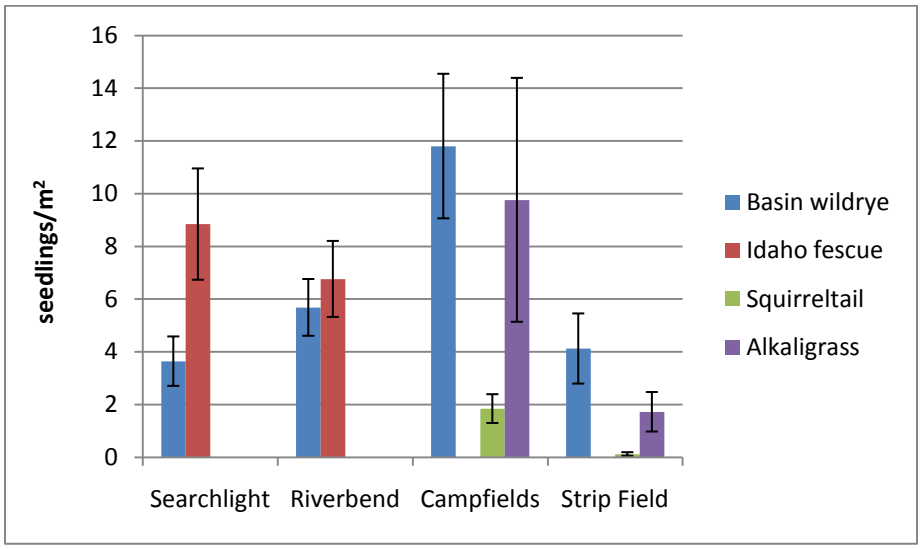

Table 1. Average plant species cover (average ± SE; n=25) for upland restoration monitoring plots at the Williamson River Delta Preserve in 2010. N=native, I=introduced, U=unknown, P=perennial, A=annual, B=biennial (USDA 2010).

	Cover (%)								
Species	**Campfields**	**Riverbend**	**Searchlight**	**Strip**	**Common name**	**Family**	**Origin**	**Duration**	**Growth Habit**
Amsinckia menziesii	2 ± 1.09	0.04 ± 0.04	0 ± 0	0.41 ± 0.28	common fiddleneck	Boraginaceae	N	A	forb
Bromus tectorum	21.6 ± 4	6.52 ± 1.08	13.34 ± 3.6	17.38 ± 4.47	cheatgrass	Poaceae	I	A	graminoid
Chenopodium album	0 ± 0	0.03 ± 0.02	0.02 ± 0.02	0 ± 0	lambsquarters	Chenopodiaceae	I	A	forb
Descurainia sophia	10.48 ± 2.73	5.04 ± 1.01	13.58 ± 3.39	2.46 ± 0.79	herb sophia	Brassicaceae	I	A/B	forb
Leymus cinereus	2.98 ± 0.47	1.97 ± 0.36	1.11 ± 0.28	0.91 ± 0.41	basin wildrye	Poaceae	N	P	graminoid
Elymus elymoides	0.1 ± 0.04	0 ± 0	0 ± 0	0.06 ± 0.04	squirreltail	Poaceae	N	P	graminoid
Capsella bursa-pastoris	0.28 ± 0.21	2.88 ± 2.23	4.08 ± 1.02	0 ± 0	shepard's purse	Brassicaceae	I	A	forb
Erodium cicutarium	0.6 ± 0.6	0.34 ± 0.32	0 ± 0	0 ± 0	redstem stork's bill	Geraniaceae	I	A/B	forb
Festuca idahoensis	0 ± 0	0.8 ± 0.19	2.08 ± 1.18	0 ± 0	Idaho fescue	Poaceae	N	P	graminoid
Galium aparine	3.46 ± 1.64	0 ± 0	0.02 ± 0.02	0 ± 0	common bedstraw	Rubiaceae	N	A	forb
Bassia scoparia	0 ± 0	1.04 ± 0.35	0 ± 0	0.01 ± 0.01	Mexican-fireweed	Chenopodiaceae	I	A	forb
Lupinus sp.	0 ± 0	0 ± 0	0.02 ± 0.02	0 ± 0	lupine	Fabaceae	U	U	forb
Nemophila sp.	0.4 ± 0.4	1 ± 0.96	2.68 ± 0.83	0 ± 0	nemophila	Hydrophyllaceae	U	U	forb
Poa pratensis	0.16 ± 0.11	0 ± 0	2.8 ± 2.8	0 ± 0	Kentucky bluegrass	Poaceae	I	P	graminoid
Puccinellia nuttalliana	1.55 ± 0.46	0 ± 0	0 ± 0	0.28 ± 0.13	Nuttall's alkaligrass	Poaceae	N	P	graminoid
Sisymbrium altissimum	0 ± 0	0.12 ± 0.12	0 ± 0	0 ± 0	tall tumblemustard	Brassicaceae	I	A/B	forb
Unknown forb	0 ± 0	0.01 ± 0.01	0 ± 0	0 ± 0	-	-	U	U	forb
Unknown grass	0.96 ± 0.81	0 ± 0	0 ± 0	0 ± 0	-	Poaceae	U	U	grass
Bare ground	47.04 ± 3.9	73.24 ± 3.63	51.6 ± 6.17	48.8 ± 5.04					
Litter	9.68 ± 1.32	7.48 ± 0.8	9.6 ± 2.55	30.56 ± 3.4					