

**POINT PINOLE REGIONAL SHORELINE
RESTORATION OF COASTAL PRAIRIE USING PRESCRIBED BURNING**

2009: First year report to the East Bay Regional Park District

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INTRODUCTION

The main goal of this research project is to assess the effects of prescribed burning on encroaching shrubs and on native and non-native plant species in Point Pinole Regional Shoreline's coastal prairie grassland. Coastal prairie management involves several primary problems, two of which are: 1) encroachment of native and non-native shrubs and trees into grassland areas, and 2) invasion by non-native perennial grasses and other weeds. Both problems are likely to affect native herbaceous species negatively. Prescribed burning may help address these management problems and also increase native herbaceous species richness and cover; however, this is only a hypothesis based on limited research and observation. Experimental evidence generated by this project will help to determine whether this management strategy effectively achieves the District's coastal prairie restoration objectives at Point Pinole.

Shrub encroachment

Several stands of the native shrub coyote brush (*Baccharis pilularis*) occupy the coastal prairie at Point Pinole (Figure 1). Whether these stands are expanding is unknown, but elsewhere along California's central coast, there is clear documentation that coyote brush is increasing in grassland areas (Ford and Hayes 2007, Russell and McBride 2003; Havlik 1984). A recent review of coastal prairie research noted that fire does not appear to prevent shrub encroachment because many shrubs, including coyote brush, are able to resprout following a fire and quickly re-establish pre-burn cover (Ford and Hayes 2007).

However, there is some evidence that fire in two consecutive years kills coyote brush (Havlik 1984); high coyote brush mortality would likely inhibit rapid re-establishment of shrub cover. Havlik (1984) reported the results of fires in two East Bay Regional Park District properties: a single fire on Brooks Island and two fires in consecutive years in Anthony Chabot Regional Park. Following the Brooks Island fire, there was only 15% coyote brush mortality, and within three years, cover of woody vegetation was close to pre-burn conditions. Following the first fire at Chabot, coyote brush mortality was again low: 20%; however, after the second fire, coyote brush mortality was 83% (cover at Chabot was not reported; Havlik 1984).

Havlik's (1984) observations need to be confirmed and expanded. Results of this study should accomplish that and would likely be of general interest to California land managers.

Control of non-native species

The study should also provide data about the effect of burning on naturalized, non-native species such as wild oats (*Avena* spp.), purple false-brome (*Brachypodium distachyon*), and filaree (*Erodium* spp.), which dominate some areas of Point Pinole's coastal prairie to the probable detriment of native herbaceous species.

Enhancement of native plant species

Two native, coastal prairie bunchgrasses are fairly abundant at Point Pinole: California oatgrass (*Danthonia californica*) and purple needlegrass (*Nassella pulchra*). Both grasses, but especially purple needlegrass, show inconsistent responses to fire (D'Antonio et al. 2002). Some of this inconsistency may relate to site-specific factors so studying the effects of burning on these bunchgrasses at Point Pinole may prove important to successful restoration and management at this site. In addition, little research has been conducted on the effects of fire on coastal prairie forbs; the study may produce valuable information regarding this often overlooked, but important component of the coastal prairie.

METHODOLOGY

Ten coyote brush stands were identified as large enough to be included in the experiment. The burn treatment was randomly assigned to 5 of the coyote brush stands (Table 1 and Figure 1). The remaining 5 stands served as unburned controls and were protected from fire by mowlines (Table 1 and Figure 1).

In addition, ten native bunchgrass-dominated areas adjacent to coyote brush stands were selected (plot 7 was the exception: the coyote brush stand and the bunchgrass-dominated area are not adjacent). The burn treatment category of a coyote brush stand was assigned to its adjacent bunchgrass area to simplify prescribed burn logistics (Table 1 and Figure 1).

Table 1: Plot treatment category for Point Pinole plots

Plot	Treatment category
PP3	burn
PP4	burn
PP5	burn
PP7	burn
PP8	burn
PP1	no burn
PP2	no burn
PP6	no burn
PP9	no burn
PP10	no burn

Cover data with line-point transects

We determined shrub and herbaceous cover with line-point transects, one transect in each of the 10 coyote brush stands and one in each of 10 adjacent bunchgrass-dominated areas. Within each coyote brush stand, a transect start-point was randomly located and permanently marked with rebar and wooden stake; a GPS point was also taken. Then a random direction for the transect was determined, with the constraint that 50% of the transect had to fall within an area of coyote brush. This standard was not always attainable, as some of the stands had fairly open canopies. Each transect was 10 meters long, and every 2 decimeters, we recorded the species hit, for a total of 50 points per transect.

We followed the same protocol in the 10 adjacent bunchgrass-dominated areas, with the difference that we had no difficulty in attaining the standard that 50% of the transect had to fall within an area of native herbaceous vegetation.

Cover data were collected over several days in mid-June 2009, with one exception: SHRUB plot no. 7 was sampled in late July 2009. Wild oats (*Avena* spp.) had already shattered and so generally were not identifiable to species. Most other species were readily identifiable.

Mortality data with tagged shrubs

A goal of the project is to determine the effect of burning on both cover and mortality of coyote brush. To collect coyote brush mortality data, we randomly selected 25 live coyote brush individuals (including a range of sizes from ~40 cm in height to ~2 meter, with single- to multi-stemmed structures) in each of the 10 coyote brush stands, recorded its location with a GPS unit, and attached a numbered metal tag to the stoutest stem with wire. Shrub selection for mortality information was made in mid- to late July 2009.

In the next 4 years of the study, we will record whether each tagged coyote brush individual is alive or dead.

RESULTS

Cover of SHRUB plots

The initial plan called for SHRUB plots to be dominated by coyote brush. However, coyote brush cover was not adequate to meet this target in 4 of the 10 SHRUB plots. Coyote brush cover¹ was at least 20% in all SHRUB plots, ranging from 20-64% cover. Average cover of coyote brush over all 10 SHRUB plots was 32%. For 2009, prior to implementation of burn treatment, there was no statistical difference in coyote brush cover between those plots selected for the burning treatment and those plots selected as unburned controls (Table 2; two-tailed t-test, p-value > 0.30).

¹ All percent cover in this report is absolute cover (that is, hits on litter, bare ground, or rock are counted in total cover).

Table 2: Coyote bush (*Baccharis pilularis*) cover in 10 plots, prior to initiation of treatment, 2009

Plot	Treatment category	% absolute cover	Average % cover by treatment
PP3	burn	30	28.0
PP4	burn	44	
PP5	burn	20	
PP7	burn	22	
PP8	burn	24	
PP1	no burn	64	36.8
PP2	no burn	36	
PP6	no burn	42	
PP9	no burn	22	
PP10	no burn	20	

Common non-native annual grasses made up most of the rest of the SHRUB plots' cover (see Appendix A). Purple false-brome (*Brachypodium distachyon*), a non-native annual grass with invasive potential, was found in all of the SHRUB plots at an average 12% cover. The California Invasive Plant Council's Invasive Plant Inventory (Cal-IPC 2006) assigns purple false-brome an invasive plant score of "moderate," that is: a species that has "substantial and apparent—but generally not severe—ecological impacts." Although little is known about its ecological effects, and no control information is available, the District may wish to consider a monitoring program for this species.

Two native grasses, purple needlegrass (*Nassella pulchra*) and creeping wild rye (*Leymus triticoides*), were present on the SHRUB plots. Seven of the 10 SHRUB plots had low cover of native perennial grasses (cover \leq 6%); the other 3 plots had 24-30% cover of native perennial grasses. Non-native forbs occurred at low levels (up to 18% cover) on most of the SHRUB plots; no native forbs were found on the SHRUB plots (see Appendix A).

Cover of GRASS plots

All 10 GRASS plots contained native perennial bunchgrasses, with an average native perennial bunchgrass cover of 27% and a range of 10-54% cover. Purple needlegrass was present on all 10 GRASS plots and dominated 4 of them. Two GRASS plots also contained California oatgrass (*Danthonia californica*) at 6 and 12% cover. For 2009, prior to implementation of burn treatment, there was no statistical difference in native perennial grass cover between those plots selected for the burning treatment and those plots selected as unburned controls (Table 3; two-tailed t-test, p-value = 1.0).

Table 3: Native perennial bunchgrass (Purple needlegrass and California oatgrass) cover in 10 plots, prior to initiation of treatment, 2009

Plot	Treatment category	% absolute cover	Average % cover by treatment
PP3	burn	24	26.8
PP4	burn	10	
PP5	burn	54	
PP7	burn	26	
PP8	burn	20	
PP1	no burn	22	26.8
PP2	no burn	38	
PP6	no burn	32	
PP9	no burn	22	
PP10	no burn	20	

Six of the GRASS plots were dominated by non-native annual grasses (see Appendix A). Purple false-brome was present in 7 of the 10 GRASS plots and dominated 2 of them. One plot contained a bent grass (*Agrostis* sp.) of unknown origin. Non-native forbs occurred at generally low levels (up to 20% cover) on 9 of the GRASS plots. Two plots had 8% cover of the native forb hayfield tarweed (*Hemizonia congesta* ssp. *luzulifolia*), one plot had 2% cover of the native forb blue-eyed-grass (*Sisyrinchium bellum*), and another had 4% cover of coyote brush (see Appendix A).

Prescribed burn

The Point Pinole Grassland Restoration Prescribed Fire took place on October 29, 2009. Although burning prescriptions were met, fuel conditions from a project perspective were not ideal. Unfortunately, two weeks prior to the burn, the region experienced a major germinating rain: for example, 4 inches fell in Oakland in a single day, 20% of the annual average, making it the biggest October storm since 1962 (*San Francisco Chronicle*, October 14, 2009). As a result, significant plant germination and initial growth had occurred by October 29, in addition to decomposition of the residual dry matter. Fire intensity was consequently fairly low and burn coverage patchy, despite the best efforts of the EBRPD fire department. Fire intensity was described as “mostly creeping fire through the dead thatch under the green grass with flame lengths under 1 foot tall” (Brad Gallup, EBRPD Fuels Management Captain, pers. comm., March 2010). It seems likely that mortality of coyote brush was low.

REFERENCES

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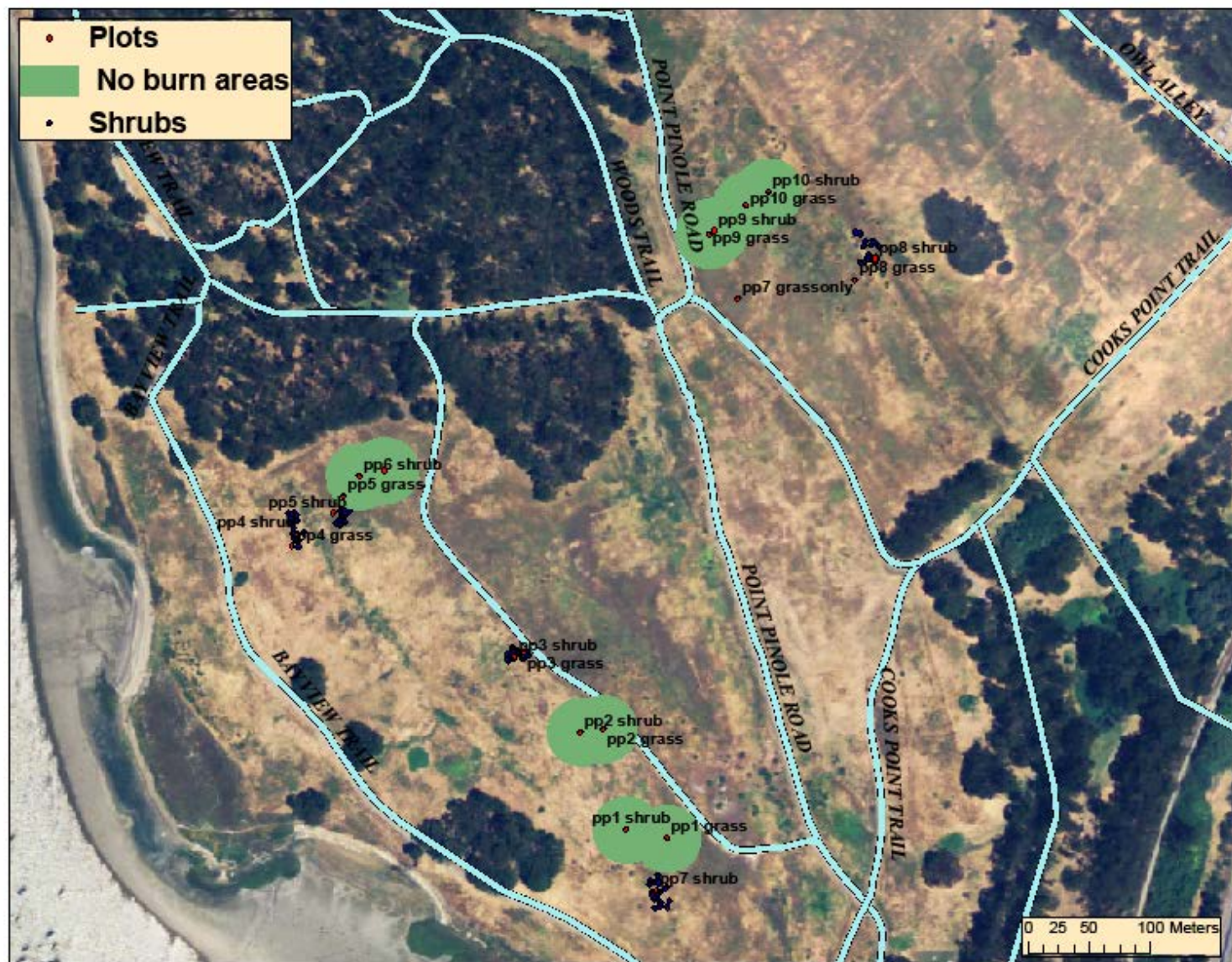


Figure 1: Location of SHRUB and GRASS plots in Point Pinole; plots within green circles are unburned controls

Appendix A: cover data for SHRUB and GRASS plots, 2009

Table A1: SHRUB plots, with % absolute cover, origin, and California Invasive Plant Council rating (Cal-IPC 2006), if any, for each species

Plot	Plot type	Species	Abs cover %	Origin	Cal-IPC
PP1	SHRUB	<i>Baccharis pilularis</i>	64	native	
PP1	SHRUB	<i>Brachypodium distachyon</i>	16	exotic	Moderate
PP1	SHRUB	litter	8	NA	NA
PP1	SHRUB	<i>Nassella pulchra</i>	4	native	
PP1	SHRUB	<i>Avena</i> sp.	4	exotic	Moderate
PP1	SHRUB	<i>Leymus triticoides</i>	2	native	
PP1	SHRUB	<i>Vulpia bromoides</i>	2	exotic	Eval No List
PP2	SHRUB	<i>Baccharis pilularis</i>	36	native	
PP2	SHRUB	<i>Avena</i> sp.	30	exotic	Moderate
PP2	SHRUB	<i>Bromus diandrus</i>	10	exotic	Moderate
PP2	SHRUB	<i>Brachypodium distachyon</i>	8	exotic	Moderate
PP2	SHRUB	litter	6	NA	NA
PP2	SHRUB	<i>Avena barbata</i>	2	exotic	Moderate
PP2	SHRUB	<i>Bromus hordeaceus</i>	2	exotic	Limited
PP2	SHRUB	<i>Leymus triticoides</i>	2	native	
PP2	SHRUB	<i>Picris echioides</i>	2	exotic	Limited
PP2	SHRUB	<i>Rumex acetosella</i>	2	exotic	Moderate
PP3	SHRUB	<i>Baccharis pilularis</i>	30	native	
PP3	SHRUB	<i>Lolium multiflorum</i>	26	exotic	Moderate
PP3	SHRUB	<i>Rumex acetosella</i>	12	exotic	Moderate
PP3	SHRUB	<i>Bromus hordeaceus</i>	10	exotic	Limited
PP3	SHRUB	<i>Bromus diandrus</i>	6	exotic	Moderate
PP3	SHRUB	litter	4	NA	NA
PP3	SHRUB	<i>Nassella pulchra</i>	4	native	
PP3	SHRUB	<i>Leymus triticoides</i>	2	native	
PP3	SHRUB	<i>Brachypodium distachyon</i>	2	exotic	Moderate
PP3	SHRUB	<i>Avena barbata</i>	2	exotic	Moderate
PP3	SHRUB	<i>Convolvulus arvensis</i>	2	exotic	
PP4	SHRUB	<i>Baccharis pilularis</i>	44	native	
PP4	SHRUB	<i>Brachypodium distachyon</i>	18	exotic	Moderate
PP4	SHRUB	<i>Avena</i> sp.	14	exotic	Moderate
PP4	SHRUB	<i>Avena barbata</i>	8	exotic	Moderate
PP4	SHRUB	litter	6	NA	NA

PP4	SHRUB	soil	4	NA	NA
PP4	SHRUB	<i>Nassella pulchra</i>	4	native	
PP4	SHRUB	<i>Picris echioides</i>	2	exotic	Limited
PP5	SHRUB	<i>Nassella pulchra</i>	30	native	
PP5	SHRUB	<i>Brachypodium distachyon</i>	24	exotic	Moderate
PP5	SHRUB	<i>Baccharis pilularis</i>	20	native	
PP5	SHRUB	<i>Avena</i> sp.	12	exotic	Moderate
PP5	SHRUB	<i>Vicia sativa</i>	6	exotic	
PP5	SHRUB	<i>Leymus triticoides</i>	6	native	
PP5	SHRUB	<i>Avena barbata</i>	2	exotic	Moderate
PP6	SHRUB	<i>Baccharis pilularis</i>	42	native	
PP6	SHRUB	<i>Vulpia bromoides</i>	24	exotic	Eval No List
PP6	SHRUB	<i>Avena</i> sp.	8	exotic	Moderate
PP6	SHRUB	<i>Rumex acetosella</i>	8	exotic	Moderate
PP6	SHRUB	litter	6	NA	NA
PP6	SHRUB	<i>Brachypodium distachyon</i>	4	exotic	Moderate
PP6	SHRUB	<i>Nassella pulchra</i>	2	native	
PP6	SHRUB	<i>Erodium botrys</i>	2	exotic	Eval No List
PP6	SHRUB	<i>Anagallis arvensis</i>	2	exotic	
PP6	SHRUB	<i>Avena barbata</i>	2	exotic	Moderate
PP7	SHRUB	<i>Avena</i> sp.	58	exotic	Moderate
PP7	SHRUB	<i>Baccharis pilularis</i>	22	native	
PP7	SHRUB	<i>Nassella pulchra</i>	4	native	
PP7	SHRUB	<i>Lolium multiflorum</i>	4	exotic	Moderate
PP7	SHRUB	<i>Brachypodium distachyon</i>	4	exotic	Moderate
PP7	SHRUB	litter	4	NA	NA
PP7	SHRUB	<i>Rumex acetosella</i>	2	exotic	Moderate
PP7	SHRUB	<i>Erodium botrys</i>	2	exotic	Eval No List
PP8	SHRUB	<i>Baccharis pilularis</i>	24	native	
PP8	SHRUB	<i>Brachypodium distachyon</i>	24	exotic	Moderate
PP8	SHRUB	<i>Plantago lanceolata</i>	10	exotic	Limited
PP8	SHRUB	litter	10	NA	NA
PP8	SHRUB	<i>Bromus hordeaceus</i>	8	exotic	Limited
PP8	SHRUB	<i>Avena</i> sp.	6	exotic	Moderate
PP8	SHRUB	<i>Brassica nigra</i>	4	exotic	Moderate
PP8	SHRUB	<i>Foeniculum vulgare</i>	4	exotic	High

PP8	SHRUB	<i>Vulpia bromoides</i>	4	exotic	Eval No List
PP8	SHRUB	rock	2	NA	NA
PP8	SHRUB	<i>Lolium multiflorum</i>	2	exotic	Moderate
PP8	SHRUB	<i>Nassella pulchra</i>	2	native	
PP9	SHRUB	<i>Nassella pulchra</i>	24	native	
PP9	SHRUB	<i>Baccharis pilularis</i>	22	native	
PP9	SHRUB	<i>Bromus hordeaceus</i>	20	exotic	Limited
PP9	SHRUB	<i>Plantago lanceolata</i>	12	exotic	Limited
PP9	SHRUB	<i>Brachypodium distachyon</i>	8	exotic	Moderate
PP9	SHRUB	<i>Vulpia bromoides</i>	6	exotic	Eval No List
PP9	SHRUB	<i>Lolium multiflorum</i>	4	exotic	Moderate
PP9	SHRUB	<i>Foeniculum vulgare</i>	2	exotic	High
PP9	SHRUB	<i>Avena fatua</i>	2	exotic	Moderate
PP10	SHRUB	<i>Lolium multiflorum</i>	38	exotic	Moderate
PP10	SHRUB	<i>Nassella pulchra</i>	24	native	
PP10	SHRUB	<i>Baccharis pilularis</i>	20	native	
PP10	SHRUB	<i>Brachypodium distachyon</i>	12	exotic	Moderate
PP10	SHRUB	<i>Vulpia bromoides</i>	4	exotic	Eval No List
PP10	SHRUB	<i>Avena sp.</i>	2	exotic	Moderate

Table A2: GRASS plots, with % absolute cover, origin, and California Invasive Plant Council rating (Cal-IPC 2006), if any, for each species

Plot	Plot type	Species	Abs cover %	Origin	Cal-IPC
PP1	GRASS	<i>Brachypodium distachyon</i>	32	exotic	Moderate
PP1	GRASS	<i>Avena sp.</i>	22	exotic	Moderate
PP1	GRASS	<i>Danthonia californica</i>	12	native	
PP1	GRASS	<i>Nassella pulchra</i>	10	native	
PP1	GRASS	<i>Avena barbata</i>	8	exotic	Moderate
PP1	GRASS	<i>Bromus diandrus</i>	4	exotic	Moderate
PP1	GRASS	<i>Erodium botrys</i>	4	exotic	Eval No List
PP1	GRASS	litter	4	NA	NA
PP1	GRASS	<i>Plantago lanceolata</i>	2	exotic	Limited
PP1	GRASS	<i>Bromus hordeaceus</i>	2	exotic	Limited
PP2	GRASS	<i>Nassella pulchra</i>	38	native	
PP2	GRASS	<i>Brachypodium distachyon</i>	24	exotic	Moderate
PP2	GRASS	<i>Lolium multiflorum</i>	16	exotic	Moderate
PP2	GRASS	litter	8	NA	NA

PP2	GRASS	<i>Vulpia bromoides</i>	4	exotic	Eval No List
PP2	GRASS	<i>Avena</i> sp.	4	exotic	Moderate
PP2	GRASS	no data collected	2	NA	NA
PP2	GRASS	<i>Picris echioides</i>	2	exotic	Limited
PP2	GRASS	soil	2	NA	NA
PP3	GRASS	<i>Lolium multiflorum</i>	46	exotic	Moderate
PP3	GRASS	<i>Bromus hordeaceus</i>	22	exotic	Limited
PP3	GRASS	<i>Nassella pulchra</i>	18	native	
PP3	GRASS	<i>Danthonia californica</i>	6	native	
PP3	GRASS	<i>Foeniculum vulgare</i>	4	exotic	High
PP3	GRASS	<i>Avena</i> sp.	2	exotic	Moderate
PP3	GRASS	<i>Vulpia bromoides</i>	2	exotic	Eval No List
PP4	GRASS	<i>Brachypodium distachyon</i>	46	exotic	Moderate
PP4	GRASS	<i>Avena fatua</i>	12	exotic	Moderate
PP4	GRASS	<i>Nassella pulchra</i>	10	native	
PP4	GRASS	<i>Lolium multiflorum</i>	8	exotic	Moderate
PP4	GRASS	<i>Foeniculum vulgare</i>	6	exotic	High
PP4	GRASS	soil	6	NA	NA
PP4	GRASS	<i>Rumex acetosella</i>	6	exotic	Moderate
PP4	GRASS	<i>Avena</i> sp.	4	exotic	Moderate
PP4	GRASS	litter	2	NA	NA
PP5	GRASS	<i>Nassella pulchra</i>	54	native	
PP5	GRASS	<i>Brachypodium distachyon</i>	20	exotic	Moderate
PP5	GRASS	<i>Erodium botrys</i>	16	exotic	Eval No List
PP5	GRASS	<i>Avena barbata</i>	4	exotic	Moderate
PP5	GRASS	<i>Foeniculum vulgare</i>	2	exotic	High
PP5	GRASS	litter	2	NA	NA
PP5	GRASS	<i>Vulpia bromoides</i>	2	exotic	Eval No List
PP6	GRASS	<i>Nassella pulchra</i>	32	native	
PP6	GRASS	<i>Vulpia bromoides</i>	28	exotic	Eval No List
PP6	GRASS	<i>Avena barbata</i>	16	exotic	Moderate
PP6	GRASS	<i>Avena</i> sp.	10	exotic	Moderate
PP6	GRASS	<i>Erodium botrys</i>	8	exotic	Eval No List
PP6	GRASS	<i>Baccharis pilularis</i>	4	native	
PP6	GRASS	<i>Geranium dissectum</i>	2	exotic	Moderate

PP7	GRASS	<i>Nassella pulchra</i>	26	native	
PP7	GRASS	<i>Lolium multiflorum</i>	24	exotic	Moderate
PP7	GRASS	<i>Vulpia bromoides</i>	14	exotic	Eval No List
PP7	GRASS	litter	10	NA	NA
PP7	GRASS	<i>Bromus hordeaceus</i>	8	exotic	Limited
PP7	GRASS	<i>Hemizonia congesta</i> ssp. <i>luzulifolia</i>	8	native	
PP7	GRASS	<i>Erodium botrys</i>	4	exotic	Eval No List
PP7	GRASS	<i>Avena</i> sp.	2	exotic	Moderate
PP7	GRASS	<i>Agrostis</i> sp.	2	unk	
PP7	GRASS	<i>Brachypodium distachyon</i>	2	exotic	Moderate
PP8	GRASS	<i>Vulpia bromoides</i>	28	exotic	Eval No List
PP8	GRASS	<i>Lolium multiflorum</i>	28	exotic	Moderate
PP8	GRASS	<i>Nassella pulchra</i>	20	native	
PP8	GRASS	<i>Hemizonia congesta</i> ssp. <i>luzulifolia</i>	8	native	
PP8	GRASS	litter	4	NA	NA
PP8	GRASS	<i>Bromus hordeaceus</i>	4	exotic	Limited
PP8	GRASS	<i>Brachypodium distachyon</i>	4	exotic	Moderate
PP8	GRASS	<i>Avena</i> sp.	2	exotic	Moderate
PP8	GRASS	<i>Sisyrinchium bellum</i>	2	native	
PP9	GRASS	<i>Bromus hordeaceus</i>	28	exotic	Limited
PP9	GRASS	<i>Nassella pulchra</i>	22	native	
PP9	GRASS	<i>Plantago lanceolata</i>	18	exotic	Limited
PP9	GRASS	<i>Vulpia bromoides</i>	16	exotic	Eval No List
PP9	GRASS	litter	10	NA	NA
PP9	GRASS	<i>Lolium multiflorum</i>	4	exotic	Moderate
PP9	GRASS	<i>Foeniculum vulgare</i>	2	exotic	High
PP10	GRASS	<i>Lolium multiflorum</i>	46	exotic	Moderate
PP10	GRASS	<i>Nassella pulchra</i>	20	native	
PP10	GRASS	<i>Brachypodium distachyon</i>	10	exotic	Moderate
PP10	GRASS	litter	10	NA	NA
PP10	GRASS	<i>Vulpia bromoides</i>	6	exotic	Eval No List
PP10	GRASS	<i>Picris echioides</i>	4	exotic	Limited
PP10	GRASS	<i>Avena barbata</i>	2	exotic	Moderate
PP10	GRASS	<i>Plantago lanceolata</i>	2	exotic	Limited