WASHINGTON NATURAL HERITAGE PROGRAM

Hanford Endemic Plants Population Monitoring

Prepared for
U.S. Fish and Wildlife Service
Region 1

Prepared by

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WASHINGTON STATE DEPARTMENT OF
Natural Resources

Hanford Endemic Plants
Population Monitoring

Umtanum desert-buckwheat (*Eriogonum codium)*
White Bluffs bladderpod (*Physaria douglasii* ssp. *tuplashensis*)
and a summary of other Hanford Rare Plant Occurrences

January 17, 2012

Prepared
for
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E2 Segments 60 and 73 (2011 data)

by
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Special thanks are due to Heidi Newsome, U.S. Fish and Wildlife Service biologist with the Mid-Columbia River. In addition to long time participation in monitoring *Eriogonum codium*, she has been the primary organizer and conductor of *Physaria douglasii* ssp. *tuplashensis* monitoring on White Bluffs.

I would also like to acknowledge the pioneering botanical inventory that Kathryn Beck and Florence Caplow did on the Hanford Nuclear Site in 1994 and 1996, work that led to the discovery and description in 1995 of both *Eriogonum codium* and *Lesquerella tuplashensis* (now reclassified as *Physaria douglasii* ssp. *tuplashensis*). Their extensive work also provided information on the vast majority of the rare plant occurrences known on the Hanford Site.

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Introduction

This report documents monitoring of two federal candidate species, *Eriogonum codium* (Umtanum desert buckwheat) and *Physaria douglasii* ssp. *tuplashensis* (White Bluffs bladderpod), conducted within the Hanford Reach National Monument (Hanford) between 2008 and 2011. This work is a continuation of research on these two species previously reported in Beck (1999a), Caplow (2003), and Dunwiddie et al. (2000), and continuing through 2011 under Section 6 Segment 73. Newsome (2011) continues to report annually on *Physaria douglasii* ssp. *tuplashensis* monitoring.

Many other rare plant taxa also occur on Hanford (see Table 4). Revisits to many of these occurrences were made during the course of this project; data from all revisits and from new sightings through 2011 are presented in Appendix C. Plant species, including rare taxa, growing in the riparian habitat along the Hanford Reach will also be treated in the Section 6 report for Segment 61.

Eriogonum codium and *Physaria douglasii* ssp. *tuplashensis* are both currently at risk because of their limited distribution, relatively small population sizes, and vulnerability to environmental and human-caused perturbations.

Eriogonum codium

Eriogonum codium is a federal candidate for listing and a state endangered species in Washington; a proposal for its federal listing as endangered under the Endangered Species Act is currently in preparation (personal communication, Tim McCracken, U.S. Fish and Wildlife Service). This species was described in 1995 by Reveal, Caplow, and Beck (Reveal et. al 1995). The global extent of the species consists of approximately 5,000 plants occurring along a one-mile linear area on Umtanum Ridge. It is not closely related to any other Washington species of *Eriogonum* (Reveal et. al 1995). It forms low mats up to 1 meter in diameter.

Monitoring and Population Viability Analysis

E. codium has been the subject of an intensive demographic monitoring project since 1997. Within the projects reported here, the WNHP coordinated and led annual Umtanum desert buckwheat monitoring in 2008-2011. Table 1 presents a summary of dates and participants in monitoring:

Table 1. Summary of dates and participants in *Eriogonum codium* monitoring, 2008-2011.

year	Seedling monitoring		PVA monitoring	
	date	**participants**	**date**	**participants**
2008	May 15	Joe Arnett(WNHP), Mark Darrach (volunteer), and Carrie Cordova (FWS)	July 10	Joe Arnett, Mark Mease (volunteer), and Cleon Rice, Tim McCracken, Kevin McCarthy, Heidi Newsome, and Carrie Cordova (FWS).
2009	May 6	Joe Arnett	July 9	Joe Arnett, Mark Darrach, Ben Grady (University of Wisconsin), Laci Bristow (FWS), Heidi Newsome, and Carrie Cordova.
2010	April 29 & 30	Joe Arnett, Mark Darrach, Lisa Saperstein and Wendy Mee (Yakima Training Center), Terri Knoke (volunteer), and Janelle Downs (Pacific Northwest National Laboratory).	July 7	Joe Arnett, Mark Darrach, Jane Abel and Lisa Hill (volunteers), and Heidi Newsome.
2011	April 28	Joe Arnett and Terri Knoke, Lorraine Seymour, Jane Abel, and Keith Abel (volunteers).	July 7	Joe Arnett and Jodi Bush, Carrie Cordova, Kathleen Fulmer, Jessica Gonzales, Tim McCracken, Ralph Thompson, Heidi Newsome, Ted Thomas.

Initial findings from 1997 through 1999 were reported in 2000 (Dunwiddie *et al.* 2000). In 2000, researchers concluded, based on counting the annual rings on dead plants, that *Eriogonum codium* is a long lived species (greater than 100 years) with high flower production, low germination rates, high seedling mortality, and high variability of growth between individuals and years. Seedling data from 1996-2011 is presented in Table 1; the counts in this table demonstrate the extreme variation in seedling production. The data in Appendix A show very low survival of seedlings beyond the spring in which they germinate.

Table 2. *Eriogonum codium* seedling data from 1997-2011.

year	seedling count	year	seedling count	year	seedling count	year	seedling count
1996	4	2000	73	2004	6	2008	12
1997	26	2001	37	2005	0	2009	5
1998	3	2002	0	2006	5	2010	67
1999	20	2003	3	2007	154	2011	79

Within the permanent monitoring plots, mortality consistently far exceeded recruitment between 1997 and 2011.

E. codium appears to be in very gradual decline. Kaye (2007) reported an annual decline, and calculated a rate, for the years monitored, of about 2/3 of one percent. A projection of the population from 1997 for 100 years suggests that the population may decline over time modestly or greatly, and that it is unlikely to grow substantially if current conditions remain the same.

Census

A census of the global extent of *Eriogonum codium* was first made in 1995, and repeated, with more precision, in 1997 (Beck 1999). Repeat counts of the entire species were made in 2005 and 2011; these counts are summarized in Table 3. While these counts are done by examining and flagging each individual plant, in some cases it is impossible to tell, without damaging the plant, whether a clump consists of more than one individual. This was made evident by rarely occurring pale flowered individuals. In a few cases these individuals grew tightly together with a normal yellow flowered individual, and that there were two individuals present was only discernible because of the differences in flower color. These two individuals would have likely been counted as one. Conversely, occasionally individual plants were found with spreading connecting branches that had been buried. In these cases, one individual may have been counted as two or more. These instances were not common, and the two situations would tend to cancel each other out. We regard these counts as fairly precise.

Table 3. *Eriogonum codium* census data from 1995, 1997, 2005, and 2011.

Census year	Population count, species wide
1995	4,900
1997	5,207
2005	4,408
2011	5,169

Physaria douglasii ssp. *tuplashensis*

White Bluffs bladder-pod is a low-growing, herbaceous, short-lived, perennial plant in the Brassicaceae (mustard) family. It is known from a single population that occurs along the lip of the White Bluffs, above the Hanford Reach, between 30 and 40 feet wide and extending for approximately 11 miles. The species occurs only in the caliche (a cemented calcium carbonate material) layer exposed at the lip of the bluffs. Threats to the species include landslides (apparently caused or increased by groundwater from nearby irrigation), fire, direct impacts from off-road vehicles, and invasive non-native plants.

Taxonomic Changes

Physaria douglasii ssp. *tuplashensis* was originally described as *Lesquerella tuplashensis* by Rollins, Beck, and Caplow in 1996. Their research recognized that while *L. tuplashensis* and *L. douglasii* were quite similar, they differed sufficiently, morphologically and phenologically, to warrant recognitions as two distinct species. In 2002, Al-Shehbaz and O'Kane (2002). recommended that the genera *Lesquerella* and *Physaria* be united as *Physaria*. They did not feel that the morphological analysis of Rollins et al. 1996 justified the recognition of *Lesquerella tuplashensis* at the species level, and they recommended that *Lesquerella tuplashensis* should be recognized at the subspecific level as *Physaria douglasii* subspecies *tuplashensis*.

Monitoring

Monitoring has been conducted since 1997 along permanent transects along the northern portion of the population according to a protocol described in Beck (1999). Heidi Newsome, a biologist with the U.S. Fish and Wildlife Service, has been leading that monitoring. The most recent summary of the results of that effort is included in Appendix B.

Additional Rare Plant Species of the Hanford National Monument

In addition to *Eriogonum codium* and *Physaria douglasii* ssp. *tuplashensis*, Hanford is also the location of numerous other plant species that have rare plant status in Washington. In many cases these are the only occurrences in Washington. Table 4 includes a list of all rare plant taxa known from Hanford. While comprehensive revisiting and monitoring were beyond the scope of this project, numerous rare plant occurrences were visited, as part of a Hanford-wide review of rare plant species. In addition to the Umtanum desert buckwheat and White Bluffs bladderpod populations, sites visited included Rattlesnake Mountain, Gable Mountain, riparian areas below White Bluffs, the lower portion of Waluke Slope, and Yakima Ridge. Appendix C includes a report from the Washington Natural Heritage Program database for all all Hanford rare plant occurrences, current as of the date of this report.

Table 4. Rare plant species present on the Hanford Reach National Monument. Element occurrence (EO) information is based on Washington Natural Heritage Program Biotics database as of November 18, 2011.

Species name	Hanford Element Occurrences	Common Name	Name in Hitchcock & Cronquist	Global Rank	State Rank	Status	
						WA	FWS
Aliciella leptomeria	001, 002, 003, 004, 005, 006, 007, 008	Great Basin gilia	*Gilia leptomeria*	G5	S1	T	
Ammannia robusta	001	grand redstem	*Ammannia coccinea*	G5	S1	T	
Anagallis minima	012, 013	chaffweed	*Centunculus minimus*	G5	S2	S	
Astragalus columbianus	031, 039, 052	Columbia milk-vetch	*Astragalus columbianus*	G3	S3	S	SC
Astragalus geyeri	003, 004, 005, 006	Geyer's milk-vetch	*Astragalus geyeri*	G4	S1	T	
Camissonia minor	001, 002, 003, 004, 005, 006, 007	small-flower evening-primrose	*Oenothera minor*	G4	S2	S	
Camissonia pygmaea	007, 012, 016, 017, 018, 019, 020, 021, 024, 042, 043, 044, 045	dwarf evening-primrose	*Oenothera pygmaea*	G3	S3	S	
Cistanthe rosea	001, 002	rosy pussypaws	*Calyptridium roseum*	G5	S1	T	
Cryptantha leucophaea	023, 036, 046, 047, 048, 049, 050, 051, 052, 053, 058, 059	gray cryptantha	*Cryptantha leucophaea*	G2G3	S2S3	S	SC
Cryptantha scoparia	001	miner's candle	*Cryptantha scoparia*	G4?	S1	S	
Cryptantha spiculifera	017, , 023, 025	Snake River cryptantha	*Cryptantha*	G4?	S2?	S	
Cuscuta denticulata	001	desert dodder	*Cuscuta denticulata*	G4G5	S1	T	
Eatonella nivea	007, 009	white eatonella	*Eatonella nivea*	G4G5	S1	T	
Eremogone franklinii var. *thompsonii*	002, 003	Thompson's sandwort	*Arenaria franklinii var. thompsonii*	G4THQ	SU	R1	
Erigeron piperianus	011, 054, 057, 058, 059, 062,063, 064, 065, 066, 068, 069, 070, 082, 083, 085, 056, 087, 088	Piper's daisy	*Erigeron piperianus*	G3	S3	S	
Eriogonum codium	001	Umtanum desert buckwheat	*Eriogonum*	G1	S1	E	C
Hypericum majus	001, 002, 003	Canadian St. John's-wort	*Hypericum majus*	G5	S2	S	
Lipocarpha aristulata	001	awned halfchaff sedge	*Hemicarpha micrantha*	G5?	S1	T	
Loeflingia squarrosa	004, 005, 006, 007	loeflingia	*Loeflingia squarrosa var. squarrosa*	G5T4?	S1	T	
Lomatium tuberosum	017, 027	Hoover's desert-parsley	*Lomatium tuberosum*	G2G3	S2S3	S	SC
Micromonolepis pusilla	003	red poverty-weed	*Monolepis pusilla*	G5	S1	T	
Mimulus suksdorfii	021, 022, 023, 024	Suksdorf's monkey-flower	*Mimulus suksdorfii*	G4	S2	S	
Nicotiana attenuata	030	coyote tobacco	*Nicotiana attenuata*	G4	S2	S	
Oenothera cespitosa ssp. *cespitosa*	005, 006, 007, 011, 012	cespitose evening-primrose	*Oenothera caespitosa var. caespitosa*	G5T5	S2	S	

Penstemon eriantherus var. *whitedii*	001, 003	fuzzytongue penstemon	*Penstemon eriantherus var. whitedii*	G4T2	S2	S	
Physaria douglasii ssp. *tuplashensis*	001	White Bluffs bladderpod	*Lesquerella*	G4?T2	S2	T	C
Rorippa columbiae	013	persistentsepal yellowcress	*Rorippa calycina var. columbiae*	G3	S1S2	E	SC
Rotala ramosior	001	lowland toothcup	*Rotala ramosior*	G5	S1	T	

Federal Status of plants under the U.S. Endangered Species Act is determined by the U.S. Fish and Wildlife Service:
E = Listed as Endangered. In danger of extinction.
T = Listed as Threatened. Likely to become endangered.
C = Candidate species. Sufficient information exists to support listing as Endangered or Threatened.
SC = Species of Concern. An unofficial status, the species appears to be in jeopardy, but there insufficient information to support listing.

Washington Status of plant species is determined by the Washington Natural Heritage Program. Factors considered include abundance, occurrence patterns, vulnerability, threats, existing protection, and taxonomic distinctness. Values include:
E = Endangered. In danger of becoming extinct or extirpated from Washington.
T = Threatened. Likely to become Endangered in Washington.
S = Sensitive. Vulnerable or declining and could become Endangered or Threatened in the state.
X = Possibly extinct or extirpated from Washington.
R1 = Review group 1. Of potential concern but needs more field work to assign conservation priority. WNHP is requesting occurrance data
R2 = Review group 2. Of potential concern but with unresolved taxonomic questions. WNHP is requesting occurrence data

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Appendix A

Eriogonum codium data for population viability analysis

1997-2011

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1=Top;2 =Slope	x-axis	y-axis	1997					1998				
					Length	Width	% Dead	97Area	97#Infl	Length	Width	% Dead	98Area	98#Infl
10206	17	1												
10206	56	1	44	45	12	8	16	75	1	12	8	16	75	1
10206	69	1	59	65	22	17	63	294	7	25	16	63	314	0
10206	70	1	75	53	21	21	3	346	28	20	14	16	220	0
10206	71	1	69	6	22	15	16	259	18	22	15	3	259	9
10206	72	1	101	55	9	8	3	57	1	11	8	16	69	0
10206	73	1	55	56	9	8	16	57	2	8	7	38	44	0
10206	74	1	50	21	24	18	16	339	15	25	19	3	373	20
10206	75	1	179	49	14	13	3	143	12	16	13	3	163	0
10206	76	1	83	98	17	13	16	174	2	15	10	16	118	0
10206	77	1	82	65	18	10	2	141	0	18	10	16	141	1
10212	78	2	192	35	14	10	16	110	6	14	10	38	110	1
10212	79	2	184	11	19	18	16	269	32	18	18	16	254	4
10212	80	2	147	98	44	21	3	726	195	44	21	3	726	45
10212	82	2	118	20	26	26	3	531	21	25	22	16	432	4
10212	83	2	101	34	46	42	3	1517	1	44	39	38	1348	1
10212	84	2	138	27	10	8	3	63	1	12	8	16	75	0
10212	85	2	169	12	29	16	16	364	14	30	14	16	330	2
10401	1	1	0	15	60	37	2	1744	78	60	38	3	1791	98
10401	3	1	194	98	11	10	1	86	0	13	9	3	92	0
10416	4	2	47	67	30	20	16	471	0	30	23	16	542	37
11403	5	1	16	18	14	10	1	110	0	13	11	63	112	0
11403	6	1	52	2	30	27	1	636	97	31	26	16	633	64
11403	7	1	53	10	28	22	3	484	30	29	25	38	569	8
11403	8	1	90	44	22	19	1	328	21	23	19	16	343	8
11403	9	1	103	22	21	17	1	280	19	21	16	1	264	0
11403	10	1	141	0	17	10	3	134	2	18	12	38	170	5
11403	11	1	162	5	28	26	16	572	71	26	20	38	408	25
11403	195													

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1=Top;2 =Slope	1999					2000					
			Length	Width	% Dead	99 Area	99 #Infl	Length	Width	% Dead	00 Area	00 #Infl	Notes
10206	17	1											
10206	56	1	12	8	16	75	0	13	9	38	92	0	
10206	69	1	26	17	63	347	0	24	18	63	339	0	
10206	70	1	19	13	16	194	0	18	12	15	170	8	infl very small
10206	71	1	22	17	16	294	0	21	17	15	280	0	
10206	72	1	11	8	16	69	0	11	8	63	69	0	
10206	73	1	9	8	38	57	0	9	7	38	49	0	
10206	74	1	26	21	38	429	1	25	21	15	412	8	2-3 flwrs/infl
10206	75	1	15	12	16	141	0	15	13	15	153	0	
10206	76	1	15	13	38	153	0	7	3	63	16	0	
10206	77	1	18	11	16	156	0	19	10	15	149	0	
10212	78	2	15	13	16	153	0	16	13	38	163	3	1-3 flwrs/infl
10212	79	2	20	20	16	314	2	21	19	15	313	2	
10212	80	2	45	24	38	848	9	42	24	15	792	52	some infls very small
10212	82	2	26	23	16	470	1	17	11	63	147	3	
10212	83	2	46	38	38	1373	0	46	40	15	1445	0	
10212	84	2	12	8	38	75	0	12	9	15	85	0	DON'T USE FOR ANALYSIS
10212	85	2	32	14	38	352	0	30	14	38	330	3	
10401	1	1	63	42	38	2078	30	55	42	15	1814	49	healthy infl
10401	3	1	13	10	3	102	0	13	11	15	112	0	
10416	4	2	32	23	3	578	33	40	28		880	76	some still emerging, healthy
11403	5	1	14	9	63	99	0	14	9	63	99	0	
11403	6	1	31	26	16	633	15	32	27	15	679	10	poor quality infl
11403	7	1	27	20	38	424	0	29	19	63	433	0	
11403	8	1	24	20	38	377	2	23	20	38	361	0	
11403	9	1	20	15	3	236	0	21	17	3	280	0	
11403	10	1	6	3	88	14	0	16	9	88	113	0	
11403	11	1	24	19	63	358	3	28	26	63	572	33	poor quality infl, tag
11403	195												

plot #	Plant No.	2001						2002				
		Length	Width	% Dead	01 Area	01 #Infl	Notes	Length	Width	% Dead	02Area	02#Infl
10206	17											
10206	56	13	9	38	92	0		13	19	16	194	3
10206	69											
10206	70	20	15	16	236	1	poor infl	19	10	16	149	1
10206	71	22	14	38	242	0		23	19	16	343	3
10206	72	10	9	38	71	0		9	9	5	64	0
10206	73	10	8	16	63	0		10	8	5	63	0
10206	74	24	21	38	396	0		28	23	16	506	51
10206	75	15	12	16	141	0		15	12	16	141	0
10206	76	7	3	16	16	0		7	3	16	16	0
10206	77	19	10	16	149	0		19	10	3	149	1
10212	78	16	15	16	188	0		17	16	16	214	0
10212	79	25	19	16	373	0		23	22	16	397	4
10212	80	28	16	16	352	19	poor infl	26	18	16	368	86
10212	82	18	11	38	156	0		16	11	16	138	28
10212	83	46	37	38	1337	0		44	38	16	1313	12
10212	84	14	10	38	110	0	DON'T USE FOR ANALYSIS	15	8	38	94	3
10212	85	29	16	16	364	0		33	13	16	337	7
10401	1	47	41	38	1513	53		46	39	16	1409	42
10401	3	13	11	16	112	0		15	12	16	141	0
10416	4	39	31	3	950	16		44	38	1	1313	135
11403	5	45	8	88	283	0		16	10	88	126	0
11403	6	34	28	38	748	0		32	30	16	754	34
11403	7	30	22	38	518	7	very poor infl	29	23	38	524	18
11403	8	25	20	38	393	0		25	21	38	412	1
11403	9	23	17	16	307	4	poor infl	22	17	16	294	3
11403	10	9	4	88	28	0		9	4	88	28	2
11403	11	32	23	38	578	7	very poor infl	32	24	38	603	29
11403	195											

plot #	Plant No.	2003						2004					
		Length	Width	% Dead	03 Area	03 #infl	Notes	Length	Width	% Dead	04 Area	04 #Infl	Notes
10206	17												
10206	56	15	11	16	130	1		14	7	38	77	0	
10206	69												
10206	70	18	13	16	184	14		27	14	38	297	7	
10206	71	17	19	38	254	14		20	15	38	236	8	
10206	72	11	9	16	78	0		11	10	38	86	0	
10206	73	11	8	16	69	1		9	8	38	57	0	
10206	74	29	24	16	547	31		29	26	38	592	6	
10206	75	15	13	16	153	0		16	13	38	163	0	
10206	76	7	3	38	16	0							
10206	77	21	10	16	165	5		18	13	88	184	0	
10212	78	19	14	16	209	35		20	16	16	251	0	
10212	79	28	24	16	528	49		27	24	5	509	18	
10212	80	28	19	16	418	93		32	18	38	452	38	
10212	82	27	15	3	318	16		35	23	3	632	13	
10212	83	49	41	3	1578	36		50	41	38	1610	38	
10212	84						DON'T USE FOR ANALYSIS						DON'T USE FOR ANALYSIS
10212	85	34	14	16	374	17		36	16	38	452	24	
10401	1	46	33	16	1192	75		49	48	16	1847	68	
10401	3	15	12	0	141	2		14	14	3	154	0	
10416	4	40	35	1	1100	110		46	45	1	1626	112	
11403	5	8	3	88	19	0		7	4	88	22	0	
11403	6	31	34	16	828	67		37	33	16	959	33	
11403	7	32	19	16	478	32		30	19	38	448	19	
11403	8	25	23	3	452	23		28	24	38	528	4	
11403	9	24	19	16	358	26		24	18	16	339	2	
11403	10	8	8	16	50	2		10	6	38	47	0	
11403	11	23	26	16	470	41		34	26	5	694	14	tag missing
11403	195												

plot #	Plant No.	2005						2006					
		Length	Width	% Dead	05 Area	05 #Infl	Notes	Length	Width	% Dead	06 Area	06 #Infl	Notes
10206	17												
10206	56	14	8	63	88	0	weak.wilted	13	8	4	82	9	
10206	69												dead
10206	70	19	15	63	224	0		16	13	3	163	19	
10206	71	20	16	63	251	0		17	13	5	174	9	
10206	72	11	9	63	78	0		9	7	4	49	0	
10206	73	10	8	63	63	0		12	8	4	75	1	
10206	74	10	8	63	63	0		23	15	5	271	11	
10206	75	16	13	38	163	0		16	13	3	163	1	
10206	76							17	12	4	160	0	recorded as dead last year
10206	77	18	13	63	184	0		20	13	3	204	1	
10212	78	22	15	38	259	0		22	18	2	311	21	
10212	79	30	26	63	613	0		25	25	3	491	66	
10212	80	32	20	63	503	0		25	25	3	491	119	
10212	82	19	14	88	209	0	only 3 living leaves	17	8	5	107	19	
10212	83	47	40	63	1477	0	very wilted	48	27	3	1018	38	
10212	84						DON'T USE FOR ANALYSIS	14	8	5	88	13	DON'T USE FOR ANALYSIS. recorded as
10212	85	34	14	63	374	0		22	17	3	294	31	
10401	1	50	40	38	1571	9	Moved tag to 70, 0?)	51	39	3	1562	1145	
10401	3	16	12	38	151	0		18	15	3	212	1	
10416	4	45	40	16	1414	1	Tag moved to edge of plant - plant grew over tag	50	46	3	1806	253	
11403	5												
11403	6	37	33	63	959	0		38	33	4	985	32	
11403	7	33	23	63	596	0		34	19	4	507	48	
11403	8	28	25	63	550	0		29	25	4	569	32	
11403	9	24	19	38	358	0		25	19	3	373	27	
11403	10	11	9	38	78	0	Missing tag - has nail	10	9	3	71	1	
11403	11	32	27	63	679	0		35	22	3	605	49	
11403	195												

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2007						2008					
		Length	Width	% Dead	07 Area	07 #Infl	Notes	Length	Width	% Dead	08 Area	08 #Infl	Notes
10206	17	12	8	3	75	0	tag # 17 also in 13006				0		
10206	56	13	7	4	71	0		14	11	6	121	0	
10206	69						dead				0		dead
10206	70	13	11	2	112	0		16	14	3	176	0	
10206	71	16	13	4	163	0		17	15	4	200	0	
10206	72	9	4	4	28	0		10	10	4	79	0	
10206	73				0			12	9	4	85	0	
10206	74	18	16	5	226	0		19	16	5	239	0	
10206	75	16	13	3	163	0		16	13	3	163	0	
10206	76				0		dead				0		dead
10206	77	18	2	3	28	0		20	13	3	204	0	
10212	78	22	17	2	294	0		23	18	3	325	0	
10212	79	25	24	3	471	0		29	25	4	569	12	
10212	80	24	22	3	415	5		25	24	3	471	23	
10212	82	15	10	3	118	0		18	15	3	212	0	
10212	83	40	29	2	911	5		38	31	3	925	1	
10212	84				0			24	17	3	320	5	
10212	85	21	13	2	214	0					0		
10401	1	42	40	3	1319	14		51	41	3	1642	72	
10401	3	17	16	1	214	0		17	15	2	200	0	
10416	4	49	45	1	1732	37		53	45	2	1873	37	
11403	5						dead				0		
11403	6	35	32	3	880	7		40	32	6	1005	0	
11403	7	35	20	3	550	0		35	20	3	550	3	
11403	8	32	25	3	628	0		30	26	3	613	0	
11403	9	25	20	5	393	3		26	19	3	388	0	
11403	10	10	9	2	71	4		9	5	2	35	0	
11403	11	30	21	3	495	2		27	20	3	424	0	
11403	195												

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2009						2010					
		Length	Width	% Dead	09 Area	09 #Infl	Notes	Length	Width	% Dead	10 Area	10 #Infl	Notes
10206	17				0						0		
10206	56	1	1	6	1	0					0		dead
10206	69				0		dead				0		dead
10206	70	14	13	3	143	0		14	14	3	154	2	
10206	71	15	15	3	177	0		16	13	3	163	2	
10206	72	8	5	4	31	0		9	7	4	49	0	
10206	73	12	9	3	85	0		5	6	5	24	0	
10206	74	14	11	5	121	0		15	10	5	118	0	
10206	75	17	14	3	187	2		18	13	3	184	1	
10206	76				0		dead				0		dead
10206	77	19	14	3	209	0		16	14	4	176	0	
10212	78	24	19	3	358	0		23	19	3	343	9	
10212	79	30	26	3	613	20		33	26	2	674	12	
10212	80	25	20	3	393	33		27	19	2	403	63	
10212	82	18	10	3	141	4		18	11	3	156	5	
10212	83	44	34	3	1175	27		49	31	3	1193	36	
10212	84				0						0		dead
10212	85	22	16	3	276	6		24	17	2	320	15	
10401	1	57	41	3	1835	62		54	42	2	1781	162	
10401	3	17	16	2	214	0		19	16	3	239	0	
10416	4	56	50	3	2199	46					0		
11403	5				0		dead				0		dead
11403	6				0		dead				0		dead
11403	7	35	21	3	577	1		37	21	3	610	24	
11403	8	29	25	3	569	2		27	27	2	573	21	
11403	9	25	20	3	393	0		26	17	3	347	11	
11403	10	11	9	3	78	0					0		dead
11403	11	35	21	3	577	2	nail but tag missing	26	15	2	306	26	nail but tag missing
11403	195												

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2011					
		Length	Width	% Dead	11Area	11#Infl	Notes
10206	17				0		
10206	56				0		dead
10206	69				0		dead
10206	70	16	15	2	188	1	
10206	71	20	17	2	267	3	
10206	72	10	9	4	71	0	
10206	73	8	7	5	44	0	
10206	74				0		dead
10206	75	23	17	2	307	6	
10206	76				0		dead
10206	77	17	14	4	187	0	
10212	78	32	28	2	704	8	
10212	79	29	26	2	592	43	
10212	80	29	26	2	592	76	
10212	82	21	14	2	231	13	
10212	83	47	37	2	1366	97	
10212	84				0		dead
10212	85	24	26	3	490	22	
10401	1	59	45	3	2085	74	
10401	3	21	19	2	313	0	
10416	4	62	51	4	2483	142	
11403	5				0		dead
11403	6				0		dead
11403	7	41	24	3	773	43	
11403	8	32	30	2	754	67	
11403	9	31	23	3	560	2	
11403	10				0		dead
11403	11	39	24	2	735	19	nail but tag missing
11403	195	28	18	1	396	15	? Pl not prev recorded

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis	1997					1998				
					Length	Width	% Dead	97Area	97#Infl	Length	Width	% Dead	98Area	98#Infl
11407	12	2	43	43	23	16	16	289	16	24	17	16	320	19
11407	13	2	57	50	20	16	1	251	15	24	18	3	339	27
11407	14	2	71	50	19	15	3	224	0	21	17	16	280	19
11407	15	2	58	73	27	12	88	254	0	27	12	88	254	0
11407	16	2	140	69	10	7	1	55	5	13	10	1	102	15
11407	112	2	166	77										
11605	28	1	16	76	33	18	3	467	13	33	18	16	467	20
11605	29	1	28	63	18	15	1	212	30	18	15	3	212	6
11605	30	1	29	20	13	10	16	102	1	13	10	16	102	0
11605	31	1	20	53	17	11	1	147	20	17	11	3	147	9
11605	32	1	120	0	18	16	3	226	32	17	15	16	200	1
11605	33	1	5	39	9	6	1	42	1	9	6	3	42	0
11605	34	1	151	4	24	19	3	358	52	25	20	3	393	15
11605	35	1	-1	2	17	15	3	200	32	18	15	16	212	6
11605	36	1	30	28	8	5	16	31	0	7	5	16	27	0
11605	37	1	172	36	34	27	1	721	188	35	29	3	797	70
11611	38	2	4	27	33	26	1	674	114	31	24	3	584	5
11611	39	2	68	5	11	9	38	78	0	12	6	16	57	0
13006	17	1	4	14	12	10	16	94	11	10	10	16	79	3
13006	18	1	15	33	15	15	1	177	32	14	14	3	154	12
13006	19	1	35	90	21	21	3	346	0	22	20	16	346	0
13006	20	1	46	0	14	10	3	110	11	14	9	3	99	2
13006	21	1	66	25	27	15	16	318	26	25	13	16	255	12
13006	22	1	90	72	29	25	16	569	43	27	26	16	551	17
13006	23	1	120	80	47	41	16	1513	142	47	43	16	1587	78
13006	24	1	118	33	28	19	16	418	13	20	27	16	424	4
13006	25	1	168	20	35	27	16	742	49	36	35	16	990	70
13024	26	2	73	40	18	12	3	170	0	20	14	3	220	1
13024	27	2	103	90	43	32	88	1081	0	42	20	88	660	12
13024	192	2	124	48										

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1999					2000					
		Length	Width	% Dead	99 Area	99 #Infl	Length	Width	% Dead	00 Area	00 #Infl	Notes
11407	12	25	16	3	314	7	28	16	15	352	32	medium quality flwrs
11407	13	25	18	3	353	16	26	18	15	368	2	
11407	14	20	17	3	267	3	20	18	15	283	3	
11407	15	23	11	88	199	0	23	11	88	199	0	very few surviving leaves
11407	16	15	13	1	153	3	18	15	1	212	20	good quality, ~20recently knocked off-
11407	112	6 leaves in May, 17 in July					2.5	2	1	4	0	too many leaves to count
11605	28	35	21	16	577	6	33	18	38	467	0	
11605	29	18	13	16	184	3	24	17	38	320	0	
11605	30	13	8	16	82	0	13	10	15	102	0	
11605	31	18	11	16	156	0	17	13	38	174	0	
11605	32	19	16	38	239	1	19	17	38	254	0	
11605	33	9	7	16	49	0	9	7	63	49	0	
11605	34	26	22	16	449	2	25	20	63	393	0	
11605	35	18	15	16	212	5	18	16	38	226	0	
11605	36	7	5	3	27	0	7	4	15	22	0	
11605	37	35	29	16	797	10	33	26	38	674	1	poor infl
11611	38	33	24	16	622	16	32	24	15	603	15	
11611	39	13	5	3	51	0	14	6	3	66	0	
13006	17	10	6	38	47	0	11	9	15	78	1	poor infl
13006	18	15	13	38	153	0	15	15	38	177	4	poor infl
13006	19	23	15	63	271	0	23	20	63	361	0	
13006	20	15	12	16	141	0	15	9	15	106	3	poor infl
13006	21	25	15	16	295	3	25	15	15	295	15	poor infl
13006	22	26	26	16	531	2	26	26	15	531	30	poor infl
13006	23	51	46	16	1843	11	50	48	15	1885	71	
13006	24	30	22	16	518	0	31	23	15	560	29	
13006	25	37	37	38	1075	5	35	32	38	880	6	
13024	26	23	16	1	289	7	27	20	3	424	30	healthy infl, infl still emerging
13024	27	36	14	63	396	12						dead-attempted to leafout this year
13024	192											

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2001						2002					
		Length	Width	% Dead	01 Area	01 #Infl	Notes	Length	Width	% Dead	02 Area	02 #Infl	Notes
11407	12	28	16	16	352	3		31	17	16	414	36	
11407	13												
11407	14	22	19	16	328	0		22	21	16	363	8	
11407	15												
11407	16	21	17	1	280	24	infl are good	20	18	1.	283	57	
11407	112	4	4	1	13	0		6	5	1	24	0	
11605	28	29	21	38	478	0		29	20	63	456	1	
11605	29	26	18	63	368	0		26	19	38	388	32	
11605	30	14	9	63	99	0		14	10	38	110	0	
11605	31	19	12	63	179	0		16	13	38	163	6	
11605	32	19	16	63	239	0		20	19	63	298	3	
11605	33	8	8	38	50	0		9	7	16	49	0	
11605	34	27	21	38	445	0		27	20	38	424	25	
11605	35	20	17	38	267	0		21	17	38	280	0	
11605	36	7	5	63	27	0		7	4	63	22	0	
11605	37	35	29	38	797	0		36	30	38	848	21	
11611	38	33	27	16	700	0		33	28	38	726	88	
11611	39	14	6	16	66	0		15	7	16	82	1	
13006	17	12	7	16	66	1		11	7	16	60	0	
13006	18	17	16	16	214	1		16	13	16	163	0	
13006	19	24	15	38	283	0		24	16	63	302	0	
13006	20	17	11	16	147	0		17	12	16	160	5	
13006	21	28	18	16	396	1	very poor infl	29	17	16	387	5	
13006	22	27	20	38	424	17	very poor infl	28	23	38	506	26	
13006	23	54	48	16	2036	14		53	49	16	2040	20	
13006	24	33	21	38	544	15	very poor infl	33	20	38	518	4	
13006	25	39	33	16	1011	2		40	35	16	1100	4	
13024	26	30	21	1	495	22		31	24	1	584	66	
13024	27												
13024	192												

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2003						2004					
		Length	Width	% Dead	03 Area	03 #infl	Notes	Length	Width	% Dead	04 Area	04 #Infl	Notes
11407	12	32	19	16	478	13		35	20	16	550	19	
11407	13												
11407	14	26	22	16	449	11		27	22	16	467	11	
11407	15												
11407	16	23	21	1	379	6		24	24	1	452	31	
11407	112	8	6	1	38	6		8	8	1	50	1	
11605	28	25	22	38	432	20		26	22	0	449	0	
11605	29	26	21	16	429	35		26	16	16	327	4	Missing tag-seemd to be
11605	30	15	10	16	118	0		15	10	16	118	0	
11605	31	13	15	88	153	0					0		
11605	32	23	23	16	415	15		22	22	16	380	2	
11605	33	26	28	16	572	0		30	29	38	683	3	
11605	34	27	22	16	467	18		27	33	38	700	4	
11605	35	21	19	3	313	37		22	19	16	328	3	
11605	36												tag pulled
11605	37	38	28	16	836	59		50	36	38	1414	13	
11611	38	32	29	1	729	75		34	32	16	855	73	
11611	39	17	9	1	120	10		15	8	3	94	0	
13006	17	11	8	16	69	3		11	8	16	69	6	
13006	18	14	15	3	165	19	Many broken off	16	11	16	138	17	
13006	19	21	15	38	247	0		20	13	5	204	0	
13006	20	16	10	3	126	5		19	16	16	239	15	
13006	21	29	16	16	364	10		31	15	16	365	13	
13006	22	30	23	16	542	18	Many broken off	31	21	16	511	22	
13006	23	52	47	16	1920	22		56	54	38	2375	46	
13006	24	36	20	16	565	9		19	13	5	194	2	
13006	25	35	29	16	797	5		26	16	38	327	12	
13024	26	34	27	1	721	38		37	28	3	814	66	
13024	27												
13024	192												

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plot #	Plant No.	2005						2006					
		Length	Width	% Dead	05 Area	05 #Infl	Notes	Length	Width	% Dead	06 Area	06 #Infl	Notes
11407	12	36	19	63	537	2		38	20	3	597	52	
11407	13												dead
11407	14							28	25	3	550	4	
11407	15										0		dead
11407	16	25	19	16	373	4	Needs tag. At 49, 130?	30	24	2	565	79	
11407	112	9	8	16	57	0		10	10	1	79	10	
11605	28	27	22	63	467	0		32	29	4	729	33	
11605	29	27	18	63	382	0	Tag needed? At 50,50?	30	26	3	613	29	
11605	30	15	10	63	118	0		17	9	2	120	0	
11605	31												dead
11605	32	23	23	63	415	0		26	12	4	245	23	
11605	33	33	27	63	700	0		34	32	4	855	62	
11605	34	34	26	63	694	0		29	24	3	547	27	
11605	35	20	22	63	346	0		23	21	3	379	53	
11605	36												
11605	37	34	26	63	694	0		55	32	4	1382	120	
11611	38	14	8	88	88	0		36	30	3	848	184	
11611	39	34	26	88	694	0		17	11	3	147	6	
13006	17	11	8	63	69	0		10	9	3	71	8	
13006	18	15	14	63	165	0		17	11	3	147	23	
13006	19	20	10	88	157	0							dead
13006	20	18	15	63	212	0		20	13	2	204	7	
13006	21	20	10	88	157	0		29	12	3	273	16	
13006	22	32	23	63	578	0		31	25	4	609	53	
13006	23	56	51	63	2243	1		56	51	5	2243	115	
13006	24	20	14	63	220	0		22	14	5	242	14	
13006	25	25	29	63	569	0		30	27	5	636	35	
13024	26	37	30	16	872	26		42	36	3	1188	117	
13024	27												
13024	192							3	2	1	5	0	retag in 2007

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plot #	Plant No.	2007						2008					
		Length	Width	% Dead	07 Area	07 #Infl	Notes	Length	Width	% Dead	08 Area	08 #Infl	Notes
11407	12	40	20	3	628	11		40	17	4	534	13	
11407	13										0		dead
11407	14	29	24	3	547	0		24	24	3	452	0	
11407	15				0						0		dead
11407	16	31	22	1	536	12		30	21	2	495	19	
11407	112	12	11	1	104	0		11	10	2	86	0	
11605	28	28	9	4	198	0	near by plants previously considered part of this?	37	28	4	814	0	
11605	29	29	24	3	547	0					0		
11605	30	16	10	3	126	0		16	11	4	138	0	
11605	31										0		
11605	32	24	22	3	415	0		23	21	3	379	0	
11605	33	34	33	3	881	3		35	33	4	907	0	
11605	34	32	290	3	7288	0		27	23	3	488	0	
11605	35	21	19	3	313	0		25	20	4	393	0	
11605	36										0		
11605	37	52	31	3	1266	0		41	30	3	966	0	
11611	38	33	23	2	596	6		38	31	2	925	2	
11611	39	15	9	3	106	0		18	10	4	141	0	
13006	17	11	8	3	69	0		11	9	4	78	0	
13006	18	16	11	3	138	0		20	10	2	157	4	
13006	19										0		dead
13006	20	19	12	2	179	2		22	15	2	259	5	
13006	21	30	11	3	259	0		31	12	4	292	0	
13006	22	31	23	3	560	5		27	25	2	530	29	
13006	23	54	50	3	2121	8		60	49	3	2309	49	
13006	24	22	14	3	242	0		17	12	3	160	7	
13006	25	30	29	3	683	4		35	28	4	770	15	
13024	26	40	35	1	1100	23		46	42	3	1517	76	
13024	27						dead, tag removed				0		
13024	192				0		tag 194	5	4		16		now 194

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2009						2010					
		Length	Width	% Dead	09 Area	09 #Infl	Notes	Length	Width	% Dead	10 Area	10 #Infl	Notes
11407	12	40	18	3	565	9		36	10	3	283	28	
11407	13				0		dead				0		dead
11407	14	28	24	3	528	0		26	26	2	531	3	
11407	15				0		plant gone no tag				0		plant gone no tag
11407	16	29	25	3	569	35	tag not visible	29	23	2	524	41	tag not visible
11407	112	12	11	2	104	5		13	12	2	123	16	
11605	28	21	28	6	462	0		7	7	6	38	4	
11605	29				0						0		no tag no plant
11605	30	16	10	4	126	0		15	8	5	94	0	
11605	31				0						0		dead, no tag
11605	32	23	21	4	379	0	mostly out of plot	20	16	3	251	13	mostly out of plot
11605	33	38	33	4	985	2		36	30	4	848	26	
11605	34	28	22	4	484	0		28	22	4	484	6	
11605	35	22	19	3	328	7		22	21	3	363	12	
11605	36				0						0		no plant
11605	37	41	32	4	1030	0		41	32	3	1030	103	
11611	38	38	34	3	1015	89		35	27	2	742	146	
11611	39	17	11	3	147	0		19	13	3	194	2	
13006	17	9	7	3	49	0		10	9	2	71	3	
13006	18	16	11	3	138	1		14	13	3	143	15	
13006	19				0		dead				0		dead
13006	20	20	13	2	204	7		20	17	2	267	5	
13006	21	30	11	4	259	0					0		dead
13006	22	30	25	3	589	8		30	23	2	542	58	
13006	23	58	53	3	2414	28		58	47	2	2141	67	
13006	24	15	11	3	130	3		23	16	2	289	24	
13006	25	32	25	3	628	1		25	19	4	373	24	
13024	26	49	40	3	1539	121		45	41	3	1449	220	
13024	27				0						0		dead
13024	192	5	4	1	16	0	now 194	7	6	2	33	2	now 194

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2011					
		Length	Width	% Dead	11Area	11#Infl	Notes
11407	12	41	17	3	547	17	
11407	13				0		dead
11407	14	31	28	3	682	0	
11407	15				0		plant gone no tag
11407	16	31	22	2	536	63	tag not visible
11407	112	17	16	1	214	7	
11605	28	10	12	6	94	0	
11605	29	39	31	2	950	35	no tag no plant in 2010
11605	30	17	10	3	134	0	
11605	31				0		dead, no tag
11605	32	28	22	3	484	26	mostly out of plot
11605	33	41	28	4	902	21	
11605	34	28	26	3	572	0	
11605	35	26	27	3	551	11	
11605	36				0		no plant
11605	37	40	27	2	848	3	
11611	38	42	37	2	1221	128	
11611	39	22	14	4	242	3	
13006	17	12	8	1	75	16	
13006	18	16	10	1	126	30	
13006	19				0		dead
13006	20				0		
13006	21				0		dead
13006	22	32	27	2	679	44	
13006	23	57	56	3	2507	139	
13006	24	25	13	2	255	24	
13006	25	34	16	4	427	17	
13024	26	48	46	3	1734	157	
13024	27				0		dead
13024	192	10	10	1	79	2	now 194

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis	1997					1998				
					Length	Width	% Dead	97Area	97#Infl	Length	Width	% Dead	98Area	98#Infl
20205	103	1	0	70	25	18	1	353	37	27	20	1	424	30
20205	104	1	109	74	39	31	38	950	83	36	29	63	820	24
20205	105	1	94	55	18	15	3	212	27	18	16	16	226	0
20205	107	1	140	0	25	20	16	393	25	27	20	63	424	21
20205	108	1	112	0	18	12	16	170	0	19	13	38	194	0
20205	111	1	67	70	2	2	1	3	0	2.5	2	1	4	0
20205	106	1	3	62	18	13	3	184	1	18	16	16	226	4
20601	40	1	9	4	14	9	16	99	11	14	9	16	99	3
20601	41	1	91	53	17	12	3	160	4	16	14	16	176	0
20601	42	1	29	40	15	10	38	118	5	11	8	38	69	0
20601	43	1	110	25	12	11	3	104	0	12	11	3	104	0
20601	44	1	124	60	25	13	63	255	17	14	11	63	121	0
20601	45	1	168	48	16	13	38	163	1	18	14	38	198	0
20601	46	1	72	49	20	14	5	220	0	20	14	4	220	7
20601	47	1	29	31	7	6	16	33	0	7	6	16	33	0
20601	48	1	165	15	47	34	16	1255	38	47	35	16	1292	65
20601	49	1	36	22	15	12	16	141	3	14	11	16	121	0
20607	51	2	96	54	20	16	3	251	23	21	17	3	280	55
23004	86	1	84	73	34	30	3	801	78	37	28	16	814	50
23008	87	2	101	0	49	39	16	1501	48	49	41	63	1578	28
23008	88	2	84	24	25	24	38	471	2	28	21	63	462	12
23408	50	2	15	30	40	30	3	942	209	38	34	3	1015	215
23408	52	2	30/56	0/33	30	22	63	518	54	34	24	63	641	44
23408	53	2	58	80	19	17	3	254	32	21	21	3	346	73

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1999					2000					
		Length	Width	% Dead	99 Area	99 #Infl	Length	Width	% Dead	00 Area	00 #Infl	Notes
20205	103	30	20	3	471	8	30	22	15	518	28	
20205	104	37	24	63	697	5	35	29	38	797	72	
20205	105	18	18	16	254	2	20	17	3	267	36	
20205	107	30	21	38	495	3	31	22	15	536	41	
20205	108	18	13	38	184	0	19	11	15	164	3	poor infl
20205	111	3	2.5	1	6	0	4	4	1	13	0	
20205	106	19	17	16	254	1	18	15	15	212	2	
20601	40	14	12	38	132	0	14	9	15	99	1	
20601	41	17	17	38	227	8	17	16	15	214	0	
20601	42	16	13	38	163	0	11	8	63	69	0	
20601	43	14	11	3	121	0	12	14	15	132	0	
20601	44											
20601	45	19	16	38	239	0	20	14	38	220	0	
20601	46	20	14	38	220	0	22	15	3	259	8	small infl
20601	47	8	7	63	44	0	7	7	38	38	0	
20601	48	48	39	16	1470	30	49	39	15	1501	89	infl poor
20601	49	15	12	38	141	1	12	12	38	113	1	looks stressed, infl poor
20607	51	25	22	3	432	30	26	22	1	449	75	
23004	86	37	29	16	843	3	37	27	15	785	16	infl sessile
23008	87	49	42	38	1616	8	48	41	38	1546	24	poor infl
23008	88	29	21	16	478	1	26	20	15	408	6	
23408	50	39	35	16	1072	42	39	39	38	1195	108	50% poor infl
23408	52											
23408	53	23	21	3	379	3	24	21	3	396	39	infl finished

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2001						2002					
		Length	Width	% Dead	01 Area	01 #Infl	Notes	Length	Width	% Dead	02 Area	02 #Infl	Notes
20205	103	33	24	16	622	4		34	26	16	694	17	
20205	104	36	22	38	622	17	poor infl	35	17	38	467	24	
20205	105	22	22	16	380	1	poor infl	21	18	16	297	13	
20205	107	35	18	3	495	12	very poor infl	33	24	38	622	16	
20205	108												
20205	111	6	5	1	24	0		5	5	1	20	0	
20205	106	21	19	16	313	0		21	21	16	346	7	
20601	40	16	10	38	126	0		18	10	16	141	4	
20601	41	18	14	16	198	1	poor infl	19	14	38	209	0	
20601	42	17	10	38	134	0		18	20	38	283	1	
20601	43	15	14	38	165	0		15	13	38	153	0	
20601	44												
20601	45	19	10	16	149	1	poor infl	20	10	16	157	1	
20601	46	22	15	38	259	0	split from 2 plants, both called 46	21	14	38	231	2	
20601	47	9	6	38	42	0		8	8	38	50	0	
20601	48	51	39	16	1562	33		53	40	16	1665	81	
20601	49	14	11	38	121	0		14	13	38	143	2	
20607	51	29	26	1	592	62		27	25	1	530	67	
23004	86	37	28	16	814	0		37	29	16	843	51	
23008	87	45	43	38	1520	5	very poor infl	46	44	38	1590	44	
23008	88	30	22	38	518	1	poor infl	33	23	16	596	25	
23408	50	31	21	88	511	26	very poor infl						
23408	52												
23408	53	27	24	16	509	34		28	24	3	528	66	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2003						2004					
		Length	Width	% Dead	03 Area	03 #infl	Notes	Length	Width	% Dead	04 Area	04 #Infl	Notes
20205	103	36	26	16	735	40		36	28	38	792	12	
20205	104	33	19	16	492	69		35	19	16	522	22	
20205	105	24	23	16	434	60		26	22	38	449	1	
20205	107	35	23	16	632	61		38	23	16	686	25	
20205	108												
20205	111	8	7	1	44	0		9	7	1	49	0	
20205	106	23	21	16	379	16		24	23	38	434	1	
20601	40	18	9	3	127	4		19	10	3	149	4	
20601	41	19	18	16	269	7		22	16	16	276	3	
20601	42	19	9	16	134	3		18	11	16	156	5	
20601	43	17	14	38	187	0		18	14	38	198	0	
20601	44												
20601	45	19	11	16	164	9		21	12	16	198	0	
20601	46	21	15	38	247	6		19	15	16	224	7	
20601	47	9	7	0	49	3		9	7	38	49	0	
20601	48	53	42	16	1748	126		51	38	38	1522	18	
20601	49	14	13	16	143	3		46	18	16	650	12	
20607	51	32	28	3	704	57		33	30	3	778	29	
23004	86	39	33	16	1011	77		41	34	3	1095	119	
23008	87	45	43	38	1520	29		46	44	16	1590	32	
23008	88	33	25	16	648	24		34	23	38	614	5	
23408	50												
23408	52												
23408	53	30	25	3	589	93		31	30	16	730	45	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2005						2006					
		Length	Width	% Dead	05 Area	05 #Infl	Notes	Length	Width	% Dead	06 Area	06 #Infl	Notes
20205	103	37	27	63	785	3		35	34	4	935	35	
20205	104	36	19	63	537	7		37	22	3	639	58	
20205	105	25	22	63	432	0		26	21	4	429	11	
20205	107	38	27	63	806	5		70	39	3	2144	30	
20205	108												tag missing, no data
20205	111	8	7	63	44	0							
20205	106	26	22	63	449	1		26	24	4	490	24	retag in 2007
20601	40	18	10	63	141	0		18	11	2	156	14	
20601	41	21	16	63	264	0		22	18	3	311	12	
20601	42	18	10	63	141	1		14	12	2	132	11	
20601	43	17	14	63	187	0		17	15	3	200	0	
20601	44												dead
20601	45	20	18	63	283	0		18	16	3	226	6	
20601	46	20	16	63	251	0		21	11	5	181	3	
20601	47	8	7	88	44	0		7	5	5	27	0	
20601	48	53	36	38	1499	20	Tough plant to define boundaries	56	53	4	2331	93	
20601	49	47	19	63	701	0		47	19	3	701	39	
20607	51	34	32	38	855	7		36	34	2	961	80	
23004	86	40	34	63	1068	0		43	39	3	1317	194	
23008	87	46	43	38	1554	7		44	36	5	1244	72	
23008	88	33	24	63	622	2		34	28	4	748	26	
23408	50												
23408	52												
23408	53	34	29	38	774	4		34	31	3	828	89	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2007						2008					
		Length	Width	% Dead	07 Area	07 #Infl	Notes	Length	Width	% Dead	08 Area	08 #Infl	Notes
20205	103	39	29	4	888	2		35	32	3	880	0	
20205	104	38	22	3	657	9		39	23	5	705	0	
20205	105	27	22	4	467	0		28	24	4	528	0	
20205	107	38	34	3	1015	9		41	32	3	1030	43	
20205	108										0		
20205	111	10	7	2	55	0		13	8	3	82	0	
20205	106	25	25	4	491	2	now tag 114	27	18	5	382	0	now 114
20601	40	18	13	2	184	2		22	15	3	259	5	
20601	41	22	20	3	346	1		24	20	3	377	2	
20601	42	17	12	3	160	4		19	15	4	224	3	
20601	43	20	17	2	267	0		22	16	3	276	0	
20601	44										0		dead
20601	45	18	17	3	240	0		22	15	3	259	12	
20601	46	19	13	3	194	0		21	14	3	231	0	
20601	47	8	4	2	25	0		8	7	5	44	0	
20601	48	59	53	4	2456	25		45	37	3	1308	57	
20601	49	16	15	2	188	5		19	18	3	269	2	
20607	51	38	33	1	985	109		41	39	0	1256	140	
23004	86	44	39	4	1348	3		43	41	2	1385	11	
23008	87	45	44	3	1555	10		47	45	3	1661	31	
23008	88	34	28	3	748	2		37	25	3	726	10	
23408	50						dead				0		dead
23408	52						dead				0		dead
23408	53	34	31	3	828	2		38	34	1	1015	16	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2009						2010					
		Length	Width	% Dead	09 Area	09 #Infl	Notes	Length	Width	% Dead	10 Area	10 #Infl	Notes
20205	103	39	30	3	919	8		43	31	1	1047	36	
20205	104	37	23	6	668	0					0		dead
20205	105	27	24	3	509	0		28	21	2	462	29	
20205	107	43	34	3	1148	38	dying where x axis lies on plant	42	41	2	1352	88	
20205	108				0						0		
20205	111	11	7	3	60	0		11	8	1	69	0	
20205	106	125	125	5	12272	4	now 114				0		now 114, dead
20601	40	19	14	3	209	7		20	14	3	220	19	
20601	41	26	20	3	408	0		26	21	2	429	1	
20601	42	18	14	3	198	1		18	14	2	198	2	
20601	43	16	16	3	201	0		20	15	3	236	0	
20601	44				0		dead				0		dead
20601	45	19	17	3	254	0		21	20	2	330	1	
20601	46	20	13	4	204	0		17	15	6	200	0	
20601	47	8	5	6	31	0	dead but data?				0		dead but data?
20601	48	45	37	3	1308	35	damage by pvc	45	43	3	1520	160	damage by pvc
20601	49	19	17	3	254	0		19	19	2	284	9	
20607	51	40	36	2	1131	114	plant grown over tag	43	36	2	1216	170	plant grown over tag
23004	86	45	42	3	1484	23		47	41	2	1513	185	
23008	87	48	44	4	1659	45		48	34	3	1282	89	
23008	88	36	23	4	650	19		35	24	3	660	48	
23408	50				0						0		dead
23408	52				0						0		dead
23408	53	36	31	3	877	30	no tag	38	36	2	1074	76	no tag

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2011					
		Length	Width	% Dead	11Area	11#Infl	Notes
20205	103	43	23	2	777	64	tagged now as 99
20205	104				0		dead
20205	105	28	17	2	374	46	
20205	107	53	30	1	1249	100	dying where x axis lies on plant
20205	108				0		
20205	111	13	9	2	92	2	
20205	106				0		now 114, dead
20601	40	24	18	2	339	32	
20601	41	31	14	2	341	19	
20601	42	20	14	2	220	22	
20601	43	20	14	2	220	0	
20601	44				0		dead
20601	45	22	20	2	346	5	
20601	46				0		dead
20601	47				0		dead but data?
20601	48	59	34	3	1576	66	damage by pvc
20601	49	18	15	2	212	8	
20607	51	42	35	6	1155	3	plant grown over tag
23004	86	47	39	2	1440	135	
23008	87	47	36	3	1329	65	
23008	88	41	24	4	773	23	
23408	50				0		dead
23408	52				0		dead
23408	53	38	36	3	1074	125	no tag

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis	1997					1998				
					Length	Width	% Dead	97Area	97#Infl	Length	Width	% Dead	98Area	98#Infl
23408	54	2	112	53	18	12	3	170	6	19	12	16	179	17
23408	55	2	192	80	11	8	16	69	5	12	8	16	75	8
23804	57	1	75	0	15	13	3	153	0	16	15	16	188	10
23804	58	1	25	12	18	17	1	240	5	20	20	16	314	14
23804	59	1	39	42	21	12	3	198	0	23	13	16	235	5
23804	60	1	110	0	40	35	1	1100	123	44	42	16	1451	65
23804	61	1	144	90	14	12	16	132	0	14	14	38	154	0
23804	62	1	181	27	13	10	16	102	2	14	10	16	110	12
23804	63	1	182	0	25	23	63	452	29	25	23	88	452	28
23804	64	1	71	60	25	17	16	334	48	23	17	16	307	13
23804	65	1	69	96	10	7	16	55	0	10	6	63	47	0
23810	67	2	179/47	19/17	47	17	3	628	69	47	17	3	628	189

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1999					2000					
		Length	Width	% Dead	99 Area	99 #Infl	Length	Width	% Dead	00 Area	00 #Infl	Notes
23408	54	19	12	3	179	0	20	13	15	204	17	
23408	55	14	9	16	99	0	13	12	15	123	2	
23804	57	18	15	16	212	0	16	16	15	201	1	poor infl
23804	58	21	21	38	346	1	21	21	15	346	2	infl finished
23804	59	23	14	16	253	0	23	13	38	235	0	
23804	60	44	41	38	1417	2	44	32	38	1106	3	poor infl
23804	61	15	13	3	153	0	16	12	15	151	0	
23804	62	15	11	3	130	0	14	11	15	121	4	
23804	63											
23804	64	21	20	63	330	0	23	17	38	307	0	
23804	65											
23810	67	51	21	3	841	61	55	23	3	994	296	66 and 68 merged w/ 67

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2001						2002					
		Length	Width	% Dead	01 Area	01 #Infl	Notes	Length	Width	% Dead	02 Area	02 #Infl	Notes
23408	54	21	13	3	214	1		22	14	16	242	13	
23408	55	15	13	3	153	1		17	11	3	147	4	
23804	57	20	19	16	298	0		21	17	16	280	8	
23804	58	23	23	38	415	1	poor infl	25	23	16	452	3	
23804	59	29	14	38	319	0		24	14	38	264	1	
23804	60	20	19	16	298	0		47	44	38	1624	12	
23804	61	47	45	38	1661	0		18	14	16	198	10	
23804	62	17	14	16	187	0		17	15	38	200	14	
23804	63												
23804	64	23	13	88	235	0		23	11	63	199	2	
23804	65												
23810	67	56	23	16	1012	168		56	24	16	1056	147	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2003						2004					
		Length	Width	% Dead	03 Area	03 #infl	Notes	Length	Width	% Dead	04 Area	04 #Infl	Notes
23408	54	22	15	16	259	8		23	14	16	253	4	
23408	55	18	12	16	170	12		18	13	3	184	4	
23804	57	22	18	16	311	4		23	20	16	361	5	
23804	58	28	27	16	594	36		31	28	38	682	5	
23804	59	25	16	38	314	1		26	17	16	347	1	
23804	60	45	40	16	1414	89		48	42	38	1583	65	
23804	61	21	17	3	280	30		22	19	16	328	11	
23804	62	18	14	16	198	53		18	15	16	212	2	
23804	63												
23804	64	24	18	63	339	3		24	17	16	320	4	
23804	65												
23810	67	60	25	16	1178	267	most infl naked stalks (poor production)	60	25	16	1178	115	clearly 2 plants- these measurements for tagged plant

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2005						2006					
		Length	Width	% Dead	05 Area	05 #Infl	Notes	Length	Width	% Dead	06 Area	06 #Infl	Notes
23408	54	23	15	63	271	6		24	15	3	283	19	
23408	55	18	14	38	198	0		21	15	2	247	31	
23804	57	23	19	63	343	0		21	16	3	264	23	
23804	58	29	28	63	638	0		31	29	3	706	58	
23804	59	26	17	63	347	0		26	18	3	368	3	
23804	60	48	39	88	1470	0	lots of die-back	49	27	5	1039	91	
23804	61	22	18	63	311	0		24	17	3	320	28	
23804	62	19	15	63	224	0		20	16	4	251	21	
23804	63												dead
23804	64	24	17	63	320	0		22	14	4	242	21	
23804	65												dead
23810	67	59	26	38	1205	49	tag missing	62	23	3	1120	338	plot tag appears to be at 9 rather than 10

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2007						2008					
		Length	Width	% Dead	07 Area	07 #Infl	Notes	Length	Width	% Dead	08 Area	08 #Infl	Notes
23408	54	23	16	3	289	0		26	17	3	347	0	
23408	55	19	14	2	209	3		24	18	2	339	0	
23804	57	25	19	3	373	2		29	24	3	547	0	
23804	58	32	28	3	704	1		34	32	3	855	6	
23804	59	18	12	3	170	0		22	14	3	242	0	
23804	60	51	25	4	1001	2		55	47	4	2030	0	
23804	61	20	20	2	314	3		25	21	2	412	0	
23804	62	18	14	3	198	1		22	18	3	311	0	
23804	63										0		dead
23804	64	24	20	3	377	2		24	23	2	434	0	2 plants?
23804	65										0		no tag
23810	67	62	25	4	1217	25		67	31	4	1631	299	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2009						2010					
		Length	Width	% Dead	09 Area	09 #Infl	Notes	Length	Width	% Dead	10 Area	10 #Infl	Notes
23408	54	24	15	3	283	10		25	15	3	295	9	
23408	55	21	17	4	280	2		22	17	2	294	14	
23804	57	25	18	4	353	8		27	19	3	403	2	
23804	58	22	10	3	173	11		33	29	3	752	35	
23804	59	21	13	4	214	2		23	19	3	343	0	
23804	60	49	39	5	1501	17		49	30	4	1155	14	
23804	61				0			24	20	3	377	11	
23804	62	21	17	4	280	5		21	16	4	264	2	
23804	63				0		dead				0		dead
23804	64	24	13	4	245	0		25	14	3	275	1	
23804	65				0		dead?				0		dead
23810	67	65	32	4	1634	221		67	33	3	1737	365	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2011					
		Length	Width	% Dead	11Area	11#Infl	Notes
23408	54	25	15	3	295	10	
23408	55	23	20	3	361	24	
23804	57	27	20	4	424	5	
23804	58	38	37	3	1104	75	
23804	59	27	15	5	318	0	
23804	60	48	30	4	1131	21	
23804	61	26	21	3	429	18	
23804	62	20	14	4	220	4	
23804	63				0		dead
23804	64	24	18	3	339	3	
23804	65				0		dead
23810	67	70	34	4	1869	398	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis	1997					1998				
					Length	Width	% Dead	97 Area	97 #Infl	Length	Width	% Dead	98 Area	98 #Infl
30408	95	1	2	66	43	27	3	912	19	48	33	16	1244	26
30408	109	1	197	6	4	3	1	9	0	4	3	1	9	0
31813	96	2	156	52	50	46	16	1806	67	56	56	16	2463	105
33007	89	1	43	69	25	22	38	432	5	27	23	16	488	50
33007	90	1	37	42	23	15	16	271	0	22	17	16	294	8
33007	91	1	105	8	70	68	5	3738	35	70	68	38	3738	160
33007	91a													
33007	91b													
33007	91c													
33007	91d													
33408	97	1	28	48	39	31	16	950	15	40	34	38	1068	45
33408	98	1	0	75	10	9	1	71	1	10	9	3	71	0
33408	99	1	114	26	44	31	63	1071	14	46	27	38	975	56
33408	99b													
33408	100	1	141	21	38	37	3	1104	9	44	39	3	1348	77
33408	101	1	71	25	53	45	3	1873	36	58	46	16	2095	142
33408	47													
33411	102	2	79	17	28	22	3	484	62	30	23	3	542	51
34206	93	1	32	16	26	18	38	368	0	27	20	38	424	17
34206	94	1	52	10	36	23	63	650	0	40	24	63	754	4

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	1999					2000					
		Length	Width	% Dead	99 Area	99 #Infl	Length	Width	% Dead	00 Area	00 #Infl	Notes
30408	95	47	34	16	1255	12	48	31	3	1169	99	
30408	109	4	4	1	13	0	4	4	1	13	5	
31813	96	57	54	16	2417	14	60	46	15	2168	100	some aborted
33007	89	18	8	63	113	0	22	16	38	276	13	poor infl
33007	90	22	15	38	259	0	24	14	15	264	0	
33007	91	74	68	16	3952	0	80	67	63	4210	40	poor infl
33007	91a											
33007	91b											
33007	91c											
33007	91d											
33408	97	39	34	16	1041	10	39	35	3	1072	55	poor infl
33408	98	10	10	3	79	0	11	10	3	86	0	
33408	99	45	23	16	813	17	45	29	38	1025	43	poor infl, done flowering
33408	99b											
33408	100	45	44	16	1555	24	39	33	15	1011	17	done flowering
33408	101	60	43	16	2026	31	59	47	15	2178	103	"poor-good infl"
33408	47											
33411	102	33	27	16	700	20	34	28	3	748	104	vigorous
34206	93	29	26	16	592	1	30	22	38	518	25	
34206	94	36	24	63	679	0	38	25	88	746	0	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2001						2002					
		Length	Width	% Dead	01 Area	01 #Infl	Notes	Length	Width	% Dead	02 Area	02 #Infl	Notes
30408	95	52	32	3	1307	202		53	33	3	1374	1	
30408	109	7	6	1	33	2	very poor infl	8	7	1	44	7	
31813	96	64	56	16	2815	51	half infl are poor	66	56	16	2903	195	
33007	89	20	16	38	251	2	very poor infl	21	17	16	280	31	
33007	90	23	13	38	235	0		24	14	3	264	6	
33007	91	79	69	38	4281	1		79	69	38	4281	195	
33007	91a												
33007	91b												
33007	91c												
33007	91d												
33408	97	41	38	38	1224	31	very poor infl	42	37	16	1221	97	
33408	98	13	12	16	123	0		12	12	16	113	0	
33408	99	47	21	16	775	8	very poor infl	47	23	16	849	117	
33408	99b												
33408	100	47	42	38	1550	3	small	48	47	38	1772	70	
33408	101	63	53	38	2622	1	small	63	53	3	2622	168	
33408	47												
33411	102	39	29	3	888	84		40	30	3	942	161	
34206	93	32	23	38	578	2		31	27	16	657	6	
34206	94	38	24	63	716	0		38	21	63	627	0	

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2003						2004					
		Length	Width	% Dead	03 Area	03 #infl	Notes	Length	Width	% Dead	04 Area	04 #Infl	Notes
30408	95	52	34	3	1389	17		51	34	3	1362	24	
30408	109	9	7	1	49	2		13	12	1	123	9	
31813	96	65	55	16	2808	33		66	56	16	2903	68	
33007	89	22	19	16	328	22		22	17	3	294	52	
33007	90	27	16	3	339	10		27	16	3	339	5	
33007	91	76	68	38	4059	124	Most infl aborted	78	63	38	3859	73	
33007	91a												
33007	91b												
33007	91c												
33007	91d												
33408	97	43	37	16	1250	54		42	37	38	1221	51	
33408	98	12	11	16	104	0		12	11	38	104	0	
33408	99	57	28	16	1253	25		52	33	38	1348	47	
33408	99b												
33408	100	49	34	38	1308	15		49	22	38	847	17	
33408	101	49	30	16	1155	36							
33408	47												
33411	102	38	31	16	925	80		37	31	16	901	59	
34206	93	32	28	16	704	6		33	29	16	752	12	
34206	94												

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2005						2006					
		Length	Width	% Dead	05 Area	05 #Infl	Notes	Length	Width	% Dead	06 Area	06 #Infl	Notes
30408	95	54	36	16	1527	34		55	34	3	1469	109	
30408	109	14	12	3	132	2		18	15	2	212	27	Remains of class 5 dead
31813	96	69	53	63	2872	19		71	58	4	3234	142	
33007	89	24	19	38	358	0		25	18	2	353	80	
33007	90	28	14	38	308	0		29	16	2	364	46	
33007	91	78	68	63	4166	15	flowers very small	82	46	5	2963	237	
33007	91a												
33007	91b												
33007	91c												
33007	91d												
33408	97				0								
33408	98	15	11	38	130	0		15	4	3	47	0	
33408	99	51	33	63	1322	5		55	33	4	1425	92	
33408	99b												
33408	100	53	27	38	1124	16		51	29	4	1162	34	
33408	101												
33408	47												
33411	102	41	33		1063	91		42	35	3	1155	170	
34206	93	32	30	38	754	3		34	31	2	828	13	
34206	94												

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2007						2008					
		Length	Width	% Dead	07 Area	07 #Infl	Notes	Length	Width	% Dead	08 Area	08 #Infl	Notes
30408	95	58	35	2	1594	17		62	42	2	2045	80	
30408	109	18	15	2	212	2		25	18	2	353	36	
31813	96	73	59	5	3383	27		72	72	6	4072	0	mort. Class 3 recorded
33007	89	25	18	3	353	1		26	22	2	449	28	
33007	90	32	17	3	427	5		29	25	2	569	6	
33007	91	83	41	3	2673	36		85	71	4	4740	4	
33007	91a												
33007	91b												
33007	91c												
33007	91d												
33408	97						dead	39	38	6	1164	0	mort class 3 recorded
33408	98	15	14	1	165	0		17	15	2	200	0	
33408	99	55	35	3	1512	48		37	34	3	988	84	
33408	99b												
33408	100	53	30	3	1249	22		24	18	3	339	14	
33408	101							55	45	3	1944	44	
33408	47												
33411	102	44	35	3	1210	30	tag # not on data sheet	49	41	3	1578	119	
34206	93	35	30	3	825	4		36	32	3	905	2	
34206	94												

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2009						2010					
		Length	Width	% Dead	09 Area	09 #Infl	Notes	Length	Width	% Dead	10 Area	10 #Infl	Notes
30408	95	62	40	3	1948	93		60	40	2	1885	273	
30408	109	22	18	1	311	31		25	20	1	393	50	
31813	96	72	68	6	3845	7		21	18	6	297	27	plant not correctly measured in 2009
33007	89	25	21	1	412	10		27	18	3	382	142	
33007	90	32	19	1	478	8		30	18	1	424	37	
33007	91	82	73	5	4701	26	tag 200 outside				0		tag 200 outside. 4 sub-areas measured in 2010
33007	91a							35	27	2	742	119	
33007	91b							22	16	2	276	56	
33007	91c							29	17	5	387	76	
33007	91d							22	22	2	380	54	
33408	97				0		dead				0		dead
33408	98	15	13	1	153	0		16	13	1	163	0	
33408	99	56	38	2	1671	124		36	23	1	650	127	additional part measured separately in 2010
33408	99b							34	14	3	374	65	previously part of 99
33408	100	51	29	2	1162	16		54	29	2	1230	167	
33408	101	52	30	4	1225	38		54	29	4	1230	191	
33408	47							19	19	1	284	105	new? May have previously been recorded as part of 99
33411	102	45	42	2	1484	104		49	39	2	1501	284	
34206	93	38	32	3	955	15		39	34	2	1041	46	
34206	94												

Eriogonum codium compiled data (November 2011)

plot #	Plant No.	2011					
		Length	Width	% Dead	11Area	11#Infl	Notes
30408	95	64	43	3	2161	100	
30408	109	25	23	1	452	45	
31813	96				0		plant not correctly measured in 2009. Dead in 2011
33007	89				0		dead
33007	90	29	19		433	33	
33007	91				0		tag 200 outside. 4 sub-areas measured in 2010
33007	91a	37	26	4	756	94	
33007	91b	24	16	3	302	47	
33007	91c	27	18	2	382	16	
33007	91d	20	21	3	330	28	
33408	97				0		dead
33408	98	17	14	1	187	3	
33408	99	31	27	3	657	10	additional part measured separately in 2010
33408	99b				0		previously part of 99
33408	100	54	30		1272	83	
33408	101	50	53		2081	203	
33408	47	19	19	4	284	14	new? May have previously been recorded as part of 99 Now taged as 47
33411	102	47	43	6	1587	166	
34206	93	37	36	5	1046	18	
34206	94						

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
11605	S1				96	37	0
20205	S2		69	86	96	outside plant	10
20205	S3		74	66	96	105	23
20205	S4		136	56	96	104	4
10206	S5		176	86	97	unnumb	1
10206	S6		62	86	97	69	4
11403	S7		101	27	97	9	3
11403	S8		113	24	97	9	2
11403	S9		108	48	97	8	2
11403	S10		133	44	97	11	0
11403	S11		169	0	97	11	0
11403	S12		169	0	97	11	0
11403	S13		169	0	97	11	0
11403	S14		169	0	97	11	0
11403	S15		169	0	97	11	0
11403	S16		169	0	97	11	0
11403	S17		169	0	97	11	0
11403	S18		169	0	97	11	0
11403	S19		169	0	97	11	0
13006	S20				97	21	0
13006	S21				97	20	0
13006	S22				97	24	0
13006	S23				97	24	0
13006	S24				97	24	0
13006	S25				97	24	0
13006	S26				97	24	1
13006	S27				97	25	1
20205	S28		18	42	97	106	13
20601	S29				97	48	1
23810	S30				97	67	0.5
11403	S31		133	255	98		0
11605	S32				98		
20205	S33		185	10	98		n.r.
11407	S34		166	77	99		
10516	S35		55	73	99		n.r
10516	S36		55	73	99		
23408	S37		55	87	99		
23408	S38		57	70	99		
23408	S39		58	70	99		
23408	S40		60	70	99		
23408	S41		61	69	99		
23408	S42		68	69	99		
23408	S43		70	69	99		
23408	S44		74	77	99		
23408	S45		61	67	99		

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
23408	S46		63	65	99		
23408	S47		62	65	99		
23408	S48		60	63	99		
23408	S49		57	66	99		
23408	S50		57	68	99		
23408	S51		55	75	99		
23408	S52		73	63	99		
23408	S53		73	62	99		
10416	S54		75	23	2000	4	27
10416	S55		66	49	2000	4	2
10416	S56		45	78	2000	4	4
10416	S57		83	85	2000	4	14
10416	S58		83	84	2000	4	13
10416	S59		25	13	2000		36
10416	S60		81	78	2000	4	11
11403	S61		161	95	2000	8	69
11403	S62		55	1	2000	7	1
11605	S63		35	11	2000	30	3.5
11611	S64		17	52	2000	38	1
11611	S65		55	33	2000	38	4
13006	S66		142	36	2000	23	0
13006	S67		156	35	2000	23	0
13006	S68		145	54	2000	23	0
13006	S69		135	21	2000	23	0
13006	S70		137	47	2000	23	0
13006	S71		151	35	2000	23	0
13006	S72		9	50	2000	18	18
20205	S73		8	52	2000	106	0.5
20601	S74		188	60	2000	48	2
20601	S75		173	11	2000	48	7
20601	S76		170	50	2000	48	0.5
20607	S77		109	65	2000	51	0.5
23004	S78		74	78	2000	86	11
23408	S79		52	94	2000	53	8
23408	S80		79	78	2000	53	4
23408	S81		79	78	2000	53	4
23408	S82		71	97	2000	53	9
23408	S83		73	94	2000	53	7
23408	S84		81	78	2000	53	6
23408	S85		77	75	2000	53	2
23408	S86		75	76	2000	53	0
23408	S87		70	65	2000	53	2
23408	S88		69	62	2000	53	5
23408	S89		74	66	2000	53	3
23408	S90		71	67	2000	53	0
23408	S91		70	66	2000	53	0

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
23408	S92		67	65	2000	53	1
23408	S93		60	66	2000	53	1
23408	S94		59	72	2000	53	0
23408	S95		59	72	2000	53	0
23408	S96		57	74	2000	53	1
23408	S97		82	80	2000	53	6
23408	S98		53	42	2000	50	11
23408	S99		46	63	2000	50	13
23408	S100		102	18	2000	54	30
23408	S101		117	33	2000	54	10
23408	S102		129	35	2000	54	13
23408	S103		119	77	2000	54	14
23408	S104		107	93	2000	54	33
23408	S105		198	71	2000	55	1
23408	S106		65	95	2000		
23804	S107		169	70	2000	61	19
23804	S108		85	6	2000	57	0.5
23804	S109		162	53	2000	62	28
23804	S110		58	90	2000	64	3
23804	S111		57	87	2000	64	2
23804	S112		88	89	2000	64	18
23804	S113		119	95	2000	61	25
23804	S114		125	98	2000	61	20
23810	S115		134	33	2000	67	3
23810	S116		137	32	2000	67	1
31813	S117		174	29	2000	96	5
33007	S118		113	21	2000		0
33007	S119		111	9	2000	91	0
33007	S120		115	6	2000	91	0
33007	S121		146	30	2000	91	0
33007	S122		137	16	2000	91	3.5
33408	S123		173	12	2000	100	2
33411	S124		96	6	2000	102	2
33411	S125		96	13	2000	102	2
33411	S126		94	29	2000	102	0
10206	S127		170	93	2001	72	1
10206	S128		69	86	2001	69	1.5
10206	S129		147	97	2001	72	11
10212	S130		200	12	2001	79	2.5
10401	S131		29	13	2001	1	20
10401	S132		58	97	2001		5
10401	S133		58	97	2001		5
10416	S134		62	79	2001	4	2
10416	S135		67	51	2001	4	0.5
11403	S136		57	3	2001	7	1.7
11407	S137		53	56	2001	12	2

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
13006	S138		138	55	2001	23	0.5
13006	S139		161	38	2001	23	0.3
13006	S140		125	55	2001	23	0.4
13006	S141		159	42	2001	23	0.5
13006	S142		159	43	2001	23	0.1
13006	S143		123	57	2001	23	4.5
13006	S144		159	45	2001	23	0.1
13006	S145		118	60	2001	23	10
13006	S146		162	50	2001	23	2
20205	S147		122	75	2001	104	2
20205	S148		68	93	2001		1
20205	S149		68	93	2001		1
20205	S150		68	93	2001		1
20205	S151		66	98	2001		1
20205	S152		66	97	2001		1
20205	S153		66	96	2001		1
23008	S154		83	46	2001	88	8
23408	S155		135	43	2001	54	13
23408	S156		114	60	2001	54	2
23804	S157		33	90	2001		24
23810	S158		167	3	2001	67	4
23810	S159		160	-5	2001	67	7
31813	S160		189	8	2001	96	8
31813	S161		178	11	2001	96	5
31813	S162		167	37	2001	96	2
33408	S163		68	71	2001	97	14
11605	S164		13	87	2003		1
11605	S165		9	87	2003		0.5
11605	S166		30	49	2003	29	8
10212	S167		19	105	2004	83	20
23804	S169		31	139	2004	61	12
23804	S170		35	134	2004	41	14
23804	S171		96	70	2004	57	3
33007	S172		48	170	2004	91	21
33411	S173		26	114	2004	102	40
10416	S174		85	17	2006	4	3
10416	S175		85	17	2006	4	3.5
11403	S176		8	28	2006	6	41
11611	S177		17	31	2006	38	2
13024	S178		124	48	2006	27	24
10206	S179	1	121	80	2007	no tag	3
10206	S180		44	51	2007	56	5
10206	S181		113	?	2007	no tag	1
10206	S182		158	95	2007	no tag	7
10206	S183		50	41	2007	56	1
10206	S184		173	98	2007	no tag	4

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
10206	S185		45	30	2007	74	13
10206	S186		173	97	2007	no tag	1
10206	S187		173	97	2007	no tag	1
10206	S188		173	97	2007	no tag	1
10206	S189		85	38	2007	70	5
10206	S190		182	44	2007	no tag	2
10206	S191		175	44	2007	no tag	1
10206	S192		95	37	2007	70	12
10206	S193		159	40	2007	no tag	6
10206	S194		168	93	2007	no tag	0
10206	S195		170	90	2007	no tag	0
10206	S196		85	21	2007	71	9
10206	S197	1	171	83	2007	no tag	0
10212	S198	2	191	97	2007	80	17
10212	S199	2	181	20	2007	85	1
10212	S200	2	187	96	2007	80	12
10212	S201	2	186	96	2007	80	7
10212	S202	2	182	97	2007	80	5
10212	S203	2	173	20	2007	85	2
10212	S204	2	168	22	2007	85	3
10212	S205	2	159	70	2007	80	12
10212	S206	2	185	64	2007	80	30
10212	S207	2	174	50	2007	78	25
10212	S208	2	163	25	2007	85	9
10401	S209	1	34	90	2007	no tag	4
10401	S210	1	33	86	2007	no tag	5
10401	S211	1	18	51	2007	1	9
10401	S212	1	51	90	2007	no tag	3
10401	S213	1	23	50	2007	1	9
10416	S214	2	76	45	2007	4	3
10416	S215	2	47	43	2007	4	6
11403	S216	1	112	48	2007	8	2
11403	S217	1	104	20	2007	9	7
11403	S218	1	35	67	2007	6	14
11403	S219	1	40	79	2007	6	8
11403	S220	1	104	20	2007	9	4
11403	S221	1	101	17	2007	9	14
11403	S222	1	86	84	2007	6	5
11403	S223	1	109	10	2007	9	3
11403	S224	1	59	42	2007	6	15
11403	S225	1	64	43	2007	6	19
11403	S226	1	190	18	2007	no tag	4
11403	S227	1	115	8	2007	9	5
11403	S228	1	119	9	2007	9	2
11403	S229	1	171	27	2007	no tag	5
11403	S230	1	140	32	2007	9	13

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
11403	S231	1	94	19	2007		
11403	S232	1	94	19	2007		
11403	S233	1	100	31	2007		
11403	S234	1	98	29	2007		
11403	S235	1	100	25	2007		
11403	S236	1	100	25	2007		
11403	S237	1	97	19	2007		
11403	S238	1	97	25	2007		
11407	S239	2	139	51	2007	16	2
11605	S240	1	14	16	2007	33?	1
11605	S241	1	14	16	2007	33?	1
11605	S242	1	14	16	2007	33?	1
11605	S243	1	14	16	2007	33?	2
11605	S244	1	185	23	2007	34	3
11605	S245	1	185	23	2007	34	3
11605	S246	1	185	23	2007	34	3
11605	S247	1	185	23	2007	34	3
11605	S248	1	178	5	2007	34	2
11605	S249	1	183	5	2007	34	7
11605	S250	1	178	5	2007	34	2
11605	S251	1	178	5	2007	34	2
11605	S252	1	178	5	2007	34	2
11605	S253	1	178	5	2007	34	2
11605	S254	1	178	5	2007	34	2
11605	S255	1	178	5	2007	34	2
11605	S256	1	189	3	2007	34	15
11605	S257	1	9	16	2007	35	3
11605	S258	1	10	14	2007	35	2
11605	S259	1	15	16	2007	35	5
11605	S260	1	24	10	2007	30	3
11605	S261	1	151	3	2007	34	4
11605	S262	1	24	14	2007	no tag	4
11605	S263	1	17	8	2007	35	3
11605	S264	1	69	62	2007	no tag	4
11605	S265	1	12	85	2007	28	7
11605	S266	1	186	7	2007	34	
11605	S267	1	194	5	2007	34	
11611	S268	2	22	65	2007	38	0
13006	S269	1	77	44	2007	21	15
20205	S270	1	175	5	2007	107	14
20205	S271	1	21	65	2007	114	1
20205	S272	1	22	43	2007	114	15
20205	S273	1	23	42	2007	114	16
20205	S274	1	140	75	2007	104	1
20205	S275	1	69	86	2007	111	12
20205	S276	1	81	90	2007	no tag	2

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
23004	S277	1	103	32	2007	86	5
23004	S278	1	106	31	2007	86	8
23004	S279	1	78	53	2007	86	3
23004	S280	1	112	82	2007	86	3
23004	S281	1	119	68	2007	86	3
23004	S282	1	118	67	2007	86	2
23008	S283	2	76	13	2007	88	11
23008	S284	2	76	10	2007	88	12
23008	S285	2	82	12	2007	88	3
23008	S286	2	72	17	2007	88	12
23408	S287	2	39	90	2007	53	5
23408	S288	2	186	90	2007	55	9
23408	S289	2	87	42	2007	53	2
23408	S290	2	43	86	2007	53	1
23408	S291	2	45	99	2007	53	4
23408	S292	2	47	97	2007	53	3
23408	S293	2	74	55	2007	53	13
23408	S294	2	66	62	2007	53	4
23408	S295	2	68	45	2007	53	17
23804	S296	1	187	20	2007	62	6
23804	S297	1	186	20	2007	62	5
23804	S298	1	133	90	2007	61	4
23804	S299	1	177	39	2007	62	1
23804	S300	1	174	24	2007	62	5
30408	S301	1	194	22	2007	109	1
30408	S302	1	195	23	2007	109	2
31813	S303	2	196	8	2007	96	8
31813	S304	2	196	3	2007	96	12
31813	S305	2	163	22	2007	96	10
31813	S306	2	163	20	2007	96	15
31813	S307	2	159	23	2007	96	6
31813	S308	2	159	23	2007	96	6
31813	S309	2	159	21	2007	96	10
31813	S310	2	160	20	2007	96	12
33007	S311	1	41	29	2007	90	4
33007	S312	1	42	30	2007	90	5
33007	S313	1	46	29	2007	90	2
33007	S314	1	46	27	2007	90	4
33007	S315	1	47	26	2007	90	5
33007	S316	1	47	28	2007	90	2
33007	S317	1	48	27	2007	90	4
33007	S318	1	54	34	2007	90	1
33007	S319	1	39	32	2007	90	12
33007	S320	1	46	72	2007	89	4
33007	S321	1	60	38	2007	90	8
33007	S322	1	67	65	2007	89	7

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
33007	S323	1	71	65	2007	89	10
33007	S324	1	158	29	2007	91	1
33007	S325	1	32	54	2007	90	2
33007	S326	1	64	30	2007	89	2
33007	S327	1	65	84	2007	89	8
33007	S328	1	65	84	2007	89	8
33007	S329	1	54	56	2007	89	1
33007	S330	1	185	82	2007	no tag	20
33007	S331	1	49	26	2007	90	5
33007	S332	1	71	80	2007	89	6
10206	S333	1	175	66	2008	75	0
10206	S334	1	75	45	2008	70	10
11403	S335	1	99	27	2008	9	4
11407	S336	2	86	33	2008	14	10
13006	S337	1	7	18	2008	18	3
23004	S338	1	102	82	2008	86	1
23004	S339	1	75	82	2008	86	3
23004	S340	1	76	70	2008	86	2
23004	S341	1	81	80	2008	86	5
23004	S342	1	86	62	2008	86	5
23408	S343	2	70	71	2008	53	3
33007	S344	1	41	52	2008	90	2
13006	S345	1	44	10	2009	18	11
13006	S346	1	70	18	2009	21	6
13006	S347	1	77	77	2009	22	9
13006	S348	1	82	72	2009	22	2
13006	S349	1	81	79	2009	22	6
10206	S350	1			2010	71	3
10206	S351	1	110	60	2010	no tag	3
10212	S352	2			2010	85	3
10212	S353	2			2010	78	10
10212	S354	2			2010	80	26
10212	S355	2			2010	80	15
10212	S356	2			2010	78	9
10401	S357	1			2010		12
10401	S358	1			2010		13
10401	S359	1			2010		13
10401	S360	1			2010	1	10
10401	S361	1			2010	1	0
10416	S362	2			2010	4	12
10416	S363	2			2010	4	14
10416	S364	2			2010	4	45
10416	S365	2			2010	4	5
10416	S366	2			2010	4	44
10416	S367	2			2010	4	40

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
11407	S368	2			2010	12	7
11605	S369	1			2010	untagged pl at 110/75	0
11605	S370	1			2010	untagged pl at 110/75	12
13006	S371	1			2010	20	12
13006	S372	1			2010	20	14
13006	S373	1			2010	23	3
13024	S374	2			2010	26	8
13024	S375	2			2010	26	4
13024	S376	2			2010	26	6
13024	S377	2			2010	26	2
13024	S378	2			2010	26	1
13024	S379	2			2010	26	4
13024	S380	2			2010	26	6
13024	S381	2			2010	26	3
20205	S382	1			2010	107	31
20205	S383	1			2010	105	19
20205	S384	1			2010	105	4
20601	S385	1			2010	45	2
20607	S386	2			2010		26
20607	S387	2			2010	51	20
23004	S388	1			2010	86	2
23408	S389	2			2010		8
23408	S390	2			2010	54	32
23408	S391	2			2010	54	34
23408	S392	2			2010	54	34
23408	S393	2			2010	54	1
23408	S394	2			2010	54	39
23408	S395	2			2010	50	13
23408	S396	2			2010	54	10
23804	S397	1			2010	57	0
23804	S398	1			2010	57	1
23804	S399	1			2010	57	1
23804	S400	1			2010	57	2
23804	S401	1			2010	57	5
23804	S402	1			2010	60	7
30408	S403	1			2010	93	3
30408	S404	1			2010	109	4
30408	S405	1			2010	109	4
30408	S406	1			2010	109	4
33007	S407	1			2010	89	22
33007	S408	1			2010	89	3
33408	S409	1			2010	98	24
33408	S410	1			2010	99	0
33408	S411	1			2010	101	12

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
33411	S412	2			2010	102	2
33411	S413	2			2010	102	2
33411	S414	2			2010	102	2
33411	S415	2			2010	102	2
34206	S416	1			2010	93	3
10206	S417	1			2011	75	1
10206	S418	1			2011	75	2
10206	S419	1			2011	73	66
10212	S420	2			2011	83	11
10212	S421	2			2011	85	2
10212	S422	2			2011	80	8
10212	S423	2			2011	78	14
10401	S424	1			2011	1	10
10401	S425	1			2011	3	40
10401	S426	1			2011	1	79
10416	S427	2			2011	4	8
11403	S428	1			2011	8	49
11403	S429	1			2011	7	49
11403	S430	1			2011	7	54
11403	S431	1			2011	7	79
11403	S432	1			2011	7	71
11403	S433	1			2011	7	53
11403	S434	1			2011	8	40
11403	S435	1			2011	8	38
11403	S436	1			2011	8	1
11403	S437	1			2011	8	1
11403	S438	1			2011	8	6
11407	S439	2			2011	14	3
11605	S440	1			2011	33	3
11605	S441	1			2011	33	4
11611	S442	2			2011	39	4
13006	S443	1			2011	23	8
13006	S444	1			2011	23	5
13006	S445	1			2011	23	2
13006	S446	1			2011	23	1
13006	S447	1			2011	23	0
13006	S448	1			2011	23	2
13006	S449	1			2011	21	0
13006	S450	1			2011	22	7
13006	S451	1			2011	22	6
13006	S452	1			2011	23	9
13006	S453	1			2011	22	13
13006	S454	1			2011	24	9
13006	S455	1			2011	23	3
13006	S456	1			2011	25	6
13006	S457	1			2011	23	6

Eriogonum codium compiled seedling data (November 2011)

plot #	Plant No.	1=Top; 2=Slope	x-axis	y-axis		seedlings only	
					Cohort	Near Adult (#)	Near Adt (cm)
13006	S458	1			2011	25	26
13006	S459	1			2011	25	31
13006	S460	1			2011	22	13
13006	S461	1			2011	22	0
13024	S462	2			2011	26	2
13024	S463	2			2011	194	14
20205	S464	1			2011	103	44
20205	S465	1			2011	111	13
33007	S466	1			2011	89	4
33007	S467	1			2011	89	3
33007	S468	1			2011	91	30
33007	S469	1			2011	89	22
33007	S470	1			2011	89	26
33007	S471	1			2011	89	26
33007	S472	1			2011	91A	57
33007	S473	1			2011	91A	29
33007	S474	1			2011	90	1
33007	S475	1			2011	90	7
33007	S476	1			2011	90	11
33007	S477	1			2011	90	10
33007	S478	1			2011	90	2
33007	S479	1			2011	90	7
33007	S480	1			2011	89	1
33007	S481	1			2011	89	2
33007	S482	1			2011	89	2
33007	S483	1			2011	90	2
33007	S484	1			2011	89	4
33007	S485	1			2011	89	4
33007	S486	1			2011	89	2
33007	S487	1			2011	89	4
33007	S488	1			2011	89	4
33007	S489	1			2011	89	4
33007	S490	1			2011	89	2
33007	S491	1			2011	91	10
33007	S492	1			2011	91	5
33007	S493	1			2011	91	21
33007	S494	1			2011	91	22
33007	S495	1			2011	91	40

Appendix B

Newsome update on the current status
of
Physaria douglasii ssp. *tuplashensis*

Update of the Current status of *Physaria douglasii ssp. tuplashensis* on the Hanford Reach National Monument (2011)

Prepared by Heidi Newsome, June 2, 2011

The White Bluffs bladderpod *Physaria douglasii ssp. tuplashensis*is a Candidate species for federal listing under the Endangered Species Act and is considered Threatened in Washington (Washington Natural Heritage Program 2007). Studies of this species began in 1997 on the only known population of *P. tuplashensis*, a species that is endemic to the Hanford Reach National Monument. Studies were conducted primarily by The Nature Conservancy of Washington (TNC) and later continued in cooperation with the Washington Department of Natural Resources Natural Heritage Program (WNHP). The species occurs as a single population in a narrow 17 km long band along the top of the White Bluffs of the Columbia River. The species is a short-lived perennial most closely related to *P. douglasii*, which grows on cobble bars on the Columbia River and is relatively common in sagebrush-steppe from southern British Columbia to northern Oregon and east into Idaho.

The studies of this species had three components: a taxonomic evaluation based on plant morphology and garden studies (Caplow et al. 2007), life history plots placed non-randomly throughout the population, and counts of reproductive individuals in 100 meter transects placed randomly throughout the northern half of the population. The population monitoring transects were sampled annually from 1997-99, in 2002, and were revisited and counted again in 2007. Following the monitoring in 2007, a large wildfire known as the “Overlook fire” burned through the northern portion of the *Physaria* population, and within the area of the established population monitoring transects. Therefore, the population monitoring was conducted again in 2008 – 2011 to assess whether or not the fire had an effect on the *Physaria* population. Data included here are summarized with the previous results of the transect portion of the monitoring study. Results from the life history plots from 1997 to 1999 were presented at the 2000 Washington Rare Plant Conference in Seattle, and a manuscript is available from Peter Dunwiddie, botanist, or Joe Arnett of WNHP.

Following the monitoring of 2002, the data were summarized by Caplow in a report issued in 2003 entitled “Studies of Hanford Rare Plants 2002” (Caplow 2003).

Within the 2003 report, a management objective for *P. tuplashensis* was proposed to be: Maintain at least 10,500 reproductive plants of *P. tuplashensis* in the northern 3.7 km of the White Bluffs population from 2003-2013. If the population remains below 10,500 plants for two years or more, initiate further research into the causes of decline and/or initiate management action(s). Monitoring in 2010 estimated the population at 9,949, however this year, 2011, the population rebounded and counts on monitoring transects were the highest ever recorded with a population estimate of 58,887. Therefore, management actions are probably not yet required based on the current assessment of the population over time. The population varies widely from year to year. Due to the plant’s life history of being a short-lived perennial, environmental conditions are important to the expression of the population each season.

The Caplow 2003 report suggests that to adequately assess the population, a full monitoring of the permanent population monitoring transects take place once every three to five years. Monitoring was conducted in 2007 to capture the 5 year interval suggested by the management objective. Monitoring was again conducted from 2008 through 2011 in order to assess the impact from the “Overlook fire.” Map 1 shows the monitoring transects within the population boundary and its association with the perimeter of the “Overlook fire.” Map 2 shows the entire extent of the recorded population of *Physaria* in relationship to the perimeter of the “Overlook fire,” as well as its relationship to neighboring agricultural development.

Methods

The northern 6 km area of the population contains the sampling plots for the following reasons: the northern portion is the most contiguous and least disturbed portion of the population; there are no evident impacts from nearby agricultural activities; and this portion of the population is generally <1 km from a vehicle track. The sampling area totals 3,700 m in length, resulting in a sampling population of 37, 100 meter long transects. In 1997, ten 100-m transects were chosen at random from this portion of the population for sampling, and the endpoints were permanently marked with rebar stakes. An additional ten transects were added in 1998, for a total of 20 randomly selected permanent monitoring transects, selected from the possible 37 transects. All flowering plants were counted along each transect, and tallied according to their location: “Top” plants are those growing on the top of the bluff, “caliche” plants are growing in the intersection with the caliche layer exposed at the top of the bluffs, and “slope” plants are growing below the caliche on the upper slope. Plants were surveyed in mid-May to early June in 1997-1999, 2002, and 2007-2011.

This season’s monitoring took place on May 24, 2011. The current weather for 2011 spring has been notably cooler and wetter than long term averages. The Hanford Meteorological Station (http://www.hanford.gov/page.cfm/HMS) recorded May 2011 as much cooler than normal, averaging 57.2°F, 4.9° below normal (62.1 F). This makes May 2011 the fifth coolest on record. Further, precipitation for May 2011 totaled 1.22 inch, 239% of normal (0.51 inch). This makes May 2011 the seventh wettest on record. This cool, moist spring followed a relatively mild winter and moist fall in 2010. These conditions seemed to delay the peak of flowering with some of the plants still in bud stage. In addition, the conditions seemed to encourage flowering even in very small plants; nearly all the plants were reproductive. This was different from the previous year, 2010, when many non-flowering plants, existing as rosettes, were noted. See photos from this season in Appendix A.

Results

Data from the 10 permanent transects installed in 1997, supplemented with an additional 10 installed in 1998, provide some indication of the magnitude and direction of trends in the overall population from 1997-2011 (Figure 1). Since these transects were randomly selected only within

the northern portion of the site, they may not necessarily represent changes in the overall population. However, they should be representative of changes that occur in over half of the area occupied by *P. tuplashensis*. The population has a large range of variability, but the data strongly suggest that if all 20 transects are sampled the mean will fall within 25% of the estimated true value. There is a definite decrease in confidence intervals between 10 and 20 transects, suggesting that 20 transects should be sampled (Caplow 2003). Figure 2 shows the total number of flowering plants counted during monitoring efforts. Many of the transects in the northern part of the monitoring area had sparser counts of flowering plants compared to transects in the more southern portion of the monitoring area.

The average number of plants per transect over 20 transects counted in 2011 was 1592. This was a big increase in average over the 2010 counts, three years post-fire when the average was only 269 plants per transect. In addition, the number of plants recorded in 2011 was highly variable, resulting in a standard deviation around the mean of 1136. The post-fire data from the period 2008-2011 reflect a highly variable population with a decline from 2008-2010, followed by a large increase in 2011. This season's average of 1592 is higher, more than double, the average of 774 plants per transect recorded in 2007, the spring season prior to the fire.

Multiplying the mean number of plants per transect by the total number of transects in the sampling area(N =37) gives a population estimate for 2011 of 58,887 plants (Figure 3). This is the first season during the post-fire period of 2008-2011 that the population estimate is well above the pre-fire population estimate of 28,618 that was recorded in 2007. The population has ranged from an estimated low of 9,949 plants (2010) to a high of 58,887 plants this season, 2011. This year is the highest year on record for the population since monitoring began in 1997, and immediately follows the year with the lowest population count on record, in 2010.

Both burned and unburned transects were sampled in 2008-2011. Transects within the burned area perimeter for the "Overlook fire" were counted as burned even if the status of that transect was not noted in the field (N=11). Unburned transects were outside of the burned area perimeter (N=9). In 2011, the average number of plants per transect for burned was 1391 while unburned was 1837 (Figure 4). The high level of variability in the data results in no significant difference in the mean between burned and unburned areas, although unburned transects have a slightly higher average number of plants than burned transects.

Figure 1: Mean number of flowering plants per transect

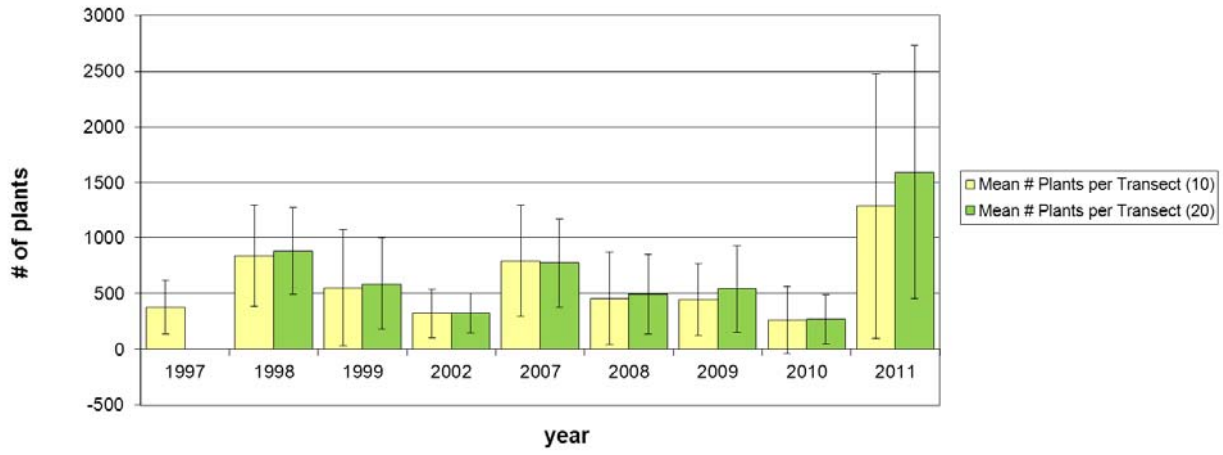

Figure 1: Mean number of flowering *Physaria tuplashensis* plants along permanent monitoring transects. Variability shown as one SD above and below the mean.

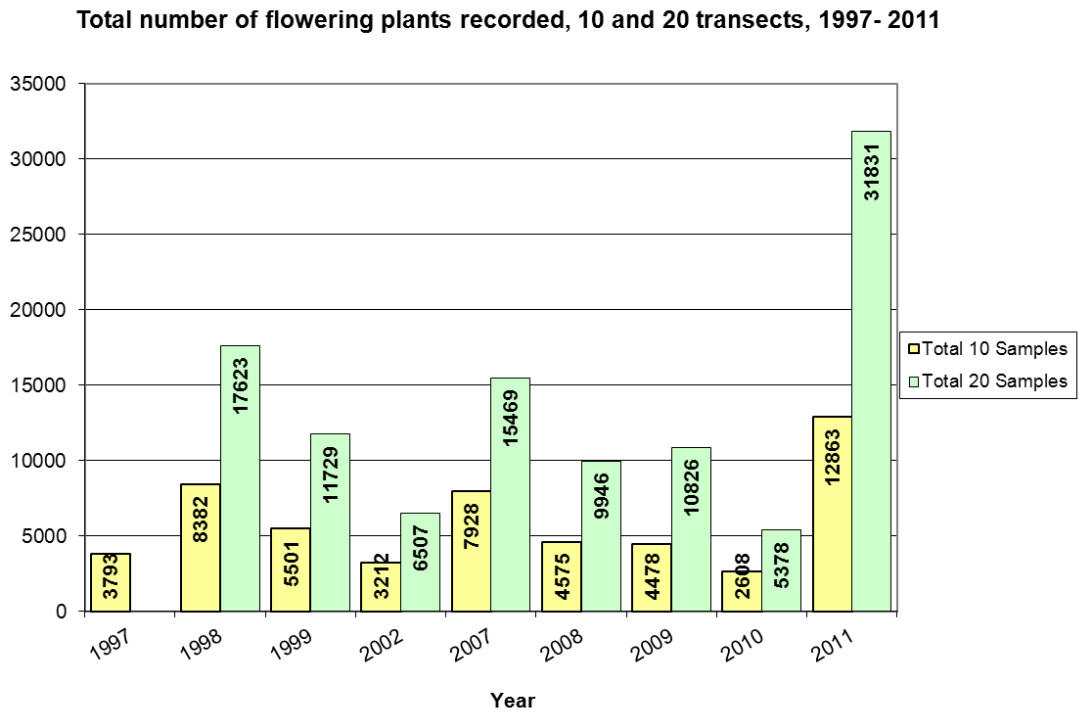

Figure 2: Total number of plants counted along 10 and 20 transects for monitoring of *Physaria tuplashensis*.

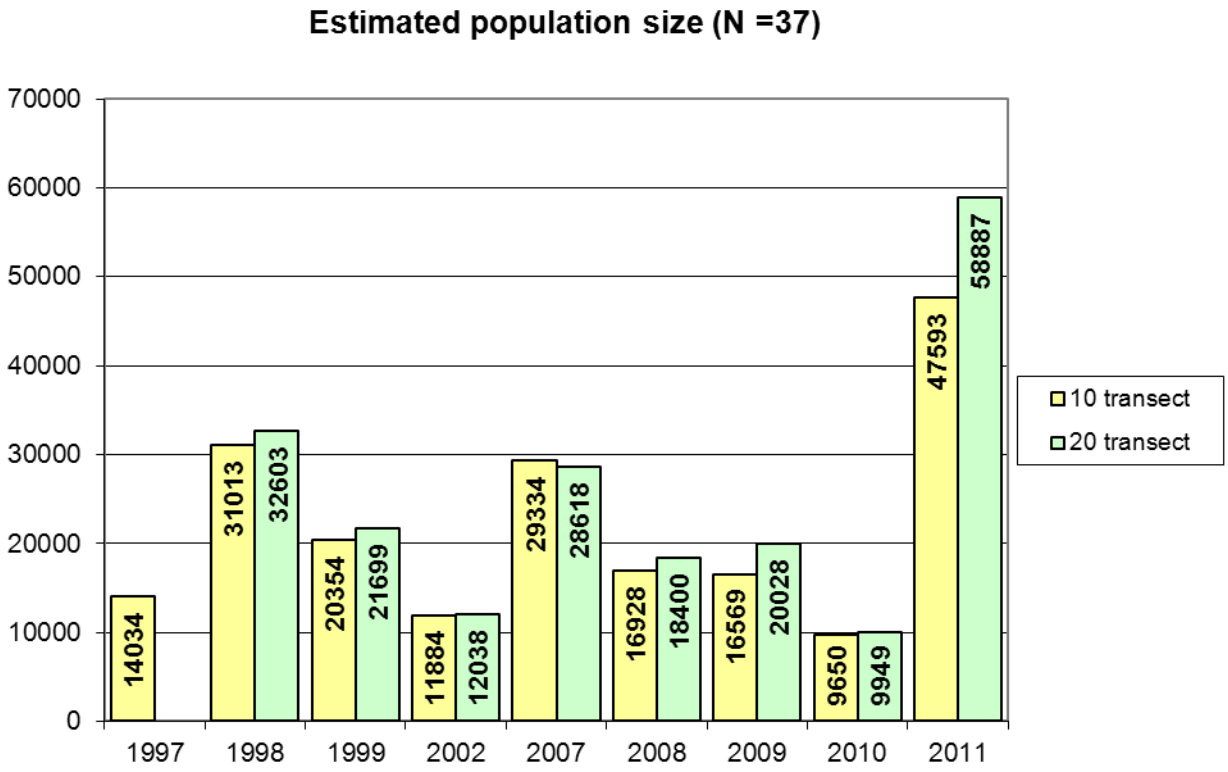

Figure 3: Estimated population size (mean # of plants per transect X total number of transects {N =37}) of *Physaria tuplashensis* along permanent monitoring transects.

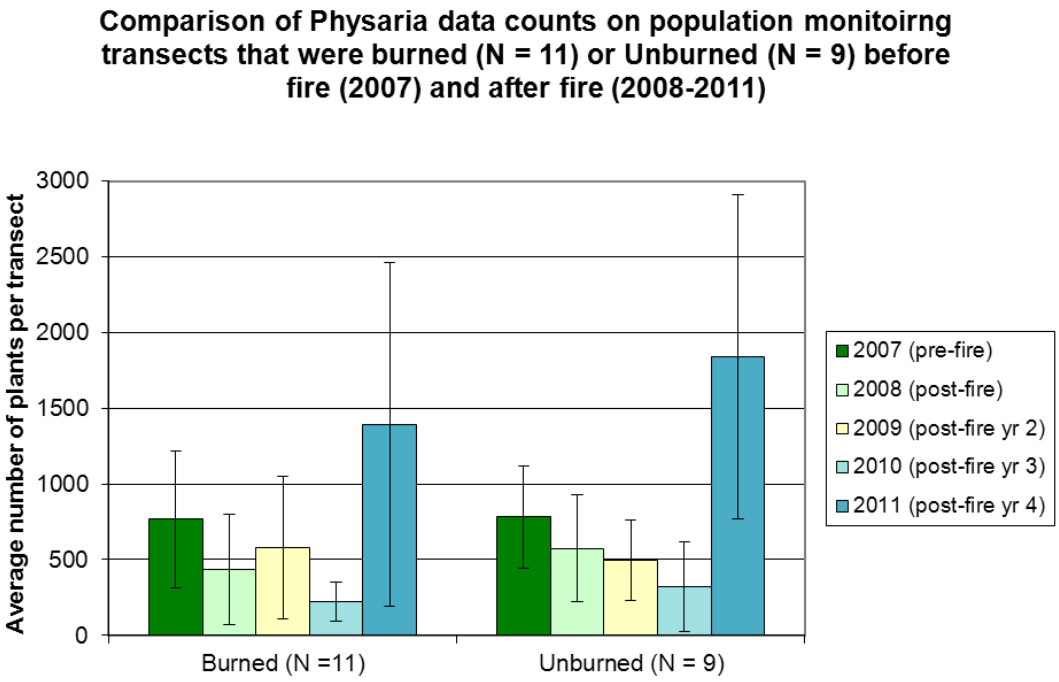

Figure 4: Mean number of flowering *Physaria tuplashensis* plants along permanent monitoring transects, burned transects versus unburned transects, for all transects. Transects within burned area perimeter of the "Overlook fire" assumed burned. Variability shown as one SD above and below the mean.

Conclusions: The 2011 monitoring of *Physaria tuplashensis* revealed that the plant population was increased from population estimates recorded in 2010, the population has now exceeded the previously documented range of variability, with this season being the highest population estimate recorded since monitoring began in 1997. Transects recorded as burned after the Overlook fire seemed to have rebounded, but perhaps not as strongly as the unburned transects. The number of plants on average per transect is now higher than the value recorded in 2007 pre-fire. The unburned transects seemed to have slightly higher counts than the burned transects; however the data have too much variability to discern that difference with any confidence.

Although the area where the bladderpod grows is in conservation status as part of the Hanford Reach National Monument, wildfire and invasion of non-native species continue to be threats to the existing population. Combined with threats due to irrigated agriculture adjacent to the Monument, (see Map 2) the bladderpod's status should continue to be tracked. Future monitoring should take place in 2014, based on this season's high population numbers. Alternatively, monitoring should take place in 2012 to capture 5 years of post-fire information for this species. Because the monitoring can be completed in a single day with relatively low effort, and additional monitoring in 2012 might be advantageous and more informative of trends in this rare species. At the current time, the listing status of this species could be reviewed with this additional information. The population seems stable, although widely fluctuates with environmental conditions. An analysis that would incorporate variables such as precipitation and temperature as covariates could be conducted to possibly determine the relationship between environmental conditions and plant response.

The management action threshold identified by Caplow (2003) suggests that a management objective for the White Bluffs bladderpod could be **"Maintain at least 10,500 reproductive plants of *Lesquerella tuplashensis* in the northern 3.7 km of the White Bluffs population from 2003-2013. If the population remains below 10,500 plants for two years or more, initiate further research into the causes of decline and/or initiate**

management action(s).” Because the 2011 season has shown that the population has rebounded well above the 10,500 level for management action, no further action is required at this time.

Acknowledgements:
Thank you to J. Abel, K. Abel and L. Hill who volunteered to help collect the data during the 2011 season. Thank you to Carrie Cordova, U.S. Fish and Wildlife Service Ecological Services, and to Wendy Gibble of University of Washington Rare Care for assisting in the monitoring. Thank you to Joseph Arnett of Washington Department of Natural Resources, Natural Heritage Program, for assisting with monitoring and for reviewing this report.

Assistant refuge manager Jack Beaujon and wildlife biologist Kevin Goldie assisted with monitoring in 2011.

References

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Appendix A:

Photos of monitoring in 2011.

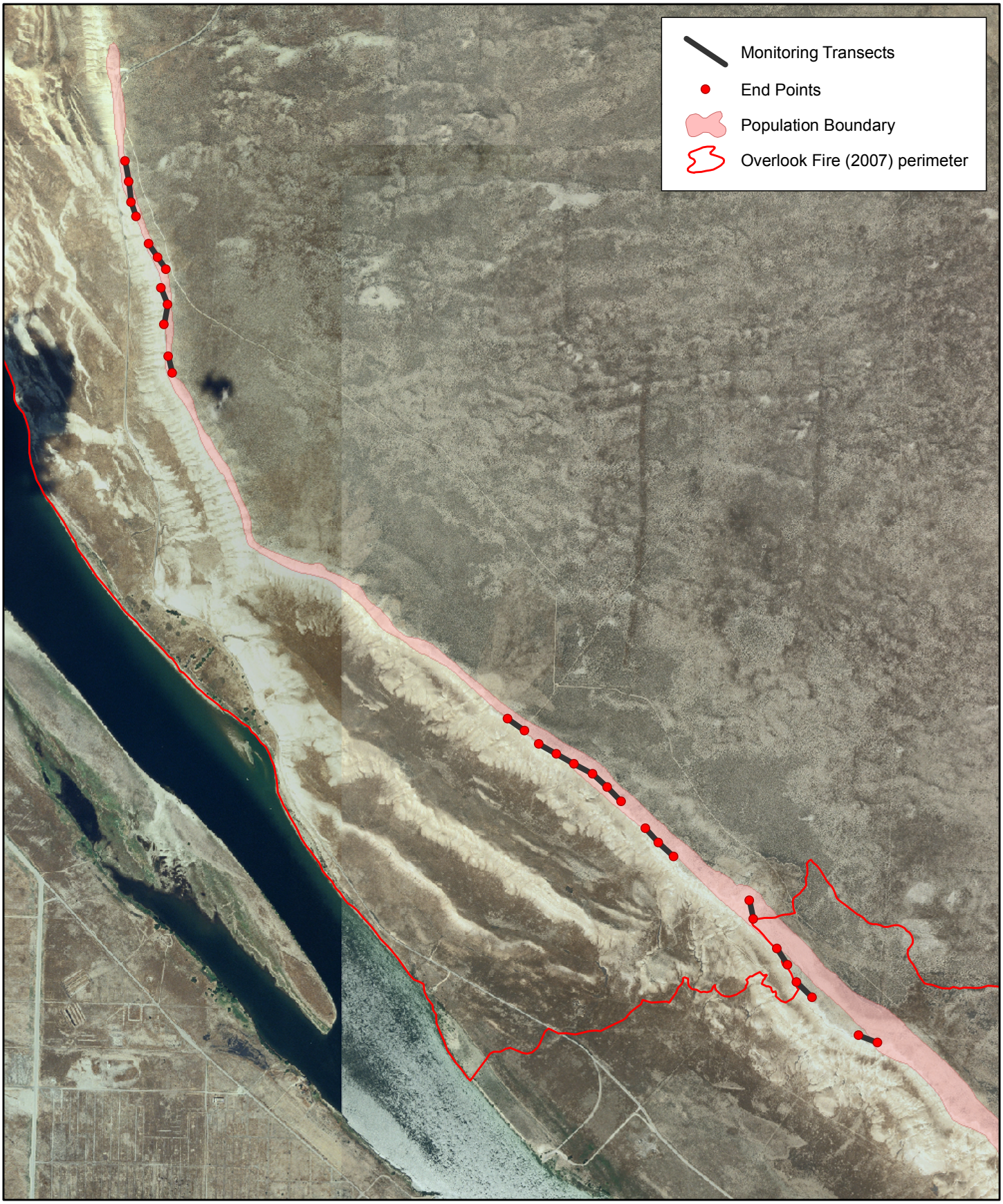
White-Bluffs Bladder-pod and Purple Sage (*Salvia dorii*)

Wendy Gibble, University of Washington Rare Care, conducting monitoring counts.

Skipper butterfly, potential pollinator of White-bluffs bladder-pod.

Joseph Arnett, Washington Department of Natural Resources, Natural Heritage Program conducting monitoring.

Volunteers Keith Abel and Lisa Hill conducting monitoring.

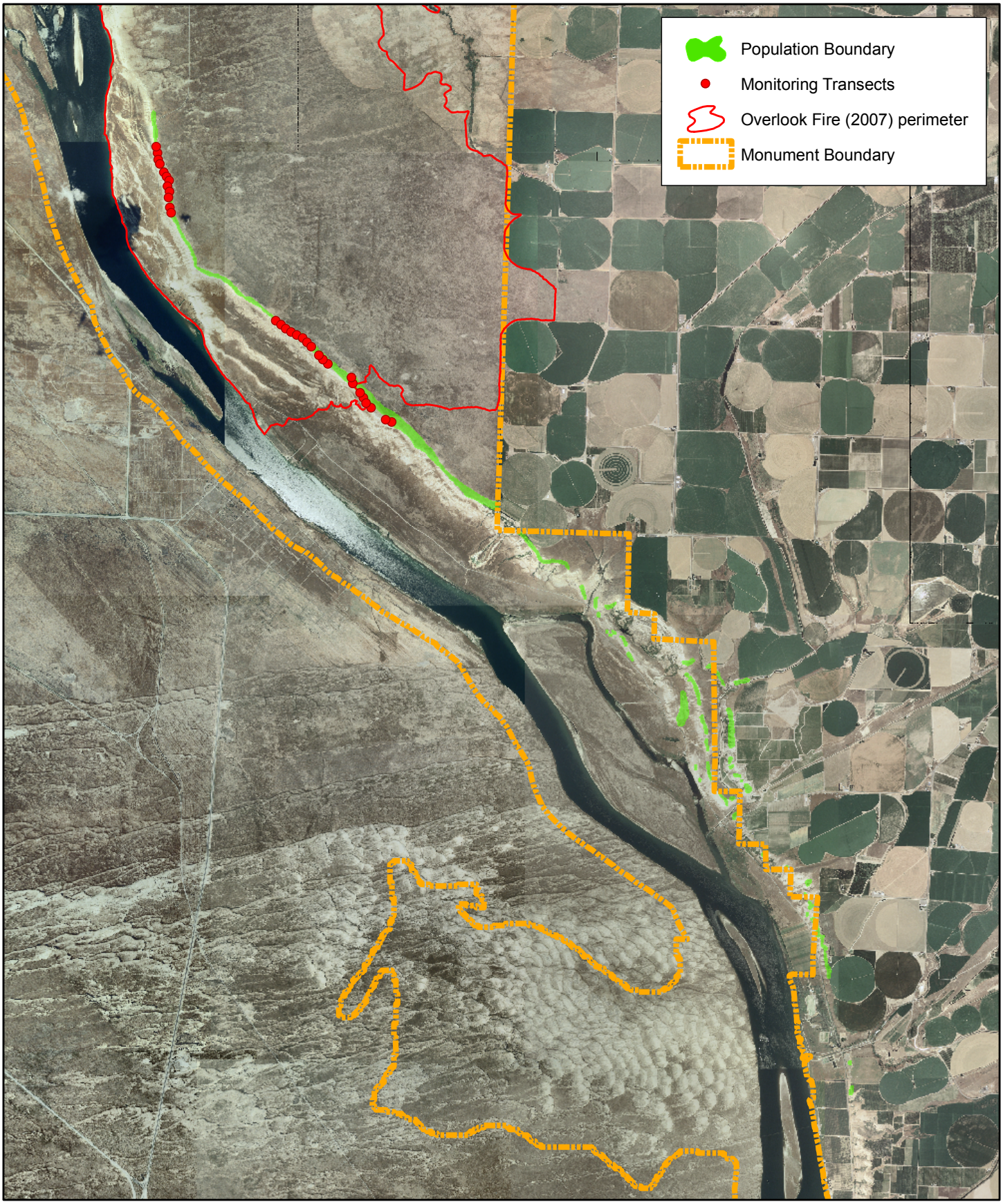


White Bluffs Bladderpod
Population Monitoring Transects

N

0 1,000 Meters

Map Name: WBBP_MonitoringTransects.mxd
Map Date: 26-Jun-2008



White Bluffs Bladderpod
Population Boundaries

N

0 4,000 Meters

Map Name: WBBP_PopulationBoundaries.mxd
Map Date: 26-Jun-2008