

Invasive Weed Assessment of Nevada State Parks in the East Lake Tahoe Basin

Final Report

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Introduction to Project:

This weed assessment project was initiated by volunteers and staff of The Great Basin Institute in June 2011 to assist the Lake Tahoe Nevada State Park and Van Sickle CA/NV Bi-State Park in locating and identifying populations of priority invasive plant species of the Tahoe Basin. The assessment of exotic plant species in these high use areas is critical in the effort to develop a strategic plan for monitoring and maintenance of priority invasives, and ecosystem health in the Tahoe Basin.

Description of Project Activities:

On-the-ground assessment of invasive plant species began on the week of July 6, 2011. At this time plant identification crews from the Great Basin Institute (GBI) began mapping and documenting populations of invasive plant species at Lake Tahoe Nevada State Park and Van Sickle Bi-State Park. Crews focused their surveys on trails, roads, waterways, and other high use areas. Due to the amount of snow in the Tahoe basin, mapping crews began working in areas of low elevation and worked their way up to higher elevation trails later in the season.

By the week of August 4, mapping crews had surveyed all of the accessible trails and roads in the two parks in search of invasive plant species. At this time, large portions of the Tahoe Rim Trail that crossed State Park Lands were still under snow. To allow the snow to finish melting and to give existing weed seeds a chance to germinate, crews were removed from the field for approximately three weeks and returned on September 12, 2011 to finish mapping the Tahoe Rim Trail. Mapping on the Tahoe Rim Trail took less time than expected, so crews were able to perform a second assessment for late-emerging invasives on all of the lower elevation roads and trails from Tunnel Creek Road up to Hobart Reservoir North Canyon Road and Marlette Lake.

Data and Results

Mapping data were collected using the Lake Tahoe Basin Weed Coordinating Group Mapping Protocol (Appendix A). GBI mapping crews identified seven invasive species in this assessment (Table 1). The descriptive mapping metadata (Appendix B) identifies the location of each infestation in UTM/UPS, the species in each infestation, the size of each infestation, and the plant phenology at the time of observation. All mapping metadata have been entered into a GIS map database and separated into different maps to show variations in plant composition and phenology in areas that were assessed for invasive plants between the dates of July 6-August 4 and September 12 -22, 2011. The GIS map database, created with ArcGIS, accompanies this report on a separate disk. Photo documentation of mapping activities can be found in Appendix C.

Table 1. Invasive plant species found by GBI crews, including codes, scientific names, and common names.

Plant Code	Scientific Name	Common Name
CADR	<i>Cardaria draba</i>	Hoary Cress
CIAR4	<i>Cirsium arvense</i>	Canada thistle
CIVU	<i>Cirsium vulgare</i>	Bull thistle
LELA	<i>Lepidium latifolium</i>	Tall Whitetop
LEVU	<i>Chrysanthemum leucanthemum</i>	Oxeye daisy
PORE5	<i>Potentilla recta</i>	Sulfur cinquefoil

GIS spatial maps of the invasive plant infestations and their general locations can be seen below. Figure 1 shows the general locations of invasives mapped within the Lake Tahoe Nevada State Park between the dates of July 6 and August 4, 2011, and September 12, and September 22, 2011. In this map it can be seen that within the Lake Tahoe Nevada State Park most invasives are concentrated around Marlette Lake. In Figure 1 it can also be seen that there were also many populations of Sulfur cinquefoil and a few populations of Hoary cress spotted in the back country as well. In Figure 2 an enlarged map of the infestations around Marlette Lake can be seen.

Figure 3 shows the locations of invasive plant populations that were identified within the Van Sickle Bi-State Park in both Nevada and California. Populations of invasives within the Van Sickle Bi-State Park were limited to approximately 25 waypoints, most of which were Bull thistle. A few small infestations of Sulfur cinquefoil were spotted in this park during the September mapping session.

Figure 1. Populations of invasive plants mapped in Lake Tahoe Nevada State Park between July 6 - August 4, 2011, and September 12 - September 22, 2011.

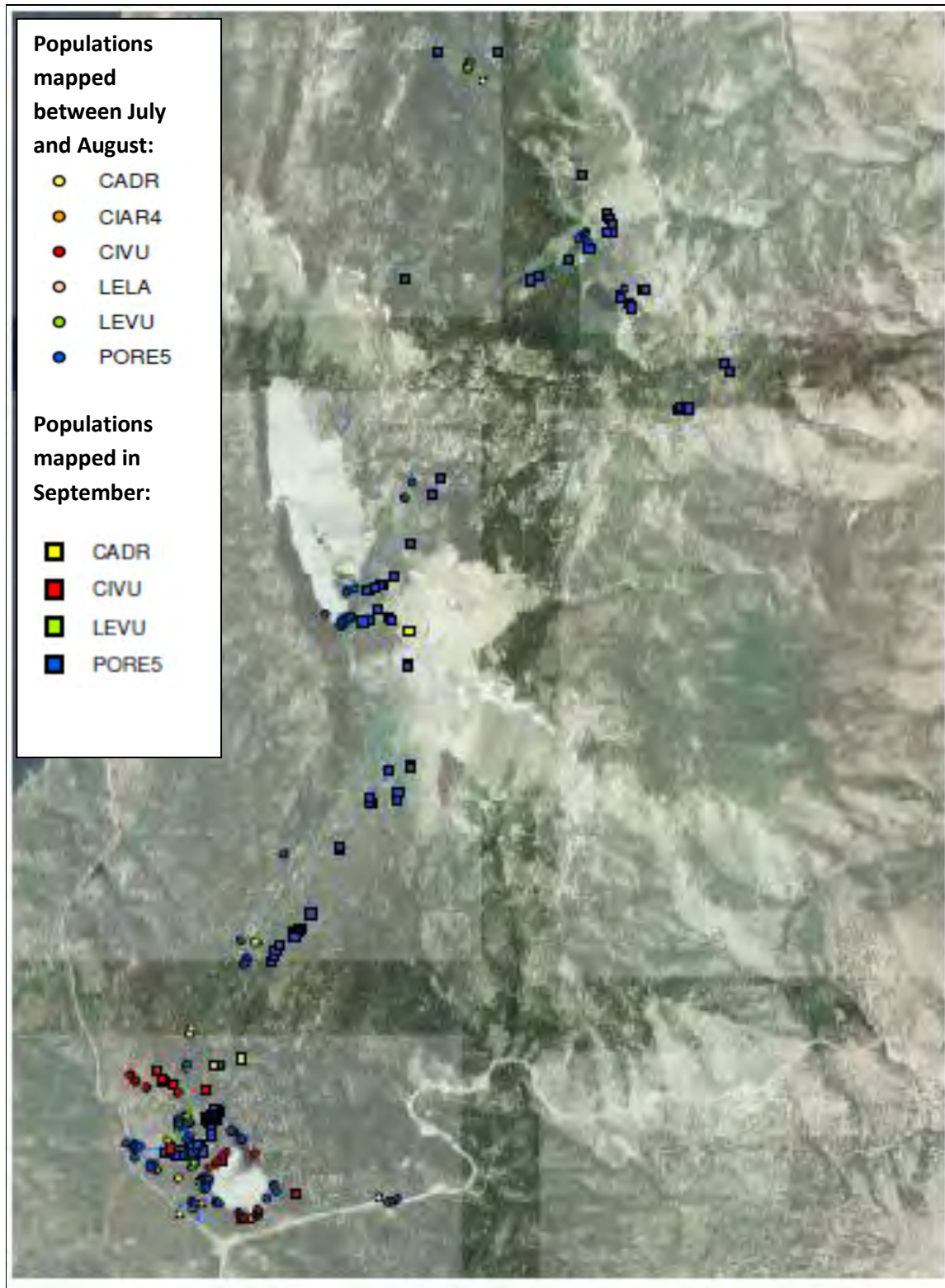


Figure 2. Enlarged map of Marlette Lake and populations of invasive plants mapped between July 6 and August 4, 2011 and September 12 and September 22, 2011.

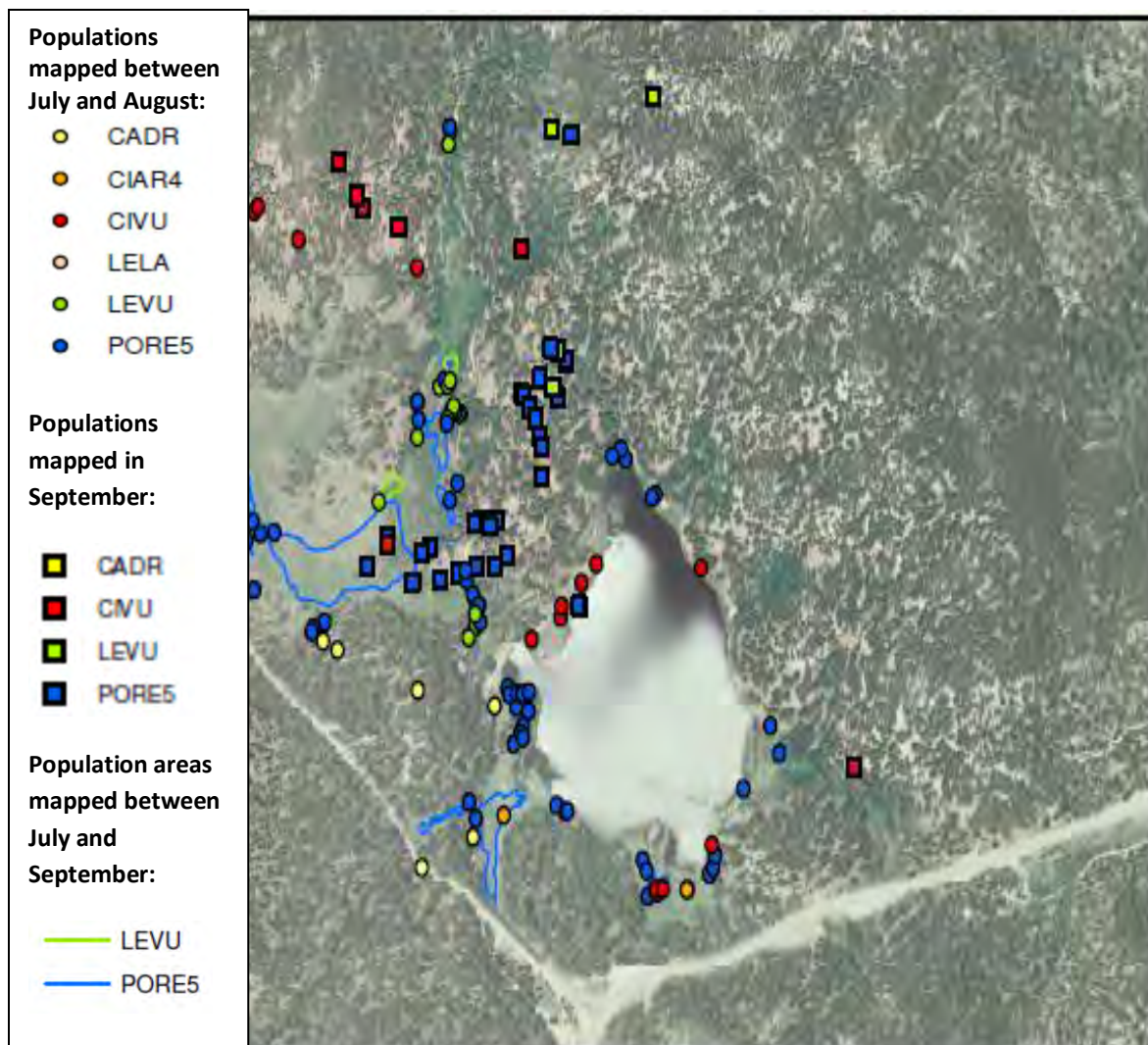
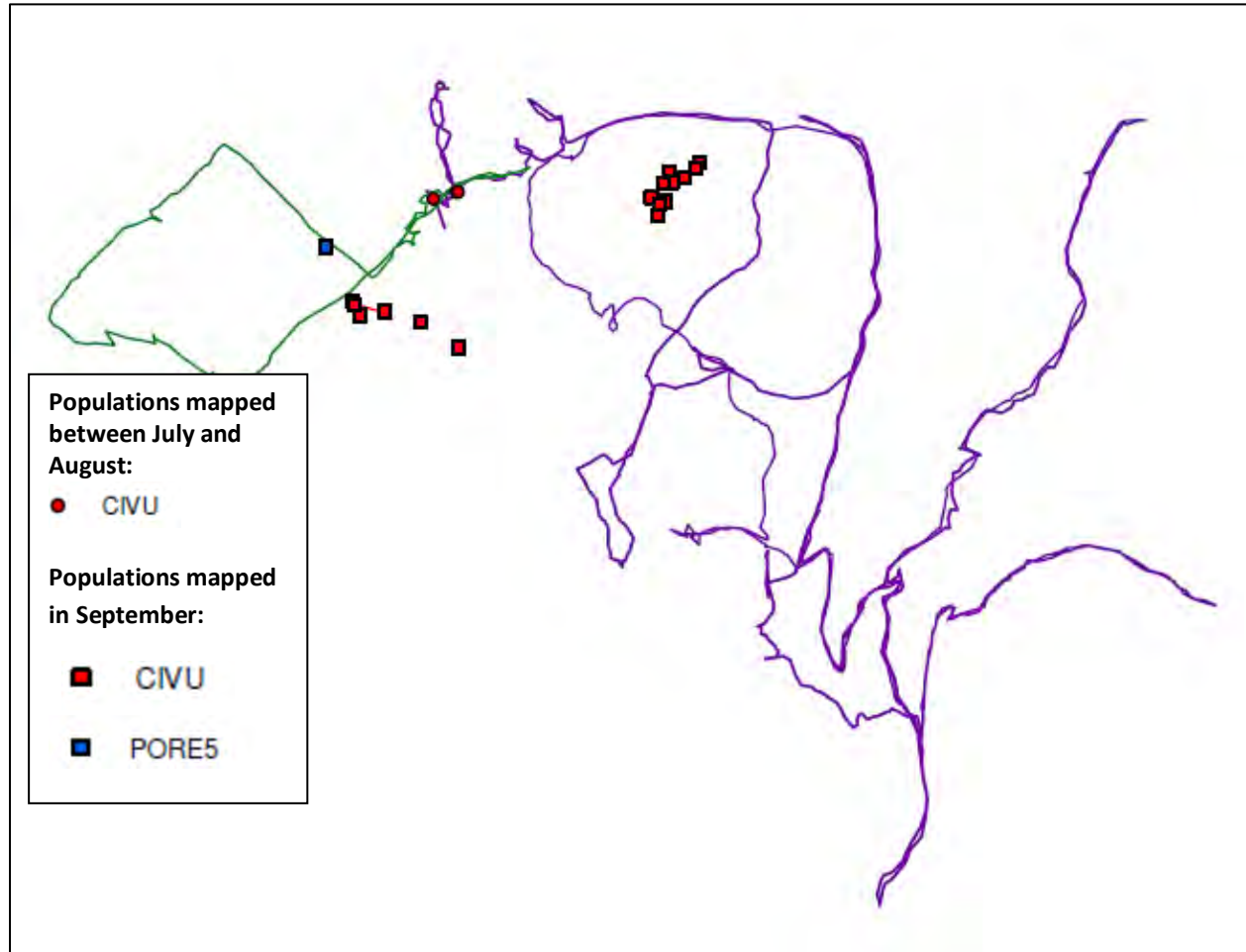


Figure 3. Populations of invasive plants mapped within the Van Sickle Bi-State Park in both California and Nevada between July 6 and August 4, 2011 and September 12 and September 22, 2011. The GIS geographic map was unavailable, so trails and roads (green and purple lines, respectively) within the park were provided for spatial representation of infestations.



In order to more effectively quantify the mapping data that were collected during the 2011 field season, mapping data were used to generate graphs assessing the percent composition of mapped invasive plant infestations (Figures 4 and 5) and the total number of invasive plants that were found (Figures 6 and 7) during the July 6-August 4, 2011 and September 12-22, 2011 mapping periods. In Between July 6 and August 4 over 97% of the infestations consisted of Sulfur cinquefoil (PORE5), Bull thistle (CIVU), Oxeye daisy (LEVU), and Hoary Cress (CADR) (Figure 4), whereas during the September mapping period (Figure 5) PORE5 and CIVU were the most common infestations found.

Sulfur cinquefoil (PORE5) was the most numerous invasive species found during both mapping periods (Figures 6 and 7). Furthermore, PORE5 became more numerous during the September mapping period, suggesting that it took longer to germinate and grow than the other invasives growing within the Tahoe Basin. As expected, most of the other invasives identified in this study had decreased in number during the September mapping period when compared to the July/August mapping period.

Figure 4. Composition (%) of plant species infestations mapped between July 6 and August 4, 2011 in Lake Tahoe-Nevada State Park and Van Sickle CA/NV Bi-State Park. See Table 1 for names corresponding with plant codes.

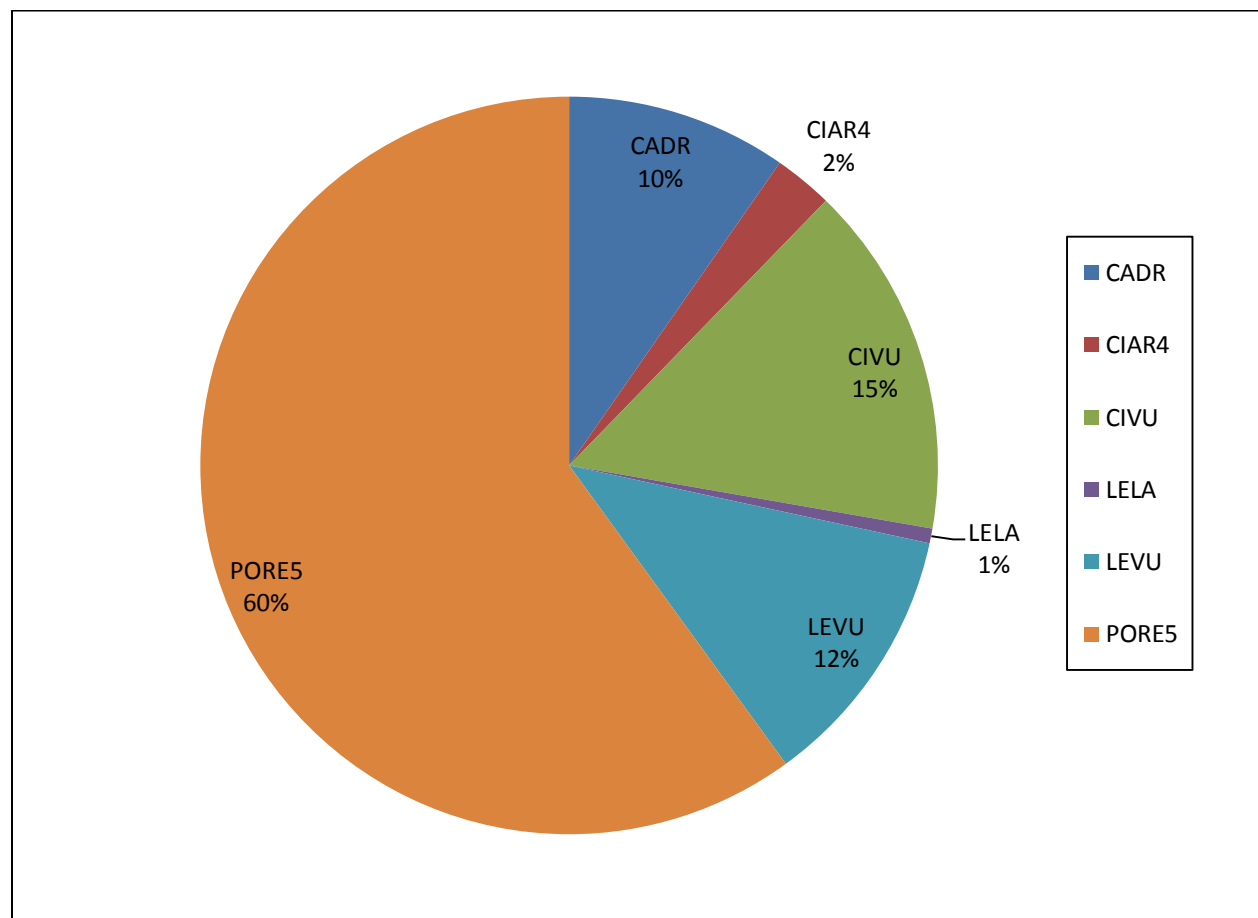


Figure 5. Composition (%) of plant species infestations mapped during September 12-22, 2011 in Lake Tahoe-Nevada State Park and Van Sickle CA/NV Bi-State Park. See Table 1 for names corresponding with plant codes.

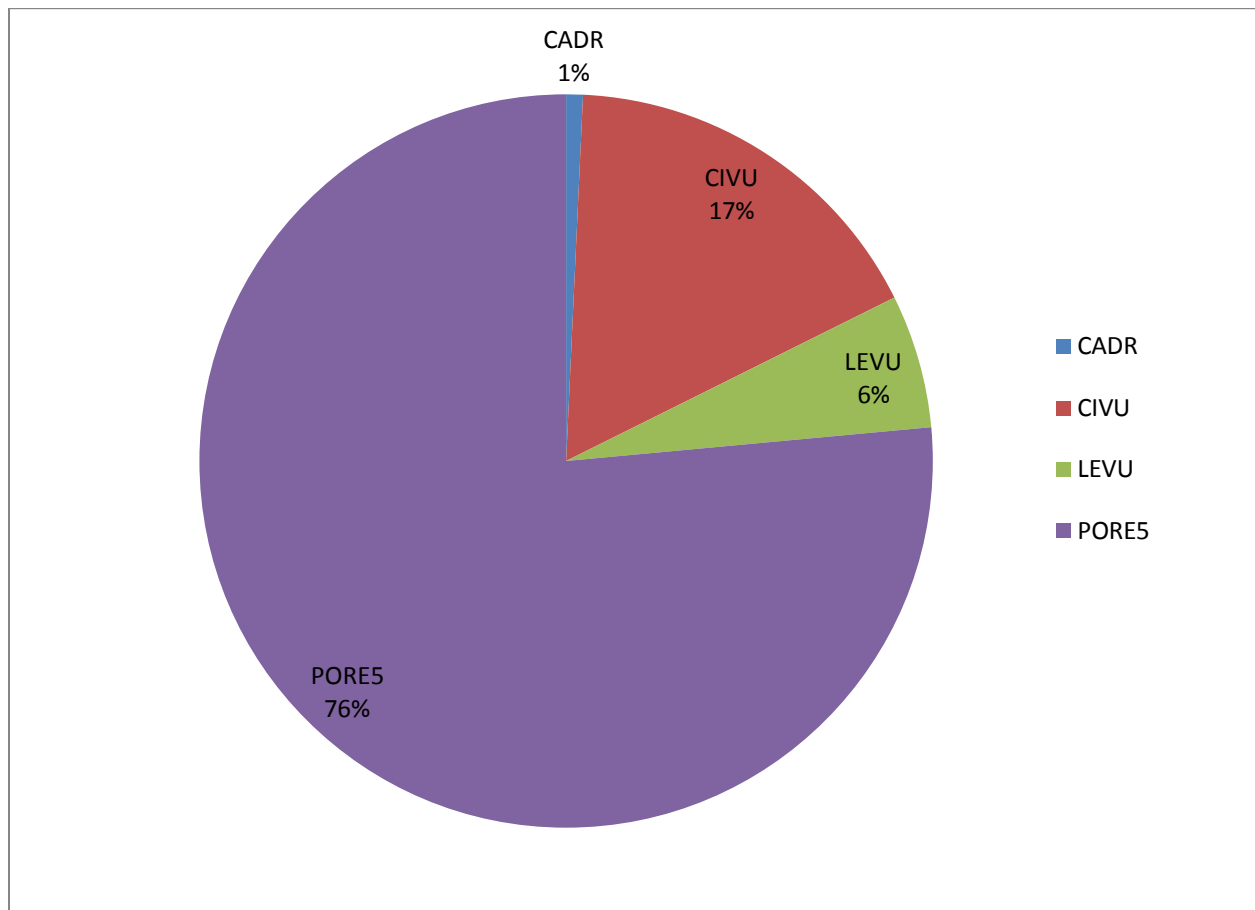


Figure 6. Estimated number of invasive plants found during assessments between July 6 and August 4, 2011 in Lake Tahoe-Nevada State Park and Van Sickle CA/NV Bi-State Park. See Table 1 for names corresponding with plant codes.

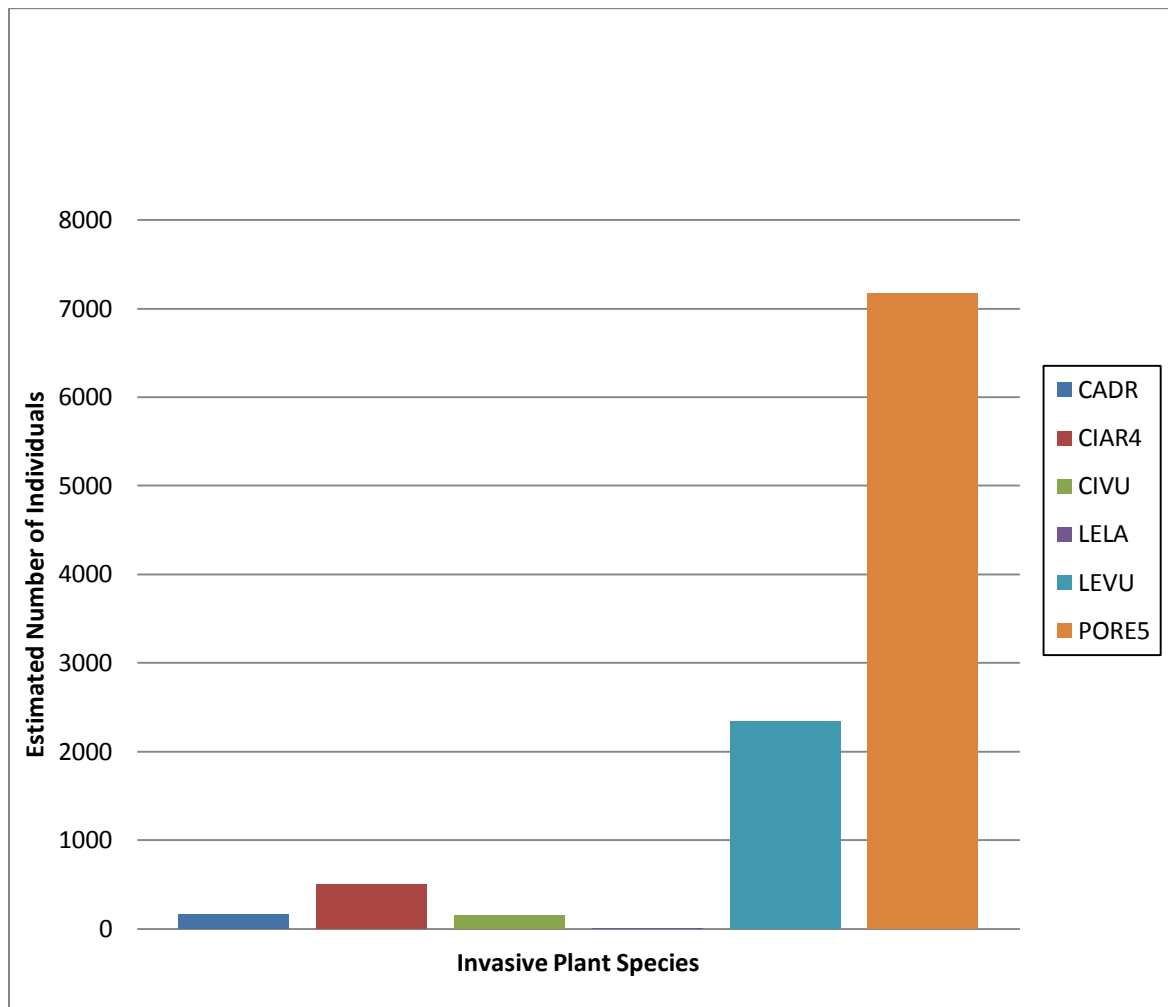
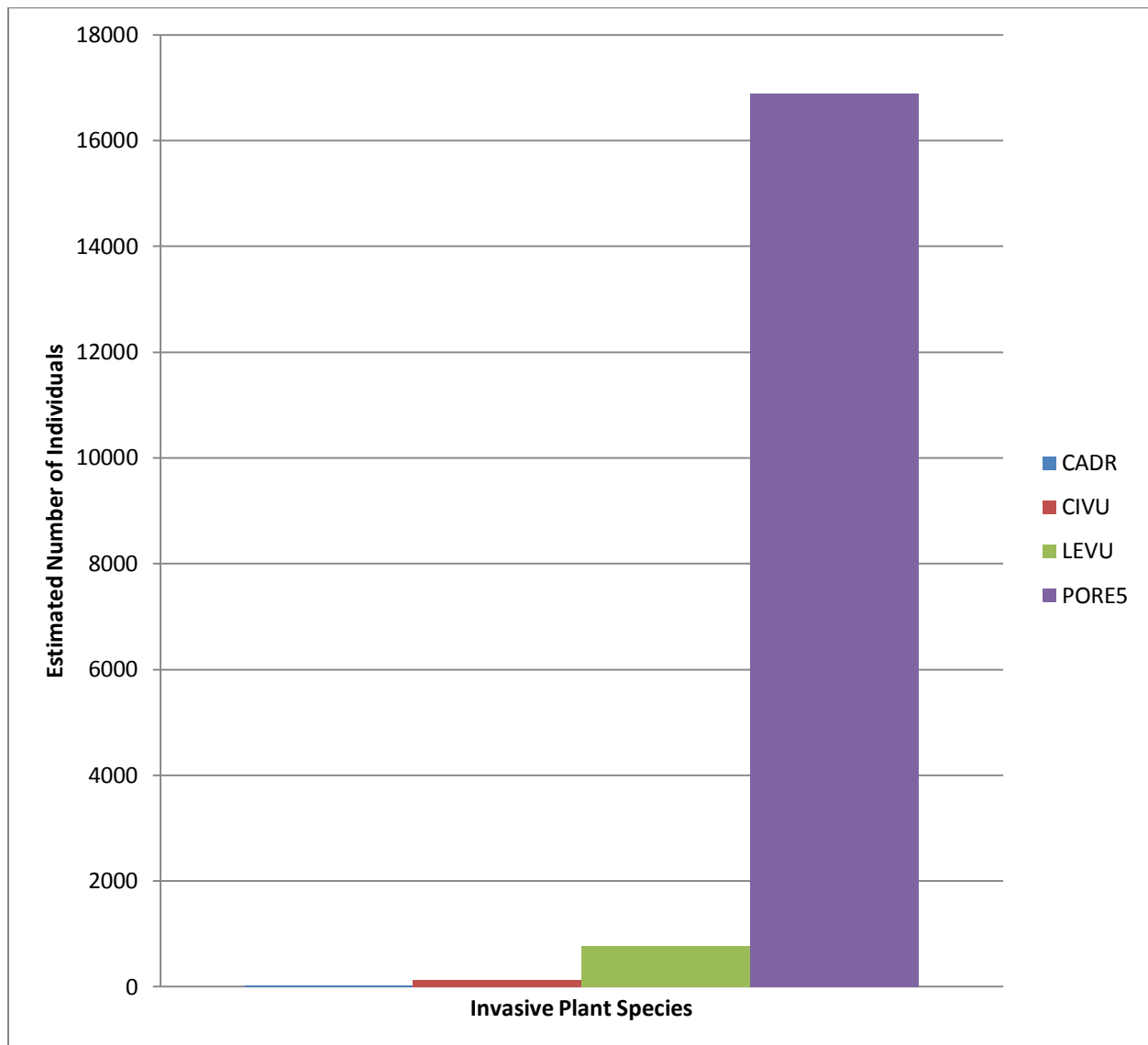


Figure 7. Estimated number of invasive plants found during assessments on 12-22 September, 2011 in Lake Tahoe-Nevada State Park and Van Sickle CA/NV Bi-State Park. See Table 1 for names corresponding with plant codes.



Discussion

Sulfur Cinquefoil (PORE5), the most common invasive found within the Nevada State Parks in the East Lake Tahoe Basin, has been defined as a Group 1 species by the Lake Tahoe Weed Management Group. The other less numerous Group 1 species found in this assessment were Hoary cress (CADR), and Canada Thistle (CIAR4). The Lake Tahoe Weed Management Group Guidelines call for all Group 1 species to be reported and immediately eradicated.

The other species found in this assessment are all defined by the Lake Tahoe Weed Management Group as Group 2 species, which are to be managed with a goal of eradication. The Group 2 species found in our assessment were Bull Thistle (CIVU), Tall Whitetop (LELA), and Oxeye daisy (LEVU).

Due to the high level of precipitation received by the Tahoe Basin during the 2010-2011 winter/spring, it is very likely that many residual seeds from previous invaders were able to meet optimum germination conditions, grow and set seed. It is, therefore, of utmost importance that these populations are treated during the 2012 field season by mechanical or chemical methods. Without treatment during the 2012 field season, it is very likely that the existing populations would increase significantly and/or spread and further threaten the delicate ecosystem of the Tahoe Basin. A recommended treatment and monitoring plan for future work can be found in Appendix D.

Appendix A: Weed mapping protocol used by GBI crews for Invasive Weed Assessment of Nevada State parks in the East Lake Tahoe basin.

**Lake Tahoe Basin Weed Coordinating Group
Mapping Protocol
Updated April 2011**

- All infestations of less than 0.01 acres (436 square feet, or about 20.9 feet x 20.9 feet) should be mapped as single points. Assign an estimated acreage or approximate square footage to the infestation and document the number of plants within the plot. Whenever possible, provide the approximate length and width in feet.
- All infestations greater than 0.01 acres should be mapped as polygons or lines.
- If multiple species coexist at the same site, map each as a separate infestation.
- Whenever possible, map parcels separately.
- Revisit and remap infestations from previous years to document changes.
- Provide all data to El Dorado County Agriculture Department no later than December of each year

Continue to collect data as required for your agency. We suggest using paper forms or a spreadsheet as well as GPS to provide backup data in the event of GPS failure. Additionally, make sure the following data is available for weed group maps:

1. Date
2. Plant common name
3. Plant code - utilizing standard Animal and Plant Health Inspection Service (APHIS) codes (see table).
4. Latitude and longitude (use your existing datum; provide the projection when reporting the data)
5. Line width (if applicable) based on greatest width infested
6. Age of infestation – new or historic (mapped during previous years)
7. Size of infestation, in units of feet, for point infestations. This is effectively the gross acreage. For points we need a length and width of the infestation (for example, 5 ft by 10 ft). For cumulative reporting this is essential and must be provided.
8. Density (assign a specific percent cover using the attached graphic as a guide; base density on canopy cover). For points, we need this to calculate the net acreage, or the percent coverage of the gross acreage. For cumulative reporting this is essential and must be provided.
9. Number of plants (if infestation is small enough to count the plants).

The following data is also very useful, but not required:

10. Growth stage
11. Distance to water (>/< 25 feet)

12. Disturbance type

13. Street address or other description of site location

Plant Codes for Mapping

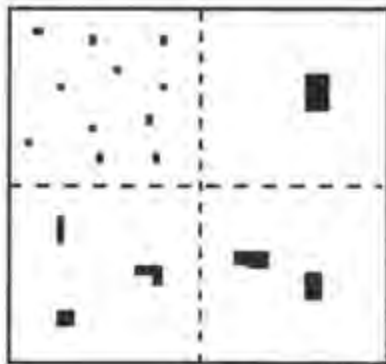
Group 1 Species: Watch For, Report, and Eradicate Immediately:

Canada thistle (<i>Cirsium arvense</i>)	CIAR4
Diffuse knapweed (<i>Centaurea diffusa</i>)	CEDI3
Dyer's woad (<i>Isatis tinctoria</i>)	ISTI
Hoary cress (<i>Cardaria species</i>)	CADR
Hydrilla (<i>Hydrilla verticillata</i>)	HYVE3
Medusahead (<i>Taeniatherum caput-medusae</i>)	TACA8
Musk thistle (<i>Carduus nutans</i>)	CANU4
Purple loosestrife (<i>Lythrum salicaria</i>)	LYSA2
Purple starthistle (<i>Centaurea calcitrapa</i>)	CECA2
Reed canarygrass (<i>Phalaris arundinacea</i>)	PHAR3
Rush skeletonweed (<i>Chondrilla juncea</i>)	CHJU
Russian knapweed (<i>Centaurea repens</i>)	ACRE3
Scotch thistle (<i>Onopordum acanthium</i>)	ONAC
Stinkwort (<i>Dittrichia graveolens</i>)	DIGR3
Sulfur cinquefoil (<i>Potentilla recta</i>)	PORE5
Tamarisk/saltcedar (<i>Tamarix spp.</i>)	TARA
Teasel (<i>Dipsacus fullonum</i>)	DIFU2
Tree of Heaven (<i>Ailanthus altissima</i>)	AIAL
Yellow starthistle (<i>Centaurea solstitialis</i>)	CESO3

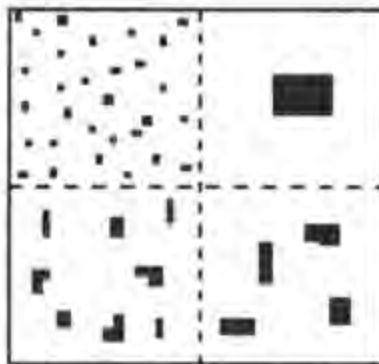
Group 2 Species: Manage Infestations With a Goal of Eradication

Bull thistle (<i>Cirsium vulgare</i>)	CIVU
Curlyleaf pondweed (<i>Potamogeton crispus</i>)	POCR3
Dalmatian toadflax (<i>Linaria dalmatica</i>)	LIDA
Eurasian watermilfoil (<i>Myriophyllum spicatum</i>)	MYSP
Klamathweed (<i>Hypericum perforatum</i>)	HYPE
Oxeye daisy (<i>Chrysanthemum leucanthemum</i>)	LEVU
Perennial pepperweed (<i>Lepidium latifolium</i>)	LELA
Scotch broom (<i>Cytisus scoparius</i>)	CYSC4
Spotted knapweed (<i>Centaurea biebersteinii</i>)	CEMA4
Yellow toadflax (<i>Linaria vulgaris</i>)	LIVU2

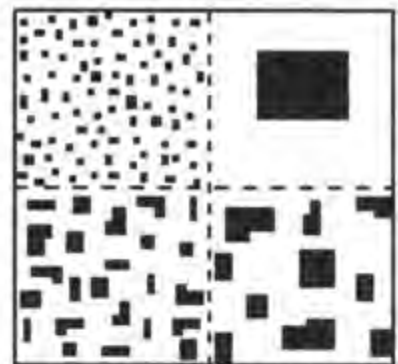
Estimating plant density:



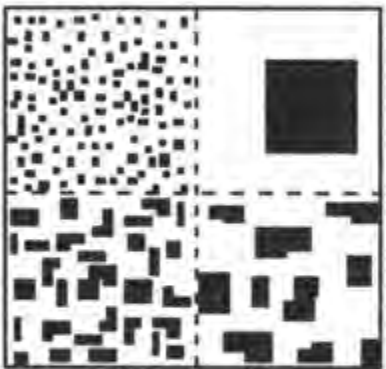
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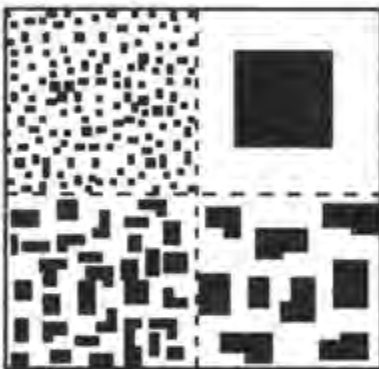
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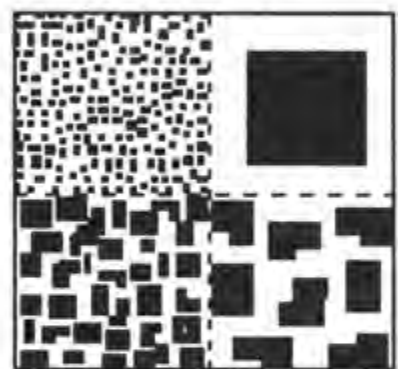
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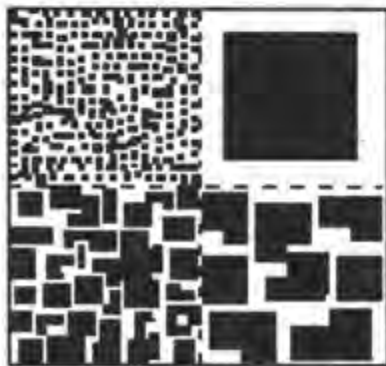
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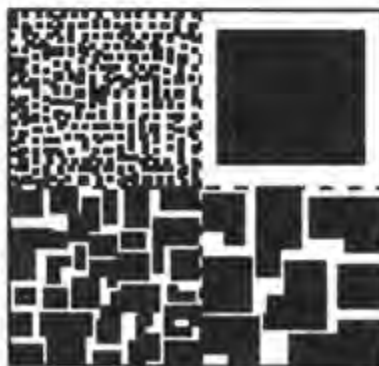
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50%



60%



90%

Appendix B: Mapping metadata from the Invasive Weed Assessment of Nevada State Parks in the East Lake Tahoe Basin.

Key:

Observation Kind: P, point; L, line; A, area

Size Class: T, <.1 acre; S, .1 to 1 acre; M, 1 to 5 acres; L, > 5 acres

Cover Class: T, < 1%; S, 1 to 5%; M, 5 to 25%; L, >25%

Growth Stage: seed; bolt, bud; flower; seed set; mature

GPS Unit	Date	Way point	UTM/ UPS	Plant Species Code	Observation Kind	Line Infestation Width (')	Size Class	Cover Class	Approx. size (ftxft)	Number of Plants	Growth Stage
201	7/6/2011	1	245630/4316017	CIVU	P		T	L	1*1	1	bud
201	7/7/2011	2	245633/4316018	CIVU	P		T	L	1*1	1	bud
201	7/7/2011	3	245611/4316017	CIVU	P		T	L	1*1	1	bud
201	7/7/2011	4	245639/4316025	CIVU	P		T	L	1*1	1	bolt
201	7/7/2011	5	245641/4316026	CIVU	P		T	L	1*1	1	bud
201	7/11/2011	6	0248033/4332868	LEVU	P		T	M	1*1	3	flowering
201	7/11/2011	7	0248031/4332877	LEVU	P		T	M	10*6	35	flowering
201	7/14/2011	15	02447863/433271	CADR	P		T	T	1*1	1	SEEDSET
201	7/18/2011	32	0252686/4342315	PORE5	P		T	T	3*3	8	BUD
201	7/18/2011	61	0252286/4342819	PORE5	P		T	T	2*2	7	BUD
201	7/19/2011	66	0251004/4344730	CADR	P		T	T	1*1	2	SEEDSET
201	7/19/2011	75	0251158/4344559	CADR	P		T	T	2*6	11	flowering
201	7/19/2011	67 (start)	0250993/4344699	LEVU	L	3	T	T		72	BUD
201	7/19/2011	68 (end)	0250996/4344697	LEVU	L	3	T	T		72	BUD
201	7/19/2011	65	0251017/4344765	PORE5	P		T	T	1*1	1	BUD

201	8/3/2011	397	0248114/4332438	CIAR4	P		T	T	25*20	200	BUD
201	8/3/2011	399	0248295/4332447	CIAR4	P		T	S	20*6	45	BUD
201	8/3/2011	405	0248569/4332283	CIAR4	P		T	S	60*20	250	BUD
201	8/3/2011	404	0248565/4332269	CIVU	P		T	T	1*6	3	BUD
201	8/3/2011	406	0248559/4332277	CIVU	P		T	T	1*1	1	BUD
201	8/3/2011	407	0248579/4332278	CIVU	P		T	T	9*6	9	BUD
201	8/3/2011	373	0249609/4338663	PORE5	P		T	M	1*1	1	FLOWERING
201	8/3/2011	374	0249620/4338675	PORE5	P		T	M	1*1	1	FLOWERING
201	8/3/2011	375	0249621/4338676	PORE5	P		T	M	2*2	4	FLOWERING
201	8/3/2011	376	0249633/4338702	PORE5	P		T	M	6*4	17	FLOWERING
201	8/3/2011	377 (START)	0249637/4338713	PORE5	L	20	T	S		148	FLOWERING , BUD
201	8/3/2011	378 (END)	0249671/4338150	PORE5	L	20	T	S		148	FLOWERING , BUD
201	8/3/2011	379	0249682/4338751	PORE5	P		T	M	1*1	1	BUD
201	8/3/2011	380	0249688/4338754	PORE5	P		T	M	2*2	3	FLOWERING
201	8/3/2011	382	0249699/4338753	PORE5	P		T	M	2*2	5	FLOWERING
201	8/3/2011	383	0249717/4338756	PORE5	P		T	M	1*1	2	FLOWERING
201	8/3/2011	384	0249722/4338773	PORE5	P		T	M	15*40	37	FLOWERING
201	8/3/2011	394	0247572/4332840	PORE5	P		T	M	12*12	65	FLOWERING
201	8/3/2011	395	0248013/4332468	PORE5	A		T	S	15473	300	FLOWERING
201	8/3/2011	396	0248033/4332431	PORE5	A		T	T	119710	500	FLOWERING
201	8/3/2011	398	0248268/4332460	PORE5	P		T	T	1*6	2	FLOWERING
201	8/3/2011	400	0248300/4332448	PORE5	P		T	T	15*6	9	FLOWERING
201	8/3/2011	401	0248521/4332448	PORE5	P		T	S	1*1	1	FLOWERING
201	8/3/2011	402	0248533/4332317	PORE5	P		T	T	9*6	8	FLOWERING
201	8/3/2011	403	0248535/4332262	PORE5	A		T	T	~ 100000	300	FLOWERING
201	8/4/2011	409	0248650/433275	CIAR4	P		T	T	12*6	14	BUD
201	8/4/2011	408	0248650/4332275	CIVU	P		T	T	25*25	35	BUD
201	8/4/2011	414	0248722/4332374	CIVU	P		T	T	2*2	2	BUD

201	8/4/2011	422	0248691/4332977	CIVU	P		T	T	6*2	8	BUD
201	8/4/2011	430	0248385/4332986	CIVU	P		T	T	1*1	1	BUD
201	8/4/2011	433	0248342/4332944	CIVU	P		T	T	1*1	2	BUD
201	8/4/2011	436	0248284/4332895	CIVU	P		T	T	4*2	2	BUD
201	8/4/2011	437	0248280/4332870	CIVU	P		T	T	1*1	1	BUD
201	8/4/2011	440	0248195/4332822	CIVU	P		T	T	30*9	5	BUD
201	8/4/2011	446	0248170/4332703	CIVU	P		T	T	1*1	4	BUD
201	8/4/2011	479	0250174/4332461	CIVU	P		T	T	12*12	17	FLOWERING , BUD
201	8/4/2011	458	0250030/4332503	LELA	P		T	T	1*1	2	FLOWERING
201	8/4/2011	410	0248715/4332309	PORE5	P		T	T	12*3	13	FLOWERING
201	8/4/2011	411	0248725/4332323	PORE5	P		T	T	4*4	4	FLOWERING
201	8/4/2011	412	0248732/4332357	PORE5	P		T	T	12*3	16	FLOWERING
201	8/4/2011	418	0248874/4332496	PORE5	P		T	T	50*25	70	FLOWERING
201	8/4/2011	419	0248918/4332573	PORE5	P		T	S	100*30	250	FLOWERING
201	8/4/2011	421	0248894/4332634	PORE5	P		T	S	1*1	1	FLOWERING
201	8/4/2011	423	0248557/4333138	PORE5	P		T	S	90*12	150	FLOWERING
201	8/4/2011	424	0248548/4333132	PORE5	P		T	T	12*9	40	FLOWERING
201	8/4/2011	425	0248471/4333132	PORE5	P		T	T	20*6	23	FLOWERING
201	8/4/2011	426	0248456/4333237	PORE5	P		T	T	20*15	40	FLOWERING
201	8/4/2011	427	0248432/4333221	PORE5	P		T	S	30*15	150	FLOWERING
201	8/4/2011	443	0248125/4332717	PORE5	P		T	T	6*3	5	FLOWERING
201	8/4/2011	444	0248131/4332701	PORE5	P		T	T	1*1	1	FLOWERING
201	8/4/2011	445	0248154/4332704	PORE5	P		T	T	6*3	5	FLOWERING
201	8/4/2011	447	0248170/4332702	PORE5	P		T	T	40*6	16	FLOWERING
201	8/4/2011	448	0248188/4332707	PORE5	P		T	T	15*15	7	FLOWERING
201	8/4/2011	450	0248170/4332607	PORE5	P		T	T	1*1	1	FLOWERING
201	8/4/2011	459	0250233/4332488	PORE5	P		T	T	4*6	8	FLOWERING
201	8/4/2011	480	0250125/4332459	PORE5	P		T	T	1*1	2	FLOWERING
201	9/13/201	501	0250155/4336485	PORE5	P		T	T	15*15	15	flowering

	1										
201	9/13/2011	502	0250407/4340250	PORE5	A		T	T	15977	300	flowering
201	9/13/2011	503 (start)	0250395/4340237	PORE5	L		T	S	30	3500	flowering
201	9/13/2011	504 (end)	0250308/4340067	PORE5	L		T	S	30	3500	flowering
201	9/13/2011	505	0250077/4339524	PORE5	P		T	T	1*1	3	flowering
201	9/13/2011	506	0249899/4339168	PORE5	P		T	T	1*1	1	flowering
201	9/13/2011	507 (start)	0249784/4339084	PORE5	L	30	T	T		230	flowering
201	9/13/2011	508 (end)	0294760/4339074	PORE5	L	30	T	T		230	flowering
201	9/13/2011	509	0249617/4339025	PORE5	P		T	T	1*1	2	flowering
201	9/13/2011	510	0249694/4339059	PORE5	P		T	T	1*1	3	flowering
201	9/13/2011	511 (start)	0249728/4338806	PORE5	L	40	T	T		400	flowering
201	9/13/2011	512 (end)	0249636/4338700	PORE5	L	40	T	T		400	flowering
201	9/13/2011	513 (start)	0249581/4338667	PORE5	L	30	T	T		30	flowering
201	9/13/2011	514 (end)	0249555/4338687	PORE5	L	30	T	T		30	flowering
201	9/13/2011	515	0249839/4337088	PORE5	A		S	T	110823		flowering
201	9/14/2011	516	0252976/4340983	PORE5	P		T	S	15*30	150	seedset
201	9/14/2011	517 (start)	0252978/4340982	PORE5	L	15	T	S		360	seedset
201	9/14/2011	518 (end)	0253012/4341000	PORE5	L	15	T	T		360	seedset
201	9/14/2011	519 (start)	0253064/4341007	PORE5	L	15	T	S		115	seedset

201	9/14/201 1	520 (end)	0253096/4340984	PORE5	L	15	T	S		115	seedset
201	9/14/201 1	521	0253541/4341375	PORE5	P		T	T	1*1	1	seedset
201	9/14/201 1	522	0253467/4341480	PORE5	A		S	T	32856	400	seedset
201	9/14/201 1	523	0249647/4336731	PORE5	A		S	T	24058	300	flowering, seedset
201	9/14/201 1	524	0249629/4336742	PORE5	A		S	T	34891	400	flowering
201	9/14/201 1	525	0249645/4336781	PORE5	A		S	T	33504	400	seedset
201	9/15/201 1	526	0247975/4333624	LEVU	P		T	T	50*10	50	flowering
201	9/15/201 1	537	0247997/4333387	LEVU	P		T	M	2*2	6	FLOWERING
201	9/15/201 1	539	0247971/4333415	LEVU	P		S	S	50*30	150	FLOWERING
201	9/15/201 1	542	0247958/4333335	LEVU	A		T	T	13799	200	FLOWERING
201	9/15/201 1	544	0247866/4333325	LEVU	P		T	S	30*40	100	FLOWERING
201	9/15/201 1	564	0248036/4332855	LEVU	P		T	T	75*50	75	flowering
201	9/15/201 1	527	0248013/4333884	PORE5	P		T	L	1*1	10	seedset
201	9/15/201 1	528	0248571/4335025	PORE5	P		T	T	50*30	50	seedset
201	9/15/201 1	529 (START)	0248597/4335063	PORE5	L	10	T	T		45	seedset
201	9/15/201 1	530 (END)	0248612/4335122	PORE5	L	10	T	T		45	seedset
201	9/15/201 1	531	0248650/4335200	PORE5	P		T	T	15*5	30	FLOWERING
201	9/15/201 1	532	0248797/4335318	PORE5	P		T	T	20*20	40	seedset
201	9/15/201	533	0248806/4335334	PORE5	P		T	T	2*2	5	FLOWERING

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201	9/15/201 1	534	0248988/4335517	PORE5	P		T	S	50*50	200	flowering, seedset
201	9/15/201 1	535	0248997/4335529	PORE5	P		T	L	1*1	20	seedset
201	9/15/201 1	536	0249319/4336214	PORE5	A		S	T	69310	1500	flowering, seedset
201	9/15/201 1	538	0247996/4333396	PORE5	P		T	T	15*15	25	seedset
201	9/15/201 1	540	0247952/4333421	PORE5	P		T	T	60*20	40	seedset
201	9/15/201 1	541	0247972/4333314	PORE5	P		T	T	25*30	30	seedset
201	9/15/201 1	543	0247121/4333356	PORE5	P		T	T	10*10	15	seedset
201	9/15/201 1	545	0247875/4333319	PORE5	P		T	T	5*5	15	flowering, seedset
201	9/15/201 1	546	0247891/4333291	PORE5	P		T	S	1*1	10	seedset
201	9/15/201 1	547	02479XX/4333268	PORE5	P		T	T	50*50	50	seedset
201	9/15/201 1	548	0247918/4333229	PORE5	P		T	S	10*10	20	seedset
201	9/15/201 1	549	0247923/4333205	PORE5	P		T	T	30*30	40	seedset
201	9/15/201 1	550	0247795/4333044	PORE5	P		T	T	50*50	40	seedset
201	9/15/201 1	551	0247750/4333043	PORE5	P		T	T	30*30	60	seedset
201	9/15/201 1	552	0247729/4333038	PORE5	P		T	T	75*50	100	seedset
201	9/15/201 1	553	0247599/4332985	PORE5	P		T	T	15*15	25	seedset

201	9/15/201 1	554	0247578/4332976	PORE5	P		T	T	10*10	10	seedset
201	9/15/201 1	555	0247472/4333010	PORE5	P		S	T	100*100	300	seedset
201	9/15/201 1	556	0247416/4332944	PORE5	P		T	T	50*50	60	seedset
201	9/15/201 1	557	0247548/4332912	PORE5	P		S	T	100*100	150	seedset
201	9/15/201 1	558	0247631/4332915	PORE5	P		T	T	75*75	180	seedset
201	9/15/201 1	559	0247683/4332931	PORE5	P		T	T	30*30	50	seedset
201	9/15/201 1	560	0247738/4332942	PORE5	P		T	S	40*40	150	seedset
201	9/15/201 1	561	0247188/4332946	PORE5	P		T	S	3*3	11	seedset
201	9/15/201 1	562	0247826/4332968	PORE5	P		S	T	100*100	300	seedset
201	9/15/201 1	563	0247928/4333140	PORE5	P		T	T	50*50	70	seedset, FLOWERING
201	9/15/201 1	565	0248056/4332855	PORE5	P		T	T	100*75	40	seedset
201	9/19/201 1	566	0252253/4342936	PORE5	A		S	S	18462	200	seedset

201	9/19/201 1	567	0252249/4342885	PORE5	P		T	T	50*30	70	seedset
201	9/19/201 1	568	0252200/4342876	PORE5	P		T	T	9*9	5	seedset
201	9/19/201 1	569	0251782/4342600	PORE5	P		T	T	9*6	10	seedset
201	9/19/201 1	570	0251465/4342410	PORE5	A		T	T	61849	200	seedset
201	9/19/201 1	571	0251385/4342373	PORE5	P		T	T	15*6	6	seedset
201	9/20/201 1	572	0250002/4342493	PORE5	P		T	T	60*30	70	seedset, FLOWERING
201	9/20/201 1	573	0250021/4342370	PORE5	P		T	T	15*3	7	flowering
201	9/21/201 1	574	0250197/4345291	PORE5	P		T	T	15*6	10	flowering
201	9/21/201 1	575	0251016/4344835	PORE5	P		T	T	1*3	2	seedset
201	9/22/201 1	576	0245683/4316049	CIVU	P		T	T	1*1	1	seedset
201	9/22/201 1	577	0245635/4316026	CIVU	P		T	T	3*3	2	seedset
201	9/22/201 1	578	0245599/4316013	CIVU	P		T	T	1*1	3	flowering

201	9/22/201 1	579	0245602/4316001	CIVU	P		T	T	1*1	1	bold
201	9/23/201 1	580	0245590/4316001	CIVU	P		T	T	1*1	1	bold
201	9/23/201 1	581	0245578/4315953	CIVU	P		T	T	1*1	1	seedset
201	9/23/201 1	582	0245594/4315978	CIVU	P		T	T	1*1	1	seedset
201	9/23/201 1	583	0245585/4315962	CIVU	P		T	T	15*1	4	flowering
201	9/23/201 1	585	0245224/4315840	CIVU	P		T	T	1*1	1	flowering
201	9/23/201 1	586	0245213/4315858	CIVU	L		T	T		18	seedset
201	9/23/201 1	587	0245343/4315801	CIVU	L		T	T		18	seedset
201	9/23/201 1	584	0245181/4315924	PORE5	P		T	T	1*1	1	seedset
202	7/12/201 1	30	0247629/4332798	CADR	A		T	T	174	43	flowering, seedset
202	7/12/201 1	7	0247384/4333754	CIVU	A		T	T	130	30	bud, bolt
202	7/12/201 1	11	0247396/4333765	CIVU	P		T	T	9*6	4	bolt

202	7/12/201 1	13	0247344/4333825	CIVU	P		T	T	6	2	bolt
202	7/12/201 1	14	0247335/4333822	CIVU	A		T	T	1324	21	bolt, buds
202	7/12/201 1	17	0247514/4333690	CIVU	P	1	T	T	6	2	bolt
202	7/12/201 1	20	0247861/4333632	CIVU	P		T	M	1	1	bolt
202	7/12/201 1	4(start)		LEVU	L	18	T	T	740	121	bud
202	7/12/201 1	5(end)	0247952/4333901	LEVU	L	18	T	T	740	121	bud
202	7/14/201 1	85	0248025/4332391	CADR	P		T	S	15*2	20	flowering, buds
202	7/14/201 1	90	024396/4332924	CaDR	P		T	T	1*1	1	flowering
202	7/14/201 1	91	0247586/4332818	CADR	P		T	T	3*3	12	flowering
202	7/14/201 1	113	0248087/4332677	CADR	P		T	S	1*2	3	flowering
202	7/14/201 1	106	0248164/4332683	PORE5	P		T	T	18*18	26	bud, flowering
202	7/14/201 1	108	0248187/4332665	PORE5	P		T	T	6*3	2	flowering, buds

202	7/14/201 1	109	0248171/4332632	PORE5	P		T	L	1*1	2	flowering, buds
202	7/14/201 1	110	0248163/4332617	PORE5	P		T	T	30*11	27	flowering, buds
202	7/14/201 1	111	0248144/4332593	PORE5	P		T	T	38*9	24	flowering, buds
202	7/14/201 1	114	0248151/4332674	PORE5	P		T	T	2*9	2	flowering, buds
202	7/19/201 1	52	0249678/4339057	PORE5	P		T	M	15*6	15	flowering, buds
202	7/19/201 1	53	0249680/4339043	PORE5	P		T	L	2*2	1	bolt
202	7/20/201 1	54	0252266/4342929	PORE5	A		T	S-M	12091	>100	flowering, buds
202	7/20/201 1	55	0252260/4342907	PORE5	P		T	M	18*18	30	buds
202	7/20/201 1	56	0252213/4342882	PORE5	P		T	L	2*2	1	bolt
202	7/20/201 1	57	0252190/4342859	PORE5	P		T	M	9*6	6	buds
202	7/20/201 1	64 (start)	0250350/4340224	PORE5	L	21	T	S		300	bolt, buds
202	7/20/201 1	65 (end)	0250309/4340059	PORE5	L	21	T	S		300	bolt, buds

202	7/20/2011	66	0249764/4339078	PORE5	P		T	M-L	60*15	50-100	bolt
202	7/20/2011	67	0249727/4338774	PORE5	P		T	S	12*5	17	bolt
202	7/20/2011	68	0249726/4338761	PORE5	P		T	S	16*4	20	bolt
202	7/20/2011	69 (start)	0249708/4338754	PORE5	L	3	T	S	3*	110	bolt
202	7/20/2011	70 (end)	0249672/4338749	PORE5	L	3	T	S	3*	110	bolt
202	7/20/2011	71	0249641/4338727	PORE5	P		T	M-L	12*3	6	buds
202	7/20/2011	72	0249639/4338716	PORE5	P		T	T	15*3	2	bolt
202	7/20/2011	73	0249637/4338698	PORE5	P		T	M	3*5	2	bolt
202	7/20/2011	79	0249000/4336215	PORE5	P		T	L	3*3	1	buds
202	7/20/2011	84	0248537/4335283	PORE5	P		T	T	4*3	12	flowering, buds
202	7/21/2011	85	0253453/4341518	PORE5	P		T	T	3*3	6	buds
202	8/3/2011	127	0248721/4335269	CADR	P		T	T	1*1	1	FLOWERING

202	8/3/2011	128	0248691/4335263	CADR	P		T	T	2*1	3	FLOWERING
202	8/3/2011	139	0248002/4334331	CADR	P		T	T	30*15	10	SEED-SET
202	8/3/2011	140	0247999/4334274	CADR	P		T	T	6*2	3	SEED-SET
202	8/3/2011	141	0247988/4333314	CADR	P		T	T	15*6	25	SEED-SET
202	8/3/2011	151	0248040/4332897	CADR	P		T	T	21*6	21	SEED-SET
202	8/3/2011	142	0247982/4333314	LEVU	P		T	S	10*6	20	FLOWERING
202	8/3/2011	145	0247968/4333330	LEVU	A		T	M	1655	>200	FLOWERING
202	8/3/2011	146	0247950/4333303	LEVU	A		T	M	2177	>200	FLOWERING
202	8/3/2011	149	0248033/4332851	LEVU	P		T	M	30*15	52	FLOWERING
202	8/3/2011	153	0248042/4332898	LEVU	P		T	S	30*15	50	FLOWERING
202	8/3/2011	155	0248030/4332909	LEVU	P		T	T	15*3	2	FLOWERING
202	8/3/2011	161(START)	0247861/4333262	LEVU	L	45	T	M		500	FLOWERING
202	8/3/2011	162(END)	0247863/4333339	LEVU	L	45	T	M		500	FLOWERING
202	8/3/2011	165	0247926/4333372	LEVU	P		T	S	40*6	50	FLOWERING
202	8/3/2011	167	0247951/4333375	LEVU	P		T	M	30*6	150	FLOWERING
202	8/3/2011	168	0247957/4333385	LEVU	A		T	S	12660	500	FLOWERING
202	8/3/2011	176	0247749/4333122	LEVU	A		T	T	2162	100	FLOWERING
202	8/3/2011	129	0248610/4335098	PORE5	P		T	S	8*4	3	FLOWERING

202	8/3/2011	130	0248599/4335028	PORE5	P		T	L	3*2	1	FLOWERING
202	8/3/2011	131	0248592/4335037	PORE5	P		T	M	30*9	15	FLOWERING
202	8/3/2011	134	0248571/4335025	PORE5	P		T	M	30*30	80	FLOWERING
202	8/3/2011	143	0247974/4333317	PORE5	P		T	S	10*10	6	FLOWERING
202	8/3/2011	144	0247963/4333321	PORE5	A		T	S	6425	50	FLOWERING
202	8/3/2011	147	0247949/4333293	PORE5	A		T	M	49754	200	FLOWERING
202	8/3/2011	148	0248031/4332847	PORE5	P		T	M	30*10	54	FLOWERING
202	8/3/2011	150	0248033/4332879	PORE5	P		T	L	3*3	3	FLOWERING
202	8/3/2011	152	0248041/4332896	PORE5	P		T	L	3*3	2	FLOWERING
202	8/3/2011	154	0248047/4332861	PORE5	P		T	S	6*3	6	FLOWERING
202	8/3/2011	156	0248023/4332918	PORE5	A		T	M	50265	400	FLOWERING
202	8/3/2011	157	0248006/4332946	PORE5	P		T	T	10*2	4	FLOWERING
202	8/3/2011	158	0248003/4332974	PORE5	P		T	S	10*30	9	FLOWERING
202	8/3/2011	159	0247980/4333161	PORE5	P		T	L	3*3	1	FLOWERING
202	8/3/2011	160	0247958/4333129	PORE5	A		T	S	18746	80	FLOWERING
202	8/3/2011	163(START)	0247861/4333340	PORE5	L	35	T	T		40	FLOWERING
202	8/3/2011	164(END)	0247865/4333306	PORE5	L	35	T	T		40	FLOWERING
202	8/3/2011	166	0247941/4333387	PORE5	A		T	S	9749	250	FLOWERING

202	8/3/2011	169	0247592/4332849	PORE5	P		T	M	18*15	20	FLOWERING
202	8/3/2011	170(START)	0247487/4332872	PORE5	L	18	T	T		53	FLOWERING
202	8/3/2011	171(END)	0247385/4332930	PORE5	L	18	T	T		53	FLOWERING
202	8/3/2011	172	0247363/4333038	PORE5	A		T	S	2945	52	FLOWERING
202	8/3/2011	173	0247381/4333078	PORE5	A		T	T	11885	300	FLOWERING
202	8/3/2011	174	0247404/4333052	PORE5	P		T	T	60*15	50	FLOWERING
202	8/3/2011	175	0247444/4333055	PORE5	A		T	S	542332	2000	FLOWERING
202	8/4/2011	188	0247875/4332324	CADR	P		T	S	2*1	2	SEED-SET
202	8/4/2011	179	0247294/4333101	PORE5	P		T	S	15*15	7	FLOWERING
202	9/13/2011	6	0249326/4332353	PORE5	P		T	S	15*6	35	MATURE
202	9/13/2011	8 (START)	0249773/4337100	PORE5	L	12	T	T		36	MATURE, FLOWERING
202	9/13/2011	9 (END)	0249770/4337083	PORE5	L	12	T	T		36	MATURE, FLOWERING
202	9/13/2011	10 (START)	0249648/4336808	PORE5	L	21	T	T		47	MATURE, FLOWERING
202	9/13/2011	11(END)	0249631/4336725	PORE5	L	21	T	T		47	MATURE, FLOWERING
202	9/14/2011	15	0249767/4338551	CADR	P		T	T	12*4	17	SEED-SET

202	9/14/201 1	12	0249534/4338706	PORE5	P		T	L	1*1	1	SEED-SET
202	9/14/201 1	13(START	0249553/4338685	PORE5	L	7	T	S		43	FLOWERING
202	9/14/201 1	14(END)	0249580/4338666	PORE5	L	7	T	S		43	FLOWERING
202	9/14/201 1	16	0249749/4338197	PORE5	P		T	M	2*1	1	FLOWERING
202	9/14/201 1	017(START)	0249752/4338180	PORE5	L	18	T	T		56	FLOWERING
202	9/14/201 1	18(END)	0249744/4338150	PORE5	L	18	T	T		56	FLOWERING
202	9/15/201 1	28	0247865/4333638	CIVU	P		T	T	21*6	2	FLOWERING
202	9/15/201 1	29	0247404/4333725	CIVU	P		T	M	1*1	1	SEED-SET
202	9/15/201 1	30	0247388/4333753	CIVU	A		T	S	226	12	FLOWERING AND SEED- SET
202	9/15/201 1	31	0247334/4333825	CIVU	A		T	S	2629	28	FLOWERING AND SEED- SET
202	9/15/201 1	32	0247507/4333685	CIVU	P		T	L	1*1	1	BOLT

202	9/15/2011	26(START)	0247954/4333929	LEVU	L		T	S		100	FLOWERING , MATURE
202	9/15/2011	27(END)	0247954/4333900	LEVU	L		T	S		100	FLOWERING , MATURE
202	9/15/2011	19	0249004/4336217	PORE5	P		T	L	2*2	1	MATURE
202	9/15/2011	20	0249001/4336205	PORE5	P		T	S	18*3	3	MATURE
202	9/15/2011	21(START)	0248581/4335329	PORE5	L	5	T	T		43	seedset, mature
202	9/15/2011	22(END)	0248563/4335318	PORE5	L	5	T	T		43	seedset, mature
202	9/15/2011	23	0248536/4335288	PORE5	P		T	M	6*3	6	SEED-SET
202	9/15/2011	24	0248537/4335270	PORE5	P		T	S	6*6	3	SEED-SET
202	9/15/2011	25	0248523/4335251	PORE5	P		T	S	15*12	10	FLOWERING AND SEED- SET
202	9/19/2011	33	0252673/4342311	PORE5	P		T	S	20*30	80	seedset
202	9/19/2011	34	0251940/4343518	PORE5	P		T	T	10*10	10	seedset
202	9/19/2011	35	0252212/4343080	PORE5	P		T	T	30*30	100	flowering,

	1										seedset
202	9/19/201 1	36	0252236/4343042	PORE5	P		T	T	40*40	110	flowering, seedset
202	9/19/201 1	37	0252268/4342987	PORE5	A		S	T	3381	150	seedset
202	9/19/201 1	38 (start)	0252345/4342191	PORE5	L	15	T	T		100	flowering, seedset
202	9/19/201 1	39 (end)	0252356/4342186	PORE5	L	15	T	T		100	flowering, seedset
202	9/19/201 1	40	0252444/4342115	PORE5	P		T	T	20*5	50	seedset
202	9/19/201 1	41	0252481/4342080	PORE5	P		T	T	30*10	60	seedset
202	9/20/201 1	42	0248812/4344952	PORE5	P		T	M	1*1	3	flowering
202	9/21/201 1	43	0252261/4346098	PORE5	P		T	T	5*5	4	seedset
202	9/21/201 1	44	0251463/4343603	PORE5	P		T	M	1*1	5	seedset
202	9/21/201 1	45	0256374/4344827	PORE5	P		T	S	1*1	2	seedset
202	9/21/201 1	46	0252034/4344269 0	PORE5	P		T	M	1*1	6	seedset

202	9/21/201 1	47	0252290/4342268	PORE5	P		T	T	11*11	8	seedset
202	9/21/201 1	48	0252615/4342273	PORE5	P		T	T	30*30	25	seedset
202	9/22/201 1	49	0245327/4315820	CIVU	P		T	T	1*10	2	seedset
202	9/22/201 1	50	0245297/4319832	CIVU	P		T	S	1*1	1	flowering
202	9/22/201 1	51 (start)	0245253/4315845	CIVU	L		S	T		16	flowering, seedset
202	9/22/201 1	52 (end)	0245216/4315853	CIVU	L		S	T		16	flowering, seedset
202	9/22/201 1	53	0245588/4315975	CIVU	P		T	S	1*2	3	flowering
202	9/22/201 1	54	0245617/4316006	CIVU	P		T	T	2*25	3	mature, seedset
202	9/22/201 1	55	0245631/4316019	CIVU	P						

Appendix C: Photo documentation of activities for the Invasive Weed Assessment of Nevada State Parks in the East Lake Tahoe Basin.

Interns mapping Spooner Lake:



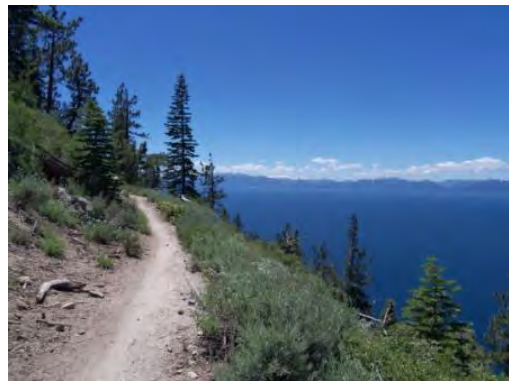
Riparian zone around Spooner Lake:



Interns identifying invasives:



Interns mapping the Flume Trail:



Interns mapping the Tahoe Rim Trail:



Appendix D: Treatment and Monitoring Plan

It is recommended that follow-up treatment and monitoring commence in late spring 2012 and continue throughout the growing season in the East Lake Tahoe Basin. In order to find new infestations, it is recommended that all areas monitored during the Invasive Weed Assessment of Nevada State Parks in the East Lake Tahoe Basin in 2011 are monitored again during the 2012 field season. It is also recommended that monitoring protocols continue to follow the Lake Tahoe Basin Weed Management Group Mapping Protocol (Appendix A). The table below outlines a recommended timeline for monitoring and treatment of invasive weeds in the East Lake Tahoe Basin.

Activity	Timing
Training and site reconnaissance	June/July 2012
Field surveys, GPS data collection and data entry. Treatment of emerging species, with priority treatment for species that are flowering. Continued monitoring of mapped infestations.	July-August
Interim Report	August 2012
Field surveys, GPS data collection and data entry. Continued treatment, re-treatment, and monitoring of mapped infestations.	August-September 2012
Reporting and GIS map database creation	October 2012
Final report	November 2012

Treatment Methods:

Recommendations for the treatment of invasives found in the project “Invasive Weed Assessment of Nevada State Parks in the East Lake Tahoe Basin” are contingent upon the types of plants being targeted and the management goals of the East Lake Tahoe Basin State Parks. Recommendations for treatment of the various plants through the use of chemical or mechanical methods are as follows:

Hoary Cress (*Cardaria draba*) – This perennial rhizomatous herb is usually treated with the application of a broadleaf herbicide*. Hoary cress can also be treated by removal of the root mass down to 20” with a spade.

Canada Thistle (*Cirsium arvense*) – Canada thistle is a perennial rhizomatous thistle that can be treated with the application of a broadleaf herbicide*. Canada thistle can also be effectively treated by mowing every three weeks (California Invasive Plant Council). If Canada thistle plants have begun to flower before the plant is eradicated, flowers must be cut off and disposed of.

* Herbicides and application rates must be selected by qualified state park personnel.

Bull Thistle (*Cirsium vulgare*) – Bull thistle, a biennial thistle, is easily treated by mechanical methods and can be dug out with a shovel two inches below the root crown for control. Bull thistle can also be treated with the application of a broadleaf herbicide*. If bull thistle plants have begun to flower prior to treatment, flowers must be cut off and properly disposed of.

Tall Whitetop (*Lepidium latifolium*) – Tall whitetop is a perennial mustard which reproduces by seed and rhizomes. This plant can be difficult to eradicate, but current research indicates that it is best managed with a combination of chemical and mechanical methods (California Invasive Plant Council). Typically, this plant is managed with a broadleaf herbicide*, but it can also be managed, and kept from going to seed, with consistent mowing and hand pulling throughout the growing season.

Oxeye Daisy (*Chrysanthemum leucanthemum*) – According to the California Invasive Plant Council, hand removal can be an efficient method to eradicate smaller populations of Oxeye daisy. For hand removal, a spade must be used to dig up and remove the plants' roots. For larger populations, mulching with 5-6" of straw can also be effective. This plant can be controlled with broadleaf herbicides*, however, a study by Stubbendieck et. al. (1992) showed that oxeye daisy was moderately resistant to MCPA, 2,4-D, and dicamba.

Sulfur cinquefoil (*Potentilla recta*) – Sulfur cinquefoil is a perennial forb that can survive for up to 20 years if left undisturbed. According to the King County Noxious Weed Control Division, sulfur cinquefoil can be effectively controlled by digging, so long as the soil is moist enough to remove most of the root ball. Broadleaf herbicides* can also be used against this plant, however, multiple treatments are usually necessary.

References:

California Invasive Plant Council. 2011. <http://www.cal-ipc.org/>.

King county Noxious Weed Control Division – Sulfur Cinquefoil. 2010. <http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/sulfur-cinquefoil.aspx>.

Stubbendieck et. al. 1992. North American Range Plants. University of Nebraska Press. Lincoln, NE.

* Herbicides and application rates must be selected by qualified state park personnel.