Implementation of the Conservation Strategy for Tahoe Yellow Cress (*Rorippa subumbellata*) 2008 Annual Report

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EXECUTIVE SUMMARY

Tahoe yellow cress (*Rorippa subumbellata* Roll.) is a low-growing, herbaceous perennial plant that is endemic to the shores of Lake Tahoe in California and Nevada. The species is endangered in both states and is currently identified as a priority 8 Candidate for listing under the Endangered Species Act. The Tahoe yellow cress Conservation Strategy (CS) (Pavlik et. al 2002) provides the basic framework for the recovery of the species that is designed to preclude listing the species under ESA. This is the eighth Tahoe yellow cress annual report completed since 2001. These reports provide a record of all conservation activities related to Tahoe yellow cress and are available on the Nevada Natural Heritage website along with research documents and general references at http://heritage.nv.gov/vlibtyc.htm.

Annual field surveys for Tahoe yellow cress (TYC) of up to 61 sites around the lake date back to 1979, and since that time, the greatest number of occupied sites in a single year was 47, while the fewest number of occupied sites was only 9. In 2008, lake level was about two feet lower than it was in 2007, and the number of TYC-occupied sites increased from 30 to 43. This number of occupied sites means that the Adaptive Management Working Group (AMWG) can operate under Level 1 (normal conditions) of the Imminent Extinction Contingency Plan defined in the Conservation Strategy. At Level 1, no changes to the normal policies and guidelines for protection of existing occurrences and potentially suitable habitat are required. Fencing continues to be the predominant management tool for conservation on public lands. Formal conservation measures on private property have yet to be implemented.

Results from research efforts have supported the adaptive management process and three manuscripts for publication in peer-reviewed scientific journals are in development. A series of experimental plantings of container-grown TYC from 2003 to 2006 have identified the optimal techniques, plant characteristics, habitat conditions, and logistical factors for restoration efforts. A second phase of experimental outplanting was initiated in 2008 to test different planting times during the regulatory survey window for TYC (June 15 to September 30). The research was funded by the Southern Nevada Public Lands Management Act (SNPLMA) in a contract between the Lake Tahoe Basin Management Unit (LTBMU) and BMP Ecosciences. A second year will commence in 2009 and results will be available before the 2010 field season. A second field research project continued in 2008 to test translocation of Tahoe yellow cress as a potential restoration or mitigation option for unavoidable impacts of construction or other development projects on the shores of Lake Tahoe. Translocation involves removing and relocating naturally occurring plants, either within the same site or to a different site. The California Department of Fish and Game (CDFG) supported the translocation research with $48,000 in Section 6 funds that were contracted to BMP Ecosciences in 2006 that will support work until March, 2009. The research will continue in 2009 supported by SNPLMA funds and results will be available before the 2010 field season.

Efforts to develop educational materials and implement conservation measures on private lands were stalled in 2008. A grant of $70,400 from the U.S. Bureau of Reclamation (BOR) to the University of Nevada Reno Cooperative Extension for development of educational materials was rescinded for non-performance. However, BOR may re-obligate the TYC project funds before July 2009 and the AMWG will be working to identify a new recipient and a list of tasks and deliverables. NRCS developed a draft template for a Stewardship Plan to provide technical assistance to private

landowners interested in protecting TYC on their lands and the AMWG and Executive Committee discussed ways that this type of plan could be made available for project proponents as a way to satisfy different permit requirements. The AMWG will need to further review the details of this is 2009.

The AMWG continued to implement the adaptive management program in 2008. The number of staff hours reported for Tahoe yellow cress activities amounted to at least 1,649 hours, of which over 300 hours were for the annual survey. Total in-kind cost contributed by each agency for all staff time and materials amounted to a minimum of $66,377 (some agencies did not report expenditures), not including any contracted funding.

Several rounds of funding from SNPLMA have been awarded to support Tahoe yellow cress conservation activities. From the Round 6 award of $350,000, the USFS obligated $159,050 to support LTBMU staff and activities into 2009 and also awarded two contracts totaling $190,950 to BMP Ecosciences to support research, manuscript preparation, and AMWG participation through 2009. The Round 7 SNPLMA award of $150,000 included $100,000 for LTBMU use and an award of $50,000 to Dr. Mary Peacock, University Nevada Reno (UNR), to conduct microsatellite DNA analysis. NRCS received Round 8 and 9 awards of $45,000 each to provide site-specific technical support to private property owners interested in TYC conservation. Finally, the LTBMU received a Round 9 award of $120,000 for TYC that has not been obligated. The AMWG will need to identify contracting needs and specific tasks for these funds in early 2009.

The Memorandum of Understanding (MOU)/Conservation Agreement (CA) to implement the Conservation Strategy (CS) was signed in 2003 with an expiration in ten years. While the Conservation Strategy is intended to be an adaptive management document, Miscellaneous Provision G.6 of the MOU/CA states that the MOU/CA and CS may only be modified by mutual written consent of the parties. This creates a problem for an adaptive management strategy since the CS is essentially frozen in time unless the mutual consent clause is met. However, the AMWG has continually updated certain elements in the CS over the past 5 years, including the 5 Year Management Plan , site rankings, Appendix C, and others. This could be problematic if the regulatory process is linked directly to the CS, such as the TRPA Shorezone Plan regulations.

At the Executive Meeting on October 7, 2008, the Committee directed the AMWG to conduct the 5 year review of the CS as specified in Clause F.1 and present the recommended changes to the CS for review prior to the 2009 Executive Meeting. They also directed the AMWG to propose a specific change to the language in Section G.6 of the MOU whereby changes to the CS could be made by annual approval at Executive Meetings. The goal was set to make these changes and have a signing ceremony of current and any new MOU participants at the 2009 Executive Meeting.

1.0 INTRODUCTION

Tahoe yellow cress (*Rorippa subumbellata* Rollins) is a low-growing, herbaceous perennial plant that is endemic to the shores of Lake Tahoe in California and Nevada. The species is endangered in both states and is currently identified as a priority 8 Candidate for listing under the Endangered Species Act. The Tahoe yellow cress Conservation Strategy (CS) (Pavlik et. al 2002) provides the basic framework for the recovery of the species. A subset of the 61 known TYC sites is prioritized for conservation with a ranking system that is based on empirical estimates of the abundance, persistence, and variability of each subpopulation. These site rankings form the foundation for specific conservation goals and objectives and an adaptive management framework structures information flow and guides management decisions. As a safeguard, the CS proposes an Imminent Extinction Contingency Plan that defines the types and degree of actions to be taken when the number of subpopulations and/or the sizes of subpopulations become critically low, so that the level of effort and resource commitment is acknowledged by all stakeholders in advance.

The goal of the Conservation Strategy is to preclude the need to list Tahoe yellow cress under ESA through promoting conditions that favor a positive metapopulation dynamic. TYC follows the general dynamics of a "mainland –island" metapopulation model. This model of metapopulation dynamics refers to spatio-temporal changes in distribution and abundance where "mainland" subpopulations persist over long periods of time while other "island" subpopulations come and go through the processes of local colonization and extirpation. Thus, the species can persist in sandy beach habitat around Lake Tahoe despite periodic high water levels and human-related impacts. Consequently, the physical and biotic conditions that are thought to determine TYC presence and abundance are a major focus for devising and testing management actions.

This is the eighth Tahoe yellow cress annual report completed since 2001. The annual reports provide a record of all conservation activities related to Tahoe yellow cress and are utilized at quarterly meetings of the Adaptive Management Working Group (AMWG). BMP Ecosciences has produced the reports since 2004 and has generally distributed hard copies of the report in April or May of each year to AMWG members after their comments have been incorporated. However, the report is not finalized until the TYC Executive Committee grants approval at their annual meeting in the fall. The final version of the 2007 annual report, including the revisions requested at the Executive Meeting in October 2008, are available on the Nevada Natural Heritage website at http://heritage.nv.gov/vlibtyc.htm.

The 2008 report has some formatting changes this year. Section 2 presents results from the annual TYC lake-wide survey and Section 3 presents a summary of results from 2008 research activities. Section 4, which in recent reports was focused on the "Friends of TYC Stewardship Program", now discusses all conservation activities on private lands. Sections 5 (Agency Activity Reports) and 6 (Five Year Management Plan) found in recent reports were combined into a single section on all AMWG conservation activities for 2008 including current AMWG membership, agency activity report summary, funding, public lands management, and regulation. A selection of photos from 2008 research and the annual survey follow. The Appendices provide materials for the annual survey, the comprehensive occurrence/ absence data for TYC at 61 sites around the lake from 1979 to 2008, the progress report on the Site Specific Information Sheets, and all of the submitted Agency Activity Report Forms.

2.0 2008 FIELD SURVEYS

2.1 METHODS

2.1.1 SITE NAMES AND RANKING

Data on the number and location of occupied TYC sites around Lake Tahoe have been critical for making management decisions. Appendices D and E of the CS presented occurrence and stem count data for a total of 51 known, historical, and potential native Tahoe yellow cress habitat sites for the years 1978-2000 (Pavlik *et al*. 2002a). These tables were subsequently combined into one comprehensive spreadsheet that has been called Appendix C since 2003 (found in this report). Although the number of named sites fluctuated after the adoption of the CS, Appendix C was consolidated in 2005 to include 62 site names, reflecting some modifications in boundaries of the 51 original sites and several newly detected sites. In 2008, one site was removed from the list because the enclosure at D.L. Bliss State Park was taken out.

The permanent D.L. Bliss enclosure at Lester Beach was built in 1989 to accommodate an outplanting of 1,168 plants. Although about 70% of the plants from the 1989 planting survived to the following year, monitoring did not continue and by 1999, only two plants remained. To test the suitability of the habitat, 100 container-grown plants were installed within the enclosure in 2006. Only 6 plants from that outplanting survived to September 2007, suggesting that the site no longer supports suitable habitat. About half of the enclosure has been taken over by two large willows and two small manzanita shrubs, all of which are trimmed back yearly by California State Park (CSP) staff. TYC is not generally able to persist alongside stabilized vegetation which has a greater advantage in utilizing available soil water. In addition, Lester Beach is extremely popular and recreational use is very heavy, placing a greater burden on ongoing fence maintenance. Therefore, the AMWG agreed to remove the fence in 2008 and recommended that CSP instead pursue fencing opportunities in the more favorable habitat, for example at General Creek in Sugar Pine State Park.

The CS established rankings for sites with sufficient data based on a composite index that includes scores for relative abundance, persistence, and variability. Based on these biological characters, 29 sites were ranked as Core, High, Medium, and Low priority for purposes of conservation, restoration, and management. (For a detailed discussion on site ranking methods and results, refer to page 53 of the CS.) In 2003, the TAG revised the site rankings in Table 13 of the CS to incorporate additional data collected since 2000 to better reflect the metapopulation dynamics of the species through two complete high and low lake level cycles. Currently, a total of 38 of the 61 named sites are ranked: 10 Core, 6 High, 13 Medium, and 9 Low (see Table 2).

The AMWG decided to maintain the 2003 site rankings into the future and rank additional sites as minimum data analysis requirements are met. Within the CS, the minimum ranking criteria are as follows: a "long-term high quality" record had < 4 NS (Not surveyed) events during the period from 1979-2000 while a "short-term, high quality" record was surveyed at least 7 consecutive years AND had 2 or less NS events in that period. Several additional sites met minimum ranking criteria in 2008. Tahoe Pines, Skunk Harbor, and Chimney Rock exceed the criteria for short term records, having been surveyed for 11 years or more (Table 1). For these sites the ratio of survey records from low lake elevation years to high lake level years is either equal or skewed toward low level years by

a single year and therefore it should be possible to rank these three sites with a high degree of confidence.

Table 1. Sites meeting the minimum ranking criteria in 2008. NS= not surveyed. Low to high= the ratio of low lake level years (6224 ft or less) surveyed to high lake elevation years (6227ft or more).

SITE NAME	Survey period	# NS events	Low to High	# surveyed yrs
Sites that meet ranking criteria				
Tahoe Pines	1997-2007	0	4:4	11
Skunk Harbor	1990-2007	2	8:7	17
Chimney Rock	1997-2007	4	5:4	12

Finally, the AMWG needs to reconsider the ranking for the site at D.L. Bliss State Park. The site has been surveyed continuously since 1979 and plants have only been recorded outside the enclosure once in 2005 when 302 plants were found. The enclosure was installed with an outplanting in 1989 and has continued to support a few plants since. Although the site was not rankable when the Conservation Strategy was completed in 2000, the AMWG ranked the enclosure as a Medium priority restoration site in 2003. However, as mentioned above, CSP removed the enclosure in 2008 and without the enclosure, the survey dataset consists of zeros and the site returns to its former status as unranked

2.1.2 DATA COLLECTION

The annual, lake-wide survey for Tahoe yellow cress was conducted on September 2-4, 2008. Participants included; Stu Osbrack, Cecilia Reed, Cheryl Beyer, and Andrew Solvilla (U.S. Forest Service [USFS]); Daniel Burmester, Curtis Hagen, Tim Nosal, and Kevin Thomas (California Department of Fish and Game [CDFG]); Tamara Sasaki, Nancy Lozano, Lisa Fields, Sarah Pitzer, Lawani Colley, Stephanie Smolewski, and Ashlie Lewis (California State Parks [CSP]); Eric Gillies (California State Lands Commission [CSLC]); Mike Bradbury (California Department of Water Resources [DWR]); Peter Maholland (Nevada Division of State Parks [NDSP]); Roland Shaw [NDF]; Rita Whitney (Tahoe Regional Planning Agency [TRPA]); Meri McEneny (private); and Alison Stanton and Kareela Collins [BMP Ecosciences].

The 23 participants were divided into 5 teams, allocated a portion of the 61 sites, and given a set of annual field survey forms developed by NNHP. Boats, provided by CDFG, NDSP, and DWR, were available for 4 of the 5 teams. At a site, team members covered the entire width of exposed beach, from waters edge to the backshore stabilized vegetation, generally keeping below the high water line. Disturbance and search effort were recorded at both occupied and unoccupied sites. Search effort is defined as the amount of person-minutes spent actively searching for and/or collecting data on Tahoe yellow cress. Any modifications to existing site boundaries were delineated using Global Positioning System (GPS) technology.

In 2008, the annual field survey forms were revised to be generic to eliminate the burden of getting data packets to every team and enable team leaders to print as many as necessary (see the template in Appendix A).The pre-printed site information on the USGS quad, county, and site ownership that stays constant in the database was removed from the form. Individual site maps were still provided but IKONOS imagery with an APN overlay was also made available for all private sites so that

surveyors could identify plants occurring on individual parcels, if necessary. The section for GPS data was revised to include space for the survey beginning and end points and the points for each TYC cluster had an option to circle whether the coordinate was an endpoint or centroid. The section on Land Use was overhauled to provide ranked reference conditions (low, medium, high) across the entire site on relative recreation intensity, beach raking, and the threat from non-native weeds. Surveyors are now asked to circle if *Rorippa curvisiliqua* co-occurs on the site in order to determine if the potential exists for misidentification. The data collection protocols were updated to reflect these changes (Appendix B). All annual survey forms, including GPS data, are provided to NNHP for addition to the national BIOTICS database and are available upon request.

2.2 RESULTS

Lake level during the first week of September was 6224.1 ft Lake Tahoe Datum (LTD), about two feet lower than it was for the survey the previous year (6,226.3 ft). A peak lake elevation of just below 6225.5 ft was recorded in late May that was sustained for several weeks before beginning a steady decline around June 21st (Fig 1). Lake elevations of 6,220 to 6,224 ft are considered low water, while elevations between 6,225 and 6,226 ft are transitional between low and high water (6,227 to 6,229.1 ft).

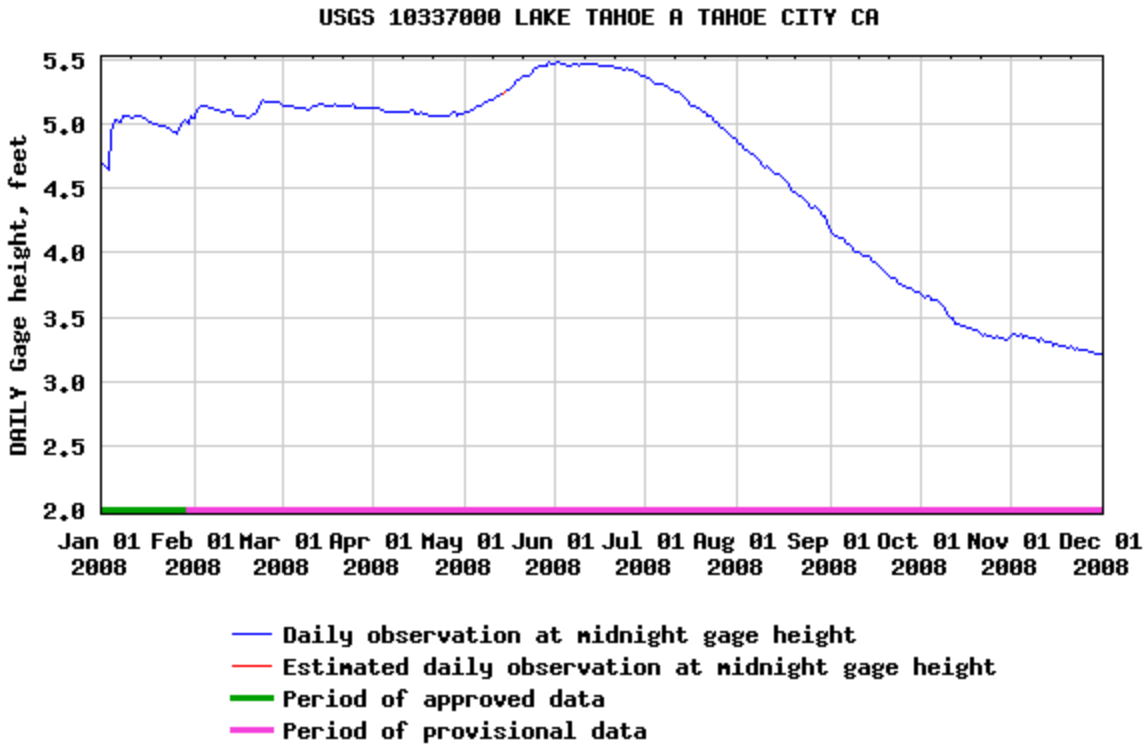

Figure 1. Elevation of Lake Tahoe in 2008 at the USGS Tahoe City Station (add 6,220.0 ft to gage height on the y axis).

During the survey period, Lake Tahoe was at a low elevation, only one and one tenth foot above the natural rim of 6,223 ft. With the decline in lake elevation, the number of TYC-occupied sites increased from 30 to 43 (Figure 2). In comparison, the last time the lake dropped from a transition

level (6,225 ft) to a low level was between 2001 and 2002 when the number of occupied sites showed a similar increase from 29 to 40 sites. The locations of the 40 occupied sites are shown in the map compiled annually by NNHP (Figure 3). The greatest number of occupied sites was recorded in 2004 and 2005, when 47 sites were occupied. The fewest number of occupied sites occurred in 1995 and 1996, when only 9 sites were occupied.

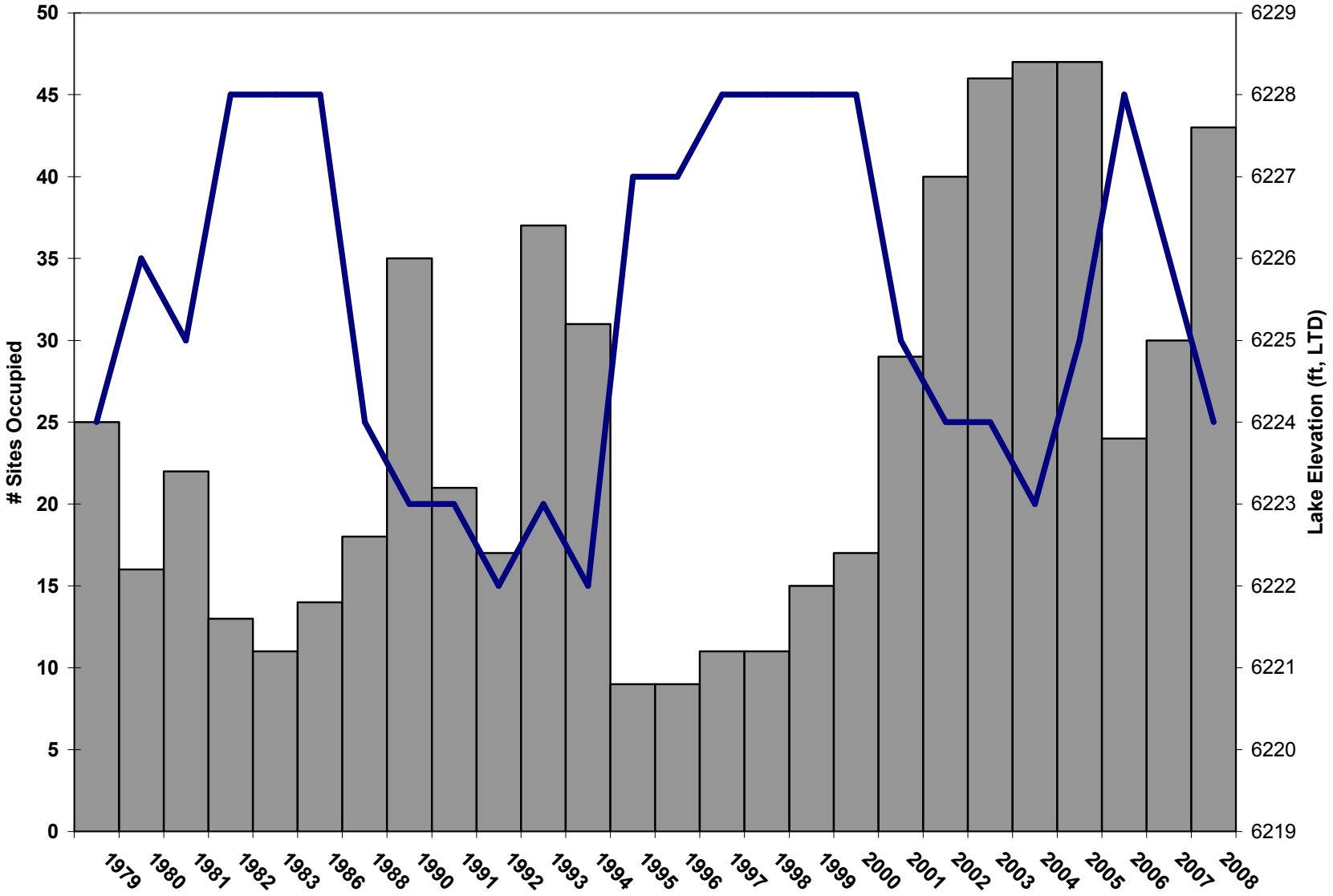

Figure 2. Lake level and number of Tahoe yellow cress sites occupied by survey year (solid blue line = lake level LTD)

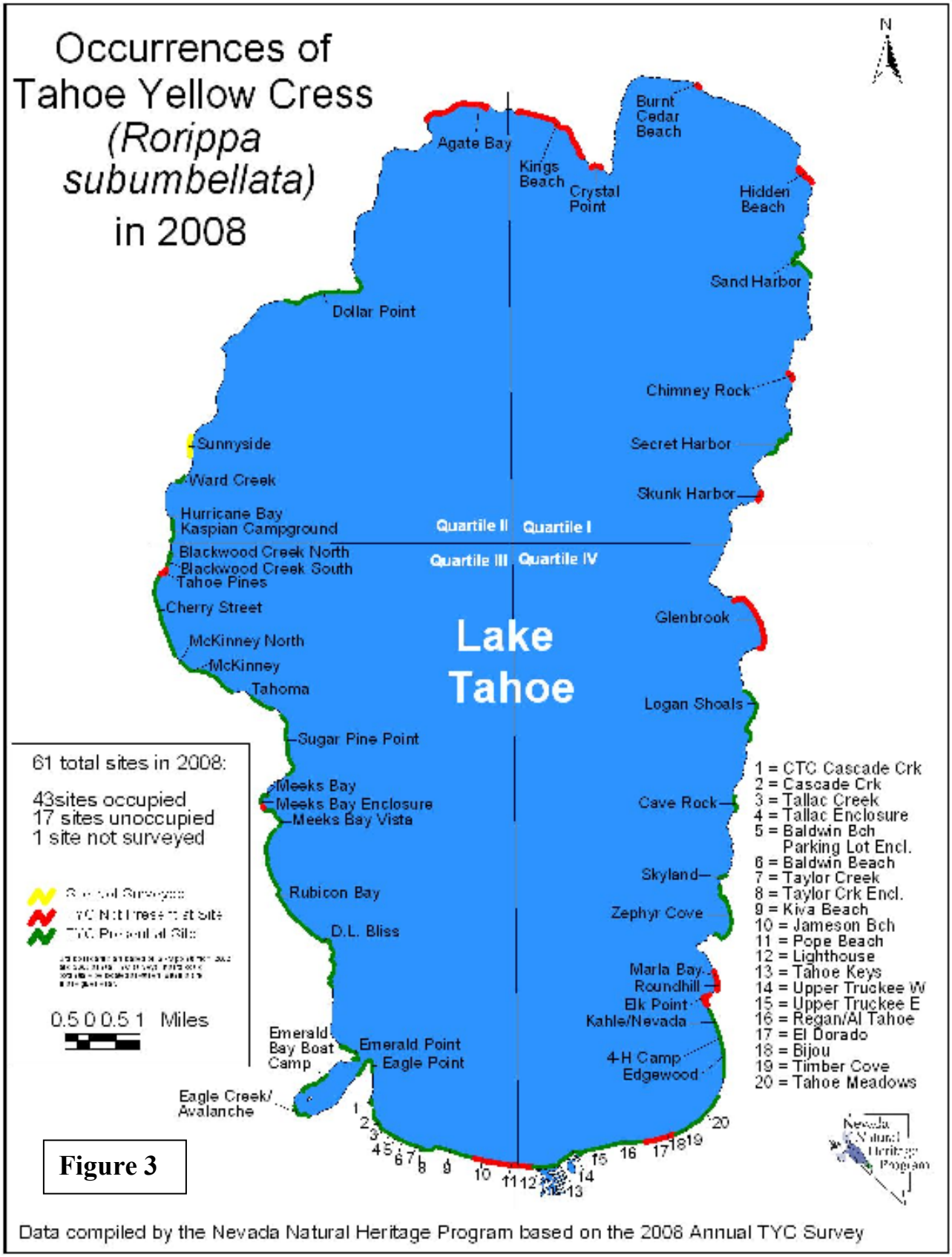

Figure 3

Data compiled by the Nevada Natural Heritage Program based on the 2008 Annual TYC Survey

All of the 61 sites were surveyed except Elk's Point, just north of Nevada Beach, and Sunnyside, near Tahoe City. The survey was incomplete at Ward Creek because surveyors were asked to leave by a property owner after only 8 stems had been counted. BMP Ecosciences observed many stems at the mouth of Ward Creek in an early season survey when scouting for potential outplanting locations and it is likely that the actual stem count exceeded the 403 stems detected in the 2007 survey because a larger habitat was exposed in 2008

The decrease in lake level of two feet exposed more habitat at most sites, and Tahoe yellow cress was present at 15 sites that had been unoccupied since being submerged during high-water in 2006. Presence at these sites could be considered either a "re-appearance" of dormant plants or rootstock established in a previous year, or a genuine re-colonization event from dispersing seeds or rootstock. Since the dispersal patterns and source-sink relationships between occupied sites are unknown, it is not possible to determine the responsible mechanism. This prevents any type of analysis of the colonization to extirpation ratio, potentially a fundamental indicator of the sustainability of the metapopulation dynamic. Despite the large gain in occupancy around the lake, TYC disappeared from one site that was occupied in 2007. Plants were present at Tahoe Pines from 2003 to 2007 and it is not clear why they disappeared in 2008.

The number of stems counted at any one site ranged from 1 to 6,014 during 2008, while survey effort, in terms of recorded person minutes, ranged from 6 to 480 minutes (Table 2). The total estimated stem count increased by more than 5,000 stems from the 2007 estimate (11,847 stems) to 17,125 stems. The total amount of time spent searching for TYC increased by about 44% in 2008 from 3,162 minutes (53 hours) to 5,674 minutes (94 hours). This increase is a function of the greater amount of beach exposed by the lower lake elevation. However, this does not includes any travel time between sites or other time. When these are taken into consideration the total number of hours reported by all staff for the annual survey exceeded 300 hours.

Table 2. Stem counts and survey effort for 61 Tahoe yellow cress sites in September 2008 (NS = not surveyed, X= incomplete survey;plants known to be present).

SITE NAME	Ownership	Rank	# Stems	Survey minutes
Sunnyside	Private/Placer Co	UNRANKED	NS	0
Ward Creek	Private	HIGH	X	75
Kaspian Campground	USFS	UNRANKED	8	60
Blackwood North	Private	CORE	15	75
Blackwood South	Placer County	CORE	281	90
Tahoe Pines (Fleur Du Lac)	Private	UNRANKED	0	21
Cherry Street/Tahoe Swiss Village	Private	LOW	9	120
McKinney North/Shores	Private	LOW	50	50
McKinney Creek	Private	UNRANKED	37	45
Tahoma	Private	LOW	245	180
Sugar Pine Point State Park	CA State Parks	UNRANKED	80	192
Meeks Bay	USFS	HIGH	21	180
Meeks Bay Enclosure (+ 1 new encl)	USFS	UNRANKED	0	15
Meeks Bay Vista	Private	UNRANKED	3	66
Rubicon Bay	Private	MEDIUM	299	158
DL Bliss State Park	CA State Parks	UNRANKED*	10	30

SITE NAME	Ownership	Rank	# Stems	Survey minutes
Emerald Point	CA State Parks	MEDIUM	29	116
Emerald Bay Boat Camp	CA State Parks	MEDIUM	6	81
Eagle Creek/Avalanche	CA State Parks	HIGH	354	160
Eagle Point	CA State Parks	MEDIUM	4	76
CTC Cascade Creek	CTC	UNRANKED	28	80
Cascade Creek	Private	HIGH	192	106
Tallac Enclosure	USFS	CORE	24	65
Tallac Creek (outside Enclosure)	USFS	CORE	69	200
Baldwin Beach	USFS	MEDIUM	101	145
Baldwin Bch Parking Lot Encl (+ 1 new encl)	USFS	UNRANKED	211	80
Taylor Creek Enclosure	USFS	CORE	2,586	200
Taylor Creek	USFS	UNRANKED	595	250
Kiva Beach/Valhalla	USFS	LOW	1	175
Jameson	Private	UNRANKED	0	18
Pope Beach	USFS	LOW	0	200
Lighthouse	Private	CORE	350	80
Tahoe Keys	Private	MEDIUM	1,959	120
Upper Truckee West	CTC	CORE	227	180
Upper Truckee East	CTC	CORE	6,014	480
Regan/Al Tahoe	Private/City SLT	LOW	174	84
El Dorado Beach	City SLT	LOW	0	6
Bijou (Timber Cove Lodge)	Public	UNRANKED	0	30
Timber Cove	Private	MEDIUM	23	40
Tahoe Meadows	Private	CORE	91	60
Edgewood	Private	CORE	1,254	120
4-H Camp/City Pump House	UNR/City	MEDIUM	337	40
Kahle/Nevada	USFS	HIGH	751	90
Elk Point	Private	UNRANKED	NS	0
Roundhill	USFS	UNRANKED	0	45
Marla Bay	Private	UNRANKED	0	40
Zephyr Cove	Private/USFS	HIGH	48	165
Skyland	Private	UNRANKED	2	20
Cave Rock	NV State Parks	MEDIUM	1	15
Logan Shoals/Vista	Private	MEDIUM	590	90
Glenbrook	Private	MEDIUM	0	60
Skunk Harbor	USFS	UNRANKED	0	40
Secret Harbor	USFS	MEDIUM	3	230
Chimney Rock	USFS	UNRANKED	0	40
Sand Harbor	NV State Parks	LOW	25	55
Hidden Beach	NV State Parks	UNRANKED	0	20
Burnt Cedar Beach	IVGID	UNRANKED	0	10
Crystal Point	Private/Placer Co	UNRANKED	0	10
Kings Beach	Private/Public	UNRANKED	0	60
Agate Bay	Private	UNRANKED	0	45
Dollar Point	Private	LOW	18	90
Total			**17,125**	**5,674**

Ranked sites supported the majority of stems (94%) and required the majority of the search effort (79%) (Table 3). Core sites, which accounted for 16% of surveyed sites, supported 64% of all stems.

High, Medium, and Low priority sites supported 8, 20, and 3% of all stems, respectively. Unranked sites supported only 6% of the stem count.

Table 3. Stem count and survey effort in the 2008 annual survey by site ranking category.

Rank	N	# Stems	# survey minutes
CORE	10	10,911	1,550
HIGH	6	1,366	776
MEDIUM	12	3,352	1,171
LOW	9	522	960
UNRANKED	24	974	1,217
Total	**61**	**17,125**	**5,674**

The number of stems counted at each site was classified into abundance categories that match the minimum viable population (MVP) stem count estimates found in the CS (Figure 4). The MVPs were derived from the relationship between mean stem count at a site and that sites' persistence during the period from 1979 to 2000. Each MVP corresponds to a different probability of persistence after 20 years; 30 stems to a 50% persistence probability, 300 stems to 75%, and 1,200 stems to a 90% probability of persistence. These MVPs were set as management targets for the different ranking categories. The goal for Core sites is to manage and restore them to a minimum of 1,200 stems in order to insure a 90% probability of persistence for the next 20 years. Likewise, the goal for High priority sites is a minimum of 300 stems and for Medium priority sites a minimum of 30 stems to ensure a 50% chance of persistence for 20 years.

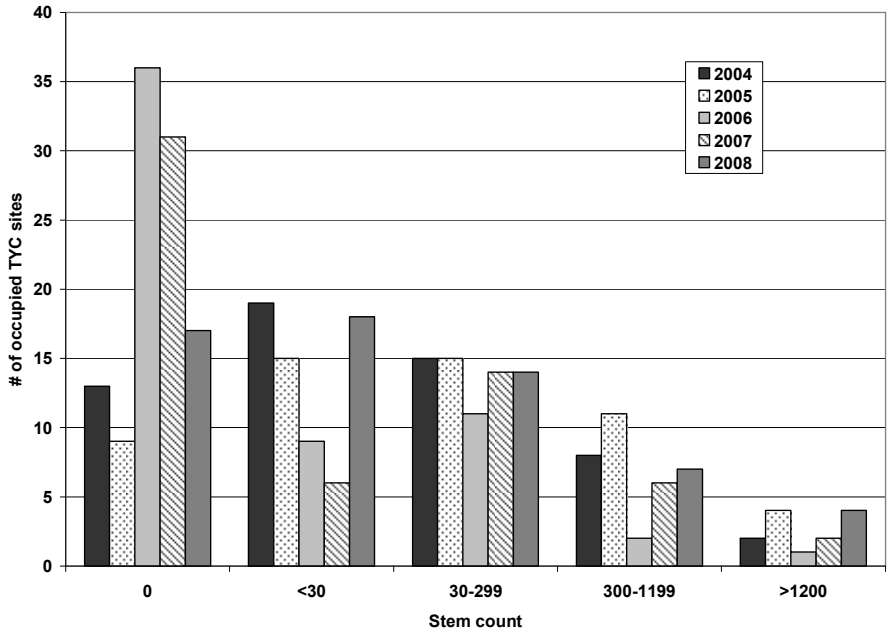

Figure 4. The number of occupied Tahoe yellow cress sites in 5 stem count abundance categories during 2004-2008. Each category corresponds to an MVP (see text for explanation).

As of 2003, a total of 37 sites had sufficient data to be ranked in a priority restoration category (Low =9, Medium=12, High=6, Core=10) while 24 sites remained Unranked (Table 4). From 2004 to 2008, the mean number of sites with actual stem counts in each abundance category (i.e. the mean value for each stem count category in Figure 4) is fairly close to the number of sites that are ranked in that category (Table 4). For instance, from 2004 to 2008 an average of 14 sites had annual stem counts between 30 and 299 stems, which is the target MVP range for the 13 Medium ranked sites. This indicates that the MVP target is continuing to accurately reflect what we see on the ground at Medium ranked sites. There is similarly good correspondence for High priority sites and it is evident that most unranked sites have not recently supported any TYC. However, 10 sites are ranked as Core, but only a mean of 3 sites actually supported a minimum of 1,200 stems during the last five years. This poor correspondence between stem count and rank for Core sites may be a function of the consistently high stem counts at Upper Truckee East. The mean stem count from 1979 to 2000 at UTE was over to 4,000 stems; more than 5 times the second highest mean stem count at Tahoe Keys (713). The inability of other sites to consistently support 1,200 stems indicates that the very large population at UTE may have skewed the target MVP for Core sites to an unrealistically high level. Since the MVPs associated with the other rankings appears to be holding in the post CS years, the Core site MVP could be re-evaluated using fitted curves that exclude UTE.

Table 4. The MVP stem count, corresponding ranking category, the number of ranked sites in each category in 2003, and the mean number of sites in each stem count category from 2004-2008 (* these are the mean of the values presented in each stem count category in Figure 4**)**

MVP Stem count	Ranking	No. sites in each ranking category in 2003	Mean no. sites in each MVP stem count category from 2004-2008*
0	Unranked	24	21
<30	Low	9	13
30-299	Medium	13	14
300-1199	High	6	7
>1200	Core	10	3

The majority of occupied sites were associated with creeks and these sites supported 81% of all stems counted in 2008 (Table 5). Large abundances of stems were recorded for Taylor, Burke, and Edgewood Creeks and the mouth of the Upper Truckee River. Of the ten core sites, only two are not associated with creeks (Tahoe Meadows and Lighthouse) but persistent clusters of plants at those sites are found near drainages. A creek tends to increase the amount of topographic diversity along the shoreline because it builds and erodes beach sands which are kept well-oxygenated and moisture rich. Sites at creek mouths also remain in open, early stages of succession due to disturbance by stream meandering. These conditions are optimal for TYC colonization and persistence.

Table 5. Ownership and stem count of occupied sites associated with creek mouths in 2008.

Creek	SITE NAME	Ownership	2008
Blackwood	Blackwood North	Private	15
	Blackwood South	Placer County	281
Burke	Kahle/Nevada	USFS	751
	4-H Camp/City Pump House	UNR/City	337
Cascade	Cascade Creek	Private	192
	CTC Cascade Creek	CTC	28
Cave Rock	Cave Rock	NV State Parks	1
Dollar/ Lake Forest/ Barton	Dollar Point	Private	18
Eagle	Eagle Creek/Avalanche	CA State Parks	354
Edgewood	Edgewood	Private	1,254
General	Sugar Pine Point State Park	CA State Parks	80
Logan House	Logan Shoals/Vista	Private	590
Mc Kinney	McKinney Creek	Private	37
Meeks	Meeks Bay	USFS	21
Rubicon/ Lonely Gulch	Rubicon Bay	Private	299
Secret	Secret Harbor	USFS	3
Skyland	Skyland	Private	2
Tallac	Tallac Creek (outside Enclosure)	USFS	69
	Tallac Enclosure	USFS	24
	Kiva Beach/Valhalla	USFS	1
Taylor	Taylor Creek Enclosure	USFS	2,586
	Taylor Creek	USFS	595
Upper Truckee River	Upper Truckee West	CTC	227
Upper Truckee River/ Trout	Upper Truckee East	CTC	6014
Ward	Ward Creek	Private	X
Zephyr	Zephyr Cove	Private/USFS	48
Total			**13,827**

Almost half (42%) of the occupied Tahoe yellow cress sites occurred on private lands, while 58% were on lands managed by public agencies (see Appendix C for site ownership). Private sites and those under mixed public/private ownership accounted for 31% of the counted stems. Protection measures were present on both public and private property. Permanent or temporary fenced enclosures are present at 9 sites on public lands: Sugar Pine Point (CSP); Upper Truckee East (CTC); Sand Harbor (NDSP); and Meeks Bay, Tallac Creek, Baldwin Beach (2), Taylor Creek, and Nevada Beach (USFS). The USFS installed a temporary fence around the 2006 experimental plantings at Pope and Nevada Beaches during the growing season to facilitate ongoing monitoring. On private lands, a fence has protected the cluster of plants at the creek mouth at Tahoe Meadows since at least 2004. At Edgewood Golf Course, hay bale wattles and some limited fencing are still protecting the erosion feature just north of Edgewood Creek that was colonized extensively by TYC in 2006. BMP Ecosciences conducted an experimental translocation of 50 plants from the erosion pit to the area around the creek mouth, but no fencing was installed around the plot (see section 3.2.3).

The most common recorded disturbances -- footprints, trash, boat dragging, beach raking -- were in evidence on occupied beaches. Canada geese were observed grazing and trampling Tahoe yellow cress along with other vegetation. Several non-native plant species occur along the shoreline, including the commonly encountered wooly mullein (*Verbascum thapsis*) and Bull thistle (*Cirsium vulgare*). These species occur in suitable Tahoe yellow cress habitat and could locally reduce abundance if not controlled.

2.3 DISCUSSION

The detection of Tahoe yellow cress at all 10 Core sites and 33 other priority and unranked sites during the 2008 annual survey means that there were a sufficient number of occupied sites that the AMWG can operate under Level 1 (normal conditions) of the Imminent Extinction Contingency Plan defined in the Conservation Strategy. At Level 1, no changes to the normal policies and guidelines for protection of existing occurrences and potentially suitable habitat are required.

Results of the 2008 survey reinforced several trends and management models. The cyclic model of Tahoe yellow cress presence was again reinforced when the lake level dropped and the number of occupied sites increased. Total abundance was increased but local abundance remained very low with the majority of occupied sites supporting fewer than 100 stems. Greater concentrations of stems were generally confined to sites with creek mouths which tend have more variable habitats. A greater majority of occupied sites were on public lands this year and the 8 public enclosures protected 9,691 stems, or 57% of the total 2008 estimated stem count. Fencing continues to be the predominant management tool for conservation on public property. Formal conservation measures on private property have yet to be implemented.

3.0 2008 RESEARCH ACTIVITIES

Just as the annual survey has provided valuable management data, results from research efforts have supported the adaptive management process. The 2008 research activities are divided into three sections. Section 3.1 presents the first year demographic data from the 2008 experimental reintroductions and the third year results from the 2006 experimental cohort. Section 3.2 presents the methods and results for translocations conducted in 2006 to 2008. Section 3.3 briefly summarizes genetic research using microsatellite DNA analysis.

3.1 EXPERIMENTAL REINTRODUCTIONS

Results from two experimental planting of container-grown plants are presented: the 2008 test of planting time and the third year results from the 2006 cohort. All surviving plants from the outplanted cohorts from the 2003 to 2005 experimental reintroductions were inundated in 2006.

3.1.1 TEST OF PLANTING TIME 2008

The research program was designed to address the Key Management Questions and results from experimental plantings from 2003 to 2006 have identified the optimal techniques, plant characteristics, habitat conditions, and logistical factors for restoration efforts. But a key question remained unanswered in 2007; when is the best time to conduct restoration outplantings of container-grown TYC? The regulatory window for TYC surveys and activities extends from June 15 to September 30, but past plantings have primarily been tested around the time of maximum lake elevation in June. Limited data from a later season planting in July 2004 suggested that late planting strongly limited growth and reproduction in both mesic and xeric microhabitats. The poor performance of the 2007 experimental translocation may be attributable to the late planting date on August 1st. Therefore, a second phase of experimental outplanting was initiated in 2008 to test plant performance at different planting times during the survey window for TYC. The research was funded as a task in a second R6 SNPLMA contract between the LTBMU and BMP Ecosciences.

The 2008 experimental design specified the following objectives:

- Plant at 4-5 sites and use individual plants as replicates.
- Install 50 founders at each site every four weeks for a total of 200 plants per site.
- Select the most optimal habitat as designated by elevation.
- Use founders derived from variable seed sources.

The greenhouse propagation for the 2008 experimental planting was again conducted in the NDF Washoe nursery. On January 17, 2008 seed was sown in supercells with greenhouse potting mix and covered with a thin layer of vermiculite to hold the seed in place. Seed was collected in September 2007 at five sites: McKinney Creek, Blackwood Creek, Taylor Creek, Upper Truckee East, and Nevada Beach. Approximately 400 cells of each seed lot were sown for a total of 2,000 cells. The plants were watered daily with a light fertilizer solution. By early April, the seedlings had created dense mats across the planting racks and were growing leggy. Racks were thinned by half to space plants and give them more light and opportunity for root growth. Detailed germination data was not collected, but no differential survival among the different seed lots was observed. Plants were removed from the greenhouse at four week intervals as needed for each planting event.

Initially, seven sites were identified as potential planting locations: Ward Creek, Blackwood Creek, Sugar Pine State Park, Lighthouse beach at the Tahoe Keys, Upper Truckee East (UTE), Tahoe Meadows, and Edgewood Golf course. Support for the project was mixed. The owners at Ward Creek had been receptive to the idea in 2007, but no permission was granted. The property owner association manager for Tahoe Keys agreed to send a flyer to the 11 lakefront properties on Lighthouse Beach, but it did not generate any response. A detailed letter was sent to the Tahoe Meadows Home Owner's Association and it was placed on the agenda for their annual meeting, but permission to plant was denied.

The outplanting was approved for the other 4 sites. The owners on the north side of Blackwood Creek continued to support outplanting as they had in 2007. Likewise, the California Tahoe Conservancy (CTC) again granted permission to utilize Upper Truckee East (UTE). New plantings were approved at Edgewood Golf Course and California State Parks approved planting at Sugar Pine State Park on the beach north of General Creek.

Planting began the week of June 16th and continued every four weeks through September 10th. A total of 784 plants were installed across all sites during the experiment (the design called for 800 plants, but 16 spaces were not planted because of rocks or other obstacles within the plots). During the period the lake declined from 6,225.5 ft to 6,224 ft LTD (see Figure 1). At UTE and Sugar Pine, container-grown founders were installed in single plots with plants from the four different planting dates randomly located within the plot. The plot at UTE contained 40 columns of plants oriented perpendicular to the water with 5 parallel rows (20 x 4 m) (Photo 1). It was located within the first 200 m of the enclosure in an area that had been planted as high beach in 2004 and 2005. At Sugar Pine the very rocky substrate made it necessary to be more flexible with the planting grid and the resulting plot was 14 x 4 m with 28 columns and 5 to 8 rows per column. At Blackwood, the plants were installed in two plots separated by about 20 m that contained 100 plants each in a 20 by 5 grid (10 x 2.5 m) (Photo 2). A grid design was not used at Edgewood. Instead, the four planting time treatments were set in clusters distributed throughout the back beach depression among the willows (Photo 3). All plants were spaced one half meter apart and marked with color-coded wooden stakes; plain for June, blue for July, green for August, and red for September. After each planting, newly planted individuals were hand-watered for 3 days.

To protect the plants on the private sites, laminated signs (8.5 x 11 inches) were placed on T posts to alert any passersby to avoid the experiment (Photo 4). At Sugar Pine, the plants were installed north of a point where a trail through the woods intersects with the beach, so CSP staff installed a single length of temporary fence along the south perimeter of the planting in order to divert foot traffic. The section of fence was equipped with the standard CSP TYC enclosure signage (Photo 5). New signs were placed on the permanent enclosure at UTE (Photo 6).

Survivorship of each plant was monitored at every planting time, continuing in October and concluding on November 6-7. Plant size was measured monthly from September to November. The first snow fell at the first of November and some plants had to be cleared of snow during the last monitoring period. November is generally considered to be outside of the growing season, but the monitoring was continued that late in order to have two months of data for the September cohort.

The total survivorship of each cohort at a site was evaluated across all monitoring months. Data from October is presented because it appeared to be the most representative of first year project success for all cohorts. Limited statistical analysis is presented for this report, but more robust analyses will be performed in combination with a second year of experimental data in 2009.

Total survivorship in October of all the container-grown plants installed across all four sites was 54.8% (430 plants). This survival rate, although low, is within the range of variation in total first year survivorship of all the past experimental cohorts (47 to 71%). Among the monthly cohorts, total survivorship ranged from 92% at UTE for the July cohort to only 10% for the June cohort at Edgewood (Figure 5). As expected, overall performance was greatest in the optimal habitat conditions within the enclosure at UTE and lowest under the drier conditions at Edgewood on the east shore. We had expected that total survivorship would decline over the season as conditions became drier, but such a linear pattern was not evident at any site. Founder performance declined steadily at Blackwood, but then rebounded to almost 90% in September. The opposite pattern was present at Sugar Pine, where survivorship steadily improved to its highest levels in August and September. The reasons for this are unclear, but it may by that cooler nighttime temperature in

September help to preserve the container-grown plants longer than expected. A more likely possibility is that the September cohort developed better root structure in the greenhouse over the summer and this enabled plants to persist once in the ground. The only site that had the expected reduction in survival in September was UTE. Our expectations that survivorship would decline as the season progressed was partly based on data from a late July planting at this site in 2004 that showed that pattern.

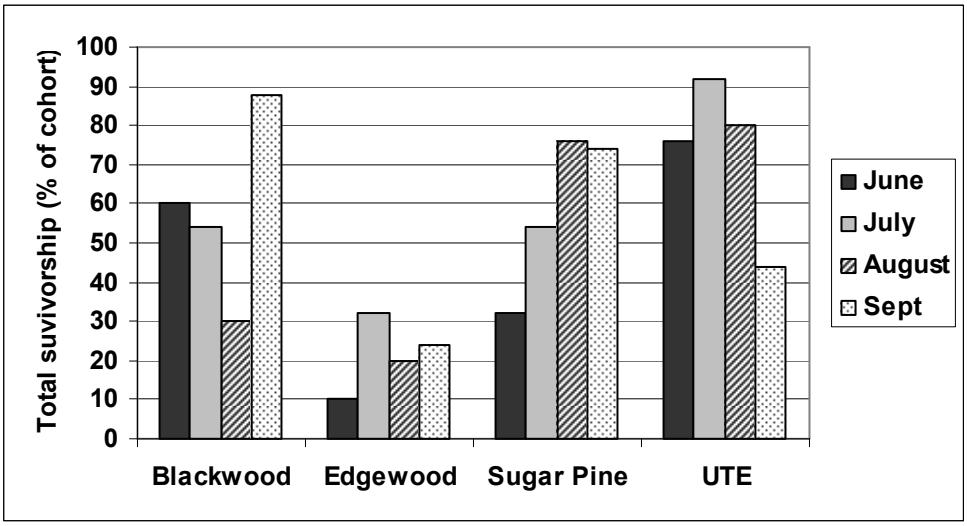

Figure 5. Percent total survivorship in October, 2008 of each founder cohort planted at monthly intervals at four sites.

Another unexpected result was the lower survivorship of the June cohort compared to July at all sites except Blackwood. Past plantings have been conducted almost exclusively in June under the assumption that optimal conditions occur in June when the lake level is at its peak. However, rather than cast doubt on the validity of past experimental plantings, the lower performance of the June cohort is likely a function of plant quality. Past results have definitively shown that low quality container-grown plants have reduced survivorship across all sites and habitat types. Although plant vigor was not qualitatively assessed (with a designation of Low or High) this year, the June cohort had rather poor root development from the overcrowding that initially occurred in the greenhouse. Subsequent cohorts had a greater recovery time, especially the September cohort.

While the total survivorship of each cohort presents an inconclusive picture of project success, the reproductive ability of each cohort in October is more straightforward. More plants from the June cohort reproduced than any other and reproduction failed completely in the September cohort (Figure 6). Founders at UTE appeared much more likely to reproduce overall than other sites, with more than 75% of both the June and July cohorts producing fruit. At Edgewood, reproduction failed in all cohorts except for three plants from June that managed to fruit. Reproduction at Blackwood and Sugar Pine was also disappointingly low. Less than 10% (18 plants) of the founders at Blackwood were reproductive in October, with apparently minimal differences between the cohorts. At Sugar Pine, 30% of the June cohort reproduced, twice as much as July, but overall, only 27 plants (13.5%) had fruit in October.

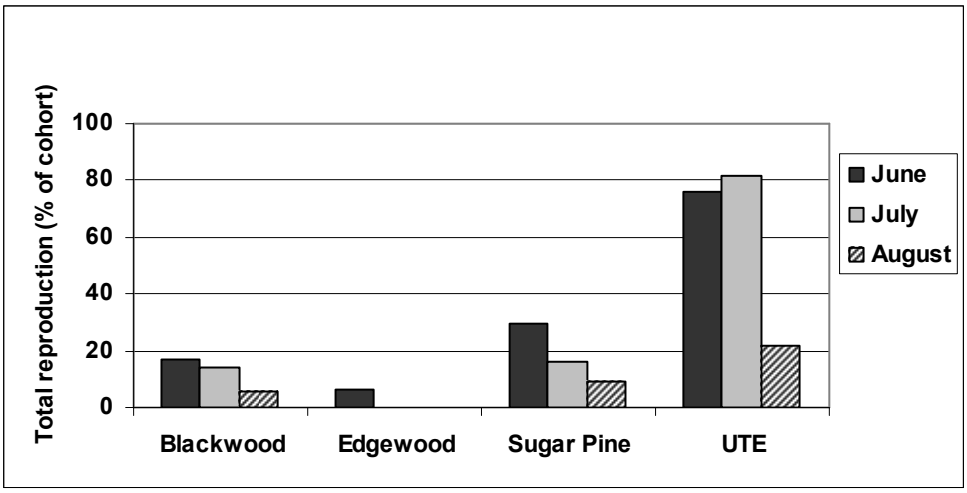

Figure 6. Percent total reproduction in October, 2008 of each founder cohort planted at monthly intervals at four sites (no reproduction occurred in September).

The poor reproduction is not surprising, given the small size of surviving plants in October. With the exception of one cohort at Sugar Pine and two at UTE, mean canopy size of all other surviving cohorts was less than 64 cm^2 (Table 6). Survivors in the June cohort at Sugar Pine were significantly larger at 167 cm^2 than the other cohorts at that site (ANOVA, Tukey-Kramer HSD $p<.01$). Likewise, founders from the June and July cohorts at UTE had a mean canopy size of over 250 cm^2, significantly larger than August or September. In comparison, the mean canopy size of surviving founders from the 2006 cohort in September, 2008 ranged from 101 to 253 cm^2 in most microhabitats, with plants as large as 624 cm^2 in the moist shoreline at Nevada Beach (see Table 7).

Table 6. Mean canopy size of founders from four cohorts in October, 2008 at four sites. (Values in a row followed by different letters are significantly different (ANOVA, Tukey-Kramer HSD $p<.01$)

		Mean Canopy (cm2)			
	N	June	July	August	September
Blackwood	116	31.5 **a**	25.0 **a**	23.3 **a**	16.6 **a**
Edgewood	37	64.1 **a**	16.4 **b**	8.8 **b**	1.8 **b**
Sugar Pine	129	166.6 **a**	62.8 **b**	42.0 **bc**	16.0 **c**
UTE	145	258.3 **a**	286.2 **a**	58.8 **b**	11.3 **c**

Sexual reproductive output was estimated based on an equation that links canopy size (area) to seed output by individual plants ($y=3.609x - 109.542$, $r = 0.81$, where y is the number of seeds per individual and x is canopy area in square centimeters) (see Figure 4 in Pavlik, Stanton, and Childs, 2002). Asexual reproductive output (cloning) was estimated from counts of plantlets that appeared within a few centimeters of the original founder. We often confirmed attachment of plantlets to founders by digging around the base of the founder to uncover the lateral underground roots that give rise to plantlets. In some cases the plantlets may have been a result of transplantation if severed roots simply regenerated new sections, rather than coming from new growth from normal vegetative segmentation, but there is no way to differentiate.

Both seed and vegetative reproduction provide a valuable metric for project success both within and among different experimental years. Total seed production in October from the 138 reproductive plants (17.6% of the total planting) surviving at all sites was estimated at 3,791 seeds. The greatest contribution was from UTE

(1,872 seeds), followed by Sugar Pine (1,278 seeds) and Blackwood (64 seeds). Vegetative reproduction only occurred at UTE, with a total of 333 plantlets. Of these, 90% were produced by the earlier planting cohorts with 39% produced in June and 51% in July.

Overall, plant performance was poor at three of the four sites. Founders only thrived at UTE, a site which has consistently out-performed other sites in previous plantings and clearly supports optimal habitat features. The substrate is relatively fine sand at UTE and the planting elevation ranged from only inches to one and a half feet above the lake. Some combination of higher elevation and poor substrates were the likely factors in the poor performance at the other three sites. The failed planting at Edgewood was in a back beach depression that appeared similar to adjacent occupied habitat, but at over three feet above the lake, it was higher than the area with established plants. The site supported greater vegetation cover and the apparently sandy substrate turned out to have a relatively thick fibrous root network from the sedges scattered across the area. The plantings at Blackwood were also over three feet above the lake. The substrate at the creek mouth was very rocky with small cobbles covering the surface and nearly devoid of vegetation. Sometimes the substrate under the surface was fairly sandy, but it was difficult to plant there. At Sugar Pine, the installation was close to the lake, mostly within one and a half feet above the water line. However, the substrate was also very rocky. The surface looked sandy in places, but large rocks were prevalent and at least 20 stakes were moved position to avoid rocks.

While multiple interacting factors lead to the largely poor performance, elevation continued to play a key role in survivorship and reproduction as it did in past experimental outplantings. In the ideal habitat at UTE, the 5 different planting rows in the plot grid had enough elevation differences that plants in row 1 experienced nearly saturated conditions for at least part of the season, while row 5 was up on the slope about around one foot higher above the lake level. One result was that founders in rows 4 and 5 were significantly smaller (only 87 and 79 cm^2 canopy area, respectively) and only 4 plantlets in row 4 and none in row 5 were produced through vegetative reproduction In contrast, plants in rows 1 and 2 were large (210 and 217cm^2 canopy area) and produced 290 plantlets. The gradient was apparently so sharp, that founders in row 1 produced twice as many plantlets (194) as those in row 2 (96).

3.1.2 2006 Experimental cohort

During 2006, 1,175 container-grown Tahoe yellow cress (founders) were outplanted at seven enclosures: Lester Beach at D.L. Bliss State Park (CSP), at Taylor and Tallac Creek at Baldwin Beach (USFS), Ebright Beach (USFS), Pope Beach (USFS), Upper Truckee East (CTC) and Nevada Beach (USFS). Founders were installed in four different microhabitats: moist shoreline, high beach, meadow, and scrub. These microhabitats were defined chiefly by the elevation above the lake and each represented different moisture and topographic regimes.

The cohorts planted at D.L. Bliss and Ebright were not monitored after 2007. At D.L. Bliss, the beach topography within the enclosure was high above the shore with stabilized vegetation and low soil water availability. Only 6 plants (6%) of the 2006 outplanting survived to September 2007 and the fence was removed in 2008. At Ebright, no identification stakes were left in the plot and only 7 plants were present (7% of the 2006 cohort) in early 2007. The plot was abandoned due to lack of any further useful information.

Monitoring at the other 5 sites continued into 2008. Total survivorship across all sites declined from 71% in the first year to 40% in the second year and to 34% in 2008. Most of the decline is attributable to a failure of founders to establish in the meadow habitat. First year survivorship across the three sites with meadow habitat was uniformly high (82-85%) with moderate seed production, but only 13% persisted into their second year with almost no reproduction. By 2008, only 2% of meadow founders (3 plants) persisted compared to 54% of the founders in the high beach and scrub and 57% in the moist shoreline (Table 7).

Microhabitat differences also explain much of the variation in overall site performance. The 2006 cohort in the meadow planting at UTE had completely failed by the third year. The other four sites supported more than one type of habitat in 2006 and total survivorship in the third year ranged from 70% at Nevada to only 13% at Taylor, with 48 and 44% of founders surviving at Pope and Tallac, respectively. If the founders from the failed meadow habitat at Tallac and Taylor are excluded, then total survivorship at Tallac increases dramatically to 66% (comparable to Nevada) but only to 19% at Taylor. The low survivorship in the high beach at Taylor is likely a function of a higher absolute elevation of the plot above the lake compared to the plots at Nevada and Pope. Likewise, the lower survivorship of founders in the moist shoreline at Pope compared to Nevada is also likely a function of plot elevation. The moist shoreline plots at Pope were closer to the water line and therefore subject to a greater degree of inundation.

Table 7. Third year survivorship and reproductive output of the 2006 founder cohort at five sites in different microhabitats by September 2008.

Site and Habitat	Founders (# planted)	Survivorship (%)	Reproduction (%)	Survivorship to reproduction (%)	Mean canopy area (cm2)	Mean seed output (per plant)	Total seed production
Nevada							
High Beach	100	70.0	91.4	64.0	253.2	934.1	56,978.2
Moist shoreline	48	89.6	100.0	89.6	624.1	2143.1	92,152.1
Scrub	50	54.0	88.9	48.0	188.2	755.8	15,871.8
Pope							
High Beach	100	58.0	93.1	54.0	229.4	757.8	40,919.4
Moist shoreline	50	28.0	85.7	24.0	167.8	580.0	6,960.4
Tallac							
High Beach	150	66	89	59	101.0	503.4	28,189.5
Meadow	75	0	0	0	0	0	0
Taylor							
High Beach	100	19	79	15	124.7	475.7	6,660.1
Meadow	50	6	100	6	18.7	29.5	29.5
UTE							
Meadow	250	0	0	0	0	0	0

The role of planting elevation relative to lake level is being investigated in the ongoing meta-analysis of the 2003, 2004, and 2006 data (2005 has been excluded due to poor initial container-grown plant quality). The analysis is replacing the qualitative designation of habitat with measured elevation above or below the lake. For instance, plots in the moist shoreline were generally located from 0 to .5 feet above Lake Tahoe across all years while the high beach plots varied according to lake elevation in each year. In low water years (2003 and 2004), the plots considered high beach

were generally three to four feet above the lake, but when the lake was high (2006) they were only 1 to 2 feet above the lake. Using the absolute planting elevation above Lake Tahoe (which is presumed equal to the elevation above the water table) enables a more robust comparison across all years and will facilitate the development of specific outplanting recommendations.

Finally, an interesting pattern emerged in the third year data from the 2006 cohort. The proportion of founders that survived to reproduce stayed relatively constant over time, despite fluctuating lake level. A total of 34% of founders survived to reproduce in September the first year in 2006 when the lake was high (6,228 ft LTD). By 2008, the lake had dropped four feet (to 6,224 ft) and the rate of reproduction declined only slightly to 31%, indicating that first year reproduction may be a good predictor of founder establishment. One might expect that the declining water table would increase stress on the surviving plants and possibly decrease growth. In fact, plant size and therefore the estimated seed output per plant were two to three times greater in 2008 than they were in 2007 (2007 data not shown, 2008 is in Table 7). Across all sites, seed output increased from 143,429 in the second year to 247,760 seeds in the third year in 2008.

3.2 TRANSLOCATION

Translocation involves moving established plants in the field from one location (the donor) to another location (the receptor), either at the same or different site. The California Department of Fish and Game (CDFG) supported the translocation research with $48,000 in Section 6 funds that were contracted to BMP Ecosciences in 2006 that will support work until March, 2009. The objective of the research is to test translocation as a potential restoration/mitigation option for unavoidable impacts of construction or other development projects on the shores of Lake Tahoe.

3.2.1 2006 TRANSLOCATION

In 2006, the AMWG approved a pilot-scale translocation of experimental individuals of Tahoe yellow cress that had been outplanted as part of a reintroduction project. In June, 2006 a total of 38 three-year old founders from the 2003 cohort were moved from Zephyr Cove to Tallac Creek and 30 one-year old founders from the 2005 cohort were moved from Pope Beach to Taylor Creek. First year plant performance was far superior at Tallac compared to Taylor. Two factors were identified as a possible cause; 1) plant age and 2) planting elevation. The plants from Zephyr Cove were 3 year olds with extensive root development, while the plants from Pope were one-year-olds with root systems that in many cases were still confined to the potting soil cone of the container. It is likely that the greater root development of the older plants gave them an establishment advantage. The other potential factor in the differential performance was that the plots at Tallac were positioned one foot closer in elevation to the lake than the Taylor plots. This resulted in significantly higher mean predawn water potentials in founders at Tallac in August, 2006 than in Taylor founders, indicating that the Tallac founders were experiencing less baseline water stress in the middle of the growing season (data not shown).

By the third year after translocation, a total of 19% of the translocated plants had survived to reproduce in September.(In comparison, 31% of the 2006 container-grown cohort survived to reproduce by the third year.) The differential in first year survivorship and reproduction between the

two sites was still evident, 16 founders (44%) were reproductive at the Tallac receptor site while only 3 plants (10%) were present at the Taylor receptor site (Table 8). The Tallac founders were moderate in size (mean canopy size, 107.0 cm^2) while the three Taylor survivors were large (mean canopy 193.0 cm^2) (data not shown).

The most important measure of the success of translocation as a restoration method is of course reproductive capacity. Estimated total seed output of the translocated plants across the three year monitoring period fluctuated from 10,142 seeds in 2006, to 2,993 in 2007, to 6,268 in 2008 (Table 8). The cumulative reproductive output of 19,403 seeds from the survivors may represent a significant contribution to the reproductive dynamics of the species and therefore may lower the perceived risk of testing translocation as a potential mitigation/restoration tool.

Table 8. Cumulative reproductive output of the 2006 translocation at two receptor sites from 2006 to 2008.

Site	# translocants	# Reproductive survivors			Estimated annual seed production		
		2006	2007	2008	2006	2007	2008
Tallac	36	24	12	16	10,132	1,722	4,506
Taylor	30	1	6	3	10	1,271	1,762

Another factor that lowered the risk of experimental translocation was that 15 of the 30 original donor plants at Pope Beach re-sprouted later in the 2006 season after being removed. By 2008, approximately 20 re-sprouted donor plants were present in the same location as the original donor plants. While the 15 plants were clearly re-sprouts it is not clear if the additional 5 plants that appeared between 2007 and 2008 is the product of delayed re-sprouting or new recruitment. Estimated seed production of the 20 plants at Pope was 16,564 in 2008.The Zephyr Cove donor site was completely inundated and the translocation ultimately saved 16 of those 36 donor plants from certain inundation. There were 39 TYC (20 re-sprouts + 19 translocated donors) living in the third year of the experiment, which represents a net gain of 9 plants over the 30 plants donated to the experiment from Pope, assuming that all of the plants at Zephyr Cove would have been lost without translocation. It is possible that the donor plants at Zephyr Cove would have re-sprouted in the future when the water declined if they had not been removed from the site. Still, the outcome of translocation in this particular experiment resulted was positive.

3.2.2 2007 TRANSLOCATION

The high lake elevation in 2006 inundated all past cohorts so there were no outplanted Tahoe yellow cress available for a translocation experiment in 2007. Therefore, the AMWG approved translocation of naturally occurring TYC, but imposed a limit of 10% of the naturally occurring stems that emerged at a site in 2007 (these will subsequently be referred to as “donor” stems or plants). To ensure that the arbitrary limit of 10% would produce statistically valid results, BMP analyzed the variances in the data from the 2006 translocation and the 2006 outplanting and determined that the 50 container-grown plants used in blocks in past outplantings represented a sufficient sample size.

The 2007 experimental design was developed to test the question: Do the methods of translocation (of naturally occurring TYC) and outplanting (of container-grown TYC) result in the same demographic performance (i.e. survival and reproduction rates) in a given microhabitat? The

experiment utilized a paired-design of one container-grown plant for each naturally occurring translocated plant, with 50 replicate pairs per site. For each pair, a naturally occurring plant from the donor location was translocated to the receptor location and a container-grown plant was outplanted one half meter away at the same elevation. The translocation took place in August at Upper Truckee East and Blackwood Creek. Implementation was delayed until August because the AMWG was debating the terms of using naturally occurring plants in the experiment and because of obstacles in site selection. The original experimental design had a more robust experimental sample size of 7 sites, including three USFS enclosures (Taylor Creek, Baldwin Beach, Meeks Bay), Edgewood Golf Course, and Ward Creek in addition to UTE and Blackwood. However, efforts to install the experiment at the other sites stalled until it was too late in the season to proceed.

Overall first year performance was poor at both sites. Total survival rates were 45 and 51% at Blackwood and UTE, respectively. No reproduction occurred and the surviving individuals were very small with a mean canopy size of 3 to 6 cm^2. The pattern of survivorship of container-grown and translocated plants was different between the sites. Although a greater proportion of translocants than container-grown founders survived at UTE, it was not significant. At Blackwood,significantly more container-grown founders survived.

At the first monitoring event in June, 2008, all but 20 of the 100 stakes at UTE had been removed and incorporated into some "beach art". Only 4 to 6 plants were apparent in the transplanted area- the only likely survivors. The failure of the experimental translocation at this site is the combined result of a late planting date in 2007 that did not allow the plants sufficient time to establish or reproduce and a lack of adequate fencing and signage protecting the experiment and discouraging vandalism.

At Blackwood, a total of 28 small vegetative plants were present in June, representing 28% of the 2007 experimental cohort. Of these, more container-grown plants (17) were present than translocants (11), which is similar to the pattern observed at end of the 2007 growing season. However, by August only 8 plants (4 of each treatment) were present and only two of those had fruit. By September, only 4 tiny, non-reproductive plants were present (2 of each treatment). This planting was not vandalized. While the decline in survivorship over the 2008 season may be the result of the two foot decline in lake level during that period, the ultimate failure of this experiment is likely due to the very late planting date in 2007. The founders that survived to the end of the first year were very tiny and did not reproduce and therefore the plants that appeared at the beginning of the 2008 were the re-sprouted material from what may have been very poorly developed root stock. Third year results from the 2006 cohort of container-grown plants indicate that first year reproduction may be a good predictor of the ability of plants to establish and survive into future years. It may follow that the lack of first year survivorship at Blackwood precluded survivorship in the second year. Since no further useful information could be obtained, the stakes were removed in September.

3.2.3 2008 TRANSLOCATION

The initial objectives of the 2008 translocation were to test translocation of naturally occurring TYC and outplanting of container-grown TYC:

- at a minimum of four sites
- under optimal lake level conditions (near peak level, early in season)

- in optimal available habitat

The guiding key management question was simple: Does translocation of naturally occurring TYC and outplanting of container-grown TYC result in the same rates of survival and reproduction?

In response to the uncertainly of the 2007 translocation, the AMWG set new site selection criteria for the 2008 experiment. Eligible sites required a 2007 stem count greater than 400 stems. The threshold of 400 stems was based on the minimum viable population (MVP) analysis contained in the Conservation Strategy that identified a population size of 300 stems as affording a 75% chance of persistence over 20 years. Since a total of 50 individuals were proposed for translocation at each site, the threshold value was set higher than 300 in provide a buffer and ensure a final stem count greater than 300.

Of the 30 sites that were occupied in 2007, seven had stem counts greater than 400, all of them Core or High priority : Ward Creek, Blackwood Creek, Eagle Creek Avalanche, Taylor Creek, UTE, Edgewood, and Nevada Beach. Sites were eliminated for various reasons. Some of the owners at Ward Creek were again receptive to the idea (they were approached in 2007), but apparently at least one member of the trust was not supportive and no permission was granted. At Blackwood, the owners were very supportive of the project but the north side of the creek only supported 305 stems and was instead used for the experimental test of outplant timing. The south side of the creek is operated as public property below high water, so fencing would have been required, but it was not apparent how that could be accomplished. Eagle Creek/Avalanche was considered too small and variable. Nevada and Taylor were withdrawn because the USFS did not support the translocation experiment of naturally occurring individuals on FS lands, citing Regional direction (FSH 2609.25.10.15.20). Consequently only two sites were selected; California Tahoe Conservancy (CTC) again granted permission to utilize Upper Truckee East (UTE) and Edgewood Golf Course gave permission to utilize the beach adjacent to the golf course..

The 2008 experiment utilized the same paired-design from 2007 with one container-grown plant for each naturally occurring translocated plant, with 50 replicate pairs per site. For each pair, a naturally occurring plant from the donor location was translocated to the receptor location and a container-grown plant was outplanted one half meter away at the same elevation. The translocation took place at Upper Truckee East (a California Tahoe Conservancy (CTC) property) on June 17th. At Edgewood Golf Course, which is private property in Nevada, the translocation took place on June 18th. The lake level was 6,225.5ft LTD, the peak for the season (see Figure 1). As in past experiments, the plots were watered for three days after outplanting/translocation and monitored at 2, 4, and 8 weeks.

At Edgewood, donor plants were removed from the eroded pit just North of Edgewood Creek that formed as a result of a storm in January 2006 (Photo 7 and 8). The receptor area was about 150m down the beach just south of the creek mouth that has historically supported TYC, although TYC has not been observed in the area since 2005. At UTE, donor plants were taken from two locations; 18 plants were moved from outside the enclosure from Harootunian Beach at the east end of the site near where Trout Creek breeched the dune in 2006 (Photo 9); donor plants were also moved from the west end of the beach near the Upper Truckee River from an area that supported thousands of plants (Photo 10). The receptor location was at the east edge of the enclosure where the 2007

translocation had occurred. Only 6 plants from the 2007 were apparent in June and the area was mostly clear of naturally occurring TYC at planting time.

Overall total survivorship of both container-grown and translocated plants was high at both sites, with 73 and 94% of the cohort surviving at Edgewood and UTE, respectively. No difference was observed in survivorship or reproduction rates between container-grown founders and those that were translocated at UTE (Figure 7). However, a significantly greater proportion of translocated than container-grown founders survived to reproduction at Edgewood according to the contingency analysis ($p<0.001$ for both Pearson's Test and Fisher's Exact Test). In contrast to the very poor growth observed in the 2007 experimental translocation, plant growth at both sites was robust. Within a site, the mean canopy size of translocated and container-grown founders was nearly identical, but the mean canopy size of plants was significantly greater at Edgewood than UTE (Figure 8). During the September planting at Edgewood, the monitoring crew observed sprinklers from the golf course reaching the translocation plot on the beach to the point of saturation. The sprinkling systems are hand positioned on the course so this may have not been a regular occurrence, but even the periodic addition of water would have contributed to substantial plant growth and is likely responsible for the observed difference in plant between the sites.

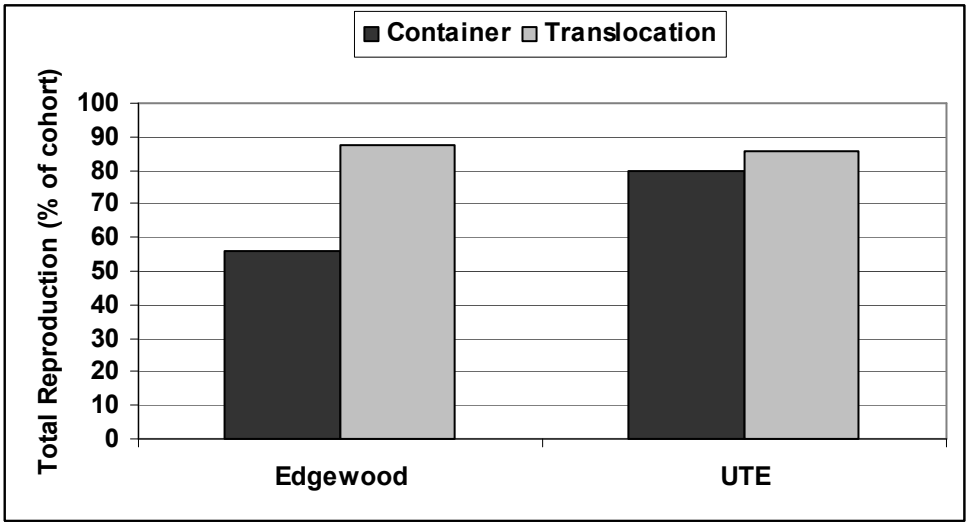

Figure 7. Percent total reproduction in September, 2008 of container-grown and translocated plants at two sites.

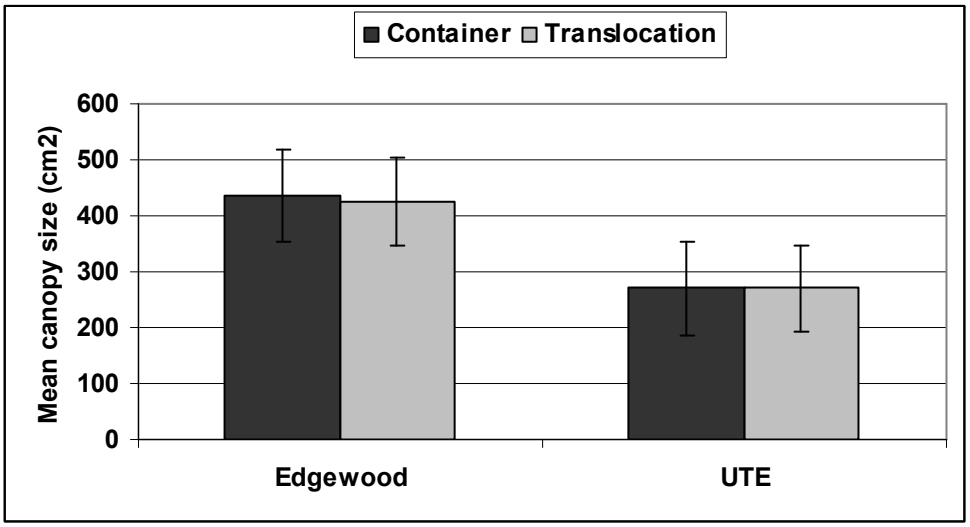

Figure 8. Mean canopy size in September, 2008 of container-grown and translocated plants at two sites.

The explanation for the better performance of translocated founders over container-grown plants at Edgewood is not clear. Several hours after the installation in June, the planting crew returned to find that two container-grown plants had been uprooted- presumably by Canadian Geese. These were re-planted, but some damage was noted within the plot during watering over the next three days. Generally, the container-grown plants are placed in the ground with the soil from the potting tube still intact because the roots are holding it together in a conical shape, although the soil tube will fall apart if there is poor root development (Photo 11). In contrast, the process of uprooting a naturally occurring TYC is an excavation process that gradually exposes a bare root structure composed on one to many root stems and some degree of fine root network (Photo 12). Eventually the main root stem breaks, sometimes after only 10 cm of root have been exposed, other times after more than 50cm is visible. The clonal growth of the plant makes it virtually impossible to manually remove the entire root from the ground. One would expect that the intact soil tube in container-grown plants would help buffer from transplant shock and by providing a "sponge" that holds more water than the surrounding sand substrate.

3.3 GENETIC RESEARCH

Microsatellite DNA analysis has become the preferred tool in the field of conservation genetics for questions regarding population genetic structure and source-sink dynamics. A microsatellite is a short block of DNA that is repeated many times within the genome. The repeated sequence is very simple, consisting of two, three or four nucleotides. The lab uses VNTRs (variable number tandem repeats) which are repeating DNA sequences that are created from small errors in DNA replication. Many repeats tend to be concentrated at the same locus and the number of repeats at a particular locus is hypervariable (highly polymorphic) between individuals of the same species.

Microsatellite loci can be isolated from genomic DNA and then amplified using PCR (polymerase chain reaction) technology. High levels of variability at the microsatellite loci permit resolution of fine scale spatial and temporal patterns in order to assess recent genetic bottlenecks, determine founder effects and how the metapopulation dynamic maintains genetic variation.

The Lab for Ecological and Evolutionary Genetics at the University of Nevada Reno (UNR) is conducting the genetic analysis using microsatellite DNA. The lab, headed by Dr. Mary Peacock, set up a contract for $50,000 in SNPLMA R7 funds with the USFS in early 2008 to 1) screen 4 newly developed genomic libraries for a sufficient number of variable markers and 2) screen recently collected TYC samples from previous TYC surveys (2006 and 2007). Dr. Peacock submitted a detailed progress report for work conducted in 2008 to the AMWG on February 25, 2009 (Appendix). A brief summary is provided below.

A total of 14 microsatellite markers were developed, 5 of which are heterozygous. Pairwise comparisons between 17 sample sites revealed statistically significant genetic differences among several pairs of sites. The main pattern that emerged was that samples from Blackwood North and South were significantly genetically different from four south shore sites (Baldwin Beach, Nevada Beach, Tahoe Keys, and Taylor Creek) and Nevada Beach and Ward Creek were also significantly different from each other. This apparent genetic differentiation of a subset of populations in the west (Blackwood and Ward) from the subset of populations in the south means that there is a possibility of genetic isolation among TYC populations. In addition, two rare alleles were identified at two loci. The same rare allele was present only at Tahoe Keys, Taylor Creek, Upper Truckee East and Ward Creek and within an outplanted sample from Pope Beach. The sampled population at Tahoe Keys had an additional rare allele. Further analysis will be required to refine and expand these observations to increase our understanding of TYC genotype patterns across the landscape.

3.4 MANUSCRIPT PUBLICATION

Three manuscripts for publication in peer-reviewed scientific journals are in development. The first manuscript was submitted in July to the Society of Ecological Restoration's journal Restoration Ecology. The paper will be included as part of the conference proceedings of the international meeting held in San Jose in 2007 within a special session on Lake Tahoe.

Doing Adaptive Management: Improving the Application of Science to the Restoration of a Rare Tahoe Plant

Bruce M. Pavlik[1], Alison E. Stanton[2], Gerald Dion[3], and Dennis D. Murphy[4]

Abstract

Adaptive management is probably the best available structure for linking science with decision-making when conserving biological resources. We have found that implementation of adaptive management can be successful if: 1) the conceptual model of the adaptive management process is modified to include benefits to biological resources in situ, 2) all stakeholders participate upfront in the strategy and design of the program, 3) key management questions are used to focus data collection and identify beneficial management actions, and 4) information flow and the sequence of project stages are clearly structured to facilitate stakeholder responses within a reasonable timeframe. These guidelines are illustrated using our experience with Tahoe yellow cress (*Rorippa subumbellata*), a plant endemic to the shores of Lake Tahoe in California and Nevada and a candidate for protection under the Endangered Species Act. The project provides an

operative example of science-driven decision-making that has been ongoing for eight years. Several corollary ingredients are identified that have improved the chances of project success and helped to sustain the long-term effort.

Two other papers are in development that will be submitted to the journal Biological Conservation as a pair. The first paper will focus on the biological evaluation of TYC and analysis of the long-term monitoring data that lead to an understanding of the life history dynamics of the species (see abstract below). This paper is in the final revision process. The second paper will focus on the adaptive management framework and will be titled Developing a Conservation Strategy for Tahoe yellow cress: II. Accommodating Metapopulation Dynamics with a Framework for Restoration and Adaptive Management

Developing a Conservation Strategy for Tahoe yellow cress (*Rorripa subumbellata*): I. Using Long-term Monitoring to Characterize Metapopulation Dynamics

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ABSTRACT

Applying a metapopulation perspective to the *in situ* conservation of a rare plant species is possible if a long-term occurrence/ absence dataset is available. A monitoring program for Tahoe yellow cress (*Rorippa subumbellata)*, a species endemic to the shores of Lake Tahoe in California and Nevada and a candidate for protection under the Endangered Species Act, was initiated in 1979. The long-term dataset provided evidence of extirpation and colonization events that indicate a mainland-island metapopulation dynamic is at work which allows the species to persist despite fluctuating lake elevations. A subset of high quality records were statistically combined to show that lake level is strongly correlated with presence around Lake Tahoe such that the number of sites occupied by TYC declines as lake level rises. Sites that supported a greater number of stems (an indicator of population size) were more persistent over the 20+ year monitoring period. The logarithmic relationship between stem count and persistence made it possible to estimate the minimum stem count required for varying probabilities of persistence. These stem counts represent a demographically based minimum viable population (MVP). The goal of the recovery process for TYC recovery is to utilize the MVP estimates as conservation target for native, created and managed populations in the effort to promote conditions that reestablish a positive metapopulation dynamic.

A technical report on the expanded analysis of the 2003-2006 experimental data: "Implementing the Conservation Strategy for Tahoe yellow cress VII. Management and science implications of multi-year experimental reintroduction" will investigate the aggregate effects of genetics, microhabitat, or water relations on founder performance (a founder indicates an outplanted individual associated with a particular cohort). The report will present specific restoration prescriptions according to lake level, founder genotype, microhabitat, and expected persistence that specifies the how, what, when, and where for successfully outplanting TYC. This report is expected to be available before June 2009.

4.0 PRIVATE LANDS CONSERVATION

4.1 STEWARDSHIP PROGRAM

The Conservation Strategy specifies that a stewardship program is an integral piece of successful TYC conservation because up to 50% of TYC is located on private land. A new Stewardship committee was formed in 2007 with a goal to create and distribute educational materials about conservation of TYC to interested businesses and landowners and to facilitate research on private lands. A grant of $70,400 from the U.S. Bureau of Reclamation (BOR) was awarded to the University of Nevada Reno Cooperative Extension to fund Leslie Allen's participation and develop materials. Draft versions of a tri-fold brochure and a postcard were developed and submitted to the AMWG for comments.

Although the AMWG provided input, the draft materials were not moved forward to publication. At the August AMWG meeting, Leslie informed the group that the emphasis of her position in Cooperative Extension had shifted toward horticulture and that UNR no longer supported her involvement in the TYC project. In response, BOR rescinded the award to UNR for non-performance, but indicated that it would be possible to re-obligate the TYC project funds before July 2009. The preferred recipient would be another non-federal entity (i.e Tahoe RCD). At the November AMWG meeting, NRCS tentatively agreed to fill the gap left by UNR and cover printing costs of the tri-fold and rack card with general funds through the Government Printing Office (GPO). Several additional steps to propel the stewardship effort were identified at the November AMWG meeting:

- AMWG needs to develop a new list of Tasks and Deliverables in early 2009 and identify a new recipient for the BOR grant.
- Publish the tri-fold brochure rack card for water sport purveyors and other lakefront businesses before Memorial Day 2009
- Develop and send annual survey letter notification to private properties in Nevada and California
- Complete and review Site Specific Information Sheets for all private sites.

4.2 PRIVATE LANDS CONSERVATION

NRCS secured another SNPLMA grant of $45,000 to provide technical assistance to private landowners interested in protecting TYC on their lands. A total of 18 private sites were identified that have a sufficient annual survey record to rank them according to their long-term viability (Table 9). This group includes 5 Core, 4 High, 4 Medium, and 5 Low Priority sites. An additional 8 private sites do not have sufficient annual survey data, either because of too many missed survey years or that plants were only detected within the last several years. Initially, stewardship efforts should target only ranked sites while annual survey data continues to accumulate for the unranked locations. However, portions of several privately owned sites are managed for public access and these may make less desirable targets for stewardship; at Blackwood South, Placer Co. allows public access

below high water, half of Tahoe Keys is open to all TKPOA members, there is no impediment to access the shoreline at Cherry St along 89, and all of Timbercove is heavily used by the public.

In August 2008, Jerry Owens (NRCS) developed a draft template for a private property Stewardship Plan. The first section of the plan contains information on site description, population characteristics, and potential threats that is similar to that found in the Site-specific Information Sheets. Landowners that adopt a Plan and assume stewardship of their TYC plant community have the option of selecting practices which may require an investment in time and money (Active Stewardship) or informed attentiveness (Passive Stewardship). Depending on the lake level the property owner may select from different Stewardship Practices that are based on the NRCS Code of Standard Practices. Three Practices are specified: Use Exclusion, Habitat Enhancement, and Monitoring. Use Exclusion includes actions that help people to avoid TYC including verbal deterrence and demarcation of plants or suitable habitat with natural barriers or fencing. Habitat Enhancement may utilize planting of container-grown TYC (if and when available), weed removal, or potential SEZ protection measures at creek mouths. Monitoring actions could include participation in the annual survey, photo monitoring, or data collection for restoration plantings. The property owner could also opt not to engage in any stewardship practices. The AMWG and the Executive Committee discussed ways that this type of plan could become part of the regulatory process and TRPA indicated that it would favor making the plan template available for project proponents as a way to satisfy permit requirements. The AMWG will need to further review the details of this is 2009.

Table 9. Restoration priority rankings for 18 private sites. (Sites with an * are partially or entirely manages for public access.)

CORE	**HIGH**	**MEDIUM**	**LOW**
Tahoe Meadow	Cascade Creek	Logan Shoals Vista	Cherry St/Tahoe Swiss Village*
Lighthouse	Zephyr Cove (private half)	McKinney North/Shores	Tahoe Keys*(TKOA)
Blackwood South*	Ward Creek	Rubicon Bay	Tahoma*?
Blackwood North	Glenbrook	Timber Cove*	Dollar Point
Edgewood			McKinney Creek
UNRANKED - Insufficient survey data			
Sunnyside			
Tahoe Pines (Fleur Du Lac)			
Jameson			
Skyland			
Crystal Point			
Marla Bay			
Meeks Vista			
Elk Point			

5.0 2008 AMWG CONSERVATION ACTIVITIES

The CS contains a list of conservation responsibilities (Table 14 in the CS) that has become the foundation of a 5 Year Management Plan that guides all AMWG activities related to Tahoe yellow

cress conservation. The Management Plan specifies actions and the responsible entities for a 5 year period for five categories: Funding; Management; Regulation; Research and Restoration; and Stewardship. Although the AMWG did not update the plan in 2008, and therefore the spreadsheet is not included as an appendix in this report, the activities and accomplishments of 2008 are discussed. It is expected that the AMWG will resume the annual update of the plan in early 2009.

5.1 AMWG MEMBERSHIP

The Adaptive Management Working Group (AMWG) consists of representatives from 11 stakeholder agencies, the Tahoe Lakefront Owner's Association, and the private consultants at BMP Ecosciences (Table 10). Although they are not a signatory on the MOU, NRCS is a funded and active participant. No representative from CTC attended meetings in 2008 except for the Executive Meeting in September. The Forest Botanist position at the LTBMU, vacant for all of 2007, was filled in February with Cheryl Beyer.

Table 10. Membership of the Tahoe yellow cress Adaptive Management Working Group (AMWG) in 2008.

Agency or Entity	AMWG Representative
TRPA	Eileen Carey
USFWS	Steve Caicco, Botanist, (meeting facilitator)
USFS LTBMU	Cheryl Beyer, Forest Botanist
	Stu Osbrack, Botanist
NDSP	Peter Maholland, Conservation Staff Specialist
NDF	Roland Shaw, Forester
NNHP	Jennifer Newmark, Administrator/Program Biologist
CDFG	James Navicky, Environmental Scientist
CSP	Tamara Sasaki, Environmental Scientist
CTC	Adam Lewandowski, Conservancy Program Analyst II
CSLC	Eric Gillies, Environmental Scientist
TLOA	Jan Brisco, Executive Director
BMP ECOSCIENCES	Bruce Pavlik, Principal and Alison Stanton, Research Botanist
NRCS	Jane Schmidt, District Conservationist
	Jerry Owens, ?

5.2 AGENCY ACTIVITY REPORTS

The CS requires a brief summary of annual agency staff time and expenditures on conservation and management activities specific to Tahoe yellow cress (Table 11). All agencies submit a generalized Agency Activity Report form with itemized expenditures for staff time and other materials for site-specific conservation activities for Tahoe yellow cress sites within their jurisdiction and for general Tahoe yellow cress conservation activities (i.e. public outreach, consultation, AMWG participation, etc.). The form also allows comments on significant disturbances to the species or its habitat and subsequent response; planned Tahoe yellow cress conservation activities anticipated for the upcoming year; and listing of all shorezone projects undertaken within potentially suitable Tahoe yellow cress habitat. Agency Activity Report forms for 2008 are supplied in Appendix E. In 2008,

the number of staff hours spent on Tahoe yellow cress amounted to at least 1,649 hours, of which over 300 hours were for the annual survey. Total in-kind cost contributed by each agency for all staff time and materials amounted to a minimum of $66,377 (some agencies did not report expenditures), not including any contracted funding. Contracted funding is discussed in Section 6.1.

Table 11. Summary of agency hours spent on Tahoe yellow cress related activities during the 2004-2008 period.

Agency/Year	2004	2005	2006	2007	2008
TRPA	326.5	200	No report	No report	77
USFWS	390	70	60	80	80
USFS	516.5	980	1,240	700	520
NDSP/NDF	333	89	116	54	51
NNHP	95	175	190	83	85
CDFG	325	334	380	209	96
CSP	218	358	233	139	133
CTC	140	606	No report	95	422
CSLC	224	235	181	110	121
TLOA	48	No report	No report	50	No report
NRCS				12	64
TOTAL	**2,616**	**3,047**	**2,400**	**1,532**	**1,649**

5.3 SITE-SPECIFIC INFORMATION SHEETS

Site-Specific Information Sheets includes general information on the site location, ownership, viability index, priority rank, and whether the site is a TRPA threshold site. The form also includes important information for management: site description, survey history, population and ecological characteristics, potential threats/concerns. Finally, the forms include descriptions of past and current activities and include recommendations for future management. The purpose of the Information Sheets is to provide a comprehensive repository of information pertaining to Tahoe yellow cress for all named locations. This format fulfills the intent of Appendix J in the CS, Proposed Actions for Core and High Priority Sites, and expands the number of sites to include private lands. The information will be useful for project review on both public and private lands in the shorezone. The public agencies are using the Information Sheets to develop Site-Specific Management Plans by expanding the recommendation section. Information Sheets for private lands could be used to develop a management plan in the future if mitigation or other circumstances required.

A total of 58 named sites have been assigned to AMWG members to complete the site- specific information sheets prior to review by the group. Final approved forms are submitted to Eric Gillies, California State Lands Commission, for inclusion in a comprehensive file that will be periodically updated. The CSLC is taking primary responsibility for completing Information Sheets for private lands. Information sheets for 6 more sites, mostly on NDSL property, were completed in 2008 bringing the number of completed forms to 37. However, most of these are in a draft form and still

need to be reviewed by the AMWG. A formal review process remains to be developed. Information Sheets are uncompleted for all 12 USFS sites and 8 private/ mixed ownership sites. The list of Site-Specific Information Sheet assignments and status is in Appendix D.

5.4 FUNDING

Table 12 presents awarded funding for the period from 2007 to 2011. For each award, the funding source, the contract amount, the contract administrator, and the recipient are identified. The tasks associated with each contract and the implementation year supported by the funding are also identified. All awards are discussed briefly below.

The US Fish and Wildlife Service awarded a congressional earmark of $100,000 to BMP Ecosciences in 2006 to conduct outplanting research and participate in the AMWG process. A limited portion of these funds remained in 2007 to support technical reporting and AMWG participation. BMP Ecosciences also received an award for $48,000 in Section 6 funds from the California Department of Fish and Game (CDFG) in 2006 to support restoration mitigation research. This contract will be completed on March 31, 2009.

Several rounds of funding from the Southern Nevada Public Lands Management Act (SNPLMA) have been awarded to support Tahoe yellow cress conservation activities. The Round 6 award of $350,000 to the USFS allocated $200,000 for contracting and $150,000 to support LTBMU staff time and other products. The LTBMU awarded a contract for $109,950 of the R6 funds to BMP in April 2007 to support research, manuscript preparation, and AMWG participation. As of January 2009, less than $10,000 remains and that contract will be completed in early 2009. A second contract for $81,000 in remaining R6 funds was awarded to BMP in April, 2008 to continue with research and additional AMWG –specified tasks. Limited funds from this award are expected to be available into 2010. The R7 SNPLMA award of $150,000 to the USFS specified $50,000 for contracting with the remainder for LTBMU use. The LTBMU awarded $50,000 of R7 funds to Dr. Mary Peacock, University Nevada Reno (UNR), to conduct microsatellite DNA analysis. The Natural Resources Conservation Service (NRCS) received two awards of $45,000 each in Rounds 8 and 9 to provide technical support to private property owners and help to develop site-specific plans for Tahoe yellow cress conservation. Finally, the LTBMU received a R9 award of $120,000 for TYC that has not been obligated to any specific contracting purposes. The AMWG will need to identify contracting needs and specific tasks for these funds in early 2009.

As mentioned in Section 6.0, the Bureau of Reclamation (BOR) award of $70,400 to the University Nevada Reno Cooperative Extension (UNRCE) to develop educational outreach materials has been revoked and will need to be re-allocated. The Nevada Division of State Parks (NDSP) also provided $11,000 in Lake Tahoe License Plate program grant funds to UNR to support Stewardship but only $450 were ever billed and the grant has since expired.

TABLE 12. Contracted funding sources for the TYC Conservation Strategy for 2007 to 2011.

					Supported year				
Funding Source	**Amount**	**Administrator**	**Recipient**	**Tasks**	**2007**	**2008**	**2009**	**2010**	**2011**
Congress	**$100,000**	USFWS	**BMP**	AMWG (carry over funds)	x				
USFWS Section 6	**$48,000**	CDFG	**BMP**	Nursery oversight	x	x			
				Mitigation/translocation feasibility experiment	x	x			
				Experimental outplanting	x	x			
				Reporting			x		
SNPLMA R6	**$109,000**	USFS	**BMP**	Meta-analysis of 2003-2006 data	x	x	x		
				Experimental outplanting	x	x			
				AMWG	x	x			
				Manuscripts	x	x			
SNPLMA R6	**$81,000**	USFS	**BMP**	Experimental outplanting			x		
				Collaboration with UNR			x	x	
				AMWG			x		
				Coordinate with NRCS			x	x	
SNPLMA R7	**$50,000**	USFS	**UNR**	Develop microsatellite DNA techniques		x	x		
SNPLMA R8	**$45,000**	NRCS	**NRCS**	Technical assistance on private lands		x	x		
SNPLMA R9	**$45,000**	NRCS	**NRCS**	Technical assistance on private lands				x	x
SNPLMA R9	**$120,000**	USFS	**TBD**	**TBD**					
NV License Plate	**$11,000**	NDSP	**UNRCE**	Stewardship tasks	?	?			
NRCS general funds	**TBD**	NRCS	**NRCS**	Publish rack-card, tri-fold			x		

5.5 PUBLIC LANDS MANAGEMENT

Many of the management activities on public lands over the last five years have focused on implementing the research agenda. Land management agencies have supported experimental outplantings within permanent enclosures and have installed temporary fencing and/or signage to protect additional plantings. However, increased levels of protection and enforcement at Core and High Priority (CHP) sites is indicated in the Conservation Strategy for TYC and has been put forth in AMWG recommendations to the Executive Officers.

Nearly all of the CHP sites have a creek or river mouth present. The deltaic depositional features that flare out from a creek channel, as well as the troughs and new channels carved by flood events, provide important low elevation (e.g. 6,223' LTD) microhabitats that essentially serve as "seed factories" for TYC. Likewise, the high elevation ($\geq$6,229' LTD) dune and meadow microhabitats that are often associated with creek mouths may serve as TYC refuges during high lake level years. Results from recent experimental plantings across this spectrum of habitats have indicated that effective CHP site protection needs to encompass the full range of microhabitats in order to accommodate the reproductive dynamics of the species.

A list was compiled in April 2008 that each agency could draw from to develop an effective, site-specific "package" for their CHP sites that will be reviewed and evaluated by the TYC AMWG for efficacy and compliance with the Conservation Strategy.

1) Explicit designation of full spectrum TYC habitat on a map overlay that each agency maintains and uses for all planning activities.

    1a) For CHP sites at creek and river mouths, the overlay should incorporate the SEZ into the habitat designation.

    1b) A list of prohibited activities (such as raking, vegetation clearing, substrate removal) within designated TYC habitat will accompany the map.
2) Install new signage to educate visitors on ways to minimize impacts while maintaining access.
3) Development and implementation of a "Native Tahoe Shoreline" program to demonstrate to visitors the features of an intact natural community.
4) Development and implementation of a re-vegetation program, using native Tahoe beach species and naturalistic barriers (e.g. logs) to direct foot traffic.
5) Installation of temporary fencing every year to allow for natural re-vegetation or to facilitate a re-vegetation program.
6) Installation of permanent fencing where allowed that enforce new boundaries of the designated TYC habitat.
7) Active patrolling during the summer visitor season.
8) Construction of boardwalks, trails, and other traffic directors where allowed.

5.6 REGULATION

The Memorandum of Understanding (MOU)/Conservation Agreement (CA) to implement the Conservation Strategy (CS) was signed in 2003 with an expiration in ten years. While the Conservation Strategy is intended to be an adaptive management document, Miscellaneous Provision G.6 of the MOU/CA states that the MOU/CA and CS may only be modified by mutual written consent of the parties. This creates a problem for an adaptive management strategy since the CS is essentially frozen in time unless the mutual consent clause is met. However, the AMWG has continually updated certain elements in the CS over the past 5 years, including the 5 Yr Management Plan , site rankings, Appendix C, and others. This could be problematic if the regulatory process is linked directly to the CS, such as the TRPA Shorezone Plan regulations.

At the Executive Meeting on October 7, 2008, the Committee directed the AMWG to conduct the 5 year review of the CS as specified in Clause F.1 and present the recommended changes to the CS for review prior to the 2009 Executive Meeting. They also directed the AMWG to propose a specific change to the language in Section G.6 of the MOU whereby changes to the CS could be made by annual approval at Executive Meetings. The current language is as follows:

G. Miscellaneous Provisions

6. Modification

The MOU/CA and CS may only be modified by mutual written consent of the Parties.

The goal was set to make these changes and have a signing ceremony of current and any new MOU participants at the 2009 Executive Meeting.

The Executive Committee also discussed opportunities for streamlining the regulatory process. Although there are different regulatory paths based mainly on the presence or absence of TYC or potential habitat, at least five permits could be required for a project. The AMWG has determined that offering regulatory relief for project proponents could provide the needed incentive for recruiting TYC stewards on private lands. However, there is no concise synopsis of the regulatory process across all agencies. Each agency provides TYC project Fact Sheets but there is no cross-walk for the permit requirements between agencies. Until this information is available, it is not possible to identify viable options for regulatory relief.

TRPA has two regulatory designations that could be applicable to Tahoe yellow cress conservation at creek mouths: Shorezone Preservation Areas (SPA) and Stream Mouth Protection Zones (SPZ). SPAs includes " those areas that have been determined to warrant protection from additional shorezone development that affects significant biological, scenic, or other natural resources and low impact recreation". Of the nine designated SPA's, at least two are private sites, Tahoe Keys and Glenbrook, but most are on public lands. SPZs "represent historical meander patterns that support, or could with restoration, migrating populations of fish". The SPZ also includes the shorezone and areas lakeward. There are 38 SPZs on official TRPA maps. It appears that the SPA and SPZ categories are designed to prohibit any new development in select areas, but it is not clear if or how the designations could be used to specifically protect TYC.

Finally, the AMWG has continued to incorporate TYC conservation activities into basin-wide planning efforts through the following activities:

- Coordinating with the Interagency Shorezone Review Committee on project application review.
- Providing comments on
    - LTBMU Forest Plan
    - TRPA Shorezone Plan
    - CTC Upper Truckee Marsh Restoration EIS

6.0 PHOTOS

Photo 1 Planting grid to test timing at UTE in June, 2008.

Photo 2 One of two planting grids at Blackwood Creek in September, 2008.

Photo 3 Cluster arrangement of planting to test timing at Edgewood in September, 2008.

Photo 4 Experimental plot protection sign for private sites.

Photo 5 Looking south at planting grid at Sugar Pine State Park.

Photo 6 New signage for the permanent enclosure at Upper Truckee East.

Photo 7. The eroded pit at Edgewood Golf Course in June, 2008.

Photo 8. The pit at Edgewood was the source of donor plants for the translocation.

Photo 9. Donor plant removal at Hartoonian Beach at the east end of UTE, June, 2008.

Photo 10. Donor plant location on the east end of UTE in June 2008.

Photo 11. Container-grown plant in intact soil tube (Nevada Beach 2006 planting).

Photo 12. Exposed root of donor plant for the translocation at Edgewood, June, 2008.

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8.0 APPENDICES

Appendix A: Generic Annual Field Survey Form (revised)

TAHOE YELLOW CRESS *(Rorippa subumbellata)* FIELD SURVEY FORM

Survey date: ____
Surveyor: ______________________________________ Affiliation: ______________________________
Email: ______________________________________ Telephone: ______________________________

LOCATION (attach copy of quad map showing boundaries and pictures taken)

Site name: ____ **Page ________ of ________**

TYC Present? Yes No Total Number of Stems: _________

Estimate the proportion (%) of the total number of stems across the entire site in each phenological stage:
Vegetative: ______ Flowering/Fruiting: ______ Senescent: ______

Survey Start Time:______________ Stop Time:____________
Total search time: __________ x Number of surveyors_________= ________________person minutes

SURVEY BOUNDARY: **USE UTM WGS84/NAD83 ONLY-**Verify the datum on your GPS before starting.

START POINT_______________E________________N

END POINT_________________E________________N

TYC LOCATIONS: For each GPS point, write the UTM coordinates OR reference a waypoint number and then circle the appropriate description.

Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**
Easting: __________________	Northing: _____________	**whole site centroid**	**cluster endpoint**	**cluster centroid**

LAND USES AND IMPACTS (reference conditions across entire site)

Recreation intensity: None Low Medium High

Beach raking: Yes No APN(s) of raked parcels:____

List non-native weeds:____

Weed threat level: Low Medium High

Rorippa curvisiliqua present: Yes No

Describe any visible management observed that protects TYC (fencing, natural barriers, signs, enclosures):____
____

Add comments, recommendations, or sketches:

Appendix B: Survey Protocols for Tahoe Yellow Cress Annual Surveys

1-Survey Date and Surveyor Contact: List contact information for survey leader. Also list all other participants.

2-Site Name: Use the official name as listed for each Survey Team.

3- TYC Presence/Total number of stems: Record total number of stems within the site boundaries. A stem is the above ground representation of a rootstock. Their appearance ranges from single rosettes from a single rootstock to clusters of rootstocks that look like a distinct "plant". Size varies from 1-2 cm up to 65 cm or even greater.

4- Estimate proportion in each phenological stage:

Vegetative plants have no reproductive parts (flowers or fruits) present. Senescent plants have gone through reproduction and the above ground parts are drying and brown.

5-Amount of person minutes spent in search: Record the survey start and stop time and then multiple that number of minutes by the number of surveyors to obtain the total number of person minutes.

6-Survey boundary: Always use WGS84/NAD83. Please verify the datum on your unit during data capture as well as during data transfer from the unit to a hard drive. You may write the UTM on the datasheet or record waypoint, but GPS files submitted to NNHP must be well organized and clear!! It is VERY IMPORTANT to identify the start and end points of the survey. DO NOT FEEL CONFINED BY PAST SURVEY BOUNDARIES-SURVEY AS MUCH AS POSSIBLE.

7-TYC locations: Handheld GPS units have limited accuracy (within 3 to 20 m). Because the acceptable NNHP Biotics error is about 6.5 m it is not necessary to take points closer together than 13-15m. For discrete clusters of plants simply take a central point and record Cluster centroid. If two clusters are separated by less than 13 m, consider them one cluster and take a central point or end points Treat TYC clusters separated by a distance greater than 13 m as two separate clusters, and take GPS coordinates for each cluster (either end points or central points). At very small sites a whole site centroid may be sufficient. **It is critical to indicate what and where particular coordinates are from to ensure proper data interpretation!** Drawing pictures is helpful as well.

8-Recreation intensity: Record your impression of the level of use at the beach, relative to other sites around the lake.

9-Beach raking (on private parcels): Evidence of raking includes rake marks, lack of a wrack line, vegetation, and/or debris. A very clean beach is a raked beach. Indicate parcels where raking occurs by APN #.

10-Non-native species: List the scientific or common names of all species and indicate the threat posed to TYC by all non-natives across the site. Don't hesitate to pull weeds if appropriate!

11-Rorippa curvisiliqua: Record if this species co-occurs with TYC at the site (helps to determine potential for misidentification of TYC).

12-Describe any visible management to protect TYC: For private sites, list the parcels (APNs) where owners have installed temp fencing or put natural barriers around TYC. For public sites, record the condition of any enclosures and note if natural barriers have been erected.

Appendix C: Presence (X) and Absence (0) of Tahoe Yellow Cress (1978-2008)

SITE NAME	OWNER ELEV	1978 6224	1979 6224	1980 6226	1981 6225	1982 6228	1983 6228	1986 6228	1988 6224	1989 6224	1990 6223	1991 6222	1992 6223	1993 6223	1994 6222	1995 6227	1996 6227	1997 6228	1998 6228	1999 6228	2000 6228	2001 6225	2002 6224	2003 6224	2004 6223	2005 6225	2006 6228	2007 6226	2008 6224
Sunnyside	Private		0	0	0	NS	NS	NS	NS	NS	0	NS	NS	X	0	0	0	0	0	0	0	0	0	0	0	NS	0	NS
Ward Creek	Private	X	50	136	20	9	121	285	186	NS	172	X	X	X	X	0	0	NS	0	0	0	NS	443	52	66	127	147	403	X
Kaspian Campground	USFS											11	10	NS	NS	NS	NS	0	NS	NS	0	1	0	0	1	4	0	15	8
Blackwood North	Private		0	78	49	152	100	197	246	NS	151	11	NS	X	X	0	0	X	0	0	30	100	60	27	54	416	21	305	15
Blackwood South	Private		35	25	58	56	359	1073	423	NS	814	NS	NS	X	X	0	0	X	X	X	600	205	272	168	163	18	667	2761	281
Tahoe Pines (Fleur Du Lac)	Private																	0	0	0	0	0	0	43	18	91	2	11	0
Cherry St/Tahoe Swiss Village	Private										X	NS	NS	X	X	0	0	0	0	0	0	0	36	109	51	25	0	0	9
McKinney North/Shores	Private													39	27	0	0	0	0	0	0	0	12	50	63	159	0	0	50
McKinney Creek	Private		0	NS	0	NS	NS	NS	NS	NS	19	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1	2	5000	0	42	37
Tahoma	Private		2	1	1	0	0	0	0	NS	0	NS	NS	X	X	0	0	0	0	0	0	0	NS	7	3	500	0	0	245
Sugar Pine Point State Park	CSP																					13	383	104	86	908	12	69	80
Meeks Bay	USFS		40	25	91	0	0	0	4	NS	152	290	148	0	0	NS	X	10	X	X	1	6	106	42	0	25	0	110	21
Meeks Bay Enclosures	USFS																			X	X	X	X	25	11	0	0	0	0
Meeks Bay Vista	Private			15	15	0	0	0	NS	NS	0	NS	NS	X	0	NS	NS	NS	0	NS	0	0	0	230	NS	0	0	0	3
Rubicon Bay	Private		0	NS	19	45	55	161	182	NS	35	NS	NS	X	X	NS	NS	NS	0	30	0	4	39	387	698	5000	11	158	299
DL Bliss State Park	CSP		0	0	0	0	0	0	0	X	X	NS	NS	X	X	X	X	X	X	X	X	7	4	2	1	303	1	6	10
Emerald Point	CSP		X	0	0	0	0	0	NS	NS	X	700	440	984	X	0	0	0	0	NS	0	1	X	70	157	244	0	10	29
Emerald Bay Boat Camp	CSP		15	0	0	0	0	0	NS	NS	8	0	0	X	X	0	0	NS	0	NS	0	5	X	0	24	77	0	0	6
Eagle Creek/Avalanche	CSP		15	NS	NS	NS	NS	NS	NS	NS	27	150	220	155	X	0	0	NS	0	NS	0	51	35	265	493	601	71	404	354
Eagle Point	CSP											20	28	61	X	0	0	0	0	NS	0	0	0	0	15	12	0	0	4
CTC Cascade Creek	CTC																							31	X	54	0	22	28
Cascade Creek	Private		0	NS	0	NS	0	0	NS	NS	170	NS	NS	X	0	X	X	X	X	100	100	28	24	75	125	NS	0	56	192
Tallac Enclosure	USFS		0	NS	0	NS	0	0	NS	NS	X	NS	NS	X	0	X	X	X	X	65	70	182*	49	33	14	28	90	149	24
Tallac Creek	USFS		0	NS	0	0	NS	60	68	NS	11	81	75	X	X	X	X	X	X	X	X	200*	40	13	0	31	0	26	69
Baldwin Beach	USFS		0	35	45	0	0	0	0	NS	4	1500	1821	X	X	X	X	0	X	X	X	4	7	62	54	54	19	49	101
Baldwin Bch Enclosures	USFS																						X	25	24	11	213	98	211
Taylor Creek Enclosure	USFS		5	100	111	429	408	191	52	NS	329	383	73	X	X	X	30	X	X	3	50	882	1152	910	521	540	664	1124	2586
Taylor Creek	USFS		0	0	0	0	0	0	0	NS	0	0	0	0	0	0	0	0	0	0	0	52	457	614	1102	509	2	143	595
Kiva Beach/Valhalla	USFS		31	NS	X	NS	NS	NS	NS	NS	NS	614	2480	NS	NS	0	0	0	0	0	0	0	0	60	99	136	0	0	1
Jameson	Private																					0	0	0	0	NS	13	0	0
Pope Beach	USFS		21	0	11	NS	NS	86	262	NS	31	X	X	15	X	0	0	0	0	0	0	4	14	16	7	4	40	0	0
Lighthouse	Private		10	0	X	0	0	NS	X	NS	X	X	X	X	X	0	0	0	0	100	250	474	394	432	18	185	99	259	350
Tahoe Keys	Private		10	0	X	0	0	NS	X	NS	X	NS	NS	X	X	X	0	0	0	0	NS	X	921	4660	1010	1723	150	255	1959
Upper Truckee West	CTC		37	20	172	148	211	80	167	NS	537	NS	NS	X	X	X	X	X	0	0	8	453	253	610	1289	425	0	50	227
Upper Truckee East	CTC		50	165	1000	NS	NS	1500	2895	NS	6529	NS	NS	X	X	X	415	X	X	1000	3000	3171	14434	13660	5000	5000	1872	3529	6014
Regan/Al Tahoe	Private/City SLT		14	0	0	0	0	0	0	NS	90	NS	NS	X	X	0	0	0	0	0	0	25	210	600	330	139	0	0	174
El Dorado Beach	City SLT		1	0	0	0	0	0	0	NS	0	NS	NS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bijou (Timber Cove Lodge)	Public																					0	2	18	25	20	0	0	0
Timber Cove	Private		0	NS	7	325	478	150	4	NS	22	NS	NS	0	0	0	0	0	0	0	0	0	0	1	2	26	0	27	23
Tahoe Meadows	Private		25	10	10	0	NS	NS	NS	NS	6	NS	NS	X	0	0	0	0	X	15	60	36	60	60	17	1070	61	X	91

Appendix C: Presence (X) and Absence (0) of Tahoe Yellow Cress (1978-2008)

SITE NAME	OWNER ELEV	1978 6224	1979 6224	1980 6226	1981 6225	1982 6228	1983 6228	1986 6228	1988 6224	1989 6224	1990 6223	1991 6222	1992 6223	1993 6223	1994 6222	1995 6227	1996 6227	1997 6228	1998 6228	1999 6228	2000 6228	2001 6225	2002 6224	2003 6224	2004 6223	2005 6225	2006 6228	2007 6226	2008 6224
Edgewood	Private		11	120	619	778	738	600	1235	NS	377	NS	NS	X	X	0	0	X	X	300	300	178	621	335	106	346	257	753	1254
4-H Camp/City Pump House	UNR/City	65	X	12	26	24	5	210	96	NS	6	NS	NS	X	0	NS	0	0	0	0	0	44	104	77	33	28	5	111	337
Nevada Beach	USFS	57	200	8	2	176	385	760	519	NS	66	8	13	10	X	0	0	0	0	25	100	0	1	1	1	78	82	761	751
Elk Point	Private		30	0	0	NS	NS	NS	NS	NS	20	NS	NS	14	X	NS	NS	NS	0	0	0	NS	NS	NS	NS	NS	NS	NS	NS
Roundhill	USFS											50	0	15	NS	NS	NS	NS	NS	NS	NS	NS	19	45	25	19	0	0	0
Marla Bay	Private																					0	NS	15	10	1	11	0	0
Zephyr Cove	Private/USFS					X	NS	NS	X	NS	X	100	145	53	X	0	0	0	0	0	0	4	93	66	59	X	0	0	48
Skyland	Private		20	0	0	NS	NS	NS	NS	NS	34	NS	NS	X	X	NS	NS	NS	0	NS	NS	NS	NS	NS	64	NS	0	0	2
Cave Rock	NVSP										X	NS	NS	X	X	0	0	0	0	0	18	6	12	0	0	3	0	0	1
Logan Shoals/Vista	Private		100	12	428	0	0	309	133	NS	1430	43	64	NS	X	NS	NS	NS	0	NS	0	NS	0	NS	1135	0	50	45	590
Glenbrook	Private		500	9	143	800	500	NS	NS	10	70	NS	NS	X	X	0	0	0	0	NS	0	0	NS	983	164	292	0	0	0
Skunk Harbor	USFS										X	0	NS	0	0	0	0	0	0	NS	0	0	0	0	0	0	0	0	0
Secret Harbor	USFS										X	7	33	0	0	0	0	0	0	NS	0	0	27	92	NS	33	0	0	3
Chimney Rock	USFS											9	19	NS	NS	NS	NS	0	0	0	0	0	0	0	0	0	0	0	0
Sand Harbor	NVSP		1	0	0	NS	NS	NS	NS	NS	0	NS	NS	0	0	0	0	0	0	0	0	0	0	3	29	112	0	0	25
Hidden Beach	NVSP																	NS	NS	NS	NS	NS	3	19	13	7	0	0	0
Burnt Cedar Beach	IVGID																	NS	NS	NS	NS	NS	4	0	0	NS	0	0	0
Crystal Point	Private													X	X	NS	NS	0	0	NS	0	0	0	0	0	NS	0	0	0
Kings Beach	Private/Public					X	NS	NS	NS	NS	NS	0	NS	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
Agate Bay	Private		0	0	0	NS	NS	NS	NS	NS	0	NS	NS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dollar Point	Private											X	NS	X	X	0	0	0	0	NS	0	0	10	83	315	1000	0	0	18
Total Sites		3	38	39	39	41	41	41	41	41	45	50	50	52	52	52	52	53	53	54	55	60	63	64	64	62	62	62	61
No. of Sites Not Surveyed		0	0	8	1	11	13	13	15	37	2	24	28	5	5	12	10	12	5	17	6	8	6	3	3	6	2	1	2
No. of Sites Surveyed		3	38	31	38	29	27	27	25	3	43	25	21	47	47	40	42	41	48	37	49	52	57	61	61	56	60	61	59
No. of Sites Occupied		3	25	16	22	13	11	14	18	2	35	21	17	37	31	9	9	11	11	15	17	29	40	46	47	47	24	30	43
No. of Sites Unoccupied		0	13	15	16	16	16	13	7	1	8	5	4	10	16	31	33	32	37	12	32	23	17	15	14	9	38	31	17

Appendix D: Site-Specific Information Sheet progress

SITE NAME	Rank	NNHP EO NUMBER	OWNERSHIP	SITE-SPECIFIC INFORMATION ASSIGNMENTS	DOCUMENT DATE/STATUS
Sunnyside	UNRANKED	929	Private/Placer Co	CSLC	
Ward Creek	HIGH	921	Private	CSLC	in-draft
Kaspian Campground	UNRANKED	901	USFS	USFS	
Blackwood North	CORE		Private	CSLC	17-Apr-08
Blackwood South	CORE	919	Private/Placer Co	BMP	
Tahoe Pines (Fleur Du Lac)	UNRANKED		Private	CSLC	17-Apr-08
Cherry Street/Tahoe Swiss Village	LOW	937	Private	CSLC	28-Oct-05
McKinney North/Shores	LOW	928	Private	CSLC	28-Oct-05
McKinney Creek	UNRANKED		Private	CSLC	28-Oct-05
Tahoma	LOW	918	Private	CSLC	
Sugar Pine Point State Park	UNRANKED		CA State Parks	CDPR	11-Nov-05
Meeks Bay & Enclosure	HIGH	917	USFS	USFS	
Meeks Bay Vista	UNRANKED	910	Private	CDPR	30-Dec-05
Rubicon Bay	MEDIUM	936	Private	CDPR	30-Dec-05
DL Bliss State Park & Enclosure	MEDIUM	916	CA State Parks	CDPR	14-Dec-05
Emerald Point	MEDIUM	924	CA State Parks	CDPR	30-Dec-05
Emerald Bay Boat Camp	MEDIUM	914	CA State Parks	CDPR	29-Nov-05
Eagle Creek/Avalanche	HIGH	915	CA State Parks	CDPR	30-Dec-05
SE Emerald Bay	UNRANKED		CA State Parks	CDPR	22-Nov-05
Eagle Point	MEDIUM	927	CA State Parks	CDPR	22-Nov-05
CTC Cascade Creek	UNRANKED		CTC	CTC	20-Dec-05
Cascade Properties	HIGH	925	Private	CTC	20-Dec-05
Tallac Enclosure & Tallac Creek	CORE	912	USFS	USFS	
Baldwin Beach	MEDIUM	931	USFS	USFS	
Taylor Creek & Enclosure	CORE	911	USFS	USFS	
Kiva Beach/Valhalla	LOW	913	USFS	USFS	
Jameson	UNRANKED		Private	USFS	
Pope Beach	LOW	909	USFS	USFS	
Lighthouse	CORE	938	Private	CTC/Jody (9/23/06)	20-Dec-05
Tahoe Keys	MEDIUM	926	Private	CTC/Jody (9/23/06)	20-Dec-05
Upper Truckee West	CORE	908	CTC	CTC	20-Dec-05
Upper Truckee East	CORE	907	CTC	CTC	20-Dec-05
Regan/Al Tahoe	LOW	905	Private/City SLT	CTC/Jody (9/23/06)	20-Dec-05
El Dorado Beach	LOW	906	City SLT	CSLC	1-May-06
Bijou (Timber Cove Lodge)	UNRANKED	903	Public	CSLC	1-May-06
Timber Cove	MEDIUM	904	Private	CSLC	1-May-06
Tahoe Meadows	CORE	902	Private	CSLC	10-May-06
Edgewood	CORE	2	Private	BMP	
4-H Camp/City Pump House	MEDIUM	1	UNR/City	USFS (Jody)	23-Sep-06
Kahle/Nevada & Enclosure	HIGH	8	USFS	USFS	
Elk Point	UNRANKED	14	Private	TRPA	
Roundhill	UNRANKED	9	USFS	USFS	
Marla Bay	UNRANKED		Private	USFS (Jody)	23-Sep-06
Zephyr Cove	HIGH	11	Private/USFS	USFS	
Skyland	UNRANKED	5	Private	NV State Parks	8-Jan-08
Cave Rock	MEDIUM	17	NV State Parks	NV State Parks	8-Jan-08
Logan Shoals & Vista	MEDIUM	10 & 6	Private	NV State Parks	8-Jan-08

SITE NAME	Rank	NNHP EO NUMBER	OWNERSHIP	SITE-SPECIFIC INFORMATION ASSIGNMENTS	DOCUMENT DATE/STATUS
Glenbrook	MEDIUM	4	Private	Jody	23-Sep-06
Skunk Harbor	UNRANKED	16	USFS	USFS	
Secret Harbor	MEDIUM	12	USFS	USFS	
Chimney Rock	UNRANKED	13	USFS	USFS	
Sand Harbor	LOW	3	NV State Parks	NV State Parks	8-Jan-08
Hidden Beach	UNRANKED		NV State Parks	NV State Parks	in-draft
Burnt Cedar Beach	UNRANKED		IVGID	Jody	23-Sep-06
Crystal Point	UNRANKED	933	Private/Placer Co	CSLC	19-Oct-05
Kings Beach	UNRANKED	932	Private/Public	CSLC	
Agate Bay	UNRANKED	920	Private	CSLC	
Dollar Point (approved template)	LOW	934	Private	CSLC	10-May-05

Appendix E: Agency Management Activity Report Forms for 2008

US Forest Service (USFS)
US Fish and Wildlife Service (USFWS)
Tahoe Regional Planning Agency (TRPA)
California State Lands Commission (CSLC)
California Department of Fish and Game (CDFG)
California State Parks (CSP)
California Tahoe Conservancy (CTC)
Nevada Natural Heritage Program (NNHP)
Nevada Division of State Parks/ Nevada Division of Forestry (NDSP/NDF)
National Resource Conservation Service (NRCS)

USDA Forest Service Lake Tahoe Basin Management Unit
Tahoe Yellow Cress Conservation Activities 2008 Annual Report

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Adaptive Management Working Group (AMWG) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future This form provides a standardize format to assist management agencies in submitting their annual report to the AMWG. This report should be completed by each management agency and submitted to the TYC TAG no later than **December 31** of each year.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of reporting agency:	USDA Forest Service-Lake Tahoe Basin Management Unit
Reporting period:	January 1 through December 31, 2008
Enter date report submitted to AMWG:	December 16, 2008

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy:

List TYC site name:	**Describe site specific activities:**	**Staff hours involved**	**Cost (include staff time and other costs)**
Ebrights Ski Beach			
Nevada/Kahle			
Nevada beach Enclosure	Temporary fence	50	1500
Pope Beach	Temporary fence	50	1500
Tallac Creek			
Tallac Enclosure			
Taylor Creek			
Taylor Creek Enclosure			
Zephyr Cove			
Forest Service Beaches	Annual Survey	100	3000
	Site Specific Conservation Activities Totals	180	6000

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e. public outreach, consultation, TAG participation, etc.):

Describe general conservation activities:	**Staff hours involved**	**Cost (include staff time and other costs)**
AMWG, and Executive Meeting participation	100	3,000
Annual Report, Experimental Design, and Proposed Translocation Project Review	100	3,000
Facilitation of Contracts (BMP and UNR)	50	1,500
Additional TYC Review, Reports, SNPLMA Proposals and Budget	100	3,000
General Conservation Activities Totals	360	10,500

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response:

List TYC site name:	Describe disturbance and response:	Staff hours involved	Cost (include staff time and other costs)
	Totals		

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year:

Temporary Fencing Continuation with outplanting and translocation timing study Annual Survey UNR Micro-satellite Genetic Studies Development of Stewardship Deliverables AMWG and Executive Meeting Participation

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat:

Project Name (list below):	Project Description including location:
Pope Beach Bathroom Replacement	Retrofit of Pope Beach Bathrooms
Roundhill Fuels Reduction	Fuels Reduction Roundhill
South Shore Fuels Reduction and Healthy Forest Restoration Project Spooner Fuels Reduction Project East Shore Beaches Trail Access and Travel Management Plan	**No Projects were implemented during the reporting period, however these projects were surveyed for and will be implemented in the future**
Nevada Beach Campground Retrofit Taylor / Tallac Creek Restoration Project	**Projects that are planned for the near future**

U.S. Fish and Wildlife Service
Tahoe Yellow Cress Conservation Activities Annual Report

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Adaptive Management Working Group (AMWG) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future

This form provides a standardize format to assist management agencies in submitting their annual report to the AMWG. This report should be completed by each management agency and submitted to Alison Stanton, BMP Ecosciences by **December 19, 2008**.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of person reporting:	Steve Caicco
Reporting period:	January 1 through December 31, 2008
Enter date report submitted to AMWG:	December 18, 2008

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy:

NONE

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e. public outreach, consultation, TAG participation, etc.):

Describe general conservation activities:	Staff hours involved	Cost (include staff time and other costs)
AMWG participation, Exec Meeting prep./attendance	80	$6,500
General Conservation Activities Totals		$6,500

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response:

NONE

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year:

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat:

NONE

Tahoe Regional Planning Agency
Tahoe Yellow Cress Conservation Activities Annual Report

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Adaptive Management Working Group (AMWG) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future

This form provides a standardize format to assist management agencies in submitting their annual report to the AMWG. This report should be completed by each management agency and submitted to Alison Stanton, BMP Ecosciences by **December 19, 2008**.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of person reporting:	Eileen Carey
Reporting period:	January 1 through December 31, 2008
Enter date report submitted to AMWG:	December 17, 2008

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy: NONE

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e. public outreach, consultation, TAG participation, etc.):

Describe general conservation activities:	Staff hours involved	Cost (include staff time and other costs)
Conservation Strategy Participation (Eileen Carey)	65	$3,250
Tahoe Yellow Cress Surveys	12	$600
These are estimates as TRPA software no longer provides tracking by activity		
General Conservation Activities Totals	77	$3,850

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response: NONE

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year:

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat:

Project Name (list below):	Project Description including location:
	No detail, APN 098-180-023
	No detail, APN 094-140-014

California State Lands Commission
Agency Tahoe Yellow Cress Conservation Activities 2008 Annual Report

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Adaptive Management Working Group (AMWG) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future.

This form provides a standardize format to assist management agencies in submitting their annual report to the AMWG. This report should be completed by each management agency and submitted to Alison Stanton, BMP Ecosciences, by **December 19, 2008**.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of reporting agency:	California State Lands Commission
Reporting period:	January 1, 2008 through December 31, 2008
Enter date report submitted to AMWG:	December 17, 2008

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy:
NONE

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e., public outreach, consultation, AMWG/TAG participation, etc.):

Describe general conservation activities:	Staff hours involved	Cost (include staff time and other costs)
TYC AMWG/TAG	29	3480
Site-Specific Plans	28	3360
2007 Annual Survey	24	2880
Shorezone Project Planning/Review/TYC Project Site Reviews	21	2520
TYC Executive Meeting	19	2442
General Conservation Activities Totals	121	$14,682

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response:

NONE

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year (2009):

- Finishing and maintaining Site-Specific Information sheets for all TYC sites
- Continued Participation on TAG, AMWG, Stewardship Subcommittee, and Exec meetings
- Participating in 2009 Annual Survey
- Continue Shorezone Project Review and Agency Coordination

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat:

Project Name	Project Description/Comments:
Desautels (Crystal Pt.)	New pier; near historic location (1993); highly disturbed from raking; no plants observed; no further action
Wallis/Harley (Ward Creek)	Pier relocation; 4 plants found, requires site specific plan to avoid plants
Gaehwiler (Tahoma)	Existing pier improvements; 2 plants found, requires site specific plan to avoid plants
Maggi/Ross (Cascade)	New pier; 4 plants found, requires site specific plan to avoid plants
Douglass (Rubicon Bay)	Pier modification; 6 plants found, requires site specific plan to avoid plants
McCosker (Jameson Beach)	Pier replacement; no plants observed; no further action
Best (Homewood/Cherry Street)	New pier; no plants observed
Whitehurst Property (Carnelian Bay)	Revetment; TYC not likely at site, poor habitat
Franciscan Owners' Assoc. (Tahoe Vista)	Revetment; potential suitable habitat
Oliver Property (Dollar Point)	Revetment; plants found near property, but not near the revetment work; site cleared by TRPA

California Department of Fish and Game
Tahoe Yellow Cress Conservation Activities Annual Report

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Adaptive Management Working Group (AMWG) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future

This form provides a standardize format to assist management agencies in submitting their annual report to the AMWG. This report should be completed by each management agency and submitted to Alison Stanton, BMP Ecosciences by **December 19, 2008**.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of person reporting:	James Navicky
Reporting period:	January 1 through December 31, 2008
Enter date report submitted to AMWG:	12/29/2008

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy: NONE

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e. public outreach, consultation, TAG participation, etc.):

Describe general conservation activities:	Staff hours involved	Cost (include staff time and other costs)
Meeting Attendance (Navicky, Feb 2008)	6	$150.00
Annual Survey- Tim Nosal, Cutis Hagen, Daniel Burmester, Kevin Thomas	90	$ 2,250
Boats for annual survey		$250
General Conservation Activities Totals	96	$2,650.00

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response: NONE

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year:

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat:

Project Name (list below):	Project Description including location:

California State Parks, Sierra District
Tahoe Yellow Cress Conservation Activities Annual Report

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Adaptive Management Working Group (AMWG) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future

This form provides a standardize format to assist management agencies in submitting their annual report to the AMWG. This report should be completed by each management agency and submitted to Alison Stanton, BMP Ecosciences by **December 19, 2008**.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of person reporting:	N. Lozano
Reporting period:	January 1 through December 31, 2008
Enter date report submitted to AMWG:	12/17/2008

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy:

List TYC site name:	Describe site specific activities:	Staff hours involved	Cost (include staff time and other costs)
Sugar Pine Point SP	Installed temp. fence around native pop	8	236.00
D.L. Bliss SP Lester Beach	Enclosure fence removal	18	201.00
	Site Specific Conservation Activities Totals	26	437.00

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e. public outreach, consultation, TAG participation, etc.):

Describe general conservation activities:	Staff hours involved	Cost (include staff time and other costs)
AMWG Meetings attended	40	1812.00
Annual survey	12	641
General Conservation Activities Totals	52	2453.00

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response: NONE

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year:

Temporary fences will be installed at Sugar Pine Point SP native populations.

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat: NONE

Nevada Natural Heritage Program Annual Report
Agency Tahoe Yellow Cress Conservation Activities

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Technical Advisory Committee (TAC) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future

This form provides a standardize format to assist management agencies in submitting their annual report to the TAG. This report should be completed by each management agency and submitted to the TYC TAG no later than **December 31** of each year.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of reporting agency:	Nevada Natural Heritage Program
Reporting period:	January 1 through December 31, 2008
Enter date report submitted to TAG:	19 December 2008

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy: NONE

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e. public outreach, consultation, TAG participation, etc.):

Describe general conservation activities:	Staff hours involved	Cost (include staff time and other costs)
Comprehensive update and reconciliation of all TYC sites through 2004	60	1980
Attendance at AMWG meetings	2	66
Provide annual TYC survey form and maps	10	330
Provide GIS map for annual report	5	165
Update and maintain virtual TYC library on the NNHP website	8	264
General Conservation Activities Totals	85	2805

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response: NONE

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year:

Update the database with 2008 data; provide GIS map for annual report; attend TYC TAG meetings when possible; provide 2009 data forms for site specific surveys; update and maintain the TYC virtual library on the NNHP website.

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat:

NONE

California Tahoe Conservancy
Tahoe Yellow Cress Conservation Activities Annual Report

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Adaptive Management Working Group (AMWG) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future

This form provides a standardize format to assist management agencies in submitting their annual report to the AMWG. This report should be completed by each management agency and submitted to Alison Stanton, BMP Ecosciences by **December 19, 2008**.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of person reporting:	Adam Lewandowski
Reporting period:	January 1 through December 31, 2008
Enter date report submitted to AMWG:	2/13/09

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy:

List TYC site name:	Describe site specific activities:	Staff hours involved	Cost (include staff time and other costs)
Upper Truckee East	Maintenance & relocation of enclosure fencing	30	$650
Upper Truckee East	Land Steward- patrol, public engagement, TYC enclosure sign maintenance, assistance with outplanting and translocation experiments	360	6,000
Upper Truckee East	GPS enclosure perimeter and TYC habitat, generate GIS map layer	11	385
	Site Specific Conservation Activities Totals	401	$7,035

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e. public outreach, consultation, TAG participation, etc.):

Describe general conservation activities:	Staff hours involved	Cost (include staff time and other costs)
Participate in AMWG	5	$170
Planning for long term TYC management in relation to Upper Truckee project	10	$340
TYC education for Lake Tahoe Water Trail Assoc. community paddle	6	$204

General Conservation Activities Totals	21	$714

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response:

List TYC site name:	Describe disturbance and response:	Staff hours involved	Cost (include staff time and other costs)
Upper Truckee West	none		
Upper Truckee East	none		
	Totals		

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year:

Maintenance of exclosures and signage; upgrade of signage; assistance with experimental outplanting/ transplanting

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat:

Project Name (list below):	Project Description including location:

Nevada Division of State Parks/Nevada Division of Forestry
Tahoe Yellow Cress Conservation Activities Annual Report

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Adaptive Management Working Group (AMWG) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future

This form provides a standardize format to assist management agencies in submitting their annual report to the AMWG. This report should be completed by each management agency and submitted to Alison Stanton, BMP Ecosciences by **December 19, 2008**.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of person reporting:	Peter Maholland (NDSP)/Roland Shaw (NDF)
Reporting period:	January 1 through December 31, 2008
Enter date report submitted to AMWG:	Dec 03, 2008

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy:

List TYC site name:	Describe site specific activities:	Staff hours involved	Cost (include staff time and other costs)
Cave Rock	None	0	$0
Sand Harbor	Delineated beach habitat in GIS and provided visitation for analysis	2	$100
Hidden Beach	None	0	$0
	Site Specific Conservation Activities Totals	2	$100

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e. public outreach, consultation, TAG participation, etc.):

Describe general conservation activities:	Staff hours involved	Cost (include staff time and other costs)
Attendance at/preparation for AMWG meetings (Peter Maholland, NDSP)	5	$250
Attendance at/preparation for AMWG meetings (Roland Shaw, NDF)	6	$300
Site Specific Management Forms	9.5	$475
Annual Site Surveys and form preparation, September 04 - 06	27.5	$1,375
Document, Proposal, and Report Review	0.5	$25
General Conservation Activities Totals	48.5	$2,425

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response:

List TYC site name:	Describe disturbance and response:	Staff hours involved	Cost (include staff time and other costs)
Sand Harbor	No significant disturbances; no response required.		
Hidden Beach	No significant disturbances; no response required.		
Cave Rock	No significant disturbances; no response required.		
	Totals	0	$0

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year:

Participate in TYC AMWG meetings and annual surveys Provide assistance as needed for research and restoration planning.

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat:

NONE

National Resource Conservation Service

Tahoe Yellow Cress Conservation Activities Annual Report

As agreed to in the Tahoe Yellow Cress (TYC) Conservation Agreement, the TYC Adaptive Management Working Group (AMWG) shall prepare an annual report describing the status of TYC. A component of the annual report is a reporting by each of the participating agencies on TYC conservation activities undertaken or planned for the future

This form provides a standardize format to assist management agencies in submitting their annual report to the AMWG. This report should be completed by each management agency and submitted to Alison Stanton, BMP Ecosciences by **December 19, 2008**.

Please complete the following fields. Press the tab key to scroll from field to field:

Enter name of person reporting:	Jerry Owens
Reporting period:	January 1 through December 31, 2008
Enter date report submitted to AMWG:	12/1/2008

Describe in the table below site-specific conservation activities for each TYC site within the agency's jurisdiction undertaken during the previous growing season. Please use site names as listed in the TYC Conservation Strategy: NONE

Describe in the field below general TYC conservation activities undertaken by the agency during the reporting period (i.e. public outreach, consultation, TAG participation, etc.):

Describe general conservation activities:	Staff hours involved	Cost (include staff time and other costs)
Development of draft Stewardship Plan for Private Landowners.	40	3,000
AMWG Meetings	24	1800
General Conservation Activities Totals	64	4800

Please describe in the field below any significant disturbances to the species or its habitat on land within agencies jurisdiction and subsequent response: NONE

Please describe in the field below planned TYC conservation activities anticipated for the upcoming year:

Continued participation with AMWG and Stewardship Planning

List and describe in the table below all shorezone projects within the agency's jurisdiction undertaken within potentially suitable TYC habitat:

NONE

Tahoe Yellow Cress Genetic Analyses
Progress report
February 25, 2009

Mary M. Peacock, Ph.D.
Department of Biology/MS314
University of Nevada, Reno
Reno, Nevada 89557
(775) 784-1958
mpeacock@unr.nevada.edu

Samples collected from 2006 and 2007:

Pope	10	**NEW SAMPLES 2007**	
Pope Beach outplanting UTE 2005-UTE05	10	Upper Truckee East 2007-UTE07	6
Pope Beach outplanting UTE 2006-UTE06	16	Lighthouse-LH	4
Pope Beach outplanting 2006 TC source-TC06	14	Upper Truckee West-UTW	2
Baldwin Beach Enclosure-BD	15	Timber Cove East-TCE	1
Blackwood South-BS	28	Tahoe Keys 2007-TK07	2
Taylor Creek-TY	30	City Pump House-CPH	1
Nevada Beach-NB	30	Edgewood 2007-ED07	3
Tahoe Meadows-TM	15	Sugar Pine Point-SP	6
Tallac Creek-TL	5	Rubicon-RB	8
WardCreek-WD	30	McKinney Creek-MC	6
Upper Truckee East-UTE	30	Blackwood South 2007-BS07	6
Tahoe Keys-TK	30	Blackwood North 2007-BN07	6
Blackwood North-BN	12	Kaspian Camp-KP	6
Edgewood-ED	30	Ward Creek-WD	30
		Baldwin Beach 2007-BD07	6
		Nevada Beach 2007-NB07	5
		Logan Shoals-LS	6
		Tallac Enclosure-TLE	6
		Taylor Creek 2007-TY07	6
		Taylor Creek Enclosure 2007-TYE07(TC07)	6
		Tallac Creek 2007-TL07	3
		CTC Cascade-CTC	4
		Eagle Creek/Avalanche-EC	6
TOTAL 2006 samples	**305**	**TOTAL 2007 samples**	**194**

1. Total herbarium samples – 4-
   1949 Agate Bay- UCD Nobs Smith
   1979 Tahoe Keys- UCD Knapp
   1934 Emerald Bay-UCD McFadden
   1982 Upper Truckee East- UCD Knapp

2. We have developed a total of 14 microsatellite markers (5 of them are heterozygous). All 14 markers were run on 384 individuals from Baldwin Beach (21), Blackwood North (16), Blackwood South (36), 4-H City Pumphouse (1), Edgewood (32), Kaspian (6), Lighthouse (4), Logan (5), McKinney (6), Nevada Beach (35), POPE (8), Pope Beach outplanting from the TC source (14), Pope Beach outplanting from the UTE 2005/2006 (26), Rubicon(8), Sugar Pine (6), Tahoe Meadows (18), Tallac Creek (5), Tahoe Keys (32), Taylor Creek (3), Timber E (1), Upper Truckee E (36), Upper Truckee W (2), and Ward Creek (36). The alleles found across those populations are listed in the table below. The variation present among samples at the

heterozygous markers has allowed individuals to be genotyped in order to perform further population-level analyses. We have also genotyped the four herbarium samples listed above using 5 heterozygous markers and one homozygous marker (ATG48).

Markers:

Marker	Repeat	Product Size	Alleles
AAC31*	(AAC)17	209	306,309
ATG30*	(CAT)6	202	218,224,227,233
TACA3*	(TACA)18	287	346,358,362,366
TACA39*	(TATG)25	258	279,291,295,299,303
B2*	(GTT)14	179	183,189,193
C114	(ACC)9	153	131
D9	(CATA)29	293	133
CA4	(GT)11	227	253
TACA23	(CATA)11	206	231
ATG44	(ATG)13	390	419
ATG48	(ATG)7	321	348
C3	(GAT)12	254	254
AAC8	(GTT)10	275	303
ATG28	(GAT)10	337	367

* = heterozygous
Highlight = rare allele

4. Preliminary Analyses:

Genetic diversity per locus and sample site ("population") was examined for genotyped individuals using FSTAT. The following tables summarize our findings.

Note: The samples from outplanted sites were included in FSTAT analyses because this program uses a priori population assignments in order to assess genetic differentiation between populations. Each sample site was treated as a population in this analysis, thus we were able to see if samples from outplantings were maintaining, losing or increasing genetic diversity in the areas where they were placed.

Table 1. Summary of genetic variation per locus and population including number of individuals sampled per site (*N*), number of alleles sampled (A), gene diversity (H_e), observed heterozygosity (H_o), and coefficient of inbreeding (F_{IS}). No F_{IS} values showed significant departure from Hardy-Weinberg Equilibrium. Highlighted allele numbers indicate that at least one of the alleles for this locus and this site is rare (see text for further explanation).

		Sample Site															
Locus		**BB**	**BN**	**BS**	**ED**	**MC**	**NB**	**P**	**PTC**	**PUTE**	**RB**	**TK**	**TM**	**TL**	**TY**	**UTE**	**WC**
	N	12	14	33	19	4	28	5	14	25	4	22	11	5	28	16	24
AAC31	***A***	2	2	1	2	2	2	1	2	2	2	2	2	1	2	2	2
	H_e	0.5	0.154	0	0.409	0.667	0.112	0	0.363	0.462	0.667	0.091	0.182	0	0.262	0.279	0.083
	H_o	0.000	0.000	NA	0.000	0.000	0.038	NA	0.000	0.083	0.000	0.000	0.000	NA	0.000	0.063	0.000
	F_{is}	1	1	NA	1	1	0.658	NA	1	0.82	1	1	1	NA	1	0.776	1
ATG30	***A***	3	3	4	4	2	4	2	4	4	3	4	3	2	4	4	4
	H_e	0.697	0.167	0.448	0.712	0.5	0.703	0.5	0.648	0.593	0.75	0.751	0.714	0.5	0.603	0.699	0.305
	H_o	0.667	0.100	0.323	0.833	1.000	0.963	1.000	0.643	0.960	0.750	0.952	0.714	1.000	0.643	0.846	0.190
	F_{is}	0	0.5	0.281	-0.17	1	-0.37	-1	0.008	-0.62	0	-0.268	0	-1	-0.067	-0.211	0.375
TACA3	***A***	4	2	3	3	-1	3	1	4	3	2	3	4	1	4	3	2
	H_e	0.708	0.506	0.682	0.68	0.417	0.564	0	0.772	0.671	0.667	0.623	0.595	0	0.744	0.703	0.503
	H_o	0.556	0.200	0.129	0.167	0.500	0.296	NA	0.308	0.143	0.000	0.158	0.286	NA	0.214	0.214	0.000
	F_{is}	0.2	0.696	0.811	0.755	-0.2	0.475	NA	0.602	0.787	1	0.746	0.52	NA	0.712	0.695	1
TACA39	***A***	3	2	2	3	3	3	2	3	3	3	5	2	1	3	4	4
	H_e	0.318	0.154	0.148	0.528	0.625	0.484	0.5	0.555	0.553	0.833	0.628	0.545	0	0.593	0.508	0.341
	H_o	0.000	0.000	0.129	0.316	0.500	0.286	1.000	0.214	0.120	0.000	0.182	0.091	NA	0.143	0.250	0.042
	F_{is}	1	1	0.789	0.402	0.2	0.41	-1	0.614	0.783	1	0.71	0.833	NA	0.759	0.508	0.878
B2	***A***	2	2	1	2	2	2	1	3	2	2	3	2	1	3	3	3
	H_e	0.436	0.143	0	0.325	0.667	0.104	0	0.324	0.462	0.667	0.338	0.2	0	0.335	0.313	0.216
	H_o	0.000	0.000	NA	0.000	0.333	0.036	NA	0.071	0.083	0.000	0.000	0.000	NA	0.000	0.071	0.045
	F_{is}	1	1	NA	1	0.5	0.658	NA	0.78	0.82	1	1	1	NA	1	0.772	0.79

Table 2. Pairwise F_{ST} values showing regional variation for all samples. Significant values are in bold.

	BN	BS	ED	KP	MC	NB	P	PTC	PUTE	RB	SP	TK	TM	TL	TY	UTE	WC
BB	0.1363	**0.139**	-0.0409	-0.1316	0.1477	0.0849	0.2211	-0.0078	0.0035	0.0034	-0.1184	0.0625	0.0671	0.435	0.0395	-0.0263	0.1194
BN		0.0391	0.1552	-0.3279	0.5357	**0.2733**	0.3704	0.1001	**0.2681**	0.3848	-0.0366	**0.208**	0.2456	0.6434	0.1012	0.1716	-0.0459
BS			0.1257	-0.2433	0.5216	**0.1626**	0.2955	0.0786	**0.2349**	0.3425	-0.1604	0.1192	0.2021	0.5144	**0.0901**	0.1164	0.0364
ED				-0.0894	0.1391	0.032	0.1749	-0.0125	-0.0044	-0.0063	-0.1309	0.02	0.0364	0.354	0.0248	-0.0381	0.1296
KP					0.3611	-0.0685	0.4118	-0.0827	-0.0076	0.0459	NA	-0.1262	0.0358	1	-0.0543	-0.1252	-0.2433
MC						0.3344	0.4049	0.194	0.0572	-0.0979	0.3591	0.242	0.2197	0.6113	0.25	0.1837	0.4814
NB							0.2599	0.056	0.0621	0.1212	-0.1158	0.0051	0.1081	0.3672	0.0784	0.0084	**0.238**
P								0.0918	0.2234	0.267	0.5988	0.1854	0.0075	0.7273	0.1219	0.1614	0.2733
PTC									0.0563	0.0147	-0.1001	0.0231	0.0027	0.3332	-0.0339	-0.0094	0.074
PUTE										-0.0667	-0.0675	0.0538	0.0941	0.3631	**0.1022**	0.0024	**0.2489**
RB											-0.0219	0.0563	0.0878	0.4115	0.0715	0.0188	0.343
SP												-0.1475	0.1203	0.8551	-0.0955	-0.1521	-0.0557
TK													0.0829	0.2705	0.0422	0.0043	0.1764
TM														0.4726	0.0455	0.0138	0.1871
TL															0.2968	0.3621	0.5468
TY																0.0294	0.0766
UTE																	0.1383

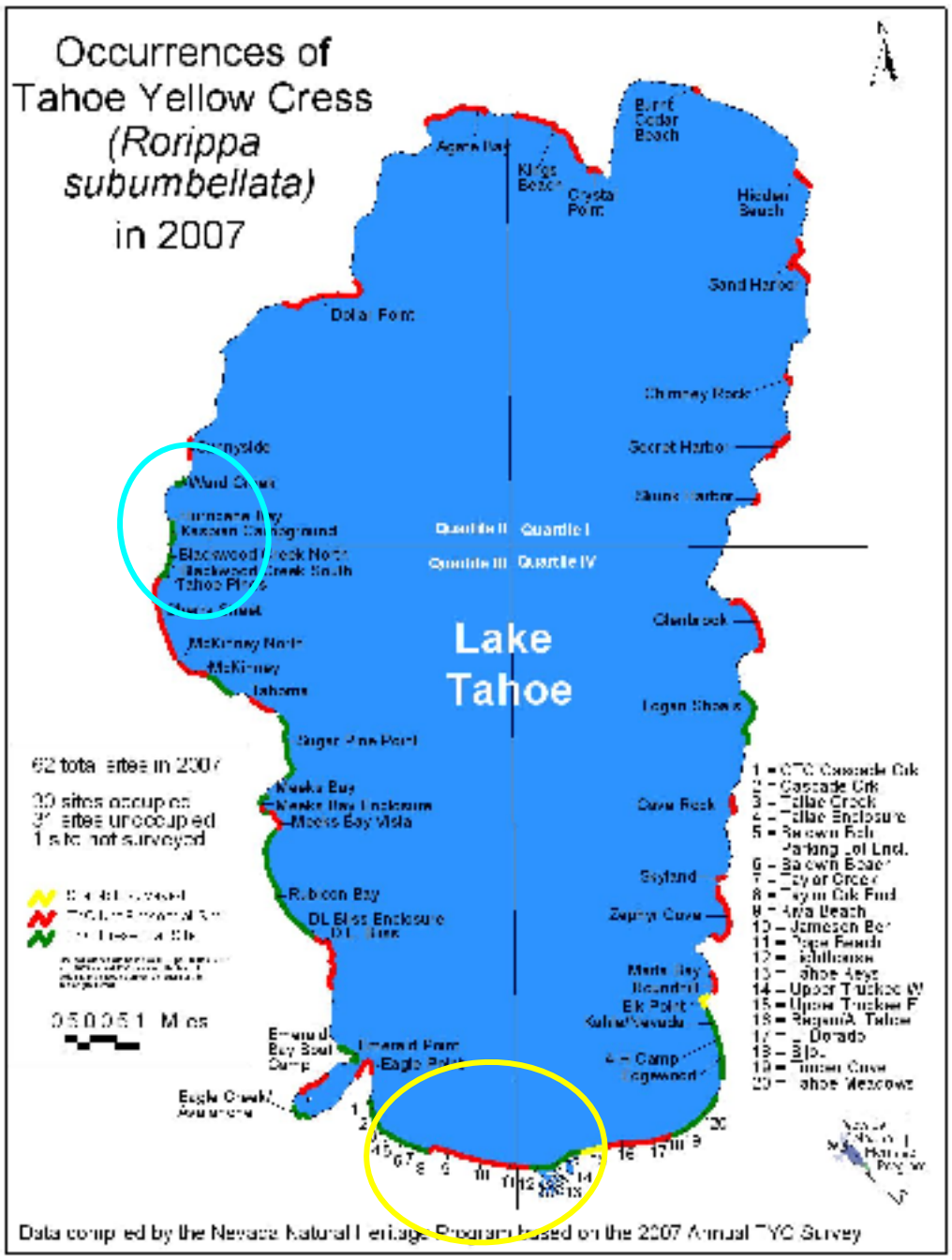

Figure 1. Distribution of Tahoe yellow cress and the general population differences identified by *F*-statistics. Populations in the west including Ward Creek, Blackwood Creek North, and Blackwood creek South (blue circle) are differentiated from populations in the South including Baldwin Beach, Nevada Beach, Tahoe Keys, and Taylor Creek (yellow circle). Due to the confounding nature of the outplantings, genetic differences identified for PUTE were ignored for the sake of this visual interpretation of the data. Please see Table 2, or the text of the discussion for specific pairwise differences.

5. Discussion.
Tahoe yellow cress (TYC) is endemic to the shores of Lake Tahoe and is generally threatened by anthropogenic disturbance and recreation. Although these data and preliminary analyses indicate that there is genetic variation in TYC, the need for conservation concern is not abated.

Genetic Differentiation. Specifically, these data show statistically significant genetic differences (F_{ST} ; Table 2) between 10 pairwise comparisons of the 17 sample sites used in the analysis. In other words, the following natural breeding sites were significantly genetically different from one another: BB and BS, NB and BN, NB and BS, TK and BN, TY and BS, and NB and WC (Table 2; Figure 1, highlights correspond to circles). In addition, the following outplanted population differed from naturally occurring populations: PUTE and TY, PUTE and WC, BN and PUTE, and BS and PUTE (Table 2). In general, the genetic variation among natural populations broadly corresponds to the geography of TYC distribution and wind-driven currents across the lake. According to pairwise F_{ST} values a subset of populations in the west are differentiated from a subset of populations in the south (Figure 1).

Although there were no significant F_{IS} values (an indicator of inbreeding), F_{ST} values indicate genetic differences between populations and we cannot rule out the possibility of genetic isolation among yellow cress populations.

Rare Alleles. Allelic distribution, or alleles per population, is a broad indicator of genetic diversity within a population. In total, two rare alleles were identified for two different loci in TYC at locus TACA39, allele 303; and at locus B2, allele 183. The sampled population at Tahoe Keys had both rare alleles and was the only population where allele 303 was present (highlights, Table 1). The rare allele (183bp) at the B2 locus was only found in 4 of the 14 naturally occurring populations: Tahoe Keys, Taylor Creek, Upper Truckee East and Ward Creek; and at one re-introduced site at Pope Beach. Although plants from both Taylor Creek and Upper Truckee East were introduced to an enclosure at Pope in 2005 and 2006, the rare allele was only maintained in the plants sourced from Taylor Creek (PTC) not from Upper Truckee East (PUTE).

Future Plans. We are currently using a Bayesian genotype clustering analysis (v 2.0, STRUCTURE) to increase our understanding of TYC genotype patterns across the landscape. The combination of F-statistics and Bayesian statistics is powerful in that the former shows long-standing genetic patterns over time, while the latter indicates natural groupings based on genotype frequencies which are shuffled each generation. Thus, the two methods allow for an understanding of past and present gene flow.