



Invasive Plant Species Early Detection in the San Francisco Bay Area Network

2009 Annual Report

Natural Resource Technical Report NPS/SFAN/NRTR—2011/493



ON THE COVER

Golden Gate Weed Watcher Intern, Richard Wong, and Volunteers, Jim Dougherty and Mary Swanson, mapping creeping capeweed (*Arctotheca prostrata*) along the Coastal Trail above Muir Beach in 2009.
Photograph by: Jen J. Rogers, NPS

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The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on an established, peer-reviewed protocol. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

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Executive Summary

In 2000, the National Park Service (NPS) created 32 networks of NPS units across the United States that were formed and funded to “improve the ability of the NPS to provide state-of-the-art management, protection, and interpretation of and research on the resources on the NPS... and to assure the full and proper utilization of the results of scientific studies for park management decisions” (NPS 1998). The San Francisco Bay Area Network (SFAN) is one of eight of these networks in the Pacific West Region of the NPS.

The San Francisco Area Network is composed of nine park units: Eugene O’Neill National Historic Site (EUON), Fort Point National Historic Site (FOPO), Golden Gate National Recreation Area (GOGA), John Muir National Historic Site (JOMU), Muir Woods National Monument (MUWO), Pinnacles National Monument (PINN), Point Reyes National Seashore (PORE), Port Chicago National Memorial (POCH), and the Presidio of San Francisco (PRSF). The network fosters collaboration and creates efficiencies of scale in designing and implementing a natural resource focused Inventory and Monitoring (I&M) program.

The network has identified many important vital signs or indicators of ecosystem health, which represent a broad suite of ecological phenomena operating across multiple temporal and spatial scales. Our intent has been to monitor a balanced and integrated “package” of vital signs that meets the needs of current park management but will also be able to accommodate unanticipated environmental conditions in the future. Invasive plants (see Glossary) represent a particularly high priority vital sign for SFAN because of the negative effects they have on the park resources, including altering landscapes and fire regimes, reducing native plant and animal habitat, and blocking views and increasing trail maintenance needs.

Parks need to know where incipient populations of highly invasive plants are becoming established, and protect the most critical areas from invasion. This year was the third field season of implementing the early detection protocol. The results detailed in this report focus on surveying road- and trail-side plants in priority areas using volunteers, and is based on the SFAN I&M Network’s Early Detection Monitoring of Invasive Plant Species in the San Francisco Bay Area Network: A Volunteer-Based Approach (Williams et al. 2009).

In 2009, lands that were managed by Golden Gate National Recreation Area included 110 subwatersheds. Of these, 33 subwatersheds are deemed at high risk of invasion and/or harm to significant biological resources. There are also 25 significant-priority, 28 moderate-priority, 21 low-priority, and 3 subwatersheds that were not ranked. Five of the 110 subwatersheds are ranked but do not overlap with National Park Lands (15-2, ranked high; 28-4, ranked high; 19-3, ranked moderate; 19-4, ranked moderate; 19-5, ranked low). Searches were conducted by teams of two or three along the prioritized trails and roads in these subwatersheds looking for up to 178 plant species, 75 of which were ranked as posing the greatest threat of invasion in these areas. In 2009, 367 target plant populations were mapped in the park. Of 58 subwatersheds searched in 2009, 27 were found to contain the highest ranked species. Eleven of these 27 subwatersheds were high priority ones.

Lands that are managed by Point Reyes National Seashore overlap 124 subwatersheds. Of these subwatersheds, 25 are deemed at high risk of invasion and/or harm to significant biological resources. There are also 27 significant-priority, 26 moderate-priority, 28 low-priority, and 18 subwatersheds that were not ranked because they only slightly overlap with National Park lands and/or were left out of the ranking process. Searches were conducted for 151 invasive species in PORE, 91 of which were ranked as posing the greatest threat of invasion in these areas. Six hundred fifty-two target plant populations were mapped in the park. Of the 114 subwatersheds searched, 27 were found to contain the highest priority species. Ten of these subwatersheds were high priority ones.

Pinnacles National Monument contains 18 regions or management units, none of which have been prioritized. In 2009, 48 occurrences of target invasive plant populations were mapped in two of the 18 management units.

Volunteers (includes full-time interns) played an important role in the implementation of the field surveys at both GOGA and PORE. At GOGA, 20 volunteers assisted staff to conduct surveys, contributing 410 hours, worth \$7,396.40. At PORE, 28 volunteers were trained, and 15 volunteers assisted staff to conduct surveys. These volunteers contributed 295 hours of their time, worth \$5,321.80. At PINN, volunteers contributed about 6 hours performing surveys.

Maps were created of all areas surveyed in GOGA, PORE, and PINN as well as for priority plant species found. Web pages were continuously updated to educate the public about the project and provide support to existing volunteers. Additions to the web pages include survey maps, species lists, and data sheets. Collaborative efforts with staff at PORE, GOGA, and the Golden Gate National Parks Conservancy continued to facilitate communication of findings and to broaden the early detection network.

Acknowledgments

In addition to the primary authors, many contributors provided critical assistance: Sean Mohren for providing valuable comments on the manuscript; Maria Alvarez and the Habitat Restoration Team for contributing new records to the GeoWeed database; Ellen Hamingson and the Habitat Restoration Program for providing important insights into invasive plant issues at PORE; Brent Johnson for providing important insights into invasive plant issues at PINN; the Golden Gate National Parks Conservancy for support and partnership; the Sonoma Ecology Center for technical assistance with the GeoWeed data management system; and the I&M interns, Richard Wong, Jessica Chappell, Claire Diedrick, Nachi Conde-Farley, and Liz Records, along with all the Weed Watcher volunteers for many hours of surveying the roads and trails.

Introduction:

Background

Invasive plant species negatively affect park resources and visitor enjoyment in several ways, including altering landscapes and fire regimes, reducing native plant and animal habitat, and blocking views and increasing trail maintenance needs. Invasive species are second only to habitat loss as threats to global biodiversity (Scott and Wilcove 1998). Given the extraordinary biodiversity of the San Francisco Bay Area, and the development pressure on private lands in the area, SFAN parks serve as crucial habitat for native species. Over 100 rare plant species can be found in SFAN parks. Invasive plants threaten many of these rare species: in Golden Gate National Recreation Area (GOGA) alone, 25 species of non-native plants were noted as directly threatening rare plant populations (NPS 2004). Trails, roads, and waterways are the main routes of infestation of new invasive species. Monitoring these routes is the most effective way to prevent the spread of existing species and the infestation of new species in SFAN parks (McNeely et al. 2001).

Inventory and Monitoring staff ranked both species and areas to prioritize search efforts for the invasive species early detection program (Williams et al. 2009). The management areas are divided based on geographical features (subwatersheds for GOGA and PORE, pre-existing management units similar to a watershed at PINN). Williams et al. (2009) contains maps of management areas. The exotic species (see Glossary) found in GOGA, PORE, and PINN were ranked based on a species invasiveness score and the known spatial extent of a species (Williams et al. 2009). Other park units in the SFAN network, besides MUWO, which is treated with GOGA, do not have finalized, ranked species lists at this time. This process resulted in List 1, 2, 3, and 4 early detection invasive plant species. List 1 species are highly invasive but not widespread. They require the most information on their abundance and environmental setting when recording data in the field. Lists 2 through 4 species are decreasingly invasive and/or increasingly widespread across each park landscape. Also, Lists 3.1 and 3.2 species were created, which represent List 1 or 2 rated plants that were either never detected during initial surveys, may not be part of a park's flora, or are difficult to identify, yet are of high concern. List 3.1 and 3.2 species are treated as List 1 and 2, respectively, for data collection purposes. Lastly, List 5 species are dune and aquatic invasives that are not encountered often but are treated as List 1 species if found. Each year, invasive species lists for each park are re-prioritized if necessary based on survey data (Williams et al. 2009). Appendix A contains the 2009 priority invasive species list by park.

Objectives

Objectives for the 2009 field season were based on the early detection protocol (Williams et al., 2009):

1. Within GOGA and PORE, identify and inventory all roads and trails in high-priority subwatersheds, and half the significant-priority subwatersheds, noting presence and absence of priority weed species. Use visual assessment and GPS technology to detect and accurately map incipient populations of the top-priority plant species on the GOGA and PORE Invasive Plant lists.

2. Train volunteers to conduct early detection surveys for top-priority SFAN Invasive Plants in the high-priority areas.
3. Train GOGA and PORE staff and park-partner staff to identify top-priority SFAN Invasive Plants for opportunistic early detection of new populations during regular work activities.
4. Revise priority species list based on information acquired during the 2009 field season.
5. Survey select trail and stream corridors for priority species at PINN.

Methods

All methodology is based on the SFAN I&M Network's Early Detection Monitoring of Invasive Plant Species in the San Francisco Bay Area Network: A Volunteer-Based Approach (Williams et al. 2009). This program can be adapted to different person-hours and skill levels, allowing parks to maximize their effectiveness based on resources available. Engaging people in detection; giving them clear direction and a point person to answer questions and receive invasives reports; and following up with feedback on reports are essential components to a good program. The following section describes sampling methods, scheduling, data management and data collection.

Prioritization

Full prioritization methods can be found in the protocol, but are summarized briefly here.

Species

The lists of target species for GOGA, PORE, and PINN were based on current knowledge and rankings, summing recognized invasiveness and biological ease of control and stratifying into priorities by feasibility of control based on categories of actual or estimated species' infested acreage in the park. A base list of all exotic species known or thought to occur in GOGA and PORE (~300 species in each park) was compiled from the National Park Service Species Database (NPSpecies). After removing known non-invasive exotic species, 175 species remained for GOGA and 142 remained for PORE. A similar selection process yielded 91 species for PINN. Species listed by the California Invasive Plant Council (Cal-IPC), California Department of Food and Agriculture (CDFA), The Nature Conservancy (TNC), and local Weed Management Areas received varying numbers of points for invasiveness, as did unlisted species which shared invasive characteristics with a listed congener. Based on best available knowledge, species also received points for altering ecosystems (affecting ecosystem processes, not just crowding out other plants) and for endangering rare plants in SFAN parks. Next, based on best available knowledge, species were ranked by ease of control independent of number of acres infested. All points were summed for the overall invasiveness score, then sorted according to feasibility of control based on number of acres infested with that species, cost for removal, politics, and access.

Areas

The list of priority areas for searches was made by ranking subwatersheds by number and degree of current infestations, risk of further infestation, and priority of resources present. Higher scores were received for low current infestation levels, high risk of further infestation based on presence of infrastructure or invadable vegetation type, and presence of rare plants or animals.

Subwatersheds were ranked, grouped along the most natural breaks, and assigned a score. Total score was obtained by adding risk to weighted (2x) rare species priority score and subwatersheds approximately quartered into high, significant, moderate, and low priority. High-priority subwatersheds are visited annually; significant, biennially; and moderate and low, once every five years.

Search Areas

GOGA manages all or part of 29 watersheds and 110 subwatersheds, based on topography. Thirty-three of these subwatersheds were deemed at high risk of invasion and/or harm to

significant biological resources. Roads and trails within the high-priority areas of the park were the first places to be searched. For the purposes of this report, data collected in the Presidio of San Francisco and Muir Woods National Monument are included with GOGA.

PORE manages all or part of 7 watersheds and 124 subwatersheds. Twenty five of these subwatersheds were deemed at high risk of invasion and/or harm to significant biological resources. These values include subwatersheds on adjacent GOGA lands that are managed by PORE (e.g. Bolinas Ridge). For the purposes of this report, data collected in those GOGA subwatersheds that are actually managed by PORE are included with PORE.

Maps have been made for the areas that need revisits and continued stewardship, and can be found online at http://science.nature.nps.gov/im/units/sfan/vital_signs/Invasives/maps.cfm and on park servers: at GOGA, on `Inpgogamahe1\Divisions\Network I&M\Individual Vital Signs\Invasive Plants\spatial_information\EDsitemaps\2009edmaps`; and at PORE on `inppore04\Resources\Natural\_Vegetation\Veg restoration team\Early detection\GIS\Finished Survey Maps\2009`. These maps are available for staff and the volunteer stewards who will adopt an area to patrol for new invasions.

PINN is divided into 18 management units, none of which have been prioritized based on their risk of invasion and/or harm to significant biological resources. Surveys conducted at PINN are primarily during peak flowering season (April through May) and consist of one week spent surveying roads, trails, and riparian corridors that are of concern to the park botanist. PINN is relatively isolated and thus, does not have an active volunteer Weed Watcher program.

Lastly, JOMU contains a small amount of natural vegetation centered on Mount Wanda. This area is not subdivided into smaller subwatersheds/management units, although distinction is made between species found on Mt Wanda versus those found in the orchard and landscaped areas maintained at the historic Muir residence to the north. No active Weed Watcher volunteer program is in effect at JOMU primarily because of limited resources. 2009 was the first year a survey was completed at JOMU, which resulted in the detection of 14 invasive plant occurrences. Data from 2009 and 2010 are being used to develop a priority list like those which exist for GOGA, PORE, and PINN. Information about these occurrences and any treatments performed on them has been communicated to JOMU park staff and will not be presented herein since they represent pilot data. However, the occurrences can be viewed through CalFlora: <http://www.calflora.org/cgi-bin/occform.cgi>

Field Methods

Searches were conducted by teams of one to four individuals along the 69 miles (GOGA) and 45 miles (PORE) of trails and roads within the high-priority areas of the parks. Teams usually covered no more than two to five survey miles per team per day, depending on target invasive plant densities, vegetation, and terrain. Each survey route was recorded both on a paper map of the area and digitized from a tracklog into a polyline layer using ArcMap (ESRI, Redlands, CA). Though survey areas were only limited by the visual range of the surveyor, the official search area used for logging both positive (plant occurrence) and negative data (areas where target plants were not found) was restricted to five meters on either side of the route. Surveys for PINN were conducted using the same methods as PORE and GOGA; however, stream corridors were surveyed in addition to roads and trails.

Along the survey route observers recorded location and associated biological information (phenology, habitat, distribution) for all high-priority target plant populations encountered. Depending on their level of training, GOGA surveyors walked the routes looking for either the 11 highest-ranked target plant species (List 1 plants), the 22 highest-ranking plants (List 1 and 2 plants), or the 74 highest-ranking plants (List 1, 2, 3.1, 3.2, and 3 plants). At PORE, surveyors searched for either the 11 highest-ranked target plant species (List 1 plants), the 30 highest-ranking plants (List 1, and 2 plants), or the 95 highest-ranking plants (List 1, 2, 3.1, 3, 5.1, 5.3 and 5.4 plants).

The level of detail of data collection was dictated by the ranking of the plant on the priority list, and the extent of the infestation. This tiered approach to data collection reduces the time needed to collect standardized, detailed data in areas of high infestations as well as the amount of training needed for beginner surveyors (Figure 1).

For the initial survey of a route, point *occurrences* and polygon *assessments* were mapped for List 1 and 3.1 species; point *occurrences* and polygon *assessments* (if patch size is less than 100 m²) for List 2 and 3.2 species; presence/absence, or point *occurrences* (if patch size is less than 100 m²) for List 3 species; presence/absence recorded for List 4 species, along with the *survey area*. List 5 species were assigned different data collection levels in each park (Appendix B). For subsequent surveys most *occurrences* should already exist.

All data was collected on paper data sheets and then entered into the GOGA, PINN or PORE GeoWeed database and/or was captured in the field using hand-held GPS/PDA units installed with ESRI's Arc Pad software with the GeoWeed tool bar and then downloaded into the GeoWeed database. Downloaded and entered data were checked against field data sheets for correctness and completeness. Staff and interns performed downloading and data-checking tasks.

Every mapping session (day/team) also included a new *survey area* to record absence data for species not seen. Assessments also included ancillary data on habitat, phenology and distribution. Species identifications for occurrences and surveys were given an associated confidence level to flag potential misidentifications.

A detailed description of all field methodology can also be found in the Early Detection of Invasive Plants SOP 2: Mapping and SOP 3: Field Data Collection (Williams et al. 2009).

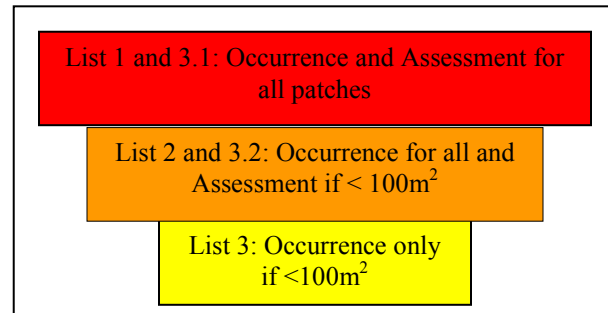


Figure 1. This protocol utilizes three tiered levels of data collection. List 1 and 3.1 species are treated similarly when encountered in the field; likewise, list 2 and 3.2 species are treated similarly. To save time, the least amount of information is recorded for list 3 species since they are much more widespread than species in the other two tiers.

Trainings

A key element of the Weed Watcher program is engaging a maximum number of searchers in opportunistic sampling, both in incidental or passive searches, as well as directed active searching. Volunteers are solicited mainly through websites that serve the local communities (e.g. Marin Chapter of the California Native Plant Society and the Golden Gate Parks Conservancy). Participants must be trained to identify target species, then to communicate location, distribution, and biological attributes to the correct entities to ensure timely response. To this end, 11 training sessions with a total of 34 participants were held in 2009 on weed identification, invasive plant mapping, and GeoWeed database trainings. Each of these courses catered to training participants to gather increasingly detailed levels of data about weed infestations.

The “WeedID” class defines the invasive species concept, how invasive species are moved around the park, how natural resources are affected, target invasive plant identification, and how to report target plant sightings. The classes are conducted through two hours of classroom instruction and one hour of field instruction. Classroom instruction relied on PowerPoint presentations, “Plant-out-of-Place” identification cards, and specimens of target species whenever possible. Power Point presentations can be found at:

inpgogamahe1:\Divisions\Network I&M\Shared\Vegetation\Invasive Plants\weedwatchers\training\plantid_train. The “Plant-out-of-Place” cards can be found at:

inpgogamahe1:\Divisions\Network I&M\Shared\Vegetation\Invasive Plants\Species\ID cards or online at http://science.nature.nps.gov/im/units/sfan/vital_signs/Invasives/ID_cards.cfm.

The invasive plant mapping course is a three-to four-hour introduction to the SFAN protocol for data collection, minimum data elements needed when mapping plants, aerial and topographic map interpretation, how to mark infestations on a map, how to calibrate distance and cover estimations, and introductory GPS and ESRI Arc Pad methods. This course is designed to be conducted half in classroom and half with hands-on activities outside. An optional introduction to the ArcPad GeoWeed applet can be included in an afternoon session. The PowerPoint presentation can be found at: inpgogamahe1:\Divisions\Network I&M\Shared\Vegetation\Invasive Plants\weedwatchers\training\plantid_train.

Analyses/GIS Manipulations

Data were examined for trends in occurrences by species type and location. Using the “filter” function, the number of occurrences for a species; total acreage for List 1 species; number of subwatersheds in which a species occurred; number of search hours and observers were also extracted.

Species List Revisions

This year was the first field season of data collection in PINN, the second field season in PORE, and the third field season in GOGA. The priority lists were revised based on the number of occurrences, and number of subwatersheds in which species were found. Species found in more than 15 subwatersheds were deemed too widespread for List 1, and species with over 50 occurrences were moved to List 3. Some list 3 species were so ubiquitous that it became inefficient to map all occurrences. These species were moved to list 4 (presence/absence). List 1 and 2 species with no occurrences were thought too rare to be reliably identified by volunteers, and were moved to Lists 3.1 and 3.2 for advanced observers.

Results

The miles of trails and roads covered, the number of persons trained and their hours spent actively searching, and the number of species of each priority type in each priority level subwatershed are presented below. The species lists for GOGA, PORE and PINN were revised after the 2008 survey year and minor adjustments were also made in 2009. Species nomenclature follows The Jepson Manual (Hickman 1993). Maps from surveys may be found in Appendix B.

GOGA

Search Effort

Seventy-nine miles of trails and roadsides were surveyed within GOGA during the 2009 field season. Fifty-eight subwatersheds were surveyed, including 44 priority subwatersheds. In total, 25 people spent just under 600 hours to complete these surveys; 410 of these hours were contributed by twenty-two volunteers. Two of the volunteers were interns who worked part time for the Weed Watchers program at both GOGA and PORE for five months.

Species Found

Twenty-seven of the 58 subwatersheds surveyed contained List 1 species. Eleven of these subwatersheds were high-priority, nine were significant-priority, four were moderate-priority, and three were low priority subwatersheds. Forty-four of the 58 subwatersheds were found to contain List 2 target species. Twenty-two of these subwatersheds were high-priority, 12 were significant-priority, 4 were moderate-priority, and 4 were low-priority. Nine subwatersheds were found to contain List 3.1 target species. Five of these subwatersheds were high-priority, 1 was significant-priority, 1 was moderate-priority, and 1 was low-priority. Fourteen subwatersheds were found to contain List 3.2 target species. Nine of these subwatersheds were high-priority, three were significant-priority, two were moderate-priority, and none were low-priority.

Three hundred and sixty-seven individual occurrences of target weed species were recorded in GOGA during early detection surveys and entered into the GOGA GeoWeed database, representing List 1, 2, 3.1, 3.2, or 3 species (Table 1). Fifty-one of these occurrences were List 1 species, 196 were List 2 species, nine were List 3.1 species, 29 were List 3.2 species, and 82 were List 3 species.

The 367 individual occurrences of target weed species that were recorded during the GOGA surveys were represented by 37 plant species. Of the 37 species recorded, eight of the 12 List 1 and all 11 List 2 species were mapped, as well as four List 3.1 species, six List 3.2 species and eight List 3 species. No List 5 species were found because there were no aquatic or dune surveys.

Table 1. GOGA Occurrences and invaded subwatersheds based on 2009 field results. Percent values for the subwatersheds invaded are based on 58 subwatersheds searched.

List	Scientific Name	Common Name	Number of occurrences	Number of subwatersheds	Percent subwatersheds invaded
1	<i>Arctotheca calendula</i>	capeweed	0	0	0%
1	<i>Arctotheca prostrata</i>	creeping capeweed	15	10	17.2%
1	<i>Centaurea calcitrapa</i>	purple starthistle	5	2	3.4%
1	<i>Cortaderia selloana</i>	pampas grass	0	0	0.0%
1	<i>Cytisus scoparius</i>	Scotch broom	5	4	6.9%

Table 1. GOGA Occurrences and invaded subwatersheds based on 2009 field results. Percent values for the subwatersheds invaded are based on 58 subwatersheds searched (continued).

List	Scientific Name	Common Name	Number of occurrences	Number of subwatersheds	Percent subwatersheds invaded
1	<i>Cytisus striatus</i>	Portuguese broom	7	4	6.9%
1	<i>Digitalis purpurea</i>	purple foxglove	3	2	3.4%
1	<i>Euphorbia oblongata</i>	oblong spurge	0	0	0.0%
1	<i>Helichrysum petiolare</i>	licorice plant	14	8	13.8%
1	<i>Ilex aquifolium</i>	English holly	2	2	3.4%
1	<i>Ulex europaeus</i>	gorse	0	0	0.0%
1	<i>Vinca major</i>	periwinkle	3	3	5.2%
2	<i>Acacia melanoxylon</i>	blackwood acacia	16	11	19.0%
2	<i>Ageratina adenophora</i>	thoroughwort	15	9	15.5%
2	<i>Centaurea melitensis</i>	totalote	38	14	24.1%
2	<i>Delairea odorata</i>	cape ivy	12	11	19.0%
2	<i>Dipsacus fullonum</i>	Fuller's teasel	9	4	6.9%
2	<i>Eucalyptus globulus</i>	bluegum eucalyptus	2	2	3.4%
2	<i>Hedera helix</i>	English ivy	20	11	19.0%
2	<i>Leucanthemum vulgare</i>	ox-eye daisy	12	8	13.8%
2	<i>Mentha pulegium</i>	pennyroyal	17	11	19.0%
2	<i>Oxalis pes-caprae</i>	Bermuda buttercup	41	12	20.7%
2	<i>Rubus discolor</i>	Himalayan blackberry	30	12	20.7%
3	<i>Brassica rapa</i>	field mustard	0	0	0.0%
3	<i>Briza maxima</i>	big quakinggrass	0	0	0.0%
3	<i>Bromus diandrus</i>	ripgrut brome	0	0	0.0%
3	<i>Carpobrotus edulis</i>	freeway iceplant	8	5	8.6%
3	<i>Conium maculatum</i>	poison hemlock	0	0	0.0%
3	<i>Cortaderia jubata</i>	jubata grass	20	13	22.4%
3	<i>Cotoneaster franchetii</i>	orange cotoneaster	6	3	5.2%
3	<i>Cotoneaster pannosus</i>	silverleaf cotoneaster	18	13	22.4%
3	<i>Ehrharta erecta</i>	panic veldt grass	7	6	10.3%
3	<i>Erechtites glomerata</i>	cutleaf burnweed	0	0	0.0%
3	<i>Erechtites minima</i>	coastal burnweed	0	0	0.0%
3	<i>Foeniculum vulgare</i>	sweet fennel	0	0	0.0%
3	<i>Genista monspessulana</i>	French broom	7	6	10.3%
3	<i>Holcus lanatus</i>	velvet grass	0	0	0.0%
3	<i>Phalaris aquatica</i>	harding grass	17	11	19.0%
3	<i>Pinus radiata</i>	Monterey pine	3	3	5.2%
3	<i>Rumex acetosella</i>	sheep sorrel	0	0	0.0%
3	<i>Schinus molle</i>	pepper tree	0	0	0.0%
3	<i>Tamarix chinensis</i>	saltcedar	0	0	0.0%
3	<i>Xanthium spinosum</i>	spiny cocklebur	0	0	0.0%
3	<i>Xanthium strumarium</i>	rough cocklebur	0	0	0.0%
3.1	<i>Ailanthus altissima</i>	tree-of-heaven	0	0	0.0%
3.1	<i>Albizia lophantha</i>	plume acacia	0	0	0.0%
3.1	<i>Anthoxanthum odorata</i>	sweet vernal grass	0	0	0.0%
3.1	<i>Berberis darwinii</i>	Darwin's berberis	0	0	0.0%
3.1	<i>Carduus acanthoides</i>	plumeless thistle	0	0	0.0%
3.1	<i>Carthamus lanatus</i>	woolly distaff thistle	0	0	0.0%
3.1	<i>Centaurea solstitialis</i>	yellow starthistle	0	0	0.0%
3.1	<i>Cirsium arvense</i>	Canada thistle	0	0	0.0%
3.1	<i>Crataegus monogyna</i>	singleseed hawthorn	3	2	3.4%
3.1	<i>Cynara cardunculus</i>	artichoke thistle	0	0	0.0%
3.1	<i>Cynodon dactylon</i>	Bermudagrass	2	2	3.4%
3.1	<i>Dittrichia graveolens</i>	stinkweed	0	0	0.0%
3.1	<i>Echium plantagineum</i>	salvation jane	0	0	0.0%
3.1	<i>Ehrharta calycina</i>	veldt grass	0	0	0.0%
3.1	<i>Hedera canariensis</i>	Algerian ivy	0	0	0.0%

Table 1. GOGA Occurrences and invaded subwatersheds based on 2009 field results. Percent values for the subwatersheds invaded are based on 58 subwatersheds searched (continued).

List	Scientific Name	Common Name	Number of occurrences	Number of subwatersheds	Percent subwatersheds invaded
3.1	<i>Hypericum perforatum</i>	Klamath weed	0	0	0.0%
3.1	<i>Nicotiana glauca</i>	tree tobacco	0	0	0.0%
3.1	<i>Phalaris arundinacea</i>	reed canary grass	0	0	0.0%
3.1	<i>Pittosporum crassifolium</i>	stiffleaf cheesewood	0	0	0.0%
3.1	<i>Pyracantha angustifolia</i>	narrowleaf firethorn	4	3	5.2%
3.1	<i>Robinia pseudoacacia</i>	black locust	0	0	0.0%
3.1	<i>Scabiosa atropurpurea</i>	mourningbride	1	1	1.7%
3.1	<i>Spartium junceum</i>	Spanish broom	0	0	0.0%
3.2	<i>Bromus madritensis ssp. rubens</i>	red brome	4	3	5.2%
3.2	<i>Bromus tectorum</i>	cheat grass	0	0	0.0%
3.2	<i>Dactylis glomerata</i>	orchard grass	1	1	1.7%
3.2	<i>Festuca arundinacea</i>	tall fescue	2	1	1.7%
3.2	<i>Hirschfeldia incana</i>	shortpod mustard	0	0	0.0%
3.2	<i>Leptospermum laevigatum</i>	Australian teatree	3	2	3.4%
3.2	<i>Pennisetum clandestinum</i>	Kikuyu grass	8	4	6.9%
3.2	<i>Rosa eglanteria</i>	sweetbriar rose	12	5	8.6%

PORE

Search Effort

Two hundred and fifty miles of trails and roadsides were surveyed during the 2009 field season at PORE, 39 of which were on GOGA property managed by PORE. In total, 15 people spent 223 hours to complete these surveys. Over a period of five months, 28 volunteers were trained. These volunteers contributed 72 hours of survey time.

During the 2009 field season at PORE, a total of 114 subwatersheds were partially to entirely surveyed. Twenty-seven of these subwatersheds were found to contain List 1 species (12 PORE subwatersheds and 4 GOGA subwatersheds). Ten (7 PORE; 3 GOGA) of these subwatersheds were high priority, nine (6 PORE; 3 GOGA) were significant priority, five (3 PORE; 2 GOGA) were moderate priority, and three (all PORE) were low priority subwatersheds. Seventy-nine of the 114 subwatersheds were found to contain List 2 target species (53 PORE, and 26 GOGA). Nineteen of these subwatersheds (13 PORE; 6 GOGA) were high priority, 21 (11 PORE; 10 GOGA) were significant priority, 25 (18 PORE; 7 GOGA) were moderate priority, and 14 (11 PORE; 3 GOGA) were low priority. Twenty-one subwatersheds were found to contain List 3.1 target species. Of these subwatersheds eight (3 PORE; 5 GOGA) were high priority, six (2 PORE; 4 GOGA) were significant-priority, four (3 PORE; 1 GOGA) were moderate priority, and three (2 PORE; 1 GOGA) were low-priority.

Species Found

Six hundred fifty-two individual occurrences of target weed species (List 1, 2, 3.1, 5.1, or 3) were recorded in PORE during early detection surveys and entered into the PORE GeoWeed database (Table 2). Forty-two of these occurrences were List 1 species, 30 were List 3.1 species, 420 were List 2 species, eight were List 5.1 species, and 157 were List 3 species.

Forty-six plant species contributed to the 652 occurrences that were recorded during the 2009 PORE surveys. Out of these 46 plant species, six of the 11 List 1 species and 17 of the 21 List 2 species were found, as were four of the 14 List 3.1 species and three of the 10 List 5.1 species. No List 5.3 or List 5.4 species were mapped in PORE.

Table 2. PORE Occurrences and invaded subwatersheds based on 2009 field results. Percentages based on 114 subwatersheds searched

List	Scientific Name	Common Name	Number of occurrences	Number of subwatersheds	Percent subwatersheds invaded
1	<i>Carduus acanthoides</i>	plumeless thistle	1	1	0.9%
1	<i>Carthamus lanatus</i>	woolly distaff thistle	7	5	4.4%
1	<i>Centaurea calcitrapa</i>	purple starthistle	0	0	0.0%
1	<i>Centaurea melitensis</i>	toçalote	6	6	5.2%
1	<i>Centaurea solstitialis</i>	yellow starthistle	0	0	0.0%
1	<i>Cotoneaster franchetii</i>	orange cotoneaster	16	11	9.6%
1	<i>Cotoneaster pannosus</i>	silverleaf cotoneaster	10	7	6.1%
1	<i>Euphorbia oblongata</i>	oblong spurge	2	2	1.8%
1	<i>Helichrysum petiolare</i>	licorice plant	0	0	0.0%
1	<i>Hypericum perforatum</i>	Klamath weed	0	0	0.0%
1	<i>Ulex europaeus</i>	Gorse	0	0	0.0%

Table 2. PORE Occurrences and invaded subwatersheds based on 2009 field results. Percentages based on 114 subwatersheds searched (continued).

List	Scientific Name	Common Name	Number of occurrences	Number of subwatersheds	Percent subwatersheds invaded
2	<i>Acacia melanoxylon</i>	blackwood acacia	1	1	0.9%
2	<i>Arctotheca calendula</i>	capeweed	0	0	0%
2	<i>Arctotheca prostrata</i>	creeping capeweed	16	15	13.2%
2	<i>Berberis darwinii</i>	Darwin's Berberis	0	0	0.0%
2	<i>Cytisus scoparius</i>	Scotch broom	15	8	7.0%
2	<i>Datura stramonium</i>	jimsonweed	0	0	0.0%
2	<i>Delairea odorata</i>	cape ivy	11	9	7.9%
2	<i>Echium candicans</i>	pride of Madeira	15	10	8.8%
2	<i>Genista monspessulana</i>	French broom	34	20	17.5%
2	<i>Hedera helix</i>	English ivy	39	26	22.8%
2	<i>Ilex aquifolium</i>	English holly	26	13	11.4%
2	<i>Leucanthemum vulgare</i>	Oxeye daisy	45	16	14.0%
2	<i>Linaria vulgaris</i>	Butter and eggs	1	1	0.9%
2	<i>Oxalis pes-caprae</i>	Bermuda buttercup	20	5	4.4%
2	<i>Pennisetum clandestinum</i>	kikuyu grass	0	0	0.0%
2	<i>Phalaris aquatica</i>	Harding grass	72	34	29.9%
2	<i>Pittosporum undulatum</i>	Victorian box	2	2	1.8%
2	<i>Rubus discolor</i>	Himalayan blackberry	69	31	27.2%
2	<i>Tetragonia tetragonioides</i>	New Zealand spinach	15	10	8.8%
2	<i>Vinca major</i>	periwinkle	35	24	21.1%
2	<i>Xanthium spinosum</i>	spiny cocklebur	4	4	3.5%
3	<i>Allium triquetrum</i>	threecorner leek	0	0	0.0%
3	<i>Acacia longifolia</i>	Sydney golden wattle	0	0	0.0%
3	<i>Acacia verticillata</i>	prickly Moses	0	0	0.0%
3	<i>Carpobrotus chilensis</i>	sea fig	0	0	0.0%
3	<i>Carpobrotus edulis</i>	freeway iceplant	42	24	21.1%
3	<i>Cortaderia jubata</i>	jubata grass	13	12	10.4%
3	<i>Cortaderia selloana</i>	pampas grass	0	0	0.0%
3	<i>Conium maculatum</i>	poison hemlock	0	0	0.0%
3	<i>Cotoneaster lacteus</i>	milkflower cotoneaster	0	0	0.0%
3	<i>Crataegus monogyna</i>	singleseed hawthorn	0	0	0.0%
3	<i>Cupressus macrocarpa</i>	Monterey cypress	3	2	1.8%
3	<i>Digitalis purpurea</i>	purple foxglove	21	11	9.6%
3	<i>Dipsacus sativus</i>	Indian teasel	0	0	0.0%
3	<i>Dipsacus fullonum</i>	Fuller's teasel	3	3	2.6%
3	<i>Drosanthemum floribundum</i>	showy dewflower	2	2	1.8%
3	<i>Echium plantagineum</i>	salvation jane	0	0	0.0%
3	<i>Ehrharta erecta</i>	panic veldt grass	8	6	5.3%
3	<i>Eucalyptus globulus</i>	bluegum eucalyptus	9	9	7.9%
3	<i>Euphorbia lathyris</i>	gopher plant	1	1	0.9%
3	<i>Festuca arundinacea</i>	tall fescue	0	0	0.0%
3	<i>Foeniculum vulgare</i>	sweet fennel	5	5	4.4%

Table 2. PORE Occurrences and invaded subwatersheds based on 2009 field results. Percentages based on 114 subwatersheds searched (continued).

List	Scientific Name	Common Name	Number of occurrences	Number of subwatersheds	Percent subwatersheds invaded
3	<i>Hypericum calycinum</i>	Aaron's beard	1	1	0.9%
3	<i>Lythrum hyssopifolia</i>	hyssop loosestrife	14	11	9.6%
3	<i>Mentha pulegium</i>	pennyroyal	32	23	20.2%
3	<i>Myoporum laetum</i>	myoporum	0	0	0.0%
3	<i>Pinus radiata</i>	Monterey pine	0	0	0.0%
3	<i>Populus alba</i>	white poplar	0	0	0.0%
3	<i>Pyracantha angustifolia</i>	narrowleaf firethorn	0	0	0.0%
3	<i>Rosa eglanteria</i>	sweetbriar rose	0	0	0.0%
3	<i>Scabiosa atropurpurea</i>	mourningbride	0	0	0.0%
3	<i>Sorghum halepense</i>	Johnson grass	0	0	0.0%
3	<i>Sparaxis tricolor</i>	Harlequinflower	1	1	0.9%
3	<i>Tanacetum parthenium</i>	feverfew	0	0	0.0%
3	<i>Verbascum blattaria</i>	moth mullein	0	0	0.0%
3	<i>Watsonia meriana</i>	bulbil bugle-lily	1	1	0.9%
3	<i>Zantedeschia aethiopica</i>	calla lily	0	0	0.0%
3.1	<i>Acroptilon repens</i>	Russian knapweed	0	0	0.0%
3.1	<i>Aegilops triuncialis</i>	barbed goatgrass	1	1	0.9%
3.1	<i>Ageratina adenophora</i>	thoroughwort	0	0	0.0%
3.1	<i>Albizia lophantha</i>	silk tree, cape wattle	0	0	0.0%
3.1	<i>Anthoxanthum odoratum</i>	sweet vernalgrass	2	2	1.8%
3.1	<i>Brachypodium distachyon</i>	purple false brome	0	0	0.0%
3.1	<i>Centaurea iberica</i>	Iberian star thistle	0	0	0.0%
3.1	<i>Dittrichia graveolens</i>	stinkweed	0	0	0.0%
3.1	<i>Ehrharta calycina</i>	perennial veldt grass	0	0	0.0%
3.1	<i>Marrubium vulgare</i>	horehound	0	0	0.0%
3.1	<i>Paspalum dilatatum</i>	dallis grass	26	20	17.5%
3.1	<i>Robinia pseudoacacia</i>	black locust	1	1	0.9%
3.1	<i>Salsola soda</i>	Russian thistle	0	0	0.0%
3.1	<i>Senecio jacobaea</i>	tansy ragwort	0	0	0.0%
5.1	<i>Alisma lanceolatum</i>	water plantain	0	0	0.0%
5.1	<i>Arundo donax</i>	giant reed	1	1	0.9%
5.1	<i>Conicosia pugioniformis</i>	Narrow-leaved iceplant	0	0	0.0%
5.1	<i>Egeria densa</i>	Brazilian elodia	0	0	0.0%
5.1	<i>Iris pseudacorus</i>	yellow flag	0	0	0.0%
5.1	<i>Lepidium latifolium</i>	perennial pepperweed	0	0	0.0%
5.1	<i>Ludwigia peploides</i>	water primrose	4	4	3.5%
5.1	<i>Myriophyllum aquaticum</i>	Parrot's-feather	3	3	2.6%
5.1	<i>Phalaris arundinacea</i>	Reed canary grass	0	0	0.0%
5.1	<i>Spartina alterniflora</i>	Smooth cordgrass	0	0	0.0%
5.3	<i>Ammophila arenaria</i>	European beachgrass	0	0	0.0%
5.4	<i>Cakile edentula</i>	European searocket	0	0	0.0%
5.4	<i>Cakile maritima</i>	European searocket	0	0	0.0%

PINN

Search Effort

Fourteen miles of trails and roadsides were surveyed during the 2009 field season. In total, five people spent 91 hours conducting surveys, six of which were volunteer hours.

Species Found

Two management units were surveyed in 2009, both of which contained List 2 species, but only one contained a List 1 species. In addition, both areas contained List 3.1, and List 3 species but List 1, List 5.1, and List 5.2 species were only found in one of the units.

Forty-eight occurrences of target weed species were recorded. Three of these occurrences were List 1, 19 were List 2, 12 were List 3.1, one was List 5.1, one was List 5.2, and 12 were List 3 (Table 6).

Sixteen plant species were recorded during surveys, which included one of nine List 1 species, five of seven List 2, three of 16 List 3, five of 15 List 3.1, one of three List 5.1, and one of three List 5.2 (Table 6).

Table 3. PINN Occurrences based on 2009 field results. Percentages based on 2 management units searched.

List	Scientific Name	Common Name	Number of occurrences	Number of units	Percent units invaded
1	<i>Acroptilon repens</i>	Russian knapweed	0	0	0.0%
1	<i>Lepidium latifolium</i>	perennial pepperweed	0	0	0.0%
1	<i>Cnicus benedictus</i>	blessed thistle	3	1	50.0%
1	<i>Melilotus alba</i>	white sweetclover	0	0	0.0%
1	<i>Nicotiana glauca</i>	tree tobacco	0	0	0.0%
1	<i>Rubus discolor</i>	Himalayan blackberry	0	0	0.0%
1	<i>Salsola tragus</i>	prickly Russian thistle	0	0	0.0%
1	<i>Taeniatherum caput-medusae</i>	Medusahead	0	0	0.0%
1	<i>Verbascum thapsus</i>	woolly mullein	0	0	0.0%
2	<i>Carduus pycnocephalus</i>	Italian thistle	4	2	100.0%
2	<i>Carduus tenuiflorus</i>	slender-flowered thistle	3	1	50.0%
2	<i>Conium maculatum</i>	poison hemlock	0	0	0.0%
2	<i>Cynodon dactylon</i>	Bermudagrass	0	0	0.0%
2	<i>Marrubium vulgare</i>	horehound	10	1	50.0%
2	<i>Veronica persica</i>	birdseye speedwell	1	1	50.0%
2	<i>Vinca major</i>	periwinkle	1	1	50.0%
3	<i>Amaranthus albus</i>	tumbleweed	0	0	0.0%
3	<i>Brassica nigra</i>	black mustard	0	0	0.0%
3	<i>Brassica rapa</i>	field mustard	0	0	0.0%
3	<i>Centaurea melitensis</i>	toocalote	2	1	50.0%
3	<i>Centaurea solstitialis</i>	yellow starthistle	0	0	0.0%
3	<i>Cirsium vulgare</i>	bull thistle	0	0	0.0%
3	<i>Hirschfeldia incana</i>	shortpod mustard	0	0	0.0%
3	<i>Lactuca serriola</i>	prickly lettuce	0	0	0.0%
3	<i>Mentha spicata</i> var. <i>spicata</i>	spearmint	0	0	0.0%
3	<i>Mentha Xpiperita</i>	peppermint	0	0	0.0%
3	<i>Plantago lanceolata</i>	lanceleaf plantain,	1	1	50.0%
3	<i>Polygonum arenastrum</i>	oval-leaf knotweed	0	0	0.0%
3	<i>Raphanus sativus</i>	wild radish	0	0	0.0%
3	<i>Rumex acetosella</i>	sheep sorrel	0	0	0.0%
3	<i>Rumex crispus</i>	curly dock	0	0	0.0%

Table 3. PINN Occurrences based on 2009 field results. Percentages based on 2 management units searched (continued).

List	Scientific Name	Common Name	Number of occurrences	Number of units	Percent units invaded
3	<i>Silybum marianum</i>	blessed milkthistle	9	9	50.0%
3.1	<i>Ailanthus altissima</i>	tree-of-heaven	0	0	0.0%
3.1	<i>Chenopodium ambrosioides</i>	Mexican-tea	0	0	0.0%
3.1	<i>Dittrichia graveolens</i>	stinkweed	0	0	0.0%
3.1	<i>Lolium multiflorum</i>	Italian ryegrass	0	0	0.0%
3.1	<i>Lolium perenne</i>	perennial ryegrass	3	1	50.0%
3.1	<i>Lolium temulentum</i>	darnel	3	1	50.0%
3.1	<i>Malva parviflora</i>	cheeseweed	2	1	50.0%
3.1	<i>Picris echioides</i>	bristly oxtongue	0	0	0.0%
3.1	<i>Piptatherum miliaceum</i>	smilo grass	0	0	0.0%
3.1	<i>Poa bulbosa</i>	bulbous bluegrass	1	1	50.0%
3.1	<i>Tragopogon dubius</i>	yellow salsify	3	1	50.0%
3.1	<i>Tribulus terrestris</i>	puncturevine	0	0	0.0%
3.1	<i>Trifolium hirtum</i>	rose clover	0	0	0.0%
3.1	<i>Verbascum blattaria</i>	moth mullein	0	0	0.0%
3.1	<i>Xanthium spinosum</i>	spiny cocklebur	0	0	0.0%
5.1	<i>Arundo donax</i>	giant reed	1	1	50.0%
5.1	<i>Iris pseudacorus</i>	yellow flag	0	0	0.0%
5.1	<i>Tamarix ramosissima</i>	saltcedar	0	0	0.0%
5.2	<i>Cotula coronopifolia</i>	brassbuttons	1	1	50.0%
5.2	<i>Crypsis schoenoides</i>	swamp prickle grass	0	0	0.0%
5.2	<i>Cyperus difformis</i>	variable flatsedge	0	0	0.0%

Discussion

Species Occurrences

The occurrence data captured by park staff and volunteers reveals that collectively, invasive species are ubiquitous throughout the park units of the SFAN (Appendix B). Because the monitoring program is in initial stages of implementation, it is difficult to draw conclusion about environmental correlations or trends in species detection at this time. However, the overall quality of the data is assumed to be high since greater than 80% of all occurrence points have either been collected by park staff or by highly trained early detection interns. The small amount of data utilized from volunteers or citizen scientists was always collected in the field under direct supervision of park staff or early detection interns. No data from unsupervised volunteers is utilized for data analyses at this point. Instead, unsupervised volunteer data, which is collected on paper maps, is currently informing park staff for removal efforts or is used as reference when those places are resurveyed during protocol implementation.

For all parks, the greatest numbers of invasive plants mapped were List 2 then List 1 species. This outcome is expected since the listings directly reflect abundances of these species in the parks based on pilot data. It follows then, that List 3 species would have the highest amount of occurrences. However, the smaller percentage of List 3 species observances in 2009 is not due to lesser numbers or distribution of these species, but rather because occurrences were only recorded for plants with a patch size of less than 100 m². Furthermore, many of the surveys conducted with supervised volunteer assistance, including training surveys, used abbreviated plant lists that focused on List 1 or 2 species. Therefore, not all surveys completed were for the entire set of List 1, 2, 3 and 4 species. The low amount of plants mapped in PINN was due to only one week spent surveying. In addition, only a small portion of this park unit was visited. Because new occurrences of invasive plants were discovered on each survey route, we are assuming that if more time was spent conducting surveys in a larger portion of PINN, additional species occurrences would have been collected.

It should be noted that the numbers of occurrences found for each species may not be a true indication of abundance, as the delineation of individual patches is somewhat subjective for many species. A species can occur across the landscape at low densities (<30% cover) and still be considered a patch, thus creating many large patches of greater than 100 m² which are not recorded. Other species, such as jubata grass (*Cortaderia jubata*) can be delineated at a much finer scale, sometimes with individual plants comprising a single patch, resulting in more occurrences. Additionally, detectability can vary during the field season for many species. For example, oxeye daisy (*Leucanthemum vulgare*) is not obvious from any distance except during its flowering period, whereas Monterey pine (*Pinus radiata*) is obvious year round. It should also be noted that the smaller number of occurrences in 2009 compared to 2008 (see Williams and Jordan 2009) does not represent an actual decline in the true number of occurrences. Many of the occurrences were mapped in 2008 and they may still be present, but were not mapped again in 2009.

Assessments were recorded in addition to occurrences for all List 1 and 3.1 species as well as all List 2 and 3.2 species with a patch size of less than 100 m². These assessments are polygons that

include the extent and coverage of all invasive plant populations detected and are critically important for assessing the rapid response potential and to detect change over time; however, this information on patch size is not presented here. Occurrence information alone can be sufficient to discern new populations that require rapid response, but a true measure of success for the parks, the reduction in extent of an invasive species, will require amended assessments of weed occurrences or other monitoring of control efforts done by park staff.

Species List Revisions

The majority of list revisions for GOGA were made after the 2007 or 2008 seasons (Williams and Speith 2008, Williams and Jordan 2009). However, in the fall of 2010, recent taxonomic developments (DiTomaso 2010) revealed that *Arctotheca calendula* (originally a List 1 species at GOGA and a List 2 species in PORE during 2009) was actually represented by two distinct species in SFAN parks, *A. calendula* and *A. prostrata*. Because no true *A. calendula* was found in 2009, all records with that name have been changed to *A. prostrata*, which was the actual species being mapped. Therefore, *A. prostrata* was added to List 1 for GOGA and List 2 for PORE. *Arctotheca calendula* was left on List 1 for GOGA and List 2 for PORE. These changes have been made retroactively and are reflected in the data summaries reported herein.

After the 2009 field season in GOGA, additional revisions were made to the priority list for the upcoming 2010 field season (Table 4). Nine species were down-listed because they were more abundant than previously known. Two List 3.1 species were moved to List 3.2 and seven List 3 species were moved to List 4. Three species were moved from List 4 to higher priority Lists in response to management concerns of the Habitat Restoration Team (one species was moved to List 2, one to List 3, and one to List 3.2) and a new species was added to list 3.2 (Table 4).

Table 4. Revisions to the GOGA priority species list for 2010.

Scientific Name	Common Name	2009 List	2010 List	Justification
<i>Brachypodium distachyon</i>	purple false brome	3.1	4	too abundant
<i>Briza maxima</i>	big quakinggrass	3	4	too abundant
<i>Bromus diandrus</i>	ripgut brome	3	4	too abundant
<i>Calendula arvensis</i>	field marigold	4	2	species of concern
<i>Cestrum aurantiacum</i>	orange Jessamine	4	3.2	species of concern
<i>Conium maculatum</i>	poison hemlock	3	4	too abundant
<i>Cynodon dactylon</i>	Bermudagrass	3.1	3.2	too abundant
<i>Erechtites glomerata</i>	cutleaf burnweed	3	4	too abundant
<i>Erechtites minima</i>	coastal burnweed	3	4	too abundant
<i>Holcus lanatus</i>	velvet grass, Yorkshire fog	3	4	too abundant
<i>Lathyrus latifolius</i>	everlasting pea, perennial pea	4	3	species of concern
<i>Rumex acetosella</i>	sheep sorrel	3	4	too abundant
<i>Solanum laciniatum</i> (= <i>S. aviculare</i>)	New Zealand nightshade	n/a	3.2	species of concern, not on 2009 priority list

After the 2009 field season in PORE, additional revisions were made to the priority list for the upcoming 2010 field season (Table 5). One List 1 species was moved to List 3.1 because it was not found in 2008. Two species were down-listed because they were more abundant than previously known (one species was moved from List 3.1 to 2, and the other was moved from List

2 to 3). Three new species were added to the PORE priority list. One species was added to list 3 because it was more abundant than expected. In response to concerns of the vegetation staff, one species was added to list 2 to learn more about its distribution, and one species was added to list 5.1 because of concern that it may be present but difficult to identify.

Table 5. Revisions to the PORE priority species list for 2010.

Scientific Name	Common Name	2009 List	2010 List	Justification
<i>Paspalum dilatatum</i>	dallis grass	3.1	2	too abundant on roadsides
<i>Hypericum perforatum</i>	Klamathweed	1	3.1	Not found in '09 or '08
<i>Phalaris aquatica</i>	Harding grass	2	3	Too abundant
<i>Lathyrus latifolius</i>	perennial pea	n/a	2	Desire to learn distribution, not on 2009 priority list
<i>Cynodon dactylon</i>	Bermudagrass	n/a	3	More abundant than expected, not on 2009 priority list
<i>Ludwigia hexapetala</i>	sixpetal water-primrose	n/a	5.1	Problematic plant, not on 2009 priority list

Since so few surveys were conducted at PINN, not enough data on park-wide distribution of priority species was collected to provide an accurate assessment of species abundance. Therefore, no species were removed from the list, and no plants were shifted from one priority list to another. The lists will be adjusted as more data are collected and as invasive plant management priorities are clarified.

Outreach

Education and outreach plays a critical role in the engagement of a network of early detectors. A number of “Weed ID” classes were held for GOGA staff, volunteers, interns, Golden Gate National Parks Conservancy (GGNPC) staff, and PORE volunteers, as discussed in the Methods section. In total, 11 classes were held with 34 individuals in attendance. Whenever possible, volunteers were trained on an individual basis to conduct early detection surveys and map incipient populations of target invasive plants.

Web pages were enhanced to provide support to Weed Watcher participants (http://science.nature.nps.gov/im/units/sfan/vital_signs/Invasives/weed_watchers.cfm). Online versions of the “Plant-out-of-Place” cards, a narrative explaining the necessity for invasive plant early detection, and information about how to take part in the Weed Watcher program are featured on the web pages. Maps and data sheets were added to the site in 2008. In 2009, these pages were improved to be more user-friendly and the WhatSNOO monthly reports were added to the website containing links to relevant maps. The potential exists to expand these pages to provide online trainings, more interactive maps, and links to reporting. Unless we can track the number of page hits, we will be less capable of measuring online outreach. Lastly, only one download of the invasive plant ID cards was recorded through a voluntary online form.

Increased volunteer involvement with the early detection program at the SFAN parks will undoubtedly result in more new detections along the trails and road corridors of the parks. While drop-in volunteers are limited in their capacity to conduct Weed Watcher surveys, encouraging drop-ins is a necessary tool for volunteer recruitment, expanding citizen involvement, and for ultimately training-up their knowledge and ability to contribute.

Collaboration

Early detection is ineffective without rapid assessment and response to invasions. Many invasive plant management teams that manage incipient and established weed populations exist in the San Francisco Bay Area parks. The importance of both collaboration and communication with these management teams is imperative to the success of an early detection program.

At GOGA there are several groups that manage invasive species. The Habitat Restoration Team (HRT), under the direction of Maria Alvarez, has adopted the GeoWeed data management system. In addition, the HRT's Invasive Plant Patrol (IPP) roving hikes now include early detection surveys as part of their protocol. There is potential to augment the existing IPP hikes with Weed Watcher hikes to cover a larger area of GOGA. The HRT works at sites throughout the park, and are host to a sizeable volunteer program of knowledgeable people who have the capacity to respond to new invasions. Continued coordination with the HRT is critical to any successful early detection program at this park.

The GGNPC also houses several weed management programs that have participated in the Weed Watcher program including the Native Plant Nurseries at Muir Woods, the Marin Headlands, and the Presidio. The Site Stewardship restoration programs housed at the GGNPC manage areas in Sweeney Ridge, Mori Point, and Tennessee Valley. These groups have the potential to make a large contribution to eradicating the species detected during our surveys if we can effectively communicate our findings to them and they can implement rapid-response.

Point Reyes National Seashore has a well-established weed management program with an affiliated volunteer program, the Habitat Restoration Program (HRP). Ellen Hamingson leads the HRP program and worked closely with the Weed Watcher program in 2009 to implement rapid response treatment for many of the infestations that were mapped by the Weed Watchers.

One of the greatest successes working with partners in 2009 was the addition of two early detection and rapid response interns that worked at PORE and GOGA. The California Exotic Plant Management Team (EPMT), which is responsible for managing weed populations at national parks across California, is integral to rapid response at parks that are not served by in-house management programs, or as an augmentation to existing programs. Funding from EPMT was vital for being able to financially support interns. In April, the interns were based out of PORE but also worked at GOGA one to two days a week. In June, they flip-flopped and moved to GOGA but worked at PORE for one to two days a week. These interns conducted surveys two days a week, and then would join either HRT or HRP on the other three days for rapid response removal work. The interns improved communication between the programs and made sure rapid response was removing priority species mapped during early detection surveys. Interns also treated some invasive species during their surveys.

With the help of the resource staff at Pinnacles National Monument, high-priority areas were surveyed using the newly developed species list. A PINN GeoWeed database that was developed in 2008 was populated with more data from the results of the 2009 surveys.

Further work at other SFAN network parks is necessary to ensure that findings will be communicated to the responsible entities for rapid response. Reliance upon shared data via the GeoWeed system is only one step in a communication process that should include an alert system of emails, reports, and phone calls. This component of the Weed Watcher program needs to be streamlined and formalized so that responsible entities for each region of network parks can be notified in a timely manner about Weed Watcher findings.

As network parks share borders with many other land management agencies, an integrated approach is key to stopping the spread of new invaders. In addition to working with the network of parks, I&M staff have helped to secure grant funding to build a Bay Area Early Detection Network (BAEDN) for the nine-county area. With funds delivered in 2009, a coordinator was hired and the website was publicly released which included an online reporting tool through CalFlora (<http://www.baedn.org>). BAEDN also worked with the Marin-Sonoma Weed Management area to prioritize early detection infestations for rapid response. In 2010, BAEDN will continue to treat more infestations and also begin trainings based largely on SFAN I&M protocols, so that parks will no longer be limited to seeing only what is within our borders.

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Glossary

Assessments: Surveys and monitoring of isolated weeds and weed population *occurrences* are defined and recorded in the database as individual *assessments*. An *assessment* can be a set of measurements taken over time, recorded for a specified weed *occurrence*. Each *assessment* relates to one specific *occurrence*, while each *occurrence* can accrue a series of *assessments* over time. An *assessment* for each *occurrence* can be recorded as a point, a line, or a polygon. *Assessments* will be used to depict the size, scale, and coverage of an occurrence and therefore will be used as a basis for monitoring the project's effectiveness. The initial *occurrence* and *assessment* data will serve as the baseline for the entire project area, and the project area will be examined regularly for the duration of the project. Periodic *assessments* will be used to determine if weed populations are increasing or decreasing in size and distribution and if *treatments* are having the desired effects.

Exotic: Occurring in a given place as a result of direct or indirect, deliberate or accidental actions by humans. Synonyms: alien, introduced, non-native, and non-indigenous.

GeoWeed: The Microsoft Access-based database developed by the Sonoma Ecology Center from the Weed Information Management System. GeoWeed is a relational database that offers digital data collection of management and spatial weed data through ESRI ArcPad applets. The San Francisco Bay Area Network uses GeoWeed for its Early Detection data. Additional information available in SFAN's protocol and at <http://geoweed.org>.

Invasive: Tending to spread, intrude, or encroach, usually aggressively and in a hurtful manner. Gardeners characterize cultivated plants as "invasive" when they spread aggressively beyond where they were intended to remain, particularly if they outcompete and displace other plants in the garden. Native species can behave invasively, but this term generally connotes non-natives which can spread into undisturbed ecosystems.

Invasive species: Official term for an exotic species whose introduction can cause economic or environmental harm or harm to human health. This definition originated in Presidential Executive Order 13112 issued February 3, 1999.

IPP: Invasive Plant Patrol. Early detection program implemented at Golden Gate National Recreation Area.

Management units: Areas to be monitored for new species/infestations. A management unit may be the entire park, critical habitat within a park, or areas of concern given their proximity to known entry points. Some parks define areas by watershed, others use site names—both are considered a management unit.

Occurrences: The weed *occurrence* is the basic unit of mapping and assessing a singular weed or weed population/infestation within WIMS and GeoWeed. Each *occurrence* defines the presence of a single species and is recorded at a specific location. The *occurrence* location is recorded as a point in space, although each *occurrence* may actually be a population of plants covering an extensive area.

Regions: A region is a uniquely named parcel of land that may have either legally defined boundaries or locally derived place names. In the protocol we may use up to three *regions* to locate each *occurrence*; one is mandatory: the sub-watershed (e.g. Fort Mason is in GGNRA26-3). *Regions* are synonymous with *area* in WIMS.

SOP: Standard Operating Procedures. These are the detailed steps explaining how to carry out the monitoring protocol.

Subwatershed: A management unit subunit of a watershed, based largely on drainages, and used to track weed work in GOGA.

Survey area: A point with typed-in length and width data, the *survey area* is mapped and documented each survey as a way of showing what area was surveyed, thus showing where target species were NOT found. The *survey area* tab in GeoWeed allows collection of negative data (species name with 0% cover and no phenology information), as well as a full inventory of plants seen (species name, % cover, phenology, identification confidence and reason for doubt). The *survey area* point is augmented by a tracklog for more detailed visualization of the survey route.

Treatments: A *treatment* is any weed management activity that occurs at a specific time over a defined geographical area. One *treatment* may affect one or more *occurrences* (of one or several species) over one or more *regions*. The WIMS and GeoWeed databases track all types of weed control methods, including manual and mechanical methods, prescribed fire, grazing, biological control, and any chemical treatments. The database also keeps track of how much staff and/or volunteer time has been spent controlling weeds.

Weed: A weed is a plant out of place. The term “noxious weed” is an official designation for weeds which cause economic harm. More precise, accepted, and general terms for environmentally harmful non-natives are exotic pest plant (although “pest” has a legal definition of causing harm, similar to “noxious”) and invasive plant species.

Appendix A: List of priority invasive species by park (2009).

Golden Gate, Muir woods, Presidio and Fort Point:

Priority	Scientific Name	Common Name	Family	Code
1	<i>Arctotheca calendula</i>	capeweed	Asteraceae	ARCA45
1	<i>Arctotheca prostrata</i>	creeping capeweed	Asteraceae	ARPR??
1	<i>Centaurea calcitrapa</i>	purple starthistle	Asteraceae	CECA2X
1	<i>Cortaderia selloana</i>	Uruguayan pampas grass	Poaceae	COSE4X
1	<i>Cytisus scoparius</i>	Scotch broom	Fabaceae	CYSC4X
1	<i>Cytisus striatus</i>	Portuguese broom	Fabaceae	CYST7X
1	<i>Digitalis purpurea</i>	purple foxglove	Scrophulariaceae	DIPUXX
1	<i>Euphorbia oblongata</i>	oblong spurge	Euphorbiaceae	EUOB4X
1	<i>Helichrysum petiolare</i>	licorice plant	Asteraceae	HEPE8X
1	<i>Ilex aquifolium</i>	English holly	Aquifoliaceae	ILAQ80
1	<i>Ulex europaeus</i>	gorse, furze	Fabaceae	ULEUXX
1	<i>Vinca major</i>	periwinkle	Apocynaceae	VIMAXX
2	<i>Acacia melanoxylon</i>	blackwood acacia	Fabaceae	ACMEXX
2	<i>Ageratina adenophora</i>	thoroughwort	Asteraceae	AGAD2X
2	<i>Centaurea melitensis</i>	totalote	Asteraceae	CEME2X
2	<i>Delairea odorata</i>	cape ivy	Asteraceae	DEODXX
2	<i>Dipsacus fullonum</i>	Fuller's teasel	Dipsacaceae	DIFU2X
2	<i>Eucalyptus globulus</i>	bluegum eucalyptus	Myrtaceae	EUGLXX
2	<i>Hedera helix</i>	English ivy	Araliaceae	HEHEXX
2	<i>Leucanthemum vulgare</i>	ox-eye daisy	Asteraceae	LEVUXX
2	<i>Mentha pulegium</i>	pennyroyal	Lamiaceae	MEPUXX
2	<i>Oxalis pes-caprae</i>	Bermuda buttercup	Oxalidaceae	OXPEXX
2	<i>Rubus discolor</i>	Himalayan blackberry	Rosaceae	RUDI2X
3	<i>Brassica rapa</i>	field mustard	Brassicaceae	BRRAXX
3	<i>Briza maxima</i>	big quakinggrass	Poaceae	BRMAXX
3	<i>Bromus diandrus</i>	ripgut brome	Poaceae	BRDI3X
3	<i>Carpobrotus edulis</i>	freeway iceplant	Aizoaceae	CAED3X
3	<i>Conium maculatum</i>	poison hemlock	Apiaceae	COMA2X
3	<i>Cortaderia jubata</i>	jubata grass	Poaceae	COJU2X
3	<i>Cotoneaster franchetii</i>	orange cotoneaster	Rosaceae	COFR3X
3	<i>Cotoneaster pannosus</i>	silverleaf cotoneaster	Rosaceae	COPA14
3	<i>Ehrharta erecta</i>	panic veldt grass	Poaceae	HERXX
3	<i>Erechtites glomerata</i>	Australian fireweed	Asteraceae	ERGL8X
3	<i>Erechtites minima</i>	Australian fireweed	Asteraceae	ERMI6X
3	<i>Foeniculum vulgare</i>	sweet fennel	Apiaceae	FOVUXX
3	<i>Genista monspessulana</i>	French broom	Fabaceae	GEMO2X
3	<i>Holcus lanatus</i>	velvet grass	Poaceae	HOLAXX

Golden Gate, Muir Woods, Presidio and Fort Point (continued):

Priority	Scientific Name	Common Name	Family	Code
3	<i>Phalaris aquatica</i>	Harding grass	Poaceae	PHAQXX
3	<i>Pinus radiata</i>	Monterey pine	Pinaceae	PIRA2
3	<i>Rumex acetosella</i>	sheep sorrel	Polygonaceae	RUAC3
3	<i>Schinus molle</i>	pepper tree	Anacardiaceae	SCMO
3	<i>Tamarix chinensis</i>	saltcedar	Tamaricaceae	TACH2
3	<i>Xanthium spinosum</i>	spiny cocklebur	Asteraceae	XASP2
3	<i>Xanthium strumarium</i>	rough cocklebur	Asteraceae	XAST
3.1	<i>Ailanthus altissima</i>	tree-of-heaven	Simaroubaceae	AIAL
3.1	<i>Albizia lophantha</i>	silk tree; cape wattle	Fabaceae	ALLO
3.1	<i>Anthoxanthum odorata</i>	sweet vernal grass	Poaceae	ANOD
3.1	<i>Berberis darwinii</i>	Darwin's berberis	Berberidaceae	BEDA
3.1	<i>Carduus acanthoides</i>	plumeless thistle	Asteraceae	CAAC
3.1	<i>Carthamus lanatus</i>	woolly distaff thistle	Asteraceae	CALA20
3.1	<i>Centaurea solstitialis</i>	yellow starthistle	Asteraceae	CESO3
3.1	<i>Cirsium arvense</i>	Canada thistle	Asteraceae	CIAR4
3.1	<i>Crataegus monogyna</i>	singleseed hawthorn	Rosaceae	CRMO
3.1	<i>Cynara cardunculus</i>	artichoke thistle	Asteraceae	CYCA
3.1	<i>Cynodon dactylon</i>	Bermudagrass	Poaceae	CYDA
3.1	<i>Dittrichia graveolens</i>	stinkweed	Asteraceae	DIGR4
3.1	<i>Echium plantagineum</i>	salvation jane	Boraginaceae	ECPL
3.1	<i>Ehrharta calycina</i>	perennial veldt grass	Poaceae	EHCA
3.1	<i>Hedera canariensis</i>	Algerian ivy	Araliaceae	HECA
3.1	<i>Hypericum perforatum</i>	Klamathweed	Clusiaceae	HYPE
3.1	<i>Nicotiana glauca</i>	tree tobacco	Solanaceae	NIGL
3.1	<i>Phalaris arundinacea</i>	reed canary grass	Poaceae	PHAR3
3.1	<i>Pittosporum crassifolium</i>	stiffleaf cheesewood	Pittosporaceae	PICR
3.1	<i>Pyracantha angustifolia</i>	narrowleaf firethorn	Rosaceae	PYAN
3.1	<i>Robinia pseudoacacia</i>	black locust	Fabaceae	ROPS
3.1	<i>Scabiosa atropurpurea</i>	mourningbride	Dipsacaceae	SCAT
3.1	<i>Spartium junceum</i>	Spanish broom	Fabaceae	SPJU2
3.2	<i>Bromus madritensis ssp. rubens</i>	red brome	Poaceae	BRMAR
3.2	<i>Bromus tectorum</i>	cheat grass	Poaceae	BRTE
3.2	<i>Dactylis glomerata</i>	orchard grass	Poaceae	DAGL
3.2	<i>Hirschfeldia incana</i>	shortpod mustard	Brassicaceae	HIIN3
3.2	<i>Festuca arundinacea</i>	tall fescue	Poaceae	FEAR3
3.2	<i>Leptospermum laevigatum</i>	Australian teatree	Myrtaceae	LELA29
3.2	<i>Pennisetum clandestinum</i>	Kikuyu grass	Poaceae	PECL2
3.2	<i>Rosa eglanteria</i>	sweetbriar rose	Rosaceae	ROEG
4	<i>Acacia baileyana</i>	cootamundra wattle	Fabaceae	ACBA
4	<i>Acacia dealbata</i>	silver wattle	Fabaceae	ACDE3

Golden Gate, Muir Woods, Presidio and Fort Point (continued):

Priority	Scientific Name	Common Name	Family	Code
4	<i>Acacia decurrens</i>	green wattle	Fabaceae	ACDE
4	<i>Acacia longifolia</i>	Sydney golden wattle	Fabaceae	ACLO
4	<i>Acacia mearnsii</i>	black wattle	Fabaceae	ACME80
4	<i>Acacia verticillata</i>	prickly Moses	Fabaceae	ACVE2
4	<i>Allium triquetrum</i>	threecorner leek	Liliaceae	ALTR4
4	<i>Alopecurus pratensis</i>	meadow foxtail	Poaceae	ALPR3
4	<i>Amaryllis belladonna</i>	belladonna lily	Liliaceae	AMBE3
4	<i>Anredera cordifolia</i>	Madeira vine	Basellaceae	ANCO6
4	<i>Arrhenatherum elatius</i>	tall oatgrass	Poaceae	AREL3
4	<i>Barbarea verna</i>	early yellowrocket	Brassicaceae	BAVE
4	<i>Barbarea vulgaris</i>	winter cress	Brassicaceae	BAVU
4	<i>Bellardia trixago</i>	bellardia	Scrophulariaceae	BETR
4	<i>Brachypodium distachyon</i>	purple false brome	Poaceae	BRDI2
4	<i>Brassica nigra</i>	black mustard	Brassicaceae	BRNI
4	<i>Briza minor</i>	little quakinggrass	Poaceae	BRMI2
4	<i>Bromus catharticus</i>	rescue grass	Poaceae	BRCA6
4	<i>Bromus hordeaceus</i>	soft brome	Poaceae	BRHO2
4	<i>Bromus stamineus</i>	roadside brome	Poaceae	BRST3
4	<i>Calendula arvensis</i>	field marigold	Asteraceae	CAAR
4	<i>Carduus tenuiflorus</i>	slender-flowered thistle	Asteraceae	CATU2
4	<i>Centaurea diluta</i>	North African knapweed	Asteraceae	CEDI4
4	<i>Centranthus ruber</i>	red valerian	Valerianaceae	CERU2
4	<i>Cestrum aurantiacum</i>	orange jessamine	Solanaceae	CEAU2
4	<i>Chrusanthemum segetum</i>	corndaisy	Asteraceae	CHSE
4	<i>Coprosma repens</i>	creeping mirrorplant	Rubiaceae	CORE4
4	<i>Cotula australis</i>	Australian waterbuttons	Asteraceae	COAU3
4	<i>Cotula coronopifolia</i>	brassbuttons	Asteraceae	COCO7
4	<i>Crocasmia X crocosmiiflora</i>	crocasmia, montbretia	Iridaceae	CRCR6
4	<i>Cupressus macrocarpa</i>	Monterey cypress	Cupressaceae	CUMA2
4	<i>Cytisus multiflorus</i>	white spanishbroom	Fabaceae	CYMU3
4	<i>Daucus carota</i>	Queen Anne's lace	Apiaceae	DACA6
4	<i>Digitaria sanguinalis</i>	crabgrass	Poaceae	DISA
4	<i>Dipsacus sativus</i>	Indian teasel	Dipsacaceae	DISA9
4	<i>Duchesnea indica</i>	mock-strawberry	Rosaceae	DUIN
4	<i>Echium candicans</i>	pride of Madeira	Boraginaceae	ECCA5
4	<i>Epipactis helleborine</i>	broadleaf helleborine	Orchidaceae	EPHE
4	<i>Erigeron karvinskianus</i>	Latin American fleabane	Asteraceae	ERKA2
4	<i>Escallonia rubra</i>	redclaws	Grossulariaceae	ESRU4
4	<i>Euphorbia peplus</i>	petty spurge	Euphorbiaceae	EUPE6
4	<i>Geranium retrorsum</i>	New Zealand geranium	Geraniaceae	GERE

Golden Gate, Muir Woods, Presidio and Fort Point (continued):

Priority	Scientific Name	Common Name	Family	Code
4	<i>Gunnera tinctoria</i>	Chilean gunnera	Gunneraceae	GUTI
4	<i>Hainardia cylindrica</i>	barbgrass	Poaceae	HACY
4	<i>Hedypnois cretica</i>	Cretanweed	Asteraceae	HECR2
4	<i>Hypericum calycinum</i>	Aaron's beard	Clusiaceae	HYCA10
4	<i>Ipomoea mutabilis</i>	oceanblue morning-glory	Convolvulaceae	IPMU6
4	<i>Kniphofia uvaria</i>	redhot poker	Liliaceae	KNUV80
4	<i>Lathyrus latifolius</i>	perennial pea	Fabaceae	LALA4
4	<i>Lepidium strictum</i>	upright pepperweed	Brassicaceae	LEST2
4	<i>Leucanthemum maximum</i>	Shasta daisy and hybrids	Asteraceae	LEMA8
4	<i>Ligustrum ovalifolium</i>	california privet	Oleaceae	LIOV
4	<i>Linaria vulgaris</i>	butter and eggs	Scrophulariaceae	LIVU2
4	<i>Lobularia maritima</i>	sweet alyssum	Brassicaceae	LOMA
4	<i>Lonicera japonica</i>	Japanese honeysuckle	Caprifoliaceae	LOJA
4	<i>Marrubium vulgare</i>	horehound	Lamiaceae	MAVU
4	<i>Mentha spicata</i> var. <i>spicata</i>	spearmint	Lamiaceae	MESP3
4	<i>Mentha X piperita</i>	peppermint	Lamiaceae	MEPI
4	<i>Muehlenbeckia complexa</i>	maidenhair vine	Polygonaceae	MUCO3
4	<i>Myosotis discolor</i>	forget-me-not	Boraginaceae	MYDI
4	<i>Myosotis latifolia</i>	broadleaf forget-me-not	Boraginaceae	MYLA4
4	<i>Narcissus pseudonarcissus</i>	common daffodil	Liliaceae	NAPS
4	<i>Nerium oleander</i>	oleander	Apocynaceae	NEOL
4	<i>Parapholis incurva</i>	curved sicklegrass	Poaceae	PAIN
4	<i>Parentucellia viscosa</i>	yellow glandweed	Scrophulariaceae	PAVI3
4	<i>Paspalum dilatatum</i>	dallis grass	Poaceae	PADI3
4	<i>Phalaris canariensis</i>	annual canarygrass	Poaceae	PHCA5
4	<i>Phalaris minor</i>	littleseed canarygrass	Poaceae	PHMI3
4	<i>Phalaris paradoxa</i>	hood canarygrass	Poaceae	PHPA5
4	<i>Pittosporum undulatum</i>	Victorian box	Pittosporaceae	PIUN2
4	<i>Polycarpon tetraphyllum</i>	fourleaf manyseed	Caryophyllaceae	POTE
4	<i>Prunus avium</i>	bird cherry	Rosaceae	PRAV
4	<i>Prunus cerasifera</i>	cherry plum	Rosaceae	PRCE2
4	<i>Ranunculus muricatus</i>	spinyfruit buttercup	Ranunculaceae	RAMU2
4	<i>Ranunculus repens</i>	creeping buttercup	Ranunculaceae	RARE3
4	<i>Raphanus sativus</i>	wild radish	Brassicaceae	RASA2
4	<i>Schinus molle</i>	pepper tree	Anacardiaceae	SCMO
4	<i>Senecio elegans</i>	redpurple ragwort	Asteraceae	SEEL
4	<i>Sinapis arvensis</i>	charlock	Brassicaceae	SIAR4
4	<i>Solanum marginatum</i>	white-margined nightshade	Solanaceae	SOMA
4	<i>Sparaxis tricolor</i> hybrid	harlequin flower	Iridaceae	SPTR
4	<i>Tanacetum parthenium</i>	feverfew	Asteraceae	TAPA6

Golden Gate, Muir Woods, Presidio and Fort Point (continued):

Priority	Scientific Name	Common Name	Family	Code
4	<i>Tetragonia tetragonioides</i>	New Zealand spinach	Aizoaceae	TETE3
4	<i>Thinopyrum junceiforme</i>	Russian wheatgrass	Poaceae	THJU3
4	<i>Tragopogon porrifolius</i>	purple salsify	Asteraceae	TRPO
4	<i>Tropaeolum majus</i>	nasturtium	Tropaeolaceae	TRMA7
4	<i>Verbascum blattaria</i>	moth mullein	Scrophulariaceae	VEBL
4	<i>Watsonia borbonica</i>	bugle-lily	Iridaceae	WABO
4	<i>Watsonia marginata</i>	fragrant bugle-lily	Iridaceae	WAMA2
4	<i>Watsonia meriana</i>	bulbil bugle-lily	Iridaceae	WAME
4	<i>Zantedeschia aethiopica</i>	calla lily	Araceae	ZAAE
5	<i>Ammophila arenaria</i>	European beachgrass	Poaceae	AMAR4
5	<i>Ammophila breviligulata</i>	American beachgrass	Poaceae	AMBR
5	<i>Aptenia cordifolia</i>	heartleaf iceplant	Aizoaceae	APCO
5	<i>Arundo donax</i>	giant reed	Poaceae	ARDO4
5	<i>Carpobrotus chilensis</i>	sea fig	Aizoaceae	CACH38
5	<i>Conicosia pugioniformis</i>	narrow-leaved iceplant	Aizoaceae	COPU18
5	<i>Drosanthemum floribundum</i>	showy dewflower	Aizoaceae	DRFL2
5	<i>Eichhornia crassipes</i>	water hyacinth	Pontederiaceae	EICR
5	<i>Mesembryanthemum crystallinum</i>	ice plant	Aizoaceae	MECR3
5	<i>Myriophyllum aquaticum</i>	parrot's-feather	Haloragaceae	MYAQ2
5	<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Haloragaceae	MYSP2
5	<i>Spartina alterniflora</i>	Smooth cordgrass	Poaceae	SPAL

Appendix A: 2009 List of priority invasive species by park (continued).

Point Reyes:

Priority	Scientific Name	Common Name	Family	Code
1	<i>Carduus acanthoides</i>	plumeless thistle	Asteraceae	CAAC
1	<i>Carthamus lanatus</i>	woolly distaff thistle	Asteraceae	CALA20
1	<i>Centaurea calcitrapa</i>	purple starthistle	Asteraceae	CECA2
1	<i>Centaurea melitensis</i>	Napa thistle, tocalote	Asteraceae	CEME2
1	<i>Centaurea solstitialis</i>	yellow starthistle	Asteraceae	CESO3
1	<i>Cotoneaster franchetii</i>	orange cotoneaster	Roseaceae	COFR3
1	<i>Cotoneaster pannosus</i>	silverleaf cotoneaster	Roseaceae	COPA14
1	<i>Euphorbia oblongata</i>	eggless or oblong spurge	Euphorbiaceae	EUOB4
1	<i>Helichrysum petiolare</i>	licorice plant	Asteraceae	HEPE8
1	<i>Hypericum perforatum</i>	Klamathweed	Clusiaceae	HYPE
1	<i>Ulex europaea</i>	gorse, furze	Fabaceae	ULEU
2	<i>Acacia melanoxylon</i>	blackwood acacia	Fabaceae	ACME
2	<i>Arctotheca calendula</i>	capeweed	Asteraceae	ARCA45
2	<i>Arctotheca prostrata</i>	creeping capeweed	Asteraceae	ARPR??
2	<i>Berberis darwinii</i>	Darwin's berberis	Berberidaceae	BEDA
2	<i>Cystisus scoparius</i>	Scotch broom	Fabaceae	CYSC4
2	<i>Datura stramonium</i>	jimsonweed, thorn apple	Solanaceae	DAST
2	<i>Delairea odorata</i>	cape ivy	Asteraceae	DEOD
2	<i>Echium candicans</i>	pride of Madeira	Boraginaceae	ECCA5
2	<i>Genista monspessulana</i>	French broom	Fabaceae	GEMO2
2	<i>Hedera helix</i>	English ivy	Araliaceae	HEHE
2	<i>Ilex aquifolium</i>	English holly	Aquifoliaceae	ILAQ80
2	<i>Leucanthemum vulgare</i>	ox-eye daisy	Asteraceae	LEVU
2	<i>Linaria vulgaris</i>	butter and eggs	Scrophulariaceae	LIVU2
2	<i>Oxalis pes-caprae</i>	Bermuda buttercup	Oxalidaceae	OXPE
2	<i>Pennisetum clandestinum</i>	Kikuyu grass	Poaceae	PECL2
2	<i>Phalaris aquatica</i>	Harding grass	Poaceae	PHAQ
2	<i>Pittosporum undulatum</i>	Victorian box	Pittosporaceae	PIUN2
2	<i>Rubus discolor</i>	Himalayan blackberry	Rosaceae	RUDI2
2	<i>Tetragonia tetragonoides</i>	New Zealand spinach	Aizoaceae	TETE3
2	<i>Vinca major</i>	periwinkle	Apocynaceae	VIMA
2	<i>Xanthium spinosum</i>	spiny cocklebur	Asteraceae	XASP2
3	<i>Allium triquetrum</i>	threecorner leek	Liliaceae	ALTR4
3	<i>Acacia longifolia</i>	Sydney golden wattle	Fabaceae	ACLO
3	<i>Acacia verticillata</i>	prickly Moses	Fabaceae	ACVE2

Point Reyes (continued):

Priority	Scientific Name	Common Name	Family	Code
3	<i>Carpobrotus chilensis</i>	sea fig	Aizoaceae	CACH38
3	<i>Carpobrotus edulis</i>	freeway iceplant	Aizoaceae	CAED3
3	<i>Conium maculatum</i>	poison hemlock	Apiaceae	COMA2
3	<i>Cortaderia jubata</i>	jubata grass	Poaceae	COJU2
3	<i>Cortaderia selloana</i>	Uruguayan pampas grass	Poaceae	COSE4
3	<i>Cotoneaster lacteus</i>	milkflower cotoneaster	Rosaceae	COLA18
3	<i>Crataegus monogyna</i>	singleseed hawthorn	Rosaceae	CRMO
3	<i>Cupressus macrocarpa</i>	Monterey cypress	Cupressaceae	CUMA2
3	<i>Digitalis purpurea</i>	purple foxglove	Scrophulariaceae	DIPU
3	<i>Dipsacus fullonum</i>	common or Fuller's teasel	Dipsacaceae	DIFU2
3	<i>Dipsacus sativus</i>	indian teasel	Dipsacaceae	DISA9
3	<i>Drosanthemum floribundum</i>	showy dewflower	Aizoaceae	DRFL2
3	<i>Echium plantagineum</i>	salvation jane	Boraginaceae	ECPL
3	<i>Ehrharta erecta</i>	panic veldt grass	Poaceae	EHHER
3	<i>Eucalyptus globulus</i>	bluegum eucalyptus	Myrtaceae	EUGL
3	<i>Euphorbia lathyris</i>	gopher plant, caper spurge	Euphorbiaceae	EULA4
3	<i>Festuca arundinacea</i>	tall fescue	Poaceae	FEAR3
3	<i>Foeniculum vulgare</i>	sweet fennel	Apiaceae	FOVU
3	<i>Hypericum calycinum</i>	Aaron's beard	Clusiaceae	HYCA10
3	<i>Lythrum hyssopifolia</i>	hyssop loosestrife	Lythraceae	LYHY2
3	<i>Mentha pulegium</i>	pennyroyal	Lamiaceae	MEPU
3	<i>Myoporum laetum</i>	myoporum	Myoporaceae	MYLA5
3	<i>Pinus radiata</i>	Monterey pine	Pinaceae	PIRA2
3	<i>Populus alba</i>	white poplar	Salicaceae	POAL7
3	<i>Pyracantha angustifolia</i>	narrowleaf firethorn	Rosaceae	PYAN
3	<i>Rosa eglanteria</i>	sweetbriar rose	Rosaceae	ROEG
3	<i>Scabiosa atropurpurea</i>	mourningbride	Dipsacaceae	SCAT
3	<i>Sorghum halepense</i>	Johnson grass	Poaceae	SOHA
3	<i>Sparaxis tricolor</i>	harlequinflower	Iridaceae	SPTR
3	<i>Tanacetum parthenium</i>	feverfew	Asteraceae	TAPA6
3	<i>Verbascum blattaria</i>	moth mullein	Scrophulariaceae	VEBL
3	<i>Watsonia meriana</i>	bulbil bugle-lily	Iridaceae	WAME
3	<i>Zantedeschia aethiopica</i>	calla lily	Araceae	ZAAE
3.1	<i>Acroptilon [Centaurea] repens</i>	Russian knapweed	Asteraceae	ACRE3
3.1	<i>Aegilops triuncialis</i>	barbed goatgrass	Poaceae	AETR
3.1	<i>Ageratina adenophora</i>	thoroughwort	Rosaceae	AGAD2
3.1	<i>Albizia lophantha</i>	silk tree, cape wattle	Fabaceae	ALLO
3.1	<i>Anthoxanthum odoratum</i>	sweet vernalgrass	Poaceae	ANOD
3.1	<i>Brachypodium distachyon</i>	purple false brome	Poaceae	BRDI2

Point Reyes (continued):

Priority	Scientific Name	Common Name	Family	Code
3.1	<i>Centaurea iberica</i>	Iberian starthistle	Asteraceae	CEIB
3.1	<i>Dittrichia graveolens</i>	stinkweed	Asteraceae	DIGR4
3.1	<i>Ehrharta calycina</i>	perennial veldt grass	Poaceae	EHCA
3.1	<i>Marrubium vulgare</i>	horehound	Lamiaceae	MAVU
3.1	<i>Paspalum dilatatum</i>	dallis grass	Poaceae	PADI3
3.1	<i>Robinia pseudoacacia</i>	black locust	Fabaceae	ROPS
3.1	<i>Salsola soda</i>	Russian thistle	Chenopodiaceae	SASO3
3.1	<i>Senecio jacobaea</i>	tansy ragwort	Asteraceae	SEJA
4	<i>Agrostis avenacea</i>	Pacific bentgrass	Poaceae	AGAV
4	<i>Agrostis capillaris</i>	colonial bentgrass	Poaceae	AGCA5
4	<i>Agrostis stolonifera</i>	creeping bentgrass	Poaceae	AGST2
4	<i>Agrostis viridis</i>	green bent	Poaceae	AGV11
4	<i>Anthemis cotula</i>	chamomile, dog fennel	Asteraceae	ANCO2
4	<i>Aptenia cordifolia</i>	heartleaf iceplant	Aizoaceae	APCO
4	<i>Avena barbata</i>	slender oat	Poaceae	AVBA
4	<i>Avena fatua</i>	wild oat	Poaceae	AVFA
4	<i>Bellardia trixago</i>	bellardia	Scrophulariaceae	BETR
4	<i>Brassica nigra</i>	black mustard	Brassicaceae	BRNI
4	<i>Brassica rapa</i>	field mustard	Brassicaceae	BRRA
4	<i>Briza maxima</i>	big quakinggrass	Poaceae	BRMA
4	<i>Briza minor</i>	little quakinggrass	Poaceae	BRMI2
4	<i>Bromus diandrus</i>	ripgut brome	Poaceae	BRCA6
4	<i>Bromus hordeaceus</i>	soft brome	Poaceae	BRHO2
4	<i>Bromus madritensis</i> ssp. <i>rubens</i>	red brome	Poaceae	BRMAR
4	<i>Carduus pycnocephalus</i>	Italian thistle	Asteraceae	CAPY2
4	<i>Carduus tenuiflorus</i>	slender-flowered thisle	Asteraceae	CATE2
4	<i>Cichorium intybus</i>	chicory	Asteraceae	CIIN
4	<i>Cirsium vulgare</i>	bull thistle	Asteraceae	CIVU
4	<i>Convolvulus arvensis</i>	field bindweed	Convolvulaceae	COAR4
4	<i>Crocasmia X crocosmiiflora</i>	crocasmia, montbretia	Iridaceae	CRCR6
4	<i>Cynosurus echinatus</i>	hedgehog dogtail	Poaceae	CYEC
4	<i>Dactylis glomerata</i>	orchard grass, cocksfoot	Poaceae	DAGL
4	<i>Erechtites glomerata</i>	Australian fireweed	Asteraceae	ERGL8
4	<i>Erechtites minima</i>	Australian fireweed	Asteraceae	ERMI6
4	<i>Geranium dissectum</i>	cutleaf geranium	Geraniaceae	GEDI
4	<i>Hirschfeldia incana</i>	shortpod mustard	Brassicaceae	HIIN3
4	<i>Holcus lanatus</i>	velvet grass	Poaceae	HOLA
4	<i>Hordeum marinum</i> ssp. <i>gussonianum</i>	Mediterranean barley	Poaceae	HOMAG

Point Reyes (continued):

Priority	Scientific Name	Common Name	Family	Code
4	<i>Hordeum murinum</i>	mouse barley	Poaceae	HOMU
4	<i>Hypochaeris glabra</i>	smooth catsear	Asteraceae	HYGL2
4	<i>Hypochaeris radicata</i>	hairy cat's ear	Asteraceae	HYRA3
4	<i>Leontodon taraxacoides</i> ssp. <i>longirostris</i>	lesser hawkbit	Asteraceae	LETAL
4	<i>Lepidium strictum</i>	upright pepperweed	Brassicaceae	LEST2
4	<i>Leucanthemum maximum</i>	Shasta daisy and hybrids	Asteraceae	LEMA8
4	<i>Lolium multiflorum</i>	Italian or annual ryegrass	Poaceae	LOMU
4	<i>Lolium perenne</i>	perennial ryegrass	Poaceae	LOPE
4	<i>Lotus corniculatus</i>	Birdsfoot trefoil	Fabaceae	LOCO6
4	<i>Medicago polymorpha</i>	California burclover	Fabaceae	MEPO3
4	<i>Melilotus alba</i>	white sweetclover	Fabaceae	MEAL2
4	<i>Melilotus indica</i>	sourclover	Fabaceae	MEIN2
4	<i>Picris echioides</i>	bristly oxtongue	Asteraceae	PIEC
4	<i>Plantago lanceolata</i>	English plantain	Plantaginaceae	PLLA
4	<i>Poa pratensis</i> ssp. <i>pratensis</i>	Kentucky bluegrass	Poaceae	POPRP2
4	<i>Polypogon monspeliensis</i>	rabbitfoot beardgrass	Poaceae	POMO5
4	<i>Raphanus raphanistrum</i>	wild radish	Brassicaceae	RARA2
4	<i>Raphanus sativus</i>	wild radish	Brassicaceae	RASA2
4	<i>Romulea rosea</i> var. <i>australis</i>	rosy sandcrocus	Iridaceae	ROROA
4	<i>Rosa canina</i>	dog rose	Rosaceae	ROCA3
4	<i>Rumex acetosella</i>	sheep sorrel	Polygonaceae	RUAC3
4	<i>Rumex crispus</i>	curly dock	Polygonaceae	RUCR
4	<i>Silene gallica</i>	windmill catchfly	Caryophyllaceae	SIGA
4	<i>Silybum marianum</i>	blessed milkthistle	Asteraceae	SIMA3
4	<i>Solanum nigrum</i>	black nightshade	Solanaceae	SONI
4	<i>Sonchus arvensis</i>	perennial sowthistle	Asteraceae	SOAR2
4	<i>Trifolium hirtum</i>	rose clover	Fabaceae	TRHI4
5.1	<i>Alisma lanceolatum</i>	lanceleaf water plantain	Alismataceae	ALLA2
5.1	<i>Arundo donax</i>	giant reed	Poaceae	ARDO4
5.1	<i>Conicosia pugioniformis</i>	narrow-leaved iceplant	Aizoaceae	COPU18
5.1	<i>Egeria densa</i>	Brazilian elodea	Hydrocharitaceae	EGDE
5.1	<i>Iris pseudacorus</i>	yellow flag	Iridaceae	IRPS
5.1	<i>Lepidium latifolium</i>	perennial pepperweed	Brassicaceae	LELA2
5.1	<i>Ludwigia peploides</i>	floating primrose-willow	Onagraceae	LUPE5X
5.1	<i>Myriophyllum aquaticum</i>	parrot's-feather	Haloragaceae	MYAQ2
5.1	<i>Phalaris arundinacea</i>	reed canary grass	Poaceae	PHAR3
5.1	<i>Spartina alterniflora</i>	smooth cordgrass	Poaceae	SPAL
5.3	<i>Ammophila arenaria</i>	European beachgrass	Poaceae	AMAR4

Point Reyes (continued):

Priority	Scientific Name	Common Name	Family	Code
5.4	<i>Cakile edentula</i>	European searocket	Brassicaceae	CAED
5.4	<i>Cakile maritima</i>	European searocket	Brassicaceae	CAMA

Appendix A: 2009 List of priority invasive species by park (continued).

Pinnacles:

Priority	Scientific Name	Common Name	Family	Code
1	<i>Acroptilon repens</i>	Russian knapweed	Asteraceae	ACRE3
1	<i>Lepidium latifolium</i>	perennial pepperweed	Brassicaceae	LELA2
1	<i>Melilotus alba</i>	white sweetclover	Fabaceae	MEAL2
1	<i>Nicotiana glauca</i>	tree tobacco	Solanaceae	NIGL
1	<i>Rubus discolor</i>	Himalayan blackberry	Rosaceae	RUDI2
1	<i>Salsola tragus</i>	prickly Russian thistle	Chenopodiaceae	SATR12
1	<i>Taeniatherum caput-medusae</i>	Medusahead	Poaceae	TACA8
1	<i>Verbascum thapsus</i>	woolly mullein	Scrophulariaceae	VETH
2	<i>Carduus pycnocephalus</i>	Italian thistle	Asteraceae	CAPY2
2	<i>Carduus tenuiflorus</i>	slender-flowered thistle	Asteraceae	CATE2
2	<i>Conium maculatum</i>	poison hemlock	Apiaceae	COMA2
2	<i>Cynodon dactylon</i>	Bermudagrass	Poaceae	CYDA
2	<i>Marrubium vulgare</i>	horehound	Lamiaceae	MAVU
3	<i>Amaranthus albus</i>	tumbleweed	Amaranthaceae	AMAL
3	<i>Brassica nigra</i>	black mustard	Brassicaceae	BRNI
3	<i>Brassica rapa</i>	field mustard	Brassicaceae	BRRR
3	<i>Centaurea melitensis</i>	Napa thistle, tocalote	Asteraceae	CEME2
3	<i>Centaurea solstitialis</i>	yellow starthistle	Asteraceae	CESO3
3	<i>Cirsium vulgare</i>	bull thistle	Asteraceae	CIVU
3	<i>Hirschfeldia incana</i>	shortpod mustard	Brassicaceae	HIIN3
3	<i>Lactuca serriola</i>	prickly lettuce	Asteraceae	LASE
3	<i>Mentha spicata</i> var. <i>spicata</i>	spearmint	Lamiaceae	MESP3
3	<i>Mentha X piperita</i>	peppermint	Lamiaceae	MEPI
3	<i>Plantago lanceolata</i>	English plantain	Plantaginaceae	PLLA
3	<i>Polygonum arenastrum</i>	oval-leaf knotweed	Polygonaceae	POAR11
3	<i>Raphanus sativus</i>	wild radish	Brassicaceae	RASA2
3	<i>Rumex acetosella</i>	sheep sorrel	Polygonaceae	RUAC3
3	<i>Rumex crispus</i>	curly dock	Polygonaceae	RUCR
3	<i>Silybum marianum</i>	blessed milkthistle	Asteraceae	SIMA3
3.1	<i>Ailanthus altissima</i>	tree-of-heaven	Simaroubaceae	AIAL
3.1	<i>Chenopodium ambrosioides</i>	Mexican-tea	Chenopodiaceae	CHAM
3.1	<i>Dittrichia graveolens</i>	stinkweed	Asteraceae	DIGR
3.1	<i>Lolium multiflorum</i>	Italian ryegrass	Poaceae	LOMU
3.1	<i>Lolium perenne</i>	perennial ryegrass	Poaceae	LOPE
3.1	<i>Lolium temulentum</i>	darnel	Poaceae	LOTE2
3.1	<i>Malva parviflora</i>	cheeseweed	Malvaceae	MAPA5

Pinnacles (continued):

Priority	Scientific Name	Common Name	Family	Code
3.1	<i>Picris echioides</i>	bristly oxtongue	Asteraceae	PIEC
3.1	<i>Piptatherum miliaceum</i>	smilo grass	Poaceae	PIMI3
3.1	<i>Poa bulbosa</i>	bulbous bluegrass	Poaceae	POBU
3.1	<i>Tragopogon dubius</i>	yellow salsify	Asteraceae	TRDU
3.1	<i>Tribulus terrestris</i>	puncturevine	Zygophyllaceae	TRTE
3.1	<i>Trifolium hirtum</i>	rose clover	Fabaceae	TRHI4
3.1	<i>Verbascum blattaria</i>	moth mullein	Scrophulariaceae	VEBL
3.1	<i>Xanthium spinosum</i>	spiny cocklebur	Asteraceae	XASP2
4	<i>Erodium botrys</i>	longbeak stork's bill	Geraniaceae	ERBO
4	<i>Erodium brachycarpum</i>	shortfruit stork's bill	Geraniaceae	ERBR14
4	<i>Erodium cicutarium</i>	redstem filaree	Geraniaceae	ERIC6
4	<i>Erodium moschatum</i>	musky stork's bill	Geraniaceae	ERMO7
4	<i>Filago [Logfia] gallica</i>	narrowleaf cottonrose	Asteraceae	FIGA
4	<i>Gastidium ventricosum</i>	nit grass	Poaceae	GAVE3
4	<i>Geranium dissectum</i>	cutleaf geranium	Geraniaceae	GEDI
4	<i>Gnaphalium luteoalbum</i>	Jersey cudweed	Asteraceae	GNLU
4	<i>Herniaria hirsuta</i> ssp. <i>cinerea</i>	hairy rupturewort	Caryophyllaceae	HEHC
4	<i>Hypochaeris glabra</i>	smooth catsear	Asteraceae	HYGL2
4	<i>Hypochaeris radicata</i>	hairy cat's ear	Asteraceae	HYRA3
4	<i>Lythrum hyssopifolia</i>	hyssop loosestrife	Lythraceae	LYHY2
4	<i>Medicago polymorpha</i>	California burclover	Fabaceae	MEPO3
4	<i>Melilotus indica</i>	sourclover	Fabaceae	MEIN2
4	<i>Nicotiana acuminata</i> var. <i>multiflora</i>	manyflower tobacco	Solanaceae	NIACM
4	<i>Plantago major</i>	broadleaf plantain	Plantaginaceae	PLMA2
4	<i>Polycarpon tetraphyllum</i>	fourleaf manyseed	Caryophyllaceae	POTE
4	<i>Polypogon interruptus</i>	ditch rabbit's-foot grass	Poaceae	POIN7
4	<i>Polypogon monspeliensis</i>	rabbitfoot beardgrass	Poaceae	POMO5
4	<i>Portulaca oleracea</i>	purslane	Portulacaceae	POOL
4	<i>Silene gallica</i>	windmill catchfly	Caryophyllaceae	SIGA
4	<i>Sisymbrium orientale</i>	oriental hedgemustard	Brassicaceae	SIOR4
4	<i>Spergula arvensis</i> ssp. <i>arvensis</i>	corn spurry	Caryophyllaceae	SPAR

Appendix B. Maps showing 2009 survey results.

Available online at:

http://science.nature.nps.gov/im/units/sfan/vital_signs/Invasives/report_maps.cfm

<http://www.calflora.org/cgi-bin/occform.cgi>

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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