



Invasive Plant Species Early Detection in the San Francisco Area Network

2011 Annual Report

Natural Resource Technical Report NPS/SFAN/NRTR—2012/620



ON THE COVER

Invasive plant interns and staff survey a section of “pig fence” in Pinnacles National Monument.
Photograph by: Eric Wrubel, NPS

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Eric Wrubel and Robert Steers

National Park Service
San Francisco Bay Area Network
Inventory & Monitoring Program
Fort Cronkhite Building 1063
San Francisco, California 94965

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

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Executive Summary

This report summarizes the results of the 2011 invasive plant early detection protocol surveys for the San Francisco Bay Area Network of National Parks Inventory and Monitoring Program (SFAN). Invasive plants (see Glossary) represent a particularly high priority vital sign for SFAN because of the negative effects they have on park resources, including altering ecosystem processes (fire regime, hydrology, soil biogeochemical cycling, etc...), reducing habitat quality, blocking views, and increasing trail maintenance needs.

The 2011 early detection surveys were conducted in all SFAN parks that contain areas with natural vegetation or unlandscaped open space. Surveys were conducted in Golden Gate National Recreation Area (GOGA), John Muir National Historic Site (JOMU), Pinnacles National Monument (PINN), and Point Reyes National Seashore (PORE). Objectives and methods for the 2011 field season were based on the early detection protocol (Williams et al. 2009). Including field seasons when pilot data was collected, 2011 was the third field season of data collection in PINN and JOMU, the fourth in PORE, and the fifth in GOGA.

Volunteers played an important role in the implementation of the 2011 field surveys. At GOGA, 19 volunteers assisted staff to conduct surveys, contributing 630 hours. At PORE, five volunteers contributed 88 hours. At PINN, three volunteers contributed 76 hours performing surveys. At JOMU two volunteers contributed 11 hours performing surveys.

Seventy-five miles of trails and roadsides were surveyed within GOGA and 1,337 individual occurrences of target weed species were recorded. Seven miles of trails were surveyed at JOMU, and 66 priority weed occurrences were recorded. Twenty-five miles of trails, fencelines, and drainages were surveyed at PINN and 66 occurrences of target weeds were recorded. One-hundred and four miles of trails and roadsides were surveyed at PORE and 438 occurrences of target weeds were recorded.

In GOGA and PORE, 25 non-native species that are new to these parks were recorded and collected during the 2011 early detection surveys. Fourteen of these newly recorded species were added to the 2012 priority lists for early detection, and all 25 species will be added to the lists of vascular plants for the parks (IRMA 2011a, 2011b).

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

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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, 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 urban development pressures, the San Francisco Area Network (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. For example, in Golden Gate National Recreation Area (GOGA), 25 species of exotic or 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 exotic species. Monitoring these routes is the most effective way to prevent the spread of existing species and the infestation of new species (McNeely et al. 2001).

During vital sign prioritization by the SFAN Inventory and Monitoring Program, invasive plant species early detection ranked as the second most important vital sign for the network (Adams et al. 2006). The early detection monitoring protocol was developed by the SFAN to locate new, isolated infestations of invasive plants before they become entrenched in the network parks (Williams et al. 2009). For this vital sign, SFAN staff ranked both species and areas (i.e. subwatersheds) in each park to prioritize search efforts. Every year, exotic species lists for each park are re-prioritized, if necessary, based on previous survey data and updated management concerns. Appendices A through D contain the 2011 priority exotic species lists for each park unit.

Objectives

Objectives for the 2011 field season were based on the early detection protocol (Williams et al. 2009) and current management priorities:

- 1) Within GOGA and PORE, survey all roads and trails in high-priority subwatersheds, and also in one-fifth of all other subwatersheds, noting presence and absence of priority exotic species. Use visual assessment and GPS technology to accurately map populations of the top-priority exotic plant species based on ranked species lists.
- 2) Train volunteers to conduct early detection surveys for top-priority SFAN exotic plants.
- 3) Train GOGA and PORE staff and park-partner staff to identify top-priority SFAN exotic plants for opportunistic early detection of new populations during regular work activities.
- 4) Revise priority species lists based on information acquired during the previous season.
- 5) Survey select roads, trails, fencelines, and stream corridors for priority species at PINN.
- 6) Survey all portions of Mt Wanda in JOMU and develop a finalized priority list for that park.

Methods

All methodology follows the SFAN early detection monitoring of invasive plant species protocol (Williams et al. 2009). The following section briefly describes sampling methods, scheduling, data management, and data collection detailed in the protocol.

Prioritization

Full prioritization methods can be found in the protocol and subsequent annual reports, but are summarized briefly here. The lists of target species for GOGA, PINN, and PORE 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.

The list of priority areas where monitoring would take place was generated once for GOGA and PORE in the year prior to protocol implementation (2008 and 2009, respectively). This was done by ranking subwatersheds using their number and degree of current infestations, risk of further infestations, and priority of natural resources present. For example, subwatersheds that scored highest, exhibited low infestation levels, high risk of further infestation based on presence of infrastructure or invadable vegetation type, and the presence of rare plants or animals.

A preliminary list of priority species was developed for the 2011 JOMU surveys, based on pilot survey data collected in 2009 and 2010, and on current knowledge of species distributions within the park and in adjacent lands.

Search Areas

GOGA manages all or part of 29 watersheds and 110 subwatersheds, which are 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 subwatersheds were the first places to be searched. For the purposes of this report, data collected in Fort Point 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 managed by PORE are included with PORE and not GOGA.

PINN is divided into 18 management units that roughly correspond to watersheds. None of these units have been prioritized based on their risk of invasion and/or harm to significant biological resources. Instead, surveys consist of surveying roads, trails, pig fence, and riparian corridors that are of concern to the park botanist. Surveys occur for one week each year during peak flowering season (April through May) and follow field methods in Williams et al. (2009). PINN is relatively isolated and does not have an active volunteer Weed Watcher program.

JOMU contains a small amount of natural vegetation centered on Mount Wanda. This area is not subdivided into smaller subwatersheds/management units. The entire Mount Wanda open space can be surveyed each year. Surveys do not occur in the orchard and landscaped areas maintained

at the historic Muir residence across the freeway (State Hwy. 4) to the north. No active Weed Watcher volunteer program is in effect at JOMU primarily because of limited I&M resources.

Field Methods

Searches were conducted by teams of one to four individuals along trails and roads within the parks. The official search area used for logging both positive (plant occurrence) and negative data (areas where target plants were not found) was restricted to 5 m on either side of the route.

Along the survey route observers recorded location and associated biological information (phenology, habitat, distribution) of priority target plant populations that were encountered. The level of detail for data collection was dictated by the ranking of the plant on the priority list, and the extent of the infestation (Figure 1).

Our Priorities	Example	Explanation	Data collected
List 1 (Highest Priority Plants)	 Capeweed	List 1 plants are highly invasive and are typically not widespread. Control or even eradication is often feasible.	<i>Point occurrences*</i> and <i>polygon assessments**</i> are recorded for all patches, regardless of their size.
List 2 (High Priority Plants)	 Cape Ivy	List 2 plants are highly invasive and usually more common than List 1 species. Small, outlier patches may be targeted for eradication or control.	<i>Point occurrences</i> are recorded for all patches regardless of their size, and <i>polygon assessments</i> are recorded for all patches smaller than 100 m ² .
List 3 (Medium Priority Plants)	 Sweet fennel	List 3 plants are usually widespread and difficult to control at the scale of the park. Uncommon species of concern are also listed here to improve our understanding of their distribution in the park.	<i>Point occurrences</i> are recorded for all patches smaller than 100 m ² .
List 4 (Lower Priority Plants)	 Rattlesnake grass	List 4 plants include all other exotic species that are not captured by Lists 1 – 3. Typically, these are ubiquitous invasive plants and are beyond control, or they are waifs.	These plants are not mapped. Observers record presence/absence.

Figure 1. Tiered levels of data collection.

For the initial survey of a route, *point occurrences* and *polygon assessments* were mapped for list 1; *point occurrences* and *polygon assessments* (if patch size is less than 100 m²) for list 2; 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*.

To improve communication and efficiency, prior species lists (lists 3.1, 3.2, 5.1, 5.2, and 5.3 [*see* Steers et al. 2011]) were restructured for the 2011 survey season. Species on these priority lists were simply re-assigned to lists 1, 2, or 3 based on their subcategory (*.1, *.2 or *.3), which determined the methodology used to document them when encountered (Figure 1). Initially, the subcategories 3.1 and 3.2 were created for species from lists 1, 2 or 3 that were rarely observed during pilot surveys (Williams et al. 2009) and were difficult to detect or identify. Also, list 5 was initially created just for focused surveys in wetlands or dunes (*ibid.*). However, as the program has evolved, the multiple subcategories have proven cumbersome so as of 2011, all species that are sampled in the same manner are included on the same species priority list.

All of the reported field data to date has been collected during surveys for the full list of species by advanced observers. No data from unsupervised volunteers is in the GeoWeed database or is utilized for data analyses or incorporated into summaries reported herein. A detailed description of field methodology can be found in the early detection of invasive plants protocol: SOP 2- Mapping; SOP 3- Field Data Collection (Williams et al. 2009).

Species List Revisions

The 2011 priority lists for each park were revised in response to concerns of resource management staff based on results of the 2010 surveys, and the publication of the Bay Area Early Detection Network (BAEDN) list of target species (BAEDN 2010). Changes to the species lists made for the 2011 field season are explained in the 2010 annual report (Steers et al. 2011). Each park unit's species lists for the 2011 field season are also included in Appendix A.

Results

The 2011 survey results are presented below. All data on species occurrences are based on the species lists for each park for the 2011 field season (Appendix A). Species nomenclature follows The Jepson Manual, First Edition (Hickman 1993) and the Jepson Online Interchange (Jepson Flora Project 2012), when recent taxonomic revisions apply. Links or directions to the survey maps are found in Appendix B.

GOGA

Search Effort

Seventy-five miles of trails and roadsides were surveyed within GOGA during the 2011 field season. Seventy-three priority subwatersheds were surveyed. In total, 21 people spent a total of 983 hours to complete these surveys; 630 of these hours were contributed by 19 volunteers. Two of the volunteers were interns who worked part-time for the Weed Watchers program at both GOGA and PORE for a six month duration.

Species Found

In 2011, 1,337 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, and 3 species (Table 1). Two-hundred and six of these occurrences were List 1 species, 640 were List 2 species, and 491 were List 3 species. The 1,337 individual occurrences of target weed species that were recorded during the GOGA surveys were represented by 61 plant species.

Twenty-one new non-native species were found during the 2011 early detection surveys that were not previously documented on the GOGA working list of vascular plants (IRMA 2011a). Fifteen of these species have been added to the GOGA 2012 priority species list (see discussion).

Table 1. GOGA 2011 survey results. New occurrences and number of subwatersheds with target species present.

2011 list	Scientific name	Common name	Number of new occurrences	Number of subwatersheds
1	<i>Ailanthus altissima</i>	tree-of-heaven	0	0
1	<i>Albizia lophantha</i>	silk tree	3	1
1	<i>Ammophila arenaria</i>	Euro-trash beachgrass	0	0
1	<i>Ammophila breviligulata</i>	American beachgrass	0	0
1	<i>Anthoxanthum odoratum</i>	sweet vernal grass	4	2
1	<i>Aptenia cordifolia</i>	heartleaf iceplant	0	0
1	<i>Arctotheca calendula</i>	capeweed	0	0
1	<i>Arctotheca prostrata</i>	creeping capeweed	18	8
1	<i>Arundo donax</i>	giant reed	1	1
1	<i>Berberis darwinii</i>	Darwin's berberis	0	0
1	<i>Cakile maritima</i>	European searocket	4	2
1	<i>Carduus acanthoides</i>	plumeless thistle	0	0
1	<i>Carex pendula</i>	hanging sedge	0	0
1	<i>Carpobrotus chilensis</i>	sea fig	1	1
1	<i>Carthamus lanatus</i>	woolly distaff thistle	0	0
1	<i>Centaurea calcitrapa</i>	purple starthistle	5	2

2011 list	Scientific name	Common name	Number of new occurrences	Number of subwatersheds
1	<i>Centaurea solstitialis</i>	yellow starthistle	0	0
1	<i>Cirsium arvense</i>	Canada thistle	0	0
1	<i>Conicosia pugioniformis</i>	narrow-leaved iceplant	0	0
1	<i>Cortaderia selloana</i>	pampas grass	0	0
1	<i>Crataegus monogyna</i>	singleseed hawthorn	10	2
1	<i>Cynara cardunculus</i>	artichoke thistle	0	0
1	<i>Cytisus scoparius</i>	Scotch broom	25	9
1	<i>Cytisus striatus</i>	Portuguese broom	17	4
1	<i>Digitalis purpurea</i>	purple foxglove	5	4
1	<i>Dittrichia graveolens</i>	stinkweed	3	1
1	<i>Drosanthemum floribundum</i>	showy dewflower	2	1
1	<i>Echium plantagineum</i>	salvation jane	0	0
1	<i>Ehrharta calycina</i>	perennial veldt grass	0	0
1	<i>Eichhornia crassipes</i>	water hyacinth	0	0
1	<i>Euphorbia oblongata</i>	oblong spurge	0	0
1	<i>Hedera canariensis</i>	Algerian ivy	0	0
1	<i>Helichrysum petiolare</i>	licorice plant	17	7
1	<i>Hypericum perforatum</i>	Klamath weed	0	0
1	<i>Ilex aquifolium</i>	English holly	0	0
1	<i>Lepidium latifolium</i>	perennial pepperweed	0	0
1	<i>Mesembryanthemum crystallinum</i>	ice plant	0	0
1	<i>Myriophyllum aquaticum</i>	parrot's-feather	11	3
1	<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	0	0
1	<i>Nicotiana glauca</i>	tree tobacco	0	0
1	<i>Phalaris arundinacea</i>	reed canary grass	0	0
1	<i>Pittosporum crassifolium</i>	stifleaf cheesewood	12	4
1	<i>Pyracantha angustifolia</i>	narrowleaf firethorn	7	4
1	<i>Robinia pseudoacacia</i>	black locust	0	0
1	<i>Romulea rosea</i> var. <i>australis</i>	rosy sandcrocus	0	0
1	<i>Rytidosperma penicillatum</i>	hairy oatgrass	15	12
1	<i>Scabiosa atropurpurea</i>	mourningbride	22	12
1	<i>Spartina alterniflora</i>	smooth cordgrass	0	0
1	<i>Spartium junceum</i>	Spanish broom	0	0
1	<i>Trifolium angustifolium</i>	narrowleaf crimson clover	7	6
1	<i>Ulex europaeus</i>	gorse	3	3
1	<i>Vinca major</i>	periwinkle	14	6
2	<i>Acacia melanoxylon</i>	blackwood acacia	22	14
2	<i>Ageratina adenophora</i>	thoroughwort	31	11
2	<i>Bromus madritensis</i> ssp. <i>rubens</i>	red brome	43	17
2	<i>Bromus tectorum</i>	cheat grass	0	0
2	<i>Calendula arvensis</i>	field marigold	11	7
2	<i>Centaurea melitensis</i>	toalote	35	14
2	<i>Cestrum parqui</i>	orange jessamine	3	2

2011 list	Scientific name	Common name	Number of new occurrences	Number of subwatersheds
2	<i>Cynodon dactylon</i>	Bermudagrass	2	2
2	<i>Dactylis glomerata</i>	cocksfoot	49	20
2	<i>Delairea odorata</i>	cape ivy	13	7
2	<i>Dipsacus fullonum</i>	Fuller's teasel	6	6
2	<i>Eucalyptus globulus</i>	bluegum eucalyptus	16	11
2	<i>Festuca arundinacea</i>	tall fescue	77	32
2	<i>Hedera helix</i>	English ivy	33	12
2	<i>Hirschfeldia incana</i>	shortpod mustard	102	42
2	<i>Leptospermum laevigatum</i>	Australian teatree	2	2
2	<i>Leucanthemum vulgare</i>	ox-eye daisy	13	9
2	<i>Mentha pulegium</i>	pennyroyal	42	21
2	<i>Oxalis pes-caprae</i>	Bermuda buttercup	69	17
2	<i>Pennisetum clandestinum</i>	Kikuyu grass	17	14
2	<i>Rosa eglanteria</i>	sweetbriar rose	9	2
2	<i>Rubus discolor</i>	Himalayan blackberry	44	16
2	<i>Solanum laciniatum</i>	New Zealand nightshade	1	1
3	<i>Arrhenatherum elatius</i>	tall oatgrass	0	0
3	<i>Brassica rapa</i>	field mustard	6	5
3	<i>Carpobrotus edulis</i>	freeway iceplant	29	9
3	<i>Coprosma repens</i>	creeping mirrorplant	2	2
3	<i>Cortaderia jubata</i>	jubata grass	41	27
3	<i>Cotoneaster franchetii</i>	orange cotoneaster	29	19
3	<i>Cotoneaster lacteus</i>	milkflower cotoneaster	12	3
3	<i>Cotoneaster pannosus</i>	silverleaf cotoneaster	53	25
3	<i>Ehrharta erecta</i>	panic veldt grass	21	13
3	<i>Erigeron karvinskianus</i>	Latin American fleabane	7	4
3	<i>Foeniculum vulgare</i>	sweet fennel	59	29
3	<i>Genista monspessulana</i>	French broom	43	26
3	<i>Gunnera tinctoria</i>	Chilean gunnera	0	0
3	<i>Lathyrus latifolius</i>	everlasting pea	76	28
3	<i>Ligustrum ovalifolium</i>	California privet	3	3
3	<i>Linaria vulgaris</i>	butter and eggs	0	0
3	<i>Lonicera japonica</i>	Japanese honeysuckle	1	1
3	<i>Phalaris aquatica</i>	harding grass	62	26
3	<i>Pinus radiata</i>	Monterey pine	46	26
3	<i>Schinus molle</i>	pepper tree	1	1
3	<i>Tamarix chinensis</i>	saltcedar	0	0
3	<i>Xanthium spinosum</i>	spiny cocklebur	0	0
3	<i>Xanthium strumarium</i>	rough cocklebur	0	0

PORE

Search Effort

One-hundred and four miles of trails and roadsides were surveyed during the 2011 field season at PORE, including GOGA property managed by PORE. A total of 53 subwatersheds were

surveyed (36 subwatersheds belonging to PORE and 17 that belong to GOGA but are managed by PORE). In total, 7 people spent 301 hours to complete these surveys, 88 of those hours were contributed by 5 volunteers, 2 of whom were interns who worked part time for the Weed Watchers program at both GOGA and PORE for 6 months.

Species Found

In 2011, 438 individual occurrences of target weed species (List 1, 2 or 3) were recorded in PORE during early detection surveys and entered into the PORE GeoWeed database (Table 2). Forty-seven of these occurrences were List 1 species, 176 were List 2 species, and 215 were List 3 species. Forty-six plant species contributed to the 445 occurrences that were recorded during the 2011 PORE surveys.

Four new non-native species were found during the 2011 early detection surveys that were not previously documented on the PORE working list of vascular plants (IRMA 2011b). Three of these species have been added to the PORE 2012 priority species list (see discussion).

Table 2. PORE 2011 survey results. New occurrences and number of subwatersheds with target species present.

2011 list	Scientific name	Common name	Number of occurrences	Number of subwatersheds
1	<i>Acroptilon repens</i>	Russian knapweed	0	0
1	<i>Aegilops triuncialis</i>	barbed goatgrass	1	1
1	<i>Ageratina adenophora</i>	thoroughwort	0	0
1	<i>Albizia lophantha</i>	silk tree, cape wattle	0	0
1	<i>Alisma lanceolatum</i>	water plantain	0	0
1	<i>Anthoxanthum odoratum</i>	sweet vernalgrass	1	1
1	<i>Arundo donax</i>	giant reed	0	0
1	<i>Brachypodium distachyon</i>	purple false brome	11	6
1	<i>Carduus acanthoides</i>	plumeless thistle	0	0
1	<i>Carex pendula</i>	hanging sedge	0	0
1	<i>Carthamus lanatus</i>	woolly distaff thistle	1	1
1	<i>Centaurea calcitrapa</i>	purple starthistle	0	0
1	<i>Centaurea iberica</i>	Iberian star thistle	0	0
1	<i>Centaurea melitensis</i>	toçalote	4	3
1	<i>Centaurea solstitialis</i>	yellow starthistle	0	0
1	<i>Conicosia pugioniformis</i>	Narrow-leaved iceplant	2	1
1	<i>Cotoneaster franchetii</i>	orange cotoneaster	7	4
1	<i>Cotoneaster pannosus</i>	silverleaf cotoneaster	11	5
1	<i>Dittrichia graveolens</i>	stinkweed	1	1
1	<i>Egeria densa</i>	Brazilian waterweed	0	0
1	<i>Ehrharta calycina</i>	perennial veldt grass	0	0
1	<i>Euphorbia oblongata</i>	eggleaf or oblong spurge	0	0
1	<i>Helichrysum petiolare</i>	licorice plant	0	0

2011 list	Scientific name	Common name	Number of occurrences	Number of subwatersheds
1	<i>Hypericum perforatum</i>	Klamath weed	0	0
1	<i>Iris pseudacorus</i>	yellow flag	0	0
1	<i>Lepidium latifolium</i>	perennial pepperweed	0	0
1	<i>Ludwigia hexapetala</i>	sixpetal water-primrose	0	0
1	<i>Ludwigia peploides</i>	water primrose	0	0
1	<i>Marrubium vulgare</i>	horehound	0	0
1	<i>Myriophyllum aquaticum</i>	Parrot's-feather	0	0
1	<i>Phalaris arundinacea</i>	Reed canary grass	0	0
1	<i>Robinia pseudoacacia</i>	black locust	1	1
1	<i>Romulea rosea</i> var. <i>australis</i>	rosy sandcrocus	6	2
1	<i>Salsola soda</i>	oppositeleaf Russian thistle	1	1
1	<i>Senecio jacobaea</i>	tansy ragwort	0	0
1	<i>Spartina alterniflora</i>	Smooth cordgrass	0	0
1	<i>Ulex europaea</i>	gorse	0	0
2	<i>Acacia melanoxylon</i>	blackwood acacia	0	0
2	<i>Arctotheca calendula</i>	capeweed	0	0
2	<i>Arctotheca prostrata</i>	creeping capeweed	0	0
2	<i>Berberis darwinii</i>	Darwin's berberis	0	0
2	<i>Cakile edentula</i>	European searocket	0	0
2	<i>Cytisus scoparius</i>	Scotch broom	0	0
2	<i>Datura stramonium</i>	jimsonweed	0	0
2	<i>Delairea odorata</i>	cape ivy	1	1
2	<i>Echium candicans</i>	pride of Madeira	1	1
2	<i>Genista monspessulana</i>	French broom	22	10
2	<i>Hedera helix</i>	English ivy	15	10
2	<i>Ilex aquifolium</i>	English holly	6	5
2	* <i>Lathyrus latifolius</i>	perennial pea	21	16
2	<i>Leucanthemum vulgare</i>	oxeye daisy	14	7
2	<i>Linaria vulgaris</i>	butter and eggs	0	0
2	<i>Oxalis pes-caprae</i>	Bermuda buttercup	9	7
2	<i>Paspalum dilatatum</i>	dallis grass	34	16
2	<i>Pennisetum clandestinum</i>	kikuyu grass	1	1
2	<i>Pittosporum undulatum</i>	Victorian box	0	0
2	<i>Rubus armeniacus</i>	Himalayan blackberry	35	19
2	<i>Tetragonia tetragonioides</i>	New Zealand spinach	3	2
2	<i>Vinca major</i>	periwinkle	14	9
2	<i>Xanthium spinosum</i>	spiny cocklebur	0	0
3	<i>Acacia longifolia</i>	Sydney golden wattle	2	1

2011 list	Scientific name	Common name	Number of occurrences	Number of subwatersheds
3	<i>Acacia verticillata</i>	prickly Moses	0	0
3	<i>Allium triquetrum</i>	Three corner leek	0	0
3	<i>Ammophila arenaria</i>	European beachgrass	0	0
3	<i>Carpobrotus chilensis</i>	sea fig	1	1
3	<i>Carpobrotus edulis</i>	freeway iceplant	8	5
3	<i>Cestrum parqui</i>	chilean jessamine	0	0
3	<i>Conium maculatum</i>	poison hemlock	16	9
3	<i>Cortaderia jubata</i>	jubata grass	4	3
3	<i>Cortaderia selloana</i>	Uruguayan pampas grass	0	0
3	<i>Cotoneaster lacteus</i>	milkflower cotoneaster	3	1
3	<i>Crataegus monogyna</i>	singleseed hawthorn	2	2
3	<i>Cupressus macrocarpa</i>	Monterey cypress	0	0
3	<i>Cynodon dactylon</i>	Bermuda grass	13	9
3	<i>Digitalis purpurea</i>	purple foxglove	13	7
3	<i>Dipsacus fullonum</i>	Fuller's teasel	4	3
3	<i>Dipsacus sativus</i>	Indian teasel	0	0
3	<i>Drosanthemum floribundum</i>	showy dewflower	0	0
3	<i>Echium plantagineum</i>	salvation jane	0	0
3	<i>Ehrharta erecta</i>	panic veldt grass	17	13
3	<i>Eucalyptus globulus</i>	bluegum eucalyptus	1	1
3	<i>Euphorbia lathyris</i>	gopher plant	11	3
3	<i>Festuca arundinacea</i>	tall fescue	31	14
3	<i>Foeniculum vulgare</i>	sweet fennel	18	11
3	<i>Hypericum calycinum</i>	Aaron's beard	0	0
3	<i>Lythrum hyssopifolia</i>	hyssop loosestrife	1	1
3	<i>Mentha pulegium</i>	pennyroyal	30	13
3	<i>Myoporum laetum</i>	myoporum	0	0
3	<i>**Phalaris aquatica</i>	Harding grass	34	21
3	<i>Pinus radiata</i>	Monterey pine	3	1
3	<i>Populus alba</i>	white poplar	0	0
3	<i>Pyracantha angustifolia</i>	narrowleaf firethorn	0	0
3	<i>Rosa eglanteria</i>	sweetbriar rose	2	2
3	<i>Scabiosa atropurpurea</i>	mourningbride	0	0
3	<i>Sorghum halepense</i>	Johnson grass	0	0
3	<i>Sparaxis tricolor</i>	Harlequin flower	0	0
3	<i>Tanacetum parthenium</i>	feverfew	0	0
3	<i>Verbascum blattaria</i>	moth mullein	0	0
3	<i>Watsonia meriana</i>	bulbil bugle-lily	0	0

2011 list	Scientific name	Common name	Number of occurrences	Number of subwatersheds
3	<i>Zantedeschia aethiopica</i>	calla lily	1	1

* *Lathyrus latifolius* is a List 2 species but was accidentally treated as a List 3 species in 2011.

** *Phalaris aquatica* is a List 3 species but was accidentally treated as a List 2 species in 2011.

PINN

Search Effort

Twenty-five miles of trails, fencelines, and drainages were surveyed during the 2011 field season at PINN. In total, 5 people spent 121 hours conducting surveys, 76 of which were volunteer hours. The volunteers were 3 I&M interns, 2 of whom worked for the Weed Watchers program and 1 who worked for the SFAN I&M Plant Community Change Protocol.

Species Found

IN 2011, 66 occurrences of target weed species were recorded in PINN during early detection surveys and entered into the PINN GeoWeed database. One of these occurrences was a List 1 species, 11 were List 2 species, and 54 were List 3 species (Table 3). The 66 individual occurrences of target weed species that were recorded during the PINN surveys were represented by 10 plant species.

Table 3. PINN 2011 survey results. New occurrences and number of subwatersheds with target species present.

2011 list	Scientific name	Common name	Number of occurrences	Number of subwatersheds
1	<i>Acroptilon repens</i>	Russian knapweed	0	0
1	<i>Ailanthus altissima</i>	tree-of-heaven	0	0
1	<i>Arundo donax</i>	giant reed	0	0
1	<i>Chenopodium ambrosioides</i>	Mexican-tea	0	0
1	<i>Cnicus benedictus</i>	blessed thistle	0	0
1	<i>Dittrichia graveolens</i>	stinkweed	0	0
1	<i>Iris pseudacorus</i>	yellow flag	0	0
1	<i>Lepidium latifolium</i>	perennial pepperweed	0	0
1	<i>Lolium multiflorum</i>	Italian ryegrass	0	0
1	<i>Lolium perenne</i>	perennial ryegrass	0	0
1	<i>Lolium temulentum</i>	darnel	0	0
1	<i>Malva parviflora</i>	cheeseweed	0	0
1	<i>Melilotus alba</i>	white sweetclover	0	0
1	<i>Nicotiana glauca</i>	tree tobacco	0	0
1	<i>Picris echioides</i>	bristly oxtongue	0	0
1	<i>Piptatherum miliaceum</i>	smilo grass	0	0
1	<i>Poa bulbosa</i>	bulbous bluegrass	0	0
1	<i>Rubus armeniacus</i>	Himalayan blackberry	0	0
1	<i>Salsola tragus</i>	prickly Russian thistle	0	0
1	<i>Taeniatherum caput-medusae</i>	Medusahead	0	0

2011 list	Scientific name	Common name	Number of occurrences	Number of subwatersheds
1	<i>Tamarix ramosissima</i>	saltcedar	0	0
1	<i>Tragopogon dubius</i>	yellow salsify	0	0
1	<i>Tribulus terrestris</i>	puncturevine	0	0
1	<i>Trifolium hirtum</i>	rose clover	1	1
1	<i>Verbascum blattaria</i>	moth mullein	0	0
1	<i>Verbascum thapsus</i>	woolly mullein	0	0
1	<i>Xanthium spinosum</i>	spiny cocklebur	0	0
2	<i>Carduus pycnocephalus</i>	Italian thistle	8	5
2	<i>Carduus tenuiflorus</i>	slender-flowered thistle	0	0
2	<i>Conium maculatum</i>	poison hemlock	0	0
2	<i>Cotula coronopifolia</i>	brassbuttons	0	0
2	<i>Crypsis schoenoides</i>	swamp prickly grass	0	0
2	<i>Cynodon dactylon</i>	Bermudagrass	0	0
2	<i>Cyperus difformis</i>	variable flatsedge	0	0
2	<i>Marrubium vulgare</i>	horehound	3	1
2	<i>Veronica persica</i>	birdseye speedwell	0	0
2	<i>Vinca major</i>	periwinkle	0	0
3	<i>Amaranthus albus</i>	tumbleweed	0	0
3	<i>Brassica nigra</i>	black mustard	0	0
3	<i>Brassica rapa</i>	field mustard	0	0
3	<i>Centaurea melitensis</i>	totalote	14	5
3	<i>Centaurea solstitialis</i>	yellow starthistle	6	3
3	<i>Cirsium vulgare</i>	bull thistle	0	0
3	<i>Hirschfeldia incana</i>	shortpod mustard	10	4
3	<i>Lactuca serriola</i>	prickly lettuce	5	4
3	<i>Lathyrus latifolius</i>			
3	<i>Mentha spicata</i> var. <i>spicata</i>	spearmint	0	0
3	<i>Mentha X piperita</i>	peppermint	0	0
3	<i>Plantago lanceolata</i>	lanceleaf plantain,	0	0
3	<i>Polygonum arenastrum</i>	oval-leaf knotweed	1	1
3	<i>Raphanus sativus</i>	wild radish	0	0
3	<i>Rumex acetosella</i>	sheep sorrel	0	0
3	<i>Rumex crispus</i>	curly dock	16	6
3	<i>Silybum marianum</i>	blessed milkthistle	2	1

JOMU

Search Effort

Seven miles of trails in the Mount Wanda section of JOMU were surveyed during the 2011 field season. In total, 3 people spent 23 hours conducting surveys, 11 of which were volunteer hours. The 2 volunteers were interns for the JOMU Natural Resources Division.

Species Found

In 2011, 40 individual occurrences of target weed species were recorded in JOMU during early detection surveys and entered into the JOMU GeoWeed database. Seventeen of these occurrences were List 1 species, 16 of these were List 2 species, and 7 were List 3 species. The 40 individual occurrences of target weed species that were recorded during the PINN surveys were represented by 11 plant species (Table 4).

Table 4. JOMU Mount Wanda 2011 survey results. New occurrences of target species.

2011 list	Scientific name	Common name	Number of new occurrences
1	<i>Centaurea calcitrapa</i>	purple starthistle	0
1	<i>Centaurea melitensis</i>	tocalote	0
1	<i>Cortaderia jubata</i>	jubata grass	0
1	<i>Delairea odorata</i>	cape ivy	0
1	<i>Dittrichia graveolens</i>	stinkweed	12
1	<i>Euphorbia oblongata</i>	oblong spurge	0
1	<i>Eucalyptus globulus</i>	bluegum eucalyptus	0
1	<i>Ficus carica</i>	fig	0
1	<i>Lepidium latifolium</i>	perennial pepperweed	3
1	<i>Malvella leprosa</i>	alkali mallow	0
1	<i>Ulex europaeus</i>	gorse	0
1	<i>Xanthium spinosum</i>	spiny cocklebur	2
2	<i>Arundo donax</i>	giant reed	0
2	<i>Bellardia trixago</i>	bellardia	0
2	<i>Cirsium vulgare</i>	bull thistle	0
2	<i>Conium maculatum</i>	poison hemlock	1
2	<i>Convolvulus arvensis</i>	bindweed	1
2	<i>Cotoneaster franchetii</i>	cotoneaster	0
2	<i>Cynara cardunculus</i>	artichoke thistle	2
2	<i>Foeniculum vulgare</i>	fennel	0
2	<i>Genista monspessulana</i>	french broom	1
2	<i>Hirschfeldia incana</i>	summer mustard	1
2	<i>Olea europaea</i>	olive	4
2	<i>Phalaris aquatica</i>	harding grass	5
2	<i>Rubus discolor</i>	Himalayan blackberry	0
2	<i>Tribulus terrestris</i>	puncturevine	1
2	<i>Zantedeschia aethiopica</i>	calla lily	0
3	<i>Ailanthus altissima</i>	tree of heaven	0
3	<i>Brassica nigra</i>	black mustard	0
3	<i>Carduus pycnocephalus</i>	Italian thistle	0
3	<i>Centaurea solstitialis</i>	yellow star thistle	7
3	<i>Silybum marianum</i>	blessed milk thistle	0
3	<i>Vinca major</i>	periwinkle	0

Discussion

Species Occurrences

The occurrence data captured during protocol implementation revealed that collectively, invasive species are ubiquitous throughout the park units of the SFAN, with PINN having noticeably lower numbers of priority exotic plant occurrences than the other park units in relation to survey area. Because the monitoring program is still in initial stages of implementation, it is difficult to draw conclusions about how environmental factors correlate with exotic species occurrences or to examine trends in species detection at this time.

It should be noted that the numbers of occurrences found for each species may not be a true indication their abundance. For example, a species that is already locally abundant along a survey route can be underestimated through relying on occurrence data alone since only one occurrence point will be used to represent the population. 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. Assessments were also recorded in addition to occurrences for all List 1 species and also for all List 2 species that have a patch size <100 m² (Figure 1). These assessments include the spatial coverage of the listed exotic plant. Assessments can be used to detect change in a species' areal extent over time; however, assessment data are not presented in this report.

Species List Revisions

After each field season, the species lists for each park unit are updated for the following field season. The majority of list revisions were made immediately following the 2007 and 2008 seasons (Williams and Speith 2008, Williams and Jordan 2010). Minor list revisions were made in subsequent years (Williams et al. 2011, Steers et al. 2011).

Based on the 2011 field season, 16 species were added to the GOGA 2012 priority list (Table 5). All of these species were placed on List 1 or List 2 to insure that spatial data is collected for all occurrences. Eleven of these species were not known to occur on GOGA lands until they were discovered during the 2011 early detection surveys; one of these species was found directly adjacent to GOGA land in 2011; one of these species was reported from the Presidio of San Francisco in 2011 and 3 of these species were thought to be in the park but were not confirmed present in GOGA until 2011. All are known to be invasive elsewhere.

Table 5. Revisions to the GOGA priority species list for 2012.

Scientific name	Common name	2011 List	2012 List	Justification
<i>Agrostis avenacea</i>	Pacific bentgrass	n/a	2	New to GOGA plant list. On Cal-IPC inventory (Cal-IPC 2006).
<i>Buddleja davidii</i>	butterfly bush	n/a	2	New to GOGA plant list. On BAEDN priority list (BAEDN 2010).
<i>Hypericum grandifolium</i>	no common name	n/a	1	Found directly adjacent to GOGA land in 2011. First recorded in California in 2010 in Marin County. CDFA Q-rated noxious weed (BAEDN 2012). On Cal-IPC Watchlist, Red Alert 2011 (Cal-IPC 2011)
<i>Iris pseudacorus</i>	yellowflag iris	n/a	2	New to GOGA plant list. CDFA Q-rated noxious weed (CDFA 2011). Cal-IPC rating: limited (Cal-

Scientific name	Common name	2011 List	2012 List	Justification
				IPC 2006).
<i>Geranium purpureum</i>	herb robert	n/a	2	New to GOGA plant list. On Cal-IPC Watchlist. Spreading rapidly in inner North Coast ranges (Cal-IPC 2011).
<i>Ligustrum lucidum</i>	glossy privet	n/a	2	Confirmed present in GOGA in 2011. On BAEDN list (BAEDN 2010).
<i>Limonium ramosissimum</i>	Algerian sea lavender	n/a	1	Reported throughout SNFRB, including Chrissy Field at PRES. Cal-IPC rating: limited (Cal-IPC 2006). On BAEDN list (BAEDN 2010).
<i>Ludwigia hexapetala</i>	six-petal water primrose	n/a	1	Confirmed present in GOGA in 2011. Cal-IPC rating: high – ALERT (Cal-IPC 2006).
<i>Ludwigia peploides</i> ssp. <i>montevidensis</i>	floating waterprimrose	n/a	1	Invasive subspecies <i>Ludwigia peploides</i> ssp. <i>montevidensis</i> is New to GOGA plant list. Cal-IPC rating: high (Cal-IPC 2006).
<i>Maytenus boaria</i>	Chilean mayten	n/a	1	Confirmed present in 2011. Invasive in Marin County Parks (pers. com., Sam Abercrombie, Marin County Parks, 2011). On Cal-IPC watch list (Cal-IPC 2011).
<i>Mercurialis annua</i>	annual mercury	n/a	2	New to GOGA plant list. On Cal-IPC watch list (Cal-IPC 2011).
<i>Stipa manicata</i>	Andean tussockgrass	n/a	1	New to GOGA plant list. Cal-IPC rating: limited (Cal-IPC 2006).
<i>Rhamnus alaternus</i>	Italian buckthorn	n/a	1	New to GOGA plant list. On BAEDN list (BAEDN 2010). On Cal-IPC Watchlist, Red Alert 2008 & 2011 (Cal-IPC 2011).
<i>Roldana petasites</i>	velvet groundsel	n/a	2	New to GOGA plant list. One large population established in GOGA in highly disturbed habitat and apparently not spreading. Naturalized in Golden Gate Park.
<i>Rytidosperma caespitosa</i>	no common name	n/a	1	New to GOGA plant list. May not be as invasive as <i>R. penicillatum</i> (GOGA List 1 species).
<i>Trifolium angustifolium</i>	narrow leaved crimson clover	n/a	1	New to GOGA plant list. On Cal-IPC Watchlist, Red Alert 2007. Spreading rapidly in Central coast grasslands (Cal-IPC 2011).

Six species were added to the PORE priority list for the 2012 field season (Table 6). All of these species were placed on List 1 or List 2. Three of these species were not known to occur in PORE until they were discovered during the 2011 early detection surveys, and 3 species were added that are not presently in PORE, but were found on lands adjacent to the park and are of concern.

One species name (*Ludwigia peploides*) was revised to differentiate the invasive non-native subspecies (*L. peploides* ssp. *montevidensis*) from the native subspecies (*L. peploides* ssp. *peploides*).

Table 6. Revisions to the PORE priority species list for 2012.

Scientific name	Common name	2011 List	2012 List	Justification
<i>Glyceria declinata</i>	waxy mannagrass	n/a	2	New to PORE plant list. Has been confused with <i>G. x occidentalis</i> in the past. Cal-IPC rating: moderate (Cal-IPC 2006).
<i>Hypericum grandifolium</i>	no common name	n/a	1	First recorded in California in 2010 in Bolinas, Marin County. CDFA Q-rated noxious weed (BAEDN 2012). On Cal-IPC Watchlist, Red Alert 2011 (Cal-IPC 2011)

Scientific name	Common name	2011 List	2012 List	Justification
<i>Limonium ramosissimum</i>	Algerian sealavender	n/a	1	Reported throughout SNFRB, including Chrissy Field at PRES. Cal-IPC rating: limited (Cal-IPC 2006). On BAEDN list (BAEDN 2010).
<i>Ludwigia peploides ssp. montevedensis</i>	floating waterprimrose	1	1	2011 ED list did not distinguish invasive <i>Ludwigia peploides ssp. montevedensis</i> from native non-invasive <i>Ludwigia peploides ssp. peploides</i> .
<i>Maytenus boaria</i>	Chilean mayten	n/a	2	Found directly adjacent to PORE land in 2012. Invasive in Marin County Parks (Abercrombie, pers. comm. 2011). On Cal-IPC watch list (Cal-IPC 2011).
<i>Rytidosperma penicillatum</i>	wallaby grass	n/a	1	New to PORE plant list. Cal-IPC rating: limited (Cal-IPC 2006). On BAEDN list (BAEDN 2010).
<i>Trifolium angustifolium</i>	narrow leaved crimson clover	n/a	1	New to PORE plant list. On Cal-IPC Watchlist, Red Alert 2007. Spreading rapidly in Central coast grasslands (Cal-IPC 2011).

At PINN no species were removed from the list, and no plants were shifted from one priority list to another for the 2012 field season.

At JOMU, the priority species list has now been finalized based on data collected from 2009 through 2011, records in CalFlora (2012), and procedures described in the protocol (Williams et al. 2009), where applicable. All species in the new finalized JOMU species list, including their 2011 and 2012 rankings, are presented below (Table 7).

Table 7. Finalized species list for the 2012 field season for JOMU.

Scientific name	Common name	2011 List	2012 List
<i>Acroptilon repens</i>	Russian knapweed	n/a	1
<i>Aegilops triuncialis</i>	barbed goatgrass	n/a	1
<i>Arundo donax</i>	giant reed	2	1
<i>Calendula arvensis</i>	field marigold	n/a	1
<i>Cardaria draba</i>	Whitetop	n/a	1
<i>Carthamus baeticus</i>	Smooth distaff thistle	n/a	1
<i>Centaurea calcitrapa</i>	Purple star thistle	1	1
<i>Centaurea melitensis</i>	Napa star thistle	1	1
<i>Cynara cardunculus</i>	cardoon	2	1
<i>Cytisus striatus</i>	striated broom	n/a	1
<i>Dittrichia graveolens</i>	stinkwort	1	1
<i>Ehrharta erecta</i>	panic veldtgrass	n/a	1
<i>Eucalyptus globulus</i>	Tasmanian bluegum	1	1
<i>Euphorbia oblongata</i>	eggleaf spurge	1	1
<i>Ficus carica</i>	common fig	1	1
<i>Genista monspessulana</i>	French broom	2	1
<i>Geranium robertianum</i>	Robert geranium	n/a	1
<i>Lepidium latifolium</i>	broadleaved pepperweed	1	1
<i>Lythrum salicaria</i>	purple loosestrife	n/a	1
<i>Nicotiana glauca</i>	tree tobacco	n/a	1

Scientific name	Common name	2011 List	2012 List
<i>Oxalis pes-caprae</i>	sourgrass	n/a	1
<i>Schinus molle</i>	Peruvian peppertree	n/a	1
<i>Sesbania punicea</i>	rattlebox	n/a	1
<i>Tamarix parviflora</i>	Fourstamen tamarisk	n/a	1
<i>Bellardia trixago</i>	Mediterranean lineseed	2	2
<i>Brachypodium distachyon</i>	False brome	n/a	2
<i>Centaurea solstitialis</i>	yellow star thistle	3	2
<i>Cestrum parqui</i>	Chilean jessamine	n/a	2
<i>Cirsium vulgare</i>	bull thistle	2	2
<i>Conium maculatum</i>	poison hemlock	2	2
<i>Cotoneaster lacteus</i>	milkflower cotoneaster	n/a	2
<i>Cotoneaster pannosus</i>	silverleaf cotoneaster	n/a	2
<i>Cynodon dactylon</i>	Bermudagrass	n/a	2
<i>Dactylis glomerata</i>	orchard grass	n/a	2
<i>Foeniculum vulgare</i>	sweet fennel	2	2
<i>Hirschfeldia incana</i>	short podded mustard	2	2
<i>Olea europaea</i>	olive	2	2
<i>Phalaris aquatica</i>	bulbous canarygrass	2	2
<i>Piptatherum miliaceum</i>	smilo grass	n/a	2
<i>Rubus discolor</i>	Himalayan blackberry	2	2
<i>Tribulus terrestris</i>	puncturevine	2	2
<i>Ailanthus altissima</i>	ailanthus	3	3
<i>Brassica nigra</i>	black mustard	3	3
<i>Carduus pycnocephalus</i>	Italian thistle	3	3
<i>Convolvulus arvensis</i>	field bindweed	2	3
<i>Lathyrus latifolius</i>	perennial pea	n/a	3
<i>Ligustrum lucidum</i>	glossy privet	n/a	3
<i>Ligustrum ovalifolium</i>	California privet	n/a	3
<i>Marrubium vulgare</i>	horehound	n/a	3
<i>Picris echioides</i>	Bristly ox-tongue	n/a	3
<i>Prunus cerasifera</i>	cherry plum	n/a	3
<i>Robinia pseudoacacia</i>	black locust	n/a	3
<i>Silybum marianum</i>	blessed milkthistle	3	3
<i>Vinca major</i>	bigleaf periwinkle	3	3

Outreach

Education and outreach play a critical role in the engagement of a network of early detectors. Several “Weed ID” classes were held for GOGA staff, volunteers, interns, Golden Gate National Parks Conservancy (GGNPC) staff, and PORE volunteers. Whenever possible, volunteers were trained on an individual basis to conduct early detection surveys and map incipient populations of target invasive plants. A workshop was also held to introduce new technologies available to the public for mapping, reporting and viewing weed occurrences. The training focused on use of

the “What’s Invasive” application described below, as well as Google Earth™ and The Calflora Database (Calflora).

In 2011 our program adopted the “What’s Invasive” data collection and reporting tool for GOGA. What’s Invasive is a free web-based application for use on Android or iPhone-based devices. It displays local lists of top invasive plants with images and short descriptions. Users can browse these lists of species and send geo-tagged observations, photos, and notes via their personal electronic devices to the What’s Invasive website. On the What’s Invasive website, users can view data and statistics for the park. This tool was a welcomed advancement in the capture and storage of volunteer or citizen science data over our older methods of using paper maps. Despite this improvement, we still do not include any data derived from unsupervised volunteers into our GeoWeed database or include data from unsupervised volunteers in annual reports.

The monthly newsletter was reformatted and renamed “Early Detection News.” The newsletter is sent via email in HTML format, so recipients can view it directly in their email client or browser window. The newsletter contains tables of monthly survey results, and news of noteworthy early detections, with links to information about featured invasive species. The monthly report also includes links to Google Earth™ KMZ files showing early detection survey routes and mapped occurrences.

Web pages were maintained 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 our volunteer program are featured on the web pages, as well as maps and the Early Detection News monthly reports.

To communicate findings to a wider audience of invasive plant workers from around the state, I&M staff presented a poster of early detection results in October at the Cal-IPC symposium in Lake Tahoe, California.

Collaboration

Early detection is ineffective without rapid response to invasions. Many invasive plant management teams exist in the SFAN parks. The importance of both collaboration and communication with these management teams is imperative to the success of an early detection program.

In March, 2011, the SFAN hosted a meeting for invasive plant program managers in GOGA to ensure that early detection survey findings would be effectively communicated to the responsible entities for rapid response. Representatives from NPS, the GGNPC, and the Presidio Trust attended. The managers provided maps of their project areas and it was agreed that the early detection program would report to them monthly, providing a summary of survey results by area in condensed tables and maps using Google Earth™. The new format for Early Detection News grew out of this meeting.

PORE has a well-established weed management program with an affiliated volunteer program, the Habitat Restoration Program (HRP). Ellen Hamingson, the NPS lead for the HRP program,

worked closely with the Weed Watcher program in 2011 to implement rapid response treatment for many of the infestations that were mapped by the Weed Watchers. She also provided on-site supervision to the seasonal early detection technician at PORE so there was daily communication between the two programs. Monthly results are reported to all PORE vegetation staff via the Point Reyes Early Detection News.

The SFAN I&M Program continued its partnership in 2011 with the California Exotic Plant Management Team (EPMT) to hire two early detection and rapid response interns that worked at PORE and GOGA. The EPMT provides grants for weed management projects at national parks across California. The interns conducted early detection surveys three days a week, and worked for HRT on the other two days for rapid response removal work. The interns improved communication between the programs and made sure priority species mapped during early detection surveys were being removed.

With the help of the resource and maintenance staff at PINN, high-priority areas were surveyed for weeds and the results were reported to Park Botanist, Brent Johnson. At JOMU, surveys were conducted with the assistance of park interns and the results were reported to the Natural Resources Specialist, Fernando Villalba.

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 are active participants in the Bay Area Early Detection Network (BAEDN), the Marin-Sonoma Weed Management Area (MSWMA) and Cal-IPC. In 2011, I&M worked with BAEDN, the California Department of Transportation (Caltrans) and private landowners to eradicate the second known North American wildland infestation of *Hypericum grandifolium*, discovered during an I&M early detection survey. I&M provided input on MSWMA funding priorities for weed management projects in Marin and Sonoma Counties, and provided expert knowledge for Cal-IPC's CalWeedMapper initiative.

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Glossary

Assessments: 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 evaluating change with or without management actions.

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 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.

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.

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

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

Treatments: A treatment is any weed management activity that occurs at a specific time over a defined geographical area. The GeoWeed databases track all types of weed control methods and 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.

Appendix A: 2011 list of priority invasive species at GOGA, MUWO, and FOPO.

Priority	Scientific Name	Common Name	Family	SpCode
1	<i>Ailanthus altissima</i>	tree-of-heaven	Simaroubaceae	AIALXX
1	<i>Albizia lophantha</i>	silk tree	Fabaceae	ALLOXX
1	<i>Ammophila arenaria</i>	European beachgrass	Poaceae	AMAR4X
1	<i>Ammophila breviligulata</i>	American beachgrass	Poaceae	AMBRXX
1	<i>Anthoxanthum odorata</i>	sweet vernal grass	Poaceae	ANODXX
1	<i>Aptenia cordifolia</i>	heartleaf iceplant	Aizoaceae	APCOXX
1	<i>Arctotheca calendula</i>	capeweed	Asteraceae	ARCA45
1	<i>Arctotheca prostrata</i>	fertile capeweed	Asteraceae	ARPR??
1	<i>Arundo donax</i>	giant reed	Poaceae	ARDO4X
1	<i>Berberis darwinii</i>	Darwin's berberis	Berberidaceae	BEDAXX
1	<i>Cakile maritima</i>	European searocket	Brassicaceae	CAMAXX
1	<i>Carduus acanthoides</i>	plumeless thistle	Asteraceae	CAACXX
1	<i>Carex pendula</i>	hanging sedge	Cyperaceae	CAPE45
1	<i>Carpobrotus chilensis</i>	sea fig	Aizoaceae	CACH38
1	<i>Carthamus lanatus</i>	woolly distaff thistle	Asteraceae	CALA20
1	<i>Centaurea calcitrapa</i>	purple starthistle	Asteraceae	CECA2X
1	<i>Centaurea solstitialis</i>	yellow starthistle	Asteraceae	CESO3X
1	<i>Cirsium arvense</i>	Canada thistle	Asteraceae	CIAR4X
1	<i>Conicosia pugioniformis</i>	narrow-leaved iceplant	Aizoaceae	COPU18
1	<i>Cortaderia selloana</i>	Uruguayan pampas grass	Poaceae	COSE4X
1	<i>Crataegus monogyna</i>	singleseed hawthorn	Rosaceae	CRMOXX
1	<i>Cynara cardunculus</i>	artichoke thistle	Asteraceae	CYCAXX
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>Dittrichia graveolens</i>	stinkweed	Asteraceae	DIGR4X
1	<i>Drosanthemum floribundum</i>	showy dewflower	Aizoaceae	DRFL2X
1	<i>Echium plantagineum</i>	salvation jane	Boraginaceae	ECPLXX
1	<i>Ehrharta calycina</i>	perennial veldt grass	Poaceae	EHCAXX
1	<i>Eichhornia crassipes</i>	water hyacinth	Pontederiaceae	EICRXX
1	<i>Euphorbia oblongata</i>	oblong spurge	Euphorbiaceae	EUOB4X
1	<i>Hedera canariensis</i>	Algerian ivy	Araliaceae	HECAXX
1	<i>Helichrysum petiolare</i>	licorice plant	Asteraceae	HEPE8X
1	<i>Hypericum perforatum</i>	Klamathweed	Clusiaceae	HYPEXX
1	<i>Ilex aquifolium</i>	English holly	Aquifoliaceae	ILAQ80
1	<i>Lepidium latifolium</i>	perennial pepperweed	Brassicaceae	LELA2X
1	<i>Mesembryanthemum crystallinum</i>	ice plant	Aizoaceae	MECR3X
1	<i>Myriophyllum aquaticum</i>	parrot's-feather	Haloragaceae	MYAQ2X

Priority	Scientific Name	Common Name	Family	SpCode
1	<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Haloragaceae	MYSP2X
1	<i>Nicotiana glauca</i>	tree tobacco	Solanaceae	NIGLXX
1	<i>Phalaris arundinacea</i>	reed canary grass	Poaceae	PHAR3X
1	<i>Pittosporum crassifolium</i>	stiffleaf cheesewood	Pittosporaceae	PICRXX
1	<i>Pyracantha angustifolia</i>	narrowleaf firethorn	Rosaceae	PYANXX
1	<i>Robinia pseudoacacia</i>	black locust	Fabaceae	ROPSXX
1	<i>Romulea rosea</i> var. <i>australis</i>	rosy sandcrocus	Iridaceae	ROROAX
1	<i>Rytidosperma penicillatum</i>	purple awned wallaby grass	Poaceae	RYPE
1	<i>Scabiosa atropurpurea</i>	mourningbride	Dipsacaceae	SCATXX
1	<i>Spartina alterniflora</i>	smooth cordgrass	Poaceae	SPALXX
1	<i>Spartium junceum</i>	Spanish broom	Fabaceae	SPJU2X
1	<i>Trifolium angustifolium</i>	narrow leaved clover	Fabaceae	TRAN6X
1	<i>Ulex europaeus</i>	gorse	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>Bromus madritensis</i> ssp. <i>rubens</i>	red brome	Poaceae	BRMARX
2	<i>Bromus tectorum</i>	cheat grass	Poaceae	BRTEXX
2	<i>Calendula arvensis</i>	field marigold	Asteraceae	CAARXX
2	<i>Centaurea melitensis</i>	totalote	Asteraceae	CEME2X
2	<i>Cestrum parqui</i>	orange jessamine	Solanaceae	CEPA9X
2	<i>Cynodon dactylon</i>	Bermudagrass	Poaceae	CYDAXX
2	<i>Dactylis glomerata</i>	orchard grass	Poaceae	DAGLXX
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>Festuca arundinacea</i>	tall fescue	Poaceae	FEAR3X
2	<i>Hedera helix</i>	English ivy	Araliaceae	HEHEXX
2	<i>Hirschfeldia incana</i>	shortpod mustard	Brassicaceae	HIIN3X
2	<i>Leptospermum laevigatum</i>	Australian teatree	Myrtaceae	LELA29
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>Pennisetum clandestinum</i>	Kikuyu grass	Poaceae	PECL2X
2	<i>Rosa eglanteria</i>	sweetbriar rose	Rosaceae	ROEGXX
2	<i>Rubus discolor</i>	Himalayan blackberry	Rosaceae	RUDI2X
2	<i>Solanum laciniatum</i>	New Zealand nightshade	Solanaceae	SOAVXX
3	<i>Arrhenatherum elatius</i>	tall oatgrass	Poaceae	AREL3X
3	<i>Brassica rapa</i>	field mustard	Brassicaceae	BRRAXX
3	<i>Carpobrotus edulis</i>	freeway iceplant	Aizoaceae	CAED3X

Priority	Scientific Name	Common Name	Family	SpCode
3	<i>Coprosma repens</i>	creeping mirrorplant	Rubiaceae	CORE4X
3	<i>Cortaderia jubata</i>	jubata grass	Poaceae	COJU2X
3	<i>Cotoneaster franchetii</i>	orange cotoneaster	Rosaceae	COFR3X
3	<i>Cotoneaster lacteus</i>	milkflower cotoneaster	Rosaceae	COLA18
3	<i>Cotoneaster pannosus</i>	silverleaf cotoneaster	Rosaceae	COPA14
3	<i>Erigeron karvinskianus</i>	Latin American fleabane	Asteraceae	ERKA2X
3	<i>Ehrharta erecta</i>	panic veldt grass	Poaceae	HERXX
3	<i>Foeniculum vulgare</i>	sweet fennel	Apiaceae	FOVUXX
3	<i>Genista monspessulana</i>	French broom	Fabaceae	GEMO2X
3	<i>Gunnera tinctoria</i>	Chilean gunnera	Gunneraceae	GUTIXX
3	<i>Lathyrus latifolius</i>	perennial pea	Fabaceae	LALA4X
3	<i>Ligustrum ovalifolium</i>	California privet	Oleaceae	LIOVXX
3	<i>Linaria vulgaris</i>	butter and eggs	Scrophulariaceae	LIVU2X
3	<i>Lonicera japonica</i>	Japanese honeysuckle	Caprifoliaceae	LOJAXX
3	<i>Phalaris aquatica</i>	Harding grass	Poaceae	PHAQXX
3	<i>Pinus radiata</i>	Monterey pine	Pinaceae	PIRA2X
3	<i>Schinus molle</i>	pepper tree	Anacardiaceae	SCMOXX
3	<i>Tamarix chinensis</i>	saltcedar	Tamaricaceae	TACH2X
3	<i>Xanthium spinosum</i>	spiny cocklebur	Asteraceae	XASP2X
3	<i>Xanthium strumarium</i>	rough cocklebur	Asteraceae	XASTXX

Appendix B: 2011 List of priority invasive species at PORE.

Priority	Scientific Name	Common Name	Family	Code
1	<i>Acroptilon repens</i>	Russian knapweed	Asteraceae	ACRE3X
1	<i>Aegilops triuncialis</i>	barbed goatgrass	Poaceae	AETRXX
1	<i>Ageratina adenophora</i>	thoroughwort	Asteraceae	AGAD2X
1	<i>Albizia lophantha</i>	silk tree, cape wattle	Fabaceae	ALLOXX
1	<i>Alisma lanceolatum</i>	lanceleaf water plantain	Alismataceae	ALLA2X
1	<i>Anthoxanthum odoratum</i>	sweet vernalgrass	Poaceae	ANODXX
1	<i>Arundo donax</i>	giant reed	Poaceae	ARDO4X
1	<i>Brachypodium distachyon</i>	purple false brome	Poaceae	BRDI2X
1	<i>Carduus acanthoides</i>	plumeless thistle	Asteraceae	CAACXX
1	<i>Carex pendula</i>	hanging sedge	Cyperaceae	CAPE45
1	<i>Carthamus lanatus</i>	woolly distaff thistle	Asteraceae	CALA20
1	<i>Centaurea calcitrapa</i>	purple starthistle	Asteraceae	CECA2X
1	<i>Centaurea iberica</i>	Iberian starthistle	Asteraceae	CEIBXX
1	<i>Centaurea melitensis</i>	Napa thistle, tocalote	Asteraceae	CEME2X
1	<i>Centaurea solstitialis</i>	yellow starthistle	Asteraceae	CESO3X
1	<i>Conicosia pugioniformis</i>	narrow-leaved iceplant	Aizoaceae	COPU18
1	<i>Cotoneaster franchetii</i>	orange cotoneaster	Roseaceae	COFR3X
1	<i>Cotoneaster pannosus</i>	silverleaf cotoneaster	Roseaceae	COPA14
1	<i>Dittrichia graveolens</i>	stinkweed	Asteraceae	DIGR4X
1	<i>Egeria densa</i>	Brazilian elodea	Hydrocharitaceae	EGDEXX
1	<i>Ehrharta calycina</i>	perennial veldt grass	Poaceae	EHCAXX
1	<i>Euphorbia oblongata</i>	oblong spurge	Euphorbiaceae	EUOB4X
1	<i>Helichrysum petiolare</i>	licorice plant	Asteraceae	HEPE8X
1	<i>Hypericum perforatum</i>	Klamathweed	Hypericaceae	HYPEXX
1	<i>Iris pseudacorus</i>	yellow flag	Iridaceae	IRPSXX
1	<i>Lepidium latifolium</i>	perennial pepperweed	Brassicaceae	LELA2X
1	<i>Ludwigia hexapetala</i>	sixpetal water-primrose	Onagraceae	LUHE5X
1	<i>Ludwigia peploides</i>	floating primrose-willow	Onagraceae	LUPE5X
1	<i>Marrubium vulgare</i>	horehound	Lamiaceae	MAVUXX
1	<i>Myriophyllum aquaticum</i>	parrot's-feather	Haloragaceae	MYAQ2X
1	<i>Phalaris arundinacea</i>	reed canary grass	Poaceae	PHAR3X
1	<i>Robinia pseudoacacia</i>	black locust	Fabaceae	ROPSXX
1	<i>Romulea rosea var. australis</i>	rosy sandcrocus	Iridaceae	ROROAX
1	<i>Salsola soda</i>	Russian thistle	Chenopodiaceae	SASO3X
1	<i>Senecio jacobaea</i>	tansy ragwort	Asteraceae	SEJAXX
1	<i>Spartina alterniflora</i>	Atlantic cordgrass	Poaceae	SPALXX
1	<i>Ulex europaeus</i>	gorse	Fabaceae	ULEUXX
2	<i>Acacia melanoxylon</i>	blackwood acacia	Fabaceae	ACMEXX
2	<i>Arctotheca calendula</i>	capeweed	Asteraceae	ARCA45
2	<i>Arctotheca prostrata</i>	fertile capeweed	Asteraceae	ARCA??

Priority	Scientific Name	Common Name	Family	Code
2	<i>Berberis darwinii</i>	Darwin's berberis	Berberidaceae	BEDAXX
2	<i>Cakile edentula</i>	European searocket	Brassicaceae	CAEDXX
2	<i>Cystisus scoparius</i>	Scotch broom	Fabaceae	CYSC4X
2	<i>Datura stramonium</i>	jimsonweed	Solanaceae	DASTXX
2	<i>Delairea odorata</i>	cape ivy	Asteraceae	DEODXX
2	<i>Echium candicans</i>	pride of Madeira	Boraginaceae	ECCA5X
2	<i>Genista monspessulana</i>	French broom	Fabaceae	GEMO2X
2	<i>Hedera helix</i>	English ivy	Araliaceae	HEHEXX
2	<i>Ilex aquifolium</i>	English holly	Aquifoliaceae	ILAQ80
2	<i>Lathyrus latifolius</i>	everlasting pea	Fabaceae	LALA4X
2	<i>Leucanthemum vulgare</i>	ox-eye daisy	Asteraceae	LEVUXX
2	<i>Linaria vulgaris</i>	butter and eggs	Scrophulariaceae	LIVU2X
2	<i>Oxalis pes-caprae</i>	Bermuda buttercup	Oxalidaceae	OXPEXX
2	<i>Paspalum dilatatum</i>	dallis grass	Poaceae	PADI3X
2	<i>Pennisetum clandestinum</i>	Kikuyu grass	Poaceae	PECL2X
2	<i>Pittosporum undulatum</i>	Victorian box	Pittosporaceae	PIUN2X
2	<i>Rubus armeniacus</i>	Himalayan blackberry	Rosaceae	RUDI2X
2	<i>Tetragonia tetragonoides</i>	New Zealand-spinach	Aizoaceae	TETE3X
2	<i>Vinca major</i>	periwinkle	Apocynaceae	VIMAXX
2	<i>Xanthium spinosum</i>	spiny cocklebur	Asteraceae	XASP2X
3	<i>Acacia longifolia</i>	Sydney golden wattle	Fabaceae	ACLOXX
3	<i>Acacia verticillata</i>	prickly Moses	Fabaceae	ACVE2X
3	<i>Allium triquetrum</i>	threecorner leek	Liliaceae	ALTR4X
3	<i>Ammophila arenaria</i>	European beachgrass	Poaceae	AMAR4X
3	<i>Carpobrotus chilensis</i>	sea fig	Aizoaceae	CACH38
3	<i>Carpobrotus edulis</i>	iceplant	Aizoaceae	CAED3X
3	<i>Cestrum parqui</i>	chilean jessamine	Solanaceae	CEPA
3	<i>Conium maculatum</i>	poison hemlock	Apiaceae	COMA2X
3	<i>Cortaderia jubata</i>	jubata grass	Poaceae	COJU2X
3	<i>Cortaderia selloana</i>	Uruguayan pampas grass	Poaceae	COSE4X
3	<i>Cotoneaster lacteus</i>	milkflower cotoneaster	Rosaceae	COLA18
3	<i>Crataegus monogyna</i>	singleseed hawthorn	Rosaceae	CRMOXX
3	<i>Cupressus macrocarpa</i>	Monterey cypress	Cupressaceae	CUMA2X
3	<i>Cynodon dactylon</i>	Bermudagrass	Poaceae	CYDAXX
3	<i>Digitalis purpurea</i>	purple foxglove	Scrophulariaceae	DIPUXX
3	<i>Dipsacus fullonum</i>	Fuller's teasel	Dipsacaceae	DIFU2X
3	<i>Dipsacus sativus</i>	indian teasel	Dipsacaceae	DISA9X
3	<i>Drosanthemum floribundum</i>	showy dewflower	Aizoaceae	DRFL2X
3	<i>Echium plantagineum</i>	salvation jane	Boraginaceae	ECPLXX
3	<i>Ehrharta erecta</i>	panic veldt grass	Poaceae	HERHXX
3	<i>Eucalyptus globulus</i>	bluegum eucalyptus	Myrtaceae	EUGLXX
3	<i>Euphorbia lathyris</i>	gopher plant	Euphorbiaceae	EULA4X

Priority	Scientific Name	Common Name	Family	Code
3	<i>Festuca arundinacea</i>	tall fescue	Poaceae	FEAR3X
3	<i>Foeniculum vulgare</i>	sweet fennel	Apiaceae	FOVUXX
3	<i>Hypericum calycinum</i>	Aaron's beard	Clusiaceae	HYCA10
3	<i>Lythrum hyssopifolia</i>	hyssop loosestrife	Lythraceae	LYHY2X
3	<i>Mentha pulegium</i>	pennyroyal	Lamiaceae	MEPUXX
3	<i>Myoporum laetum</i>	myoporum	Myoporaceae	MYLA5X
3	<i>Phalaris aquatica</i>	Harding grass	Poaceae	PHAQXX
3	<i>Pinus radiata</i>	Monterey pine	Pinaceae	PIRA2X
3	<i>Populus alba</i>	white poplar	Salicaceae	POAL7X
3	<i>Pyracantha angustifolia</i>	narrowleaf firethorn	Rosaceae	PYANXX
3	<i>Rosa eglanteria</i>	sweetbriar rose	Rosaceae	ROEGXX
3	<i>Scabiosa atropurpurea</i>	mourningbride	Dipsacaceae	SCATXX
3	<i>Sorghum halepense</i>	Johnson grass	Poaceae	SOHAXX
3	<i>Sparaxis tricolor</i>	harlequin flower	Iridaceae	SPTRXX
3	<i>Tanacetum parthenium</i>	feverfew	Asteraceae	TAPA6X
3	<i>Verbascum blattaria</i>	moth mullein	Scrophulariaceae	VEBLXX
3	<i>Watsonia meriana</i>	bulbil bugle-lily	Iridaceae	WAMEXX
3	<i>Zantedeschia aethiopica</i>	calla lily	Araceae	ZAAEXX

Appendix C: 2011 List of priority invasive species at PINN.

Priority	Scientific Name	Common Name	Family	Code
1	<i>Acroptilon repens</i>	Russian knapweed	Asteraceae	ACRE3
1	<i>Ailanthus altissima</i>	tree-of-heaven	Simaroubaceae	AIAL
1	<i>Arundo donax</i>	giant reed	Poaceae	ARDO4
1	<i>Chenopodium ambrosioides</i>	Mexican-tea	Chenopodiaceae	CHAM
1	<i>Cnicus benedictus</i>	blessed thistle	Asteraceae	CNBE
1	<i>Dittrichia graveolens</i>	stinkweed	Asteraceae	DIGR
1	<i>Iris pseudacorus</i>	yellow flag Iris	Iridaceae	IRPS
1	<i>Lepidium latifolium</i>	perennial pepperweed	Brassicaceae	LELA2
1	<i>Lolium multiflorum</i>	Italian ryegrass	Poaceae	LOMU
1	<i>Lolium perenne</i>	perennial ryegrass	Poaceae	LOPE
1	<i>Lolium temulentum</i>	darnel	Poaceae	LOTE2
1	<i>Malva parviflora</i>	cheeseweed	Malvaceae	MAPA5
1	<i>Melilotus alba</i>	white sweetclover	Fabaceae	MEAL2
1	<i>Nicotiana glauca</i>	tree tobacco	Solanaceae	NIGL
1	<i>Picris echinoides</i>	bristly ox-tongue	Asteraceae	PIEC
1	<i>Piptatherum miliaceum</i>	smilo grass	Poaceae	PIMI3
1	<i>Poa bulbosa</i>	bulbous bluegrass	Poaceae	POBU
1	<i>Rubus armeniacus</i>	Himalayan blackberry	Rosaceae	RUDI2
1	<i>Salsola tragus</i>	prickly Russian thistle	Chenopodiaceae	SATR12
1	<i>Taeniatherum caput-medusae</i>	Medusa-head	Poaceae	TACA8
1	<i>Tamarix ramosissima</i>	saltcedar	Tamaricaceae	TARA
1	<i>Tragopogon dubius</i>	yellow salsify	Asteraceae	TRDU
1	<i>Tribulus terrestris</i>	puncturevine	Zygophyllaceae	TRTE
1	<i>Trifolium hirtum</i>	rose clover	Fabaceae	TRHI4
1	<i>Verbascum blattaria</i>	moth mullein	Scrophulariaceae	VEBL
1	<i>Verbascum thapsus</i>	woolly mullein	Scrophulariaceae	VETH
1	<i>Xanthium spinosum</i>	spiny cocklebur	Asteraceae	XASP2
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>Cotula coronopifolia</i>	brass buttons	Asteraceae	COCO7
2	<i>Cyperus schoenoides</i>	swamp prickly grass	Poaceae	CRSC
2	<i>Cynodon dactylon</i>	Bermudagrass	Poaceae	CYDA
2	<i>Cyperus difformis</i>	variable flatsedge	Cyperaceae	CYDI4
2	<i>Marrubium vulgare</i>	horehound	Lamiaceae	MAVU
2	<i>Veronica persica</i>	birdseye speedwell	Scrophulariaceae	VEPE3
2	<i>Vinca major</i>	periwinkle	Apocynaceae	VIMA
3	<i>Amaranthus albus</i>	tumbleweed	Amaranthaceae	AMAL
3	<i>Brassica nigra</i>	black mustard	Brassicaceae	BRNI

Priority	Scientific Name	Common Name	Family	Code
3	<i>Brassica rapa</i>	field mustard	Brassicaceae	BRRRA
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 Xpiperita</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

Appendix D: 2011 List of priority invasive species at JOMU.

Priority	Scientific Name	Common Name	Family	Code
1	<i>Centaurea calcitrapa</i>	purple starthistle	Asteraceae	CECA2X
1	<i>Centaurea melitensis</i>	toocalote	Asteraceae	CEME2X
1	<i>Cortaderia jubata</i>	jubata grass	Poaceae	COJU2X
1	<i>Delairea odorata</i>	cape ivy	Asteraceae	DEODXX
1	<i>Dittrichia graveolens</i>	stinkweed	Asteraceae	DIGR3X
1	<i>Euphorbia oblongata</i>	oblong spurge	Euphorbiaceae	EUOB4X
1	<i>Eucalyptus globulus</i>	bluegum eucalyptus	Myrtaceae	EUGLXX
1	<i>Ficus carica</i>	fig	Moraceae	FICAXX
1	<i>Lepidium latifolium</i>	perennial pepperweed	Brassicaceae	LELA2X
1	<i>Malvella leprosa</i>	alkali mallow	Malvaceae	MALE3X
1	<i>Ulex europaeus</i>	gorse	Fabaceae	ULEUXX
1	<i>Xanthium spinosum</i>	spiny cocklebur	Asteraceae	XASP2X
2	<i>Arundo donax</i>	giant reed	Poaceae	ARDO4X
2	<i>Bellardia trixago</i>	bellardia	Scrophulariaceae	BETRXX
2	<i>Cirsium vulgare</i>	bull thistle	Asteraceae	CIVUXX
2	<i>Conium maculatum</i>	poison hemlock	Apiaceae	COMA2X
2	<i>Convolvulus arvensis</i>	field bindweed	Convolvulaceae	COAR4X
2	<i>Cotoneaster franchetii</i>	orange cotoneaster	Rosaceae	COFR3X
2	<i>Cynara cardunculus</i>	artichoke thistle	Asteraceae	CYCAXX
2	<i>Foeniculum vulgare</i>	fennel	Apiaceae	FOVUXX
2	<i>Genista monspessulana</i>	French broom	Fabaceae	GEMO2X
2	<i>Hirschfeldia incana</i>	summer mustard	Brassicaceae	HIIN3X
2	<i>Olea europaea</i>	olive	Oleaceae	OLEUXX
2	<i>Phalaris aquatica</i>	harding grass	Poaceae	PHAQXX
2	<i>Rubus discolor</i>	Himalayan blackberry	Rosaceae	RUDI2X
2	<i>Tribulus terrestris</i>	puncturevine	Zygophyllaceae	TRTEXX
2	<i>Zantedeschia aethiopica</i>	calla lilly	Araceae	ZAAEXX
3	<i>Ailanthus altissima</i>	tree of heaven	Simaroubaceae	AIALXX
3	<i>Brassica nigra</i>	black mustard	Brassicaceae	BRNIXX
3	<i>Carduus pycnocephalus</i>	Italian thistle	Asteraceae	CAPY2X
3	<i>Centaurea solstitialis</i>	yellow starthistle	Asteraceae	CESO3X
3	<i>Silybum marianum</i>	blessed milkthistle	Asteraceae	SIMA3X
3	<i>Vinca major</i>	periwinkle	Apocynaceae	VIMAXX

Appendix E. Maps showing 2011 survey results.

Available online at:

http://science.nature.nps.gov/im/units/sfan/vital_signs/Invasives/EDNews.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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Natural Resource Stewardship and Science

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

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