



Invasive Plant Monitoring Protocol for the Mediterranean Coast Network—Santa Monica Mountains National Recreation Area and Channel Islands National Park

Narrative, Version 1.0

Natural Resource Report NPS/MEDN/NRR—2016/1171



ON THE COVER

Measuring a Spanish broom (*Spartium junceum*) infestation along the Backbone Trail.
Photograph courtesy of Santa Monica Mountains National Recreation Area

*And since, methinks I would not grow so fast
Because sweet flowers are slow and weeds make haste.*
-William Shakespeare

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Authors

Irina C. Irvine¹, Tarja Sagar¹, Lena Lee², Christy A. Brigham¹, John Tiszler¹, Leigh Ann Starcevich³, Dirk Rodriguez⁴, Tim Handley², Stacey Ostermann-Kelm²

¹National Park Service
Santa Monica Mountains NRA
401 West Hillcrest Drive
Thousand Oaks, California 91360

³West Environmental and Statistical
Consultants
456 S.W. Monroe Avenue, Suite 106
Corvallis, Oregon 97333

²National Park Service
Mediterranean Coast Network
Inventory and Monitoring Program
401 West Hillcrest Drive
Thousand Oaks, California 91360

⁴National Park Service
Channel Islands National Park
1901 Spinnaker Drive
Ventura, California 93001

Editor

Sonya Daw
National Park Service
Inventory and Monitoring Program
Flagstaff, Arizona 86011

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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. These reports are 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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List of Standard Operating Procedures (SOPs)

This report is linked to the following Standard Operating Procedures (SOPs):

SOP 1: Field Preparation, Permits and Equipment

SOP 2: Field Data Collection Training

SOP 3: Safety

SOP 4: Using a GPS - Field Data Collection and Processing

SOP 5: Data Sheets

SOP 6: Field Data Collection

SOP 7: Collecting and Identifying Unknown Plants

SOP 8: Data Entry and Data Management

SOP 9: Database Structure

SOP 10: Data Analysis and Reporting

SOP 11: Reviewing and Revising the Target Invasive Species List

SOP 12: Obtaining Data from Interior Parkland Monitoring Programs

SOP 13: Annual Report Template

The SOPs are available in this document:

Irvine, I. C., T. Sagar, L. Lee, C. A. Brigham, J. Tiszler, L. A. Starcevich, D. Rodriguez, T. Handley, and S. Ostermann-Kelm. 2016. Invasive plant monitoring protocol for the Mediterranean Coast Network—Santa Monica Mountains National Recreation Area and Channel Islands National Park: Standard Operating Procedures, Version 1.0. Natural Resource Report NPS/MEDN/NRR—2016/1171.1. National Park Service, Fort Collins, Colorado.

Version 1.0 (March 2016)

Change History

Version numbers will be incremented by a whole number (e.g., Version 1.3 to Version 2.0) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.6 to Version 1.7) when there are minor modifications that do not affect requirements or procedures for publication in the series.

The following revisions have occurred to this protocol since March 2016:

Previous Version #	Date	Revised by	Changes	Justification	New Version #

- Record the previous version number, date of revision, author of the revision, paragraphs and pages where changes were made, the reason for making the changes, and the new version number.
- Notify the MEDN Data Manager of any changes to the protocol narrative or SOPs so that the new version number can be incorporated in the metadata of the project database.
- Post new versions on the internet and forward copies to all individuals with a previous version of the protocol narrative or SOPs.

Abstract

The Mediterranean Coast Network (MEDN) parks protect and conserve important elements of the unique flora of coastal southern California. Native plant diversity and ecological functions within the MEDN are threatened by urban and agricultural development, intensive recreational use, and changing fire regimes, which all contribute to the introduction and spread of non-native invasive plant species (NNIS). The presence, distribution and rate of spread of NNIS are important indicators of overall habitat quality within MEDN parks.

Created by a partnership that includes the MEDN Inventory and Monitoring Program, Santa Monica Mountains National Recreation Area (SAMO) and Channel Islands National Park (CHIS), this document describes our long-term monitoring program to assess target NNIS on publicly owned lands parkwide. The overarching goal of the program is to determine whether the distribution and abundance of NNIS are increasing or decreasing within these parks. More specifically, we will monitor the distribution and cover of target NNIS at high-risk areas (points of entry, dirt roads, and trails) throughout the parks. We rely on data collected through the MEDN Terrestrial Vegetation Monitoring Program and the Water Quality and Riverine Integrity Monitoring Program for information on interior parklands (away from roads and trails). The invasive plant monitoring program includes three complementary components: (1) points of entry (trailheads, ports, airstrips, and campgrounds), (2) official dirt roads and trails, and (3) interior parklands. CHIS will implement monitoring at points of entry and interior parklands, and all three components will be implemented at SAMO.

Each year, we will monitor all 16 points of entry (POE) at CHIS and all of the 123 POE at SAMO (30-31 per year). At SAMO, we will also monitor NNIS along official dirt roads and trails (DRT). Monitoring at both parks will be accomplished using park staff and interns, partially funded by the MEDN Inventory and Monitoring Program. Annual status reports and periodic trend reports will be published in the National Park Service Natural Resource Publications Management Report Series or in peer-reviewed journals.

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Acronyms

ANI:	Anacapa Island
CABR:	Cabrillo National Monument
CHIS:	Channel Islands National Park
CPR:	cardiopulmonary resuscitation
DRT:	official dirt roads and trails
GIS:	geographic information system
GPS:	geographic positioning system
GRTS:	generalized random tessellation stratified design
GSA:	General Services Administration
I&M:	NPS Inventory and Monitoring Program
MEDN:	Mediterranean Coast Network of the NPS Inventory and Monitoring Program
NNIS:	non-native invasive plant species
NISIMS	National Invasive Species Information Management System
NPS:	National Park Service
POE:	points of entry
QA/QC:	quality assurance / quality control
RMZ:	Santa Monica Mountains Resource Management Zone
SAMO:	Santa Monica Mountains National Recreation Area
SCD:	satellite communication device
SBI:	Santa Barbara Island
SCI:	Santa Cruz Island
SMI:	San Miguel Island
SOP:	standard operating procedure
SRI:	Santa Rosa Island
TNC:	The Nature Conservancy
WQRI:	Water Quality and Riverine Integrity (monitoring program)

1.0 Background and Objectives

1.1 The National Park Service Inventory and Monitoring Program

The purpose of the National Park Service (NPS) Inventory & Monitoring (I&M) Program is to gather and provide scientific information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems. As part of the NPS effort to improve park management through greater reliance on scientific knowledge, the primary role of the I&M Program is to collect, organize, and make available natural resource data on key vital signs and to contribute to the NPS institutional knowledge by interpreting these data through analysis, synthesis, and modeling. The I&M Program defines vital signs as a subset of physical, chemical, and biological elements and processes of park ecosystems that are thought to represent the overall health or condition of park resources, known or hypothesized effects of stressors, or elements that have important human values (Fancy et al. 2008).

The five goals of the I&M Program (Fancy et al. 2008) are to

1. Inventory the natural resources and park ecosystems under NPS stewardship to determine their nature and status.
2. Monitor park ecosystems to better understand their dynamic nature and condition and to provide reference points for comparisons with other, altered environments.
3. Establish natural resource inventory and monitoring as a standard practice throughout the NPS system that transcends traditional program, activity, and funding boundaries.
4. Integrate natural resource inventory and monitoring information into NPS planning, management, and decision-making.
5. Share NPS accomplishments and information with other natural resource organizations and form partnerships for attaining common goals and objectives.

These goals are accomplished through parkwide inventories and long-term monitoring programs. In establishing a service-wide natural resources I&M Program, the NPS created networks of parks that are linked by geography and shared natural resource characteristics. Working within and across networks improves the efficiency of inventory and monitoring because parks are able to share budgets, staffing, and other resources to plan and implement an integrated program. The Mediterranean Coast Network (MEDN) is one of 32 monitoring networks across the NPS. The MEDN comprises three NPS units: Cabrillo National Monument (CABR), Channel Islands National Park (CHIS), and the Santa Monica Mountains National Recreation Area (SAMO). The *Mediterranean Coast Network – Vital Signs Monitoring Plan* (Cameron et al. 2005) provides the foundation for the long-term ecological monitoring programs of the network and describes the rationale and basis for the programs.

1.2 Rationale for Monitoring Non-Native Invasive Plants

The MEDN parks protect a unique and diverse flora. They are part of California's South Coast Ecoregion (Hickman 1993, Bailey et al. 1994, Figure 1), which contains more than 30% of California's native plant species in less than 10% of the state's land area (California Department of

Fish and Game 2008). More endemic plant and animal species occur in this ecoregion than any other ecoregion in the country (Stein et al. 2000). This species richness and high endemism are contained within vegetation communities that are typical of Mediterranean-type climate regions, including evergreen chaparral and summer-deciduous sage scrub occurring in association with woodland, grassland, riparian, and coastal bluff communities (Rundel 2000, Rundel and Tiszler 2007).

The South Coast Ecoregion is also notable for the tremendous human population growth and urban expansion that has occurred since the 1940s (Bunn et al. 2007). Approximately 20 million people (i.e., nearly 50% of California's population) live within the ecoregion. A defining characteristic of this population growth is the juxtaposition of urban landscapes with parklands and other natural areas (Bunn et al. 2007). The resulting habitat loss and fragmentation threaten the long-term sustainability of ecosystems and organisms protected in public lands. There are also significant immediate and ongoing effects of population growth on protected areas. These include polluted air, changed hydrological and nutrient cycles, biological invasions, altered fire regimes, and impacts from heavy recreational use (Flather et al. 1998, Minnich and Dezzani 1998, Paul and Meyer 2001, Rundel and King 2001, Groffman et al. 2002, Allen et al. 2005, Keeley et al. 2005, CDFG 2008).

Urban development, in conjunction with earlier land conversion for ranching and crop production, has transformed the landscape and had a profound impact on biodiversity. The entire California Floristic Province is internationally recognized as a biodiversity "hotspot" because of its exceptionally high levels of plant endemism and biodiversity (Myers et al. 2000). Southern California is a "hotspot within a hotspot" of threatened and endangered species, with over 200 plant species listed as protected or considered sensitive (Wilcove et al. 1998, Stein et al. 2000, USGS 2003, Hunter 1999). Coastal sage scrub, a unique and defining component of South Coast vegetation, has been reduced to 15% of its pre-industrial extent (Ricketts et al. 1999). The majority of oak savannas and woodlands in the region have been cut down, and most coastal habitats have been highly altered (Ricketts et al. 1999). The MEDN parks protect some of the best remaining examples of these vegetation types, harboring 25 federally listed threatened or endangered plant taxa.

The establishment and spread of non-native, invasive plant species (NNIS) is perhaps the most significant threat to native plant diversity in the MEDN parks, as it is in natural areas throughout the nation (Wilcove et al. 1998, Powell et al. 2011, Pimentel et al. 1999, Marler 1998). Non-native plant infestations in natural areas increase by an estimated 1,862 ha (4,600 acres) each year in the United States (Asher and Harmon 1995), significantly altering local flora. Economic globalization, increased transportation, human migration, land use change, and outdoor recreation all contribute to the spread of non-native species. The proximity of MEDN parks to major metropolitan centers of international trade (Los Angeles and San Diego) and large human populations (9.8 million and 3.1 million, respectively; US Census 2010) puts these parks at particular risk of invasion by non-native plants.

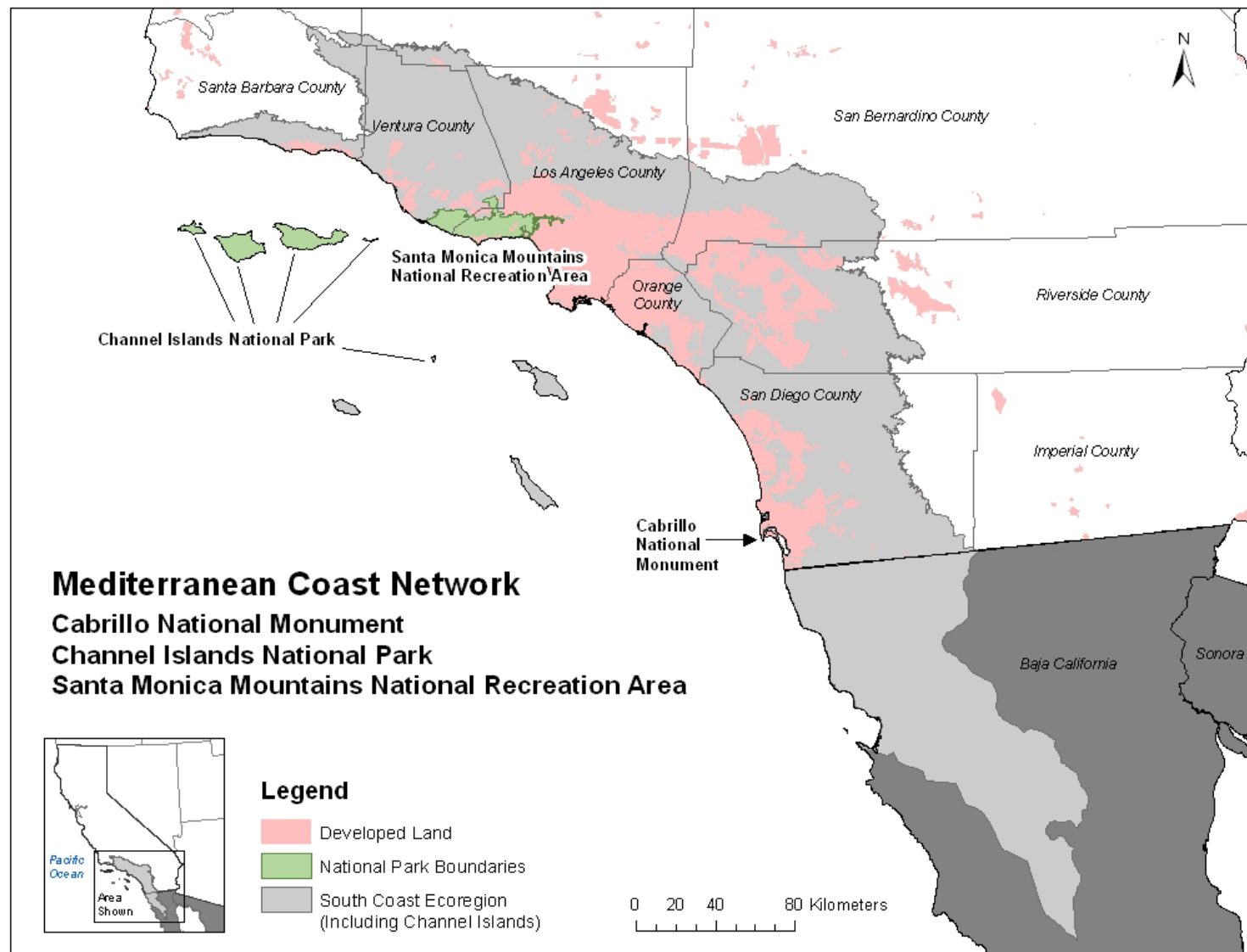


Figure 1. Location of the three parks within the Mediterranean Coast Network of the NPS I&M Program and the South Coast Ecoregion boundary.

Presently, non-native plants comprise 27% of the Channel Islands flora, 31% of the Santa Monica Mountains flora and 45% of the Cabrillo National Monument flora (NPSpecies 2014). The introduction and establishment of non-native plants in Southern California is generally associated with urban, agricultural or ranching activities. Once introduced, non-natives often spread beyond the bounds of the disturbance that enabled their introduction (Dowell and Krass 1992, Morse et al. 1995). Thus, as the scope of human activities in Southern California is only expected to increase, the numbers and distribution of non-native species are also expected to increase.

National parks, like other natural landscapes, are impacted by new non-native plant species arriving through predictable (e.g., roads, trails, and riparian corridors), sudden (e.g., long-distance dispersal through cargo containers, air freight, and flotsam), and unexpected anthropogenic pathways (e.g., non-native seed in restoration planting mixes). While many non-natives simply become minor elements in the landscape, others are invasive. An invasive species is a non-indigenous species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Noxious Weeds Act of 1974). Invasive species have the capacity to out-compete native plants, alter nutrient cycling, and to reduce native wildlife habitat quality (Pimentel et al. 1999, Bossard et al. 2000). In the worst case, invasive species alter ecosystem function in a way that promotes their spread (Richardson et al. 2000).

Non-native invasive plant species have been directly linked to the replacement of dominant native species (Tilman 1999), the loss of rare species (King 1985), changes in ecosystem structure, alteration of nutrient cycles and soil chemistry (Ehrenfeld 2003), shifts in community productivity (Vitousek 1990), altered fire regimes (Keeley et al. 2005, Keeley et al. 2011), and changes in water availability (D'Antonio and Mahall 1991). Overall, NNIS are second only to habitat destruction as a threat to wildland biodiversity (Wilcove et al. 1998).

In MEDN parks, we have evidence of several negative impacts from NNIS. Populations of *Pentachaeta lyonii* (SAMO), and *Galium buxifolium* (CHIS), both federally listed endangered species, are now declining due to resource competition from NNIS (Moroney et al. 2011, McEachern et al. 2010, respectively). Additionally, at SAMO, unnaturally frequent fires have promoted landscape type conversions to non-native forbs and annual grasses, with small mammal herbivory as an additional driving factor (Orrock and Witter 2010). Non-native herbaceous community types are more susceptible to ignition for a longer period of time each year than native shrublands. Thus, once established, these non-native communities promote fire regimes that are harmful to neighboring native communities (Witter et al. 2007).

Plant invasions are a challenge to the NPS mission to ensure that natural and cultural resources remain “unimpaired for the enjoyment of future generations.” The 2006 NPS management policies (NPS 2006) state that “high priority will be given to managing invasive species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controllable.” More recently, the NPS emphasized the importance of invasive species issues and their associated impacts by identifying NNIS as one of three major areas of focus under the Natural Resource Challenge to understand, measure, and improve the health of park ecosystems (NPS 2010).

There is a growing urgency to be proactive in protecting resources that are at risk from current and future invasions (Marler 1998). Long-term suppression programs are needed to address high-impact species, yet eradication efforts are most successful for infestations less than one hectare in size (Rejmanek and Pitcairn 2002). Eradication of infestations larger than 100 ha is usually unsuccessful. Efforts to control such large infestations are often so costly as to be unsustainable (Rejmanek and Pitcairn 2002). Further, in their detailed review of the invasive species problem in the United States, the US Congress, Office of Technology Assessment (1993) stated that the environmental and economic benefits of supporting prevention and early detection initiatives significantly outweigh any incurred costs, with the median benefit-to-cost ratio being 17:1 in favor of early identification and control.

Fortunately, there is often a lag period between the introduction of an invasive and subsequent colonization of new areas (Sakai et al. 2001). Thus, managers typically have an opportunity to find and eradicate NNIS populations before they become well-established. This strategy requires resource managers to (1) detect invasive species early (i.e., find a new species or an incipient population of an existing species while the infestation is small (less than 1 ha)), and (2) respond rapidly to eliminate the NNIS and all of its associated regenerative material. We have found that invasive species can only be controlled through active, coordinated, long-term management efforts predicated on an understanding of how invasives spread within and affect native plant communities.

Because NNIS tend to establish in disturbed areas and impact native biota, the frequency and distribution of plant invasions are valuable measures of ecosystem health. In fact, invasive plant monitoring was the top-ranked MEDN vital sign for implementation (Cameron et al. 2005). The current protocol will be implemented only at SAMO and CHIS, and not at CABR, because of CABR's small size (65 ha), and the use of a comprehensive "search and destroy" management strategy that covers the entire park. We may revise the protocol in the future to include CABR if the park's NNIS status or needs change. Furthermore, while the park boundaries for CHIS and CABR encompass marine and terrestrial environments, this protocol covers only terrestrial environments.

1.3 Network Parks and Current NNIS Monitoring Efforts

Channel Islands National Park

Land Ownership and Management

Channel Islands National Park comprises five islands located off the coast of southern California: Santa Barbara Island (SBI), Anacapa Island (ANI), Santa Cruz Island (SCI), Santa Rosa Island (SRI), and San Miguel Island (SMI). The islands range in size from 268 ha to over 25,000 ha (Table 1, Figure 2). The three smaller islands (SBI, ANI, and SRI) are entirely owned and managed by the NPS. SMI is owned by the US Navy but managed by NPS. The largest island, SCI, lies completely within the park's boundary, although only the eastern quarter of the island is owned and managed by NPS. The remainder of SCI is owned by The Nature Conservancy (TNC), and both the NPS and TNC work together in support of island-wide projects. The Nature Conservancy will monitor airstrips on their land using the methods described in this protocol as time and funding allow.

Table 1. The islands of Channel Islands National Park and their areas.

Island	Hectares
San Miguel	3,879
Santa Rosa	21,486
Santa Cruz	25,089
Santa Barbara	268
Anacapa	
East islet	45
Middle islet	63
West islet	183
Total:	51,012

Native Plant Communities, Animal Introductions, and the Establishment of Invasive Plants

Plant communities occurring on the islands include coastal sage scrub, riparian, marsh, non-native annual grassland, native perennial grassland, coyote brush scrub, coastal bluff scrub, Torrey pine woodland, Bishop pine woodland, and island chaparral. Within the park, there are 779 known plant species, of which approximately 27% are not native to California. The islands are also home to 75 plant species that are endemic to one or more of the islands. Twenty-one of these endemics are restricted to a single island.

Many NNIS were first brought to the islands during the ranching and farming period that began in the mid-1800s, and were only eliminated in the recent past from some of the islands (Table 2; Morrison 2007, MacDonald and Walker 2008, Collins 2009). Introduction of these species as well as the intensive grazing of the islands by large herbivores such as cattle and sheep caused profound changes to the islands' native plant communities and ecosystems. Under intensive grazing pressure the native plants declined while the NNIS that were adapted to the impacts associated with grazing thrived. As a result, some NNIS, especially annual grasses like ripgut brome (*Bromus diandrus*) or wild oats (*Avena fatua*), are the dominant plant species in some island communities.

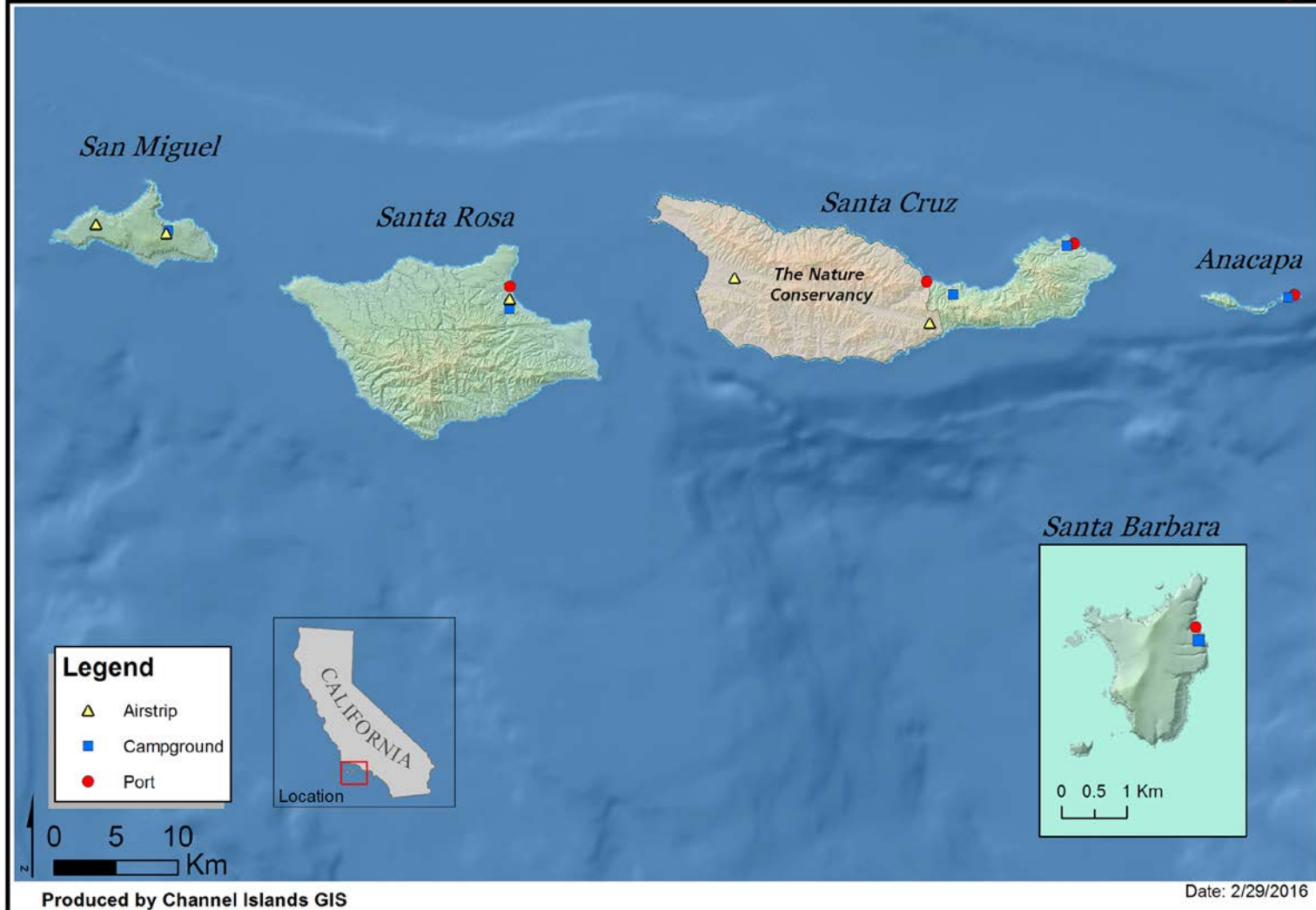


Figure 2. Map of Channel Islands National Park showing all 16 major points of entry: ports, airstrips, and campgrounds. The western part of Santa Cruz Island is owned and managed by The Nature Conservancy.

Table 2. The year(s) domestic feral animals were eliminated from Channel Islands National Park. Domestic animals and their feed were likely important sources of NNIS on the islands.

Non-native fauna	ANI	SBI	SCI	SMI	SRI
Cattle	---	---	1999	1917?	1998
Domestic sheep	1937	1946	2001	1970s	1960s
Horses	---	1919	2009	1948	2023 (est.)
Goats	---	---	1920	1890?	1900s
Rabbits	1960s	1981	---	---	---
Burros	---	1922	---	1976	1880s
Pigs	---	---	2006	1993	1897?
Deer	---	---	---	---	2013
Elk	---	---	---	---	2011

SCI = Santa Cruz Island, SRI = Santa Rosa Island, SBI = Santa Barbara Island, SMI = San Miguel Island, and ANI = Anacapa Island.

Current Monitoring and Treatment Efforts

Although CHIS has a long-term vegetation monitoring program (Rodriguez 2006, Tiszler et al. in press) and there have been efforts to record the presence of NNIS throughout the park, there is no formal program to specifically monitor NNIS. This protocol describes the first long-term effort to consistently and systematically record invasive plant species on the islands. Monitoring at CHIS will target the 18 NNIS listed in Table 3. These species were chosen because of their negative ecological impacts and the potential to control or eradicate them from the islands. New NNIS that are discovered on the islands may be added to the target list by staff in consultation with outside experts following the guidelines described in Standard Operating Procedure (SOP) 11 for determining the species' potential for spread and ecological impact, as well as feasibility of control or eradication.

CHIS staff undertake a variety of invasive plant eradication efforts, several of which have been successful in eliminating targeted plants from selected areas (Table 3). Sweet fennel (*Foeniculum vulgare*) has been nearly eliminated from the east end of SCI, and timely eradication efforts after yellow starthistle (*Centaurea solstitialis*) was first observed on SRI resulted in the apparent elimination of that invasive plant from the entire island. A major effort is underway to eliminate iceplant (*Malephora crocea*) from the east islet of Anacapa Island by 2016. Still, most widespread infestations such as sweet fennel on the main body of SCI or short-pod mustard (*Hirschfeldia incana*) on SRI will require considerable additional funding and increased staffing to successfully reduce or eliminate their presence on the islands.

CHIS has implemented the following policies to reduce the likelihood of accidentally introducing additional NNIS to the islands:

- Importation of firewood, gravel, soil, etc., to the islands is prohibited
- Carton boxes as containers for transporting supplies to the islands are prohibited
- Revegetation efforts must use island-collected seed and island-grown plants

- Use of boot brushes by all staff and visitors to the islands is encouraged
- Public education is provided regarding the impacts and costs associated with the spread of invasive plant species and the need to prevent future introductions
- Contractors must employ all NNIS introduction and spread prevention protocols (e.g., certified weed-free materials, equipment cleaning, etc.)

Table 3. List of 18 invasive plant species that will be monitored at Channel Islands National Park, the islands where they are currently present, and treatment status as of 2015. Additional, newly discovered NNIS may be added to this list in the future. All NNIS newly discovered within a park are initially considered part of the target NNIS.

Species (scientific name)	Common name	Islands	Treated
<i>Acacia melanoxylon</i>	black acacia	SCI	Yes – removed from NPS property, may still be present on TNC property.
<i>Capsella bursa-pastoris</i>	shepherd's purse	SCI, SRI, SMI, SBI	Yes – hand pulled on SBI the past two years and nearly eradicated.
<i>Carduus pycnocephalus</i>	Italian thistle	SRI	No
<i>Centaurea melitensis</i>	tocolote	SCI, SRI, SMI, SBI, ANI	Yes – appeared at a restoration site on SBI and was physically removed. May still be present on the island. No actions on other islands.
<i>Centaurea solstitialis</i>	yellow starthistle	SCI, SRI	Yes – eradicated from SRI, still present on TNC portion of SCI.
<i>Cortaderia jubata</i>	Pampas grass	SCI, SRI, SMI	Yes – treated (manual or chemical) whenever found. May still be present on islands.
<i>Delairea odorata</i>	Cape ivy	ANI	Yes – manual removal and chemical application but treatments were ineffective.
<i>Eucalyptus globulus</i>	blue gum	SCI, SRI	Yes – trees were removed in support of a restoration project on SCI but other stands still present on both islands due to cultural significance.
<i>Foeniculum vulgare</i>	sweet fennel	SCI, SRI, SMI	Yes – chemical treatment and manual removal on all islands. Nearly eradicated from east end of SCI, is found occasionally on SRI and SMI but treated when found.
<i>Hirschfeldia incana</i>	short-pod mustard	SCI, SRI, SMI	Yes – chemical treatment along roads on SRI but still present in large numbers on SCI and SRI. Manual removal of plants on SMI over last three years. Numbers are decreasing each year.
<i>Lavatera cretica</i>	Cornish mallow	ANI, SRI	No
<i>Malephora crocea</i>	coppery mesemb (iceplant)	ANI	Yes – there is an on-going project to remove this plant from the East ANI by 2016. Mostly hand pulled but some chemical treatment.
<i>Olea europaea</i>	olive tree	SCI	Yes – thousands of feral olives have been removed from SCI but some trees, deemed as culturally significant, remain on the island.
<i>Phalaris aquatica</i>	Harding grass	SCI	Yes – main stand has been treated multiple times on the east end of SCI but it is still present at main stand and in outlying areas.
<i>Raphanus raphanistrum</i>	wild radish	SCI, SRI	No
<i>Salsola tragus</i>	Russian thistle	SCI, SRI	No
<i>Spartium junceum</i>	Spanish broom	SCI	Yes – a few plants were found on the east end of the island in 2000. They were all promptly removed and appear to be eradicated.
<i>Vinca major</i>	periwinkle	SCI	Yes – occurrences were found around the Prisoner's area of the island and in rare plant habitat. They were manually removed, but it may still be present elsewhere on the island.

SCI = Santa Cruz Island, SRI = Santa Rosa Island, SBI = Santa Barbara Island, SMI = San Miguel Island, and ANI = Anacapa Island.

Santa Monica Mountains National Recreation Area

Land Ownership and Management

The Santa Monica Mountains National Recreation Area (62,593 ha) is a complex matrix of private and public lands (Figure 3). NPS owns 15% of the property within the recreation area, although approximately 57% of the recreation area is protected as parkland or other publicly owned land. The remaining 43% is privately owned. Many NPS parcels are relatively small and surrounded by private property. The average parcel size is 405 ha (1,000 acres), with numerous recreation trails, roadways, and fire clearance zones bordering and crossing property boundaries. These features result in a high edge-to-interior ratio with many pathways for NNIS to travel into and across NPS property. Given this pattern of private and public land ownership, local, state, and NPS managers coordinate management activities to best meet the conservation and preservation mandates of the multiple agencies responsible for land management within the recreation area.

Native Plant Communities and Invasive Species at SAMO

Native plant communities at SAMO include chaparral, coastal sage scrub, grassland, oak woodland, riparian, coastal strand, and salt marsh. Chaparral and coastal sage scrub are the most widespread communities. There are 1,155 plant species reported to occur in the Santa Monica Mountains area, of which 353 (31%) are non-native.

In 2000, a panel of experts (academics, subject matter specialists, and local land managers) identified 19 of the 353 non-native species as invasive and ecologically harmful, but still of sufficiently limited distribution that a concerted effort could limit the spread of or eradicate the species from the recreation area (Althoen et al. 2007). The remaining non-native species were determined to be of limited ecological consequence, or are already too widespread to effectively control. Since that time six additional species have been added to the target list. Monitoring of NNIS at SAMO will focus on the target 25 species (Table 4), as well as any new NNIS noted within the recreation area.

Current Monitoring, Treatment, and Management Efforts

Although systematic monitoring of NNIS has not been conducted at SAMO, staff routinely participate in the Los Angeles and Ventura County Weed Management Areas and work with neighboring land management agencies to survey and assess regional NNIS. Ongoing efforts in Los Angeles and Ventura counties include reporting and mapping invasive species on the target 25 NNIS list (Table 4), as well as NPS field work, other park agency field work, and providing data to CalWeedMapper (a state-wide project to map and track NNIS managed by the California Invasive Plant Council and Cal Flora). Park managers also consult with, and when appropriate, assist private landowners with NNIS problems that affect park resources (i.e., as seed source populations). However, access to most private lands is difficult to secure. Surveys and mapping of rare and endangered species (including NNIS presence), fuel modification zones, and habitat restoration sites throughout the park are ongoing and provide detailed information on NNIS presence for particular areas. Additionally, in 2006, SAMO completed a two-year survey and mapping project of the original 19 target NNIS along public roads, trails, and major riparian corridors in the Santa Monica Mountains and Simi Hills. Over 4,000 infestations were detected, with 85% of the infestations under 100 m² in size.

SAMO uses a strategic approach to reduce or eliminate established NNIS populations that show signs of impacting native biodiversity (e.g., diversity is reduced in the areas they occupy; Moroney et al. 2011). Infestations are mapped and then assessed to prioritize removal efforts. For example, experience has shown that it is more efficient to remove populations high in a watershed before removing those that are downstream, and to remove outlying populations before removing larger or central infestations. SAMO maintains the following NNIS management goals:

1. Prevent introduction and establishment of new NNIS populations within the park.
2. Remove NNIS populations that are threatening rare or sensitive species or habitats.
3. Eradicate NNIS populations that are currently present in low numbers within the park (*i.e.*, species that can be feasibly eradicated).
4. Prevent expansion of current NNIS populations.

This protocol describes the first long-term effort to consistently and systematically record invasive plant species at SAMO. It will not address the effects of NNIS treatment (*i.e.*, efficacy monitoring) because that analysis will be carried out through each park's Invasive Plant Management Plans (*in development*) as part of the population treatment prioritization and adaptive management process. However, the annual reports generated by this program will document existing populations, as well as those treated on NPS and on other park partners' land (as that information is available). In addition, this protocol will provide valuable parkwide early detection of new species and new populations of existing species that may not be detected by routine invasive plant treatment and surveys on NPS land only. All this information will allow for holistic prioritization of all infestations for treatment that will maximize the effectiveness of NPS resources, and will be shared with partners to allow for recreation area-wide prioritization and coordination.

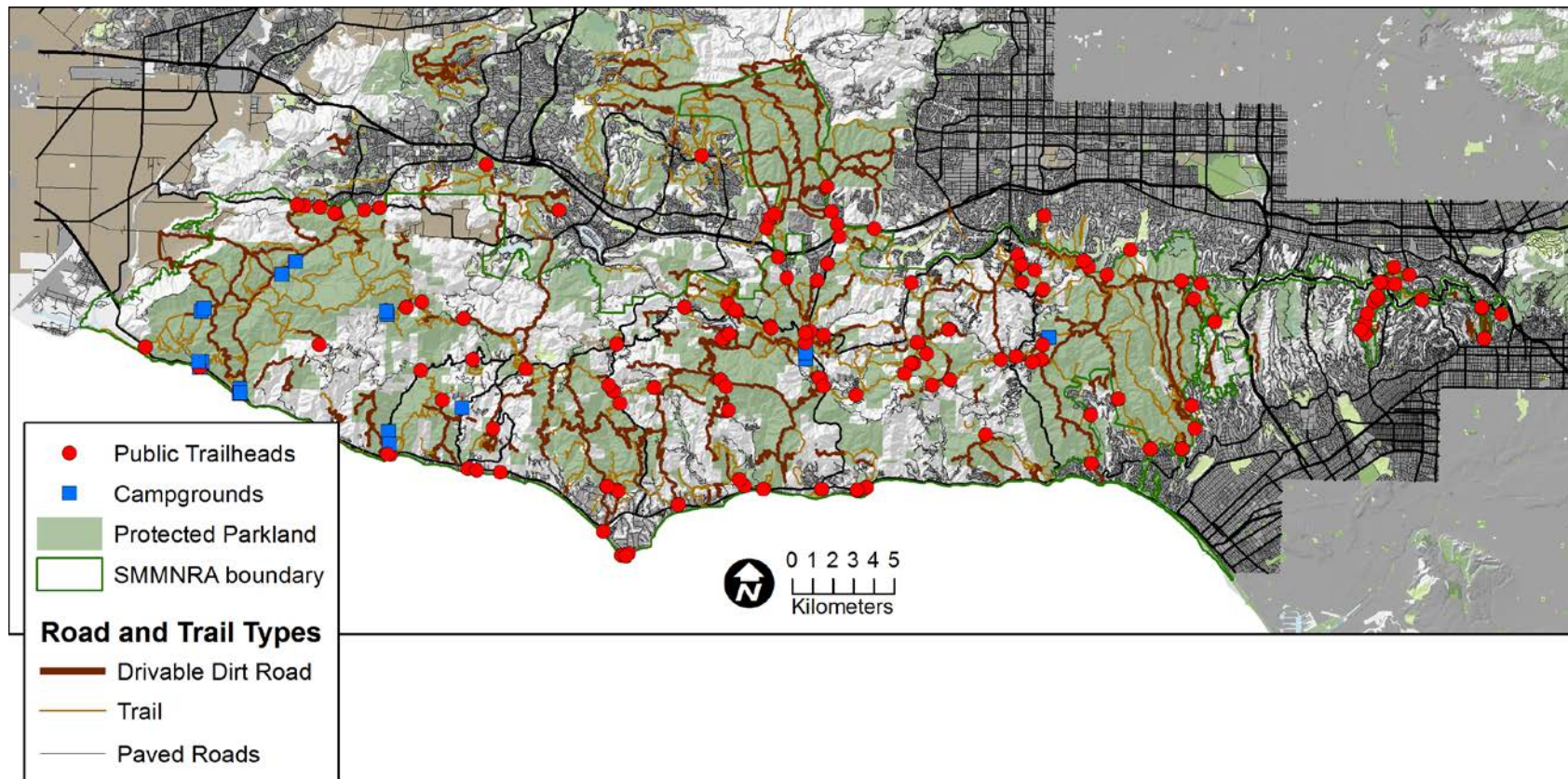


Figure 3. Map of Santa Monica Mountains National Recreation Area (SAMO) drivable dirt roads, trails, trailheads, and campgrounds, all of which are considered high-risk areas for non-native invasive plant species. SAMO boundary is shown in green. There are over 680 miles (1094 km) of trails at SAMO. All trailheads and campgrounds are POE. Drivable dirt roads are monitored if not privately owned

Table 4. List of 25 target invasive plant species that will be monitored at Santa Monica Mountains National Recreation Area. All NNIS newly discovered within a park are part of the target NNIS. In the table below, the site of infestation is listed with the first year of treatment. In most cases these species occur elsewhere in the park on NPS land, other parkland, and on private land. *Indicates species added since the development of the original list of 19 target NNIS in 2000.

Species	Common name	Treatment history
<i>Acroptilon repens</i>	Russian knapweed	Rancho Sierra Vista 2012 - treated on NPS land but bulk of population is on neighboring parkland. 2013 post fire treated all, follow-up in 2014 & 2015, eradication expected in 2017.
<i>Ailanthus altissima</i>	tree of heaven	Cheeseboro Cyn 2012 controlled 2013, King Gillette 2012 controlled 2013, Las Virgenes Cyn 2013 control expected 2016
<i>Arundo donax</i>	giant reed	Las Virgenes Cyn 2013, small population controlled 2013; Upper Trancas Cyn 2013 small population controlled and monitoring only
<i>Asphodelus fistulosus</i>	onionweed	Yellow Hill 2009 hand pulled, population growing slowly
<i>Carduus pycnocephalus</i>	Italian thistle*	Cheeseboro Cyn 2006, Rancho Sierra Vista 2012, Rocky Oaks 2011, Zuma Cyn 2011 controlled, not expanding as of 2015
<i>Carthamus lanatus</i>	saffron thistle, wooly distaff thistle*	Small populations found on non-NPS land and treated in 2011
<i>Centaurea solstitialis</i>	yellow starthistle	Paramount 2005 as of 2013 populations under control (~50 gross acres), Peter Strauss 2006 as of 2013 population at routine maintenance (~7 gross acres), Hennessey 2011 controlled as of 2013, Cheeseboro 2011 controlled and monitoring, Rocky Oaks controlled 2011 monitoring as of 2013
<i>Cirsium vulgare</i>	bull thistle*	Cheeseboro Cyn treated small population in 2006, now monitoring and removing seedlings
<i>Conium maculatum</i>	poison hemlock	Rancho Sierra Vista 2009, Paramount 2011 entire riparian corridor treated for 2 yrs not controlled but not expanding, Zuma Cyn 2011 not controlled but not expanding
<i>Cortaderia jubata</i>	Pampas grass, jubata grass	Franklin Cyn 2012, a few individuals treated, population static
<i>Cynara cardunculus</i>	artichoke thistle*	Arroyo Sequit (~2 acres eradicated as of 2015) and Rancho Sierra Vista (a few individuals) treated in 2010-14, controlled
<i>Cyperus involucratus</i>	umbrella sedge*	Circle X grotto area 2013, a few individuals treated, population controlled, Solstice Canyon 2011-12, small patch at Robert's house treated but not controlled
<i>Delairea odorata</i>	Cape ivy	Franklin Cyn 2012, population expanding
<i>Euphorbia terracina</i>	Geraldton carnation spurge	Solstice Cyn 2002-present, now down to routine maintenance levels; Zuma Cyn 2009 & Trancas Cyn 2011 work ongoing and not controlled; Rancho Sierra Vista 2010 - controlled
<i>Foeniculum vulgare</i>	sweet fennel	Rancho Sierra Vista 2011 50 gross acres nearly eradicated, Deer Creek 2012 control expected 2015, Zuma 2012 control expected 2015, Whelan 2013 control expected 2016
<i>Lepidium latifolium</i>	perennial pepperweed	Paramount Ranch 2005, population near control, Cheeseboro 2006 small population treated, not expanding, Peter Strauss 2012 population static

Table 4. (continued) List of 25 target invasive plant species that will be monitored at Santa Monica Mountains National Recreation Area. All NNIS newly discovered within a park are part of the target NNIS. In the table below, the site of infestation is listed with the first year of treatment. In most cases these species occur elsewhere in the park on NPS land, other parkland, and on private land. *Indicates species added since the development of the original list of 19 target NNIS in 2000.

Species	Common name	Treatment history
<i>Myoporum laetum</i>	Myoporum	Rancho Sierra Vista 2013, a few prior landscape plants removed, eradicated
<i>Nicotiana glauca</i>	tree tobacco	Cheeseboro Cyn 2008 treated populations are controlled but new populations found 2013 and not yet treated
<i>Pennisetum setaceum</i>	fountain grass	Sandstone Peak 2011, a few individuals treated but species is expanding through mountains rapidly, Deer Creek 2013, controlled
<i>Phalaris aquatica</i>	Harding grass	Rancho Sierra Vista 2006 50 gross acres nearly controlled as of 2013; Rocky Oaks 2008 expect full control of 30 gross acres in 2015, Zuma Cyn 2011 5 acres now down to routine maintenance levels
<i>Ricinus communis</i>	castor bean	Franklin Cyn 2011 inconsistent treatment due to lack of funding population static; Zuma Cyn 2012 under control; Rancho Sierra Vista 2012, eradicated
<i>Salsola australis</i>	Russian thistle	Cheeseboro Cyn 2006 treated but expanding there and throughout the mountains
<i>Silybum marianum</i>	milk thistle*	Cheeseboro Cyn 2006, Rocky Oaks 2011, Rancho Sierra Vista 2012
<i>Spartium junceum</i>	Spanish broom	Saddle Peak 2011 ~8 acres coming under control as of 2013, Backbone Trail 2011 populations expanding, Circle X Ranch 2011 not expanding but not controlled. Newton Canyon trailhead to backbone trail treated for several years, not expanding but not eradicated.
<i>Vinca major</i>	periwinkle	Paramount 2013 expanding slowly in riparian, Diamond X landscape plantings expanding slowly, Cheeseboro not being treated due to lack of funding, Rocky Oaks not yet treated due to lack of funding

1.4 Monitoring Objectives

The overarching goal of this protocol is to determine the status and trends of NNIS within SAMO and CHIS and to provide information (in addition to data from the Invasive Plant Management Plans at each park) to assist park managers with the strategic and cost-effective control of NNIS. We focus monitoring on areas at high-risk of NNIS infestation: points of entry (POE: trailheads, ports, airstrips, campgrounds) at CHIS and SAMO, and official dirt roads and trails (DRT) at SAMO. The combination of frequent disturbance (i.e., visitor use, maintenance, fire), NNIS vectors (i.e., hikers, horses, bicycles, and pets), and high propagule pressure (i.e., large numbers of park visitors) make POE and DRT vulnerable to infestation by NNIS (Gelbard and Belnap 2003, Alston and Richardson 2006, Davies and Sheley 2007, Mortensen et al. 2009, Bella 2011). Studies have demonstrated that roads, trails, trailheads and ports are often the introduction sites for invasive species due to the disturbance from maintenance or traffic (Alston and Richardson 2006, Mortensen et al. 2009).

Our focus on target NNIS in high-risk areas promotes early detection and rapid response management of invasive species, as recommended by the Federal Interagency Committee for Management of Noxious and Exotic Weeds (FICMNEW 2003). The early detection and rapid response approach involves eliminating new invasive species when they first arrive at a site, which is more cost-effective than removing well-established populations. We will also use NNIS data collected from two other MEDN I&M programs, the Terrestrial Vegetation Monitoring Program (Tiszler et al. in press), and the Water Quality and Riverine Integrity Monitoring Program to sample interior parkland (Federico et al. in preparation), including riparian areas. By including the other I&M protocols' NNIS data, we are able to broaden the area and the habitat types that can be sampled for NNIS without increasing expense to this protocol, keeping it sustainable in the long-term.

Any newly documented NNIS within the park will be targeted for immediate removal. Data collected through this monitoring program will be used in the Invasive Plant Management Plan (*in development*) for each park. Infestations will be systematically evaluated and prioritized according to each park's forthcoming Invasive Plant Management Plan before a management decision is made regarding whether to treat the populations or just monitor them over time. Due to the large number of invasive plant infestations at CHIS and SAMO, monitoring of NNIS removal efforts (effectiveness monitoring, as opposed to status and trend monitoring) will be performed separately from the monitoring described in this protocol.

Our specific monitoring and management objectives are to

1. Determine the trends in the presence and distribution of target NNIS at points of entry (CHIS and SAMO), official dirt roads and trails (SAMO), and on interior parklands throughout the parks.
2. Provide the status of target NNIS annually to park invasive plant management programs. Provide immediate notification if any previously unknown non-native plant species are detected during monitoring, or if a new disjunct location of an existing NNIS is discovered.

Reports generated from this monitoring program will also include summaries of invasive plant data collected through the MEDN Terrestrial Vegetation Monitoring Program (Tiszler et al. in press) and MEDN Water Quality and Riverine Integrity Monitoring Program (WQRI; Federico et al. in preparation).

2.0 Sampling Design

In this section we describe the target population, sampling frames, site selection process, revisit design, response design (the process by which data are collected), and sampling window for our monitoring program.

2.1 Rationale for Choosing This Sampling Design

The rationale for our sampling design is based on three factors: (1) the typical introduction, establishment and dispersal patterns of NNIS from areas of frequent disturbance, (2) the need for a highly efficient program that incorporates invasive plant data from other programs, and (3) our desire for an unbiased assessment.

As previously described, invasive species are most often introduced at roads, trails, and POE (Mortensen et al. 2009, Alston and Richardson 2006, Gelbard and Belnap 2003) as a result of frequent disturbance at these locations. To promote detection of NNIS before they are widespread, we focus our sampling effort on POE and DRT at SAMO, and POE at CHIS. At this time, we are unable to monitor DRT at CHIS due to funding and staffing constraints.

Monitoring for NNIS on lands away from DRT and POE (interior parklands) at CHIS and SAMO will be conducted using slightly different methods via the MEDN Terrestrial Vegetation Monitoring Program (Tiszler et al. in press) and the MEDN Water Quality and Riverine Integrity Monitoring Program (Federico, et al. in preparation). In future years, data from all three monitoring programs will be analyzed and summarized individually and then evaluated and reported by the Invasive Plant Monitoring Program to comprehensively assess the status and trends of NNIS within the parks.

An important factor governing our sampling design is the need to assure that the sampling sites along DRT remain representative over time, or more specifically, that sampling sites are subject to NNIS control treatment with the same probability and frequency as all other unsampled locations in the inference area defined by the sampling frame. Potential for bias exists because NNIS at monitoring sites may have a higher detection probability than NNIS farther away from monitoring sites, and therefore NNIS at sampling locations may be treated more frequently than other NNIS populations. The likelihood of this bias influencing our results is relatively small given that our treatment programs typically treat a small number of high-priority infestations, and treatment priority is determined through the Invasive Plant Management Plan for each park (*in development*). As described in detail below, our sampling design will allow us to test whether monitoring sites remain representative of the target population over time.

2.2 Overview

Points of Entry (CHIS and SAMO)

We define a POE (trailhead, port, airstrip, or campground) survey area as the hardscape or developed area (e.g., compacted earth, gravel, pavement, fencing) of the POE and the first 50 m along any dirt road or trail connected to the POE, plus a 20 m zone surrounding these areas. We will record the presence and absence, distribution pattern (none, isolated, linear, scattered, patchy, continuous or monoculture), and density in three classes (<10, 10 – 100, >100 individuals) for species on the parks'

target NNIS lists, as well as for newly documented NNIS. The POE will be censused, not sampled. We will census all 16 POE at CHIS and all 123 POE at SAMO. See Appendix A for images of each POE type.

Dirt Roads and Trails (SAMO)

We will monitor 60 randomly selected sites per year on official dirt roads and trails. At each randomly selected location, a 500-m transect will be subdivided into 10 equal sub-transects (50 m long). Presence and absence, trail width, NNIS distribution pattern (none, isolated, linear, scattered, patchy, continuous or monoculture), and density in three classes (<10, 10 – 100, >100 individuals) of target NNIS and any newly discovered NNIS will be recorded at each sub-transect along the trail as well as within 2 m of each side of the trail along the transect.

Interior Parklands (CHIS and SAMO)

Monitoring of target NNIS in areas away from roads, trails, and developments will be conducted via the MEDN Terrestrial Vegetation (Tiszler et al. in press) and the MEDN Water Quality and Riverine Integrity (Federico, et al. in preparation) Monitoring Programs. Monitoring data collected by these programs will be used to determine the presence and spread of NNIS into interior vegetation communities. The Terrestrial Vegetation Monitoring Program will record canopy cover, density, richness, and frequency of NNIS at randomly selected locations throughout CHIS and SAMO. The Water Quality and Riverine Integrity Monitoring Program will record canopy cover of NNIS along randomly selected riparian sites. Summary data on NNIS presence and percent cover detected through these monitoring programs will be reported in the annual and trend reports for this protocol, thereby providing more comprehensive reporting than achieved through this protocol/monitoring program alone.

2.3 Target Populations

CHIS

By including data from the three monitoring programs (Table 5) described above, the *overall* target population for reporting at CHIS includes the target NNIS on all parklands that are within the administrative boundary of the park and managed by the NPS, excluding lands with slopes >40 degrees (except on ANI) and the area within 5 m of official roads and trails (except within 50 m of a POE) on all islands. The area covered by our target population includes nearly all of ANI, SBI, SMI, and SRI, as well as the eastern quarter of SCI. The combined area of these lands is about 32,000 ha (Figure 2). The western three-quarters of SCI is within the administrative boundary of the park, but is owned and managed by The Nature Conservancy (TNC) (Figure 2). At current funding levels, monitoring of TNC lands on SCI by NPS personnel is not possible except at Prisoner's Harbor, which will be monitored as a POE. TNC will monitor airstrips on their land on SCI.

Table 5. Summary of the components of the three complementary long-term monitoring programs that comprise the MEDN invasive plant species monitoring strategy.

Component	Description of data collection	Justification	Protocol
Points of Entry (POE): trailheads, ports, airstrips, campgrounds	Presence/absence, distribution pattern and density of target NNIS, and new NNIS detected within the footprint of POEs, plus 50 m along adjoining trails or roads, and a 20 m zone surrounding these areas.	Area of frequent disturbance and high propagule pressure	MEDN Invasive Plants
Dirt Roads and Trails (DRT)	Presence/absence, distribution pattern and density of target NNIS and new NNIS detected within 500-m-long strip transects at randomly selected locations along official roads and trails.	Area of frequent disturbance and high propagule pressure	MEDN Invasive Plants
Interior Parklands (away from roads and trails)	Distribution and cover of all non-native species at randomly selected locations within interior parklands.	Early detection of NNIS presence or spread into interior vegetation and status and trends in NNIS	MEDN Terrestrial Vegetation, MEDN Water Quality and Riverine Integrity

SAMO

By including the three monitoring programs described above, the *overall* target population for reporting at SAMO includes the target NNIS on parklands within the recreation area, excluding the following: areas adjacent to paved roads, areas having slopes >40 degrees, certain coastal areas (beaches, bluffs, and coastal marshes), reservoirs, isolated park units less than 2 ha, and privately owned lands (with the exception of those owned by the Mountains Restoration Trust). Areas immediately adjacent to paved roads are excluded from the target population due to concerns for the safety of individuals collecting data along narrow roads with poor visibility in the Santa Monica Mountains. While NNIS are known to occur on privately owned lands, they are excluded from the target population because securing long-term access is difficult, and though paved roads are known vectors for NNIS, worker safety is our first concern. Beaches and bluffs were excluded because of the degree of long-term sustained disturbance they receive and the difficulty of defining a trail in these locations. Therefore, the area of inference for the target population consists of approximately 54% of the recreation area.

Sampling Frames

Points of Entry (CHIS and SAMO)

All POEs at CHIS ($n = 16$) and SAMO ($n = 123$) will be monitored. As stated above, we define a POE (trailhead, port, airstrip, or campground) survey area as the hardscape or developed area (e.g., compacted earth, gravel, pavement, fencing) of the POE and the first 50 m along any official dirt road or trail connected to the POE, plus a 20 m zone surrounding these areas. The sampling frame for

each POE was determined by satellite imagery/aerial photography. In the future, the boundary may be delineated by GPS in the field if images are not available to create a shapefile.

Roads and Trails (SAMO)

The sampling frame for roads and trails at SAMO consists of all areas that are within 2 m of the edge of an official dirt road or trail on public lands, and more than 50 m from a POE. There are 1,094 km (680 miles) of official dirt roads and trails at SAMO as of 2015. Unauthorized trails or those deemed unsafe by the Field Crew Leader will be excluded.

Interior Parklands (CHIS and SAMO)

Terrestrial Vegetation Monitoring

The sampling frame for terrestrial vegetation monitoring is described in detail by Tiszler et al. (in press). Briefly, at both parks the sampling frame consists of all undeveloped areas within the target land area that are more than 5 m from a road, trail, or developed area, and which have a slope <40 degrees, except on ANI. On ANI, all lands will be evaluated for sampling because it is a small island and the exclusion of areas >40 degree slope would leave little remaining land. The SAMO sampling frame includes some private lands within the recreation area that are designated for future acquisition as parklands and certain public lands that are now closed to NPS access but may be opened in the future. Although sampling sites will be randomly selected on these lands, they will only be monitored if and when these lands become available for access and staffing levels allow.

Water Quality and Riverine Integrity Monitoring

The sampling frame for the Water Quality and Riverine Integrity (WQRI) Monitoring Program is described in detail by Federico et al. (in preparation) and briefly below. We recognize that the sampling of riparian vegetation achieved through the WQRI program is very limited in scope, which is driven by the limited budget for WQRI monitoring.

CHIS: Freshwater is found only on three of the five islands that comprise CHIS: SCI, SRI and SMI. Streams occur in numerous canyons on SCI, however none have been the subject of routine sampling or study. There are only two named drainages on SMI and one does not have surface water at its mouth most of the year. In September 2014, surface water on SRI was surveyed by physically walking all 2nd through 4th order streams. During the driest period of the year, the island was found to have 71 km (44 miles) of surface water. Due to land ownership at SCI being primarily TNC and because of the limited budget for this protocol, the sampling frame for the WQRI monitoring includes only SRI.

SAMO: The sampling frame was originally defined in the *Protocol for Monitoring Aquatic Amphibians in the Mediterranean Coast Network* (Delaney et al. 2011) as a GIS layer of the stream network, excluding the eastern urban section of SAMO and cells that (1) contained less than 50% protected parklands, (2) contained no intermittent or perennially flowing streams, or (3) were dangerous to access. The eastern urban region was eliminated from the sample frame because of access and ownership limitations, small overall size, and its high proportion of development coupled with the logistics associated with working in this area.

2.4 Site Selection

The selection of monitoring sites through the use of generalized random tessellation stratified sampling (GRTS; Stevens and Olsen 1999) is advantageous over both simple random site selection and stratified random site selection. Because the GRTS sample draw is spatially balanced, it minimizes clustering of sites that can occur under a simple random selection. Additionally, spatial balance means that spatial independence is maximized and spatial autocorrelation is minimized, thus providing maximum information per plot and increasing sampling efficiency (Stevens and Olsen 2004, Theobald et al. 2007). GRTS sampling improves upon systematic sampling by randomizing sites across space, reducing the possibility of correspondence with spatial patterns in the sampling frame.

Because all POE will be surveyed annually or biannually, no site selection procedure is needed. However, POE at SAMO were assigned to one of four panels (explained in more detail below) using an equiprobable draw of 123 points from the finite sampling frame of 123 POE.

Monitoring points along DRT were selected using an equiprobable GRTS draw of 1,024 points from the linear sampling frame of official dirt roads and trails. By sampling 60 sites per year, we will monitor 30 linear km (500 m × 60 transects) of DRT annually. The methods for performing a GRTS draw are found in Stevens and Olsen (2003, 2004) and in the R (R Core Team 2013) *spsurvey* package manual (Kincaid and Olsen 2015). The R code used for the GRTS draw in this protocol is provided in Appendix B.

Sites for the Terrestrial Vegetation Monitoring Program were selected using GRTS to provide a spatially balanced sample of randomly distributed points across the landscape. Monitoring sites for the WQRI Monitoring Program will be selected using GRTS, although the more specific details are still being determined (Federico et al. in preparation).

2.5 Revisit Design

Points of Entry (CHIS and SAMO)

At CHIS, 12 POE will be monitored annually or biannually in conjunction with the Terrestrial Vegetation Monitoring Program (Tiszler et al. in press) to make the most efficient use of both staff time and transportation funds (Table 6a). The airstrips at SCI will be monitored annually by TNC, and the port and airstrip at SRI will be monitored annually by California State University Channel Islands (CSUCI). However, NPS will monitor the POE on SRI if CSUCI cannot. The 123 POE at SAMO will be split between four panels according to their order in a GRTS draw. Panels A, B, and C have 31 POE each, and Panel D has 30 (Table 6b).

Table 6a. Revisit design for 16 points of entry at CHIS. The monitoring will begin in 2016.

Island	Year							
	1	2	3	4	5	6	7	8 etc.
Santa Barbara Island Landing Cove Campground	X	X	X	X	X	X	X	X
Anacapa Island Landing Cove Campground	X	X	X	X	X	X	X	X
Santa Cruz Island Prisoner's Harbor (pier) Del Norte Campground	X	-	X	-	X	-	X	-
Santa Cruz Island Scorpion Harbor (pier) Scorpion Ranch Campground	-	X	-	X	-	X	-	X
Santa Cruz Island (TNC) Airstrip Airstrip	X	X	X	X	X	X	X	X
Santa Rosa Island Becher's Bay Pier (CSUCI) Becher's Bay Airstrip (CSUCI) Campground (NPS)	X	X	X	X	X	X	X	X
San Miguel Island Ranger Station Airstrip Dry Lake Bed Airstrip Campground	X	X	X	X	X	X	X	X

Table 6b. Revisit design for points of entry at SAMO. Each year 30-31 of the 123 points of entry will be monitored. The list of all POE can be found in Appendix C. The monitoring will begin in 2016.

Panel	Year							
	1	2	3	4	5	6	7	8 etc.
A	31				31			
B		31				31		
C			31				31	
D				30				30

Dirt Roads and Trails (SAMO)

Monitoring of official dirt roads and trails (DRT) will be conducted using two types of panels: serially alternating panels, each of which will be revisited every three years, and panels of sites that are newly selected each year and never resampled. This [(1-2), (1-n)] revisit design consists of three panels of 30 sites, each of which are visited one year and rested the following two years, as well as a panel of 30 new sites each year that are never revisited (Table 7).

The response design (i.e., measurements taken at the site) will be the same for both types of panels. Every 6 years, we will compare results from the never-revisit sites to results from the permanent sites to determine if NNIS treatment at permanent monitoring sites is causing them to become unrepresentative of the population as a whole. We will make adjustments as deemed necessary, including moving to a completely never-revisit design and replacing an annually visited site that has been treated for NNIS with a new site if needed, to avoid biasing our inference to the larger population.

Table 7. Long-term revisit design for monitoring official dirt roads and trails at SAMO showing the number of plots per panel and which panels are visited each year in a [1-2] serially alternating revisit design. The monitoring will begin in 2016.

Panel	Year											
	1	2	3	4	5	6	7	8	5	6	7	8 etc.
A	30			30			30			30		
B		30			30			30			30	
C			30			30			30			30
Never revisit sites	30	30	30	30	30	30	30	30	30	30	30	30
Total sites visited	60	60	60	60	60	60	60	60	60	60	60	60

Interior Parklands (CHIS and SAMO)

At SAMO sites will be visited following a [2-4] serially alternating panel design. Each panel will be visited for two consecutive years, rested for four years, and then visited again for two consecutive years, with successive panels overlapping by one year. At CHIS a serially alternating augmented panel design, [(1-0), (1-3)], will be employed, where a core panel is visited every year and four additional panels are visited for one year and rested for three years. Both designs permit estimation of individual year-to-year variation (e.g., variation in presence or abundance due to annual variation in precipitation) and long-term trends. At SAMO a total of 300 sites will be monitored, with 100 sites visited each year. At CHIS there will be a total of 365 sites, with 146 sites visited each year. A full description of the sampling design is provided in the Terrestrial Vegetation Monitoring Program protocol (Tiszler et al. in press).

The revisit design for WQRI monitoring is still in development (Federico et al. in preparation).

2.6 Sampling Window

Monitoring of POE at CHIS will occur from January through June and ideally on the same month each year for each island. This prolonged window for monitoring is necessary because the POE monitoring will be coordinated with interior parkland monitoring and also considers occasionally limited access to the islands due to staffing, weather, and bird breeding season (Tiszler et al. in press). The islands will be visited according to the following schedule, which follows the progression of the growing season across the islands: ANI in January – March, SBI in February, SCI in March, SRI in April, and SMI in May. For the islands sampled later in spring, some early season NNIS may need to be identified from their senescent plant parts.

Monitoring POE and DRT at SAMO will be conducted in the month of June of each year. June is the later part of the growing season at SAMO, so we expect to observe the greatest number of species (early and late season species), although some early season species may have to be identified from senescent plant parts.

Monitoring of native vegetation at SAMO will occur from April to June (Tiszler et al. in press). Sampling of riparian areas at both CHIS and SAMO generally will occur during the spring months (February – May), depending upon the timing of precipitation.

2.7 Response Design

As described below, we are interested in the distribution pattern and density of NNIS within the POE, DRT, and interior parkland monitoring components. For all components we will collect site-specific data to serve as covariate data in later analyses.

Points of Entry

At each POE the field crew will

1. Survey the hardscape, including the first 50 m of trail entrances (Zone 1) and the 20 m area around the hardscape (Zone 2), using the boundaries based on aerial photography, and record via GPS any NNIS infestations.
2. Characterize the general vegetation community in the survey area (Zones 1 and 2 combined).
3. Record any visible NNIS populations that are outside of Zones 1 and 2 (Figure 4).

The general vegetation community will be characterized with the following parameters:

- Dominant vegetation community type: chaparral, coastal sage scrub, grassland, oak woodland, riparian, or other.
- General state of the vegetation community:
 - intact (relative canopy cover of natives $\geq 90\%$)
 - intermediate (relative canopy cover of natives 51-89%)
 - disturbed (relative canopy cover of natives $\leq 50\%$)

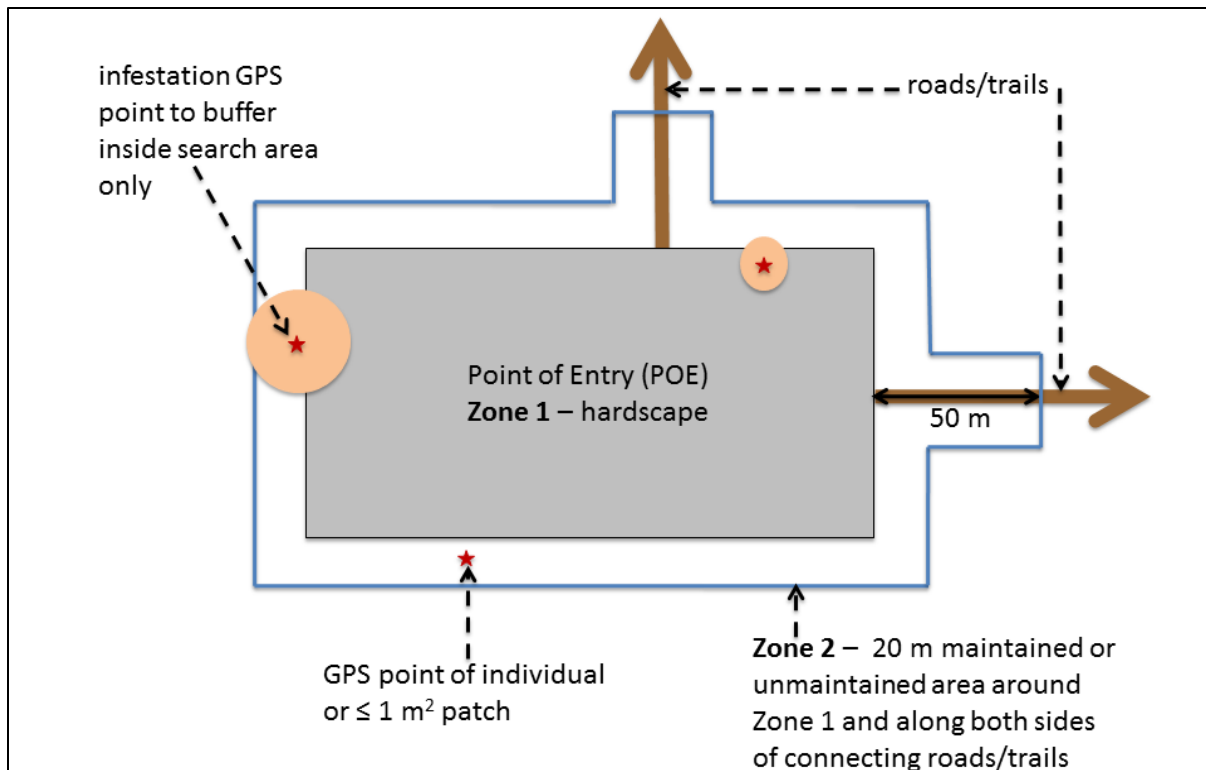


Figure 4. Diagram of an example point of entry. The POE survey area includes the hardscaped area and the first 50 m of any official connected dirt roads or trails (Zone 1), plus a 20 m area (Zone 2) surrounding these Zone 1.

Within the POE survey area (the hardscape and 50 m along any official connected dirt road or trail, plus a 20 m zone surrounding this area), we will use a GPS unit to map the center of each target NNIS individual or patch with a point, or map the starting and ending points if the infestation is linear. To record an estimate of area of target NNIS within the survey area, we will use buffered points or buffered lines if the area of the infestation is $\geq 1 \text{ m}^2$ (e.g., record the point buffered to 5 m). If a patch extends outside the survey area, we will record only the portion of the patch that is within the survey area. Individual NNIS within 2 m of each other are recorded as one patch, whereas individuals separated by $\geq 2 \text{ m}$ are recorded as different patches. For each NNIS infestation, we record the following:

- Date and location
- Species name
- GPS point identification code
- Density class of target NNIS within the infestation (classes: <10 , $10 - 100$, >100 individuals). *This coarse abundance metric will not be used in statistical analyses but will be used to provide park managers with more information than presence/absence alone about the infestation(s) for treatment purposes and for tracking the temporal and spatial change in density classes.*
- The spatial distribution of the population within the infestation (none, isolated, linear, scattered, patchy, continuous or monoculture, see Figure 5)

For NNIS patches detected outside of the POE survey area but within eyesight, we will record the following to alert park managers to the infestation(s):

- Species name
- Bearing/direction of the infestation from a GSP point taken at the POE

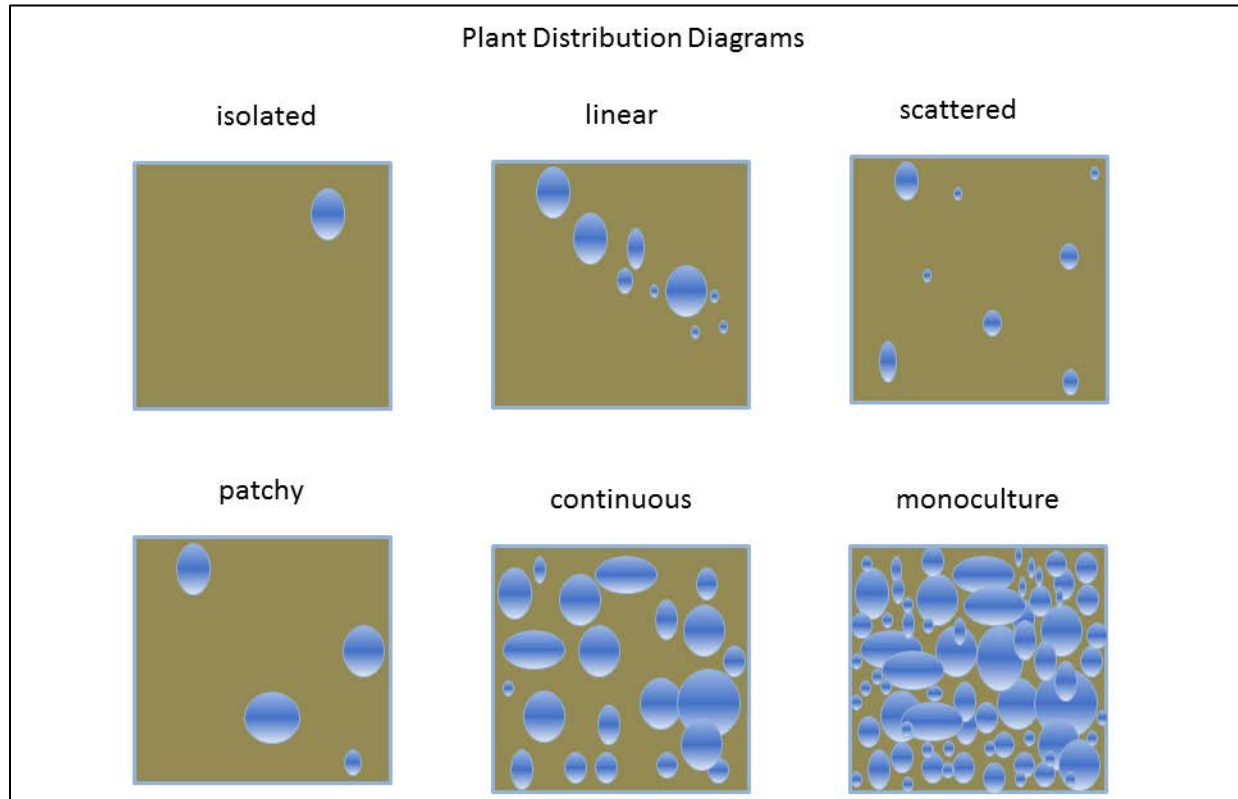


Figure 5. Plant distribution pattern descriptions used to describe NNIS infestations.

Dirt Roads and Trails

At each DRT sampling location, the presence and absence of target NNIS will be collected within 2-m-wide strip transects on either side of the trail along a randomly selected 500 m transect. The GRTS point will be located in the middle of the transect and continue 250 m in the both directions. Monuments will not be placed to mark the permanent sites due to trail maintenance and safety concerns. However, the GPS units have sub-meter accuracy, and we will also fully document each site to allow us to relocate transects. Within each of ten 50 m sub-transects, the presence and absence, distribution pattern, and density class (same categories as for the POEs listed above) of each target NNIS will be recorded to monitor NNIS attributes along the trail over time (Figure 6). Trail width is determined by trail use type and may vary over the 500 m transect (e.g., single use is 0.46-0.60 m wide and multi-use is 0.91-1.2 m wide), which must be taken into account in data analyses. At each sampling location, we will record the width of the road or trail at the GRTS point and again at the end of the transect.

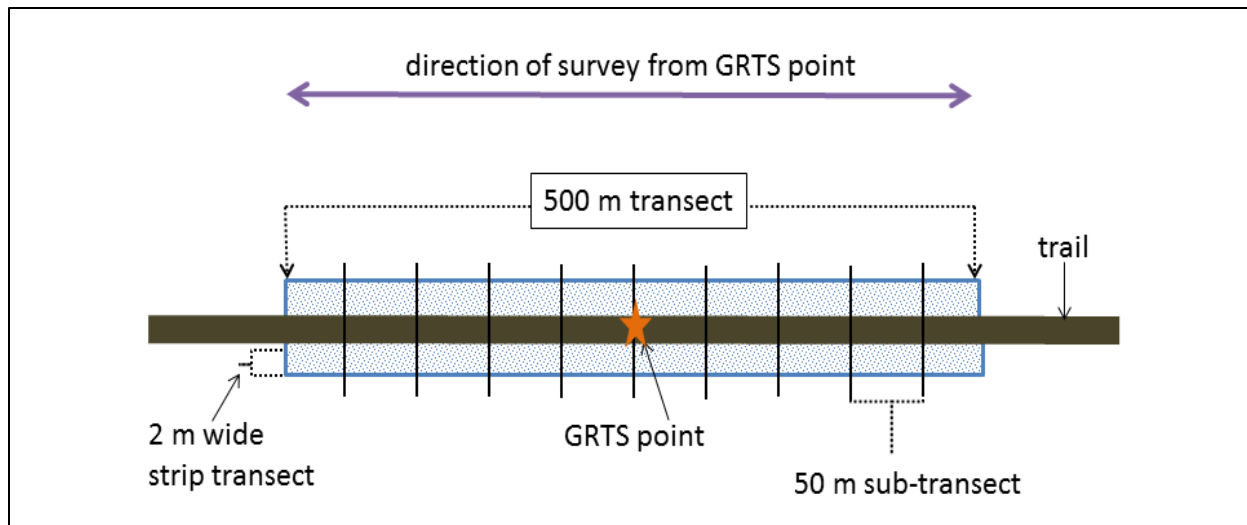


Figure 6. Diagram of strip transects at a GRTS point used to monitor NNIS on official dirt roads and trails. Presence/absence, distribution pattern, and density class of NNIS are recorded along the trail bed and in 2 m strip transects on both sides of the trail. The 500 m transect is equally divided into ten 50 m sub-transects. Trail bed width is recorded at the beginning and end of the transect.

At each sampling location, we will use the following covariate data within the survey area:

- Most abundant vegetation community type: chaparral, coastal sage scrub, grassland, oak woodland, riparian, or other
- General state of the vegetation community:
 - intact (relative canopy cover of natives $\geq 90\%$)
 - intermediate (relative canopy cover of natives 51-89%)
 - disturbed (relative canopy cover of natives $\leq 50\%$)

For NNIS patches located outside of the DRT survey area but within eyesight, we will record the following to alert park managers to the infestation(s):

- Species name
- Bearing/direction of the infestation from a GPS point taken along the trail

Interior Parklands

The response design for monitoring NNIS within interior parklands is described by Tiszler et al. (in press), which provides for monitoring all vegetation, including non-native species, occurring beyond 5 m from trails and developed areas at CHIS and SAMO.

Both parks will monitor (1) *Vegetation and soil surface cover*—foliar cover by individual plant species and soil surface cover by type (bare earth, pebbles, rock, biotic crust, litter) using a 30 m line-point intercept transect, (2) *Shrub Density*—seedling and stem counts of shrubs rooted in a 1 m $\times$ 30 m plot adjacent to the vegetation monitoring transect, (3) *Tree Density*—stem counts and basal area of trees rooted in a 10 m $\times$ 30 m plot centered on the vegetation monitoring transect, and 4) *Species*

Richness—all plant species (native and non-native) rooted in a 1 m × 30 m plot. Counts of NNIS that occur on plot species lists will be used to generate presence/absence data for areas away from trails.

The WQRI Monitoring Program (Federico et al. in preparation) will record invasive plants using the biotic structure assessment methodology of the California Riverine Assessment Method for Wetlands (http://www.cramwetlands.org/sites/default/files/2013.03.19_CRAM%20Field%20Book%20Riverine%206.1_0.pdf). This program will record the species present and relative cover of NNIS.

3.0 Field Methods

This section of the protocol covers field methods for NPS staff collecting data for POE and DRT, with additional details in SOPs 2-8. Interior parklands are monitored according to the MEDN Terrestrial Vegetation Monitoring Program protocol (Tiszler et al. in press), and NNIS in riparian areas will be monitored through the WQRI Monitoring Program protocol (Federico et al. in preparation).

3.1 Preparations

Below is an overview of field season preparations and completion dates. CHIS does not expect to hire interns but SAMO interns may assist in data collection at CHIS.

- Recruit and hire interns to assist with field data collection (SOP 1). Recruitment of field technicians (interns) should begin December of the previous year and be completed by January 15th.
- At SAMO, obtain permits and land access information, including lock codes or keys (SOP 1, Appendix D). Sites will be accessed primarily by driving to the closest trailhead and then walking to the sampling site. At CHIS, boats or planes are taken to the POEs. Complete by April 30th.
- Organize and prepare equipment at least one month in advance of the field season (SOP 1). Complete by December 30th of previous year at CHIS and April 30th at SAMO.
- The Program Lead from each park will conduct an Operational Risk Management Analysis exercise with their supervisor and the field crew. Complete by December 15th for CHIS and by May 15th for SAMO. Measures to mitigate safety concerns will be identified and actions taken to implement these measures. Once adequate mitigation measures are in place, the Program Lead will initiate completion of the Protocol Readiness Review Certification (SOP 3). The Protocol Readiness Review Certification must be completed before fieldwork can begin (December 15th for CHIS and by May 15th for SAMO).
- Hold an in-depth safety meeting with all field crew members for CHIS by January 15th and for SAMO by May 20th. Provide training on communication devices and discuss potential safety threats (e.g., boat safety, terrain hazards, poison oak, and illegal marijuana cultivation) that may be encountered in the field, as well as ways to mitigate those threats (SOP 3).
- Train field staff as described in SOPs 2-8. Training will occur during the last 2 weeks of December at CHIS and last 2 weeks of May at SAMO. Training will include radio use and safety procedures (SOP 3), use of a Global Positioning System (GPS) unit (SOP 4) for navigation and data collection, establishment of monitoring sites and field data collection (SOP 6), collecting and documenting unknown plants (SOP 7), and data entry and quality assurance and control procedures (SOP 8).

3.2 Qualifications and Training

Detail-oriented observers are essential for collecting credible, high-quality data on native and target NNIS species. Misidentification of species and observer bias in the estimation of abundance will

affect our ability to detect trends or changes in NNIS populations through time (Elzinga et al. 1998). Field observers must be proficient at accurately identifying plants and estimating areas and distances.

Training is essential for developing competent observers. Herbarium specimens and comparative notes on difficult or uncommon species should be provided for field observers. Observers should be informally tested on their ability to identify plant species, with the testing focused on the more problematic look-alike species. Training to recognize and identify new species will focus on plants that are on state and regional “watch lists” and familiarization with species that are problematic elsewhere. Necessary skills to be acquired or honed before data collection begins each field season are reviewed below, with detailed descriptions in the SOPs:

- **GPS USE.** Knowledge of the use of a GPS is essential to document the monitoring sites, and will be employed to record site data. SOP 4 (use of a GPS) should be thoroughly reviewed. Training sessions described below will require field crew members to practice the use of a GPS.
- **PLANT IDENTIFICATION.** Plant identification skills are critical. SAMO will employ interns to carry out the field crew member tasks, and intense training on plant ID will occur at the beginning of the field season (SOP 7). Even so, fine tuning ID skills for plant species is still important. The Program Lead or designee (e.g., lead biotech) will provide training for all crew members. Training will consist of field-based identification of all target NNIS and other plants anticipated to be observed during the field season, with emphasis on difficult-to-ID species. Additionally, field crews will be instructed in the use of taxonomic keys, and reference materials will be available to all crew members.
- **SAFETY.** Personnel safety is the highest priority. The environmental conditions and the rigorous physical component of fieldwork at CHIS and SAMO require that all safety procedures are followed. As described in SOP 3, the Program Lead and field staff will complete a pre-season Operational Risk Management Analysis (a.k.a., GAR: green, amber, red analysis), complete safety documents, complete training on the use of communication devices (radio and satellite communication devices), and review necessary field attire and equipment found in SOPs 2-3. Afterward, the Program Lead for each park, along with the I&M program manager and the superintendents of each park will approve a field season readiness document prior to the field season. Permanent field staff will complete safety training, including CPR and first aid.
- **DATA COLLECTION.** Data collection at POE and DRT must be conducted according to SOP 4 and SOP 6. Meticulous data collection and recording is required. To reduce error, the spatial data are recorded on Trimble GPS units using a customized data dictionary (series of drop down menus) developed by the National Invasive Species Information Management System (NISIMS). Using the same data collection methodologies for early detection of invasive weeds as that of the park’s Invasive Plant Management Program will help park managers track, assess, and treat infestations in one comprehensive system. All other data at DRT and POE will be collected with paper datasheets (SOP 5).
- **DATA ENTRY.** At SAMO, data will be entered as soon as possible after data are collected, preferably on the same day. At CHIS, data will be entered upon return to the mainland. Adequate time will be scheduled for this important task. Guidance for data entry is provided in detail in

SOPs 4 and 8. Daily data entry allows for the rapid resolution of any technical issues with the GPS units and verification of data.

- **DATA VERIFICATION.** Data verification (i.e., quality check and quality assurance) will be performed by the Program Lead and the Data Manager according to SOP 8 no later than the end of the season, and sooner if possible. Careful and thorough searches for incorrect and missing data are crucial to allow for proper analyses. Monitoring data will not be reported on or distributed without proper verification and certification from the Data Manager.

3.3 Calibration and Testing

Accurate plant identification and consistent estimation of plant distribution patterns and density classes are essential to collecting high quality data. To ensure that data are collected in a consistent manner, two types of checks will occur: (1) pre-data collection calibration checks, and (2) tests to allow interns to collect data independently. All field crew members will be trained in plant identification and consistent estimation of abundance while they are in the field together. Before beginning official data collection, park staff and interns will perform assessments at POE and DRT sites for at least three days as a group to ensure they are consistent in abundance estimation (see calibration datasheet in SOP 5). If necessary, additional plots/transects will be read as a group until the team members are consistent.

For no less than the first two weeks of data collection, each field crew (typically two people) will have at least one permanent NPS staff member who is skilled in plant identification, visual quantification of vegetation abundance, and the use of a GPS. If, after two weeks of data collection, the Program Lead or Field Crew Leader feels that field crew members are sufficiently qualified to collect data independently, he/she will administer a field calibration test. For the test, each field crew reads a set of 10 plots (either POE or DRT); >80% of all cover estimates must match the crew leader's estimates. Testing to allow independent data collection will be separate for POE and DRT sites. If intern-only crews are established, the following procedures will be implemented throughout the field season: (1) datasheets will be reviewed, initialed, and dated on a daily basis by the Field Crew or Program Lead, and (2) the Field Crew or Program Lead will go in the field for no less than a half day with the crew once every two weeks to ensure plant identification, data collection methods, and visual abundance estimates are correct.

3.4 Data Collection

Non-spatial data will be recorded on paper datasheets (SOP 5) and spatial data will be collected electronically via GPS units. Detailed instructions for establishment of sites and data collection at POE and DRT are provided in SOP 6. Data are entered as soon as possible after collection, as described further in section 4.0. At the end of each day the Field Crew Lead at each park is responsible for ensuring that all geospatial data are uploaded into the file geodatabase and all datasheets are completed properly (SOP 8).

Adequate time must be given to properly set up transects (DRT), and for decision-making associated with boundary decisions (POE). While efforts have been made to minimize problems, they will inevitably be encountered. Furthermore, each field crew member should understand the implications

of and process for rejecting sites. For the GRTS sample to remain spatially-balanced, if a point is rejected, the replacement point must be the next sequential point in the sample list. For example, if points 1-50 are being used yet point 40 was rejected for safety concerns, it should be replaced with GRTS point 51.

Transects (DRT) that originate within the sampling area but cross fence lines or are otherwise clearly outside of the area to be monitored may be moved using a 5 m offset in a random direction up or down the trail (determined by a coin toss). Record the coordinates of the new point in transect notes. If offsetting does not resolve the problem, the transect location should be dropped from the sample. Dropped locations must be entered into the Access database with an explanation of why the site was excluded. The criteria and procedures for dropping and adding transects are in SOP 6. Sites must be added in sequential order from the list of GRTS points.

Briefly, data collection at POE involves the following steps:

1. Record the perimeter of the hardscape of the POE using a GPS unless it has been defined at the office via GIS (which will be the case unless there have been alterations to the POE and no recent satellite image is available). The hardscape of the POE is the graded or compacted area and the cut slope adjacent to it. We are only interested in significant boundary changes at POEs that would be evident by examining the aerial image and boundary during field data collection. The purpose of delineating Zones 1 and 2 at POEs is to quantify the size of the POE and to be able to record the location of NNIS as being in Zone 1 or 2; therefore, highly precise boundary delineations are not needed. Still, the boundaries should be checked each time a POE is monitored. Once the boundaries are confirmed, then flag or otherwise delineate the survey area.
2. Collect ancillary data (vegetation type, native community intactness) about the survey area.
3. Map populations within the survey area. Use the GPS to record a point or line (or point/line with buffer) for each patch of target NNIS within the survey area. If a patch extends outside the survey area, only record the portion of the patch that is within the survey area. Clusters of NNIS that are separated by a gap of less than 2 m should be recorded as one patch, while clusters that are separated by a gap of more than 2 m should be recorded as different groups.
4. For each point or line, record the following: species name, spatial distribution pattern of the population, and the density class.
5. Record target species along with a GPS point and the bearing/direction where they are observed outside of the survey area but within eyesight. The presence of target species beyond the survey area will trigger an assessment and mapping by a separate invasive plant management team.

Briefly, data collection for DRT consists of the following:

1. Collect ancillary data (vegetation type, native community intactness) about the surrounding area along the transect that is within eyesight.
2. Locate the GRTS point. Using a combination of measuring tape and flagging, and a 2 m avalanche pole, mark the boundaries of each of the 10 sub-transects (2-m-wide $\times$ 50-m-long strip transects) that parallel both sides of the road or trail. Record the trail width at the beginning and

at the end of the 500 m transect. The edge of the road/trail is defined as the outer edge of the graded area where the natural vegetation begins (or, if vegetation is not present, where the soil is level with the surrounding ungraded area).

3. For the strips (road/trail bed, and two strips on either side), record the spatial distribution pattern and the density of each target NNIS found in each sub-transect.
4. Record target NNIS species that are observed outside of the survey area but within eyesight, as well as their bearing/direction. The presence of target species beyond the survey area will trigger an assessment and mapping by a separate invasive plant management team.

Complete Identification of Unknowns

The Program Lead or Field Crew Lead is responsible for ensuring complete resolution of all unknown plants to the extent possible (SOP 7). Plants are ideally identified to species level within the week of collection.

New Species

The Program Lead at each park is responsible for ensuring that plant species not on the current park list are updated in NPSpecies. This requires a voucher specimen be collected.

End of Season Procedures

Prior to the departure of the field crew, the Program Lead will conduct a protocol review meeting, which includes discussions with the field crew, MEDN I&M Program Manager, and the Data Manager to identify problems, issues, and recommendations regarding the monitoring procedures. If the MEDN I&M Program Manager and Data Manager cannot participate in the protocol review meeting, results of the meeting will be sent to them so that a discussion can be held to determine if any changes are needed to the protocol. This decision should not be made on a park by park basis. The following steps are necessary for closing out the field season and preparing the annual report:

1. Double-check that all data have been entered and verified (a person other than who entered electronic data checks it against the datasheets), and use database queries to validate all data in the database for logical consistency. Spatial files also need to be verified and validated.
2. Ensure that all unknown plants were vouchered and identified to the extent possible (SOP 7).
3. Inspect all equipment for damage and note any missing equipment for the next field monitoring period.
4. Clean and repair all equipment prior to returning it to the Program Lead.
5. File all reference materials and extra data forms in their appropriate filing cabinet.
6. Clean the inside and outside of all vehicles used in the field.
7. Copy and file paper records in appropriate locations, archiving them off-site as directed by the data management plan and SOP 8.

4.0 Data Management

The following section outlines general procedures for data entry, checking, analysis, and report development. **This section is required reading for anyone involved in the collection or processing of data for this program, including field crews.** Proper data management ensures that data will be reliable, relatively free of errors, and ready for analysis.

Specific data management procedures are described in the MEDN data management plan (Lee 2005) and SOP 8. The MEDN vital signs monitoring plan (Cameron et al. 2005) provides an overview of the network's information management and reporting plan. All project personnel must know and understand their responsibilities in data management.

4.1 Data Management Overview

The stages of the data management life cycle are summarized below and in Figure 7. Quality assurance and documentation are not limited to any particular stage, but rather occur throughout the life cycle.

- *Preparation* – Training, logistics planning, print forms and maps.
- *Data acquisition* – Field data collection.
- *Data entry and processing* – Data entry on a daily basis, database uploads, GPS processing, etc.
- *Quality review* – Program Lead(s) oversee data verification (paper datasheet checked against electronic record) and validation (reviewed for completeness and logical consistency using queries within the database). Data verification and validation constitute the quality review.
- *Metadata* – Documentation of the year's data collection (e.g., version of protocol followed) and results of the quality review. The required list of metadata information for SAMO is provided in SOP 8.
- *Data certification* – Program Lead(s) in consultation with the Data Manager certifies the data in the database after it has been verified and validated. The data are certified as complete for the period of record.
- *Data delivery/archiving* – Certified data and metadata are delivered to the MEDN Data Manager for archiving.
- *Data analysis* – Data are summarized and analyzed.
- *Product development* – Reports, maps, and other products are developed.
- *Product delivery* – Deliver reports and other products for posting and archiving.
- *Posting and distribution* – Distribute products as planned and/or post to NPS websites.
- *Archiving and records management* – Review analog and digital files for retention (or destruction) according to NPS Director's Order 19. Retained files are renamed and stored as needed.
- *Season closeout* – Review and document improvements needed to the database, procedures or infrastructure.

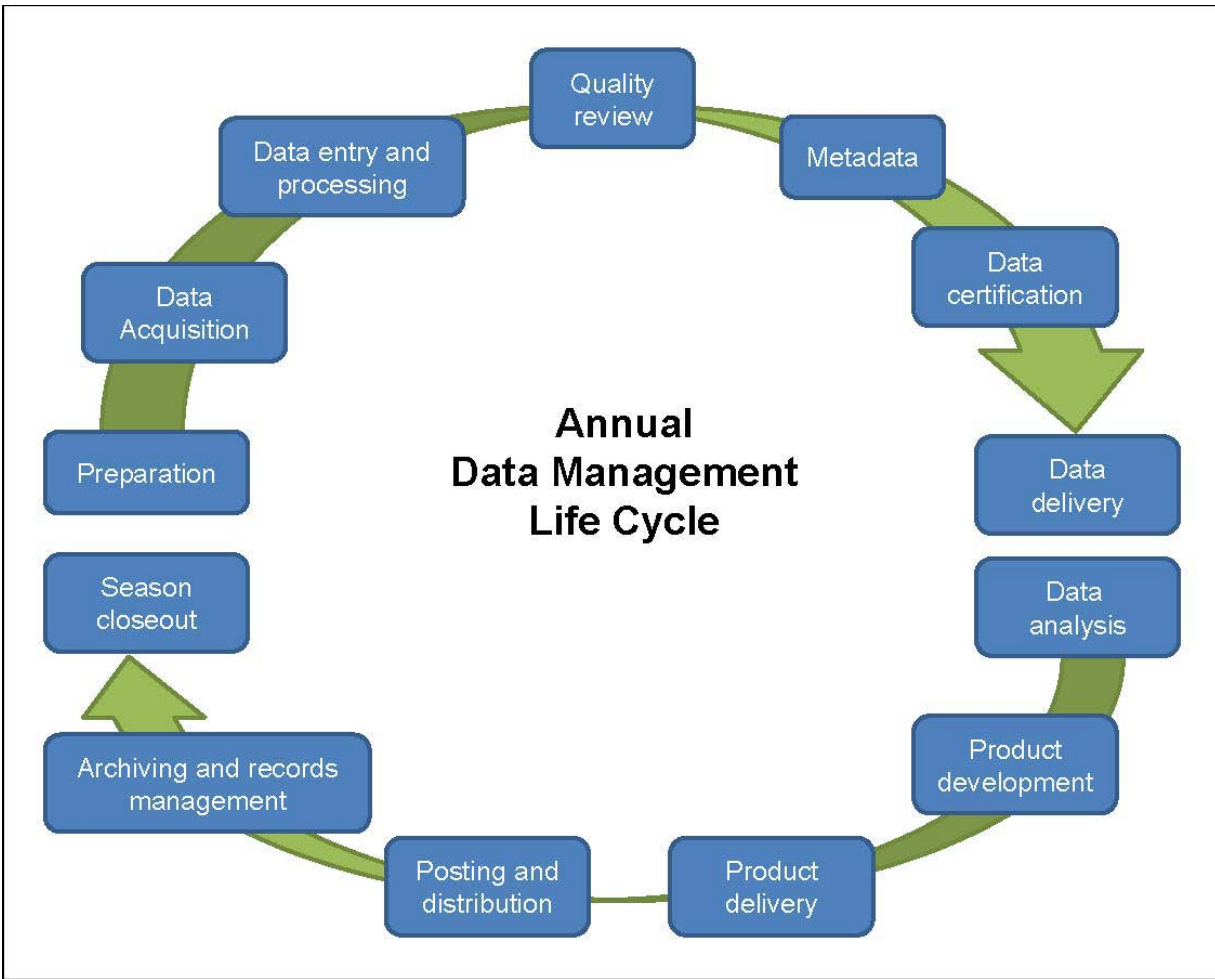


Figure 7. Recommended flow diagram of the stages of data management from pre-season preparation to season closeout. Quality review includes data verification (checking paper datasheets against the electronic data) and validation (queries for logical consistency and completeness) that require input from the Program Leads.

4.2 Database Design

The MEDN Invasive Plant Monitoring Program will collect spatial data (using GPS technology) and non-spatial tabular data. Maintenance of these two different datasets requires two database management systems – one for spatial data and one for tabular data.

Geodatabase for Spatial Data

Spatial data for the MEDN Invasive Plant Monitoring Program will be collected and managed using ArcGIS 10 and Trimble GPS units with Terrasync (field) and Pathfinder Office (office) software. MEDN will adopt the National Invasive Species Information Management System (NISIMS) data dictionary and geodatabase to collect invasive species locations at POE. Using the same data collection methodologies for early detection of invasive weeds as that of the park's Invasive Plant Management Program will help park managers track, assess, and treat infestations in one comprehensive system. The geodatabase is maintained by the MEDN Data Manager and the parks' Invasive Plant Management Team Program Leaders, in consultation with the Program Lead. The file

geodatabase stores spatial, as well as non-spatial data on invasive plants and their location. For this protocol, only spatial data will be stored in the file geodatabase. Details of the file geodatabase, including a list of tables and fields, and a description of the structure and relationship links among data tables are presented in SOP 9, as well as in the NISIMS User's Guide (<https://irma.nps.gov/App/Reference/Profile/2216091>, Section 5).

Geodatabase Workflow

The workflow for collecting geospatial data is briefly summarized below. Additional details on GPS field data collection and processing are included in SOPs 4, 6, and 8

- *GPS data collection* – Point or line mapping of invasive plants at POE are collected on a Trimble GPS unit using the NISIMS TerraSync data dictionary (UTM coordinate system, NAD83 datum). Specifically, the “Weed Survey” data dictionary will be used to record spatial information. This data dictionary contains fields that collect point and line data on an invasive plant location. Both the point and line feature have the same attributes, including a buffer distance field and notes that may be relevant for the park's Invasive Plant Management Program.
- *GPS data processing* – At the office, GPS data are downloaded and differentially corrected to obtain greater spatial accuracy using Pathfinder Office software. Data are checked for errors and corrected as needed.

GPS data export – Once data have been checked and verified, data are exported to the park's NISIMS file geodatabase feature class for storage. Feature classes are homogeneous collections of common features, each having the same spatial representation, such as points, lines, or polygons, and a common set of attribute columns. Codes built into the data dictionary prevent long strings from being truncated by field character limit restrictions in the shapefiles. This is beneficial for keeping long scientific names intact.

Access Database for Non-Spatial Data

The MEDN Invasive Plant Database for non-spatial, tabular data is a customized relational database developed in MS Access 2007. The MEDN Data Manager is responsible for the development and maintenance of the database. The design of this database follows the Natural Resource Database Template (NRDT) and is consistent with NPS Inventory and Monitoring Program guidance for the management of natural resource data (Lee 2005, see SOP 9).

The database consists of a "back-end" database, where data in a series of related tables reside, and a "front-end" database, where users can enter, view, edit, error-check, summarize, and export data through an interactive interface. By splitting the database into front- and back-end components, multiple users can interact with the data simultaneously.

The back-end database schema (tables, fields, and relationships) is provided in SOP 9. The front-end database contains the forms, queries, and reports customized with Visual Basics for Applications (VBA) programming code. Data entry forms are designed to meet the requirements of Program Leads and are based on existing field forms used to record data. The database is structured to minimize data entry errors by guiding the data entry technician through a simple two-form digital

data entry process. Details of the database, including a description of the structure and relationship links among data tables are presented in SOP 9.

The Program Lead(s) participate in and oversee data collection and entry at each park. After verification, validation, and certification procedures have been followed, the database is used to create summaries for annual reports, and data are uploaded to the master database for long-term storage.

The master database will house all data collected using this protocol. Network parks will have read-only access to this database and can use it to conduct multi-year data summaries and analyses for reports and publications.

4.3 Data Entry, Verification, and Validation

The Program Lead is responsible for ensuring that all data collected are accurate and complete, and that data are entered properly into the database on a daily basis. Data should be uploaded/entered daily after each survey in order to keep current with data entry tasks, and to identify any errors or problems as close to the time of data collection as possible. Data entry forms in the database are patterned after the corresponding field form, and have built-in pick-lists and validation rules to test for missing data or illogical combinations.

As soon as possible after data are entered, records should be checked in the database and/or against the paper datasheet by generating a data verification report that displays the data from the database in a format similar to that of the original datasheet. In the case of electronically collected data, data are reviewed (verified), by someone other than the person who entered the data. Data verification is the process of ensuring the electronic data match what was recorded on the hardcopy field forms. Once the data have been entered and saved, the (with assistance from the MEDN Data Manager) will run validation queries (built by the Data Manager in consultation with the Program Lead) and evaluate the data for completeness and logical consistency. The creation of data validation queries requires a reviewer to have extensive knowledge of what the data mean and how they were collected. Queries and reports have been built in the database to look for apparent outliers, inconsistencies in entry, null values, or any other anomalous data points (see SOP 8). Anomalies are reported to the Program Lead for resolution. Unresolved anomalies will be documented and included in the metadata and certification report. Any questions about the data, data entry procedures, or difficulties with the database are to be resolved by the Program Lead(s) in consultation with the MEDN Data Manager.

Once the data have been certified, the working database will be transferred to the MEDN Data Manager, who will upload it to the master database. While uploading the data to the database, the data will be subjected to an automated data quality process that will flag potential missing sites and invalid or improperly formatted data.

4.4 Metadata Procedures

Data documentation or the creation of metadata is a critical step toward ensuring that datasets are usable for their intended purposes well into the future. The development of metadata is defined as structured information about the content, quality, and condition of data. Additionally, metadata

provide the means to catalog datasets within intranet and internet systems, making data more accessible to a broad range of potential users. Metadata for all MEDN monitoring data will conform to Federal Geographic Data Committee (FGDC 1998) and NPS guidelines (NPS 2011) and will contain all components of supporting information such that the data may be confidently analyzed and synthesized. For long-term projects such as this one, metadata creation is most time consuming the first time it is developed – after which most information remains static from one year to the next (see SOP 8 for a list of metadata requirements). Metadata records in subsequent years then only need to be updated to reflect current publications, references, taxonomic conventions, contact information, data disposition and quality, and to describe any changes in collection methods, analysis approaches, or quality assurance for the project.

Specific procedures for metadata development and posting are outlined in the MEDN data management plan (Lee 2005). In general, the Program Lead and MEDN Data Manager will work together to create and update an FGDC- and NPS-compliant metadata record in XML format. The Program Lead(s) should update the metadata content as changes to the protocol are made, and each year as additional data are accumulated. Edits within the document should be tracked so that any changes are obvious to those who will use it to update the XML metadata file. The MEDN Data Manager will post edited metadata records to the NPS IRMA (Integrated Resource Management Applications) data system, where they will be available to the public.

4.5 Sensitive Information

Metadata development includes determining whether or not the data include any sensitive information. For example, the location of an endangered species population could be considered sensitive data. Prior to completing metadata, the Program Lead should identify any sensitive information in the data. The Program Lead's findings should be documented and communicated to the MEDN Data Manager. At this time, we do not anticipate that sensitive information will be present in the Invasive Plant Monitoring Program.

4.6 Data Certification and Delivery

Data certification is a benchmark in the project information management process indicating that (1) the data are complete for the period of record, (2) they have undergone and passed the quality assurance checks, and (3) they are appropriately documented and in a condition for archiving, posting, and distribution. Certification is not intended to imply that the data are completely free of errors or inconsistencies that may not have been detected during quality assurance reviews.

To ensure that only data of the highest quality are included in reports and other project deliverables, the data certification step is an annual requirement for all tabular and spatial data. Results sections of annual and trend reports will include a summary of the data verification and validation steps, the number and nature of the errors found, and how they were corrected. The Program Lead is primarily responsible for completing certification, in consultation with the MEDN Data Manager. The certified data and updated metadata should be delivered to the MEDN Data Manager according to the specified timeline. Additional details of the certification and delivery processes are included in SOP 8. Data certification will be completed by November 1st, each year.

4.7 Data Archival

File structure, version control, and regular backups are carefully controlled to preserve the integrity of MEDN datasets. Field datasheets will be stored in designated file cabinets at each network park. After field datasheets have been entered into the database, these datasheets will be scanned into PDF documents and stored in the project directory on the server. After all data for a field season have been entered, verified, validated, and certified by the Program Lead, the database will be sent to the MEDN Data Manager for archiving and distribution on the NPS IRMA (Integrated Resource Management Applications) data system. The archived database will be stored on a secure server with regularly scheduled back-ups and will be read-only accessible to the network parks. A complete copy of the database also will be archived and stored on the MEDN network server prior to any database version changes.

Once the data have been archived, any changes made to data values must be documented in the edit log database table. Paper field data sheets will not be altered; field data will be reconciled to the database through the use of the edit log. Any editing of archived datasets will be accomplished jointly by the Program Lead and MEDN Data Manager.

Certified and archived non-sensitive data, along with any associated metadata, will be made available through the NPS IRMA (Integrated Resource Management Applications) data system. The MEDN Data Manager will post certified datasets to IRMA, where they may be downloaded for research and management applications. Other datasets, including those containing sensitive data, may be requested in writing from the Program Lead and MEDN Program Manager. Sensitive data will be released only with a signed confidentiality agreement.

5.0 Data Analysis and Reporting

5.1 Overview

Data analysis on a routine basis is essential for quality control checks on the overall program, as well as to provide information on the status of invasive plants for park managers. Summary data analysis for this program will be performed on an annual basis, with more in-depth trend analyses completed after every sixth year of monitoring (when the DRT panels have been visited twice and the POE panels have been visited three times) to provide parks with timely data syntheses of both DRT and POE.

5.2 Analysis of SAMO DRT Pilot Data from 2013 to 2014

A DRT pilot study using the methods described in the previous draft of this protocol was conducted in 2013 and 2014. Eighty DRT sites were selected with GRTS sampling and visited both years. The response design consisted of six 5-m-wide by 30-m-long belt transects in which NNIS cover was collected by species. We found that 32% of the sites in 2013 and 27% of the sites in 2014 contained target NNIS. However, the large proportion of zeros in the data set and the patchy nature of NNIS infestation yielded a dataset that did not meet assumptions for modeling trend with parametric models and exhibited poor power for trend testing with nonparametric tests.

The census and mapping of the original 19 target NNIS at SAMO that was completed in 2007 detected over 4000 infestations. The patchiness of NNIS distribution and resulting zero-rich dataset prompted a change from monitoring the total area infested to monitoring the occupancy rate of NNIS. One suggestion to overcome this problem was to survey all the DRT in a panel design and record all target NNIS encountered. This was infeasible for several reasons, but primarily because SAMO has 680 miles of trails, so a sampling method was necessary. Using a conservative spatial analysis, we compared the initial locations of DRT points drawn by GRTS for this protocol to the mapped infestation locations that were recorded during the census. Only point information (and not area of infestation) from the 2007 data was used for the comparison.

Three sets of DRT points were spatially compared to the 2007 locations in GIS: (1) all the DRT points generated from the GRTS draw (1,024), (2) the 80 DRT points sampled in the two pilot years, and (3) the first 240 points (i.e., the number of points from the pilot study panel design). In all three scenarios, approximately 50% of DRT points are within 250 m of a known target NNIS infestation, and 72% are within 500 m of a known infestation (Table 8).

Occupancy analysis requires site definition resulting in an occupancy rate that ranges from 0.20 to 0.80 so that the probability of observing a species is reasonable and the estimates are meaningful (MacKenzie et al. 2006). Structuring the sites in this way also provides a basis for detecting trends in either direction. Based on this analysis, a 200 m to 500 m transect for the DRT sampling designed to detect presence/absence would have a high likelihood of encountering a target NNIS in the Santa Monica Mountains.

Table 8. Comparison of DRT points from the initial GRTS draw to the 2007 Invasive Plant Census locations.

Distance to a known target NNIS location	All GRTS Points 1024		GRTS Points (pilot) 80		GRTS Points first 240	
	N	%	N	%	N	%
50	162	16%	16	20%	38	16%
100	292	29%	22	28%	100	42%
150	393	38%	31	39%	89	37%
200	469	46%	39	49%	111	46%
250	523	51%	41	51%	120	50%
300	582	57%	50	63%	136	57%
500	754	74%	61	76%	173	72%
1000	954	93%	78	98%	226	94%
1000+	1024	100%	80	100%	240	100%

5.3 Annual Reports

Following each field season’s data verification, validation, and certification, the Program Leads from each park will work together to produce one annual report that summarizes the methods used during the previous field season, personnel involved, and summary statistics to address objectives (Table 9) for both parks. Each year’s field data will be used to generate a map of the total area monitored and infested by each species. Similarly, we will summarize and include the NNIS data collected by the MEDN Terrestrial Vegetation and Water Quality and Riverine Monitoring Programs.

Annual reports should be prepared using the latest Natural Resources Report template and instructions to authors (see <http://nature.nps.gov/publications/nrpm/templates.cfm>). Annual reports will typically not include interpretation of the data. The purpose of the reports is to quickly summarize the current year’s field methodology, summarize the data, and report the status of NNIS distribution and abundance. Status estimates will be obtained with the Horvitz-Thompson estimator (Horvitz and Thompson 1952) with inclusion probabilities obtained from the GRTS sampling design. Confidence intervals will be derived from the neighborhood variance estimator for GRTS surveys (Stevens and Olsen 2003, 2004). Each year the summary statistics will be presented along with those of preceding years to help put the current year’s results in context. Interpretation of trends and the influence of covariates will be addressed in periodic trend reports (SOP 10). However, status assessments will be placed in the context of available trend data when possible. The annual report will include the following sections:

- *Introduction.* Explains the purpose and background of the project, including the monitoring objectives.
- *Methods.* A brief description of the methods and objectives, with reference to the full monitoring protocol. Explanation of any deviations from the methods described in the protocol. List all locations monitored and the staff who collected data.

- *Results and Discussion.* Results will include a summary of the data verification and validation steps, the number and nature of the errors found, and how they were corrected. The results of the current period's effort will be presented in the context of trend information where available and appropriate. Limited discussion of results will be included where necessary.
- *Literature Cited.* As applicable.

The draft annual report is due to the I&M Program Manager in January following the field season. The report will be submitted for publication in the Natural Resources Data Series. The primary access site for all reports will be the MEDN website at <http://science.nature.nps.gov/im/units/medn/>.

Table 9. Summary of the data reported in annual reports to address monitoring objectives. Not all summary statistics will be reported, but are necessary to calculate averages across sites. SAMO and CHIS (island by island) statistics will be reported separately in the annual report.

Type of data	Specific metric
Points of Entry (POE) summary statistics	• Size of survey area (m²) • Number of NNIS per POE (richness) • Number of NNIS per area (richness/m²) • Average and total gross and net area infested (m² NNIS) per species, per POE • Total gross and net area infested by all NNIS (sum across NNIS)
Data summarized across POEs to describe the status of NNIS distribution and abundance	• Histogram of number of NNIS per POE • Total infested area per species (sum of all POEs) • Average patch size (m² NNIS) • Average net infested area • Total area infested by all NNIS (sum of areas)
Dirt Roads and Trails (DRT) specific summary statistics	• Proportion of infested sub-transects • Number of NNIS per transect • Proportion of different distribution pattern categories per transect • Proportion of density classes per transect
Data summarized across sites along official roads and trails to describe the status of NNIS distribution and abundance	• Number of sites surveyed (and list in appendix with ID) • Histogram of number of NNIS per site summed across sites • Histogram of number of NNIS per transect • Mean of distribution pattern categories summed across all sites • Proportion of density classes summed across all sites
Summary metrics from terrestrial vegetation monitoring and riverine monitoring	• Histogram or distribution of number of NNIS per point • Data on presence and foliar cover in interior parklands (away from official roads and trails) and along streams

5.4 Periodic Trend Reports

Trend estimation will be obtained by modeling changes in the estimated proportion of occupied sites over time with simple linear regression. Because the outcome of interest is a proportion, a logistic or arc-sine square-root transformation will likely be needed to meet model assumptions. Trend within distribution pattern categories will be analyzed with a multinomial regression model (Hosmer and Lemeshow 2000), which will provide inference on relative trends among distribution categories.

Because the NNIS discovered at monitoring sites may be targeted for removal, the revisit design includes panels of never-revisited sites to assess both the representativeness of the serially alternating panel sites and to increase the spatial distribution of sampled sites. Every six years, outcomes from the [1-2] panel will be compared to outcomes from the [1- n] panels to determine if revisits to a site impact outcomes of interest. Details of these analyses are provided in the Data Analysis and Reporting SOP (SOP 10).

6.0 Personnel and Operational Requirements

6.1 Roles and Responsibilities

This monitoring program is cooperatively implemented by park and MEDN network staff. Supervision of protocol implementation across parks will be provided by the MEDN I&M Program Manager in collaboration with the Chiefs of Resources at each park (who directly supervise the Program Leads). Program Leads are the botanist (CHIS) or ecologist (SAMO) designated to implement the invasive plant monitoring protocol at each park (Table 10). The Program Lead at each park will train field leads and/or interns or seasonal employees to assist with monitoring.

Data management is the shared responsibility of the Program Lead and the MEDN Data Manager. The Program Lead is responsible for data collection, data entry, data verification and validation, and data certification (with the Data Manager), as well as data summary, analysis, and reporting. The Data Manager is responsible for the design of the database, including QA/QC procedures built into the database, and for the proper handling of both spatial and non-spatial data. The Data Manager is also responsible for data archiving, data security, quality control, data certification (in consultation with the Program Lead), and data dissemination.

The Program Lead (unless delegated to a Field Crew Lead) is responsible for, among other activities, day-to-day scheduling and field operations of the Crew Members. We anticipate there will be 3-4 Crew Members (i.e., interns or park staff) collecting field data at SAMO in addition to the Program Lead. Data collection at CHIS will be performed by the CHIS botanist, with occasional assistance from park staff or interns.

The Program Leads are also responsible for annual reporting and working with the MEDN Program Manager to schedule periodic trend reports. The MEDN Program Manager is responsible for general oversight, reviewing and providing input on annual reports, and assisting with the alignment of financial resources and collaborators to ensure trend reports are produced on a timely basis

Table 10. Roles, responsibilities, and minimum qualifications of the primary positions in the MEDN Invasive Plant Monitoring Program.

Position	Roles	Responsibilities	Minimum qualifications
Program Lead (one for each park)	- Serves as liaison among project cooperators (cooperating agencies), other related projects (e.g., other monitoring efforts by neighboring locales), and between other staff (crew leader and members) and the other parks - Prepares annual reports - Works with collaborators and MEDN I&M Program Manager on trend analyses - Reports to MEDN I&M Program Manager	- Recruits and hires crew members and volunteers - Coordinates and leads annual safety meetings - Coordinates field schedules and supplies - Provides regular updates to the MEDN Program Manager and cooperators of the progress of monitoring and any areas where adjustments may be needed - Acts as a direct channel of communication between this project and others of this nature, thus building relationships and cooperation with similar projects - Data entry and providing data to the I&M network in a quality checked format, along with copies of all original data - Drafts annual report suitable for publication in Natural Resource Data Series - Leads or assists with the preparation, analysis and write-up of the periodic trend reports	- Excellence in identifying and teaching the identification of native and invasive plant species found in the network parks - Experience managing projects and communicating results in a clear and concise manner to all interested parties through a variety of media - Experience collecting and quality checking reliable data - Experience training crews and performing field work
Crew Lead (may be the same person as Program Lead or may be delegated)	Serves as the leader of the field crew members and is the primary liaison between the Program Lead and the crew members	- Participates in field training - Acts as the primary coordinator for field schedules and supplies - Takes primarily responsible for the safety of crew members - Accompanies crew members in the field - Acts as a direct liaison between the Program Lead and the crew members - Enters and quality checks all data before submitting for analysis	- Experience performing field work - Experience training, leading and coordinating crews - Experience with data collection, entry and quality assurance - Experience with teaching outdoor safety and route finding - Experience in identifying (and explaining the identification of) native and invasive plant species found in network parks - Experience using a GPS unit - Must be able to hike long distances and carry a heavy backpack

Table 10. (continued) Roles, responsibilities, and minimum qualifications of the primary positions in the MEDN Invasive Plant Monitoring Program.

Position	Roles	Responsibilities	Minimum qualifications
Crew Member (Intern)	- Serve as the backbone of the field operation by performing all field work related to the monitoring project - Works under supervision of Program Lead	- Participates in field training - Alerts crew leader of any safety or scheduling conflicts, or needed supplies - Responsible for all loaned equipment and using it properly - Collects reliable, accurate data and submits it to the crew leader in a timely manner	- Capacity to learn to identify native and invasive plant species - Capacity to learn the use of GPS unit and willingness to undergo training if necessary - Experience working with a variety of personalities in close settings under arduous conditions - Must be able to hike long distances and carry a heavy backpack - Preferably have experience performing field work in vegetation measurements, have experience working with dichotomous keys and identifying species
MEDN Data Manager	Oversees spatial and non-spatial database and data management	- Serves as primary steward of Access database and GIS data and products - Develops data entry and QA/QC procedures - Maintains and updates database applications - Provides database and GPS training as needed - Certifies data with Program Leads - Works with MEDN ecologists to analyze spatial data and develop metadata for spatial data products - Creates database queries to support summary, analysis, and reporting of findings - Facilitates check-in, review and posting of data, metadata, reports, and other products to national databases and clearinghouses	- Proficient with MS Access and database design - Proficient with ArcGIS, and uploading and downloading GPS units - Experience working with large datasets
MEDN Program Manager	Oversees scientific rigor of monitoring program; coordinates implementation of monitoring at both parks. Provides additional assistance (e.g., field assistance, supplies, statistical advice) as needed and feasible.	- Oversees protocol development and implementation at each park - Reviews draft annual reports and serves as Peer-review Manager - Assists with obtaining resources and coordinating the production of periodic trend reports	- Experience performing field work, leading and coordinating field crews - Experience with data collection, entry, and quality assurance - Experience with designing monitoring plans - Experience with analyzing, interpreting, and reporting scientific data

7.0 Program Reviews

Quality assurance extends beyond data management and must be an integral component of all aspects of the monitoring program. The U.S. Forest Service Inventory and Analysis Program identified three aspects of quality assurance (prevention, assessment, and correction), which are referred to as the QA triangle. Thorough training in all aspects of the program reduces errors and cannot be overly emphasized. In the context of the monitoring program, error prevention is addressed through development of safety plans, the sampling design, and data management plans. Although prevention is important, it is not sufficient by itself due to changing programs, funding, environments, and technologies. Thus, this protocol includes the following section for assessment (i.e., the review process) and correction (i.e., protocol revision).

7.1 Review Process

Small changes to existing documents, such as formatting, simple clarification of existing content, minor changes to the monitoring schedule or budget, changes to the target invasive species lists, or general updates to data management SOPs, are reviewed in-house by appropriate network staff and cooperators (e.g., every 1-3 years). More substantial changes that are significant in scope and impact, such as those made to the sampling design, data collection methods, or analysis techniques, generally require an outside review coordinated in collaboration with the NPS Pacific West Regional Office, using reviewers familiar with NNIS monitoring and data analysis. A review of this program will be conducted at least every 6-12 years or as needed as a result of changing mandates, funding, or priorities. Each trend or synthesis report offers an opportunity to assess how well the protocol is meeting the stated goals of the program as well as park management needs.

Determining the status and trends of selected indicators of the condition of park ecosystems is an essential goal of the I&M Program. Understanding the spatial and temporal scales over which change occurs is paramount to achieving this goal. When making changes to this protocol, the following issues should be addressed:

1. NPS staff and outside reviewers (statisticians and subject matter experts) should be involved in the review process.
2. The process should be documented and the criteria for determining whether or not change is warranted should be clearly stated (e.g., data reliability or applicability, etc.)
3. If change is required, all relevant programmatic elements should be updated (objectives, sampling design, field methods and forms, data management, analysis, reporting).
4. Precautions should be taken to ensure that past data are comparable to the future data, potentially by having a period of overlap between changes in methodology. For example, if there are changes in resources available for monitoring (i.e., funding, staff), consider reducing the number of plots visited in a balanced manner to maintain the integrity of the long-term dataset.

7.2 Protocol Revision

This protocol consists of a narrative with appendices and a separate document containing all SOPs. The protocol narrative provides the history and justification for the program and an overview of monitoring methods. The protocol narrative will be revised only if major changes are made to the program. The SOPs, in contrast, are specific, step-by-step instructions for performing each task. They are expected to be revised more frequently than the protocol narrative. Careful documentation of such revisions, including an archive of previous versions, is essential for maintaining consistency in data collection, analyses, and reporting. To summarize changes, the monitoring database for each component contains a field to identify the protocol version used to gather and analyze data.

The narrative and each SOP contain a Change History Log that should be completed each time the narrative or an SOP is revised. The purpose of this log is to explain why changes were made and to track document version numbers. Former and active versions of the protocol narrative and SOPs are stored on separate drives on the network server.

7.3 Document Life Cycle

The MEDN Data Manager and Program Manager, along with the Program Leads, will oversee archiving of protocol documents. Each document can be classified into one of six life cycle stages, as described below.

1. Draft documents: Documents that have been drafted or revised but have not yet been reviewed and approved.
2. Review documents: Draft documents distributed for peer or administrative review.
3. Active documents: Documents that have been reviewed and approved and are currently implemented for active monitoring projects.
4. Inactive documents: These are documents that have been replaced or removed from implementation and have an archived copy.
5. Archived documents: Comprehensive set of active protocol documents, published NPS Natural Resource Report series versions of the complete protocol, and inactive documents (see above). These are stored as read-only and provide the history of protocol components through time.
6. Distribution copies: PDF versions of approved protocol components for posting to websites or otherwise sharing outside the NPS.

The master active protocol narrative with appendices, and each SOP are maintained as separate MS Word files. These active documents are available for minor updates or corrections using the “track changes” feature in MS Word. The master documents will be stored on SAMO’s network. At the end of the season the Program Leads will meet to discuss any changes to CHIS methodology for the master document. CHIS will store a copy of the most recent document on its network server. During the first few years of protocol implementation, any errors or updates to the documents should be recorded using track changes and the files should be resaved to the master document.

8.0 Budget

8.1 Startup Costs, Yearly Budget, and Schedule

The MEDN I&M Program, SAMO, and CHIS will jointly fund this monitoring program. MEDN I&M will contribute approximately \$26,000 annually to support SAMO-based staff to implement monitoring, in addition to in-kind support from the MEDN Program Manager and Data Manager and vehicle and equipment use. SAMO will contribute the balance of costs (approximately \$26,800) for implementation, including staff wages, equipment, vehicles, and other expenses. At CHIS, I&M funding is provided through the park base funding to support implementation of this protocol, and in-kind support is provided by the MEDN Program Manager and Data Manager. We estimate that over 30% of our budget will be spent for data management activities performed by the Data Manager, interns, and Program Lead(s).

MEDN I&M will provide funding and support for periodic trend analysis. The network spends approximately \$20,000 to \$35,000 per year on trend analyses or other data analysis assistance, with the funds rotating among Vital Signs programs. The MEDN I&M Program will fund statistical assistance for the periodic trend and synthesis reports associated with this monitoring effort; park and network staff will also contribute substantially to the data preparation, writing, and data interpretation.

The initial cost of field equipment and supplies for monitoring POE at both parks and finding and relocating plots at SAMO is approximately \$32,350 (Table 11). Seventy percent of the equipment cost is for precision GPS devices necessary for navigation to plot location and mapping. Most of the necessary equipment is already owned by the parks and available for general use. As this and other monitoring programs develop, however, it may become necessary to obtain dedicated equipment. Over time it will be necessary to provide funds for replacement equipment and software upgrades. If possible, MEDN I&M will contribute to equipment costs, although the parks are prepared to cover these costs as necessary.

Table 11. Equipment list for invasive plant monitoring. Cost estimates are in 2015 dollars and reflect equipment needed for both CHIS and SAMO.

Type of equipment	Equipment	Cost
Geolocation Equipment	Trimble GeoExplorer 6000XT (3)**	21,000
	Trimble TerraSync Pro Software (3)**	9,600
Field Equipment	Digital Field Cameras w/ Bluetooth GPS Geotagging (3)	1,050
	Supplies (flagging, 50 m tapes, etc.)**	200
Safety and Transport	first aid kits, backpacks, snake gaiters**	500
	Estimated total initial equipment costs	\$32,350

**Denotes equipment already in the parks' inventory.

A breakdown of the schedule of annual tasks and responsible parties is provided in Table 12. Yearly operational costs for implementation of the invasive plant Monitoring Program, based in 2015

dollars, total \$51,800. This includes implementation staff salary (CHIS \$7,200 and SAMO \$30,350), vehicles and miscellaneous equipment (\$3,450), and I&M program support staff (\$10,800), including the Data Manager (Tables 13a-d). At this time, CHIS field efforts for this protocol will utilize permanent staff (no interns). In addition to the permanent staff, SAMO will also hire two interns to accompany permanent staff to implement the terrestrial vegetation and invasive plant protocols. The cost of maintaining two interns for six months is approximately \$5,800; if park housing is provided the total cost is \$8,200. Training for crews implementing both protocols will occur in the latter half of March. The interns will work primarily for the Terrestrial Vegetation Monitoring Program during April-May and will be dedicated to the Invasive Plant Monitoring Program for the month of June.

Table 12. Schedule of activities and responsible parties for program implementation at CHIS and SAMO.

Park	Month	Activity	Responsible party
Channel Islands National Park	February-July	- Survey points of entry for all islands on a rotating schedule - NNIS monitoring done in conjunction with interior parkland monitoring	CB
	August	QA/QC	CB
	September	Data certification, archiving, metadata production	CB,D
	October	Data analysis	CB,D
	November	Prepare joint CHIS/SAMO annual report and update MEDN I&M website	CB,D
Santa Monica Mountains National Recreation Area	December-January	- Coordinate with cooperating agencies, renew permits - Review prior field season notes and make necessary adjustments - Prepare field equipment, datasheets, and site visit information packets - Recruit interns	SB,R SB,P,R SB,R SB,P,R
	February-March	- Hire interns, complete training and coordination with terrestrial vegetation protocol - Safety training and completion of Protocol Readiness Review	SB,P,R SB,P,R, PM
	June	- Field season monitoring, data entry - Field season report and meeting	SB,P,R, crew leader, interns
	August	Complete data verification and validation	SB,P,R,D
	September	Data certification, archiving, metadata production	SB,P,R,D
	October	Data analysis of current year's results	SB,P,R,D
	November	Prepare joint CHIS/SAMO annual report and update MEDN I&M website	SB,P,R,D, PM

CB = CHIS Botanist, SB = SAMO Botanist, P = SAMO Plant Ecologist, R = SAMO Restoration Ecologist, D = MEDN Data Manager, PM = MEDN I&M Program Manager

Table 13a. Annual budget for invasive plant monitoring: CHIS staffing for monitoring and reporting. Cost estimates are in 2015 dollars and based on permanent staff step 5 wages plus 35% benefits, rounded to the nearest \$50. The annual cost of living increase of 1-2% will apply when authorized in the future.

Time period	Botanist (GS11)		
	FTE ¹	Cost	Total
December	0.0	0	0
February	0.05	450	450
April-June	0.1	3,350	3,350
July-August	0.1	850	850
September	0.1	850	850
October	0.1	850	850
November	0.1	850	850
Total Yearly		\$7,200	\$7,200

¹Full Time Employee = 40 hours per week. The numbers shown are the portion of an FTE required during each specified time period.

Table 13b. Annual budget for invasive plant monitoring: SAMO staffing for monitoring and reporting. Cost estimates are in 2015 dollars and based on permanent staff step 5 wages plus 35% benefits, rounded to the nearest \$50. The annual cost of living increase of 1-2% will apply when authorized in the future. Intern stipends (\$500 per month) and housing (\$200 per month) are included in the intern cost estimate.

Time period	Botanist (GS9)		Plant Ecologist (GS12)		Restoration Ecologist (GS11)		Interns		Total
	FTE ¹	Cost	FTE	Cost	FTE	Cost	FTE	Cost	
December-February	0.1	700	0.1	1,000	0.1	850			2,550
March	0.1	700	0.1	1,000	0.1	850	2.0	1,400	3,950
June	0.2	1,400	0.2	2,000	0.3	2,500	2.0	1,400	7,300
July-August	0.2	1,400	0.1	1,000	0.2	3,350			5,750
September	0.1	700			0.1	850			1,550
October	0.1	700	0.1	1,000	0.3	2,500			4,200
November	0.1	700	0.1	1,000	0.4	3,350			5,050
Total Yearly		\$6,300		\$7,000		\$14,250		\$2,800	\$30,350

¹Full Time Employee = 40 hours per week. The numbers shown are the portion of an FTE required during each specified time period.

Table 13c. Annual budget for invasive plant monitoring: MEDN Network staffing for program administration and support for CHIS and SAMO. Cost estimates are in 2015 dollars and based on permanent staff step 5 wages plus 35% benefits, rounded to the nearest \$50. The annual cost of living increase of 1-2% will apply when authorized in the future.

Time period	MEDN Data Manager (GS11)		MEDN I&M Coordinator (GS12)		Total
	FTE ¹	Cost	FTE	Cost	
Total Yearly	0.06	\$6000	0.04	\$4,800	\$10,800

¹Full Time Employee = 40 hours per week. The numbers shown are the portion of an FTE required during each specified time period.

Table 13d. Annual budget for invasive plant monitoring: CHIS and SAMO equipment and supplies. Cost estimates are in 2015 dollars and based on permanent staff step 5 wages plus 35% benefits, rounded to the nearest \$50. The annual cost of living increase of 1-2% will apply when authorized in the future.

Time Period	GSA vehicles (SAMO only)		Miscellaneous	Total
	# ¹	Cost	Cost	
February			850	850
March	2.0	1,000	100	1,100
June	2.0	1,000	500	1,500
Total Yearly		\$2,000	\$1,450	\$3,450

¹# of GSA vehicles estimated @ \$500/month (\$400 for vehicle lease plus \$100 for additional mileage).

While permanent employees are more costly on an hourly basis, the knowledge and experience they bring to the work provides greater survey efficiency, increased capability to respond to unforeseen circumstances, and ultimately, higher quality data for the funds expended. For these reasons the parks are willing to contribute funding and in-kind support to implement this protocol.

Yearly GSA vehicle costs for SAMO are estimated at \$2,000. Uniforms, supplies, and equipment replacement needs are estimated at \$1,450. Replacement costs of equipment such as GPS units cannot be amortized and are therefore not included in the annual budget. Replacement of these units will incur an occasional but significant cost to the project. Facilities and computer costs and costs for administrative services such as purchasing, human resources, and IT support are not included in this budget projection. SAMO estimates that six hours per day (taking into account preparation, travel, office data management, etc.) are available for monitoring for the month of June with two 2-person teams. Our aim is to maximize the number of points that can be completed in one season.

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Appendix A: Images of Points of Entry and of a Dirt Roads and Trails Site

Figure A.1 - Airstrip

Figure A.2 - Campground

Figure A.3 - Port

Figure A.4 - Trailhead with a parking lot

Figure A.5 - Photograph of a parking lot with zone delineation

Figure A.6 - Photograph of a trailhead with zone delineation

Figure A.7 - Photograph of a Dirt Roads and Trails site with zone delineation

Airstrip



Figure A.1. Airstrip on Santa Rosa Island (Channel Islands National Park). Zone 1 is the hardscape plus 50 m along both sides of the connecting unpaved road. Zone 2 is a 20 m area surrounding Zone 1.

Campground



Figure A.2. Campground at Sycamore Canyon (Santa Monica Mountains National Recreation Area). Zone 1 is the hardscape plus 50 m along two connecting trails. Zone 2 is a 20 m area surrounding Zone 1, modified to clip out the areas that would otherwise fall on a paved highway.

Port



Figure A.3. Prisoner's Harbor (port) on Santa Cruz Island (Channel Islands National Park). Zone 1 is the hardscape plus 50 m along two connecting unpaved roads/trails. Zone 2 is a 20 m area surrounding Zone 1, modified to clip out the ocean past the beach.

Trailhead with a parking lot



Figure A.4. Trailhead with a parking lot at Rocky Oaks (Santa Monica Mountains National Recreation Area). Zone 1 is the hardscape plus 50 m along two connecting trails. Zone 2 is a 20 m area surrounding Zone 1.

Photograph of a parking lot with zone delineation



Figure A.5. Photograph of a parking lot with zone delineations that show the hardscape (Zone 1) and the maintained and unmaintained areas of Zone 2.

Photograph of a trailhead with zone delineation



Figure A.6. Photograph of a trailhead with zone delineations that show the hardscape (Zone 1) and the unmaintained areas of Zone 2.

Photograph of a Dirt Roads and Trails site with zone delineation



Figure A.7. Photograph of a Dirt Roads and Trails site with trail edge identified in red. White transect tape is shown in the middle of the trail.

Appendix B: R Code for Generating GRTS Points and POE Panels

GRTS Points R Code:

```
library(spsurvey)
library(rgdal)
library(latticeExtra)
library(maptools)

# ROADS AND TRAILS
# Read and process dbf from the shapefile: attribute table from
# shapefile that is in same directory that R is started from

SAMOrat <- readOGR(".", "subsetSAMOrat")
names(SAMOrat)
[1] "LPP"          "PUBLIC"        "PROTECT"       "NRA"
"LPP_Status"
[6] "Monitor"      "BUFF_DIST"

att <- read.dbf("subsetSAMOrat")
names(att)
[1] "LPP"          "PUBLIC"        "PROTECT"       "NRA"
"LPP_Status"
[6] "Monitor"      "BUFF_DIST"     "length_mdm"

#Design specifications, note: panel allocations currently for
#network
SAMOInvasives_DesignSpecs <- list(None=list(panel=c(main = 1024),
                                             seltype="Equal" ))

set.seed(68466450)
LastTick <- TimeStamp(LastTick) # show time & memory usage
output.name.RAT<- 'SAMOInvasives_RAT_GRTS_sample_20130531'
SAMOInvasives_GRTS_20130531 <- grts(design=
SAMOInvasives_DesignSpecs,
    DesignID='SAMO Invasives',
    type.frame='linear',
    src.frame='shapefile',
    in.shape='subsetSAMOrat',
    att.frame=att,
    prjfilename='subsetSAMOrat',
    out.shape= output.name.RAT
    )
```

POE Panel R Code:

```
# Utilization of this code without first installing R packages  
rgdal and spsurvey will result in error.  
# This output results from the grts.equi.r function of the SDrawGUI  
package, WEST Inc., 2015, Version 1.04.
```

```
library(rgdal)  
library(spsurvey)
```

```
# Read in the shapefile of interest from which sampling occurs.
```

```
shp <- readOGR( "C:/Users/lstarcevich/Google  
Drive/WEST/Projects/NPS/MEDN/InvasivePlants/POE_GRTS",  
"SAMO_POEs_Leanne" )
```

```
# Prepare the design of the sampling for use in the grts function.
```

```
Equaldsgn <- list(None=list(panel=c(Main=(123)),  
seltype='Equal',over=0))
```

```
# Set the random seed  
set.seed(94727)
```

```
# Draw the sample via the grts function in package spsurvey.
```

```
SAMO_POE_Sample <- grts(design=Equaldsgn,  
DesignID='Site',  
type.frame="finite",  
src.frame='sp.object',  
sp.object=shp,  
shapefile=FALSE)
```

```
# Plot the original shapefile, along with the sample.
```

```
plot(shp)
```

```
plot(as(SAMO_POE_Sample, 'SpatialPointsDataFrame'),col='red',pch=19,  
add=TRUE)
```

```
SAMO_POE_Sample$panel[1:31]=1  
SAMO_POE_Sample$panel[32:62]=2  
SAMO_POE_Sample$panel[63:93]=3  
SAMO_POE_Sample$panel[94:123]=4
```

Appendix C: List of Points of Entry Monitoring Sites and Their Location

Table C.1. Names and locations of points of entry monitoring sites at Channel Island National Park. *The airstrips on Santa Cruz Island are on The Nature Conservancy land and will be monitored by that organization. **Will be monitored by California State University Channel Islands. Coordinates are shown in UTM.

Site_ID	Island	X_Coord	Y_Coord	Site name
POE-01	ANI	281880.86	3766512.07	Landing Cove
POE-02	ANI	281880.86	3766512.07	Campground
POE-03	SCI	264192.34	3770577.63	Scorpion Harbor
POE-04	SCI	264192.34	3770577.63	Scorpion Harbor Campground
POE-05	SCI	252131.97	3767556.70	Prisoner's Harbor
POE-06	SCI	252131.97	3767556.70	Del Norte Campground
POE-07	SCI	252383.33	3764256.10	Main Ranch Airstrip*
POE-08	SCI	236619.75	3767882.39	Christy Ranch Airstrip*
POE-09	SRI	218459.99	3767196.53	Santa Rosa Port**
POE-10	SRI	218434.07	3766203.70	Santa Rosa Airstrip**
POE-11	SRI	772670.72	3765084.71	Campground
POE-12	SMI	190870.17	3771403.02	San Miguel Ranch Airstrip
POE-13	SMI	184984.23	3772215.92	Dry Lake Bed Airstrip
POE-14	SBI	311420.91	3706513.08	Landing Cove
POE-15	SBI	311420.91	3706513.08	Campground

Table C.2. Names and locations of points of entry monitoring sites at Santa Monica Mountains National Recreation Area. Coordinates are shown in UTM.

Site_ID	X_Coord	Y_Coord	Site Name
POE-001	314134.4	3771994	Sycamore Canyon Campground Entrance (Point Mugu State Park)
POE-002	322295.6	3776214	BBT - Sandstone Peak Trailhead (Circle X Ranch)
POE-003	340027.2	3780103	Morrison Ranch
POE-004	316848.9	3778459	Big Sycamore Canyon Horse Corral (just north of Danielson Ranch)
POE-005	332165.8	3767391	Busch Trailhead (Zuma/Trancas Canyons)
POE-006	341956	3773938	Malibu Creek State Park Campground
POE-007	352387.5	3778794	Top o' Topanga Overlook
POE-008	372290.8	3776564	Fryman Canyon / Nancy Hoover Pohl Overlook (Fryman Canyon Park)
POE-009	321367.2	3768970	Leo Carrillo SP / Yellow Hill Rd
POE-010	338161.7	3774911	Malibu Crk St Pk / Crags Dr
POE-011	347896.2	3773930	Lower Stunt High Trail Trailhead
POE-012	361057.6	3776620	Mandeville / Garden Land Rd
POE-013	350814.9	3769945	Tuna Cyn Rd
POE-014	343512.1	3780307	Zev Yaroslavsky LV Highlands Trailhead
POE-015	351559.9	3773647	BBT - Hondo Canyon
POE-016	375214.4	3776217	Runyon Cyn Rd Trailhead North (Runyon Canyon Park)
POE-017	335665.5	3766478	Winding Way Trail (Escondido Cyn Natural Area)
POE-018	321314.2	3776017	Circle X Ranch Campground Entrance
POE-019	341019.3	3777659	Malibu Creek State Pk / Liberty Cyn
POE-020	318007.2	3774369	Serrano Rd Terminus
POE-021	325772.3	3768172	La Piedra State Beach Parking Lot
POE-022	337766.6	3772634	BBT - Corral Canyon Trailhead (Malibu Creek State Park)
POE-023	349061.5	3772645	Saddle Peak Rd / Hondo Cyn Trail
POE-024	370218.8	3777442	Barker Fire Rd
POE-025	342730.5	3767252	Malibu Bluffs, Michael Landon Center
POE-026	338113.4	3776377	Paramount Ranch Main Entrance (Paramount Ranch)
POE-027	348973.8	3775120	Red Rock Cyn Entrance
POE-028	362085.8	3775500	Canyonback Rd (N end of Mtn Gate development)
POE-029	320983.8	3781102	Los Robles Trail (COSCA Lands)
POE-030	343225.4	3780936	Morrison Trailhead
POE-031	316906.2	3781260	Olympia Farms Trailhead
POE-032	355999.7	3770902	Santa Ynez Cyn Park Trailhead
POE-033	333237.8	3764100	Point Dume State Preserve Main Entry
POE-034	325567.6	3773639	Arroyo Sequit
POE-035	353651.6	3777093	Santa Maria Road
POE-036	369469.1	3774903	Franklin Canyon Park - Ranch
POE-037	326551.1	3770252	Charmlee Regional Park / Charmlee Natural Area

Table C.2. (continued) Names and locations of points of entry monitoring sites at Santa Monica Mountains National Recreation Area. Coordinates are shown in UTM.

Site_ID	X_Coord	Y_Coord	Site Name
POE-038	342155.7	3775026	Las Virgenes View Trail Trailhead
POE-039	347126.2	3773451	Stunt Ranch/Stunt Rd
POE-040	370973.1	3777351	Iredell Ln at Fire Road
POE-041	344944.5	3767322	PCH, Adamson House (Malibu Lagoon State Beach)
POE-042	338557.3	3775997	Malibu Creek SP/Reagan Meadows
POE-043	353552	3773650	BBT - Topanga State Park Main Entrance
POE-044	355638.2	3778510	Dirt Mulholland / Greenbriar Dr
POE-045	332258.3	3772371	BBT - Kanan Dume Rd N - overflow
POE-046	342838.3	3774844	Gillette Ranch
POE-047	312073.3	3773542	BBT - Ray Miller Trailhead / La Jolla Canyon (Point Mugu State Park)
POE-048	358916	3769240	Temescal Gateway Park
POE-049	331997.3	3765176	Point Dume / Zuma, Westward Beach Rd
POE-050	328186.4	3773185	BBT - Encinal Cyn Rd
POE-051	353222	3778046	Viewridge Trailhead
POE-052	369284.1	3775117	Hillcrest Dr / Beverly Dr
POE-053	324068.8	3771630	Nicholas Flat Trailhead
POE-054	340264.5	3775175	Malibu Crk St Pk / Cistern Trail
POE-055	347270.3	3773448	Stunt Ranch Entrance
POE-056	371665.8	3777803	Wilacre Park Main Entrance
POE-057	338687.8	3767723	Solstice Canyon Trailhead - inner lot
POE-058	343016.5	3778357	Bark Park Trailhead (Baldwin OS)
POE-059	352304.8	3773802	BBT - Dead Horse Trail Trailhead (Topanga State Park)
POE-060	357933	3779051	Caballero Cyn Trailhead
POE-061	335978.5	3776224	Peter Strauss Ranch (Peter Strauss Ranch)
POE-062	342603.2	3772731	Malibu Ck St Pk/Tapia Park (Malibu Creek State Park)
POE-063	312337.6	3776155	La Jolla Valley North Campground (Point Mugu State Park)
POE-064	361104	3770240	Casale Rd. End
POE-065	323072.1	3776478	BBT - Mishe Mokwa Trailhead S
POE-066	332486.8	3772071	BBT - Kanan Trailhead (Zuma/Trancas Canyons)
POE-067	370425.5	3777434	Tree People parking lot (Coldwater Cyn/Wilacre)
POE-068	348187.5	3772391	BBT - Lois Ewen Overlook
POE-069	361429.4	3777374	East End Dirt Mulholland
POE-070	343593.7	3779694	Juan Bautista de Anza Trailhead West
POE-071	317302.9	3781222	Rancho Potrero Trailhead
POE-072	332893.9	3763999	Pt Dume, Lower Trailhead from Beach (Point Dume State Preserve)
POE-073	320228	3780995	Wendy Trailhead
POE-074	325326.8	3768256	El Pescador State Beach Parking Lot

Table C.2. (continued) Names and locations of points of entry monitoring sites at Santa Monica Mountains National Recreation Area. Coordinates are shown in UTM.

Site_ID	X_Coord	Y_Coord	Site Name
POE-075	370057.2	3776753	WODOC parking lot (Franklin Canyon - upper)
POE-076	353619.8	3774349	Topanga / Hillside Dr
POE-077	355875	3778187	Vanalden Ave S terminus
POE-078	332648.4	3774395	Rocky Oaks
POE-079	345330.6	3780082	Juan Bautista de Anza Trailhead East
POE-080	333105.2	3763970	Point Dume State Preserve, Admin Rd
POE-081	325112.7	3775650	BBT - Yerba Buena Rd
POE-082	326920.2	3768077	El Matador State Beach Parking Lot
POE-083	370914.4	3778198	end of Shady Oak Rd
POE-084	338472.2	3776086	Paramount Ranch/Mulholland Hwy
POE-085	353922.6	3774733	Musch Camp (Topanga State Park)
POE-086	334496.6	3772262	BBT - Latigo Cyn Rd (NPS BBT)
POE-087	342812.6	3772318	BBT - Tapia Trailhead (MCSP BBT)
POE-088	332706.3	3767141	Bonsall Trailhead (Zuma/Trancas Canyons)
POE-089	346834.1	3772935	BBT - Stunt Rd
POE-090	360449.1	3777498	Nike Missile Overlook (Westridge-Canyonback Wilderness Park)
POE-091	342532.6	3777524	De Anza Park (Malibu Creek SP)
POE-092	353103.2	3773505	92 Trail / Entrada Rd
POE-093	323005.6	3773101	Malibu Springs/Mulholland Hwy
POE-094	340409.7	3780816	Cheeseboro Canyon Trailhead (Simi Hills)
POE-095	340598.2	3778697	Abrams Trailhead
POE-096	316164.1	3777841	Big Sycamore Canyon Horse Camp (Danielson Ranch, Point Mugu State Park)
POE-097	338027.3	3772314	Corral Cyn / Mesa Peak Mtwy
POE-098	347160.7	3777424	Secret Trail Trailhead
POE-099	344427	3771885	BBT - Piuma Rd Hairpin Trailhead
POE-100	337829.8	3774671	Malibu Ck St Pk / Lookout Rd
POE-101	357320.8	3771705	Temescal Ridge Trailhead (Topanga State Park)
POE-102	353603.2	3777048	Santa Maria Road
POE-103	369615.2	3775918	Lake & Franklin Cyn fork
POE-104	341921.4	3774465	Malibu Creek State Park
POE-105	347428.5	3774498	Yucca Trailhead
POE-106	344466.9	3767208	Malibu Lagoon State Beach
POE-107	309431.3	3774247	Pt Mugu SP/Chumash Trail
POE-108	356009	3768516	Topanga SP - Los Liones Dr (Topanga State Park)
POE-109	352585.6	3777445	Ed Edelman Park Trailhead
POE-110	369486	3775410	Hastain Trailhead (Franklin Canyon - upper)

Table C.2. (continued) Names and locations of points of entry monitoring sites at Santa Monica Mountains National Recreation Area. Coordinates are shown in UTM.

Site_ID	X_Coord	Y_Coord	Site Name
POE-111	341928.9	3774962	Grasslands Trail North
POE-112	338140.3	3771132	Corral Cyn Rd/Baller Mtwy
POE-113	356789.2	3777823	Top of Reseda
POE-114	312130.4	3773265	Thornhill Broom Beach Camping (mouth of La Jolla Canyon)
POE-115	360459.8	3769231	BBT - Will Rogers SHP Main Entrance (Topanga State Park)
POE-116	343005.8	3782156	Las Virgenes Canyon Trailhead
POE-117	352561	3778297	Topanga Cyn Bl / Henry Ridge Mtw
POE-118	321468.7	3769465	Leo Carillo Campground
POE-119	340217.1	3775293	Malibu Crk St Pk / Phantom Trail
POE-120	339861.5	3767255	Corral Canyon Trailhead
POE-121	375340.6	3774658	Runyon Cyn Rd Trailhead South
POE-122	318762.3	3780851	Rancho Sierra Vista Main Entrance
POE-123	360951	3771369	end of Queensferry Rd

Appendix D: Obtaining and Renewing Permits (SAMO)

Introduction

Permits are needed for data collection and potential collection of unknown plants on non-NPS lands. The permit expiration dates should be kept in a tickler and renewals should occur as a component of the pre-field season preparations. *Be sure to ask about any newly closed trails when communicating with partner agencies. We do not want to monitor a trail they are attempting to close.*

Where permit related documents and permit information can be found

Permit information for SAMO is located on the network drive in

Plant_Ecology\Inventory and Monitoring\Invasive Plant Species Monitoring_permissions and permits

Within this folder are separate folders for each organization that issued a permit or granted permission for the long-term vegetation monitoring project. Within each organization folder there are word documents of submitted permit requests (as well as annual reports and renewal requests if required), PDFs of issued permits, and other permit related documents.

Information about submitting annual reports and renewal requests, such as contact information and when reports are due, can be found in

\Plant_Ecology\ Inventory and Monitoring \Invasive Plant Species Monitoring_permission and permits\list of permittees when reports are due and contact information

Application/Renewal of permits

Permit application

Applications can be found in that organization's folder and/or on that organization's website. Unless changes have been made in what is to be done, the permit application should be the same from year to year and need only minor revisions.

Explanation of the project

The application form only allows a brief explanation of what the permit is being requested for. Therefore, you may want to include a lengthier, more detailed explanation with the permit application. *Be sure to ask about any newly closed trails when communicating with partner agencies. We do not want to monitor a trail they are attempting to close.*

Indemnification letter

Many landowners require a hold harmless agreement, waiver or release, or statement of insurance to protect them in the event of accidents. However, the federal government cannot by law indemnify an individual, organization, or agency. Instead, NPS will offer, as a substitute, a letter stating that all NPS employees and officially recognized volunteers of the NPS are covered by the Federal Tort Claims Act (PL 89-506; 80 Stat. 306). This act provides compensation for property losses, property damage, personal injuries, and deaths claimed to have resulted from the negligent or wrongful acts or omissions of employees and volunteers in the course of their duties. In addition, claims for

compensation for injury or death sustained by employees or volunteers of the government are covered under the Federal Employees' Compensation Act. Finally, all employees and volunteers are covered under the Office of Workers Compensation Program, to cover potential liabilities for personal injury or death.

The NPS shall cooperate in the submission of claims pursuant to the Federal Tort Claims Act against the United States for losses, damages, injuries and deaths arising out of the project. The NPS will require adequate liability insurance and workers compensation coverage to be obtained, carried and maintained by its agents, contractors and subcontractors who perform work or conduct activities on the property. The NPS will require any of its volunteers doing any tasks on the property to sign a volunteer form which makes the volunteer a federal employee for the purpose of being covered by the Federal Tort Claims Act (PL 89-506; 80 Stat 306) and Federal Workers Compensation Act (16 U.S.C.; 742 (c) (3)).

For examples of an indemnification and insurance coverage letter, see Figures D.1 and D.2 at the end of this Appendix.

Permit renewal

Some permits will need to be renewed annually while others will not need to be renewed for several years. Those that need to be renewed annually will need to have an annual (progress) report included with the permit renewal. Those that are renewed after several years will need to have the latest report included. If the permit is not renewed, a final report will need to be submitted.

The renewal permit has several parts—the permit application, explanation of the project, annual/progress report, and necessary attachments. Look in the particular organization's folder to see what renewals have been included in the past and include those parts, updated as necessary.

Annual/progress report (or final report)

This is a report summarizing the activities done and data collected for the year(s) the permit was granted (see annual report section above).

Annual report organization

Annual reports are organized similarly to scientific articles in that they are separated into sections such as the purpose/objectives of the study, methodology, results, and brief discussion. Look at the previously submitted annual reports and use these as a guideline. Some sections will need little or no revision, while others will need extensive revision. Also, read the original permit request to be sure all activities listed in the request are discussed in the annual report.

Note that you are writing the report for the year that just passed. If the report is due 12/31/2012 or 1/31/13, write only about activities done in 2011. If nothing was done that year you will need to say so and why.

Purpose/objectives of the study

This is a summary statement of what is hoped will be accomplished if the permit is granted. This section should not need to be changed unless the objectives or purpose of the study changes.

Methodology

This section explains what methods will be used to conduct the study and is separated into two subsections: data collection and data analysis. If new locations were added, you will need to revise the data collection and/or the results/conclusions section to include the information for the new locations. For the data analysis section, if data have been collected for two or more years and no analysis has been done, you will need to explain why.

Changes in methodology from the permit request and why changes were made

Discuss any changes in methodology that were made from what was proposed in the original permit request and the reason why those changes were made. Also, any requested activities included in the permit that were not done in the year the report covers and the reasons why they were not done will need to be stated.

Information on the methodology and purpose for monitoring can be found in

G:\Plant_Ecology\Inventory and Monitoring\MEDN Vegetation Monitoring Protocol

Preliminary results or conclusions

Summarize the data collected that year and state any conclusion that can be made. Consult the park database manager for the current location of the data.

Attachments

Attachments may include a map of the area where monitoring is to occur, proof of insurance, etc.

List of permit grantors and their contact information

California Department of Fish and Wildlife—Submit annual reports to CDF&W by October 1. See report or copies of reports for what to include. Reports or other correspondence can be mailed or e-mailed as listed below.

Send Original to:
Branch Chief
Department of Fish and Wildlife
Habitat Conservation Planning Branch
1416 8th Street, 12th Floor
Sacramento, CA 95814
Attn: Mary Ann Showers
mshowers@dfw.ca.gov
(916) 651-6594

Send copy to:
Ed Pert
Regional Manager
South Coast Region
4949 Viewridge Avenue
San Diego, CA 92123
Attn: Mary Meyer
mmeyer@dfw.ca.gov

California State Parks—Annually (permit expires the end of December each year) renew permit from California State Parks. Include annual report of work from the year prior with the renewal.

Send to:

California State Parks
1925 Las Virgenes Road
Calabasas, CA 91302
Attn: Suzanne Goode (Suzanne.goode@parks.ca.gov)
(818) 880-0364

Ventura County Watershed Protection District—Annually (permit expires at the end of July each year) renew permit from Ventura County Watershed Protection District and include copies of any reports and/or studies. Visit their website for blank permit requests
(http://portal.countyofventura.org/portal/page/portal/PUBLIC_WORKS/Watershed_Protection_District/About_Us/VCWPD_Divisions/Planning_and_Regulatory/Permits).

Send to:

Ventura County Watershed Protection District
800 South Victoria Avenue
Ventura, CA 93009
(805) 654-2001

Mountains Recreation and Conservation Authority—Submit to MRCA an update memorandum by 12/31 each year and 3 copies of any reports or publications no later than 3 months after completion/publication.

Note: Fernando Gomez should be contacted at least 48 hours before work is started each season
fernando.gomez@mrca.ca.gov (310) 858-7272 ex. 141

Send report to:

MRCA
Attn: Judi Tamasi
judi.tamasi@mrca.ca.gov
(310) 589-3230 ex. 1221
Or call: Paul Edelman (310) 589-3230 ex. 128

Conejo Open Space Conservation Agency—Submit a copy of the report annually.

Send to:

COSCA
2100 East Thousand Oaks Blvd.
Thousand Oaks, CA 91320
Attn: Shelly Austin
SAustin@toaks.org
(805) 449-2339

Mountains Restoration Trust—Submit a copy of the report annually.

Send to:

Mountains Restoration Trust
3815 Old Topanga Canyon Road
Calabasas, CA 91302
Attn: Debbie Sharpton
dsharpton@mountainstrust.org
(818) 591-1701 ext. 203

Examples of an indemnification and insurance coverage letter



Figure D.1. An example of a shorter version of an indemnification and insurance coverage statement letter.



United States Department of the Interior

NATIONAL PARK SERVICE
Santa Monica Mountains National Recreation Area
401 West Hillcrest Drive
Thousand Oaks, California 91360-4207

January 15, 2010

Matt Kouba
Conejo Recreation and Park District
403 W. Hillcrest Drive
Thousand Oaks, CA 91360

Mr. Kouba,

This letter is offered as a substitute for your 'Conejo Open Space Conservation Agency Research Agreement, Waiver, and Release' form. The federal government cannot by law indemnify an individual, organization or agency, but will help in the submission of claims against the Federal Government for actions of its employees and volunteers as stated below. The activity to be covered is long term vegetation monitoring at Wildwood Regional Park and Lake Eleanor Open Space. Only National Park Service (NPS) employees or officially recognized volunteers will be working on this project. Access will be by foot on a seasonal basis to collect long term vegetation monitoring data.

The NPS, including employees and officially recognized volunteers of the NPS, are covered by the Federal Tort Claims Act (PL 89-506; 80 Stat. 306). This act provides property losses, property damage, personal injuries, and deaths claimed to have resulted from the negligent or wrongful acts or omissions of employees and volunteers in the course of their duties. In addition, claims for compensation for injury or death sustained by employees or volunteers of the government are covered under the Federal Employees' Compensation Act. Finally, all employees and volunteers are covered under the Office of Workers Compensation Program, to cover potential liabilities for personal injury or death.

The NPS shall cooperate in the submission of claims pursuant to the Federal Tort Claims Act against the United States for losses, damages, injuries and deaths arising out of the project. The NPS will require adequate liability insurance and workers compensation coverage to be obtained, carried and maintained by its agents, contractors and subcontractors who perform work or conduct activities on the property. The NPS will require any of its volunteers doing any tasks of the property sign a volunteer form which makes the volunteer a federal employee for the purpose of being covered by the Federal Tort Claims Act (PL 89-506; 80 Stat 306) and Federal Workers Compensation Act (16 U.S.C.; 742 (c) (3)).

Thank you,

Woody Smeck
Superintendent

Figure D.2. An example of a longer version of an indemnification and insurance coverage statement letter required by some agencies

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.

NPS 159/132085, 368/132085, March 2016

National Park Service
U.S. Department of the Interior



Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

2016

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