

Cape-Ivy Removal
Golden Gate National Recreation Area and Point Reyes National Seashore
PMIS 80291
NRPP Resources Management FY2004-FY2006
Final Report

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PURPOSE

PMIS Project 80291 funded Cape-ivy treatments in FY2004 through FY2006 with a goal of complete eradication of all previously known patches of Cape-ivy (*Delairea odorata*) at Point Reyes National Seashore (PORE) and local eradication of high-priority occurrences with containment of larger infestations at Golden Gate National Recreation Area (GOGA). Cape-ivy is one of the highest priority non-native invasive plants for both PORE and GOGA. It spreads rapidly and directly impacts numerous threatened and endangered species through habitat conversion and alteration of soil and water chemistry. Cape-ivy out-competes all other plants species by completely covering ground surfaces and climbing tree and shrub limbs to shade out native plants and pull down trees. Some studies have also shown that Cape-ivy contains toxic alkaloids which may have effects on fish, mammals and invertebrates.

The total removal completed during the three year project was 27.72 acres at PORE and 29.9 acres at GOGA. This report provides further detail on mapping and surveying, site selection, methods, results and monitoring for the purpose of guiding future follow-up and monitoring.

OBJECTIVE

The objectives of this project were to:

- PORE: removal and subsequent follow-up work on 16 previously untreated acres and support for ongoing efforts to eradicate the remaining 10 acres already subject to containment. Target acreage = 27.0 acres
- GOGA: removal of high priority occurrences and newly discovered small occurrences and containment of additional large occurrences. Priority given to removal of occurrences in watersheds where all occurrences have been contained. Target acreage = 38.89 acres
- Improve and protect habitat for federally listed species at both park units including
 - Myrtle's silverspot butterfly (Endangered)
 - California freshwater shrimp (Endangered)
 - mission blue butterfly (Endangered)
 - San Bruno elfin butterfly (Endangered)
 - California red-legged frog (Threatened)
 - coho salmon (Threatened)
 - steelhead (Threatened)
 - northern spotted owl (Threatened)

METHODS

Detailed Site Mapping

Between the end of the last NRPP-funded project in FY01 and the FY04-06 project, the parks needed to first reassess all sites to determine the extent and condition of each site. In 2004, all known populations of Cape-ivy within PORE were mapped and surveyed on

the ground (Figure 1). Survey information included percent cover of Cape-ivy and other dominant species in the site, travel time to the site, site hazards and other descriptive information. A total of 28.51 acres was mapped. Previously undocumented sites were mapped or digitized in the second year of the project, adding 8.92 acres to the total known infestations. In 2006 all debris piles were mapped to ensure tarps are removed over the next three to five years. GOGA has similar locational data, including polygons of each infestation/treatment area (Figure 2).



Figure 1. Cape-ivy locations throughout Point Reyes National Seashore.

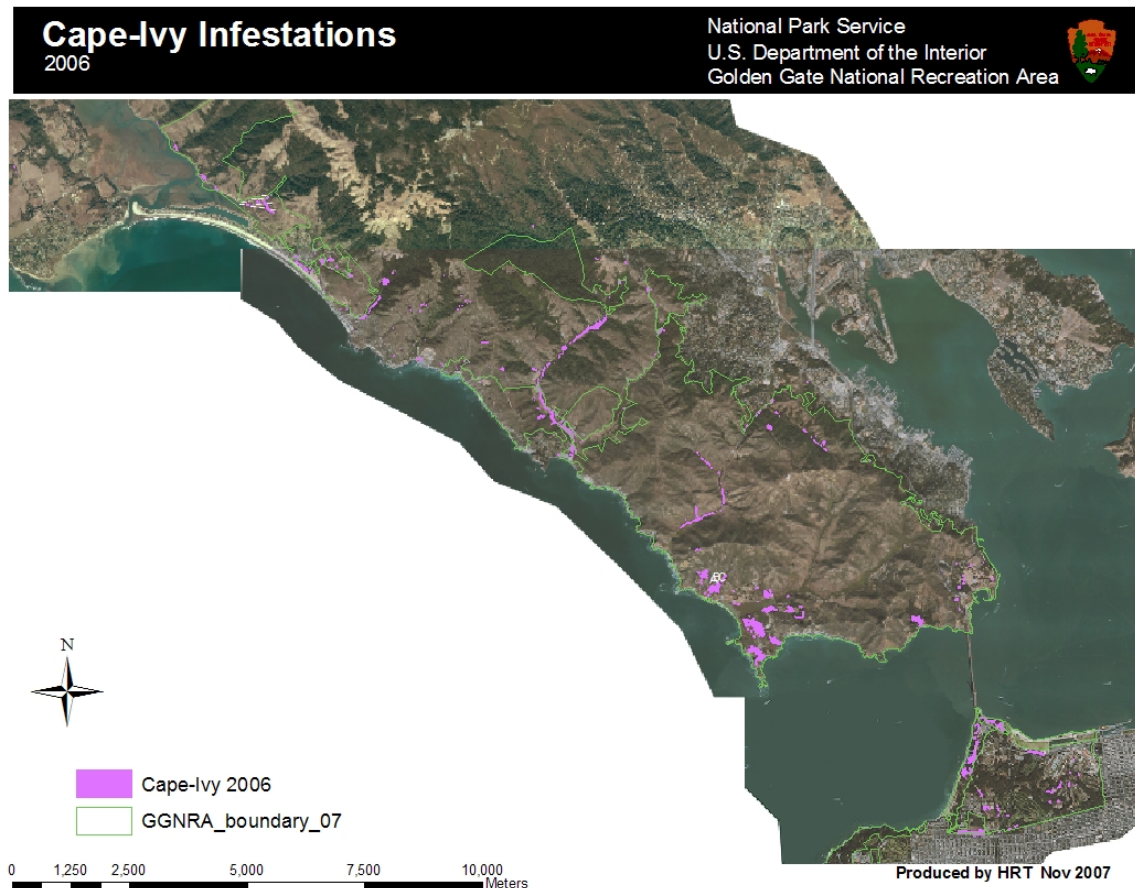


Figure 2. Cape-ivy locations throughout Golden Gate National Recreation Area.

Selection of Treatment Sites

The second step in this project was site prioritization and selection. Cape-ivy sites at both park units were prioritized based on habitat quality, presence of rare or endangered species, site access, and costs associated with Cape-ivy removal at each site. Habitat quality and rare species presence were weighted the highest for ranking contracting sites. Additional sites were prioritized for volunteers to work on due to easy access and minimal hazards at these sites. The use of this ranking system was continued in 2005 and 2006 and all high to moderate priority sites in the initial site list were removed. Priorities were maintained throughout the project. At the 2004 California Invasive Plant Council annual conference, new information regarding the fertility of Cape-ivy revealed that select infestations within GOGA were likely host to the fertile variety of ivy. Morse Gulch, part of the area with fertile seed, was moved up in priority as a result.

Most new sites discovered at PORE in 2005 and 2006 were not selected for treatment due to a lack of funds to conduct work in new sites, with the exception of the Coast Trail site which occurs in the wilderness area, the new Lagunitas Creek site which supports habitat for endangered species, and the Lupton House site which had the potential to spread down a drainage into high quality riparian habitat. The Inverness Park sites will be included as part of another park project to restore the Giacomini wetlands. Other sites

were not selected because they were not included in the original proposal and were lower priority in terms of habitat or were too large to take on at this time. These include L Ranch and Palomarin at PORE.

Site Treatments

Point Reyes National Seashore

Removal of Cape-ivy at PORE involved contracted crews, volunteer groups, individual contractors, the California Exotic Plant Management Team (EPMT), the Marin Conservation Corps AmeriCorps, and park staff. Follow-up removal was completed primarily by volunteers and park staff, but follow up has been and can be contracted as well depending on the amount of follow up necessary.

Initial removal in this report refers to either sites that have not been worked on in over 3 years and have grown back (those treated between 1999 and 2001) or sites where removal work has never occurred before. While some sites did have some initial removal done prior to 2001, the majority of work done at that time consisted of cutting containment lines around sites so that Cape-ivy would not immediately spread. Initial removal was done by park staff, volunteers or contractors. Park staff and volunteers used rakes and Mcleods to scrape the ground of Cape-ivy and other debris. Hand picks were used to loosen the soil for removal of individual plants in less dense areas to ensure that all root material was removed from the ground. Loppers and hand saws were also used when necessary to cut branches in order to access the Cape-ivy. In many cases, there was a lot of other dense vegetation that needed to be compromised in order to be able to remove the Cape-ivy. However, most of this native vegetation, such as blackberry, hedge nettle, cow parsnip, salmonberry, poison oak, alders, and willows, grew back very quickly. Sites of this nature treated in 2004 had these species fully grown back in by 2006. Cape-ivy debris was piled up on tarps where it was left to compost. To ensure quicker composting and less follow-up, piles were covered with a second tarp which was secured with ground staples.

Contract crews used similar methods as described above. The major difference was the use of chainsaws; contracted sites were often much more heavily vegetated. Special measures were taken to protect rare species. To the greatest extent possible, all non-weed material adjacent to creeks was left in place to provide cover and reduce erosion within California freshwater shrimp habitat. Work locations and timing were adjusted as needed when biological monitors located California red-legged frogs within treatment areas.

Golden Gate National Recreation Area

Removal efforts were by lead by multiple work group types. The majority of large infestations were initially treated by a contracted forestry crew in the fall and winter months. Initial removal methods involved cutting back and hauling infested native vegetation to clear 90% of the infestations. Material was either hauled to debris dumpsters when accessible or piled and covered with landscape fabric to decompose on site. Park volunteer programs assisted in smaller-scale removal efforts in sensitive and appropriate sites.

The equivalent of three full time AmeriCorps members were hired to assist the project manager in hand removal of re-sprouting Cape-ivy throughout the course of the grant. Five individual contractors were used to conduct hand removal follow-up during peak seasons of Cape-ivy re-growth. Herbicide foliar application was used in areas of low native vegetative cover. Herbicide application was conducted by Natural Resources staff and the project manager. In 2006 herbicide efforts increased with the assistance of an SCA Exotic Plant Management Team.

Several treatment methods were tested at both parks. At one GOGA site, experiment plots were set up to test propane flaming during the wet season in 2005 as a method of eradicating re-sprouting Cape-ivy. Three treatments at three week intervals did not prove effective as it appeared underground roots were not killed by the heat. The method did not appear to be effective on Cape-ivy; however it demonstrated effectiveness on other invasive plant species and has been used at restoration sites. Herbicide testing was done on both piles and infestations at PORE. Hydro-obliteration, a technique using high pressure water, was tested at GOGA. (See Lessons Learned).

RESULTS

Point Reyes National Seashore

All 27 target acres were treated within the project period. In 2004, 8.75 acres of initial Cape-ivy removal was conducted. After completion of compliance requirements and hiring of a project manager, the fieldwork began in April of 2004. The first few months were spent re-inventorying all sites and adding new sites as they were found. Due to chainsaw use constraints during spotted owl breeding season (February through July), initial removal began in late August through September of 2004. It took on average 210.4 person hours for contractors to remove one acre of Cape-ivy; heavy brush made access to sites difficult and required more chainsaw work than expected; hauling plant material to dumpsters and filling dumpsters was time consuming; lastly, some sites such as Glenbrook Creek and Lake Ranch required 30 to 45 minutes of hiking time each way. With the given conditions and the cost for contracting, removal of Cape-ivy by contracted crews came to an average of \$7,332 per acre. Additional removal was conducted by volunteer groups, park staff, the California Exotic Plant Management Team (CaEPMT), and individual contractors.

In 2005, 16.72 acres of initial Cape-ivy removal was conducted throughout the Seashore. It took an average of 203.7 person-hours for contractors to remove one acre of Cape-ivy, six person-hours fewer per acre than the previous year. Contracted costs increased by 4%, averaging \$7640 per acre. Long hiking time was again an issue for some sites such as Glenbrook Creek and Pelican Point. These sites, located within the perimeter of the 1995 Mount Vision Fire, have extremely dense vegetation that is difficult to navigate through. Niman Ranch was a particularly difficult site as there was a tremendous amount of eucalyptus duff that contractors had to remove to get to the Cape-ivy. Dense vegetation was also present at the majority of the other sites; however, work continued to progress

swiftly in the second year of removal. In addition to the acreage removed by contracting crews, the CaEPMT and volunteers removed 0.123 acres at various sites. Two to four full follow-up visits were made to each site, including all 2004 sites and many of the 2005 sites.

In 2006, contract crews treated the remaining 2.02 acres. The majority of work focused on follow-up removal at all previously treated sites. Individual contractors and park interns supervised by an AmeriCorps volunteer coordinator were a less expensive alternative for conducting follow up. Each site was retreated between two and four times throughout the year. Larger sites usually required many visits just to complete a single round of follow up and thus did not have as many complete follow ups throughout the year as smaller sites did.

The table below summarizes acres treated by site across each funded year:

Cape-ivy Site	Acres Treated		
	2004	2005	2006
McClure's Beach	0.007		
Palomarin Parking Lot	0.097*		
Dogtown Satellite	0.113*		
Lake Ranch Shortcut	0.192*		
Lairds Landing	0.211		
Greenpicker	0.214		
NDOC	0.224	0.007	0.240
Fern Creek	0.24	0.196	
Pierce Point Ranch	0.322	0.112*	
Lake Ranch Sites	0.442*		
McCurdy Gulch	0.757		
Pierce Pt. Eucalyptus Site	0.954*		
Lagunitas Creek	2.159*		0.335*
Glenbrook Creek	2.814**	2.765*	0.025*
RCA Creek		0.119*	
Muddy Hollow		0.125*	
Rift Zone		0.155*	
Home Ranch		0.195*	
Randall Spur		0.284*	
Niman Ranch		0.507*	
Marshall Beach/Lairds Landing		0.6*	
Pelican Point		0.602*	
Dogtown		1.258*	
Wilkins Ranch		2.495*	
Lower Glenbrook Creek			

Chimney Rock/ Nunes Ranch		2.964*	
Palomarin		4.331*	1.55*
Coast Trail			0.113*
Total Acres Treated	8.746	16.715	2.263
Project Total			27.724

Table 1. Cape-ivy project site treatment summary. (Note: * = Contractor, **= Combination of contractors and volunteers; no * signifies work completed by park staff, interns and volunteers.)

Golden Gate National Recreation Area

Natural Resources staff treated 29.86 of the 39.89 acres of the grant (Table 2). Shortfalls in treated acres were due in part to the higher contractor cost, as projected treatment acres were based on 2001 bid estimates. Accessibility and site conditions were more challenging as the grant progressed. Wetlands, dense stands of poison oak, steep slopes and distant locations impeded the rate of removal. Despite the shortfall in acreage, sites were treated in such a method as to leave them in a condition easily controlled by restoration volunteer program efforts.

Table 2. Cape-ivy treatment acreage by work group

	FY04	FY05	FY06
Contractor crew	3.5 acres	10.5 acres	8.1 acres
Volunteers		0.4 acres	0.6 acres
Herbicide		0.7 acres	6.1 acres
Total	3.5 acres	11.6 acres	14.8 acres

Total Treated: 29.9 acres

The most important achievement of the Cape-ivy removal project expanded upon previous efforts by crews, volunteers and staff, completing the treatment of infestations on entire watershed levels. In Tennessee Valley, 6.5 acres were treated in two tributaries and the main corridor of Elk creek. At Stinson Gulch, where 3.2 acres were infested, 1.5 acres were treated in 2005 and 1.2 acres with the earlier grant. Follow-up efforts are now at a manageable level and maintained through Park volunteer programs.

Another important success was the treatment of remote satellite populations. Sweeney Ridge in the south district hosts diverse coastal scrub on steep impenetrable slopes. Infestations are remote and three small patches totaling a quarter acre were treated that volunteers would otherwise not have been able to access.

Of all vegetation types, Cape-ivy removal in dry coastal scrub appears to have been the most successful. In Rodeo Valley, patches that were discovered over the course of surveys were treated with very few revisits need. Also, four sites from the first grant have been resurveyed for several years with no individuals of Cape-ivy found. Even over the course of this grant, a one-acre site on the Marincello trail has been reduced to annual visits for only a handful of individuals after intensive attention early on.

MONITORING AND FOLLOW-UP

Point Reyes National Seashore

Two types of vegetation monitoring are being conducted to document the success of removal of Cape-ivy at PORE. In 2004, photo monitoring points were set up and species lists compiled to show the condition of native habitat prior to treatment. At each point, between one and three photographs were taken in different directions to give a visual overview of each site prior to removal. Each site has a species list, specifying the dominant native and non-native species inside and outside of the site boundary. This provides baseline data to which future species composition can be compared. At the end of this project, a project binder was prepared including a copy of this report, individual maps of each project area showing pile locations and treatment perimeters, and a detailed follow-up worksheet for each site with dates for follow-up, tarp removal, and any other prescribed maintenance. It is now the responsibility of the park to maintain these sites through volunteer and internship assistance. Funding to support a fourth year of an AmeriCorps Habitat Restoration Volunteer Coordinator will ensure the long-term success of this project. Funds have been secured to continue this program through FY09. In FY09, 70% of the position will be dedicated to cape-ivy management and 30% will be funded by a dune restoration project.

Golden Gate National Recreation Area

Site monitoring relies upon established photomonitoring points. These points will continue to be maintained by park staff to determine site success over time. Follow-up maintenance of sites is currently underway through the GOGA Habitat Restoration Team volunteer program.

DISCUSSION AND LESSONS LEARNED

Point Reyes National Seashore

Some of the methods used in Phase Two of NRPP funding were a large improvement over those used in Phase One (1999-2001). The goal of Phase One was to *contain* patches of Cape-ivy. However, since very little work was done from the time that project ended until this recent project began, Cape-ivy had time to fully recover and containment lines grew back in. While full eradication is a necessity with this species, it was an unrealistic goal for the scale and extent of Phase Two. Eradication requires three full years; year one is initial treatment with years two and three generally providing sufficient follow-up time for eradication in most habitat types. Because of funding cycles and breeding bird constraints, Phase Two could not treat all sites in year one; initial treatments were conducted through year three. While many sites are near eradication at the completion of Phase Two, all sites required some level of follow up in 2007. We will continue to follow up on select sites in FY08-09, and have secured Recreational Fee monies to do so through a task agreement with the Marin Conservation Corps AmeriCorps member.

Golden Gate National Recreation Area

This project represents the most extensively evaluated invasive plant species at GOGA and has served as a model in evaluating other invasive plant species in the park.

Development in managing large scale debris management has opened up the opportunity to explore new techniques that include a matrix of herbicide, debris boxes, covered piles, propane flaming and the new hydro-obliteration. These tools have been adapted for use on other invasive plant species as well as understanding their use to meet site-specific needs. The Cape-ivy removal project established a new approach to large-scale management of the species and demonstrated the use of propane flaming for the greater restoration community. These approaches were shared in a poster format at the California Invasive Plant Council Conference in Chico, California in 2005.

Summary of Lessons Learned

- *Cost Estimates.* Changes in contractor cost significantly affected the ability of this project to achieve all project goals. Original hourly costs were calculated at \$25 per hour. In the three years between the proposal submittal and receipt of funds, hourly rates increased to over \$40 per hour. Contractors stated their increases were based on new workers' compensation requirements and increased fuel costs. By the end of the project, hourly rates had increased closer to \$45 per hour. Future projects should carefully examine hourly wages and budget for cost increases (within reason). Additionally, it would help if parks had regional assistance in negotiating these types of contracts as parks rely more and more on contract assistance for vegetation control projects.
- *Follow-up* on sites was originally programmed through large contractors, however through the course of this project both parks successfully worked with AmeriCorps, SCA, volunteers and small contractors (individuals working for less than \$2500 on individual sites). Our "small contractors" became invaluable and conducting independent follow up with little direction, focusing on removing resprouts and reporting on site conditions. Parks with easy access to local labor may find this approach likewise efficient and cost effective.
- *Herbicide.* At GOGA, herbicide application was worked best under conditions with low native vegetative cover such as eucalyptus forests and iceplant. Foliar application was not appropriate in vegetation that was dense and difficult to move around in, such as coastal scrub; brushy sites with high native cover return required significant cutting back of vegetation for follow-up visits. At PORE, herbicide treatments at the Lupton site netted a 54% reduction in Cape-ivy cover.
- *Re-mapping* is crucial for projects that have a lapse in funding between projects. While original sites were mapped relatively accurately, it was evident that some sites had grown considerably since the 2001 treatments. For example, the Palomarin site at PORE extended far beyond the originally mapped boundaries; remapping in 2005 added an additional 2.36 acres. Mapping of other new PORE sites added an additional 3.56 acres.
- *Mapping.* An MBX-3 differential GPS unit in connection with a Garmin III+ and HP iPaq handheld computer with ArcPad software was superior to a Trimble Geo Explorer with BOB differential GPS receiver when mapping under tree canopy.
- *Debris pile control.* At PORE, use of landscape fabric or "tarping" to cover vegetative debris piles was significantly more efficient and effective than previously methods of mulching and pile-turning. In high wind or seasonally flooded areas, it is critical to use ground staples every 12-inches with supplemental heavy woody debris

to weight down the pile when available. After 18 months, the underlying material is dead and the tarp can be removed. Any small quantities of live Cape-ivy remaining in the pile is easily removed, bagged and transported off-site.

- *Debris pile guidelines.* At GOGA, cutting vegetation requires approximately a quarter of contracted crew time. Raking, hauling and consolidating piles consumed the other three-quarters. Therefore a reduction in debris removal represents a significant cost savings. Debris boxes were used when sites were close to roads, however many sites had vegetative debris piled on site. Large amounts of time were consumed over the course of the first year in raking, covering and weeding around the numerous and small vegetative piles by staff and AmeriCorps members. Contracting modifications in fall of FY03 included creating fewer debris piles that were larger and shaped for ease of covering. This made a significant difference in time spent managing piles over the course of the year; however, it slowed the work of the crews. In the final year, herbicide worked well to manage piles in appropriate locations.
- *Alternatives to landscape fabric.* A single pile was covered with a clear tarp to test solarization as a of debris pile management. During the winter months, the Cape-ivy continued to grow prolifically under the tarp; however, in the warm summer months, the Cape-ivy decomposed fully. The clear tarp cost about the same as the black landscape fabric and was perhaps only slightly more effective. Black landscape fabric is probably still the preferred choice due to its durability; clear plastic disintegrates rapidly and should be removed as soon as decomposition is complete. However, for any Cape-ivy patches that occur in open sun, clear plastic sheeting may be a highly effective method for solarizing.
- *New technologies.*
 - *Flaming* was applied to treat seedlings. This was unsuccessful. Equipment was heavy and difficult to get out to the sites, and required multiple treatments. It was simpler to let seedlings grow to a visible size and then remove by hand.
 - *Hydro-obliteration* uses high pressure water applied to vegetation. This tool clears the area of non-woody vegetation and appears to greatly reduce the biomass. Early trial runs at GOGA demonstrate that it has the similar effect of cutting, mowing or burning. Most native vegetation has re-sprouts at the root crown shortly after treatment. Little water run-off was observed once applied. Test plots are underway to quantify effects. Results are forthcoming.

CONCLUSION

This project successfully addressed a critical need to control a highly invasive, seriously impacting non-native plant¹ throughout a variety of habitats at two national park units. Without this funding, Cape-ivy would have continued to infest significant riparian, wetland and upland habitat. While total eradication does not happen overnight, both parks are committed to this ongoing effort to get all known sites to control levels. All existing sites will continue to be monitored, and adjacent drainages and roads surveyed for the

¹ California Invasive Plant Council Inventory Database. <http://www.cal-ipc.org/ip/inventory/>

next two years through existing early detection programs the San Francisco Bay Area Inventory and Monitoring Network's Early Detection Program (initiated in FY07).

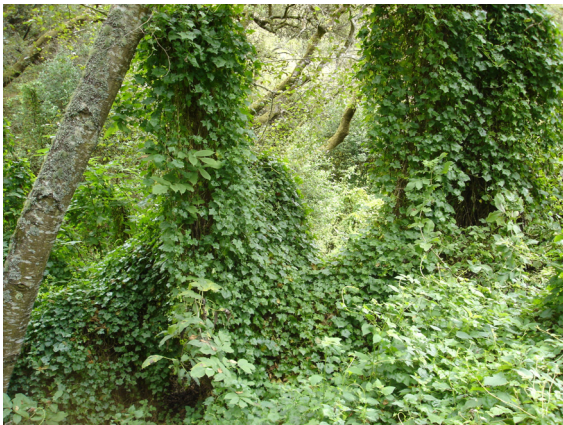
Appendix I: Project Photographs



Photos 1 & 2: Golden Gate NRA Site 4019 before treatment (left) and after (right). Native wetland species *Scirpus* and *Juncus* released from Cape-ivy cover.



Photos 3 & 4: Golden Gate NRA Stinson Gulch before treatment (left) and after (right). Wetland habitat released from near 100% Cape-ivy cover.



Photos 5 & 6: Point Reyes NS Wilkin's Ranch before treatment (left) and after (right).



Photos 7 & 8: Point Reyes NS Lagunitas Creek before treatment (left) and after (right).



Photo 9: PORE-GOGA Field test using flaming to wilt seedlings at Palomarin site (left). Photo 10: Final composting of Cape-ivy piles.

Appendix II: Budget Details

FY04	GOGA	PORE
Personnel Services	10,368	27,675
AmeriCorps member	26,000	-
Contractor Crew	19,900	51,580
Individual Contractor	11,400	-
Supplies	8,459	495
GSA Vehicle	-	1,310
Total	76,127	81,060
FY05		
Personnel Services	39,464	49,831
AmeriCorps member	28,000	4,000
Contractor Crew	70,000	82,501
Individual Contractor	8,665	-
Vehicle	3,000	3,378
Supplies	3,854	2,530
Total	152,983	142,240
FY06		
Personnel Services	52,621	71,636
AmeriCorps member	13,000	30,000
Contractor Crew	68,482	47,656
Individual Contractor	9,480	5,427
Vehicle	6,870	6,184
Supplies	5,704	6,206
Travel	-	491
Total	156,157	167,600