

Developing Landscape Plant Selection Lists for the Presidio of San Francisco

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The problem

The Presidio of San Francisco is an urban national park with significant natural and cultural resources. Over the last 15 years both natural and cultural landscapes on the Presidio have undergone extensive restoration. Restoring cultural landscapes often involves planting non-native plants. How can the Presidio protect both its cultural and natural landscapes during this process? By developing lists of approved and prohibited plants.

The Presidio

The Presidio is home to a dozen distinct plant communities, made up of more than 300 species of native plants (Frey and Stevenson 2010). The plants of the Presidio include nineteen plant species identified as rare by the California Native Plant Society, five of which are on the federal list of threatened and endangered species. Because of its historic significance, the Presidio was designated a National Historic Landmark District in 1962 (National Park Service and Presidio Trust 2001). The Presidio was included within the legislative boundary of the newly formed Golden Gate National Recreation Area in 1972. In 1996, Congress created a new federal agency, the Presidio Trust, to manage the interior 80% of the Presidio. The Presidio Trust's mission is to preserve and enhance the natural, cultural, scenic, and recreational resources of the Presidio for public use in perpetuity, while achieving long-term financial sustainability. The Presidio Trust and the National Park Service work together, supported by the Golden Gate National Parks Conservancy, to manage the 1,500 acres of the Presidio. The Vegetation Management Plan (National Park Service and Presidio Trust 2001) and the Presidio Trust Management Plan (Presidio Trust 2002) are two of the key documents that guide work in the Presidio.

Rehabilitating cultural landscapes

Rehabilitating cultural landscapes requires an analysis of current conditions, historic photos, historic aerial images, and an understanding of historic cultural norms to identify what exists at the site and what was there historically. Period photos can be particularly useful to help determine the complexity and extent of the historic plantings. Trees and any unique or old specimen plants that may date from the period of significance are often retained. However,

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additional plants are usually required to rehabilitate the look and feel of the landscape. If possible, species used historically are used during rehabilitation. However, certain factors can lead to species being substituted for; the historic species may be (1) not identifiable, (2) hard to maintain, (3) pose a genetic contamination risk, or (4) be invasive. In these cases, a species that has similar form may be chosen as a substitute. Many of the Presidio's landscapes were created over time without specific planting plans so the Presidio has some latitude to select plants that fit our modern-day restrictions and then arrange them in a manner that is both within the guidelines of rehabilitation and consistent with any restrictions and desires for the site.

Landscape plant selection lists

Weed risk assessments have been used to evaluate plants proposed for use for at least 25 years (e.g., Forcella et al. 1986). These assessments evaluate traits of the potential invader (Goudet and Keddy 1988), characteristics of the recipient habitat, climate matching (Thuiller et al. 2005), and information on whether the species has been recorded elsewhere as a weed (Westbrooks 1981; Rejmánek 2000; Thuiller et al. 2005; Richardson and Thuiller 2007). Inclusion of all of these factors helps to accurately predict invasiveness, but the factor that is most predictive is whether or not the species is invasive in another region (Mack 1996; Reichard and Hamilton 1997; Kolar and Lodge 2001; Gordon et al. 2008). If the region where the species is already invasive has a climate similar to the recipient region, the risk of invasion increases (Thuiller et al. 2005).

Our goal was not only to evaluate a species for invasiveness but also to evaluate a host of other factors including potential to cross-pollinate with native and non-native plants, maintenance, and historic compatibility. These other factors were added to invasiveness for evaluation. In addition, we adopted a simplified approach assessing whether the species is invasive elsewhere and whether the species is invasive in particular regions (Mediterranean climates, coastal California, Bay Area, and San Francisco) as a proxy for a more complete weed risk assessment.

Making Version One: List creation

After the Presidio became a park, the rehabilitation of designed landscapes came under new scrutiny. Natural resources staff were sometimes faced with the challenge of seeing new plantings go in, or being asked about a plant, and not having a clear policy that would allow for the prohibition of unwanted plants.

The need for a systematic approach led to the creation of a set of landscape plant selection lists in January 1999 as part of the creation of the Vegetation Management Plan (National Park Service and Presidio Trust 2001). The three lists contained 256 taxa.

The plant lists were intended to provide plant selection guidance only; any planting design used the Presidio lists only as a starting point. Plant choices were then assessed as part of project review by a team including planning, natural resources, integrated pest management, and maintenance staff.

Plant List 1 contained plants that could be used without conditions: they met sustainability goals, did not pose a threat to native plant resources, and maintained the character of

the Presidio's historic landscapes.

Plant List 2 contained plants that could be considered for use under certain conditions. Proponents were encouraged to avoid the use of any plant species that might escape into natural areas, historic forest, or other landscaped areas. The condition usually referred to how far away from the Native Plant Community Zone (NPCZ) the species could be planted, but other restrictions could be applied. Some examples include:

- Do not plant within 300 feet of the NPCZ.
- Limited to historic neighborhoods and do not plant within 100 feet of the NPCZ.
- Limited to historic neighborhoods and do not plant within 50 feet of the NPCZ.
- Surround by at least 15 feet of lawn or a hard barrier (e.g., sidewalk).
- Only to be used in turf and must be mown to prohibit seed set.
- Only sterile variety is allowed.
- Grown at Presidio Native Plant Nursery.¹

Plant List 3 contained plants that were prohibited from use. This list contained:

- Horticultural species that are difficult to confine to formal landscape areas, become aggressive competitors, and/or are difficult to eradicate once established in natural areas;
- Species that, for pest management reasons, are inappropriate inside the Presidio (e.g., those which attract aphids); and
- Horticultural species, including commercially available “California Native” species, that have the potential to cross-pollinate or hybridize with Presidio-native plants.

The 1999 lists served their function well, but as the number and scale of designed landscape rehabilitation projects accelerated, additional plants were requested. The 1999 lists had not made any provisions for reviewing new species, so the evaluation differed by species over time. And, because new information on species became available over time, some species need to be shifted to a different list—but there was no process for that either. Each year new species are introduced into the landscape trade. A list that doesn't change means that these new species are not available. It became clear that the system needed to be updated.

Making Version Two

Once we determined that we were going to update the lists we made a comprehensive list of plants to be evaluated and identified experts who could help us.

In May 2010 we compiled a list of 446 taxa for review. The list included most of the 256 taxa on the 1999 lists, excluded a few taxa that are invasive and not likely to be requested (e.g., *Rubus discolor*), included only a few natives (or potential natives) that are routinely used in the landscape trade in the Bay Area (e.g., *Prunus ilicifolia*), added all species that had been proposed since the original list had been published, and added any species that Presidio Trust staff identified that might be useful in creating designed landscapes in the future.

We identified Marcel Rejmánek, Barrie Coate, and Frank Almeda as professionals whose input could assist our process. Rejmánek is a professor at the University of California–Davis who has published widely on predicting and quantifying the risk of invasions by plants. Coate owns a business in the Bay Area, Barrie D Coate & Associates, and has been practicing horticultural analysis for decades. Frank Almeda is chairman and senior curator of botany at the California Academy of Sciences. He has published widely on the taxonomy of various tropical plant groups, plant biodiversity, biogeography, and evolution, and is a co-author of the Marin County Flora (Howell et al. 2007).

We asked Rejmánek and Coate to review the list of the 446 taxa, note invasiveness risk as they perceived it, and make comments about suitability in the Presidio landscape. We asked Almeda to identify genera for which we should be concerned about cross-pollination. Once Almeda determined that there was only a very small possibility of intergeneric crosses for any of the species in the Presidio, we asked him to review all the genera that include both a native plant found inside the Presidio and a non-native plant on the landscape plant selection lists. He reviewed 49 genera and identified ten that would likely pose a risk (Table 1).

After compiling our expert input on the 446 taxa, we were able to assign each to one of our three lists.

Moving beyond Version Two: Reviewing species

After building Version Two, we developed a process for reviewing new proposed species (and periodically evaluating species already on the list). First, we identified characteristics of each list to which a plant might get assigned (Table 2) and built a matrix (Figure 1) to help assign plants to lists. List 2 was broken down into sublists to keep the total number of lists to three while keeping the conditions diverse enough to capture restrictions that might be imposed. Second, we creating a questionnaire for proponents of plant species. The questionnaire functions to collect information relevant to the listing process. See Figure 2 for the most recent version.

From May 2010 through August 2011, 16 new plant taxa were reviewed for the first time, and 23 taxa already on a list were reviewed again. Of the 16 new species, eight have been added to List 1, four to List 2, and four to List 3. Of the species that were already on a list that were reviewed again, six remained on their respective lists; four were moved from List 1 to List 2, five from List 1 to List 3, one from List 2 to List 1, and six from List 3 to List 2; and one was left on List 2 but had its condition changed.

Table 1. Genera reviewed to determine risk of cross-pollination with native species.

	Low risk	High risk
Acer	Galium	Arctostaphylos
Aesculus	Lasthenia	Ceanothus
Allium	Lathyrus	Fragaria
Alnus	Lonicera	Iris
Arbutus	Mahonia	Lotus
Aristolochia	Mimulus	Salix
Asarum	Nassella	Quercus
Bromus	Poa	Ranunculus
Carex	Prunus	Rosa
Clarkia	Rubus	Rumex
Cornus	Sambucus	
Cyperus	Satureja	
Daucus	Silene	
Dichelostemma	Solanum	
Dichondra	Solidago	
Equisetum	Vaccinium	
Erigeron	Vicia	
Euphorbia	Viola	
Festuca	Vulpia	
Fraxinus		

List	Title	Definition	Condition
1	Approved plants	Low invasive risk, no hybridization risk, supports the historic character of the landscape, and does not require excessive maintenance once established.	Allowed without condition
2A	Historic and moderate invasion risk and spreads by seed	Historic Presidio species, excluding species with high invasive potential and most genera that are hybridization risks with natives, except <i>Rosa</i> sp.	Limited to historic neighborhoods and do not plant within 100 feet of the NPCZ
2B	Historic and moderate invasion risk and not known to spread by seed		Limited to historic neighborhoods and do not plant within 50 feet of the NPCZ
2C	Moderate invasion risk and only known to spread vegetatively	Moderate invasive not known to spread by seed, or historic Presidio species that are not known to spread by seed and are not invasive in the Bay Area or coastal California but are invasive in other relevant climates	Surround by at least 15 feet of lawn or a hard barrier (e.g. sidewalk).
2D	Moderate invasion risk and spreads by seed	Moderate invasive known to spread by seed, or historic Presidio species that are known to spread by seed and are not invasive in the Bay Area or coastal California but are invasive in other relevant climates	Do not plant within 300 feet of the NPCZ
2E	Presidio native or presumed Presidio native	Select natives likely to be requested	Grown at Presidio Native Plant Nursery. Requests due July 1st 18 months before planting.
2F	Insufficient information	Insufficient information or conflicting information to assign to either low or moderate risk. Treated as moderate risk. Not historic	Do not plant within 300 feet of the NPCZ
2G	Turf	Turf species	Only to be used in turf and must be mown to prohibit seed set
3	Restricted plants	High invasion potential - Invasive in Bay Area, coastal California, or other relevant climates. Or, important vector for SOD.	Not allowed

Table 2. List definitions.

Definitions.					
Invasive - Difficult to confine and difficult to eradicate					
Relevant climates - Mediterranean Europe, Australia, Southern South America, South Africa					
Non-relevant climates - all other climates					
Historic - documented as being present for more than 50 years					
	Invasiveness				Genetics
	High potential - Invasive in Bay Area, coastal California, or other relevant climates	High potential - Invasive in other relevant climates but not in Bay Area or coastal CA	Moderate potential - Invasive only in non-relevant climates	Low potential - Not known to be invasive	Potential to cross-pollinate with natives
Historic @ Presidio (spreads vegetatively)	3	2C	2B	1	2A/3*
Historic @ Presidio (spreads by seed)	3	2D	2A	1	2B/3*
Non-historic (spreads vegetatively)	3	3	2C	1	3
Non-historic (spreads by seed)	3	3	2D	1	3
Native	2E	2E	2E	2E	2E

* Requires case by case review to assign to either category

Figure 1. Matrix used to assign plants to lists.

PLANT QUESTIONNAIRE					
Latin name		Common name			
Is this species already listed?		List 1 / List 2 / List 3 / Not yet listed			
Note any latin synonyms:					
Evaluator		Date			
<i>Determination: To be completed by Presidio Trust</i>					
A		Use		Y	N
A1	Was species planted historically (more than 50 years ago) at the Presidio?				
A2	Has species been used subsequent to historic period of significance but maintains the character of the designed landscapes found at the Presidio?				
A3	Was species planted historically (more than 50 years ago) in the SF Bay Area?				
A4	Was species planted historically (more than 50 years ago) in California? Check 1950s or 60s Sunset Western Garden or 1950s or 60s Manual of Cultivated Plants by L. H. Bailey.				
A5	Is species low maintenance, long-lived, or drought tolerant once established?				
A6	Is species commonly subject to pests or diseases?				
A7	Is species native or potentially native to San Francisco?				
B		Genetics			
Does species pose a threat because of potential cross-pollination to:					
B1	Native plant species?				
B2	Horticultural plant species?				
C		Invasiveness			
C1	Does species spread vegetatively?				
C2	Does species spread by seed?				
C3	Is species documented as invasive anywhere? See www.hear.org/GCW				
C4	Is species documented as invasive in other Mediterranean climates? Mediterranean Europe, Australia, Central Chile, Southern South America, or South Africa www.hear.org/GCW				
C5	Is species documented as invasive in the US? In which states (or regions)? http://plants.usda.gov/java/				
C6	Is species documented as invasive in Bay Area or coastal California? http://science.nature.nps.gov/im/units/sfan/vital_signs/invasives/atlas/2010Priority%20Lists_GOGA.pdf http://www.cal-ipc.org/ip/inventory/weedlist.php?region=CW				
C7	Does species occur in the Bay Area? If so, report counties. www.calflora.org				
C8	Is species known to spread in horticultural practice in Bay Area?				
Notes / Report of findings					

Figure 2. May 2011 questionnaire.

Each time a list is updated, a PDF is created and posted on a shared network drive. That new document joins the most up-to-date questionnaire and a text description. Presidio Trust staff that are managing projects have access to this file and share it with any consultants they work with.

Conclusions

There is inherent tension between being true to historic landscape species and filtering that list for concerns about invasive species, maintenance, and cross-pollination risk. However, the transparent process and questionnaire described above (1) empowers a project proponent to identify potential new species, (2) makes the process of adding new species clear, (3) almost doubled the number of reviewed species (Table 3), and (4) has established transparent criteria for species assessment.

Using only the characteristic of whether a species is invasive elsewhere to evaluate invasiveness has the benefit of speeding up the review process but increases the risk of allowing invasive species and of excluding non-invasive species.

All 446 taxa reviewed by the experts have not yet gone through the questionnaire process, so they have received a different level of scrutiny than the species being reviewed using the questionnaire. A questionnaire should be developed for all species and periodically reviewed.

Occasional problems crop up when dealing with plant synonyms. If the species is reviewed under one name and reviewed again under a different name, there is a risk that the result of evaluation will not be the same. This is particularly true if one species was reviewed as part of the long list and a synonym is reviewed with a questionnaire. A database would help with this problem.

The compiled information should be transferred to a new web-accessible database. In an online database links can be checked more easily by a project proponent and any information relevant to the species can be stored along with the questionnaire.

This process can be a model for other parks and municipalities considering plants for use in the designed landscape. All landscapes include natural and cultural resources, and all landscapes are at risk from invasive species.

Acknowledgments

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Michael Boland has been dedicated to the Presidio for more than a decade and was essential in getting the lists to Version Two.

Michael Lamb is a vigilant steward of the Presidio's landscape and was a partner in building these lists.

Table 3. Taxa on each list for Version 1 (1999), Version 2 (2010), and after one year of Version 2 (as of 22 August 2011).

	List			Total
	1	2	3	
1999	137	26	93	256
2010	139	167	140	446
8/22/2011	139	180	143	462

Endnote

1. The Presidio's own native plant nursery collects seed by watershed to be grown for projects in the Presidio. To protect genetic diversity, our protocols call for collecting no more than 5% of available seed, collecting throughout the growing season, and collecting from as many individuals as possible. Under some circumstances propagules from outside the Presidio are used. In these cases it must be determined that (1) there are insufficient propagules inside the Presidio to maintain a viable population, (2) a suitable collection site exists, and (3) a suitable planting site exists.

References

- Bell, C.E., C.A. Wilen, and A.E. Stanton. 2003. Invasive plants of horticultural origin. *Horticultural Science* 38(1).
- Forcella, F., T.J. Wood, and S.P. Dillon. 1986. Characteristics distinguishing invasive weeds within *Echium* (Bugloss). *Weed Research* 26: 351–364.
- Gaudet, C.L., and P.A. Keddy. 1988. Predicting competitive ability from plant traits: A comparative approach. *Nature* 334: 242–243.
- Gordon D.R., D.A. Onderdonk, A.M. Fox, R.K. Stocker, and C. Gantz. 2008. Predicting invasive plants in Florida using the Australian Weed Risk Assessment. *Invasive Plant Science and Management* 1:178–195.
- Howell J.T., F. Almeda, W. Follette, and C. Best. 2007. *Marin Flora: An Illustrated Manual of the Flowering Plants, Ferns and Conifers of Marin County, California*. Mill Valley, CA: California Academy of Sciences and California Native Plant Society (Marin Chapter).
- Kolar, C.S., and D.M. Lodge. 2001. Progress in invasion biology: Predicting invaders. *Trends in Ecology and Evolution* 16: 199–204.
- Mack, R.N. 1996. Predicting the identity and fate of plant invaders: Emergent and emerging approaches. *Biological Conservation* 78: 107–121.
- National Park Service and Presidio Trust. 2001. *Vegetation Management Plan and Environmental Assessment*. San Francisco: National Park Service and Presidio Trust.
- Pimentel, D., R. Zuniga, and D. Morrison. 2005. Update on the environmental and economic costs associated with alien-invasive species in the United States. *Ecological Economics* 52: 273–288.
- Presidio Trust. 2002. *Presidio Trust Management Plan: Land Use Policies for Area B of the Presidio of San Francisco*. San Francisco: Presidio Trust.
- Reichard, S.E. 1997. Prevention of invasive plant introductions on national and local levels. In *Assessment and Management of Plant Invasions*. J.O. Luken and J.W. Thieret, eds. New York: Springer-Verlag, 215–228.
- Reichard, S.H., and C.W. Hamilton. 1997. Predicting invasions of woody plants introduced into North America. *Conservation Biology* 11: 193–203.
- Richardson, D.M., and W. Thuiller. 2007. Home away from home—objective mapping of high-risk source areas for plant introductions. *Diversity and Distributions* 13: 299–312.
- Thuiller, W., D.M. Richardson, P. Pysek, G.F. Midgley, G.O. Hughes, and M. Rouget. 2005. Niche-based modelling as a tool for predicting the risk of alien plant invasions at a global scale. *Global Change Biology* 11: 2234–2250.

- Westbrooks, R. 1981. Introduction of foreign noxious plants into the United States. *Weeds Today* 14: 16-17.
- Williamson, M. 1996. *Biological Invasions*. London: Chapman and Hall.
- Williamson, M., and A. Fitter 1996. The varying success of invaders. *Ecology* 77: 1661-1666.
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