Appendix C: Healthy Nature Planning and Analysis Reports

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Rancho San Antonio Open Space Preserve

Appendix C-1:

Biodiversity of the Midpeninsula Regional Open Space District

Prepared for:

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PREFACE

This report provides an overview and assessment of the biological conservation values within the Vision Plan Area—the approximately 371,000-acre area that includes the Midpeninsula Regional Open Space District's jurisdiction, sphere of influence, and adjacent land holdings. This summary touches on aspects of the biological resources within the District's approximately 57,000 acres of open space preserves, though importantly, this high-level assessment does not address important site-level conditions and considerations that are instead the subject of general plans, management plans, and other implementation plans.

The report integrates existing information, including prior regional plans, District policies, reports, scientific studies, and geographic information system data. It was developed by ecologist Jodi McGraw, with the assistance of Justin Burks, and input from Nadia Hamey, Registered Professional Forester, on forest management (Section 6).

The report completes a critical first task in the technical component of the Vision Planning Process, which is designed to evaluate the existing conditions of the biological resources within the plan area. Information contained in this report can be used to develop various aspects of the "Healthy Plants, Animals, and Water" component of the Vision Plan, including the goals, criteria, and priority actions; it also provides information that might aid outreach to the community through implementation of the project's Community Engagement and Public Participation Plan.

As the next step in the Vision Planning process, key components of the analysis presented here will be integrated in a spatial analysis designed to identify areas within the Vision Plan Area that are most important to conserving biodiversity. Data currently anticipated to be included in the analysis include:

- Vegetation, with scores for the various types based upon their ratings (Table 3, Figure 3);
- Streams, scored based upon the stream rating (Table 4, Figure 4);
- Watersheds, scored based upon the watershed rating (Table 5, Figure 5);
- Ponds (Figure 7);
- Rare species occurrences, with scores reflecting the frequency of rare species (Figure 8); and
- Landscape connectivity, including linkages as well as habitat patches weighed by their size (Figure 9).

Additional data presented in this report can be integrated into the analysis, which will be designed to identify areas where habitat protection, restoration, and/or management protects, can be conducted to promote one or more biodiversity conservation objectives.

Importantly, the maps here are developed for large-format printing and while they can also be viewed on a computer screen, they will lack detail if printed on letter-sized paper.

EXECUTIVE SUMMARY

Centered on the San Francisco Peninsula, the Vision Plan Area features diverse ecosystems of the Santa Cruz Mountains Bioregion, from salt-water wetlands to towering redwood forests. These ecosystems support rich assemblages of plants and animals, and provide a host of important services, including water filtration, crop pollination, and carbon sequestration. Their viability requires conservation of large contiguous habitat areas and management to address the various factors that fragment and degrade habitat. Conservation in the region, which is an important part of the Central Coast Ecoregion (TNC 2006) and the California Floristic Province, which is a global biodiversity hotspot (Myers et al. 2000), can also help promote statewide and global conservation.

Nearly 78% of the approximately 370,000-acre Vision Plan Area, which includes the District's jurisdiction, sphere of influence, and landholdings, features natural or semi-natural land cover, including vegetation and water (Table 1, Figure 1). Converted lands, including developed areas and intensive agriculture (e.g. row crops), are concentrated in the relatively flat Santa Clara Valley, leaving the wetlands that fringe the San Francisco Bay, and the variable terrain of the Santa Cruz Mountains relatively intact (Figure 1).

Terrestrial Communities

Across the Vision Plan Area, fine-scale variability in geology, soils, hydrology, and microclimate, as well as history of land use and natural disturbance, including fire, interact in complex ways to support diverse communities of plants and animals, which include 33 mapped natural plant communities (Table 1, Figure 1). The complex geology of the Santa Cruz Mountains plays a large role in the diversity of natural systems, by creating variable topography and giving rise to unique soils including serpentine, sandstone, and shale-derived soils, each of which features unique assemblages of plants and animals adapted to the their inimical conditions (Section 1.2).

Serpentine communities and maritime chaparral are among the Vision Plan Area's sensitive plant communities: globally rare communities that collectively cover on an estimated 19,648 acres within the plan area, including 1,355 acres in the District's nearly 57,000 acres of open space preserves (Table 2, Figure 2). Other sensitive communities include extensive wetlands, riparian forests, valley oak woodlands, and old-growth redwood forests.

Rare Species

These sensitive communities comprise several of the region's species 'hot spots'—species-rich areas that support many of the Vision Plan Area's 96 plants and 66 animals that are rare, threatened or endangered (Table 8). These species, which include 11 plants and 16 animals that have been listed as state or federally endangered (Tables 6 and 7), are concentrated in the region's grassland, maritime chaparral, riparian, serpentine, and old-growth forest communities, representative areas of which are found within the District's open space preserves (Table 8, Figure 8).

Aquatic Ecosystems

District open space preserves, and the broader Vision Plan Area, also feature important aquatic systems, including streams and ponds, which give rise to wetlands and riparian vegetation, provide a source of free water for terrestrial species, and support several rare and endangered species (Section 2). The Vision Plan Area's ponds provide breeding habitat for California red-legged frog, California tiger salamander, San Francisco garter snake, and western pond turtle, which require intact, adjacent upland habitats as occur within the District's open space preserves (Section 2.2).

The Vision Plan Area contains just over 1,100 miles of coastal streams, including 37 miles of cool, mountain creeks, such as San Gregorio Creek, that drain to the Pacific Ocean and provide habitat for endangered coho salmon—a species that is at the southern end of its range in the Santa Cruz Mountains (Table 4, Figure 4). These streams also support the threatened steelhead trout, which inhabits an additional 160 miles of creeks in the Vision Plan Area, including several such as Stevens Creek, which drain to the San Francisco Bay (Table 4, Figure 4). District open space preserves contain important breeding habitat within these and other streams, and also protect watershed lands which are essential to maintaining in-stream habitat conditions, as well as water quality in the San Francisco Bay and near-shore environments of the Pacific Ocean (Table 5, Figures 5 and 6).

Landscape Connectivity

Connectivity within the Vision Plan Area's streams is critical to maintaining populations of coho salmon, steelhead, and other anadromous fish, such as Pacific lamprey, which live as adults in the bay and ocean but return to the upper reaches of mountain streams to breed. Removal of fish passage barriers, including dams as well as some bridges and culverts, can facilitate access to important spawning habitat, and increase fish populations. Streams also provide important linkages for terrestrial species, particularly in urban or intensively cultivated areas where dense riparian vegetation creates important cover that facilitates movement by animals. Stream corridors may facilitate movement of species across the densely developed Santa Clara Valley and Highway 101 and Interstate 280, thus connecting the bay lands in the northeastern portion of the District to intact habitat within the Santa Cruz Mountains foothills (Figure 9).

Such landscape connectivity is critical to the maintenance of biodiversity within the Santa Cruz Mountains. The Vision Plan Area support large, contiguous habitat patches, including the northern portion of a 61,000-acre patch centered on Big Basin State Park, which is the largest area of contiguous habitat in the Santa Cruz Mountains (Figure 9). Such large habitat areas are essential, as they support a disproportionate richness of species, are more resistant to habitat degradation caused by edge effects, and are important for wide-ranging species. The central and western portions of the plan area feature numerous large patches, which together can support population of species with large home ranges, including mountain lions, which feature home ranges of up to 100 square miles (Beier 1993).

Long-term persistence of mountain lion as well as the genetic diversity and viability of other species within the Santa Cruz Mountains relies on maintaining connectivity to the adjacent Diablo and Gabilan mountain ranges, which are located to the east and south. This linkage, which can create a more than 100-mile latitudinal gradient that can enable species range shifts in response to climate change, requires restoring connectivity through the Highway 17 corridor, which constitutes a major choke point in the linkage. The District, which manages a series of open space preserves in this area, can partner with state transportation and wildlife agencies to promote connectivity through this area (Figure 9).

Habitat Management

The District's approximately 57,000 acres of open space preserves create the backbone of a network of protected lands in the Vision Plan Area, which includes 156,000 acres (42%) of parks, open space, and private lands protected though conservation easements. Though safeguarded from development, habitat within these protected lands is threatened by a variety of factors that degrade and fragment habitat, imperil rare species populations, and disrupt important ecosystem services (Table 9).

To address these threats, the District recently adopted a comprehensive resource management policy, which identifies goals and specific implementation measures to address the myriad, often interrelated, threats (MROSD 2011). In addition to providing measures for the protection of landscape connectivity, special-status species populations, and sensitive communities, the policies address broader issues of watershed management.

Soil Erosion

District resource management policies include implementation measures to limit soil erosion and sedimentation, the threat of which is greatest in the rugged western slopes underlain by erosive sedimentary rocks, and in the southeastern portion of the District where erosive serpentine underlies steep slopes covered by chaparral (Figures 10 and 11).

Non-Native Plants

The policies also incorporate measures to control and prevent the establishment of invasive plants, which outcompete native plants, degrade habitat for animals, and can alter ecosystem structure and functions, including by promoting fire (Table 11). These species dominate 9,557 acres, 860 acres (9%) of which are within District open space preserves (Table 10, Figure 12), and invasions are ongoing.

Grasslands

District resource management policies also address the need for stewardship of the Vision Plan Area's widespread plant communities. In addition to the invasion and spread of non-native plants, the region's grasslands are being degraded by encroachment from woody plant species in the absence of fire, which is a natural part of the disturbance regime. Grazing management in six open space preserves with a total of approximately 7,000 acres of grasslands is helping prevent unnatural succession, reduce cover of non-native plants, and reduce fine fuels that can promote wildfire. Expanding grazing management to other preserves including Windy Hill, Monte Bello, and Long Ridge (Figure 13), may help protect an additional 1,000 acres of grasslands from shrub and tree encroachment from adjacent coastal scrub and hardwood woodlands, thus maintaining important habitat for several grassland plants and animals.

Hardwood Forests

The Vision Plan Area's nearly 47,902 acres of hardwood forest, 37.8% of which are located in District open space preserves, are also subject to unnatural succession. Exclusion of fire from these forests, which are otherwise dominated by species of oak, tanoak, and California bay, facilitates establishment of Douglas fir—a conifer mapped as emergent or co-dominant on 17,848 acres of hardwood forest. Prescribed fire or forest management treatments that simulate their effects by killing Douglas fir can be used to maintain hardwood forests and habitat oak-dependent animals (Table 14). Forest management treatments are also needed to address the negative effects of sudden oak death—a pathogen killing oaks and tanoaks in approximately half of the District's open space preserves (Figure 15). Treatments include removing infected carriers (e.g. California bay), applying fungicide to heritage oaks, and fuel management projects to reduce the threat of severe wildfire caused by the dead wood (Table 14).

Redwood-Douglas Fir Forests

Fire and other forest management and restoration techniques can also be used to restore coast redwood-Douglas fir forests, which cover an estimated 78,271 acres (21%) of the Vision Plan Area, including 12,915 acres in District open space preserves (Figure 14). As a result of extensive harvests during the past two centuries, Specifically, tree thinning can create more widely-spaced, larger redwood trees more characteristic of old-growth forests. Such thinning treatments are being used by a variety of conservation organizations in central and northern California to buffer and expand old growth-forests, which provide important habitat for marbled murrelet, Vaux's swift, and other species that require late-seral forests, which are also less fire-prone and more fire-resistant (Table 14).

Fire Management

Fire management treatments, including prescribed fire as well as treatments that mimic its effects, can be used to promote the natural community structure and species composition within grasslands, shrublands, and other forests in the Vision Plan Area. As a result of their evolution with recurring fire, many native plants and animals feature adaptations to fire and the habitat conditions it creates. An estimated 21,048 acres of vegetation within the Vision Plan Area, including 8,419 acres within District open space preserves, features fire-dependent communities—chaparral and closed cone conifer forests featuring plants that regenerate following fire (Table 15, Figure 16). Treatments to promote fire-adapted and fire-dependent species should be designed to protect fire-sensitive species, such as California sycamore and other riparian species.

Fire management projects for vegetation management can also reduce the risk of wildfire, which threatens lives and property particularly where residential development occurs in close proximity to natural vegetation. Notably, 8,749 acres of development occurs within a half mile of a District open space preserve (Figure 17). Developed by integrating a variety of information and considerations, including fuel conditions, fire behavior, development patterns, infrastructure, and community input, two recent Community Wildfire Protection Plans developed within the Vision Plan Area identify priorities areas for fuel reduction and other wildfire threat abatement projects (Figure 17). Vegetation management protects in these areas, which can include shaded fuel breaks and prescribed burning within District open space preserves, can reduce threat of wildfire in the region.

Global Change

By the end of the century, the average annual temperature in California is predicted to increase by up to 8.1^{o} F (Cayan et al. 2008). The future hotter and likely drier climate in the region may threaten the viability of many rare species in the Vision Plan Area, including narrowly endemic species (e.g. serpentine plants and insects), salmonids, pond-breeding species, and species that inhabit wetlands and coast redwood-Douglas fir forest (Table 16). Aspects of the Vision Plan area that can promote resiliency of species to climate change include wet areas, such as springs and streams, which provide water and feature moister microclimates; cooler north-facing slopes and steep canyons (Table 17, Figure 18).

By the end of the century, sea level is anticipated to rise by more than 4.5 feet (Heberger et al. 2009). The resulting inundation and attendant erosion and flooding could eliminate coastal and bay habitats, including rock outcroppings, dunes, cliffs, and wetlands. Protecting land adjacent to the coast can facilitate migration of these systems, where feasible, and conserve the sensitive communities and species they support as sea level rises.

TERRESTRIAL COMMUNITIES

Vegetation

The Vision Plan Area features a complex and diverse mosaic of vegetation, including 33 mapped natural plant communities that support diverse assemblages of native plants and animals (Table 1, Figure 1). Broadly speaking, the coastal terraces and adjacent foothills support extensive grasslands with patches of coastal scrub and maritime chaparral, which are innervated by hardwood woodlands and conifer forests that line the canyons (Figure 1). These forests, which include extensive areas of coast redwood and Douglas-fir forest (Section 6), predominate on the higher-elevation western slope and ridgeline of the Santa Cruz Mountains, where winter rainfall and summer fog are more plentiful. The warmer and drier eastern slope of the range is dominated by chaparral, with forests comprised of oaks, California bay, and other hardwoods on the cooler north-facing slopes and canyons. The inland foothills support grasslands and oak savannas, which give way to flat expanses of land that has largely been converted to urban use in the Santa Clara Valley. Extensive wetlands ring the southern San Francisco Bay in the northeastern portion of the District, while the San Mateo Coast features a range of communities along the coastal strand, including beaches, dunes, bluffs, cliffs, and wetlands (Figure 1).

Vegetation Conservation Values

Provide habitat for diverse assemblages of plants and animals

Facilitate movement of plants, animals, and ecological processes, such as fire

Provide ecosystem services—benefits to humankind from including:

- Water filtration (wetlands and riparian vegetation trap sediment)
- Soil stabilization/erosion regulation
- Carbon sequestration
- Pollination for crops
- Pest control
- Natural hazard regulation (e.g. prevent flooding)

Provide aesthetic values (e.g. scenery)

Across the Vision Plan Area, fine-scale variability in geology, soils, hydrology, and microclimate, as well as history of land use and natural disturbance, including fire, interact in complex ways to give rise to a diversity of plants and animals, each of which is adapted to the unique conditions.

- The bay and estuaries support coastal salt marsh communities, the dominant species of which depend on the hydrology, and grade from cordgrass (*Spartina foliosa*) in the low tidal zone, to pickleweed (*Salicornia pacifica*) in the middle zone, saltgrass (*Distichlis spicata*) in the hightide zone.
- Stream corridors are lined by riparian forests, which on the coast side primarily support red alder (*Alnus rubra*), and arroyo willows (*Salix* lasiolepis) while those on the eastern slope of the Santa Cruz Mountains feature big leaf maple (*Acer macrophyllum*), California sycamore (*Platanus racemosa*), and cottonwood (*Populus* spp.).
- Oak forests are dominated by coast live oak particularly along the coast and in lower-elevation areas, interior live oak (*Quercus wislizenii*) further inland, and canyon live oak (*Q. chrysolepis*) at higher elevations; stands of black oak are restricted to the highest elevation ridgeline, while blue oak (*Q. douglasii*) occur on the lower elevation foothills of the interior.
- Conifer forests are dominated by coast redwood (*Sequoia sempervirens*) and Douglas-fir (*Pseudotsuga menziesii*) on the western slope of the Santa Cruz Mountains and in drainages on the eastern slope, where foothill pines (*Pinus sabiniana*) and knobcone pines (*Pinus attenuata*) are scattered amidst manzanitas in the higher-elevation areas in the southeastern portion of the Vision Plan Area.

Geology and soils play a particularly important role in adding to the biodiversity of the District. The Santa Cruz Mountains feature largely-granitic and metamorphic Salinian Block basement rocks that are overlain by a series of marine sedimentary rocks from Paleocene to Pliocene-era, which in turn, are often overlain by non-marine sediments of the Pleistocene and Holocene (Thomas 1961). Mountain building, including uplift, folding, and faulting, combined with erosion including landslides, have created fine-scale variation in geologic formations that provide the parent material for soil development, which is also influenced by the variable climate, hydrology, and the vegetation itself. Biologically-significant geology and soils include:

1. Outcroppings of **serpentine soil** on the eastern slope of the Santa Cruz Mountains, which are derived from the Franciscan Complex. These soils have high concentrations of heavy metals that are toxic to most plants; however, serpentine soils support unique and diverse communities that include numerous narrowly endemic species adapted to the inimical soil conditions (Section 3). Within the District, serpentine areas are around the Sierra Azul Open Space Preserve, in the southeast, and in the inland foothills near the city of Woodside.
2. Outcroppings of **sandy soils** derived from sandstone and granite that support species endemic to the northern portion of the Santa Cruz Mountains, including Montara manzanita (*Arctostaphylos montaraensis*), King's Mountain Manzanita (*Arctostaphylos regismontana*) and Santa Cruz cypress (*Hesperocyparis abramsiana*).
3. Outcroppings of shale which support sparse maritime chaparral and knobcone pine in a community known as '**The Chalks'** in the Waddell, Green Oaks, and Cascade creek watersheds in the southwestern portion of the District.

Sensitive and Biologically-Highly Significant Communities

These and other natural communities within the District area globally rare, being restricted just to the San Francisco Bay Area, or in some cases, the Santa Cruz Mountains. These sensitive communities, which cover 19,648 acres within the Vision Plan Area, are priorities for conservation (Table 2, Figure 2).

Other communities, such as wetlands, riparian communities, and grasslands, though once more widespread, have been made rare as a result of widespread habitat conversion for urban and agricultural uses (Table 2). These biologically-highly significant communities support rich assemblages of plants and animals, many of which are in decline within the state or globally (Section 3).

Maintaining biodiversity within the Vision Plan area, and Santa Cruz Mountains more broadly, will require conserving the sensitive and biologically highly-significant communities, as well as representative areas of the other naturally communities, including the more widespread types, which provide extensive habitat and important ecosystem services. To identify the areas within the Vision Plan Area that are most important for biodiversity conservation, the natural communities were prioritized (Table 3, Figure 3).

District open space preserves support 1,356 acres of sensitive communities (Table 3, Figure 3). These include extensive areas of serpentine within Sierra Azul OSP, saltwater wetlands in Ravenswood OSP and Stevens Creek Shoreline Nature Study Area, maritime chaparral at Pulgas Ridge OSP, and California buckeye woodlands scattered within the preserves along Skyline.The District resource management policies address protection of these and other sensitive communities and habitats on District lands, including through the policies for the management of vegetation, grazing, forest, wildland fire, and invasive species, as well as the policy related to ecological succession.

Table 1: Vegetation within the District Vision Plan Area

Vegetation and Other Land Cover	Plant Communities	Acres	Percent in District Preserves
Coastal Strand	***Coastal strand***[1]	**405**	**0%**
Grassland	*California annual grassland*	36,174	16.6%
	Native grassland	278	23.7%
	Grassland Subtotal	**36,451**	**16.7%**
Coastal Scrub	Coastal scrub	16,570	0.1%
	Mixed coastal scrub	2,158	10.9%
	Coastal bluff scrub	102	0%
	California sagebrush scrub	204	66.7%
	Coyote brush scrub	960	45.1%
	Mixed coyote brush scrub	21,171	21.0%
	Poison oak scrub	1,338	33.5%
	Coastal Scrub Subtotal	**42,503**	**13.4%**
Chaparral	Ceanothus chaparral	473	47.1%
	Chamise chaparral	7,875	23.4%
	Manzanita chaparral	851	71.6%
	Mesic chaparral	2,805	70.5%
	Mixed chaparral	11,021	47.1%
	Chaparral Subtotal	**23,026**	**42.8%**
Oak savanna	***Oak savanna***	**41**	**22.8%**
Hardwood Forest	California bay	3,303	31.3%
	California buckeye	921	29.8%
	Coast live oak	14,206	18.7%
	Mixed hardwood forest	26,779	51.8%
	Oak woodland	3,049	15.0%
	Hardwood Forest Subtotal	**48,257**	**37.9%**
Conifer Forest	Foothill pine woodland	236	70.3%
	Knobcone pine forest	591	74.6%
	Monterey pine forest	189	0%
	Redwood forest	52,195	12.6%
	Douglas fir forest	8,141	1.9%
	Mixed Douglas-fir forest	17,849	34.7%
	Santa Cruz cypress forest	6	0%
	Conifer Forest Subtotal	**79,206**	**17.1%**
Riparian	*Riparian shrubland*	1,743	18.3%
	Riparian woodland	4,236	23.4%
	Riparian Subtotal	**5,980**	**21.9%**
Wetland	*Wet meadows*	64	14.2%
	Freshwater marsh	884	5.2%
	Salt/brackish marsh	4,704	2.4%
	Wetland Subtotal	**5,652**	**3.0%**

Table 1: Vegetation within the District Vision Plan Area

Vegetation and Other Land Cover	Plant Communities	Acres	Percent in District Preserves
Other Natural and Semi-Natural Land Cover	*Water*	27,216	0.8%
	Barren/Rock	255	47.3%
	Non-native or ornamental plants	9,557	9.0%
	Sparsely vegetated or unvegetated	9,425	3.9%
Other Natural and Semi-Natural Land Cover Subtotal		**46,452**	**3.4%**
Converted Land Cover	Agriculture	3,924	2.5%
	Quarry/Mine	1,590	0%
	Built up/Urban	77,464	0.3%
Converted Land Cover Subtotal		**82,978**	**0.4%**
Total		**370,951**	**15.3%**

[1] Biologically highly significant plant communities are *italicized.*

Table 2: Sensitive plant communities within the District Vision Plan Area

Type	Community	Acres	Percent in District Preserves
Coastal Strand[1]	**Dune**	**31**	**0%**
Grassland	California annual grassland - purple needlegrass	40	57.2%
	Purple needlegrass	2	100.0%
	Native grassland	63	55.9%
	Meadow barley	5	93.7%
	Dwarf coyote brush prairie	167	0%
	Grassland Subtotal	**276**	**23.3%**
Chaparral	Brittleleaf manzanita	79	99.7%
	Chamise - leather oak[2]	10	100.0%
	Leather oak[2]	<1	0%
	Giant chinquapin	5	76.4%
	Interior live oak - Kings Mountain manzanita	85	0.8%
	Manzanita chaparral - knobcone pine[3]	420	0%
	Chaparral Subtotal	**600**	**15.6%**
Hardwood Forest	California buckeye woodland	919	29.9%
	Valley oak woodland	1,674	4.1%
	Hardwood Forest Subtotal	**2,593**	**13.2%**
Conifer Forest	Douglas-fir - chinquapin forest	47	93.1%
	Old growth coast redwood forest	3,349	0.1%
	Older second growth and other older redwood forests	4,554	1.9%
	Monterey pine forest	189	0%
	Santa Cruz cypress forest	4	0%
	Conifer Forest Subtotal	**8,143**	**1.7%**
Riparian	Box elder forest	40	2.1%
	California sycamore woodland	35	22.2%
	Central Coast riparian forest	955	1.8%
	Riparian Subtotal	**1,030**	**2.5%**
Wetland	Bulrush marsh	14	2.4%
	Cattail marsh	18	36.1%
	Freshwater marsh	820	4.7%
	Salt/brackish marsh	4,704	2.4%
	Sedge-rush meadow	29	30.8%
	Wetland Subtotal	**5,652**	**3.0%**
Serpentine	**Native Plant Communities on Serpentine Soils[2]**	**1,390**	**38.0%**
	Total	**19,648**	**7.1%**

[1] Communities along coast, including dunes and bluffs

[2] Community on serpentine (ultramafic) soil, which typically supports rich assemblages of rare and unique plants and animals

[3] Coastal knobcone pine forests are actually maritime chaparral (e.g. 'The Chalks')

Table 3: Vegetation and land cover types in the Vision Plan Area according to their priority for conservation

Priority	Category	Acres	Percent of Total Vegetation	Percent In District Preserves
Sensitive and Biologically Highly-Significant Native Communities				
1	Sensitive[1]	19,648	5.3%	6.9%
2	Biologically Highly Significant[2]	69,667	18.8%	11.1%
	Sensitive and Biologically Highly-Significant Subtotal	**89,315**	**24.1%**	**10.2%**
Other Native Communities Based on Relative Rarity in Vision Plan Area				
3	Uncommon (1,000 acres)	3,065	0.8%	63.7%
4	Fairly Common (>1,000 acres - 10,000 acres)	34,589	9.3%	49.3%
5	Common (>10,000 acres)	142,071	38.3%	19.1%
	Other Native Communities Subtotal	**179,725**	**48.4%**	**23.6%**
Other Land Cover				
6	Non-Native	18,953	5.1%	6.4%
7	Degraded and Agricultural	3,924	1.1%	2.5%
8	Urban/Built Up	79,034	21.3%	0.3%
	Other Land Cover Subtotal	**101,911**	**27.5%**	**1.5%**
	Total	**370,951**	**100%**	**15.3%**

[1] Communities designated as rare in California (S1-S3) and/or globally (G1-G3)

[2] Non-sensitive types that have high richness particularly of special status species

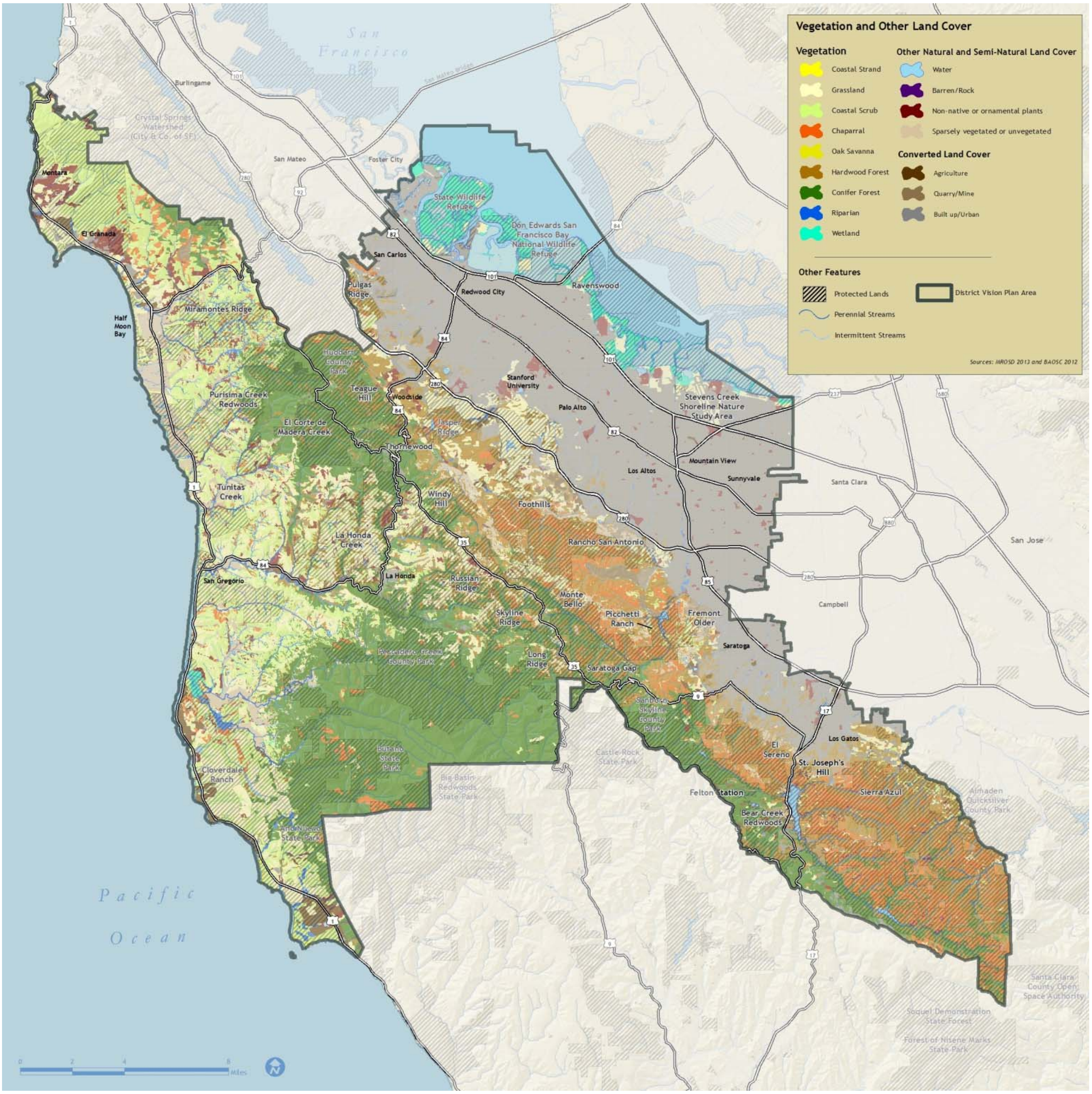

Figure 1: Vegetation and other land cover

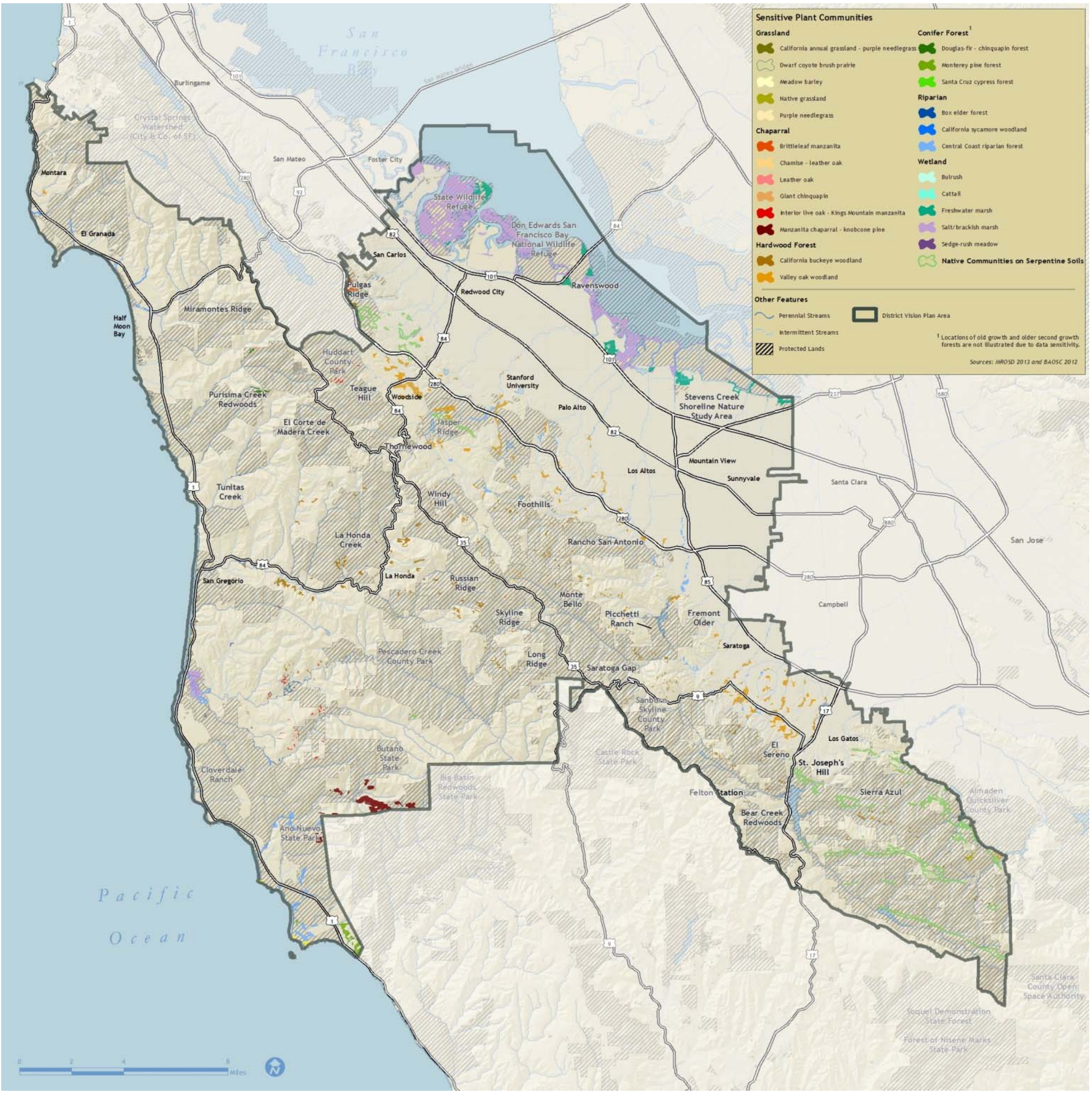

Figure 2: Sensitive plant communities

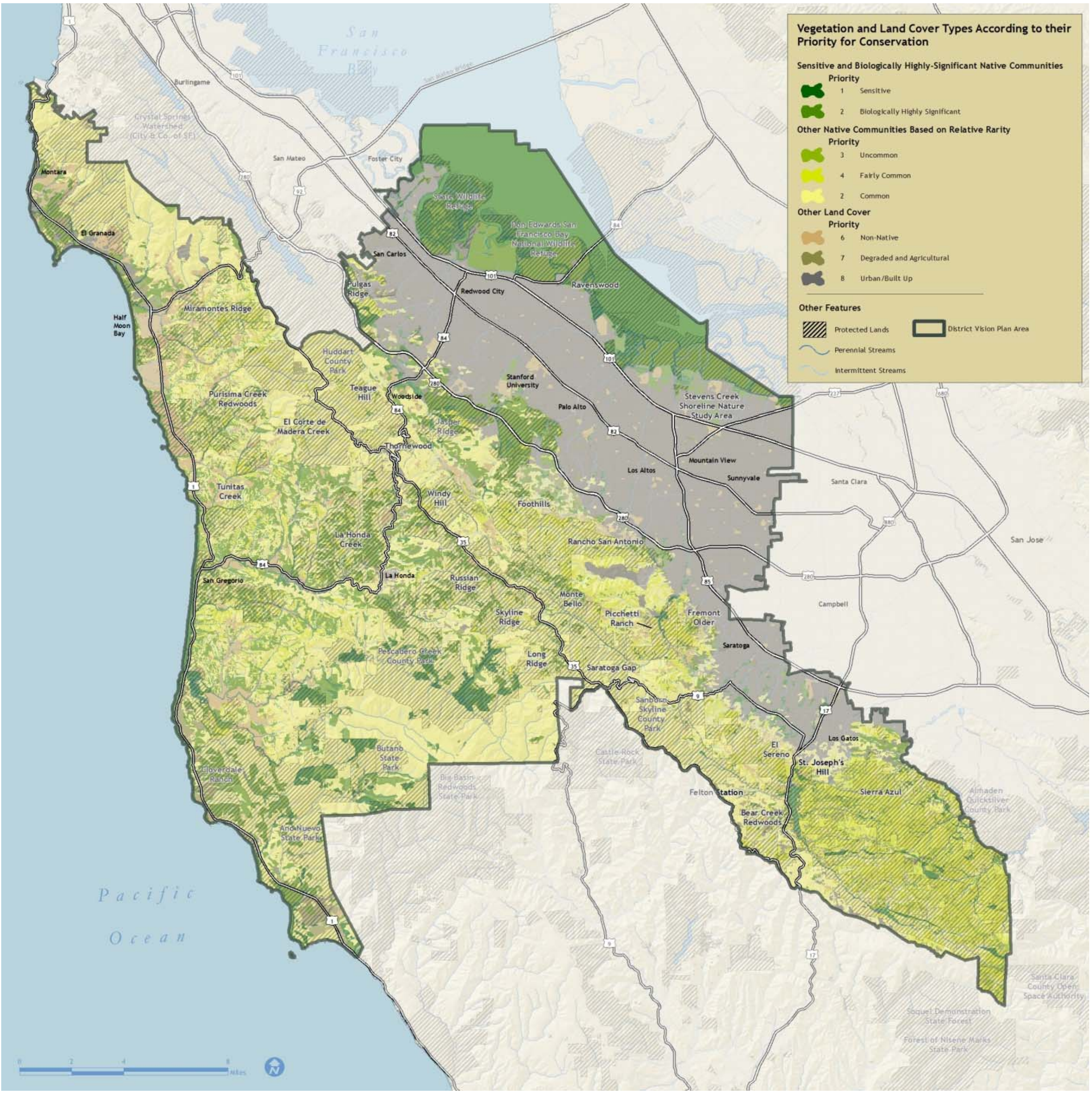

Figure 3: Vegetation and land cover types according to their priority for conservation

AQUATIC COMMUNITIES

Streams and Watersheds

The Vision Plan Area features just over 1,100 miles of coastal streams that drain to the Pacific Ocean directly or via the San Francisco Bay (Table 4, Figure 4). These streams support a wealth of biodiversity conservation values (inset box).

Stream Conservation Values

Provide habitat for riverine species, including a variety of invertebrates and fish; most notably, endangered coho salmon and threatened steelhead trout.

Provide breeding habitat for amphibians and reptiles, including foothill yellow-legged frog, California red-legged frog, western pond turtle, and San Francisco garter snake.

Support freshwater wetlands and riparian forests, which provide important nesting habitat for many Neotropical migratory birds.

Provide freshwater to terrestrial animals, such as black-tailed deer and mountain lion.

Feature riparian corridors that can facilitate animal movement through urbanized or cultivated areas

Safeguard water quality in the San Francisco Bay and Pacific Ocean.

Importantly, nearly 37 miles of cool mountain streams that drain directly to the Pacific Ocean support the endangered Central California Coast coho salmon (*Oncorhynchus kisutch*); the Santa Cruz Mountains constitute the southern end of this species' range. An additional 160 miles of streams support threatened Central California Coast steelhead trout (*Oncorhynchus mykiss irideus*); these include streams that drain to the San Francisco Bay (Table 4, Figure 4).

Steps to conserve the imperiled salmonids, anadromous fish that breed in coastal streams but live their adult lives in the Pacific Ocean, can help conserve a wide range of resident fish species and other riverine species, such as foothill yellow-legged frog *(Rana boylii*), as well as promote other stream conservation values. Therefore, for purposes of planning, streams were generally characterized according to their value for coho salmon and steelhead, and according to their hydrology; specifically, whether they flow year round (perennial) or flow seasonally in typical rainfall years (intermittent) (Table 4).

As part of prior plans, watersheds were rated according to their importance for recovery of endangered coho salmon (NMFS 2010) and threatened steelhead trout (CDFW 2012; Figure 5), as well as the condition of the watershed—the land drained by a stream—which can greatly influence stream water quality and other habitat conditions downstream, including habitat within the San Francisco Bay and near-shore environment of the Pacific Ocean.

Watersheds in the Bay Area were also previously characterized according to their existing conditions based on a variety of land uses, including urbanization, cultivation, and timber harvest (BAOSC 2012). Most watersheds on the northern and eastern portion of the District were characterized as "suburban" or "urban", owing their relative density of development. Watersheds on the western slope of the Santa Cruz Mountains were largely classified as 'rural', reflecting their lower-density residential development; with a few characterized as 'agricultural' or 'forestry' based on their respective land uses (Figure 5). Notably, the Mindego Subwatershed of San Gregorio Creek Watershed, and the Upper Stevens Creek Watershed, as well as several upper watersheds of the Guadalupe River in the southeastern portion of the District, were rated as "Wildland', reflecting their low-intensity and frequency of land use.

Results of these prior plans were used to rate watersheds within the Vision Plan Area according to their value for conservation (Table 5, Figure 6). For steelhead watersheds, the land use condition was also factored in, to reflect the fact that conservation of land within urban and suburban watersheds is less likely to influence stream habitat conditions than conservation of lands in watersheds of relatively lower-intensity land use (Table 5).

District open space preserves feature several tributaries to San Gregorio Creek, a coho stream including Bogess, Harrington, and La Honda creeks in the La Honda Creek OSP, and Mindego and Alpine creeks in Russian Ridge OSP (Figure 6). Along with El Corte de Madera OSP, these District lands protect significant portions of the watersheds of these creeks, which are among the highest priorities for conservation, as well as other headwaters of the San Gregorio Creek Watershed.

The District OSPs also contain significant portions of several steelhead streams, including Tunitas Creek (Tunitas Creek OSP) and Lobitos Creek (Purisima Creek Redwoods OSP) in San Mateo’s northern coastal watersheds, as well as streams that drain to the San Francisco Bay, including Stevens Creek (Monte Bello OSP) and upper Guadalupe Creek (Sierra Azul OSP; Table 6).

The District’s resource management policies for wildlife management and water resources feature numerous goals and practices to protect and enhance stream habitat for all riparian and riverine species, as well as safeguard water quality. The policies and practices address several factors that fragment and degrade stream habitat and watersheds (Section 5), including sedimentation and pollution, unnatural barriers to upstream migration, maintenance and restoration of important stream habitat features, including pools created through large woody debris recruitment.

Table 4: Streams reaches supporting rare salmonids (Tier 1)	
Stream by Major Watershed	**Miles**
Gazos Creek Watershed	
Gazos Creek	7.7
Middle Fork Gazos Creek	1.1
Gazos Creek Watershed Total	**8.9**
Pescadero Creek Watershed	
Bradley Creek	2.2
Butano Creek	8.8
Evans Creek	0.4
Honsinger Creek	3.6
Lambert Creek	0.6
Little Boulder Creek	0.7
Oil Creek	4.1
Pescadero Creek	24.9
Peters Creek	4.9
Slate Creek	1.3
Tarwater Creek	0.9
Pescadero Creek Watershed Total	**52.4**
Pilarcitos Creek Watershed	
Apanolio Creek	3.5
Arroyo Leon	8.2
Mills Creek	2.6
Pilarcitos Creek	5.9
Tributary to Mills Creek	1.5
Pilarcitos Creek Watershed Total	**21.6**
San Francisquito Creek Watershed	
Bear Creek	3.5
Los Trancos Creek	6.7
San Francisquito Creek	13.3
Tributary to Bear Creek	5.2
Tributary to Los Trancos Creek	2.5
San Francisquito Creek Watershed Total	**31.2**
San Pedro Creek Watershed	
South Fork San Pedro Creek	0.4
Middle Fork San Pedro Creek	0.1
San Pedro Creek Watershed Total	**0.5**
San Gregorio Creek Watershed	
Alpine Creek	5.5
Bogess Creek	5.0
Harrington Creek	4.8
La Honda Creek	5.0
Langley Creek	1.7
Mindego Creek	2.9
San Gregorio Creek	11.3
Tributary to San Gregorio Creek	3.8
Woodruff Creek	1.3
San Gregorio Creek Watershed Total	**41.2**
Tunitas Creek Watershed	

Table 4: Streams reaches supporting rare salmonids (Tier 1)

Stream by Major Watershed	Miles
East Fork Tunitas Creek	2.7
Tunitas Creek	5.2
Tunitas Creek Watershed Total	**7.9**
Other Watersheds	
Denniston Creek	1.1
Frenchmans Creek	3.4
Guadalupe Creek	0.1
Lobitos Creek	5.0
Old Womans Creek	1.7
Pomponio Creek	1.9
Soquel Creek	1.8
Stevens Creek	12.3
Waterman Creek	2.9
Whitehouse Creek	3.4
Other Watersheds Total	33.6
All Tier 1 Streams	**196.3**

[1] Criteria used to rate streams. Only Tier 1 streams are listed in this table; all streams are illustrated in Figure 4.

Tier 1a: Stream reach supports coho salmon

Tier 1b: Stream reach supports steelhead, but not coho salmon

Tier 2a: Stream reach is perennial and is located in a watershed that supports coho salmon or steelhead; however, the stream itself is not occupied.

Tier 2b: Stream reach is intermittent and is located in a watershed that supports coho salmon or steelhead

Tier 3: Stream reach is perennial and not located in a coho salmon or steelhead watershed

Tier 4: Stream reach is ephemeral/intermittent and not located in a coho salmon or steelhead watershed

Table 5: Subwatersheds according to their tier which indicates their priority for conservation

Subwatershed	Major Watershed	Acres	% of Total Area
Tier 1a: Core Watersheds for Coho Recovery (NMFS 2010)			
Gazos Creek	Gazos Creek	7,174	2.1%
Alpine Creek	San Gregorio	3,548	1.0%
Bogess Creek	San Gregorio	2,542	0.7%
Harrington Creek	San Gregorio	3,092	0.9%
Kingston Creek	San Gregorio	787	0.2%
Mindego Creek	San Gregorio	2,464	0.7%
San Gregorio Creek	San Gregorio	5,371	1.6%
Soquel	Soquel	710	0.2%
	Tier 1a Total	**25,688**	**7.6%**
Tier 1b: Phase I Watersheds for Coho Recovery (NMFS 2010)			
Honsinger Creek	Pescadero	1,682	0.5%
Oil Creek	Pescadero	2,819	0.8%
Pescadero Creek	Pescadero	13,633	4.0%
Peters Creek	Pescadero	6,307	1.9%
Slate Creek	Pescadero	1,929	0.6%
Tarwater Creek	Pescadero	1,194	0.4%
Upper Pescadero Creek	Pescadero	3,817	1.1%
Clear Creek	San Gregorio	956	0.3%
Coyote Creek	San Gregorio	1,126	0.3%
El Corte de Madera Creek	San Gregorio	4,742	1.4%
La Honda Creek	San Gregorio	3,940	1.2%
Langley Creek	San Gregorio	273	0.1%
Lawrence Creek	San Gregorio	1,557	0.5%
Weeks Creek	San Gregorio	644	0.2%
Woodhams Creek	San Gregorio	545	0.2%
Woodruff Creek	San Gregorio	1,923	0.6%
San Lorenzo River	San Lorenzo	213	0.1%
Waddell Creek		812	0.2%
Waterman Creek		1,175	0.3%
	Tier 1b Total	**49,286**	**14.5%**
Tier 1c: Phase II Watersheds for Coho Recovery (NMFS 2010)			
Bradley Creek	Pescadero	3,918	1.2%
Little Butano Creek	Pescadero	2,607	0.8%
Lower Butano Creek	Pescadero	3,205	0.9%
South Fork Butano Creek	Pescadero	1,961	0.6%
Upper Butano Creek	Pescadero	6,010	1.8%
East Waddell Creek		11	0.0%
	Tier 1c Total	**17,712**	**5.2%**
Tier 2a: Steelhead Watershed (non-Urban or suburban)			
Apanolio Creek	Pilarcitos	1,251	0.4%
Arroyo Leon	Pilarcitos	3,020	0.9%
Mills Creek	Pilarcitos	2,419	0.7%
Bear Creek	San Francisquito	1,087	0.3%
Bear Gulch	San Francisquito	1,939	0.6%
Dry Creek (San Francisquito)	San Francisquito	1,012	0.3%

Table 5: Subwatersheds according to their tier which indicates their priority for conservation

Subwatershed	Major Watershed	Acres	% of Total Area
West Union Creek	San Francisquito	3,548	1.0%
Dry Creek (Pilarcitos)	Tunitas	1,495	0.4%
East Fork Tunitas Creek	Tunitas	1,490	0.4%
Tunitas Creek	Tunitas	4,472	1.3%
Denniston Creek		2,578	0.8%
Frenchman's Creek		2,622	0.8%
Pomponio Creek		4,548	1.3%
Soquel Creek		165	0.0%
Whitehouse Creek		1,836	0.5%
	Tier 2a Total	**33,483**	**9.9%**
Tier 2b: Steelhead Watershed Characterized as Urban or Suburban			
Albert Canyon	Pilarcitos	735	0.2%
Pilarcitos Creek	Pilarcitos	3,829	1.1%
Corte Madera Creek	San Francisquito	9,290	2.7%
Los Trancos Creek	San Francisquito	4,473	1.3%
San Francisquito Creek	San Francisquito	8,960	2.6%
Stevens Creek	Stevens	10,282	3.0%
Guadalupe Creek	Guadalupe	4,065	1.2%
Guadalupe River		286	0.1%
Hale Creek		2,292	0.62%
Lobitos Creek		2,580	0.8%
Permanente Creek		5,492	1.48%
San Pedro Creek		1,466	0.4%
SF Bay and Estuary		33,374	9.8%
West Branch Permanente Creek		2,263	0.61%
	Tier 2b Total	**89,387**	**24.1%**
Tier 3a: Non-anadromous fish watershed (Not characterized as urban or suburban)			
Upper Guadalupe Creek	Guadalupe	3,059	0.9%
Upper Los Gatos Creek	Guadalupe	23,688	7.0%
Madonna Creek	Pilarcitos	1,073	0.3%
Nuff Creek	Pilarcitos	683	0.2%
Upper Stevens Creek	Stevens	10,837	3.2%
Arroyo de los Frijoles		2,251	0.7%
Cascade Creek		1,334	0.4%
Cold Dip Creek		1,106	0.3%
Green Oaks Creek		1,140	0.3%
Martini Creek		822	0.2%
Purisima Creek		5,649	1.7%
Unknown Coastal Creek		7,664	2.3%
Upper Pilarcitos Creek		89	0.0%
Upper San Mateo Creek		556	0.2%
Uvas Creek		154	0.0%
Small Coastal Drainages		2,034	0.6%
	Tier 3a Total	**62,139**	**18.3%**
Tier 3b: Non-Anadromous Fish Watershed Characterzed as Urban or Suburban			
Alamitos Creek Watershed	Guadalupe	4,983	1.5%

Table 5: Subwatersheds according to their tier which indicates their priority for conservation

Subwatershed	Major Watershed	Acres	% of Total Area
Los Gatos Creek	Guadalupe	5,147	1.5%
Ross Creek	Guadalupe	2,943	0.9%
Corinda Los Trancos Creek	Pilarcitos	561	0.2%
Adobe Creek		7,679	2.3%
Arroyo Canada Verde		2,025	0.6%
Arroyo de en Medio		1,621	0.5%
Atherton Channel		8,386	2.5%
Barron Creek		2,017	0.54%
Belmont Creek		760	0.2%
Calabazas Creek		10,721	3.2%
Cordilleras Creek		4,169	1.2%
Deer Creek		961	0.3%
Kanoff Creek		400	0.1%
Matadero Creek		5,705	1.54%
Montara Creek		1,035	0.3%
Pillar Point Marsh		763	0.2%
Redwood Creek		7,304	2.2%
San Tomas Aquino Creek		6,283	1.69%
San Vicente Creek (San Mateo County)		1,057	0.3%
Saratoga Creek		7,763	2.09%
Sunnyvale Channel		9,403	2.8%
Small Coastal Drainages		1,457	0.4%
	Tier 3b Total	**93,142**	**25.1%**
	Grand Total	**370,838**	**100.0%**

[1] Tier 1: Coho Salmon Recovery Plan Watersheds (NMFS 2010)

Tier 1a: Core Watershed

Tier 1b: Phase 1 Watershed

Tier 1c: Phase II Watershed

Tier 2: Steelhead (non-coho salmon) watersheds in the Watershed Integrity analysis (BAOSC 2012)

Tier 2a: Not characterized as urban or suburban

Tier 2b: Characterized as urban or suburban

Tier 3: Non-anadromous fish watersheds in the Watershed Integrity analysis (BAOSC 2012)

Tier 3a: Not characterized as urban or suburban

Tier 3b: Characterized as urban or suburban

Figure 4: Stream reaches according to their priority for conservation

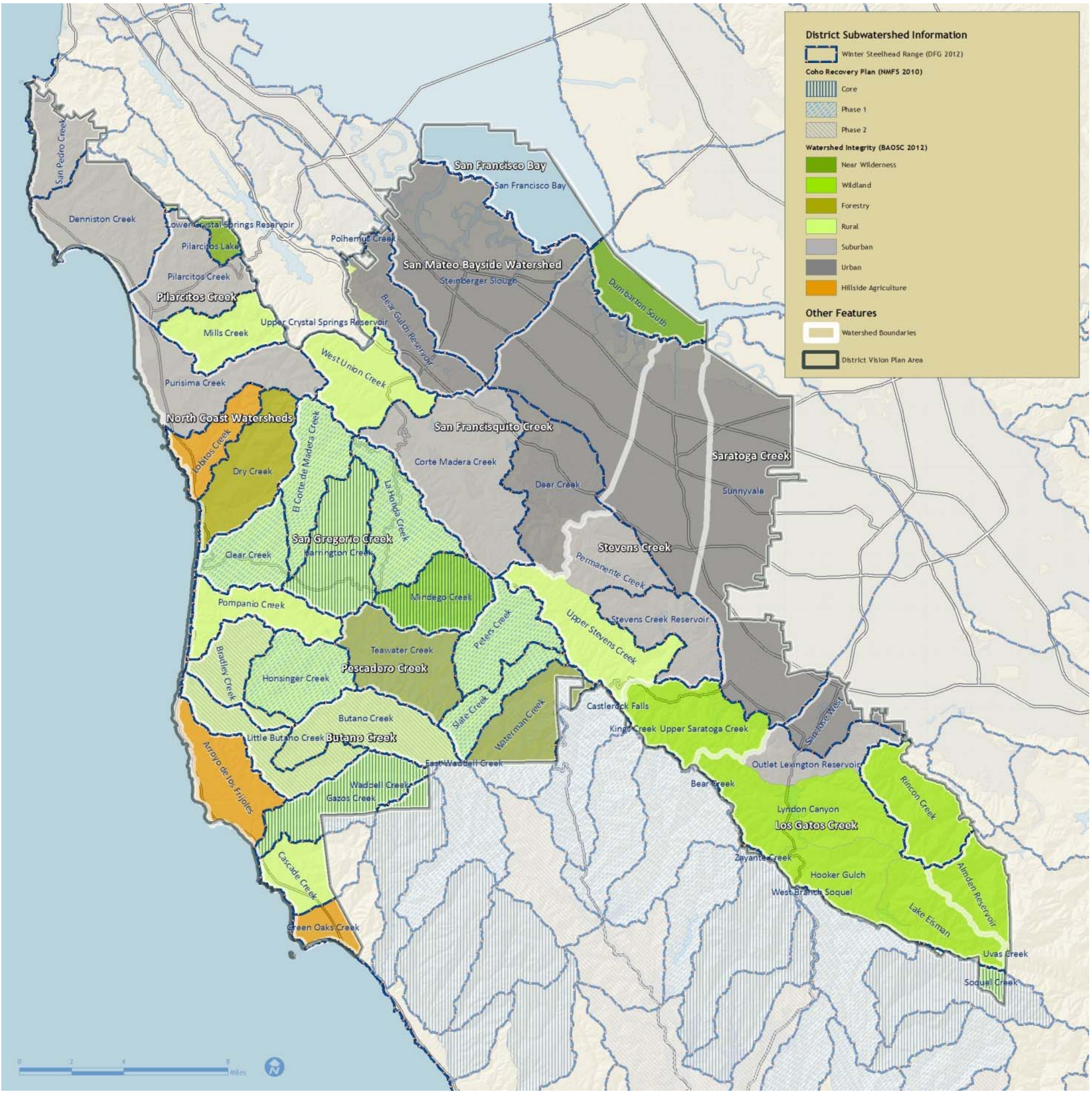

Figure 5: District subwatershed information from prior plans

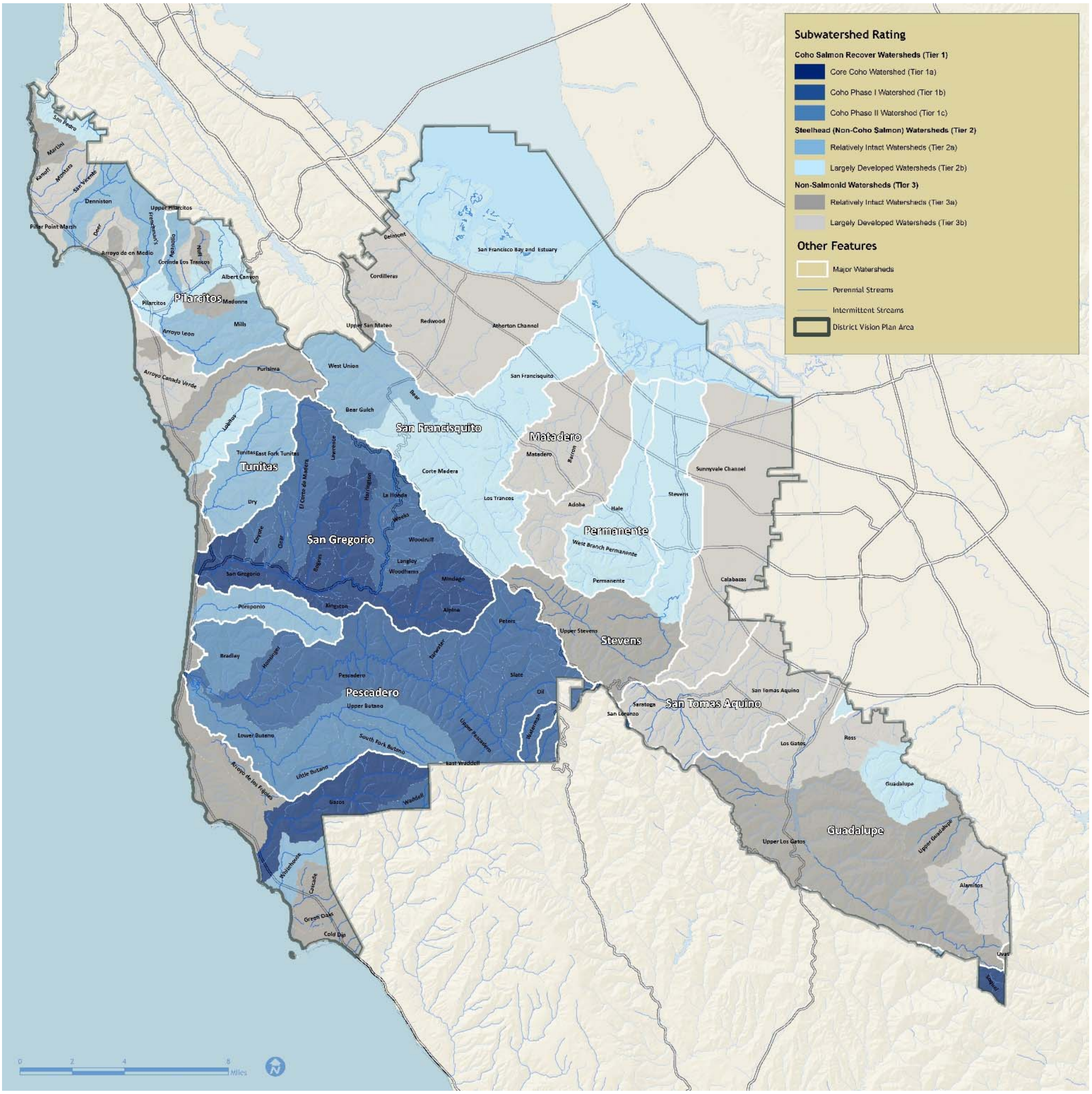

Figure 6: District subwatershed rating for conservation

Ponds and Other Water Bodies

The District features numerous water bodies, including a portion of the San Francisco Bay, several reservoirs, lakes, and ponds (Figure 7). Like streams, ponds within the Vision Plan Area feature a diversity of important biodiversity conservation values (inset box).

Existing District preserves features numerous ponds, including several that provide important breeding habitat for special-status species, including San Francisco garter snake, California red-legged frog, and western pond turtle (Section 3). Though many of these ponds were artificially created as part of historic cattle ranching operations, these ponds replace habitat lost elsewhere including in the urbanized portions of the District, and are critical to the recovery of many endangered species populations (USFWS 2003).

Pond Conservation Values

Support rare wetlands including freshwater marshes along their margins

Provide habitat for native aquatic species, including pond-breeding amphibians such as San Francisco garter snake, California red-legged frog, and western pond turtle.

Provide habitat for birds including migrants along the Pacific flyway and resident and breeding birds that nest in adjacent marshes and riparian areas.

Supply water for terrestrial species, including black-tailed deer and mountain lion.

May confer resiliency to a future hotter, and likely drier, climate.

The District open space preserves (OSPs) contain 12 ponds that have failed. Located within the La Honda Creek, Skyline Ridge, Monte Bello, and Fremont Older OSPs, these ponds require repairs to restore their hydrology and habitat (Figure 7). Such restoration supports the District's resource management policy to maintain and enhance habitat that has particular value for native animals, and may also facilitate conservation grazing, which the District uses to maintain grassland habitat and reduce fire threat on selected lands.

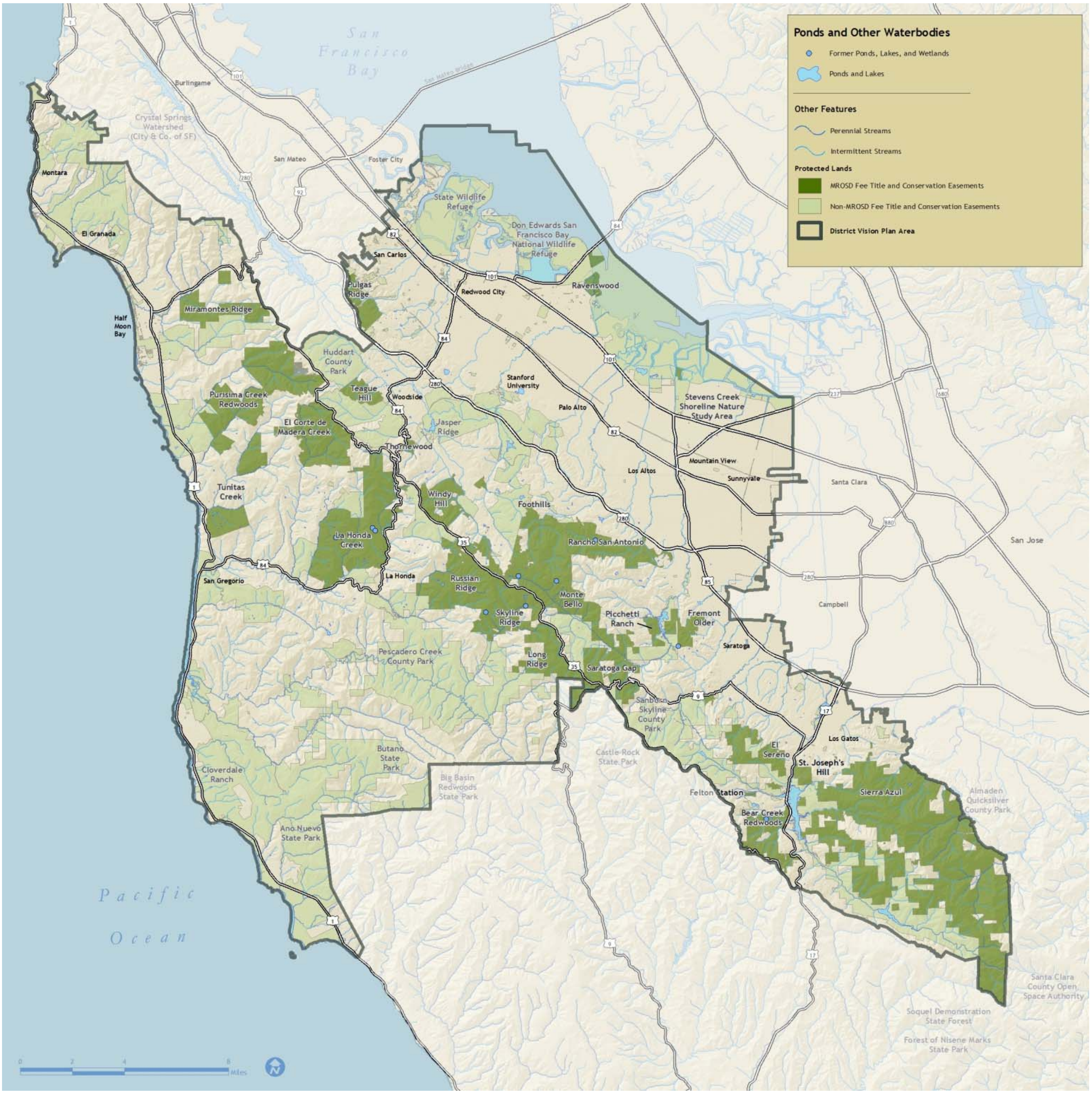

Figure 7: Ponds and other water bodies

RARE SPECIES

The Vision Plan Area supports at least 96 rare, threatened, or endangered plant species, 11 of which are state or federally-listed as threatened or endangered (Table 6). The plan area also supports at least 66 species of rare, threatened, or endangered animals; these include 16 species that have been listed as threatened or endangered (Table 7).

Within the Vision Plan Area, rare plants and animals are concentrated within a series of 'hot spots', including sensitive communities (Table 8, Figure 8). The Districts OSPs safeguard portions of many of areas, which are critical for regional biodiversity conservation (Table 8).

Several rare species within the Vision Plan Area are experiencing declines due to a variety of factors, including habitat conversion, fragmentation, and degradation (Section 5). The District resource management polices incorporate numerous goals and implementation measures designed to protect and enhance rare species habitat within District open space preserves. Coordinated measures by the District and other conservation agencies and organizations working within the region will be essential to the recovery and long-term persistence of these and other species.

Table 6: Rare and locally unique plants

Scientific Name	Common Name	Status[1]
Acanthomintha duttonii	*San Mateo thorn-mint*	*FE, SE, List 1B.1*
Agrostis blasdalei	*Blasdale's bent grass*	*List 1B.2*
Allium peninsulare var. franciscanum	*Franciscan onion*	*List 1B.2*
Amsinckia douglasiana	*Douglas' fiddleneck*	*List 4.2*
Androsace elongata ssp. acuta	*California rockjasmine*	*List 4.2*
Arabis blepharophylla	*coast rock cress*	*List 4.3*
Arctostaphylos andersonii	*Anderson's manzanita*	*List 1B.2*
Arctostaphylos montaraensis	*Montara manzanita*	*List 1B.2*
Arctostaphylos regismontana	*Kings Mountain manzanita*	*List 1B.2*
Astragalus nuttallii var. nuttallii	*Nuttall's milkvetch*	*List 4.2*
Astragalus pycnostachyus var. pycnostachyus	*coastal marsh milk-vetch*	*List 1B.2*
Astragalus tener var. tener	*alkali milk-vetch*	*List 1B.2*
Calandrinia breweri	*Brewer's redmaids*	*List 4.2*
California macrophylla	*round-leaved filaree*	*List 1B.1*
Calochortus umbellatus	*Oakland mariposa lily*	*List 4.2*
Calochortus uniflorus	*large flowered star tulip*	*List 4.2*
Calyptridium parryi var. hesseae	*Santa Cruz Mountains pussypaws*	*List 1B.1*
Castilleja latifolia	*Monterey Indian paintbrush*	*List 4.3*
Centromadia parryi ssp. congdonii	*Congdon's tarplant*	*List 1B.1*
Chloropyron maritimum ssp. palustre	*Point Reyes bird's-beak*	*List 1B.2*
Chorizanthe cuspidata var. cuspidata	*San Francisco spineflower*	*List 1B.2*
Chorizanthe robusta var. robusta	*robust spineflower*	*FE, List 1B.1*
Cirsium andrewsii	*Franciscan thistle*	*List 1B.2*
Cirsium fontinale var. campylon	*Mt. Hamilton fountain thistle*	*List 1B.2*
Cirsium fontinale var. fontinale	*fountain thistle*	*FE, SE, List 1B.1*
Cirsium praeteriens	*lost thistle*	*List 1A*
Clarkia concinna ssp. automixa	*Santa Clara red ribbons*	*List 4.3*
Collinsia multicolor	*San Francisco collinsia*	*List 1B.2*
Chloropyron maritimum ssp. palustre	*Point Reyes bird's-beak*	*List 1B.2*

Table 6: Rare and locally unique plants

Scientific Name	Common Name	Status[1]
Cypripedium fasciculatum	clustered lady's slipper	List 4.2
Cypripedium montanum	mountain lady's slipper	List 4.2
Dirca occidentalis	western leatherwood	List 1B.2
Dudleya abramsii ssp. *setchellii*	Santa Clara Valley dudleya	FE, List 1B.1
Elymus californicus	California bottle brush grass	List 4.3
Eriogonum luteolum var. *caninum*	Tiburon buckwheat	List 1B.2
Eriophyllum latilobum	San Mateo woolly sunflower	FE, SE, List 1B.1
Eryngium aristulatum var. *hooveri*	Hoover's button-celery	List 1B.1
Erysimum ammophilum	sand-loving wallflower	List 1B.2
Erysimum franciscanum	San Francisco wallflower	List 4.2
Fritillaria agrestis	stinkbells	List 4.2
Fritillaria liliacea	fragrant fritillary	List 1B.2
Galium andrewsii ssp. *gatense*	serpentine bedstraw	List 4.2
Grindelia hirsutula var. *maritima*	San Francisco gumplant	List 3.2
Hesperocyparis abramsiana var. *butanoensis*	Santa Cruz Cypress (Butano Ridge)	FE, SE, List 1B.2
Hesperolinon congestum	Marin western flax	FT, ST, List 1B.1
Heterotheca sessiliflora ssp. *sessiliflora*	sessileflower false goldenaster	List 1B.1
Hoita strobilina	Loma Prieta hoita	List 1B.1
Horkelia cuneata var. *sericea*	Kellogg's horkelia	List 1B.1
Iris longipetala	Central Coast iris	List 4.2
Juglans californica var. *hindsii*	Northern California black walnut	List 1B.1
Lasthenia californica ssp. *macrantha*	perennial goldfields	List 1B.2
Lathyrus jepsonii var. *jepsonii*	Delta tule pea	List 1B.2
Legenere limosa	legenere	List 1B.1
Leptosiphon croceus	coast yellow leptosiphon	List 1B.1
Leptosiphon rosaceus	rose leptosiphon	List 1B.1
Lessingia arachnoidea	Crystal Springs lessingia	List 1B.2
Lessingia hololeuca	woolly headed lessingia	List 3
Lessingia micradenia var. *glabrata*	smooth lessingia	List 1B.2
Limnanthes douglasii ssp. *sulphurea*	Point Reyes meadowfoam	SE, List 1B.2
Leptosiphon ambiguus	serpentine leptosiphon	List 4.2
Lomatium parvifolium	small leaved lomatium	List 4.2
Hosackia gracilis	harlequin lotus	List 4.2
Lupinus arboreus var. *eximius*	San Mateo tree lupine	List 3.2
Malacothamnus aboriginum	Indian Valley bush-mallow	List 1B.2
Malacothamnus arcuatus	arcuate bush-mallow	List 1B.2
Malacothamnus davidsonii	Davidson's bush-mallow	List 1B.2
Micropus amphibolus	Mount Diablo cottonseed	List 3.2
Microseris paludosa	marsh microseris	List 1B.2
Monardella antonina ssp. *antonina*	San Antonio Hills monardella	List 3
Monardella undulata	curly leaved monardella	List 4.2
Monolopia gracilens	woodland woollythreads	List 1B.2
Orthotrichum kellmanii	Kellman's bristle moss	List 1B.2
Pedicularis dudleyi	Dudley's lousewort	List 1B.2
Penstemon rattanii var. *kleei*	Santa Cruz Mountains beardtongue	List 1B.2
Pentachaeta bellidiflora	white-rayed pentachaeta	FE, SE, List 1B.1
Perideridia gairdneri ssp. *gairdneri*	Gairdner's yampah	List 4.2

Table 6: Rare and locally unique plants

Scientific Name	Common Name	Status[1]
Pinus radiata	Monterey pine	List 1B.1
Piperia candida	white-flowered rein orchid	List 1B.2
Plagiobothrys chorisianus	Artist's popcorn flower	List 1B.2
Plagiobothrys chorisianus var. *chorisianus*	Choris's popcorn flower	List 1B.2
Plagiobothrys chorisianus var. *hickmanii*	Hickman's popcorn flower	List 1B.2
Plagiobothrys diffusus	San Francisco popcornflower	SE, List 1B.1
Plagiobothrys glaber	hairless popcornflower	List 1A
Potentilla hickmanii	Hickman's cinquefoil	FE, SE, List 1B.1
Quercus dumosa	Nuttall's scrub oak	List 1B.1
Ranunculus lobbii	Lobb's aquatic buttercup	List 4.2
Ribes victoris	Victor's gooseberry	List 4.3
Sanicula hoffmannii	Hoffmann's sanicle	List 4.3
Sidalcea malviflora ssp. *purpurea*	purple-stemmed checkerbloom	List 1B.2
Silene verecunda ssp. *verecunda*	San Francisco campion	List 1B.2
Streptanthus albidus ssp. *peramoenus*	most beautiful jewel flower	List 1B.2
Suaeda californica	California seablite	FE, List 1B.1
Thermopsis macrophylla var. *macrophylla*	California false lupine	List 1B.3
Trifolium amoenum	showy rancheria clover	FE, List 1B.1
Trifolium hydrophilum	saline clover	List 1B.2
Usnea longissima	long-beard lichen	

[1] Federal Status Designations:

FE = Federally Endangered. Species in danger of extinction throughout all or significant portions of its range.

FT = Federally Threatened. Species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

State Status Designations:

SE = State Endangered. Species whose continued existence in California is jeopardized.

ST = State Threatened. Species, although not presently threatened with extinction, may become endangered in the foreseeable future.

California Rare Plant Rank Designations:

List 1A = Plants presumed extinct in California

List 1B = Most plants in this category are endemic to California and have experienced significant declines over several decades; these plants are rare, threatened, or endangered throughout California and elsewhere.

List 2 = Species that are common outside of California, but rare, threatened, or endangered within California

List 3 = A review list of species for which necessary information is not available to either categorize in one of the other rankings or to reject outright.

List 4 = "Watch List" plants with limited distribution or infrequent presence throughout California. Populations of these species may exist along the perimeter of the species' range, may have declined significantly in specific locations within its range, may exhibit unique morphology, or occur on uncommon substrates.

Decimals after any of the "Status" categories represent a "Threat Rank" (e.g., "List 1B.1"):

0.1 = Seriously threatened populations in California, where over 80% of occurrences are threatened

0.2 = Marginally threatened populations in California, where between 20% and 80% of occurrences are threatened

0.3 = Populations with limited threats, where fewer than 20% of occurrences are threatened or with no known current threats

Table 7: Rare and locally unique animals

Common Name	Scientific Name	Status[1]
Invertebrates		
A freshwater isopod	*Calasellus californicus*	
Edgewood blind harvestman	*Calicina minor*	
Edgewood Park micro-blind harvestman	*Microcina edgewoodensis*	
California brackishwater snail (mimic tryonia)	*Tryonia imitator*	
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT
monarch butterfly	*Danaus plexippus*	
Mormon metalmark	*Apodemia mormo*	
San Bruno elfin butterfly	*Callophrys mossii bayensis*	FE
unsilvered fritillary	*Speyeria adiaste adiaste*	
Fish		
steelhead trout	*Oncorhynchus mykiss irideus*	FT
tidewater goby	*Eucyclogobius newberryi*	FE
Amphibians		
California red-legged frog	*Rana draytonii*	FT
foothill yellow-legged frog	*Rana boylii*	CSSC
California tiger salamander	*Ambystoma californiense*	FT, ST
Reptiles		
California mountain kingsnake	*Lampropeltis zonata*	CSSC
San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	FE, SE
coast horned lizard	*Phrynosoma blainvillii*	CSSC
western pond turtle	*Actinemys marmorata*	CSSC
Birds		
Alameda song sparrow	*Melospiza melodia pusillula*	CSSC
American peregrine falcon	*Falco peregrinus anatum*	FE (Delisted), SE, FP
American White Pelican	*Pelecanus erythrorhychos*	CSSC
bank swallow	*Riparia riparia*	ST
black skimmer	*Rhyncops niger*	CSSC
black swift	*Cypseloides niger*	CSSC
burrowing owl	*Athene cunicularia*	CSSC
California black rail	*Laterallus jamaicensis coturniculus*	ST, FP
California clapper rail	*Rallus longirostris obsoletus*	FE, SE
California gull	*Larus californicus*	CSSC, WL
California horned lark	*Eremophila alpestris actia*	CSSC, WL
California least tern	*Sternula antillarum browni*	FE, SE
Cooper's hawk	*Accipiter cooperii*	WL
double-crested cormorant	*Phalacrocorax auritus*	CSSC, WL
golden eagle	*Aquila chrysaetos*	CSSC, FP, WL
grasshopper sparrow	*Ammodramus savannarum*	CSSC
great blue heron	*Ardea herodias*	
loggerhead shrike	*Lanius ludovicianus*	CSSC
long-eared owl	*Asio otus*	CSSC
marbled murrelet	*Brachyramphus marmoratus*	FT, SE
northern goshawk	*Accipiter gentilis*	CSSC
northern harrier	*Circus cyaneus*	CSSC
olive-sided flycatcher	*Contopus cooperi*	CSSC
osprey	*Pandion haliaetus*	WL

Table 7: Rare and locally unique animals

Common Name	Scientific Name	Status[1]
peregrine falcon	*Falco peregrinus anatum*	FP
pileated woodpecker	*Dryocopus pileatus*	
purple martin	*Progne subis*	CSSC
saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	CSSC
sharp-shinned hawk	*Accipiter striatus*	WL
short-eared owl	*Asio flammeus*	CSSC
snowy egret	*Egretta thula*	
Swainson's hawk	*Buteo swainsoni*	ST
tricolored blackbird	*Agelaius tricolor*	CSSC
Vaux's swift	*Chaetura vauxi*	CSSC
western snowy plover	*Charadrius alexandrinus nivosus*	FT, CSSC
white-tailed kite	*Elanus leucurus*	FP
Mammals		
American badger	*Taxidea taxus*	CSSC
hoary bat	*Lasiurus cinereus*	
pallid bat	*Antrozous pallidus*	CSSC
ring-tailed cat	*Bassariscus astutus*	FP
salt-marsh harvest mouse	*Reithrodontomys raviventris*	FE, SE, FP
salt-marsh wandering shrew	*Sorex vagrans halicoetes*	CSSC
San Francisco dusky-footed woodrat	*Neotoma fuscipes annectens*	CSSC
Steller sea lion (northern sea-lion)	*Eumetopias jubatus*	FT
Townsend's big-eared bat	*Corynorhinus townsendii*	CSSC
western red bat	*Lasiurus blossevillii*	CSSC
Yuma myotis	*Myotis yumanensis*	

[1]Federal Status Designations:

FE = Federally Endangered. Species in danger of extinction throughout all or significant portions of its range.

FT = Federally Threatened. Species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

State Status Designations:

SE = State Endangered. Species whose continued existence in California is jeopardized.

ST = State Threatened. Species, although not presently threatened with extinction, may become endangered in the foreseeable future.

CSSC = California species of special concern. Animal species with California breeding populations that may face extinction in the near future.

FP = Fully protected by the State of California under Sections 3511 and 4700 of the Fish and Game Code.

WL= Department of Fish and Game Watch List

Table 8: Rare species hot spots within the Vision Plan Area

Hotspot	Description	Species Found in Hotspot[1]	District Open Space Preserves Featuring the Hotspot
Aquatic			
Coastal streams and lagoons	Perennial streams that flow to the Pacific Ocean or the San Francisco Bay	Coho, steelhead, tidewater goby, California red-legged frog, foothill yellow-legged frog, Pacific giant salamander, and rough skinned newt	Many OSPs including Purisima Creek, Tunitas Creek, El Corte de Madera, La Honda Creek, Russian Ridge, Los Trancos, Monte Bellow, and Sierra Azul OSPs
Ponds and freshwater wetlands	Natural and human-created ponds and wetlands	San Francisco garter snake , California red-legged frog, California tiger salamander, western pond turtle, and tricolored blackbird	Many OSPs including Tunitas Creek, La Honda Creek, Russian Ridge, Skyline Ridge OSPs, and others
Bay wetlands	Wetlands fringing the San Francisco Bay	California seablite, northern harrier, California black rail, California clapper rail, salt-marsh harvest mouse, salt-marsh wandering shrew	Ravenswood OSP and Stevens Creek Natural Study Area
Terrestrial			
Coastal Bluffs and Dunes	Coastal strand communities	Western Snowy Plover, globose dune beetle, sandy beach tiger beetle, and coastal marsh milk-vetch	
Grasslands	Grasslands throughout District	Grasshopper sparrow, burrowing owl, white-tailed kite, golden eagle, Swainson's hawk, northern harrier, and American badger	Many OSPs including La Honda Creek, Windy Hill, Russian Ridge, Skyline Ridge, Monte Bello, Long Ridge OSPs
Serpentine Communities	Grasslands, shrublands, savannas, and woodlands on serpentine soil	Bay checkerspot butterfly, most-beautiful jewelflower, Mount Hamilton thistle, fragrant fritillary, San Mateo Thorn-mint, Marin western flax, Crystal Springs lessingia, Santa Clara valley dudleya, and others	St. Joseph's Hill and Sierra Azul OSPs
Maritime chaparral	Endemic communities on nutrient poor soils in reach of summer fog	Montara manzanita, King's Mountain manzanita, and Santa Cruz manzanita	El Corte de Madera and Teague Hill OSPs
Riparian woodlands	Deciduous woodlands along streams	San Francisco common yellowthroat, yellow warbler, Cooper's hawk, sharp-shinned hawk, long-eared owl	Many OSPs including Miramontes Ridge, Purisima Creek Redwoods, Tunitas Creek, La Honda Creek, Saratoga Gap, and Sierra Azul OSPs

Table 8: Rare species hot spots within the Vision Plan Area

Hotspot	Description	Species Found in Hotspot[1]	District Open Space Preserves Featuring the Hotspot
Sandstone Outcroppings	Sandstone outcroppings that create unique soil conditions and provide substrate for bryophytes	Santa Cruz cypress, and mosses including *Orthotrichum kellmanii*	
Coast Redwood Forest	Forests dominated by coast redwood and Douglas fir, including old-growth forests	San Francisco dusky-footed woodrat, marbled murrelet, Vaux's swift, sharp-shinned hawk, Cooper's hawk, pileated woodpecker, and olive-sided flycatcher	Many OSPs Purisima Creek Redwoods, Teague Hill, El Corte de Madera, La Honda Creek, Windy Hill, Russian Ridge, and Bear Creek

[1] Scientific names and species status are provided in Tables 6 and 7.

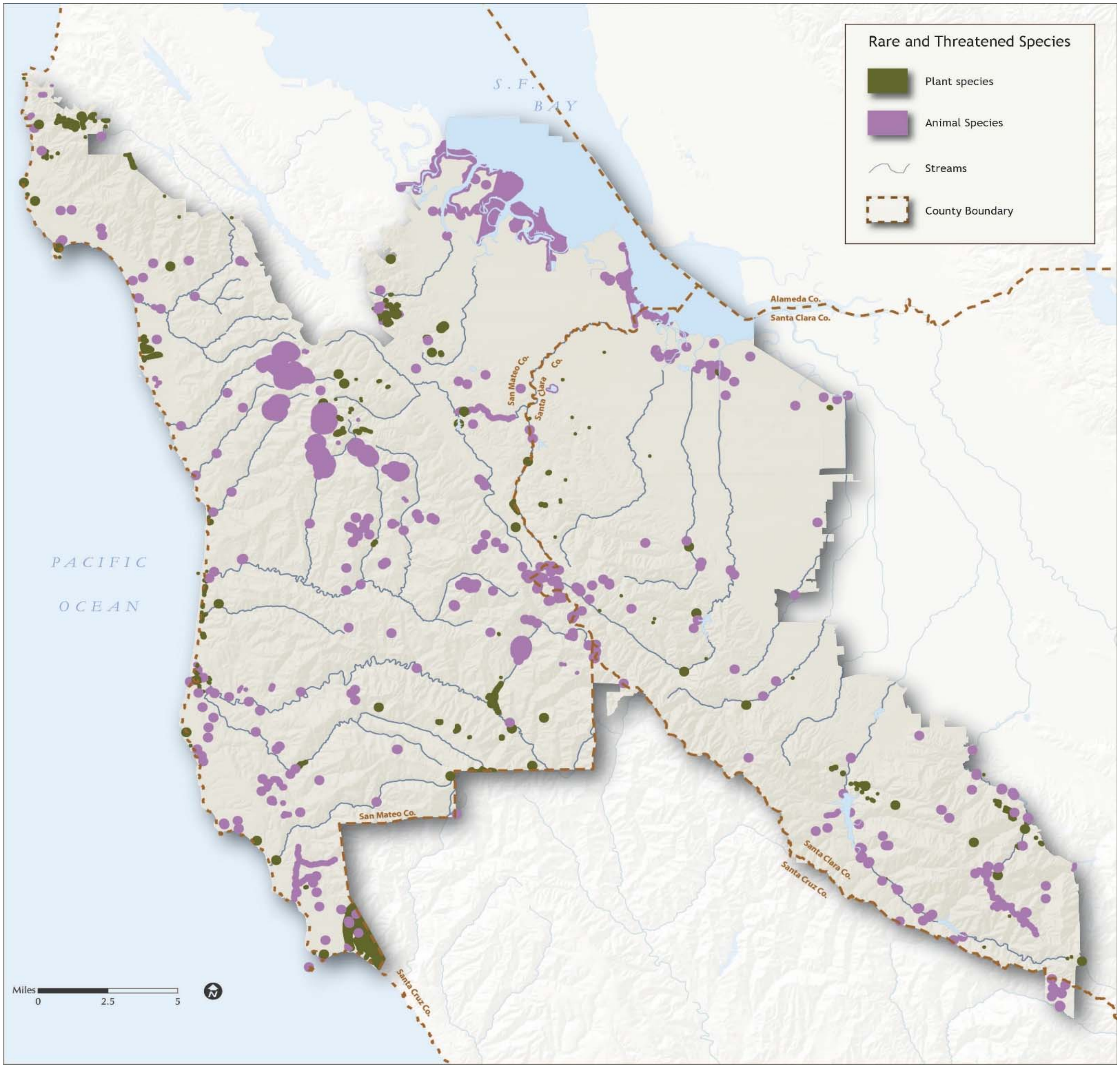

Figure 8: Known rare species occurrences

LANDSCAPE CONNECTIVITY

Long-term persistence of plants and animals within the Vision Plan Area, and the maintenance of biodiversity in the Santa Cruz Mountains Bioregion as a whole, will rely on maintaining connectivity between habitat patches within the District as well as between the Santa Cruz Mountains and the adjacent Diablo and Gabilan ranges. Over a variety of spatial and temporal scales, landscape connectivity promotes the maintenance of populations and genetic diversity, and enables individuals and species to adapt to changing conditions, including changes in climate (inset box).

The Vision Plan Area contains large contiguous blocks of habitat within the Santa Cruz Mountains Bioregion. Within the District, there are also numerous terrestrial and aquatic linkages that can help connect habitat, thus promoting long-term persistence of the species (Figure 9).

Landscape Connectivity Values

Large, interconnected patches of habitat can:

- support species with large home ranges such as mountain lions, for which individual habitat patches are insufficient to support persisting populations;
- facilitate species movement in response to changes in habitat suitability, to disperse to establish a new territory, and as part of seasonal or other migration;
- facilitate recolonization of habitat patches after a disturbance (e.g. fire);
- promote exchange of genetic material to facilitate population viability; and
- enable species range shifts in response to climate change.

Habitat Patches

The District contains large patches of relatively intact terrestrial and aquatic habitat within the Santa Cruz Mountains Bioregion (BAOSC 2013, Mackenzie et al. 2011; Figure 9). This includes approximately half of the largest contiguous habitat patch—a more than 61,000 acre area centered on Big Basin State Park, in the southwestern portion of the District. Other large patches of terrestrial habitat within the District are concentrated on the western slope of the Santa Cruz Mountains, where habitat is fragmented primarily by relatively sparse, residential development and relatively low-traffic, two-lane roads. Wetlands along the San Francisco Bay constitute the region’s aquatic habitat patches (BAOSC 2013; Figure 9). Such large habitat areas are essential, as they support a disproportionate richness of species, are more resistant to habitat degradation caused by edge effects, and are important for wide-ranging species

Linkages

The long-term persistence of populations and the maintenance of biodiversity within the Santa Cruz Mountains will require maintaining linkages between remaining patches of terrestrial and aquatic habitat.

Terrestrial Linkages

The District features numerous important landscape linkages, which can facilitate movement of both terrestrial and aquatic species (BAOSC 2013; Figure 9). The terrestrial linkage connecting the intact habitat in the northern portion of the Santa Cruz Mountains to the Diablo and Gabilan ranges to the south traverses the eastern slope of the Santa Cruz Mountains 23 miles through the District. This linkage was developed by combining the least cost corridors (i.e. most direct route through the most suitable habitat) of a suite of focal species, chosen to be representative of terrestrial species in the region (Inset box).

This important terrestrial linkage crosses Highway 17— a four-lane, divided highway which features high traffic volume and a concrete median, and is lined with attendant residential development. The north-south-trending highway constrains animal movement, rendering this area a choke point, or tenuous portion of the linkage (Figure 9). Though not a barrier to the east-west linkage, other highways within the District create barriers for the movement of animals and ecological processes (e.g. fires and gene flow). Notably, Highway 101 and Interstate 280 are parallel, multi-line highways that traverse the Santa Clara Valley and adjacent foothills, and create barriers to connectivity between the upland habitat and the bay lands. Other smaller highways and major roads within the District, including Highways 1, 35, 84, and 92 may also inhibit movement of animals and processes (Figure 9). Though their width and traffic volume is much lower than that of Highways 17 and 101 and Interstate 280, these roads, may contain the movement of less vagile species.

Focal Species for the Linkage Designs (BAOSC 2013)

Terrestrial Linkages

- American badger
- Black-tailed deer
- Bobcat
- California Quail
- Mountain lion
- Ringtail
- Western grey squirrel
- Wrentit

Aquatic Linkages

- Coho salmon
- Steelhead trout

Crossing structures, such as underground culverts or overpasses with directional fences that guide animals to safe routes across these and other highways can promote connectivity, as well as enhance public safety by reducing vehicle-animal collisions. The District resource management policies include numerous implementation measures designed to achieve the goal of protecting ecosystem integrity by maximizing habitat connectivity (MROSD 2011). Importantly, the District features open space preserves on either side of Highway 17, and thus will be an important partner in efforts to promote connectivity through the region (Figure 9).

Aquatic Linkages

The Vision Plan Area also features numerous steams that support coho salmon and steelhead trout: anadromous fish that must migrate from spawning (breeding) areas often high within the watersheds, to the ocean or San Francisco Bay, in the case of some steelhead runs (Figure 9; Section 2.1). Access to upstream habitat in these important aquatic linkages is constrained by numerous artificial barriers to fish passage, including dams and impassible road crossings (i.e. bridges and roads). Removing or retrofitting these features can facilitate access by anadromous fish to spawning habitat upstream, thus potentially increasing the size and viability of the rare salmonid populations.

Importantly, these and other stream corridors can also facilitate movement of terrestrial species, particularly in urban or intensively cultivated areas where dense riparian vegetation creates important cover for animals (Naiman et al. 1993, Hilty and Merenlender 2004). Such stream corridors may facilitate movement of species across the densely developed Santa Clara Valley and Highway 101 and Interstate 280, thus connecting the bay lands in the northeastern portion of the District, to the foothills on the eastern slope of the Santa Cruz Mountains (Figure 9). Importantly, though it may not be feasible to create the recommended 2 km riparian buffer in these urbanized areas (BAOSC 2013), increasing the width can promote use of riparian corridors by a broader suite of animals.

The District resource management policy for habitat connectivity, as well as the wildlife management policies, includes a variety of implementation measures to increase the connectivity within riparian and riverine systems (MROSD 2011). These include addressing anthropogenic fish passage barriers, and protecting and restoring riparian areas to promote their use by animals, as well as their other important values. District open space preserves feature portions of many of the important aquatic linkages, including tributaries to San Gregorio Creek and Stevens Creek (Section 2.1; Figure 9), providing opportunities for the District to work directly to promote landscape connectivity through implementation of these policies.

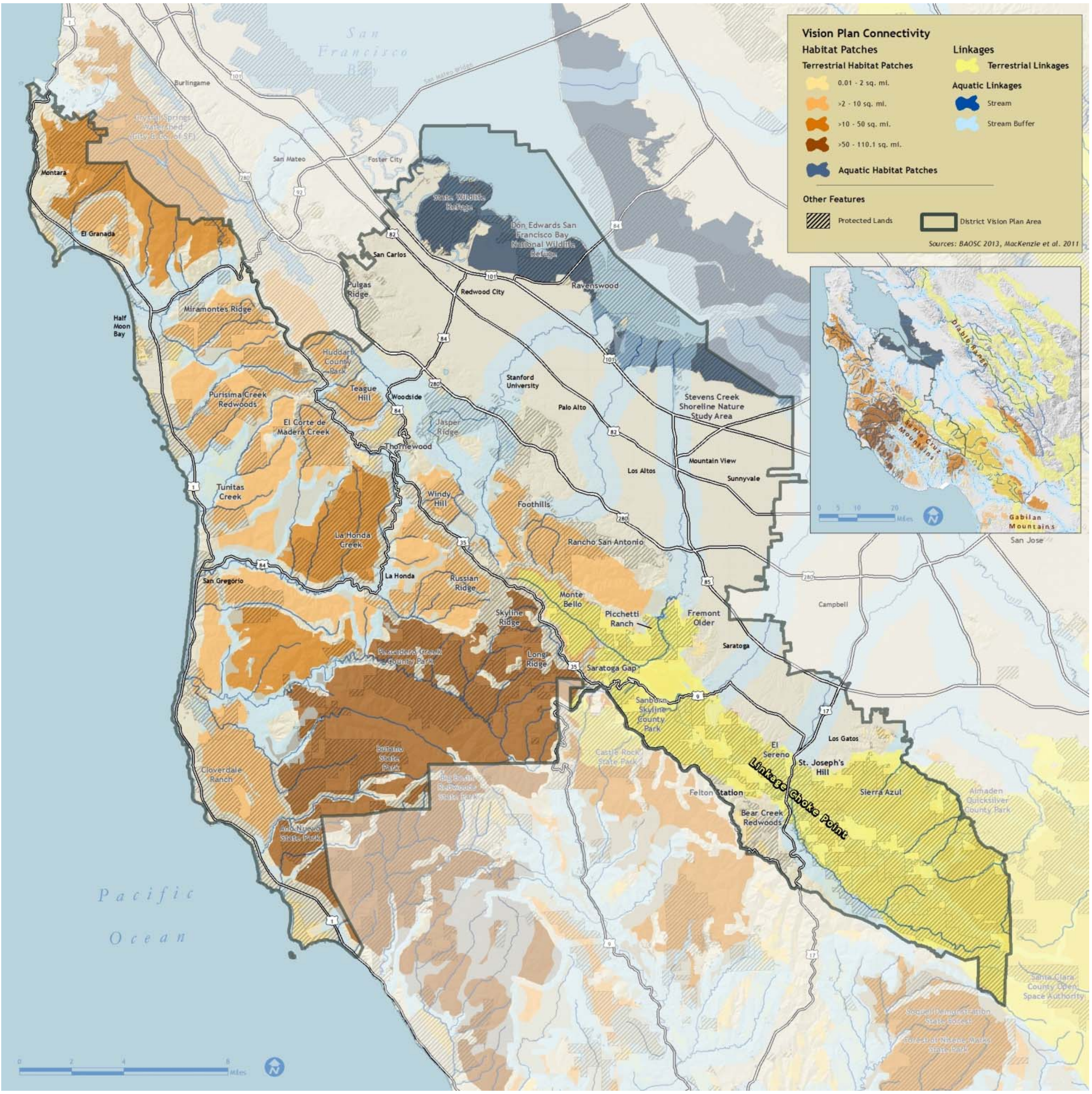

Figure 9: Habitat patch and landscape linkages

THREATS TO BIODIVERSITY

The biological conservation values of the Vision Plan Area are threatened by a variety of factors that can convert, fragment, and/or degrade habitat (Table 9). Many of these threats can also negatively impact the region's cultural resources, recreation opportunities, water supplies, and scenic beauty.

The nature and extent of the threats vary across the landscape, due to a variety of factors including topography (e.g. slopes), vegetation (e.g. forests vs. grasslands), existing land use, population growth pressure (e.g. proximity to existing development and roads), and local land use policies. Threats also differ depending on the conservation value in question; activities that are negative for some biological systems and species might not affect, or might even improve, others.

This section further evaluates three threats that degrade biological resources within the Vision Plan area, including the District open space preserves: erosion and sedimentation, non-native plants, and grassland succession. Factors degrading forests are discussed in Section 6, while Section 7 discusses fire exclusion and Section 8 outlines potential impacts of global change.

Table 9: Threats to ecological viability of the species and communities within the Vision Plan Area

Type	Threat	Impacts
Habitat loss and fragmentation	Development	Urban, suburban, and exurban development displace native plants and animals, and render the landscape less permeable to species and ecological processes (e.g. fire).
	Agricultural conversion	Conversion of natural vegetation including grazing land to agricultural crops (e.g. row crops, vineyards, orchards, and tree farms), displaces native plants and animals. Food safety practices associated with some agriculture including fencing, depredation, poison bait stations, draining water features, and clearing vegetation can further impact animals. Agricultural activities can cause mortality to slow-moving or nesting species.
	Transportation Projects	Construction of new roads, highways, and rail lines, and expansion of existing transit corridors, can fragment habitat, isolate plant and animal populations, and cause direct mortality due to vehicle collisions.
	Mining	Mining displaces native plants and animals, can pollute air and water, and can promote non-native species.
Incompatible human uses	Incompatible grazing	Inappropriate intensity or seasonality of grazing, and cattle activity in grazing sensitive communities (e.g. wetlands and riparian areas) can displace native plants and degrade habitat for native animals in some cases. Conversely, cessation of grazing in grasslands can cause succession to other community types (e.g. coastal scrub) in the absence of other disturbances (e.g. fire), thus extirpating populations of species that require grasslands.

Table 9: Threats to ecological viability of the species and communities within the Vision Plan Area		
Type	**Threat**	**Impacts**
	Incompatible forest management	Harvest activities and roads can displace some species of native plants and animals including those that require late-seral forest conditions or are wary of human activity, can cause erosion and stream sedimentation, limit recruitment of large woody debris into streams, promote the invasion and spread of non-native species, and result in direct mortality to slow-moving or nesting species.
	Stream Water use	Stream diversions can directly impact native animals and degrade habitat by reducing flows and increasing stream temperature, which can impact coho, steelhead, and other fish. Dams displace upland habitat and create barriers to aquatic species migration, thus eliminating upstream habitat for anadromous fish. Construction of diversion channels can cause direct mortality.
	Recreation	Incompatible use of natural lands by off-highway vehicles, bicycles, equestrians, hikers, campers, hunters, and fisherman, can displace native plants and animals, cause erosion, and promote the invasion and spread of non-native plants as well as populations of human commensals, including corvids that negatively impact other species including marbled murrelet.
	Other stream habitat modifications	Streambed alterations, channelization, dredging, flood-control structures, water diversion structures, culverts, dams, fords, bridges, and other modifications can degrade stream habitat, impede migration, and cause direct mortality to riverine species.
Biological invasions	Invasive plants	Invasive plants outcompete native plants, degrade habitat for native animals, alter disturbance regimes (e.g. fire frequency), and alter nutrient cycling (e.g. nitrogen availability).
	Non-native animals	Non-native animals outcompete, predate upon, and hybridize with native animals, negatively impact native plants through herbivory, and promote non-native plant invasions through disturbance (e.g. feral pig diggings).
	Emergent diseases	New diseases impact native plants (e.g. sudden oak death), amphibians (Chytrid fungus or "*Bd*", Ranaviruses, etc.) and birds (West Nile virus and Avian flu).
Altered fire regimes	Fire suppression	Fire suppression eliminates fire-adapted and early successional species, including species such as King's mountain manzanita (*Arctostaphylos ohloneana*) and can ultimately result in type conversion of vegetation (e.g. chaparral transitions to forest).
	Inappropriate fire frequency or seasonality	Increased fire frequency and inappropriate fire seasonality can eliminate even fire-adapted species and communities.

Table 9: Threats to ecological viability of the species and communities within the Vision Plan Area

Type	Threat	Impacts
Altered hydrologic regimes	Stream flow (including flood control)	Flood management can eliminate early-successional riverine and riparian species, prevent transport of sediment and pollution, and alter habitat conditions and displace some native species (e.g. reduced flow increases water temperature and decreases oxygen).
	Pond hydroperiod	Reducing the period of seasonal pond inundation can eliminate aquatic species that require sufficient time to complete their lifecycle.
Pollution	Nitrogen deposition	Deposition of nitrogen from pollution in the atmosphere fertilizes vegetation, can promote the invasion and spread of non-native plants, and alters the competitive balance between native plant species, thus displacing poor competitors including many endemic species in serpentine communities.
	Sedimentation	Sediment degrades spawning habitat for salmonids and other fish, and reduces the size of ponds and their period of inundation.
	Pathogens	Pathogens from cultivated land, livestock operations, septic tanks, and other sources pollute streams, sloughs, and other aquatic systems.
	Fertilizers	Agricultural run-off increases productivity in aquatic systems, degrading stream, pond, slough, wetland, and other habitat.
	Biocides	Herbicide and pesticides can impact native plants and insects, and biomagnify within food webs to acutely impact top predators.
	Other Chemicals	Other chemicals including those used to manufacture illicit drugs, including methamphetamine, can poison terrestrial and aquatic species.
	Genetic erosion	Non-local genetic material introduced into natural systems from hatcheries, nurseries, and other sources can disrupt locally-adaptive genetic complexes and evolutionary processes (e.g. speciation).
Global change	Hotter, drier climate	Climate change can displace species directly, and alter competition, predation, disease, and other species interactions and ecological processes, including disturbances such as fire, thus affecting native species.
	Increase in atmospheric CO_2	Increased atmospheric carbon dioxide can fertilize plants, promote the invasion and spread of non-native species, and alter competitive balances between native plants, thus displacing poor competitors including many native plants.
	Sea Level Rise	Higher sea levels will inundate and remove or degrade coastal and bay communities including rock outcroppings, dunes, cliffs, and wetlands that cannot migrate to adjacent land if it is build up or armored.

Erosion and Sedimentation

The steep, mountainous terrain of the Vision Plan Area receives abundant precipitation, which can occur as part of high-intensity rainfall events that can cause soil erosion in areas featuring sparser vegetation and/or more erosive soils. Moreover, deep gullies can form in areas underlain by less stable geologic formations, including sedimentary rocks such as sandstones and shales of the Purisima formation, and the metamorphic formations including the San Franciscan, which is a melange that includes serpentine.

While erosion is a natural part of the geology and thus broader ecology Peninsula, a variety of land use activities can promote erosion, including:

- development, which increases run-off by creating impervious surfaces;
- agriculture, which generally reduces plant cover;
- roads and trails, which remove vegetation, and can channel run-off when not properly constructed or maintained; and
- fires, which removes vegetation canopy that intercepts rain drops and roots that bind soil.

These and other factors that exacerbate erosion can degrade habitat through a variety of mechanisms, including:

- removing vegetation, including sensitive plant communities and habitat for rare and endangered plants and animal species;
- promoting the invasion and spread of non-native plants, including many invasive plants that are adapted to colonizing bare areas such as jubata grass (*Cortaderia jubata*; D'Antonio et al. 1999); and
- causing sedimentation of aquatic systems, including ponds, streams, the San Francisco Bay, and the near-shore environment of the Pacific Ocean.

Gauges of Soil Erosion Potential

Universal Soil Loss Equation (Figure 10): Measures soil loss potential based on:

- Precipitation
- Vegetation cover
- Soil erositivity
- Slope distance
- Slope steepness

Landslide Frequency (Figure 11): Occurrence of previous slides and earth flows, where future landslides are more likely to occur (USGS 1997).

Within the Vision Plan Area, areas featuring higher potential for soil erosion based on multiple gauges (inset box) occur in two broad areas (Figures 10 and 11):

1. The steep terrain on the higher-elevation, western slopes of the Santa Cruz Mountains, particularly in areas underlain by Purisima Formation, which features highly-erosive sandstones and siltstone. This formation underlies nearly 40,000 acres, which are concentrated in the Pescadero and San Gregorio watersheds—the two highest priority watersheds for conservation of rare salmonids and other riverine species (Section 2.1). Stream sedimentation degrades spawning habitat for fish has been identified as a major threat to the recovery of coho and steelhead in these and other coastal watersheds (NMFS 2010).

2. The steep terrain on the eastern slope of the Santa Cruz Mountains, within the Los Gatos Creek and Upper Guadalupe Creek watersheds. The Upper Los Gatos Creek Watershed including the Bear Creek Open Space Preserve, features extensive areas of prior landslides, where future slides and earth flows are most likely to occur (USGS 1997). The eastern portion of this watershed, as well as the upper Guadalupe Creek Watershed, feature extremely steep slopes that support fire-prone chaparral, which leaves slopes open to extensive erosion once burned.

Portions of these areas are underlain by the Franciscan Complex, a melange of metamorphic rocks including serpentine, which are prone to slides.

The District takes a variety of measures to limit soil erosion and sedimentation by implementing measures as part of two resource primary management policies:

- Geology and soils, the goal of which is to avoid or minimize soil loss and prevent or remediate contamination related to human land use, and protect unique or exceptional geologic features; and
- Water resources, the goal of which is to protect and restore natural water courses, wetlands and hydrologic processes.

Notably, protection of land in open space preserves is key to reducing soil erosion that could result from development, intensive agriculture, and other land uses.

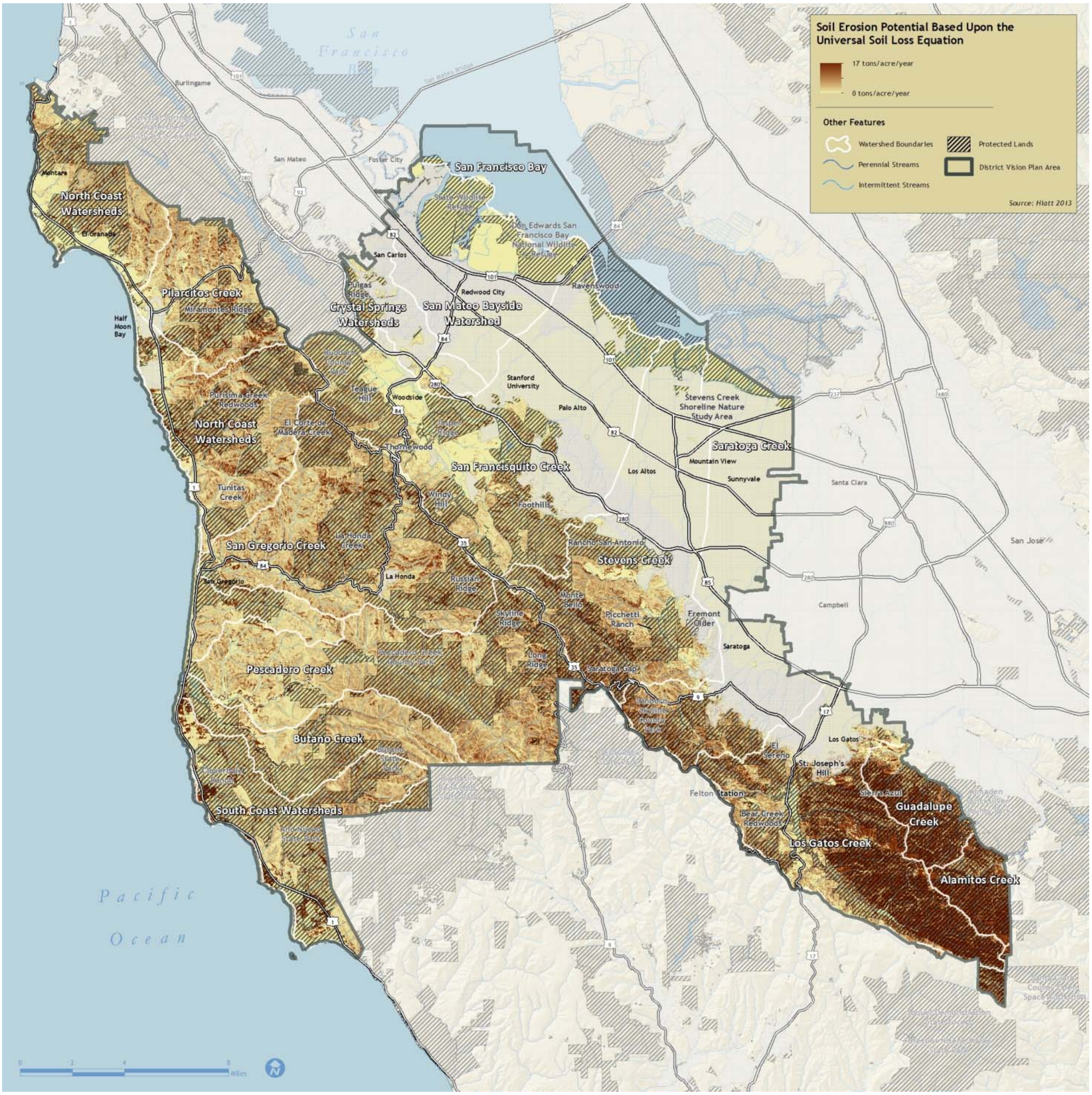

Figure 10: Soil erosion potential based upon the Universal Soil Loss Equation

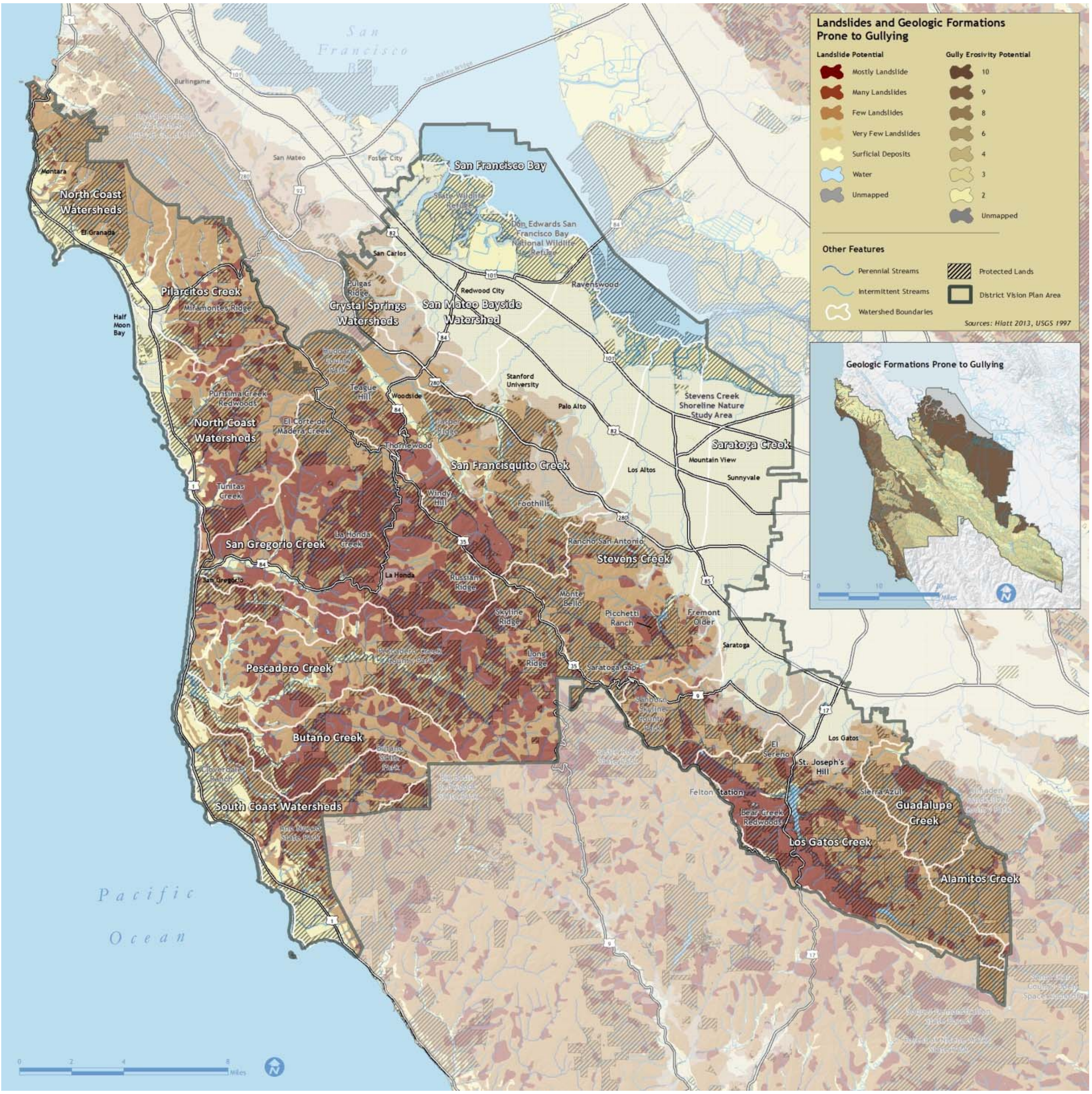

Figure 11: Landslides and geologic formations prone to gullying

Non-native Plants

Natural lands within the Vision Plan Area support populations of many plant species that are not native to California. These non-native species dominate 9,557 acres, 860 acres (9%)[1] of which are within District open space preserves (Table 10, Figure 12). Additional unmapped areas also likely support high concentrations of non-native plant species, which also occur at lower abundance within the region's native plant communities (Figure 1).

Table 10: Non-native plants within the Vision Plan Area and District Open Space Preserves

Non-Native Plant Cover	Acres	Percent in District Preserves[1]
Non-Native Herbs		
Harding grass	155	50.3%
Ruderal	927	31.1%
Poison Hemlock	6	71.1%
Yellow Star-thistle Series	224	73.3%
Pampas Grass	4	0.0%
Non-Native Grass	1,987	0.0%
Non-Native Herbs Subtotal	**3,303**	**16.2%**
Non-Native Shrubs	**113**	**43.4%**
Non-Native Trees		
Acacia	12	77.8%
Eucalyptus	3,341	5.4%
Monterey Cypress	6	0.0%
Planted Pines	776	11.3%
Non-Native Trees	2,008	<0.1%
Non-Native Trees Subtotal	**6,143**	**4.5%**
Total Non-Native Plant Cover	**9,559**	**9.0%**

Non-native plants of all life forms occur within the District, including grasses, forbs, shrubs, and trees. Species that are relatively widespread within natural communities, often as a result of their long tenure in California, are often regarded as naturalized; these include many annual grasses such as oats (*Avena* spp.), bromes (*Bromus* spp.), and barleys (*Hordeum* spp.), which arrived with Spanish missionaries and now predominate within much of the region's grasslands. Species that have large impacts on natural systems, and can often spread rapidly following invasion, are referred to as invasive; examples of such species within the District include cord grass (*Spartina* spp.), jubata grass (*Cortaderia jubata*), yellow-star thistle (*Centaurea melitensis*), and French broom (*Genista monspessulana*).

The magnitude of the impacts of non-native plants depends on their ecology and abundance, as well as the ecology of the system that they invade (Levine et al. 2003). Table 11 lists the various mechanisms by

[1] The relatively high percentage of non-native plant communities located within in the District OSPs reflects the finer-scale mapping conducted in the District lands, where non-native vegetation types were more likely to be differentiated from native types than elsewhere in the Vision Plan Area, which was more coarsely mapped.

which non-native plants can impact native species, natural communities, ecosystem functions, and processes within the Vision Plan Area, and provides examples of each for District open space preserves.

The District manages invasive plants on District lands, following the Invasive Species Management Policy, the goal of which is to control invasive species that have a substantial impact on preserve resources in order to foster the restoration of native vegetation and habitat (MROSD 2011). Recent initiatives have included attempts to eradicate slender false brome (*Brachypodium sylvaticum*), a perennial bunchgrass that recently established near Woodside and is not otherwise known from California. The District's program included controlling the species within the Thornewood OSP, as well as and education and cost-sharing program with private landowners to ensure effective eradication.

Table 11: Examples of impacts of non-native plant species within the Vision Plan Area and District Open Space Preserves

Impact	Description	Examples and Occurrences within the Vision Plan Area	Examples within the District Open Space Preserves
Outcompete Native Plants	Non-native plants can deplete soil moisture and/or nutrients, shade-out native species, compete for limited space, and/or create conditions that deter native plant establishment, such as dense thatch	Non-native Mediterranean annual and perennial grasses complete with native forbs (i.e. wildflowers) and grasses, reducing their distribution and abundance. Impacts are acute in serpentine grasslands, which support high concentrations of rare native plants that are negatively impacted by thatch that builds up in the absence of grazing, and can be exacerbated by atmospheric nitrogen deposition.	Grasslands and oak savannas throughout the District, including La Honda, Russian Ridge, and Long Ridge OSPs, and serpentine grasslands in Sierra Azul and St. Joseph's Hill OSPs.
Alter Community Structure	Non-native plants alter the structure of native communities, oftentimes degrading habitat for native animals.	• Non-native trees including Monterey cypress (*Cupressus macrocarpa*), eucalyptus (*Eucalyptus* spp.), and acacia (*Acacia* spp.), establish in grasslands and shrublands, and can create perches for birds that predate on small mammals and birds. Established as wind breaks and often planted in early homesteads, these and other trees occur patchily through the Vision Plan Area, and are prevalent in northwestern San Mateo County. • Non-native cord grass (*Spartina* spp.) invades San Francisco bay mudflats used by foraging endangered clapper rail, and displaces native pickleweed marsh used by the salt marsh harvest mouse.	• Non-native trees occur in the Madonna Creek, Tunitas Creek, Thornewood, Fremont Older, St. Joseph's Hill, and Sierra Azul OSPs, and at lower densities in other preserves. • Non-native cordgrass has established within the Ravenswood OSP, Stevens Creek Natural Study Area
Modify Hydrology	Non-native plants can alter hydrological conditions, which can in turn alter community structure	• Non-native cordgrass traps sediment, chokes channels, and elevates mudlfats, converting them to cordgrass meadow. Giant reed (*Arundo donax*), a large perennial grass, colonizes riparian areas, narrows channels and reduces surface and	• Ravenswood OSP, Stevens Creek Natural Study Area

Table 11: Examples of impacts of non-native plant species within the Vision Plan Area and District Open Space Preserves

Impact	Description	Examples and Occurrences within the Vision Plan Area	Examples within the District Open Space Preserves
	and species composition.	ground water through extensive evapotranspiration, thus degrading habitat for steelhead, California red-legged frog, and western pond turtle, and other aquatic species in San Francisquito Creek.	
Promote Fire in Non-Fire Adapted Systems	Non-native plants can create fuel conditions that promote fire, which can kill native species that are not adapted to fire.	• Non-native grasses can create fine fuels that promote fire in shrublands where widely spaced native shrubs and sparse herbs typically will not sustain fire. A grass-fire cycle can convert shrublands and woodlands to grasslands. • Eucalyptus and Monterey cypress are fire-promoted, and produce fuels that can promote fire in adjacent native communities	• Non-native grasses create fine fuels adjacent to shrublands in throughout much of the non-forested areas in the District. • Non-native trees occur within Madonna Creek, Tunitas Creek, Thornewood, Fremont Older, St. Joseph's Hill, and Sierra Azul OSPs, and at lower densities in other preserves.

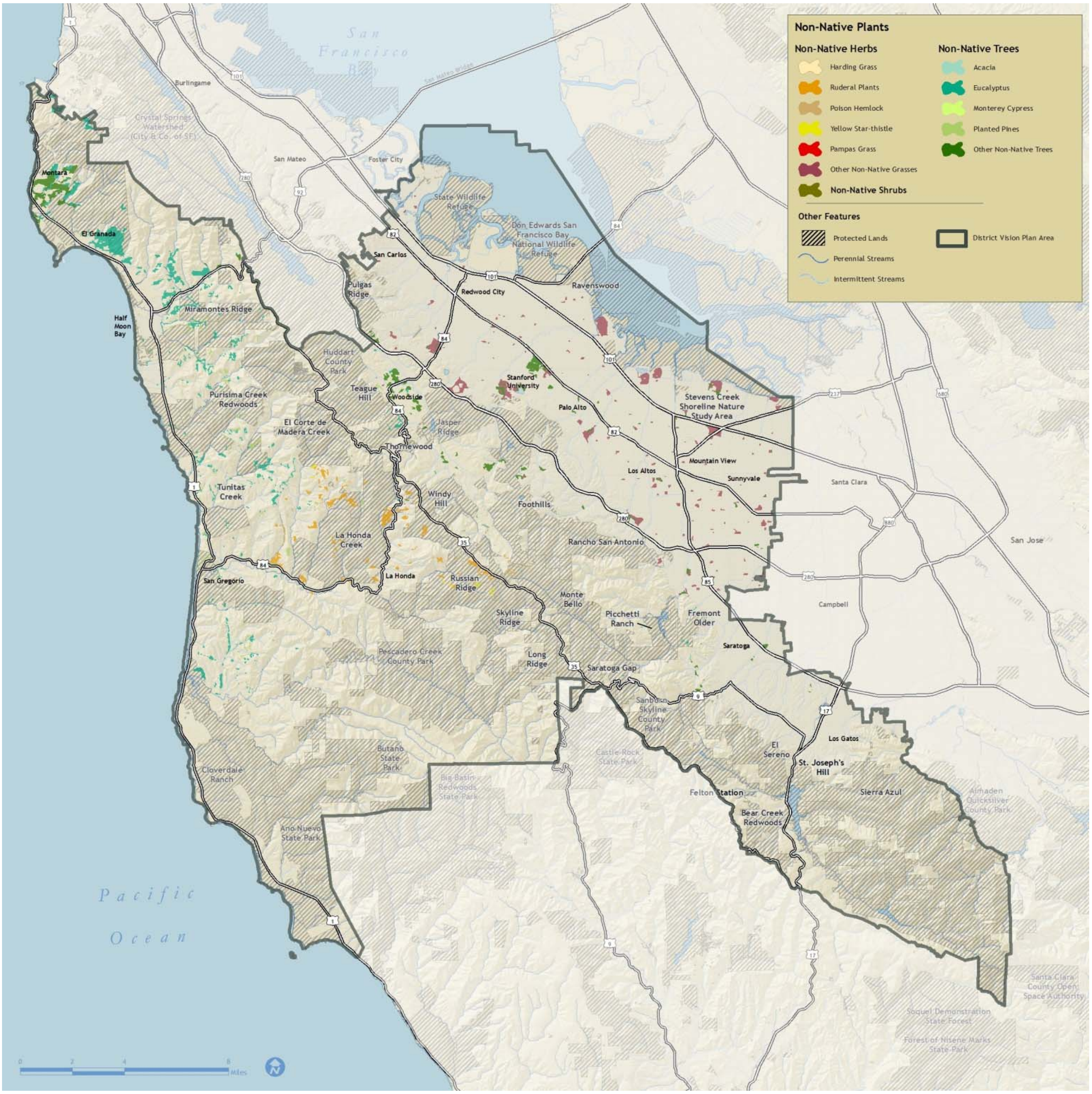

Figure 12: Communities dominated by non-native plants

Grassland Habitat Succession

The Vision Plan Area contains over 36,000 acres of grasslands—plant communities that feature moderate to dense cover of herbaceous (non-woody) plants, including primarily grasses but also forbs (broad-leafed herbs, or "wildflowers"). These include serpentine grasslands, which occur on outcrops of serpentine soil at the base of the eastern slope of the Santa Cruz Mountains, native perennial grasses featuring purple need grass, which often occurs in drier microsites (e.g. south-facing slopes or sandier soils), and coastal prairies—moist grasslands on the western slope of the Santa Cruz Mountains, within reach of the coastal fog (Table 2, Figure 2). The rich native grasslands support a diverse assemblages native plants and animals, many of which are either not found, or occur at lower abundance, in the California annual grasslands, which occur on inland areas on non-serpentine soils.

Though once widespread, California grasslands have been greatly diminished by conversion to agriculture and urban land use. As a result of widespread habitat loss and fragmentation, grasslands within the Vision Plan Area support many species that are rare or endangered (inset box).

Rare Grassland Species

Plants

*San Mateo thorn-mint**
Marin western flax
round-leaved filaree
Point Reyes meadowfoam
purple-stemmed checkerbloom
most beautiful jewel flower

Animals

American badger
Bay checkerspot butterfly
burrowing owl
golden eagle
grasshopper sparrow
northern harrier
white-tailed kite

**Serpentine grassland species listed in italics.*

Though the 6,087 acres of grasslands (16.6% of total) within the District open space preserves are protected from development, the persistence of rare species that they support is threatened by fire exclusion and exotic plants. In the absence of recurring fire, woody plant species including coyote brush (*Baccharis* pilularis) and Douglas fir (*Pseudotsuga menziesii*) invade from adjacent shrublands and forests and outcompete native herbaceous plants; over time, these and other woody species can convert grasslands to shrubland or woodland (McBride and Heady 1968, McBride 1974, Heady et al. 1988).

The persistence of native grassland species is also threatened by exotic plants, which have invaded and in many places become dominated by exotic grasses and forbs (Stromberg et al. 2002). These exotic plants compete with native grassland herbs for scarce soil resources and light, reducing their abundance and diversity (Corbin and D'Antonio 2004). In highly-productive coastal prairie grasslands, and serpentine grasslands fertilized by atmospheric nitrogen deposition, exotic plants also contribute to the accumulation of dense litter (thatch) on the soil surface (Weiss 1999). Such litter inhibits establishment of many native grassland herbs (Facelli and Pickett 1991, Hayes and Holl 2003), and can create a fire hazard.

Recognizing these threats, the District resource management policies include the use of well-managed livestock grazing to maintain and enhance the diversity of native plant and animal communities, as well as manage vegetation to reduce the risk of wildfires, among other benefits. Currently, the District uses conservation grazing to manage grasslands within La Honda, Purisima Creek Redwoods, Russian Ridge, Skyline Ridge, Tunitas Creek, and La Honda Creek OSPs; these preserves have the largest area of grasslands.

In other OSPs where grazing is not being used, grasslands may become degraded in the absence of other management to counteract the effects of fire exclusion, included prescribed fire, mowing, or other woody vegetation removal. For example, at Windy Hill OSP, the relatively large contiguous grassland observed in the 1991 aerial image has contracted and become fragmented coyote brush encroachment (Figure 13 a and b). Brush encroachment has been much reduced at Monte Bello and Long Ridge OSPs, where only marginal increases in shrub cover appear to have occurred at the ecotone (transition area) between coastal scrub and grasslands in the upper drainages (Figure 13 c-f). Examination of thatch and species composition would be required to characterize the full impacts of the lack of disturbance in these grasslands.

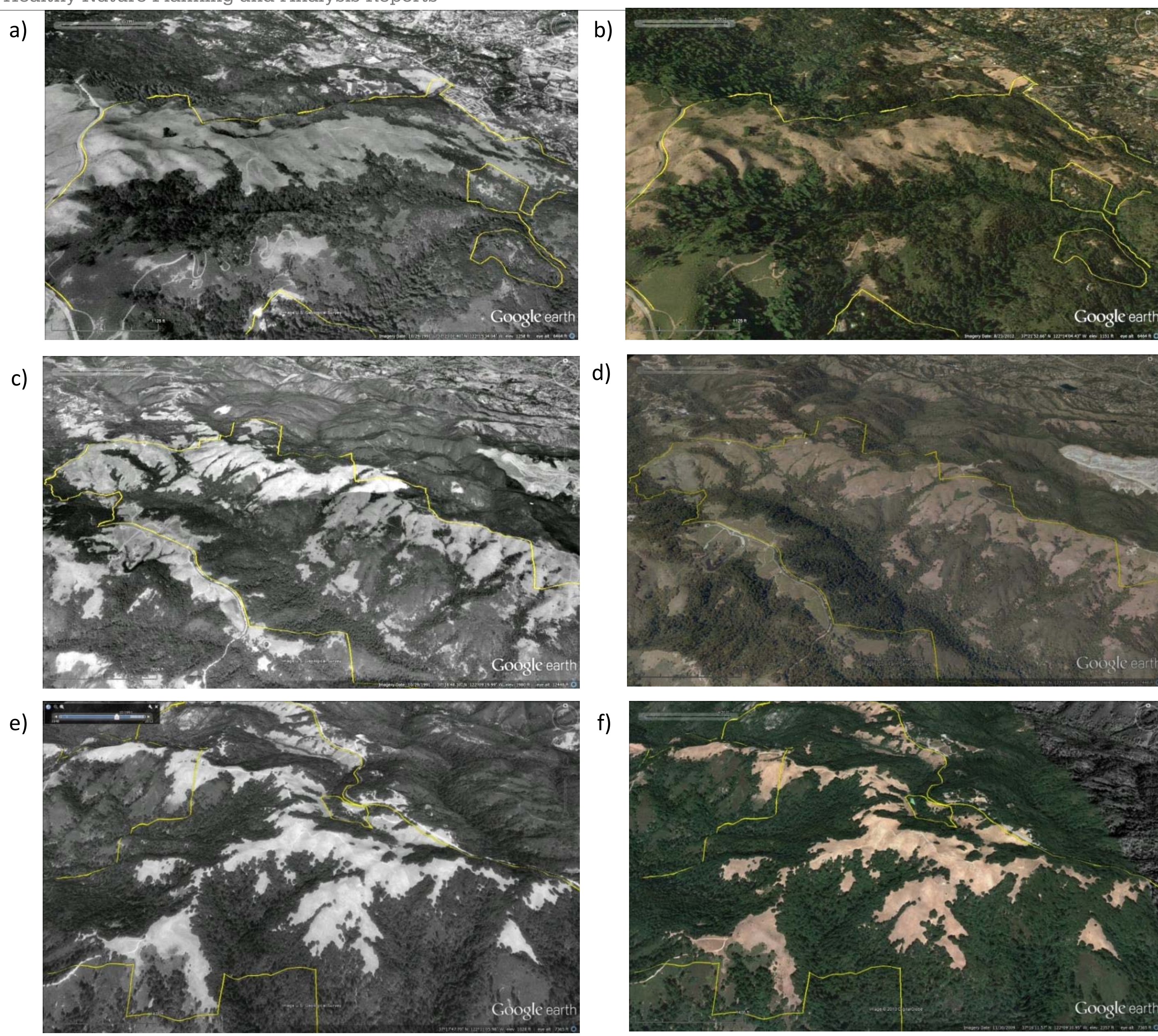

Figure 13: Grasslands within three ungrazed District Open Space Preserves in 1991 (left) and near present (right), showing: Windy Hill OSP in a) 1991 and b) 2012; Monte Bello OSP in c) 1991 and d) 2010; and Long Ridge OSP in e) 1991 and f) 2010.

FOREST MANAGEMENT AND RESTORATION

Nearly 140,000 acres (38%) of the Vision Plan Area supports forests, which are characterized by relatively dense canopy cover of trees, with an understory of primarily shade-tolerant herbs and shrubs (Table 12, Figure 14). Given their extensive cover within the Vision Plan Area, forests play a critical role in conservation of biodiversity, as well as provide a host of important ecosystem services, including protecting water quality and sequestering carbon. This section outlines key management considerations for the two main forest types.

Table 12: Forests of the Vision Plan Area

Vegetation and Other Land Cover	Acres	Percent in District Preserves
Forests		
Redwood-Douglas Fir Forest	78,271	16.5%
Hardwood Forest	47,902	37.8%
Closed-Cone Conifer Forest	961	59.5%
Riparian Forest	5,947	21.9%
Non-Native Forest	6,155	4.9%
Forest Communities Subtotal	**139,235**	**23.9%**
Other Vegetation		
Native	108,586	20.3%
Non-Native	3,412	17.1%
Other Vegetation Subtotal	**111,998**	**20.0%**
Other Land Cover		
Converted	82,932	0.4%
Water	27,116	0.7%
Other Land Cover	9,669	5.0%
Other Land Cover Subtotal	**119,717**	**0.8%**
Total	**370,951**	**15.3%**

Conifer Forest Management

The Vision Plan Area contains 78,271 acres of coast redwood-Douglas fir forests (Table 12; Figure 14), of which 12,915 acres (16.5%) are within District open space preserves. Located primarily on the western slope of the Santa Cruz Mountains, where coastal fog supplements the more plentiful rainfall, stands of this forest also occur straddle the ridgeline and innervate canyons on the eastern slope, which also feature a cooler, moister microclimate. These forests are dominated by coast redwood and/or Douglas fir, though feature also some hardwoods including predominantly tanoak and Shreve oak (*Quercus parvula* var. *shrevei*).

The Santa Cruz Mountains feature the southernmost expansive area of coast redwood-Douglas fir forests—a community type restricted to a 450-mile long strip of the Pacific coast between southern Monterey County and southern Oregon, where it is confined to areas within reach of the summer fog. Of the approximately two million acres of forest, less than 5% has not been harvested, and remains in its 'old growth' condition (Evarts and Popper 2011). A similar percentage of these forests in the Santa Cruz Mountains consist of old growth, the largest patch of which is nearly 3,400 acres and is located within Big Basin State Park (SRL 2008). Just to the north, within the Vision Plan area, the Butano and Pescadero watersheds contain additional old growth forests, with other older forests mapped in the adjacent San Gregorio Creek watershed.

Due to their stand structure, canopy architecture of their trees, and other unique habitat conditions, old-growth forests provide important habitat for many species (Table 13). Notably, Vaux's swift (*Chaetura vauxi*) nests in hollow snags which are more prevalent in older forests, while the federally-endangered seabird marbled (*Brachyramphus marmoratus*) nests on large branches or 'platforms' that occur primarily in old coast redwood and Douglas-fir.

Table 13: Biologically-important characteristics of old-growth forests

Characteristic	Biological Significance
Large, living trees (200+ years old)	Feature decadent wood, broken tops, reiterated crowns, platforms, dead tops, and basal hollows, which provide important habitat for a variety of species including marbled murrelet, Vaux's swift, and pileated woodpecker; also contain a high diversity of bryophytes, fungi, and invertebrates within their canopies.
Large standing dead trees (snags)	Standing dead or mostly dead trees provide nesting, foraging, and roosting habitat for a variety of birds and mammals
Downed trees (logs)	Provide humid and thermally stable microhabitats for amphibians, reptiles, small mammals, and invertebrates on land. In streams, create pools and scours for fish, and stabilize stream banks.
Multiple plant layers	Trees of varying ages, and understory trees as well as shrubs and herbs, create a diversity of habitat conditions and food sources for animals, and promote fog drip collection.
Carbon Sequestration	Old-growth forests remove and sequester carbon dioxide from the atmosphere

Other coast redwood and Douglas-fir forests within the District have experienced timber harvest of varying type, intensity, and frequency. Most forests were clear cut in the mid-1800s, and then were subject to subsequent harvest in the 1950s and 1960s; forests in the El Corte de Madera and Purisima Creek watersheds were subject to third and fourth harvests in the 1970s and 1980s (MROSD 2011). Despite the harvest history, District preserves feature residual single old growth trees and small stands of old growth. District open space preserves also feature older Douglas fir, which develops late seral conditions earlier than coast redwood (MROSD 2011).

When compared to old growth forests, these previously-harvested forests generally feature higher densities of smaller diameter trees, which establish primarily through resprouting. This dense stand structure, coupled with more than a century of fire suppression, creates dense fuels that present a fire hazard. Coast redwoods in old growth forests typically survive fires, which typically burn the surface and do not penetrate the fire-resistant bark. However, unmanaged second-growth forests often feature substantial, and more contiguous biomass that can promote a crown fire. Such fires can kill even large trees, thus decreasing roots that hold soil in place, and promoting soil erosion and stream sedimentation.

Forests within the Vision Plan Area can be managed following the practices of conservation forestry, which are designed to promote biodiversity and ecosystem functions within a landscape that features protected forest reserves, as well as private timber lands managed for sustainable production (inset box).As part of the forests reserves, District open space preserve can be managed to accelerate late-seral forest conditions, buffer aquatic ecosystem, and enhance the complexity of the forest stand structure in ways that can promote biodiversity by creating a broader range of microhabitats.

Conservation Forestry Practices
(Adapted from Lindenmayer et al. 2006)

- Protect and buffer late seral stage forests
- Create a range of habitat conditions.
- Retain elements of stand structural complexity
    - Trees from multiple age cohorts
    - Large living trees and snags
    - Large diameter logs on the forest floor
    - Vertical heterogeneity created by multiple canopy layers
    - Horizontal heterogeneity, including canopy gaps
- Buffer aquatic ecosystems
- Manage the forest to maintain habitat connectivity
- Carefully design and manage road networks
- Conduct appropriate fire management

Selective harvest of trees can provide a mechanism to accelerate late-seral stand conditions. Removing trees to create the lower-density conditions characteristic of old-growth forests promotes the growth of remaining trees, by reducing their competition for light and soil resources which can limit growth. Such thinning treatments are being used by a variety of conservation organizations in central and northern California (Table 14)

The locations and other aspects of such thinning treatments must be carefully planned in consideration of landscape-level and site-level conditions, as well as desired future conditions (i.e. goals). A variety of logistical considerations can also present opportunities or constrain selective harvest:

- Occurrence of roads, which are needed for access by equipment;
- Topography, which can influence the yarding (method of moving logs to a landing site), which can be done by ground- based tractor/skidder, cable, or helicopter; and
- Effects on the environment, including geology, soils, biological resources, cultural resources, water quality, and noise, among others.

Permitting costs, which are an expensive component of forest restoration projects, can be offset by commercializing the wood that is removed to achieve the ecological objectives. Though some woody debris should be left on the forest floor to create important habitat (Table 13), excess logs that would degrade habitat and create a fire danger can be sold to offset costs. Forest thinning projects can be used to permit other restoration work, including stream restoration projects (e.g. culvert or bridge upgrades) that require lake and streambed alteration agreements.

The District's resource management policies address a goal for forest management, which is to **"**Manage District land to retain and promote biologically diverse, dynamic forest conditions; maintain and enhance high quality forest and aquatic habitat; encourage and enhance the development of late-seral conifer forest; provide for visitor experiences within diverse forest habitat; and promote District and regional fire management objectives." Implementation measures for this policy are designed to ensure that forest management activities are compatible with the protection special-status plants and animals, riparian and riverine ecosystems, and water quality, among other natural resources, and include management to promote late-seral habitat conditions. More detailed analysis would be needed to evaluate land where such management would be appropriate and feasible; however, based on landscape-level analysis of available data, El Corte de Madera, Purisima Creek, and Tunitas Creek, and Long Ridge OSPs, are important candidates, as they can buffer or expand Old Growth and/or marbled murrelet habitat.

Hardwood Forest Management

Located primarily on the upper elevation slopes, ridgeline, and eastern slope of the Santa Cruz Mountains, 47,092 acres of forest within the Vision Plan Area are dominated by hardwoods, including a oaks, tanoak, California bay (*Umbellularia californica*), and California buckeye (*Aesculus californicus*) (Table 12, Figure 14). This includes 18,107 acres of hardwood forest located within District open space preserves.

Hardwood forests are facing two main threats that necessitate active management: widespread tree mortality due to sudden oak death, and Douglas fir encroachment in the absence of natural fire.

Sudden oak death (SOD) is an emerging disease caused by pathogen, *Phytophthora ramorum*, that has resulted in extensive mortality of tanoak (*Nothiocarpus densiflorus*) and oaks (*Quercus* spp.), including coast live oak (*Q. agrifolia*), black oak (*Q. kelloggii*), Shreve's oak (*Q. parvula,* var. *shrevei*), and canyon live oak (*Q. chrysolepis*) within approximately 175 miles of the California coast. First report in the early 1990s, SOD spread rapidly coastal hardwood and conifer forests from central California to Central Oregon, including throughout much of the Santa Cruz Mountains (Rizzo and Garbelotto 2003).

Sudden oak death effects likely depend upon the extent of mortality caused, but can include:

- shifts in plant community composition (e.g. oaks replaced by less-susceptible tree species);
- declines in animal populations that rely on tanoak and oak, such as black-tailed deer (*Odocoileus hemionus*), acorn woodpecker (*Melanerpes formicivorus*), and band-tailed pigeon (*Patagioenas fasciata*);
- increased fuels and thus fire behavior (e.g. greater fire frequency and/or severity of impacts).

Over time, direct and indirect effects of the disease can cascade through the affected systems and alter ecosystem structure and functions.

The Vision Plan Area contains the highest concentration of recorded SOD detections in the Santa Cruz Mountains (Figure 15); importantly, the high frequency of observations likely reflects the more intensive monitoring of District preserves conducted as part of the District's annual monitoring (inset box). Detections straddle the ridgeline and extend from Purisima Creek Redwoods OSP in the northwest, to El Sereno and Bear Creek Redwoods OSPs in the southeast; importantly observations east of Highway 17 are sparse, and most observations are west of Highway 9 (Figure 15).

Elements of the District's 10-Year Sudden Oak Death Program

- Annual monitoring to detect symptomatic plants in new areas
- Mapping of potentially resistant trees
- Treating selected heritage trees with a fungicide
- Establishing a collaborative fund for research to guide management
- Removal of selected California bay, a carrier for the SOD pathogen, to prevent spread
- Staff training regarding disease detection and best management practices to prevent spread
- Outreach to the increase public awareness of how to prevent SOD spread

In recognition of its potential impacts, the District adopted a ten-year plan in 2005 to slow the spread of SOD, collaboratively study impacts on wildland ecology and recreation, and develop a restoration strategy for heavily-infested forests.

Forest management techniques to address SOD are largely experimental but can include (Table 14):

- Treat heritage oaks—large, mature, and iconic trees—with a fungicide (e.g. Agri-Fos) to prevent SOD infection;
- Treat California bay (*Umbellularia californica*), a carrier of SOD, with fungicide; and
- Remove infected California bay and other carriers to prevent spread of SOD.

Infected biomass should be properly disposed to prevent disease transmission, and reduce fire hazard.

The Vision Plan Area's hardwood forests are also susceptible to degradation due to unnatural succession. Exclusion of fire from these forests facilitates establishment of Douglas fir—a late-seral stage species that is susceptible to fire when young, but is invading oak woodlands throughout California as part of fire exclusion (Barnart et al. 1996, Hunter and Barbour 2001). Douglas fir is mapped as emergent or co-dominant within 17,848 acres of hardwood forest in the Vision Plan Area. Prescribed fire or forest management treatments that simulate their effects by killing Douglas fir can be used to maintain hardwood forests and habitat oak-dependent animals (Table 14).

Table 14: Forest management treatments

Treatment	Objectives	Description	Appropriate Conditions	Forests Being Managed Using Treatment	Potentially Suitable District Preserves
Thinning Dense, Stagnated Redwood Stands	Promote late-seral forest conditions, which include: • Large, well-spaced trees • Snags • Large woody debris	Identify recruitment trees based on size and developed structure and remove selected trees that compete with them, thus accelerating their growth and creating spacing characteristic of old-growth forests	Dense second-growth forests where intraspecific competition limits individual tree growth	• Byrne/Milliron Forest (Land Trust of Santa Cruz County) • Garcia Forest (The Conservation Fund) • Sempervirens 236 (Sempervirens Fund) • Swanton Pacific Ranch (Cal Poly Foundation)	El Corte de Madera, Purisima Creek, and Tunitas Creek, and Long Ridge OSPs, which can buffer or expand Old Growth and/or marbled murrelet habitat; other areas of dense, stagnated redwood.
Maintain Open Areas	• Maintain forest gaps that support shade-intolerant plants (e.g. Santa Cruz mountains pussypaws, Dudley's lousewort, and Santa Cruz Mountains beardtongue • Encourage a mosaic of vegetation conditions, to promotes diversity	Clear vegetation to create early successional conditions; broadcast burn or pile burn to expose bare mineral soil and scarify seeds	Pocket meadows and shrublands impacted by encroaching trees. Also homogeneous, low diversity forests	Private forest lands in the Santa Cruz Mountains.	
Remove Encroaching Douglas Fir	Prevent encroachment of Douglas-fir into grasslands, shrublands, and hardwood forests, which occurs in the absence of natural fire	Cut and lop/ scatter or pile-burn mature Douglas fir. Graze or mow forest edges to remove juveniles. Implement prescribed broadcast burns.	Grasslands, shrublands, and hardwood forests including oak woodlands, which featuring emerging Douglas-fir	Private forest lands in the Santa Cruz Mountains.	Saratoga Gap, Long Ridge, Skyline Ridge, Monte Bellow, Russian Ridge, Windy Hill, and El Corte de Madera OSPs all feature Douglas-fir/Mixed hardwood

Table 14: Forest management treatments

Treatment	Objectives	Description	Appropriate Conditions	Forests Being Managed Using Treatment	Potentially Suitable District Preserves
					or Douglas-fir/Coast Live Oak forests
Remove Non-Native Trees	• Reduce threat to biodiversity • Reduce potential fire hazard.	Cut and treat non-native trees, particularly invasive trees including eucalyptus and acacia, but also planted conifers (*Pinus* spp. and *Cupressus* spp.)	Where non-native trees are present and can or may spread into sensitive habitats	Many private lands in the Santa Cruz Mountains. Wicklow Big Sur Land Trust	Miramonte Ridge, Tunitas Creek, Thornwood, and Fremont Older OSPs
Treat Sudden Oak Death	• Limit the spread of SOD • Mitigate detrimental forest effects of SOD • die-off	• Treat heritage oaks with fungicide to protect them from the pathogen • Treat California bay (*Umbellularia californica*) with fungicide; remove infected trees to prevent spread • Clear infected or dead trees to reduce fire hazard	Preserves featuring heritage oaks Other areas with confirmed SOD infestation nearby or in specific trees on Preserves Heritage trees	Preliminary treatment currently occurs on various private properties. Fuels treatment of massive tanoak die-off currently being considered at Mitteldorf Preserve (Big Sur Land Trust)	Preserves with SOD Detections: Miramonte Ridge, Purisima Creek, El Corte de Madera Creek, Teague Hill, Thornewood, La Honda Creek, Windy Hill, Foothills, Russian Ridge, Skyline Ridge, Long Ridge, Monte Bello, Rancho San Antonio, Picchetti Ranch, and Fremont Older OSPs

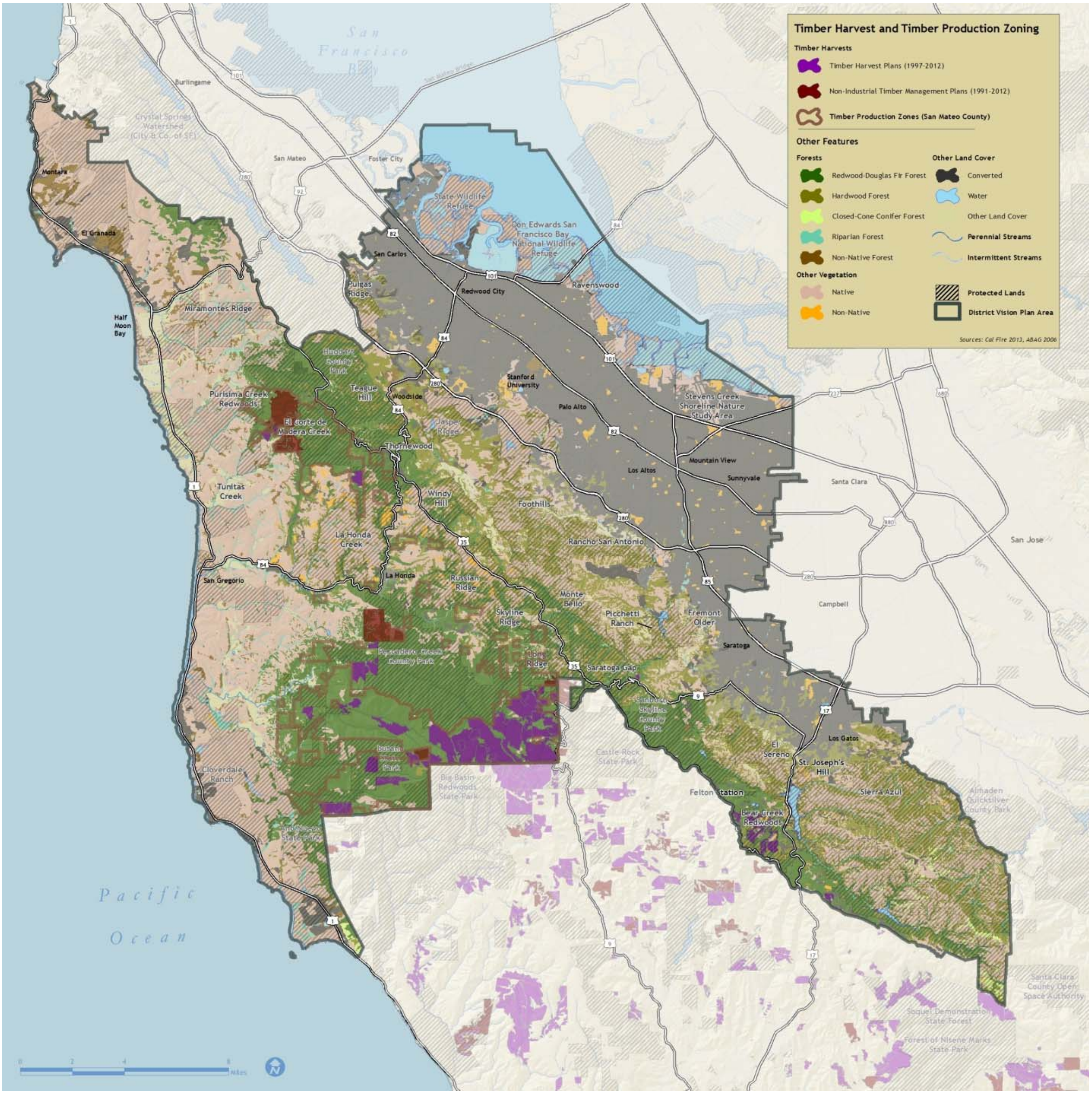

Figure 14: Forests and timber harvest

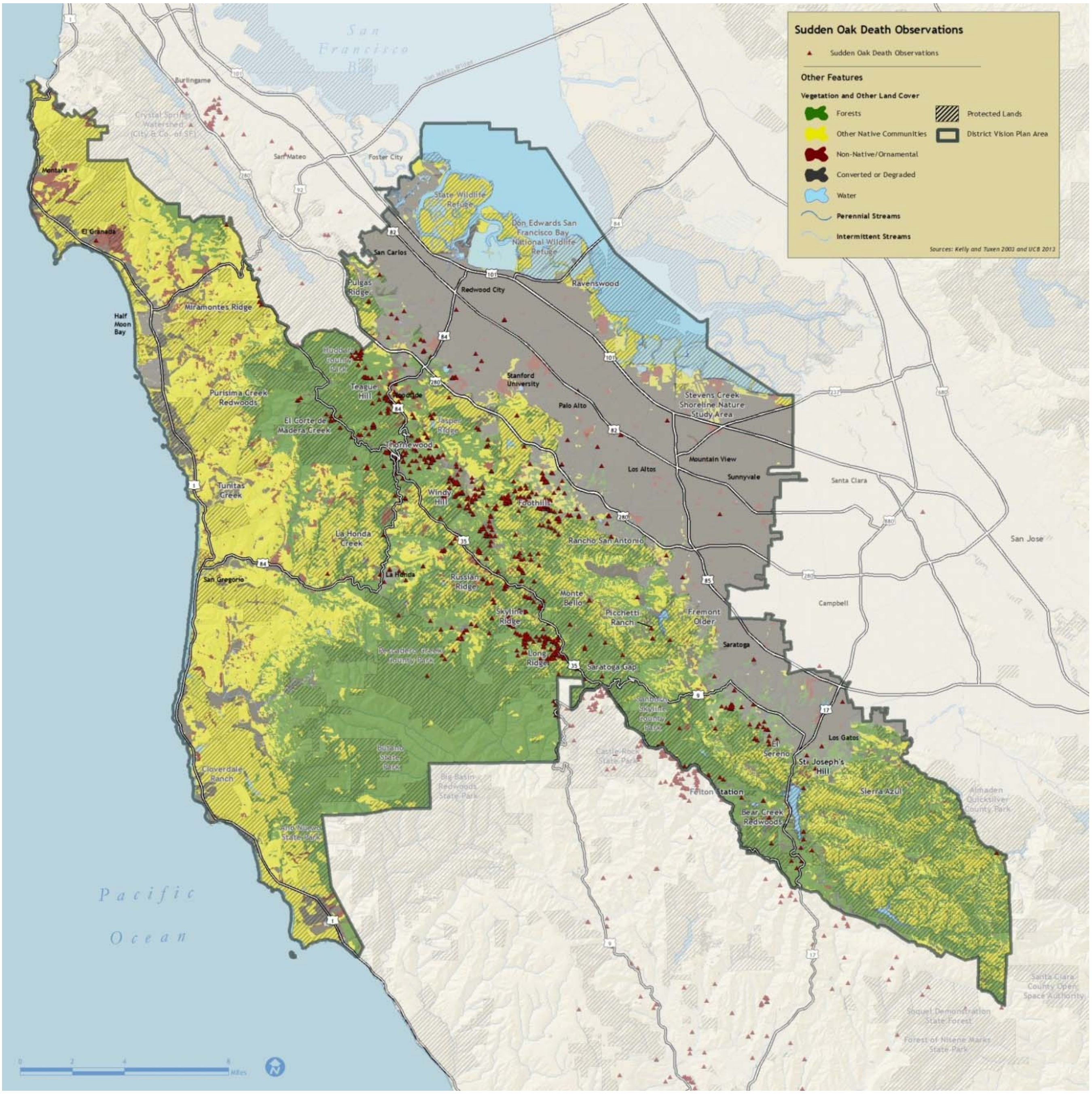

Figure 15: Sudden Oak Death observations

FIRE MANAGEMENT

The hot temperatures and seasonal drought that characterize the Mediterranean climate in the Vision Plan area are conducive to fire. Human inhabitants of the region historically used fire to modify the landscape; specifically, the native Ohlone used fire to promote native plants and animals used for food, ranchers burned grasslands to remove woody vegetation and thus increase forage including, loggers used fire to burn slash, and farmers used fire to remove crop stubble and prepare soils for planting (Stephens and Fry 2005).

Many of the vegetation communities on District lands evolved with the occurrence of periodic fire and have acquired unique adaptations to withstand and regenerate after a fire (Keeley and Keeley 1987). Without periodic fire, these plant communities build abnormally high and dangerous fuel levels and are susceptible to large scale destructive fire events.

In order to protect lives, property, and valuable timber, however, wildfires are actively suppressed within the Peninsula. This fire exclusion can alter ecosystem structure and functions, as well as lead to the accumulation of high fuel loads which exacerbate fire danger. The District's resource management policies address these and other aspects of fire management.

Ecosystem Needs

Fire plays an important role in the structure and function of the plant communities within the Vision Plan Area, including by promoting establishment of fire-adapted native plants, creating and maintaining early successional habitat conditions required by some animals, and cycling nutrients. By disrupting these processes, fire exclusion can have a host of cascading negative effects on biodiversity including causing declines in populations of fire-dependent plants and animals and impacting riverine species by reducing stream flows. Importantly, fire exclusion promotes build-up of fuel, which results in unnaturally intense and severe fires, which can negatively impact species even in fire-adapted systems.

Like other forms of disturbance, fire can promote the invasion and spread of non-native plants, many of which originate from other regions with a Mediterranean climate where fire is also an important part of the natural disturbance regime (Hobbs and Huenneke 1992, D'Antonio et al. 1999). At the same time, some invasive plants are sensitive to fire, which can be used as a technique to control their populations.

The native plant communities within the District were generally characterized based on their response of their dominant species to fire (Table 15, Figure 16):

- **Fire dependent:** These natural communities are dominated by plant species that cannot persist without recurring fire. The primary fire-dependent communities are:
  - closed cone conifer woodlands and forests, including Santa Cruz cypress, foothill pine, knobcone pine; and
  - chaparral, including that dominated by chamise, manzanita, and ceanothus (Keeley and Keeley 1987).

Kings Mountain Manzanita (*Arctostaphylos regismontana*)

This shrub, which is endemic to the northern Santa Cruz Mountains, likely requires fire to persist. As with other obligate-seeding manzanitas in maritime chaparral communities in the region, fires kill the adults, which lack a burl from which to resprout. Fires also create bare mineral soil and may scarify seeds, thus promoting germination. Importantly, fire removes trees including Douglas fir and oaks, which colonize chaparral in the absence of fire and shade out the shrubs.

- **Fire sensitive:** These natural communities are dominated by plant species that are killed by, and do not regenerate well following, fire, which is not an important component of the natural disturbance regime. Fire sensitive communities primarily include:
    - riparian communities, which feature dominant species adapted to recurring flood, but not fire which causes mortality and does not typically promote regeneration, including arroyo willow (*Salix lasiolepis*), box elder (*Acer negundo*), and California sycamore (*Platanus racemosa*)
    - wetland communities, including freshwater and saltwater/brackishwater marshes and wet meadows; and
    - dunes and other coastal strand communities.
- **Fire adapted:** These natural communities feature species adapted to fire within the natural range of variation of the disturbance regime (i.e. type, seasonality, intensity, and frequency). This category includes all terrestrial communities not characterized as fire dependent or fire sensitive.

Table 15: Vegetation according to its origin and fire relationship

Land Cover Type and Fire Relationship	Acres	Percent in District Preserves
Native Plant Communities		
Fire Dependent	21,048	40.2%
Fire Adapted	211,970	21.7%
Fire Sensitive	8,503	6.5%
Native Plant Communities Subtotal	**241,521**	**22.8%**
Non-Native Plant Communities		
Fire Promoted	4,137	6.7%
Fire Tolerant	5,189	8.0%
Fire Susceptible	6	71.1%
Non-Native Plant Communities Subtotal	**9,332**	**1.3%**
Other Land Cover	**120,098**	**1.0%**
Total	**370,951**	**15.3%**

Likewise, the non-native vegetation was generally classified into three categories (Table 15, Figure 16):

- **Fire promoted:** plant species featuring adaptations that facilitate its establishment and potentially spread following fire. Fire-promoted non-native communities include acacia, eucalyptus, pampas grass, Monterey cypress, and planted stands of pine; and
- **Fire susceptible:** non-native community dominated by plant species that are killed by, and do not regenerate well following, fire, which is not an important component of the natural disturbance regime. Poison hemlock (*Conium maculatum*) was classified as fire-sensitive.
- **Fire tolerant:** species adapted to fire, which is unlikely to promote spread, or present an effective control technique. This category includes Harding grass (*Phalaris aquatic*) as well as all vegetation for which dominant species were not available (i.e. those mapped generally as non-native/ornamental).

Site specific examination of vegetation conditions and other factors would be required to inform specific management strategies for open space within the District.

Fire Threat

Though a natural part of the upland ecosystems within the Vision Plan Area, fire poses a threat to lives and property. This threat is most acute at the wildland-urban interface, where development is adjacent to relatively undeveloped areas or 'wildlands', including open space (Figure 17). A state-wide analysis identified extensive areas of land within the Vision Plan Area as part of the wildland-urban interface; this includes areas of relatively dense development, including subdivisions, as well as sparse residential development that abut wildlands of all types, including protected areas such as parks and open space preserves, as well as private areas including timber lands (Figure 17; CalFire 2003). Areas designated as "communities at risk" feature at least one house per 20 acres and located within 1.5 miles of areas characterized as having high, very high or extreme fire threat, based on fuel rank and fire rotation (Figure 17). As part a more fine-scale mapping project, the District identified 8,749 acres of urban lands at the interface of District Open Space Preserves (Figure 17; MROSD 2013).

To address the threat posed by wildfire in the region, the state and local fire agencies, in partnership with other agencies and organizations, as well as private landowners and the broader public, have recently developed two Community Wildfire Protection Plans (CWPPs) within the Vision Plan Area:

1. Lexington Hills CWPP (2009), which covers just over 25,000-acre area in the eastern slope of the Santa Cruz Mountains in western Santa Clara County; and
2. San Mateo and Santa Cruz County CWPP (2010), which covers all of San Mateo and Santa Cruz counties.

These plans identify priority areas for fuel reduction and other fire safety measures, designed primarily to protect lives and property (Figure 17). Most are targeted in high-density rural communities, though they also include 'areas of special interest' featuring lower density development. The priority areas were identified through public participation in community meetings, and by integrating a variety of information and considerations, including fuel conditions, fire behavior, development patterns, and infrastructure. Communities with CWPPs receive priority for grants for hazardous fuel reduction projects through the California Fire Safe Council.

The District participated in development of the CWPPs, which include priority areas located in District open space preserves, including Pulgas Ridge, Bear Creek Redwoods, and Sierra Azul, and along Highway 35 within Saratoga Gap, Long Ridge, Skyline Ridge, Monte Bello, Russian Ridge, Coal Creek, and Windy Hill OSPs (Figure 17).

Management of District Open Space Preserves to Reduce Fire Threat

Fuel Management

- Disking, mowing, and brushing along roads and trails, and around parking areas and structures
- Invasive plant removal
- Conservation grazing
- Prescribed burning

Other Risk Reduction Measures

- Preserve closures during periods of high fire risk
- staff training and equipment to combat fire

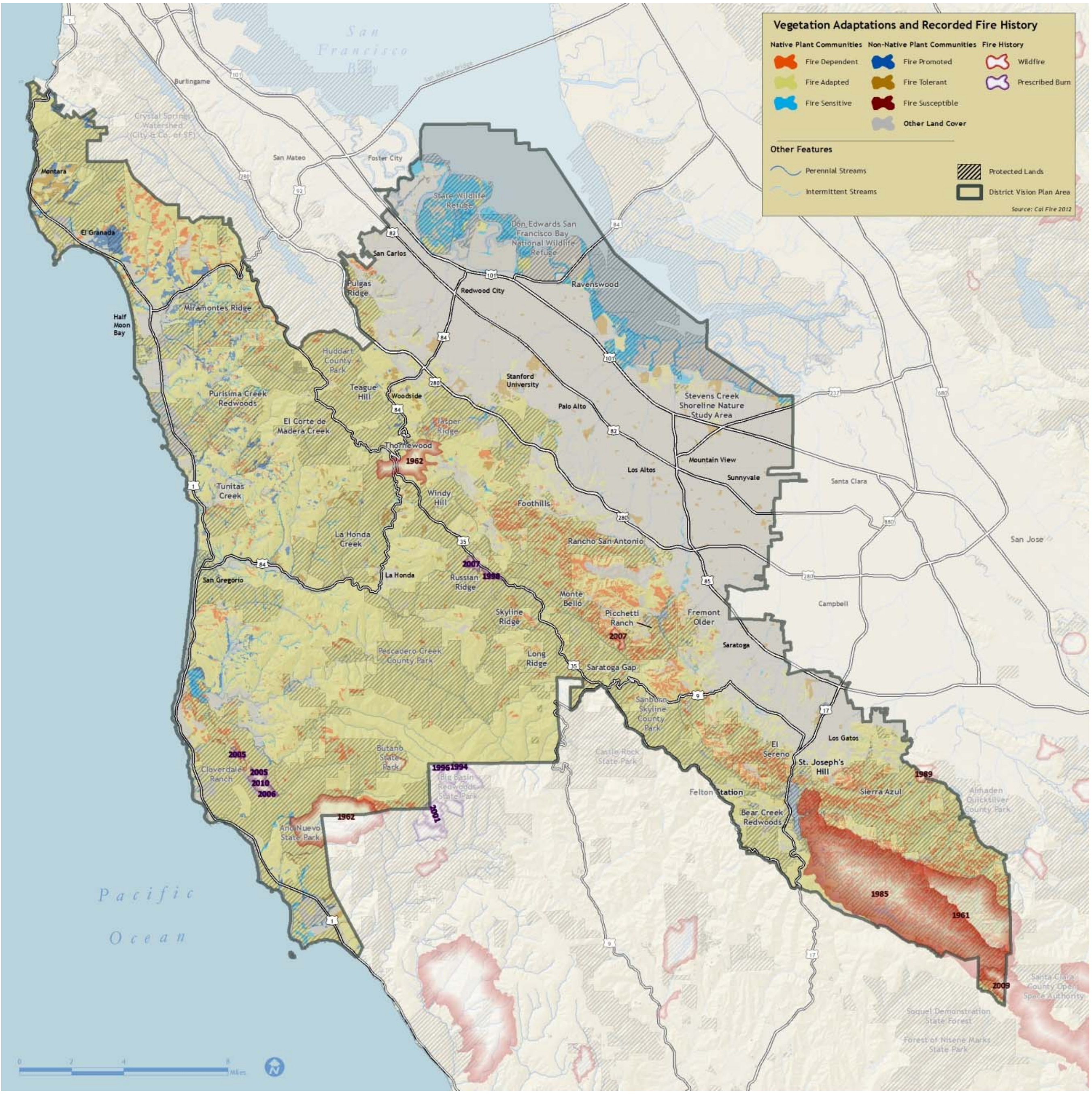

Figure 16: Vegetation adaptations and recorded fire history

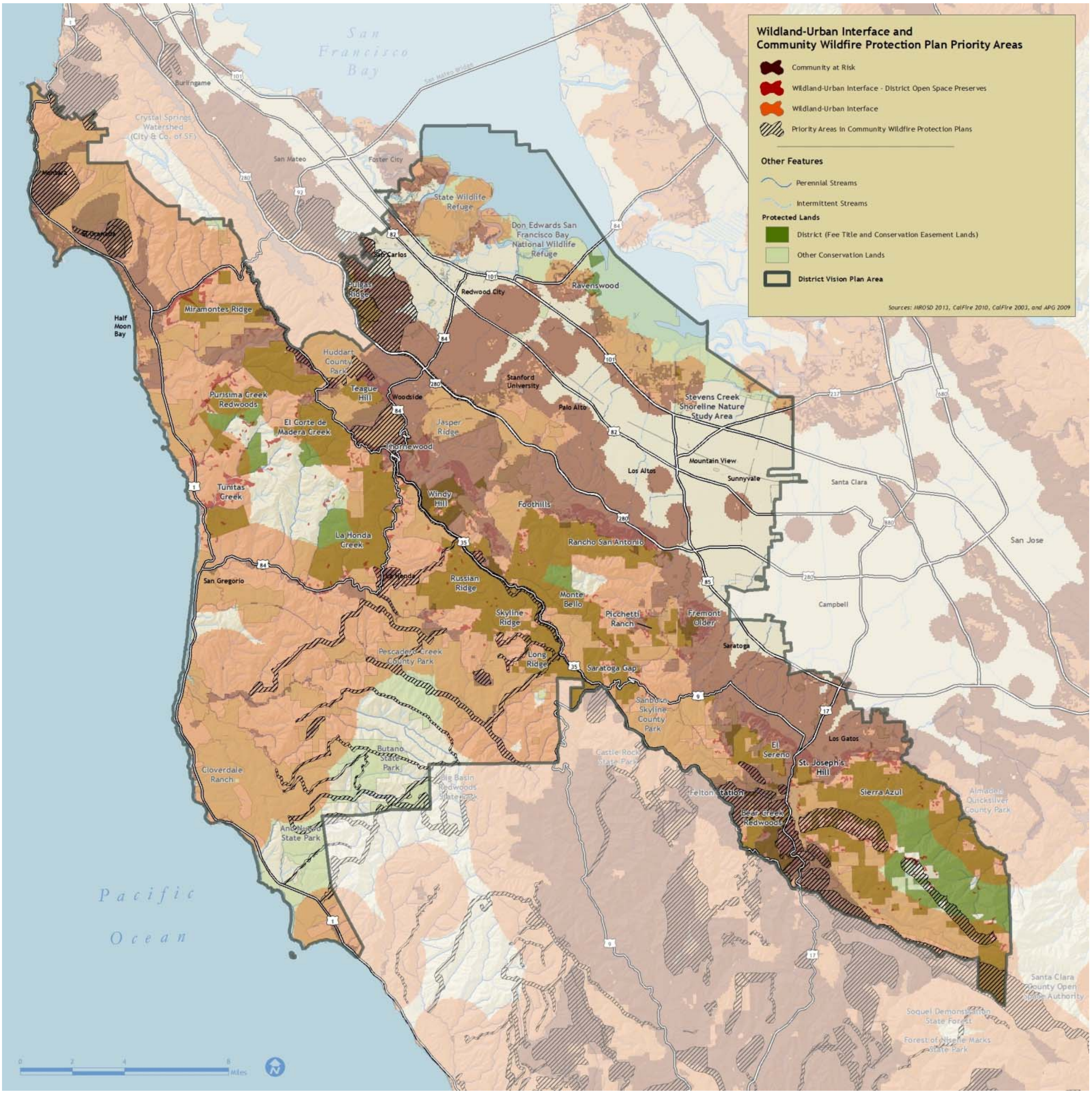

Figure 17: Wildland-Urban Interface and Community Wildfire Protection Plan Priority Areas

GLOBAL CHANGE

Species, communities, and entire ecosystems have the potential to be greatly altered by global change, including climate change and sea-level rise.

Climate Change

Potential Impacts

By the end of the century, the average annual temperature in California is predicted to increase by up to 8.1° F (Cayan et al. 2008). Though the change in California's precipitation is expected to be less than 10% (Cayan et al. 2008), the increase in temperature will promote water loss due to evaporation and transpiration, creating a climatic water deficit for plants (Flint and Flint, unpublished data). Moreover, a continuation of the trend of 33% reduction in the frequency of California summer fog (Johnstone and Dawson 2010) could exacerbate the drought stress caused by the predicted hotter and likely drier conditions.

The vulnerability of species and communities to climate change depends on their exposure, sensitivity, and capacity to adjust to change (Hanson and Hoffman 2011). Table 16 identifies types and examples of species and systems that could be most vulnerable based on five considerations (Hanson and Hoffman 2011). Notably, coast redwood and species that inhabit coast redwood-Douglas fir forest may be vulnerable to declines and ultimately extirpations in a future hotter and likely drier climate, particularly if the incidence of summer fog is reduced as has been observed over the past 50 years (Johnstone and Dawson 2010).

More frequent fire predicted to accompany the hotter, drier climate will likely alter dramatically the structure and species composition of the natural communities within the Santa Cruz Mountains (Fried et al. 2004). Across the Central Coast Ecoregion, the extent of shrublands and conifer forests are predicted to decline while the area of grassland increases (Lenihan et. al. 2008). These predictions suggest that coastal scrub, maritime chaparral, and coast redwood- Douglas fir forests could decline while grasslands will expand.

Potential for Area to Mitigate Climate Change Impacts

The Vision Plan Area features habitat that can promote resiliency of the species and communities within the Santa Cruz Mountains and broader Central Coast Ecoregion to climate change through a variety of mechanisms (Table 17, Figure 18). Wet areas, such as seeps, springs, streams, ponds, marshes, lakes and reservoirs, feature cooler microclimates, provide sources of free water, and may indicate areas of greater ground water that may be resilient in the face of climate change (Howard and Merrifield 2010). As a result of its mountainous terrain, the Vision Plan Area features topographic variability that creates a variety of microclimates. Importantly, narrow, deep canyons and north-facing slopes receive less insolation (solar radiation) and thus have cooler microclimates (Figure 18).

Sea Level Rise

In the past century, sea level has risen by eight inches, and is anticipated to rise by more than 4.5 feet (55 inches) by the end of this century (Heberger et al. 2009). The resulting inundation and attendant erosion and flooding could eliminate coastal and bay habitats, including:

- **rock outcroppings** and used for roosting and nesting by coastal seabirds, such as double-crested cormorants, brown pelicans, and pigeon guillemots, and as haul-out sites for marine mammals including harbor seals;

- **bluffs** utilized by nesting birds including Black Swifts, unique plant assemblages featuring succulents (*Dudleya* spp.); and
- **dunes** utilized by many plant and animal species including nesting Western Snowy Plovers, and globose dune beetles; and
- **wetlands** including salt marsh and brackish marsh, which support a diverse assemblage of shorebirds including California clapper rail, California black rail, salt-marsh harvest mouse, and salt-marsh wandering shrew (Section 3).

While new habitats could be created adjacent to the areas that will be inundated, this will not be possible where the adjacent land is already developed or is armored (e.g. by sea walls or levees).
A state-wide analysis found that the anticipated sea level rise would result in the erosion of 525 acres of dunes, and 1,536 acres of cliffs in coastal San Mateo County (Heberger et al. 2009). In addition, of the estimated 9,600 acres of wetlands, only 1,856 acres (20%) would be able to migrate into adjacent natural land. An additional 4% (345 acres) could move into adjacent non-natural land (e.g. agricultural areas, parks etc.), while the remaining 76% of the county's wetlands, 7,040 acres, would be lost. Protecting land where wetland migration is feasible will be essential to conserving these sensitive communities and species as sea level rises.

Table 16:
Biological systems in the Vision Plan Area that could be most vulnerable to climate change

Criteria	Terrestrial	Aquatic
Specialized habitat or microhabitat	• Serpentine species • coastal prairie grassland species	• Endangered salmonids including coho salmon and steelhead trout • Pond-breeding species, including California tiger salamander, California red-legged frog, San Francisco garter snake, and western pond turtle
Narrow environmental tolerances that are likely to be exceeded	• Coast redwood, which requires cool, foggy areas, and is near the southern end of its range • Maritime chaparral endemic species (e.g. *Arctostaphylos regismontana*), which require fog • Species at the southern end of their range, including white-flower rein orchid (*Piperia candida*) and *Geocalyx graveolens*, a liverwort • Black oak and other species at the edge of their elevational range atop Skyline	• Coho salmon and steelhead trout, which are sensitive to changes in water temperature • Species at the southern end of their range including Pacific giant salamander and rough-skinned newt
Dependence on specific environmental triggers or cues that are likely to be disrupted	• Breeding birds • Migratory species (butterflies, birds, and bats)	• Breeding amphibians, which require specific hydroperiods
Dependence on interspecific interactions that are likely to be disrupted	• Insect-pollinated plants, especially those with specialist pollinators • Insectivorous bats, especially specialist (e.g. pallid bats feed largely on Jerusalem crickets)	• Increased stream biological productivity due to higher temperatures could alter competitive relationships in stream assemblages
Poor ability to colonize new, more suitable locations	• many plants • limited mobility animals, including flightless insects	• Pond invertebrates, amphibians, and reptiles that cannot disperse through upland habitats, particularly developed areas

Table 17:
Refugia and aspects of climate change resiliency conferred by the Vision Plan Area

Refugia	Contribution to Climate Resiliency	Occurrence in Vision Plan Area
Areas of Reduced Solar Insolation	Areas or reduced solar radiation feature cooler microclimate and typically greater vegetation cover and thus evapotranspiration	Variable, mountainous topography results in north-facing slopes being well-distributed throughout the Vision Plan Area
Streams and riparian areas	• Source of perennial water for animals • Feature cooler microclimates due to evaporation and transpiration • Riparian corridors can facilitate animal movement in response to climate change	• 1,100 miles of streams that provide water and cooler microclimates • Streams through developed areas (e.g. Santa Clara Valley) provide corridors that promote migration in response to a changing climate
Ponds, lakes, sloughs, and reservoirs	• Source of water for animals • Feature cooler microclimates due to evaporation and transpiration	Numerous ponds, lakes, reservoirs, marshes, and other wetlands
Seeps and springs	Source of perennial water and indicators of where groundwater may be more plentiful and thus persist in a future hotter, drier climate (Howard and Merrifield 2010)	• Numerous mapped seeps and springs (additional unmapped springs likely occur in the landscape)
Steep elevational gradients	• Interconnected habitat reduces the distance species need to move along an elevation gradient • Precipitation and winter minimum temperature increase with elevation	• Elevation ranges from sea level to over 3,000 feet in less than 10 miles from both east (bay) and west (Pacific Ocean). • Steep terrain occurs within contiguous habitat patches including the patch connecting Skyline to the Sea near Big Basin State Park facilitating migration inland and along an elevational gradient
Connectivity along a latitudinal gradient	Interconnected habitat enables movement along a latitudinal gradient, along which precipitation increases and mean annual temperature decreases	The Vision Plan Area is contiguous with habitat further north in the Santa Cruz Mountains, a northwest to southeast trending mountain range that spans nearly 80 miles.

Figure 18: Areas of potential climate resiliency

GEOGRAPHIC INFORMATION SYSTEMS DATA

The following table lists the GIS datasets used to prepare this report. Information about the datasets is provided in the References section.

Dataset	Sources
Biodiversity	
Coho Recovery Plan Priority Watersheds and Distribution	NMFS 2010
Ponds and Other Waterbodies	MROSD 2013 and USFWS 2011
Rare Species Occurrences	CCH 2013, DFG 2008, DFW 2013, MROSD 2013
Vegetation and Sensitive Habitat	BAOSC 2012 and MROSD 2013
Watershed Integrity	BAOSC 2012
Winter Steelhead Distribution and Range	DFG 2012
Connectivity	
Aquatic and Terrestrial Linkages	BAOSC 2013
Habitat Patches	BAOSC 2013 and Mackenzie et al. 2011
Erosion	
Landslide Potential	USGS 1997
Universal Soil Loss Equation and Gully Erosivity Potential	Hiatt 2013
Fire	
Communities at Risk and Wildland-Urban Interface	Cal Fire 2003
Community Wildfire Protection Plans Priority Areas	APG 2009 and Cal Fire 2010
Fire History	Cal Fire 2012
Wildland-Urban Interface - District Open Space Preserves	MROSD 2013
Forests	
Old Growth	SRL 2008 and Singer 2003
Older Second Growth	Singer 2012
Sudden Oak Death Occurrences	Kelly and Tuxen 2003 and UCB 2013
Timber Harvest Plans and Non-Industrial Timber Management Plans	Cal Fire 2013
Timber Production Zones	ABAG 2006
Land Use	
Protected Lands (Fee Title and Easement)	MROSD 2013
Physical	
Coastline	MROSD 2013
Hillshade	MROSD 2013
Major Roads	MROSD 2013

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Appendix C-2:

History of Timber Harvests

Within the Midpeninsula Regional Open Space District

Prepared for:

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CONTENTS

INTRODUCTION

Timber harvesting within the Midpeninsula Regional Open Space District's jurisdiction (Figure 1) is primarily restricted to redwood and Douglas-fir dominated coniferous forest, with associated hardwood, primarily tanoak, madrone, California bay, black oak, and various live oaks. These conifer-dominated areas are located in the central and southern portions of the District's boundary, with the greatest acreage occurring on the western slope of the Santa Cruz Mountains just north of Big Basin State Park (Figure 1). Of the 370,000 acres within the District boundary, only 1,698 acres (0.4%) is within Santa Cruz County. Santa Cruz County, outside of the District boundary, is the County area with the largest acreage of Timber Production Zone (TPZ) parcels, and includes the largest acreage harvested within the Santa Cruz Mountains.

> **Timber Harvest Planning Documents**
>
> Timber Harvest Plan (THP): Plan for each timber harvest or entry; THPs expire after 5-7 years
>
> Non-Industrial Timber Management Plan (NTMP): Long-term plan that allows periodic harvests on ownerships of up to 2,500 acres of timberland, with updates on sustainability analysis and biological assessment prior to each harvest, when a notice of timber operations (NTO) is filed.

In the past 16 years, 9,425 acres have been approved for operational harvest within the District (Figure 2). Timber Harvest Plans (THPs) accounted for 8,781 acres and Non-Industrial Timber Management Plans (NTMPs) accounted for 644 acres. An additional 995 acres have been approved for harvest in the six NTMPs within the District boundary, though have not yet been harvested.

Harvests under THPs or NTMPs can occur at most, every 10 years; however, a longer rotation is common. Of the acres approved for harvest under THPs in the past 16 years, 1, 346 acres (15%) have been harvested twice over that time period. The average annual harvest rate within the District has been approximately 618 acres over the past 15 years, with only approximately 5% coming from NTMPs, which are designed to provide for more sustainable management.

TIMBER HARVEST REGULATIONS

Timber harvesting in the District jurisdiction is conducted pursuant to the California Forest Practice Rules (FPRs) and may be further regulated by other state and federal statutes [Endangered Species Act (ESA), Clean Water Act (CWA), etc.]. Santa Cruz, San Mateo and Santa Clara counties all have additional Special County FPRs.

San Mateo County:

Timber harvesting under a THP or NTMP is conducted pursuant to the FPRs. Due to public concerns regarding timber harvests occurring in rural-residential areas, the County Board of Supervisors in 1992 Implemented an ordinance, restricting timber harvesting on non-Timberland Preserve Zone (TPZ) zoned parcels from occurring within 1,000 feet of any legal residence on an adjacent parcel unless that adjacent landowner owner grants written permission. Conversions are permitted for less than 3 acres, no more than once every 5 years per parcel. Exemptions are permitted for fire hazard reduction, removal of dead, dying or diseased trees, and fire salvage. Approximately three acres have been approved for conversion and approximately 229 acres have been approved under exemptions (principally fire hazard reduction) in the past two years.

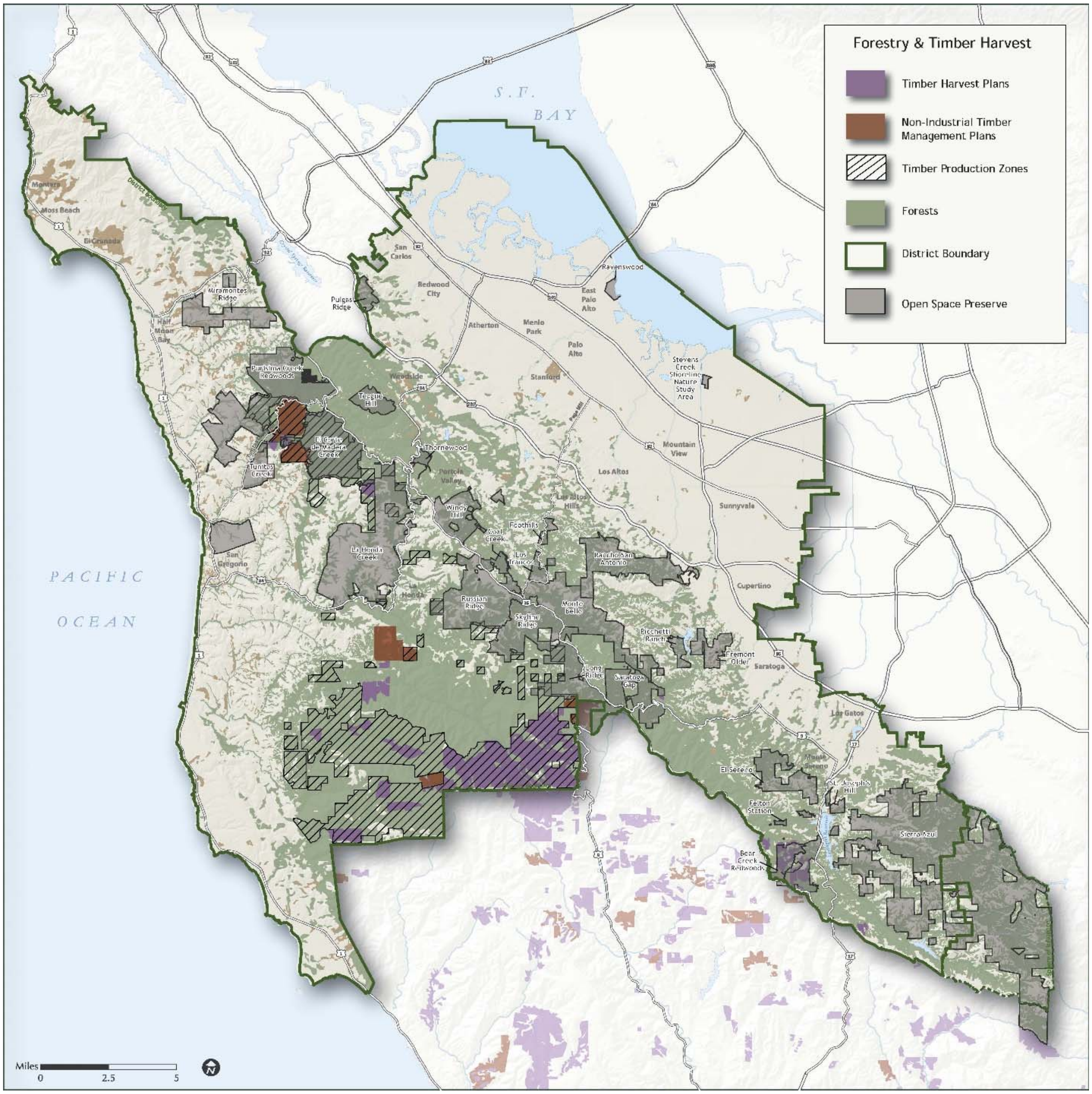

Figure 1: Timber harvests and timber production zoning within the District's boundary

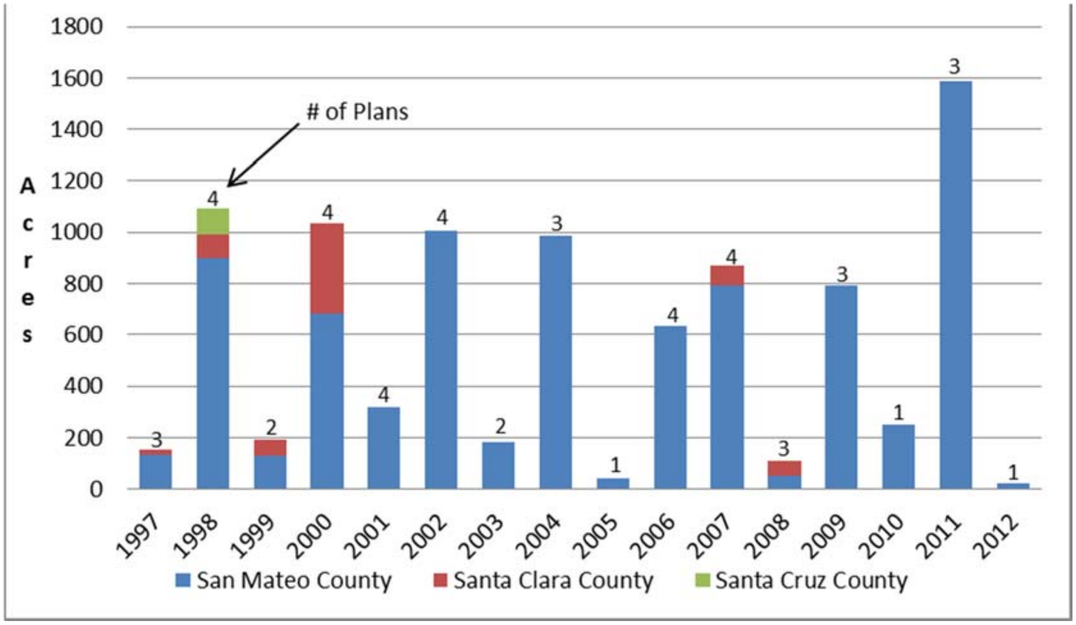

Figure 2: Timber harvests within the District's boundary (1997-2012)

Santa Clara County:

Timber harvesting under a THP or NTMP is conducted pursuant to the FPRs and is not restricted by zoning. Santa Clara County did not designate and zone qualifying timberlands to TPZ as allowed by the California Timberland Productivity Act (1982). Santa Clara County has only one parcel zoned TPZ. Recent harvests have also occurred on land zoned "Ranchland" And "Hillsides" as well as "Other Public Open Lands". The latter corresponds to a harvest in what is now Bear Creek Redwoods Open Space Preserve (OSP), which was approved prior to District acquisition. Approximately 17 acres were approved within the county for fire hazard removal exemptions, with no conversions, in the last past two years.

Santa Cruz County:

Timber harvesting is conducted pursuant to the FPRs on parcels zoned Timber Production (TP), Commercial Agriculture (CA - outside the Coastal Zone), Parks Recreation and Open Space (PROS) and Mining (M3). Given concerns for the environment and harvesting in rural-residential areas, the Board of Supervisors in 1999 ruled that timber harvesting on all other zoning designations was not allowed, except for three acre or less conversion or exemption permits (primarily for fire reduction) .

Within the District boundary, most timberland is eligible for timber harvesting per zoning, given applicable County, State, and Federal regulatory constraints. The TPZ zoning in San Mateo County (which is eligible for timber harvest without neighbor consent) covers approximately 2% of the county area, though roughly 43% of the county contains forests that include some redwood trees. Of the 28,201 acres zoned for timber production within the District's boundary, 4,583 acres (16%) are within District open space preserves.

TIMBER HARVEST HISTORY

The extraction of forest products in the Santa Cruz Mountains began around 1777, with arrival of European settlers. Mechanical sawmilling began around 1841. The first mechanical mills used water power to drive the saws. During this time, draft animals (oxen and horses) were primarily used to transport logs to the mills from the forest and lumber to the end user. By the 1850s, steam began to replace water flow as the power source in many sawmills. Steam-driven log yarders (steam donkeys) were used in woods operations starting in the latter 1880s. With the development of new technologies, the rate of harvest increased. Two seminal events contributed to increased forest resource extraction in the Santa Cruz Mountains:

1. California gold rush, which began in 1849, and resulted in high demand for wood in San Francisco, which had become the primary hub for materials and manpower destined for the gold fields; and
2. The 1906 San Francisco earthquake and fire, which destroyed many of the existing wood-frame structures (Standiford et al. 2012).

By the mid-1850s, many small sawmills were in existence throughout the portions of the District populated by redwood forest. These mills cut most of the accessible old-growth redwood trees of good form, leaving scattered residual old growth behind. There is no official definition of old growth; however, for the purposes of this discussion, old growth refers typically to large trees, with platy bark and deep fissures, large limbs, reiterated tops, basal hollows, and cavities (characteristics which also greatly enhance habitat complexity), that also generally had been growing before European settlement.

Clear-cutting of the old-growth redwood/Douglas-fir conifer forests of the Santa Cruz Mountains continued more or less unabated until the mid-1920s. By 1930, most of the contiguous stands of old-growth timber had been cut.

A proportionally small, yet biologically significant, portion of the total old-growth forest within the Santa Cruz Mountains was preserved and transferred to park land. In the mid-1880s, individuals, agencies, and organizations initiated efforts to safeguard old-growth redwood forests. In 1901, California Redwood Park—the first redwood forest park and second California State Park—was established in Big Basin, which is located in the southwestern portion of the District (Evarts and Popper 2011). Early California redwood conservation efforts within the Santa Cruz Mountains are recognized as pioneering and exemplary, and helped grow the greater conservation movement in California. Some instrumental conservation organizations such as the Save-the- Redwoods-League, and the Sempervirens Fund continue to conserve redwood, including old growth, within the Santa Cruz Mountains.

By 1940, forestland within the District's boundary was comprised of predominantly robust stands of small second-growth redwood and Douglas-fir ranging from ten to eighty years old, with remnant stands of old growth located primarily in protected lands or inaccessible areas on private land. The next wave of harvesting focused on cutting scattered residual old-growth and was conducted on a smaller scale than the turn of the century operations. State regulations at the time required that four "seed trees" per acre, eighteen inches in diameter or larger, be retained. All other trees could legally be cut.

In July 1956, local timber operators voluntarily formed the Central Coast Timber Operators Association (Original Documents of the Central Coast Timber Operators Association). The purpose of this organization was to create a mutually agreeable set of logging standards beyond what State and County regulation required. The impetus for these self-imposed voluntary standards was the increasing public concern over logging operations and their potential effects on streams, roads, and particularly drinking water. Some careless logging operators whose lack of consideration for these legitimate public concerns resulted in increasing conflict between neighbors and timber harvesting. On August 14, 1956, the Central Coast Timber Operators Association adopted self-imposed rules which included an assessment of surface water on every proposed timber harvest site to determine whether the water was being used for domestic purposes, rigorous confirmation of property lines and rights-of-way, strict attention to logging slash treatment and a prohibition of log hauling on weekends and legal holidays. Discussions also began regarding developing practices for improving stream crossings and road and landing construction as well as establishing buffer zones adjacent to creeks.

History of Timber Harvest Regulations

In 1967 the California Board of Forestry formed a sub-committee to discuss county-specific forest practice rules. It was during these discussions that the basic principles of selection silviculture began to take shape. Three operational standards were adopted at this time and formed the basis for single-tree selection silviculture in San Mateo, Santa Cruz and Santa Clara counties:

1. **The 60-40 Rule:** No more than 60 percent of trees 18 inches in diameter or larger could be cut during any harvest entry and no more than 40 percent of the trees 8 to 18 inches could be cut per entry;
2. **10-year Minimum Reentry Period:** A minimum harvest entry interval of 10 years was established, based upon the practice of several local foresters at that time; and
3. **Lopping Requirement:** All logging slash must be cut to within 30 inches of the ground. This operation was first tested for economic effectiveness by Big Creek Lumber Company on a harvest site in San Mateo County in the 1960s (Dale Holderman and Bud McCrary, pers. comm.).

Benefits of selective harvesting (the 60-40 Rule) can include: release of residual trees to improve growth rates and add volume to specific retained trees, management of specific tree species to shift species composition toward a desired composition and structure, and increase in separation of the horizontal and vertical continuity of fuels to reduce fire hazard.

Interestingly, it was lopping requirement that had the most immediate impact on timber operations in the Santa Cruz Mountains. Timber fallers and equipment operators could no longer knock down or damage smaller conifers and hardwoods, at least not without incurring prohibitive cleanup costs. As a result, the quality of timber operations improved significantly (Dale Holderman and Bud McCrary, pers. comm.).

Timber Harvest Regulations in the District

- 1956 Central Coast Timber Operators Association
- 1960's: Santa Cruz County Rules
- 1973: Professional Foresters Law
- 1973: California Forest Practice Act
- 1982: Timberland Productivity Act/SB856
- 1976 and 1999 Special County Rules

In 1973, the California State Legislature passed the Z'berg-Nejedly California Forest Practice Act, enabling legislation that charged the California Board of Forestry and Fire Protection with establishing the California Forest Practice Rules. The 60-40 cutting rule became the operational standard for the Southern Subdistrict of the Coast District, which includes the Santa Cruz Mountains. Many progressive landowners have historically harvested below this level.

The Z'berg-Nejedly California Forest Practice Act permitted individual counties to create their own separate logging regulations as long as those regulations were more protective than state regulations. January 1, 1983 saw the passage of California Senate Bill 856, which removed county authority to regulate the conduct of timber operations, including Santa Cruz, San Mateo, and Santa Clara counties, which were actively regulating timber harvests at the time. This bill was enacted in response to timber industry outcry to a decision by the Santa Clara County Board of Supervisors in 1980 to not process County timber harvest permits, which was viewed as effectively creating a de-facto prohibition (Martin 1989). Local counties were also beginning to require Environmental Impact Reports (EIR's) under the Environmental Quality Act, and imposing environmental and operational requirements and mitigations for timber harvests within the Santa Cruz Mountains, to which the timber industry objected. Senate Bill 856 would have significantly diminished county roles in overseeing harvesting within their jurisdictions: counties would no longer had the ability to approve or deny timber harvests within their jurisdictions; instead, those decisions would be made by the State of California.

Recognizing the fact that counties might have specific needs, and that some had actively been regulating timber operations, SB 856 enabled individual counties to petition the Board of Forestry for Special County Rules. The Board of Forestry only allowed the six counties that previously had regulated timber harvests, and were politically most boisterous and impacted by SB 856, to propose such rules. These include San Mateo, Santa Clara and Santa Cruz counties, as well as Monterey, San Francisco, and Marin counties. These six counties were allowed to participate in the THP review process as members of the "Review Team" for THPs within their jurisdiction, and were given the ability to comment on and appeal THPs, though all final approval authority would remain with the State. The vast majority of counties with the vast majority of timber resources within the State were thus excluded from similar oversight. The Board of Forestry passed some of the requested Special County Rules and rejected others. Interestingly, the enacted rules that were allowed were remarkably similar to the operational standards adopted by the Central Coast Timber Operators Association during the 1950s.

Under California Forest Practice rules specific to the Southern Subdistrict of the Coast District (located primarily within the Santa Cruz Mountains), clearcutting has been outlawed since 1970. Since that time, single tree selection has been the only silvicultural practice allowed in the Southern Subdistrict. While clearly environmentally superior to the clearcutting that the Board of Forestry allows throughout the rest of the State, substantial road and log-landing construction, and near-stream operations were often widely noted as substantial sources of sediment pollution within the Santa Cruz Mountains by the California Department of Fish and Wildlife in stream surveys between the 1960s and 1980s. During the mid to late 1990s, additional stream habitat and water quality regulations were incorporated into the Forest Practice Rules to better protect forested watersheds with anadromous fish runs, and/ or watersheds that had been designated as impaired (polluted) by sediment by the Regional Water Quality Control Board, during timber operations.

Increasing population and rural mountain residential development have created pressures on redwood forestlands in California, and particularly on the Central Coast. Tensions resulting from population increases and ongoing residential encroachment into forestlands in the District have increased over time. Environmental deficiencies of timber harvests were often encountered by the growing population of mountain residents, and conflicts between rural-residential uses and expectations, and timber uses and expectations, have ensued. Significant new conflicts were introduced with the addition of helicopter logging within rural residential areas, beginning in the mid-1990s. Additionally, demographics of Santa Cruz Mountain Counties have changed since the 1980s, with the influence of economic growth and development in Silicon Valley. Residences within the forested mountains have become desirable as retreats from the urban areas within easy commute distance. These circumstances have created significant logistical and socio-political challenges that timber harvesting must now take into account.

In recent years, a couple of potential harvests, of the many submitted to Cal Fire, have sparked public controversy and were eventually either withdrawn or denied. These were Non-Industrial Timber Management Plans and included: San Jose Water Company and the San Francisco YMCA. Significant issues raised by those opposing the harvests included: the indefinite, forever approval of NTMPs, which once approved cannot be amended; protection of old-growth and late-seral forests, watersheds, streams, and municipal and domestic water supplies; impacts of helicopter logging; effects on residential and recreational uses on adjacent lands; loss of terrestrial habitat important for preservation; increased fire risk; and acreage limitations for NTMPs.

IMPLICATIONS OF TIMBER MANAGEMENT

Ecologically sustainable forestry can have numerous benefits. These benefits include: providing local, sustainable products for consumers; supporting working forestlands that provide a buffer against the pressures of land conversion and rural residential development; and, in some cases, maintaining and promoting biological diversity in redwood forest ecosystems. Restoration forestry, which focuses on utilizing timber harvest to restore forests degraded by previous logging, may utilize limited harvest entries to restore and promote increased biodiversity, including by accelerating growth and characteristics of older (late-seral) forests, and adding complexity to younger stands that have been biologically simplified by past harvest practices.

The cessation of harvesting may have environmental consequences which include effects on forest structure and species composition, such as increasing density of trees leading to a stagnated condition when tree growth slows dramatically and stem exclusion or die off begins to take place. Shade-tolerant tree species that would otherwise be kept in check by forest management or historic fire intervals, such as Douglas-fir, can fill in the understory thereby increasing competition.

Lack of forest management can also have other environmental effects, including neglect of road maintenance, which may cause failed drainage structures and damage to road infrastructure, as well as increases in erosion and sediment delivery. Funds to maintain infrastructure (roads, erosion control, etc.) must be procured elsewhere; if funding is not available, adequate maintenance may not get done. The District has, and will continue to direct substantial funds, and staff resources to abandon/restore pre-existing problematic timber road infrastructure, and to upgrade and maintain existing timber infrastructure to maintain emergency and patrol access, access for restoration and environmental stewardship, and access for recreational activities.

When forest management is removed from the land, the presumed fire-surrogate effects of harvesting are also absent. These effects include lopping of slash to reduce the fire hazard, as well as reducing the horizontal and vertical continuity of fuels to alter fire behavior. The fire-surrogate effects of harvesting remain a topic of debate. Logging can generate substantial slash, creating the need for lopping, and increasing forest floor fuel loads. The typical harvest rotation grows trees to a harvestable size (often within the 18 to 30 inches in diameter), then removes them, creating a perpetually young, smaller diameter stand (within the context of the overall age/ size range possible for these forests). Younger forests are typically less resilient to fire than a larger older stand. Stand replacement fires in old-growth forests, for example, have been reported to have had recurrence intervals in the multiple hundreds of year time frame, a testament to the fire resiliency of such older, larger, less dense stands. (Agee

1993, Arno and Fiedler 2005, Noss 2000, Kohm and Franklin 1997, FEMAT, 1993).

Absent forest management, other aspects of stewardship may also be less likely to take place, including monitoring and controlling invasive species, and potentially enhancing stream health through restoration actions. Restoration forestry remains a tool to potentially balance revenue needs for forest-related stewardship, enhance the resiliency to fire, and to promote/ accelerate forest ecological recovery to restore forests to a more similar condition to the forests that preceded European settlement. The THP process, in addition to providing potential revenue for restoration/ management, also potentially provides an expedited, less-costly process to undertake forest restoration and stewardship activities, than other options, such as county development permit processes.

There are potential environmental consequences associated with limiting/reducing the amount of land available for forest management on the Central Coast. Conversely, there are environmental benefits to sourcing raw materials locally, which subsequently become finished products sold to local markets. Prior to the 2009 economic recession, the annual per capita consumption of forest products used by individual Californians was a little over 700 board feet. That is the equivalent of a tree 24 inches in diameter at the base and 100 feet tall. In order to supply California with its annual wood fiber needs, thirty-six million times that volume had to be harvested.

Curtailing the supply of locally available timber has no effect on the overall production of forest products, as demand for these products doesn't change. Eliminating the local supply simply exports the procurement process to other locations. The importation of forest products from outside of the region results in an increase in fossil fuel consumption. Sourcing, manufacturing, and selling products locally reduces this fuel consumption.

Another potential environmental consequence of exporting the procurement of forest products is the fact that few (if any) locations elsewhere have forest practice regulations that provide the environmental protections currently in place on the Central Coast, which may result in increased harvesting in a less protective manner somewhere else.

Curtailing the supply of locally-available timber also has a direct effect on forest products manufacturers. When the available supply of raw material (logs) drops too low, the manufacturing facilities are at risk. This not only affects local economies, it also may also place pressure on landowners to pursue other economic uses of their forestlands. This can include conversion of forests to other land uses, such as residential use. Well-managed forests can foster ecosystem integrity, while continuing to provide wood and non-wood values.

Agencies Involved in Timber Harvest Review in the District

California Department of Forestry and Fire Protection (CAL FIRE)

California Department of Fish & Wildlife

California Geological Survey

San Francisco/Central Coast Regional Water Quality Control Boards

Counties of Santa Cruz, San Mateo, and Santa Clara

FOREST PRACTICE RULES AND THEIR BENEFITS FOR FOREST ECOSYSTEMS

The California Forest Practice Rules (FPR) include provisions to protect the public trust resources and mitigate negative cumulative environmental effects. The rules have evolved since 1973 to incorporate specific rule sections addressing watercourse protection, erosion control, preservation of habitat values, sensitive species protection, long-term sustained yield, and fire hazard reduction, among other things. Many of these revisions were made in response to public and reviewing agency concerns that public trust resources were not being adequately protected, and that significant cumulative environmental effects were occurring, despite the FPRs. The THP and NTMP have been determined through the courts to be functionally equivalent to an Environmental Impact Report. This includes the need to evaluate cumulative impacts, and also includes a public process as required by CEQA.

As regulatory documents, THPs and NTMPs are reviewed in the office and in the field by a suite of agencies (inset box). In addition, depending on location and circumstances, THP and NTMPs are reviewed by California State Parks, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, water districts, private road associations, or other resource professionals, archaeologists, geologists, wildlife biologists, and scientists, as well as the public.

Individual THPs and NTMPs require road and habitat assessments and provide the opportunity for proactive maintenance and restoration work to address problems often resulting from past harvesting, and to improve property conditions.

Forest Practice Rules addressing watercourse and lake protection provide for equipment exclusion buffer zones, legacy tree retention and recruitment, and canopy preservation. Many of these rules have been strengthened since the mid-1990s, in response to concerns statewide that the FPRs were not adequately protecting associated resources. The recent adoption of Anadromous Salmonid Protection Rules into the FPRs is a recent example of such revisions, aimed at preserving and enhancing watercourse health and riparian zone function to protect anadromous fish (salmonids) and their habitat from timber-harvest-related impacts.

Timber Harvest within Conservation Lands: **Case Studies**

Byrne Forest: Since 1984, the Land Trust of Santa Cruz County has owned the 322 acre Byrne Forest, the purchase of which was conditioned on ongoing management for educational and recreational uses, and as a sustainable working forest. Seven sustainable harvests over the last 25 years have generated $3.9 million (in 2014 dollars) for ongoing stewardship of the forest and other conservation lands in Santa Cruz County.

San Vicente Redwoods: Non-profit conservation organizations in the Santa Cruz Mountains partnered to protect the 8,532-acre property, which features Conservation Areas, which will be preserved without timber harvest, Restoration Areas, where timber harvest can occur to promote the restoration objectives, and Working Forests which will be managed using sustainable timber harvest.

CHANGES WITHIN LOCAL FORESTS

The Santa Cruz Mountains have been subjected to rural-residential development pressure, including encroachment into forestlands for more than a century. This has often been preceded by timber harvesting and related road (including railroad) infrastructure. More recently, the transition of the Santa Clara Valley into a regional economic powerhouse has predictably placed extreme land-use pressures on adjacent rural lands including local forestlands. It also created some speculation on forested properties, using timber harvesting as a way to pay for and construct residential infrastructure (access roads and building sites) for future sale with the ‘new’ amenities. These operations occurred on non-TPZ parcels, which had not recently been logged, and were often in proximity to other rural residences, perpetuating conflict, and leading counties to resolve conflicts through zoning restrictions.

Properties that historically were owned and maintained with periodic selective harvesting as an objective have now become desirable as upscale rural-residential areas for Silicon Valley. Continued harvesting may not meet the residential objectives of all of these new landowners, and these owners may have the financial resources to adequately manage and maintain their properties without the need for harvest income. This continues the trend of economic pressure on local forestlands, and has also resulted in a population of new residents who may not have substantial knowledge of local logging practices or the area's longtime history of sustainable forest management. Nonetheless, even well-informed new property owners may still choose not to harvest their property. Demographic and economic changes continue to further public discussion with elected representatives, various government regulatory agencies and the local forestry community.

One such area of discussion is the wildland-urban interface areas which can be a threat to timber, habitat and residential values as well. This interface may pose logistical problems for carrying out beneficial management practices, as well as social hurdles to implement successful forestry projects. These challenges can often be overcome with a clear message and open communication, and wildland-urban interface projects continue to be successfully implemented within the District's boundary.

Forest preservation efforts in the Santa Cruz Mountains have removed viable timberlands from harvest going back to at least the preservation of Big Basin in the early 1900s, and has continued since. In the last thirty years, tens of thousands of acres of potentially harvestable forestland have been acquired for parks and open space. While many of these lands had been previously harvested, or could legally be harvested under current land use regulations, timber harvesting has generally not been undertaken by the entities now administering these lands. Two notable exceptions to this trend are the Byrne Forest and the San Vicente Redwoods property (inset box). Ongoing and future conservation efforts will continue to purchase forest land in the area. Several open space organizations, including the District, are now considering limited forest management, where appropriate, as a mechanism to achieve their conservation goals, which include forest restoration.

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Appendix C-3:

Conservation Value Analysis

for the Healthy Nature Theme of the Vision Plan

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INTRODUCTION

Purpose

This report describes spatial analyses that were conducted to characterize the relative biodiversity conservation value of land within the Vision Plan Area—an approximately 370,000-acre area which includes the Midpeninsula Regional Open Space District jurisdiction, sphere of influence, and land holdings (Figure 1). The purpose of the analysis was to integrate multiple sources of spatial data, which were used to characterize existing conditions for biodiversity in the plan area (JMc 2013a), to create a single data layer that can be used to identify areas where land protection, restoration, and stewardship projects can best advance the goals of the Vision Plan's *Healthy Nature* theme.

Overview

Spatial data developed by the District and its conservation partners, as well as other publicly available information depicting terrestrial and aquatic ecosystems, rare species habitat and occurrences, and areas important for landscape connectivity, were synthesized in a geographic information system (GIS). This GIS was used to assess the individual conservation values presented by these and other features, as outlined in detail in the report, *Biodiversity of the Midpeninsula Regional Open Space District* (JMc 2013).

The GIS was then used to conduct an overlay analysis in order to identify areas of co-occurring features where conservation actions could achieve multiple benefits for biodiversity conservation. Weights were applied to the features to indicate their accuracy and relevance for directing conservation work to achieve the *Healthy Nature* theme goals. The resulting layer depicting the relative value of land for conserving biological resources on District open space preserves, as well as adjacent lands, was used to inform priority actions designed to promote goals of the *Healthy Nature* theme of the Vision Plan.

METHODS

Data Inputs

Table 1 lists data layers synthesized as part of the *Healthy Nature* component of the Vision Plan which were integrated in the conservation value analysis (Table 1). More detailed information about the data used in each theme is provided in the existing conditions report (JMc 2013).

Additional data used in the existing conditions report (JMc 2013), such as erosion and gullying potential layers, fire ecology and fire hazard, and insolation (solar radiation), were evaluated for inclusion in the analysis; however, these and other layers were excluded from the model because they were determined to be insufficiently accurate, precise, or complete, and/or they were deemed less relevant to locating land protection, restoration, and stewardship projects.

Model Weights and Scores

To depict the relative importance of the various data layers for determining conservation value, each layer was assigned a weight; the weights of all layers sum to 100, such that they represent the percent of the total conservation value comprised by each layer (Table 1).

The layer weights were multiplied by the normalized score assigned to each feature within each layer (Table 2). Like the weights, the feature scores were designed to reflect their relative value for conservation (Table 3).

Scores for features were normalized within each layer (divided by the maximum score) so that each had a maximum value of 1; as a result, the maximum feature score, when multiplied by the weight for the layer, equals the weight. The products of the weights and the normalized scores were summed as part of a simple, additive model to characterize conservation value:

Relative Conservation Value =
30 (vegetation) + 20 (streams) + 15 (watershed value) + 10 (rare species) + 10 (patches) + 7.5 (terrestrial linkages) + 7.5 (aquatic linkages)

RESULTS

Within the Vision Plan Area, total conservation value scores ranged between 3.75 and 83.96 and averaged 36.0 (Table 4). District lands averaged 6% higher conservation value than unprotected lands, and were similar in conservation value to other conservation lands, such as state parks. Average conservation value scores for unprotected lands may reflect, in part, lack of available data for rare species occurrences on these lands.

Ecological Systems

Throughout the Vision Plan Area, areas of highest biodiversity conservation value are associated with the following systems and geographic areas (Figure 1).

1. **Salmonid Streams:** Coastal streams and watersheds that support endangered coho salmon and threatened steelhead, as well as streams and watersheds that drain to the San Francisco Bay and feature steelhead runs, are important not only for rare salmonids, but also because they provide important landscape linkages and are often lined with sensitive riparian communities.
2. **Old-growth redwood forests:** Located primarily in the southwestern portion of the Vision Plan area, these previously uncut stands of coast redwood and Douglas-fir forest support rare species including marbled murrelet, Vaux's swift, sharp-shinned hawk, Cooper's hawk, pileated woodpecker, and olive-sided flycatcher; they also often occur in watersheds supporting rare salmonids including the Pescadero Creek Watershed.
3. **Coastal terrace prairie grasslands:** Located on the rounded ridgetops on the coast side of the Santa Cruz Mountains, these grasslands support rare plants and animals, including diverse assemblages of rare birds including grasshopper sparrow, burrowing owl, white-tailed kite, golden eagle, Swainson's hawk, and northern harrier; they also often occur in watersheds supporting salmonids including the San Gregorio Watershed.
4. **Serpentine communities**: Found primarily on the interior foothills, these communities feature high concentrations of endemic plants and insects, including Bay checkerspot butterfly, most-beautiful jewelflower, fragrant fritillary, and San Mateo Thorn-mint; they also occur in watersheds that support steelhead including the San Francisquito Creek Watershed.
5. **Bay wetlands:** Wetlands ringing the San Francisco Bay support saltwater and brackish water marshes—biologically highly-significant communities that provide habitat for numerous rare species including California seablite, northern harrier, California black rail, California clapper rail, salt-marsh harvest mouse, and salt-marsh wandering shrew.
6. **Ponds and Freshwater Wetlands:** Scattered throughout the intact habitat, these aquatic systems provide breeding habitat for many rare species including San Francisco garter snake, California red-legged frog, California tiger salamander, and western pond turtle, and tricolored blackbird, and provide a source of free water for terrestrial species.

Land conservation and stewardship projects in these and other high-value systems can maximize the biodiversity conservation benefits.

Watersheds

Land within the subwatersheds of the San Gregorio and Pescadero creek watersheds averaged the highest conservation value, along with land within the Gazos, Waterman Gap, and Soquel creek subwatersheds (Table 5, Figure 2). These watersheds feature coast redwood forest, coastal grasslands, and other intact terrestrial communities as well as rare species occurrences; they are also important for endangered salmonids. Moreover, land within the southwestern watersheds is part of the largest contiguous habitat patch in the Santa Cruz Mountains, which covers more than 60,000 acres and extends from Big Basin to Highway 84. Maintaining habitat within large contiguous habitat patches can promote diversity in part by maintaining populations of species that have large home ranges, such as mountain lion (JMc 2013).

Generally speaking, land protection as well as stewardship projects in these watersheds have the potential to result in greater benefits for both terrestrial and aquatic species and communities. However, site-specific conditions should be evaluated in prioritizing conservation actions.

Lands under District Stewardship

Comparison of mean conservation value of land within 29 land holdings totaling more than 55,000 acres, for which the District is responsible for land stewardship, revealed that the Ravenswood, La Honda Creek, Russian Ridge, and Long Ridge open space preserves, and Stevens Creek Shoreline Nature Study Area, averaged the highest conservation value (Table 6, Figure 3). Other District-managed lands with above-average conservation value include: Skyline Ridge, El Corte de Madera Creek, St. Joseph's Hill, Sierra Azul, Tunitas Creek, and Monte Bello open space preserves (Table 6).

All else being equal, habitat restoration and management projects in these open space preserves and other lands can have a greater benefit for biodiversity than elsewhere. However, conditions of the site and aspects of the habitat management project will ultimately determine the benefits of stewardship, and should be used to prioritize projects.

SUMMARY

Within District-managed lands, as well as the Vision Plan Area more broadly, priority aquatic and terrestrial ecosystems, rare species populations, and habitat patches and landscape linkages, co-occur within the landscape, creating opportunities to achieve multiple benefits with conservation actions in high conservation value areas. Watersheds of high conservation value include the Gazos, Waterman Gap, and Soquel creek, as well as many subwatersheds within the San Gregorio and Pescadero creek watersheds (Table 5, Figure 2).

Stewardship of District- managed lands has the potential to most greatly promote biodiversity conservation goals within the Ravenswood, La Honda Creek, Russian Ridge, and Long Ridge open space preserves, and Stevens Creek Shoreline Nature Study Area; Skyline Ridge, El Corte Madera Creek, St. Joseph's Hill, Sierra Azul, Tunitas Creek, and Monte Bello open space preserves also contain land featuring multiple co-occurring biodiversity conservation values (Table 6, Figure 3).

Protecting, buffering, connecting, restoring, and stewarding lands within these high priority watersheds and land holdings, as well as other areas of high conservation value, can safeguard riparian and riverine habitat, old-growth redwood forests, coastal terrace prairie grasslands, serpentine communities, and ponds and wetlands. In so doing, such actions can promote populations of the diverse suites of rare species that they support, as well as help keep common species common. Prioritizing work in areas of high relative conservation value can help advance the goals of the *Healthy Nature* theme of the Vision Plan. Conservation in these areas can also protect working lands as well as scenic and cultural resources, and provide opportunities for compatible access and recreation.

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TABLES

**Table 1:
Weights applied to the scores of the main data layers incorporated in the conservation value analysis model**

Model Component[1]	Weight
Vegetation[2]	30
Streams	20
Watersheds	15
Rare Species	10
Habitat Patches	10
Terrestrial Linkage	7.5
Aquatic Linkage	7.5
Total	100

[1]Individual data sources are listed in JMc 2015.

[2] Also includes water bodies such as ponds.

Table 2: Weights and scores for revised model to calculate conservation value[1]

		Base Score	Normalized Score[2]	Weight	Final Score
Vegetation	Sensitive Communities	10	1.00	30	30.0
	Biologically Highly Significant Community	8	0.80	30	24.0
	Uncommon Natural Vegetation	6	0.60	30	18.0
	Fairly Common Natural Vegetation	5	0.50	30	15.0
	Common Natural Vegetation	4	0.40	30	12.0
	Non-native vegetation	2	0.20	30	6.0
	Cultivated Areas	1	0.10	30	3.0
	Urban	0	0.00	30	0.0
Streams	Coho Stream	4.5	1.00	20	20.0
	Steelhead Stream	4	0.89	20	17.8
	Perennial tributary to a salmonid stream	3.5	0.78	20	15.6
	Ephemeral tributary to a salmonid stream	3	0.67	20	13.3
	Other Perennial Stream	2	0.44	20	8.9
	Other Intermittent Stream	1	0.22	20	4.4
Watersheds	Coho Core	4	1.00	15	15.0
	Coho Phase I	3.5	0.88	15	13.1
	Coho Phase II	3	0.75	15	11.3
	Steelhead Non-Urban	2.5	0.63	15	9.4
	Steelhead Urban	2	0.50	15	7.5
	Other Non-Urban	1.5	0.38	15	5.6
	Other Urban	1	0.25	15	3.8
Rare Species	3-4 mapped species	3	1.00	10	10.0
	2 mapped species	2	0.67	10	6.7
	1 mapped species	1	0.33	10	3.3
	no mapped species	0	0.00	10	0.0
Habitat Patch	76-100 percentile of patch size	4	1.00	10	10.0
	51-75 percentile of patch size	3	0.75	10	7.5
	26-50 percentile of patch size	2	0.50	10	5.0
	1-25 percentile of patch size	1	0.25	10	2.5

Table 2: Weights and scores for revised model to calculate conservation value[1]

		Base Score	Normalized Score[2]	Weight	Final Score
	Not in a Habitat Patch	0	0.00	10	0.0
Terrestrial Linkage	Within Choke Point	2	1.00	7.5	7.5
	Within Remainder of Linkage	1	0.50	7.5	3.8
	Not in terrestrial linkage	0	0.00	7.5	0.0
Aquatic Linkage	Within Stream Corridor	2	1.00	7.5	7.5
	Within Remainder of Stream Buffer	1	0.50	7.5	3.8
	Not in aquatic linkage	0	0.00	7.5	0.0

[1] Detailed information about these data layers and the features is provided in JMc 2015.

[2] Base score divided by the maximum value for the layer.

Table 3: Data layers and scores for weighted overlay analysis for biodiversity.

Layers	Description	Scores	Explanation
Vegetation[2]	Land cover types with ratings reflecting relative conservation value	Sensitive Communities (10) Biologically Important Community (8) Uncommon Natural Vegetation (6) Fairly Common Natural Vegetation (5) Common Natural Vegetation (4) Non-native vegetation (2) Cultivated Areas (1) Urban (0)	Scores reflect biodiversity value of vegetation and other land cover types for biodiversity. Higher scores are assigned to sensitive communities (e.g. serpentine grassland), as well as those that provide important habitat, including those that promote persistence of endangered species (riparian areas). Other native communities are scored based on their occurrence in the Vision Plan Area. Non-native vegetation of greater value than cultivated areas, which in turn are more valuable for biodiversity conservation than urban areas as the former can be more readily restored and is more permeable.
Streams	Priority streams for aquatic biodiversity and the adjacent riparian areas. Streams will be buffered to protect riparian corridors, with the width of the buffer greater for high-rated streams: Tier 1-3: 100 feet Tier 4: 50 feet	Tier 1a: Coho Stream (4.5) Tier 1b: Steelhead Stream (4) Tier 2a: Perennial tributaries to a salmonid stream (3.5) Tier 2b: Ephemeral tributaries to a salmonid stream (3) Tier 3: Other Perennial Stream (2) Tier 4: Other Intermittent Stream (1)	Scores and buffer widths reflect stream values based on anadromous fish distribution and hydrology (perennial streams were assigned higher value than intermittent streams).

Table 3: Data layers and scores for weighted overlay analysis for biodiversity.

Layers	Description	Scores	Explanation
Watersheds	Relative value of land within each watershed for protecting stream biodiversity	Tier 1a: Coho Core (4) Tier 1b: Coho Phase I (3.5) Tier 1c: Coho Phase II (3) Tier 2a: Steelhead Non-Urban (2.5) Tier 2b: Steelhead Urban (2) Tier 3a: Other Non-Urban (1.5) Tier 3b: Other Urban (1)	Coho watersheds are the highest priority, and scored based on the recovery plan designations. Other watersheds are scored based on whether they support steelhead and then their extent of development. In already urbanized watersheds, protecting land within the watershed is less likely to promote stream conditions, hence the reduced value.
Rare Species	Frequency of overlapping rare species occurrences	Score reflects the frequency of rare species occurrence areas: • >3-4 species (3) • 2 species (2) • 1 species (1) • No mapped rare species (0)	Scores based on frequency in categories rather than raw numbers, to reduce their variability and in recognition that the data are not comprehensive, and certain areas (e.g. public lands, particularly District lands) have more records due to higher frequency of surveys and reports.
Habitat Patches	Intact habitat patches (contiguous, vegetated areas not separated by roads or development, scored according to their size) or aquatic habitat patches.	Normalized habitat patch sizes classified using natural breaks: • 36-100% of max. patch size (4) • 15-35% of max. patch size (3) • 5-14% of max. patch size (2) • 0-4% of max. patch size (1) • Outside of habitat patch (0)	Larger areas of intact habitat can support more species, including populations of species with large home ranges, and can be more effectively managed to maintain viability.
Terrestrial Linkages	The terrestrial linkage from the Bay Area Critical Linkages project, with the area around Highway 17 being most critical to maintaining	Within choke point (2) Within remainder of linkage (1)	The choke point across Highway 17 is most critical for terrestrial.

Table 3: Data layers and scores for weighted overlay analysis for biodiversity.

Layers	Description	Scores	Explanation
	connectivity within the Santa Cruz Mountains		
Aquatic Linkages	Aquatic linkages are streams that support salmonids	Stream corridor (stream and 100 foot buffer) (2) Stream buffer (1 km buffer) (1)	The Bay Area Critical Linkages project identified streams and buffered them by 2 km (1 km on each side of the stream) to designate a linkage. This scoring system recognizes that the immediate stream corridor (stream and 100 feet buffer) is most crucial, with the other 1 km also important.

[1] Detailed information about these data layers and the features is provided in JMc 2015

[2] Also includes water bodies such as ponds

Table 4: Conservation value of land by protection status

	Conservation Value			
Land Status	Average	Minimum	Maximum	Standard Deviation
District Lands (Fee and Easement)	37.0	3.8	78.6	12.2
Other Protected Lands	37.0	3.8	84.0	15.0
Private, Unprotected Land	34.9	3.8	80.3	14.9
All Land	36.0	3.8	84.0	14.5

Table 5: Subwatersheds ranked according to their average conservation value

Rank	Subwatershed	Major Watershed	Acres	Conservation Value: Average	Minimum	Maximum	Standard Deviation
1	Tarwater Creek	Pescadero	1,194	45.9	19.9	78.4	9.8
2	Slate Creek	Pescadero	1,929	43.8	22.9	78.4	10.0
3	Langley Creek	San Gregorio	273	43.7	21.9	73.4	9.5
4	Gazos Creek		7,174	43.0	18.8	80.3	9.3
5	Little Butano Creek	Pescadero	2,607	42.6	27.0	74.3	10.0
6	Upper Pilarcitos Creek		89	42.0	16.9	55.8	8.5
7	Bogess Creek	San Gregorio	2,542	41.9	18.8	75.3	8.7
8	Harrington Creek	San Gregorio	3,092	41.2	18.3	78.6	7.8
9	Peters Creek	Pescadero	6,307	40.6	16.9	84.0	10.5
10	Alpine Creek	San Gregorio	3,548	40.6	15.0	75.3	10.1
11	Upper Pescadero Creek	Pescadero	3,817	40.3	16.9	84.0	8.5
12	South Fork Butano Creek	Pescadero	1,961	39.6	25.0	74.3	8.1
13	Oil Creek	Pescadero	2,819	39.6	22.9	78.4	6.3
14	Honsinger Creek	Pescadero	1,682	39.4	22.9	76.7	9.0
15	Waterman Creek		1,175	39.3	16.9	68.7	6.7
16	Mindego Creek	San Gregorio	2,464	39.3	15.0	75.3	8.0
17	Kingston Creek	San Gregorio	787	39.2	18.8	72.5	7.7
18	Upper Butano Creek	Pescadero	6,010	39.2	15.0	74.3	8.0
19	Soquel Creek	Soquel	710	39.2	15.0	69.0	5.5
20	Pescadero Creek	Pescadero	13,633	38.6	19.1	80.6	10.7
21	El Corte de Madera Creek	San Gregorio	4,742	38.4	16.9	74.5	9.7
22	San Gregorio Creek	San Gregorio	5,371	38.1	18.8	77.5	11.1
23	Woodruff Creek	San Gregorio	1,923	37.4	13.1	73.4	8.5
24	Woodhams Creek	San Gregorio	545	37.3	16.9	59.2	8.6
25	Waddell Creek		812	37.0	16.9	70.2	10.1
26	Coyote Creek	San Gregorio	1,126	36.6	19.1	70.6	8.5
27	Clear Creek	San Gregorio	956	36.0	16.9	70.6	10.2
28	Whitehouse Creek		1,836	35.8	13.1	72.0	8.1
29	Dry Creek (Pilarcitos)	Tunitas	1,495	35.2	13.1	67.4	9.2
30	Lower Butano Creek	Pescadero	3,205	35.1	14.3	72.4	10.8
31	Pomponio Creek		4,548	35.1	19.1	68.0	8.6
32	SF Bay and Estuary		33,374	34.7	7.5	71.9	9.1

Table 5: Subwatersheds ranked according to their average conservation value

				Conservation Value			
Rank	Subwatershed	Major Watershed	Acres	Average	Minimum	Maximum	Standard Deviation
33	Bradley Creek	Pescadero	3,918	34.1	17.3	71.3	9.1
34	East Fork Tunitas Creek	Tunitas	1,490	33.9	13.1	69.7	8.5
35	Uvas Creek		154	33.8	19.1	55.1	6.4
36	Mills Creek	Pilarcitos	2,419	33.8	13.1	69.7	9.6
37	Weeks Creek	San Gregorio	644	33.6	13.1	63.5	9.0
38	Alamitos Creek Watershed	Guadalupe	4,983	33.4	7.5	61.4	6.3
39	La Honda Creek	San Gregorio	3,940	33.4	16.5	68.4	9.6
40	Upper Guadalupe Creek	Guadalupe	3,059	33.4	9.4	64.1	6.8
41	Lawrence Creek	San Gregorio	1,557	33.3	16.9	56.5	4.9
42	Guadalupe Creek	Guadalupe	4,065	32.4	7.5	67.1	8.4
43	Frenchman's Creek		2,622	32.1	12.4	68.0	7.3
44	Lobitos Creek		2,580	31.9	16.0	67.8	9.7
45	Apanolio Creek	Pilarcitos	1,251	31.8	13.1	72.2	7.8
46	Arroyo Leon	Pilarcitos	3,020	31.2	13.1	69.7	10.0
47	Tunitas Creek	Tunitas	4,472	31.0	13.1	68.0	8.7
48	Bear Creek	San Francisquito	1,087	30.6	13.1	64.7	12.0
49	Denniston Creek		2,578	30.5	13.1	72.2	8.0
50	West Union Creek	San Francisquito	3,548	29.1	13.1	59.0	5.6
51	Arroyo de los Frijoles		2,251	29.0	5.6	56.6	7.1
52	Los Trancos Creek	San Francisquito	4,473	29.0	11.3	62.8	8.5
53	East Waddell Creek		11	28.5	18.3	40.3	7.3
54	Upper Stevens Creek	Stevens	10,837	28.2	8.6	60.8	6.9
55	Bear Gulch	San Francisquito	1,939	28.1	13.1	58.7	5.0
56	Cold Dip Creek		1,106	28.1	8.6	65.3	10.6
57	Upper Los Gatos Creek	Guadalupe	23,688	27.8	5.6	62.8	8.0
58	San Lorenzo River	San Lorenzo	213	27.6	13.1	46.9	6.7
59	Cascade Creek		1,334	27.2	5.6	58.3	9.3
60	San Pedro Creek		1,466	27.2	11.3	70.3	6.9
61	Pilarcitos Creek	Pilarcitos	3,829	27.0	7.5	66.1	10.0
62	Purisima Creek		5,649	26.7	5.6	57.0	6.7
63	Corte Madera Creek	San Francisquito	9,290	26.1	7.5	60.8	7.3
64	Albert Canyon	Pilarcitos	735	25.6	7.5	57.9	8.2

Table 5: Subwatersheds ranked according to their average conservation value

Rank	Subwatershed	Major Watershed	Acres	Conservation Value: Average	Minimum	Maximum	Standard Deviation
65	Upper San Mateo Creek		556	25.4	5.6	43.4	10.7
66	W. Branch Permanente Cr.	Permanente	2,263	25.1	7.5	54.2	6.6
67	Nuff Creek	Pilarcitos	683	25.0	5.6	49.8	5.9
68	Madonna Creek	Pilarcitos	1,073	24.9	11.6	57.2	7.9
69	San Vicente Creek (SMCO)		1,057	24.8	3.8	47.9	7.5
70	Pillar Point Marsh		763	24.0	3.8	48.9	10.2
71	Dry Creek	San Francisquito	1,012	23.8	9.4	60.9	12.4
72	Martini Creek		822	23.7	5.6	37.1	4.3
73	Unknown Coastal Creek		7,664	23.2	5.6	65.3	9.3
74	Soquel Creek		165	23.0	9.4	49.4	8.6
75	Saratoga Creek	San Tomas Aquino	7,763	21.3	3.8	50.7	8.1
76	Montara Creek		1,035	19.8	3.8	50.1	7.7
77	Green Oaks Creek		1,140	19.7	8.6	55.2	10.8
78	Arroyo de en Medio		1,621	19.7	3.8	53.0	9.2
79	Arroyo Canada Verde		2,025	18.2	9.8	41.5	8.2
80	Los Gatos Creek	Guadalupe	5,147	18.1	3.8	57.6	10.9
81	Corinda Los Trancos Cr.	Pilarcitos	561	18.1	7.5	56.8	8.3
82	San Francisquito Creek	San Francisquito	8,960	18.1	7.5	71.9	12.2
83	Kanoff Creek		400	16.3	3.8	38.6	9.7
84	Permanente Creek	Permanente	5,492	15.4	7.5	59.2	9.8
85	Adobe Creek		7,679	15.2	3.8	50.7	9.8
86	Deer Creek		961	15.1	3.8	48.5	6.9
87	Stevens Creek	Stevens	10,282	14.7	7.5	65.3	9.4
88	Matadero Creek	Matadero	5,705	13.6	3.8	38.2	10.9
89	San Tomas Aquino Cr.	San Tomas Aquino	6,283	13.2	3.8	48.2	10.9
90	Hale Creek	Permanente	2,292	12.8	7.5	50.8	7.8
91	Ross Creek	Guadalupe	2,943	12.7	3.8	42.6	8.9
92	Cordilleras Creek		4,169	8.7	3.8	40.4	8.5
93	Guadalupe River		286	8.5	7.5	11.3	1.7
94	Calabazas Creek		10,721	8.5	3.8	59.6	8.6
95	Barron Creek	Matadero	2,017	6.8	3.8	37.5	4.5
96	Atherton Channel		8,386	6.3	3.8	41.5	6.2

Table 5: Subwatersheds ranked according to their average conservation value

				Conservation Value			
Rank	Subwatershed	Major Watershed	Acres	Average	Minimum	Maximum	Standard Deviation
97	Redwood Creek		7,304	5.8	3.8	41.1	6.1
98	Sunnyvale Channel		9,403	5.1	3.8	55.8	5.1
99	Belmont Creek		760	3.9	3.8	19.3	1.4

Table 6:
Lands under District stewardship, ranked according to their average conservation value.

			Conservation Value			
Rank	**Unit Under District Stewardship**	**Acres**	**Average**	**Minimum**	**Maximum**	**Standard Deviation**
1	Ravenswood OSP	283.4	40.9	7.5	45.8	4.0
2	La Honda Creek OSP	5,712.5	40.6	16.5	78.6	8.5
3	Stevens Creek Shoreline Nature Study Area	59.8	39.1	11.3	62.4	4.1
4	Russian Ridge OSP	3,123.8	38.2	11.3	75.3	8.5
5	Long Ridge OSP	1,976.8	36.8	21.4	78.4	7.9
6	Skyline Ridge OSP	2,029.0	35.8	15.0	78.4	8.7
7	El Corte de Madera Creek OSP	2,772.7	34.9	13.1	74.5	6.2
8	St. Joseph's Hill OSP	181.4	34.4	11.3	53.9	8.9
9	Sierra Azul OSP	18,317.9	32.7	9.4	69.0	6.1
10	Tunitas Creek OSP	1,630.6	32.4	11.6	69.7	9.1
11	Monte Bello OSP	3,159.5	30.8	11.6	60.8	6.6
12	Purisima Creek Redwoods OSP	4,632.5	29.8	15.4	67.8	7.1
13	Felton Station	44.4	29.4	8.6	36.5	4.4
14	Teague Hill OSP	617.3	29.2	19.1	59.0	4.7
15	Windy Hill OSP	1,375.9	29.1	14.3	60.8	6.6
16	Miramontes Ridge OSP	1,619.1	29.1	11.6	69.7	9.2
17	Picchetti Ranch OSP	293.4	28.6	15.4	48.1	5.3
18	Los Trancos OSP	276.2	28.2	13.5	47.3	5.7
19	Fremont Older OSP	732.6	27.7	3.8	60.8	5.6
20	Rancho San Antonio Co. Pa	286.9	27.7	7.5	50.8	10.4
21	El Sereno OSP	1,417.6	27.2	15.8	49.4	3.6
22	Saratoga Gap OSP	1,578.7	26.6	15.4	55.8	4.8
23	Coal Creek OSP	489.8	25.8	9.4	54.6	5.3
24	Rancho San Antonio OSP	2,147.9	25.8	7.5	54.2	6.1
25	Foothills OSP	239.0	23.8	9.8	50.7	4.7
26	Thornewood OSP	153.7	22.9	13.5	44.8	6.2
27	Pulgas Ridge OSP	364.9	21.6	3.8	38.2	8.0
28	Bear Creek Redwoods OSP	1,377.1	20.1	5.6	51.3	6.1
	All Lands under District Stewardship	**56,895**	**30.3**			

FIGURES

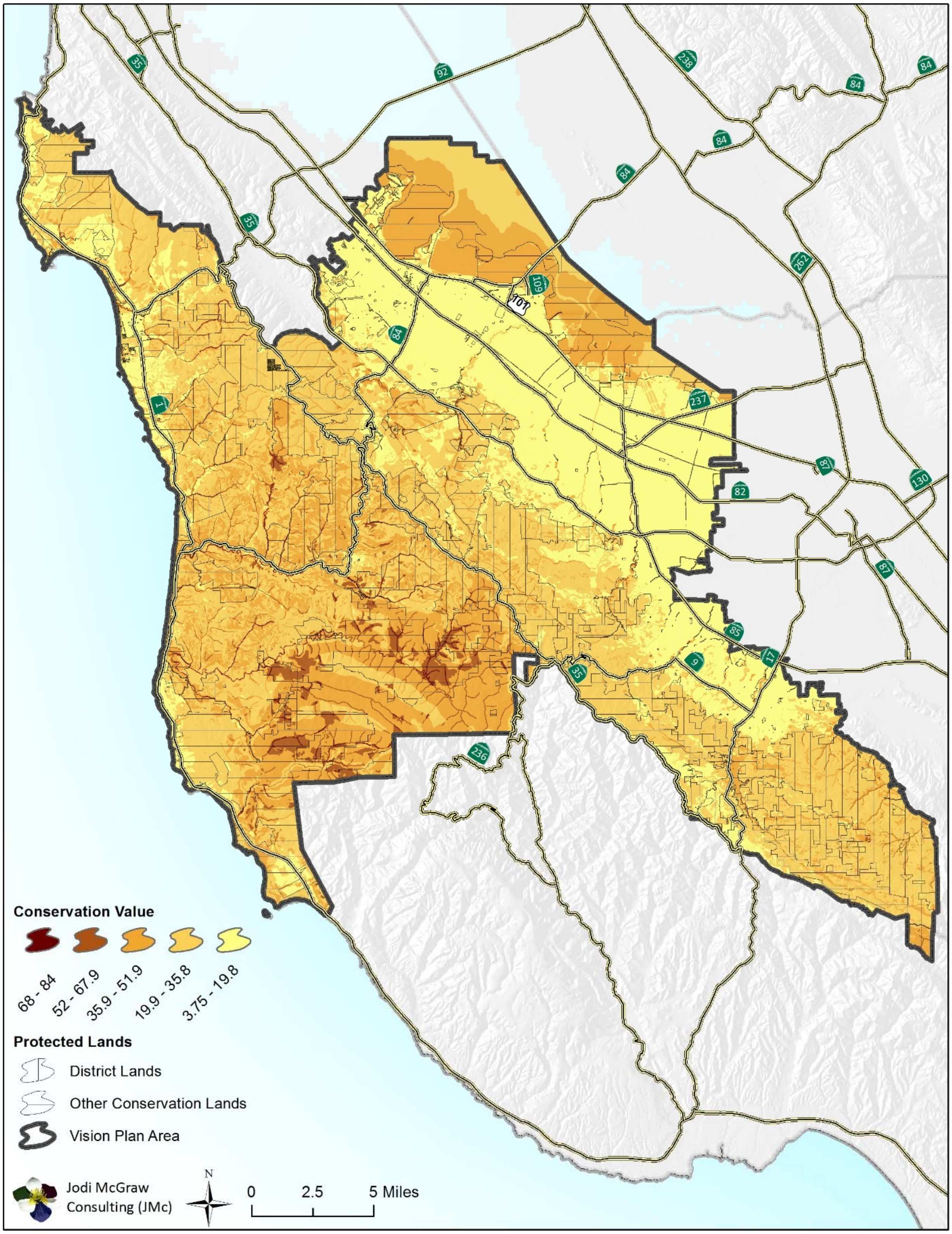

Figure 1: Conservation Value

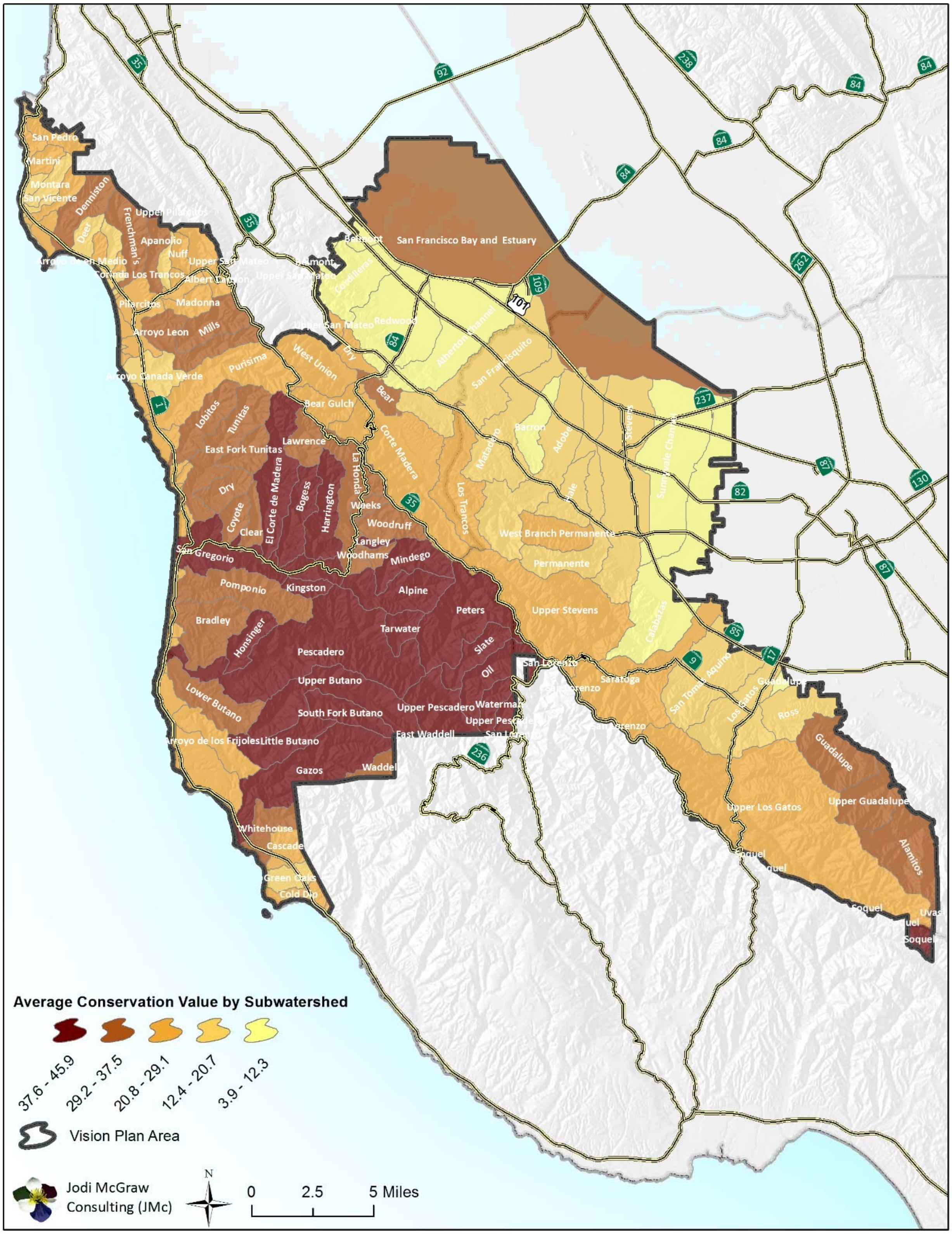

Figure 2: Average conservation value of land within each subwatershed

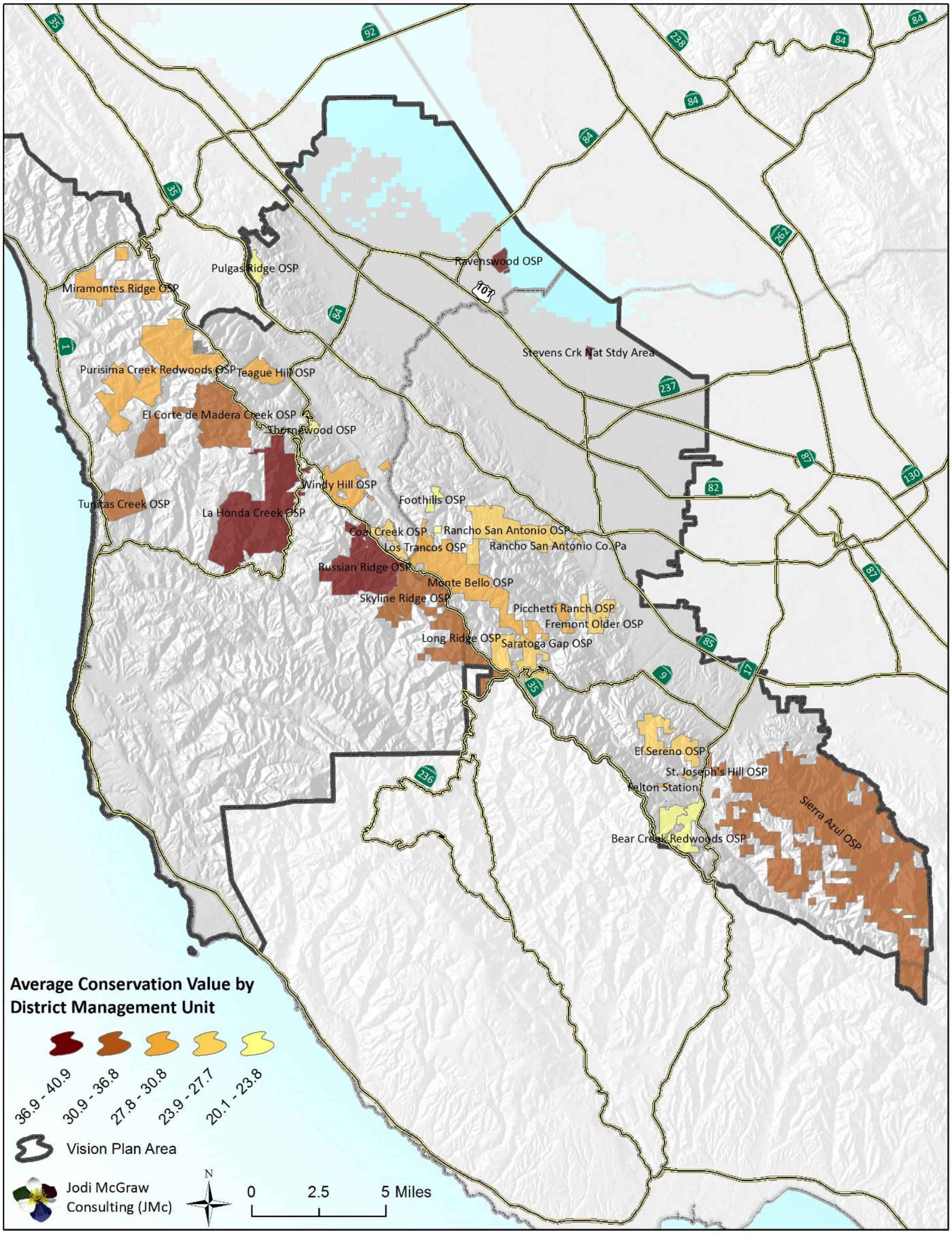

Figure 3: Average conservation value of lands for which the District conducts stewardship