Berberis nevinii
(Nevin's barberry)

5-Year Review:
Summary and Evaluation

Photograph by Chris Wagner, SBNF. Used with permission.

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, CA

August 14, 2009

5-YEAR REVIEW

Berberis nevinii (Nevin's barberry)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Berberis nevinii (Nevin's barberry) is a rhizomatous evergreen shrub in the Berberidaceae (barberry family). Individual shrubs are 3 to 12 feet (1 to 4 meters) tall, with gray-green serrated leaves, yellow flowers, and reddish berries. Fourteen native occurrences are distributed discontinuously across southern California from the foothills of the San Gabriel Mountains in Los Angeles County, south and east to the Loma Linda Hills on the San Bernardino/Riverside County border, and south to the Vail Lake/Oak Mountain area near the foothills of the Peninsular Ranges in southwestern Riverside County. *Berberis nevinii* is actively cultivated in the nursery trade and has been introduced into native habitats, which has contributed to confusion regarding the species' native range. This species generally grows on sandy soils in low-gradient washes, alluvial terraces, and canyon bottoms, along gravelly wash margins, or on coarse soils on steep, generally north-facing slopes in association with the following plant communities: alluvial scrub, cismontane (e.g., chamise) chaparral, coastal sage scrub, oak woodland, and/or riparian scrub or woodland.

Methodology Used to Complete This Review:

This review was prepared by the Carlsbad Fish and Wildlife Office (CFWO), following the Region 8 guidance issued in March 2008. We used survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game (CDFG). Personal communications with experts were our primary sources of information used to update the species' status and threats. One letter was received in response to our *Federal Register* Notice

initiating this 5-year review and information relevant to this review was incorporated as necessary. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provides an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

Lead Regional Office: Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist, Region 8; (916) 414-6464.

Lead Field Office: Stacey Love and Bradd Baskerville-Bridges, Carlsbad Fish and Wildlife Office; (760) 431-9440.

Federal Register (FR) Notice Citation Announcing Initiation of This Review:

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the *Federal Register* on March 5, 2008 (USFWS 2008b, p. 11945). One letter relative to *Berberis nevinii* was received on March 6, 2008, in response to this notice.

Listing History:

Original Listing
FR Notice: 63 FR 54956 (USFWS 1998)
Date of Final Listing Rule: October 13, 1998
Entity Listed: *Berberis nevinii* (Nevin's barberry), a plant species.
Classification: Endangered

State Listing
Berberis nevinii was listed by the State of California as endangered in 1987.

Associated Rulemakings:

Critical habitat for *Berberis nevinii* was proposed on February 6, 2007 (USFWS 2007a, p. 5552), and a revised proposal was published on October 17, 2007 (USFWS 2007b, p. 58793). The final rule designating approximately 6 acres (3 hectares) of critical habitat for *B. nevinii* was published on February 13, 2008 (USFWS 2008a, p. 8412).

Review History: None.

Species' Recovery Priority Number at Start of 5-Year Review:

The recovery priority number for *Berberis nevinii* is 2 according to the Service's 2008 Recovery Data Call for the CFWO. This number is based on a 1 to 18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983, pp. 43098–43105). This number indicates that the taxon is a species that faces a high degree of threat and has a high potential for recovery.

Recovery Plan or Outline:

To date, a recovery plan has not been prepared for *Berberis nevinii*.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy:

The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is a plant, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status:

Species Description

Berberis nevinii is an evergreen shrub 3 to 12 feet (1–4 meters) tall. The pinnately compound leaves (featherlike arrangement of the leaflets) are gray-green with serrate, spine-tipped margins. The flowers, clustered in loose racemes, have six yellow petals arranged in two series. The berries are juicy, yellowish to red, less than 0.3 inch (6–8 millimeters) long with brownish seeds. This species flowers from March through April. *Berberis nevinii* is distinguished from other members of the genus by its nearly flat, narrow, serrate, pinnately veined leaflets, few flowered racemes, and reddish fruits (Munz 1974, p. 245; Niehaus 1977, p. 1; Williams 1993, pp. 362-363).

Species Biology and Life History

Life history characteristics and population demographics of *Berberis nevinii* are largely unknown. *Berberis nevinii* shrubs are long-lived (more than 50 years) (Mistretta and Brown 1989, p. 5) with low reproductive rates likely due to sporadic production of fertile seed (Mistretta and Brown 1989, p. 5). Several occurrences of *B. nevinii* consist of only single plants that have existed for years or decades without reproducing sexually (Mistretta and Brown 1989, p. 5), suggesting a self-incompatible breeding system (White 2001, p. 36). *Berberis nevinii* likely does not reproduce by vegetative means (Mistretta and Brown 1989, p. 5; S. Boyd, Rancho Santa Ana

Botanic Garden, *in litt*. 2006, p. 1). It has been suggested that *B. nevinii* may be a paleo-endemic relic (meaning that its present distribution is a remnant of a formerly wider distribution) (Reiser 2001, p. 3), which could explain its limited (small and widely scattered) distribution and low reproductive rates in the wild (V. Soza, Rancho Santa Ana Botanic Garden, pers. comm. 2003, p. 1).

Berberis nevinii is a fire-adapted species, where mature individuals may survive and re-sprout following fire (Mistretta and Brown 1989, p. 5; White and Leatherman 2001, p. 36). Observations of *B. nevinii*'s life history characteristics (including post-fire resprouting, fruits adapted for animal dispersal, and seed germination independent of fire) match the description of the "fire-resister" or "non-refractory seed" syndrome (Keeley 1991, p. 82; White and Leatherman 2001, p. 36). Species sharing this life history syndrome are resilient to fire, but require fire-free periods for seed germination, seedling establishment, and subsequent population expansion (Keeley 1991, p. 82).

Spatial Distribution and Abundance

As mentioned above, *Berberis nevinii* has never been observed as a common species, even within its limited range (Neihaus 1977, p. 2; Mistretta and Brown 1989, p. 7). Its historical distribution likely consisted of fewer than 30 scattered occurrences in Los Angeles, San Bernardino, and Riverside Counties (Service 1998, p. 54958), and possibly San Diego County (Neihaus 1977, p. 1; Reiser 2001, p. 3; CNDDB 2008, Element Occurrence (EO) 45) (Figure 1).

Although we did not estimate a total number of occurrences of *Berberis nevinii* in the listing rule, records show that a total of 24 occurrences were known at the time of listing. As stated in the listing rule (USFWS 1998, pp. 54957–54958), the majority of occurrences were located in two geographic areas in:

1) The vicinity of Vail Lake and Oak Mountain in western Riverside County (16 occurrences collectively supporting 200 to 250 individuals); and

2) San Francisquito Canyon on the Angeles National Forest in Los Angeles County (three occurrences supporting 130 to 250 individuals) (Table 1; Boyd et al. 1989, pp. 14, 16; MWD 1991, pp. 4-151, 4-152; CNDDB 1997, pp. 1–33).

At the time of listing, three other occurrences—each consisting of a single individual—were known from the Loma Linda Hills area in southern San Bernardino County: one near the mouth of Scott Canyon, one near Pilgrim Road, and one in a side canyon off of San Timoteo Canyon (CNDDB 1997, EOs 4, 5; A. Latch, University of Redlands, *in litt*. 1997, p. 1). Additionally, a single plant was known from Lopez Canyon in the foothills of the San Gabriel Mountains on the Angeles National Forest in Los Angeles County (USFWS 1998, p. 54958). An occurrence of two individuals was also reported in 1987 from an area south of Temecula Creek in western Riverside County (CNDDB 1997, EO 22) and was not specifically identified in the listing rule.
.

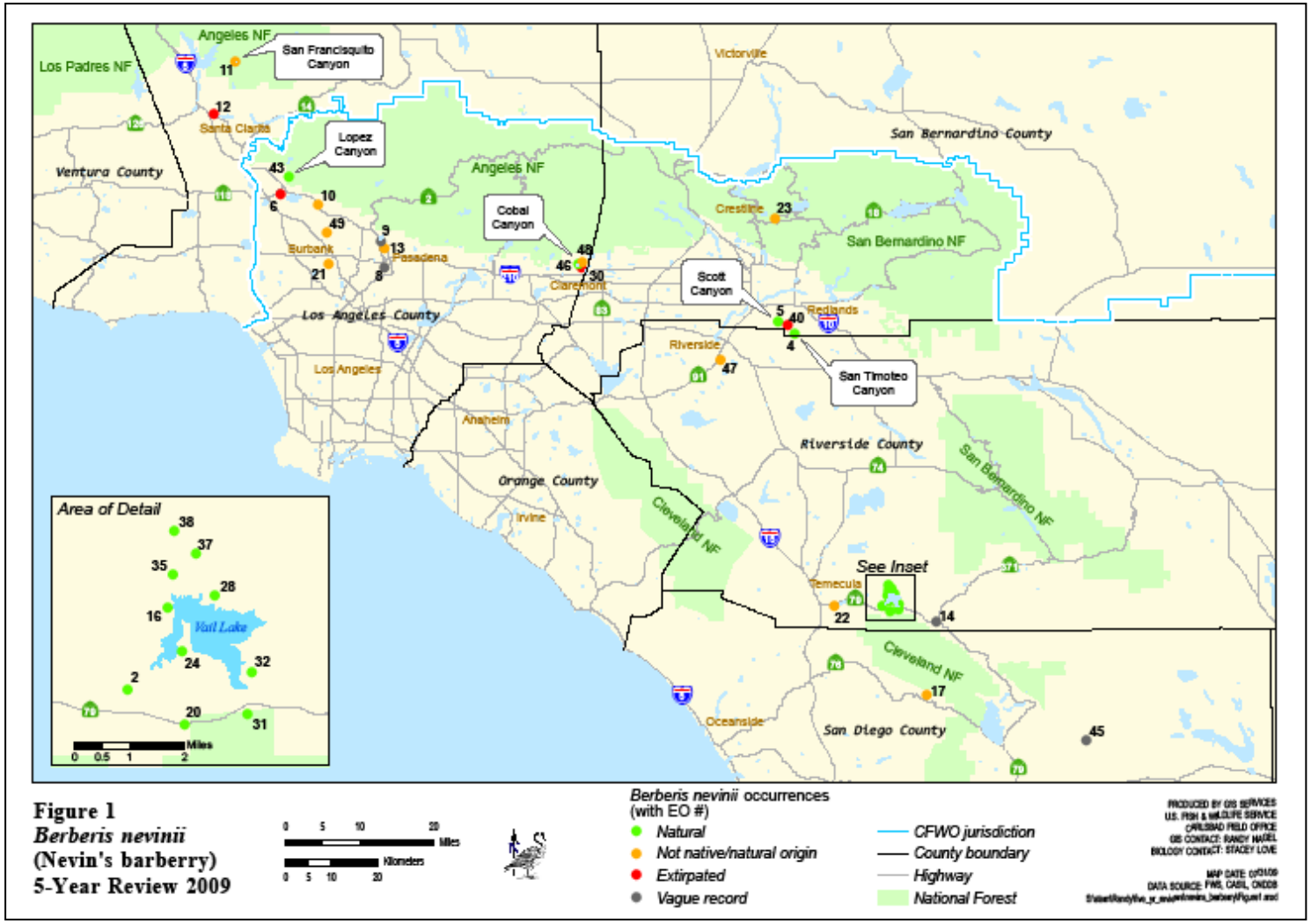

Figure 1: Distribution of known *Berberis nevinii* occurrences.

Table 1: Known occurrences of *Berberis nevinii*.

Occurrence	Native	Extant	Location Description	County	Owner code	CNDDB Element Occurrence (EO)	Estimated Number of Plants				Threats Code[1]
							Highest Count Pre-listing	Year	Last Count Post-listing	Year	
x	N	Y	San Francisquito Canyon - near Powerhouse #2	Los Angeles	ANF	19^	1	1985			
						11	131	1986			
x	N	N	San Francisquito Canyon/Santa Clara River	Los Angeles	Unk	12					
1	Y	Y	Lopez Canyon	Los Angeles	ANF	43	1	1997	1	2000	f,a,s,l
x	Y	N	Van Nuys Blvd, San Fernando Valley[T]	Los Angeles	Pvt	6	~100	1932	0	1999	
						7^					
x	N	Y	Sunland[2]	Los Angeles	State	10	unk	1904	1	2006	
x*	N	Y	Wildwood Canyon	Los Angeles	Local	49			1	2007	
x	Y	?	Devil's Gate, Arroyo Seco	Los Angeles	Unk	9					
x	N	Y	Arroyo Blvd/Washington Blvd	Los Angeles	Local	18^	5	1987	unk	1999	
			North of Rose Bowl			13					
x	Y	?	South Pasadena, Arroyo Seco	Los Angeles	Unk	8	unk	1961			
x	N	Y	Griffith Park	Los Angeles	Local	21	40	1986	25	2000	
x*	N	Y	Griffith Park near Observatory	Los Angeles	Local	n/a					
x*	N	Y	Mt. Baldy Road/Padua Ave	Los Angeles	Local	48	1	1997			
2*	Y	Y	Cobal Canyon	Los Angeles	Local	46			1	2005	r,f,a,s,l
x	Y	N	San Antonio Wash	Los Angeles	Unk	30	<5	1980's	0	2005	
x	N	N	North of highway 18	San Bernardino	Pvt	23	unk	1966			
3	Y	Y	Near the mouth of Scott Canyon	San Bernardino	Unk	5	1	1990's			u,r,f,a,s,l
x	Y	N	Pilgrim Road, south of Redlands	San Bernardino	Unk	40	unk	1988			

Occurrence	Native	Extant	Location Description	County	Owner code	CNDDB Element Occurrence (EO)	Estimated Number of Plants				Threats Code[1]
							Highest Count Pre-listing	Year	Last Count Post-listing	Year	
4	Y	Y	Side canyon of San Timoteo Canyon	San Bernardino/ Riverside	Pvt	4	7	1987	3	2009	u,r,f,a,s,l
x*	N	Y	City of Riverside, granitic knoll	Riverside	Unk	47	1	1999			
5	Y	Y	Oak Mountain Summit	Riverside	BLM	38	2	1990	2	2006	r,f,a,s,l
6	Y	Y	South-facing slope of Oak Mountain	Riverside	Pvt	37	1	1989			u,r,f,a,s,l
7	Y	Y	North of Vail Lake	Riverside	Pvt	35	24	1989			u,r,f,a,l
						36^					
8	Y	Y	Northeast of Vail Lake	Riverside	Pvt	28	4	1989			u,r,f,a,s,l
9	Y	Y	West of Vail Lake Dam	Riverside	Pvt	16	unk	1989	2	2006	u,r,f,a,s,l
x	n/a	n/a	Northwest of Vail Lake[3]	Riverside	Pvt	29	?	1987			
10	Y	Y	South of Vail Lake	Riverside	Pvt	24	134	1987			u,r,f,a,l
						34^					
11	Y	Y	Temecula Creek East	Riverside	Pvt	33^	1	1989			u,r,f,a,s,l
						32	3	1989			
12	Y	Y	Agua Tibia Mountain Foothills	Riverside	CNF	31	5	1989	5	2006	f,a,s,l
13	Y	Y	Dripping Springs	Riverside	Pvt	41^	unk	1995			u,r,f,a,s,l
						2	1	1989			
14	Y	Y	Arroyo Seco Creek near Hwy 79	Riverside	Pvt	20	1	1989			u,w,r,f,a,s,l
						27^	1	1991			
	N	Y	Dripping Springs Campground Guard Station[4]	Riverside	CNF	26^	5	1989			
x	N	?	South of Temecula Creek	Riverside	Pvt	22	2	1987			
x	Y	?	Aguanga	Riverside	Unk	14	?	1927			
x	N	Y	Southwest of Palomar Mountain	San Diego	Tribe	17	20	1987			
x	?	?	Anza-Borrego	San Diego	Unk	45	?	?			

Threats Key (Factor: threat):

Ownership Key:
ANF - Angeles National Forest
BLM - Bureau of Land Management
CNF - Cleveland National Forest
Local - self-explanatory
Pvt - private
State - self-explanatory
Tribe - tribal lands
Unk - unknown

A: u - urbanization
A: r - recreational activities
A: w - road widening
E: f - fire management practices
E: a - altered fire regimes
E: s - small population size
E: l - low reproductive output

Notes:

* New occurrence since listing

^ CNDDB element occurrence (EO) number deleted by CNDDB circa 2007-2008. These occurrences were grouped with the other EO numbers in the same row. See text for further discussion.

(1) See text for discussion of

(2) 1904 native location generally mapped in Big Tujunga Wash was moved (remapped) by CNDDB circa 2007-2008 to this 2006 nonnative location next to the I-210 in Sunland.

(3) Former CNDDB EO number 29 was deleted by CNDDB in 2008, as it was discovered to be an error.

(4) CNDDB EO number 26, a nonnative occurrence, was merged with presumably native occurrences into EO 20.

(T) Type locality - presumed extirpated

The majority of *Berberis nevinii* occurrences are mapped in the CNDDB. Since listing, 13 *B. nevinii* occurrences in close proximity to each other were grouped together into six occurrences by CNDDB, which effectively removes seven occurrences from the total number of occurrences (CNDDB 2008, EOs 2, 11, 20, 24, 32, 35). Therefore, we now recognize that the 24 occurrences of *B. nevinii* known at the time of listing were in fact 17 occurrences.

Berberis nevinii was introduced into horticulture around 1920 (Wolf 1940, p. 2) and was subsequently planted at numerous sites throughout the species' range (Boyd 1987, p. 2; Boyd and Banks 1995, p. 24; Reiser 2001, p. 3). The availability of *B. nevinii* in the nursery trade and the introduction of cultivated specimens into native habitats have contributed to confusion regarding the species' native range. At the time of listing, we believed *B. nevinii* to be naturally occurring in San Francisquito Canyon. We are now aware that this species was planted in the bottom of the canyon in 1929 following a flood. Moreover, one of the individuals used in the planting originated as a seedling in the San Fernando Valley in Los Angeles County (T. Payne, Horticulturalist, *in litt*. 1945, p. 1) where the species is thought to no longer occur (Niehaus 1977, p. 1; Boyd 1987, p. 3; CNDDB 2008, EO 6). *Berberis nevinii* appears to have naturalized (established as a part of the flora of a locale other than their place of origin; i.e., nonnative) within San Francisquito Canyon, spreading beyond the canyon floor where it was planted (Payne 1945, *in litt*., p. 1) to the canyon slopes (Soza and Boyd 2000, p. 2; Soza and Fraga 2003, p. 1).

We are unaware of any evidence indicating that this species naturally occurred in San Francisquito Canyon prior to it being planted there in 1929. However, Boyd (Soza and Boyd 2000, p. 3) noted that oaks in the canyon likely pre-date the flood, which indicates that not all vegetation was scoured from the site by floodwaters and if *B. nevinii* naturally occurred in the canyon prior to this event, some individuals may have survived. One of the San Francisquito Canyon occurrences has been estimated at 130 to 200 plants in the past (Soza and Boyd 2000, p. 2; CNDDB 2008, EO 11), but recent surveys estimate the occurrence at 91 plants after a fire burned through the entire occurrence in 2002 (Soza and Fraga 2003, p. 2). Since listing, three occurrences at San Francisquito Canyon were grouped into two occurrences by CNDDB (CNDDB 2008, EO 11, 12); thus, we recognize that there are two nonnative occurrences in San Francisquito Canyon.

Since listing, CDFG determined that the *Berberis nevinii* occurrence south of Temecula Creek mentioned above (but not in the listing rule) is likely cultivated; however, this needs to be verified (CNDDB 1997, EO 22; CNDDB 2008, EO 22). According to the report, one plant was found in a garden and another plant was found at the base of a bluff, which was planned for preservation in open space (CNDDB 2008, EO 22). In April 2008, a Service biologist visited the site and could not locate any plants (T. McKinney, U.S. Fish and Wildlife Service, pers. obs. 2008, p. 1). For purposes of this review, we assumed that this occurrence is not natural and likely extirpated.

Six occurrences of *Berberis nevinii* have been identified since listing; however, five of these occurrences were likely cultivated, as follows:

1. One occurrence near the Griffith Park Observatory in Los Angeles County just over a mile south of known cultivated *B. nevinii* (White and Leatherman, 2001, p. 36; CNDDB

2008, EO 23). According to park staff, *B. nevinii* was commonly planted after fire (CNDDB 2008, EO 23).

2. An isolated occurrence in the City of Riverside consisting of one plant found growing in the cracks of a granite outcrop was probably dispersed there by a bird or mammal from cultivated plants (White and Leatherman, 2001, p. 36; CNDDB 2008, EO 47).

3. Three occurrences at Sunland, Wildwood Canyon, and Mount Baldy Road/Padua Avenue are presumed to be of cultivated origin (CNDDB 2008, EOs 10, 48, 49; L. Gross, Rancho Santa Ana Botanic Garden, pers. comm. 2008, p. 1).

The only natural occurrence of *B. nevinii* found since listing is at the mouth of Cobal Canyon at the south base of the San Gabriel Mountains in Los Angeles County; three plants were observed in 2000, but only one plant was found in 2005 (Fraga 2005, p. 3; CNDDB 2008, EO 46).

New information on the status of previously known *Berberis nevinii* occurrences has been reported since listing. One occurrence near Pilgrim Road from the Loma Linda Hills area in southern San Bernardino County has been extirpated (A. Sanders, University of California Riverside, *in litt*. 2006, p. 3). A nearby occurrence in a side canyon off of San Timoteo Canyon has three individuals, although only one individual was reported at the time of listing (Latch 1997, *in litt*., p. 1; M. Wall, Rancho Santa Ana Botanic Garden, *in litt*. 2009, p. 5).

Currently, there are 14 extant, native occurrences of *Berberis nevinii*. Of the 17 occurrences presumed extant at listing, three (two in San Francisquito Canyon and one south of Temecula Creek) are likely not native. One occurrence known at the time of listing has been extirpated (Pilgrim Road). Only one of the six *B. nevinii* occurrences found since listing appears to be of natural origin (Cobal Canyon).

At the time of listing, it was thought that there could be fewer than 500 native *Berberis nevinii* plants (Boyd et al. 1989, pp. 14, 16; MWD 1991, pp. 4-151, 4-152; CNDDB 1997, pp. 1–33; USFWS 1998, p. 54958). Because the *B. nevinii* in San Francisquito Canyon are no longer considered native, the total number of native *B. nevinii* individuals across its range may be less than 370 (if we subtract plant count estimates in San Francisquito Canyon from the total number of 500 individuals at listing (Table 1)). However, if we tally plant estimates at each occurrence, the total number of *B. nevinii* individuals may be less than 200. The majority of these plants are located in the Vail Lake/Oak Mountain area, where some believe the species was possibly undercounted (Boyd et al. 1989, pp. 14, 16; MWD 1991, pp. 4-151, 4-152; CNDDB 2008, pp. 1–34; Table 1). Outside of the Vail Lake/Oak Mountain area, only four isolated, native *B. nevinii* occurrences remain: two in the foothills of the San Gabriel Mountains in Los Angeles County, and two in the Loma Linda Hills in southern San Bernardino County. All of these occurrences outside of the Vail Lake/Oak Mountain area consist of one individual, with the exception of one occurrence in a side canyon off of San Timoteo Canyon in the Loma Linda hills area (mentioned above), which has three individuals remaining.

The distributional range of the extant, native occurrences of *Berberis nevinii* is smaller since listing, primarily because of the determination that the northwestern portion of the range at

San Francisquito Canyon is now considered nonnative (i.e., 17 occurrences at listing compared to 14 currently). Likewise, the number of native individuals is lower since listing because of the determination that the plants in San Francisquito Canyon are now considered nonnative (i.e., under 500 plants at listing compared to under 370 plants currently).

Habitat or Ecosystem

At the time of listing, *Berberis nevinii* was found in two habitat types: gravelly wash margins in alluvial scrub (Niehaus 1977, p. 2; Boyd 1987, p. 7) and on coarse soils in chaparral (Boyd 1987, p. 7), typically between 900 and 2,000 feet (300 and 650 meters) in elevation (USFWS 1998, p. 54958).

Since listing, suitable habitat was described in the final rule designating critical habitat for *Berberis nevinii* (USFWS 2008a, pp. 8419–8420). Characterizing *B. nevinii* habitat is difficult due to the varied soils, bedrock substrates, and topography on which this species naturally occurs (USFWS 2008a, p. 8419). Most native occurrences of *B. nevinii* are between 1,400 and 1,700 feet (427 to 518 meters) in elevation (Boyd 1987, p. 2; CNDDB 2008, pp. 1–34), although one native occurrence on the Oak Mountain summit north of Vail Lake is at approximately 2,700 feet (823 meters). *Berberis nevinii* occurs in varied topography from nearly flat sandy washes, terraces, benches, and canyon floors to gravelly wash margins, steeply-sloped banks of drainages, steep rocky slopes, ridges, and mountain summits (CNDDB 2008, pp. 1–34). Native occurrences are strongly associated with alluvial soils or soils derived from nonmarine sedimentary based substrates, especially sandy arkose (sandstone derived from granitic material) (Boyd 1987, p. 7; Boyd and Banks 1995, p. 24; Soza and Boyd 2000, p. 25).

Berberis nevinii occurs in association with the following plant communities: alluvial scrub, cismontane (e.g., chamise) chaparral, coastal sage scrub, oak woodland, and/or riparian scrub or woodland (Boyd 1987, pp. 2, 7; Boyd et al. 1989, pp. 6–8; USFWS 1998, p. 54958; CNPS 2001, p. 96; CNDDB 2008, pp. 1–34). Native occurrences of *B. nevinii* in Lopez Canyon (Table 1), the Loma Linda hills area, as well as many of those found in the Vail Lake/Oak Mountain area, occur within the California Wildlife Habitat Relationships (CWHR) landcover described as coastal scrub or mixed chaparral (USFWS GIS data 2006). Boyd (1987, pp. 2, 7) notes that plants typically associated with desert plant communities are found intermixed with chaparral and coastal sage scrub species at many of these sites. *Berberis nevinii* is occasionally found in coast live oak woodland south of Vail Lake, which is characterized by open to dense stands of the large evergreen *Quercus agrifolia* (coast live oak) in close association with surrounding scrub vegetation (Boyd et al. 1989, p. 7; CNDDB 2008, EOs 2, 20, and 31). Additionally, the coast live oak woodland in this area is found primarily in sandy washes, benches, and canyons on north-facing slopes, near ephemeral stream channels, or associated with springs (Boyd et al. 1989, pp. 7–8). *Quercus agrifolia* is locally common immediately south of the *B. nevinii* at the Lopez Canyon site (Soza and Boyd 2000, pp. 23, 26). Several stands in the Vail Lake/Oak Mountain area occur within the CWHR landcover described as valley foothill riparian, and several occurrences are also partly characterized as annual grassland (USFWS GIS data 2006). The Scott Canyon site is described as having an abundance of annual grasses (Boyd 1987, pp. 44–48; CNDDB 2008, EO 5).

Berberis nevinii is considered a drought-tolerant species, but it will also tolerate large amounts of water in cultivation without apparent damage (Wolf 1940, p. 2; Lenz and Dourley 1981, p. 130; A. Sanders, University of California Riverside, *in litt*. 1997, p. 2). Observations of native occurrences suggest that, within its general habitat, *B. nevinii* may be associated with more mesic microhabitats. Niehaus (1977, p. 2) noted that *B. nevinii* occurs mostly at the margins of dry washes in or below the foothill zone, but is not present in the driest portion of a wash. At some sites, *B. nevinii* is associated with species such as *Lepidospartum squamatum* (scale-broom) and *Prunus ilicifolia* (holly-leaved cherry), which require groundwater (Niehaus 1977, p. 2). Many of the plants in the Vail Lake/Oak Mountain area are growing on mesic north- or northwest-facing slopes. Several stands are in canyons draining the south flank of Oak Mountain and are associated with springs or seepages (Boyd et al. 1989, p. 14). The two plants on the summit of Oak Mountain are on clay soils that have a high water-holding capacity. In the late spring and early summer, this site may receive greater moisture in the form of condensation from intrusion of marine air (Soza 2003, pers. comm., p. 1). These observations of *B. nevinii* occurring in mesic microhabitats are consistent with shared characteristics of species associated with the fire-resister or non-refractory seed syndrome mentioned above (Keeley 1991, p. 82; White and Leatherman 2001, p. 36).

Several observers have noted that seedlings and immature *Berberis nevinii* occur in areas with some measure of protection, either in the shade or cover of another plant (Boyd 1987, pp. 77–78; Mistretta and Brown 1989, p. 10). This suggests the need for some relatively long fire-free period to allow for canopy growth and the creation of conditions conducive to germination, establishment, and recruitment of *B. nevinii* into chaparral (White and Leatherman 2001, p. 36; S. White, Scott White Biological Consulting, *in litt*. 2007, p. 1). Boyd (1987, p. 77) noted that mature cultivated individuals were located in areas exposed to full sunlight, and Reiser (2001, p. 3) noted that mature *B. nevinii* shrubs frequently tower above associated subshrubs (low-growing perennial plants with the lower stems woody). Based on field observations, seedlings may be shade tolerant, but as *B. nevinii* matures, it may require more sunlight (Mistretta and Brown 1989, Attachment: "Report on the Population and Ecological Data of *Mahonia nevinii*" by Joy Nishida, p. 1). A similar shade and sunlight requirement is noted for several other resprouting chaparral shrub species, where seedlings and saplings are found mostly in the shade of other plants and seldom in the open, but recruitment into the shrub population appears to require the later development of a canopy gap, such as may be created by a fire event (Keeley 1992, pp. 1,206–1,207).

In summary, extant, native occurrences of *Berberis nevinii* are found primarily between 1,400 and 1,700 feet (427 to 518 meters) in elevation. Data indicate that this species is strongly associated with alluvial soils or soils derived from nonmarine sedimentary based substrates (especially sandy arkose) and associated with mesic microhabitats in a variety of plant communities, including alluvial scrub, cismontane chaparral, coastal sage scrub, oak woodland, and riparian scrub or woodland. Data also indicate that *B. nevinii* may require long periods between fires for successful recruitment and population growth.

Five-Factor Analysis:

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Threats attributed to this factor in the listing rule include urbanization, off-road vehicle use, horseback riding, and road widening (USFWS 1998, p. 54961).

Urbanization

The listing rule identified urbanization as a threat to *Berberis nevinii*. A majority of the occurrences and individuals of *B. nevinii* are on private lands subject to urbanization (Table 1). Specifically, occurrences of *B. nevinii* in the Vail Lake area were included in a community plan (Vail Lake Specific Plan No. 275), which proposed the subdivision of parcels in the Vail Lake area into 20 acre (8 hectare) lots (USFWS 1998, p. 54961; Table 1). These occurrences comprise the majority of *B. nevinii* individuals across its range (Table 1). The Vail Lake Specific Plan No. 275 was withdrawn in 1992 (A. Krizek, Riverside County Planning Department, pers. comm. 2007, p. 2).

Since listing, Vail Lake Specific Plan No. 324 was proposed in 2000 for the entire area around Vail Lake. Specific Plan 324 proposes a large scale development including 690 acres of homes, 350 acres of commercial business park, a 45 acre corporate research village, a golf course, park, and open space. In January of 2006, there was a proposal to abandon Specific Plan No. 324, however this proposal has not been acted upon and the file is currently inactive (A. Krizek, Riverside County Planning Department, pers. comm. 2008, p. 1).

Urban development is the primary threat to *Berberis nevinii* and its habitat in the vicinity of Vail Lake (USFWS 2008a, p. 8423). Land grading for residential development and associated roads may affect the topography of the site; alter soil composition and structure; change vegetation community composition and structure through clearing or thinning of vegetation and the introduction of nonnative plants; increase erosion potential; and change hydrological (drainage and water infiltration) patterns, thereby decreasing the quality and extent of available habitat for *B. nevinii*. In addition, urban development may increase the frequency of fire on the landscape due to increased combustible fuel loads and potential for fire ignition resulting from the incursion and spread of annual nonnative grasses. Threats from indirect effects related to urbanization—including altered fire regimes, fire management practices, recreational activities, and road widening—are discussed in this section and under Factor E below.

Recreational Activities

Recreational activities may impact the physical and biological features essential to the conservation of the species by destroying, degrading, fragmenting, or otherwise altering the

topography, soil, and vegetation community in ways that make areas less suitable for *B. nevinii* (USFWS 2008a, p. 8423).

The listing rule identified habitat degradation from off-road vehicles and horseback riding to *Berberis nevinii* at the side canyon off San Timoteo Canyon occurrence (USFWS 1998, p. 54961; Table 1). Since listing, hiking, camping, and recreational facility development have been included with off-road vehicles and horseback riding as recreational activities that threaten *Berberis nevinii* (USFWS 2008a, p. 8423). These activities may alter or destroy surface and subsurface structure through trampling and clearing or thinning of vegetation, the introduction of nonnative plants, soil disturbance or compaction, and increased erosion and changes to hydrological (drainage and water infiltration) patterns (USFWS 2008a, p. 8423).

Although not discussed in the listing rule, recreational uses associated with the Vail Lake Village Resort and Campground (private) and the Dripping Springs Campground (Cleveland National Forest) were identified as a threat to three *Berberis nevinii* occurrences (CNDDB 2008, EOs 2, 20, 24). Since listing, hiking and biking along an adjacent fire road was noted as threat to the Cobal Canyon occurrence consisting of a single individual (CNDDB 2008, EO 46).

At least 36 percent (5 of 14) of *Berberis nevinii* occurrences are currently known to be threatened by recreational activities. Seven additional occurrences near urban areas are likely threatened by these activities due to lack of protection from off-road vehicle access and close proximity to roads (Table 1).

Road Widening

The listing rule identified road widening as a threat to *Berberis nevinii*. Specifically, a proposal to widen State Route 79 (SR-79) south of Vail Lake was noted as a potential threat as it may directly impact *B. nevinii* occurrences and promote development in the area (USFWS 1998, p. 54961). An occurrence consisting of two plants in Arroyo Seco Creek (Table 1) is in close proximity to SR-79. According to geographic information system (GIS) data provided by the County of Riverside, planned widening of SR-79 in that area partially overlaps one of the *B. nevinii* individuals mapped in CNDDB (Dudek 2003a, pp.7-25, 7-26, 7-31; USFWS GIS data 2008).

Summary of Factor A

Urbanization threatens 10 of the 14 extant native occurrences supporting the majority of known individuals of *Berberis nevinii.* Recreational activities continue to threaten *B. nevinii* and its habitat at 12 of the 14 known extant native occurrences. Road widening threatens one occurrence of *B. nevinii*. Threats attributable to Factor A have the potential to impact 12 of the 14 known native occurrences. No new threats attributable to factor A have been identified since listing.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The potential threat from unrestricted collection and vandalism by individuals as a result of increased publicity was noted in the listing rule (USFWS 1998, p. 54962). However, we have no evidence that unrestricted collection and vandalism are currently a threat to this species.

FACTOR C: Disease or Predation

As stated in the final listing rule (USFWS 1998, p. 54962), disease and natural predation are not known to be threats to *Berberis nevinii*.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to have some potential to protect *Berberis nevinii* included: (1) Federal laws and regulations, including the National Environmental Policy Act (NEPA), the Act, in those cases where these species occur in habitat occupied by other listed species, and section 404 of the Federal Clean Water Act; (2) State laws, including the Native Plant Protection Act (NPPA, the California Endangered Species Act (CESA), the California Environmental Quality Act (CEQA), and section 1603 of the California Fish and Game Code; (3) regional planning efforts pursuant to the California Natural Community Conservation Planning Program (NCCP); (4) land acquisition and management by Federal, State, or local agencies, or by private groups and organizations; and (5) local land use processes and ordinances. The final listing rule (USFWS 1998, pp. 54962–54964) provides an analysis of the level of protection that was anticipated from these regulatory mechanisms. This analysis is updated below.

State Protections

State laws providing protection to *Berberis nevinii* include the NPPA enacted in 1977, CESA enacted in 1984, CEQA enacted in 1970, and the NCCP Act enacted in 1991.

Native Plant Protection Act (NPPA) and California Endangered Species Act (CESA): In 1987, the California Fish and Game Commission listed *Berberis nevinii* as endangered under NPPA (Division 2, chapter 10, section 1900 *et seq.* of the California Fish and Game Code (CFG)) and CESA (Division 3, chapter 1.5, section 2050 *et seq.* of the CFG). Both NPPA and CESA include prohibitions forbidding the "take" of *B. nevinii* (Chapter 10, Section 1908 and Chapter 1.5, Section 2080, CFG code). However, sections 2081(b) and (c) of CESA allow the CDFG to issue incidental take permits for State-listed threatened and endangered species if:

1) The authorized take is incidental to an otherwise lawful activity;

2) the impacts of the authorized take are minimized and fully mitigated;

3) the measures required to minimize and fully mitigate the impacts of the authorized take are roughly proportional in extent to the impact of the taking on the species,

maintain the applicant's objectives to the greatest extent possible, and are capable of successful implementation;

4) adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with and the effectiveness of the measures; and

5) issuance of the permit will not jeopardize the continued existence of a State-listed species.

The Natural Community Conservation Planning (NCCP) Act: The NCCP program is a cooperative effort between the State of California and numerous private and public partners with the goal of protecting habitats and species. NCCPs identify and provide for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. The program began in 1991 under the State's NCCP Act (CFG Code 2800–2835). The primary objective of the NCCP program is to conserve natural communities at the ecosystem scale while accommodating compatible land uses (*http://www.dfg.ca.gov/nccp/*). Regional NCCPs provide protection to federally listed species by conserving native habitats upon which the species depend. Many NCCPs are developed in conjunction with Habitat Conservation Plans (HCPs) prepared pursuant to the Endangered Species Act. The Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) is an example and is discussed below.

California Environmental Quality Act (CEQA): CEQA is the principal statute mandating environmental assessment of projects in California. The purpose of CEQA is to evaluate whether a proposed project may have an adverse affect on the environment and, if so, to determine whether that effect can be reduced or eliminated by pursuing an alternative course of action or through mitigation. CEQA applies to projects proposed to be undertaken or requiring approval by State and local public agencies (*http://www.ceres.ca.gov/topic/env_law/ceqa/summary.html*). CEQA requires disclosure of potential environmental impacts and a determination of "significant" if a project has the potential to reduce the number or restrict the range of a rare or endangered plant or animal; however, projects may move forward if there is a statement of overriding consideration. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

Federal Protections

National Environmental Policy Act (NEPA): NEPA (42 U.S.C. 4371 *et seq.*) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the Federal agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.14(f)). These mitigations can provide some level of protection for

listed species. However, NEPA does not require that environmental impacts be avoided, only that effects be assessed and the analysis disclosed to the public. Therefore, this regulatory mechanism may not be adequate to fully protect the species.

Clean Water Act: Under section 404, the U.S. Army Corps of Engineers (Corps) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term "wetland" refers to areas meeting the Corps' criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, NEPA, and the Endangered Species Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law that may provide protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10. Section 7(a)(2) of the Act requires Federal agencies, including the Service to ensure that actions they fund, authorize, or carry out do not "jeopardize" a listed species or result in the "destruction or adverse modification" of habitat in areas designated by the Service to be "critical." Critical habitat has been designated for this taxon (USFWS 2008a, pp. 8412–8440). A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project. Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical (50 C.F.R. § 402.02).

Under Section 9(a)(2) or the Act, with respect to endangered plant taxa, it is unlawful to remove and reduce to possession (i.e. collect) any such taxon from areas under Federal jurisdiction; maliciously damage or destroy any such taxon on any such area; or remove, cut, dig up, or damage or destroy and such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law. As noted above *Berberis nevinii* is listed as endangered by the State of California. Therefore, this species is afforded protections under section 9 of the Act on non-Federal lands.

Under Section 10(a)(1)(A) of the Act there are provisions for collection of plants or plant parts for scientific purposes or to enhance the propagation and survival of the species. Under section 10(a)(1)(B) the Service may issue "incidental take" (take is defined in section 3(18) of the Act) permits for listed animal species to non-Federal applicants. Take and therefore incidental take protections are not extended to plants. "Incidental take" refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). To qualify for an incidental take permit, applicants must

develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to [avoid], minimize, and mitigate the project's adverse impacts to listed species including listed plants. Issuance of an incidental take permit by the Service is subject to section 7 of the Act; thus, the Service is required to ensure that the actions proposed in the HCP are not likely to jeopardize the animal or plant species or result in the destruction or adverse modification of critical habitat. Therefore, HCPs may provide an additional layer of regulatory protection to animals as well as plants. Although Section 10(a)(1)(B) allows for exemptions to take prohibitions under section 9 for animals it does not allow for similar exemptions for plants. Habitat Conservation Plans (HCPs) are discussed below under Regional Planning Efforts. Section 10 of the Act affords no exemption to section 9 prohibitions regarding plants except in cases where the State issues an incidental take permit under section 2081(b) and (c) of CESA. Therefore, violation of take or other prohibitions afforded to State listed plants, including *Berberis nevinii,* constitutes violation of section 9 of the Federal Endangered Species Act as noted above.

Western Riverside County Multiple Species Habitat Conservation Plan

The MSHCP was finalized and approved on June 22, 2004. This NCCP/HCP establishes a multiple species conservation program to minimize and mitigate the expected loss of habitat values and incidental take of "covered" species, including *Berberis nevinii*. All extant native occurrences of *B. nevinii* in the MSHCP Plan Area (10 occurrences) will be protected or will remain within the MSHCP Conservation Area (Table 1). The Service concluded that the MSHCP would not jeopardize the continued existence of *B. nevinii* in its Biological and Conference Opinion (USFWS 2004, p. 334).

The MSHCP identifies the following species-specific conservation goals that will be implemented for the long-term conservation of *Berberis nevinii*: (1) to include within the MSHCP Conservation Area at least 8,000 acres (3,230 hectares) of suitable habitat in the Vail Lake area; (2) to include within the MSHCP Conservation Area the known locations for *B. nevinii* in the San Timoteo/Badlands area, Jurupa Hills area, and Agua Tibia/Vail Lake area; and (3) to conduct surveys for the species in certain areas of suitable habitat until the conservation goals are met (Dudek 2003b, p. P-225). In addition, the MSHCP requires surveys to be conducted for
B. nevinii within the MSHCP Conservation Area at least every eight years to verify occupancy at a minimum of 75 percent of the known locations. Management measures will be triggered, as appropriate, if a decline in species distribution is documented below this threshold. Other management actions will help maintain habitat and populations of *B. nevinii* by addressing competition from nonnative plants, controlling flood control activities, and taking steps to prevent the alteration of the natural fire regime (USFWS 2004, p. 333). Thus, the Western Riverside County MSHCP may provide significant conservation benefits to *B. nevinii*, including a MSHCP Conservation Area that protects core habitat areas and known occurrences, long-term management and monitoring of the preserve area, and special guidelines, policies, and survey requirements to ensure that significant occurrences of *B. nevinii* and its essential habitat are protected under the plan.

National Forest Management Act (NFMA): The National Forest Management Act (36 C.F.R. 219.20(b)(i)) has required the U.S. Forest Service to incorporate standards and guidelines into Land and Resource Management Plans, including provisions to support and manage plant and animal communities for diversity and for the long-term, range-wide viability of native species. Recent changes to NFMA may affect future management of listed species, particularly rare plant occurrences, on National Forests. On January 5, 2005, the Forest Service revised National Forest land management planning under NFMA (USFS 2005b, pp. 1023–1061). The new planning rule changed the nature of Land Management Plans so that plans generally would be strategic in nature and could be categorically excluded from NEPA analysis, and thus not subject to public review. Under this new planning rule, the primary means of sustaining ecological systems, including listed species, would be through guidance for ecosystem diversity. If needed, additional provisions for threatened and endangered species could be provided within the overall multiple-use objectives required by NFMA. The final rule did not include a requirement to provide for viable populations of plant and animal species, which had previously been included in both the 1982 and 2000 planning rules. On March 30, 2007, however, the United States District Court in *Citizens for Better Forestry et al. v. USDA* (N.D. Calif.) enjoined the U.S. from implementing and utilizing the 2005 rule until it complies with the court's opinion regarding the Administrative Procedure Act, the Act, and the NEPA. On May 14, 2007, the Forest Service published a Notice of Intent to prepare an environmental impact statement to analyze and disclose potential environmental consequences associated with a National Forest System land management planning rule. On April 28, 2008, the Forest Service replaced previous National Forest System land management planning rules after completing a Final Environmental Impact Statement. However, on June 30, 2009, the United States District Court in *Citizens for Better Forestry et al. v. USDA* (N.D. Calif.) enjoined the Forest Service from implementing and utilizing the 2008 rule due to violations of NEPA and the Act. Due to the uncertainty regarding the future of regulations under the NFMA, the impact of any revisions of this rule to listed species is unknown at this time.

Two occurrences of *Berberis nevinii* are on U.S. Forest Service (Forest) lands: the Lopez Canyon occurrence (Table 1) consisting of one plant on the Angeles National Forest and the Agua Tibia Mountain Foothills occurrence consisting of five individual plants on the Cleveland National Forest.

In 2005, a non-jeopardy biological and conference opinion (USFWS 2005) was issued that addressed the Revised Land and Resource Management Plans (Revised LRMP) for the four southern California national forests (Angeles, Cleveland, Los Padres, and San Bernardino). These plans described the strategic direction for these four forests at a broad program-level for land and resource management. Included in these plans were: land use zones that identified management intent and anticipated level of public use in any area of the forests; and standards which are fundamental requirements that defined the parameters for the activities that the Forest anticipated. In the biological opinion for the Revised LRMP, the Service concluded that:

1) No new permanent loss of occupied habitat is expected with the potential exception of areas within the Wildland–Urban Interface (WUI) Defense Zone (areas directly adjoining structures and evacuation routes that are converted to a less-flammable state to increase defensible space and firefighter safety). New projects will be implemented so that they promote the recovery of *Berberis nevinii* except within the WUI Defense Zone.

Expansion of facilities or new facilities will be designed to focus public use away from *B. nevinii* habitat;

2) Existing ground disturbance due to facilities overlap 30 acres (12 hectares) (16 percent) of occupied habitat within the Forests, and potential impacts are expected to be minimized by conservation measures to be implemented as appropriate to a particular site and activity as determined through site-specific section 7 consultation and analysis; and,

3) The WUI Defense Zone overlaps a substantial area of *Berberis nevinii* habitat. However, due to the clumped and relatively isolated nature of *B. nevinii* occurrences within occupied habitat, maintaining individuals within the WUI Defense Zone is frequently possible while making fuels less flammable (USFWS 2005, p. 128; USFS 2005a, p. 81).

We have learned since issuing our opinion that the *Berberis nevinii* in San Francisquito Canyon (Table 1) in the Angeles National Forest are of cultivated origin, decreasing the estimate of occupied *B. nevinii* habitat on Forest lands from 141 acres (57 hectares) to 8 acres (3 hectares) (USFS 2005b, p. 233). However, this new information does not change our conclusion.

The Revised LRMP standards mentioned above can be changed by a forest plan amendment (USFS 2005a, p. 1). Although the plans set important parameters for authorization of specific projects, the plans do not themselves authorize projects. Actual authorization of projects depends on analysis of site-specific effects, project-level section 7 consultation under the Act, and consistency with appropriate management direction and applicable legal requirements (USFWS 2005, p. 8). On June 8, 2009, the United States District Court in *Center for Biological Diversity et al. v. U.S Fish and Wildlife Service et al.* (N.D. Calif) determined the BiOp issued by the Service for the revised LRMPs for the four southern California forests was not in accordance with law due to failure to issue incidental take statements as part of the BiOp. Currently, the court ruling is under review by the Service and Department of Justice.

Summary of Factor D

The above laws and regulations have greatly reduced the likelihood of the destruction of *Berberis nevinii* habitat. The Act, in conjunction with State law, may be particularly beneficial to the conservation of *B. nevinii* and its habitat. Although the laws, regulations, and planning efforts mentioned above may reduce the likelihood of major habitat loss and alteration, they may not be as effective at preventing ongoing smaller-scale losses.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

The listing rule identified fire management practices, altered fire regimes, small population size, and low reproductive output as threats to *Berberis nevinii* under Factor E (USFWS 1998, pp. 54964–54965).

Fire Management Practices

The listing rule identified fire management practices as a threat to *Berberis nevinii*, as increased urbanization in or near *B. nevinii* habitat necessitates fire protection programs in these areas (USFWS 1998, p. 54964).

Activities associated with fire management, such as fuel treatments, prescribed burns, and wildfire suppression, may impact the physical and biological features essential to the conservation of *Berberis nevinii*. The creation of fuel breaks, brush clearing or thinning, and the use of heavy equipment and off-road vehicles for fire management could physically remove or disturb soils and alter soil composition, remove or destroy vegetation, increase erosion, and alter the topography and hydrologic patterns in or near *B. nevinii* occurrences. Fire management activities could facilitate the incursion or spread of invasive, nonnative plants by potentially dispersing seeds and creating (disturbance) conditions that increase the competitive edge of nonnative species over native species, thereby altering the composition of the vegetation community (USFWS 2008a, p. 8423).

In 2004, the Vail Lake/Oak Mountain area burned in the Eagle fire. According to GIS data provided by the California Department of Forestry and Fire Protection, a majority (6 of 10) of *Berberis nevinii* occurrences in the vicinity of Vail Lake are within or partially within the perimeter of the fire. These occurrences contain the largest number of native *B. nevinii* individuals; however, because of difficulty in access to the area, the effect on *B. nevinii* in this area is not known.

Altered Fire Regimes

The listing rule identified altered fire regimes as a threat to *Berberis nevinii*. Increases in urbanization and human activity in or near *B. nevinii* habitat are generally accompanied by an increased incidence of accidental fires (USFWS 1998, p. 54964). *Berberis nevinii*'s specific response to altered fire regimes (e.g., changes to fire frequency, timing, or intensity) was unknown at the time of listing (USFWS 1998, p. 54964).

Since listing, we identified overly frequent fire as a substantial and immediate threat to this species (USFWS 2008a, p. 8423). *Berberis nevinii*'s life history characteristics indicate that it likely recruits into chaparral during fire-free periods and may require long intervals between fires for recruitment and population increases (White 2007, *in litt*., p. 1). Overly frequent fire on the landscape could potentially kill young *B. nevinii* before they reach their reproductive potential and may adversely affect mature *B. nevinii* by causing repeated resprouting that depletes stored resources faster than they can accumulate during fire-free periods (White 2007, *in litt*., p. 1). In addition, repeated burnings over short intervals could eventually lead to type conversion (wholesale replacement) of chaparral/shrublands with nonnative annual grassland (Keeley et al. 1999, p. 1831). This type conversion has been observed in areas surrounding urban centers (Keeley 2006, p. 382).

Small Population Size

The listing rule identified small population size as a threat to *Berberis nevinii*, noting that most *B. nevinii* individuals are concentrated in the Vail Lake area (USFWS 1998, pp. 54964–54965).

Small population size may be the result of any of several conditions including local extirpations or ongoing factors limiting establishment and survival. Barrett and Kohn (1991) have discussed the consequences of small population size in plants. They stress the need for maintaining genetic diversity, especially for rare alleles (different forms of a gene). Maintaining diversity of alleles in self-incompatible (outcrossing) plants is important to ensure production of fertile seeds, and thus is important for the survival of plant populations. The likelihood of maintaining diversity decreases in smaller populations (Barrett and Kohn 1991, pp. 9, 10, and 13).

Since listing, the total number of native *Berberis nevinii* individuals across its range was reduced from 500 to fewer than 370 because of the reclassification of the San Francisquito Canyon occurrences from native to nonnative. In addition, 57 percent (8 of 14) of *B. nevinii* occurrences consist of three or fewer individuals, and 29 percent (4 of 14) of occurrences consist of only one individual (Table 1). Thus, small population size is likely a significant threat to *B. nevinii*, and impacts from threats discussed above under Factor A that negatively affect *B. nevinii* individuals are more likely to threaten the survival of the species as a whole.

Low Reproductive Output

Low reproductive output was identified in the listing rule as a threat to *Berberis nevinii* (USFWS 1998, pp. 54964–54965); however, observations of reproduction at specific *B. nevinii* occurrences were not discussed.

Low reproductive output of *Berberis nevinii* may be evidence of the potential impact of small population size on fitness described above. There appears to be little to no regeneration by seed occurring at most *B. nevinii* sites (Mistretta 1994, p. 186). Low seed set (including plants bearing fruits that lack seed) and lack of viable seed has been noted by both botanists and horticulturalists trying to obtain seed for propagation, even from within larger occurrences (Wolf 1940, p. 2; Boyd 1987, pp. 3, 44, 56; Mistretta and Brown 1989, pp. 4–5; Mistretta 1994, p. 186; Wall 2009, *in litt*., p. 5). In addition, several occurrences of *B. nevinii* consist of only a single plant that has existed for years or decades without reproducing (Mistretta and Brown 1989, p. 5; CNDDB 2008, EO 5).

We know of only a few native occurrences where regeneration by seed may have occurred in the recent past. As noted by Nishida in Boyd (1987, p. 62), the largest stand of *Berberis nevinii* located on the Vail Lake peninsula consists of approximately 111 individuals of various sizes, including a seedling, which suggests a range of ages and past reproduction. Another occurrence on the summit of Oak Mountain north of Vail Lake consists of two plants: a very old one and a substantially smaller one at some distance to the northeast (Table 1; G. Wallace, U.S. Fish and Wildlife Service, pers. obs. 2006, p. 1). Fruits with seeds were noted at the Agua Tibia Mountain Foothills occurrence to the southeast of Vail Lake in 2006 (Table 1; Wallace 2006, pers. obs., p. 1). The San Timoteo Canyon occurrence also contained individuals of several size

(age) classes (Boyd 1987, pp. 51–52); however, this occurrence has been partially destroyed and fruits collected in 2009 at two of the three remaining plants did not contain viable seed (Table 1; Sanders 2006, *in litt*., pp. 1–2; Wall 2009, *in litt*., p. 38).

Regeneration by seed has been noted at a few naturalized (i.e., nonnative) stands of *Berberis nevinii*. The San Francisquito Canyon site (Table 1) appears to have one of the most vigorous naturally regenerating occurrences of the species, as indicated by a wide range of ages of mature individuals, the presence of numerous seedlings and immature plants (Boyd 1987, p. 7; Mistretta and Brown 1989, p. 10; Soza and Boyd 2000, p. 2), and fruits containing seed (Boyd 1987, p. 7). Reproduction has also been observed at a site southwest of Palomar Mountain (Table 1) in San Diego County, a site supporting 20 plants presumed to be of cultivated origin (Boyd 1987, pp. 3, 73). The role that naturalized occurrences will have in recovery of the species is not known at this time. However, one of the San Francisquito Canyon occurrences may at some point be determined to play a recovery role because it is one of only three occurrences for the species that we know has more than 20 individuals (Table 1; CNDDB 2008, EO 11), it is one of only a few occurrences with any evidence of reproduction by seed, and it may contain the only verifiable remnant of the extirpated San Fernando Valley population.

Climate Change

Since listing, it has become apparent that there is potential for threats to biota from ongoing, accelerated climate change (IPCC 2007). Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, IPCC 2007). However, predictions of climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects. One study predicted that 5 to 10 percent of California's native plant species would no longer find suitable habitat within the state, and thus be vulnerable to extinction, if average temperatures warmed 5–6° F (Morse et al. 1995, p. 393). Whether or not this would include *Berberis nevinii* is unknown. While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to *B. nevinii* at this time. Any changes in fire frequency resulting from climate change could directly threaten the persistence of the fire-prone occurrences of *B. nevinii* near Vail Lake in Riverside County.

Summary of Factor E

In summary, fire management practices threaten *Berberis nevinii* across its range as urbanization increases in or near *B. nevinii* habitat. In addition, we identified altered fire regimes as a substantial and immediate threat to the species, as overly frequent reoccurrence of fire could potentially kill young *B. nevinii* before they reach their reproductive potential, hinder or preclude natural replacement of aging individuals, and may adversely affect mature *B. nevinii* as well. Small population size and low reproductive output are likely significant threats to the long-term survival of the species. Adverse environmental conditions resulting from climate change could also pose potential threats to *B. nevinii*.

III. RECOVERY CRITERIA

This species does not have a recovery plan.

IV. SYNTHESIS

Currently, 14 native occurrences of *Berberis nevinii* are distributed in discontinuous populations across southern California, with the vast majority of *B. nevinii* individuals located in the Vail Lake/Oak Mountain area. Since listing, *B. nevinii* in San Francisquito Canyon (Los Angeles County) were determined to be nonnative, bringing the northern extent of the geographical range south to the San Fernando Valley. The threats to this species are essentially the same as they were at the time of listing and include urbanization, recreational activities, road widening, fire management practices, altered fire regimes, small population size, and low reproductive output. The latter four are intrinsic and therefore rangewide in their impacts.

Most threats facing *Berberis nevinii* are rangewide and are exacerbated by the species' low reproductive output. Most *B. nevinii* occurrences (12 of 14 occurrences) and individuals are impacted by urbanization, recreational activities, fire management practices, and altered fire regimes. Since listing, one occurrence in the Loma Linda Hills area has been extirpated. Threats from small population size are of particular concern; as a result of small population size, other threats that negatively affect *B. nevinii* individuals are more likely to threaten the survival of the species as a whole. In addition, low reproductive output is a significant threat and may be evidence of the potential impact of small population size on fitness. At the time of listing, the total number of *B. nevinii* plants was estimated to be less than 500 across its range; this estimate is notably reduced with the reclassification of the San Francisquito Canyon occurrences from native to nonnative. Moreover, 57 percent (8 of 14) of *B. nevinii* occurrences consist of three or fewer individuals, and 29 percent (4 of 14) of occurrences consist of only one individual. If these small isolated occurrences were to die out there could be a considerable loss of genetic diversity and species resilience.

Due to the rangewide threats mentioned above, *Berberis nevinii* remains in danger of extinction throughout its entire range. We recommend that the current listing status for *B. nevinii* remain unchanged, as endangered.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
__X__ No Change

New Recovery Priority Number and Brief Rationale: No change is recommended.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Cooperate with the Western Riverside Regional Conservation Authority to acquire occupied *Berberis nevinii* habitat around Vail Lake, and to establish land management practices on these lands that will benefit the species.

2. Determine causes and remedies of low reproductive output in *Berberis nevinii*. Investigate its breeding system; pollinators; seed dispersal mechanisms; and seedling requirements and establishment.

3. Work with partners to help conserve *Berberis nevinii*. Identify opportunities through the Service's Partners for Fish and Wildlife Program to seek habitat restoration and enhancement opportunities.

4. Identify partners to help support efforts to survey *Berberis nevinii* occurrences around Vail Lake, including occurrences within or partially within the perimeter of the 2004 Eagle fire.

5. Verify presence of the occurrence near the mouth of Scott Canyon in San Bernardino County.

6. Determine the genetic origins of cultivated specimens that are successfully reproducing, in particular, the *Berberis nevinii* in San Francisquito Canyon.

VII. REFERENCES CITED

Barrett, S.C.H., and J.R. Kohn. 1991. Genetic and evolutionary consequences of small population size in plants: implications for conservation. Pages 3–30 in D.A. Falk and K.E. Holsinger (editors), Genetics and conservation of rare plants. Oxford University Press, New York and Oxford.

Boyd, S.D. 1987. Habitat parameters of *Mahonia nevinii* (Gray) Fedde (Berberidaceae). Technical Report No. 3. Rancho Santa Ana Botanic Garden, Claremont, California.

Boyd, S.D., and D.L. Banks. 1995. A botanical assessment of the Agua Tibia Wilderness Area, Cleveland National Forest, California. Unpublished report submitted to the Cleveland National Forest.

Boyd, S.D., L.E. Arnseth, and T.S. Ross. 1989. Botanical assessment of Bedford Properties holdings surrounding Vail Lake, Pauba Valley, western Riverside County, California (Technical Appendix A) in S.G. Nelson, S.D. Boyd, L.E. Arnseth, and T.S. Ross. Biological assessment of Bedford Properties holdings surrounding Vail Lake, Pauba Valley, western Riverside County, California. Unpublished report submitted to Riverside

County Board of Supervisors and Riverside County Planning Department, Riverside, California.

Cayan, D., M. Dettinger, I. Stewart, and N. Knowles. 2005. Recent changes towards earlier springs: early signs of climate warming in western North America? U.S. Geological Survey, Scripps Institution of Oceanography, La Jolla, California.

[CNDDB] California Department of Fish and Game, Natural Diversity Database. 1997. Element Occurrence Reports for *Berberis nevinii*. Unpublished cumulative data current to January 15, 1997.

[CNDDB] California Department of Fish and Game, Natural Diversity Database. 2008. Element Occurrence Reports for *Berberis nevinii*. Unpublished cumulative data current to June 1, 2008.

[CNPS] California Native Plant Society. 2001. *Berberis nevinii* Gray. Page 96 in D.P. Tibor (editor). California Native Plant Society's Inventory of rare and endangered plants of California, sixth edition, Sacramento, California.

[Dudek 2003a] Dudek & Associates, Inc. 2003. Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP), Final MSHCP, Volume I, The Plan, Part 2 of 2. Unpublished Report submitted to the U.S. Fish and Wildlife Service.

[Dudek 2003b] Dudek & Associates, Inc. 2003. Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP), Volume II – Section B, Species Accounts. Unpublished Report submitted to the U.S. Fish and Wildlife Service.

Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington, DC.

Fraga, N. 2005. 2004–2005 surveys of threatened, engangered [sic], forest sensitive and watchlist plants species (TESPW) in the areas burned by the Grand Prix and Old Fire of 2003, for the San Bernardino National Forest. Unpublished report submitted to San Bernardino National Forest, Fawnskin, California.

[IPCC] Intergovernmental Panel on Climate Change. 2007. Climate change 2007: the physical science basis. Summary for policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC Secretariat, World Meteorological Organization and United Nations Environment Programme, Geneva, Switzerland.

Keeley, J.E. 1991. Seed germination and life history syndromes in the California chaparral. Botanical Review 57(2):81–116.

Keeley, J.E. 1992. Recruitment of seedlings and vegetative sprouts in unburned chaparral. Ecology 73(4):1194–1208.

Keeley, J.E. 2006. South coast bioregion. Pages 350–390 in N.G. Sugihara et al. (editor), Fire in California's ecosystems. University of California Press, Berkeley and Los Angeles, California.

Keeley, J.E., C.J. Fotheringham, and M. Morais. 1999. Reexamining fire suppression impacts on brushland fire regimes. Science 284:1829–1832.

Lenz, L.W., and J. Dourley. 1981. California native trees and shrubs, for garden and environmental use in southern California and adjacent areas. Rancho Santa Ana Botanic Garden, Claremont, California.

Mistretta, O. 1994. Genetics of species re-introductions: applications of genetic analysis. Biodiversity and Conservation 3:184–190.

Mistretta, O., and W.J. Brown. 1989. Species management guide for *Mahonia nevinii* (Gray) Fedde. Technical Report No. 4. Rancho Santa Ana Botanic Garden, Claremont, California.

Morse, L.E., L.S. Kutner, J.T. Kartesz. 1995. Potential impacts of climate change on North American flora, in Our Living Resources. LaRoe E.T., et al., Eds. U.S. Department of Interior, National Biological Service, Washington, D.C.

[MWD] Metropolitan Water District of Southern California. 1991. Eastside reservoir project, draft environmental impact report. Draft report prepared by the Metropolitan Water District of Southern California, Los Angeles, California.

Niehaus, T. 1977. Status report on *Berberis nevinii*. Unpublished report. California Native Plant Society, Berkeley, California.

Reiser, C.H. 2001. Rare plants of San Diego County. 2001 edition. Aquafir Press. Unpublished report.

Soza, V., and S. Boyd. 2000. Surveys and monitoring for *Berberis nevinii* (Berberidaceae) on the Angeles National Forest. Unpublished report submitted to USDA Forest Service, Angeles National Forest, Arcadia, California.

Soza, V., and N. Fraga. 2003. Monitoring program and 2003 monitoring data for *Berberis nevinii* (Berberidaceae), Nevin's barberry on the Angeles National Forest. Unpublished report submitted to USDA Forest Service, Angeles National Forest, Arcadia, California.

[USFS] U. S. Forest Service. 2005a. Land Management Plan. Part 3 design criteria for the southern California national forests. Document prepared by the U.S. Forest Service.

[USFS] U. S. Forest Service. 2005b. Biological assessment for the revised Land Management Plans (Forest Plans) for the four southern California national forests. Unpublished document submitted to the U.S. Fish and Wildlife Service.

Service (U.S. Fish and Wildlife Service). 1983. Endangered and threatened species listing and recovery priority guidelines. Notice. Federal Register 48:43098–43105.

[USFWS] U.S. Fish and Wildlife Service. 1998. Endangered and threatened wildlife and plants; endangered or threatened status for three plants from the chaparral and scrub of southwestern California. Federal Register 63:54956–54971.

[USFWS] U.S. Fish and Wildlife Service. 2004. Intra-Service Formal Section 7 Consultation/Conference for Issuance of an Endangered Species Act Section 10(a)(1)(B) Permit (TE-088609-0) for the Western Riverside County Multiple Species Habitat Conservation Plan, Riverside County, California; Ref. No. FWS-WRIV-870.19, dated June 22, 2004. Carlsbad Fish and Wildlife Office, Carlsbad, California.

[USFWS] U.S. Fish and Wildlife Service. 2005. Biological and Conference Opinions on the Revised Land and Resource Management Plans for the Four Southern California National Forests, California (1-6-05-F-773.9).

[USFWS 2008a] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants; designation of critical habitat for *Berberis nevinii* (Nevin's barberry); final rule. Federal Register 73:8412–8440.

[USFWS 2008b] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants: initiation of 5-year reviews of 58 species in California and Nevada; availability of completed 5-year reviews in California, Nevada and southern Oregon. Federal Register 73:11945–11950.

White, S.D., and B. Leatherman. 2001. *Berberis nevinii* (Nevin's barberry). Pages 35–37 in DOI Bureau of Land Management South Coast Resource Management Plan: Draft Biological Evaluation. Draft report prepared for USDI Bureau of Land Management, Riverside, California (March 19).

Wolf, C.B. 1940. *Mahonia nevinii*, Nevin's Mahonia. Rancho Santa Ana Botanic Garden Leaflets of Popular Information No. 35.

Personal Communications

Boyd, Steve. 2006. Curator of the Herbarium, Rancho Santa Ana Botanic Garden, Claremont, California. E-mail to Annalaura Averill-Murray, U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, dated October 26, 2006. Subject: Re: follow-up question.

Gross, LeRoy. 2008. Senior Curatorial Assistant, Rancho Santa Ana Botanic Garden, Claremont, California. Phone conversation with Stacey Love, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, July 28, 2008.

Krizek, Alisa. 2007. Riverside County Planning Department. Phone conversation with Sally Brown, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, February 22, 2007.

Krizek, Alisa. 2008. Riverside County Planning Department. Phone conversation with Stacey Love, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, April 15, 2008.

Latch, Anita. 1997. Student, University of Redlands, Redlands, California. E-mail to Mary Meyer, California Department of Fish and Game, dated August 21, 1997. Subject: Berberis nevinii details.

McKinney, Tony. 2008. GIS Coordinator, U.S. Fish and Wildlife Service, Carlsbad, California. E-mail to Stacey Love, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, dated August 7, 2008. Subject: Re: Fw: Berberis nevinii CNDDB occurrence.

Payne, Theodore. 1945. Horticulturalist, Los Angeles, California. Letter addressed to Dr. H. McMinn, Mills College, Oakland, California, dated June 19, 1945.

Sanders, Andrew. 1997. Curator/Museum Scientist, University of California Riverside, Riverside, California. E-mail to James C. Dice, California Department of Fish and Game, dated August 19, 1997. Subject: Berberis nevinii – Loma Linda fire.

Sanders, Andrew. 2006. Curator/Museum Scientist, University of California Riverside, Riverside, California. E-mail to Annalaura Averill-Murray, U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, dated July 12, 2006. Subject: Re: Nevin's barberry records.

Soza, Valerie. 2003. Botanical Field Studies Coordinator, Rancho Santa Ana Botanic Garden, Claremont, California. Correspondence to Jesse Bennett, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, dated February 6, 2003.

Wall, Michael. 2009. Seed Conservation Program Manager, Rancho Santa Ana Botanic Garden, Claremont, California. E-mail to Stacey Love, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, dated July 7, 2009. Subject: FW: Wild burros and rare plants San Timoteo Canyon.

Wallace, Gary. 2006. Botanist, U.S. Fish and Wildlife Service, Carlsbad, California. E-mail to Annalaura Averill-Murray, U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, dated October 3, 2006. Subject: Re: couple of BENE questions.

White, Scott D. 2007. Consulting Biologist, Scott White Biological Consulting, Upland, California. Letter to Jim Bartel, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, dated April 4, 2007.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

***Berberis nevinii* (Nevin's barberry)**

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

ACTING **Lead Field Supervisor, U.S. Fish and Wildlife Service**

Approve _____ Date AUG 1 4 2009

Scott A. Sobiech