Hesperolinon congestum (Marin dwarf-flax)

5-Year Review:
Summary and Evaluation

Large-flowered forma - Nicasio Ridge. Highly-congested influorescence forma - Mt. Burdell.
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U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Sacramento, California

September 2011

5-YEAR REVIEW

Hesperolinon congestum (Marin Dwarf Flax)

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 of 1973, as amended (Act) to conduct a status 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, be changed in status from threatened to endangered, or otherwise remain unchanged in status. 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:

Hesperolinon congestum (Marin dwarf flax) is an annual herb in the flax family (Linaceae). It is known to occur in serpentine soils in San Mateo, San Francisco, and Marin Counties, typically in association with bunchgrasses, chaparral, or other dry grasslands. Occurrences vary in number from a few plants to thousands and in size from a few meters to tens of acres. Between years, population numbers can vary greatly as can the precise location and spatial extent of the plants. The species generally flowers from early May through June or July, and is sensitive to the amount and timing of rainfall. The species is distinguished by rose-to-whitish flowers that are congested at the tips, with hairy sepals.

Methodology Used to Complete This Review:

This review was prepared by the Service's Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from our Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area (Recovery Plan) (FWS 1998), from experts who have made observations at various localities of this species or who had studied threats, section 7 consultation files for Federal actions affecting this species, and from the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game. We received no information from the public in response to our Federal Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of this updated information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. This review synthesizes all this information to

evaluate the listing status of the species and provide 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:

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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 25, 2009 (74 FR 12878).

Listing History:

Original Listing
FR Notice: 60 FR 6671
Date of Final Listing Rule: February 3, 1995
Entity Listed: *Hesperolinon congestum*, a plant species
Classification: Threatened

State Listing
Hesperolinon congestum was listed by the State of California as threatened in 1992.

Associated Rulemakings: None

Review History: None

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Hesperolinon congestum* is 8C according to the Service's 2010 Recovery Data Call for the SFWO, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (FWS 1983). The number 8 indicates that the taxon is a species, faces a moderate degree of threat, and has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline:

Name of Plan or Outline: Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area
Date Issued: A final recovery plan was published September 30, 1998

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 a DPS 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 Biology and Life History:

Spatial Distribution: *Hesperolinon congestum* is found on serpentine soils in Marin, San Francisco, and San Mateo Counties. Its historical range has not been established, but likely included all occurrences at the time of listing, as well as extirpated occurrences on former serpentine areas in San Francisco and San Mateo Counties that are now urban development. The 1995 listing stated there were 14 populations of the species which were considered extant, but only discussed 12 of them. The status and relevant threats discussed in the original listing are generally consistent with CNDDB reports examined for this 5-year review. However, we discovered that the 14 populations indicated in the listing did not match the 18 CNDDB occurrences which are recorded in CNDDB (2011) to have been reported by the time of listing. There is insufficient information in the listing itself to determine how the occurrences may have been grouped, or if there were changes in the CNDDB database since the time of listing. At the present time, we believe there are 23 extant occurrences of the species (Table 1, Figure 1). Ownership status is largely a variety of public entities (City, State, County, Federal, public utilities) as well as some private lands (Table 2). Five are new occurrences since listing, three of which have been reported to the CNDDB, and two of which have not yet been reported (one a recent reintroduction to a former CNDDB site considered extirpated). In this 5-year review, we discuss the occurrences for six group areas in which they are clustered, and compare the information at time of listing with current information. The group names are (ordered from South to North): Edgewood-Woodside, Crystal Springs, San Francisco, Tiburon, Central Marin, and Mount Burdell. We have organized this information by County, as was the case in the 1995 listing.

San Mateo County (Edgewood-Woodside, Crystal Springs groups):

Time of Listing: The listing stated that five populations were known from San Mateo County, two on San Francisco Water Department land, and three on private land.

Current Status: We believe there are ten extant populations in San Mateo County. The Edgewood-Woodside group includes CNDDB element occurrence numbers (#) 4, 5, 17, and 29. One CNDDB occurrence was discovered in 2007 (#29, Stulsaft Park), another site has not been visited since before listing (#5, Woodside Glen), and two within Edgewood Park (#4 and 17) were last reported in 2004 in the CNDDB, and observed by others in 2010.

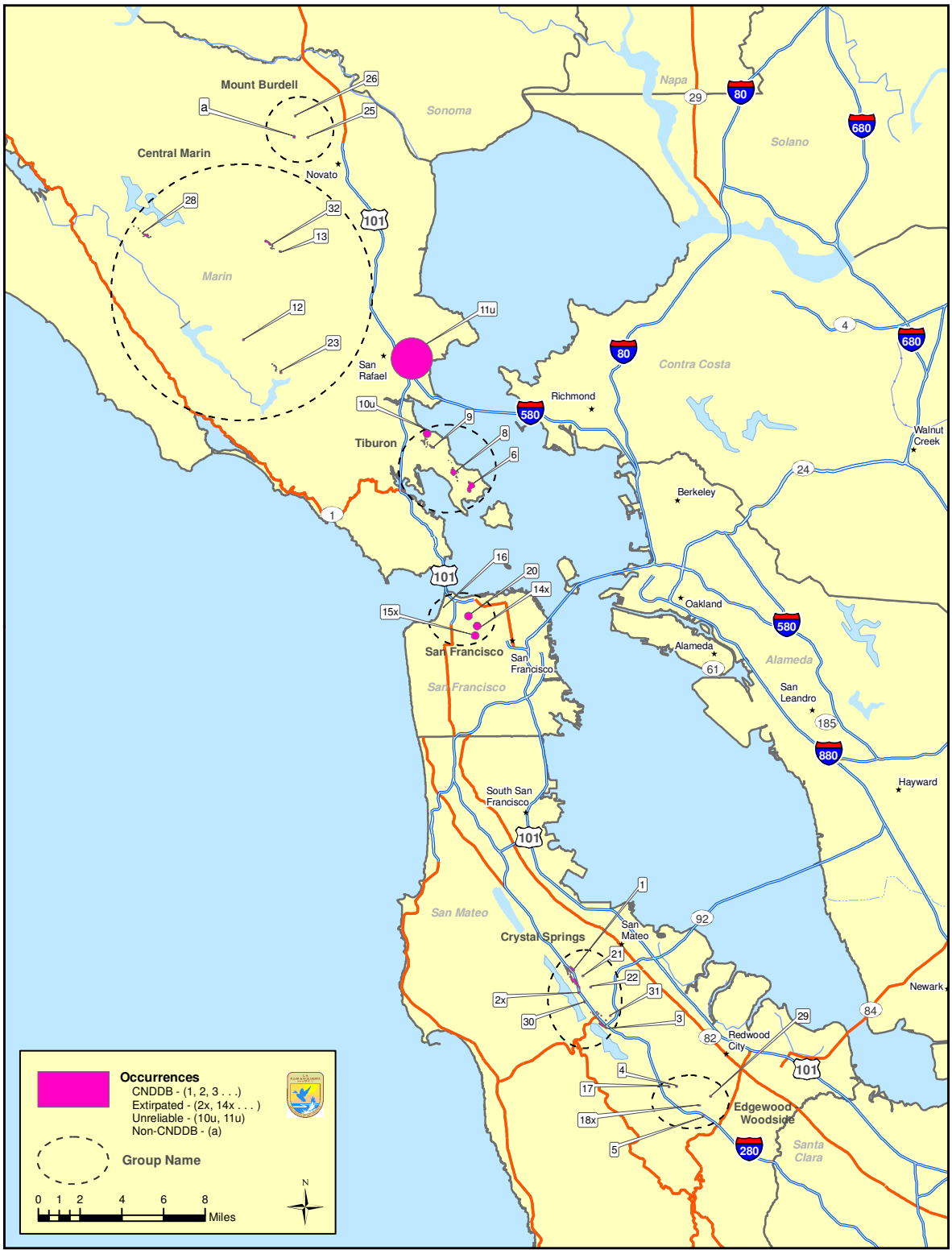

Figure 1. Distribution of *Hesperolinon congestum* (Marin dwarf flax) prepared for 2011 5-year review. Violet circles specify the distance accuracy of point occurrences; irregular violet polygons are the actual spatial extent of occurrences. Non-CNDDB occurrence "a" is based on a recent report that does not provide an exact location and is to be considered approximate.

Six of the occurrences in San Mateo County are in the Crystal Springs group, in proximity to Crystal Springs Reservoir along Pulgas Ridge. All are CNDDB occurrences, three of which are within larger open spaces on land owned by the City and County of San Francisco and managed by the San Francisco Public Utility Commission (SFPUC) (#1, 3, 30). Two other CNDDB occurrences are more isolated and surrounded by development; one by an SFPUC pipeline (#22), and another on a hillslope by Hillcrest Detention Home (#31) discovered since listing in 2003. Four occurrences (#1, 3, 22, 30) in this group were noted in CNDDB (2011) as being observed as recently as 2001. There are much more recent surveys in the reservoir area not yet reported to the CNDDB (D. Craven-Green, SFPUC, *in litt.* 2010; C. Niederer, Creekside Center for Earth Observation, *in litt.* 2011; T. Ramirez, SFPUC, *in litt*. 2011; *see* Table 1).

There are two known extirpations in San Mateo County, one each in the Edgewood-Woodside and Crystal Springs groups (#18 and 2, respectively), and both took place prior to listing. One other occurrence in the Crystal Springs group is presumed extant for the purpose of this 5-year review, but has not been observed since 1987 (#21). It may not exist currently, as the location appears to be completely developed based on our inspection of aerial imagery for this 5-year review; ground surveys would be needed to confirm presence/absence.

San Francisco County (San Francisco group):

Time of Listing: The listing mentions one population in San Francisco County.

Current Status: The occurrence mentioned in the listing on the Presidio (#16) remains today and is censused annually by the National Park Service (M. Chasse, National Park Service, *in litt.* 2009). It is actually two subsites. Since listing, we note one re-occurrence on the Presidio where the species had been extirpated. This is the result of a restoration experiment at Inspiration Point (#20) (WEI 2010a; Chasse, *in litt.* 2011; C. Niederer and S. Weiss, Creekside Center for Earth Observation, *in litt.* 2010). Historically, the species was somewhat more widespread in San Francisco County, as indicated by two other occurrences extirpated prior to listing due to urban development.

Marin County (Tiburon, Central Marin, and Mount Burdell groups):

Time of Listing: The listing mentions six populations in Marin County. In the Tiburon group, these are Ring Mountain (#9), St. Hilary's Church (#6), and Middle Ridge (#8). The other three populations discussed in the listing are in the Central Marin group, located north of Alpine Lake (#23) in an area known as Azalea Ridge, somewhat farther north on Carson Ridge (#12), and in the Golden Gate National Recreation Area south of Nicasio Reservoir (#28).

Current Status: At the time of this review, there are 11 occurrences which we consider extant in Marin County. These include all five mentioned in the listing and six others not mentioned in the listing. Two of the additional locations are in close proximity in the vicinity of Big Rock, one very near and just south of Lucas Valley Road (#13) and another larger occurrence to the north and west (#32). The other three occurrences not mentioned in the listing are in open space near Mount Burdell (#25, 26, and one other smaller occurrence, denoted "a", not yet reported to CNDDB). Based on CNDDB notes, we consider occurrences #10 and 11 to be so unreliable as

to discount their existence, and are not considered extant for the purpose of this 5-year review. Number 10 was examined in 1986, not found, appears undeveloped and is noted by CNDDB (2011) as "possibly extirpated", and that it may actually have been collected at #9. Number 11 has not been seen for about 130 years, is at an atypically low elevation for serpentine in this area, the location accuracy is 1 mile, and noted in CNDDB (2011) as "a best guess".

Spatial Distribution and Abundance:

With the exceptions of #16 and 32, abundance estimates at the 23 extant locations has been occasional and often qualitative (Table 1). Nevertheless, the frequency and recency of presence/absence data for the majority of the populations are sufficient to conclude they are extant for the purpose of this 5-year review, even in the absence of quantitative estimates. Of the twenty-three populations, fourteen were observed in 2006-2011, six were last seen 2001-2005, one was seen in 1998, and the other two were last seen prior to listing. Two of the five new occurrences (#32, a) were noted near other occurrences and may or may not be part of those other occurrences, two others (#29, 31) are separate and appear to be isolated discoveries, and one (#20) was experimentally re-introduced.

For this 5-year review, we collated and examined all available census and presence/absence information (Table 1). Abundance estimates vary greatly among occurrences and between years. The Presidio population (#16) varied from <100 plants in 2000-2002, to >1,000 plants in 2004-2005, and then only 226 plants in 2009. The other site with intensive monitoring as part of a Service consultation (West of Big Rock, #32) displays relatively modest variability, with a 5,000-20,000 plant count range over the last ten years. There are several semiquantitative descriptions of the plant being recently very abundant in many, but not all, of the Marin County locations (#9, 13, 32, 25, 26) (Table 1). For example, the Ring Mountain population (#9) was estimated at 5,000 plants in 1986, "thousands" in 1998, "millions" in 2007, "hardly any" in 2008, and in 2009 - while not estimated - the mapped extent of the population is similar to that in 1998 (R. Bittman, Department of Fish and Game, *in litt.* 2009a; E. Buxton, California Native Plant Society, *in litt.* 2010). On nearby Middle Ridge (#8), LSA (2010; citing pers. comm. with E. Buxton) indicate that few plants had been seen in recent years. At Nicasio Ridge (#28), the species has been monitored only for presence/absence; it is nevertheless considered a "large" population that varies between 10,000 to perhaps over 100,000 plants (Chasse, *in litt.* 2011). In San Mateo County, the latest report (observation or count) in three sites is older than a decade. However, limited surveys and observations in the Crystal Springs Reservoir area indicate overall populations there in the 1,000-10,000+ range (Niederer, *in litt*. 2011; Foree, SFPUC, *in litt.* 2009; Ramirez, SFPUC, *in litt*. 2011). Such widespread variability is not surprising, as numbers are known to be greatly affected by rainfall, showing larger populations in years with abundant spring rains.

In the absence of regular plant surveys of some kind (presence/absence; plant number; occurrence area), no conclusion can be made regarding the population trend for most occurrences (Table 1). For those few sites with regular surveys, #32 appears to be stable (relatively constant during the 2003-2009 survey period; ~4-fold range) and #16 appears to be unstable (~20-fold increases and declines over the 1995-2010 survey period).

Based on examination of CNDDB (2011) and comparison with current aerial imagery, we noted several development-related losses of habitat that had supported *Hesperolinon congestum* during our review that appear to have occurred since listing. For example, at Middle Ridge (#8), the species has been extirpated from one of the three polygons from what appears to be a water tower. A small portion of the Big Rock occurrence (#32) was lost at the expense of a movie studio reservoir. The Hillsborough occurrence (#21) appears that it may have been lost due to development. Elsewhere, throughout most of the current range, the landscape of occurrences examined for this 5-year review appears to have remained substantially undeveloped since listing.

Habitat or Ecosystem:

Hesperolinon congestum is restricted to serpentine soils in Marin, San Francisco, and San Mateo Counties in either chaparral or bunchgrass habitats. Serpentine soils are formed from weathered volcanic rock, with a low calcium-magnesium ratio, lack of soil nitrogen, potassium, or phosphorus, and elevated heavy metals (mineral toxicity). It is believed that *Hesperolinon congestum*'s tolerance for this soil chemistry allows it to grow where most other plant species cannot. Many of the occurrences are very small in area although a few are much larger; the total known occupied habitat of the species is estimated to be about 349.2 acres (Table 2; assuming the CNDDB 2011-listed area, or 0.1 acre for point observations where no area is provided).

Changes in Taxonomic Classification or Nomenclature:

Genetics:

Genetic work comparing species in the genus *Hesperolinon*, including *Hesperolinon congestum*, has been done since listing to determine the relation of serpentine specialism and phylogeny to soil chemistry and disease resistence (Springer 2009b). This study found that rust disease was less frequent in flax populations growing in more stressful low-calcium serpentine soils in the field and greenhouse. Phylogenetic mapping suggested that the ability to tolerate such extreme soils evolved multiple times within the genus.

One communication mentioned different forma of *Hesperolinon congestum* at various locations (D. Smith, California Native Plant Society, *in litt.* 2011a, *see* cover page of this 5-year review for photographs). Specifically, two of three Mt. Burdell populations have flowers that are much more congested than the third Mt. Burdell population, which more resembles the populations at Big Rock (to the south). The Nicasio Ridge occurrence (#28) is a large-flowered forma. The genetics of these forma has not yet been studied.

Species-specific Research and/or Grant-supported Activities

Since listing, a dissertation was completed that looked at rust disease resistance in relation to soil calcium among 13 species of the genus *Hesperolinon*, including *Hesperolinon congestum* as well as other state-listed and non-listed species (Springer 2006). In this work, it was hypothesized that low-calcium soils served as a refuge for serpentine species such *Hesperolinon congestum* from this disease and, therefore, from competition with more common flax species which

showed higher incidence of rust. Various studies were done including greenhouse tests, field studies, and genetic studies. Four peer-reviewed articles were subsequently published (Springer 2007, 2009a, 2009b; Springer et al., 2007).

There has been significant research addressing the effects of nitrogen on serpentinic soils, consequential invasion by grasses and other species that compete with the native serpentine plants generally, and the use of grazing as a means of mitigating this threat (Weiss 1999). Further work has been done which has associated the invasive vegetation threat with atmospheric nitrogen from fossil-fuel burning, and to establish critical atmospheric nitrogen loads on the basis of accumulating evidence of its effect on endemic serpentine species (Weiss 2006). Fenn et al. (2010) mapped areas of critical load exceedance and vegetation types in California, and outlined a variety of threat management strategies involving biomass removal techniques such as mowing, selective herbicide, weeding, alternative fuels, and animal grazing. This work discussed application of these strategies to serpentine areas with specific attention to the listed Bay checkerspot butterfly and its host plant, but the same strategies may be applicable to other serpentine species such as *Hesperolinon congestum*. Other recent experimental work has suggested non-native grass invasion into serpentine communities may be facilitated by nitrogen addition (Going et al. 2009).

The Upland Habitat Goals Project, which has received several million dollars of support from various sources including the Service, is in progress to develop a science-based process to identify types, amount and distribution of habitats needed to sustain upland resources generally, but with some specific attention to listed species (BAOSC 2011). Nitrogen loads can be compared to observations of non-native grass invasion to establish thresholds beyond which the native species begin to be replaced by non-natives like rye grass. These analyses indicate that 4.5-5.0 kg-N/ha/year is close to a critical load for serpentine natives like *Hesperolinon congestum*, a value which is considered relatively clean air (Weiss, *in litt.* 2011; Fenn et al. 2010). Other spatial layers of interest such as land protections, status, and urbanization are being used by the Upland Habitat Goals Project to evaluate threat risk and identify conservation targets.

Since listing, there have been three seed collections (M. Wall, Rancho Santa Ana Botanical Garden, *in litt*. 2009): (1) from four cultivated plants at the Rancho Santa Ana Botanical Garden; (2) from 100 plants on a cut slope near an existing water tank (#8); and (3) from 358 fruits of plants on a serpentine slope bordering the south edge of an existing reservoir off Lucas Valley Road (reference says it is from #13, but it may actually be from #32 which is near a reservoir north of the road, such as that mentioned in the collection notes).

There has been one experimental reintroduction of *Hesperolinon congestum* attempted at former occurrence #20 (Inspiration Point) which has had limited success. This was first tried in 2003 using Ring Mountain seed, which first germinated in 2005 and was seen again at least in 2008. These plants were later removed, and the reintroduction repeated with Presidio stock in October 2009 (Niederer and Weiss, *in litt.* 2010). Very low numbers emerged from plots tarped, flamed, or scraped, before reseeding; plugs were also not particularly successful (Niederer, *in litt.* 2011).

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

The threat of habitat destruction continues in several forms, and varies both regionally and with specific location (Table 2). In our final listing rule, proposed development on private property was mentioned as a threat to three populations in San Mateo County (unspecified, but probably #5, 18, and 21), and two populations in Marin County (#6 and 8). Number 18, however, was considered extirpated prior to the listing. Based on our inspection of aerial imagery, #21 may no longer exist, as no open space was visible. As previously noted, a small portion of #8 has already been lost since listing, apparently to development. The current threat to #6 (St. Hilary's Church) is related to a proposed residential development known as the Martha property (also called Easton Point), which has been litigated since 1976. As of the latest information obtained for this 5-year review (Prado 2009), it is believed to involve about 32 home lots and would retain 50 percent of open space on the property, including fire road access points. The threat to #8 (Middle Ridge) is the proposed Alta Robles development, which would involve construction of 14 large homes and infrastructure on 52 acres. Recent information concerning the Alta Robles development indicates there would be some direct impacts to *Hesperolinon congestum*, as well as likely indirect impacts due to construction at distances of 25-to-125 feet from the species and/or potential habitat (MCL 2011; MIJ 2010; Town of Tiburon 2010). These distances are far less than the 500-foot buffer recommended in our Recovery Plan for protection of this species (FWS 1998). Comments on environmental documents for Alta Robles by the California Native Plant Society question the validity of surveys as well as the effectiveness of mitigation measures, and recommend further reduction in the development as well as additional protections (Town of Tiburon 2010). Not only do such developments result in direct losses of the species and its habitat where the development takes place, but could result in numerous indirect effects on adjacent areas due to runoff, landslides, foot traffic, dogs, and non-native plant competition (MCL 2011; LSA 2010; see Factor E, below). These indirect effects may occur on both private and public lands, particularly in areas which lack permanent protections. Such indirect effects are likely to be ongoing to some extent at all of the Tiburon populations due to nearby developments. The information reviewed indicates that both Alta Robles and Easton Point proposals would affect jurisdictional wetlands, requiring a permit to be obtained from the U.S. Army Corps of Engineers (Corps) under Clean Water Act (CWA) Section 404. In order to consider issuance of such a permit, the Corps would need to consult with the Service on listed species including *Hesperolinon congestum* (*see* Factor D, below). As of this 5-year review, we are unaware of a 404 permit application or consultation request for either development proposal.

Our final listing rule mentions threats to occurrences on SFPUC lands as involving proposed trail construction and accompanying fences. Based on information provided by the SFPUC and review of Service files, several planned actions may affect the species (E. Natesan, SFPUC, pers. comm. 2011). One such activity is the Crystal Springs/San Andreas Transmission Upgrade project, whose modest effect on *Hesperolinon congestum* will be mitigated through conservation

and enhancement measures addressed in formal consultation (FWS 2010; Table 2). There is also a planned dam improvement project for Crystal Springs Reservoir which could affect *Hesperolinon congestum* or presently unoccupied serpentine area which is potential habitat over a more widespread area by allowing a higher maximum water level than at the present time. That project will also have some direct effect on the species which will be compensated by seed collection, habitat preservation, and habitat/plant compensation measures that are not yet fully specified. These measures would likely be applied to a portion (but not all) of SFPUC occurrences or potential habitat (FWS 2011; Vincent Griego, U.S. Fish and Wildlife Service, pers. comm. 2011). Another planned project, replacement of SFPUC's Pipeline #2, is in proximity to occurrence #22; effects related to this nearby work or subsequent maintenance are unknown at this time. We were unable to confirm any future plans for trail construction or fences as mentioned in the listing. Much of SFPUC lands is already fenced and not publicly accessible. However, San Mateo County has indicated a desire for more recreational access to SFPUC lands (Natesan, pers. comm. 2011). Since listing, there have been various efforts to increase public access to areas in the general vicinity of the Crystal Springs occurrences of *Hesperolinon congestum* (BayNature 2003; Mercury News 2010; Coastsider 2010). Other than verifying that changes in access to some SFPUC lands have occurred, the effects on *Hesperolinon congestum*, the lack thereof, and/or measures to prevent such effects, were not evaluated further for this 5-year review.

Since listing, there has been some habitat loss at West of Big Rock (#32) due to a new reservoir associated with a movie studio, but with conservation of much more habitat, and other measures required by a formal consultation (FWS 2000). Currently, however, the movie studio intends to conduct second and third future phases nearby, involving various buildings, parking, stormwater, landscape, and creek restoration work. More development, even without actual direct impacts, may indirectly impact *Hesperolinon congestum* through occasional foot traffic, or local atmospheric pollutants. These effects have not yet been evaluated.

Our 1995 listing discussed foot traffic and trash dumping under both Factor A and E; *see* Factor E, below, for discussion of recreational traffic effects.

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

Our 1995 listing speculated that excessive collection or visitation could result from the listing itself. During this review, we noted many references to viewings of *Hesperolinon congestum* or public participation in weeding activities that specifically mention the species' listing status, or other research activities near the species (Table 2). Because these activities are guided and/or monitored, we do not believe that this particular activity is causing a loss of the species. The effect of recreational activities is caused primarily by other forms of foot traffic, and is discussed below under Factor E.

FACTOR C: Disease or Predation

Disease or predation was not mentioned as a factor for this species in the final listing rule. Studies since listing have suggested that moderate grazing can create more favorable conditions

for native serpentine species like *Hesperolinon congestum* by selectively reducing annual grasses, preventing thatch acccumulation, mechanically breaking down the litter and opening canopy, and acting as a net exporter of nitrogen (Weiss 1999, Fenn et al. 2010). Available information for this 5-year review suggests either no impact (at #25 and 26) or a postulated benefit of grazing (at #28 and 32) (Table 2). It should be noted that this effect has been shown for other plant species, or described for serpentinic areas generally, and has not yet been studied for *Hesperolinon congestum*.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, the California Endangered Species Act was not considered to provide adequate protection to the species in their natural habitats.

California Environmental Quality Act (CEQA): The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. 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.

California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA): The CESA (California Fish and Game Code, Section 2080 *et seq*.) prohibits the unauthorized take of State-listed threatened or endangered species. The NPPA (Division 2, Chapter 10, Section 1908) prohibits the unauthorized take of State-listed threatened or endangered plant species. The CESA requires State agencies to consult with the California Department of Fish and Game on activities that may affect a State-listed species and mitigate for any adverse impacts to the species or its habitat. Pursuant to CESA, it is unlawful to import or export, take, possess, purchase, or sell any species or part or product of any species listed as endangered or threatened. The State may authorize permits for scientific, educational, or management purposes, and to allow take that is incidental to otherwise lawful activities. *Hesperolinon congestum* is listed as threatened by CESA.

Furthermore, with regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants to be taken in the process of habitat modification. Where landowners have been notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify the California Department of Fish and Game 10 days in advance of changing land use in order to allow salvage of listed plants. We do not consider salvage to provide adequate protection for these species because transplanting often results in failure due to unknown reproduction and survival requirements of the species and inappropriate or inadequate reintroduction sites.

Endangered Species Act of 1973, as amended: The Act is the primary Federal law providing protection for these species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has been required to analyze the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out

activities that may affect listed species. 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 CFR 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.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. 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). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California's related Natural Community Conservation Planning program. HCPs can only protect plants where they co-occur with animals. During this 5-year review, we did not identify any HCP that includes *Hesperolinon congestum*.

With regard to federally listed plant species, section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed plant species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the "take" of federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits: (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction; and (2) the removal, cutting, digging, damage, or destruction of endangered plants on any other area in knowing violation of a state law or regulation or in the course of any violation of a state criminal trespass law. Federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species.

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 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. 1502.16). These mitigations usually provide some protection for listed species.

However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

Summary of Factor D: In summary, the Endangered Species Act is the primary Federal law that has provided protection for this species since the date of its listing as endangered in 1995. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species separate from the Endangered Species Act.

Since listing, no substantial changes have been made to the above regulations. No additional legal protections are afforded to the species. Accordingly, the threat is the same or similar to the time of listing.

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

Our 1995 listing mentions footpaths as a specific threat to the San Francisco population (#16) and a portion of one population in Edgewood Park (#4 or #17) of this species, and identifies pedestrian and off-road vehicle traffic, hiking and bicycle trails, garbage dumping, and low plant numbers of edaphic specialists, as general effects for all species covered in the listing.

Ground disturbance in serpentine areas from unmonitored casual recreational activities continues to be a threat to the species. For this 5-year review, hiking and biking activity has been mentioned as a potential or actual threat for at least fourteen occurrences (from South to North: #4, 17, 5, 29, 1, 30, 3, 5, 6, 8, 9, 23, 32, 28). We noted references to possible damage related to photographers on foot at Ring Mountain (#9, Buxton, *in litt.* 2010, pers. comm. 2011). At Middle Ridge (#8), unleashed dogs are mentioned to be the main cause of ground disturbance (often by professional dog-walkers), and hiking and bike traffic were also noted (Bittman, *in litt.* 2009a, 2009b; Buxton, *in litt.* 2010, pers. comm. 2011; LSA 2010). This may be a more widespread threat at other publicly accessible occurrences. Previously, human recreational use and unleashed dogs in particular, was believed to be an important threat contributing to a decline in the Presidio occurrence prior to our listing (#16; Halloran 1996). The Town of Tiburon has adopted a management plan which identifies plant trampling and informal trail creation resulting from these informal uses as a threat to all of its open spaces including occurrence #8 (LSA 2010). That plan recommended a variety of measures, however, implementation appears to be discretionary and contingent on funds, not required. Elsewhere, the Presidio occurrence (#16) has since been fenced and foot traffic is likely no longer a threat there. The road expansion threat to #16 mentioned in the CNDDB is probably not a threat today either, but the site remains vulnerable due to its proximity to major roads (and the effect of local atmospheric nitrogen deposition, *see* below).

In our final listing rule, encroachment by native shrubs was identified as a threat to the San Francisco occurrence (#16). During this 5-year review, we noted invasion by native or non-native plants as being specifically mentioned as a threat for twelve of the known occurrences (from South to North: #4, 17, 29, 1, 30, 3, 5, 22,16, 6, 8, 23; *see* Table 2). Atmospheric nitrogen deposition derived from combustion sources like motor vehicles and industry in urban areas may

be enriching otherwise low-nutrient serpentine soils. This may be allowing other native and non-native plant species, such as rye grass (*Lolium spp.*) or wild oats (*Avena spp.*), to invade some serpentine areas and compete with serpentine specialist species such as *Hesperolinon congestum*. Over time, thatch and soil buildup from the invading plants can further enrich serpentine soils. The effect of nitrogen enrichment is believed to vary somewhat with proximity to sources such as freeways. Based on the estimated critical load of 4.5-5.0 kg-N/ha/year for serpentine natives such as *Hesperolinon congestum*, nitrogen is a potential threat to this species throughout its range with the exception of more rural parts of Marin County (Weiss, *in litt.* 2011; Fenn et al. 2010). Another theory mentioned is that local strains of some exotic grasses may have become adapted to survival on the serpentine soils (Natesan pers. comm 2011; Buxton pers. comm. 2011). There are several potential ways described in Fenn et al. (2010) to address this threat involving grazing, mowing, selective herbicides, weeding, and/or fire but these have not, to our knowledge, been tested for specific benefit to *Hesperolinon congestum*.

Studies in the south bay suggest that non-natives have had an effect on other native serpentine plants at Edgewood Park (Weiss 1999), although it has not yet been demonstrated for *Hesperolinon congestum* in particular. During this 5-year review, we noted a variety of other invading/competing species of interest mentioned depending on location including, for example, non-native grasses and other herbs at most locations, star thistle (*Centaurea solstitialis*) and Monterey pine (*Pinus radiata*) in the Crystal Springs area, coastal scrub and chaparral at the San Francisco occurrence (#16), pampas grass (*Cortaderia spp.*) and French broom (*Genista monspessulana*) in Tiburon occurrences (#8), and goatgrass (*Aegilops spp.*) at a central Marin County occurrence (#23) (Table 2). French broom is of special concern because of its ability to fix nitrogen, and fire risk associated with this species. The non-native threat may be even more widespread than documented in CNDDB (2011). Control of french broom and other invasives is done at Old St. Hilary's and Ring Mountain Preserves as well (in the vicinities of #6 and 9, respectively), and for star thistle and medusa-head (*Taeniatherum caput-medusae*) at Mount Burdell (near #25, 26, and a) (MCPOS 2010). However, these invasives have not yet been identified as a threat specific to *Hesperolinon congestum* at these locations. *Avena* has been reported to be expanding within two Tiburon occurrences (#6, 8), is not currently being managed and likely represents a greater specific threat to *Hesperolinon congestum* than French Broom (Table 2; Buxton pers. comm. 2011).

Maintenance activities as a threat were not discussed in our listing rule. During this 5-year review, maintenance as a potential threat was noted at a number of locations and in various forms. Maintenance activities identified since listing included access roads (#4, 1, 3, 30), pipeline maintenance (#22), highway maintenance (#13), disking (#31), herbicide spraying (#13, 28), and "other" maintenance (#1, 3, 30) (Table 2). Maintenance can have a direct effect by disturbing the plants and its habitat, or indirect effects by altering the hydrology/runoff or land stability of a site.

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. For example, preliminary results indicate an increase in average maximum summer air temperature at Golden Gate National Recreation area, located near the Presidio (near occurrences #16 and 20), and a statewide reduction in fog frequency (Madej et al. 2010; Johnstone and Dawson 2010). Summer fog is important to upland coastal vegetation and partly determines the distribution of coastal species due to effects on sunlight, air temperature, and humidity. *Hesperolinon congestum* abundance and flowering period is believed to be affected generally by year-to-year variations in rainfall, so it may be sensitive to climate change. However, there is inadequate information to make accurate predictions regarding its effect on this species at this time.

Low plant number remains a threat to the smaller population size occurrences of *Hesperolinon congestum*. The small areas of these occurrences render them susceptible to extirpation as a result of localized stochastic events or disturbances from threats already discussed.

III. RECOVERY CRITERIA

Recovery is the process by which the decline of an endangered or threatened species is arrested or reversed, and the threats to its survival are neutralized, so that its long-term survival in nature can be ensured. The goal of this process is the maintenance of secure, self-sustaining wild populations of the species. Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that overall threats have been minimized sufficiently, and the species has become robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. In summary, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is an adaptive process that may or may not fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this first 5-year review on progress that has been made toward recovery since the species was listed by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The recovery criteria for *Hesperolinon congestum* are described in our Recovery Plan (FWS 1998). Below, we restate each criterion, the threat factors addressed, the extent to which it is met, and the current relevance to the species' current status and threat:

1. **Secure and protect specified recovery areas from incompatible uses: Occupied habitat or 21 populations representing the range of the species along with adjacent unoccupied habitat and a 150-meter (500-foot) buffer.**

Chapter II of our Recovery Plan further specifies that there should be seven such protected populations in each of the north (Carson Ridge northward), central (Tiburon and San Francisco County), and southern (San Mateo County) portions of *Hesperolinon congestum*'s range, but allows for flexibility in this distribution depending on additional information (FWS 1998). This criterion addresses factors A, B, D, and E. This criterion is still relevant. However, there is insufficient definition in the Recovery Plan of the term "population" or how to apply it to make a finding as to whether the criterion is met. *Hesperolinon congestum* occurs in various forms: (1) small concentrations of plants that sometimes occur as a single isolated patch, as a series of such patches in close proximity; and/or (2) distributed in association with the distribution of serpentine outcrops over a geologic formation over a somewhat wider area (e.g., near Crystal Springs Reservoir). The way in which this plant occurs, and the reporting of its occurrences, varies in such a manner that it cannot be equated to a consistent definition of population. In San Mateo County, for example, there are eight and five polygons in occurrence #3 and 1, respectively. Elsewhere, similarly spaced polygons in Edgewood Park are called separate occurrences (#4, 17). Also, the exact location and number of occurrence polygons can vary between years (Bittman, *in litt.* 2009a; Ramirez, *in litt*. 2011).

Moreover, many of the populations are smaller than the 2,000 individuals which the Recovery Plan states should be targeted, and the 500-foot buffer recommended in the Recovery Plan may not be available due to urbanization around some populations. Finally, the terms "secure" and "protect" were not defined in our Recovery Plan. For the purpose of this 5-year review, an area is considered secured and protected only if it has full and permanent legal protection from incompatible use, such as provided by a conservation easement, or some equally effective permanent protection such as a required term and condition of a formal consultation. Physical protection administered by action (or the prohibition of action), is considered separately under the management criterion.

Based on this interpretation of protection, this criterion has not been met. Although there are 24 occurrences believed to be extant, and many have some level of oversight, very few if any can be considered secured and protected on a permanent basis. Our Recovery Plan mentions a conservation easement only for the Ring Mountain occurrence (#9). Occurrences West of Big Rock (#32) on private land, and south of Nicasio Reservoir (#28) on National Park land, have been covered by Service formal consultations which provide for some oversight and monitoring (FWS 2000, 2001). Portions of SFPUC lands may also be covered by consultations (FWS 2010, 2011). The two occurrences in the Presidio area (#16, 20) are on National Recreation Area land, and despite consistent monitoring and oversight, are subject to some continuing threats (Chasse, *in litt.* 2009, 2011; WEI 2010a), and are not considered stable at this time (Table 1).

As previously discussed, parts of Tiburon occurrences #6 and 8 remain at risk of loss due to proposed developments. A management plan has been adopted to address human use and non-native species threats for that portion of occurrence #8 which is in Tiburon open space (LSA 2010). This plan does include a thorough evaluation of methods and actions, but does not cite a

legal authority which would require their implementation. Based on the iminent development threat, and the apparent discretionary nature of the protections in the management plan, we cannot consider these occurrences secured and protected at this time.

2. Management plan approved and implemented for recovery areas, including survival of the species as an objective; for all populations and any occupied or unoccupied habitat identified as essential to survival.

This criterion addresses listing factors A and E, and is considered up-to-date and still relevant to the species' current status and threats. This criterion has not been met. Since listing, some occurrences have experienced improved management, while others have incurred an increasing level of threat of incompatible use. Most management efforts are a general practice, at best aimed at sensitive species broadly, but are not specific to *Hesperolinon congestum*. The Edgewood occurrences (#4, 17) may benefit from management techniques mentioned in a 1997 Master Plan, such as habitat buffers around sensitive habitat and fencing, however, this plan lacks specific actions related to this species (FWS 1998). Since listing, the SFPUC developed a Peninsula Watershed Management Plan applicable to occurrences on SFPUC lands in the Crystal Springs group (#1, 3, 22, 30) (SFPUC 2004). This plan addresses vegetative management that may benefit rare plants and serpentine grasslands in several policies and actions. As of this 5-year review, many of the actions stated in SFPUC (2004) are not yet fully developed. As discussed above (criterion #1), the Town of Tiburon has adopted a plan, but its implementation is not necessarily guaranteed (LSA 2010).

The extent of implementation and frequency of monitoring and subsequent remedial action was not researched for each plan and action for this 5-year review. Based on our limited review, however, none of the management plans include survival of *Hesperolinon congestum* as an objective, nor do the plans cover all populations of this species, or all occupied or unoccupied habitat necessary for recovery. We found mention of weeding activities being done for at least at least eight occurrences (#4, 17, 29, 16, 6, 8, and unspecified Crystal Springs reservoir and Mount Burdell occurrence(s) or portions thereof; *see* Table 2). Pursuant to formal consultations, the Service reviewed grazing management activities for one major occurrence which included monitoring and grazing assessment (#28), and we conditioned a movie studio development on various conservation and protection measures of another occurrence (#32). From this 5-year review, it appears that the proposed (and hence required) measures for the West of Big Rock occurrence (#32) have been or are being implemented (WRA 2009; Wall, *in litt.* 2009), however, we could not verify that the proposed measures for #28 had been implemented (E. Hamingson, National Park Service, *in litt.* 2011). Taken together, we could not verify that existing plans are being fully implemented, that their implementation is required, nor that they cover all occurrences and habitat deemed essential for recovery.

3. Population monitoring in specified recovery areas shows stable or increasing plant numbers for a period of 20 years that include the normal precipitation cycle (or longer if suggested by the results of demographic monitoring).

This criterion addresses listing factors A, C, D, and E. It is still relevant, but lacks sufficient definition of the term "stable" and how it would apply to this species, to make a finding. This is

because the species can vary considerably in area and plant number with the amount of rainfall. There may not be a reasonable expectation of much constancy or increase in plant numbers due to the large variations in precipitation between years, as reflected by the population estimates summarized in this review (Table 1). Additional refinement of this criterion, possibly taking into account long term responses to precipitation, appears to be in order.

There is sufficient information to conclude that this criterion is not yet met. Foremost, this is because there has been very little consistent monitoring at all (except for #16 and 32), and it has not been 20 years since publication of the Recovery Plan. There have been a variety of qualitative and semi-quantitative descriptions throughout the species' range, but these are insufficient to make a finding with respect to whether the species is exhibiting normal variation in abundance or is being threatened further, since listing.

IV. SYNTHESIS

At the time of listing, *Hesperolinon congestum* was known from 14 populations. Today, we believe there are 24 extant occurrences; this includes five additional occurrences, one a re-introduction to a formerly extirpated area (#20). Two CNDDB reports of populations presumed extant are deemed unreliable at this time due to age or location information (#10, 11), and one other population which we have considered extant may already have been lost due to development (#21). The one re-introduction attempt has thus far had marginal success. Some of the newly reported occurrences are near existing groups. Because of the absence of prior negative surveys, we cannot consider these new occurrences to represent an expansion of the species' range. These occurrences may have always existed, but were revealed by the increase in observation and reporting in the 16 years since listing. Throughout the species' range, non-native (and native) plant encroachment, possibly facilitated by atmospheric nitrogen deposition, as well as various recreational activities, continue to be pervasive threats. These threats are a consequence of adjacent urban development or activities, lack of management, or incomplete management. There appears to be some level of recent threat management activity, whether or not a management plan is in place. The existence of a management plan, however, does not ensure that actions are being funded and implemented, and the extent to which management measures have been effective in protecting this particular species is unknown.

The threat of development continues, both in the form of potential irretrievable loss of serpentine habitat due to proposed new developments, as well as the effects of adjacent existing development in terms of atmospheric nitrogen deposition and human use. Most of the serpentine habitat associated with this species (~300 of 349 acres; Table 2) is on public land which does not appear to have changed since listing. A little more than half the occurrences have had any monitoring within the last five years. Most of this monitoring information, both for populations as well as for threats, is qualititative and largely based on casual observation. Such limited information is insufficient to identify a long term trend in population size, area, species distribution, or related threats. However, the census data for the larger occurrences suggests that the species seems to be doing well in those locations, at least in wet years (Table 1).

Based on this 5-year review, we have determined that there are insufficient assurances that all areas essential to the recovery of *Hesperolinon congestum* have been secured and protected, and

are being managed, to avoid threats. There is also insufficient information to make a finding of population stability of the species. Accordingly, we believe that *Hesperolinon congestum* still meets the definition of a threatened species, and recommend no status change at this time.

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

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Secure and protect all occurrences and potential (unoccupied) serpentine grassland habitat necessary for recovery of *Hesperolinon congestum* on SFPUC lands in the Crystal Springs group (as previously mentioned, our Formal Consultation applies only to a portion of the occurrences, *see* FWS 2011). The conservation easements, together with a comprehensive and complete management plan, should be sought to permanently protect all occurrences and potential habitat from future habitat loss due to changes in land use. The management plan should include provisions for monitoring, actions as necessary to quantify and address threats of non-native species encroachment, and means to resolve foreseeable potential conflicts created by human use or operations and maintenance activities.

2. Secure and protect to the maximum extent practicable, all occurrences and potential (unoccupied) serpentine grassland habitat necessary for recovery of *Hesperolinon congestum* at the St. Hilary's Church (#6) and Middle Ridge (#8) locations. In addition to recreational and non-native plant threats, portions of these sites are believed to be iminently threatened by potential conversion to housing developments. Avoidance of any loss is the preferred strategy. Permanent conservation easements should be sought to preclude future loss. One venue for Service participation would be during consultations pursuant to issuance of a permit from the Corps under CWA Section 404. Additionally, there need to be assurances that management, including regular monitoring and corrective action, will be timely implemented as needed to address other primary threats of non-native vegetation and human passive use. Reported adverse human impacts from recreational uses (primarily dog-walking; other uses mentioned include hiking, biking, photography, horse-back riding, photography) to this species or its habitat should be investigated, monitored, and prevented by necessary means, including restricted use/entry where other means have proven ineffective.

3. Surveys should be conducted at least once (preferably more often) in this next five years at all known locations of *Hesperolinon congestum*. In order of priority, surveys should be done for the 10 sites for which this review found no observational information at all in the last five years (#17, 5, 1, 30, 3, 21, 22, 31, 23, and 28), the non-CNDDB site (a), and all other sites. A survey protocol should be developed, which will ideally allow detection of the peak flowering period, a reasonable estimate of population area and size, photodocumentation (of entire area, and close-ups of plant forma), establishment of reproduceable photo points, and a rapid assessment of the extent of visible threat factors of human-caused ground disturbance, and non-native/native species invasion.

4. Assess the effectiveness of one or more weed control measures on *Hesperolinon congestum*. This may involve comparing weed densities in areas (occurrence area and adjacent buffer) which are controlled for weeds versus those which are not, or evaluating a chronosequence before, during, and after weed control measures; or comparing different measures. For example, where grazing is used, a study might seek to establish empirical relationships between the control measure (e.g., grazing or grazer density) and weed densities, and the response by *Hesperolinon congestum* (or lack thereof).

There are a variety of other key needs for the recovery of this species mentioned in our Recovery Plan, including: (1) studies of effects of vegetation management practices (grazing, burning, herbicide), fertilizer, and runoff; (2) demographic studies such as soil seed bank, and other reproductive features (mating system, pollination); and (3) surveys of potential habitat to identify new populations. Surveys of potential habitat could also be useful to identify candidate unoccupied serpentine areas for enhancement (i.e., usually tree/scrub removal) and outplanting. Population genetic studies could be done to determine the extent of differentiation throughout the species' range, and how this compares to phenotypic variation noted between populations (e.g., Smith, *in litt*. 2011a). These studies may be useful to select outplanting material should unoccupied restoration sites be identified. If such studies are warranted, collection and preservation of material for genetic study could be done at the same time of population surveys (recommendation #1, above). As mentioned elsewhere in this review, there is also an outstanding need to refine the recovery criteria in order to objectively assess population number and stability. These actions and others listed in our Recovery Plan may be essential for recovery of the species, but may require additional information and analysis to prioritize and implement. Based on this five year review, the above-recommended four measures are aimed at providing the most immediate of information and threat reduction needs.

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

Hesperolinon congestum (Marin Dwarf Flax)

Current Classification:

Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Steven Schoenberg, Sacramento Fish and Wildlife Office

Date Submitted to Region 8: _____

FIELD OFFICE APPROVAL:

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

Approve _____ Date 8 Sept 2011

APPENDIX: LARGE TABLES PREPARED FOR 2011 5-YEAR REVIEW OF *HESPEROLINON CONGESTUM* (MARIN DWARF FLAX)

Table 1: Population information for *Hesperolinon congestum* (Marin Dwarf Flax) prepared for 2011 5-year review.

Table 2: Threats, estimated area, and protections/management of extant occurrences of *Hesperolinon congestum* (Marin Dwarf Flax) prepared for 2011 5-year review.

Table 1. Population information for *Hesperolinon congestum* (Marin Dwarf Flax) prepared for 2011 5-year review.

Occurrence				first report	other CNDDB report	last other report	years since last report	census data and other observations; blank = no report; other notations = visited, for symbol definitions, see footnotes (below) and reference notes (right column)																											references/notes other than CNDDB 2011
	trend	name	#					1981	1983	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
SAN MATEO COUNTY																																				
Edgewood-Woodside Group																																				
	unk	Edgewood West	4	1983	2004	2010	1		pr		800						2,000					pr							>1,500					*	**	Correlli *in litt.* 2009; *"present", Shell *in litt.* 2009, Niederer *in litt.* 2009; **"fewer now" (than in 1992), Niederer *in litt.* 2011
	unk	Edgewood East	17	1983	2004		7		3,000			30-50p					900												>4,000							Correlli *in litt.* 2009
	unk	Woodside	5	1979	1986		25	1,000-1,500			175																									
	new	Stulsaft Park	29	2007			4																									500				new discovery since listing
	ext	Canada College	18	1979							0																									extirpated prior to listing; 1/2 site remains undeveloped
Crystal Springs Group																																				
	unk	Crystal Springs1	1	1981	2001	2010	1							1000+p		1,100									5000*	pr					640p*		13 *****		100's,p ****	*ESA (2010); **Foree *in litt.* 2009; ***"1000s if not tens of 1000's on eastern shore of lower crystal springs and at Pulgas Ridge", includes #1, 30, 3, Niederer *in litt.* 2011 (polygon-specific counts in Ramirez *in litt* . 2011);****Craven-Green 2010, cited in FWS 2010; *****ICF 2009
	unk	Crystal Springs2	30	1989	2001	2009	2							300											2,486	160										
	unk	Crystal Springs3	3	1940	2001	2009	2						>15,600							10,300	5,170				586	1,230								10,000 ***, **		
	ext	Crystal Springs4	2	1961																																extirpated before listing; site developed
	?	Hillsborough	21	1987			24					44																								site location looks developed on GIS, possibly extirpated
	unk	Polhemus Road	22	1988	2001		10						57												143	54										
	new	Hillcrest	31	2003			8																					200								
SAN FRANCISCO COUNTY																																				
San Francisco Group																																				
	unstab	Presidio	16	1965	2008	2010	1			6,600		150								996	347	182	187	172	87	62	66		1559	1293	401	1320	1,086	226	569	censused annually; Chasse *in litt.* 2009, 2011
	ext	Laurel Hills	14	1892	1912																															extirpated before listing; site developed
	ext	Lone Mtn	15	1877																																extirpated before listing; site developed
	new/ reintr	Inspiration Pt	20	1985		2011	0			1																				70*			170*		**	habitat still exists; *from 2003 seed, **from 2009 seed/plugs - very low number noted (Niederer *in litt.* 2011; Niederer and Weiss *in litt.* 2010)
MARIN COUNTY																																				
Tiburon Group																																				
	unk	St. Hilary's Church	6	1954	1998		13				250											16	100's													
	unk	Middle Ridge	8	1951	2004		7								1,875p										200p	12p			0p							
	unk	Ring Mountain	9	1961	2006	2010	1				5,000												1000's								pr	*	var*,**	*	***	***"very good year" countywide included this site, Smith *in litt.* 2011b; **"did amazingly well" countywide included this site, Smith *in litt.* 2009; *2007-"millions", 2008-"hardly any",2009-map only, Buxton *in litt.* 2010.
	unrel	Marin Day School	10	1961	1986		25				0																									CNDDB 2011 notation suspects location misreported
X	unrel	San Rafael	11	1880's			130																													old; 1 mile location uncertainty
Central Marin Group																																				
	unk	Alpine Lake North	23	1990	1997	2002	9								1000's*		242					2,951					135p									Springer *in litt* 2003
	unk	Carson Ridge	12	1948	1998	2008	3				75												pr										**			*#12, 23 combined estimate for 1990;**CNPS 2009 (species list only)
	unk	Big Rock Ranch S	13	1935	1994	2010	1										<50		pr						*								**	***	***	*"numerous" Wall *in litt.* 2009; **"did amazingly well" county wide included this site, Smith *in litt.* 2009; ***"very good year" countywide included this site, Smith *in litt.* 2011b.
	new/ stable	West of Big Rock	32	1999	2000	2009	2																	75p	20,000*			*19,000	*14,350	*18,524	*5,303	*9,752		*8,177		*WRA 2009; 200,000 yr 2000 estimate in CNDDB (2011) deemed typo error (Fraser *in litt* . 2011)
	unk	S of Nicasio Res.	28	1995	2001	2010	1													438					>4,895p	650p							*present all years; **est. 10,000-100,000			*Chasse *in litt.* 2009 **Chasse *in litt.* 2011
Mount Burdell Group																																				
	unk	N of Fire Road	25	1993		2010	1											100+															*	**	**	*litt.* 2009; **present 2009, very good 2010, county wide
	unk	N of Saddle Marsh	26	1993		2010	1											100+															*	**	**	
	new	unspecified	a	~2009			2																											*		*Smith *in litt* . 2011b, year of discovery unspecified, not examined in 2010

Footnotes:

new = reported since listing; no trend evaluation possible	# = numbers are CNDDB element occurrence numbers; occurrence "a" was found in this 5-yr review but is not yet reported to CNDDB
unk = trend not evident	X = no group association; isolated occurrence between groups
? = possibly extirpated but considered extant for this 5-yr review; groundtruthing needed	p = partial census
reintr = reintroduced to formerly extirpated location	pr = present, CNDDB report, no census
stable = considered stable population in this 5-yr review for census period	*,**,*** = present, qualitative non-CNDDB observation; see reference/notes
unstab = considered unstable population in this 5-yr review for census period	var = variable, potentially conflicting observations; see reference/notes
ext = extirpated	unrel = considered unreliable; not counted as extant in this 5-yr review

Table 2. Threats, estimated area*, and protections/management of extant occurrences of *Hesperolinon congestum* (Marin Dwarf Flax) prepared for 2011 5-year review.

*Area estimate based on CNDDB 2011, or minimum 0.1 acre for point occurrences

name	Occurrence	Ownership/	Estimated	Threats Summary	Protections/Management Summary
SAN MATEO COUNTY	#	management	Area (acres)		
Edgewood-Woodside Group					
Edgewood West	4	County	0.1	proposed (?) bench (CNDDB 2011); rye grass "starting", research activities nearby, PG&E access road upslope (Corelli *in litt.* 2009) vs. non-natives may not even be a threat (Niederer *in litt.* 2009); rye grass (Fenn et al. 2010)	
Edgewood East	17	County	2	trail use, trail not fenced (CNDDB 2011) vs. area is fenced from nearby trails (Corelli *in litt.* 2009); PG&E pipeline nearby (Niederer *in litt.* 2011; Shell *in litt.* 2011b); non-native grasses beginning to come in (Corelli 2009)	Non-native weeding occurs (WEI 2010b; Niederer *in litt.* 2011); effectiveness/need unknown
	Edgewood generally			non-native and native competition, thought is related to nutrients, global warming (Shell 2009); atmospheric nitrogen and rye grass (Weiss 2006; Fenn et al. 2010)	Within Edgewood Park; has 1997 master plan (FWS 1998), but resultant management/effectiveness/assurances unknown; timed mowing, weeding (Shell *in litt.* 2011a)
Woodside	5	Private	5	development, lack of fencing, dumping, erosion, runoff, (CNDDB 2011)	mitigation for listed Bay Checkerspot butterfly (CNDDB 2011, not verified)
Stulsaft Park	29	Redwood City	0.1	non-natives, off-trail use (CNDDB 2011)	Within a Redwood City park; Non-native weeding occurs (Acterra 2011); effectiveness/need unknown
Crystal Springs Group					
Crystal Springs1	1	SFPUC	88	For all Crystal Springs occurrences on SFPUC lands: trail use (bike, foot), new trails, non-native plant competition (esp. star thistle); two small (<0.1 ac) populations within this occurrence are 5-20 ft from pending CSSA upgrade project; likely impacts to be mitigated (see protections/management summary)	For all Crystal Springs Occurrences on SFPUC lands: has some de facto protection from development being on land managed by SFPUC, but other threats continue (FWS 2011); limited(?) conservation easements currently under negotiation with FWS (SFWO) to provide in perpetuity weeding, defined limits for SFPUC actions (infrastructure, maintenance), but not in place yet; some limited hand pulling/spot herbicide treatment of star thistle is already being done (Ramirez *in litt*. 2011); watershed management plan includes protective polices for serpentine grassland species, actions under development (SFPUC 2004); Effects of pending small project on #1 to be mitigated by enhancement of potential habitat at Boat Ramp Fountain Thistle Habitat location by removal of Monterey Pine, weeding (FWS 2010)
Crystal Springs2	30	SFPUC	6	access road construction/maintenance, other operations/ maintenance, reservoir enlargement, (FWS 2010, CNDDB 2011)	
Crystal Springs3	3	SFPUC	37		
Polhemus Road	22	SFPUC	0.1	pipeline work, trail, trash, non-natives (esp. star thistle)	
Hillsborough	21	Private	0.1	development, erosion (CNDDB 2011)	"may be" set aside open space (CNDDB 2011), unverified in this 5-yr review
Hillcrest	31	County	0.1	"disking" (CNDDB 2011); noted nearby development on GIS (this review)	County land may offer some protection; no other information
SAN FRANCISCO COUNTY					
San Francisco Group					
Presidio	16	NPS	0.1	non-native grasses and trees, native shrubs, roadway proximity (Chasse *in litt.* 2009); road expansion (CNDDB 2011)	National Park; native shubs removed, grass/forbs handweeded (Chasse *in litt.* 2009);
Inspiration Pt.	20	NPS	0.1	mowing during bloom period (formerly, Niederer *in litt.* 2011)	National Park; unspecified restoration measures; outplanting (WEI 2010a, Niederer *in litt.* 2011; Niederer and Weiss *in litt.* 2010)
MARIN COUNTY					
Tiburon Group					
St. Hilary's Church	6	Private/MC open space	68	hiking; development (CNDDB 2011); non-natives (MCPOS 2010), esp. *Avena* (Buxton *in litt.* 2011)	Invasive non-native removal (French broom/jubata grass, MCPOS 2010); historical site wildlife preserve; part(?) Marin County open space, CNDDB (2011)
Middle Ridge	8	Private/Tib. open space	50	development, trampling (CNDDB 2011); off-leash dogs (Bittman *in litt.* 2009b), non-natives (Buxton *in litt.* 2010), esp. *Avena* (Buxton *pers. comm.* 2011); trail damage/trampling by dog-walking mainly, also photography/ hiking/biking (Bittman *in litt.* 2009a; Buxton *in litt.* 2010, *pers. comm.* 2011; LSA 2010)	Invasive non-native removal (broom, pampas grass, Montery pine), and various passive recreational use actions as part of management plan with measures recommended prepared, but appears discretionary (LSA 2010) and may be limited to Tiburon open space; actions on private portion unknown. Pampas/jubata grass removal (MCPOS 2010)
Ring Mountain	9	MC open sp.	24	foot traffic ("photographers") (Buxton *in litt.* 2010)	TNC conservation easement (CNDDB 2011); Marin open space manages
Central Marin Group					
Alpine Lake North	23	MMWD	18	trail maintenance, trail use (bike , foot), non-natives (goatgrass) (CNDDB 2011)	Marin MWD owner/manager may limit land use changes
Carson Ridge	12	MMWD	0.1	no information	Marin MWD owner/manager may limit land use changes
Big Rock Ranch S	13	County	0.1	highway maintenance, roadside spraying	no information, but Marin County owns
West of Big Rock	32	Private	28	erosion (due to grazing, pedestrians) (CNDDB 2011); FWS (2000) identifies new reservoir loss, potential grazing benefit	Conservation measures required under FWS (2000), include 40+ acre permanent conservation easement, grazing management, monitoring, and signage
S of Nicasio Res.	28	NPS	22	erosion/trampling (due to grazing) (CNDDB 2011; FWS 2001); potential grazing benefit, herbicides (FWS 2001)	National Recreation Area; proposed annual monitoring/assessment of grazing impact required under FWS (2001) could not be verified (Hamingson *in litt.* 2011); GGNRA does presence/absence only here (Chasse *in litt.* 2009).
Mount Burdell Group					
N of Fire Road	25	County	0.1	no observable negative impact (light grazing) (CNDDB 2011)	Invasive non-native control (star thistle, medusa-head) in Mount Burdell area generally (MCPOS 2010)
N of Saddle Marsh	26	County	0.1	no observable negative impact (light grazing) (CNDDB 2011)	
	a	County	0.1	no specific threats information	
	Total estimated area (ac) =		349.2		