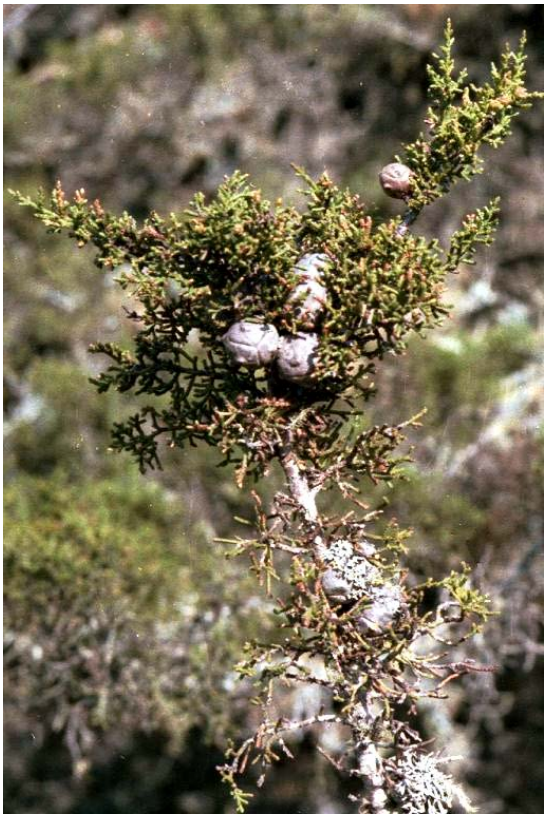
Hesperocyparis [=*Cupressus*] *goveniana*
Gowen cypress

5-Year Review:
Summary and Evaluation



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U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
Ventura, California

March 2012

5-YEAR REVIEW
***Hesperocyparis* [=*Cupressus*] *goveniana* (Gowen cypress)**

I. GENERAL INFORMATION

Purpose of 5-year Review:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (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, 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:

Hesperocyparis goveniana is a small coniferous tree in the cypress family that occurs in Monterey pine forest and maritime chaparral habitats. It is sparsely branched with a wide crown, and its foliage is composed of light-green scale-like leaves. Female cones are serotinous, only opening to release seeds when exposed to very high heat or fire. *Hesperocyparis goveniana* is currently found in only two stands. The largest stand (Del Monte Forest) is near Huckleberry Hill on the west side of the Monterey Peninsula on lands owned by the Pebble Beach Company and the Del Monte Forest Foundation. The second stand (Point Lobos) occurs approximately 10 kilometers (6 miles) south of the Huckleberry Hill stand on the north side of Gibson Creek inland of the Point Lobos Peninsula, and is on land owned by the California Department of Parks and Recreation (Service 2004). *H. goveniana* was listed in 1998 due to continued urban development near the stands; such development reduces the opportunities for ecosystem processes, such as periodic fire that is needed for stand regeneration.

Methodology Used to Complete the Review:

This review was carried out by staff of the Ventura Fish and Wildlife Office. Information was collected from a variety of sources including: online data, published and unpublished literature, personal communications with experts in the field, and direct field observation. At the time of listing, this plant was recognized as *Cupressus goveniana* ssp. *goveniana*. In 2006, the name of the genus for this taxon reverted to *Callitropsis*, and the taxon was re-recognized as a full species

rather than a subspecies. In 2009, the species name was revised to *Hesperocyparis goveniana*, to reflect recent findings in genetic studies. For this review, we will use the currently recognized name for the taxon, *Hesperocyparis goveniana*, rather than the name under which the species was listed, (*Cupressus goveniana* subsp. *goveniana*) or the name used in the last 5-year review (*Callitropsis goveniana*).

Contact Information:

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Federal Register Notice Citation Announcing Initiation of This Review:

On May 25, 2011, the U.S. Fish and Wildlife Service (Service) announced initiation of the 5-year review for this taxon under the name *Cupressus goveniana* ssp. *goveniana* and began a 60-day request for information from the public regarding the species' status (Service 2011, 76 FR 30377). No information was received as a result of this request.

Listing History:

Original Listing
FR notice: 63 FR 43100
Date listed: August 12, 1998
Entity listed: subspecies (*Cupressus goveniana* ssp. *goveniana*)
Classification: threatened

Associated rulemakings: None

Review History: The status of *Hesperocyparis goveniana* was reviewed during preparation of the Recovery Plan for this species (at the time referred to as the subspecies *Cupressus goveniana* ssp. *goveniana*), which was approved in 2004, and in the previous 5-year review (referred to as *Callitropsis goveniana*), which was published in March 2008. The 5-year review published in March 2008 resulted in a recommendation for no change to the listing classification of threatened.

Species' Recovery Priority Number at Start of 5-Year Review: The previous 5-year review adjusted the recovery priority number from 9C to 8C on a scale of 1 to 18; this reflected the change in taxonomy from a subspecies to a species. This number, 8C, indicates a species under a moderate degree of threat that has a high potential for recovery. The letter C indicates that there is some degree of conflict from construction or other development projects.

Recovery Plan or Outline:

Name of plan or outline: *Recovery Plan for Five Plants from Monterey County, California*

Date issued: August 18, 2004

Dates of previous revisions, if applicable: No revisions have been made.

II. REVIEW ANALYSIS

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

The Endangered Species Act of 1973, as amended, defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

Updated Information and Current Species Status

Taxonomy and Genetics

Hesperocyparis goveniana is a small coniferous tree in the cypress (Cupressaceae) family. It is sparsely branched with a wide crown, and its foliage is composed of light-green scale-like leaves. It generally reaches a height between 5 and 7 meters (17 to 23 feet) (Munz and Keck 1959), though James Griffin noted one individual at a height of 12 meters (40 feet) at Huckleberry Hill (Griffin and Critchfield 1976). *Hesperocyparis goveniana* is distinguished from its close relative pygmy or Mendocino cypress (*H. pigmaea*) by its much taller stature, the lack of a long, whip-like terminal shoot, and light to yellow-green rather than dark dull green foliage (Bartel 1993).

Based on genetic analysis completed since listing, the taxon was recognized as a full species (Bartel *et al*. 2003; Adams *et al.* 2009). In a 2006 review of Old World and New World cypresses, data from anatomy, biochemistry, micromorphology, reproductive development, reproductive morphology, and vegetative morphology were combined with molecular sequence data and used to revise their taxonomy (Little 2006). In doing so, the genus name for *Cupressus goveniana*, along with other *Cupressus* taxa, was revised to *Callitropsis.* In response to an argument by Debreczy *et al.* (2009) that the genus name *Callitropsis* should not be applied to the western hemisphere cypresses, but was a monotypic genus of *Callitropsis nootkatensis*, Adams *et al.* (2009) sequenced three nuclear gene regions and one chloroplast gene region from the disputed taxa. From the results of this research, in 2009, Adams *et al*. described a new genus for the western hemisphere cypresses, *Hesperocyparis* -- hence the current name *Hesperocyparis goveniana*. The taxonomic revision, published since listing, changes the listed entity from subspecies to full species in a different genus, but does not alter the definition, distribution, or range of the taxon from what it was at the time of listing.

Genetic diversity measures that would classify an individual, population or species compared to other individuals, populations or species (Prasanna 2005) are unknown since no examination of genetic diversity between populations or within each population has been undertaken. However, there are genetic studies for several congeneric species (*i.e.*, species sharing the same genus) with similar distribution to *Hesperocyparis goveniana* or that occur in close proximity to the species, including tecate cypress (*H. forbesii*) and Monterey cypress (*H. macrocarpa*) (Kafton 1976, Conkle 1987, Truesdale and McClenaghan 1998). Studies from the two congeneric species demonstrate that genetic differentiation over short spatial scales is possible within the genus. The different soil types and vegetation associations of the two populations give further suggestion that there may be genetic differences. Additionally, there may be significant genetic differentiation among some stands within populations, particularly where *H. goveniana* grows in two differing habitats (mixed pine or chaparral) in the Point Lobos population. In general, different populations of a species should be managed as genetically distinct because they are likely adapted to slightly different environments within the area they occur (Rogers 2004, Frankham *et al.* 2002).

Life History Characteristics

Hesperocyparis goveniana is a long-lived species (85-127 years) that exhibits recruitment in pulses after stand-replacing fires (Doak *et al.* 2000). The species achieves pollination by wind; natural seed dispersal occurs during September and October, although seeds are not light enough to be carried far from the parent plant (Sudworth 1967). *H. goveniana* also needs light and bare mineral soils for seedling establishment, and seedling mortality is higher due to fungal infections in areas with herbaceous cover (Vogl *et al.* 1988). Female cones are subglobose (not quite spherical), 10 to 15 millimeters (0.4 to 0.6 inches) long and bear 90 to 110 dark brown to black seeds (Bartel 1993). Female cones are also serotinous, only opening to release seeds when exposed to very high heat or fire, and cones may be produced on a tree as young as four years of age (Wolf and Wagener 1948). These adaptations are typically associated with plants that grow in areas that have frequent fires (Vogl *et al.* 1988).

Distribution

Hesperocyparis goveniana is only known from two locations in coastal Monterey County, California, and the two populations are located approximately 6.4 kilometers (4.0 miles) apart (see map in Appendix). One population is located on Huckleberry Hill in the Del Monte Forest on the Monterey Peninsula, and covers approximately 40 hectares (100 acres) (Service 2004). The stand is on lands owned by the Pebble Beach Company and the Del Monte Forest Foundation. A large portion of the Del Monte Forest stand is within a 34 hectare (84 acre) area designated by the Pebble Beach Company as the Samuel F.B. Morse Botanical Reserve and donated to the Del Monte Forest Foundation in 1976. The second population is located on Point Lobos Ranch, a unit managed by the California Department of Parks and Recreation (State Parks) on the inland side of Highway 1, and covers 8 hectares (19 acres). Both populations are on lands designated as permanent open space for preservation of native habitat. Even though *H. goveniana* is wind-pollinated, we believe that the two populations are biologically isolated because of the distance between the populations, and the fact that the two populations are not in alignment with each other and the prevailing northwesterly winds.

It is widely believed that during the last glacial era, the temperate coastal climate was more favorable for cypresses and other conifers; increasing aridity since then probably accounts for the restriction of cypresses and other species to a few coastal sites (Vogl *et al.* 1988). No records exist that document the historical extent of the two populations. The last major loss of *H. goveniana* was in the early 1980s, before the species was listed, when approximately 840 trees were cut in the Del Monte Forest stand for construction of the Poppy Hills Golf Course (Service 2004).

Habitat Characteristics

The species generally occurs in pygmy forest and maritime chaparral habitats (Jones and Stokes Associates 1996). Both of these habitat types are represented in the Point Lobos population (Doak *et al.* 2000). The tree may also occur in pure stands or in mixed stands with Monterey pines (*Pinus radiata*) or Bishop pines (*P. muricata*) (Griffin and Critchfield 1976). Frequently an understory of chaparral shrubs is also present with *Hesperocyparis goveniana*. It survives best in full sunlight on bare mineral soils with no plant cover or litter, and reproduction is generally restricted to burned areas (Vogl *et al.* 1988).

The species is adapted to shallow Cieneba or podzolic soil types, underlaid by a shallow hardpan soil (Vogl *et al.* 1988). Specific adaptation to these soils, which exhibit severely reduced nutrient availability, precludes establishment by other local tree types. This adaptation essentially restricts the species to two small islands of historical habitat on the Monterey coast. Within the pygmy forest on the Monterey Peninsula, *Hesperocyparis goveniana* occurs where claypan or hardpan soils are shallow, acidic, strongly leached, and poorly drained (Griffin and Critchfield 1976; Jones and Stokes Associates 1996). The Point Lobos stand occurs on Cieneba soils on the inland granitic bedrock geologic formation (Jones and Stokes Associates 1996). While *H. goveniana* can grow in a variety of habitats with minor disturbances, it apparently requires mineral soil surfaces and unshaded conditions for successful recruitment (Doak *et al*. 2000). These soil surfaces tend to be podzolic, stabilized sand dunes with a caliche-like, impermeable layer (M. Stromberg *in litt.* 2002).

Recruitment rates for the species are extremely low in maritime chaparral habitat due to the high density of vegetation and the intolerance of this species to germinate in a shaded environment (Doak *et al.* 2000). Recruitment is higher, but still low, in mixed conifer habitat (Doak *et al*. 2000). This recruitment effect is reflected in the age distributions within these habitat types. The age of trees in chaparral habitat are skewed toward much older age classes, while the trees in the mixed conifer habitat, where recruitment is higher, exhibit a much broader age distribution (Doak *et al.* 2000). The effect on overall population numbers of these recruitment rates is unknown, and more research would be needed to draw any definitive conclusions about potential increases or declines.

The Role of Fire in Regeneration and Recruitment

Although there is only general information available on the phenology and seed production of this species, observations indicate that cones open and release seeds in response to intense heat, such as fire or during periods of hot, dry weather. A catastrophic disturbance event, such as fire, is generally unpredictable, large in scale, and will usually result in an entire stand or large portions of a stand being replaced after a single disturbance event and thus result in an even-age

structure in the next forming stand. The mass synchronized openings of the serotinous cone type observed during catastrophic disturbance events are likely a critical part of the natural regeneration process for this species and indicates that this is a fire-adapted species. This synchronized seed dispersal ensures that many parent trees will contribute seed to the freshly-cleared podzolic soils required by *Hesperocyparis goveniana* for seedling establishment, and lead to the prolific post-fire recruitment observed in this species (Doak *et al*. 2000, Jones and Stokes Associates 1996, Vogl *et al*. 1988).

An additional regeneration technique, known as fine-scale gap-phase regeneration, is generally characterized by recruitment in gaps, often caused by treefall, and is occurring at a small scale within the Del Monte Forest population. This recruitment strategy is common in communities that have attained compositional equilibrium and often result in a mosaic of gap, building, and mature phases. It is likely that limited fine-scale gap-phase regeneration occurs in areas bordering pure stands where more nutrient-rich soils allow Monterey and Bishop pines to grow. Occasional losses of large individual pines from road cuts or treefall will allow establishment of *Hesperocyparis goveniana* individuals. Currently the only observable *H. goveniana* seedlings occur on road cuts in the Del Monte Forest (Figure 1), where the disturbed substrate allows for opportunistic establishment (K. Barry, Service biologist, pers. obs. 2011a). Within the Point Lobos Ranch, however, severe erosion on the road cuts precludes the possibility of seedling establishment until a time when top soil can be replaced. It is likely that this sort of recruitment, in infrequently occurring light gaps, is opportunistic rather than the standard type of regeneration for this species.

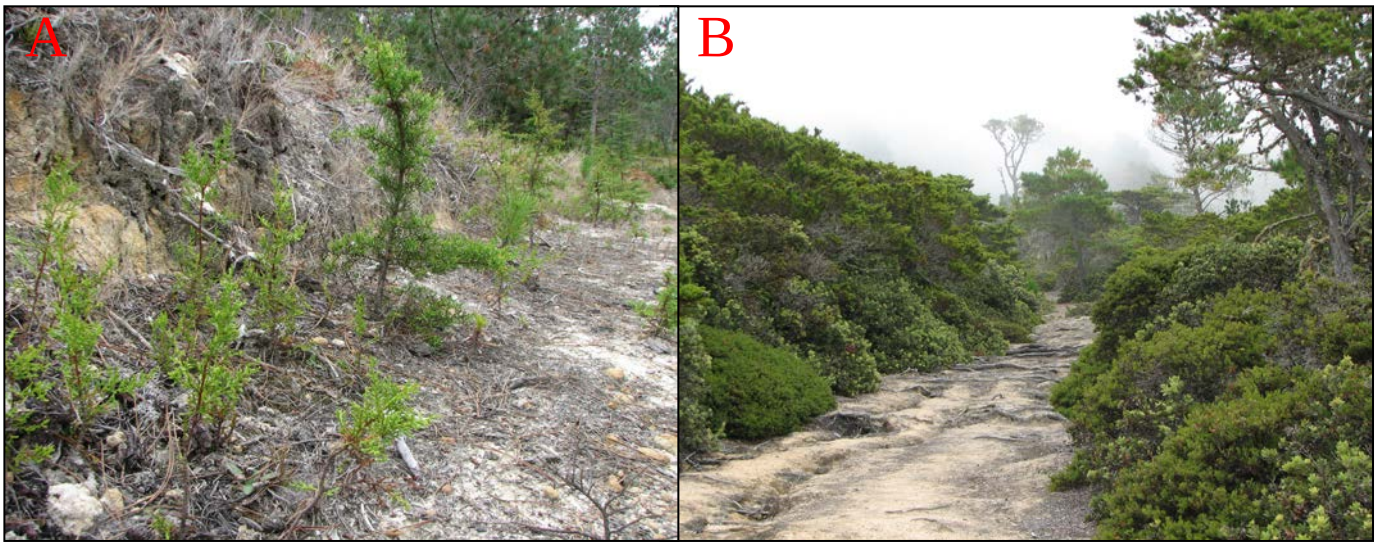

Figure 1: Image A shows *Hesperocyparis goveniana* seedling establishment on a road cut in the Del Monte Forest. In contrast, Image B shows erosion on the road cuts within Point Lobos Ranch, which prevents *H. goveniana* from establishing. Photos by Kirstina Barry.

At least three fires have burned within the Del Monte Forest population of *Hesperocyparis goveniana* since 1901 (Service 2004). Additionally, human driven disturbance in the form of

tree cutting, recreation, and road and trail formation have removed individual trees at irregular intervals. As a result of this irregular disturbance, there is a broad range of tree ages and vegetation densities within Del Monte Forest. Areas within this population where surrounding vegetation density is low due to recent disturbance--specifically road cuts--exhibit high levels of recruitment of this species (K. Barry, pers. obs. 2011a; C. West, Service biologist, pers. obs. 2007). Further evidence for the catastrophic disturbance model of regeneration is provided by the age structures of *H. goveniana* in the Point Lobos area (Doak *et al.* 2000). While some variation in age was found in individuals in the bordering mixed conifer areas, the majority of individuals were of only two age classes, indicating two separate catastrophic disturbance events.

Considering that this species relies on catastrophic fire disturbance, which is a large, stand-replacing disturbance event, utilizing a gap-phase program that focuses on replacement of individuals to manage *Hesperocyparis goveniana* populations may be less effective. The morphological traits exhibited by this species (serotiny, small tree stature, rapid production of cones, shade intolerance, and even-aged stands) indicate evolution under natural successional cycles driven by fire and the high likelihood that this species has evolved to germinate, grow, and reproduce as a stand (California State Parks 1979, Perry and Lotan 1979, Johnson and Gutsell 1993, Enright *et al.* 1998). Such disturbance regimes, and the resulting stand growth patterns, are not uncommon and must be considered in order to design effective management strategies that will achieve the recovery goals of healthy stands and sustainable populations. It is likely that the best management tool to achieve "abundant natural regeneration," as called for in the Recovery Plan, would be to initiate partial stand replacement via controlled burns as disturbance events in 50- to 85-year cycles, as suggested by Yadon (*in litt.* 2002) and Doak *et al.* (2000). Using computer modeling to simulate such fire cycles, as has been done by Franklin *et al.* (2001) and Syphard *et al.* (2006), could clarify this cycle period. The Recovery Plan recommends that monitoring be undertaken for at least 12 years or possibly as much as one generation, which was estimated by Doak (2000) to be approximately 75-85 years. In light of our current understanding, the length of time in between disturbance events may warrant a monitoring period of at least one fire cycle to determine that successful recruitment is leading to an increase in the overall size of the populations. Monitoring efforts should also include a genetic analysis component to ensure widespread recruitment from parent individuals throughout the stand.

Five-Factor Analysis

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

Development

At the time of listing, the taxon's proximity to urbanized areas was the primary threat to this species (63 FR 43100). The species was listed as threatened in 1998 primarily due to habitat loss, fragmentation, and secondary impacts from development of privately owned land contiguous with what is now known as the Huckleberry Hill stand. This threat continues, as proposals for additional development of residential neighborhoods and resort areas are currently under review by the County of Monterey, and will result in the increase of urbanization adjacent to the Del Monte Forest population. The current documents under review are revised proposed

amendments to Monterey County's Local Coastal Program (LCP) that were developed in conjunction with the California Coastal Commission (PBC/CCS 2009). This alternate proposal from the Pebble Beach Company includes the preservation of over 257 hectares (635 acres) of sensitive habitat, hotel and residential development, and improvement of the California Coastal Trail through the Del Monte Forest (PBC/CCS 2009). At the time of this 5-year review, the Pebble Beach Company is preparing and submitting a Draft Environmental Impact Report regarding the proposed amendment to the LCP. The initial proposal, which was rejected by the Coastal Commission, included the removal of *Hesperocyparis goveniana* individuals in the construction of a new golf course (Monterey County Planning and Building Inspection 2007). Mitigation proposals via landscaping using the species were presented, but would not adequately mimic functional, natural habitat, as this species is part of a complex successional system in habitats shaped by fire (CCC 2007).

Current development proposals will likely continue to encroach on habitat that is already surrounded by urbanized areas. Similar encroachment can be seen around the Point Lobos population, where properties immediately surrounding the Ranch continue to be developed (K. Barry, pers. obs. 2011b). The proximity of permanent structures and human habitation is likely to impede future management of both populations. With no room for the Del Monte Forest population to expand because of planned development, increasing the size of both populations, as called for in the Recovery Plan, will remain a challenge to the land managers.

Existing development allowed on the immediate edge of occupied habitat, such as that along the upper ridge of Huckleberry Hill, constrain active management techniques (such as prescribed burning) that are likely to be necessary in the future. The disruption of natural fire cycles was considered a primary threat at the time of listing and remains a major and continuing threat to this species (V. Yadon *in litt.* 2002; Jones and Stokes Associates 1996). As succession continues and native chaparral along with nonnative species fill in as understory, the availability of bare soil exposed to direct sun, which this taxon requires for establishment, will be reduced. Fire is necessary to clear the understory and litter layers and remains the best management tool for maintaining *Hesperocyparis goveniana* habitat (Jones and Stokes Associates 1996). As mentioned previously, development continues to encroach and surround *H. goveniana* habitat, and the ability to safely and effectively use fire as a management tool has been greatly reduced. Jones and Stokes Associates (1996) found that existing development surrounding the Del Monte Forest likely precludes the use of fire as a management tool. For this reason, continued development on lands immediately adjacent to occupied habitat indirectly alters the occupied habitat.

State Parks personnel have discussed plans for constructing a trail to allow public viewing of the Point Lobos population of *Hesperocyparis goveniana* (T. Moss, Senior Environmental Scientist, California State Parks, *in litt*. 2011). State Parks is in the beginning stages of developing a general management plan for the Point Lobos Ranch and has not yet begun to assess the potential impacts of a trail on the *H. goveniana* population (T. Moss *in litt.* 2011).

Conservation Measures Undertaken

State Parks employees have made concerted efforts to remove nonnative plants such as French broom (*Genista monspessulana*) from areas around the Point Lobos stand (T. Moss, pers. comm.

2007, *in litt.* 2011), and the Pebble Beach Company is continuing its policy of nonnative plant removal within and surrounding the Del Monte Forest stand (PBC 2011; E. Love, Forestry and Ecology Manager, Pebble Beach Company, pers. comm. 2011; D. Messenger *in litt.* 2002). These removal efforts have been effective within the Point Lobos stand, as very few French broom seedlings are encroaching on the population there, but localized re-establishment of nonnative species into other previously-cleared areas has been observed (T. Moss *in litt.* 2011). Manual nonnative plant control will likely be necessary as part of ongoing management activities both around and within the *Hesperocyparis goveniana* populations.

Within the past decade, the Pebble Beach Company removed Monterey cypresses that were established in the *Hesperocyparis goveniana* stand and replaced them with 300 *H. goveniana* individuals in and around the existing population (E. Love, pers. comm. 2011). The *H. goveniana* individuals that were planted in the upper quarry are in suitable substrate for this species, and have survived and established themselves with little management. Others that were planted along the fringes of suitable habitat, including the lower area of an abandoned sand quarry, experienced high mortality (E. Love, pers. comm. 2011). At the Point Lobos Ranch, there is currently no area for *H. goveniana* to expand its range; however, significant numbers of new trees could be established by removing old roadways and restoring the habitat (T. Moss *in litt.* 2011). Old roadways currently comprise 5.9 percent of potential habitat for *H. goveniana* in the Point Lobos stand (T. Moss *in litt.* 2011).

The entirety of the Del Monte Forest population is contained within private property owned and maintained by the Del Monte Forest Foundation and the Pebble Beach Company. The currently proposed amendments to the Monterey County LCP include plans to preserve 257 hectares (635 acres) of sensitive habitat, including the stand of *Hesperocyparis goveniana* near Huckleberry Hill (PBC/CCS 2009). Limited potential exists for population expansion at the Huckleberry Hill site into an unused sand quarry; individual outplantings of *H. goveniana* in to the lower portion of the quarry have experienced high mortality, likely due to unsuitable substrate (E. Love, pers. comm. 2011). Most of the Point Lobos population occurs on State Parks land. Other than observations that scattered development is occurring in the vicinity, specific information on the status of *H. goveniana* individuals on adjacent private lands was not available for this review. Plans for development of access trails at this site could impact some parts of this population unless they are routed to correspond with existing access roads as part of a restoration effort. The principal threat facing *H. goveniana* at this time is that of secondary succession in the absence of natural fire regimes. Seedlings are observed in areas that receive adequate sunlight, such as outcroppings and areas of soil disturbance (*i.e.*, trail edges), suggesting that *H. goveniana* can establish in the absence of fire (Vogl *et al*. 1988); however, fire is much more effective at releasing the seeds from the serotinous cones of the species, as well as clearing the dense understory of chaparral vegetation to create light gaps required by this species (Enright *et al.* 1998, Vogl *et al*. 1998).

In summary, *Hesperocyparis goveniana* is less threatened by habitat modification than at the time of listing because its habitat at Pebble Beach has been proposed to be set aside for conservation, and the Point Lobos population is on lands that are preserved by the State of California. The proximity of permanent structures and human habitation, however, is likely to constrain future management options. Increasing the size of both populations, as called for in the

Recovery Plan, will remain a challenge to land managers because of continuing development in the vicinity of both populations.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes:
At the time of listing, overutilization was not considered a threat to this species, and is not considered a threat now.

FACTOR C: Disease or Predation:
At the time of listing, disease was not considered a threat to this species. While there is no imminent threat from any specific disease, the potential effects of a disease on a dense, thicket-like stand of trees inhabiting a small area would be substantial. The fungal parasite *Seiridium cardinale*, which causes cypress canker disease, has reached epidemic status in the Mediterranean cypress (*Cupressus sempervirens*) in Greece, and a similar outbreak of disease or introduction of insect pests in the Monterey Peninsula region could be catastrophic for *Hesperocyparis goveniana* (D. Rogers *in litt.* 2002). The likelihood of this taking place increases with microclimatic changes, which may occur due to ongoing threats from air pollution and climate change (D. Rogers *in litt.* 2002). Many cankers and root molds may become more prevalent as water conditions change, placing additional stress on individual trees. Compounding the threat is the exclusion of fire in *H. goveniana* stands, which may result in increased diseases and pests in an aging forest (Jones and Stokes Associates 1996). Although no insect or disease threat has been identified for this species at this time, stand health in the two extant populations should be monitored to preclude any such future losses.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms:
At the time of listing, we did not discuss any particular concerns regarding the adequacy of existing regulatory mechanisms to remove and reduce threats to *Hesperocyparis goveniana* from the threats discussed in Factors A and E. Below we discuss the existing regulatory mechanisms at the County, State and Federal levels, and the extent to which they ameliorate the threats from the other factors.

County Protections: *Hesperocyparis goveniana* and its habitat are addressed in the Monterey County Local Coastal Program (LCP). The plan states that this environmentally sensitive habitat, among others, should be protected for its high scientific, educational, scenic and wildlife values. The Carmel Area Land Use Plan includes Gowen Cypress Woodland among its recognized rare, endangered, or sensitive terrestrial species and habitats, and the plan designates all areas occupied by this species as critical (Monterey County 2007). The critical designation applies to the environmentally sensitive habitat of the Gowen Cypress Woodland as well as to *H. goveniana* itself due to its federally threatened status and its 1B.2 endangered designation by the California Native Plant Society (2011).

The Del Monte Forest Area Land Use Plan (Del Monte Forest LUP) and the Monterey County Coastal Implementation Plan (Implementation Plan) describe management requirements, and specifically address environmentally sensitive habitat protections, buffer zones, tree removal regulations, and other various development-oriented guidelines (Monterey County 1984;

Monterey County 1988). Generally, in environmentally sensitive areas and habitats, the Implementation Plan requires that all development should be avoided except where it is necessary to support resource-dependent uses, such as nature education and research, hunting, fishing and aquaculture, or activities for maintenance of existing structures and roads, or activities for watershed restoration (Monterey County 1988). Additionally, the Implementation Plan requires land use and development adjacent to environmentally sensitive habitat areas to be in accordance with the following: densities should be compatible with long term protection and maintenance of the adjoining resources; developments must include a buffer zone of 30.5 meters (100 feet) between any environmentally sensitive habitat and any potential development site; and access to sensitive areas must be controlled and limited to low-intensity recreational, scientific or educational uses (Monterey County 1988). According to the Del Monte Forest LUP, *Hesperocyparis goveniana* is treated in the same manner as Monterey cypress (*H. macrocarpa*), and allows for tree removal only in cases where life or property is immediately threatened or the tree is determined to be diseased by a qualified arborist (Monterey County 1984). Otherwise, a coastal development permit must be obtained for the removal of trees. The LCP amendments that Pebble Beach is proposing do not affect the current designations of *H. goveniana* as sensitive habitat.

State Protections: *Hesperocyparis goveniana* is not a State-listed taxon under the California Endangered Species Act. However, the California Environmental Quality Act (chapter 2, section 21050 et seq. of the California Public Resources Code) affords some protection to the taxon under State law via mitigation requirements because there are both Federal and county protections in place for the species. In 2007, the Coastal Commission's denial findings identified significant potential impacts from the Pebble Beach Company's LCP amendment to environmentally sensitive habitat, including the federally endangered Yadon's piperia (*Piperia yadonii*) and the federally threatened *H. goveniana* (CCC 2007). In addition, the goal of the resource management program within State Parks is to protect, restore, and maintain the natural resources in the State Parks System (California State Parks 2007). The resource management plan for Point Lobos Ranch includes a statement of purpose "to perpetuate forever, for public enlightenment, inspiration and esthetic enjoyment, an area of unique natural beauty and ecological significance including the Monterey cypress-covered headlands, unique Gowen cypress pygmy forests… and the aquatic and terrestrial flora and fauna in an essentially pristine state" (California State Parks 1979).

Federal Protections: No populations occur on Federal lands; however, the Service has designated critical habitat for Yadon's piperia on both the state-owned Point Lobos Ranch and within the privately-owned Del Monte Forest where *Hesperocyparis goveniana* is known to occur. Where the species occurs on private lands, protections afforded by section 7 of the Endangered Species Act are triggered only if there is a Federal nexus (i.e., an action funded, permitted, or carried out by a Federal agency). Section 7(a)(2) of the Act requires Federal agencies to consult with the Service to ensure that any project they fund, authorize, or carry out does not jeopardize a listed species nor adversely modify its critical habitat

The above-listed regulations provide certain protections for *Hesperocyparis goveniana* on private and public property. California State Park natural resource goals provide direction to protect, restore and maintain habitat for the species on lands at Point Lobos Ranch (California

State Parks 2011). While some regulatory protections are afforded the species, many of the current threats to the species, such as invasive species encroachment, habitat type conversion, and fragmentation effects, are either unregulated or not addressed by land use regulations. The most applicable regulation affecting such threats relates to buffer zones around existing populations, which are likely not wide enough to provide adequate management flexibility. While a 30.5 meter (100 feet) buffer (Monterey County 1988) may be adequate when considering direct impacts to habitat, additional space may be required to implement certain management methods. Specifically, the utilization of controlled burns as a management tool for mimicking natural fire cycles in *H. goveniana* habitat may require a larger buffer to adequately manage crews, equipment, smoke, and other issues. In summary, we believe that when this species occurs on private lands, the best opportunity for protection is afforded by the Monterey County LCP, which was approved by the California Coastal Commission in 1987, and includes the Land Use Plans.

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

At the time of listing, we discussed that this species was threatened by habitat alteration due to the influence of continued urban development in Pebble Beach and to the disruption of natural fire cycles that are likely to result from fire suppression activities. In addition, stands of *Hesperocyparis goveniana* at both locations have been invaded by aggressive nonnative species, including pampas grass (*Cortaderia jubata*), French broom (*Genista monspessulana*), and fireweeds (*Erechtites* spp.) (63 FR 43100). In the previous 5-year review, we identified erosion and lack of reproduction as threats not discussed at the time of listing. In this 5-year review, we further expand on the threat that climate change presents to *H. goveniana*.

Erosion

Erosion was not identified as a threat to this species at the time of listing in 2008. In 2007, observations at the Del Monte Forest stand indicated that activity from hikers and mountain bikers was causing considerable and damaging erosion (C. West, pers. obs. 2007). The Pebble Beach Company acknowledged that they did not have the personnel resources necessary to patrol or enforce trespassing and mountain biking restrictions on these portions of its property (E. Love, pers. comm. 2007). Trails were cut through the surrounding area and even entered the stand itself. Mountain bike jumps and bridges made from cut tree trunks from within the stand were also visible throughout the area (C. West, pers. obs. 2007). Recent observations from 2011 indicate that there is less erosion from mountain biking than in previous years (K. Barry, pers. obs. 2011a), and unauthorized mountain bike jumps are regularly removed by the Pebble Beach Company (E. Love, pers. comm. 2011).

Remnants of old, cleared ranch roads total 5.9 percent of the Point Lobos stand (T. Moss *in litt*. 2011). Removal of anchoring vegetation and poor drainage in these areas have allowed the topsoil to be completely washed away in much of the road system and caused severe erosion in the surrounding habitat (Figure 1) (T. Moss *in litt.* 2011; C. West, pers. obs. 2007). Continued flushing with surface water during rains prevents soil accumulation and vegetation establishment. Water seeping from the soil layer upslope of one of these exposed areas, or water falling as rain onto an exposed area, is not slowed by soil or vegetation, and therefore accumulates and behaves like a stream. Upon reaching natural drainages, this swift-moving

water cuts deep ravines, further removing the limited topsoil and eroding habitat (T. Moss *in litt*. 2011; K. Barry, pers. obs. 2011a; C. West, pers. obs. 2007).

Invasive Species

At the time of listing, displacement by invasive species was considered a key threat. While this threat remains, the Pebble Beach Company regularly works to control problem species in the *Hesperocyparis goveniana* stand (E. Love, pers. comm. 2011). In 2011, no pampas grass was observed at either population of *H. goveniana*, and while considerable numbers of French Broom were present at both occurrences, they were all small, recently-recruited individuals that germinated between removal projects (K. Barry, pers. obs. 2011a). These control efforts are critical to the persistence of *H. goveniana*, and will need to be continued for the foreseeable future.

Understory Litter Accumulation Leading to Lower Recruitment

At the time of listing, accumulation of understory litter leading to lower recruitment was not considered a major threat to this species. Currently, recruitment seems to be occurring with frequency only at the Del Monte Forest population, where two fires in the past 60 years (1959, 1987) have cleared ground litter, understory, and canopy in portions of the stand allowing for regeneration of the species (K. Barry, pers. obs. 2011a). At the Point Lobos stand, recruitment was primarily associated with the mixed conifer habitat and was very limited in the maritime chaparral habitat, where it was likely hindered by the understory plant community (Doak *et al.* 2000). This threat will likely continue until the natural disturbance cycles can be restored or until adequate surrogates for natural disturbance factors are identified and implemented. In recent observations of the Point Lobos stand, State Park officials confirmed that there were no *Hesperocyparis goveniana* seedlings observed (T. Moss, pers. comm. 2011). Lack of recruitment is likely coupled with understory litter accumulation, leading to an interruption of natural disturbance cycles, erosion of topsoil and fragmentation of habitat by roads (T. Moss *in litt*. 2011).

Climate Change

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, Intergovernmental Panel on Climate Change (IPCC) 2007). *Hesperocyparis goveniana*'s small and isolated range increases its vulnerability to random fluctuations in annual weather patterns and environmental disturbances such as can be brought about by climate change. The potential impacts of climate change on the flora of California were discussed by Loarie *et al*. (2008). Based on modeling, they predicted that species' distributions will shift in response to climate change; specifically that the species will "move" or disperse to higher elevations and northward, depending on the ability of each species to do so. Species diversity will also shift in response to these changes with a general trend of diversity increases shifting towards the coast and northwards with these areas becoming de facto future refugia. However, predictions of climatic conditions for smaller sub-regions, such as coastal Monterey County, 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. 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 *H. goveniana* at this time. Small-ranged species, however, are more vulnerable to extinction due to these changing conditions (Loarie *et al.* 2008); we consider *H. goveniana* to be such a species.

In summary, within the Del Monte and Point Lobos Ranch stands, the threats identified at the time of listing and within the Recovery Plan are still present, although the threat from habitat alteration has been reduced. Fire suppression, resulting in the disturbance of the natural fire regime, and accumulation of understory litter accounts for a large proportion of the threat to the species. Therefore, the long-term persistence of *Hesperocyparis goveniana* stands is still a concern. The germination and establishment of new seedlings depends on open substrate and either fire or a method that can act as a substitute for fire, such as controlled burns or thinning, to manage the demographic profile of the stand (*i.e.*, encourage seedling recruitment and reduce the number of older individuals). Research on suitable management methods in the absence of fire for this species is still lacking. Climate change, newly identified as a threat to *H. goveniana* in this review, will affect this species and its surrounding ecosystem in still uncertain ways.

III. RECOVERY CRITERIA

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, over all, the threats have been minimized sufficiently, and the species is 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. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise 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 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) 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 objective for *Hesperocyparis goveniana* is removal from the Service's list of threatened and endangered species. At the time the Recovery Plan was written, all Listing Factors except for Factor B were identified as potential threats to the persistence of this species. The recovery plan indicates that delisting for *H. goveniana* can be considered when the following four criteria (indicated in italics) have been achieved:

1. Monitoring of the Del Monte Forest population and the Point Lobos population for a minimum of 10 years (or longer if needed) shows long-term reproductive success in both populations. As determined by research, protected habitat must be of adequate size (large enough to support a functioning ecosystem, including areas that support suitable unoccupied

habitat for population expansion and fluctuations in distribution) to ensure that ecosystem and community processes and associated species (e.g., hydrologic regime, fire, food webs, fauna, Monterey pine forest communities) are maintained, and that the locations are adequate to provide for population expansion and for colonization of new areas as microhabitat conditions change.

This recovery criterion addresses Listing Factors A and E. This criterion specifically calls for monitoring ecosystem parameters to ensure that natural processes are able to function. This is critical for this species, because a limited amount of suitable habitat is available. Because no such long-term monitoring has been initiated at either stand of *Hesperocyparis goveniana*, we consider that this criterion has not been met. We believe that this criterion is adequate and appropriate to the recovery of this species.

2. Twelve or more years (or possibly as much as one generation) of monitoring have determined that successful recruitment has increased the overall size of both populations. Regeneration success should be measured in terms of abundant natural regeneration (with parental contributions from many trees for genetic purposes) and measured directly with genetic analysis if possible.

This recovery criterion addresses Listing Factors A and E. An increase in the overall size of the population may be possible at the Del Monte Forest site due to available habitat in the old quarry site and areas of reduced density resulting from a fire in 1987. At Point Lobos, the proximity of pure Monterey pine forest, deep drainages, and potentially unsuitable soil types bordering the stand, in conjunction with the high density of vegetation within much of the occupied habitat, may limit opportunities for population growth. However, certain management practices, such as vegetation thinning and/or restoration of old roadways within the stand, may increase the carrying capacity of this stand. Since no such long-term monitoring at either stand of *Hesperocyparis goveniana* has been initiated, we consider that this criterion has not been met. We believe that this criterion is adequate and appropriate to the recovery of this species.

3. A prescribed burn plan is established to improve surrounding habitat to reduce high vegetation cover and promote recruitment, or research has documented an alternative method to burning that is successful in promoting reproduction. Appropriate management to improve the surrounding habitat would need to be successfully implemented. Funds must be available for appropriate long-term management.

This recovery criterion addresses Listing Factors A and E. No prescribed burn activity or planning has been undertaken at either *Hesperocyparis goveniana* site. Observations of the Santa Cruz cypress (*H. abramsiana*) indicate that seeds will readily germinate with other forms of disturbance, such as scraping or other disturbance that exposes the mineral soils (Kuhlmann 1986, Service 1998, McGraw 2007). While controlled burning may more closely mimic the action of a natural fire, scraping could be used as a form of management in certain situations where proximity to urban habitation precludes controlled burning as an option. However, no research has been undertaken specifically regarding the response of *H. goveniana* to scraping or other surrogates for burning as a method to reduce vegetation cover and in turn promote recruitment and improve the surrounding habitat. As a result, we consider that this criterion has

not been met. We believe that this criterion is adequate and appropriate to the recovery of this species.

4. A seed bank is established at a recognized institution certified by the Center for Plant Conservation (CPC). The seed bank is needed for protection of the species in case of an unforeseen naturally occurring event that would create a lack of reproduction or die-off from disease. Seeds should represent the remaining genetic diversity of the species and the viability (i.e., germination percentage) of the seed collection should be determined.

While some horticultural use of this species has been documented, the sources of these lineages are unknown. A single adult specimen from the Huckleberry Hill population in the Del Monte Forest grows in the University of California at Santa Cruz Arboretum, but the specimen is not being utilized in any formal seed banking capacity (S. McCabe, Coordinator of Research and Education, Arboretum, University of California, Santa Cruz, pers. comm. 2007). Three batches of seed totaling approximately 1200 seeds are housed at Rancho Santa Ana Botanic Garden (a CPC affiliate) (M. Wall, Seed Curator and Program Manager, Rancho Santa Ana Botanic Garden, *in litt.* 2007). All three of these batches originated from the Del Monte Forest stand and it is estimated that 33 percent of these may be viable (M. Wall *in litt.* 2008). Two are from along one trail and the third is from along a second trail. Germination experiments on these seeds showed a germination rate of 9 percent (M. Wall *in litt.* 2008). This collection represents a very small proportion of the remaining genetic diversity of this species and should not be considered a complete seed bank. This collection is not funded, further testing for viability is not planned, and additional collection of seed has not been contracted for this species (M. Wall *in litt.* 2008). We consider that this criterion has not been met. We believe that this criterion is adequate and appropriate to the recovery of this species.

IV. SYNTHESIS

Hesperocyparis goveniana exists in only two natural occurrences. The species was listed as threatened in 1998 primarily due to habitat loss from development of privately owned land contiguous with what is now known as the Huckleberry Hill stand. Proposals for additional development of residential neighborhoods and resort areas are currently being developed by the Pebble Beach Company, and initial agreements in coordination with the California Coastal Commission indicate that up to 257 hectares (635 acres) of sensitive habitat (including *Hesperocyparis goveniana* stands) will be preserved. The population on Point Lobos Natural Reserve land is largely protected from direct development. Development in areas immediately adjacent to both populations continues; such changes in surrounding land use will limit future management activities that can be undertaken to benefit *Hesperocyparis goveniana*. Additional pressures on these small populations exist in the form of trampling from mountain-bikers and hikers, erosion from mountain-bikers and poorly-formed roads, and low recruitment due to disruption of natural successional cycles resulting from suppression of the natural fire regime. All of these pressures threaten the continued existence of this species.

Because there are only two populations of this species, other potential threats should not be overlooked. In an aging population with limited recruitment, senescence, disease, and invasion by pest species are possible. Additionally, without sufficient recruitment, over time regular

mortality of old trees may cause population numbers to drop and make the individual occurrences more susceptible to stochastic extinction.

Because all threats that were known at the time of listing are still threats, and because little progress has been made toward implementing management actions that would generate stable recruitment regimes or improve habitat conditions, we conclude that *Hesperocyparis goveniana* still meets the definition of threatened. No status change is recommended at this time.

V. RESULTS

Recommended Classification

____ Downlist to Threatened

____ Uplist to Endangered

____ Delist (Indicate reasons for delisting per 50 CFR 424.11):

__X__ No change is needed

New Recovery Priority Number: N/A

VI. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Experiments should be undertaken to determine the effectiveness of mechanical clearing and controlled burns for the recruitment of young saplings. Any experiments conducted should include a genetic analysis component to determine the diversity of recruitment based on clearing method used.

2. Land managers should attempt to reclaim unused road and trail systems within existing stands. Restoration of these areas by replacing topsoil and planting native vegetation to anchor it in place could reduce erosion and increase the amount of suitable habitat within the existing stands. Within the Point Lobos stand, 0.46 hectares (1.1 acres) could be recovered, allowing recruitment to increase population size.

3. An effort should be made to determine where trees have been intentionally planted within the naturally occurring populations. For each of these plantings, it should be noted from where the seeds originated. All plantings should be undertaken from stock that derives from, and thus is genetically consistent with, the targeted planting area.

4. Genetic analyses should be undertaken to determine the relatedness of the two stands and a seed bank should be created by collecting seed from both stands and many individuals per site.

5. Any plans for trail construction or recreational public use at Point Lobos Ranch should only be considered if natural ecological processes within the stand will not be negatively impacted. In addition, no structures, fencing, signage, or other improvements should be installed near or within the stand that could hinder management activities, such as heavy equipment use, or prescribed burns.

VII. REFERENCES

Literature Cited

Adams, R. P., J. A. Bartel, and R. A. Price. 2009. A new genus, *Hesperocyparis*, for the cypresses of the western hemisphere. Phytologia 91:160-185.

Bartel, J.A. 1993. Cupressaceae. Pp. 111-114 *in*: J.C. Hickman (ed.). The Jepson Manual: higher plants of California. University of California Press, Berkeley. Pp. 112-113.

Bartel, J.A., R.P. Adams, S.A. James, L.E. Mumba, and R.N. Pandy. 2003. Variation among *Cupressus* species from the western hemisphere based on random amplified polymorphic DNAs. Biochemical Systematics and Ecology 31:693-702.

[CCC] California Coastal Commission. 2007. Staff Recommendation for Denial of Monterey County LCP Amendment 1-07 (Measure A in the Del Monte Forest). Prepared June 1, 2007 (for June 13, 2007 hearing).

California Native Plant Society. 2011. Record for *Hesperocyparis goveniana* Inventory of Rare and Endangered Plants (online edition, v8-01a). California Native Plant Society. Sacramento. Accessed on Wednesday, September 14, 2011.

California State Parks. 1979. Point Lobos State Reserve and Carmel River State Beach general plan, October 1979. California State Parks. California. Available online at < http://www.parks.ca.gov/pages/21299/files/449.pdf>. Accessed March 11, 2008.

California State Parks. 2007. California State Parks website. California. Available online at < http://www.parks.ca.gov/>. Accessed March 11, 2008.

California State Parks. 2011. Natural Resource Management. California State Parks website. California. Available online at < http://www.parks.ca.gov/?page_id=22197>. Accessed October 24, 2011.

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.

Conkle, M. T. 1987. Electrophoretic analysis of variation in native Monterey cypress (*Cupressus macrocarpa* Hartw.). Pages 249-256 in: T. S. Elias (ed.). Conservation and management of rare and endangered plants: Proceedings of a conference on conservation and management of rare and endangered plants. November 5-8, 1986. California Native Plant Society, Sacramento.

Debreczy, Z., K. Musial, R. A. Price and I. Rácz. 2009. Relationships and nomenclatural status of the Nootka cypress (*Callitropsis nootkatensis*, Cupressaceae) Phytologia 91:140-159.

Doak, D., J. Borgeson, S. Danner, A. Graff, M. Kauffman, P. Shahani, and D. Thomson. 2000. Ecological factors affecting the recovery of coastal milkvetch (*Astragalus tener* var. *titi*, Fabaceae), Hickman's cinquefoil (*Potentilla hickmanii*, Rosaseae) and Pacific Grove clover (*Trifolium polyodon,* Fabaceae); and ecological factors affecting the recovery of Gowen cypress (*Cupressus goveniana* ssp. *goveniana*, Cupressaceae) and Monterey clover (*Trifolium trichocalyx*, Fabaceae). Unpublished report prepared for California State Department of Fish and Game. 53 pp.

Enright, N.J., R. Marsula, B.B. Lamont, and C. Wissel. 1998. The ecological significance of canopy seed storage in fire-prone environments: a model for resprouting shrubs. The Journal of Ecology 86:960-973.

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, D.C.

Frankham, R., J. D. Ballou, D.A. Briscoe, Smithsonian Institution. 2002. Introduction to Conservation Genetics. Cambridge University Press.

Franklin, J., A.D. Syphard, D.J. Mladenoff, H.S. He, D.K. Simons, R.P. Martin, D. Deutschman, and J.F. O'Leary. 2001. Simulating the effects of different fire regimes on plant functional groups in Southern California. Ecological Modeling 142:261-283.

Griffin, J.R., and W.B. Critchfield. 1976. The distribution of forest trees in California and supplement. USDA Forest Service Research Paper PSW-82/1972.

[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.

Johnson, E.A., and S.L. Gutsell. 1993. Heat budget and fire behaviour associated with the opening of serotinous cones in two *Pinus* species. Journal of Vegetation Science 4:745-750.

Jones and Stokes Associates, Inc. 1996. Recovery strategies for six coastal plant species on the Monterey Peninsula. Report prepared for the California Department of Fish and Game, Sacramento, California. 35 pp. + appendices.

Kafton, D.L. 1976. Isozyme Variability and Reproductive Phenology of Monterey Cypress. Ph.D. Thesis, University of California, Berkeley, California. 196 pp.

Kuhlmann, H. 1986. Reproductive biology of Santa Cruz cypress. Unpublished master's thesis, San Jose State University, San Jose, California.

Little, D.P. 2006. Evolution and circumscription of the true cypresses (Cupressaceae: *Cupressus*). Systematic Botany 31:461-480.

Loarie, S.R., B.E. Carter, K. Hayhoe, S. McMahon, R. Moe, C.A. Knight and D.D. Ackerly. 2008. Climate Change and the Future of California's Endemic Flora. PLoS ONE 3(6):e2502. doi:10.1371/journal.pone.0002502

McGraw, J.M. 2007. Distribution, abundance, size structure and conservation status of three populations of the endangered Santa Cruz cypress (*Callitropsis abramsiana*). Boulder Creek, California. Prepared for the U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California.

Monterey County. 1984. Del Monte Forest Area Land Use Plan. 1984. Local Coastal Plan, Monterey, California. September 24, 1984.

Monterey County. 1988. Monterey County Coastal Implementation Plan. PART 2: Regulations for Development in the North County, Land Use Plan Area (Chapter 20.144). Monterey County Board of Supervisors. Adopted January 5, 1988.

Monterey County. 2007. Carmel Area Land Use Plan. Local Coastal Program. Monterey, California. April 14, 1983

Monterey County Planning and Building Inspection. 2007. Project description: Pebble Beach Company's Del Monte Forest Preservation and Development Plan. Monterey, California. Available online at <http://www.co.monterey.ca.us/pbi/major/pbc/pbc_desc.htm>. Accessed June 26.

Munz, P.A., and D.D. Keck. 1959. A California Flora. University of California Press, Berkeley, California. Pp. 62.

[PBC] Pebble Beach Company. 2011. Pebble Beach Resorts Green Initiatives: Forestry/Ecology Department Activities. <http://www.pebblebeach.com/about/green-initiatives/environmental-programs/nature> Accessed September 8, 2011.

[PBC/CCS] Pebble Beach Company/Coastal Commission Staff. 2009. Agreement Summary: Pebble Beach Company and Coastal Commission Staff Reach Agreement in Principle on a New LCP Amendment and Project for the Del Monte Forest. December 7, 2009.

Perry, D.A., and J.E. Lotan. 1979. A model of fire selection for serotiny in lodgepole pine. Evolution 33:958-968.

Prasanna, B.M. 2005. Measures of Genetic Diversity. Presentation for the Ninth Asian Maize Workshop on December 5, 2005.

Rogers, D.L. 2004. Genetic erosion: no longer just an agricultural issue. Native Plants Journal Vol 5: 112-122.

Sudworth, G.B. 1967. Forest trees of the Pacific slope. Dover Publications. New York, New York.

Syphard, A.D., J. Franklin, and J.E. Keeley. 2006. Simulating the effects of frequent fire on Southern California coastal shrublands. Ecological Applications 16:1744-1756.

Truesdale, H.D., and L.R. McClenaghan, Jr. 1998. Population genetic structure of Tecate cypress (Cupressaceae). Southwestern Naturalist 43:363-373

[Service] U.S. Fish and Wildlife Service. 1998. Recovery plan for the Santa Cruz cypress (*Cupressus abramsiana*). U.S. Fish and Wildlife Service, Portland, Oregon. 51 pp. + appendices.

[Service] U.S. Fish and Wildlife Service. 2004. Recovery Plan for Five Plants from Monterey County, California. U.S. Fish and Wildlife Service, Portland, Oregon. xii + 159 pp.

[Service] U.S. Fish and Wildlife Service. 2011. Endangered and Threatened Wildlife and Plants; 5-Year Reviews of Species in California, Nevada, and the Klamath Basin of Oregon. Federal Register 76:30377-30382.

Wolf, C.B., and W.W. Wagener. 1948. The New World Cypresses. Vol. 1. Aliso 1:1-250

Vogl, R.J., W.P. Armstrong, K.L. White, and K.L. Cole. 1988. The closed-cone pines and cypress. In: Barbour, M.G. and J. Major (eds.) Terrestrial Vegetation of California. California Native Plant Society, Spec. Pub. No. 9. Sacramento. Pp. 295-324.

Letters Cited

Messenger, D.L. 2002. Facsimile letter from Ms. Derinda L. Messenger, Esq., Lombardo and Gilles, PLC, to Ms. Heidi E.D. Crowell, U.S. Fish and Wildlife Biologist, Ventura Fish and Wildlife Office, Ventura, California. Dated July 2.

Moss, Tom. 2011. Email to Kirstina Barry, Biologist, U.S Fish and Wildlife Service. Discussion of Gowen cypress populations, including habitat, soil erosion problems, life cycles, and plans for future management. Senior Environmental Scientist, California Department of Parks and Recreation. September 15.

Rogers, Deborah L. 2002. Letter from Dr. Rogers, Conservation Geneticist and Director of the Monterey Pine Forest Ecology Cooperative, University of California, Davis, California, to Ms. Diane Noda, Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California. Dated June 6.

Stromberg, M.R. 2002. Letter from Dr. Mark R. Stromberg, Resident Reserve Director, U.C. Hastings Reserve (including notes from Vern Yadon, Emeritus Director, Pacific Grove Museum of Natural History, and Steve Staub, Professional Forester, Del Monte Forest Foundation), to Ms. Diane Noda, Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California.

Wall, Michael. 2007. E-mail to Connie Rutherford, U.S. Fish and Wildlife Service, regarding seed collections of *Callitropsis goveniana*. Seed program manager, Rancho Santa Ana Botanic Garden, Claremont, California. Dated May 2.

Wall, Michael. 2008. E-mail to Chris West, U.S. Fish and Wildlife Service, regarding seed collections and viability of *Callitropsis goveniana*. Seed program manager, Rancho Santa Ana Botanic Garden, Claremont, California. Dated March 6.

Yadon, Vern. 2002. Comment letter on the draft recovery plan for five plants from Monterey County, California, from Mr. Yadon to Ms. Diane Noda, U.S. Fish and Wildlife Service, Ventura, California. Dated June 28.

Personal Communications

Love, Eric. 2007. Personal meeting with Chris West, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service. Examination of cypress grove and discussions regarding habitat, soil erosion problems, trespassing, life cycles, history of Huckleberry Hill grove, fire history of the area, plans for future management. Forester, Pebble Beach Company, Monterey, California. Dated March 1.

Love, Eric. 2011. Telephone call with Kirstina Barry, Biologist, U.S. Fish and Wildlife Service. Discussion of Gowen cypresses in the Del Monte Forest, Land Use Plan, ownership, and management of invasive species. Forestry and Ecology Manager, Pebble Beach Company. September 15, 2011.

McCabe, Stephen. 2007. Telephone message for Chris West, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service. Specimens and seeds of threatened and endangered species maintained in the arboretum at the University of California at Santa Cruz. Coordinator of Research and Education, Curator of Succulents, Arboretum, University of California, Santa Cruz. Dated May 9.

Moss, Tom. 2007. Personal meeting with Chris West, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service. Examination of cypress grove and discussions regarding habitat, soil erosion problems, life cycles, history of Point Lobos grove, and plans for future management. Ranger/Naturalist, Restoration Planner, California Department of Parks and Recreation. Dated March 1.

Moss, Tom. 2011. Telephone call with Kirstina Barry, Biologist, U.S Fish and Wildlife Service. Discussion of Gowen cypress population, inlcuding habitat, soil erosion problems, life cycles, and plans for future management. Senior Environmental Scientist, California Department of Parks and Recreation. September 12, 2011.

Personal Observations

Barry, Kirstina. 2011a. Meeting at Point Lobos State Reserve with Tom Moss and meeting in Del Monte Forest with Eric Love. U.S. Fish and Wildlife Service biologist. September 21, 2011.

Barry, Kirstina. 2011b. Visit with staff of the Santa Lucia Conservancy in Carmel, California. U.S. Fish and Wildlife Service biologist. September 21, 2011.

West, Chris. 2007. Meeting at Point Lobos State Reserve with Tom Moss and meeting in Del Monte Forest with Eric Love. U.S. Fish and Wildlife Service biologist. March 1, 2007.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Hesperocyparis goveniana* (Gowen cypress)

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened

____ Uplist to Endangered

____ Delist

_X__ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: N/A

Review Conducted By: Kirstina Barry

FIELD OFFICE APPROVAL:

Field Supervisor, Fish and Wildlife Service

Approve _____ Date 3/28/12

Appendix

Map showing distribution of *Hesperocyparis goveniana*