Scientific Review:
Proposed Rule to List the San Fernando Valley Spineflower as Threatened under the Endangered Species Act

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I am plant ecologist (Ph.D. Botany, 1990, Virginia Polytechnic Institute and State University) with particular expertise on Southern California plants, vegetation, and conservation. I was invited by the U.S. Fish and Wildlife Service to provide an expert scientific review of the proposed rule to list the San Fernando Valley Spineflower (SFVS), *Chorizanthe parryi* var. *fernandina*, as a threatened species under the Endangered Species Act. I was specifically asked to provide comments about population trends and life history characteristics that might affect the species and factors that may affect its continued existence.

I found this document to be well written. The issues it discusses are thoroughly researched and well considered. A very convincing argument has been made for listing the SFVS under the Endangered Species Act. However, in my view, the interpretation of the current and future impacts of stressors on the SFVS is overly optimistic. The recommendation for listing as Threatened would insufficiently address the species' precarious condition. In my view, the evidence indicates that Endangered status would be more appropriate.

The Species Report noted that historical records indicate that the SFVS once had a much broader geographic distribution in southern California (including inland and coastal Los Angeles as well as Orange County). However, the species experienced a massive decline and was presumed extinct during much of the 20th Century. Currently, only two small isolated populations are known to exist (1) on Laskey Mesa in the Upper Las Virgines Open Space Preserve (population discovered in 1999) and (2) in Santa Clarita on land owned by the Newhall Land Company (population discovered in 2000). These populations are approximately 17 miles (27 km) apart and each is less than 20 acres (8 hectares) in total spatial extent. Regional geography and the species' low vagility suggest that gene flow between these populations is nonexistent. Numbers of extant plant in these populations varies from year to year and place to place. Seed viability is high but seed longevity and the extents of these populations' seed banks are not known.

The Laskey Mesa population is relatively secure because it exists within a large State of California owned wildland preserve. In contrast, the Santa Clarita population is at considerably greater risk because it is surrounded by land that has been proposed for extensive development (residential, commercial, and other purposes). If the development proposal is successful, 24% of the Santa Clarita SFVS population will be extirpated. The remaining 76% will consist of a scattered archipelago of tiny patches made more vulnerable by their existence

within the urban-wildland interface (Bar-Massada et al. 2014).

The Species Report rates the current impact level of development as a stressor to the San Fernando Valley Spineflower as low for both populations. It does so because neither population is currently within the direct footprint of urban development. This is a narrow assessment of the situation and trivializes the damage done by the steady march of development up to now. Although the precise reasons for the SFVS's extreme rarity are not known, no one will argue with the contention that habitat loss and other factors associated with development (agricultural and urban) are the reasons the SFVS now occurs in just two localities at the edge of the Los Angeles metropolitan area. Moreover, all of the stressors discussed in the proposed listing document have strong links to development

The Species Report indicates that additional significant impacts due to development on the Laskey Mesa population are likely to be minimal. I agree. However, it seems naïve to imagine that over the next 25 years (the foreseeable future), the impact of development on the Santa Clarita population will be only moderate. The proposed VCC development will extirpate all SFVS plants within that area. Moreover, all of the extant patches in the areas known as Grapevine Mesa, Entrada, Magic Mountain, and Airport Mesa will be isolated within very small islands or narrow peninsular strips of preserved habitat. Although the Potrero and San Martinez Grande patches will remain surrounded by large areas of open-space, they will still be in close proximity to areas proposed for extensive development. Because there are only 2 populations -- one very vulnerable (Santa Clarita) and one not (Laskey Mesa) -- it seems dangerous to split the difference and predict that the future threat of development will be only moderate. Does (high + low) / 2 = moderate? The logic of this moderate prediction also does not readily align with the high future impact level that is expected because the populations are small, isolated, and largely surrounded by a sea of urban development.

Virtually nothing is known about edge effects in Southern California shrublands and grasslands. The open structure of the vegetation in which the SFVS occurs suggests that external effects are likely to penetrate deeply into patches. Evidence from other ecosystem types suggests that the amount of space required to buffer edge effects depends upon the particular effect being considered and a single rule of thumb distance is unlikely to be universally effective against factors as disparate as microclimate, disturbance, invasion, and interspecific interactions (Primack 2014). So, the narrow proposed buffer zones surrounding the Santa Clarita SFVS preserves are unlikely to truly insulate plants from the adjacent urban environment. The Species Report cites a Conservation Biology Institute publication statement that, to be highly effective at resisting invasive animal invasions, buffers must be greater than 300 ft (91 m) wide. However, 47% of the proposed buffers for the Santa Clarita population will be 200 ft (61 m) or less. Therefore, the scientific basis for the EIR/EIS determination that these proposed buffers will be "moderately effective" seems very weak.

The Species Report indicates that proposed corridors connecting patches are not expected to facilitate expansion of existing SFVS populations or enable them to spread to new areas. Whether the corridors will allow for patch to patch movements of animals dispersing SFVS

seeds is unknown. If the SFVS patches become surrounded by fences designed to limit human access, some wildlife will also be excluded and the value of the corridors be greatly limited.

The very small stature of SFVS plants make them likely to be especially vulnerable to disturbances such as trampling and erosion. Social trails (also known as informal trails or desire paths) inevitably become established in wildland areas that abut urban development. Plenty of evidence of this exists throughout public- and privately-owned open spaces in Southern California. Although well-delineated hiking trails, fencing, and signs will prevent many people from trampling SFVS populations, such measures are unlikely to be perfect deterrents and, in some cases, may actually attract trespassers (nearby residents seeking solitude, kids seeking adventure, constructing forts, motocross-biking, etc). Therefore, it seems likely that recreational impacts on SFVS will increase, particularly in Santa Clarita, where the proximity to high densities of humans will increase in the proposed developments. In addition, access roads for utilities and oil/gas easements are entry points that will already dissect the areas where the SFVS occurs. If the Santa Clarita developments are established as proposed, it seems unrealistic to expect that weekly inspections by a preserve manager or biologist will prevent trampling, erosion, and other forms of habitat degradation during the foreseeable future time frame (25 years). In addition, barriers that deter people (example: chainlink fences) will also prevent some wildlife (for example: coyotes, bobcats, mule deer) from entering and leaving SFVS preserves. Exclusion of these species, particularly the carnivores, should be expected to affect trophic processes and have top-down consequences (Crooks and Soule 1999) for the SFVS.

I agree that the impacts of non-native animals, specifically Argentine ants, are currently moderate but should be expected to become high in the future. This invasive species is already known to occupy the Santa Clarita population's habitat and evidence from many areas in California and elsewhere indicates that their spread would very difficult to deter if the proposed Santa Clarita development were to proceed. Argentine ants are aggressive and capable of displacing native ants and other invertebrates. As the Species Report explained, this is of great concern because native ants and other insects are SFVS pollinators and may also help maintain existing populatoins by dispersing seeds short distances (within patches). Attempts to control Argentine ants by chemical means may have unintended negative effects on pollinators and/or other invertebrate ecosystem constituents. Given the tenacity of Argentine ants, such eradication measures would probably need to be continued for the foreseeable future.

In contrast to the expectations for invasive animals, the Species Report's prediction that the impact of invasive non-native plants on the SFVS will go from moderate today to low in the future is not convincing. Ecological restoration plans as well as plans to xeriscape the proposed Santa Clarita developments are the rationale for this rosy view of the future. California has been thoroughly invaded by non-native plants since the early 1800s (Schiffman 2007) and there are no examples of shrubland or grassland restoration projects in Southern California that have successfully excluded non-native invasive plants for long time periods (nothing even close to 25 years). Moreover, little is known about the biology of the SVFS, the environmental conditions it requires, or the precise factors that caused its extirpation from nearly all of its historic range. Therefore, successful restoration efforts will necessarily involve methodological

experimentation and adaptive management. Restoration project failures should be expected. Because nearby development will not be an issue at Laskey Mesa, restoration efforts there should be expected to be more successful than at Santa Clarita. Still, Southern California's propensity for periodic droughts makes sustainable restoration efforts difficult in many places. In addition, the measures taken to maintain in fuel modification zones adjacent to developments also complicate restoration efforts (Algiers 2015). If the proposed developments in Santa Clarita are successful, a very large proportion of that population will occur in areas where fuel reductions will be necessary (Spring, Airport Mesa, Magic Mountain, Entrada, Grapevine Mesa). Even if done carefully by hand by trained technicians, the effects of this annual work on the SFVS are unknown. In addition to widespread non-native grass annual grasses and forbs, Southern California's wildland-urban interfaces contain many examples of ornamental plants that have opportunistically escaped from developments into wildlands. Although most such occurrences remain localized, their potential effects on SFVS cannot be predicted. Moreover, species invasions are often characterized by long lag phases (often exceeding 25 years) during which the invaders are mistakenly perceived to be innocuous and their populations grow unchecked (Kowarik 1995). For all these reasons, it is unrealistic to expect invasive non-native plants to be less impactful on the SFVS in the future than they are today.

The effects of fire on the SFVS are largely unknown. The Species Report identifies wildfires as a low level current stressor and does not expect this status to change in the foreseeable future. Intervals between recent fires have been similar and at both Laskey Mesa (2 – 18 years) and Santa Clarita (0 – 16 years). However, intervals of this length are considered to be short and may have facilitated the spread and maintenance of invasive annual grasses in SFVS areas (Zedler et al. 1983, Syphard et al. 2006 and Syphard et al. 2007). As the Species Report notes, that annual grasses are extremely flammable and increase the likelihood of future fires and conversion of shrublands to non-native grasslands. Rating the current status of fire as a low level stressor ignores this history and shifts the baseline for interpreting the impact of future fires. In addition, the proposed plan for development in Santa Clarita will put the SFVS within the urban-wildland interface and thereby should increase the potential for fire to affect population patches. The Species Report suggests that increased proximity to development may allow fire-fighting efforts aimed primarily at protecting human habitations to also protect the SFVS. This is certainly possible. However, negative alternative scenarios may also be possible. For example, during a fire vegetation clearing efforts done to defend vulnerable structures could destroy patches of the SFVS. Therefore, the prediction that future fire effects will be low seems unrealistic.

At this point, nothing is known about the population genetics of the SFVS. A study is currently in progress but the results are not yet available. Because this species currently consists of 2 small isolated populations located at the edge of what had been a more geographically extensive historical range, it is likely that the species' overall heterozygosity is considerably less than what it was a century ago. The degree to which the 2 populations are genetically distinct is not yet known as is the amount of variation within the populations (from patch to patch). The

latter is of particular concern for the Santa Clarita population patches because development is expected to further isolate them.

During the 25-year foreseeable future time scope, factors associated with development and other processes will probably negatively affect the size of the Santa Clarita population, or even completely extirpate it. After all, that was the historical experience of most SFVS populations in Southern California during the 20th Century. If the Laskey Mesa population becomes the only remaining viable population, the species will be limited in one location and risks to its long-term sustainability of SFVS will be magnified.

The Species Report does a very good job of outlining the effects that climate change may have on the SFVS. Countless uncertainties exist and I agree that the uncertainties and risk will continue in the foreseeable future.

One potential stressor that was not addressed by the Species Report is nitrogen deposition associated with fossil fuel combustion. Several recent studies have shown that nitrogen can have important consequences to native and non-native plant species as well as vegetation processes in Southern California (for example: Kimball et al. 2014, Allen et al. 2016). Although there is no information available about how nitrogen deposition has affected the SFVS and the ecosystem it occupies, it seems implausible to expect that the effects have been negligible.

The Species Report states that numerous field botanists have searched unsuccessfully for additional populations of this species. Presumably environments similar to the ones that the SFVS currently occupies and/or historically occupied have been targeted. This inability to discover more populations suggests that some yet-to-be-identified factors have negatively affected the ability of the SFVS to persist. Given this situation and the likely impacts of known stressors, it would be prudent to offer maximal protection for this species by listing it as Endangered.

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