pending listing actions, in accordance with section 4(b)(3)(B)(iii) of the Act; notification of this finding was published on January 20, 1984 (49 FR 2485). Such a finding requires the petition to be recycled, pursuant to section 4(b)(3)(C)(i) of the Act. The finding was reviewed in October of 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, and 1993. Publication of this proposal constitutes the warranted finding for these species, as well as for *Arctostaphylos confertiflora, Helianthemum greenei, Heuchera maxima, Malacothrix indecora, Malacothrix squalida, Phacelia insularis* var. *insularis,* and *Thysanocarpus conchuliferus.*

Summary of Factors Affecting the Species

Section 4 of the Endangered Species Act (16 U.S.C. 1531 *et seq.*) and regulations (50 CFR part 424) promulgated to implement the listing provisions of the Act set forth the procedures for adding species to the Federal lists. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). These factors and their application to *Arabis hoffmannii* (Munz) Roll., *Arctostaphylos confertiflora* Eastw., *Berberis pinnata* Lag. ssp. *insularis* Munz, *Castilleja mollis* Penn., *Dudleya blochmaniae (*Eastw.) Moran ssp. *insularis* (Moran) Moran, *Dudleya nesiotica* (Moran) Moran, *Dudleya* sp. nov. ''East Point'' (S. McCabe), *Galium buxifolium* E. Greene, *Gilia tenuiflora* Benth. ssp. *hoffmannii* (Eastw.) A.& V. Grant, *Helianthemum greenei* Rob., *Heuchera maxima* E. Greene, *Malacothamnus fasciculatus* (Nutt.) E. Greene ssp. *nesioticus* (Rob.) Kearn., *Malacothrix indecora* E. Greene, *Malacothrix squalida* E. Greene, *Phacelia insularis* Munz var. *insularis,* and *Thysanocarpus conchuliferus* E. Greene are as follows:

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

The single most important loss of resources to insular ecosystems is the loss of soils, as the soils are the foundation for the unique island ecosystems and the insular endemic species found within them. This loss of soils is the result of historic grazing and browsing by sheep, goat, cattle, deer, elk, and bison, and rooting by pigs on the various islands starting in the early 1800's, and in certain cases, continuing today.

The increased loss of soils and the resulting change in vegetation have been documented from sediment and pollen records in a soil core dating back 5,200 years from the Old Ranch Canyon marsh on eastern Santa Rosa Island (Cole 1994). Rates of sedimentation prior to the introduction of livestock averaged 9 mm/year (yr) (0.35 in/yr), increasing to 58 mm/yr (2.28 in/yr) after the introduction of grazing (Cole 1994). Pollen records demonstrate that the conversion of brushland to grassland occured with the onset of ranching in the early 1800's. This change in vegetation is reflected by an increased abundance of grass pollen, a decrease in pollen from the mint and pea families, and a massive increase in sediment (Cole 1994). The potential for large sediment loads is also illustrated by the recent attempts to stabilize soils at Johnson's Lee on the south side of Santa Rosa Island; rice straw wattles placed along hillside contours trapped large volumes of sediment after only one season of rains (Sellgren 1994).

A comparison of historical descriptions of island vegetation with current conditions indicates that large-scale alteration of habitats caused by large numbers of non-native mammals on the islands resulted in significant loss of soils as well as changes in plant communities in terms of structural composition, species richness, species composition, and absolute cover. In 1883, Thompson and West described the effects of sheep grazing on Santa Cruz Island: ''The island becomes at some times overstocked, and may be said to be in that condition much of the time. The result is that the grasses, being cropped so close, die out, and allow the loosened soil to be removed by wind and rain'' (Hochberg *et al.* 1980a). However, at that time, vegetation elsewhere on the island was still relatively intact; Greene described mixed forests of large-leaved maple (*Acer macrophyllum*), live oak (*Quercus agrifolia*), black cottonwood (*Populus trichocarpa*), and willow (*Salix laevigata*) thriving in the canyons (Hochberg *et al.* 1980a). Another account was given by Delphine Adelaide Caire in 1933, who reflected on the conditions of Santa Cruz Island: ''Its present natural beauty does not come up to that of the past. The bed of the stream that skirts the Main Ranch on its way from Pacacho Diablo was much narrower than it is today; mountain slopes were heavily wooded and centuries-old oaks were numerous. In the course of years, rains have accomplished their ruinous work, carrying off a great amount of topsoil, the innumerable trails cut by sharp sheep trotters having been a contributing factor in such devastation'' (Hochberg *et al.* 1980a).

The importance of soils in maintaining habitat for the proposed taxa is found not only in their physical properties, but in their biotic properties as well. Healthy soils play host to a complex matrix of soil organisms, including fragile microbial components, that assist in such processes as water-holding capacity, soil fertility, and nutrient cycling. These processes have been adversely affected by the activities of alien mammals. For instance, the loss of leaf litter from trampling and rooting changes soil temperatures, increases the loss of moisture, reduces the humus layers, and results in a reduced soil fauna (Bennett 1993). The breakdown of organic material, transport of fungal spores, and nutrient recycling have been documented for soil mites on Santa Catalina Island (Bennett 1993). Soil mite diversity decreased with increased disturbance, creating impoverished nutrient levels in the soil (Bennett 1993). A feature of arid-land soils (typical of the island soils) is the presence of a cyanobacterial-lichen crust that facilitates stabilization of steep slopes and nutrient cycling (Belnap 1994). The crusts are extremely brittle during the dry summer months and can be eliminated by the shattering influences of trampling by non-native herbivores (Belnap 1994). The historic and current presence of non-native herbivores and pigs has reduced leaf litter and compacted and degraded the soil structure, resulting in accelerated rates of erosion (Klinger *et al.* 1994, Nishida 1994).

Even after the agents that initiated erosion have been removed, loss of soils continues (Clark *et al.* 1990, Halvorson 1993). Because both the biotic and physical properties of the soils have been degraded or lost altogether, the soils that remain behind provide poor conditions for seedlings to germinate and establish. On Santa Rosa Island, a grove of island oaks (*Quercus tomentella*), a Category 2 candidate for Federal listing, has shown few signs of regeneration on soils severely affected by erosion even after an exclosure was built to eliminate cattle, elk, and deer (Danielsen 1989a, 1989b). All 16 taxa in this proposed rule are threatened with habitat instability due to the loss and degradation of soils on all islands.

Several historic accounts include specific references to the abundance and distribution of several of the proposed taxa, which can be compared to current abundance and distribution information. In a letter to Hoffmann in 1932 concerning *Berberis pinnata* ssp. *insularis,* Munz remarked that,