

wind patterns (Romspert and Burk 1979 and Norris and Norris 1961), and precipitation patterns (Willoughby 2000 and Willoughby 2001) supported our assumption that the habitat, in terms of dune action, precipitation, and vegetation, was uniform in variation and continuous throughout the dune system. Based on rainfall data collected from November 16, 2000 to March 16, 2001 (1.40 inches of precipitation was recorded at Cabuilla Ranger Station in the northwest part of the dunes and 2.67 inches of precipitation was reported at Buttercup Campground in the southern end of the dunes (Willoughby 2001)), BLM indicated that more precipitation may fall in the southern portion of the Algodones Dunes compared to the northern end of the dunes. However, given the limited precipitation data available for the Algodones Dunes (5 months) and the relatively short linear extent of the dunes (40 mi long) (64 km long), we could not project a rainfall gradient and, instead, assumed that the precipitation was uniformly variable and continuous throughout the dune system. Based on observations of unimpeded sand and wind movement across existing paved roads, we did not expect that the paved roads would represent a barrier to the dispersal of the fruits and seeds of *Astragalus magdalenae* var. *peirsonii*. Surveys conducted by BLM indicate variability in occurrences of standing plants from year to year (Willoughby 2000 and Willoughby 2001) and that at any given time, these occurrences may represent standing plants, root crown regrowth, or seedlings of *Astragalus magdalenae* var. *peirsonii*. We assumed that if standing plants were not found in a particular grid cell during a survey, but were recorded as present in other survey years, then that grid cell may be occupied by either root crowns or seeds of this species. BLM randomly selected survey transects and, as expected, this random selection results in gaps between transects. We projected the distribution of *Astragalus magdalenae* var. *peirsonii* across the gaps by assuming that the values of unknown grid cells are more closely related to nearby cells rather than distant cells.

From the data provided by BLM we were able to calculate scores for each of these variables and then extrapolate the values for each variable for the entire dune area. We made this extrapolation based on a statistical method called Kriging, which calculates new values for unsurveyed areas based on the known values for the cells that were surveyed. The data for these four variables was then standardized to a scale of 0 to 5

points so that the range of scores, from low to high, would be comparable to one another. The standardized scores were then totaled for each cell, for a possible high score of 20 points. This set of values was then further refined using the Kriging method to generate a map similar in appearance to a topographic map, showing the resulting scores of the model in the same way a topographic map shows variations in elevation. A line was then drawn around those areas of higher-quality psammophytic scrub habitat described above and considered essential to the conservation of *Astragalus magdalenae* var. *peirsonii*.

Primary Constituent Elements

In accordance with section 3(5)(A)(i) of the Act and regulations at 50 CFR 424.12, in determining which areas to propose as critical habitat, we consider those physical and biological features (primary constituent elements) that are essential to the conservation of the species and that may require special management considerations or protection. These include but are not limited to: Space for individual and population growth and for normal behavior; food, water, air, light, minerals or other nutritional or physiological requirements; cover or shelter; sites for germination or seed dispersal; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

Much of what is known about the specific physical and biological requirements of *Astragalus magdalenae* var. *peirsonii* is described in the Background section of this proposal and in the final listing rule. The proposed critical habitat is designed to provide sufficient habitat to maintain self-sustaining populations of *A. m.* var. *peirsonii* throughout its range and to provide those habitat components essential for the conservation of the species. These habitat components provide for: (1) Individual and population growth, including sites for germination, pollination, reproduction, pollen and seed dispersal, and seed bank; (2) intervening areas that allow gene flow and provide connectivity or linkage within segments of the larger population; and (3) areas that provide basic requirements for growth, such as water, light, and minerals.

The conservation of *Astragalus magdalenae* var. *peirsonii* is dependent upon a number of factors including the protection and management of existing population sites and habitat, the maintenance of normal ecological functions within these sites, including connectivity between groups of plants

within close geographic proximity to facilitate gene flow among the sites by pollinator activity and fruit as well as seed dispersal. Some of the factors associated with the observed and potential distribution of this species include: seeds will likely germinate if germination requirements of scarification and moisture are met within a germination time frame for the species (Porter, *in litt.* 2003); germination patterns likely reflect the distribution of the seed bank in the shifting sands, (seeds will not effectively germinate below a certain depth); and distribution patterns of standing plants may, in large part, reflect the distribution pattern of adequate rainfall for a particular year.

The areas we are proposing to designate as critical habitat provide some or all of the habitat components essential for the conservation of *Astragalus magdalenae* var. *peirsonii*. These habitat components and primary constituent elements are generally associated with psammophytic scrub (e.g., *Croton wigginsii*, *Eriogonum deserticola*, *Helianthus niveus* ssp. *tephrodes*, *Palafoxia arida* var. *gigantea*, *Pholisma sonora*, and *Tiquilia plicata*). Based on the best available information at this time, the primary constituent elements of critical habitat for *A. m.* var. *peirsonii* consist of:

(1) Intact, active sand dune systems (defined as sand areas that are subject to sand-moving winds that result in natural expanses of slopes and swales) within the historical range of *A. m.* var. *peirsonii* that are characterized by:

(A) substrates of the Rositas soil series, specifically Rositas fine sands of sufficient depth to promote *A. m.* var. *peirsonii* and discourage creosote bush scrub; and

(B) wind-formed slopes of less than 30 degrees, but generally less than 20 degrees.

Criteria Used To Identify Critical Habitat

We identified critical habitat essential to the conservation of *Astragalus magdalenae* var. *peirsonii* in the primary locations where it currently occurs or has been known to occur in the Algodones Dunes. We are proposing to designate critical habitat to maintain self-sustaining populations of *A. m.* var. *peirsonii* within the range of the taxon in the United States.

Astragalus magdalenae var. *peirsonii* has a very limited range even within the Algodones Dunes. Less than one-third of the area delineated by the ISDRA has documented occurrences of *A. m.* var. *peirsonii*. Extreme fluctuations in populations have been demonstrated.