

Summary of Factors Affecting the Species

Section 4 of the Act and regulations (50 CFR part 424) promulgated to implement the listing provisions of the Act describe the procedures for adding species to the Federal lists. We may determine a species (which is defined in section 3 of the Act as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature) to be endangered or threatened because of one or more of the five factors described in section 4(a)(1) of the Act. These factors, and their application to the Sierra Nevada DPS of the mountain yellow-legged frog (mountain yellow-legged frog), are as follows:

A. *The present or threatened destruction, modification, or curtailment of its habitat or range.* A number of hypotheses, including habitat loss, have been proposed for recent global amphibian declines (Bradford *et al.* 1993; Corn 1994; Alford and Richards 1999). Habitat destruction, however, does not appear to be the primary factor leading to the decline of the mountain yellow-legged frog. The mountain yellow-legged frog occurs at high elevations in the Sierra Nevada, which have not had the types or extent of large-scale habitat conversion and disturbances which have occurred at lower elevations (Bradford *et al.* 1993; Knapp 1996; Knapp and Matthews 2000). Large scale habitat conversion has not been identified within the range of this species; thus, direct habitat destruction or modification associated with intensive human activities, as measured by urban or agricultural land use within the mountain yellow-legged frogs' range, has not been implicated in the decline of this species (Davidson *et al.* 2002). However, other human activities have played a role in the modification of mountain yellow-legged frog habitat. These include livestock grazing, non-native fish introductions (see Predation, Factor C, below), timber management, road construction and maintenance, recreation, water diversions, fire management activities, and introduction of environmental contaminants (see Other, Factor E, below). These activities have modified habitat in ways that have fragmented and isolated mountain yellow-legged frog populations, and thereby, may have caused or contributed to the decline of this DPS (Bradford *et al.* 1993).

Grazing

Grazing of livestock in Sierra Nevada meadows and riparian areas (aquatic

ecosystems and adjacent upland areas that directly affect them) began in the mid-1700s with the European settlement of California (Menke *et al.* 1996). Following the gold rush of the mid-1800s, grazing rose to a level that exceeded the carrying capacity of the available range and caused significant impacts to meadow and riparian ecosystems (Meehan and Platts 1978; Menke *et al.* 1996). From 1870 to 1908, within the range of the mountain yellow-legged frog in the high Sierra Nevada, meadows were converted to summer rangelands for grazing cattle, sheep, horses, goats, and in some areas pigs; however, the alpine areas were mainly grazed by sheep (Beesley 1996; Menke *et al.* 1996). This practice resulted in the degradation of these extremely sensitive areas (Menke *et al.* 1996).

In general, livestock grazing within the range of the mountain yellow-legged frog was at a high but undocumented level until the establishment of national parks (beginning in 1890) and national forests (beginning in 1905). Within established national parks, grazing by cattle and sheep was replaced by that of packstock, such as horses and burros. Within established national forests, the amount of livestock grazing was gradually reduced and better documented, and the types of animals shifted, with reductions in sheep and increases in cattle and packstock. In general, livestock grazing within the national forests has continued with gradual reductions since the 1920s, except for an increase during World War II. Continuing decreases, motivated by concern towards resource protection, conflicts with other uses, and deteriorating range conditions, continued from the 1950s through the early 1970s but still exceeded sustainable grazing capacity in many areas (Menke *et al.* 1996; University of California (UC) 1996a). Grazing management that is more sensitive to riparian areas has been implemented and continues to increase since the 1970s (UC 1996a).

Packstock grazing is the only grazing currently permitted in the Sierra Nevada national parks. Packstock grazing also is permitted in national forests within the Sierra Nevada. However, there has been very little monitoring of the impacts of packstock use in this region (Menke *et al.* 1996). Use of packstock in the Sierra Nevada increased since World War II as a result of increased road access and increases in leisure time and disposable income (Menke *et al.* 1996). Demand for packstock use and recreational riding in the Sierra Nevada are projected to

increase as California's human population increases (USFS 2001).

Observational data indicate livestock negatively impact mountain yellow-legged frog populations by altering frog habitat and trampling individuals (R. Knapp, *in litt.* 1993a, 1993b, 1994, 2002; Jennings 1996; A. Carlson, pers. comm. 2002; USFS 2002; V. Vrendenburg, *in litt.* 2002).

Livestock grazing causes changes in wetland systems, including meadows, streams, and ponds; modifies mountain yellow-legged frog habitat by removing overhanging banks that provide shelter; and contributes to the siltation of breeding ponds. Pond siltation may decrease the survivorship of overwintering larvae, subadults, and adult mountain yellow-legged frogs as the overwintering habitats need to be deep enough so that the entire water column does not freeze and underwater caves and crevices are available (Bradford 1983; Pope 1999a).

Grazing of livestock in riparian areas impacts vegetation in multiple ways, including: soil compaction, which increases runoff and decreases water availability to plants; herbage removal, which promotes increased soil temperatures and evaporation rates at the soil surface; and direct physical damage to the vegetation (Kauffman and Krueger 1984; Cole and Landres 1996; Knapp and Matthews 1996). Streamside vegetation protects and stabilizes streambanks by binding soils to resist erosion and to trap sediment (Chaney *et al.* 1990). A study by Kauffman *et al.* (1983) indicated that livestock grazing may have weakened the streambank structure through trampling and removal of vegetation, thereby promoting conditions for erosion. Removal of vegetative cover within mountain yellow-legged frog habitat decreases available habitat, exposes frogs to predation (R. Knapp, *in litt.* 1993b), and increases the threat of dessication (Jennings 1996). Grazing may result in changes to vegetation composition, resulting in an increased density of forested stands and the expansion of trees into areas that were formerly treeless (Cole and Landres 1996).

Livestock grazing can cause a nutrient loading problem due to urination and defecation in or near the water, and can elevate bacteria levels in areas where cattle are concentrated near water (Meehan and Platts 1978; Stephenson and Street 1978; Kauffman and Krueger 1984). The nutrient status of streams can markedly influence the growth of microflora and microfauna and directly and indirectly affect many other characteristics of the stream biota