DELTA GREEN GROUND BEETLE

Elaphrus viridis

USFWS: Threatened

CDFG: None

Species Account

Status and Description. The delta green ground beetle was listed as a federally threatened species on August 8, 1980 (45 FR 52807). These carabid beetles are colored in metallic green and bronze and are approximately 0.6 centimeters (1/4 inch) in length (USFWS 1999). The beetle is distinguished from other carabid beetles by its size, color and spotting patterns, lack or reduction of circular pits on the elytra (first pair of wings, which in beetles are hardened and act as a protective covering for the flight wings), and degree of hairiness (USFWS 2001).

Range, Populations and Activity. The historic range of the delta green ground beetle is unknown (USFWS 1999). The widespread disruption of wetland and grassland habitat of the Central Valley since the mid-1800's suggests that the beetle's range has shrunk and become highly fragmented (USFWS 2001). A single delta green ground beetle specimen was collected in the 1800's in an unspecified area of California. The species was rediscovered in the greater Jepson Prairie area of Solano County in 1974, where it presently occurs (USFWS 1999). The diking and plowing of one of the sites where the beetle was discovered in 1974 and 1975 has presumably caused the beetle to be extirpated from that site (USFWS 1999). There have been unconfirmed reports of the delta green ground beetle from a wildlife preserve in the Sacramento Valley in the vicinity of Sutter Buttes, but these reports are currently considered unlikely (USFWS 2005).

The delta green ground beetle's life history is somewhat unknown and is based on observations of other species and inferred from limited data (USFWS 1999). Adult beetles seem to be active from the time they emerge in January until mid-May, after which they enter an inactive phase called a diapause. Female beetles probably reproduce only one time a year in early winter (USFWS 1999). Captive-bred specimens have shown seven stages of its life cycle, with each stage taking five to seven days and a total of 35 to 45 days for complete development (USFWS 1999). The seven stages include egg, three larval instars or molts, pre-pupa, pupa, and adult (USFWS 1999). The beetle larvae often hide in dense vegetation or deep cracks (up to 15-18 inches) in the ground, where they presumably pupate and survive the hot Sacramento Valley summer and fall before they emerge as adults in the winter. Adults remain active during the wet season in winter and spring and may enter another diapause as adults in late spring or early summer (USFWS 1999). The beetle's life span is estimated at 9-12 months or more, but whether adults live for more than one year is unknown (USFWS 1999).

Delta green ground beetle adults and larvae are presumed to be predatory and feed by sight (USFWS 2001). The diet of delta green ground beetle most likely includes small soft-bodied arthropods and invertebrates, such as springtails (order Collembola), terrestrial chironomid midges, and beetle larvae (USFWS 1999).

A possible predator the delta green ground beetles is the California tiger salamander (USFWS 2005). Serpa (1985) speculated that shorebirds are not a significant predator because Delta green ground beetles freeze when they see large objects move, and are so cryptically colored that they are almost impossible to see when they are not moving.

Adult delta green ground beetles are often found from early February to mid-May, but have been seen as early as late fall. The beetle is largely diurnal but may be active during the evening (USFWS 1999). Larvae of the beetle are rarely seen due to their small size and because they hide in dense vegetation and deep cracks in the ground (USFWS 1999).

Habitat Use. Delta green ground beetles appear to prefer grassland habitat that is interspersed with vernal pools or playa pools, which are larger vernal pools that typically hold water for long time periods (USFWS 1991). The preferred habitat of the delta green ground beetle is largely unknown. Some entomologists believe that the species prefers more open habitats along the edges of pools, trails, roads and ditches, where they often hide in cracks in the ground and under low lying vegetation such as filaree (*Erodium* sp.), Baker's navarretia (*Navarretia leucophala* ssp. *bakeri*) (USFWS 1999, USFWS 2001, USFWS 2005). Arnold (1989) found that habitat variables most strongly associated with the Delta green ground beetle were Baker's navarretia cover, alkali heath (*Frankenia* sp.) cover, downingia (*Downingia* sp.) cover, and soil type. Arnold speculates that Baker's navarretia may be a good habitat indicator for the Delta green ground beetle (R. Arnold pers. com.).However, the small size and elusive habits of the beetle often hinders observation in other more densely vegetated habitat types (USFWS 2001). Adult beetles may also occur in the surrounding grasslands (USFWS 2001).

Population Levels and Occurrence in Plan Area. Delta green ground beetles occur exclusively along the edges of large vernal pools in the Valley Floor Grasslands and Vernal Pools Natural Community. Presently, the beetle is only known from the Jepson Prairie area in Solano County. The beetle is estimated to occur in an area of less than 5,000 acres (USFWS 1999). Population sizes are unknown and difficult to estimate, but only a few hundred have been seen since their rediscovery in 1974 and only 50 specimens have been collected (USFWS 1999). Recently the number of beetles appears to have declined, possibly due to the temporary removal of managed grazing (USFWS 1999). The beetle's current range includes the Solano Land Trust's Jepson Prairie Preserve and adjacent privately owned sites (UC Berkeley 2001). All records of the delta green ground beetle occurrences are from within the Plan Area. (See the Species Occurrence map)

Dispersal. Dispersal is commonly considered important for carabid beetles, but whether or not delta green ground beetles disperse is uncertain (USFWS 1999). Only seven observations of beetles in flight have been documented, all of which were for very short distances (USFWS 1999). The beetles have also been seen swimming and moving in vernal pools. These activities are most likely not related to true dispersing or large migratory behavior, but rather may be an adaptation to changes in the season, time of day (or night), or other environmental conditions (USFWS 1999).

Threats to the Species. The delta green ground beetle is believed to have been extirpated from much of its former range. Loss and alteration of vernal pool and grassland habitat in the mid-1800's were most likely significant factors in the species' decline (USFWS 1999).

Known Delta green ground beetles are currently relatively secure. Most of the known habitat lies outside of the current urban boundaries, is owned by the Solano Land Trust/The Nature Conservancy

(Jepson Prairie, Wilcox Ranch), or is being considered for other conservation uses such as mitigation banks. Potential habitat that could support unknown populations occurs in the vernal pool areas north of Potrero Hills and north of Travis AFB. Other threats associated with declining populations of the delta green ground beetle include introductions of invasive plants [such as the garden lippia (*Phyla* sp.)], urban and suburban development, alterations of vernal pool hydrology, incompatible grazing practices, pipeline and transmission line operation and maintenance, naturally occurring events, vandalism, illegal collecting, and potential exploratory drilling and sludge disposal activities (USFWS 1999, USFWS 2001).

Critical Habitat. Critical habitat was designated for the delta green ground beetle in Solano County on August 8, 1980 (45 FR 52807 -- see Code of Federal Regulations 50:17.96). The U.S. Fish and Wildlife Service designated two areas, which are separated by one-half mile and total approximately 960 acres (USFWS 1999). These areas include the Jepson Prairie Reserve and the western portions of the Gridley Mitigation Bank.

Within the mapped critical habitat areas or map units, critical habitat for the delta green ground beetle includes those areas possessing both of the primary constituent elements. These primary constituent elements include: 1) essential vernal pool and surrounding grassland habitat; and 2) associated land areas that surround and drain into essential vernal pool habitat.

A recovery plan for the delta green ground beetle (and Solano grass) was published on September 11, 1985. A revised recovery plan for the species will be included in the draft recovery plan for northern California vernal pool species.

Conservation Issues. Conservation of this beetle depends on the protection of its vernal pool habitat. The beetle's current range includes the Jepson Prairie Preserve, which is largely protected. Efforts are underway to control invasive nonnative plants within the Jepson Prairie Preserve, including grazing, prescribed fire, and hand application of herbicides. Some evidence suggests that the absence of grazing can have a negative effect on the Delta green ground beetle, and sheep grazing appears to be more compatible with the beetle than cattle grazing (USFWS 2005). Although the effect of prescribed burning on the Delta green ground beetle is unknown, it may prefer open habitat which is fostered by periodic fires (USFWS 2005). The Delta green ground beetle also occurs on private land. Although some of this land is protected under conservation easements and mitigation banks , ongoing negotiations are required to ensure protection of the habitat.

References and Literature Cited

Arnold, R. A. 1989. Evaluation for habitat quality for the threatened Delta green ground beetle in the vicinity of Jepson Prairie Preserve for PGT and PG&E's gasoline expansion project. Unpublished report, submitted to: Pacific Gas & Electric Co., San Ramon, California.

Arnold, R. Entomological Associates Pleasant Hill, California. Personal Communication.

Federal Register. 1980. 45 FR 528-07. [August 8, 1980].

Serpa, L. 1985. Element stewardship abstract for the Delta green ground beetle, *Elaphrus viridis*. The Nature Conservancy, 8 pages.

UC Berkeley. 2001. California's Endangered Insects. Essig Museum of Entomology. University of California, Berkeley, California. Available on the Internet at: http://shanana.berkeley.edu/essig/endins/elaphrus.htm.

USFWS (U.S. Fish and Wildlife Service). 1985. Delta green ground beetle and Solano grass recovery plan. Portland, Oregon.

____. 1999. Biological opinion for the Solano project water service contract renewal. U.S. Fish and Wildlife Service, Sacramento, California. 107 pp. + append.

____. 2001. Endangered Species Division, Sacramento Fish and Wildlife Office. Available on the Internet at: http://sacramento.fws.gov/es/animal_spp_acct/delta_green_beetle.htm.

U.S. Fish and Wildlife Service (USFWS). 2005 Recovery plan for vernal pool ecosystems of California and Southern Oregon. Portland, OR.