

adequate habitat needs to be protected and land uses adjacent to the preserve need to be compatible with maintaining the integrity of the preserve. Habitat is not restricted solely to the area actually occupied by the species. It must include an area that is large enough to maintain the ecological functions upon which the species depends and have a ratio of edge to total area that minimizes fragmentation and edge effects.

Failure to protect sufficient habitat results in the eventual decline of the target species. Small preserves adjacent to urban areas have additional stress placed on them due to the need to manage a host of human-caused impacts. The increased stress urban wildland areas receive has been documented by many authors (Keeley 1993).

In the case of *Polygonum hickmanii* at the School District Preserve, the site remained unfenced and unsigned for several years, was subject to bicycle and heavy equipment traffic, and served as a repository for yard waste (C. Kelley, *in litt.* 1999). Local residents also have used the preserve for golf practice (Biotic Resources Group 2002). A management plan for the preserve was completed in 1998 (Wittwer, *in litt.* 2002). However, prescribed management actions are not always implemented according to schedule due to budget limitations.

Habitat fragmentation also affects plant-pollinator interactions in a number of ways. The abundance of specific pollinators may decline due to the elimination of nesting sites, decreases in food source plants due to changes in composition of the plant community, increases in competition from nonnative pollinators, and increases in the exposure to pesticides (Rathcke and Jules 1993; Jennersten 1988; Kearns and Inouye 1997). In plant species that are obligate outcrossers (those that require pollinators to effect seed development), reduced pollinator availability can result in limited seed production. Even if a plant species is not an obligate outcrosser, genetic variability within the plant population can be reduced with potentially deleterious long-term consequences (see discussion below on random extinction). We believe the effects of habitat fragmentation discussed above are similar to those that could affect the long-term persistence of the *Polygonum hickmanii*.

Ecological processes that would be important to maintain within preserve areas for *Polygonum hickmanii* include, but are not limited to, the integrity of edaphic (soil) conditions, hydrologic processes (surface flows), the associated

“wildflower field” plant community, plant-pollinator interactions, and seed dispersal mechanisms. Maintaining such processes will be severely compromised by the small size of the areas being set aside as preserves or open spaces, the extent of edge subject to external influences, and the particular kinds of adjacent land use to which the preserves will be subject. Threats resulting from alteration of habitat due to adjacent changes in land use (discussed in Factor A) are exacerbated by the small size of the preserves and the proximity of nearly all of the colonies to the edges of the preserves or open spaces, or to roads. Distances of less than 24 m (80 ft) are not considered to be effective at buffering from chemical pollutants (*e.g.*, herbicides, pesticides, and other contaminants) (Conservation Biology Institute (CBI) 2000). Depending on site configuration or circumstances, buffers of up to 91 m (300 ft) may not be adequate to provide sufficient buffering from invasive animals and increased fire frequency (CBI 2000).

#### Random Extinction

This species is considered to have a high risk of extinction in the wild in the immediate future based on criteria put forth by the World Conservation Union, as modified for plants (Keith 1998). Species with few populations and individuals are vulnerable to the threat of naturally occurring events, causing extinction through mechanisms operating either at the genetic level, the population level, or the landscape level. Decrease in genetic variability will reduce the likelihood that individuals in a population will persist in a changing environment. Additionally, populations with lower levels of genetic diversity are more likely, on average, to experience reduced reproductive success due to inbreeding depression. Species with few populations or those that are low in number may be subject to forces at the population level that affect their ability to complete their life cycles successfully. For example, reduced numbers of individuals may lead to a reduction in number of pollinators and subsequently seed set. Additionally, if the host plants are partially self-incompatible, reduction in population size may lead to increased self-pollination and may reduce the level of genetic variability. At the landscape level, random natural events, such as storms, drought, or fire, could destroy a significant percentage of individuals or entire populations; a hot fire could destroy a seedbank as well. The restriction of colonies to small sites

increases their risk of extinction from such naturally occurring events.

The genetic characteristics of *Polygonum hickmanii* have not been investigated; therefore, the degree to which these characteristics contribute to the likelihood of *P. hickmanii* being vulnerable to extinction for these reasons is unknown. However, random events operating at the population and landscape levels clearly have the potential for increasing the chance of extinction for *P. hickmanii*.

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by this taxon in determining the actions to take in this rule. Based on this evaluation, the appropriate action is to list *Polygonum hickmanii* as endangered. The species is threatened with extinction due to habitat alteration resulting primarily from urban development, inadequate preserve design, and vulnerability to naturally occurring events due to low numbers of individuals and occupied acreage of the entire taxon. All of the colonies are on private lands. Although conservation efforts have been prescribed as part of mitigation for two of the three projects (high school and recycled water distribution project), and are expected to be proposed for the third project (Polo Ranch development), the small extent of occupied habitat, small colony sizes, and imminent threats lessen the chance that such efforts will lead to secure, self-sustaining colonies at these sites.

#### Critical Habitat

Section 3 of the Act defines critical habitat as—(i) the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species, and (II) that may require special management consideration or protection; and (ii) specific areas outside the geographic area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species. “Conservation” means the use of all methods and procedures that are necessary to bring an endangered species or a threatened species to the point at which listing under Act is no longer necessary.

Critical habitat receives protection under section 7 of the Act through the prohibition against destruction or adverse modification of critical habitat with regard to actions authorized, funded, or carried out by a Federal agency. Section 7 of the Act also