

remains within these regions. Many of the Solano-Colusa vernal pools have been destroyed or degraded by agricultural conversion, water impounding for waterfowl habitat enhancement, urban development, and road-building. Most of the vernal pools in the Livermore Region have been destroyed or degraded by urban development, agriculture, water diversions, poor water quality, and long-term overgrazing (Keeler-Wolf *et al.* 1998). Many breeding sites in the Bay Area population are in artificial water bodies rather than natural vernal pools. Overall, 43 percent (83) of the records are in stock, farm, or berm ponds used for cattle grazing and as a temporary source of water for small farm irrigation (CNDDDB 2002).

California tiger salamander localities in Contra Costa and Alameda Counties may be affected by ORV use; at least 10 proposed housing developments; 3 golf courses; infrastructure construction, including expansion of an airport, a landfill, and a power station; and highway construction (CNDDDB 2002). These development projects may destroy upland habitat and wetland breeding habitat, killing salamanders and reducing the viability of populations at the affected localities.

In eastern Contra Costa and Alameda Counties, especially the Livermore and Amador Valleys, urban expansion continues at a rapid pace. California tiger salamander populations in the Livermore Valley are severely threatened by the ongoing conversion of 14,527 ha (35,897 ac) of grazing land to subdivisions and vineyards (Stebbins 1989; East Bay Regional Park District (EBRPD) 1999). Almost the entire valley floor, and large portions of the adjacent hills, are being developed or are being considered for development and eventual annexation. The North Livermore and South Livermore Valley Specific Plans represent 11,727 ha (28,977 ac) of planned urban development in and around Livermore Valley (EBRPD 1999). Urban Growth Boundaries encompass 108,262 ha (267,520 ac), including the Livermore, La Costa, Amador, Sunol, and Vallecitos valleys in east Alameda County and the Clayton, Lone Tree, Deer, and Briones valleys of eastern Contra Costa County (Alameda County Planning Department 1993; EBRPD 1999). These valleys constitute much of the core area inhabited by the Bay Area California tiger salamander population. Shaffer *et al.* (1993) found that the East Bay Counties of Alameda and Contra Costa supported the greatest concentrations of California tiger salamander. Three localities are known from near San

Francisco Bay in southwestern Alameda County, and are partially protected by San Francisco Bay National Wildlife Refuge.

California tiger salamanders at a university in Palo Alto declined to near extirpation due, in part, to urban development of adjoining upland areas (Barry and Shaffer 1994), but water management and other take-reduction efforts have been implemented in recent years to protect the population (Thomas Reid Associates 1998). A locality within the City of San Jose is threatened by urban development. Several areas in southern Santa Clara County also are undergoing urban expansion.

*Central Valley Population* (Yolo, Solano, Sacramento County south of the Cosumnes River, northeastern Contra Costa, eastern San Joaquin, western Amador, western Calaveras, western Tuolumne, eastern Stanislaus, Merced, western Mariposa, and northwestern Madera Counties): Forty-seven percent (286 of the 608 sites) of the known California tiger salamander records are in this population (CNDDDB 2002). Subpopulations at 37 of recorded locations in the Central Valley Population are considered extirpated (CNDDDB 2002; Service 2003). Urban development and agriculture have eliminated much of the grassland and vernal pools. From 1996 to 1998, 14,361 ha (35,487 ac) of native habitat were converted to urban and agricultural uses in Yolo, Solano, Contra Costa, Merced, Sacramento, San Joaquin, Stanislaus, and Madera Counties (CDC 2000). There are 146,600 ha (362,253 ac) of potential habitat for the California tiger salamander in the Central Valley (Service 2003). The species historically occurred as far north as Butte County but has not recently been documented north of the Cosumnes River. The remaining sites inhabited by the California tiger salamander occur in the low-elevation foothills on the eastern side of the Central Valley (Shaffer *et al.* 1993).

Of 127 California tiger salamander localities where wetland type was identified, 26 percent (33) were in vernal pools. These wetland type localities within the Central Valley population of California tiger salamanders occurs within the southeastern Sacramento Valley and southern Sierra foothills vernal pool regions (Keeler-Wolf *et al.* 1998). Vernal pools in both regions are threatened by conversion of grasslands and grazing land to housing developments and intensive agriculture (see Factor E).

California tiger salamander localities in the Central Valley population may be affected by recently implemented

development projects, including vineyards and proposed highway construction. These development projects may destroy upland habitat and wetland breeding habitat, killing salamanders and reducing the viability of populations at the affected localities. Large vineyards planted in areas along the San Joaquin-Sacramento County line have degraded and destroyed habitat for California tiger salamanders.

In Yolo and Solano Counties, the major impacts to California tiger salamander populations have been agricultural. Portions of the California tiger salamander locality at Jepson Prairie in Solano County is protected by the University of California Natural Reserve System and the Solano Land Trust. However, some upland habitat may have been disrupted by construction of a natural gas pipeline in the vicinity. California tiger salamanders also were found at some proposed power plant sites near Jepson Prairie.

In Stanislaus County, California tiger salamanders were considered extirpated until they recently were found by biologists surveying a potential route for a highway bypass near Oakdale (California Department of Transportation 2000). This highway route threatens the only known population of California tiger salamanders in the Oakdale area. However, other populations are known to exist within Stanislaus County outside the Oakdale area.

*South San Joaquin Population:* (western Madera, central Fresno, and northwestern Tulare Counties north of the St. Johns and Kaweah Rivers): Nine percent (56 of the 608 sites) of the known California tiger salamander sites are in this population (CNDDDB 2002). However, 18 of these sites in the South San Joaquin population are considered extirpated (CNDDDB 2002; Service 2003). From 1996 to 1998, 4,509 ha (11,142 ac) of native habitat were converted to urban and agricultural uses in Fresno, Tulare, and Madera Counties (CDC 2000). There are 24,450 ha (60,418 ac) of potential habitat for the California tiger salamander in the southern San Joaquin Valley (Service 2003).

Ninety-seven percent (31) of 32 localities for which wetland type was identified in the South San Joaquin population are within vernal pools. These wetland type localities within the South San Joaquin population of the California tiger salamander occur within the southern Sierra Foothill Vernal Pool Region (Keeler-Wolf 1998). Although we are unaware of a specific quantified estimate of loss for this vernal pool region, we believe that a significant