

Area of Critical Environmental Concern (ACEC), but predominantly occurs in East Mesa and in areas adjoining the Algodones Dunes (*i.e.*, Imperial Sand Dunes, Glamis Sand Dunes). In Arizona, the flat-tailed horned lizard is found in the Yuma Desert south of the Gila River and west of the Gila and Butler Mountains (Rorabaugh *et al.* 1987). The flat-tailed horned lizard is patchily distributed throughout its range, and has been recorded at elevations as high as 520 meters (m) (1,706 feet [ft]) above sea level, but is more commonly found below 250 m (820 ft) in areas with flat-to-modest slopes (Turner *et al.* 1980).

The range of the flat-tailed horned lizard extends into Mexico from the international border in the Yuha Desert in California, south to Laguna Salada in Baja California, and from the international border in the Yuma Desert in Arizona, south and east through the Pinacate Region to the sandy plains around Puerto Penasco and Bahia de San Jorge, Sonora (Johnson and Spicer 1985, Gonzales-Romero and Alvarez-Cardenas 1989).

The distribution of the flat-tailed horned lizard is not contiguous across its range, because of fragmentation by large-scale agricultural and urban development, primarily in the Imperial Valley and the Coachella Valley. In addition, the Salton Sea, Colorado River, East Highline Canal, New Coachella Canal, and All American Canal are barriers to movement of flat-tailed horned lizards.

Due to this habitat fragmentation and existing geographic barriers, the distribution of flat-tailed horned lizards appears to be currently divided on a broad scale into at least four geographically discrete populations: three in California and one in Arizona. The three populations in California are located in the Coachella Valley, the west side of the Salton Sea/Imperial Valley, and the east side of the Imperial Valley.

The Coachella Valley population of flat-tailed horned lizards was likely much more extensive and connected to other populations in California in the past. Now it is isolated by extensive agricultural development in the southern half of the Coachella Valley and by the Salton Sea. The other two populations of flat-tailed horned lizards, on the west side of the Salton Sea/Imperial Valley and the east side of the Imperial Valley, are isolated from the Coachella Valley population and each other by agricultural and urban development of the Imperial Valley and by the Salton Sea. The Arizona population is isolated from populations in California by agricultural and urban

development around Yuma, and ultimately by the Colorado River.

Hodges (1997) estimated that the flat-tailed horned lizard historically (prior to agricultural or urban development of either the Coachella or Imperial Valleys) occupied up to 979,037 hectares (ha) (2,419,200 acres [ac]) in Arizona and California. Approximately 51 percent (503,173 ha [1,243,340 ac]) of this historical habitat remains in the United States, with about 56,770 ha (140,300 ac) in Arizona and 446,390 ha (1,103,040 ac) in California (Hodges 1997). The Salton Sea area could arguably be considered ephemeral historical habitat, present at some points and absent at others, as the area changed through time. Hodges (1977) included the Salton Sea as historical habitat. If the area the Salton Sea currently occupies is not considered historical habitat, then approximately 57 percent (557,072 ha [1,376,525 ac]) of historical habitat remains in the United States.

Johnson and Spicer (1985) estimated that in 1981 approximately 59 percent of the species range occurred in Mexico, with the majority of the range in Mexico occurring in the state of Sonora. However, the distribution of the species in Mexico is poorly understood because few surveys have been conducted to determine where the species occurs in Mexico (CEDO 2001). In Sonora, about 14 percent of the habitat was estimated to be threatened by urban, agricultural or recreational use, and habitat degradation in 1981 (Johnson and Spicer 1985). In Baja California Norte, considerable habitat loss has occurred in the Mexicali Valley, where urban and agricultural development extends from Mexicali to the Colorado River (Johnson and Spicer 1985, Foreman 1997).

The majority (about 60 percent) of the species' range in Mexico lies within two federally protected areas: (1) The Upper Gulf of California and Colorado Delta Biosphere Reserve, and (2) the Pinacate and Gran Desierto de Altar Biosphere Reserve (CEDO 2001). The National Park of Pinacate is an area administered by the Mexican government with use restrictions similar to those in a national park in the United States. The Pinacate area is primarily a volcanic zone within which flat-tailed horned lizard habitat is probably limited to the sandy perimeters of Volcan Pinacate. The Upper Gulf of California Biosphere Reserve includes flat-tailed horned lizard habitat in the vicinity of the Colorado River Delta in Sonora, Mexico.

The flat-tailed horned lizard is most commonly found in sandy flats and valleys in a creosote (*Larrea tridentata*)—white bursage (*Ambrosia dumosa*) plant association (Turner *et al.*

1980; Muth and Fisher 1992; Foreman 1997). Turner *et al.* (1980) stated the best habitats are generally low-relief areas with surface soils of fine packed sand or pavement, overlain with loose, fine sand. Flat-tailed horned lizards are also known to occur at the edges of vegetated sand dunes, on barren clay soils, and sparse saltbush communities, but Turner *et al.* (1980) suspected that these recorded occurrences were actually individuals that had dispersed from more suitable habitats. Within a creosote plant community in West Mesa, California, Muth and Fisher (1992) found that flat-tailed horned lizards preferred sandy substrates with white bursage and Emory dalea (*Psoralea emoryi*), and avoided creosote and *Tequila plicata*. In Arizona, Rorabaugh *et al.* (1987) found flat-tailed horned lizard abundance correlated with big galleta grass (*Hilaria rigida*) and sandy substrates, but suggested that the presence of sandy substrates were more important than that of big galleta grass.

Several researchers have investigated the relationship between density of perennial plants and flat-tailed horned lizard abundance. The relationships observed varied among studies (Altman *et al.* 1980, Turner and Medica 1982, Beauchamp *et al.* 1998). Altman *et al.* (1980) and Turner and Medica (1982) found the relative abundance of horned lizards was significantly and positively correlated with perennial plant density in creosote-white bursage plant communities. However, Beauchamp *et al.* (1998) found flat-tailed horned lizards to be present in higher relative densities in sparsely vegetated areas with large patches of concretions, gravel, and silt, than they were in sandy or densely vegetated areas. Altman *et al.* (1980) also reported finding flat-tailed horned lizards in desert pavement areas. Foley (2002) found little correlation in substrate texture and distribution of flat-tailed horned lizards when using three experimental treatments consisting of sandy, rocky and mixed substrates. However, Grant and Wright (2002) found flat-tailed horned lizard abundance was positively correlated with percentage of sand cover.

Information concerning population dynamics of flat-tailed horned lizard populations is limited and inconclusive. Since 1979, population trends were monitored using a combination of scat counts and lizards observed along transects (Wright 2002). Different methods of transect selection, numbers and experience of observers, numbers of repetitions, and lengths and shapes of transects have been used from year to year (Wright 2002).