also possible that tamarisk affects E. t. extimus by altering the riparian insect fauna (Carothers and Brown 1991). Some sources also speculated that nests in tamarisk stands may be more easily located by brown-headed cowbirds (see cowbird discussion below). Hunter et al. (1987) reported the willow flycatcher as one of seven midsummer-breeding builders of open nests that were found in tamarisk at higher elevations but not lower elevations. Nesting *E. t. extimus* have been found in tamarisk at middle elevations (610-1200 m (2000-3500 feet)) (Hundertmark 1978, Hubbard 1987, Hunter et al. 1987, Brown 1988, Sogge et al. 1993, Muiznieks et al. 1994). However, nest success in tamarisk at these elevations appears to be low (Sogge and Tibbitts 1992, Sogge et al. 1993, Muiznieks et al. 1994). The species is essentially absent from tamarisk-dominated habitats below 610 m (2000 feet). On the lower Colorado River (approximately 25 m (80 feet)) where tamarisk is widely dominant, the only territories found in recent decades were in relict stands dominated by willow, cottonwood, and other native vegetation (Muiznieks et al. 1994). Unitt (1987) speculated that at higher elevations and in the eastern portion of its range, some E. t. extimus populations may be adapting to tamarisk.

Water developments also likely reduced and modified southwestern willow flycatcher habitat. The series of dams along most major southwestern rivers (Colorado, Gila, Salt, Verde, Rio Grande, Kern, San Diegito, and Mojave) have altered riparian habitats downstream of dams through hydrological changes, vegetational changes, and inundated habitats upstream. New habitat is sometimes created along the shoreline of reservoirs, but this habitat (often tamarisk) is often unstable because of fluctuating levels of regulated reservoirs (Grinnell 1914, Phillips et al. 1964, Rosenberg et al. 1991). Construction of Glen Canyon Dam on the Colorado River allowed establishment of a tamarisk riparian community downstream in the Grand Canyon, where a small population of E. t. extimus exists, with poor reproduction (Brown 1991, Sogge et al. 1993). However, Lake Powell, formed upstream of the dam, inundated what was apparently superior habitat, with E. t. extimus considered common (Behle and Higgins 1959).

Diversion and channelization of natural watercourses are also likely to have reduced *E. t. extimus* habitat. Diversion results in diminished surface flows and increased salinity of residual flows. Consequent reductions and composition changes in riparian

vegetation are likely. Channelization often alters stream banks and fluvial dynamics necessary to maintain native riparian vegetation.

Suckling et al. (1992) suggested that logging in the upper watersheds of southwestern rivers may constitute another potential threat to the southwestern willow flycatcher. They stated that logging increases the likelihood of damaging floods in southwestern willow flycatcher nesting habitat.

Finally, the willow flycatcher (all subspecies) is listed among neotropical migratory birds that may be impacted by alteration of wintering habitat, as through tropical deforestation (Finch 1991, Sherry and Holmes 1993).

Population Trends for Each State Are Discussed Briefly Below

California. All three resident subspecies of the willow flycatcher (E. t. extimus, E. t. brewsteri, and E. t. adastus) were once considered widely distributed and common in California, wherever suitable habitat existed (Wheelock 1912, Willett 1912, Grinnell and Miller 1944). The historic range of E. t. extimus in California apparently included all lowland riparian areas of the southern third of the State. Unitt (1984, 1987) concluded that it was once fairly common in the Los Angeles basin, the San Bernardino/Riverside area, and San Diego County. Willett (1912, 1933) considered the bird to be a common breeder in coastal southern California. Nest and egg collections indicate the bird was a common breeder along the lower Colorado River near Yuma in 1902 (T. Huels, University of Arizona in litt., transcripts of H. Brown's field notes).

All three willow flycatcher subspecies breeding in California have declined, with declines most critical in E. t. extimus, which remains only in small, disjunct nesting groups (Unitt 1984 and 1987, Gaines 1988, Schlorff 1990, Service unpubl. data). Only two nesting groups have been stable or increasing in recent years. One is on private land where habitat impacts from livestock grazing have been virtually eliminated (Harris et al. 1987, Whitfield 1990). This group on the South Fork of the Kern River experienced numerical declines in 1991 and 1992, but increases in nesting success were realized in 1992 and 1993, attributed to shaking (killing) or removing cowbird eggs or nestlings found in flycatcher nests, and trapping cowbirds (Whitfield and Laymon, Kern River Research Center, in litt. 1993). The other apparently stable nesting group is along the Santa Margarita River on Marine Corps Base Camp Pendleton,

where cowbird numbers have also been reduced by trapping (Griffith and Griffith 1993). Approximately eight other nesting groups are known in southern California, all of which consisted of six or fewer nesting pairs in recent years (Unitt 1987, Schlorff 1990, Service, unpubl. data). Using the most recent information for all areas, approximately 70 pairs and 8 single southwestern willow flycatchers are known to exist in California. Where information on population trends since the mid-1980's is available, most areas show declines. Three recent status reviews considered extirpation from California to be possible, even likely, in the foreseeable future (Garrett and Dunn 1981, Harris et al. 1986, Schlorff 1990). The State of California classifies the willow flycatcher as endangered [California Department of Fish and Game (CDFG) 1992].

Arizona. Records indicate that the former range of the southwestern willow flycatcher in Arizona included portions of all major watersheds (Colorado, Salt, Verde, Gila, Santa Cruz, and San Pedro). Historical records exist from the Colorado River near Lee's Ferry and near the Little Colorado River confluence (Phillips, pers. comm., cited in Unitt 1987), and along the Arizona-California border (Phillips 1948, Unitt 1987), the Santa Cruz River near Tucson (Swarth 1914, Phillips 1948), the Verde River at Camp Verde (Phillips 1948), the Gila River at Fort Thomas (W.C. Hunter, pers. comm., cited in Unitt 1987), the White River at Whiteriver, the upper and lower San Pedro River (Willard 1912, Phillips 1948), and the Little Colorado River headwaters area (Phillips 1948).

The southwestern willow flycatcher has declined throughout Arizona. The subspecies was apparently abundant on the lower Colorado River in 1902 (T. Huels in litt., transcripts of H. Brown's field notes), but only four to five territories were located in 1993 (Muiznieks et al. 1994). Elsewhere in the State, *E. t. extimus* persists only in several small, widely scattered locations. In the Grand Canyon, several groups of nesting birds have fluctuated from a high of 11 singing males in 1986 (Brown 1988) to two pairs and three single birds in 1992 (Sogge and Tibbitts 1992). Grand Canyon surveys in 1993 located 13 birds; six unpaired individuals, two pairs, and what appeared to be one male with two females. No nesting attempts were successful (Sogge et al. 1993). Although Brown (et al. 1987) noted E. t. extimus as nesting in Havasu Canyon, in 1993 none were located there and cowbirds were abundant (Sogge et al. 1993). A