

Two National Wildlife Refuges are in the subarea (fig. 2), each dependent on a sustaining water supply. The fish and wildlife resources of San Bernardino National Wildlife Refuge (NWR) are inextricably tied to the water resources of the San Bernardino artesian basin, more than one-half of which is in Mexico. Another system of great importance to wildlife, particularly to migratory birds, is the Arivaca Cienega (a type of wetland) of Arivaca Creek within the Buenos Aires NWR. In addition, springs and intermittent drainages support approximately 30 acres of riparian habitat at Fort Bowie National Historic Site, 180 acres within the Chiricahua National Monument, and more than 300 acres of riparian wetland habitat including 101 acres of Oak Riparian Forest in the Coronado National Memorial.

DOI bureaus are participating in the Arizona adjudication of water rights , particularly as it addresses the issues of allocation and ground- and surface-water interaction  in the Mexican Highlands. Under Arizona law, uses of surface water must adhere to the doctrine of prior appropriation (the rule of "first in time, first in right"), and most ground-water uses are limited by the doctrine of reasonable use. The reasonable-use doctrine provides no limits on the quantity and timing of its withdrawal. The Bureau of Land Management, U.S. Fish and Wildlife Service, and National Park Service have submitted claims in adjudications to protect water rights for surface- and ground-water uses, including uses that maintain riparian habitat. The Bureau of Indian Affairs has supported Gila River Indian Community claims, and the Bureau of Reclamation has Central Arizona Project authority on the San Pedro River. This adjudication, referred to as the Gila River Adjudication, will resolve several issues that are significant to management of the San Pedro Riparian National Conservation Area.

Water Quality

Presently, several point and nonpoint contaminant issues affect the Mexican Highlands, and continued border development likely will influence these issues. Industrial effluent  (primarily metals and organic contaminants from the border maquiladoras), undertreated sewage , and agricultural chemical and nutrient runoff  are examples. Undertreated sewage has entered the streamflow in the Santa Cruz and San Pedro Rivers. The Santa Cruz River receives effluent discharge from the Nogales International Wastewater Treatment Plant. Meanwhile, in Naco, Sonora, Mexico, floods carry sewage, along with daily accumulations of leaky septic tanks, into the San Pedro. The San Pedro River has also experienced localized mortalities of fishes and potentially long-term effects on amphibian populations  as a result of the release of acidic waters into the drainage because of tailings dam failures  in Cananea, Sonora, Mexico. In addition, chemical solvents and solid waste  have been dumped for many years in sensitive areas or those prone to flooding in drainages of the Santa Cruz and San Pedro Rivers, increasing the potential for water-quality degradation.

A primary water-quality concern is the effect of water-quality degradation on plant and animal communities and their habitats . Riparian areas of the Mexican Highlands are host to a wide variety of amphibians, reptiles, and mammals. Numerous species of birds, many of which are consid-

ered obligate riparian users, have also been documented. Several birds and fishes reach the northernmost extension of their range in a few restricted areas along the U.S.–Mexico border. Integral to the survival of all these species is the presence of high-quality surface waters.



Figure 5. Santa Cruz River at Rancho Santa Cruz (photo courtesy of National Park Service, Rivers and Trails Conservation Program).

Wildlife habitat  currently is closely monitored within national parks, wildlife refuges, and national conservation areas. Such monitoring needs to be expanded to obtain information pertaining to water resources and water-dependent environments over broader areas to adequately assess long-term trends. For example, a healthy, properly functioning watershed depends on adequate vegetative cover in the uplands. Without adequate cover, runoff and erosion increase, riparian function and water quality decline, and infiltration is reduced. Acquiring critical parcels of land and additional water rights  in the drainage may be necessary to protect the resources of the Mexican Highlands.

Existing information  is inadequate for assessing the extent and degree of water-quality degradation. Identification and documentation of faulty or inappropriate sewage-disposal systems is necessary to prevent the seepage of contaminants. Comprehensive contaminant monitoring is integral for understanding the effects of all types of water use. Information is also needed on the effects of changing land-use patterns. These data may be used to develop strategies for resource protection and enhancement as human population pressures  increase. For example, a strategy could involve wastewater reclamation and reuse, which could enhance habitat quality in the Santa Cruz River riparian corridor.