

# FIFTEEN YEARS OF COUNTING WINTER RAPTORS AT SANTA CRUZ FLATS, PINAL COUNTY, AZ

BY DOUG JENNESS, 4375 E. ROLLINS RD., TUCSON, AZ, [D\\_JENNESS@HOTMAIL.COM](mailto:D_JENNESS@HOTMAIL.COM)

**ABSTRACT:** Between 2006 and 2020 volunteers conducted an annual 1-day January raptor count at the Santa Cruz Flats in Pinal County, Arizona. Surveying designated sections of this agricultural area, teams counted wintering raptors. The data show that numbers fluctuate from year to year, but discernible trends are not evident. Exceptions are White-tailed Kite (*Elanus leucurus*), observed in early years of the count but not reported since 2009, and Crested Caracara (*Caracara cheriway*), whose numbers have substantially increased. Placed in the context of broader knowledge about raptors at this location, these data set a potentially useful baseline for evaluating plans that could significantly alter the habitat and wildlife at the Flats.

Many raptors migrate through and winter in southern Arizona. The Sulphur Springs and San Rafael valleys in Cochise and Santa Cruz counties, respectively; the farmlands around Yuma; the extensive agricultural fields west of Phoenix; and the fields, feedlots, and dairies at the Santa Cruz Flats and the Stanfield-Maricopa and Coolidge-Florence areas of Pinal County are among the best-known areas for viewing raptors during the winter. Other than the Santa Cruz Flats survey, few annual raptor surveys have been conducted at these locations. A winter survey of agricultural fields on the Yuma Mesa, south of the city of Yuma, was conducted by 2 people between 2004 and 2015 (L. Piest and H. Detwiler unpub. data). A 2-person (D. Jenness and L. Johnson) 1-day count of raptors at an 87 km<sup>2</sup> area near Coolidge was conducted December 2017-2019 (eBird 2020). The count at the Santa Cruz Flats is the longest-running winter raptor survey in Arizona for which the data are publicly accessible (AZFO Census Data 2020). Before 2006 no systematic count of raptors had been made there, and no part of the area has been included in a Christmas Bird Count circle.



Figure 1. Santa Cruz Flats looking east toward Picacho Peak with Santa Catalina Mountains in background, 25 January 2017. Photo by Doug Jenness

The Santa Cruz Flats is in the basin of the Santa Cruz River northwest of Tucson, which, with its diversion channels, flows intermittently northwest across Pinal County to the Gila River. The area covered in the survey encompasses approximately 900 km<sup>2</sup> and has a mean elevation of 500 m. To the northeast, the area surveyed is bordered by the Picacho Mountains (Figure 1), to the south by the Silverbell Mountains, and to the west by the Sawtooth Mountains. Some 150 years ago this area supported a thriving grassland, an ecosystem known as the Sonoran savanna grassland (Brown 2014, Brown et al. 2017). An influx of homesteaders in the early 20th century brought grazing livestock and cultivation, and over time the fragile grassland was mostly replaced by a mosaic of pastures, pecan orchards, cultivated fields, and desert scrub laced with irrigation ditches. Only a few remnants of that grassland still exist. Land ownership includes the Arizona State Trust (480 km<sup>2</sup>), private parties (287 km<sup>2</sup>), and the Tohono O'odham Nation (the 31-km<sup>2</sup> San Lucy Farm).

The principal cultivated crops are cotton (*Gossypium* spp.) and alfalfa (*Medicago sativa*). Others include Bermuda grass (*Cynodon dactylon*), maize (*Zea mays*), wheat (*Triticum aestivum*), barley (*Hordeum vulgare*), sorghum (*Sorghum bicolor*), and rapeseed (*Brassica napus*). The area also includes sod farms (570 ha), several pecan (*Carya illinoensis*) groves

(500 ha), a date (*Phoenix dactylifera*) orchard (10 ha), a vegetable produce farm (300 ha), a dairy farm, and one of the largest cattle feedlots in Arizona (260 ha). Adjacent to the active fields, fallow parcels have grown up to mesquite (*Prosopis velutina*), creosote bush (*Larrea tridentata*), saltbush (*Atriplex* spp.), Fremont's desert thorn (*Lycium fremontii*), bursage (*Ambrosia* spp.), and other shrubs. Some never-cultivated areas, particularly on the bajadas to the north and south of the cultivated fields, are dominated by saguaro (*Carnegiea gigantea*), cholla (*Cylindropuntia* spp.), palo verde (*Cercidium* spp.), mesquite, and ironwood (*Olnheya tesota*). Cattle graze in these never-cultivated areas, which contain a scattering of livestock water tanks. Along the erratic water flows of the Santa Cruz River and the Greene Canal, riparian strips of Fremont cottonwood (*Populus fremontii*) mixed with tamarisk (*Tamarix* spp.), Mexican palo verde (*Parkinsonia aculeata*), and occasionally Goodding's willow (*Salix gooddingii*) thrive. Seasonally flooded hardpan depressions called playacitas inhibit plant growth and water percolation in some areas. These lead to severe dust storms (Brown et al. 2017).

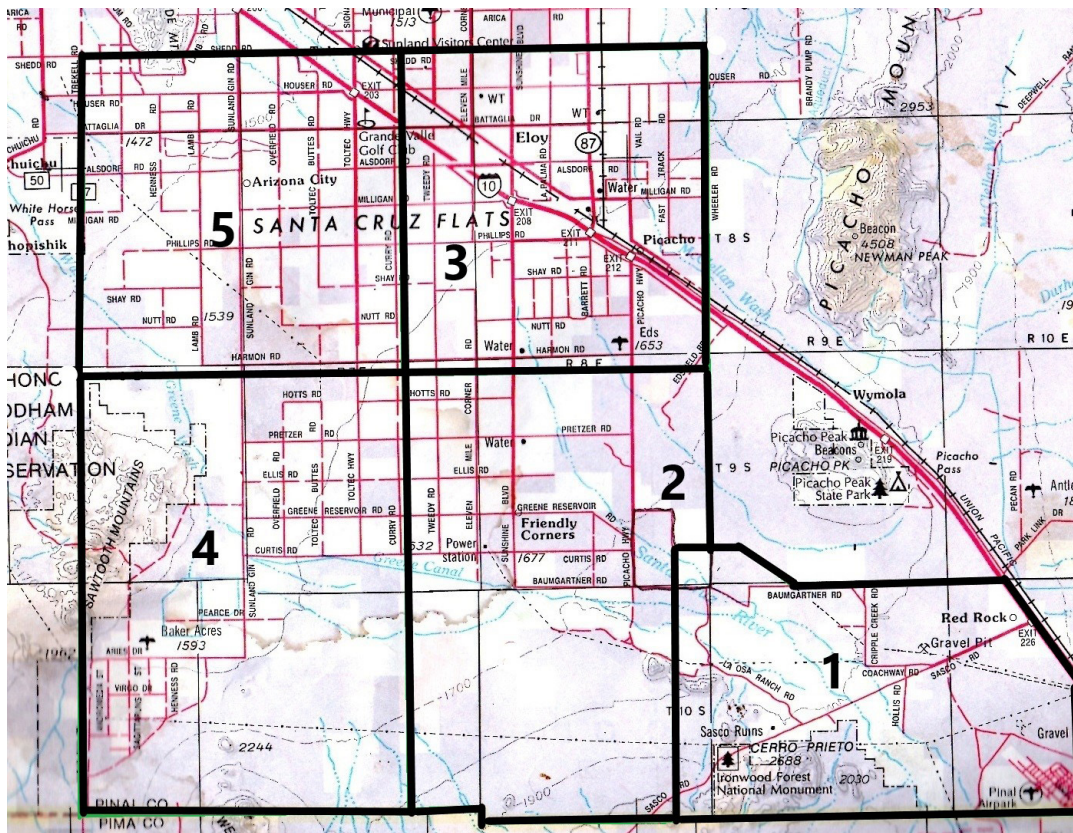


Figure 2. Survey area is divided into 5 sections.

This patchwork of agricultural areas and desert habitat at the Flats attracts abundant rodents, thousands of wintering sparrows, a large population of doves, some shorebirds, and many insects, all of which offer a ready food supply for wintering raptors (Brown et al. 2017). Clumps of tamarisk and Mexican palo verde, as well as hay barns, provide roosting sites for owls. Numerous telephone poles and high electric power towers, as well as rows of trees along roads, provide perches.

## METHODS

The count was conducted on the third Saturday in January each year except 2007 and 2017, when it was held on the fourth Saturday. It was organized as an "area count" in which teams cover specifically designated tracts all on the same day. Teams used motor vehicles to cover as much of their assigned areas as possible. During the first 3 years, the survey

was conducted over an area of 810 km<sup>2</sup>. This area was divided into 3 sections, with one team covering each section. In 2009, an additional 88 km<sup>2</sup> was added to the north end of the area, and the survey area was divided into 4 sections, each surveyed by one team. In 2016, without changing the overall survey boundaries, the area was reorganized into 5 sections, each surveyed by one team (Figure 2).

Each team included 3-6 volunteers, with the total number of participants ranging from 9 in 2006 to 20 in 2016. A total of 76 volunteers participated in at least one count; 16 participated in 5 or more counts (AZFO Census Data 2020). Despite turnover, continuity was maintained, with experienced volunteers familiar with their areas returning to the same area each year.

Teams were typically in the field 6-8 hours between 0800 and 1600. Each team had at least one spotting scope and traveled in one vehicle. The rare instances when more than one vehicle was used, they traveled together as one team. Teams drove farm roads in their sections, stopping frequently to scope fields and pastures, power poles, and wooded edges, and to check barn lofts, tamarisk groves, and stands of pines or other trees for owls. The horizon was scanned for soaring raptors and vultures. Generally, teams followed the same routes within their areas each year. All roads in the survey area fall completely in one section or another so that teams aren't driving the same roads and double counting birds. For a few species, more than one subspecies and several plumage forms show up in the winter, and where possible these were reported. Teams also tallied 2 species of vulture—Black Vulture (*Coragyps atratus*) and Turkey Vulture (*Cathartes aura*). North American vultures are no longer considered to be closely related to most raptors (Chesser et al. 2019), but for the survey, raptors were defined behaviorally, not taxonomically, to count all "birds of prey," including hawks, eagles, kites, falcons, vultures, and owls. Since 2008, predawn owling has been conducted between 0400 and 0700. Occasionally, playbacks were used to try to locate Western Screech-Owls (*Megascops kennicottii*) and Barn Owls (*Tyto alba*). The annual tally for each species observed, with a breakdown by team, is posted on the Arizona Field Ornithologists website (AZFO Census Data 2020).

Although weather on the days of the count was not recorded by the teams, historic records since 2010 are available for Eloy, the nearest city (Time and Date 2020). In most years of the count, the weather was sunny or partly cloudy. In 2010, 2016, and 2018, it was overcast. In most years the high temperature was 21°-23° C. The high temperature was lower in 2016 (16° C), 2017 (18° C), and 2018 (16° C).

## RESULTS

Of the 44 raptors found in Arizona (AZFO 2020), 20 species were reported during the 15-year survey. The annual number of species ranged from 13 to 16 (mean=14.7). The number of individual raptors ranged from 236 to 752 (mean = 421.5; Table 1). Because the number of teams varied from 3 to 5, however, the number of raptors per party hour more accurately reflects the totals, which are the figures used in this article (Table 1). Calculating by party hours, the mean number of raptors ranged from 8.74 (2011) to 20.98 (2016) and the mean for the 15-year period was 14.68. Between the first 5 years of the survey (2006-2010) and the second 5 years (2011-2015), the annual mean per party hour for 3 of the more numerous species—Red-tailed Hawk (*Buteo jamaicensis*), American Kestrel (*Falco sparverius*), and Northern Harrier (*Circus cyaneus*)—decreased. The drop in mean numbers per party hour for Red-tailed Hawks was 28.9%, American Kestrels 15.3%, and Northern Harriers 47.4%. In 2015, it was unclear whether the 5-year decrease of these 3 species on the winter survey represented a trend at the Santa Cruz Flats or was a short-term drop within a longer-range period of fluctuations (Jenness 2015a). Five years later, it appears likely to be the latter.

Viewing the overall context of each species will provide a broader picture of raptors wintering at the Santa Cruz Flats. Variations in the number of individuals among the species are different, and considering the species' preferred habitats and food sources, as well as their relationship to summering and migrating populations, will offer a better sense of their current status at the Flats in winter.

Table 1 Survey Results Santa Cruz Flats Raptor Count, 2006-20. Species Number per Party Hour

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean
Total No.	338	358	299	403	277	236	448	340	284	425	752	598	587	437	540	421.5
Party Hours	22.00	24.50	21.00	28.50	20.50	27.00	26.75	26.45	26.50	27.50	35.85	34.50	34.50	34.50	34.00	28.27
No./Party Hour	15.36	14.61	14.24	14.14	13.51	8.74	16.75	12.85	10.72	15.45	20.98	17.33	17.01	12.67	15.88	14.68

**SPECIES**

Black Vulture	0.09	1.92	0.05	2.88	0.15	0.48	4.22	1.81	0.45	4.15	4.13	2.70	2.70	1.30	2.41	1.96
Turkey Vulture	0.00	0.04	0.00	0.04	0.00	0.00	0.00	0.19	0.23	0.11	0.08	0.06	0.00	0.17	0.15	0.07
White-tailed Kite	0.09	0.08	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Golden Eagle	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northern Harrier	1.86	1.22	1.71	1.23	1.02	0.52	2.02	0.95	0.45	0.44	1.53	1.33	1.28	0.96	0.79	1.15
Sharp-shinned Hawk	0.09	0.20	0.00	0.00	0.05	0.00	0.00	0.04	0.00	0.22	0.06	0.00	0.00	0.00	0.06	0.05
Cooper's Hawk	0.27	0.16	0.05	0.21	0.05	0.07	0.22	0.04	0.04	0.07	0.20	0.09	0.06	0.03	0.06	0.11
Bald Eagle	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Harris's Hawk	0.00	0.00	0.00	0.07	0.29	0.15	0.11	0.00	0.15	0.15	0.17	0.14	0.03	0.03	0.06	0.09
Red-tailed Hawk	9.00	6.65	8.00	5.86	7.41	4.33	5.79	6.24	5.58	5.56	8.70	7.22	7.25	6.20	7.12	6.73
Ferruginous Hawk	0.27	0.37	0.24	0.32	0.20	0.26	0.41	0.15	0.26	0.33	0.31	0.20	0.38	0.20	0.12	0.27
Barn Owl	0.09	0.20	0.05	0.07	0.05	0.00	0.19	0.00	0.00	0.00	0.03	0.03	0.06	0.00	0.00	0.05
Great Horned Owl	0.00	0.04	0.00	0.14	0.10	0.15	0.04	0.04	0.19	0.22	0.20	0.26	0.06	0.12	0.18	0.12
Burrowing Owl	0.05	0.04	0.19	0.00	0.00	0.04	0.07	0.11	0.26	0.25	0.25	0.14	0.06	0.06	0.06	0.11
Crested Caracara	0.09	0.82	0.38	0.46	1.32	0.81	1.23	1.13	0.45	1.09	1.45	1.45	2.17	0.96	1.97	1.05
American Kestrel	3.00	2.24	2.76	2.18	2.10	1.37	1.50	1.29	2.08	2.40	2.73	2.52	1.97	1.91	2.09	2.14
Merlin	0.09	0.29	0.14	0.11	0.10	0.04	0.22	0.00	0.11	0.04	0.17	0.20	0.14	0.17	0.09	0.13
Peregrine Falcon	0.09	0.04	0.05	0.07	0.19	0.04	0.11	0.04	0.00	0.07	0.20	0.17	0.20	0.09	0.21	0.10
Prairie Falcon	0.27	0.29	0.38	0.11	0.05	0.22	0.41	0.30	0.23	0.22	0.45	0.43	0.41	0.26	0.29	0.29

**PREDAWN SURVEY**

Barn Owl	NA	NA	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.33	0.00	0.09
Western Screech-Owl	NA	NA	0.00	0.00	0.50	0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Great Horned Owl	NA	NA	2.50	2.00	1.00	2.00	1.33	2.67	1.60	2.40	4.00	2.77	3.27	2.00	2.55	2.31

## Buteos and parabuteos

### Red-tailed Hawk

The Red-tailed Hawk, widely distributed throughout North America and highly adaptable, is the most numerous raptor at the Santa Cruz Flats. It is a common breeding bird nesting in a wide variety of sites: saguaros, tall trees, palms, telephone poles, and electric towers. Breeding pairs may begin nest building in December (pers. obs.) and are often seen constructing or sitting on nests or engaged in aerial courtship during the January raptor survey. From November to February the breeding population is greatly augmented by migrants and wintering birds. Most often these hawks are observed perched on telephone poles or trees. Typically, individual birds are observed hunting or roosting, although adult pairs will frequently be seen together during breeding season. One year, however, a team reported 28 Red-tailed Hawks feeding together on the ground while the field was being plowed. For several weeks in the winter of 2015-2016 a field with corn stubble near the Red Rock feedlot attracted up to 20 at a time, hunting rodents.

For the 15-year count, the range of Red-tailed Hawks reported was 4.33 to 9.00 per party hour (mean = 6.73). This is a wide range showing considerable flux in the number reported. Comparing the mean per party hour for each 5-year period of the survey also shows this: in the first 5 years the mean was 7.38, the second 5 years the mean was 5.50, and the mean was 7.30 for the third 5 years.



Figures 3a-3c. "Western" Red-tailed Hawk has a spectrum of plumages. Light morph, 28 November 2013 (left); rufous, 20 January 2013 (center); dark, 28 November 2013 (right). Photos by Muriel Neddermeyer

The Red-tailed Hawk varies considerably in appearance, and 6 subspecies are currently recognized in the United States (AOU 1957, Preston and Beane 2009). By far the most common subspecies found in Arizona and reported in all seasons at the Santa Cruz Flats is the "Western" Red-tailed Hawk (*B. j. calurus*). Within this subspecies, plumage variation ranges from light to dark with various intermediates along a continuum (Figures 3a, 3b, 3c). The light form generally has a dark brown crown and nape, dark brown back, and light to heavy markings on the belly that may form a band. The darkest are chocolate brown, and intermediate (rufous) birds typically have rufous breasts and dark bellies (Wheeler 2003). On the annual count, teams attempt to distinguish light, intermediate, and dark forms, although it can be difficult to determine where a dark morph ends and an intermediate morph begins. The mean for the 15-year period is 91% light, 6% dark, and 3% rufous (AZFO Census Data 2020). The much smaller number of dark and intermediate variants, with dark outnumbering intermediate, corresponds to previous Arizona data (Monson 1998). The dark and rufous forms are more common in the winter at the Flats, though occasionally are reported in the summer.

Another subspecies reported in small numbers at the Santa Cruz Flats during the winter count in all but one year is the "Harlan's" Red-tailed Hawk (*B. j. harlani*). *Harlani* is distinctive enough that it has twice been considered a separate species (1830–91 and 1944–72). It has been identified as a subspecies (1891–1944 and 1973 to the present; Clark 2018), however, its status remains under discussion (Clark 2018, AOS 2019). Its known breeding range is most of the Alaskan interior, Yukon, and far northwestern British Columbia (Clark 2018), although more study may be required

to determine if the range is broader (Sullivan et al. 2018). It winters primarily in the south-central United States with small numbers found in western states, including Arizona (Wheeler 2003). As with *B. j. calurus*, *B. j. harlani* has a range of color forms, with the dark variant by far the most numerous throughout its range, 88-92% according to Liguori and Sullivan (2010a). At the Santa Cruz Flats only the dark form has been observed on the annual winter survey, although several sightings of light variants have been reported at the Flats at other times, for example this bird photographed in February 2014 (Figure 4). The earliest reported *harlani* at the Flats is 24 October; the latest is 21 March (eBird 2020). One or 2 are typically reported on the winter raptor survey each year, and they are often seen at the same site over several years, suggesting they have staked out a winter territory in that location. The reports of 4 or 5 Harlan's Hawks in the first 2 years of the count may be erroneous because documentation required for this taxon for the survey was not as rigorous during those years as it was in later years.



Figure 4. "Harlan's" Red-tailed Hawk, light variant showing some leucistic features in outer flight feathers, 3 February 2014. Photo by Keith Kamper

A currently recognized subspecies sometimes reported at the Santa Cruz Flats is "Fuentes" Red-tailed Hawk (*B. j. fuertes*), considered to be resident from southeast Arizona east to central Texas and south to northern parts of Mexico. In Arizona pure *fuertes* are rare and most are intergrades with *calurus* (Wheeler 2003). In the first few years of the winter survey, *fuertes* was reported with up to 20 one year. However, the reports weren't substantiated and in later years no attempt was made to distinguish or list it separately from *calurus*.

During the 2007 count one team reported a "Krider's" Red-tailed Hawk, considered by Wheeler (2003) and others to be a light form of the "Eastern" Red-tailed Hawk (*B. j. borealis*), although the American Ornithologists' Union (1957) designated it as a separate subspecies. However, this variant is so rare in Arizona that more details, particularly a photograph, would have been needed to document it. Liguori and Sullivan (2010b) stated they knew of no documented records west of the Rocky Mountains. Recently, however, a likely Krider's was photographed in Maricopa County, Arizona (Clark 2016).

### Ferruginous Hawk (*B. regalis*)

The current southern extent of the Ferruginous Hawk's (Figure 5) breeding range is central Arizona, although it previously bred in southern grasslands in the state (Phillips et al. 1964, Glinski 1998a). Now many Ferruginous Hawks winter in agricultural areas throughout southern Arizona, including the Santa Cruz Flats. Although this species is a regular at the Flats, the numbers typically are not as high as they are in other parts of southern Arizona, such as the Yuma area (L. Piest and H. Detwiler unpubl. data). The range for the annual count is 0.12 to 0.41 per party hour (mean = 0.27). Although often seen perched on telephone poles, Ferruginous Hawks are also frequently observed hunting on the ground in plowed fields or fields with recently harvested crops. Its preferred prey are cottontails (*Sylvilagus* spp.) and jackrabbits (*Lepus* spp.), although it will feed on many rodents. Like many other buteos, the Ferruginous Hawk displays a range of plumages from light to dark. According to Wheeler (2003), dark and intermediate forms are a small part of this hawk's population. Three dark variants have been reported in the 15 years of the count, 2.7% of the total Ferruginous Hawks observed.



Figure 5. Ferruginous Hawk, 28 December 2013. Photo by Muriel Neddermeyer

### Harris's Hawk (*Parabuteo harrisi*)

The Harris's Hawk (Figure 6), a common resident in much of southern Arizona, is infrequently reported at the Santa Cruz Flats during all seasons. The number of Harris's Hawks recorded during the annual winter count has ranged from 0.0 to 0.29 per party hour (mean = 0.09). Most years, this hawk was reported close to a couple of farmyards with tall eucalyptus trees (*Eucalyptus* spp.). This nonmigratory hawk is noted for inhabiting Sonoran Desert habitat in Arizona, including nesting in saguaros. Even though extensive saguaro/palo verde habitat surrounds the cultivated fields at the Santa Cruz Flats, no Harris's Hawk nests have been reported. Mader (1978) surveyed for and compared the behaviors of Red-tailed and Harris's Hawks in southern Arizona and concluded that the latter prefer habitat with a greater diversity of flora. He noted that populations of small animals and birds were noticeably larger in such areas. Particularly important for Harris's Hawks, rabbit density increases with plant species diversity (Mader 1978). Bednarz (1988) also suggested that among raptors, Harris's Hawks in New Mexico were relative specialists taking, on average, larger prey, particularly cottontail rabbits. Possibly, the desert habitat at the Flats has been too degraded by cattle grazing to attract the Harris's Hawks. In recent years, however, this hawk's numbers have increased in urban and suburban locations where tall trees suitable for nesting and plentiful prey can be found (Dawson 1998). As only a few tall trees surround some farmsteads at the Flats, Harris's Hawk numbers are fewer than they are in urban areas.



Figure 6. Harris's Hawks are not numerous at Santa Cruz Flats, 5 November 2016. Photo by Doug Jenness

### Swainson's Hawk (*B. swainsoni*)

Swainson's Hawk is a common spring and fall migrant in Arizona, and in 2020 nesting was confirmed at the Santa Cruz Flats (Jenness 2020). This hawk does not winter at the Flats or anywhere else in the state, so is not included in the January count. The earliest recorded report of a Swainson's Hawk at the Flats is 24 February and the latest is 31 October. Spring migration reaches its peak in April and early May (Wise-Gervais 2005a). Larger flocks are typically seen in fall migration at the Flats, which can begin as early as late June (pers. obs.) and peaks with flocks of over 200 in late August and September. Swainson's Hawks favor freshly cut or flooded alfalfa fields where they often forage with Turkey Vultures and occasionally caracaras or follow tractors tilling the soil. In migration, they primarily eat insects, especially grasshoppers, dragonflies, and caterpillars and are sometimes referred to as "grasshopper hawks."

### Zone-tailed Hawk (*B. albonotatus*)

The Zone-tailed Hawk, partial to riparian areas, occasionally wanders into the Santa Cruz Flats. Both adults and immature birds have been reported in 9 out of the past 15 years in every season, including twice in January (eBird 2020). However, it has eluded detection on the annual winter survey.

### Rough-legged Hawk (*B. lagopus*)

The Rough-legged Hawk is a rare and irregular winter visitor to Arizona's grasslands and agricultural areas. Only a few have been reported at the Santa Cruz Flats since 2000, all from December to February (eBird 2020). It's possible one could show up on the annual raptor count, but so far none has been reported.

### Gray Hawk (*B. plagiatus*)

The Gray Hawk has been reported at the Santa Cruz Flats only 3 times, all since 2015. Two reports were in September and one in March (eBird 2020). These individuals were likely transients. As this species' range continues to expand in the state (Corman 2005a), more sightings are likely.

## Northern Harrier

A common wintering raptor at the Flats, the Northern Harrier is often seen perched on the ground or gliding low over fields hunting rodents and small birds. It doesn't breed at the Flats, although a few nesting records have been recorded in other parts of the state (Wise-Gervais 2005b). The earliest reported arrival at the Flats was 26 July, and most arrive in September and October and leave in March and April. Stragglers, however, occasionally linger into May; one was observed as late as 17 May. The range for the 15-year period of the raptor count is 0.44 to 2.02 per party hour (mean = 1.15). The mean for the first 5 years was 1.41, for the second 5 years 0.88, and for the last 5 years 1.18.

## Falcons

### American Kestrel

The most numerous falcon at Santa Cruz Flats in all seasons is the American Kestrel, which breeds and winters there. Primarily a cavity nester, it uses woodpecker holes in saguaros and trees. During migration and in the winter its population swells. The cultivated fields (particularly alfalfa, which is harvested year-round at the Flats) attract many insects, small birds, and rodents, which are prey for this small raptor. It is readily viewed perched on telephone poles and wires. The 15-year range for kestrels is 1.29 to 3.00 per party hour (mean = 2.14). The first 5 years the mean was 2.46, the second 5 years 1.73, and the last 5 years 2.24.

### Merlin (*Falco columbarius*)

The Merlin (Figure 7) is an uncommon wintering falcon that breeds in Canada and the northern United States (Wheeler 2003). It typically arrives at the Flats in October with an early date of 28 September. Most depart by the end of March with a lingering individual recorded as late as 14 April. Merlins are small-bird specialists and often are observed in trees along the edges of fields or perched in tall snags surrounded by open habitat. On the annual winter count the number has ranged from 0.00 to 0.29 per party hour (mean = 0.13). The mean was 0.15 the first 5 years, 0.08 the second 5 years, and 0.15 the third 5 years. Individuals of 2 subspecies, *F. c. columbarius* and *F. c. richardsonii*, have been recorded during the surveys.

### Prairie Falcon (*F. mexicanus*)

The Prairie Falcon winters at the Flats in small numbers and occasionally is reported in other seasons as well. Typically, it preys on birds but sometimes feeds on rodents. It likely nests in the cliffs of the surrounding mountains. Reported in every year of the count, Prairie Falcon numbers have ranged from 0.05 to 0.45 per party hour (mean = 0.29). The mean the first 5 years was 0.22, the second 5 years 0.28, and the last 5 years 0.37.

### Peregrine Falcon (*F. peregrinus*)

The Peregrine Falcon has been reported in all but one year of the winter survey with a range of 0.00 to 0.21 per party hour (mean = 0.10). The mean for the first 5 years was 0.09, the second 5 years 0.07, and the last 5 years 0.21. It nests in the adjacent Picacho Mountains (pers. obs.). Of the 3 subspecies found in North America, "American" (*F. p. anatum*) is expected in Arizona (Glinski 1998b, Wheeler 2003). However, on the 2016 count, one team photographed a juvenile "Tundra" or "Arctic" peregrine (*F. p. tundrius*; Figure 8). This subspecies winters south of the United States mostly in southern South America, although some can be found along the southern coast of California. Migrants may be seen inland as far east as Arizona during migration but are rare in the winter (Wheeler 2003).



Figure 7. Merlin, 28 December 2013.  
Photo by Muriel Neddermeyer

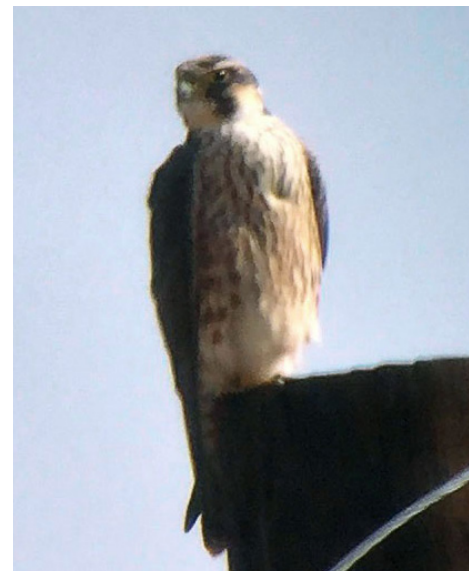


Figure 8. "Tundra" Peregrine Falcon is rare in Arizona, 16 January 2016. Photo by Nathan Robert Williams



## Crested Caracara

The first reported sighting of Crested Caracaras at the Santa Cruz Flats was of 6 individuals on 27 November 1965 (Monson and Phillips 1981). The next report wasn't until 1986 (Ganley 1977-1997) and the third 10 years after that (Stevenson 1996). Then in the late 1990s and early 2000s reports became more frequent, not only due to an increase in caracaras but also because more birders visited the area. Except for the first sighting, most reports were of single caracaras with an occasional 2-4 individuals reported. Then in the winter of 2006-2007 up to 33 individual caracaras were reported feeding together. The numbers continued to increase, and in December 2009, 46 were reported and by January 2014 as many as 104 were counted all foraging in one field (pers. obs.). Large groups of caracaras continued to be reported, although since 2018 reports of 20 or more caracaras have become fewer (eBird 2020).

Caracaras have been reported every year of the winter raptor survey ranging from 0.09 to 2.17 per party hour (mean = 1.05), and the data reflect the rise in numbers. During the first 5 years of the survey, the mean per party hour was 0.61, in the second 5 years 0.94, and the last 5 years 1.60. The increase between the first 5 years and the last 5 years was 89.59%. Even though caracaras have been reported in every week of the year at the Santa Cruz Flats, foraging of more than 5 birds together has been observed only in the months of October through May, with one exception of 5 caracaras observed together 28 July 2019 (Duman and Williams 2019), and most reports are between November and February (Figure 9). Social foraging of caracaras, which is documented in other parts of their range (Morrison and Dwyer 2020), has been reported at 3 other locations in southern Arizona in the past decade, including at least 2 reports of more than 30 birds (eBird 2020, unpub. data). Those reports have also been between November and January. None of those areas, however, have consistently attracted as many caracaras as has the Santa Cruz Flats.



Figure 9. Scores of Crested Caracaras forage at Santa Cruz Flats in the winter, 24 November 2017. Photo by Doug Jenness

What draws many caracaras to the Santa Cruz Flats in the winter is the subject of ongoing research (Jenness 2015b, Jenness et al. 2018, Jenness et al. 2019). Preliminary findings suggest that available food at Santa Cruz Flats increases from November through February. This includes the seasonal pasturing of ewes that are lambing, which creates a supply of carcasses and afterbirth. Also, more cattle forage on range land at the Flats in winter, as many are moved to higher elevations farther north in the state in summer. More cattle not only mean more carcasses, but also more dung (especially around water tanks), which attracts beetles and other invertebrates caracaras feed on. Caracaras are also attracted to invertebrates and small rodents stirred up by the disruption of soil created by the disking of harvested cotton fields at the Flats, which occurs November-January. Another consideration is that caracara nesting has been confirmed at the Santa Cruz Flats (Jenness and Glinski 2014, Jenness 2015b). Young birds tend to stay in the general area of their nest for the first months after hatching, and nonbreeding first- and second-year birds that wander widely in the summer may return in the winter when they know food is plentiful.

## Accipiters

Of the 3 *Accipiter* species found in Arizona, 2 can be found at the Santa Cruz Flats in winter: Cooper's Hawk (*Accipiter cooperii*) and Sharp-shinned Hawk (*A. striatus*). The Cooper's Hawk, which is slightly more numerous in the winter at the Flats than is the latter species, has been reported in every year of the winter survey. Its mean range per party hour was 0.03 to 0.27 (mean = 0.11). The range per party hour for the first 5 years was 0.15, and for each of the last 5-year periods it was 0.09. Cooper's Hawks are reported less frequently in the summer at the Flats than in the winter, with only 5 reports of single birds from May through July, 4 of them in riparian habitat (eBird 2020).

The Sharp-shinned Hawk is present at Santa Cruz Flats only in the winter, with an early arrival date of 7 October and a late departure of 30 April. The numbers per party hour ranged from 0.00 to 0.22 (mean = 0.05). The means for the first, second, and third 5-year periods respectively were 0.07, 0.05, and 0.02 per party hour.

With numerous doves and sparrows present at the Flats in winter, one might expect *Accipiters*, which primarily feed on small birds, to be more common. However, these raptors are primarily forest birds and are more frequently found in locations with large trees. At the Flats these habitats are rare and are primarily found at the riparian corridor, along a few roadsides, and around some farmyards.

## White-tailed Kite

The White-tailed Kite (formerly Black-shouldered Kite; Figure 10) was first reported in Arizona in the 1970s in Cochise County. Since then it has been a localized and erratic resident in the southern half of the state (Gatz 1998, Corman 2005b). The first documented nesting in the state was of 2 pairs at the Santa Cruz Flats in 1983 in a row of cottonwoods in the northwest section of the current raptor count area (Gatz et al. 1985). Since then this kite has been reported irregularly at the Flats. It was reported in 3 of the first 4 years of the winter raptor count with a range per party hour for the years reported of 0.08 to 0.28. Based on other sightings, White-tailed Kites were likely nesting in at least 1 or 2 locations in those years. However, since 2009 none have been reported on the count, and other sightings at the Flats have been sporadic, none suggesting probable nesting. Inhabiting a locality for a few years and then disappearing has exemplified this raptor's behavior in other parts of the state and is likely in response to changes in prey availability (Corman 2005b).



Figure 10. White-tailed Kite is rarely seen today at Santa Cruz Flats, 13 February 2011. Photo by Matt Van Wallene

## Eagles

The Golden Eagle (*Aquila chrysaetos*), which breeds in mountains throughout Arizona, may show up anywhere in the state in winter. At the Santa Cruz Flats, at least one is reported nearly every winter and observations have occurred in all months from November through March. Likely a few pairs nest in the mountains surrounding the Flats (Driscoll 2005). This species is scarce enough, however, that only one has been reported on the annual winter count, in 2014.

Even though Bald Eagles (*Haliaeetus leucocephalus*) visit the Flats less frequently than do Golden Eagles—only 3 or 4 known individuals—they have been reported twice on the count: at the Red Rock feedlot in 2014 and near Arizona City in 2017. The latter bird (Figure 11) had a leg band, and the Arizona Game and Fish Department (AZGFD) identified it as a bird that fledged nearly 5 years earlier farther north at a site on the San Carlos Apache Nation.



Figure 11. This Bald Eagle, fledged on San Carlos Apache tribal lands, was found on the count, 28 January 2017. Photo by Muriel Neddermeyer

## Osprey (*Pandion haliaetus*)

The Osprey is frequently observed during spring and fall migration, but rarely winters at the Santa Cruz Flats. A rare visitor was observed in the winter of 2016-17 (Figure 12), however, it was missed during the January 2017 count. Ospreys are most often reported near ponds at the sod farms or at larger irrigation canals where fish can be found. They have been reported at the Flats in every month except June and July, with the earliest fall arrival 27 August and the latest spring sighting 14 May.

## Vultures

### Black Vulture

The Black Vulture, first reported in Arizona in 1920, has been slowly expanding its range in the state, where it is a permanent resident. By the 1960s it was established at the Santa Cruz Flats (Phillips et al. 1964), and breeding has been confirmed in the surrounding mountains (Corman 2005c). Foraging and roosting flocks of more than 150 can be found year-round at the Flats. On the annual count the range is 0.05 to 4.22 per party hour (mean = 1.96). This broad range likely reflects finding a large group or groups on a given day, and this may occur as a matter of chance. Cattle and sheep operations, a nearby ostrich farm, and roadkill produce enough carcasses that the vultures remain in the area year-round. Unlike Black Vultures in Central and South America and some places in the southeastern United States, they typically are not found in cities in Arizona. Instead they are most often observed in the open desert and ranches where free-ranging cattle often succumb to starvation and thirst, and ranchers create carcass dumps (Corman 2005c).

### Turkey Vulture

Unlike Black Vultures, few Turkey Vultures are found at the Flats in the winter; they migrate farther south. They are common at the Flats in the summer and likely nest in nearby mountains with suitable cliff ledges (Corman 2005d). Many summer birds are nonbreeders, taking a few years to nest (Rea 1998). Roosting vultures can be observed in the riparian corridors, as well as on mountain cliffs. A few Turkey Vultures of a different subspecies migrating from farther north in North America remain at the Flats over the winter (Rea 1998). Between 0.00 and 0.23 per party hour (mean=0.07) have been recorded on the winter raptor count.

## Owls

Six species of owl have been reported at the Santa Cruz Flats during the winter—3 are resident, 1 partially migratory, and 2 accidental. Four owl species have been reported on the annual survey.

### Great Horned Owl (*Bubo virginianus*)

The Great Horned Owl, common throughout North America, is the most widely distributed owl at the Flats and has been reported in 13 of 15 years by the daytime survey teams and in all 13 years of predawn owling. The range per party hour for the daytime survey was 0.00 to 0.26 (mean = 0.12), and for predawn owling the range was 1.00 to 4.00 (mean = 2.31). Very adaptable, this owl nests in farm buildings and takes over raven or buteo nests on saguaros, trees, and power poles. During the raptor count, day teams found them roosting in trees or barns. The predawn owling team followed a route with stops where the owls were heard calling from riparian woodlands, pecan groves, or farm buildings. This route was adjusted over the years, as more experience was gained on where to expect the owls, increasing the number per party hour detected over the last 5 years of the count (mean = 2.92). Of 123 Great Horned Owls reported over the 15 years, 80 (65%) were detected during the predawn owling period.



Figure 12. Ospreys rarely winter at Santa Cruz Flats, 11 November 2016. Photo by Matt Van Wallene

## Barn Owl

The Barn Owl is a resident of the Santa Cruz Flats that typically nests in farm buildings or stacks of hay bales, and often roosts in the winter in tamarisk clumps and other thickly vegetated areas, particularly the Santa Cruz River riparian corridor. Over the 15 years of the survey, the number of Barn Owls reported per party hour by day teams ranged from 0.00 to 0.20 (mean = 0.05). The Barn Owl's tendency to roost in dense vegetation during the day makes detection difficult, creating an element of chance in finding them. These owls weren't easily detected during predawn owling either; only 3 of the 23 recorded were reported during predawn owling.

## Burrowing Owl (*Athene cunicularia*)

Burrowing Owls (Figure 13) were reported on all but 2 years of the count with a range of 0.00 to 0.26 (mean = 0.11) individuals observed per party hour. Assessing its status at the Santa Cruz Flats from the numbers observed during the annual winter count gives an incomplete picture. Part of the population in central Arizona, including the Flats, migrates farther south in the winter, particularly juveniles and females (Ogonowski and Conway 2009). Moreover, these owls tend to perch in the open less often during the winter than during other seasons (C. Conway pers. comm.), making them harder to find. More Burrowing Owls, therefore, are detected in other seasons when more pairs and young are present. At all seasons Burrowing Owls are observed near their burrows along the edge of irrigation ditches adjacent to sod farms and cultivated fields, particularly alfalfa. They prefer sites with little vegetation to afford a view, and they usually perch on berms at the edge of ditches and canals and occasionally on irrigation pumps and telephone wires. Burrowing Owls face a challenge throughout the United States as their native grassland habitats, abundant with burrowing rodents, have been urbanized, overgrazed, or brought under cultivation. The U.S. Fish and Wildlife Service lists this owl as a national bird of conservation concern (Klute et al. 2003), and the AZGFD (2020) designates it as a Tier 1B species of greatest conservation need in Arizona. To survive under conditions of disturbance to their original grassland, Burrowing Owls have contrived ways to adapt. They find nesting cavities around earthen irrigation ditches and concrete-lined canals, either created by pockets of erosion or by rodents such as round-tailed ground squirrels (*Spermophilus tereticaudus*), which are numerous at the Flats. These burrows, however, are vulnerable to disruption from burning vegetation, repairs, cultivation getting too close, or water overflows. Consequently, Burrowing Owls may appear at a location for several years, then disappear.



Figure 13. Burrowing Owls, 11 March 2020. Photo by Doug Jenness

## Western Screech-Owl

Single Western Screech-Owls were reported in 3 consecutive years during predawn owling from a mesquite thicket adjacent to the same cattle tank. It's not surprising that these owls weren't detected by day teams as they typically don't call during the day and roost out of sight, but before sunup one would expect to detect more of them. I've heard them at other times near cattle tanks fringed by mesquites and surrounded by saguaros away from the main roads and cultivated fields. This suggests that this nonmigratory bird's population is greater than is shown by the winter raptor count, but this owl goes undetected because it resides in more remote areas of the Flats.

## Owl outliers

The Northern Saw-whet Owl (*Aegolius acadicus*), which nests farther north and in high-elevation mountains in Arizona, occasionally is found roosting at low elevations in the winter. One was discovered in a tamarisk clump at the Santa Cruz Flats 28 December 2007 (AZFO Historical Data 2007). An immature Spotted Owl (*Strix occidentalis*), another high-elevation species, was discovered in a large tamarisk 8 January 2013 (pers. obs.). The closest breeding habitat for both species is 60 km away in the Santa Catalina Mountains. Two other owls not yet reported at the Flats that could show

up in the winter are Long-eared (*Asio otus*) and Short-eared (*A. flammeus*) Owls. The former is often reported roosting in southern Arizona, sometimes in groups, in low-elevation riparian areas. A roost was found near Pinal Airpark just south of the Flats in the early 1970s (R. Glinks pers. comm.). Enough riparian habitat exists at the Flats that one or more are likely to turn up some time there. During the 1970-1971 winter Short-eared Owls were banded in abandoned farm fields in Avra Valley, to the south of the Santa Cruz Flats (R. Glinks pers. comm.). At the Flats, some retired cropland is beginning to support grasses that might attract Short-eared Owls. Even though many saguaros flourish in the bajadas surrounding the cultivated fields, no Elf Owls (*Micrathene whitneyi*) have been reported.

## DISCUSSION

Fifteen years of counting wintering raptors at the Santa Cruz Flats have established a species list for the raptors most commonly wintering there. The survey has also identified an increase in Crested Caracaras and a decline in White-tailed Kites. For most species, however, the numbers are too small to determine trends. Even with the more numerous species, such as Red-tailed Hawk, American Kestrel, and Northern Harrier, the results don't show significant declines or upswings that represent a pattern. They reveal, however, some fluctuation in the numbers observed from winter to winter. The ups and downs of the most abundant wintering species, often in the same year, affect the annual mean raptor totals per party hour. A wide difference (82.37%) in total raptors observed per party hour was shown between the lowest in 2011 (8.74) and highest in 2016 (20.98). Another way of looking at this variation is how much the annual totals deviate from the mean (14.68 per party hour) for the 15-year period (Figure 14). The distance the totals are dispersed from the mean (or expected total) is referred to as the standard deviation. This figure was only 2.82 for the 15-year period, which overall doesn't express wide variation. This variation is even less if the 2011 and 2016 totals are removed. As Figure 14 shows, the 8.74 and 20.98 totals were outliers. Many factors might explain the exceptionally high and low figures in those years: food availability, conditions on the breeding grounds, variation in team efforts, weather, etc. One-day annual surveys offer a snapshot of the wintering raptor population, and more counts per season would likely provide a more complete picture.

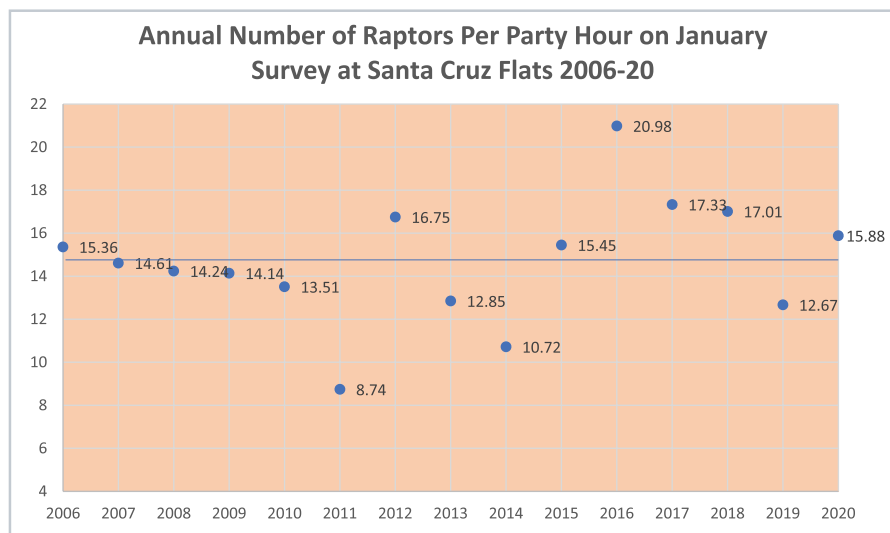


Figure 14. Graph shows large fluctuation in number of raptors seen on the annual count. The mean per party hour for the 15-year period (solid line) is 14.68.

The agricultural habitat at the Santa Cruz Flats described earlier, which includes pastures, pecan orchards, cultivated fields, and desert scrub, is considered for many avian studies to be a specific habitat separate from desert grasslands, wetlands, woodlands, etc. From 2016 through 2020 we attempted to identify more distinct habitats within this agricultural environment, including specific crops, plowed fields, pastures, desert scrub, riparian, and dwellings, where raptors were seen. This action produced no unequivocal data on field or habitat use. These microhabitats are so interconnected that on many occasions raptors were seen perched on poles or trees between 2 different habitats or crops, or flying from one habitat to another.

## PROSPECTS FOR RAPTORS AT SANTA CRUZ FLATS

The main achievement of the annual raptor count has been to provide a general baseline for the status of raptors wintering at the Santa Cruz Flats. Since 2006, when the count began, the agricultural lands and wildlife habitat have not been appreciably altered. Several proposed projects, however, could significantly alter the habitat throughout the Santa Cruz Flats, adversely affecting wildlife in the entire area.

The most imminent threat is the proposed Interstate 11, a divided highway projected to run from Las Vegas, Nevada through Phoenix, Arizona to Nogales, Arizona, across farmlands in the Maricopa-Stanfield area and through the Santa Cruz Flats. Of the 2 proposed options that would affect the Santa Cruz Flats, one would follow the current I-10 corridor. The “preferred” route, however, would add another corridor, creating a new route west of I-10. This 610 m-wide corridor would enter the northwest corner of the Flats near Chuichu Road and cut diagonally southeast through active farms and the riparian corridor along Sasco Road, destroying habitat used by wildlife, including wintering raptors. The 20-year land use scenario following the construction of I-11 is to convert the entire Santa Cruz Flats into a residential area, eliminating important wildlife habitats (ADOT and NDOT 2019). This conversion of the Santa Cruz Flats is envisioned in Eloy’s expansion plans. Eloy, the only incorporated city in the area, through a series of annexations, has expanded south so that a large part of the farmland north of Pretzer Road and south of I-10 is already within its city limits. Eloy currently comprises 294.5 km<sup>2</sup>. Some 116.5 km<sup>2</sup> were annexed since 2000. Moreover, its “planning area” is nearly 5 times larger, including a total of 1,386 km<sup>2</sup>, virtually the entire Santa Cruz Flats, including Arizona State Trust land (Eloy General Plan 2020a). Eloy’s recent annexations haven’t removed much land from agriculture, and, according to its own report, the city’s sluggish recovery from the 2008 recession has slowed down its development plans (Eloy General Plan 2020b). However, the construction of I-11 could accelerate residential and commercial development in that area.

Another threat is Arizona’s mandated Drought Contingency Plan, although it remains to be seen how this will affect agriculture at the Santa Cruz Flats. The multistate plan, ratified by the Arizona state legislature in January 2019 and by the U.S. Congress in April 2019, will reduce water from the Central Arizona Project to farmers in Pinal County by 60% for 3 years and 100% after that if water levels drop further at Lake Mead (Cong. Rec. 2019, AZ Dept. Water Resources 2020). Farmers’ only recourse in Pinal County, including the Santa Cruz Flats, will be to tap aquifers again, which creates surface subsidence and dangerous fissures that adversely affect the natural environment (Brown et al. 2017).

Using the I-10 corridor for I-11 instead of carving out a new corridor could help mitigate the adverse effects on agriculture and wildlife at the Santa Cruz Flats. Finding ways of assisting farmers to meet their water needs would also positively affect wildlife and natural diversity in the area. The yearly survey of wintering raptors will continue to add knowledge about these raptors’ status and hopefully aid their protection.

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