# Southwestern Willow Flycatcher Nesting Success, Cowbird Parasitism, and Habitat Characteristics at the Pueblo of Isleta, New Mexico

## 2005 Report

**Jacqueline Smith and Kristine Johnson**

**Natural Heritage New Mexico, Museum of Southwestern Biology**
**167 Castetter Hall, University of New Mexico, Albuquerque, NM 87131**
**Natural Heritage Publication No. 06-GTR-306**

**September 2006**

## Table of Contents



## List of Tables

## List of Figures



## Appendix

## Introduction

The Southwestern Willow Flycatcher (SWFL, *Empidonax traillii extimus*) breeds in riparian areas of the southwestern United States. The subspecies was listed as federally endangered by the US Fish and Wildlife Service (USFWS) in February 1995 (USFWS 1995). Breeding populations in the middle Rio Grande of New Mexico are found in isolated fragments of suitable habitat situated between large tracts of unsuitable habitat.

The SWFL is one of several declining species that apparently have been impacted by Brown-headed Cowbird (BHCO, *Molothrus ater*) parasitism (USFWS 2002, Rothstein and Robinson 1994, Holmes 1993). Among SWFL populations, cowbird impact varies widely. In New Mexico, reported rates vary from 18% in the Cliff Gila Valley to 40% at other sites (USFWS 2002).

Cowbird parasitism rates are related to habitat characteristics. Cowbird parasitism rates are typically lower in large patches of unfragmented habitat (Smith et al. 2000, Robinson et al. 1995). In general, parasitism rates and cowbird densities typically decline with increasing densities of low vegetation, probably because nests in dense vegetation are harder for cowbirds to find (USFWS 2002, Uyehara and Whitfield 2000, Staab and Morrison 1999, Larison et al. 1998). Parasitism rates are higher when vegetation above nests provides perches for female cowbirds (Averill-Murray et al. 1999, Staab and Morrison 1999, Larison et al. 1998). Parasitism has also been found to be higher when nests are located closer to unforested areas (Brittingham and Temple 1983).

A second factor that could influence parasitism rates is the presence of alternative hosts. Although some studies expect a positive correlation between number of cowbirds present and host availability (Thompson et al. 2000, Robinson 1999), the presence of alternative hosts could also reduce cowbird pressure on SWFLs (Robinson et al. 2000, Spautz 1999). Alternative hosts could swamp cowbird laying efforts, give warning calls to potential hosts when cowbirds were present, or deter cowbirds, in the case of hosts with aggressive defense behavior such as Red-winged Blackbirds (*Agelaius phoeniceus,* Clotfelter 1998). Finally, vegetation features and alternative host availability could interact to increase or decrease parasitism rates. In 2000 and 2004, the Pueblo of Isleta site had no nest parasitism in the presence of a large cowbird population. In 2003, however, the parasitism rate was 33% (Smith and Johnson 2004).

The purpose of this study was to continue work done in 2003 and 2004, which included: 1. conducting protocol surveys for nesting and migratory willow flycatchers in suitable habitat at the Pueblo of Isleta, 2. monitoring nests for success and brood parasitism, 3. determining the distribution of alternative hosts for brood parasitism, and 4. collecting data on vegetation at SWFL nests.

## Methods

### *SWFL Surveys*

In 2003, three sites on the Pueblo of Isleta were identified as suitable breeding habitat for SWFLs: South of Isleta Marsh Expanded, South of Highway 147 Bridge, and Isleta Return Channel (Smith and Johnson 2004). In 2004 and 2005, we conducted surveys at two of these sites: South of Isleta Marsh Expanded and Isleta Return Channel. Although only the southern portion of the South of Isleta Marsh Expanded site is suitable for SWFLs, we surveyed the entire area. The northern portion of the site had an insufficient understory. Site names are exactly as reported in Johnson and Smith (2000) and Smith and Johnson (2004). All maps showing locations of territorial males and nests were created in ESRI ArcGIS, version 9.0.

We followed survey protocols and habitat evaluation as outlined in the USFWS SWFL survey protocol (Sogge et al. 1997). There were no imminent projects planned within this habitat; therefore, we followed a three-visit schedule, per the 2001 protocol addendum (USFWS 2000). Starting 16 May 2005, we visited both sites within the recommended dates: survey 1, 15-31 May; survey 2, 1-21 June; survey 3, 22 June – 10 July. We conducted surveys between sunrise and 9:00 am. Both sites were accessible to thorough walking surveys within suitable habitat.

Observations of SWFLs were used to determine status: migrant, territorial male, unpaired male, pair (breeding/non-breeding), or fledgling. Any bird detected at a site in May that was not present in later surveys was considered to be a migrant. SWFLs were differentiated from other flycatchers by vocalizations, and we considered any birds detected between 15 June and 25 July to be of the southwestern subspecies (*E. t. extimus*; Rourke et al. 1999).

We determined breeding status based on activity of territorial birds. The observer sat or stood quietly in the habitat and watched for the presence of a female, listened for *whitt* and interaction calls between the pair mates, and looked for territorial defense, copulation, carrying of nesting material, carrying of food, incubation, or feeding of young.

All survey results were reported on standard SWFL survey and detection forms (Appendix 1, Sogge et al. 1997). In addition, as required by our USFWS permit, during the course of the study, we informed biologists at the USFWS New Mexico Ecological Service Office and New Mexico Game and Fish Department of detections of SWFLs and their nests.

### *Nest Monitoring*

We monitored SWFL nests to determine fate, productivity, and brood parasitism. Nest monitoring followed standard SWFL nest monitoring protocol (see details in Rourke et al. 1999). We kept nest calendars to estimate transition times and allow accurate assessment of nest fate with minimum disturbance. To avoid triggering premature fledging, we did not visit nests during the last few days of the nestling period. Nests were checked every two or three days near hatching, or if the approximate hatch date was unknown. Otherwise, nests were checked every four to seven days. During nest checks,

we entered the territory and determined activity by the adults, approached the nest from a different path each time, quickly checked the contents with a mirror pole, and left by a different path, to avoid leaving a dead end scent path for predators. To determine whether a nest successfully fledged, we checked for fledglings being fed in the territory. All nest site coordinates were recorded with GPS units, taken in North American Datum (NAD) 27, and plotted on digital USGS 7.5 minute quad maps. Territories in which nests failed were visited at least twice to check for re-nesting.

### *Alternative Hosts*

To determine the distribution of alternative hosts at the South of Isleta Marsh site, we mapped a 100 x 100 m grid over the habitat, which created 15 intersection points on the site. We ran three point counts at these points in 2004; between 16 and 18 June, 21 and 22 June, and 28 June and 2 July. In 2005, we conducted two point counts on 16 and 24 June. During each count, we waited for five minutes after arriving at a point to allow activity to resume after our disturbance, then we recorded all birds heard and seen from that point for five minutes. We recorded species, number, compass heading, and distance (0-25 m; 26-50 m). Birds estimated to be more than 50 m away were not recorded; these birds would either be within range of another point or out of the habitat. Alternative host individuals were mapped if they were recorded two or more times at similar compass headings, if one or more records was over 25 m from the point but both were within 90° of each other, or if the records were within 180° but were both less than 25 m away.

### *Vegetation Characteristics*

Vegetation measurements were collected at nests using methods recommended by Dr. Peter Stacey of the University of New Mexico (P. Stacey, pers. comm. 2004, Kus 1998). This method differs from the method used in previous years on the Pueblo but is the same as that used in other SWFL habitats in New Mexico in 2004 and earlier.

We recorded two types of vegetation measurements. First, we recorded nest-centered data similar to Rourke et al. (1999, p. 24). This included data on nest height, substrate tree species and height, and distance to water. When distances could not be estimated on site they were measured using GIS on an aerial photo.

Second, vegetation cover was estimated in four five-meter radius plots by noting the volume occupied between the ground and 3 m, 3-6 m above the ground, and 6 m to the top of highest canopy over the plot (Kus 1998). One plot was centered at the nest tree, and three more plots were located 15 m from the nest tree at due north and at 120º and 240º compass headings. Estimates were recorded as percent volume occupied by all plants and percent of the total plant cover volume contributed by the top three species. Volume estimates were recorded in categories of 0, 1-10, 11-25, 26-50, 51-75, 76-90, and 90-100%. In 2004, vegetation cover was also measured at randomly selected non-use sites. We selected a non-use site for each nest by selecting a compass heading and distance from a random numbers table. We accepted only headings and distances that determined a site inside the Isleta Return Channel Site. .

## Results

### *SWFL Surveys*

No Willow Flycatchers were detected at the South of Isleta Marsh Expanded site. We surveyed three times for a total of three hours.

The Isleta Return Channel site was flooded in the spring by the return channel that flowed over its banks and into the habitat. In late May, the entire area was inundated with at least 0.9 m of water. It flowed into the north and was deepest (up to 1.5 m deep) in the southern area. Later in the breeding season, the northern portion of the habitat dried out, leaving isolated ponds. The southern portion of the habitat stayed wet throughout the breeding season. Heavy beaver activity occurred in the habitat, especially in the northwest part. The entire site is approximately 1.2 km in length, with an average canopy height of 15 m. The dominant plant species are Rio Grande cottonwood (*Populus deltoides*), coyote willow (*Salix exigua*), and Russian olive (*Eleagnus angustifolia*). The cottonwood overstory dominates the northern and eastern portions of the site, and Russian olive and coyote willow dominate the central and western portions, where cottonwoods exist as single emergent trees.

We spent about 30 hours in the habitat mapping SWFL territories, including the surveys. We found seven nests and six SWFL pairs in nine territories (Table 1, Figure 1). There were more territories than pairs because three of nine territories disappeared early in the season. By the end of the season, only 12 adults and six territories remained at the site.

Table 1. Summary of survey dates and results.

| Site | Year | Dates Visited | Adults | Pairs | Territories | Nests | Fledglings |
|---|---|---|---|---|---|---|---|
| Isleta Return Channel | 2005 | 5/16, 6/7, 6/30, 7/5 | 12 | 6 | 9 | 7 | 8 |
| Isleta Return Channel | 2004 | 5/18, 5/19, 6/18, 7/6, 7/19 | 14 | 7 | 7 | 10 | 13 |
| Isleta Return Channel | 2003 | 5/23, 6/13, 6/18, 6/19, 6/30 | 12 | 5 | 5 | 6 | 7 |
| South of Isleta Marsh (expanded) | 2005 | 6/1, 6/14, 7/25 | 0 | 0 | 0 | 0 | 0 |
| South of Isleta Marsh (expanded) | 2004 | 5/25, 7/12 | 0 | 0 | 0 | 0 | 0 |
| South of Isleta Marsh (expanded) | 2003 | 5/23, 6/19, 6/27 | 0 | 0 | 0 | 0 | 0 |

### *Nest Monitoring*

Seven nests were found in the breeding season, built by six pairs of SWFLs (Table 2, Figure 1). Nest 4b was a second nest built by pair 4 in a different tree after nest 4 failed. Nest 11 was the only one found to be parasitized. The nest success rate was 3 of 7 (43%), but 3 of 6 (50%) pairs were successful in fledging young. Eight young successfully fledged this year.

Of the three years, 2003 had the fewest pairs breeding and the lowest nest and pair breeding success (Table 3). The year 2004 had the highest number of breeding pairs and the highest nest and pair breeding success.

Table 2. Summary of nests found. Nest number does not match territory number because territories were not all mapped when nests were found.

| Territory | Nest | Date Discovered | Last Known Nest Contents | Nest Fate |
|---|---|---|---|---|
| 1 | 1 | 6/14/05 | 3 SWFL nestlings | Fledged |
| 4 | 4 | 6/7/05 | Empty | Tipped over |
| 4 | 4b | 6/30/05 | 1 SWFL nestling | Fledged |
| 6 | 6 | 6/21/05 | 3 SWFL nestlings | Disappeared |
| 7 | 7 | 7/5/05 | empty | Never started |
| 10 | 10 | 5/24/05 | 4 SWFL nestlings | Fledged |
| 11 | 11 | 6/7/05 | 1 SWFL egg and 1 BHCO egg | Abandoned |

Table 3. Nest and pair success rates and number of pairs breeding for three years at the Isleta Return Channel Site.

| Year | Nest Success | Pair Success | N Pairs Breeding |
|---|---|---|---|
| 2005 | 43% | 50% | 6 |
| 2004 | 50% | 71% | 7 |
| 2003 | 33% | 40% | 4 |

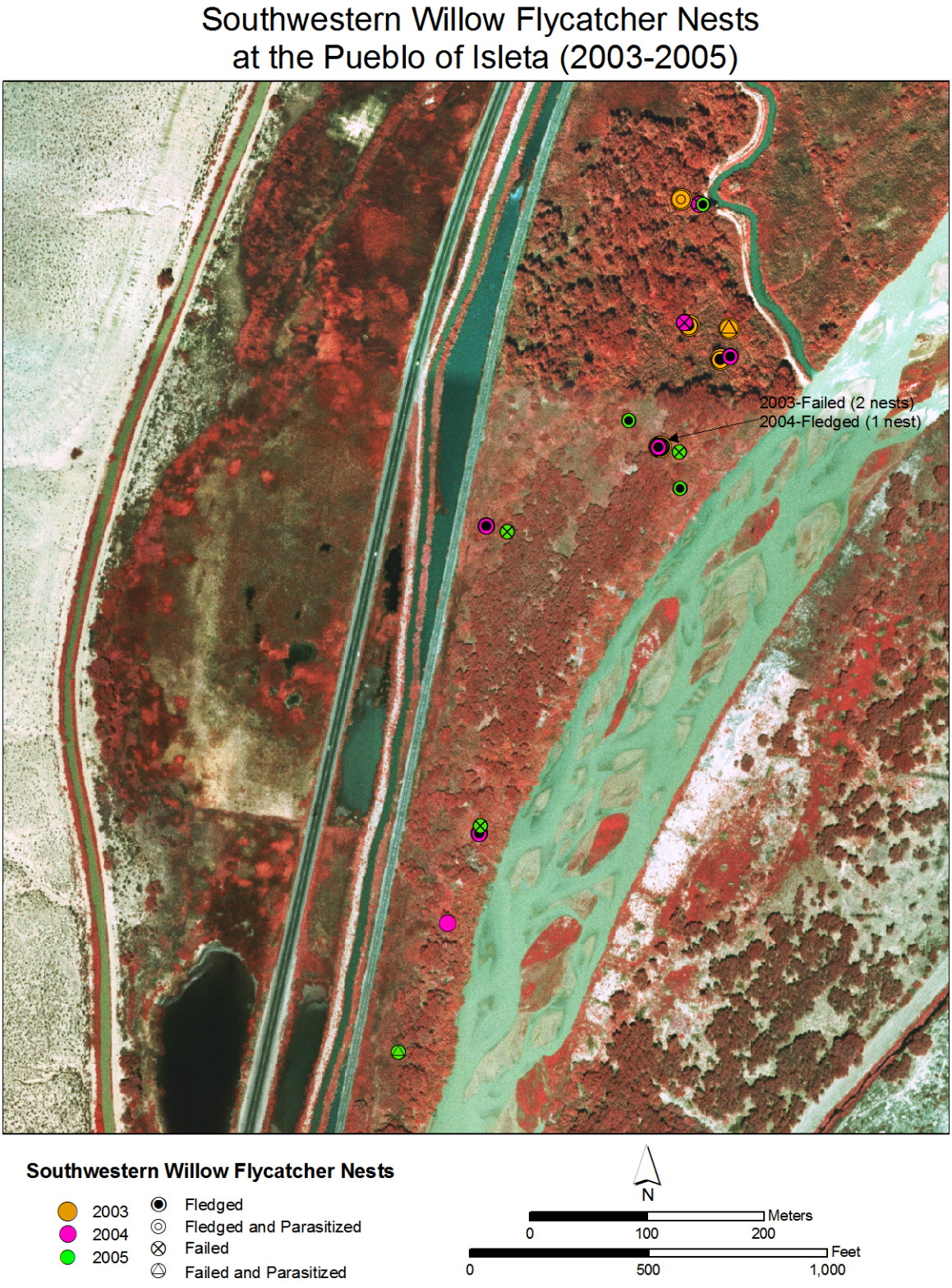


Figure 1. Map showing SWFL nests at the Isleta Return Channel Site for 2000 and 2003-2005.

### *Alternative Hosts and BHCO Parasitism*

At the Isleta Return Channel site we mapped 35 territories of nine possible alternate host species (Table 4; Figures 2-7). The only species recorded during the point counts but deleted from the list of potential hosts were Black-chinned Hummingbird (*Archilochus alexandri*), because they are too small to host BHCO nestlings, and Cooper's Hawk (*Accipiter cooperii*), because they are too large (as cited in Lowther 1993: Friedmann 1929, 1963, Friedmann et al. 1977, Friedmann and Kiff 1985). Although brown-headed cowbirds were seen at the site (Figure 2), only one SWFL nest was parasitized. Twelve BHCO individuals were seen during point counts.

Comparisons between years in abundances of alternative hosts are not straightforward because the method of mapping alternative hosts was different in 2003, and there were three point count surveys in 2004 but only two in 2005. In 2003, surveys for alternative hosts were not conducted in the narrow southern portion of the Isleta Return Channel site because there were no SWFLs nesting there. However, we can compare the number of alternate hosts per SWFL, and the number of hosts per BHCO (Table 5). The highest number of hosts per SWFL was 2003 when there were two nests parasitized, and the lowest was in 2005, with one nest parasitized.

The only two BHCO territories in 2005 were in the southern portion of the habitat near the only parasitized SWFL nest (Figure 2). In 2004, we mapped 13 territories, and eight of these were in the southern area. There were no nests parasitized in 2004. In 2003, 21 BHCO were mapped throughout the gallery forest in the western half of the site, and only five were mapped further south and east where SWFLs were nesting. There were two of six nests parasitized in 2003.

Some alternate host territories were near SWFL nests (Table 6 and Figures 2-7). Nest 11, the only nest to be parasitized, had two Red-winged Blackbird territories nearby. No other nest had Red-winged Blackbirds nearby. The southern area of the site is the only area where SWFL habitat is adjacent to Red-winged Blackbird habitat.

Table 4. Alternate host species and territories mapped. Only the northern portion of the site was surveyed in 2003. Number of parasitized nests in parentheses.

| Species | 2003 (2) | 2004 (0) | 2005 (1) |
|---|---|---|---|
| Western Wood-pewee | 0 | 3 | 4 |
| Bewick's Wren | 6 | 0 | 0 |
| Gray Catbird | 8 | 4 | 4 |
| Common Yellowthroat | 0 | 4 | 3 |
| Yellow-breasted Chat | 0 | 8 | 1 |
| Summer Tanager | 0 | 0 | 1 |
| Spotted Towhee | 16 | 7 | 5 |
| Black-headed Grosbeak | 12 | 10 | 6 |
| Blue Grosbeak | 0 | 1 | 3 |
| Red-winged Blackbird | not recorded | 15 | 8 |
| Total | 42 | 52 | 35 |

Table 5. Total alternative hosts, SWFL pairs, and BHCO territories.

| | 2003 (2) | 2004 (0) | 2005 (1) |
|---|---|---|---|
| # hosts | 42 | 52 | 35 |
| # SWFL pairs | 4 | 7 | 6 |
| # BHCO territories | 25 | 13 | 2 |
| hosts / SWFL | 10.5 | 7.4 | 5.8 |
| hosts / BHCO | 1.68 | 4 | 17.5 |
| hosts / SWFL * BHCO | 0.42 | 0.57 | 2.9 |
| total hosts / BHCO | 1.84 | 4.5 | 20 |

Table 6. Alternate host territories within 50 m of each nest.

| Nest | Western wood-Pewee | Gray Catbird | Common Yellowthroat | Yellow-breasted Chat | Summer Tanager | Spotted Towhee | Black-headed Grosbeak | Blue Grosbeak | Red-winged Blackbird | Brown-headed Cowbird |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | 1 | 1 | | | |
| 4 | | | | 1 | | 1 | | | | |
| 4b | | | | | | | | | | |
| 6 | | | 1 | | | | | | | |
| 7 | 1 | 1 | | | | 1 | | | | |
| 10 | | | | | | | | | | |
| 11* | | | | | | | | | 2 | |

*nest 11 was the only parasitized nest in 2005.

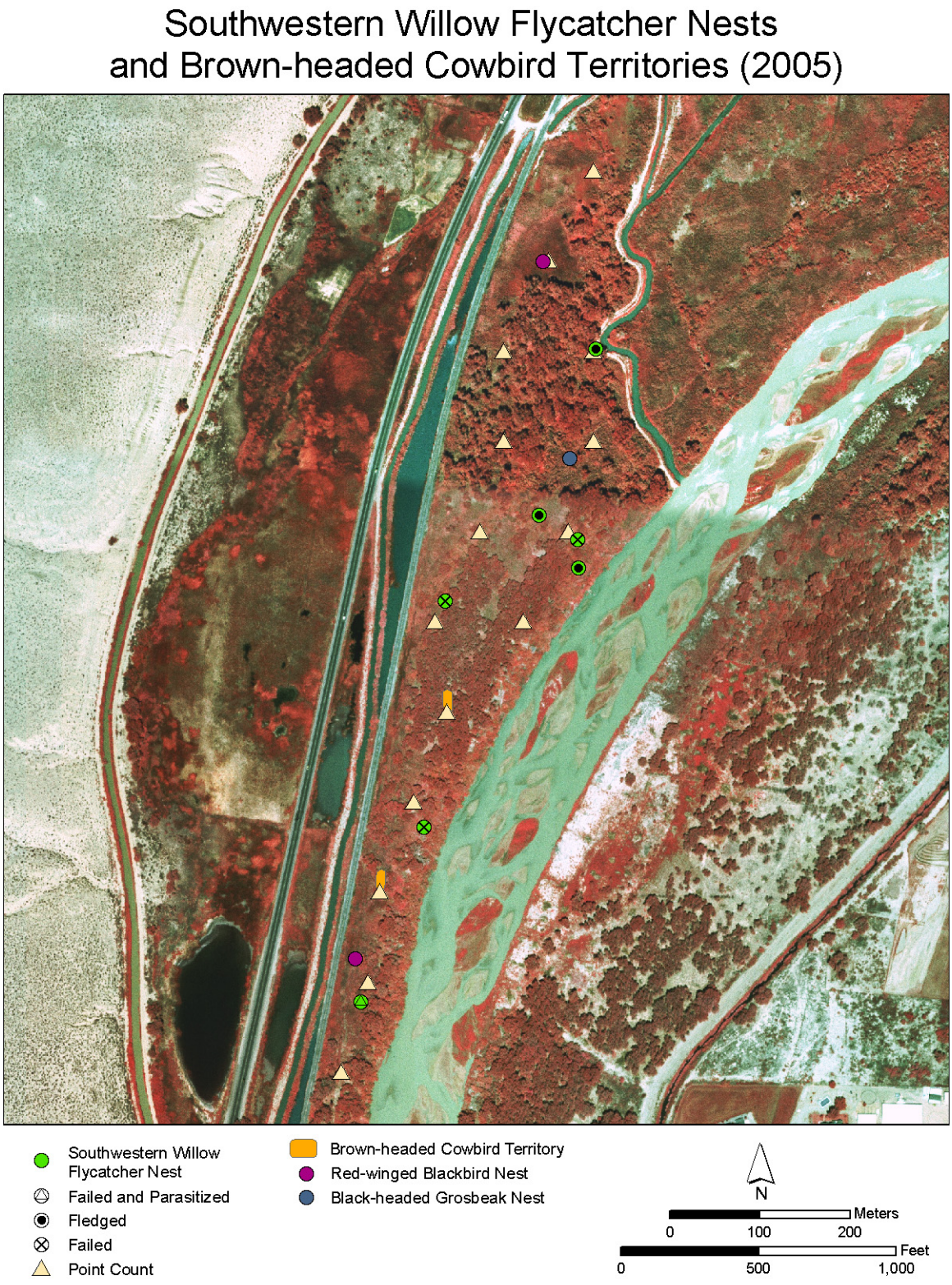


Figure 2. Brown-headed Cowbirds territories and SWFL nests in 2005.

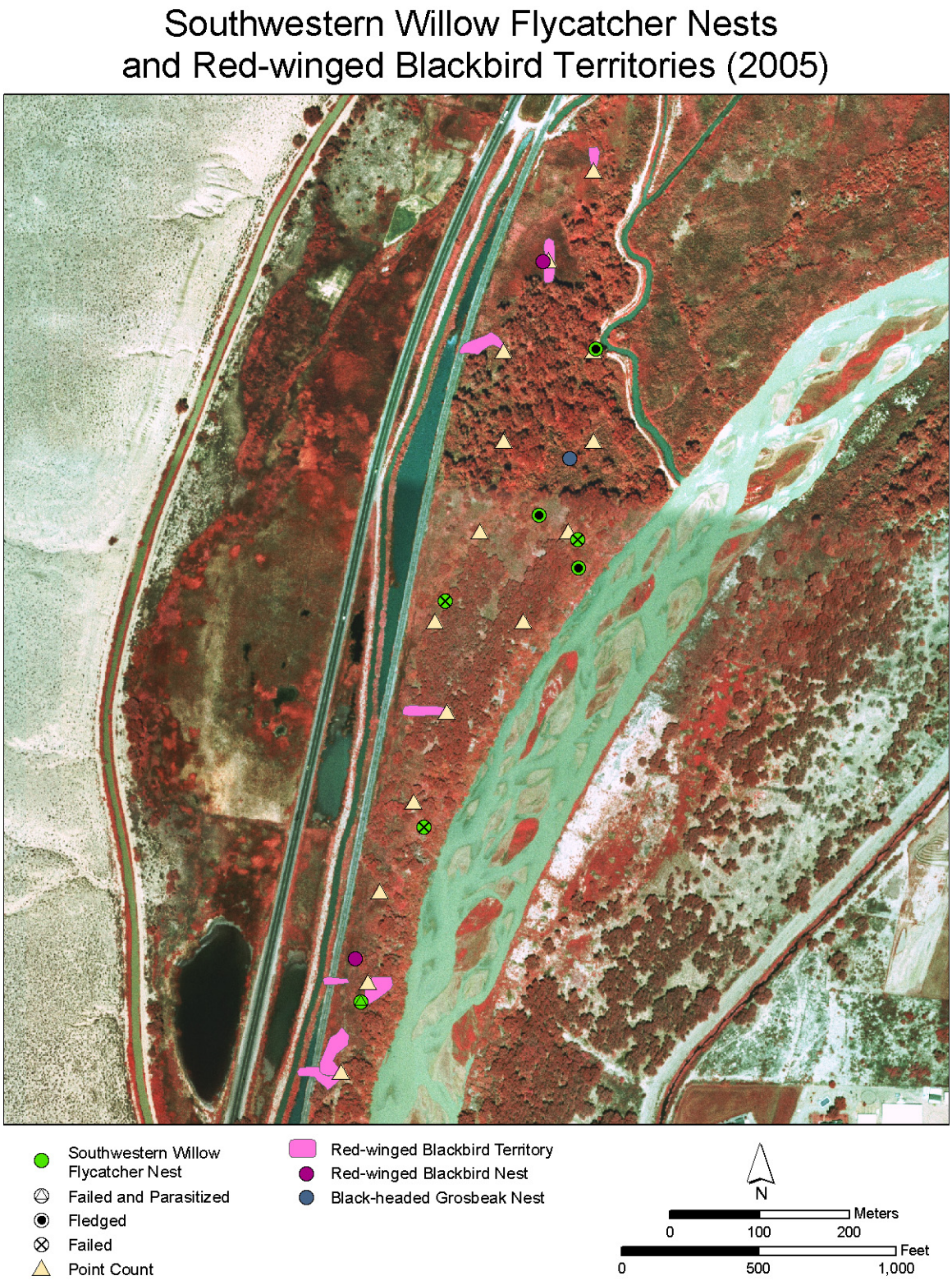


Figure 3. Red-winged Blackbirds territories and SWFL nests in 2005.

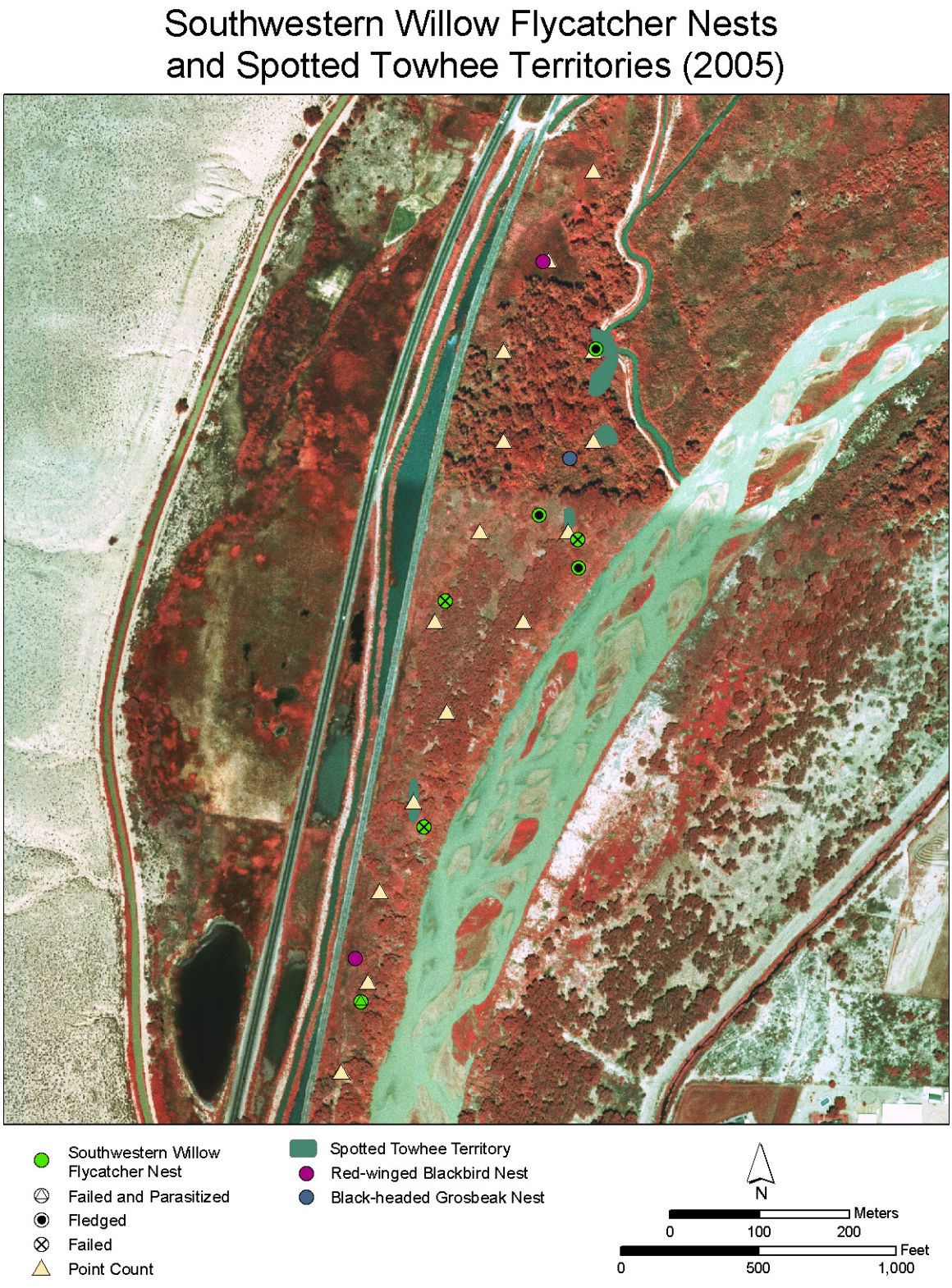


Figure 4. Spotted Towhee territories and SWFL nests in 2005.

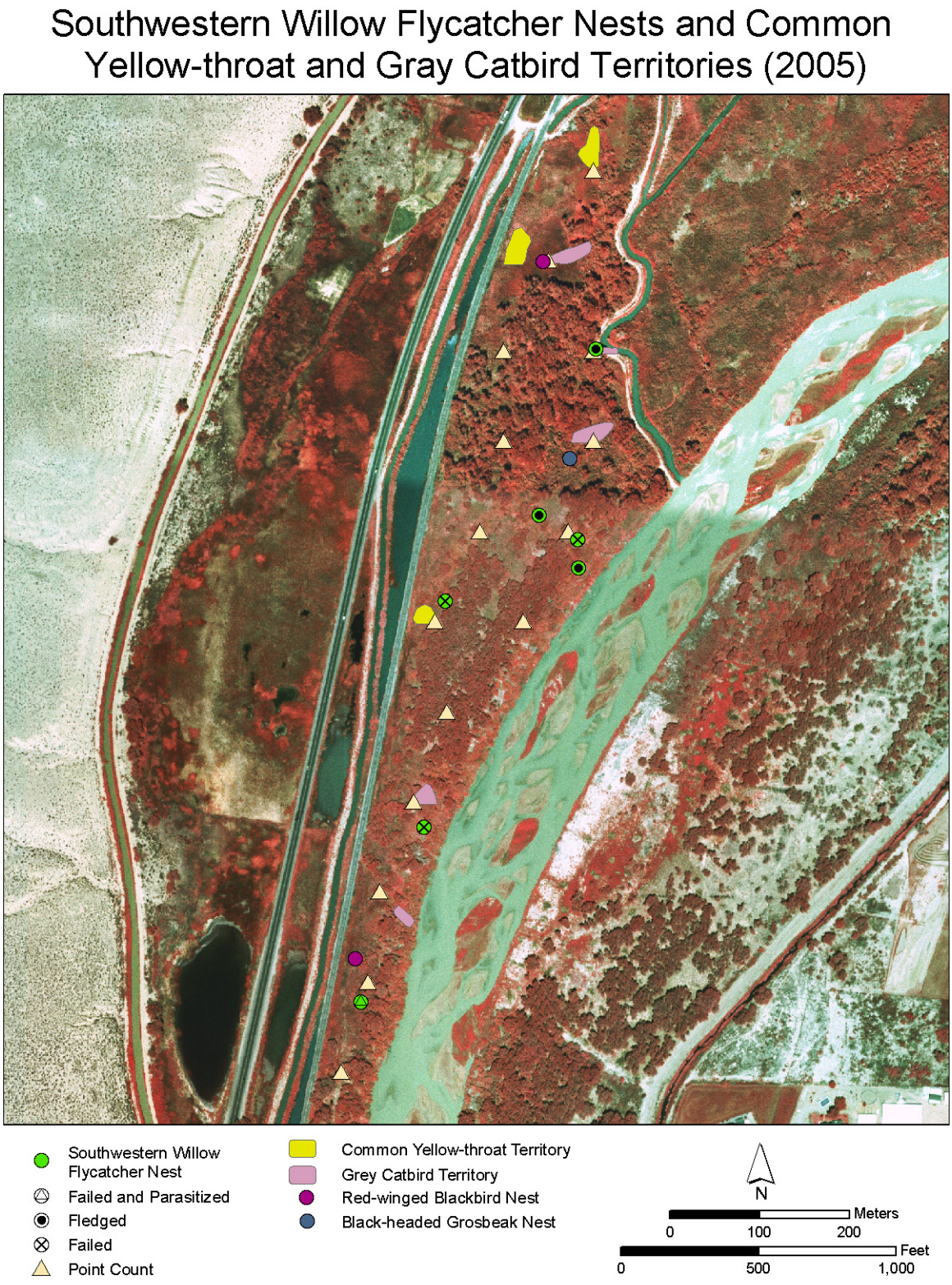


Figure 5. Common Yellow-throat and Gray Catbird territories with SWFL nests in 2005.

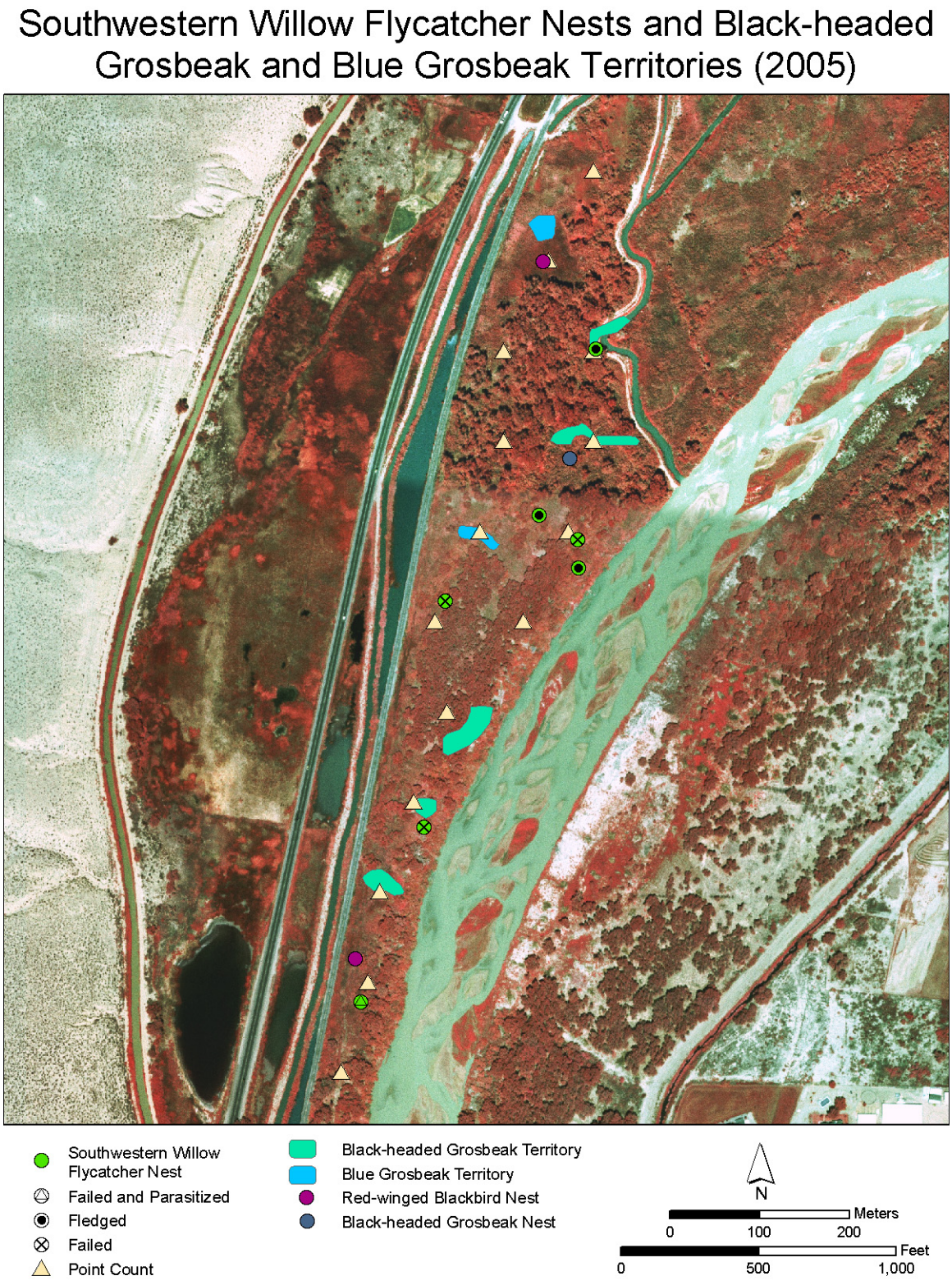


Figure 6. Black-headed Grosbeak and Blue Grosbeak territories with SWFL nests in 2005.

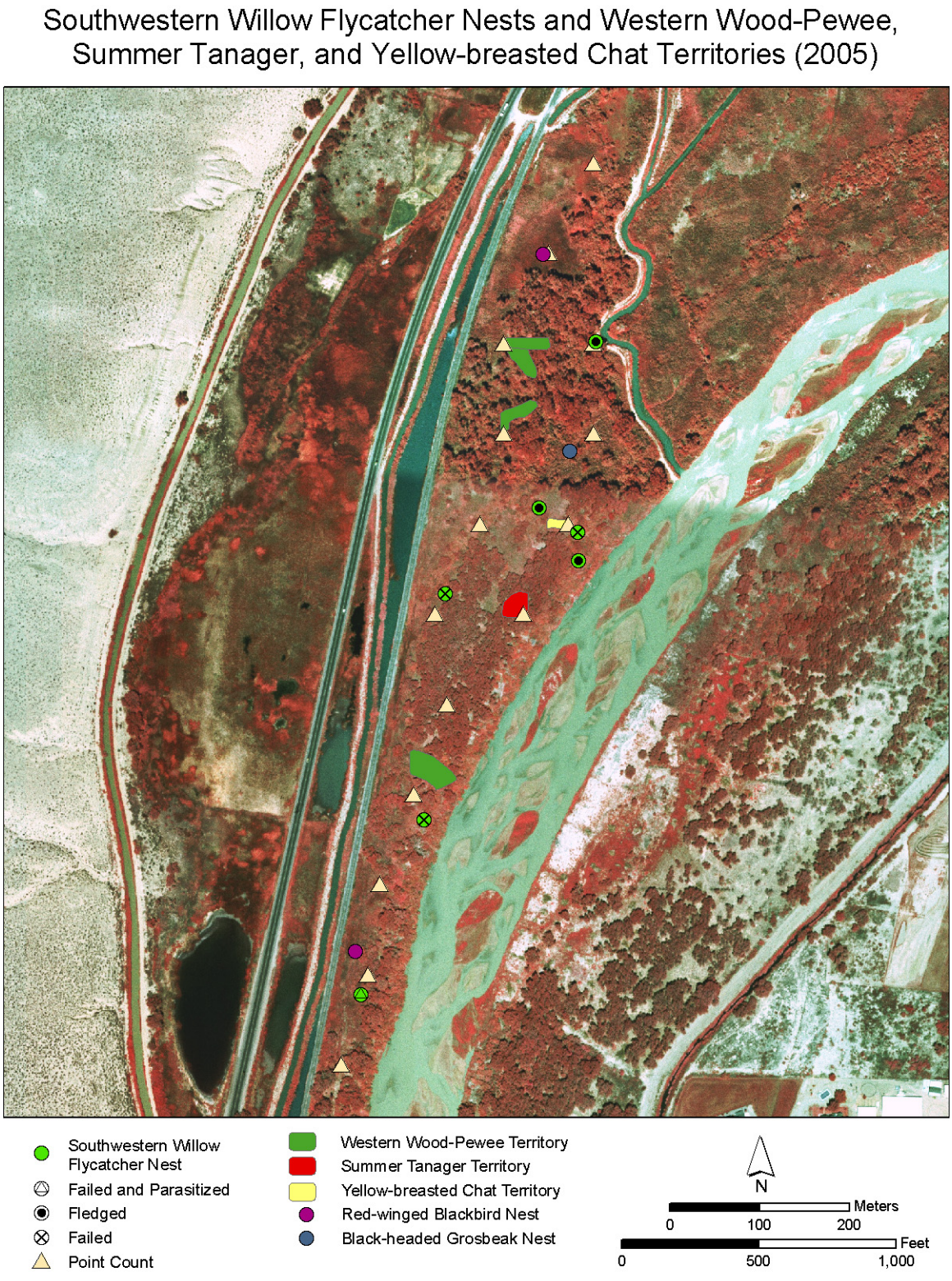


Figure 7. Western Wood-Pewee, Summer Tanager, and Yellow-breasted Chat territories with SWFL nests in 2005.

***Vegetation Characteristics***

SWFL nests were placed in Russian olive, coyote willow, and salt cedar in 2004 and 2005, but only Russian olive and coyote willow in 2003 (Table 4). The average height of the nest tree, nest height, DBH of nest tree, and average distance from the nest to the edge of the nest tree canopy for nests in 2004 and 2005 are shown in Table 7. Although there were no significant differences between nest and control plots, there are differences worth noting. The distance from the nest or center of the plot to the edge of the clump of vegetation was less for nests in 2004 and 2005 than for control plots (14.4 and 14.6 m vs. 31.75 m, Table 8). The distance to the edge of the riparian habitat was greater for nest plots in 2004 and 2005 than for control plots (64 and 43 vs. 29 m, Table 8; not measured in 2003). Finally, the distance to surface water was less for nests in 2004 than for control plots, but more in 2005 (32 and 50 vs. 41 m, Table 8).

Table 7. Species of substrate tree by nest.

| **Tree species** | **Nest 2003** | **Nest 2004** | **Nest 2005** |
|---|---|---|---|
| Russian olive | 1, 1b, 2, 3, 5 | 1, 1b, 1c (all the same tree), 4, 4b (two trees) | 6 |
| coyote willow | 4 | 2,5,8 | 1, 10, 4 |
| salt cedar | | 3, 7 | 4b, 7, 11 |

We noted an inverse relationship between number of fledglings from a nest and nest tree DBH, although it was not significant (Figure 9). One of the nests is an outlier in this pattern; it failed and was in a 30 cm DBH Russian Olive tree. But even without this point, the pattern remains.

Number of fledglings also varied with the distance from the nest to the edge of the nest tree canopy (Figure 10). Number of fledglings decreased significantly with an increase in the distance from the edge of the tree's canopy ($df=10$, $p<.02$).

Average vegetation cover in 2005 was consistently lower than in 2004 (Figure 11). In every height category, cover was more dense at the nest than away from it. In both years, the densest vegetation was at the nest in the 0-3 m interval; this interval at the nest also had the lowest variance of any category in both years. In 2005, there was less difference in cover between height intervals at the nest than away from it; density decreased less with height at the nest than away from it. In 2004, however, vegetation at the nest decreased more steeply from the ground to the canopy at the nest than away from it.

When the vegetation cover data for the nest that was parasitized is separated from the cover data of nests that were not, it becomes apparent that the nest-centered cover at 0-3 m is less than half of the average for the other nests in the same year (2005; Figure 12). The 3-6 m height interval is about average for the parasitized nest, but the 6 m and higher level was less dense than at most of the unparasitized nests. The vegetation at the

near-nest plots of the parasitized nest was average that of nests that were not parasitized (Figure 13).

Table 8. Nest-centered data for three years. Non-use data was only collected in 2004.

| nest year | 2003 | 2004 | 2005 | non-use 2004 |
|---|---|---|---|---|
| height nest tree | | 4.8 | 4.9 | |
| nest height | 3.42 | 3 | 2.7 | |
| DBH nest tree (cm) | | 3.8 | 7.7 | |
| distance to edge of substrate | | 0.6 | 0.72 | |
| distance to edge of clump | 26.5 | 14.4 | 14.6 | 31.75 |
| distance to edge of riparian | | 64 | 43 | 29.4 |
| average canopy height | | 21 | 28.6 | 27.5 |
| distance to water | | 32 | 50 | 41 |

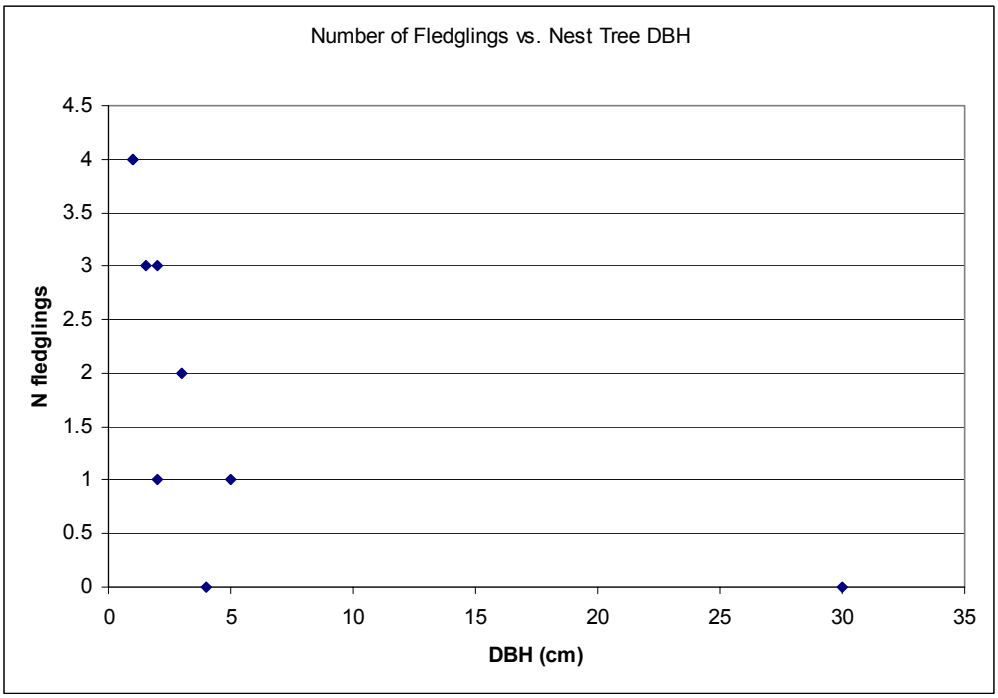


Figure 8. Number of fledglings in a nest plotted against nest tree diameter.

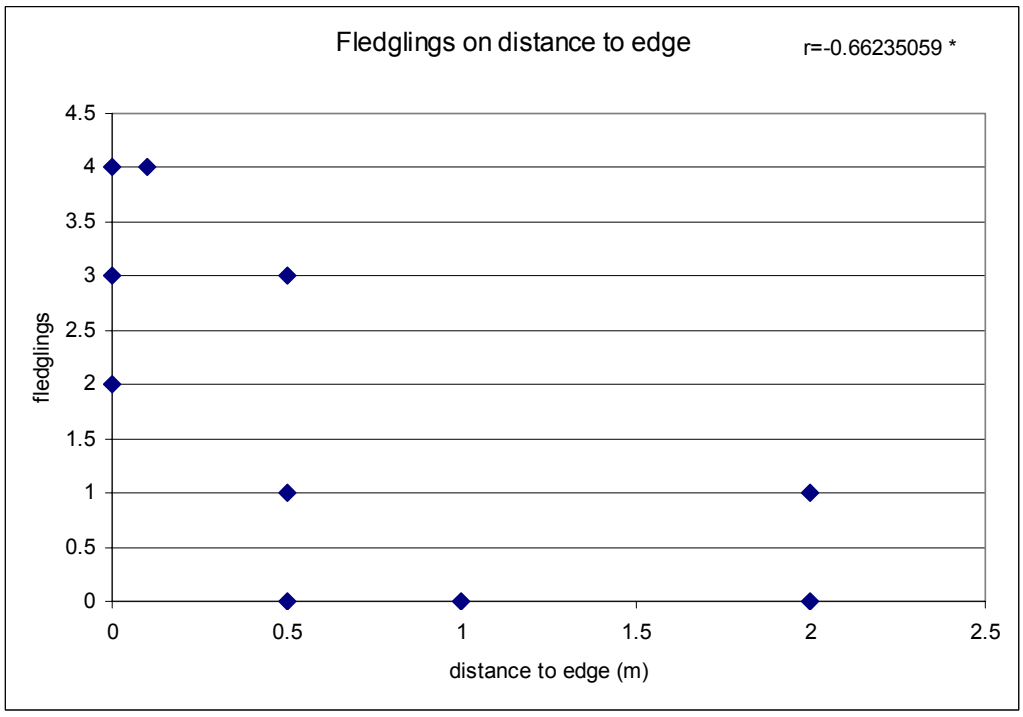


Figure 9. Relationship between number of fledglings and the distance from the nest to the edge of the nest tree canopy.

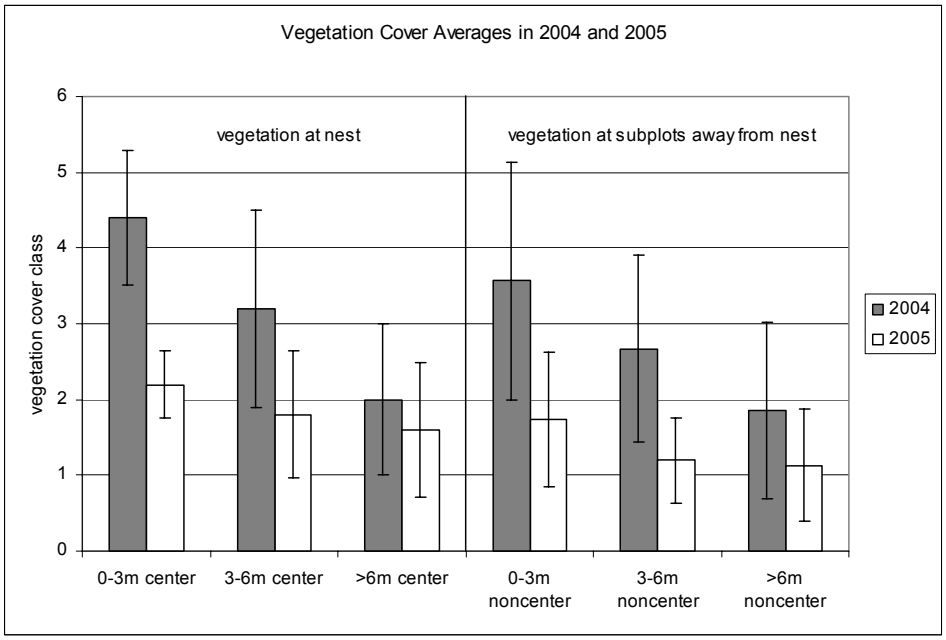


Figure 10. Vegetation at nest-centered plots and near-nest plots in 2004 and 2005.

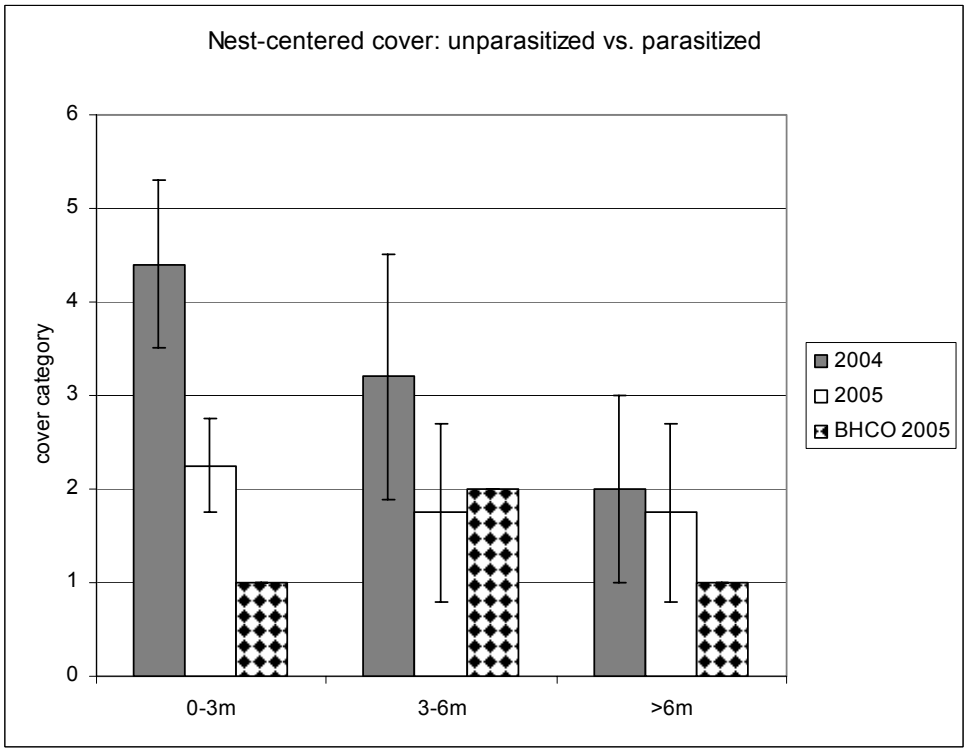


Figure 11. Nest-centered vegetation cover for 2004 nests and 2005 parasitized and unparasitized nests. There were no parasitized nests in 2004.

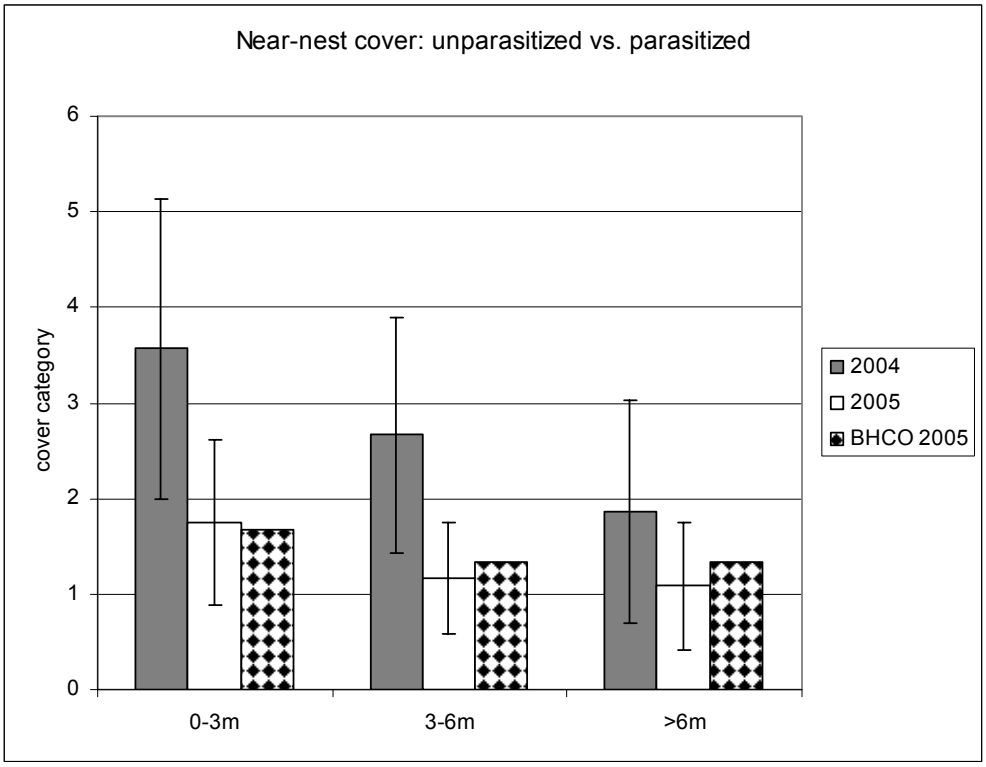

Figure 12. Near-nest vegetation for 2004 nests and 2005 parasitized and unparasitized nests.

## Discussion

This study continued the surveys, nest monitoring, and alternative host mapping begun in 2003 (Smith and Johnson 2004) and continued in 2004 (Smith and Johnson 2005). Those two studies and the present one address two specific tasks laid out in the executive summary of the Southwestern Willow Flycatcher Recovery Plan (USFWS 2002): to "initiate or continue monitoring of SWFL populations and nests at core occupied and suitable breeding sites," and to "evaluate the relationship between cowbird parasitism, habitat quality, alternative hosts, and SWFL population levels on the Middle Rio Grande."

### *Alternate Hosts and BHCO Parasitism*

Our data do not show a relationship between alternative hosts and BHCO parasitism on SWFL nests. In the year of highest number and highest proportion SWFL nests parasitized, 2003, the number of alternate hosts was intermediate between the other two years. The number of alternate hosts per BHCO territory, on the other hand, was intermediate for the year with the least BHCO parasitism, 2004. The number of hosts per SWFL pair also shows no pattern; it is highest for the year with highest parasitism, but intermediate for the year with no parasitism. Even when the number of hosts per SWFL pair is averaged by the number of BHCO territories, they still do not correlate with parasitism levels: the lowest number of hosts per SWFL per BHCO occurs in the year with the highest level of parasitism, but the highest number is for the year with an intermediate level of parasitism. Although sample sizes of parasitized nests are low, our data do not suggest that alternative host abundance explains BHCO nest parasitism on SWFLs at this site.

Other factors could explain patterns in BHCO nest parasitism. The location of parasitized nests may provide insight into the predictors of nest parasitism at this site. The northern and southern portions of the site have different shapes. The northern part is a large area of about 100-150 m wide with edges only on the dirt road and return channel at the northeast side and the river channel on the east side for about 200 m. On the other sides, suitable habitat borders other forest or wetland habitat. The southern part of the habitat is narrow and linear, bounded on either side by the Rio Grande to the east and the railroad tracks on the west and tapering to a width of about 70 m. SWFL habitat in the south is more exposed to edges like railroad tracks, open cattail marshes, and the river channel.

In 2003, when all nests were in the north portion of the habitat, two of the five nests were parasitized. These nests were along the return channel where large trees provide perches for female BHCO. The presence of perches two to three meters tall has been shown to be positively correlated to rates of BHCO parasitism (Hauber and Russo 2000). Hauber and Russo measured rates of BHCO parasitism in ground-nesting birds; presumably female BHCO searching for SWFL nests benefit from higher perches such as the partly dead Russian olives at the edges of this habitat.

The only other occurrence of BHCO parasitism in these three years was in 2005 in the very southern part of the habitat. Both nests in the south failed that year, and the southernmost nest was parasitized. This part of the habitat is narrow and has long edges

exposed to the road and railroad tracks on the west and the river channel on the east. In addition to those edges, a large area of cattail marsh hosts many nesting red-winged blackbirds to the west. BHCO parasitism rates increase with the amount of edge (Sedgwick and Knopf 1988) and open area (Brittingham and Temple 1983). BHCO probably forage in agricultural fields to the west. Additionally, perches are available above this part of the habitat, as at the north edge.

Vegetation around the nest may also partly explain nest parasitism. The one parasitized nest in 2005 happened to have much lower cover from 0-3 m. This nest also had lower vegetation volume above 6 m. This nest was in a large, multi-trunked salt cedar that was dense in the 3-6 m interval, but not below or above. Low vegetation density may have made the nest more visible from above (Smith and Johnson 2004). Parasitized nests in 2003 also seemed to have lower vegetation density, but the pattern was not conclusive (Smith and Johnson 2004).

### *Vegetation and Nest Success*

SWFL consistently choose nesting locations near the edge of a clump of trees, with dense vegetation in the first 3 meters above the ground. Additionally, they have better success in small trees (DBH and canopy). Nests are often in a very small tree growing in the canopy of a large tree. Dense vegetation may hide the nest and the adults' movements from nest predators and parasites, while nesting in a small tree may make it difficult for heavy terrestrial predators (e.g. raccoons) to reach the nests.

Large differences in vegetation cover between 2004 and 2005 are probably due to a change in cover estimation, not any large change in actual vegetation cover. We measured vegetation at the same time of year, but leaves might have fallen at different times in the two years.

### *Water and nest Success*

The year 2005 was extremely wet at this site. Flowing water was present over the entire habitat. The southern area is lower than the northern part; when there was no longer water in the north, water was about 0.5 m deep in the southern part. The year 2004 was only somewhat wet from spring rains. The southern portion of the habitat was inundated early in the breeding season and water remained adjacent to it in the ditch just east of the railroad tracks. The northern portion had no standing water in 2004. In contrast, 2003 was an extremely dry year; no water was present in the habitat or in the ditch east of the railroad tracks.

These differences, along with vegetation discussed above, may explain some differences between years in the distribution and nesting success of SWFLs at this site. In 2004, the habitat had intermediate amounts of water but had the highest number of birds breeding and the highest success rates. In 2003, the habitat was very dry and had the lowest number of birds and breeding success. We expected the increased water in 2005 to increase the number of breeding birds and increase their success, but there may have been too much water. Intermediate amounts of water seem to have led to increased SWFL numbers and breeding success. It is also interesting that the number of breeding birds correlates positively with the success rates. Perhaps if the habitat is better in a certain year, more birds settle there and have increased success.

More evidence for the idea that 2005 had too much water for the SWFL is that most of the nests and all the breeding success were located in the northern portion of the habitat, the area with the lowest depth water. In 2004, however, there were four nests in the northern portion and two in the southern. Only two of four nests in the north were successful, but both nests in the south were successful. Another nest in the middle between the north and south, on the west edge in a bulrush marsh, blew down with one egg before it was found. In 2003, the very dry year, SWFL only bred in the northern portion. Most of the birds in 2003 nested close to the drain at the NE edge of the habitat, a persistent source of water.

In summary, habitat shape and adjacent habitat type appear to have more influence on nest parasitism rates than alternative host abundances, at least at this site. Habitat size and amount of edge, adjacent habitat types, and BHCO abundance and behavior seem to be the determinants of nest parasitism rates. SWFL prefer to nest near water, near the edge of a clump of vegetation. They prefer and seem to have higher success when there is dense vegetation at the nest, and they have increased success in small trees. SWFL prefer intermediate water levels and have higher nest success as well. Next year we will have soil moisture data for the entire breeding season and site and we will be able to analyze the birds' territory choices and nesting success based on water abundance. Another year of data will also help determine the factors influencing nest parasitism rates.

## Literature Cited


Averill-Murray, A., S. Lynn, and L.M. Morrison. 1999. Cowbird parasitism of Arizona Bell's Vireos (*Vireo bellii arizonae*) in a desert riparian landscape: implications for cowbird management and riparian restoration. Pp. 109-120 in M.L. Morrison, L.S. Hall, S.K. Robinson, S.I. Rothstein, D.C. Hahn, and T.D. Rich. 1999. Research and management of the Brown-headed Cowbird in western landscapes. Studies in Avian Biology 18.

Brittingham, M.C., and S.A. Temple. 1983. Have cowbirds caused forest songbirds to decline? BioScience 33(1):31-35.

Clotfelter, E.D. 1998. What cues do brown-headed cowbirds use to locate red-winged blackbird host nests? Animal Behaviour 55:1181-1189.

Friedmann, H. 1929. The cowbirds: a study in the biology of social parasitism. C. Thomas, Publ., Springfield, IL.

Friedmann, H. 1963. Host relations of the parasitic cowbirds. U.S. Nat. Mus. Bull. No. 233.

Friedmann, H., L.F. Kiff, and S.I. Rothstein. 1977. A further contribution to knowledge of the host relations of the parasitic cowbirds. Smithson. Contr. Zool. 235.

Friedmann, H., and L.F. Kiff. 1985. The parasitic cowbirds and their hosts. Proc. West. Found. Vert. Zool. 2:225-304.

Hauber, M.E., and S.A. Russo. 2000. Perch Proximity Correlates with Higher Rates of Cowbird Parasitism of Ground nesting Song Sparrows. Wilson Bulletin 112(1):150-152.

Holmes, B. 1993. An avian arch-villain gets off easy. Science 262:1514-1515.

Johnson, K., and H. Smith. 2000. Southwestern Willow Flycatcher surveys at Isleta Pueblo, New Mexico. New Mexico Natural Heritage Program report to U.S. Army Corps of Engineers. New Mexico Natural Heritage Program, Albuquerque, NM. 17 pp.

Kus, B.E. 1998. Use of restored riparian habitat by the endangered Least Bell's Vireo (*Vireo bellii pusillus*). Restoration Ecology 6(1):75-82.

Larison, B., S.A. Laymon, P.L. Williams, and T.B. Smith. 1998. Song Sparrows vs. cowbird brood parasites: impacts of forest structure and nest-site selection. Condor 100:93-101.

Lowther, P.E. 1993. Brown-headed Cowbird (*Molothrus ater*). *In* The Birds of North America, No. 47 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Robinson, S.K. 1999. Cowbird ecology: factors affecting the abundance and distribution of cowbirds. Pp. 4-9 in M.L. Morrison, L.S. Hall, S.K. Robinson, S.I. Rothstein, D.C. Hahn, and T.D. Rich. 1999. Research and management of the Brown-headed Cowbird in western landscapes. Studies in Avian Biology 18.

Robinson, S.K., F.R. Thompson III, T.M. Donovan, D.R. Whitehead, and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. Science 267:1987-1990.

Robinson, S.K., J.P. Hoover, and J.R. Herkert. 2000. Cowbird parasitism on a fragmented landscape: effects of tract size, habitat, and abundance of cowbirds and hosts. Pp. 280-297 in J.N.M. Smith, T.L. Cook, S.I. Rothstein, S.K. Robinson, and S.G. Sealy, eds. Ecology and management of cowbirds and their hosts. University of Texas Press, Austin, TX.

Rothstein, S.I., and S.K. Robinson. 1994. Conservation and coevolutionary implications of brood parasitism by cowbirds. Trends Ecol. Evol. 9:162-164.

Rourke, J.W., T.D. McCarthy, R.F. Davidson, and A.M. Santaniello. 1999. Southwestern Willow Flycatcher nest monitoring protocol. Technical report 144, Arizona Game and Fish Department, Phoenix, AZ.

Sedgwick, J.A., and F.L. Knopf. 1988. A High Incidence of Brown-headed Cowbird Parasitism of Willow Flycatchers. Condor 90:253-256.

Smith, J.N.M., T.L. Cook, S.I. Rothstein, S.K. Robinson, and S.G. Sealy. 2000. Ecology and management of cowbirds and their hosts. University of Texas Press, Austin, TX.

Smith, H., and K. Johnson. 2004. Southwestern Willow Flycatcher nesting success, cowbird parasitism, and habitat characteristics at the Pueblo of Isleta, New Mexico. Natural Heritage New Mexico, Museum of Southwestern Biology, Albuquerque, NM. Natural Heritage Publication No. 03-GTR-255.

Smith, J., and K. Johnson. 2005. Southwestern Willow Flycatcher nesting success, cowbird parasitism, and habitat characteristics at the Pueblo of Isleta, New Mexico. Natural Heritage New Mexico, Museum of Southwestern Biology, Albuquerque, NM. Natural Heritage Publication No. 05-GTR-283.

Sogge, M.K, R.M. Marshall, S.J. Sferra, and T.J. Tibbitts. 1997. A Southwestern Willow Flycatcher natural history summary and survey protocol. Colorado Plateau Research Station at Northern Arizona University. Technical Report NPS/NAUCPRS/NRTR-97/12.

Staab, C.A., and M.L. Morrison. 1999. Managing riparian vegetation to control cowbirds. Pp. 18-22 in M.L. Morrison, L.S. Hall, S.K. Robinson, S.I. Rothstein, D.C. Hahn, and T.D. Rich. 1999. Research and management of the Brown-headed Cowbird in western landscapes. Studies in Avian Biology 18.

Thompson, F.R. III, S.K. Robinson, T.M. Donovan, J.R. Faaborg, D.R. Whitehead, and D.R. Larsen. 2000. Biogeographic, landscape, and local factors affecting cowbird abundance and host parasitism levels. Pp. 271-279 in J.N.M. Smith, T.L. Cook, S.I. Rothstein, S.K. Robinson, and S.G. Sealy, eds. Ecology and management of cowbirds and their hosts. University of Texas Press, Austin, TX.

U.S. Fish and Wildlife Service. 1995. Final rule determining endangered status for the Southwestern Willow Flycatcher. Federal Register 60:10694.

U.S. Fish and Wildlife Service. 2000. Southwestern Willow Flycatcher revised protocol. http://www.usgs.nau.edu/swwf/Protocol%202000%20memo%20R2.pdf.

U.S. Fish and Wildlife Service. 2002. Final recovery plan for Southwestern Willow Flycatcher (*Empidonax traillii extimus*). Region 2 Office, U.S. Fish and Wildlife Service, Albuquerque, NM.

Uyehara, J.C., and M.J. Whitfield. 2000. Association of cowbird parasitism and vegetative cover in territories of Southwestern Willow Flycatchers. Pp 204-209 in J.N.M. Smith, T.L. Cook, S.I. Rothstein, S.K. Robinson, and S.G. Sealy, eds. Ecology and management of cowbirds and their hosts. University of Texas Press, Austin, TX.