NEOTROPICAL MIGRATORY BIRD CONSERVATION ACT –

FINAL REPORT

# Restoration of priority habitats for Neotropical migratory birds in the Madrean Sky Islands region, northwest Mexico

NMBCA grant 5139 - MT-N911

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Planting willows in February 2013 with ranch owner at Rancho La Esmeralda

**2014**

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## Introduction

In 2011, biologists at the University of Montana (UM) partnered with Sky Island Alliance (SIA) and began a coordinated and multifaceted approach to landscape conservation in the Sky Islands region of northwest Mexico. SIA is a non-profit organization based in Tucson, Arizona, that is dedicated to the protection and restoration of biological diversity in the Madrean Sky Islands region in the southwestern United States and northwestern Mexico. This effort, sponsored by the U.S. Fish and Wildlife Service (USFWS) Neotropical Migratory Bird Conservation Act (NMBCA) and other partners, expanded our existing work in the region by bolstering support for active habitat restoration efforts in degraded riparian vegetation areas, education and outreach efforts focused on conservation of Neotropical migratory birds (NMB) and their habitats, and research and monitoring efforts to assess the efficacy of restoration treatments and guide future efforts in this and other similar regions. This final report summarizes the main objectives of this project, details our activities and accomplishments during the project, and outlines future objectives and tasks we plan to achieve after the project.

## Objectives and Approaches

Our project had four main objectives and approaches:

- **Restoration of riparian vegetation.** First, we proposed to apply the majority of support we received from NMBCA directly to restoration of cottonwood-willow vegetation in riparian areas along major drainages to target an environment that is both critical to NMB along the western flyway and that is rare, threatened, and degraded across much of our region.
- **Experimental Design.** Second, we proposed to approach restoration efforts as an experiment by establishing rigorous study and sampling designs that will facilitate monitoring changes in abundance and richness of breeding and migratory birds and vegetation structure across time and to compare these parameters between restoration “treatments” and nearby “controls” where no restoration occurs.
- **Habitat Prioritization.** Third, we proposed to complement ongoing research on bird communities in the Madrean Sky Islands of Sonora and Chihuahua, Mexico, which was supported by other sponsors, by identifying areas and habitat features that have high value to breeding birds across a range of montane vegetation communities.
- **Community Support.** Finally, we proposed to integrate restoration and monitoring on private lands with our existing outreach and education efforts by providing on-the-ground activities such as classes, trainings, and workshops focused on NMB conservation, riparian restoration, and management for a broad range of local and regional audiences in northwest Mexico. By integrating our education programs with examples of successful riparian restoration efforts, we hoped to expand our prospects for restoring more areas in the future and to galvanize local landowners and their communities to conserve and enhance habitats for NMB.

Our approach is based on the principle that linking restoration, monitoring, and education while maintaining relationships based on trust and credibility with landowners offers excellent prospects to conserve NMB while enhancing the ecological and economic values of riparian areas.

## Project Activities and Accomplishments

Our project includes three primary activity areas:

- I - Restoration, Management, and Outreach
- II - Monitoring and Research
- III - Outreach and Education

A summary of our methods and accomplishments associated with each of these activity areas follows. Moreover, an overview of all objectives, accomplishments, and outputs of this project is provided following this narrative (see Appendix A).

## I. Restoration, Management, and Outreach

This activity included four main goals and groups of project activities:

- **Goal 1:** Engage landowners and establish signed management and restoration agreements.
- **Goal 2:** Apply restoration treatments in riparian areas and designate nearby control areas where no restoration occurs using a rigorous experimental design that will facilitate future monitoring. Restoration treatments included fencing to exclude cattle and other livestock, erosion control, and tree plantings and other induced meandering structures.
- **Goal 3:** Monitor and maintain these structures under our restoration agreements to ensure their proper function, which will allow us to assess their long-term conservation efficacy
- **Goal 4:** Foster and support understanding and enthusiasm for environmental conservation and habitat restoration by training local and regional volunteers, partners, landowners, and members of local communities. These trainings have built capacity to assess, restore, and manage riparian areas in our project region.

Specifically, we were obligated to apply restoration treatments along at least 25 km of riparian corridors, protect at least 467 hectares of riparian vegetation; and install restoration structures at >30 sites as part of this cooperative agreement.

***Activities and Accomplishments***

**Goal 1: Management and restoration agreements with landowners:**

Bi-national efforts in natural resource protection and restoration can be challenging due to a range of cultural and communication issues, especially when they involve private lands. Thus, incorporation of local knowledge and experience can greatly augment success. In Mexico, the form, approach, and timing of project proposals can influence success and long-term viability of

conservation and restoration projects, more than technical or financial soundness of proposed activities. To this end, in May 2012 we enlisted the help of Eduardo Lopez Saavedra, an expert in conservation, landowner agreements (LOAs), and community outreach and cooperation in Sonora. Sr. Lopez Saavedra was Executive Director of BIDA (Biodiversidad y Desarrollo Armónico), a non-profit conservation group in Sonora, and used a range of techniques to engage, encourage, and facilitate participation from local landowners in agreements and workshops. Sr. Lopez Saavedra's long history working with landowners in Sonora and his communication skills combined with our existing relationships with landowners were great assets and crucial for developing and maintaining rapport with landowners.

Based on those methods and approaches, we established signed LOAs with 11 landowners and ejidatarios in four focal areas: Río Cocóspera, Arroyo Milpillas, Río Santa Cruz, and the Río Altar watershed. Copies of all signed landowner agreements will be transferred to USFWS with this final report and an example of an agreement is included in this report (see Appendix B). A summary of all landowners that signed agreements (LOAs) is presented in Table 1.

During the course of the project, we attempted to obtain additional LOAs with other landowners that did not come to fruition or in one case that required small modifications to the terms. One potential landowner agreement, with Sr. Eduardo Robles of Rancho El Taráis, was not finalized because the landowner was not comfortable signing the document. His reply, translated from Spanish, reads:

> *"I believe that I could give you authorization so that you can continue your work, but not via an obligatory contract. This reply is probably sufficient for your scope of work. It's not my practice to commit my ranch to contracts of any sort. I ask for your understanding on this."*

It should be noted that his cousin Sr. Carlos Robles largely facilitated access to this neighboring ranch and that the Robles family has demonstrated an outstanding level of support and

Table 1. Landowner agreements, landowner names, and work schedules associated for all project sites.

| Area | Owner | Agreement Signed (2012) | Fencing installed | Volunteer work dates |
|---|---|---|---|---|
| Río Cocóspera - Aribabi | Carlos Robles Elías | Jan-13 | 2010-2013 | May & Nov. -13 |
| Río Cocóspera - Aribabi | Carlos Carranza Elías | Aug-13 | Jan-14, 2014 | Nov-13 |
| Río Cocóspera - Taráis | Eduardo Robles Elías | Aug-13 | Spring 2013 | None |
| Arroyo Milpillas | Ventura Rivera (ejido spokesman) | Oct-12 | Summer 2013 | None |
| Río Santa Cruz | Alejo León | Oct-12 | No new fencing | Apr-13 |
| Río Santa Cruz | Ignacio Sinohui | Oct-12 | Spring 2013 | Apr-13 |
| Río Santa Cruz | Rigoberto de la Rosa | Oct-12 | Spring 2013 | Apr-13 |
| Río Santa Cruz | José Luis Mendoza | Oct-12 | Spring 2013 | Apr-13 |
| Río Santa Cruz | Manuel Mendoza | Oct-12 | Spring 2013 | Apr-13 |
| Río Santa Cruz | Rubén Yanez Ozuna | Oct-12 | Spring 2013 | Apr-13 |
| Rancho La Esmeralda | Roberto Corella Pompa | Jan-13 | Winter - Spring 2013 | Feb-13 |

enthusiasm for conservation projects on their ranches (see link). In addition, the originally proposed landowner agreement with Sr. Martín Padrés was not signed due to unfortunate circumstances during the initial stages of this project. As a result, this landowner and the important Ciénega Saracachi were removed from inclusion in the project, and modification approved by USFWS. Other landowners that declined to participate are the Soto brothers from Rancho La Candelaria along the Río Cocóspera. Although our initial efforts with the Soto family were very positive, their time commitments to other affairs made it challenging to secure their participation during the concluding stages of our efforts.

We were successful in finding acceptable terms for cooperation with all landowners. In the case of Sr. Carlos Robles, changes to the LOA were needed to accommodate ongoing conservation and restoration efforts on his ranch, which made terms acceptable to all parties. These additional terms including reimbursing Sr. Robles ($3,000 USD) for costs associated with installing 8.2 km of fencing to exclude cattle along the Río Cocóspera, which was associated with conservation plans for the ranch that Sky Island Alliance helped to galvanize just before the project period. Grazing within this area was limited to a maximum of 3 months per year during the non-growing season.

Participating landowners were given the option to use the newly-fenced exclusion areas as pastures for grazing during the non-growing (cool-season) season or to exclude cattle permanently (see LOA - Section IV, No. 4). Very few of the fenced exclosures have access fences built into them, meaning that nearly all fenced areas (at least at the time of installation) will not be used by landowners during the cool season, and will become year-round exclosures. The following summarizes the main sections and content of the LOA including the obligations of both Sky Island Alliance and participating landowners:

I. Introduction: This section notes a period of five years for the agreement during which SIA and participating landowners will cooperate to improve habitat for NMB on their ranches. Mexican landowners, though committed to the intent of the project, were not comfortable entering into LOAs with longer timeframes due to uncertainties with future financial resources. Sky Island Alliance will continue to work with these landowners and communities through our programs and will make efforts to locate additional financial support to maintain exclosures and provide future outreach to landowners. Given past successes in the region, we expect protections established during this project to be maintained for a minimum of 25 years.

II. Project description and scope of work: This section notes where each property is located and which restoration structures are prescribed for the property.

III. Responsibilities for Sky Island Alliance:
   a. Collect baseline data on NMB and vegetation before restoration treatments, which was performed by staff of the University of Montana and University of Arizona.
   b. Apply restoration treatments utilizing an experimental design that allows us to evaluate its success and improve any future efforts.
   c. Provide technical assistance to participating landowners to achieve habitat improvement as described in the project description.

d. Based on estimates provided to SIA by participating landowners, we agreed to provide all fencing materials needed to complete proposed cattle exclosures as well as a working wage (30 pesos per t-post) for labor required to install fencing. The number of days required to complete installation will be established ahead of time and this payment for labor will be made after all fencing has been installed. While there will be discussion between the party about scope, SIA has the last word on restoration efforts just as the landowners have the last word on which areas are suitable for fencing. All payments for fencing required a written receipt.
e. Provide advance notice to the landowner when entering their properties to visit work sites. As part of the follow up, we established dates and times for visits and invited landowners to participate in restoration activities.
f. Train local communities, volunteers and partners in methods to evaluate, restore and manage areas for the benefit of NMB and other wildlife.

IV. Responsibilities for participating landowners
a. Monitor and maintain restoration infrastructure in good working condition.
b. Notify SIA about any activity or natural event that impacts the restoration structures and or riparian areas as soon as possible, with the idea that landowners can determine the most effective corrective measures.
c. Authorize SIA and their representatives to visit the properties for any restoration efforts promoted within this document.
d. If applicable, reroute cattle grazing within the exclusion areas for a minimum of *x* growing seasons to allow for proper vegetative growth. This was modified with each rancher to mean that cool-season grazing (Dec.–Feb.) would be acceptable if they wanted to graze within the exclosures outside of the growing season.

V. Responsibilities mutually agreed upon:
a. Both parties will cooperate and include other partners that could be affected by habitat improvements to ensure all participants were able to successfully complete their commitments.
b. We will monitor the proposed improvements for a period of 5 years, according to the rules established by the USFWS to ensure the intended benefits for wildlife habitat.
c. Upon successful completion of the terms of this agreement, the participating landowners will assume all of the responsibility for the wellbeing of the restoration treatments installed on their property.
d. Nothing in this agreement should be interpreted to mean that SIA has any obligation to make any future payments in excess of the agreed terms.
e. Any party is able to terminate this agreement under reasonable grounds provided that written notice is provided to other parties at least 30 days prior to the absolution of the agreement. Valid grounds include: a material violation of the agreement, sale of property, death of a participating landowner, and detrimental conduct or communication promulgated by one party, whether physical, monetary or in some other form. Upon receipt of the grievance, the other party will have 30 days to look for a solution before the agreement is nullified.

f. If this agreement is terminated before the 5 year period ends, any unpaid funds promised to the other party will be paid by the party filing the grievance.
g. This agreement and project description can be modified and/or extended via a mutual decision by all parties. Any modification made to this agreement needs to be agreed upon in writing by all parties before the changes take effect.

Sky Island Alliance and their partners fostered relationships based on trust and credibility with all cooperating landowners during a period of several years that began before this project and through dozens of meetings with landowners and community leaders. The rapport that we have developed with landowners comes from both mutual trust and respect, and is based on a long and developing history of having kept our word and performed responsibly. Given this solid foundation, we anticipate excellent prospects for the long-term maintenance, monitoring, and efficacy of our restoration efforts. With the addition of future financial support, we are uniquely positioned to build upon this investment, and to protect nearby riparian areas that are greatly in need of management and restoration efforts.

**Goal 2: Application of restoration treatments and designation of controls**

Over the course of this project, we installed over 20 km of fencing that protects 25.4 km of creeks, rivers, wetlands, and associated riparian areas at our 11 project sites. In total, that effort provided protection for an estimated 569 ha (~1,406 ac) of riparian areas (Table 2), which exceeded our goal of 467 ha protected by 22%. Additionally, volunteers working together with landowners and local residents installed an estimated 1,275 pole plantings and 3 plug-and-pond structures (see *Goal 4* below for details). Figure 1 provides an example of success we experienced in planting Goodding's willow (*Salix gooddingii*). Figure 2 shows the process of installing a Plug and Pond structure. Figure 3 provides a sample of photos of the fences we installed at each of the study sites. Additionally, detailed maps of all restoration sites and structures are presented in Appendix C.

Several of the erosion control structures we proposed in our original plan were deemed upon closer study to be unnecessary, especially given the inherent potential for these sites to improve over time after being fenced off from cattle. Others that were not installed as proposed were removed because of: 1) falling within the property boundaries of an adjacent and non-participating property owner (La Esmeralda) and 2) high probability of destruction of any rock work along the Río Santa Cruz given the large size and volume of the watershed and the potential for flash flooding. In the interest of conserving time and resources, we did not spread out the pole plantings across all river lengths and instead, harvested, trimmed and planted willows based on site-specific needs and opportunities.

Table 2: Summary of proposed and completed restoration actions and coverage by focal area and landowner and summary of total river length and area protected.

| Area | Owner | Fencing (km) | | River Protected (km) | | Structures | Protected (ha) | Protected (ac) |
|---|---|---|---|---|---|---|---|---|
| | | Proposed | Installed | Proposed | Achieved | | | |
| Rio Cocóspera | | | | | | | | |
| Rancho El Aribabi | Carlos Robles | 6.20 | 8.22 | 5.3 | 6.3 | 3 plug & pond | 181 | 447 |
| Rancho El Aribabi | Carlos Carranza | 0.60 | 1.04 | 1.4 | 1.4 | 300 poles | 26 | 63 |
| Rancho El Taráis | Eduardo Robles | 0.70 | 0.91 | 1.6 | 1.6 | none | 82 | 204 |
| Rancho La Candelaria | Soto | 1.30 | 0.00 | 1.3 | 0.0 | none | | |
| Arroyo Milpillas | | | | | | | | |
| Ejido Miguel Hidalgo | Ventura Rivera | 1.75 | 1.36 | 1.8 | 1.8 | none | 33 | 81 |
| Río Santa Cruz | | | | | | | | |
| Ejido Miguel Hidalgo San Lázaro | All members (see below) | | | 8.4 | 8.4 | none | 153 | 378 |
| | Alejo León | 0.00 | 0.00 | | | 125 poles | | |
| | Ignacio Sinohui | 0.60 | 0.81 | | | 75 poles | | |
| | Rigoberto de la Rosa | 0.40 | 0.64 | | | none | | |
| | José Luis Mendoza | 1.00 | 1.07 | | | 100 poles | | |
| | Manuel Mendoza | 0.60 | 0.84 | | | 175 poles | | |
| | Dora and Rubén Ozuna | 1.50 | 1.05 | | | 100 poles | | |
| Río Altar Watershed | | | | | | | | |
| Rancho La Esmeralda | Roberto Corella | 3.75 | 4.17 | 4.2 | 5.9 | 400 poles | 94 | 232 |
| TOTAL | | 18.4 | 20.1 | 24.0 | 25.4 | 1275 poles | 569 | 1405 |


Figure 1: Before and after views (2.5 month time frame) at Rancho La Esmeralda (Cañón Planchas de Plata). The mesquite with flood debris in the background on the left is a reference point. Top: volunteers plant willows in February 2013 and Bottom: checking fences in early May 2013; 48 of 49 willows had survived and were leafing out.

Figure 2: Three Plug & Pond structures installed at Rancho El Aribabi (Robles) to reconnect spring water to historic channels from which it had been cut off. Top: before, May 2013 (dark tree above wheelbarrow is reference point). Bottom: after, August 2013 soil from old channels and logs were used to build earthen dam diversions and protect dams. Water now flows to the Río Cocóspera via surface and subsurface flows from the source of the ciénega.

**Río Santa Cruz**

**Arroyo Milpillas**

**Rancho El Aribabi (Robles)**

Figure 3: Illustrations of each major project site and examples of fences installed. Detailed maps of all restoration sites and structures are presented in Appendix C.

**Rancho El Aribabi (Carranza)**

**Rancho El Taráis**

**Rancho La Esmeralda**

Figure 3, continued: Illustrations of each major project site and examples of fences installed. Detailed maps of all restoration sites and structures are presented in Appendix C.

**Goal 3: Monitor and maintain restoration infrastructure:**

Project staff verifies and performed quality assurance and control on all fencing installed by Mexican ranchers to ensure compliance with proposals and to accurately document any deviations from those plans and map fences and structures. All fences were installed correctly according to LOA specifications and were in good working order as of the last date visited in 2014, the final piece being a small section on Rigoberto de la Rosa's managed parcel along the Río Santa Cruz that was surveyed in February 2014 and other fences at Rancho La Esmeralda checked in May 2014. Restoration structures, including plug & pond sites and pole-planting areas are all functioning well and as planned. It should be noted that there was anecdotal evidence from a cowboy at Rancho La Esmeralda that some of the saplings we planted in the main drainage (Cañón Planchas de Plata) were swept away by flooding. These stochastic events can happen on occasion but more important is the maintenance of the fenced cattle exclusion areas, especially after seasonal floods occur. Those same pulses of water in spring and summer when riparian trees are producing wind-dispersed seeds and rich sediment is being deposited are the ideal conditions needed for germination of cottonwood and willow seeds. Ranchers are expected to maintain as needed all fencing and restoration structures, according to the LOAs. Moreover, we will continue to seek additional funding opportunities to support monitoring of avian and vegetation responses and to expand and maintain restoration infrastructure in the future.

**Goal 4: Training and outreach:**

We experienced great successes in fostering enthusiasm for NMB conservation and habitat restoration in the project area. These efforts included trainings with local and regional volunteers and partnerships with post-secondary educational institutions. These accords have helped us reach the next generation of land stewards in Sonora and opened their eyes to restoration techniques and potential career options focused on environmental management and conservation. By getting these students and faculty involved in volunteer opportunities, trainings, and field trips, we have built capacity for conservation and encouraged communities to get involved in and lead restoration, research and education in their regions.

In addition to working with UNISIERRA (Universidad de la Sierra) in Moctezuma, Sonora, and UNISON (Universidad de Sonora) in Hermosillo, Sonora, we have cultivated an excellent working relationship with Instituto Tecnológico Superior de Cananea (ITSC). ITSC and especially Professor Guillermo Molina, were extremely dedicated to this work, and it would have been much more difficult to achieve our training and educational goals without their support. More information about this partnership is located below (see *Project Activity III*).

SIA garnered the support of 68 binational volunteers to implement the restoration fieldwork included in this project, totaling over 1,300 hours of effort and thus exceeding our target for this project. In Table 3 we provide a general overview of volunteer involvement during our workshop and volunteer events. Additionally, not included are approximately 60 hours donated by 5 volunteers in 2013 and 2014, which assisted us in scouting for placement and checking the alignment of cattle exclusion fencing installed after our restoration efforts.

Table 3: Summary of volunteer contributions during our Sonoran riparian restoration series work weekends:

| Project location | Field project dates | Volunteers | Hours | Restoration |
|---|---|---|---|---|
| Rancho La Esmeralda | Feb. 22-24, 2013 | 16 | 320 | 400 willows |
| Río Santa Cruz & Milpillas | April 4-7, 2013 | 7 | 224 | 575 willows |
| Rancho El Aribabi | May 10-12, 2013 | 15 | 280 | 3 Plug & Ponds |
| Rancho El Aribabi | November 8-10, 2013 | 30 | 492 | 300 willows |
| TOTALS | | 68 | 1316 | 1275 plantings; 3 plug & ponds |

# II. Monitoring and Research

This activity included three main goals and sets of project activities:

- **Goal 1: Monitor Restoration Treatments.** First, we proposed to obtain baseline estimates of abundance and diversity of birds and vegetation in areas where we applied restoration treatments and in nearby areas that we selected as controls where no alteration in management occurred . Those data were gathered to facilitate monitoring the effects of restoration in the future and to provide guidance to enhance the success of efforts. To estimate baseline conditions for monitoring the effects of restoration, we used a before-after/control-impact (BACI) design, which will allow rigorous comparisons between areas where restoration was implemented and paired control areas.
- **Goal 2: Document NMB Status in Region.** Second, as part of match and non-match activities associated with this project, we documented the status, abundance, distribution, and habitat of breeding birds in montane vegetation communities in the Sky Island mountain ranges that are adjacent our project sites, identified sites and habitat features that are of high value to breeding NMB, and threats to birds and their habitats.
- **Goal 3: Share Information.** Finally, we disseminated data on birds gathered during activities associated with goals 1 and 2 to the public by uploading them to databases available on the internet.

## ***Activities and Accomplishments***

We accomplished all field work and data collection associated with goal 1 between March and July 2012, and field work associated with goal 2 in between May 2009 and July 2012. During subsequent years, we entered and proofed all data into a database, completed data analyses, and wrote final reports. The narrative below describes our accomplishments related to each of these 3 goals.

### Goal 1: Monitoring restoration treatments:

In spring and summer of 2012, we established sampling transects in riparian areas at the four projects sites where restoration treatments were proposed. To establish baseline conditions before the application of restoration treatments, we measured abundance and diversity of migratory and breeding birds, vegetation structure, and geomorphology along each transect between early April and late July 2012. We surveyed birds along each transect at 2- to 4-week intervals a total of 6 times during 2012. To quantify baseline conditions of riparian vegetation,

we measured canopy cover and vegetation volume in the understory along each transect once during late spring or summer after trees had leaved out.

Methods: We established 19 transects that totaled 29.15 km in length in riparian areas at the four project sites (Table 4 at end of report). We placed transects in areas where participating landowners indicated interest in restoring riparian vegetation. Because negotiations with landowners regarding restoration activities were largely unsuccessful in areas covered by 3 transects (Arroyo Cocóspera –Joffroy, San Lázaro – Western flat and Western boundary) and because areas along other transects included sufficient controls, we discontinued surveys along these 3 transects during the 2012 field season. Thus, we focused our efforts along 16 transects that totaled 24.97 km. Transects ranged from 0.30 to 2.57 km in length (Table 5) and followed drainage channels, trails, and narrow unimproved roads. Because the exact locations of eventual restoration treatments were not always known *a priori* at the start of the field season (due to variation in the timing of landowner agreements), we divided transects into 50-meter (m) sections. We noted each section when gathering data so that data could be associated with eventual treatment and control areas at each project site.

To establish baseline conditions before the application of restoration treatments, we measured bird abundance, breeding status, and diversity; vegetation structure; and geomorphology along transects in spring and summer 2012 (Table 4). We surveyed birds along transects a total of 6 times (Table 4). After training field technicians in mid to late March, we began surveys on 2 April, before the peak of spring migration for most bird species. We continued surveys through 22 July, which is during the late breeding season. Survey timing allowed roughly 1-3 surveys during the migratory season and 3-6 surveys during the breeding season, depending on the species of interest. We began surveys 20 minutes before local sunrise, ended approximately 3.5 hours after sunrise, and did not survey during periods of rain or high wind.

To estimate bird abundance independent of variation in detection probability, we used distance sampling methods (Buckland et al. 2001). For each bird detection, we recorded the species, number of individuals, sex (if known), detection type (aural or visual), behavior (singing, calling, drumming, flying or silent), and the minimum perpendicular distance from the transect line to the actual or estimated location of each individual or center of each flock. We used laser rangefinders to measure distances and trained field technicians in distance estimation to assure accuracy. To supplement estimates of abundance based on distance methods and to quantify the abundance of rare species, we also estimated the total number of individuals, pairs, or flocks of each species along each transect during each visit. To classify breeding status, we searched for nests and young and observed bird behavior along each transect mainly after distance surveys and used North American Ornithological Atlas Committee (1990) methods to classify the status of each species as possible, probable, or confirmed breeding, or as non-breeding.

To quantify baseline conditions of riparian vegetation, we measured canopy cover and vegetation volume in the understory (0-1 m above ground) along each transect. These metrics were selected because volume of understory vegetation should respond rapidly following restoration, whereas canopy cover is likely to take longer time periods to respond. To estimate canopy cover, we used a spherical densiometer. To estimate vegetation volume in the understory, we used a 1 × 1 m cover board. Vegetation measurements began 15 m from the start of each transect and continued

at alternating distances of 20 and 30 m across the entire length of transects. At each of these distances, we measured canopy cover and vegetation volume at 2 points that were 10 m from the transect line in a perpendicular direction. Thus, each 50-m section contained a total of 4 sampling points. To estimate canopy cover, we made 4 densiometer readings at each point and turned 90º between each reading. To estimate vegetation volume, we placed the cover board at each point and estimated the proportion of the board that was covered by vegetation from 8 m away from two points that were parallel to and 10 m away from transect lines.

To quantify baseline riparian geomorphology, we focused on the greenline, which is defined as the first linear grouping of vegetation along the drainage channel. We focused in this area because riparian geomorphology relies on these vegetation communities to retain stability. Thus, we conducted greenline surveys to assess bank stability (Winward 2000) by sampling community composition along the greenline. We walked two 121-m transects along each kilometer of transect and recorded the dominant vegetation community in each 1-meter interval along greenlines for both banks. Because other vegetation methods proved to be more descriptive, these surveys were not completed at all sites.

Results: We assembled large datasets on migratory and especially on breeding birds in riparian vegetation to monitor the effectiveness of restoration treatments. We detected 174 species of birds across the four project areas during field work in spring and summer 2012 (Table 6). Collectively, our observations indicate high levels of diversity of both migratory and especially breeding bird species, and the high value of riparian areas at project sites to bird populations in this region. Nonetheless, the condition of riparian vegetation at most sites had been degraded by long histories of livestock grazing, which offers excellent opportunities to improve habitat conditions for birds. In total, effort during standardized surveys along transects resulted in 16,507 detections of 21,388 individuals of 158 species of birds. Additionally, vegetation sampling produced a total of 2,276 estimates of canopy cover and understory vegetation volume at sampling points.

Numbers of detections of breeding species were typically much higher than that for migratory species. The most frequently detected breeding species were Yellow Warbler (1,149 detections of individuals, pairs, or flocks; see Table 5 for scientific names), Bewick's Wren (1,064 detections), Lucy's Warbler (745 detections), Vermilion Flycatcher (573 detections), and Summer Tanager (567 detections; Table 7). We also detected 400 Yellow-breasted Chats, 181 Song Sparrows, and 110 Common Yellowthroats, which because of their preferences for low shrubs and forbs that tend to be highly disturbed and degraded by livestock grazing are important indicator species for monitoring changes in bird communities. Additionally, we detected 38 other breeding species >100 times and an additional 10 species >50 times, which should allow us to monitor changes in abundance of large numbers of species over time. In contrast, the most frequently detected migratory species were Lark Sparrow (172 detections), Wilson's Warbler (136 detections), Black-headed Grosbeak (114 detections), Audubon's Warbler (76 detections), Chipping Sparrow (72 detections), and Green-tailed Towhee (55 detections; Table 8). Additionally, we detected 8 other migratory species ≥20 times, which may allow us to monitor changes in abundance of a moderate number of species over time.

To describe spatial variation in bird abundance, we computed relative abundance as the mean number of detections of each species per 100 m of effort within both treatment and control areas at each study site. When calculating relative abundances, we considered only those detections made within 100 m of the transect line and omitted observations of flyovers. Relative abundances of most species varied widely among sites and occasionally between treatment and control areas within sites (Tables 7 and 8). Moreover, virtually all breeding species were found across each of the four study sites (exceptions included Song Sparrow, Common Yellowthroat, Acorn Woodpecker, and Rock Wren). Large numbers of estimates and high precision (e.g., small standard errors) suggest sample sizes are sufficient to monitor the effectiveness of restoration treatments after vegetation and birds respond to management.

We observed several rare or otherwise notable bird species during surveys. At Arroyo Cocóspera, we observed Red-naped Sapsucker, Marsh Wren, and Indigo Bunting during the migration season, and White-tipped Dove, Green Kingfisher, Rose-throated Becard, and Sinaloan Wren during the breeding season. Observations of White-tipped Dove at Arroyo Cocóspera are the northernmost records of this species in potential breeding habitat anywhere in its range (Russell and Monson 1998, Flesch 2008a). Moreover, observations of Sinaloan Wren at Arroyo Cocóspera are northernmost records of this species in potential breeding habitat in Sonora (Flesch 2008a and b). At Arroyo Milpillas, we observed breeding Sulphur-bellied Flycatcher and nesting Zone-tailed Hawk. At San Lázaro, we observed an Ovenbird on 23 May 2012, which is a very rare migrant in Sonora and only the fifth record for the state and first since 1983 (Russell and Monson 1998).

To describe spatial variation in riparian vegetation structure, we computed mean canopy cover and mean vegetation volume in the understory in treatment and control areas at each site (Figure 4). Canopy cover was relatively low at San Lázaro and La Esmeralda, moderate at Arroyo Cocópera, and high at Arroyo Milpillas (Figure 4). Variation in understory vegetation volume generally followed the opposite pattern. For example, understory vegetation volume was especially low at Arroyo Milpillas where an abundance of large trees and moderate grazing in the narrow canyon has discouraged its development. Understory vegetation volume was moderate along the Río Santa Cruz at San Lázaro, where levels of grazing are fairly high in some areas. Although estimates of vegetation structure (and bird abundance) sometimes varied between treatments and controls, subsequent estimates across time will be standardized to as to describe relative differences from the baseline values reported here.

Conclusions and Future Opportunities: Despite high bird species richness, baseline surveys suggest many species will benefit from restoration treatments. Most of our project sites were heavily grazed by domestic livestock and understory vegetation was degraded and poorly developed. Thus, habitat conditions for species that are obligated to areas with dense shrubs or forbs such as Bell's Vireo, Song Sparrow, Common Yellowthroat, Yellow-breasted Chat, and many migratory species (e.g., Wilson's Warbler), were poor and abundances were likely much lower than they would be otherwise. We anticipate these and many other species will respond quickly to restoration treatments as grasses, sedges, forbs, and riparian shrubs increase in density and volume following reductions in grazing pressure and the effects of erosion-control and induced-meandering structures. Remarkably, some positive changes in vegetation structure are already apparent after only one spring growing season at some sites. Over the long term, our

restoration efforts should also bolster canopy cover and tree density, thus augmenting abundances of canopy-nesting species such as Yellow Warbler, Summer Tanager, and Bullock's Oriole.

Despite excellent prospects for future successes, the long-term effectiveness of this project depend on additional outreach to landowners and maintenance of restoration infrastructure, monitoring bird and vegetation responses in future years, and sufficient time for flora and fauna to respond to treatments. Although relationships with landowners are excellent at all project sites, and landowners should maintain restoration infrastructure, we hope to acquire additional resources to support this effort in the future to realize these goals.

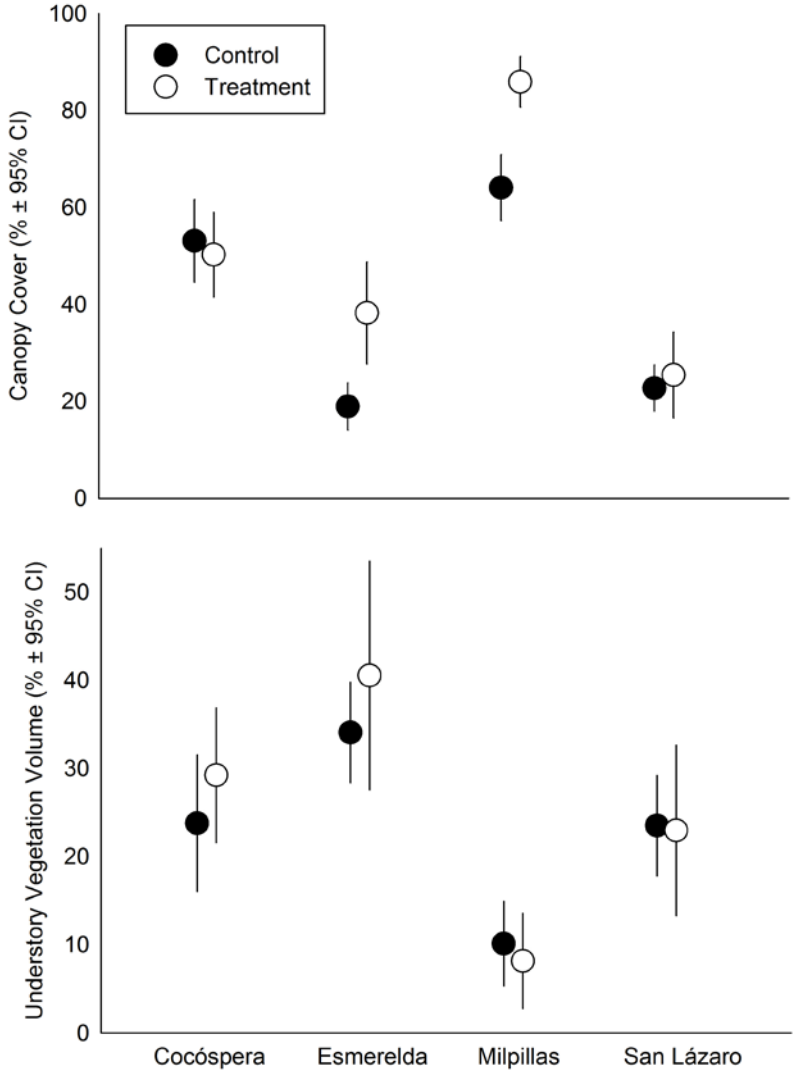


Figure 4. Preliminary estimates of canopy cover and understory vegetation volume within treatment and control areas at each of the 4 project sites. Estimates are means ± 95% confidence intervals for each site and group. Canopy cover was measured with a spherical densiometer and understory vegetation volume between 0 and 1 meter above ground was measured with a 1 × 1 m cover broad.

**Goal 2: Research on Sky Island birds:**

With support from the U.S. National Park Service, USFWS - Southwest Region Migratory Bird Office, and Veolia Environment Foundation, we filled important gaps of knowledge on birds in montane vegetation communities in the Sky Island Mountains and adjacent Sierra Madre Occidental in Sonora and Chihuahua, Mexico (Flesch 2014). Research products associated with those efforts can be found at the following link, and are summarized here briefly because they are linked to match and non-match activities associated with this project.

Between 2009 and 2012, Dr. Aaron D. Flesch and his field associates completed field work to assess the distribution, abundance, diversity, and habitat relationships of breeding birds in 26 Sky Islands and 6 areas in the adjacent Sierra Madre Occidental in northwest Mexico. These areas are near restoration project sites. We estimated the presence, density, and breeding status of birds during the breeding season at 1,562 points ($n$ = 1,851 total point counts) along 210 transects (289 km in total length) that spanned all major montane vegetation communities in the region between 1,150 and 2,750 m elevation. We also described the type, composition, and structure of vegetation, presence and intensity of land use and disturbance, and other habitat features at survey points. Moreover, we evaluated biogeographical relationships of breeding bird communities in montane vegetation across virtually the entire Sky Islands region by using data gathered in Mexico and that from 22 additional mountain ranges in the U.S. Our efforts represent the first assessment of biogeographical relationships for any taxa based on data from across the Sky Islands region, and the first systematic study of bird communities and bird-habitat relationships in the Sky Islands of Mexico since Joe Marshall Jr. (1957) visited portions of 9 Sky Islands and 5 areas in the adjacent Sierra Madre Occidental in Mexico in the early 1950s.

During those efforts, we detected 199 species of birds including 165 species of landbirds that were at least presumably breeding and 7 species that were possibly breeding. In the Sky Islands, we observed 152 species that were at least presumably breeding, 8 species that were possibly breeding, and estimate that 169 species breed in montane vegetation communities. Based on a comprehensive review of past efforts, we found evidence of spatiotemporal changes in the status and distribution of a large number of species and that more species had expanded (vs. contracted) their distributions across time. Although some of those changes could be attributable to variation in survey effort, natural range expansion, changes in vegetation structure that have affected the quality and quantity of habitat, and the effects of island size and isolation on extinction-colonization dynamics, likely drove these patterns for many species. For example, many species we observed in the Sky Islands or broader study region for the first time have strong Madrean affinities (e.g., Mountain Trogon, Brown-backed Solitaire, Crescent-chested Warbler, Slate-throated Redstart), which as a group, seem to have expanded their ranges northward in recent decades. In contrast, many other species we found to be more broadly distributed are dependent on pines (e.g., Northern Goshawk, Hairy Woodpecker, Greater Pewee, Plumbeous Vireo, Grace's Warbler, Olive Warbler) or are subject to hunting pressure by humans (e.g., Wild Turkey). These patterns were likely driven by the cessation of commercial logging and degradation of an extensive network of logging roads that was present during Marshall's time and the subsequent recovery of pines, which have matured to varying extents and are now subject to virtually no active logging in the Sky Islands of Mexico. Despite those auspicious trends, local extinctions of some populations due to natural disturbance or habitat degradation

linked to past logging, the effects of island size and isolation, and climate change, have likely caused extirpation or range contractions of other populations, especially those that are dependent on mature coniferous forest with large trees and cavities (e.g., Thick-billed Parrot, Flammulated Owl, Purple Martin, Pygmy Nuthatch).

We also derived a large number of inferences on bird-habitat relationships. Densities of most species (65% of 72) varied markedly among 8 major montane vegetation communities, which ranged from oak savannah at low elevations to mixed-conifer forest at high elevations. Much larger proportions of species occurred at maximum densities in mixed-conifer forest and in montane riparian vegetation, and more species were fairly restricted to mixed-conifer forest than other communities indicating its importance for conservation. In contrast, smaller proportions of species occurred at maximum densities or were relatively restricted to oak, oak-pine, or pine-oak woodland, or showed little evidence of variation in densities among communities, suggesting lower levels of habitat specialization. Habitat models that described variation in densities of 30 bird species often included significant effects of cover of conifer trees (10 species), a principal component representing increasing tall-tree cover and decreasing shrub cover (9 species), and cover of broadleaf deciduous trees (7 species). Moreover, cover of broadleaf deciduous trees, fire severity, tree density, and other habitat factors were found to have only positive effects on bird densities. Collectively, these results and the remote and wild character of most Sky Islands in Mexico, suggest high conservation value and the importance of preserving this diverse and ecologically unique region for future generations. Additional information on this project can be obtained at the link provided above (e.g., http://www.aaronflesch.com/Publications/Reports/Flesch_2014_Sky.Island.Birds_Final%20Report.pdf.)

**Goal 3: Data Dissemination:**

Data collected during this effort and that collected in the Sky Islands in 2009-2012 are available to the public through databases on the internet. These data are on SIA's Madrean Archipelago Biodiversity Assessment (MABA) database (http://www.madrean.org/maba/symbfauna/). The MABA project aims to establish baseline data on flora and fauna in the Sky Islands of northern Sonora and Chihuahua and across the borderlands of Arizona and New Mexico. There are over 100,000 bird records in the MABA database with a majority being from the state of Sonora. These records catalog the staggering biological diversity in this region. We thank Dr. Tom Van Devender of SIA for help in creating and populating this database, and for formatting and uploading those data noted above.

## III Outreach and Education

Our third project activity focused on promoting regional conservation through broader outreach and education measures to accomplish two main goals:

- **Goal 1:** Engender a conservation-oriented land ethic in landowners and communities. A conservation-minded ethos increases the likelihood that landowners and residents will preserve valued natural areas and wildlife such as NMB that depend on them. A strong land ethic provides an invaluable asset in orchestrating grassroots conservation efforts.

- **Goal 2:** Provide resources to empower landowners to restore and conserve their land . Linking landowner ethics with the means to establish conservation-minded land management strategies has the potential to ensure the persistence of important natural areas and species into the future.

***Activities and Accomplishments***

**Goals 1 and 2: Promote a conservation oriented land ethic and train people in methods to assess, restore, and manage riparian areas.**

Over the last several years, SIA project staff has worked closely with Mexican landowners and local people to illustrate and describe the benefits of restoration actions and installation techniques through actual on-the-ground examples. Through the establishment of working relationships with 11 participating landowners and associated community members and students, we have had a chance to gain their trust and encourage their participation in restoration efforts at other ranches. Several landowners have taken a keen interest in active restoration techniques. During our efforts in San Lázaro in April 2013, for example, many of the ejidatarios and their families joined us in fieldwork to learn about techniques for pole planting of riparian vegetation. They have seen the results of this activity firsthand and know that incipient vegetation they had a hand in establishing can anchor the riverbank. Sr. Carlos Robles, of Rancho El Aribabi, knows from his own experience that resting riparian areas from grazing has dramatic benefits for wildlife habitat conditions and he continues to promote these techniques to his colleagues. One of those colleagues, Roberto Corella Pompa, was so impressed with the work he witnessed that he proposed to fence off another perennial stretch (Cañón Yerbabuena) on his ranch following our initial efforts. This additional acreage offset the loss of proposed but incomplete work at Rancho La Candelaria along the Río Cocóspera.

In terms of match associated with this project, we have provided conservation information and resources to a broad audience in Sonora and in the U.S.-Mexico borderlands over the last several years. We translated our riparian restoration guide into Spanish to better engage landowners and communities in Mexico, and acquired two Spanish language guides to generate interest and understanding of local flora and fauna. In addition to continuing MABA expeditions (see below), SIA has promoted our conservation efforts through talks and workshops, some of which have been highlighted in previous annual reports. These include: 1) the 2011 Congreso Universitario de Biología held at the University of Sonora, 2) 2011 II Congreso de Ecología held at the Centro de Estudios Superiores del Estado de Sonora (CESUES), 3) 2012 Madrean Archipelago Conference in Tucson, AZ, 4) a 2012 meeting of biologists with the Mexican National Park Service (CONANP) and 5) a 2012 Arizona Coordinated Bird Monitoring training held near Nogales, Sonora. This final training represented the products of our exciting partnership with Sonoran Joint Venture. Each participant received Kaufman's field guide "*Guía de campo a las aves de Norteamérica*" courtesy of Sonoran Joint Venture.

SIA partnered with Sonoran Joint Venture and the Tucson Audubon Society to provide a training workshop to increase the technical ability of Mexican and U.S. volunteers and professionals in the Sky Island region. This workshop was held at Rancho La Esmeralda in September 2012 and reviewed an area-search sampling protocol designed by Arizona's Coordinated Bird Monitoring

project. We combined this opportunity with a restoration component that included a pole planting and a Zuni bowl erosion control structure demonstrations, which increase the water storage capacity of riverbanks and arrest erosion. Among the 40+ participants were 15 Mexican students and faculty members from ITSC as well as representatives from the U.S. Forest Service, the University of Arizona, and the University of Sonora.

SIA staff members Sergio Avila, Christopher Morris, Tom Van Devender, and Carianne Campbell have taken part in other more recent events in northern Sonora (Table 9). Perhaps the most beneficial has been ITSC's ExpoTec, a twice-annual community event that showcases student projects; here we have been able to promote environmental restoration to school authorities and the community at large, and, more importantly, have the students speak about their efforts. In addition to organizing an environmental forum and sharing information about SIA's projects in northern Sonora, we have offered students training opportunities, and led several field visits to "El Pinalito". This 2 km perennial stretch outside of Cananea on the flanks of the Sky Islands has reaped the benefits of this involvement, as ITSC staff and students have initiated and maintained stream erosion control and pole planting efforts after having learned these techniques during the past two years on NMBCA projects. As part of our ExpoTec attendance, we took students and faculty out to El Pinalito in June 2013 (40 participants) and December 2013 (60 participants). During the December 2013 project, SIA staff oversaw the installation of 300 willow pole plantings. Photos and presentation files are available of these events upon request.

In February of 2014, Dr. Tom Van Devender gave presentations in Spanish at the Instituto Tecnológico Superior de Cananea (ITSC) and the Universidad de la Sierra in Moctezuma, entitled "*Biodiversidad del Archipiélago Madrense: Del Campo al Internet*." A total of 228 people attended in Cananea and Moctezuma, including students, teachers, Ajos-Bavispe Reserve biologists, and citizens interested in natural history resources. In both cities, Tom also presented

Table 9: List of selected outreach and educational events in 2012-2014 as associated with match support for this project.

| Date | Staff: | Location | Event | No. people | Affiliation |
|---|---|---|---|---|---|
| Nov. '12 | 3 SIA staff | UNISON, Hermosillo | Slideshow to recruit volunteers | 25 | Students |
| May '13 | 1 SIA staff | San Lázaro | Santa Cruz Valley Nature and Heritage Festival | 25 | Southern AZ |
| June '13 | 2 SIA staff | ITSC (Cananea) | ExpoTec- Promote restoration in Sonora | 50 | ITSC |
| Sep. '13 | 1 SIA staff | REI -Tucson | Slideshow to recruit volunteers | 20 | General public |
| Nov. '13 | 3 SIA staff | Reserva Los Fresnos | Restoration workshop w/UNISON, UniSierra, ITSC | 16 | Naturalia, CONANP |
| Dec. '13 | 2 SIA staff | ITSC (Cananea) | ExpoTec- Promote restoration in Sonora; training | 100 | ITSC |
| Feb. '14 | 3 SIA staff | Reserva Los Fresnos | Riparian restoration | 20 | ITSC, Naturalia |
| Feb '14 | 1 SIA staff | Moctezuma and Cananea | Presentation of Green Fire Movie | 228 | UNISIERRA and ITSC |
| June '14 | 2 SIA staff | ITSC (Cananea) | ExpoTec- Promote restoration in Sonora | 50 | ITSC |
| TOTAL | | | | 534 | |

the documentary film "Green Fire," about the life of biologist Aldo Leopold and his influence on the modern environmental movement, especially the protection of fauna, flora and habitats in protected natural areas. The film explores the value of wilderness, wildlife management, and habitat restoration.

ITSC has proven to be a superb collaborator, consistently providing volunteers for restoration work who bring the skills back to their own communities to improve watershed health; in fact, we hired Professor Guillermo Molina to help with outreach efforts in Sonora. His personal and professional relationships with ITSC have already provided SIA opportunities to meet new landowners in the region, such as the owner of Rancho Bacasobabi. SIA staff visited this ranch near Bacoachi in February 2014 to look at several springs on the property and provide input on how to properly study and conserve them. While Guillermo is not supported by NMBCA funds, he has been able to cultivate this and other relationships through this project in Sonora, thereby ensuring future impacts of our efforts well beyond the life of the project. This critical role translates into greater conservation outcomes on-the-ground and a deeper sense of commitment to the long-term viability of those outcomes.

The Madrean Archipelago Biodiversity Assessment (MABA) program funded largely by the Veolia Environment Foundation of France was a major source of match support for this integrated effort. Expeditions associated with MABA began in 2011 and continue to be a productive way to integrate professional biologists and students into the scientific discovery process and are focused in the Mexican Sky Islands region. The most recent and 8$^{th}$ overall MABA expedition in April 2014 focused on the Sierra Huérfana, which is the southwestern-most Sky Island and is located 80 km east of Hermosillo, Sonora, a city of about one million inhabitants with two major universities. A total of 55 biologists (botanists, entomologists, herpetologists, and ornithologists), photographers, journalists, and college students participated in this expedition, which lasted 5 days. Participants were from organizations including the Comisión Nacional de Áreas Naturales Protegidas (CONANP), U.S. Fish and Wildlife Service, U.S. Forest Service, Arizona Game and Fish Department, Universidad Nacional Autónoma de México (UNAM), Universidad de Sonora, Universidad de la Sierra, Instituto Tecnológico Superior de Cananea, University of Arizona, Harvard University, Tucson Audubon Society, Imágenes de Sonora Magazine, Sociedad Sonorense de Historia, and SIA. Participants were equally split between the US and Mexico. One of the goals of this expedition was to document biodiversity to help justify the establishment of the Sierra Huérfana as a federally-protected natural area in Mexico. Trip co-organizor José María Martínez is leading these efforts. CONANP and members of the Comunidad Rural de Pueblo de Álamos hosted a *carne asada* (barbecue) at the camp at Rancho dos Potrillos and the expedition also employed three local ranch owners as guides for daily hikes to different areas.

**Mechanisms to ensure adequate local public participation in project implementation:**
We have engaged residents in our project areas in Sonora to not only collaborate but also to learn easy, low-cost techniques that will be helpful for long-term restoration of riparian systems. The 11 LOAs include members from 4 private ranches (La Esmeralda, El Aribabi-Robles, El Aribabi-Carranza, and El Taráis) and two ejidos, Ejido Miguel Hidalgo and Ejido Miguel Hidalgo Grupo Cinco. Our partnerships with local technical schools and universities have allowed us to reach the next generation of land stewards in Sonora, an achievement we are

confident will pay dividends in the future. Sky Island Alliance has signed agreements of collaboration that allow us and partner organizations to mutually benefit from future volunteer opportunities, trainings and field trips, build capacity and encourage communities to get involved in and lead restoration, research, and education in their area. Moreover, SIA staff continues to be successful in providing *prácticas profesionales* (internships) in Sonora; one current example includes a biology student from the Universidad de Sonora in Hermosillo that is being advised by SIA wildlife biologist Sergio Avila.

Agreements generated during this effort that demonstrate the breadth of public participation that this project has helped to garner include the following schools and agencies:

- ITSC (Instituto Tecnológico Superior de Cananea)
- UNISIERRA (Universidad de la Sierra, Moctezuma)
- UNISON (Universidad de Sonora, Hermosillo)
- CEDES (Comisión de Ecología y Desarollo Sustentable del Estado de Sonora)
- Naturalia, A.C.
- CESU (Desert Southwest Cooperative Ecosystem Studies Unit)
- CONANP (Comisión Nacional de Áreas Naturales Protegidas)-*in progress*
- University of Arizona-*in progress*

This work is part of our ongoing outreach to members and the community at large. We actively report on restoration work days and project progress to keep active volunteers engaged and to spread our enthusiasm to potential new participants through print and online publications. Some of these outreach products are as follows:

- **YouTube Photo Essays.** Short videos highlighting this restoration work is on SIA's YouTube Channel.
    - San Lázaro (Río Santa Cruz) April 2013: http://www.youtube.com/watch?v=0R9YBdZt1Cs
    - Rancho El Aribabi May 2013: http://www.youtube.com/watch?v=v3Uy7zu8SYc
- **Articles in SIA's newsletter, *Restoring Connections,* and on the website at www.skyislandalliance.org**
- **Article in El Imparcial, a daily newspaper in Hermosillo, Sonora.** April 2014 (See Appendix D)

## IV. Additional Details and Conclusions

**Consultation with relevant management authorities and other government officials:**
We engaged all relevant management agencies and local government officials during this project. CEDES (State of Sonora natural resource agency) was aware of our efforts and we engaged them for help and suggestions on the management planning process and in implementation. The local authorities in the Río Santa Cruz and Milpillas areas, both the Ejido and Municipio, were aware and supportive of this project.

**Conclusions and future opportunities**

We are grateful to the U.S. Fish and Wildlife Service for the opportunities to improve habitat for NMB and to provide examples of those efforts for local communities in Mexico. We see tremendous potential to continuing fostering environmental awareness in northwest Mexico and feel that a great opportunity would be missed if activities detailed in his report do not to continue. Providing even small amounts of financial support to landowners for management and maintenance of fencing and other infrastructure on their ranches can provide the necessary continuity and allow us to further develop working relationships with landowners to protect riparian areas. In addition, baseline estimates of vegetation and bird communities summarized here can facilitate rigorously monitoring the effects of restoration and thus help improve future efforts. We will continue to pursue sponsorship opportunities to help maintain the restoration, monitoring, and education efforts started here and to expand those efforts into neighboring communities in Mexico. As evidence of those efforts, Sky Island Alliance recently obtained funding to hire an outreach coordinator in Sonora whose main responsibilities are to network with landowners, ensure our interests in the region are communicated to current and potential partners, and to help maintain the agreements and infrastructure created during this effort. The ability of Sky Island Alliance to recruit regional volunteers for restoration activities will also be an invaluable resource for ensuring the continued success of this project. Given Sky Island Alliance's focus on implementing habitat improvement for wildlife and our excellent track record in obtaining funding, maintaining the agreements and infrastructure established during this project are high priorities that we expect will be successful long into the future.

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Table 4. Timing of bird, vegetation, and geomorphological sampling among study sites and transects during the 2012 field season in Sonora, Mexico, April-July 2012.

| | | *NMB survey dates* | | | | | | *Additional vegetation surveys* |
|---|---|---|---|---|---|---|---|---|
| Site | Transect | Visit 1 | Visit 2 | Visit 3 | Visit 4 | Visit 5 | Visit 6 | |
| Cocóspera | Soto | 5-Apr | 23-Apr | 19-May | 11-Jun | 26-Jun | 17-Jul | 15-Jul |
| Cocóspera | Carranza/Robles Side | 2-Apr | 22-Apr | 16-May | 10-Jun | 25-Jun | 18-Jul | 8-Jun |
| Cocóspera | Robles Canyon | 2-Apr | 22-Apr | 16-May | 10-Jun | 25-Jun | 18-Jul | 8-Jun |
| Cocóspera | Upper Carranza | 3-Apr | 23-Apr | 18-May | 11-Jun | 26-Jun | 17-Jul | 9-Jun |
| Cocóspera | Roadside channel | 4-Apr | 22-Apr | 17-May | 10-Jun | 25-Jun | 18-Jul | 21-Jun |
| Cocóspera | Lower Carranza | 4-Apr | 22-Apr | 17-May | 10-Jun | 25-Jun | 18-Jul | 21-Jun |
| Cocóspera | Joffroy | 5-Apr | - | - | - | - | - | - |
| Arroyo Milpillas | Upper Milpillas | 14-Apr | 26-Apr | 20-May | 12-Jun | 24-Jun | 8-Jul | 16-Jun |
| Arroyo Milpillas | Lower Milpillas | 14-Apr | 26-Apr | 20-May | 12-Jun | 24-Jun | 9-Jul | 15-Jun |
| La Esmerelda | Ranch | 12-Apr | 24-Apr | 30-May | 14-Jun | 28-Jun | 12-Jul | 29-Jun |
| La Esmerelda | Lower Esmeralda | 12-Apr | 24-Apr | 30-May | 14-Jun | 27-Jun | 12-Jul | 30-Jun |
| La Esmerelda | Lower Canyon | 13-Apr | 25-Apr | 29-May | 13-Jun | 10-Jul | 19-Jul | 31-May |
| La Esmerelda | Upper Canyon | 13-Apr | 25-Apr | 29-May | 13-Jun | 11-Jul | 19-Jul | 1-Jun |
| San Lázaro | El Ranch West | 15-Apr | 28-Apr | 21-May | 22-Jun | 5-Jul | 22-Jul | 24-May |
| San Lázaro | El Ranch East | 15-Apr | 28-Apr | 21-May | 22-Jun | 5-Jul | 22-Jul | 25-May |
| San Lázaro | Town | 16-Apr | 29-Apr | 23-May | 23-Jun | 7-Jul | 21-Jul | 4-Jul |
| San Lázaro | Eastern bound | 16-Apr | 29-Apr | 23-May | 23-Jun | 6-Jul | 21-Jul | 3-Jul |
| San Lázaro | Western flat | 27-Apr | 9-May | 22-May | - | - | - | - |
| San Lázaro | Western bound | 27-Apr | 9-May | 22-May | - | - | - | - |

Table 5. Length of transects and habitat description of surveyed areas at each study site and transect in Sonora, Mexico.

| Site | Transect | Length (km) | Habitat Description |
|---|---|---|---|
| Cocóspera | Soto | 1.54 | Mature overstory dominated by *Populus fremontii* with modest riparian understory transitioning to more open, drier upland vegetation, including *Prosopsis spp*. |
| Cocóspera | Carranza/Robles Side | 0.43 | Young overstory with large component of *Salix spp.* with little riparian understory vegetation. Some areas dominated by low wetland vegetation. |
| Cocóspera | Robles Canyon | 1.44 | Late successional riparian forest with mature canopy cover dominated by *Populus fremontii* and moderate to dense low vegetative cover. |
| Cocóspera | Upper Carranza | 1.50 | Dry, open early successional riparian vegetation with sparse canopy cover of *Populus fremontii* and *Salix spp*. |
| Cocóspera | Roadside Channel | 0.30 | Moderate riparian canopy cover dominated by *Salix spp.* and modest understory cover. |
| Cocóspera | Lower Carranza | 1.00 | Mid-successional riparian vegetation with areas of dense canopy cover dominated by *Populus fremontii* and *Salix spp* and patchy areas of high understory cover. |
| Arroyo Milpillas | Upper Milpillas | 1.66 | Mature riparian canopy cover dominated by *Populus fremontii and Platanus racemosa* with almost no understory vegetation. |
| Arroyo Milpillas | Lower Milpillas | 2.13 | Early to mid-successional riparian canopy dominated by *Populus fremontii* and *Salix spp.* with sparse understory cover. |
| La Esmerelda | Ranch | 2.57 | Early successional riparian vegatation with little canopy cover and moderate upland shrub understory cover. |
| La Esmerelda | Lower Esmeralda | 1.80 | Early successional riparian vegetation with sparse canopy cover of *Populus fremontii* and *Platanus racemosa* and moderate upland shrub understory cover. |
| La Esmerelda | Lower Canyon | 1.64 | Mid- to late successional riparian canopy dominated by *Platanus racemosa* and areas of moderate understory complexity. |
| La Esmerelda | Upper Canyon | 1.63 | Mid- to late successional riparian canopy with large *Salix spp.* component and areas of moderate understory complexity. |
| San Lázaro | EL Ranch West | 1.52 | Mature, but sparse riparian canopy dominated by *Populus fremontii* and sparse understory vegetation. |

| | | | |
|---|---|---|---|
| San Lázaro | EL Ranch East | 1.76 | Mature, but sparse riparian canopy dominated by *Populus fremontii* and sparse understory vegetation. |
| San Lázaro | Town | 1.68 | Sparse riparian canopy dominated by *Populus fremontii* and sparse understory vegetation. Some areas heavily impacted by proximity to town. |
| San Lázaro | Eastern Bound | 2.37 | Patchy riparian canopy coverage of *Populus fremontii* and *Salix spp.* with some areas of dense riparian shrub cover. |

Table 6. Presence and distribution of 174 bird species detected during surveys in four mid-elevation riparian areas in Sonora, Mexico, April-July 2012. Presence is denoted by X, ? indicates uncertain status.

| Common Name | Scientific Name | Río Cocóspera | Arroyo Milpillas | La Esmeralda | San Lázaro |
|---|---|---|---|---|---|
| Black-bellied Whistling-Duck | *Dendrocygna autumnalis* | | | | X |
| Wood Duck | *Aix sponsa* | X | | | |
| Gadwall | *Anas strepera* | X | | | |
| Mallard | *Anas platyrhynchos* | X | | | X |
| Mexican Duck | *Anas p. diazi* | X | | | |
| Northern Shoveler | *Anas clypeata* | X | | | |
| Bufflehead | *Bucephala albeola* | X | | | |
| Gambel's Quail | *Callipepla gambelii* | X | X | X | X |
| Double-crested Cormorant | *Phalacrocorax auritus* | X | | | |
| Great Blue Heron | *Ardea herodias* | X | X | | X |
| Great Egret | *Ardea alba* | X | | | X |
| Green Heron | *Butorides virescens* | X | | | |
| Black Vulture | *Coragyps atratus* | X | | X | X |
| Turkey Vulture | *Cathartes aura* | X | X | X | X |
| Osprey | *Pandion haliaetus* | X | X | | X |
| Northern Harrier | *Circus cyaneus* | X | | | X |
| Sharp-shinned Hawk | *Accipiter striatus* | X | X | X | X |
| Cooper's Hawk | *Accipiter cooperii* | X | | X | X |
| Common Black-Hawk | *Buteogallus anthracinus* | X | X | X | |
| Gray Hawk | *Buteo nitidus* | X | X | X | X |
| Short-tailed Hawk | *Buteo brachyurus* | X | | X | |
| Swainson's Hawk | *Buteo swainsoni* | X | | | X |
| Zone-tailed Hawk | *Buteo albonotatus* | X | X | | X |
| Red-tailed Hawk | *Buteo jamaicensis* | X | X | X | X |
| American Kestrel | *Falco sparverius* | X | | | X |
| Killdeer | *Charadrius vociferus* | | | | X |
| Spotted Sandpiper | *Actitis macularius* | | | | X |
| Wilson's Snipe | *Gallinago delicata* | X | X | | |
| Band-tailed Pigeon | *Patagioenas fasciata* | | X | | |
| Eurasian Collared-Dove | *Streptopelia decaocto* | X | | X | X |
| White-winged Dove | *Zenaida asiatica* | X | X | X | X |
| Mourning Dove | *Zenaida macroura* | X | X | X | X |
| Inca Dove | *Columbina inca* | X | X | X | X |
| Common Ground-Dove | *Columbina passerina* | X | X | X | X |
| White-tipped Dove | *Leptotila verreauxi* | X | | | |

| Common Name | Scientific Name | Río Cocóspera | Arroyo Milpillas | La Esmeralda | San Lázaro |
|---|---|---|---|---|---|
| Yellow-billed Cuckoo | *Coccyzus americanus* | X | X | X | X |
| Greater Roadrunner | *Geococcyx californianus* | X | | X | X |
| Barn Owl | *Tyto alba* | | | | X |
| Western Screech-Owl | *Megascops kennicottii* | X | | | |
| Whiskered Screech-Owl | *Megascops trichopsis* | | | X | |
| Great Horned Owl | *Bubo virginianus* | X | | X | X |
| Northern Pygmy-Owl | *Glaucidium gnoma* | | | X | |
| Elf Owl | *Micrathene whitneyi* | X | | X | X |
| Lesser Nighthawk | *Chordeiles acutipennis* | X | | X | X |
| Common Nighthawk | *Chordeiles minor* | | X | | X |
| Common Poorwill | *Phalaenoptilus nuttallii* | X | | X | |
| Buff-collared Nightjar | *Caprimulgus ridgwayi* | X | | X | |
| Broad-billed Hummingbird | *Cynanthus latirostris* | X | X | X | X |
| Violet-crowned Hummingbird | *Amazilia violiceps* | X | X | | |
| Black-chinned Hummingbird | *Archilochus alexandri* | X | X | X | X |
| Anna's Hummingbird | *Calypte anna* | | X | X | X |
| Costa's Hummingbird | *Calypte costae* | X | | | |
| Broad-tailed Hummingbird | *Selasphorus platycercus* | | X | X | X |
| Rufous Hummingbird | *Selasphorus rufus* | | | X | |
| Elegant Trogon | *Trogon elegans* | X | X | X | |
| Belted Kingfisher | *Megaceryle alcyon* | X | | | X |
| Green Kingfisher | *Chloroceryle americana* | X | | | |
| Acorn Woodpecker | *Melanerpes formicivorus* | X | X | X | X |
| Gila Woodpecker | *Melanerpes uropygialis* | X | X | X | X |
| Red-naped Sapsucker | *Sphyrapicus nuchalis* | X | | | |
| Ladder-backed Woodpecker | *Picoides scalaris* | X | X | X | X |
| Arizona Woodpecker | *Picoides arizonae* | | X | X | |
| Northern Flicker | *Colaptes auratus* | X | X | X | X |
| Gilded Flicker | *Colaptes chrysoides* | X | | | X |
| Northern Beardless-Tyrannulet | *Camptostoma imberbe* | X | X | X | X |
| Western Wood-Pewee | *Contopus sordidulus* | X | X | X | X |
| Willow Flycatcher | *Empidonax traillii* | | | X | |
| Hammond's Flycatcher | *Empidonax hammondii* | X | X | | |
| Gray Flycatcher | *Empidonax wrightii* | X | X | X | X |
| Dusky Flycatcher | *Empidonax oberholseri* | X | X | | |
| Pacific-slope Flycatcher | *Empidonax difficilis* | X | X | X | X |
| Cordilleran Flycatcher | *Empidonax occidentalis* | | ? | ? | |

| Common Name | Scientific Name | Río Cocóspera | Arroyo Milpillas | La Esmeralda | San Lázaro |
|---|---|---|---|---|---|
| Black Phoebe | *Sayornis nigricans* | X | X | X | X |
| Say's Phoebe | *Sayornis saya* | X | | X | X |
| Vermilion Flycatcher | *Pyrocephalus rubinus* | X | X | X | X |
| Dusky-capped Flycatcher | *Myiarchus tuberculifer* | X | X | X | X |
| Ash-throated Flycatcher | *Myiarchus cinerascens* | X | X | X | X |
| Brown-crested Flycatcher | *Myiarchus tyrannulus* | X | X | X | X |
| Sulphur-bellied Flycatcher | *Myiodynastes luteiventris* | | X | | |
| Tropical Kingbird | *Tyrannus melancholicus* | X | | X | X |
| Cassin's Kingbird | *Tyrannus vociferans* | X | X | X | X |
| Thick-billed Kingbird | *Tyrannus crassirostris* | X | X | X | X |
| Western Kingbird | *Tyrannus verticalis* | X | X | X | X |
| Rose-throated Becard | *Pachyramphus aglaiae* | X | | | |
| Loggerhead Shrike | *Lanius ludovicianus* | X | | | |
| Bell's Vireo | *Vireo bellii* | X | X | X | X |
| Plumbeous Vireo | *Vireo plumbeus* | X | X | | X |
| Cassin's Vireo | *Vireo cassinii* | X | | X | X |
| Hutton's Vireo | *Vireo huttoni* | X | X | X | X |
| Warbling Vireo | *Vireo gilvus* | X | X | X | X |
| Mexican Jay | *Aphelocoma wollweberi* | | X | X | X |
| Chihuahuan Raven | *Corvus cryptoleucus* | X | | | X |
| Common Raven | *Corvus corax* | X | X | X | X |
| Purple Martin | *Progne subis* | X | | | X |
| Violet-green Swallow | *Tachycineta thalassina* | X | | | X |
| Northern Rough-winged Swallow | *Stelgidopteryx serripennis* | X | X | | X |
| Cliff Swallow | *Petrochelidon pyrrhonota* | X | | | |
| Barn Swallow | *Hirundo rustica* | X | X | X | X |
| Bridled Titmouse | *Baeolophus wollweberi* | X | X | X | X |
| Verdin | *Auriparus flaviceps* | X | X | X | X |
| Bushtit | *Psaltriparus minimus* | | | X | |
| White-breasted Nuthatch | *Sitta carolinensis* | X | X | X | X |
| Cactus Wren | *Campylorhynchus* | X | X | X | |
| Rock Wren | *Salpinctes obsoletus* | | X | X | |
| Canyon Wren | *Catherpes mexicanus* | X | X | X | |
| Sinaloa Wren | *Thryothorus sinaloa* | X | | | |
| Bewick's Wren | *Thryomanes bewickii* | X | X | X | X |
| House Wren | *Troglodytes aedon* | X | | X | X |
| Marsh Wren | *Cistothorus palustris* | X | | | |

| Common Name | Scientific Name | Río Cocóspera | Arroyo Milpillas | La Esmeralda | San Lázaro |
|---|---|---|---|---|---|
| Blue-gray Gnatcatcher | *Polioptila caerulea* | X | | | X |
| Black-tailed Gnatcatcher | *Polioptila melanura* | | | X | |
| Black-capped Gnatcatcher | *Polioptila nigriceps* | X | | X | |
| Ruby-crowned Kinglet | *Regulus calendula* | X | X | X | X |
| Eastern Bluebird | *Sialia sialis* | X | | | X |
| Western Bluebird | *Sialia mexicana* | X | | | |
| Townsend's Solitaire | *Myadestes townsendi* | | | X | X |
| Swainson's Thrush | *Catharus ustulatus* | X | X | | X |
| Hermit Thrush | *Catharus guttatus* | X | X | X | X |
| American Robin | *Turdus migratorius* | X | X | X | X |
| Northern Mockingbird | *Mimus polyglottos* | X | X | X | X |
| Curve-billed Thrasher | *Toxostoma curvirostre* | | X | | X |
| Crissal Thrasher | *Toxostoma crissale* | | | X | |
| European Starling | *Sturnus vulgaris* | | | | X |
| Phainopepla | *Phainopepla nitens* | X | X | X | X |
| Ovenbird | *Seiurus aurocapilla* | | | | X |
| Orange-crowned Warbler | *Oreothlypis celata* | X | X | X | X |
| Lucy's Warbler | *Oreothlypis luciae* | X | X | X | X |
| Nashville Warbler | *Oreothlypis ruficapilla* | | X | X | |
| Virginia's Warbler | *Oreothlypis virginiae* | | X | | |
| MacGillivray's Warbler | *Geothlypis tolmiei* | | | X | X |
| Common Yellowthroat | *Geothlypis trichas* | X | | X | X |
| Yellow Warbler | *Setophaga petechia* | X | X | X | X |
| Audubon's Warbler | *Setophaga coronata auduboni* | X | X | X | X |
| Black-throated Gray Warbler | *Setophaga nigrescens* | X | X | X | X |
| Townsend's Warbler | *Setophaga townsendi* | | X | X | X |
| Wilson's Warbler | *Cardellina pusilla* | X | X | X | X |
| Painted Redstart | *Myioborus pictus* | X | X | | |
| Yellow-breasted Chat | *Icteria virens* | X | X | X | X |
| Green-tailed Towhee | *Pipilo chlorurus* | X | X | X | X |
| Rufous-crowned Sparrow | *Aimophila ruficeps* | X | X | X | X |
| Canyon Towhee | *Melozone fusca* | X | X | X | X |
| Abert's Towhee | *Melozone aberti* | | | | X |
| Rufous-winged Sparrow | *Peucaea carpalis* | X | X | X | X |
| Chipping Sparrow | *Spizella passerina* | X | X | X | X |
| Brewer's Sparrow | *Spizella breweri* | X | | X | X |
| Vesper Sparrow | *Pooecetes gramineus* | X | | | X |

| Common Name | Scientific Name | Río Cocóspera | Arroyo Milpillas | La Esmeralda | San Lázaro |
|---|---|---|---|---|---|
| Lark Sparrow | *Chondestes grammacus* | X | X | X | X |
| Five-striped Sparrow | *Amphispiza quinquestriata* | X | | X | X |
| Black-throated Sparrow | *Amphispiza bilineata* | X | X | X | X |
| Lark Bunting | *Calamospiza melanocorys* | | | | X |
| Song Sparrow | *Melospiza melodia* | X | | | X |
| Lincoln's Sparrow | *Melospiza lincolnii* | X | X | X | X |
| White-crowned Sparrow | *Zonotrichia leucophrys* | X | X | X | X |
| Hepatic Tanager | *Piranga flava* | X | X | X | X |
| Summer Tanager | *Piranga rubra* | X | X | X | X |
| Western Tanager | *Piranga ludoviciana* | X | | X | X |
| Northern Cardinal | *Cardinalis cardinalis* | X | X | X | X |
| Pyrrhuloxia | *Cardinalis sinuatus* | X | | | X |
| Black-headed Grosbeak | *Pheucticus melanocephalus* | X | X | X | X |
| Blue Grosbeak | *Passerina caerulea* | X | X | X | X |
| Lazuli Bunting | *Passerina amoena* | X | X | X | X |
| Indigo Bunting | *Passerina cyanea* | X | | | |
| Varied Bunting | *Passerina versicolor* | X | X | X | X |
| Red-winged Blackbird | *Agelaius phoeniceus* | | | | X |
| Western Meadowlark | *Sturnella neglecta* | X | | | |
| Great-tailed Grackle | *Quiscalus mexicanus* | | | | X |
| Bronzed Cowbird | *Molothrus aeneus* | X | X | X | X |
| Brown-headed Cowbird | *Molothrus ater* | X | X | X | X |
| Hooded Oriole | *Icterus cucullatus* | X | X | X | X |
| Bullock's Oriole | *Icterus bullockii* | X | X | X | X |
| Scott's Oriole | *Icterus parisorum* | X | X | X | X |
| House Finch | *Carpodacus mexicanus* | X | X | X | X |
| Pine Siskin | *Spinus pinus* | | | | X |
| Lesser Goldfinch | *Spinus psaltria* | X | X | X | X |
| House Sparrow | *Passer domesticus* | X | X | X | X |

Table 7. Relative abundances of the 48 most common breeding bird species along line transects that spanned treatment and control areas at 4 study sites in Sonora, Mexico, April-July 2012. Number of detections (No.) is the total number of individuals, pairs, or flocks encountered within 100 m of transect lines during 6 surveys with flyovers omitted. Relative abundance is expressed as the mean number of detections of each species per 100 m of effort. Parenthetical numbers are in km.

| | | Esmerelda | | | | Cocospera | | | | San Lázaro | | | | Milpillas | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Treatment (1.47) | | Control (6.18) | | Treatment (3.43) | | Control (2.78) | | Treatment (1.9) | | Control (5.46) | | Treatment (1.6) | | Control (2.19) | |
| Species | No. | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Yellow Warbler | 1149 | | | 0.06 | 0.02 | 1.37 | 0.21 | 1.56 | 0.09 | 0.55 | 0.12 | 1.95 | 0.20 | 0.75 | 0.14 | 0.68 | 0.12 |
| Bewick's Wren | 1064 | 0.34 | 0.06 | 1.17 | 0.12 | 1.14 | 0.06 | 1.37 | 0.11 | 0.48 | 0.05 | 1.50 | 0.15 | 0.29 | 0.06 | 0.14 | 0.03 |
| Lucy's Warbler | 745 | 0.22 | 0.06 | 1.01 | 0.22 | 0.55 | 0.12 | 0.39 | 0.10 | 0.39 | 0.08 | 0.96 | 0.21 | 0.18 | 0.07 | 0.80 | 0.14 |
| Vermilion Flycatcher | 573 | 0.06 | 0.01 | 0.38 | 0.05 | 0.82 | 0.07 | 0.69 | 0.07 | 0.30 | 0.02 | 1.00 | 0.06 | 0.06 | 0.01 | 0.15 | 0.02 |
| Summer Tanager | 567 | 0.16 | 0.04 | 0.35 | 0.08 | 0.79 | 0.07 | 0.72 | 0.06 | 0.19 | 0.03 | 0.89 | 0.15 | 0.35 | 0.09 | 0.30 | 0.02 |
| House Finch | 541 | 0.16 | 0.04 | 0.63 | 0.10 | 0.65 | 0.10 | 0.65 | 0.09 | 0.26 | 0.06 | 0.79 | 0.11 | 0.04 | 0.00 | 0.09 | 0.01 |
| Blue Grosbeak | 469 | 0.26 | 0.05 | 0.70 | 0.17 | 0.67 | 0.21 | 0.59 | 0.18 | 0.41 | 0.13 | 1.25 | 0.29 | 0.12 | 0.03 | 0.26 | 0.02 |
| Cassin's Kingbird | 432 | 0.12 | 0.02 | 0.32 | 0.05 | 0.26 | 0.06 | 0.43 | 0.06 | 0.24 | 0.02 | 0.99 | 0.14 | 0.11 | 0.03 | 0.12 | 0.02 |
| Bell's Vireo | 401 | 0.17 | 0.01 | 0.63 | 0.07 | 0.73 | 0.11 | 0.29 | 0.05 | 0.15 | 0.03 | 0.42 | 0.07 | | | 0.04 | 0.00 |
| Yellow-breasted Chat | 400 | 0.08 | 0.02 | 0.37 | 0.12 | 1.14 | 0.28 | 0.86 | 0.19 | 0.29 | 0.06 | 0.63 | 0.16 | 0.09 | 0.05 | 0.04 | 0.00 |
| Brown-headed Cowbird | 373 | 0.16 | 0.03 | 0.33 | 0.09 | 0.39 | 0.08 | 0.31 | 0.09 | 0.22 | 0.04 | 0.78 | 0.11 | 0.22 | 0.05 | 0.27 | 0.07 |
| Brown-crested Flycatcher | 343 | 0.14 | 0.03 | 0.43 | 0.07 | 0.32 | 0.08 | 0.35 | 0.07 | 0.24 | 0.05 | 0.61 | 0.06 | 0.25 | 0.06 | 0.21 | 0.04 |
| Dusky-capped Flycatcher | 338 | 0.17 | 0.03 | 0.35 | 0.05 | 0.35 | 0.03 | 0.33 | 0.05 | 0.22 | 0.05 | 0.40 | 0.07 | 0.20 | 0.04 | 0.11 | 0.06 |
| Lesser Goldfinch | 313 | 0.12 | 0.01 | 0.32 | 0.06 | 0.26 | 0.07 | 0.32 | 0.06 | 0.22 | 0.04 | 0.42 | 0.12 | 0.15 | 0.07 | 0.17 | 0.09 |
| Ladder-backed Woodpecker | 297 | 0.10 | 0.02 | 0.35 | 0.04 | 0.40 | 0.04 | 0.26 | 0.03 | 0.09 | 0.02 | 0.31 | 0.05 | 0.09 | 0.02 | 0.18 | 0.03 |
| Gila Woodpecker | 294 | | | 0.08 | 0.01 | 0.24 | 0.03 | 0.56 | 0.06 | 0.22 | 0.03 | 0.55 | 0.07 | 0.08 | 0.02 | 0.07 | 0.04 |
| White-winged Dove | 293 | 0.29 | 0.05 | 0.69 | 0.10 | 0.20 | 0.03 | 0.22 | 0.05 | 0.08 | 0.03 | 0.17 | 0.05 | 0.16 | 0.08 | 0.05 | 0.02 |
| Northern Cardinal | 263 | 0.08 | 0.01 | 0.44 | 0.06 | 0.40 | 0.06 | 0.40 | 0.03 | 0.10 | 0.02 | 0.16 | 0.02 | 0.04 | 0.00 | | |
| Western Wood-Pewee | 257 | 0.14 | 0.02 | 0.17 | 0.02 | 0.17 | 0.03 | 0.23 | 0.09 | 0.09 | 0.02 | 0.51 | 0.06 | 0.58 | 0.15 | 0.41 | 0.06 |
| Rufous-crowned Sparrow | 212 | 0.28 | 0.04 | 0.67 | 0.09 | 0.04 | 0.00 | | | 0.11 | 0.02 | 0.11 | 0.03 | 0.14 | 0.04 | 0.07 | 0.02 |
| Canyon Towhee | 210 | 0.13 | 0.02 | 0.49 | 0.05 | 0.15 | 0.02 | 0.07 | 0.01 | 0.13 | 0.02 | 0.21 | 0.04 | 0.05 | 0.01 | 0.08 | 0.02 |
| Common Ground-Dove | 204 | 0.07 | 0.00 | 0.16 | 0.03 | 0.36 | 0.04 | 0.22 | 0.06 | 0.20 | 0.03 | 0.44 | 0.09 | 0.07 | 0.04 | 0.07 | 0.02 |
| Varied Bunting | 196 | 0.23 | 0.02 | 0.75 | 0.12 | 0.30 | 0.04 | 0.14 | 0.04 | 0.11 | 0.03 | 0.26 | 0.16 | 0.07 | 0.02 | 0.06 | 0.02 |
| Bridled Titmouse | 195 | 0.11 | 0.02 | 0.14 | 0.04 | 0.17 | 0.04 | 0.17 | 0.04 | 0.07 | 0.02 | 0.29 | 0.03 | 0.14 | 0.03 | 0.14 | 0.03 |
| Verdin | 193 | 0.10 | 0.02 | 0.58 | 0.06 | 0.15 | 0.04 | 0.07 | 0.02 | 0.12 | 0.04 | 0.15 | 0.03 | | | 0.07 | 0.01 |
| Song Sparrow | 181 | | | 0.04 | 0.00 | 0.21 | 0.03 | 0.35 | 0.04 | 0.14 | 0.03 | 0.38 | 0.06 | | | | |
| Mourning Dove | 180 | 0.08 | 0.01 | 0.13 | 0.01 | 0.15 | 0.05 | 0.15 | 0.06 | 0.12 | 0.02 | 0.42 | 0.05 | 0.05 | 0.01 | 0.05 | 0.02 |
| Northern Beardless-Tyrannulet | 174 | 0.07 | 0.02 | 0.29 | 0.05 | 0.19 | 0.03 | 0.14 | 0.02 | 0.08 | 0.02 | 0.10 | 0.02 | 0.11 | 0.01 | 0.08 | 0.02 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phainopepla | 173 | 0.12 | 0.04 | 0.46 | 0.11 | 0.23 | 0.08 | 0.31 | 0.08 | 0.05 | 0.01 | 0.16 | 0.05 | 0.07 | 0.00 | | | |
| Lark Sparrow | 172 | | | 0.10 | 0.04 | 0.22 | 0.06 | 0.17 | 0.03 | 0.18 | 0.06 | 0.47 | 0.13 | | | 0.04 | 0.00 | |
| White-breasted Nuthatch | 151 | 0.04 | 0.00 | 0.04 | 0.00 | 0.10 | 0.01 | 0.13 | 0.03 | 0.10 | 0.02 | 0.33 | 0.05 | 0.13 | 0.03 | 0.10 | 0.03 | |
| Ash-throated Flycatcher | 149 | 0.08 | 0.01 | 0.38 | 0.07 | 0.09 | 0.01 | 0.06 | 0.01 | 0.08 | 0.02 | 0.20 | 0.04 | 0.06 | 0.02 | 0.04 | 0.01 | |
| Rufous-winged Sparrow | 148 | 0.09 | 0.05 | 0.37 | 0.05 | 0.21 | 0.05 | 0.09 | 0.03 | 0.07 | 0.04 | 0.15 | 0.03 | | | 0.05 | 0.01 | |
| Northern Flicker | 141 | | | 0.05 | 0.02 | 0.09 | 0.01 | 0.22 | 0.03 | 0.10 | 0.03 | 0.42 | 0.05 | 0.07 | 0.03 | | | |
| Hooded Oriole | 128 | 0.12 | 0.02 | 0.57 | 0.06 | 0.06 | 0.02 | | | | | 0.05 | 0.01 | 0.05 | 0.02 | 0.07 | 0.00 | |
| Broad-billed Hummingbird | 118 | 0.19 | 0.02 | 0.24 | 0.02 | 0.09 | 0.01 | 0.09 | 0.02 | 0.04 | 0.00 | 0.04 | 0.00 | 0.15 | 0.07 | 0.07 | 0.01 | |
| Common Yellowthroat | 110 | | | | | 0.32 | 0.05 | 0.07 | 0.02 | 0.20 | 0.05 | 0.31 | 0.13 | | | | | |
| Gray Hawk | 104 | 0.04 | 0.00 | 0.09 | 0.01 | 0.10 | 0.02 | 0.08 | 0.01 | 0.06 | 0.01 | 0.25 | 0.04 | 0.05 | 0.01 | 0.04 | 0.00 | |
| Canyon Wren | 94 | 0.12 | 0.02 | 0.14 | 0.03 | 0.05 | 0.01 | | | | | | | 0.17 | 0.05 | 0.09 | 0.01 | |
| Thick-billed Kingbird | 92 | 0.07 | 0.01 | 0.27 | 0.04 | 0.08 | 0.03 | 0.07 | 0.02 | 0.06 | 0.01 | 0.12 | 0.01 | 0.05 | 0.01 | 0.05 | 0.02 | |
| Acorn Woodpecker | 88 | 0.05 | 0.01 | 0.06 | 0.02 | | | | | 0.04 | 0.00 | 0.23 | 0.03 | 0.22 | 0.06 | | | |
| Five-striped Sparrow | 85 | 0.22 | 0.08 | 0.39 | 0.17 | 0.08 | 0.02 | | | | | | | | | | | |
| Bullock's Oriole | 73 | | | 0.07 | 0.00 | 0.04 | 0.00 | 0.05 | 0.02 | 0.08 | 0.02 | 0.30 | 0.08 | 0.14 | 0.00 | 0.04 | 0.00 | |
| Black-throated Sparrow | 61 | 0.04 | 0.00 | 0.17 | 0.03 | | | 0.04 | 0.00 | 0.07 | 0.03 | 0.11 | 0.02 | | | 0.04 | 0.00 | |
| Rock Wren | 61 | 0.05 | 0.01 | 0.27 | 0.04 | | | | | | | | | 0.05 | 0.01 | 0.06 | 0.02 | |
| Hutton's Vireo | 59 | 0.05 | 0.01 | 0.08 | 0.03 | 0.06 | 0.01 | 0.10 | 0.02 | 0.07 | 0.00 | 0.04 | 0.00 | 0.05 | 0.01 | 0.06 | 0.03 | |
| Northern Rough-winged Swallow | 56 | | | 0.04 | 0.00 | 0.04 | 0.00 | 0.04 | 0.00 | 0.15 | 0.04 | 0.18 | 0.05 | | | 0.06 | 0.01 | |
| Tropical Kingbird | 50 | | | 0.07 | 0.02 | 0.04 | 0.00 | 0.17 | 0.06 | | | 0.22 | 0.04 | | | | | |

Table 8. Relative abundances of the 27 most common migratory bird species along line transects that spanned treatment and control areas at 4 study sites in Sonora, Mexico, April-July 2012. Number of detections (No.) is the total number of individuals, pairs, or flocks encountered within 100 m of transect lines during 6 surveys with flyovers omitted. Relative abundance is expressed as the mean number of detections of each species per 100 m of effort. Parenthetical numbers are in km.

| | | Esmerelda | | | | Cocospera | | | | San Lázaro | | | | Milpillas | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Treatment (1.47) | | Control (6.18) | | Treatment (3.43) | | Control (2.78) | | Treatment (1.9) | | Control (5.46) | | Treatment (1.6) | | Control (2.19) | |
| Species | No. | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Lark Sparrow | 172 | | | 0.097 | 0.043 | 0.216 | 0.063 | 0.173 | 0.034 | 0.180 | 0.057 | 0.468 | 0.129 | | | 0.036 | 0.000 |
| Wilson's Warbler | 136 | 0.144 | 0.108 | 0.324 | 0.108 | 0.144 | 0.036 | 0.216 | 0.144 | 0.144 | 0.075 | 0.263 | 0.193 | 0.216 | 0.144 | 0.406 | 0.192 |
| Black-headed Grosbeak | 114 | 0.090 | 0.012 | 0.155 | 0.027 | 0.097 | 0.012 | 0.072 | 0.020 | 0.058 | 0.014 | 0.137 | 0.024 | 0.137 | 0.068 | 0.036 | 0.000 |
| Audubon's Warbler | 76 | | | 0.054 | 0.018 | 0.047 | 0.012 | 0.090 | 0.018 | 0.324 | 0.000 | 0.270 | 0.234 | 0.450 | 0.018 | 0.270 | 0.054 |
| Chipping Sparrow | 74 | 0.036 | 0.000 | 0.090 | 0.018 | 0.234 | 0.018 | 0.360 | 0.252 | 0.216 | 0.000 | 0.335 | 0.150 | 0.036 | 0.000 | | |
| Green-tailed Towhee | 55 | 0.036 | 0.000 | 0.252 | 0.072 | 0.097 | 0.032 | 0.036 | 0.000 | 0.126 | 0.054 | 0.252 | 0.108 | | | 0.072 | 0.000 |
| Warbling Vireo | 32 | | | 0.054 | 0.018 | 0.090 | 0.054 | 0.072 | 0.000 | 0.036 | 0.000 | 0.180 | 0.036 | 0.162 | 0.054 | 0.036 | 0.000 |
| Western Flycatcher | 30 | 0.036 | 0.000 | 0.072 | 0.021 | 0.061 | 0.024 | 0.090 | 0.018 | 0.036 | 0.000 | | | 0.072 | 0.000 | 0.072 | 0.021 |
| American Robin | 27 | | | 0.036 | 0.000 | 0.072 | 0.000 | 0.072 | 0.000 | 0.036 | 0.000 | 0.036 | 0.000 | 0.108 | 0.031 | 0.036 | 0.000 |
| White-crowned Sparrow | 27 | | | 0.036 | 0.000 | 0.090 | 0.054 | 0.054 | 0.018 | 0.072 | 0.000 | 0.191 | 0.084 | | | | |
| Lazuli Bunting | 23 | 0.288 | 0.000 | 0.108 | 0.072 | | | 0.072 | 0.000 | 0.072 | 0.000 | 0.036 | 0.000 | | | 0.054 | 0.018 |
| Western Tanager | 22 | 0.036 | 0.000 | 0.047 | 0.012 | 0.054 | 0.018 | 0.108 | 0.000 | 0.072 | 0.000 | 0.036 | 0.000 | | | 0.126 | 0.054 |
| Ruby-crowned Kinglet | 21 | | | | | 0.180 | 0.108 | 0.144 | 0.000 | 0.054 | 0.018 | 0.036 | 0.000 | 0.072 | 0.000 | 0.036 | 0.000 |
| Gray Flycatcher | 20 | | | 0.036 | 0.000 | 0.144 | 0.000 | 0.180 | 0.000 | 0.036 | 0.000 | 0.090 | 0.054 | 0.036 | 0.000 | 0.072 | 0.000 |
| Brewer's Sparrow | 16 | | | 0.054 | 0.018 | 0.090 | 0.054 | 0.072 | 0.000 | | | 0.108 | 0.000 | | | | |
| Solitary Vireo | 15 | | | | | 0.144 | 0.000 | 0.036 | 0.000 | | | 0.119 | 0.024 | | | 0.036 | 0.000 |
| Lincoln's Sparrow | 13 | 0.072 | 0.000 | 0.036 | 0.000 | 0.036 | 0.000 | | | 0.036 | 0.000 | 0.090 | 0.018 | 0.036 | 0.000 | 0.036 | 0.000 |
| Nashville Warbler | 10 | 0.072 | 0.000 | 0.108 | 0.000 | | | | | | | | | 0.072 | 0.000 | 0.108 | 0.000 |
| Orange-crowned Warbler | 10 | 0.036 | 0.000 | | | | | | | 0.036 | 0.000 | 0.054 | 0.018 | | | 0.090 | 0.054 |
| Vesper Sparrow | 10 | | | | | 0.252 | 0.000 | 0.108 | 0.000 | | | | | | | | |
| Black-throated Gray Warbler | 9 | | | 0.144 | 0.000 | 0.036 | 0.000 | | | | | | | | | 0.072 | 0.036 |
| Eastern Bluebird | 8 | | | | | 0.072 | 0.000 | 0.061 | 0.024 | | | 0.036 | 0.000 | | | | |
| Townsend's Warbler | 7 | | | | | | | | | 0.072 | 0.000 | | | 0.054 | 0.018 | 0.072 | 0.000 |
| MacGillivray's Warbler | 6 | | | 0.036 | 0.000 | | | | | 0.036 | 0.000 | 0.054 | 0.018 | | | | |
| Hermit Thrush | 5 | 0.036 | 0.000 | | | 0.072 | 0.000 | | | | | | | 0.036 | 0.000 | 0.036 | 0.000 |
| House Wren | 5 | 0.036 | 0.000 | | | 0.036 | 0.000 | | | 0.036 | 0.000 | 0.036 | 0.000 | | | | |
| Violet-green Swallow | 5 | | | | | 0.036 | 0.000 | | | | | 0.072 | 0.036 | | | | |

Appendix A: Summary of objectives, accomplishments, expected outputs, and issues or problems encountered while working on NMBCA grant 5139 - MT-N911 in northern Sonora Mexico during the 2011-2014 project years.

| Objective | Expected Output | Description of activities completed during project period | % complete | Description of ongoing activities, problems encountered, issues that need to be addressed, or actions to be taken) |
|---|---|---|---|---|
| *Activity I - Restoration and Management* | Establish signed management and restoration agreements with landowners in 4 focal areas | Site assessments, continued outreach, pre-proposal development and presentation, final proposal and landowner agreement development and presentation. Management and restoration agreements have been pursued in 4 focal areas. | 100% | Eleven of eleven planned LOAs are complete and accompany this report. Communication is often hampered by the travel schedules of ranch owners; in fact, the owners of a potential 12th property (La Candelaria) dropped out due to business obligations. |
| | Apply restoration treatments including fencing ca. 25 km or 467 ha of riparian areas, build 30 erosion control or induced meandering structures | 20.1 km of fencing has been installed (protecting 25.44 km of rivers and creeks), along with 3 plug & pond structures and 1575 pole plantings. Total acreage benefiting from restoration is 569 ha | 100% | Additional opportunities have been identified at mine-controlled land near Arroyo Milpillas and an adjacent drainage belonging to Ejido Miguel Hidalgo Grupo Cinco. Talks with the mine would only be held if additional funding is secured. |
| | Monitor and maintain restoration infrastructure | Fencing installation has been verified for accuracy and photo documentation of all structures has been consistently gathered. | 100% | We have documented all newly installed fencing and restoration infrastructure through maps and photographs. |
| | Train volunteers, partners, and local communities in methods to assess, restore, and manage riparian areas | Over 130 volunteers, over 75% of whom hail from northern Sonora, have completed restoration installations. We have now participated in the last three ITSC Expo-Tec events (Summer 2013 & 2014, Winter 2013) to share collaborative restoration experiences in Cananea. | 100% | The best community involvement example from our projects was a group of ~15 from the town of San Lázaro helped pole plant willows in early April 2013. We will continue to look for other opportunities to engage our Sonoran contacts from this project. |

| | | | | |
|---|---|---|---|---|
| *Activity II - Monitoring and Research* | Obtain baseline estimates of abundance and richness of NMB, vegetation structure, and geomorphology in restoration treatments and in nearby controls for monitoring | All field work completed in riparian habitats including surveys along 16 transects visited up to 6 times between April and July 2012. All vegetation work and geomorphology sampling complete. Data has been entered into the computer and summarized here. | 100% | Surveys began in early April not March because timing of migration was late. Randomization of treatments was somewhat haphazard due to complexities of landowner approval and need. Analyses will commence in winter 2013. |
| | Identify sites and habitat features that are of high value to NMB and threats to NMB in nearby montane habitats | All field work has been completed in montane habitats including surveys at >1600 points in 25 Sky Islands and 7 areas of adjacent Sierra Madre | 100% | Final report for our partners (NPS and FWS R2) was presented in summer 2014. |
| | Disseminate data on NMB to the public through web-based databases | MABA database largely complete. All bird records from 2009-2012 have been uploaded into the database and are available on the World Wide Web | 100% | All data have been uploaded to MABA database. |
| *Activity III - Outreach and Education* | Teach students, community members and landowners about the region's biodiversity through trainings, presentations and other tools | We have participated in the last 3 ITSC Expo-Tec events in Cananea to share collaborative restoration experiences.. The last two events have been complemented by site visits to a perennial stretch near town (El Pinalito) where ITSC faculty and students have installed pole plantings and restoration structures with our guidance. | 100% | Christopher Morris of SIA will be presenting a poster on this NMB project at the 2014 North American Congress on Conservation Biology in Missoula, Montana in July. |
| | Provide workshops and experiential learning opportunities for local people and landowners related to biodiversity conservation and riparian restoration focused on NMB | The Mexican ranchers have been consistently involved in all fieldwork. Over 130 volunteers, over 75% of whom hail from northern Sonora, have completed restoration installations. We also led a bird tour of San Lázaro for the Santa Cruz Valley Nature and Heritage Festival in Summer 2013. | 100% | We are highly interested in keeping these relationships alive and well. Although we are currently out of funding, we are looking for new opportunities. |

| | | | |
|---|---|---|---|
| Offer field classes, internships, and job training for college students studying biology, land management, and ecotourism | Three scientific expeditions to mountain ranges in Sonora, Mexico. These MABA expeditions are gatherings of scientists, professors, and students from agencies and institutions in the US and Mexico. These trips provide valuable biodiversity data while offering a unique networking and educational environment for professionals and students working in the region | 100% | We are highly interested in keeping these relationships alive and well. Although we are currently out of funding, we are looking for new opportunities. |
| Steward current and develop new relationships with landowners, ejidos and academic institutions to foster cooperative management, signed agreements, and restoration on private lands | Through outreach in the Río Cocóspera, Río Sonora and Sierra San Luis areas we have developed relationships with more than 15 ranchers in northern Sonora. We have been able to fund an outreach coordinator in Sonora through other funding to increase our reach. | 100% | We are highly interested in keeping these relationships alive and well. Although we are currently out of funding, we are looking for new opportunities. |
| Elevate current conservation designations on private lands to higher levels of protection by using mechanisms provided by the Mexican federal government and institutional agreements | El Aribabi was declared as a protected area in March 2011 (approx 4,000 has - 10,000-acre). Three neighbors of El Aribabi (included in NeoTrop project) received protection of their lands in May 2012, adding up to 8,900-has or 22,250-acre. These protected lands are improved by restoration activities, in addition to outreach and education, community training and eco-tourism as an alternative source of funds for landowners). Also of note is the April 2014 MABA expedition to the Sierra Huérfana supporting the local communities' desire to receive federal protection of the range. | 100% | We are highly interested in keeping these relationships alive and well. Although we are currently out of funding, we are looking for new opportunities. |
| Develop and disseminate web-based and print resources in Spanish to advance education goals | Completed 2012 | 100% | We are highly interested in keeping these relationships alive and well. Although we are currently out of funding, we are looking for new opportunities. |

| | | | |
|---|---|---|---|
| Implement Sonoran Joint Venture bird workshop to teach bird identification, use and care of binoculars and field guides, an overview of basic bird biology, ecology, and conservation issues, and how to guide birders in the field to provide skills to promote ecotourism | During our April 2013 work project at San Lázaro SIA disseminated SJV's pocket field guide to area birds "Nuestras Aves del Río Santa Cruz" to local residents at San Lázaro as well as Milpillas. SIA led a bird tour in May 2013 of San Lázaro for the Santa Cruz Valley Nature and Heritage Festival. SIA distributed Spanish language bird field guides "Guía de campo a las aves de Norteamérica" (provided by Sonoran Joint Venture) to at least a dozen landowners and community members. Photos of these events are included in this report as an addendum. | 100% | A bird monitoring trip (sponsored by Sonoran Joint Venture) to Pan Duro was postponed in 2013 due to the illness of the landowner. It had been rescheduled for spring 2014 but recent border conflicts have forced the indefinite postponement of said workshop. Company travel to Mexico for SJV was not able to mesh with our needs during project dates. |

Appendix B: Sample landowner agreement.

Agreement of Collaboration for Habitat Improvement

I. Introduction

This agreement (set to last for five years) is executed the _____ day of 2012 between the landowner or *ejidatario* _____ of _____ and Sky Island Alliance (SIA), represented by _____, whose title is _____, with the aim of improving riparian habitat on the landowner's property. Currently, restoration work is scheduled to be carried out during the month of _____ on this property. Both parties will agree in advance to any schedule changes.

SIA and the landowner agree to implement (on the property indicated above) the following habitat improvement project:

Habitat Restoration for Migratory Birds of the Sky Island region of northwest Mexico (sponsored by the Neotropical Migratory Bird Conservation Act)

SIA plans to accomplish its project goals (outlined below) through the construction of restoration fencing and erosion control structures along a minimum of 20 kilometers of riparian area on five focal areas in Sonora over two years.

For the purpose of this document, "Collaborators" will refer to the signers of this document and "Participating Landowners" will refer to the private property owners or "ejiditarios" participating in this agreement. We, as Collaborators, believe that this agreement illustrates our willingness to conserve and protect critical riparian habitat in the area.

The Participating Landowners agree to manage the project area on their property in accordance with this agreement. In exchange for this participation, SIA agrees to implement the project and work in tandem with the Participating Landowners through each step of the process.

II. Property description and scope of work

This agreement concerns the property of _____, located _____ in Sonora, Mexico. The proposed area to be fenced covers an extension of _____ kilometers and is located _____.

RESPONSIBILITIES OF THE PARTIES
By signing this document, the Collaborators agree to the following:

III. Responsibilities of SIA

1 – Collect baseline data on NMB, vegetation and geomorphology before application of the restoration treatments (Performed exclusively by our partners at the University of Montana).

2 – Apply restoration treatments utilizing an experimental design in order to better understand progress and how to improve future efforts.

3 – Provide technical assistance to the Participating Landowners in order to achieve the desired habitat improvements.

4 – Based on estimates turned into SIA by the Participating Landowners, provide: 1.) All the necessary fencing material for creating the riparian cattle-exclusion zones and, 2.) Daily wages not to exceed $_____ (Mexican pesos) for the labor necessary for the "posteros" to install the fencing, according to the project description. The number of days needed for the installation will be agreed upon prior to the project's start and this payment will come after the total fencing has been installed. While both parties will consult with each other, SIA makes the ultimate decision on restoration matters just as the Participating Landowner makes the ultimate decisions on fencing matters. Each payment made to the Participating Landowner requires a receipt of payment.

5 – Provide advanced notice to the Participating Landowners when planning a site visit to the property. SIA will propose several dates on which to complete the work and will also invite the Participating Landowners to participate in the restoration treatments to be completed on site.

6 –Train local communities, volunteers and partners in the methodology for managing and restoring the riparian areas for the good of the NMB.

IV. Participating Landowner responsibilities

1 – Maintain the restoration infrastructure in good working order.

2 – Notify SIA (Trevor or Christopher) about any activities or natural event which impacts the restoration structures or riparian habitat as soon as possible so that both parties can arrive at a solution on how to mitigate the damage.

3 – Authorize SIA and its representatives to enter the property for site visits intended to carry out project responsibilities described in this agreement.

4 – If it applies, reroute cattle grazing from the project areas for a minimum of _____ growing seasons in order to hasten sufficient vegetative response of that pasture.

V. Collaborators mutually agree that:

1 – We will cooperate together with any third properties affected by this habitat improvement project to reach a successful and satisfactory conclusion as established under this agreement.

2 – We will monitor the restoration improvements we propose in this agreement for a period of five years, according to US Fish & Wildlife Service protocol, to ensure the desired wildlife habitat benefits.

3 – The Participating Landowners, upon successful completion of this project, will assume all responsibility for the welfare of the habitat improvements implemented on their property.

4 - Nothing in this agreement shall be interpreted as a requirement of SIA's future involvement in any subsequent project or any subsequent payments above and beyond those covered in this agreement.

5 – Any party can terminate this agreement with reasonable cause, provided 30 days' written notice to the other party. Examples of reasonable cause are: material breach of the contract, sale of the property, death of the landowner, and conduct or communication detrimental to the other party, whether such act is physical, monetary or otherwise. The other party will then have 30 days from receipt of the notice to seek a remedy before the agreement will be terminated.

6 – If this agreement is terminated prior to its indicated expiration of five years, the group requesting the cancellation will reimburse the other group for any outstanding costs and payments.

7 – This agreement and project description can be modified and/or extended, provided there's mutual interest. Any modification made to this agreement must be done only after the changes have been agreed upon by representatives of both parties in writing.

Our signatures below testify our guarantee that we each have the capacity, absolute power and authority to execute this agreement and fulfill the requirements outlined in this project description.

APPROVED:

_____ _____

Signature Date Signature Date

_____ _____

Sky Island Alliance official representative Participating Landowner's printed name

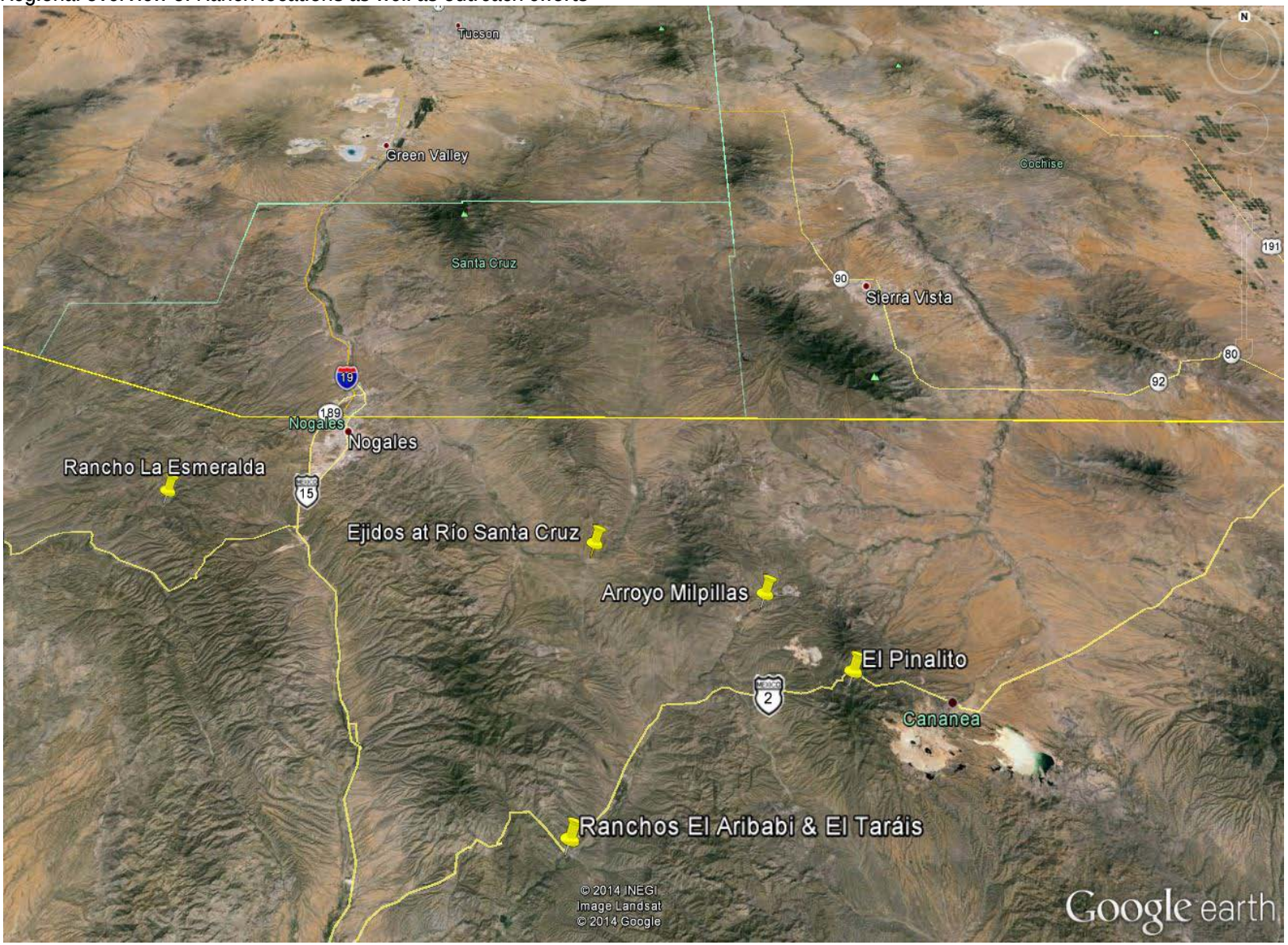
WITNESSED:

_____ _____

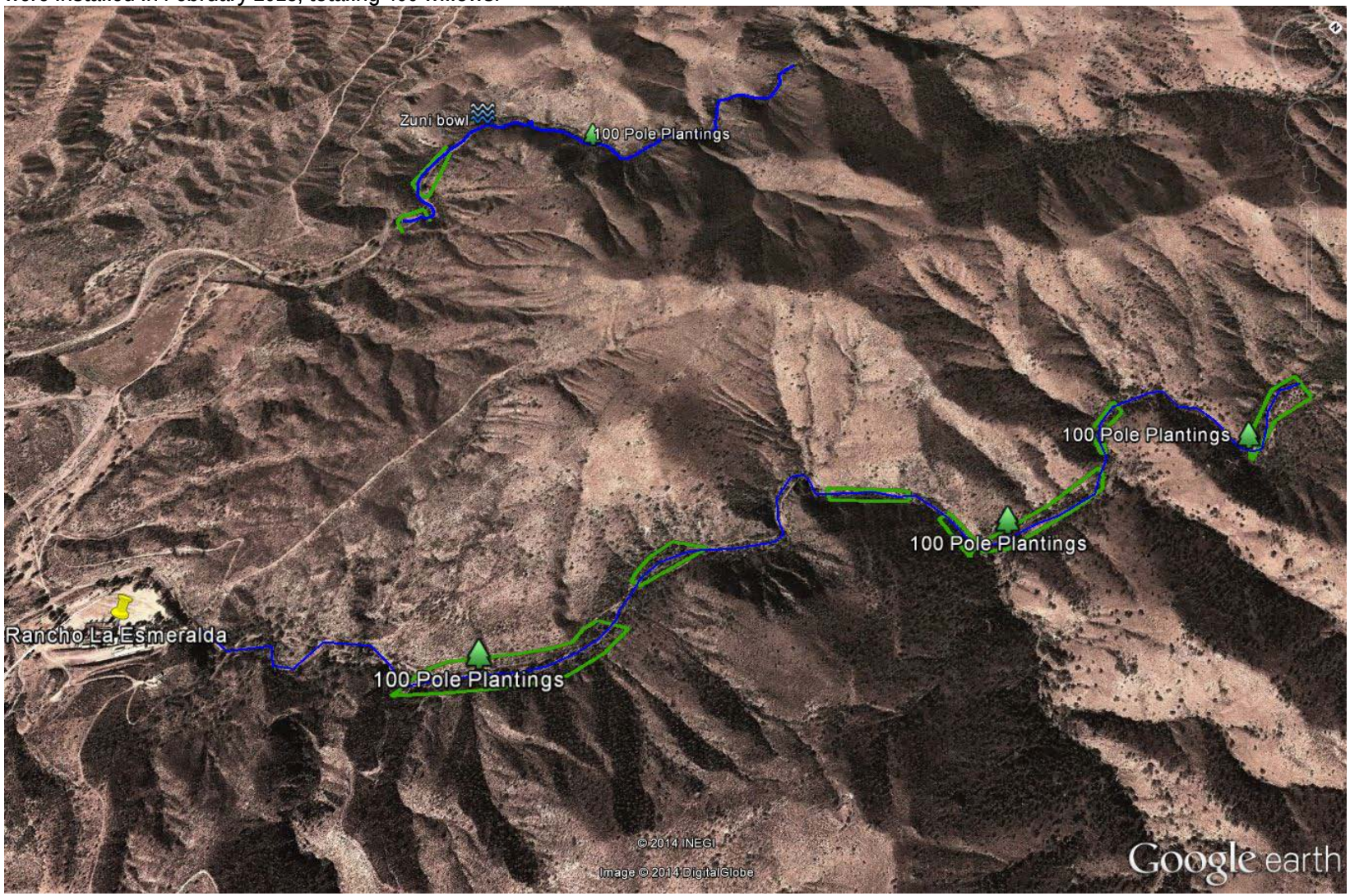
Name Date Name Date

Appendix C:
Maps of Restoration Work Areas, including all implemented restoration structures. Google Earth and ARC GIS files are available upon request.

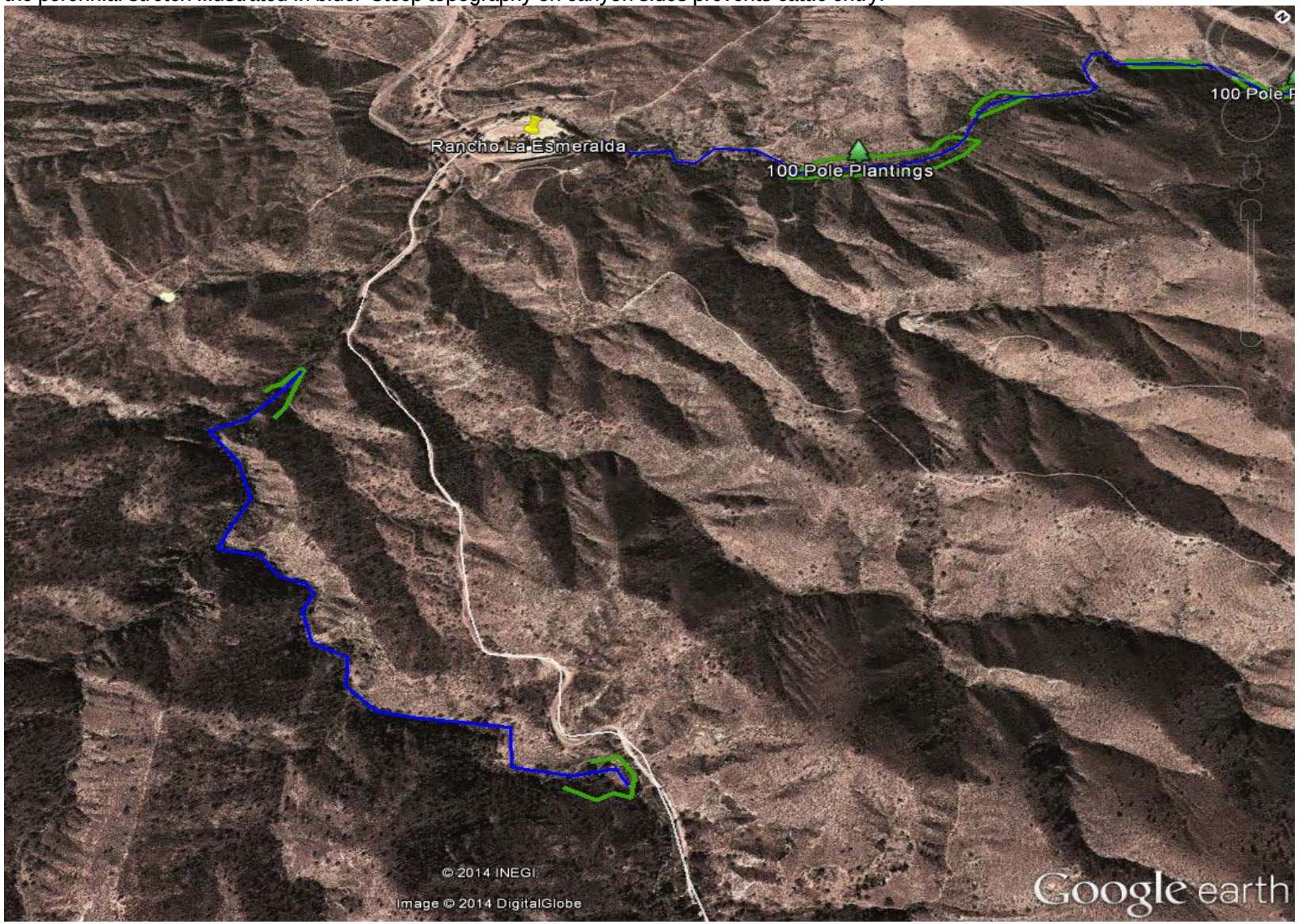
Regional overview of Ranch locations as well as outreach efforts



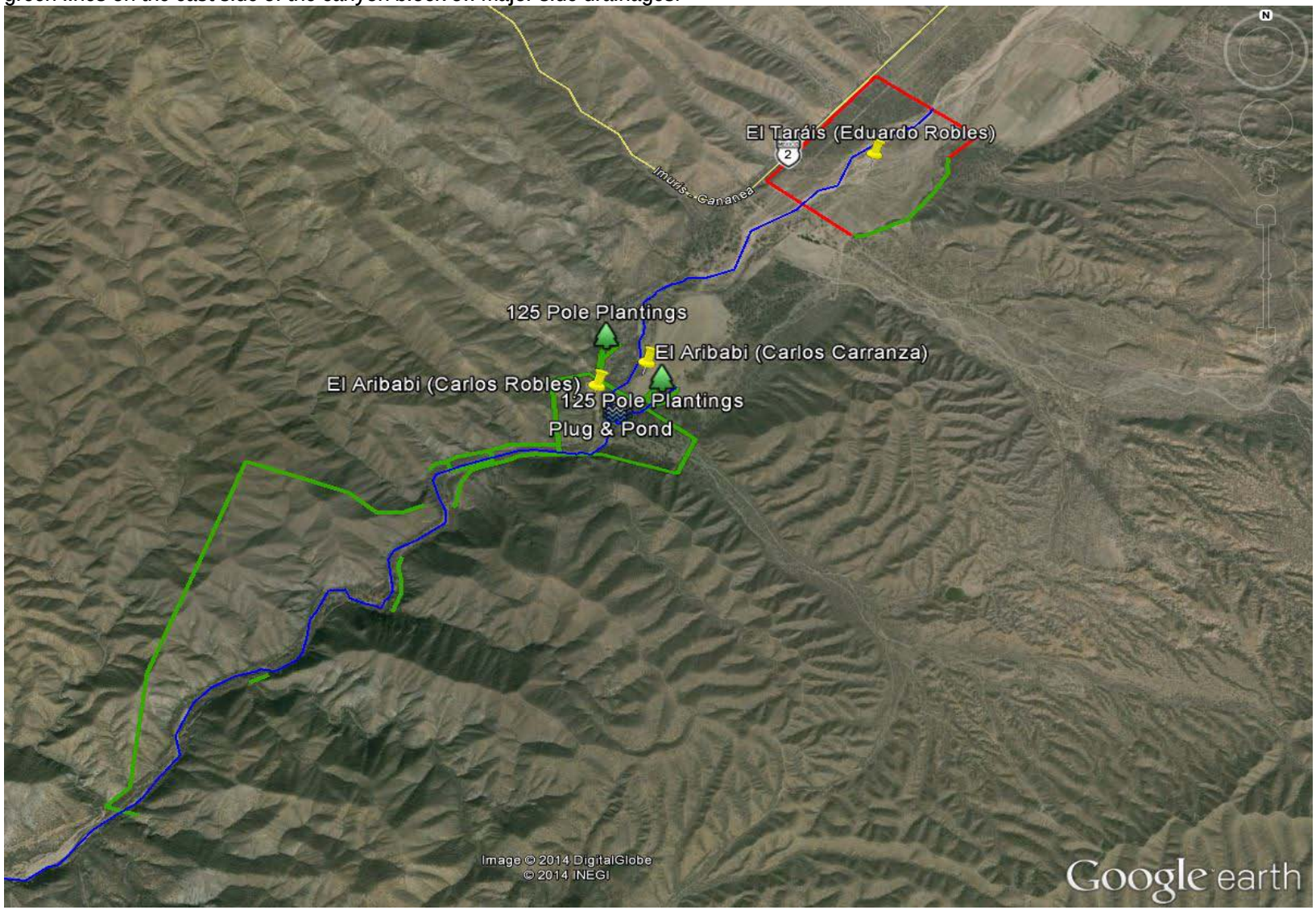
Rancho La Esmeralda (upper) – Cañón Planchas de Plata - 3.25 kilometers of new fencing (illustrated by 7 polygons outlined in green) was installed above the ranch house. Cañón Adrián - .5km of fencing was installed (top of this photo); the topography at the top of that perennial stretch prevents cattle from entering to the spot indicated by that blue line's terminus. A Zuni bowl was installed here in fall 2012 and 4 pole planting zones combined were installed in February 2013, totaling 400 willows.



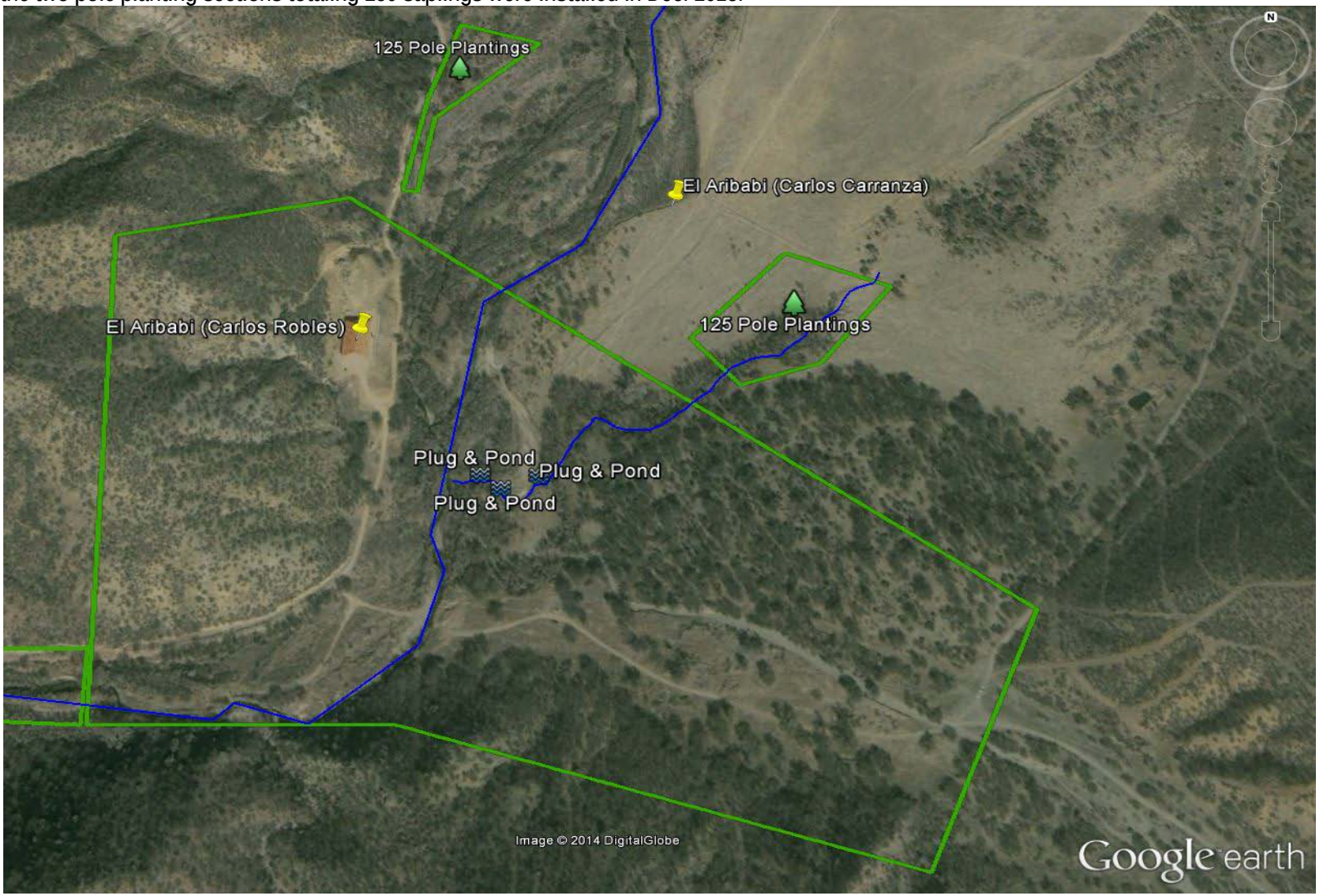
Rancho La Esmeralda (lower) – Cañón Yerbabuena - .42km of new fencing was installed in fall 2013 (bottom left of this photo) to exclude cattle from the perennial stretch illustrated in blue. Steep topography on canyon sides prevents cattle entry.



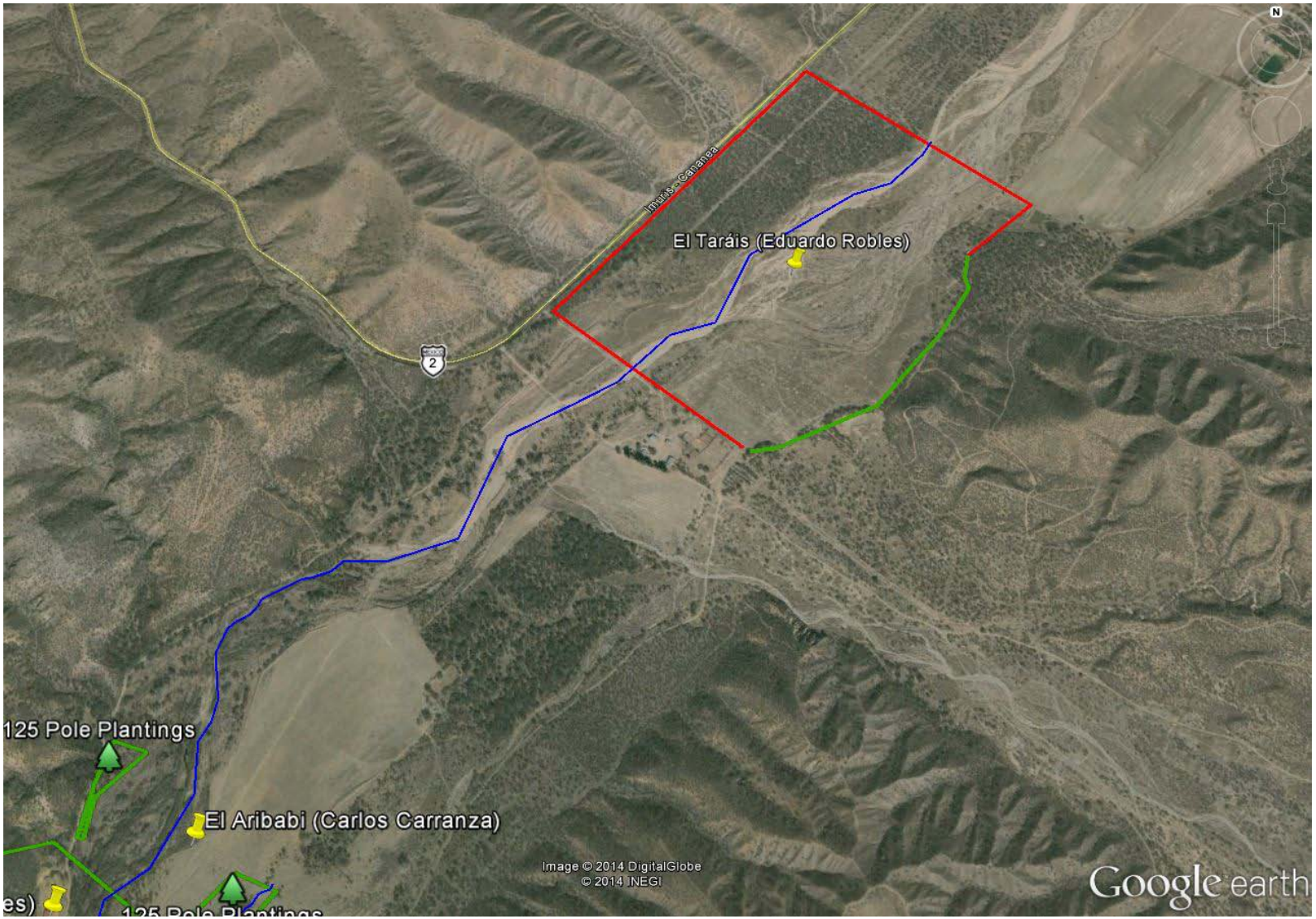
View of Río Cocóspera at Rancho El Aribabi – Blue line throughout represents the 9.3km of total riparian protection afforded via our restoration efforts. 8.22 km of recent fencing (green lines to the SW of the pole plantings) and steep topography prohibit cattle from accessing canyon below. The smaller green lines on the east side of the canyon block off major side drainages.



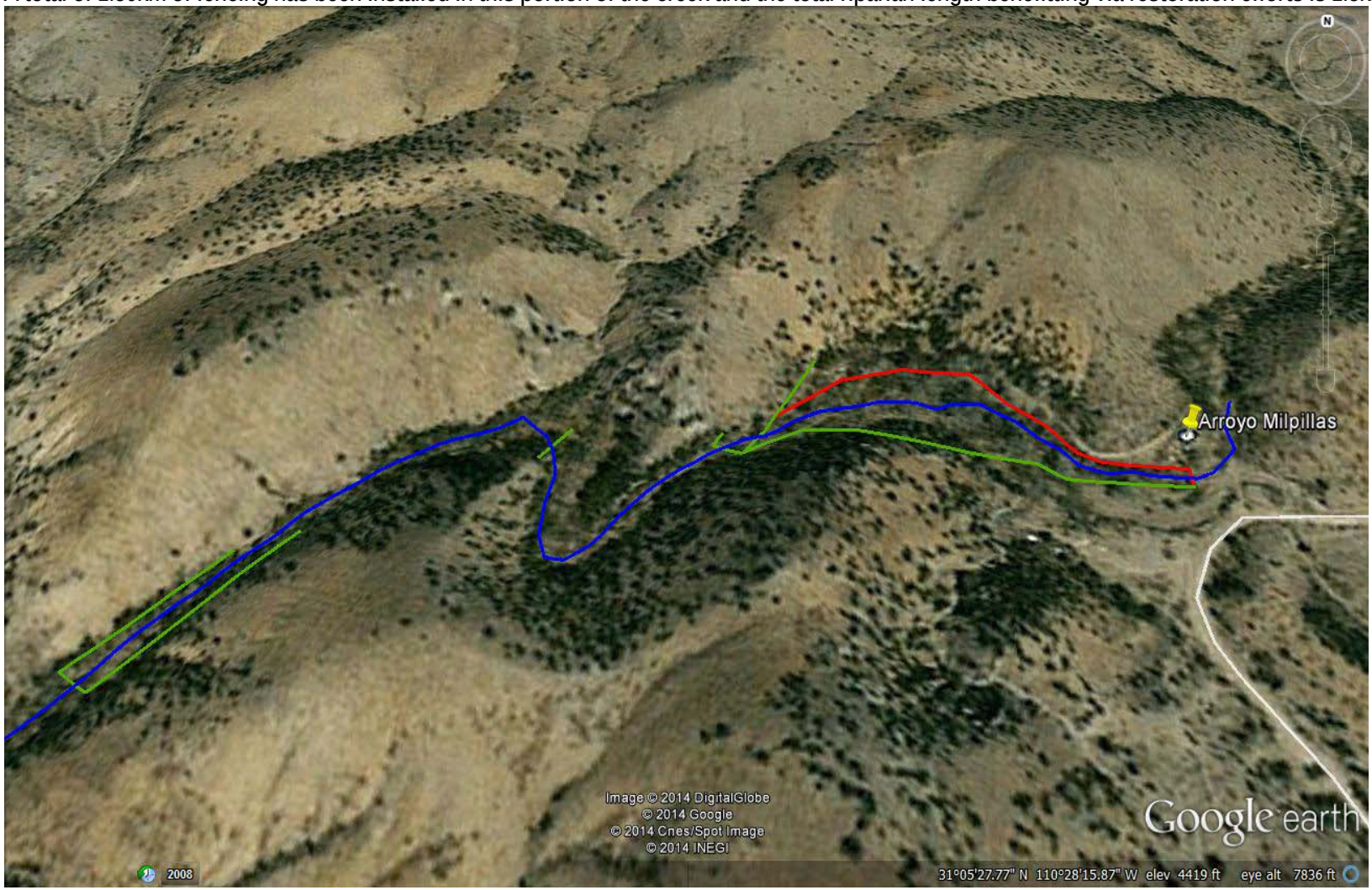
Rancho El Aribabi (Robles and Carranza) – 3 Plug & Pond structures (earthen dams to induce ponding) were installed on Sr. Robles' section. The green fencing containing those structures is the top part of 8.2km of recently installed fencing under our project that will protect the canyon below (seen on overview map). The smaller two polygons north of there represent 1.04km of new fencing in Carlos Carranza's section installed in Jan. 2014; the two pole planting sections totaling 250 saplings were installed in Dec. 2013.



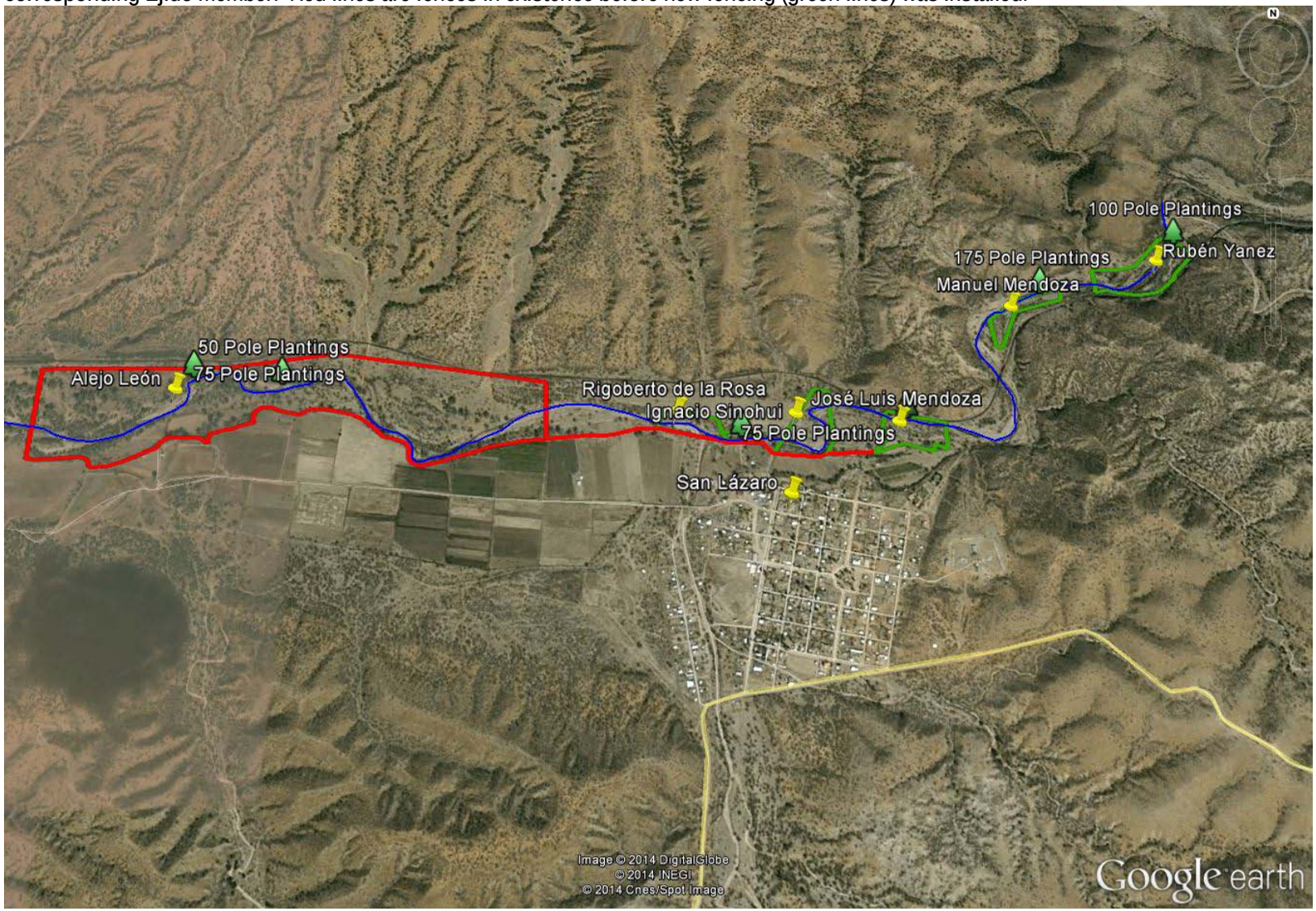
Rancho El Tarais – Green dogleg lines on this map represent .91km of new fencing installed in summer 2013, which completes a large cattle exclusion area. The Zuni bowl proposed for the middle of this area was eschewed in favor of doing fixes to the 3 Plug & Ponds on Carlos Robles' section of Rancho El Aribabi.



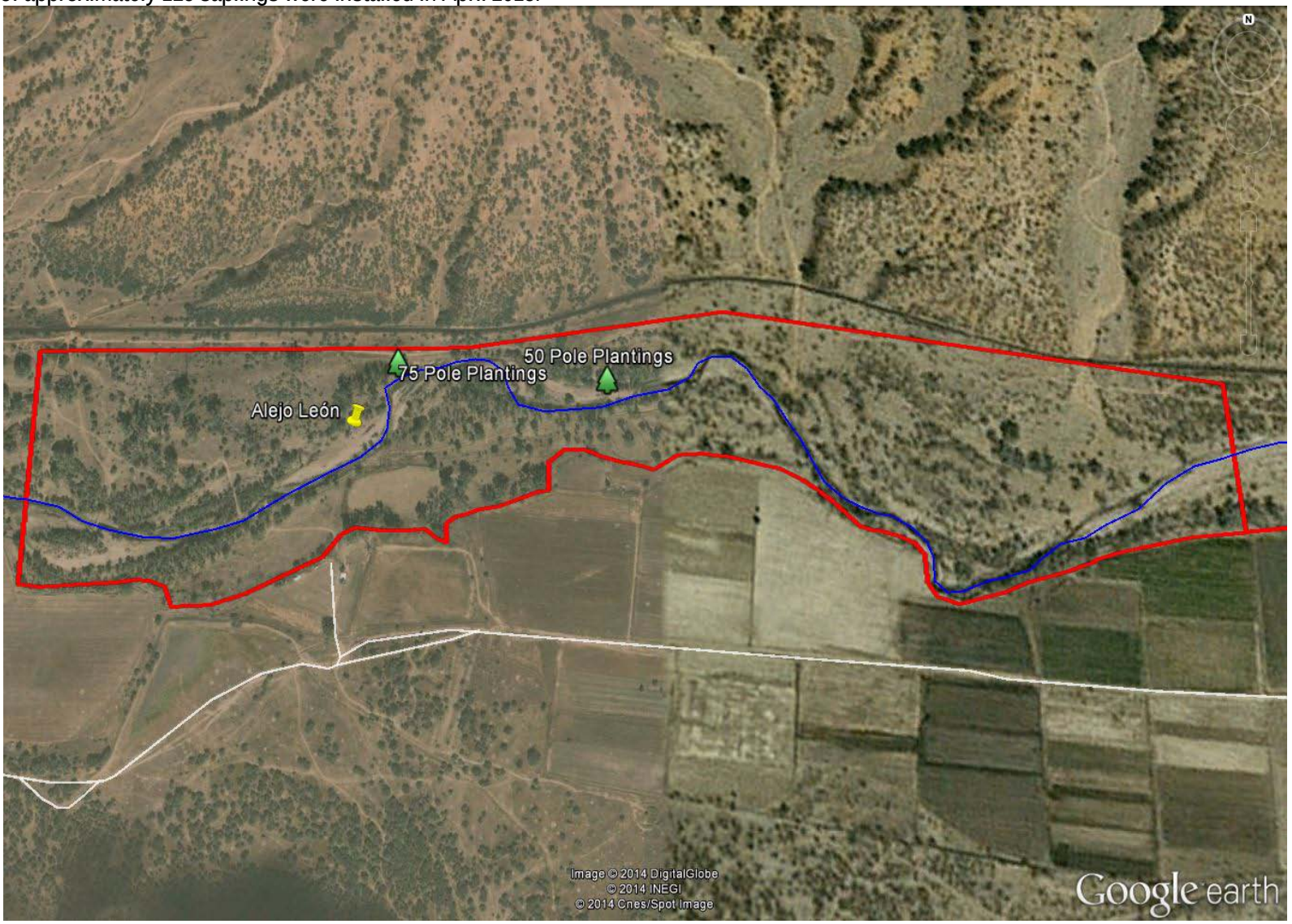
Arroyo Milpillas (upper) – New fencing (in green) when combined with rugged topography connects with existing fencing (in red) to create a large exclusion area. The Ejido Miguel Hidalgo Grupo Cinco spokesman Ventura Rivera didn't allow us to install pole plantings on our planned project day. A total of 1.36km of fencing has been installed in this portion of the creek and the total riparian length benefitting via restoration efforts is 1.8km.



Río Santa Cruz – The extent of river that has been enhanced as a result of our efforts is 8.4km (blue line). Road crossing weirs were deemed as insufficient and were not installed. Pole planting plans were modified and are listed property by property heading west to east with each corresponding Ejido member. Red lines are fences in existence before new fencing (green lines) was installed.



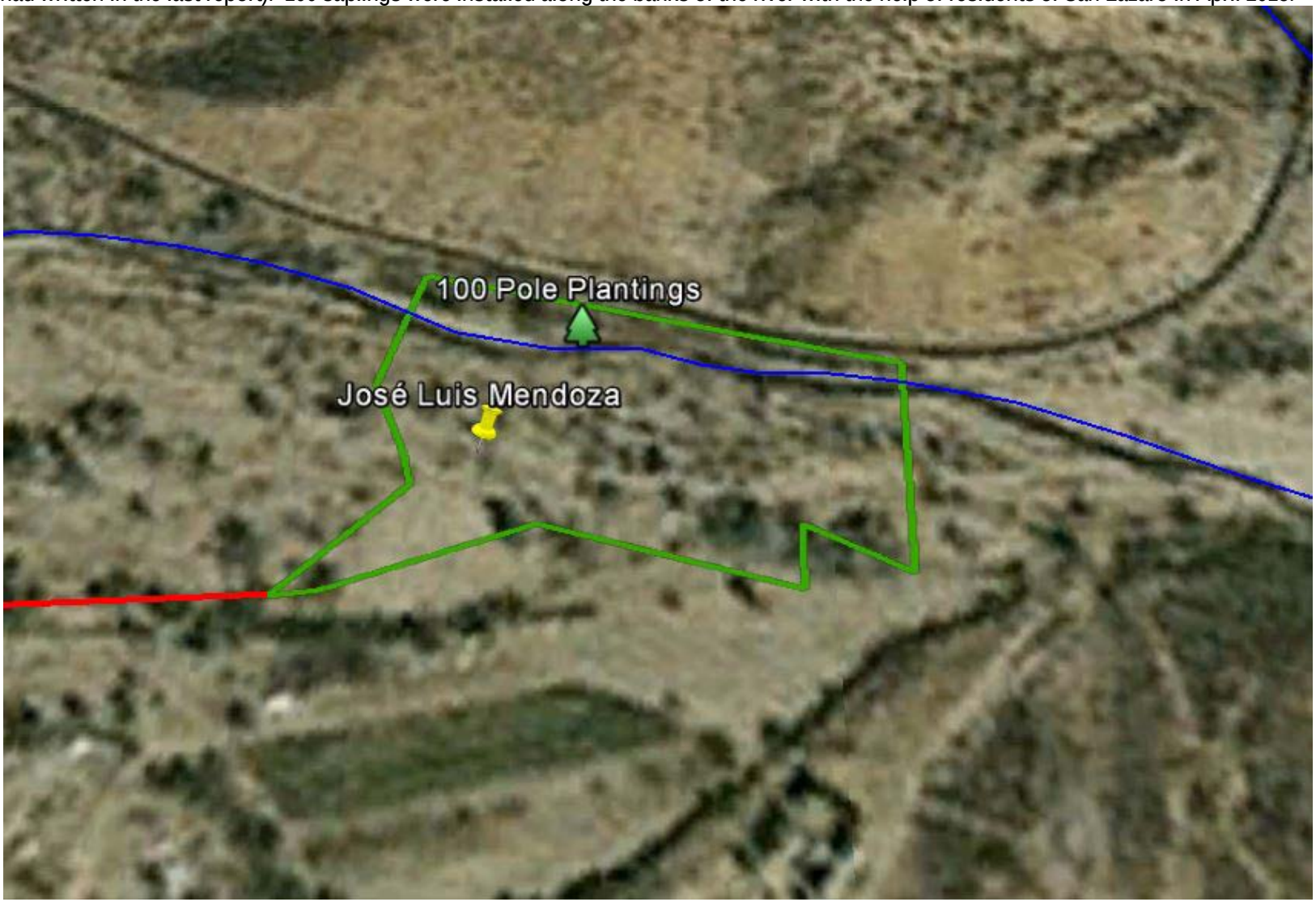
Alejo León – As his communal sections were already completely fenced, no new fencing was installed. Two pole planting zones with a combined total of approximately 125 saplings were installed in April 2013.



Rigoberto de la Rosa – Green lines mark the .64km of new fencing that was installed; some of this included the bottom (south side of river) where he used our new fencing materials to replace old dilapidated fencing (seen in red).

Ignacio Sinohui – Red lines mark the existing fence and the green lines represent new fencing that was installed, totaling .81km in both areas combined. The existing dilapidated sections that were fixed with our supplied fencing materials are on the south side of the river in each polygon. 75 saplings were installed along the banks of the river with the help of residents of San Lázaro.

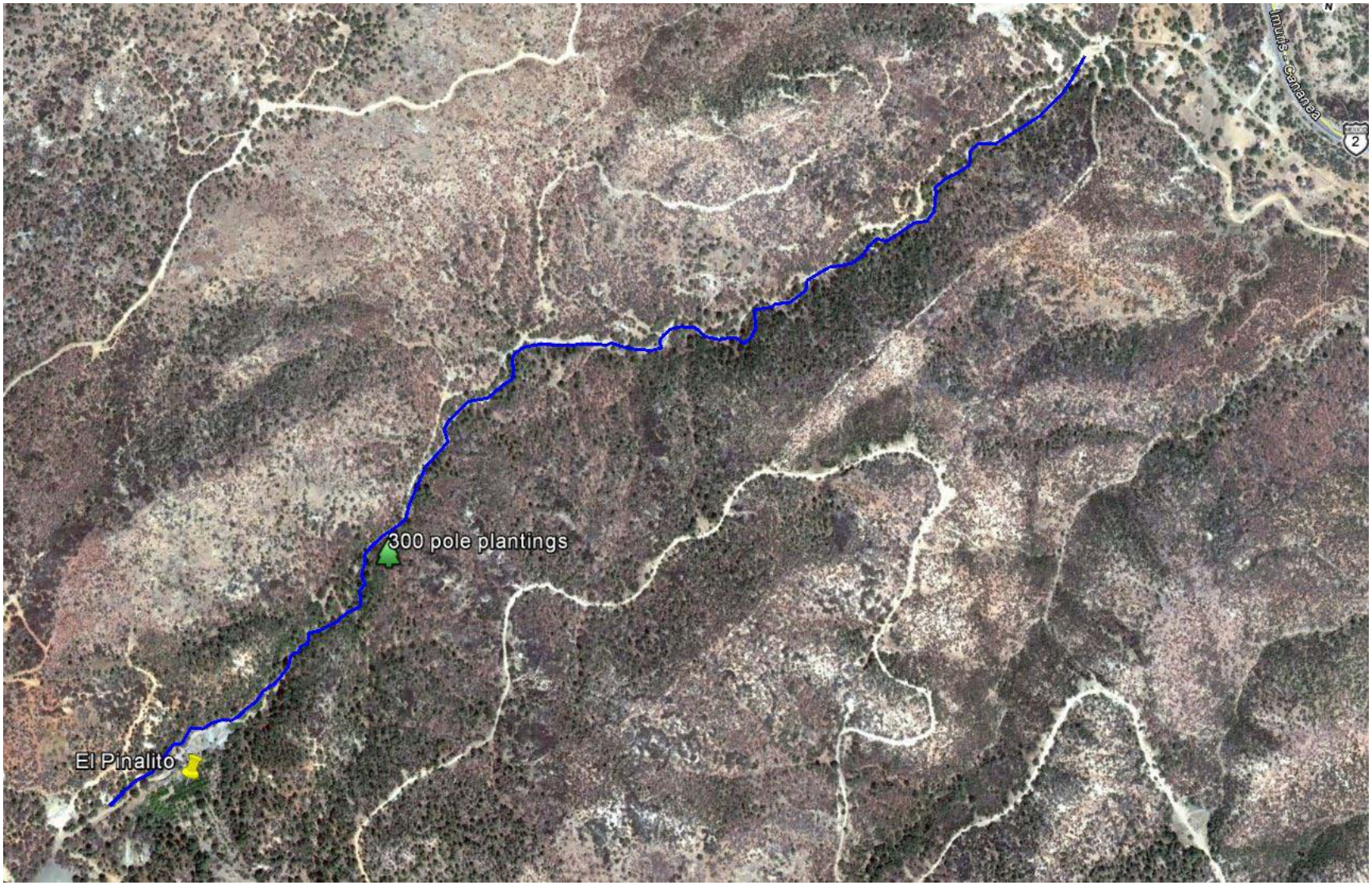
José Luis Mendoza – The red line marks existing fence and the green lines mark 1.07km of new fence. Due to the Ejido member's need to water cattle on the northern bank (in between this exclosure and Ignacio's to the west), he would not allow us to enclose that northern boundary (contrary to what I had written in the last report). 100 saplings were installed along the banks of the river with the help of residents of San Lázaro in April 2013.



Manuel Mendoza – Green lines mark the actual new fencing that was installed, totaling .44km. Green tree logo marks the site of approximately 175 new saplings we installed with the residents of San Lázaro in April 2013.

Rubén Yanez – Green lines mark the actual new fencing that was installed, totaling 1.05km. Ejido members requested that uncolored area between Rubén's parcel and Manuel's parcel to the west stays unfenced for ranching purposes. The tree logo marks the site of approximately 100 newly installed saplings.

El Pinalito (OUTREACH)- To date, this natural area outside of Cananea has been the site of several restoration applications learned via trainings and work projects led by Sky Island Alliance. These include rock erosion control structures in the main channel as well as 300+ willow pole plantings. ITSC has also monitored wildlife patterns here via hidden "camera traps" provided by SIA.



**Appendix D: Article in El Imparcial, a daily newspaper in Hermosillo, Sonora, describing this projects outreach activities.**

TODO SOBRE
ARIZONA
EL IMPARCIAL



PREMIA SKY ISLAND ALLIANCE A ITSC

# ESFUERZOS POR LA NATURALEZA

Por su gran compromiso a ambos lados de la frontera es que el Instituto Tecnológico Superior de Cananea recibirá el galardón 'Cuidado de la Tierra', en manos de una reconocida institución arizonense.

POR GRISELDA CÓRDOVA

Gran labor dio inicio el 20 de agosto de 2012, cuando ITSC firmó un convenio histórico con Sky Island Alliance, con el fin de trascender fronteras con labores de educación ambiental, trabajos de restauración y conservación en el Noroeste de Sonora y Suroeste de Arizona.

Los trabajos propios de este acuerdo son programados por SIA, siempre bajo la supervisión del personal especializado de la organización. El ITSC, por su parte, también cuenta con su propia agenda de actividades, explicó Guillermo Molina Padilla.

"Para el Instituto Tecnológico Superior de Cananea es un honor ser galardonado con este premio, dado el enorme significado que representa, además de ser un reconocimiento a las acciones emprendidas por nuestra escuela en beneficio de la preservación y restauración del equilibrio ecológico en un entorno transfronterizo", agregó.

Para el coordinador del acuerdo y jefe del Departamento de Ingeniería Electromecánica e Industrial, con este premio se felicita y premia también a todos aquellos participantes que hicieron realidad este proyecto.

Con más de 60 voluntarios, entre ellos alumnos, docentes y personal administrativo, la labor se llevó a cabo por alrededor de 700 horas, distribuidas en 7 proyectos de restauración, de los cuales, 5 se realizaron en distintas localidades en el Estado de Sonora.

La finalidad fue, comentó Guillermo, mejorar el crítico hábitat de las aves neotropicales, así como establecer bancos de arroyos y ríos por medio de estructuras de control de erosión en las áreas protegidas del cañón de Aravaipa, en Arizona.

"Tenemos una agenda ambiciosa que contempla dar seguimiento a los trabajos de restauración y conservación en propiedades privadas y ejidos del Norte del Estado de Sonora, así como en zonas protegidas del Estado de Arizona", añadió.

"El medio ambiente no tiene fronteras. Los proyectos de colaboración que SIA implementa en ambos lados de la frontera resaltan las relaciones positivas. Los resultados de nuestros proyectos son compartidos y los beneficios son para toda la región, incluyendo comunidades humanas y naturales.

"A través de nuestra colaboración y participación activa, SIA y ITSC ponen de manifiesto su compromiso con la educación y la formación de valores en la región, incluida la protección y conocimiento de nuestro medio ambiente regional", concluyó Sergio.

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Mutuo beneficio

Sky Island Alliance es una organización no gubernamental, sin fines de lucro, dedicada a la protección de las especies nativas y la restauración ecológica prioritaria del Suroeste de Estados Unidos y el Noroeste de México.

"Gracias a nuestra dedicación participación en actividades de conservación del ambiente durante el año 2013, el Instituto Tecnológico Superior de Cananea será reconocido por Sky Island Alliance con el premio 'Cuidado de la Tierra, que se entrega por primera vez a una institución educativa mexicana", indicó Guillermo.

*Su obra altruista trasciende las fronteras entre Sonora y Arizona.*

Sergio Avila Villegas, fundador del Programa de Conservación del Norte de México de SIA, por su parte relató que los parabienes no quedan sólo en eso, para también Guillermo Padilla recibirá el premio 'Voluntario del Año 2013'.

*Lo gran labor del ITSC es reconocido por la Sky Island Alliance.*

Fotos cortesía: Instituto Tecnológico Superior de Cananea

## ADEMÁS...

La región de las islas Serranas es un puente biológico para animales migratorios como los colibríes, el jaguar y las grullas; allí conviven especies de animales y plantas en un lugar único por su belleza paisajística y su topografía accidentada.

UN VERDADERO CAPITÁN AMÉRICA

# HÉROE DE LA VIDA REAL

Tras la euforia de los héroes del universo de Marvel, es tiempo de echar un vistazo a aquellos héroes de carne y hueso que velan diariamente por el bien de la comunidad; tal es el caso de Benjamin Hernández Santillán, 34 años de edad.

POR NALLELY PIMENTEL

Su historia, digna de un protagonista de novela gráfica, ha sido marcada por distintas tragedias a lo largo de su vida, pero eso nunca lo ha detenido para hacer el bien con una filosofía altruista que se refleja en su frase personal: 'nosotros podemos cambiar el mundo'.

Residente del Oeste del valle de Arizona el mayor tiempo de su vida, Santillán supo desde joven que su misión en la vida era ayudar a quienes le rodean, y sería en un departamento de bomberos donde lograría tal cometido.

A cargo de su familia desde la adolescencia, se graduó con altos honores de la preparatoria Trevor G. Browne y, consecuentemente, ingresó al programa Metro Tech Fire Science, donde se capacitaría para recibir educación médica de rescate.

Su alto grado de compromiso le valió el ser invitado a integrarse a las más prestigiosas universidades del país, recibiendo su título en Fire Science Technology por el Colegio Comunitario de Glendale, próximo a obtener su título en Gerencia de Servicios de Bomberos.

### Su obra altruista

Además, formó parte durante 4 años del reconocido Departamento de Bomberos de Phoenix, el cual cuenta con más de 1 mil 500 miembros activos, de los cuales sólo 257 son de origen hispano.

En su haber también se cuentan la preparación que recibió en 2005 como paramédico, múltiples reconocimientos y premios, el ser especialista en toxicología médica y ser voluntario en su tiempo libre para explicar a la comunidad cómo instalar alarmas y detectores de humo.

Su labor altruista y sentido de ayuda comunitaria sin límites lo impulsan también a ser un asiduo colaborador en la iglesia local, donde organiza festejos para familias necesitadas, rallies de comida, además de hacer conciencia sobre padecimientos como el cáncer y el VIH Sida.

La comunidad arizonense lo reconoce con vítores por su trayectoria de servicio, y próximamente será nombrado Capitán Oficial de su estación, lo cual revela que su nombre se ha vuelto sinónimo de humildad, caridad y amor al semejante.

Fotos cortesía: Agencia Thanatos/Benjamín Hernández Santillán