



PettersMinck

Bird Refuge Management

ASUNCIÓN, PARAGUAY
INTERACTIVE QUALIFYING PROJECT

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WPI



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Authorship

Wesley Fischer, Anthony Gringeri, Keeghan O’Leary, and James Velez were the contributors to the creation of this report. Wesley Fischer was responsible for the tower design, computer generated designs, material selection, and writing some bird profiles. Anthony Gringeri was responsible for writing one-half of the bird profiles, and all updates to the Android application. Keeghan O’Leary was responsible for surveying the construction site and for writing one-third of the bird profiles. James Velez was responsible for all communications in Spanish and for writing the methodology and results sections.

Abstract

This project looked to benefit and increase ecotourism, specifically bird-watching, in Benjamín Aceval. Research and collaboration with the Municipality of Benjamín Aceval and an independent conservation group, Karugua ha'e Tekove contributed to this goal. The team created schematics for an elevated bird observatory and made improvements to the existing mobile application that profiles birds frequently found in Benjamín Aceval. Recommendations include: Install the observatory, other access structures, and promotional road signs, and add the refuge to a “must see” list of international birding tours.

Acknowledgement

There are many people and organizations that helped to make this project a success with their countless hours of guidance and advice throughout the Interactive Qualifying Project process.

We would like to show our gratitude and recognize them for their efforts. We thank Dr. Jose Petters of the Karugua ha'e Tekove for his time, advice and expertise, the entirety of Karagua ha'e Tekove for all the tours and work that they helped us accomplish, Ms. Rebeca Sosa for her assistance in coordinating meetings with the municipality, and to Mayor Oscar Duarte and the Municipality of Benjamín Aceval for the acquisition of building materials, construction experts and their time and effort in this project.

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Executive Summary

Background

The Santuario de Aves de Rio Verde in Benjamín Aceval boasts impressive flora, fauna and breathtaking landscapes, but lacks essential structures that would guarantee it a hotspot for ecotourism.

Project Goal

The team focused on the design and construction of an elevated bird observatory within the bird refuge in Benjamín Aceval, Paraguay. In addition, to improve an already-existing Android application by adding more birds, a search bar feature, and a way to share the bird checklist. The goal was to increase access to the birds through physical and virtual infrastructure and to augment ecotourism and conservation within Benjamín Aceval.

Deliverables

This project produced two main deliverables. First, plans for an elevated bird observatory were produced. This will serve visitors by providing a greater view of the refuge's flora and fauna. Secondly, an Android application was created by a past team (2017) that serves as a guide to the different types of birds found specifically in Benjamín Aceval. The application was developed further to provide more information and utility to visitors.

Methods

The team used multiple information-gathering mediums, such as meetings and emails, to communicate construction logistics and ideas. On-site observations and meetings with experts

further informed the team. The CAD software served in the design the observatory and Android Studio made it possible to update the application.

Results

The team designed, developed and initiated the construction of an elevated bird observatory within the Santuario de Aves de Rio Verde. This work received help from the Municipality of Benjamín Aceval and Karagua ha'e Tekove, a local conservation group. The Municipality of Benjamín Aceval has secured construction materials and promises a completion date in mid-May, 2018. The Android application was updated with fifty-two new bird profiles and two new features: a search tool and a sharing tool. The search tool allows users to find birds by their scientific name or common name. The sharing tool allows users to discuss their bird list with others.

Recommendations

The team recommends that the bird observation tower be installed and that other access structures be designed and built. Second, to bring traffic to the city and sanctuary, the municipality and Karagua ha'e Tekove should work together to place the Rio Verde Sanctuary on an international bird-watching tour. Lastly, the refuge could be advertised better throughout Benjamín Aceval and the surrounding area, possibly including Asuncion.

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1 Introduction

The International Union for Conservation of Nature (IUCN) defines ecotourism as “responsible travel to natural areas that conserves the environment and sustains the well-being of local people” (Taylor, 2003). Ecotourism is one of the fastest growing sectors of tourism worldwide. The travel and tourism industry as a whole is extremely robust; the growth rate is roughly 1% faster than the world economy. As travelers become more aware of travelling sustainably, their willingness to spend on environmentally-friendly travel has also increased. Places that offer something environmentally unique to travelers have an advantage in this aspect.

South America is one of the planet’s prime ecotourism destinations. Throughout many countries in South America, ecotourism has become a major attraction, economic stimulus, and source of increased travel to many areas of the continent. The continent is well-known for places such as the Amazon to the north and Patagonia to the south, but many other South American countries also host a widely untapped potential for ecotourism.

Paraguay, the smallest landlocked country in the Americas, is rich in history and hosts a diverse set of wildlife. On paper, Paraguay has a large number of parks and reserves that many rare native species of bird, such as the White-winged Nightjar, call home (Fatbirder, 2018). This poses many opportunities for growth in the ecotourism industry. However, like any country, the appeal to the modern tourist depends heavily on the services, amenities, and infrastructure that exist there. Currently, there are only a limited number of guides or tours that exist in Paraguay. Tourists that are unfamiliar with the area or lack Spanish skills will find exploration difficult without an expert guide (Fatbirder, 2018). In order for Paraguay to grow as a site for birding and other ecotourism activities, locals must be trained to provide a more informative and considerate experience. Additionally, physical infrastructure is generally insufficient in more rural areas of

Paraguay, so the common tourist or researcher will face further challenges. Regulations and infrastructure need to be put into place to ensure the safety of tourists and the protection of nature.

Benjamín Aceval, a rural town outside of Paraguay's capital, is home to a still-developing bird refuge. Situated on an area of wetlands, the refuge is incredibly biodiverse, and home to many native species of bird. This refuge has potential to become an important part of the area's ecotourism scene. In 2017, WPI students worked to establish a self-guided tour through the refuge and created an Android application that profiles nearby birds and trees. The local wildlife conservation group, Karugua ha'e Tekove, help maintain the refuge and continue to make improvements, such as installation of informational signs. With the work of volunteers, more improvements in the areas of infrastructure and services need to be made. This project aims to improve infrastructure in the wildlife refuge in Benjamín Aceval through the construction of an elevated bird observatory and progression of the previously developed Android application.

2 Background

2.1 Overview

This section presents the information needed to understand the past and present project of *Bird Refuge Management* in the rural town of Benjamín Aceval, Paraguay. First, basic information in regards Paraguay's culture, environment, and history is given. Ecotourism in Paraguay is presented. A narrow view of birding in Paraguay is given, along with its relevance in Benjamín Aceval. The basics of bird watching infrastructure is shown, including an introduction to basic structures and their application to Benjamín Aceval's local wildlife refuge.

2.2 Paraguay

Paraguay is located in the south-central region of South America and is one of only two landlocked countries on the continent. It is a country with rich culture, and a history of political and economic change. Paraguay is composed of two different geographic regions: Region Oriental and Chaco Boreal. The country contains six major rivers; the best-known is the Paraná River. Paraguay is a country with great natural diversity which creates perfect habitats and conditions for birds.

2.3 Birding in Paraguay

Paraguay is home to nearly 700 species of bird, some of which are rare. This makes Paraguay an attractive destination for both bird researchers and watchers alike. Avian tours are becoming more popular throughout Paraguay (Figure 1). However, “[Paraguay] is perhaps the

most underbirded country in South America” due to its current state of development (Birding, 2017).

Underdeveloped infrastructure and unfamiliarity with conservation efforts are the main reasons for Paraguay’s small birding industry. There are a few Paraguayan groups



Figure 1: Established bird-watching itinerary in Paraguay

that work nationwide to change these conditions. One such group, Guyra Paraguay, works to conserve and promote the sustainable use of biological diversity, with an emphasis on birds. In 2016, they worked with the United States National Audubon Society to develop a national birding trail along with a bird identification app (Guyra Paraguay, 2016).

Due to the increase in awareness and conservation efforts, Paraguay is headed toward a better birding presence. Rural areas can leverage their rich biodiversity to attract tourists and improve the economy. Benjamín Aceval, a rural town in central Paraguay is one of these. Unfortunately, Benjamín Aceval lacks the infrastructure that would allow birders to research and sightsee properly.

2.4 Benjamín Aceval

Benjamín Aceval is a town in Paraguay (Figure 2) located 50 kilometers north of Asunción that has great potential for birding, due to the ornithological diversity and an active local bird watching association. A small bird refuge has been set aside, where many rare species of bird, such as the Great Egret and the Red-crested Finch, can frequently be found (Fatbirder, 2018). Karugua ha’e Tekove, the local birdwatching volunteer group, can serve as a source of

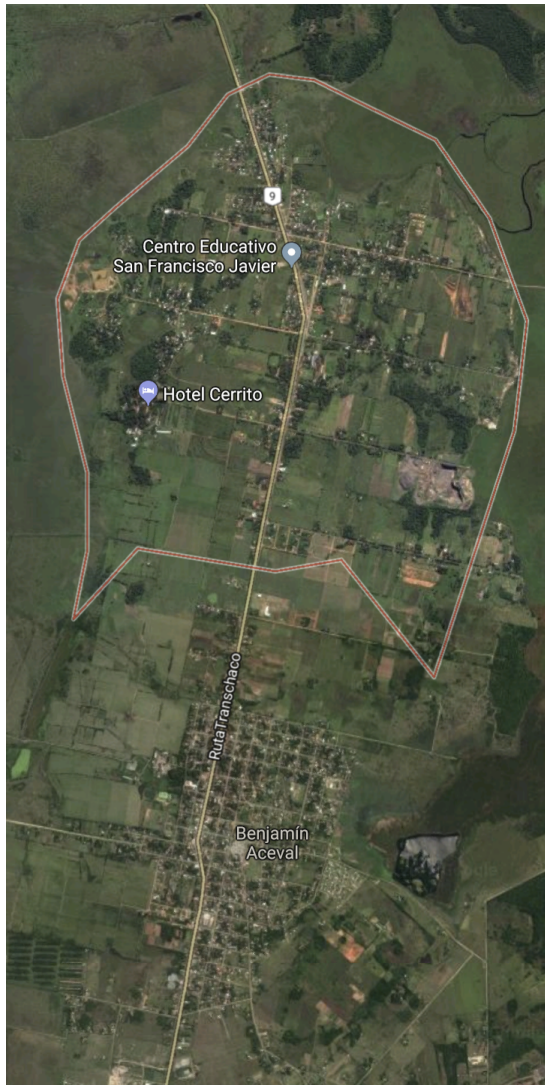


Figure 2: Aerial view of Benjamín Aceval

maintenance and personnel for future birding activities (Facebook: Karugua ha'e Tekove, 2018). Karugua ha'e Tekove works to research, educate, and most importantly, conserve the wetlands that are vital to maintain a strong bird biodiversity and to attract birders.

However, Karugua ha'e Tekove cannot work alone. The Municipality of Benjamín Aceval must be an ongoing and supportive partner. In Benjamín Aceval, politics and the avenues for project approval are different than that of towns in the United States. In Paraguay the culture is easy going and friendly, or *Tranquillo*. It relies a great deal on one-to-one relationships and personal interactions. Emails or memos tend not to carry much weight. Karugua ha'e Tekove has worked with the Municipality of

Benjamín Aceval in the past, and, in fact, one of its members is on the city council.

2.5 Bird Watching Structures and Signage

When building in places that are focused on bird observation in wetland areas, observing platforms are a welcomed feature. Other minor structures such as signage, rest stations, gateways, and trash cans will also provide a more convenient and or informational visit to a natural area.



Figure 3: Example of large elevated bird observatory

An elevated bird observatory presents many advantages to bird watching. The observatory acts to hide people and equipment so that they don't disturb the birds (Building Blinds, 2015). Bird observatories come in many shapes and sizes - from small one-man photographic blinds to large, multi-story towers (Figure 3).

Some bird sanctuaries and refuges have installed informational signage. These signs help visitors to better understand the species that are present. This information includes wildlife names, photos, and descriptions that inform tourists passing through.

2.6 Infrastructure Needed in Benjamín Aceval

The Benjamín Aceval bird refuge lacks the infrastructure and certain services and amenities that will accommodate visitors. With the collaboration of Hotel Cerrito's pre-existing services and amenities, Benjamín Aceval's bird refuge has potential for growth. The students staffing the hotel already provide housing and restaurant services. With the addition of a guided birding tour and its necessary infrastructure, tourists will have a local experience unique to Benjamín Aceval.



Figure 4: Benjamín Aceval bird refuge with points of interest

The 2017 WPI project titled “The Birds and Trees of Benjamín Aceval” laid the groundwork to increase ecotourism in this refuge by cataloging the birds and trees in the refuge, establishing points of interest for a self-guided tour, creating model signage, and developing an Android application that supports the self-guided tour with bird information (Zylich, 2017).

The most important structure that needs to be constructed is an elevated platform at the most popular point to enhance viewing (Figure 4, Site 13). Work has been done to select locations for fabricated signs throughout the refuge (Figure 4) (Zylich, 2017). These signs contain information regarding birds in the refuge. Five of thirteen signs have already been placed in the Benjamín Aceval refuge.

3 Methodology

3.1 Overview

This methodology details information-gathering techniques, deliverables, and a timeline. The team gathered information in four ways: establishing relationships, meetings, WhatsApp group, and email chains. The elevated bird observatory is discussed in regard to its plan, design, and construction. The methodology behind the application updates is explained. A timeline appears as a large figure.

3.2 Information Gathering

Gathering information from relevant communities and people was crucial to the success of our project. The 2017 Birds and Trees IQP group was interviewed for a first-hand account of

life in Paraguay and work in the bird refuge (1 Feb. 2017). Subsequently, a long-term discussion was started with Dr. Jose Petters, founding member of the Karugua ha'e Tekove and our main contact on the ground, about the size of the tower and work within the refuge. Further messages and meetings narrowed down the scope of the project and specified deliverables.

3.2.1 Establishing Relationships

After initial conversations with Dr. Petters, the team needed to gather information from other local sources. These people included: the students of Escuela Agrícola de San Francisco, Ms. Rebeca Sosa, and Mayor Oscar Duarte. During a volleyball game, the students of the school mentioned the love for wildlife they are raised with. Rebeca Sosa informed us on the inner workings of the municipality. Mayor Duarte brought to our attention the construction professionals he can assign to help. These relationships built trust, familiarity, and mutual respect. The establishment of these relationships allowed for an energetic and cooperative project.

3.2.2 Meetings

The meeting process contributed significantly to information gathering. These meetings fostered productive brainstorming and troubleshooting. For example, the team interviewed the 2017 Birds and Trees IQP group on February 1st, 2018 (Zylich, 2017). This semi-structured interview elicited genuine responses and steady flow. Three themes helped guide the questions: daily life in Paraguay, project logistics, and challenges faced while on-site. The 2017 IQP group indicated that Mayor Duarte was a foremost source of information. They also suggested to rely on his help because he heads all major projects in Benjamín Aceval. Upon arrival to Paraguay, the team met (18 Mar. 2018) with Dr. Petters and members of Karugua ha'e Tekove to discuss

the design and placement of the bird observatory at site 13. A meeting (21 Mar. 2018) with Mayor Oscar Duarte took place to present the final design for approval. When the mayor was unavailable, the team contacted Silvana Vergara, the mayor's personal secretary through meetings (4 Apr. 2018) and emails. Like many executive secretaries, she managed day to day operations. She provided the team with updates and facilitated the construction process.

3.2.3 WhatsApp and Email Chains

WhatsApp, an international messaging platform, became the primary communication method for day-to-day operations and ideas. Emails to Silvana Vergara encouraged her to keep track of materials and construction on schedule. Dr. Petters received all emails for approval, critiques and proper Paraguayan phrasing. All were emails carbon-copied with Prof. Traver, Prof. Wolf, Dr. Petters, and the rest of the IQP team.

3.3 Deliverables

This section describes the physical deliverables. The processes and methods for their installation will be discussed, as well as materials and collaborations with locals.

3.3.1 Elevated Bird Observatory

Design of the bird observatory was highly dependent on location and materials. Upon arrival to Benjamín Aceval, a location for the bird observatory was decided with Dr. Petters. Once the location was secured, the construction materials were selected. A general design for our observatory was approved by Dr. Petters before arrival in Benjamín Aceval, along with schematics that included computer models (See appendix: figure 7.1,7.2). Land surveying was

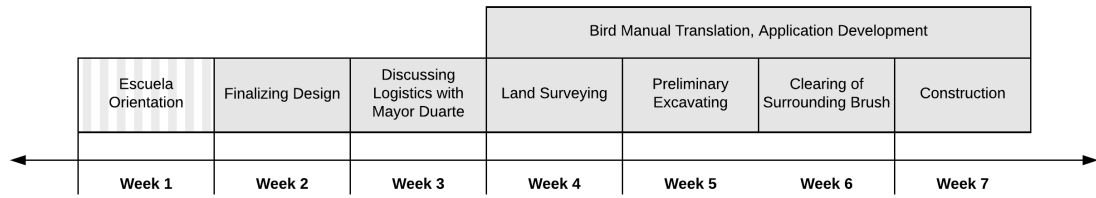
conducted by means of a tape measure and rope markers (2 Apr. 2018). Tools, materials, and workers were provided by the municipality of Benjamín Aceval. Since the structure is left to those residing in Benjamín Aceval, it was important that residents feel their own sense of pride towards it. To ensure this, Mayor Duarte recruited local carpenters and construction workers to the task.

3.3.2 Android Application

Upon arrival in Benjamín Aceval, Dr. Jose Petters requested that improvements be made to an Android application that accompanies tours in the Benjamín Aceval refuge. This application profiles bird species that are commonly found in Benjamín Aceval, with information such as on-site photos, size, descriptions, and an audio clip of each bird. According to the expertise of Dr. Jose Petters, it was decided that fifty-two birds were to be added to the application along with the fifty pre-existing species. In a meeting held with Petters (18, Mar. 2018), ideas were exchanged about features that would be useful. Petters expressed that a way to share the bird checklist would be useful. After adding the bird profiles, the team decided that a search tool would be useful, as the amount of bird profiles increased by more than double.

3.4 Approximate Timeline

The following is an approximate timeline of events following our arrival in Paraguay.



4 Results

4.1 Overview

The bird refuge is closer to having a bird observation tower than it was at the beginning of the project. To further the development of the bird refuge in Benjamín Aceval, the team designed and helped push for the construction of an elevated bird observation tower. In addition, a revised Android application offers new information and features.

4.2 Bird Observation Tower

This section details the obstacles and results of the bird observation tower in regard to material acquisition and construction. After an initial meeting with the Karugua ha'e Tekove and a tour of the refuge, the team changed the design for the tower to fit the refuge's needs. The tower was made smaller, eaves extended, birdhouses placed at each corner, and materials were changed to reflect the materials available. The team contributed to a wetlands workshop where students from the schools of Benjamín Aceval visited the bird refuge, took a tour, and listened to presentations from relevant wetland professionals and the bird refuge management team. In response to the team's description of the tower, students from the Colegio Parroquial Subvencionado Santa Rosa de Liman said that they liked it.

4.2.1 Materials Acquisition

The fundamental building materials were local caranday palm trees, cement, and tar. The caranday palm trees grow in the area and supply construction project throughout Benjamín Aceval. The cement comes from a local company that is located only a few kilometers from the

sanctuary. The source of the tar is unknown, but the tar seals the wood from decay in the humid, moist climate. These three materials make up the main components of the observation tower.

The timely procurement of materials challenged the team. Small local governments, by nature, are understaffed and busy. Moreover, there was a major election cycle during the time of the project and many officials were preoccupied with the activities (22 Apr. 2018). Daily attempts to make contact in person and electronic correspondence yielded responses and ultimately set the materials acquisition process in motion. The biggest acquisition problem was the supply of suitable Caranday logs; it seemed to take a very long time to realize that they were not available. Their replacement, a kind of pre-cured wood (25 Apr. 2018), was eventually chosen by the municipality, but this too seemed to go on forever.

4.2.2 Construction

In spite of the construction delays, the team prompted several changes to the refuge. These took place over a series of days. For example, the municipality installed eleven new benches at site 13 (2 Apr. 2018) and its workers cleared brush surrounding the construction site (19 Apr. 2018) to increase visibility. The team dug holes for the main platform support posts (11 Apr. 2018). A major Paraguayan newspaper, *ABC Color* (ABC Digital), published the project efforts. With the completed building plans produced by the team, the municipality of Benjamín Aceval should be able to finish by mid-May, 2018.

4.3 Android Application Updates

The Android application developed by a previous team was updated and enlarged. The new version includes fifty-two additional species of birds, complete with photos, descriptions,

and bird calls. The photos were taken by Jose Petters and Paulo Norberg. The full-sentence descriptions, written by the team in English and Spanish, are based on a Paraguay bird guide (Vázquez, 2006). The bird calls came from Xeno-Canto, an open-source bird call website. The update also allows users to save their bird checklist and share it with friends. The addition of a search bar allows users to find any bird within the application.

5 Recommendations

5.1 Finish Construction

While construction is planned to be completed in mid-May, any and all efforts to complete the tower would be beneficial to the project and to the Town of Benjamín Aceval.

5.2 International Bird Tour

There are many international bird watching tours, however Paraguay does not appear on most of them. Including the refuge on one of these international tours would be extremely beneficial for Benjamín Aceval. Karagua ha'e Tekove and the Municipality of Benjamín Aceval should invest in having the refuge placed on a national or international tour. It would increase ecotourism, conservation awareness, and economic growth.

5.3 Additional Structures

The team recommends that further towers be constructed in the refuge to ease bird observation and draw more attention to the refuge. It is suggested to not only add more observatories, but also walkways and decks to make it easier to interact with the fauna of the refuge. The addition of more structures would increase visitation to the refuge and help it to become more reputable.

5.4 Advertisement Signs

It is recommended that the refuge become better advertised on the Transchaco road. Additional signs would make the refuge more obvious and well-known to potential visitors. It

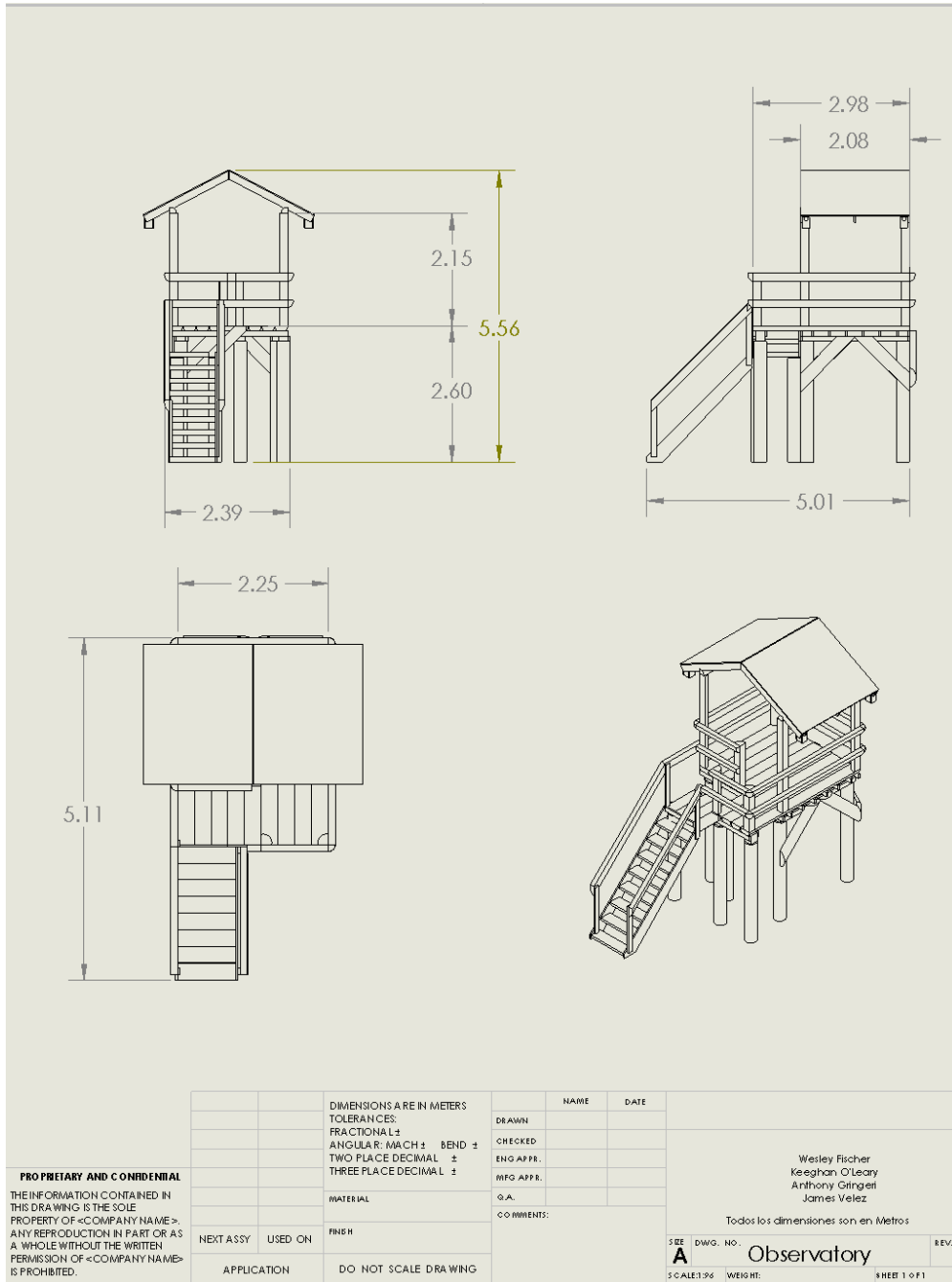
would be relatively simple to place signs on the side of the road to denote where the refuge is while also advertising the wildlife and landscape.

6 Conclusion

The team successfully completed bird observation tower designs to the satisfaction of the Municipality of Benjamín Aceval and Karugua ha'e Tekove and turned construction over to them. The municipality believes they can finish the construction in mid-May, 2018. Updates to the application were completed, with the addition of fifty-two new birds and two new features. The team also prompted further change in the refuge, evident through the addition of eleven benches in the refuge and plans for more to be added. With these changes, the refuge should become a more attractive birding site, and with the presence of more people, increase the economy of Benjamín Aceval.

7 Appendix

7.1 Bird Observatory Schematics



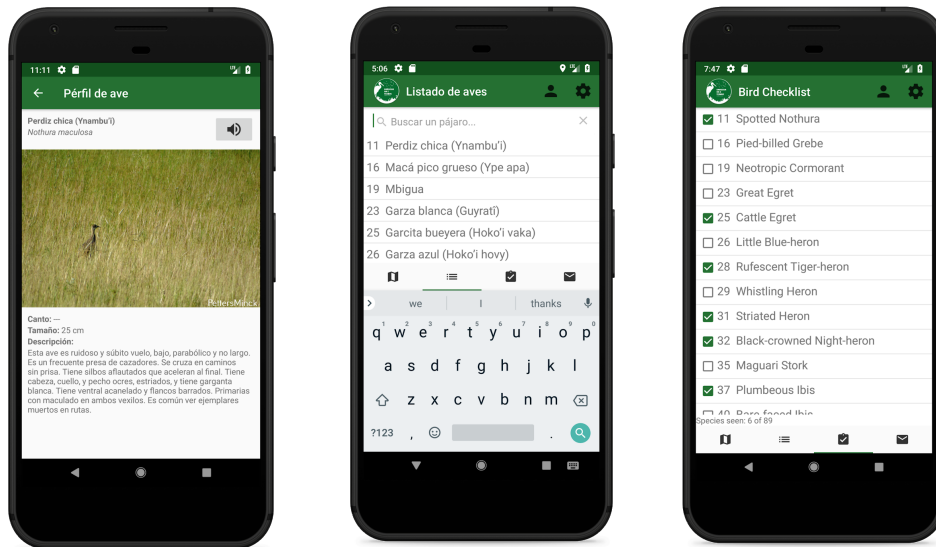
Appendix 1: Engineering diagrams for the elevated bird observatory

7.1 Final Observatory Rendition



Appendix 2: Final rendition for elevated bird observatory

7.3 Android Application for Bird Observation



Appendix 3: Examples of changes to the Android application

7.4 Map of the Rio Verde Sanctuary



Appendix 4: Points of interest in the Benjamín Aceval refuge

7.5 Photo of Construction Site



Appendix 5: Construction clearing for better viewing

8 Citations

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<https://www.itaipu.gov.py/es/sala-de-prensa/noticia/parque-lineal-es-construido-con-materiales-ecologicos>

A recent article about the construction of a park using ecological materials in Ciudad del Este, “The ITAIPU linear park appears to be one of the most popular places for citizens in the coming years, due to its varied leisure and recreation options that will be available to the public. It reuses three spaces, located in Area 1 of Ciudad del Este, to turn them into a new attraction of the region.”

4. Building Blinds: Hiding in Plain Sight. (2015, September 23). Retrieved January 18, 2018, from <https://academy.allaboutbirds.org/building-blinds-hiding-in-plain-sight/>

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It is important to take into account the effect human presence has on bird populations in the wild. “Ecotourism can be a vehicle for community-based conservation if it is conducted with an emphasis on the well-being of local ecosystems and human communities.”

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Paraguay is home to a variety of avian species, although it is often overlooked. “In addition, no fewer than ten globally threatened or near threatened birds have been recorded at Laguna Blanca.”

7. Peak, D. (2008). Poverty alleviation through tourism: a case study from Paraguay. *E-Review of Tourism Research*, 6(1).

This study illustrates the effects of tourism on the Paraguayan economy and poverty line. “The current tourism product in rural Paraguay is mainly nature tourism and is targeted towards the Brazilian and Argentinean market; these markets constitute 97% of the visitors to Paraguay.”

8. Taylor, J. E., Dyer, G. A., & Stewart, M. (2003, July). The Economics of Ecotourism: A Galápagos Islands Economy-Wide Perspective. Retrieved January 23, 2018, from <http://www.journals.uchicago.edu/doi/10.1086/377065>

This article shows how ecotourism affects a region. "... presents ecotourism as a self-sustaining cycle of increased tourism, increased incomes, and increased incentives for conservation..."
9. Gouvea, R. (2004). Managing the ecotourism industry in Latin America: challenges and opportunities. *Problems and Perspectives in Management*, 2, 71-9.

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12. Frommer's, Sustainable Travel & Ecotourism in South America. (n.d.). Retrieved January 29, 2018, from <https://www.frommers.com/destinations/south-america/planning-a-trip/sustainable-travel--ecotourism>

This site details information and challenges of South American countries with ecotourism. "On paper [Paraguay] has an impressive list of parks and reserves..."

13. Best Birding Locations in Central & South America. (2015, October 19). Retrieved January 29, 2018, from <http://www.selectlatinamerica.co.uk/blog/best-birding-locations-central-south-america/>

This site references the best birding locations in South America. “Latin America is simply one of the best continents for birding on earth. In total there are over 3,000 species roughly equating to thirty two percent of the world’s bird species.”
14. Fundación Paraguaya. (n.d.). Retrieved January 30, 2018, from <http://www.fundacionparaguaya.org.py/?lang=es>

This site is the website for Fundacion Paraguaya, and contains all pertinent information to the foundation. “All our students get involved in an active way and acquire practical skills and business management.”
15. GWC. (2017). South America. Retrieved January 30, 2018, from <https://www.globalwildlife.org/our-work/regions/south-america/>

This is committed to the protection of wildlife in South America through the establishment of protected areas. “In 2014, GWC, Rainforest Trust, and local partner ProAves created the first protected area in the Serranía de Perijá, a permanent sanctuary.”
16. Secretaría Nacional de Tecnologías de la Información y Comunicación, Benjamín Aceval. (n.d.). Retrieved January 30, 2018, from <http://www.munibenjaminaceval.gov.py/index.php/la-ciudad>

This site contains important background information on the region of Benjamín Aceval, Paraguay. “Benjamín Aceval has a total of 16,248 inhabitants, of whom 8076 are men and 8,171 are women, according to estimates by the Directorate General of Statistics, Surveys and Censuses.”
17. The Editors of Encyclopædia Britannica. (2017, November 02). Humid subtropical climate. Retrieved January 30, 2018, from <https://www.britannica.com/science/humid-subtropical-climate>

This site contains information on the facts of a subtropical climate. “In summer, these regions are largely under the influence of moist, maritime airflow from the western side.”

18. Karugua ha'e Tekove. (2016, August 14). Retrieved January 30, 2018, from https://www.facebook.com/pg/karuguahaetekove/about/?ref=page_internal

This is the Facebook page for the group promoting conservation and advocacy in the Benjamín Aceval area.

19. Guyra Paraguay. (n.d.). Retrieved February 5, 2018, from <http://guyra.org.py/>

Guyra Paraguay Association is a non-profit civil society organization focused on the preservation of Paraguay’s natural habitats. “In 2016, they worked with the United States National Audubon Society to develop a national birding trail along with a bird identification app.”

20. Smith, P. (n.d.). Republic of Paraguay. Retrieved February 5, 2018, from http://fatbirder.com/links_geo/america_south/paraguay.html

This Fatbirder article describes Paraguay as the hidden gem in the birding world. “Located in the heart of the continent where five major biomes meet.”

21. Quinn, P. (n.d.). *Survey Design: A Mini-Guide to Some Best Practices*. doi:https://canvas.wpi.edu/courses/6223/files/1017981?module_item_id=165061

This mini-guide contains crucial information on designing and piloting surveys. “Phrase survey items as neutrally as possible.”

22. Federal Research Division. (2005, October). COUNTRY PROFILE: PARAGUAY. Retrieved February 22, 2018, from <https://www.loc.gov/rr/frd/cs/profiles/Paraguay-new.pdf>

The Library of Congress published a profile of Paraguay in 2005. The document contains information such as geography, history, and economy as it pertains to Paraguay. “Paraguay has fertile soil and lush forests that support its agriculture and timber industries.”

23. Vázquez, J. L. (2006). *Guía para la identificación de las aves de Paraguay*. Buenos Aires, Argentina: Vázquez Mazzini Editores.

This guide is used as a tool for identifying birds that are common to Paraguay. It includes brief descriptions, illustrations, and information helpful to identifying birds.

24. ABC Digital. (2018, April 28). La belleza de las aves en los humedales - Especiales. Retrieved from <http://www.abc.com.py/especiales/fin-de-semana/construiran-un-mirador-de-aves-en-los-humedales-de-benjamin-aceval-1697612.html>

This is an article describing the efforts to build the bird observatory in the bird refuge of Benjamín Aceval.