



# WETLAND CONSERVATION AND EDUCATION IN BENJAMÍN ACEVAL, PARAGUAY

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# **Wetland Conservation and Education in Benjamín Aceval, Paraguay**

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## **Authorship Page**

All group members, Christine, Colin, and Nicolas, contributed equally to the project and the completion of this report.

## **Abstract**

This project raised wetland conservation awareness through the development and implementation of an interactive and hands-on educational program for students from nine schools in Benjamín Aceval, Paraguay. The educational program utilized last year's IQP, online research, and student and teacher interviews. The program included in-class presentations that were reinforced through interactive activities and wetland tours. The program featured a wetland workshop that provided more than 50 students hands-on experience and detailed information about their local wetlands. Through this workshop students learned directly from environmental professionals who guided tours of the local wetland in Benjamín Aceval. Pre- and post- program questionnaires showed that the presentations improved attitude, skill, and knowledge for wetland conservation. The workshop identified topics that students liked most. Thirty-one percent want to learn more about plants and animals. The team delivered recommendations to the project collaborators: Benjamín Aceval schools and the local conservation group, Karugua Ha'e Tekove. The recommendations suggest that (1) Karugua Ha'e Tekove take over the educational program, (2) there be semi-annual workshops and/or science fairs for the students, (3) there be a guidebook dedicated to the wetlands and area of Benjamín Aceval, and (4) the program be extended to the Qom communities. The expansion of the education program to Qom schools would support the wetland conservation awareness objective. These actions collectively have the potential to increase wetland conservation in the area.

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## **Executive Summary:**

### **Purpose:**

The project raises awareness for wetland conservation to the residents of Benjamín Aceval. Benjamín Aceval is a community of approximately 16,000 residents with numerous unprotected wetlands. The students and people of Benjamín Aceval have inconsistent levels of understanding in regards to the importance of the environment and specific ecosystems such as wetlands. The team looked to build on the foundation of the project completed last year that developed a baseline for informing students about wetland conservation and encouraging them to conserve their local wetlands.

### **Recommendations:**

The team developed four recommendations.

1. Transfer the responsibility of school presentations and wetland tours to Karugua Ha'e Tekove. Karugua Ha'e Tekove - or *Wetland is Life* - is an environmental conservation group that resides in Benjamín Aceval.
2. Develop a semi-annual workshop and/or science fair in regards to wetlands that could be run by Karugua Ha'e Tekove.
3. Create a guide that includes information about wetlands and the city of Benjamín Aceval.
4. Expand the educational program to the Qom community with collaboration from Karugua Ha'e Tekove.

### **Results:**

The team presented an educational program to over 450 students from nine schools in the area of Benjamín Aceval. Pre- and post-lecture questionnaires, coding techniques, and interviews were used to determine the success of the deliverables. The questionnaires were used to measure the attitude, knowledge, and skill of the students before and after the program. On average, students showed positive attitude, knowledge, and skill towards wetlands and wetland conservation. The post-questionnaire showed that students retained a significant amount of the information presented to them. The presentations were co-sponsored by Karugua Ha'e Tekove. This group has the opportunity to provide an ongoing presence while WPI students are not in Paraguay and therefore could take the responsibility of delivering presentations at the schools. Over 50 students participated in the wetland conservation workshop and were given the opportunity to learn from various environmental professionals through wetland tours and presentations. Students were asked to complete a survey at the end of the workshop. These surveys were coded and 31 percent of students expressed an interest in learning more about animals and plants. Other wetland topics of interest for the future include: conservation, cleaning, importance, types, origin, characteristics, and general information. The success of the workshop presents an opportunity to continue holding workshops and potentially science fairs with the help of Karugua Ha'e Tekove. In an effort to expand information about wetlands to the public, a distributive wetland guide would be beneficial. The results display the effectiveness of the school presentations and wetland tours that give reason to incorporate the educational program into the school curriculum. The nine participating schools did not include any from the Qom community. Given the success of the program within the nine schools, there is potential for expansion to the Qom community.

**Methods:**

The team's approach to accomplish this goal was to increase student engagement and awareness by delivering local wetland tours with the help of environmental professionals and the conservation group Karugua Ha'e Tekove. The team researched teaching methods for environmental education, interviewed students and teachers, and met with important school administrators in order to connect with local schools. In addition, recommendations and outcomes were utilized from the previous year's project in order to arrive at the deliverables proposed in this project.

**Deliverables:**

The deliverables for this year differed from those of the previous year. The educational program utilized outcomes and recommendations from the previous project as a baseline from which to develop surveys and the workshop further.

1. Wetland Conservation Educational Program: The focus of this program was to educate students in the area of Benjamín Aceval about wetlands and wetland conservation. The program was delivered in Spanish with the use of Microsoft Powerpoint to nine schools in the area. The program incorporated information and an activity appropriate for students from ages 4-18.
2. Wetland Conservation Workshop: With the help of Karugua Ha'e Tekove, a workshop was planned and delivered. The workshop began in the morning at the Santuario de aves de Río Verde with tours led by environmental professionals and moved to La Escuela Agrícola in the afternoon for presentations. The environmental professionals included biologists specializing in birds, aquatic plants, mammals, and amphibians. Over fifty students from local schools participated in the workshop. The workshop included a tour of the most well-known local wetland, presentations, and multiple activities.

## **Resumen Ejecutivo:**

### **Propósito:**

El proyecto creó conciencia para la conservación de los humedales entre los habitantes de Benjamín Aceval, Paraguay. Benjamín Aceval es una comunidad de aproximadamente 16,000 habitantes, con numerosos humedales que no están siendo protegidos en la actualidad. Los estudiantes de la localidad, y en general, los habitantes del mismo tienen niveles inconsistentes de comprensión sobre la importancia del medioambiente y los ecosistemas específicos, como los humedales. El equipo de trabajo quería construir sobre la base del proyecto llevado a cabo el año pasado, el cual desarrolló un punto de referencia para informar a los estudiantes locales sobre la conservación de los humedales y alentarlos a conservar sus humedales locales.

### **Recomendaciones:**

El equipo propuso cuatro recomendaciones a la Fundación Paraguaya:

1. Que las presentaciones escolares y las visitas a los humedales continúen a cargo de Karugua Ha'e Tekove - o *Humedales es Vida* – que es un grupo de conservación ambiental en Benjamín Aceval.
2. Desarrollar una jornada semestral y/o una feria de ciencias en Benjamín Aceval/Cerrito, con respecto a los humedales, que podría ser dirigida por Karugua Ha'e Tekove.
3. Crear una guía que incluya información sobre los humedales y la ciudad de Benjamín Aceval
4. Expandir el programa educativo sobre la importancia de conservar a los humedales a la comunidad Qom con la colaboración del grupo Karugua Ha'e Tekove.

### **Resultados:**

El equipo llevó a cabo un programa educativo sobre la importancia de conservar los humedales a más de 450 estudiantes de nueve escuelas en el área de Benjamín Aceval. Se utilizaron cuestionarios previos y posteriores de las presentaciones, técnicas de codificación y entrevistas para determinar el éxito de los entregables. Los cuestionarios se usaron para medir la actitud, el conocimiento y la habilidad de los estudiantes antes y después del programa. En general, los estudiantes mostraron una actitud positiva, conocimiento y habilidad hacia los humedales y la conservación de los humedales. El cuestionario posterior mostró que los estudiantes retuvieron una cantidad significativa de la información que se les presentó. Las presentaciones fueron patrocinadas por Karugua Ha'e Tekove. Este grupo tiene la oportunidad de proporcionar una presencia continua mientras que los estudiantes de WPI no estén en Paraguay y, por lo tanto, podrían asumir la responsabilidad de realizar presentaciones durante el año en las escuelas. Más de 50 estudiantes participaron en la jornada de conservación de humedales y se les dio la oportunidad de aprender de varios profesionales del medio ambiente a través de una visita guiada a un humedal local y presentaciones sobre la flora y fauna de los humedales. Se les pidió a los estudiantes que completaran una encuesta al final de la jornada. Estas encuestas fueron codificadas y el 31 por ciento de los estudiantes expresaron su interés en aprender más sobre animales y plantas. Otros temas de interés que expresaron los estudiantes que se podría tratar en el futuro incluyen: conservación, limpieza, importancia, tipos, origen, características e información general sobre humedales. El éxito de la jornada presenta la oportunidad de continuar realizando jornadas y ferias de ciencias con la ayuda de Karugua Ha'e Tekove. En un esfuerzo por difundir la información sobre los humedales al público, una guía sobre humedales sería



beneficiosa. Estos resultados muestran la efectividad de las presentaciones escolares y los recorridos por los humedales, que aportan razones para incorporar el programa educativo en el plan de estudios de las escuelas locales. Las escuelas de la comunidad Qom no fueron incluidos en el programa educativo durante este proyecto. Dado el éxito del programa en las nueve escuelas, existe un potencial de expandir el mismo a la comunidad de Qom.

### **Metodología:**

El enfoque del equipo para lograr el objetivo del proyecto fue aumentar el compromiso y la conciencia de los estudiantes mediante la realización de visitas a humedales locales con la ayuda de profesionales ambientales y el grupo de conservación Karugua Ha'e Tekove. El equipo investigó métodos de enseñanza para la educación ambiental, entrevistó a estudiantes y profesores, y se reunió con importantes administradores escolares para conectarse con las escuelas locales. Además, se utilizaron recomendaciones y resultados del proyecto del año anterior para cumplir los objetivos propuestos en este proyecto.

### **Entregables:**

Los entregables para este año difieren de los del año pasado. El programa educativo utilizó los resultados y recomendaciones del proyecto anterior como un punto de referencia desde la cual desarrollamos encuestas y la jornada.

1. Programa Educativo de Conservación de Humedales: El objetivo de este programa fue educar a los estudiantes del área de Benjamín Aceval sobre humedales y su conservación. El programa fue llevado a cabo en español con el uso de Microsoft PowerPoint a nueve escuelas en el área. El programa incorporó información y una actividad apropiada para estudiantes de 4 a 18 años.
2. Jornada sobre conservación de humedales: con la ayuda de Karugua Ha'e Tekove, se planificó y se impartió una jornada. La jornada comenzó en la mañana en el Santuario de Aves de Benjamín Aceval con visitas guiadas por profesionales del medio ambiente y se trasladó a La Escuela Agrícola San Francisco en la tarde para llevar a cabo presentaciones. Los profesionales ambientales incluyeron biólogos especializados en aves, plantas acuáticas, mamíferos y anfibios. Más de cincuenta estudiantes de escuelas locales participaron de la jornada. La jornada incluyó un recorrido por los humedales locales más conocidos, presentaciones y múltiples actividades.

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## **1. Introduction**

Wetland conservation and wetland conservation education demand global attention. Many countries fail to address wetland conservation despite the benefits wetlands provide to the environment. Current conservation policies in developing countries lack effective environmental maintenance plans. This could derive from individual beliefs, a culture that does not prioritize wetlands, or a systemic governmental problem. A potential solution includes behavioral change within the public in relation to wetland conservation. In the following paragraphs, there will be a discussion on wetlands and some causes of their destruction. Then, there will be a concentration on the country of Paraguay and its school system where the team worked. Lastly, to inspire greater participation in wetland conservation among students in Benjamín Aceval, Paraguay, the team's solution will be presented.

Improvement of Earth's condition can be achieved through environmentally responsible behaviors among all humans. The promotion of such behaviors requires increased public awareness of current environmental issues and their impacts. Environmental education that focuses on specific topics evokes a place identity, an emotional connection with a specific setting, with one's surroundings. A desire results for protective environmental actions (Lawrence, 2012). These behavioral changes can improve environmental preservation.

Wetlands provide important ecosystem services such as “water purification, the buffering of runoff and river discharge, the production of food and fiber, and ecotourism” (Reis, et al., 2017). They also benefit farming as a reserve for water and soil enhancer when they flood. This contribution to food production has encouraged human development around wetland ecosystems (Reis, et al., 2017).

Urbanization and human interference threaten the integrity of many wetlands. Human-induced pollution, deforestation, and man-made exhaust exacerbate climate change and, therefore, threaten wetlands (Da Ponte, et al., 2017). Overuse of wetland resources further provokes wetland destruction. The majority of the public remains unaware of the wetlands' inability to sustain an infinite amount of utilization with no consequences (Rojas, Romero & Cruzans, 2017). These seemingly small behaviors destroy the wetlands that play a huge part in the balance of the global environment.

In the middle of South America resides Paraguay, a country landlocked by Brazil, Argentina, and Bolivia. This small country contains immense beauty enhanced by a vibrant culture. A wide variety of people from all parts of Paraguay embody the culture of this country. These people come from cities and towns of varied sizes, as well as small farming communities dependent on the land. This land presents great opportunities for agriculture, yet constitutes a delicate environment.

Paraguay hosts a multitude of diverse wetland systems. As a result, a variety of wildlife seen nowhere else around the world thrives in these areas. However, overuse of these ecosystems has threatened their survival. If this deterioration of the environment continues, the delicate balance of the wetlands will remain in peril. Public action, especially in schools, may reduce the risk imposed upon wetlands and their inhabitants.

The town of Benjamín Aceval in Paraguay includes multiple school systems for students of all ages. Although students succeed in this school system, a new pedagogy intended for engagement through hands-on learning can enhance the educational experience.

The team's project aims to educate students in Paraguayan schools about the value of wetland preservation. The destructive manner of humans has placed this precious ecosystem in

danger. Awareness of the value of wetlands and conservation approaches can be promoted through the implementation of wetland conservation education in the schools of Benjamín Aceval. The current pedagogy for environmental education needs improvement. This project introduces a new interactive pedagogy that focuses on student engagement. The team worked with students of Benjamín Aceval, who represent part of the future of this country.

## **2. Background**

The following chapter reviews the literature needed to understand environmental education issues in Benjamín Aceval. It begins with a discussion about Paraguay, specifically the area of Benjamín Aceval. The chapter continues with an analysis of wetlands. The focus shifts to the organization Karugua Ha'e Tekove and the implementation of environmental education methods. The chapter combines these subjects to guide the development of a wetland educational program.

### **2.1 Paraguay**

A strong sense of culture is present within every Paraguayan. Paraguayans embrace their differences in ethnic and national background and are unified by it. All citizens of the country know “the historical, cultural and social influences that have molded Paraguay as a nation” (Lambert & Nickson, 2013). It is evident that Paraguayans place greater importance on the community over individuals. Whether in the capital city or a rural town, Paraguayans can count on their collective unity (Sunal et al., 2010).

In Paraguay lies a rural town called Benjamín Aceval that is home to approximately 16,000 people. Most of the town consists of agricultural land where families have historically worked (SNTIC, n.d.). Benjamín Aceval contains 28 schools that are located along or near the Transchaco highway (Educación Escolar Básica, 2010).

In recent years there has been an increase in local educational opportunities. New schools have been created by sponsor organizations such as the Fundación Paraguaya, a poverty elimination non-profit. These schools focus on the fields of agriculture and business development (SNTIC, n.d.). These schools promote careers in agriculture and hospitality, the first of which can supplement efforts to promote environmental awareness and action.

## **2.2 Environment**

This section addresses several global environmental issues and how to raise awareness and enhance knowledge to create sustainable solutions. First, the importance of wetlands and the issues that impact wetlands are discussed. Then the section addresses prevalent environmental issues that affect ecosystems in Paraguay. The section closes with a look at an environmental conservation group in the area of Benjamín Aceval and their work.

### **2.2.1 Wetlands**

Paraguay's wetlands are a valuable natural resource. Wetlands are defined as, "areas where water covers the soil all or part of the time" (EPA, 2017) . Wetlands provide a habitat for a wide variety of plants and animals and protect communities through their flood reduction capabilities.

A delicate balance exists between the environment and all of its ecosystems. Any unnatural activity that disrupts this balance results in severe destruction within the environment. Wetlands require systematic preservation to avoid such disruptions. Many wetlands are legally recognized as protected areas yet remain affected directly and indirectly by human development (Reis, et al., 2017).

Every wetland is unique and requires its own specific conservation plan. Many conservation plans exist with varying levels of effectiveness (Lourival, et al., 2009). The effectiveness of conservation plans can be improved through the provision of frameworks that determine the connectivity of natural wetlands to the surrounding land (Reis, et al., 2017). Wetland map utilization can keep track of wetland inventory as well as aid in the management and protection of local wetlands. These maps provide data for a variety of wetlands around the world (Wilén, Carter, & Jones, 2002).

Benjamín Aceval lies in the Lower Chaco, a semi-arid region in Paraguay that contains a variety of ecosystems such as forests and wetlands. The Chaco accounts for 60 percent of Paraguayan land, yet has the lowest population density in the country (Prado, 1993). Agricultural expansion and forest-focused conservation methods endanger this region's wetlands (Grau, et al., 2015). Man-made structures and practices, such as agriculture, dams, and fragmentation, drive deforestation and overall change in the environment. Such disruptions affect the health of the Chaco. Appropriate conservation methods must be applied to maintain the Chaco, its wetlands, and water.



Wetland management should be addressed collectively by all involved parties.

Communities who will be impacted by, or who will impact, wetland planning measures should be included in the planning process. “Detailed problem analyses and recommendations for solutions have to be elaborated on a case-by-case basis in close cooperation between scientists, local decision makers, wetland managers and the people living in the respective wetlands” (Junk, 2012). In Benjamín Aceval, this includes mayor Oscar Diosnel Duarte Morales as well as local environmental groups and professionals (SNTIC, n.d.).

### **2.2.2 Karugua Ha’e Tekove**

Karugua Ha’e Tekove is an environmental conservation organization based in Benjamín Aceval that aims to protect wetlands and similar ecosystems. The group includes “young people of the city of Benjamín Aceval and of the national territory, specialists, scholars of the natural sciences, and naturalists of other lines” (Karugua Ha’e Tekove, 2016). It creates various activities for outreach, education, recreation, and research to increase environmental awareness and prevent the degradation of the area’s valuable wetlands. Specifically, the group keys in on the wildlife that inhabit the wetlands. The Facebook page includes descriptions of individual species that populate the wetlands and videos of mistreated wetland species that aim to evoke a sympathetic response. They appear to be successful in raising awareness with over 3,000 likes and posts that reach hundreds of people (Karugua Ha’e Tekove, 2016). Karagua Ha’e Tekove provides a platform for those passionate about environmental conservation to network. The

development of a network among the organization and the schools of Benjamín Aceval provides more exposure to conservation efforts and potential avenues for environmental education.

## **2.3 Environmental education**

This section combines issues of environmental conservation and education to promote environmental activism among rural Paraguayan students. It begins with a look at the current education system in Paraguay, its effectiveness, and how environmental education can be applied. Following that, there is a discussion on the importance of student engagement in environmental education. Then, it addresses behavioral changes towards conservation as a result of student engagement. The section concludes with a review of the previous IQP focused on wetland conservation education in Paraguayan Schools.

### **2.3.1 Education system in Paraguay**

The education system in Paraguay implements a strict curriculum. The majority of lessons are delivered to the students as lectures. Students are unfamiliar with teaching methods that promote hands-on activities and field trips. Many children do not attend school, but those who do perform fairly well in comparison to other low and middle income countries. Paraguay ranks at the 20th percentile for access to education though it ranks at the 69th percentile in learning (PNEP, 2014). However, schools vary greatly, and so do their performances.

### **2.3.2 Engaging and informing students**

Many avenues may inspire students to pursue environmental activism. The experiences of current environmental professionals can be a source of understanding how to encourage children

along this path. Chawla (1999) interviewed environmentalists to identify the formative life experiences that led to their environmental commitment. The most important years were in childhood, and the key influences were natural areas, family, negative experiences (such as destruction of a beloved place), organizations, and education (Chawla, 1999).

Exposure to natural areas can educate students more powerfully than a typical lecture. Student engagement with an environmental subject can be enhanced with a visit to a natural area (Lawrence, 2012). Researchers have determined that excursions to natural areas develop environmentally responsible behaviors with nature (Lawrence, 2012). Once students become interested and engaged, substantial learning can take place.

The United States has a variety of environmental groups and corporations that focus on environmental improvement and education. These groups provide educational opportunities for students to gain hands-on experience with wetlands through various activities.

Environmental Concern (EC) is a not for profit corporation that aims to educate future generations about the importance of wetlands. EC offers field trips that have the highest potential to encourage hands-on learning for students in attendance (ECI, n.d.). The Project WET Foundation aims to educate students and teachers about the value of water. Their mission is to “reach children, parents, teachers and community members of the world with water education that promotes awareness of water and empowers community action to solve complex water issues” (Project WET, 2016). The success of this mission depends on outreach methods that

include the distribution of education materials, training workshops, community water events, and the development of a worldwide water network.

### **2.3.3 Changing behavior**

To provide students with information about environmental problems is not the only goal. More importantly, environmental education must go beyond the communication of information and instead promote actual behavior change. In environmental education, one cannot simply tell students how to behave and provide them with good reasons to do so (Heimlich & Ardoin, 2008). One must model good behavior for students, give them opportunities to practice, and provide helpful feedback. Quality environmental education provided to students of Benjamín Aceval resulted in behavioral changes to enhance wetland conservation efforts (Lawrence, 2012).

### **2.3.4 Previous IQP**

The goal of the previous IQP team was to increase public awareness of wetland conservation in Benjamín Aceval. The team concentrated on student education in regards to wetland conservation. To reach this goal, the team conducted research and interviews in Benjamín Aceval to establish project deliverables. The first project deliverable was a wetland conservation lesson plan. The lesson plans were designed for certain age groups to be included in future teachings in Benjamín Aceval. Aside from the lesson plan, the team created a more in-depth wetland conservation workshop. Students participated in activities, interactive games, and talks from ecological professionals. As a result of these two deliverables, the team saw positive

developments in students: 34% of students improved their skill, 20% improved their attitude, and 23% improved their knowledge (Ochoa, Matthews, Cervoni, & Traver, 2017).

### **3. Methodology**

The following chapter describes the methodology for the project. The project schedule is laid out with a Gantt chart of the timetable and activities. The deliverables of last year's IQP were evaluated, specifically the lesson plan and workshop. Based on this assessment, the educational program was further developed to include a greater interactive experience.

Throughout the project the current network among conservation experts, students, and local residents was strengthened. Finally, the success of the project was assessed.

#### **3.1 Project schedule**

The Gantt chart provides a schedule for the project. This chart depicts the activities that were conducted along with their dates. The chart includes checkpoints for March 12th through May 2nd. The Gantt chart can be found in Appendix A.

#### **3.2 Evaluate success of last year's IQP**

This wetland conservation project in Benjamín Aceval began in the spring of 2017 when the WPI team of Natalia Cervoni, Marlon Matthews, and Ricardo Ochoa completed their IQP (Ochoa, et al., 2017). Therefore, before the current team began the project, the success of the

previous year's project was assessed. The assessment evaluated the outcomes of the previous projects' deliverables: a lesson plan and a workshop. This evaluation of the outcomes, which includes students' retention of the previously disseminated information and current attitude on wetland conservation, determined the starting point for this year's project.

### **3.2.1 Lesson plan**

The current team first gauged the success of the 2017 lesson plan that was taught in seven schools. This plan provided teachers a resource to teach students about the importance of wetland conservation in their local community. To understand the success of the lesson plan, the current team assessed outcomes at both the teacher and student level.

For teachers, a simple interview to determine the effectiveness of the lesson plan was designed. The interview addressed demographics (which school(s) they teach at, gender) as well as teacher opinions. Important questions included whether the teacher has used the lesson plan, why or why not, and whether they considered the lesson plan useful. In addition to this information, the current team solicited feedback from teachers who would like to elaborate on the value of the plan. The script for this interview is included in Appendix B. The current team used content analysis, according to the method by Schmidt (2004), to critique the plan and determine revisions as necessary.

Similar to the procedure with teachers, the current team met with students to solicit their feedback. This feedback goes beyond the type of data collected by last year's project to focus on what students would like to see in a new lesson plan. The script for this interview is included in

Appendix B. This script also measured knowledge, attitude, and skill towards wetland conservation. The current team kept in mind that there might be sources of information other than the lesson plan and workshop where students could have learned about wetlands, such as Escuela Agrícola San Francisco's emphasis on agriculture and the environment in its curriculum. The script also recorded student demographics (school attended, grade, age). Student surveys were completed under the supervision of a classroom teacher.

### **3.2.2 The wetland conservation workshop**

The previous IQP team recommended that the current team plan and execute a workshop for students. The previous team was contacted to learn about the activities included in their workshop. After this, the current team asked the students who participated in last year's program about activities they enjoyed. The current team analyzed the students' responses to the workshop to select activities where students felt they learned most. The team consulted with teachers, Dr. Jose Petters, and other members of Karugua Ha'e Tekove to identify the best plan to expand this educational program. Interviews were conducted and analyzed with content analysis to understand the community's preferences (Berg, 2007). Scripts for interviews with students, teachers, and school leaders are included in Appendix B.

### **3.3 Developing an educational program about wetlands**

The previous team's wetland workshop and lesson plan were expanded upon to create a coherent educational program. The incorporation of new activities to the current workshop and school presentations further aided in the development of environmentally responsible behaviors

and knowledge of wetlands among students. These activities were designed in accordance with the feedback the team received from students and teachers as outlined in section 3.2. These activities can be found in Appendix C. The team's initiative was an interactive, outdoor activity such as a visit to a local wetland to increase student engagement, environmental responsibility, and knowledge of wetlands.

### **3.3.1 Environmental education methods**

The environmental education methods must result in knowledge gain, engagement, and motivation toward protection of the environmental topic at hand. Hands-on learning in a natural area exemplify a direct method of environmental education. An outdoor activity shifts the typical classroom education to a setting more closely related to the environmental topic. A tour of a natural area makes use of the environment to observe and analyze certain aspects of nature.

### **3.3.2 Mapping the wetlands**

The team referred to established wetland maps to inform students about the wetlands located within and around Benjamín Aceval (Croft-Cusworth, 2018). These maps were used in addition to a map of Benjamín Aceval schools in order to locate each school's closest wetland site. Google Earth was used as the medium for adding pins to locate specific schools and nearby wetlands. The close proximity of wetlands around the schools evoked a sense of reality within students and teachers to become more informed and involved in wetland conservation.



### **3.3.3 Developing a wetland tour**

An outdoor activity, such as a wetland tour, better engages students in comparison to an activity in a classroom. The introduction of interactive learning breaks students out of their typical education routine; this increases wetland knowledge retention. In addition, students can develop an emotional connection to the wetlands that could lead to general environmentally responsible behaviors (Lawrence, 2012).

In order to have a successful wetland tour, there must be a knowledgeable guide to lead it. The guide is important for the provision of detailed information about the environment, wetlands, and the plants and animals that reside there. Through tours, connections between the knowledgeable guides and students or other participants can be made, that help the network.

### **3.4 Establish a network around wetland conservation**

A network for wetland conservation was further developed for the students of Benjamín Aceval. The proposed educational program for students, environmental groups, and professionals was able to catalyze the network's development. The program connected students to environmental groups and professionals through the use of presentations and a wetland conservation workshop. Karugua Ha'e Tekove co-presented in some of the presentations delivered at the schools. When no Karugua Ha'e Tekove member was available to aid in the presentation, the group would be introduced by the team. Environmental groups were able to use the program as a tool to recruit new members from the community. The workshop brought

together students, teachers, environmental groups, and professionals in a one day event to discuss wetland conservation.

### **3.5 Evaluation of the project**

The success of the project was evaluated using several measures. The current team utilized the previous IQP team's questionnaire to measure knowledge, attitude, and skill prior to the presentations. Also, a questionnaire was developed to analyze students' retention of knowledge after the presentations. Any new material taught was incorporated into the new, supplemental survey. The questionnaires can be found in Appendix D.

Throughout the implementation of the educational program, specific goals measured the success. These goals included: to teach students about wetlands, environmental conservation, and environmentally responsible behavior; to teach students how to identify and develop solutions for environmental concerns; and to establish a network among groups of students and professionals. After the completion of the program, the team reviewed the goals to evaluate success. The review of these goals led to the creation of a list of recommendations for Karugua Ha'e Tekove and future projects in the area.

### **3.6 Ethics**

Appropriate measures were taken to ensure the physical and psychological safety of all participants in this project. Standard American procedures for the protection of minors were used; permission was obtained from school directors to work with their students. Participants were informed that they were not required to participate in the interview or answer specific

questions. Survey and interview responses were kept confidential through the assignment of randomized participant identification numbers. If consent has been provided by the participant, identities will be non-confidential. Responses were aggregated for data analysis to protect individuals. Before the team began to work on the project, first established ourselves among the community as familiar friendly faces. All work conducted with students, including student questionnaires and interviews, were limited to school context and supervised by local teachers.

#### **4. Results and discussion**

This project raises wetland conservation awareness through an interactive educational program taught in Benjamín Aceval schools. The educational program consisted of hands-on activities, on-site wetland tours, and songs. These activities were featured through in-school presentations and a Saturday wetland conservation workshop. The in-school presentations included songs, hands-on activities and demonstrations about wetlands, and conversations that introduced wetland information to students and teachers.. The Saturday workshop included guided tours of the Santuário de Aves de Rio Verde and presentations that were delivered by Karugua Ha'e Tekove and other environmental professionals. To determine the success of the educational program, questionnaires and responses were analyzed from the presentations and workshop. Wetland conservation awareness can be maintained after the teams departure through collaboration with Karugua Ha'e Tekove.

#### **4.1 In-school presentation questionnaire results**

A pre-presentation questionnaire measured the students' attitude, knowledge, and skill about wetlands and conservation. This served as a baseline from which to determine how much students learned in the presentation. After the presentation, a post-presentation questionnaire gauged the presentation's success. The results of the post-presentation questionnaire showed that students retained a significant amount of information. The worst performance had an 81 percent accuracy. The data for the pre- and post-presentation questionnaires can be found in Appendix E.

#### **4.2 Wetland conservation workshop**

In addition to presentations given at schools in Cerrito and Benjamín Aceval, the group developed and hosted a wetland conservation workshop attended by over 50 students. The workshop represented two schools of the nine schools visited. There were three objectives for the wetland conservation workshop. The first objective was to give local students the opportunity to learn about wetlands and wetland conservation. The second objective was to engage students and promote environmental responsibility within students through activities. The third objective was to develop a network between Karugua Ha'e Tekove and schools.

All nine schools were invited to the wetland conservation workshop. As wetland conservation education is not included in the curriculum of the schools, the workshop and the classroom presentations provided these students with the opportunity to expand their wetland conservation knowledge. The classroom presentations represent the standard pedagogy. The workshop presents similar information, but through more engaging activities that aid in educating students.

The activities in the workshop included a guided tour of the Santuario de aves de Río Verde wetland and group activities that took place outdoors. This is distinctly different from the classroom lecture pedagogy that Paraguayan students usually encounter, and it was clear that they enjoyed it a great deal because the indoor presentations by experts left them listless or even headed for the door. To motivate students to act to protect wetlands, pedagogy itself must be active.

The tours and presentations were not possible without the help of Karugua Ha'e Tekove. The organization guided the tours and introduced the team to the guest speakers that spoke at the event. Karugua Ha'e Tekove utilized their resources to invite guest speakers on topics such as amphibians, reptiles, birds, and plants. As the third objective of this workshop was to develop a network between Karugua Ha'e Tekove and the participating schools, the workshop served to bring together students and teachers to the organization and vice versa. This was a step forward to reinforce the existing network that aims to promote a sustainable wetland conservation education program.

#### **4.2.1 Workshop survey results**

The survey distributed to students upon conclusion of the workshop was intended to measure their knowledge and attitude. The survey collected information on what the students knew before the workshop, what they learned during the workshop, and what they would like to learn more about. Data on what the students knew before, and learned after the workshop measures knowledge gained. Data on what students would like to learn more about in the future measures attitude. The topics and responses were put into a matrix, then analyzed for frequency.

“Birds” and the “importance of wetlands” were the two most frequent topics before the workshop each with a frequency of 17.9 percent. This graph can be found in Appendix F. The data shows that there is already a baseline for wetland knowledge with the workshop participants. The reason for this knowledge could derive from the stress that was placed on these two topics in the team’s in-class presentations.

The graphs that depict topics learned after the workshop display a frequency of 25.7 percent for each of the topics of “animals” and “general wetlands”. This graph can be found in Appendix F. Although students were informed of animals prior to the workshop, the students claimed to have learned even more about animals subsequent to the workshop. The topic of general wetlands may comprise of most or all individual topics as it did have a higher frequency in comparison to the other topics. Regardless, this data displays increased knowledge of wetlands due to the workshop.

The topics with the highest frequency in terms of what students want to learn represent the topics that sparked students’ interests as a result of the workshop. The categories, “animals” and “plants”, had the highest frequency of 26.3 percent. Aside from these topics being attractive to students, the data also displays topics that did not gauge the interests of students to the same extent. The graph can be found in Appendix F.

#### **4.3 Developing and reinforcing a network**

The project completed last year established a baseline network between students, professionals, and the community of Benjamín Aceval. The network was formed between these parties who participated in both the lesson plan and the workshop. The main focus of the network was to raise awareness for Karugua Ha’e Tekove in the local schools. This organization

is important for the sustainability of the objective of the project, to increase environmental awareness and responsibility within the area.

Members from the organization Karugua Ha'e Tekove attended the majority of the team's presentations to the schools and the wetland conservation workshop. When they attended the presentations, the members were able to introduce themselves and the organization to the students and professors in the classrooms. When a member could not be in attendance, the presentation would include a segment where Karugua Ha'e Tekove and their objective would be introduced to the students and teachers by a member of the team.

Attendance at these presentations was important for spreading awareness for the Karugua Ha'e Tekove organization. At the end of these events, the students and teachers in the area became more aware of the group and its purpose. It was evident that some students and teachers were interested in learning more about the group when they asked more questions about them. Also, at the end of one presentation at one of the schools students were keen on taking a photograph with a member of Karugua Ha'e Tekove after a successful wetland tour.

Similarly with the workshop, Karugua Ha'e Tekove was able to promote wetland conservation and also introduce themselves to the students and teachers. Students were given the opportunity to ask questions directly to the members of the organization as well as other environmental professionals. The tours also provided students and teachers hands-on experience that should increase the likelihood of collaboration between the organization and schools in the future.

## **5. Conclusions**

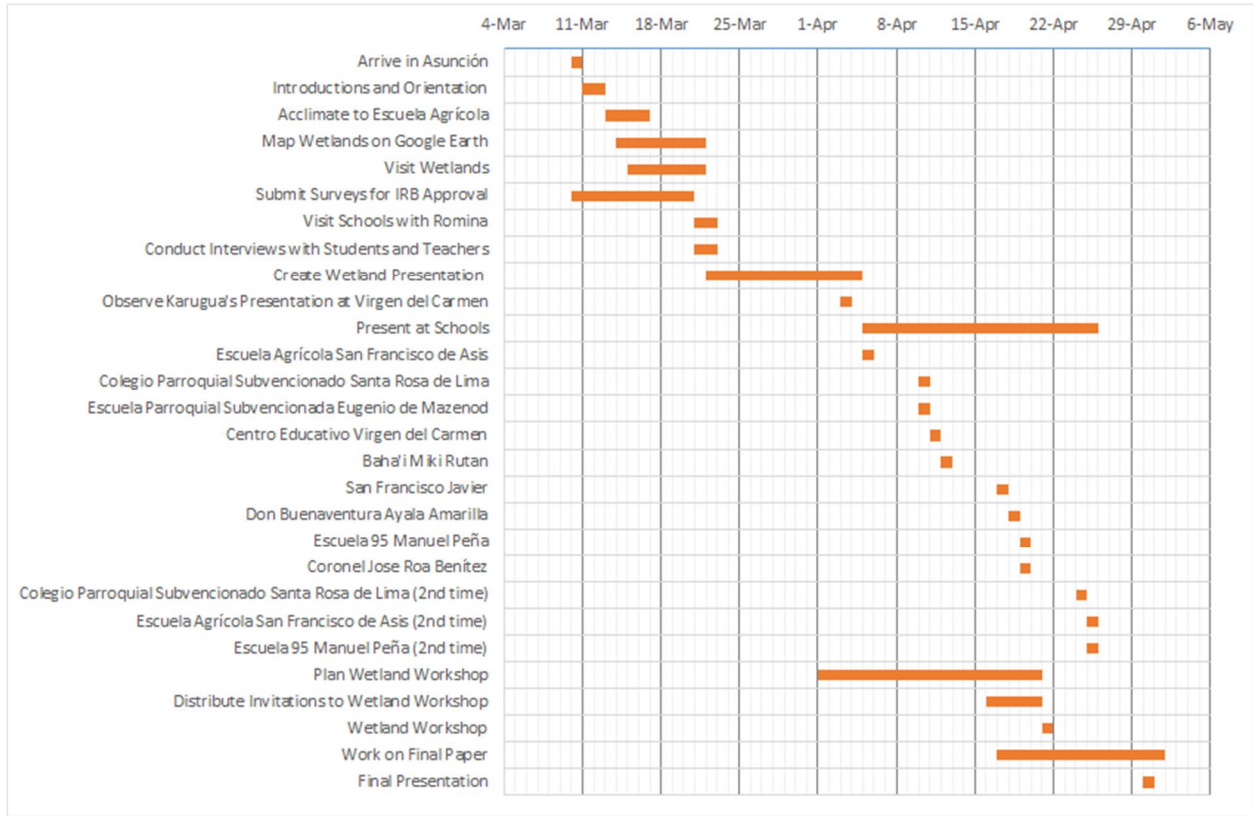
The team implemented a successful wetland conservation educational program in Benjamín Aceval. This program further developed the previous year's deliverables with a focus on student engagement. The deliverables included interactive in-school presentations and an on-site wetland conservation workshop. The results from these deliverables show increased awareness and knowledge in the participants. A foundation for wetland conservation knowledge has been reinforced in the area of Benjamín Aceval. With this foundation, there is potential for Karugua Ha'e Tekove and its mission to protect wetlands to expand its influence within the community.

## **6. Recommendations**

As a result of the project, the team developed recommendations. The first recommendation is to transfer the responsibility of in-school presentations to Karugua Ha'e Tekove, as they reside in the area year-round, are committed to wetland conservation, and have expert members. The second recommendation is for Karugua Ha'e Tekove to host semi-annual wetland workshops and/or science fairs. The third recommendation is to develop a guidebook that presents natural and cultural highlights on the wetlands and the town of Benjamín Aceval. The fourth and final recommendation is to expand the wetland conservation education program to the Qom community schools.



## Appendix A: Project Timeline



## Appendix B: Semi-Structured Interview Scripts

### Script Draft (Teacher)

Context: We are talking to you to learn about the school systems in Benjamín Aceval and environmental education in these schools. My friends and I would like to gain more knowledge about the topics of environmental education that are already in place. We also want to get your thoughts on last year's project conducted by our fellow WPI students and how we can improve it. We expect this interview to take about 20 minutes. We will keep your name anonymous. You are not required to participate in this interview. You may skip any questions you prefer to not answer. Do you have any questions for us? Are you ready to get started?

**Contexto: Nosotros vamos a hablar con usted de la sistema de educación en Benjamín Aceval y la educación medioambiental en este escuelas. Mis amigos y yo nos gustaríamos ganar más conocimiento de los temas de educación medioambiental que ya están aplicado. También queríamos saber vos pensamientos de la presentación del año anterior realizado por los otros alumnos de WPI y cómo podemos mejorarlo.**

How long have you been teaching or working in this school?

**¿Por cuánto tiempo enseñaste o trabajaste en este escuela?**

What subject(s) do you teach?

**¿Cuál materias enseñas?**

How old are the students you teach?

**¿Cuántos años tienen los estudiantes que enseñas?**

How many students are in your class?

**¿Cuántos estudiantes tienes en tu clase?**

Because we're new to schools in Paraguay, could you describe the kinds of classes that students like the most?

How about the least?

**¿Porque somos nuevos a las escuelas de Paraguay, nos puedes describir los tipos de clases que los estudiantes le gustan más?**

**¿Y el menos?**

In what ways do students participate in class?

**¿Cómo participan los estudiantes en la clase?**

How much time does it take to prepare for each class?

**¿Cuánto tiempo toma preparar por cada clase?**

What are the biggest challenges you have faced with teaching?

**¿Que eran los desafíos más prominente que has enfrentado durante vos enseñanzas?**

What environmental topics are currently taught to the students?

**¿Cual tópicos medioambiental estas enseñando a los estudiantes en este momento?**

Because we're here to learn about wetland conservation in the area, can you tell us about environmental conservation in Benjamin Aceval?

**¿Porque estamos aquí para aprender de la conservación de humedales, nos puedes hablar sobre la conservación de humedales en Benjamín Aceval?**

Have you taught any lessons relating to wetlands? Can you tell us about them?

What did the students think about them?

**¿Has presentaste lecturas sobre los humedales? ¿Puedes hablarnos de las lecturas?**

**¿Qué pensaron los estudiantes sobre las lecturas?**

*Show pictures and give reminders about what the project did last year.*

Were you involved with last year's wetland conservation activities?

What did you think of it?

Strengths, weaknesses of it?

Were you able to use it?

What would you have done differently?

**¿Estabas involucrado en los actividades de la conservación de humedales en al año anterior?**

**¿Qué te pareció?**

**¿Algunos fuerzas o debilidades?**

**¿Lo podrías usar?**

**¿Que irías diferente?**

Would it be of any help to you if we develop activities or lessons on wetlands?

**¿Sería de alguna ayuda a ti si desarrollamos actividades o lecciones sobre los humedales?**

**Script Draft (Student)**

*Record school attended, teacher, grade, age, gender*

*Show picture of the wetland animals and provide a list for the students to choose from.*

Because we're interested in wetlands that can be home to many animals, which of these wetlands animals is your favorite?

Capybara, jaguar, iguanas (reptiles), insects, birds, toucans, ask specifics? For older students. the list of animals won't be necessary.

**Nosotros estamos muy interesado sobre los humedales que habitan muchos diferentes animales.  
¿Cual animal de los humedales es tu favorito?**

Do you remember the students from WPI who taught the lessons here last year?

*Show pictures of the people and activities from last year's lesson plan; give a list of activities from lesson plan that they did.*

**¿Recuerdas los alumnos de WPI que presentaron la lección el año anterior?**

What were your favorite activities from the lesson?

What activities were not your favorites from the lesson?

**¿Cuál actividades te gustaba más?  
¿Cuál actividades no eran tus favoritos?**

*Show pictures of the people and activities from last year's workshop; give a list of activities from workshop that they did.*

What were your favorite activities from the workshop?

**¿Cual eran tus actividades favoritos de la jornada?**

What kind of activities do you and your friends wish you did more?

**¿Que tipo de actividades desean que tú y tus amigos hicieron más?**

What activities did you and your friends not enjoy as much?

**¿Cuál actividades no les gustaban tu y tus amigos?**

Some people think we should protect the environment and others don't. What do you think?

**Algunas personas piensan que deberíamos proteger el medioambiente y otros no piensan eso. ¿Que piensas?**

*For those that steer towards not protecting the environment.*

I appreciate your position. Why do you think people would want to protect the environment?

**Agradezco tu opinión. ¿Porque piensas hay gente que quieren proteger el medioambiente?**

*For those that steer towards protecting the environment.*

I appreciate your position. Why do you think people wouldn't want to protect the environment?

What kinds of things should people do to protect the environment?

**Agradezco tu opinión. ¿Porque piensas hay gente que no quieren proteger el medioambiente? ¿Qué cosas deberíamos hacer para proteger el medioambiente?**

Think of all your classmates, what do they think about the environment?

**¿Piensa de tu compañeros de clase, que piensan ellos del medioambiente?**

What activities/lessons made you think differently about the environment?

**¿Cuál actividades o lecciones te hicieron pensar diferente del medioambiente?**

What have you done differently, if anything, for the environment because of the lesson or workshop?

**¿Qué has hecho diferente por el medioambiente después de participar en la lección o el jornada?**



*Prompted image. "La Red Alimentaria" - The Food Web.*



*Prompted image. Last Year's Wetland Conservation IQP team.*

## Appendix C: Activities

### Actividad 1 - Canción

#### Letras:

**“Hu-me-da-les, hu-me-da-les,  
con-sér-va-los, con-sér-va-los.**

**Man-tener-los lim-pios, man-tener-los lim-pios.**

**Ka-ru-gua, Ka-ru-gua.”**

### Actividad 2 - Humedales esponjosos

Fondo:

El Almacenamiento de agua y la protección contra inundaciones.

Materiales:

Tapa o tapa de 28cm x 13cm

2 tazas de agua

Papel de construcción azul

Piezas de Lego

10 esponjas

Tijeras

Procedimiento:

Usando una bandeja plástica rectangular o una tapa de aproximadamente 28cm x 13cm, coloque algunas casas de las piezas de Lego adentro la bandeja. Corta una tira de papel de construcción azul y colócalo en el centro de la bandeja. Pregúnta a los estudiantes qué creen que les pasará a las casas si se vierte agua sobre el papel azul. Vierta lentamente una taza de agua en el papel de construcción azul y discuta cómo se mojan las casas porque el agua no tiene a dónde ir. Saque todo de la bandeja y sequelo.

En otra bandeja rectangular, coloque esponjas pequeñas a lo largo de los lados del papel azul. Pregúnteles a los estudiantes de qué saben lo que piensan que sucederá ahora cuando se vierte el agua en el papel azul. Vierta lentamente otra taza de agua sobre el papel azul. Discute los resultados. Relacione este experimento con los humedales. Las áreas de humedales cerca de ríos, arroyos y océanos también absorben el agua debido a su vegetación de esponja. Si eliminamos las áreas de humedales para construir casas, granjas u hoteles, el exceso de agua no tiene otro lugar adonde ir y causa inundaciones en estas áreas.

Metas de aprendizaje:

Predecir, oralmente o por escrito, qué pasará con las casas con o sin humedales;

Construya un área de humedal en una bandeja para mostrar cómo los humedales absorben agua;

y

Proporcione una definición oral o escrita de llanuras de inundación y humedales.



## Appendix D: Questionnaires

### Pre-Presentation Questionnaire (Last year's Post-Presentation Questionnaire)

Cuestionario para el comienzo de la lección  
Conservación de los Humedales

Instrucciones: Esta encuesta es anónima. Está diseñada para determinar actitudes sobre el medio ambiente. No hay respuestas correctas o incorrectas, sólo las diferencias de opinión. Escoge la opción que más refleja su opinión.

**1. Estoy a favor del ahorro de áreas salvajes remotas, como el Chaco, aunque pocas personas viven allí o no tienen la oportunidad para viajar allí.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**2. Los humedales son caracterizados por el agua, los sedimentos, y las especies de plantas y animales que viven allí.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**3. Si una planta o un animal no es de utilidad para los seres humanos, entonces no necesitamos perder nuestro tiempo tratando de protegerlo.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**4. Los humedales tienen las mismas importancias que los bosques.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**5. El gobierno debe aprobar leyes para proteger los humedales, de modo que todos sean obligados a protegerlos.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**6. Yo podría escribir una carta a mi intendente para urgirle a aloca más recursos para conservar los humedales.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**7. Estoy interesado en conversar con mis padres y otros adultos en la comunidad sobre la conservación para ayudar a conservar los humedales, específicamente los del Chaco.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**8. Yo sé dónde se bota la basura y me puedo cometer a tirarla en el área correcta para que la basura no termine en los humedales, donde puede ser peligroso para los animales que viven allí.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**9. Los humedales tienen muchos beneficios para la salud, la economía, y la biodiversidad.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**10. Yo podría organizar un grupo de mis amigos para ir a los humedales a recoger basura.**

Totalmente de acuerdo   De acuerdo   Neutro   No de acuerdo   Totalmente no de acuerdo

**Post-Presentation Questionnaire (Last year's Post-Presentation Questionnaire)**

Cuestionario para el final de la lección  
Conservación de los Humedales

**1. Las plantas acuáticas son importantes para ser utilizado como materiales de construcción, hierbas medicinales y razones cultural.**

Cierto o Falso

**2. Los aves son el animal más común en los humedales de Benjamín Aceval.**

Cierto o Falso

**3. Los humedales mantienen los niveles de agua y también filtran el agua.**

Cierto o Falso

**4. Un humedal saludable tiene mucha biodiversidad de las plantas y los animales.**

Cierto o Falso

**5. Hay oportunidades para que cada persona se involucra en la conservación de los humedales.**

Cierto o Falso

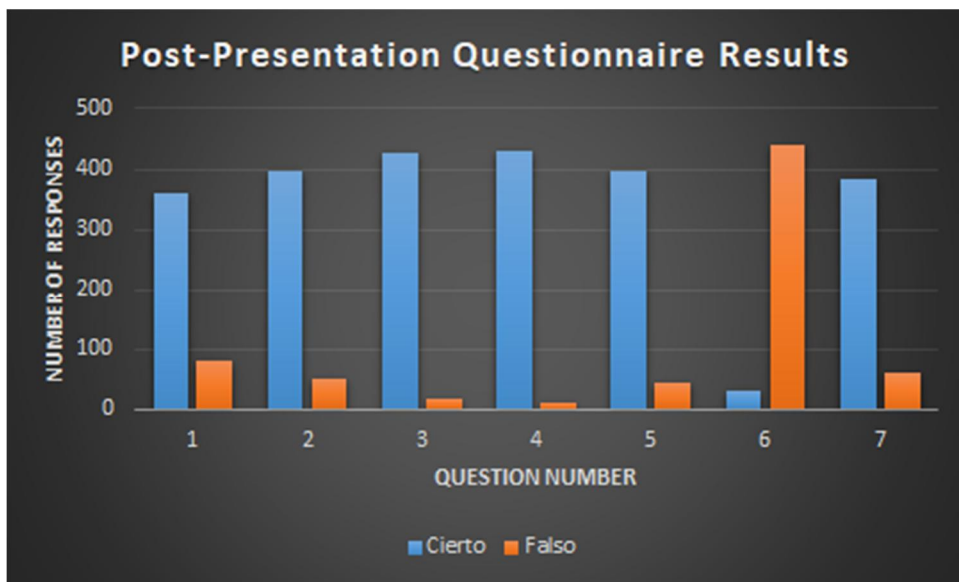
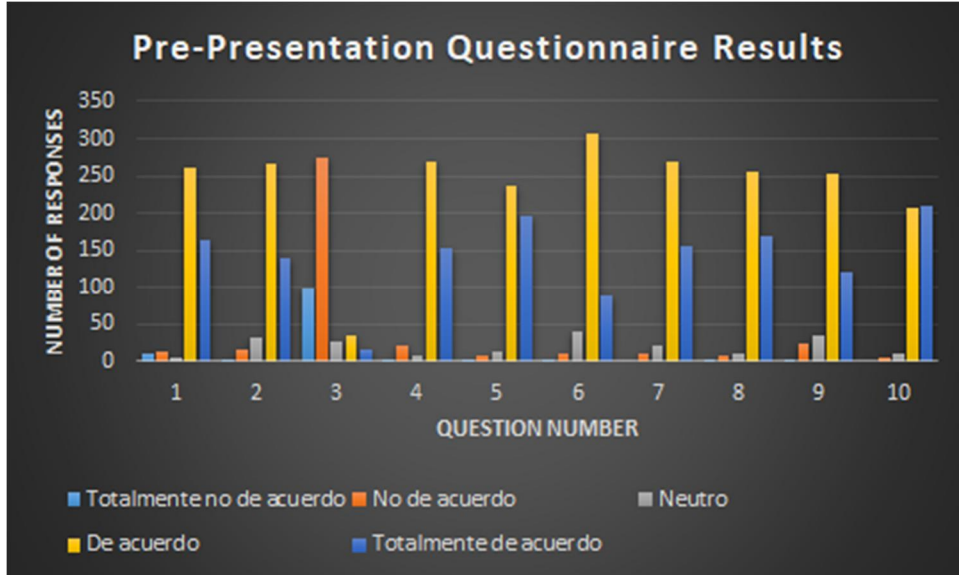
**6. Podemos tirar basura en los humedales porque saben cómo filtrarse.**

Cierto o Falso

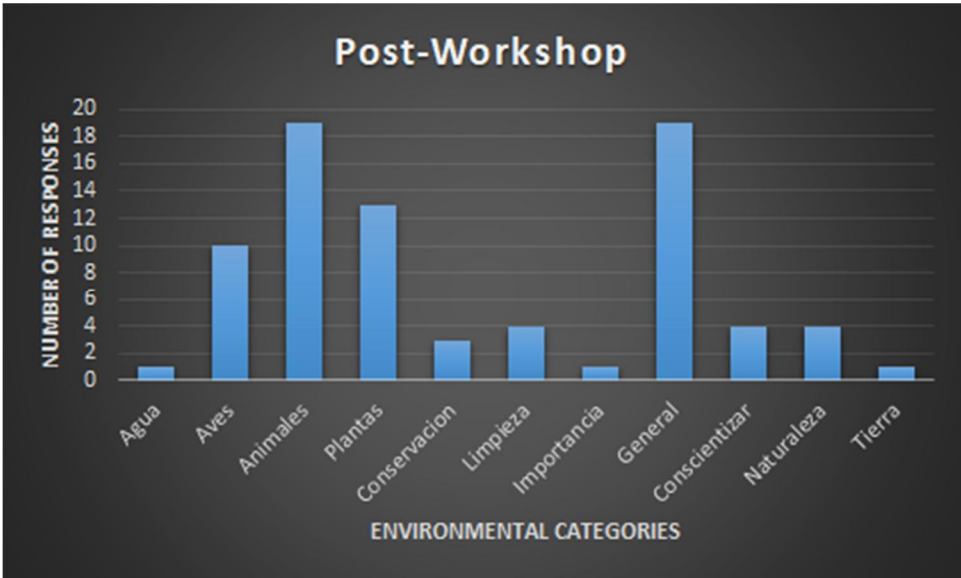
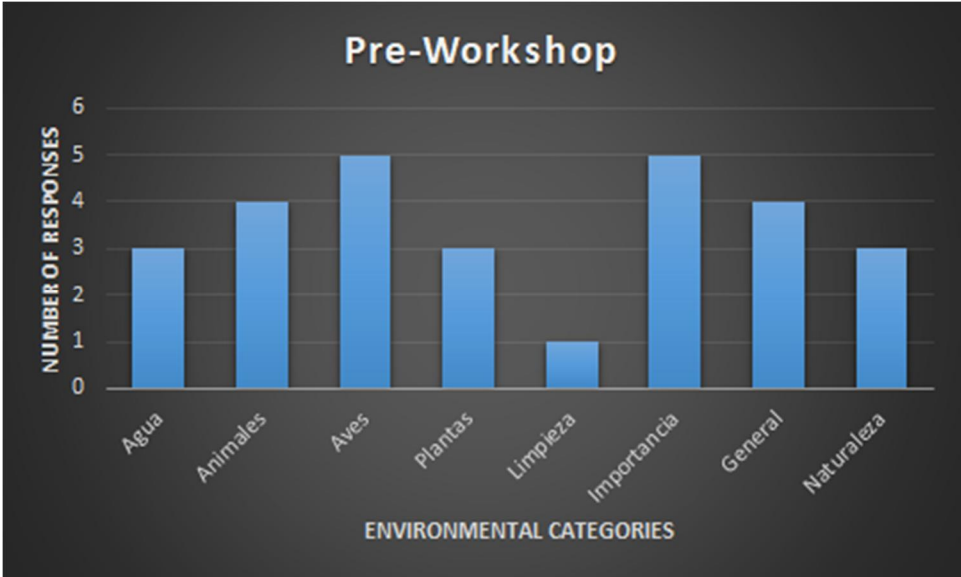
**7. Hay humedales cerca de mi escuela.**

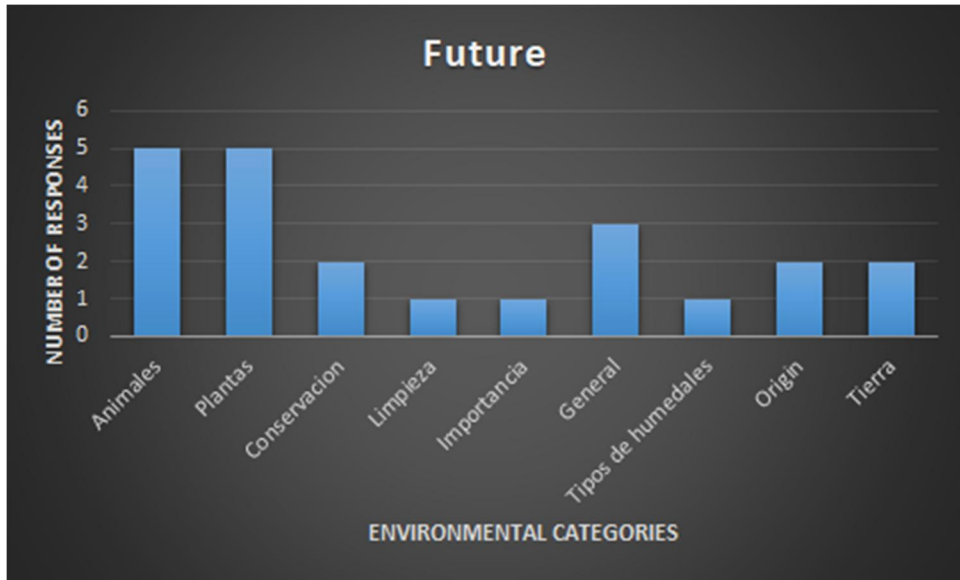
Cierto o Falso

## Appendix E: School Presentation Questionnaire Results



### Appendix F: Workshop Survey Results





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