Plant Signage: Increasing Environmental Education Opportunities at Parque Municipal Summit

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Internship Title:

Plant Signage: Increasing Environmental Education Opportunities at Parque Municipal Summit

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The focus of my project was to expand signage at Parque Municipal Summit in order to facilitate informal environmental education. In order to effectively accomplish this goal, I had to conduct relevant primary and secondary research. It was necessary to investigate and incorporate stakeholder opinion, due to the fact that little information exists in the literature pertaining to natural parks and environmental education in Latin America.

Parque Municipal Summit was founded in 1923 by the United States, as a nursery and scientific research facility. The original experiment was to test the ability of Old World tropical plants to grow in Central America. As a result, it was an important refuge for tropical plants valued for their economic, ornamental, medicinal and agricultural uses. In the 1960's and 1970's, the park was changed to a botanical garden, zoo, and a research and conservation facility. There are over 150,000 visitors to Summit Park every year, which includes students, families, tourists and more. The main services provided by Summit include environmental education, recreation, and access to a natural place for urban dwellers. There is a lot of potential for the development of educational programs at Summit.

There is a great demand for increased and improved signage at Summit Park. Environmental education is an important part of Summit's mission. Everyone can learn something from more informative and attractive signs. To exacerbate this necessity, there have been a few fires in the past couple of decades, in which all information pertaining to plants and their characteristics were lost.

The main objectives of the project are to bring together environmental education and public interest. Environmental issues are very important in modern times due to impending climate change, pollution, deforestation and many more reasons. In order to increase visitors' knowledge and interest in plants and environmental issues, I created signs with information about various trees and plants at Summit. I also made two self-guided tours in English, with information about exotic and native plants. These types of informative materials provide the general public with a type of learning commonly referred to as 'informal learning,' that is, learning that goes on outside of the classroom in a much less structured

manner. In order to accomplish these tasks, it was necessary to discover public opinion on what they believe to be interesting facts about plants.

I made a questionnaire and conducted many interviews and discussions with various stakeholders, in order to find out the opinions and interests of park visitors and employees. I received forty responses to the questionnaires, which, along with the interviews, provided a vast amount of baseline data to inform both the park and myself. I found out that visitors to Summit are most interested in biology, environmental services and human use facts about plants, and are significantly less intrigued by cultural or historical aspects. The average amount of information that people want to read on a given sign is about three lines. About a third of respondents said that they would like to read information in English on the signs. Many people also informed me that they would like to see more themed gardens and paths at the park.

I made, in total, twenty-five signs with about three facts per sign, accompanied by relevant photographs. I also made two self-guided tours. Every sign has English translations, and I made English versions of the self-guided tours. In order to discover interesting information to include in the signs, I carried out extensive research in the relevant primary literature and reference books.

There are many ways that Summit Park could increase environmental education beyond the programs already in place and the work that I have done there. It is my contention that they should create themed gardens and exhibits, containing specific types of plants such as orchids or medicinal plants. More self-guided tours would increase the availability of information to visitors and provide them with something they could read and learn from later on, and have as a souvenir of the park. This would also have the effect of increasing visibility of the park, thus bringing more people in who could learn from the diverse life forms present there.

Resumen Ejecutivo- Español

Señalización de Plantas: Aumentando las Oportunidades de la Educación Ambiental en Parque Municipal Summit

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Mis intenciones en mi proyecto fueron para desarrollar la señalización en Parque Municipal Summit para dar la educación ambiental informal a los visitantes. Para hacer esto, tenía que hacer investigaciones primarios y secundarios. Necesitaba investigar y incorporar las opiniones del público, porque no hay mucha información sobre la educación ambiental en los parques naturales de Latinoamérica.

Parque Municipal Summit fue fundado en 1923 por los Estados Unidos, como un vivero y facilidad para investigaciones científicas. El experimento original en Summit fue para probar las habilidades de las plantas tropicales asiáticas de crecer en los ambientes de Centroamérica. Por eso, fue un refugio importante de plantas tropicales de usos económicos, ornamentales, medicinales y alimenticias. En los sesentas y setentas, Summit cambió a un jardín botánico, zoológico y centro de investigaciones. Cada año, hay 150.000 visitantes en el parque, incluyen estudiantes, familias, turistas y otras. Los servicios primarios de Summit son la provisión de la educación ambiental, la recreación y el acceso a la naturaleza para los capitalinos. Hay mucha potencial de desarrollar las programas educativas en el Summit.

Hay una gran necesidad de letreros en el Parque Summit. La educación ambiental es una parte importante de la misión de Summit. Todo el mundo puede aprender mucha información por los letreros. Hubo unos incendios en el pasado, y toda la información de plantas estaba perdida.

Los objetivos del proyecto incluyeron integrar la educación ambiental con los intereses del público. El medio ambiente es un tema importante porque hay mucha contaminación y deforestación en los tiempos modernos. Para expander los conocimientos e intereses de los visitantes sobre las plantas y el medio ambiente, creé letreros para algunos árboles y plantas. También, hice algunas guías autodidactas en ingles para algunas plantas exóticas y nativas. Estas cosas dan la educación informal al público. Para hacer estas cosas, tenía que descubrir la opinión del público.

Hice algunas respuestas, entrevistas y discusiones para saber los opiniones y intereses del público sobre las plantas. Recibí cuarenta respuestas de las encuestas. Las encuestas y entrevistas suministran muchos datos importantes para el Summit y mi proyecto. Descubrí que la gente quiere aprender los datos como la biología, servicios ambientales y usos humanos de plantas más que los temas de la cultura y

historia. El promedio de cantidad de información que el público quiere leer en un letrero es tres líneas. Las encuestas me enseñaron que hay mucha gente quien quiere leer letreros y guías en ingles. Algunas personas me preguntaron cuando va a ser más jardines temáticas en el Summit.

He creado veinticinco letreros con cerca de tres hechos cada letrero, acompañado con algunas fotos. Además hice dos guías autodidactas. Todos tienen traducciones o versiones en ingles. Hice investigaciones para tener información interesante para la señalización informativa.

Hay muchas acciones que el Summit puede hacer para aumentar la educación ambiental. Sugiero que cree unos jardines y exposiciones de tipos específicos de plantas, como plantas medicinales u orquídeas. Recomiendo que el centro botánico cree y distribuya más guías autodidactas, porque suministran a los visitantes algunas cosas que podrán leer más tarde y que serán recuerdos del parque. También, letreros y guías aumentan el anuncio y la visibilidad del Parque.

III. Host Organization

Parque Municipal Summit was established in 1923 by the US government in order to serve as a scientific institution specializing as a nursery and botanical garden for native and exotic plants (Alcaldía de Panamá). The original experiments held at the park were aimed at testing the success of old world plants in Neotropical environments. These plants were selected for their use as food, medicine, economic and aesthetic crops, most notably in the US Canal Zone, but throughout other parts of the country and region as well. For instance, during World War II when the Japanese blockaded the US supply of rubber from Asia, Summit took an increased interest in rubber trees, in the case that the supply would be cut off for an extended period of time.

Academic programs and conservation efforts have been integral parts of the park's objectives and mission since its inception. In the late 1950's, it was converted to a public park much like it is today, and also received its first animal residents. In 1971, with the help of the Missouri Botanical Gardens, the park continued its work in botanical and scientific research. The park was home to such important scientific researchers as Tom Croat, who lived there while he was researching and writing the book "Flora of Barro Colorado" (Croat 1978). This is an example of just one of the many important contributions Summit has made to academia. Summit Park also sits in the important watershed of the Panama Canal, and the unoccupied tracts of land are thus important in protecting the land from deforestation and erosion (Ibañez et al. 2002).

In 1979 management of the park was reverted to Panama. In 1985 the municipality of Panama City gained control and it became the botanical garden, zoo and municipal park as it functions today. The Mayor of Panama City administers the park, with the assistance of a board of directors, which was put in place in 2005 (Tribaldos 2010). Every year, there are around 150,000 Panamanian and international visitors who come to Summit, making it the most visited park in Panama.

IV. Introduction

There is a great need for increased environmental education in modern times, due to impending climate change and other threats to the planet. Education about the way that the natural world around us works will increase the chance that we will one day learn to live in harmony with it. Panama in particular is a country where public education both within and outside of the school system is in need of development (Salas 2011). This type of education is very effective through informal learning, or learning that occurs outside the classroom through observation, interaction and the like (Gorlitz and Schmidt 2009). Students are frequently presented with opportunities to learn in formal classrooms, however they should also be given the chance to learn in another way, that is, experientially, from their own backyards, community organizations, at school and at nature parks and zoos. This must occur if we hope to pass on to them the skills they will need to solve problems and think creatively in the future.

Signs and guides are just a couple of ways to enhance children's knowledge, skills, and understanding of the plant world (King 2009). At the botanical gardens and zoo of Parque Municipal Summit in Panama, this type of learning goes on every day as schoolchildren, families, tourists and others tour the diverse biological life forms present there. Being the most frequented natural park in Panama, Summit is an ideal location for the provision of educational information, particularly in the themes of biology, history and the environmental sciences. Due to the diversity of people that visit the park, the information presented there should appeal to the broadest possible audience. Some signs exist to inform visitors of what they are

looking at, but there is a general lacking of interpretive material. There is also a demand for this information to be presented in English.

It is important to bear in mind and integrate what type of information people working at the park would like to exhibit in the signage. Just as vital is including what the audience frequenting the park desires most to see included in the signs. This will make it possible to maximize the level to which signs can act to spark interest, advocate conservation efforts and foster the advancement of knowledge (Allenstein 1990).

Interpretative Material

Creating interpretive signs of trees and plants is an important step in the development of the park as an informative and pleasurable place to visit. Signage is the means through which people are able to learn about, in this case, the plants they are looking at. This can be achieved in many ways. It is necessary to maintain communication between the designer and the stakeholders. With strong and thorough communication comes effective and constantly evolving informative signage (King 2009).

By including information that provokes interest, deeper thought and even poses questions that cause people to observe a given exhibit more closely, discussion with others and a learning process will surely ensue (Andersen 2003). Framing these facts in a simplistic, easily understood way without diluting them makes them available to the broadest possible audience. The use of graphics and images is a very effective way of making signage more appealing (Monroe 2007).

Another powerful tool for getting people interested in the exhibits they are looking at is the ability to interact with what the sign is telling them about (Arndt et al. 1993). A good example of this is the Cannon Ball Tree, for which the visitor would read a sign that tells them that the fragrance is used for perfumes, at which point they could smell the flower and enjoy its pleasing odor. By including this type of learning in signage and guides, the visitor will be able to be informed through both reading and physical observation. The beauty of this method of informal learning (signage) is that it does not require a great amount of staff attention, unlike many other forms of this type of education (Galper 1987).

People are often intrigued to learn about the various interactions that occur between flora and fauna. These types of facts are good to include not only due to high interest, but also to teach the many ecological interactions occurring all around us (Robinson 1988). For instance, by walking through a line of Cecropia trees and reading that they give shelter to Amazon Ants and provide food for diverse organisms, and are not just a common road-side colonizer, people are able to learn something about a plant they most likely see all the time as they travel around the region.

Recreation, relaxation, education, inspiration, cultural enlightenment and social interaction are common reasons why people travel to parks, and these motives must be kept in mind when putting together sign content (Ballantyne 2007). Facts included are thus meant to invoke happy thoughts and keep readers interested. This information aims to teach visitors about Panama in particular and the more interesting facts about its plants and history.

Many people visit a zoo or botanical garden as an aesthetically pleasing place to relax while getting out of the city and enjoying such as a family picnic or to enjoy nature, however there are many other services that a park can simultaneously work to provide (Wolf and Tymitz 1980). The goals of conservation and increasing general botanical knowledge are an important part of the park's mission. These issues are gaining headway in popular media and there is thus a lot of interest in such aspects of the park and its plants as environmental services provided by plants (Mazur and Lee 1993). These concepts can be encouraged through the transmittance of informal learning and formal educational programs.

Need for Signs at Parque Municipal Summit

When I first arrived at the park, it was clear that it needed comprehensive expansion of its plant signage right away. The content and quantity of plant signage in the park is relatively lacking as compared to the better-developed animal signage (Appendix D, Figure 7). Plants also generally receive less interest than animal exhibits, but are just as important ecologically. There is a huge diversity of plants in the park, and this offers a unique educational opportunity that should be taken advantage of. The proximity of Summit Park to the urban metropolis of Panama City makes it an important access point to the natural world for urbanites. Over half of the population of the federation of Panama lives in Panama City, and it is a popular tourist destination as well (U.S. Department of State 2009).

Historically, the focus of research and operations at Summit Park have centered on plants. For this reason, there is a degree of cultural heritage that is

being preserved by teaching Panamanians about both the park's history and the plants living there. This high level of biological diversity and abundance of flora in Panama is an important point of pride in the national identity of the Isthmus. Maintaining this type of aspect of a society is valued in a way that is often overlooked when an organization or group is developing a program (Montanye 2006).

Aesthetically pleasing signage also gives the park an increased feeling of consistency and order when people pass through its paths and gardens. Currently, there are multiple different formats for the signs placed around the park. Many are old and weathered, or contain little information beyond just the name of the plant. Others are more durable; however do not fit the format currently being developed. Some examples of the old signs are included in Appendix D. The layout of the signs I made has also been ordained to be of a particular design, which will maintain a consistent program for creating signage into the future.

There were several fires at the park, including one in the 1970's, during which most of the office buildings burned down and all the physical documents contained within the park were lost, according to discussions with Park Director Nestor Correa and Botanical Garden administrator Marianne Akers. This included compiled information about the inventory of plants present in the park and their biological characteristics. An inventory was taken of the plants as part of a University of Panama PhD candidate's thesis, but little information has been compiled describing most of those plant species. There is thus now a need to

produce new interpretive material for inclusion about the plants within the park's limits.

The park has also recently received a generous grant of about a million dollars from the Mayor of Panama City. The park is thus currently undergoing rapid development. These additional funds are allowing for projects for the park's expansion, such as a petting zoo, a cultural and historical museum, more parking, a new entrance, an adequate cafeteria, better exhibits, and more developed signage. The main impeding factors in this development are the limited employee numbers, worker efficiency and the bureaucracy of getting projects and their funding to come through.

V. Objectives and Hypotheses

The informative products created by this project aim to stimulate interest in the various aspects of botany and horticulture and educate the general public about the importance of plant diversity in conservation efforts. I achieved these goals through an application of biological theories, economic and ecological of botany, technical knowledge, English expertise, as well as assisting in research (primary literature and questionnaires) pertaining to park-goers' interests. The hope is that the signage and guides will increase general awareness about the topics of study emphasized within them.

It was expected that people would be most interested in the historically and biologically important and intriguing facts about the various plants. Signs and guides were thus created with this hypothesis in mind and were adapted as more and more was learned about what Panamanian and foreign visitors are interested in, as well as through consultation and discussion with park administrators and employees.

VI. Area, Location of Study

I created the products of this internship for Summit Park, and they went directly to that institution and will be used as they see fit. The signs will be placed in the botanical gardens, and along various paths and gardens around the park. I conducted interviews and discussions within the confines of the park as well. Summit Park lies on a 250-hectare piece of land, 55 hectares of which is devoted to the zoo and botanical garden. The rest is preserve land in the important biological corridor of the Isthmus of Panama.

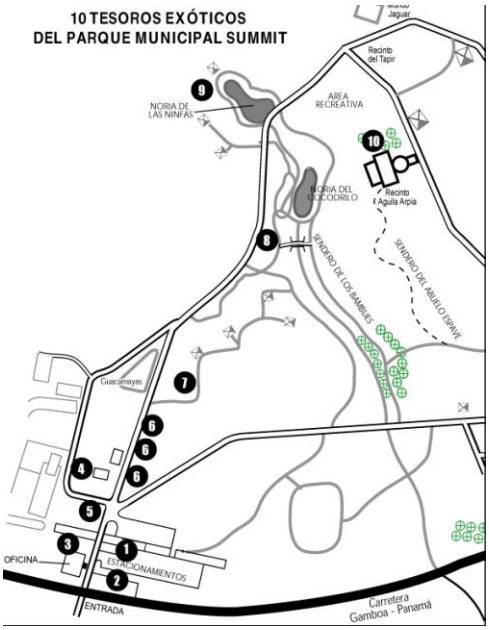

Figure 1: Map of Parque Municipal Summit

Academic and field research, meetings and other work were conducted at Parque Municipal Summit, STRI Library, Parque Natural Metropolitano, Cerro Ancon and the Ciudad del Saber. Various other parks and museums were visited as well (such as Parque Nacional Soberania, Futuro Forestale conservation land, Parque

Nacional Altos de Campana, Barro Colorado Island), but signage was not as closely analyzed as at the aforementioned sites.

Figure 2: Map of other Study Sites

VII. Methods

I created signs containing botanical, environmental, cultural and historical information about various plants at Summit Park through various means and methods. I achieved this goal through both primary and secondary research. Firstly, I had to determine how I should approach and execute making effective signs and guides. The next step was to develop my own primary research into what people involved with the park would be interested in reading about in the signage. I was then able to create the most effective possible signs. The major aspects of my investigation and work included discussions with park staff, questionnaires, giving a tour to University students, literature research, and creating signs and guides. There were many limitations imposed that constrained the ways in which I developed the project, but in the end I was able to make the necessary adaptations to create an important and useful product for the park.

Survey Methodology

Incorporating the perspectives and expectations of all the parties involved and affected by Summit Park posed a difficult task, but it was undoubtedly a very important factor for me to emphasize. It was of particular importance because most of the literature about what to include in botanical garden, museum and zoo signage was researched and published in Western cultures of Europe and North America. This information has diminished relevance in Central and Latin America, because of the very different culture affluent there. Thus, I gave due regard to the opinions and thoughts of stakeholders and the people visiting the park, so that I could establish

baseline information and determine how to approach creating signage in this relatively new field of study.

Discussions with Stakeholders

In order to effectively find out what type of content should be contained within these signs, I composed many dialogues with park administrators and staff (Murdock 2003). The aim of these conversations was to determine how to make my signs appeal to as broad an audience as possible, while maintaining an educational and informative framework. It was vital to frequently speak with my advisor Marianne Akers to assess how my project was moving along and learn as much as I possibly could about the park in my time there. Much of the park staff have been working there for many decades, and thus have an extensive knowledge of the plants there, how things have progressed over the years and more. I therefore spoke with these individuals on a constant basis. It was also very important to hear the many opinions of other actors and involved parties such as visitors and volunteers; pertaining to what values they have for the park and also to inform me about what type of information should be included in signage.

These discussions were carried out in various ways. Several formal meetings were held with my supervisors and park administrators. These focused mainly on the progression of my internship, development of my products, review of content and results, park history, park visitation, current and past programs, and much more. Oftentimes I would also hold short conversations in passing with park workers, volunteers and visitors pertaining to various topics of discussion such as

what signs have been like in the past, current educational programs, how the landscaping and gardening department functions, topics of interest for sign content, Panamanian culture, etc.

Questionnaires

In order to inform myself about what type of information should have been included in signs, I determined that it was necessary to survey park visitors about what type of content and formatting they wanted to read on informative signage. Questionnaires are a simple but effective means of determining people's thoughts and opinions about a given subject and putting into perspective my own opinions, attitudes and conceptions. There is a specific process involved with developing an effective questionnaire that will yield effective results, which I approached in the following manner, as described in Empirical Political Analysis (Brians et al. 2011). I decided upon a short and simple page of five questions to survey as many people as possible under the given time constraints, and obtain the information I sought after.

In creating the questionnaire, I developed and revised questions in close accordance with what Marianne Akers and the Botanical Garden staff thought was important information to include and discover more about. It is vital to include key stakeholders in this evaluation process in order to have an effective and helpful survey of opinions (Russ-Eft and Preskill 2001). I also integrated what my secondary research findings informed me are effective methods. I was working directly with the literature from the experts of this field of study, as well as the staff

at the park in order to have the most effective information about creating signage as possible.

The content of the questions included in the questionnaire were aimed at discovering how to design and bring together information pertaining to what people think is attractive and interesting signage. The questions asked about the overarching themes of language literacy and preference, types of plants that people are interested in learning about in self-guided tour pamphlets, types of facts about plants people are interested in, and how much information to include on a given sign. I could have asked for more responses to other questions that asked about descriptive factors such as education, occupation, age, etc., however felt that it would make the questionnaire too lengthy and would not provide relevant information for my study. Appendix C contains the full questionnaire, complete with questions and possible responses.

I was careful to word the questions in such a way that they would be easily and quickly understood and people would respond in the correct manner. Responses were typically given in the closed-ended manner given by the multiple options available to choose from, however I also left a line where people could write in responses. This would allow them to include something that particularly interested them or that we may have left out for brevity's sake.

Questionnaires were administered with park visitors of various age groups and occupations. This occurred during the Harpy Eagle fair, at which time I handed out the carried out the survey at both the Botanical Garden exhibit and the park entrance. The thought was that at any given time the most people would be visiting

Summit Park during this major event, and the most diverse demographics would be represented. A brief summary of what my intentions were and what the information would be used for was given to each and every respondent before they filled out the survey, to ensure that I was being transparent and ethical. This went along the lines of (In Spanish, except one case which was English):

> "I work with the botanical center here at Summit, and we are currently developing our environmental education programs and signage. We would like to find out the public's opinion about this subject, so would you be willing to fill out a short questionnaire to help us accomplish this?"

I was sure to ask a collective group of people that seemed to be a representative and random sample of people visiting the park, including professionals, students, families members, children, etc.

After completing the survey, I broke down the responses into coded numerical terms for ease of processing and analyzing on the computer. This was then entered into Microsoft Excel, and statistical analyses were carried out using Microsoft Excel and SPSS. The results of the data were then examined and analyzed for trends and to inform what content to include in park signage.

Tour with Southern Illinois University Students

Talk about how the tour would be carried out, topics of discussion. Then in results discuss what types of trends were seen. Then in discussion go into what this all means and recommendations can continue this, effectiveness of types of facts

given in teaching the group was a good metric for determining how effective the type of information I would include in signs was.

In March, I was employed by the botanical gardens as an English-speaking tour guide for a group of nine students on a short field study from Southern Illinois University. I took the students on a tour around the park, giving an informative lecture about the park and its plants, whilst conducting discussions, and stopping frequently to look at different characteristics of plants and share knowledge about their history. It provided an excellent academic exchange for everyone involved, as well as feedback about my own work.

This group interaction gave me the opportunity to ascertain the primary aspects of plants that the members of the group of university students were interested in learning about. This type of research is typically referred to as a group interview (Morgan 1996). It offers the benefit of obtaining a realistic view of people's thoughts and opinions. I, the moderator, was able to gain an understanding of how much and what type of information about a given plant species or characteristic that the group was interested in learning about. This was due to the comfort level of the group interaction between the University students; there were no professors or outside actors present and the informal nature of the discussion allowed for open and honest contributions (Lederman 1990). I made note of which of the various types of information they were most interested in learning about. I later analyzed and took into account these observations when designing signs.

Additionally, I handed out copies of the self-guided tours to act as a teaching aid and test their effectiveness. I was able to also observe how and to what degree

students utilized this resource. Possible themes for future guides were also ascertained.

There are potential drawbacks and flaws to this type of research. Only ten students were present for the discussion, primarily from natural sciences backgrounds. This offers only a narrow spectrum of opinion as compared to the vast diversity of people visiting the park. There is also always the chance of social biases or norms taking a toll on the progression of the discussion.

Interpretative Material Methodology

The creation of the signs and guides themselves took a lot of research and compilation of information. This was achieved through secondary research, Spanish to English translations and vice versa, formatting, and constant refinement of information.

Secondary Research

It was very important to initially spend many days reading the relevant literature pertaining to creating effective signage available in books and on online journals. This informed me of the proper way to approach my own research and process of creating a quality product. I also had to figure out what type of facts people like to read about in signs, which I read a lot about in the primary literature, and also learned about from my discussions and questionnaires, as I talked about above.

Once I had adequately determined what type of information should be included in signs and guides, I researched certain plants pertaining to their biological, environmental, human history, cultural and human-use characteristics. I conducted research using the primary literature and reference books relevant to my area of study, and lots of applicable facts were found in plant reference books (Pérez 2008; Smith et al. 2004; Gentry 1996). The information in these books was mostly biological, however there were also many other types of important facts about the plants. I also derived much of the contextual and informative materials from the STRI library at Tupper, via online journals available through McGill VPN and with resources made available by Marianne Akers at Summit Park.

I visited various other nature parks and paths to discover what other organizations are doing to increase educational opportunities. I went to Cerro Ancon, where they have a short path with signs for some trees. Parque Natural Metropolitano also contained many signs throughout its network of trails. I of course made an assessment of the current signage existing at Parque Municipal Summit. Some photographs of the signs I observed at other parks and paths are included in Appendix E. I was also observant during the many hikes that I went on that were compulsory for other courses taken concurrently with the Internship.

Signs

The signs that I made include a few brief yet interesting facts about selected plant species. This was done so that everyone, regardless of their educational background or age, could understand the signs. The common names are given in

both Spanish and English, along with the scientific name for those more interested in botany. Asking a thought-provoking question can assist greatly in helping people to become interested in and realize the importance and significance of a plant (Schnackenberg 1997). The data collected with the questionnaires was used to directly inform the content of the signs. Additionally, I was able to apply my past knowledge effectively in making the signs, and it was a fitting job in terms of my academic specialization. Due to my interest in ecology, history and botany, I had a lot of information and knowledge to contribute.

The signs have photos and graphics on them to catch the eye and help get relevant points across. These visual aids also assist in the learning process (Schnackenberg et al. 1997). The selected photographs and images are meant to explain visually the main points included in the text of a sign. Pictures also help to appeal to illiterate visitors. The pictures were provided by Summit Park, taken by myself and taken off of the Internet. Between one and three different pictures are included on an individual sign.

They are designed in a standardized format in order to maintain consistency throughout the park, which appeals to sign readers in that they can easily recognize a plant sign by its familiar design (Ransley 1988). It is vital to have signs with the right amount of information and type of content, so that readers can take from the signs impactful lessons (Wholey et al. 2004). This consists of a friendly font with green colored Spanish writing and grey colored English writing. I used the relatively simple and user-friendly interfaces of Microsoft Word 2008 to put together the signs on my computer. Although I have the expertise to use a more

advanced program such as Photoshop of Adobe Acrobat, this more simplistic program was chosen so that when signs are created later on after I have left, the current staff will have the expertise necessary to edit my work or create new signage in the same format. They are constructed out of regular printer paper and ink, which is then laminated for waterproofing and durability. I also painted a large sign for our exhibit at the Harpy Eagle Fair, in order to increase visibility of our display and inform people of our positions at the park. Examples of a few signs are attached in Appendix G; and the display sign is pictured in Appendix D, Figure 8.

These will be distributed across the park wherever specimens are presented, in a logical order that aims to catch visitors' attention. Gardens will, in the near future, be created along unoccupied corridors with multiple signs for particularly noteworthy species, such as an Orchid and epiphyte garden, a stand of Cecropia trees, and a Mahogany tree walk. There is already a Heliconia garden with a winding path in front of 'El Mundo Jaguar,' and also an 'Abuelo Espave' trail that cuts through the middle forest section of the park. Additionally there is a large nursery containing many plants and signs, complete with plants for sale. These types of gardens and displays that increase exploration of nature can greatly enhance both physical development and environmental knowledge of visitors of various age groups (Miller 2010). These are very enjoyable stops along the way for visitors, and fill in relatively unused space very nicely.

Self-Guided Tours

I was given the task of creating the English versions of two self-guided tours, one concerning ten different native plant species and the other concerning ten different exotic plant species. I was asked to do this due to my specialization in the English language, plant biology, and technical computer skills. The park provided most of the information for the guides; I simply had to create an English version that was concise yet informative.

Limitations

There were some slight logistical problems that arose over the course of the project. I had to apply my adaptive management skills, and take effective action and make helpful recommendations to my host institution about how to deal with such issues.

Some concern was raised over creating cheap yet durable signs that are impervious to sun bleaching and weathering. This could be alleviated by sun proofing sprays or perhaps sun resistant ink and paper. Such responses require funding to be run through a bureaucratic process, as well as the footwork to actually go and attain the materials. Considering the potential time saved in avoiding later replacement of signs from sun bleaching, this may be worthy cost for the foreseeable benefits.

The park is undergoing rapid expansion, and will thus be moving some exhibits and signs around. The flow from sign to sign may as a result not remain

exactly as was originally laid out. I dealt with this by not making any signs that were necessarily specific to one location.

Another unfortunate potential drawback is the chance of theft of the signs. Signs have been known to 'disappear' from around the park, so a way to solidly secure them would be advantageous to pursue. This task could be accomplished by punching a hole in the signs and using a very durable metal and wood attachment to hang them. The hanger would have to be suited to each given location, for instance, a nail to a tree or a post and screw for a bushy plant.

Much of the literature available about the plants I was making signs for focuses on the less attention grabbing or flashy facts about plants that visitors are more likely to be interested in. I had to constantly pick and choose information that would keep people reading the signs. Additionally, I had to word them such that it did not feel like you were reading from a textbook.

As a temporary student intern, it was sometimes difficult for me to help the park develop its educational programs because I did not have the relevant knowledge and experience necessary. I had only limited knowledge of the aspects of environmental education, graphic design and thus had to work hard to learn as much as I could about these topics. The culture and language nuances unique to Panama were also relatively new to me, so I had to try and break this barrier down. These challenges were overcome by frequently speaking with park workers and native Panamanians. It was therefore important to keep an open mind about what people told me, and to above all be inclusive of stakeholder opinions. Additionally, although my many meetings with my supervisors and coworkers were very

informative and productive, it was sometimes difficult to find enough time to together read through and edit my work.

Working by myself posed it's own challenges to me. The full workload fell upon my shoulders, requiring me to work extended hours. It was also very difficult to obtain feedback on the finer details of my project. I did have very helpful professors and teaching assistant that would always respond quickly with applicable advice addressing any struggles that I was working through.

Code of Ethics

I was sure to follow the code of ethics very closely to ensure that involved parties were being treated fairly and informed of my good intentions. This was especially important due to the nature of human involvement inherent to the surveying methods that I carried out. I was sure to obtain free and informed consent from any person that I conducted an interview or other survey method with. This was most vital during the administration of questionnaires to visitors during the Harpy Eagle Fair.

VIII. Results

I was able to collect a vast amount of information to increase my understanding of informal environmental education and how to most effectively present my work. The experimental results of this project include the about forty responses questionnaires that I collected, as well as discussions with visiting Southern Illinois University students and other people. The interviews have provided a way of learning exactly what visitors to the park are interested in and were conducted with exactly this goal in mind. I created informative signs and guides for various native and exotic plants present at the park. I was also able to conduct some preliminary research with my experiments for the future creation of other informative sheets, signs and/or pamphlets.

Discussions with Stakeholders

I had frequent meetings and worked very closely with my supervisor Marianne Akers about almost every aspect of my internship. These meetings made many important contributions to my end results. On our first couple of meetings she took me on two extended walking tours of the park to learn about what plant species needed signage, where they were and what type of material and information to include. As my research and work developed, we had regular meetings in order to review the content, wording, design, placement, and choices for species to be included on the signs. I also learned extensive details about the park from her, particularly the botanical garden. Additionally, she explained the internal

functioning of the park, such as working conditions, accountability, management and much more.

At the formulation of my internship, I met with Nestor Correa and we talked about the various possible internship opportunities that I had at the park, finally arriving at a consensus for expanding plant signage. He was also very informative of park history, projects going on in the park's expansion, and his correspondence with the Mayor and municipality of Panama City.

I met with Medardo Rosas on several occasions and he told me many things about the history and workings of the park, as well as some plans for the future. Some of the larger projects that would increase the quality and visitation of the park in the future include more parking lots, more exhibits, a petting zoo, a new cafeteria and entrance, and there is even the possibility that a Polish company will build a theme park on part of the vast amount of unused land owned by the park. I also talked with many other staff and volunteers about how things work and what about plants they would like to see available information developed for.

Questionnaires

There is a wealth of information that was made available by administering questionnaires upon the visitors of the park. The responses to the questionnaires consist of various types of data, depending on the type of questions and types of responses. Most is nominal data, which cannot be analyzed very deeply with statistical tests or measures (Brians et al. 2011). On the other hand, interval data gives hard numbers that may be processed for measures such as central tendency.

Summary and frequency statistics are given for all five questions contained in the questionnaire, and are good representatives of trends and characteristics of the data.

Question one and two represent nominal data, which was analyzed through frequency distributions. I coded the data to ease the processing of the information, as seen in table 3 (Brians et al. 2011). In both question one and two I found that the mode, or most common response, was Spanish. In the percent column of Table 1, there are 95% of respondents that speak Spanish and 52.5% of respondents that speak English. In the percent column of Table 2, it says that there were 87.5% of respondents that prefer to speak Spanish, and 32.5% that prefer to speak English. Note that code C represents a desire to read either Spanish or English, which was included in the calculation of both preferred languages. For question one, 'other' represents an individual who spoke Spanish and Italian. For question two, 'other' represents someone who had no preference between Spanish, English, Dutch and French. No consistent trends were seen in other languages spoken or preferred, but they included Portuguese, French, Dutch, Italian and Kuna. Each of these was indicated only once (besides French, which occurred twice). Figures 1 and 2 represent this data graphically, illustrating the portions of knowledge about each respective language for the sample population.

Table 1: Q1- Languages Spoken

	Frequency	Percent
A	18	45
B	16	40
C	1	2.5
D	4	10
E	1	2.5
Total	40	100

Table 2: Q2- Languages Preferred

	Frequency	Percent
A	26	65
B	4	10
C	9	22.5
D	1	2.5
Total	40	100

Table 3: Coding for Q1 and Q2

Language(s) spoken	Code	Preferred Language(s)	Code
Spanish	A	Spanish	A
Spanish, English	B	English	B
English	C	Spanish, English	C
Spanish, English, Other	D	Other	D
Other	E		

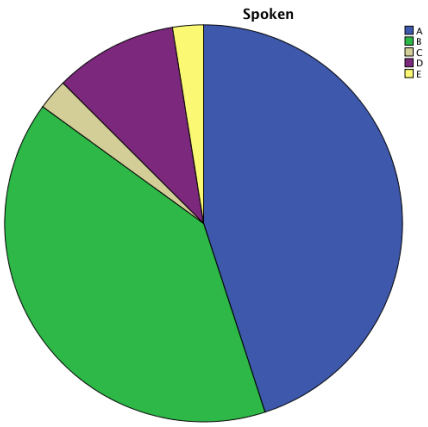

Figure 3: Q1- Languages Spoken

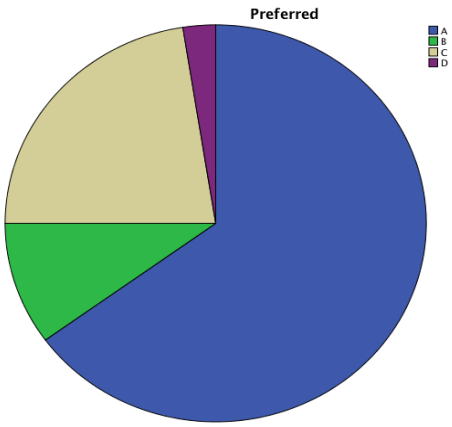

Figure 4: Q2- Languages Preferred

Question three required the ranking of ten types of plants, and thus represents an ordinal data set. The results were thus looked at through a weighted scoring system (sums and averages), as well as the average rank that the respondents gave to each respective type of plant. A higher sum of ranking scores represents a type of plant that was ranked consistently highly. There is a clear preference for some types of plants over others, based on the Sum of Scores column in Table 4. Most notably, people were interested in medicinal plants followed by fruiting trees, orchids, symbioses between plants and animals and prehistoric plants. These scores all fall above the mean of 5.5. Lumber trees and spices and condiments also received a significant amount of interest, with scores just 0.2 and 0.4 below the mean, respectively. The rest of the scores dropped off fairly rapidly. The same trends can be observed by looking at the average score and average rank columns in Table 4. One respondent also filled in the 'other' category with the response 'flowering trees' ranked highest.

Table 4: Q3- Interest Ranking for Types of Plants

Choice #	Type of Plant	Sum of Scores	Average Score	Average Rank
1	Fruiting trees	88	6.3	2
2	Spices and condiments	71	5.1	7
3	Medicinal plants	114	8.1	1
4	Lumber trees	74	5.3	6
5	Biodiesel producing plants	59	4.2	9
6	Orchids	85	6.1	3
7	Epiphytic plants	54	3.9	10
8	Prehistoric plants	80	5.7	5
9	Symbioses between plants and animals	81	5.8	4
10	Plants from other parts of the world	66	4.7	8

Many respondents simply checked off types of plants that they were interested in rather than ranking them, thus representing a nominal data set. The numbers of plant types checked off for each survey were summed up and ranked based on level of interest. I saw about the same level of interest in both analyses of question three for all plant types with the exception of biodiesel producing plants and lumber trees, which saw increased and decreased levels of interest, respectively.

Table 5: Q3- Interest in Types of Plants

Choice #	Type of Plant	Total Responses	Rank	Rank (from Table 4)
1	Fruiting trees	16	2	2
2	Spices and condiments	11	5	7
3	Medicinal plants	21	1	1
4	Lumber trees	8	9	6
5	Biodiesel producing plants	12	3	9
6	Orchids	11	5	3
7	Epiphytic plants	6	10	10
8	Prehistoric plants	11	5	5
9	Symbioses between plants and animals	12	3	4
10	Plants from other parts of the world	10	8	8

Question four asks for a response that consists of interval data, and can be tested for measures of frequency and central tendency. In the frequency details denoted in Table 6, there are similar responses for the amount of content that respondents would like to read and what was actually put into the signs that I made. This is reinforced by the measures of central tendency and standard deviation in Table 7. The median and mode are both 3, and the means differ by only 0.28. The standard deviations are also very similar. The maximum and minimum for the actual sign content is interestingly enough quantifiably one less than that of peoples' responses.

Table 6: Q4- Number of Lines in Responses and on Signs

	Responses		Sign Content	
Lines	**Frequency**	**Percent**	**Frequency**	**Percent**
1	0	0	2	8
2	11	27.5	4	16
2.5	1	2.5	0	0
3	12	30	13	52
3.5	1	2.5	0	0
4	11	27.5	6	24
5	4	10	0	0
Total	40	100	25	100

Table 7: Q4- Descriptive Analyses and Measures of Central Tendency

Statistics	Responses	Sign Content
N	40	25
Mean	3.2	2.92
Median	3	3
Mode	3	3
Std. Deviation	0.9727	0.86217
Minimum	2	1
Maximum	5	4

Question five is comprised of nominal data, which was analyzed through frequency distributions. By comparing the number of responses to the actual facts on the signs, it is clear that roughly the same proportions of types of facts are

represented in both the responses to the questionnaires and the facts included on the signs. The only significant variation from this trend that I saw when comparing the two was with the amount of biology facts included on signs, being represented proportionately more than other themes.

Table 8: Q5- Content and Interest of Types of Plant Facts

Theme	Facts on Signs	Responses
Biology	31	25
Enviro. Services	18	23
Human History	4	7
Cultural	5	10
Human Use	15	25

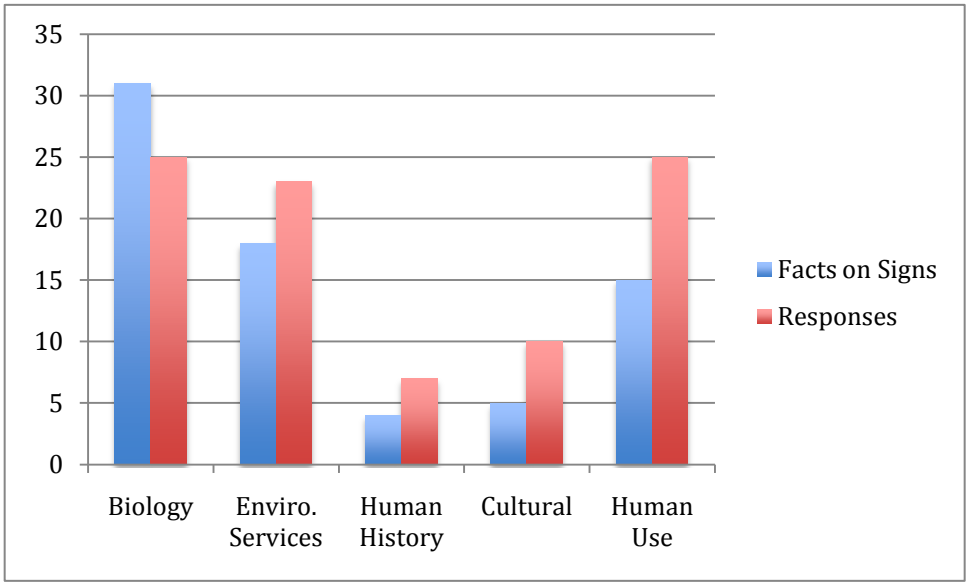

Figure 5: Q5- Comparison of Content and Responses of Types of Plant Facts

The information attained from these questionnaires was of great importance in informing me how to approach and complete the task of creating effective signage.

Tour with Southern Illinois University Students

This meeting was an enriching experience for all involved parties and provided the opportunity for academic exchanges from varying perspectives. Over the two or three hour tour, I was able to impart a lot of knowledge about many of the key plants present at summit. A good group dynamic was obtained in a relatively natural setting; it was not a forced or difficult exchange that was occurring. This allowed us to have a meaningful discussion about interests in plants

The primary subject areas that the group of students was most engaged in learning about were human use facts and information about plant biology and ecology, specifically plant-animal symbioses. Once I determined this, I would use these types of facts to segway into other interesting biological or ecological characteristics. I later would apply these findings and principles to the creation of signs as well.

Signs

There are many different plant species in the park that signs could be made for, and I prioritized by choosing ones that are particularly noteworthy or interesting. This resulted in a total of twenty-five signs for nineteen plant species. I based this on what Summit Park wanted to purvey and what the public would like to

learn about. It was also deemed important to have a lot of signs for particular species that would be on walks or garden sections of the park.

The quantity of information that the park staff and myself thought would be an appropriate amount was between one and four lines, which matches up very well with the results presented in Tables 6 and 7. This decision was based upon the thought that these many facts take about as long to read as someone would want to continue reading a given sign for. Additionally, I kept a certain level of simplicity for the signs, and did not want to crowd them with superfluous facts. This is important so that children or less educated individuals can still benefit from signage. It is also sometimes difficult to come up with much more than a few facts that would hook a reader's attention. In the case of a particularly important or interesting plant species, I split a species onto two or three separate signs. These will be placed together in a grouping of a few of the plant specimens, or in separate locations within the park.

When quantifying what type of information a given sign contained for Table 8 and Figure 3, human uses and ecosystem services could often have been considered one and the same, because they both refer to benefits that go directly to humans. Thus, economic and material uses were considered 'human use;' and conversely environmental, health and other uses were considered 'ecosystem services.'

By visiting other similar parks in the area as to determine what are effective practices at other museums and parks. When visiting other sites, I noticed that most of the informative materials for plants at most other locations contained only the

common and Latin names of the plant, typically nothing more. A few of the key species had some facts included on signs. Cerro Ancon has a short path called 'Sendero El Caucho,' which contains eight tree species labeled by their common and Latin names. There are also some guides that they have recently produced that explain some interesting facts about plant species there, one of which is attached in Appendix E, Figure 14. Parque Natural Metropolitano has a couple of flower gardens, including a Heliconia nursery and a bonsai garden. They also have a lot of nicely made signage. The signs there are fewer and farther apart than at Summit, however convey more information.

Self-Guided Tours

This double-sided guide was based on information provided by the park, and is meant as a condensed compilation for people to quickly learn a lot about many different important plants. There are two versions, English and Spanish. They are included in Appendix F.

IX. Discussion

The data that I collected offers potential for an informative analysis. This assisted me in the process of creating signage. It also offered the park and myself important baseline information pertaining to visitors' opinions and desires about what is contained within the confines of the park.

Survey of Park Visitors and Staff

The discussions I held with the staff of the park informed me of the main visions that they are trying to actualize. It became clear to me after these many conversations that the goals of conservation and increasing general botanical knowledge are an important part of the park's mission. Many people also assisted me in learning more about some key plants and aspects of the park. This learning was not just one way; I too was able to impart some of my own knowledge and ideas to many individuals during our discussions.

Talks with visitors gave me a good sense of what a desirable park would look like, as well as how to accommodate their desires with the creation of signs and guides. A few people I spoke with at the Harpy Eagle fair were very excited to find out when new gardens would be created, such as an orchid garden. Many people who approached our table at the fair wanted to know if there were any guides or literature that they could buy or take with them, indicating that they want to learn more but the botanical gardens has not yet made the necessary resources available to facilitate this desire.

The responses to the questionnaire have provided very helpful feedback and baseline information for the development of signage and guides, as well as the park as a whole. Each question yields different indicators of how the park should be developed.

By including a question about which languages were understood and preferred by respondents, I could extrapolate whether or not including English facts should be included on the signs. The 87.5% of responses to question 2 indicating a preference for Spanish show that, quite logically, this is the primary language that should be emphasized on signs. The 32.5% of responses to question 2 indicating preference to read English shows that a large portion of the sample population in fact desires inclusion of this language on signs. Furthermore, the low response rate and mixed responses for preference of other languages suggests that it is undesired by the vast majority to include anything but Spanish and English.

Question three was asked in order to ascertain what type of plants people were interested in reading about and seeing, and they accomplished just that. The botanical garden staff now knows which types of plants should be developed in terms of signs, guides, gardens, exhibits and in nursery sales.

The results of question four suggest that the amount of content that I included when making each individual sign was almost exactly what the public desires. The fact that the range of content on the signs was from 1-4 and that in the responses was from 2-5 could account for the mean of the responses being 0.28 greater than that of the actual sign content. It also suggests that perhaps I could

have added information if anything, however it was my feeling that this would have just crowded the signs with too much information.

Although the two data sets represented in question five of the questionnaire are not measured on the same metric, it is clear that they are describing the exact same thing. The same trends are seen in both of the results, indicating that the information I included in the signs consists of the type of content that the general public would like to learn about.

It is clear that there is however a slight anomaly in the data when one considers the jump in biology facts as seen in Figure 3. Although biology, ecosystem services and human use facts received about the same level of interest based on the questionnaire results, there is a higher proportion of biology facts on the actual signs as compared to other types of information. This is because it was Summit and my prerogative to enlighten the general public about the natural sciences while still catering to their interests. It is also partly due to the fact that there is simply much more information available on this field of study. Some plants that were prioritized for getting signs made for them also had few to no relevant or interesting facts about them besides their biological aspects.

I made sure that people consented to filling out a questionnaire before they actually did so. When I asked people if they wanted to participate in a survey about park signage, only a few people refused. This indicated a successful explanation of the survey and an overall desire of the people to assist in the development of environmental education programs.

Interpretative Materials

The format and content of the signs that I created were optimized through comprehensive review and research such that they would interest readers to the utmost while informing them of pertinent facts. The end product will undoubtedly convey upon the public vast learning opportunities.

My assistance in putting together these signs and guides were of great value to the park. This is because there are limited personnel with expertise in botanical sciences paired with the technical and linguistic knowledge required to fabricate effective signage and other materials in English and Spanish.

By visiting other parks, I was able gain an appreciation for just how important it is to have sufficient interpretative materials in order to facilitate even the most basic environmental education. Simply having the name of a plant, like at Cerro Ancon, is insufficient and does not offer very much information to the reader. This lack of information on signage is to some degree made up for by their recent addition of nicely designed informative pamphlets. Parque Natural Metropolitano does a fairly good job with its Guayacan trail in engaging visitors in an interactive learning experience. This is because they provide opportunities to think critically and an ordered signs with interesting facts and eye-catching graphics. This helped me to learn how to capture visitors' attention. It was also clear to me that the themed gardens at PNM were good methods of drawing visitors in.

The English self-guided tours to native and exotic plants provide a means for English-speaking visitors to learn about tropical plants. The guides also provide visitors with some educational literature that they can take with them and have as a

souvenir and educational pamphlet after they leave. This ideally has the effect of giving them a lasting lesson to carry with them. The guides also have the effect of increasing visibility of the park and advertising its services and contents to people who may not know about it.

They contain a map containing the locations of the listed plants, which allows for a distinct type of informal learning. By having to find a plant in the park when only given an approximate location on a map, the reader is given the challenge of identifying a given plant species from others, based on the characteristics given to them on the sheet. This type of activity is known to boost understanding of plant biology by engaging the party in an identification process (Lisowski and Disinger 1991).

The guides were also vital learning tools for the tour and discussion with a group of students studying at Southern Illinois University. As I walked the group around the park, I pointed out plants and said some facts beyond what the guide said, and the students could read the sheets later for more information. They were also able to identify some plants before I even had the chance to point them out. They will ideally have the same effect on other visitors.

Professional Lessons

I learned many important lessons in my time as an intern at Summit, and it was an overall positive learning experience. I believe that this feeling is reciprocal; in that both my host institution and myself benefited greatly from our joint efforts. I

was able to provide many useful products for them, and they facilitated my research and advancement of knowledge in the areas of study that I targeted.

The themes of primary and secondary research, time management, project development, public interaction, administrative correspondence and more were most heavily emphasized through the course of my internship. I learned how to adequately approach the surveying of public opinion, as well as how to use that information to create effective informative materials. I had also never made such fine-tuned interpretative materials, and gained important lessons on the subject both practically and through my research. It was vital to plan out and allot the proper amount of time and effort before the project actually occurred, as well as adaptively manage this aspect in the face of adverse events. I was in constant dialogue with my supervisors and park administrators and employees about how to carry out my task at hand, as well as to revise and improve upon my work. Additionally, I had never made such a comprehensive report on the subject of my research efforts. This entire experience will undoubtedly be an invaluable experience in my continuing academic and professional careers.

X. Recommendations

Great work is being done at Summit; however there are a lot of projects involved with its ongoing development that still need to be completed. Research, development and production of all sorts of reports and materials could be done there. Interns in years to come would have many themes they could explore and a plethora of learning opportunities. It would have also been very helpful to have a second or even third peer working with me so that ideas could have been brainstormed during meetings. This would have also made it possible for work to been created, edited, drafted and finalized from more than one perspective.

The park would benefit greatly from increased advertisement in tourism books, newspapers, in the city, in magazines and other places. By increasing visibility, they could benefit fiscally by boosting ticket sales. More importantly, if more people came to the park then more people would inherently be educated by the services and information that the park has to offer. Now that signage and guides for plants have been expanded to containing the English language, a new demographic could benefit from the informative material.

Currently, the method for fabricating and hanging signage is insufficient. I suggest that they secure and weatherproof signs more effectively by using weather- and sun-proof inks and papers, which they then laminate. These could be protected from vandalism and theft by either being hung above where people can reach, or by using a secure method of attaching them to the exhibit, such as a metal pole in the ground or a metal hole-punch and nail.

It would be a great educational service and resource for the public if the park were to create informative materials in the subjects about plants that they are interested. I came up with a set of seven types of plants that signs, guides and exhibits should be developed for, based on the questionnaire results (question three), secondary research I conducted and discussions that I held with various stakeholders. Some of these should get more priority than others, simply due to the fact that they received more interest than others. Medicinal plants and fruiting trees are the most important to increase knowledge of due to their highly elevated and consistent level of interest. Orchids, plants that have symbioses with animals, prehistoric plants, spice and condiment plants, and biodiesel producing plants also received a lot of interest and should all have informative literature developed for them at the park. The types and quantity of facts given pertaining to these plants seem to be exactly what the public would like to see, based on the questionnaire results (Questions four and five).

It is my contention that Summit Park should increase the availability of tours and educational materials about the park to visitors and school groups. These should emphasize interactive ways to get visitors to simultaneously learn about plants, think critically and enjoy themselves. They could come in the form of more than just the self-guided tours that we have been producing. Pamphlets, games, scavenger hunts, other types of tours and much more could be developed to provide more learning opportunities to visitors. Perhaps a method such as posing a question, and then revealing the answer after someone opens a small door would increase critical thinking and interaction.

Parque Metropolitano Summit is providing many great services to the public, and I hope that they continue the good work that they are doing. The employees there are well intentioned and on the whole the park is run very well. My best wishes go out to them in their ongoing efforts to educate and provide a recreational venue for visitors.

XI. Acknowledgements

I would like to firstly thank Marianne Akers for her help every step along the way; I could not have accomplished so much without her guidance and knowledge. I learned many aspects about the park from Nestor Correa and Medardo Rosas, and they were also instrumental in making the internship possible and helping me to develop a project that would benefit all involved parties. The head of the botanical gardens, Jose Valencia, and the rest of the staff at Parque Summit were always keen on helping me in any way possible and teaching me more about the park, and for that I send my gratitude. I would like to thanks my internship professors Roberto Ibañez and Rafael Samudio, as well as my teaching assistant Kecia Kerr, who always offered me indispensible advice when it came to furthering my research and managing my work-study program. Many thanks to Catherine Potvin for her work in organizing such a successful program and offering her helpful advice and comments about working, living and studying in Panama. Lastly, I would like to thank McGill University, Parque Municipal Summit and the Smithsonian Tropical Research Institution for facilitating the rich learning opportunity that I had in Panama.

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XIII. Appendices

Appendix A- Effort and Time Spent

Aspect of Project	Days, Hours
Literature Research	7, 56
Meetings/Review of Work with Summit	4, 32
Creating Signs/Guides	7, 56
Giving Tours/Interviews, Questionnaire	4, 32
Progress Report, Informal Presentation	3, 24
Final Symposium	2, 16
Final Report, Executive Summaries	6, 48
Total	33, 264

Appendix B- Budget

Activity	Cost (Balboas)
Transportation	8.80
Food	20.00
Cell Phone	30.00
Printing Costs	18.00
Total	76.80

Appendix C- Questionnaire

Encuesta

Señalización de plantas

¿Qué idiomas puede hablar?

- Español
- Ingles
- Otro (Especifique) _____

¿Cuál idioma prefiere leer?

- Español
- Ingles
- Otro (Especifique) _____

Estamos desarrollando giras auto-didácticas de plantas. ¿Cuál gira te interesas más?

(Ponlos en orden de tu interés)

- _____ Árboles frutales
- _____ Especias y condimentos
- _____ Plantas medicinales
- _____ Árboles maderables
- _____ Plantas que producen biodiesel
- _____ Orquídeas
- _____ Plantas epifitas
- _____ Plantas prehistóricas
- _____ Simbiosis entra plantas y animales

- ____ Plantas de otras partes del mundo
- Otro (Especifique) _____

¿Qué cantidad de información quiere leer en un letrero?

- Un línea
- Dos líneas
- Tres líneas
- Cuatro líneas
- Más (Especifique) _____

¿Qué clase de información quiere aprender sobre plantas?

- Biología
- Servicio al medio ambiente
- Historia humano
- Cultural
- Uso humanos
- Otro(Especifique) _____

Appendix D- Existing Signs and Gardens

Figure 6: Sign for the Abuelo Espave Trail

Figure 7: Example of Animal Signage

Figure 8: Botanical Garden Exhibit at Harpy Eagle Fair

Figure 9: Example of Old Plant Signage

Figure 10: Entrance to Nursery

Figure 11: Shaded Area within Nursery

Appendix E- Signs, Guides and Gardens of Other parks

Figure 12: Example of Tree Sign at El Caucho Trail

Figure 13: El Caucho Trail

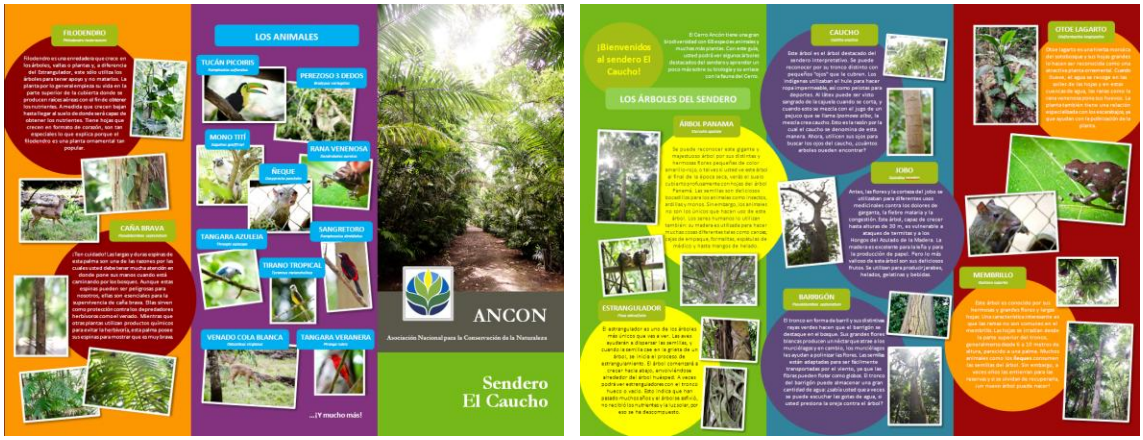

Figure 14: El Caucho Trail Guide to Plants and Animals

Figure 15: Tree Sign at STRI

Figure 16: Example of a Plant Sign at PNM

Figure 17: Guide for Nursery at PNM

Appendix F- Self-Guided Tours

10 Exotic Treasures of Parque Summit

1. Cola - ***Cola acuminata***

Every time that you drink a Coca Cola, you are enjoying the flavor of the seed of this tree. In Nigeria, the plant's country of origin, people chew the seeds because they are rich in caffeine. The Arabs of North Africa import the seeds in camel caravans in order to sell them in the markets as a stimulating delicacy.

2. Teca - ***Tectona grandis***

The Teca, native to Southern Asia, was introduced to Summit in 1926. Products made from the wood of this plant can last more than 1000 years when in contact with water. It is also highly resistant to termites. It is the preferred lumber used to make luxury yachts. Its highest value in the world market is its great use for reforestation of Panama, although it is not native to the Americas.

3. Ice Cream Palm – ***Euterpes sp.***

This palm grows in the flood plains of the shores of the Amazon River in Brazil. The people there call it Assaí. The blue pulp of the fruit is used to make ice cream and a creamy drink that is very popular amongst Brazilians. The hearts of the fruits are harvested and canned in order to make a palm salad that is popular in Europe. As a result, the palm is in danger of going extinct.

4. Pandanus - ***Pandanus sp.***

Grows on ocean shores. Like mangroves, its roots form a barrier against waves and storms. There are 400 species of Pandanus in the islands of the Pacific. The fiber is used to make clothing and rope. Some of the species have edible fruits.

5. Talipot Palm - ***Corypha umbraculifera***

This palm grows as big as a roof the size of a small house. It flowers only one time in its around 40 year lifecycle, and dies immediately afterwards. If you see a leaf that is bitten and bending over in an L-shape, you are looking at the house of the bat *Artibeus*, or tent-making bat. The bats bite the vein, which then bends over and serves as a refuge for them during the hot and bright day.

6. Palma real – ***Roystonea sp.***

This elegant palm is the national tree of Cuba. It can be recognized by its numerous soft fleshy plumes and the green upper span of the trunk. It has immense fruit production that sustains the diets of many birds.

7. Cinnamon – ***Cinnamomum verum***

The Cinnamon that we buy in the supermarket comes from the bark of this tree. When you rub the leaves, you notice a scent similar to that of cinnamon. Although cinnaomon is grown in many tropical countries, those with the best quality come from the sandy and unfertile soils of Sri Lanka. (Sri Lanka is an island to the south of India.)

8. Cannon Ball Tree - ***Couroupita guianensis***

This tree is cultivated for its beautiful flowers. They are large and grow in spikes coming from the trunk. Each flower lives for just one day. The tree is named after a fruit that looks like a cannon ball. The fragrance of the flowers is used for making perfumes.

9. Monkey Pot - ***Lecythis pisonis*** **antes** ***L. zabucaja***

The primary human use of this tree is for producing delicious edible nuts. The tree protects its seeds with a large capsule and its wood forms a pot, complete with a lid. When the seeds mature, the plant drops the lid and then seed to the soil. Small animals eat all the nuts they can because it is very rare to find a nut in one in the soil. The scent of the flowers is extraordinary.

10. Rubber- ***Hevea brasiliensis***

The white latex in the bark of this tree is the natural rubber that is mixed with the synthetic rubber used to make tires. The more natural rubber in the tire, the stronger the tire! It is also used for balloons, surgical gloves, vehicle hoses and sports balls. Each leaflet has three leaves.

Figure 18: Self-Guided Tour of Exotic Plants

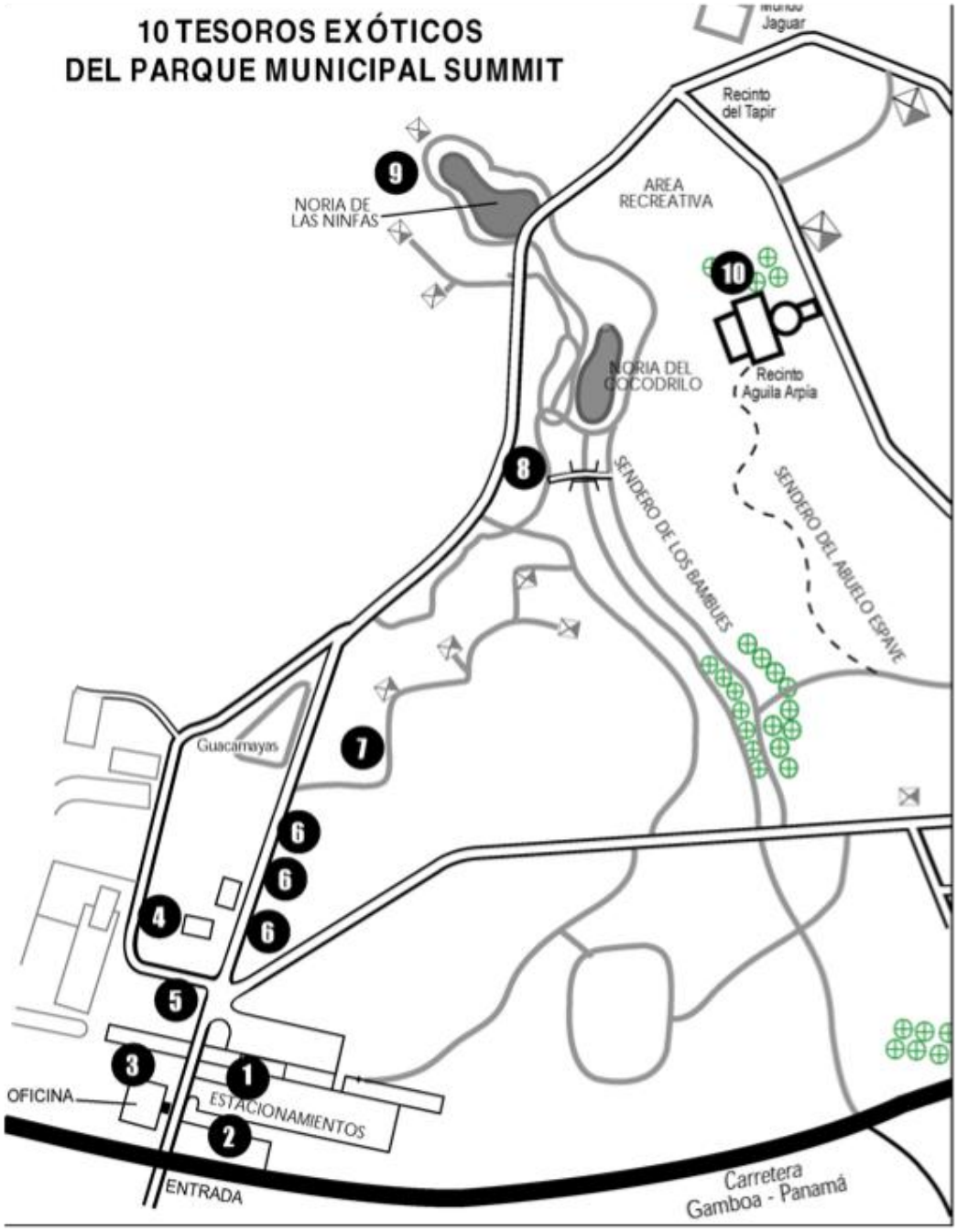

Figure 19: Map of Plants for Self-Guided Tours of Exotic Plants

10 Native Treasures of Parque Summit

1. Guachapalí – ***Samanea saman***
This gigantic tree supports a community of epiphytic plants. Look at the quantity of bromeliads and orchids living on its branches. The wood is used for making bowls and trays because it dries out without warping. Inside the legume there is a sweet and delicious paste surrounding the seeds. Some countries grind them to feed to livestock and horses.

2. Panama Tree – ***Sterculia apetala***
This is the national tree of Panama. The seeds are edible and delicious. Monkeys, squirrels and insects eat them. The oil serves as a lubricant for fine machinery and for making soap.

3. Níspero, Sapote, Chewing Gum Tree – ***Manilkara sapote***
When the Spanish came to the Americas, they found the Mayans chewing the latex of this tree. Today, we make Chiclets from it. The timber of the "Chewing Gum Tree" is very resistant to moisture, and excellent for roof rafters and wall posts. The Níspero beams in the Mayan temples have lasted for more than a thousand years.

4. Vanilla - ***Vainilla sp.***
Vanilla flavoring comes from a climbing orchid native to Panama. When the seed capsules are fermented, they are converted to the essence of vanilla that so many of us enjoy in ice creams and candies.

5. Dos Caras, Papelillo – ***Miconia argentea***
This tree is of great interest to bird lovers. It produces flowers and fruits throughout the year. The small purple fruits are eaten by birds, which disperse the seeds in all directions. How many of these trees can you find in Summit?

6. Mahogany, Kaoba – ***Swietenia macrophylla***
The hardwood of this tree is possibly the most valuable lumber in the Americas. It is the national tree of Honduras. The reddish brown wood shimmers with extraordinary beauty. It is used for fine furniture (there are probably examples in your home). It is also popular for high end pianos, drums and guitars because it produces a memorably rich tone.

7. Monkey's Ear, Corotú – ***Enterolobium ciclocarpum***
This is one of the largest trees in the lowlands of Panama. The name "Monkey's Ear" comes from the round shape of the seed capsule. Farmers encourage these trees to grow on pastures so that the cattle will eat the legumes. The robust trunk makes excellent cayucos because it does not rot in contact with water.

8. Algarrobo – ***Hymenea courbaril***
The resin of this tree produced amber during the time of the dinosaurs. Today the resin is used to make varnish. The pulp of the fruits is edible and nutritious. The lumber is used in many luxury homes.

9. Carate, Almácigo, Naked Indian – ***Bursera simaruba***
When the thin copper-colored bark is shed, the tree reveals a green layer of chlorophyll on its inner bark. The lumber is often used as posts for living fences. The resin of the trunk is useful as glue. The male and female flowers are found on distinct trees.

10. Barrigón – ***Pseudobombax septenatum***
You can recognize this tree by its swollen trunk streaked with green. The green is chlorophyll that allows it to photosynthesize when it sheds its leaves in the dry season. The flowers, with their many white stamens are reminiscent of a barber's brush. They are pollinated by bats.

Figure 20: Self-Guided Tour to Native Plants

Appendix G- Examples of Signs

Palma Talipot

Corypha umbraculifera

- Esta gran palma florece solamente una vez en su vida de aproximadamente 40 años.
- Son plantadas para su belleza y majestad.
- Los murciélagos *Artibeus* mastican las venas rígidas para crear una vivienda sombreada.
    - This giant palm flowers only once in its about 40 year life.
    - They are planted for the beauty and majesty.
    - *Artibeus* bats bite the veins in order to create a shady refuge.

Figure 21: Example of Signage- Talipot Palm

Laurel, Muñeco

Cordia alliodora

- ¿Cómo se reconoce? Tiene flores blancas y un tronco con ramificación verticilada.
- Hormigas *Aztecas* viven en sus ramitas terminales con abultamientos huecos y atacan los herbívoros del Laurel.
- Se utiliza en plantaciones agroforestales en asociación con café y cacao.
    - This tree has white flowers and upward branching.
    - *Aztec* ants live in nodes with holes in them, and attack the herbivores of Laurel.
    - It is used in agroforestry plantations in association with coffee and cocoa.

Figure 22: Example of Signage- Laurel

Vainilla

Vanilla planifolia

- Esta epifita es un miembro de la familia *Orchidaceae*, cuales tienen flores bellísimas.
- Las capsulas de semillas secas producen un sabor muy rico.
- Está utilizado para helado y otras comidas dulces.
    - This epiphyte is a member of the *Orchidaceae* family, which have very beautiful flowers.
    - The dried seed capsules produce a delicious flavor.
    - The flavoring is often used for ice cream and sweets.

Figure 23: Example of Signage- Vanilla