

Learning in the Field: Creating Interpretive Material to Contribute to Environmental Education at Parque Natural Metropolitano



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Smithsonian



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Number of Days Spent in the Field

Nursery & Trail Work		Hours			
		office	field		
February					
1	Introduction and orientation to the park		4		
11	planification, visit of the trail and the nursery and preparation		8		
25-26	Preparation and research material (STRI library)	14			
March					
3	Research material	7			
4-5	Write manual text		14		
10	Write manual text		6		
11	Write manual text		7		
12	Write manual text		6		
18-19	Write manual text		16		
25-26	Write manual text		14		
April					
5	Compile manual elements (text, pictures, etc.)		7		
6	Compile manual elements		8		
7	Design and format manual		8		
8	Design and format manual		8		
9	Design and format manual		8		
10	Design and format manual		8		
11	Visit parque Summit		5		
12	Design and format manual		7		
13	Design and format manual		7		
14	Hand in first draft to park supervisor		7		
15	Edit manual	6			
16	Hand in second draft to park supervisor	7			
19	Edit manual / Paper writing	7			
20	Edit manual / Paper writing	7			
21	Edit manual / Paper writing	7			
22	Edit manual / Paper writing	7			
23	Symposium	8			
24	Paper editing	8			
25	Paper editing	8			
26	Paper editing	5			
Total number of hours		91	148	▶	239
Total number of days		11.38	18.5	▶	29.88

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1. Introduction

The ecological and geographic features, which Panama offers its local inhabitants as well as its ever-growing tourist population, seem to be endless in variety, scope and interest. The Republic of Panama can be classified as a colossal ecosystem; the biodiversity of the country's fauna includes over 900 species of birds, more than 200 species of mammals, and almost 400 species of amphibians and reptiles (Casado, 2001). Panama is home to several parks and trail systems that function as a gateway to entry into the unique nature and wildlife of the country. Interesting and diverse flora and fauna can be found throughout the isthmus, and as a result more and more businesses and institutions across the country are dedicating significant efforts, funding, and research to insure that these natural treasures are as accessible to all as possible.

Since the high abundance of native wildlife is an inherent part of the Panamanian national identity, the Federal Government recognizes the need to preserve the country's unique natural characteristics from uncontrolled population growth and urban development. 25 per cent of the country's territory, about 2 million hectares of land, is within the national protected areas system. This land comprises 48 protected areas, 14 of which are classified as Natural parks (Casado, 2001).

According to the Panama Tourism Bureau IPAT, tourism is the fastest growing and single largest industry in Panama today. IPAT defines a tourist as someone whose minimum stay in the country is more than 24 hours and whose maximum stay is no longer than 12 months. The 2006 annual report stipulates that

the tourism industry contributed 1.45 billion dollars to the nation's economy, accounting for a significant 9.5 per cent of Panama's total gross domestic product. Although the country boasts an abundance of natural destinations throughout its geographic landscape, of the tourists who visit Panama, 85 per cent choose to remain exclusively in Panama City (McBride, 2008).

In addition to being the most visited part of the country, Panama City is also home to more than half of its 3,360,474 citizens (U.S. Department of State, 2009). This abundance of tourists and city dwellers located in the country's capital city emphasizes the crucial and immediate need for venues and activities geared towards both of these significant population groups.

Institutions situated in Panama City must recognize the untapped economic potential presented by the tourists and local inhabitants alike. Within minutes of the centre of Panama City, there is a rich and diverse natural habitat that is unique and exciting to discover. Urban tourism establishments must focus on improving and enhancing their images and public appeal in order to better cater to as large a target market as possible. This will insure the sustainability of the natural habitat in the heart of the capital city, as well as the national pride Panamanians feel toward their country and the incredible natural wonders it offers.

1.1 Host Information

The Parque Natural Metropolitano (*PNM*) is a unique organization that serves as a wildlife reserve situated in the center of a major metropolitan region. In fact, the park is the only wildlife refuge in Central America to be located within the limits of a

metropolitan city, which explains why the park is commonly referred to as “el pulmon de la ciudad de Panama”(Parque Natural Metropolitano, 2010).

Although the park spans a relatively small area (232 hectares) (Viquez & Denvers, 2006), the institution is important on a regional scale. Parque Natural Metropolitano, along with other nearby protected areas (Camino de cruces, and Sobreania Natural parks) is significant for both the conservation of “ la cuenta del canal” and also as a part of the Panamanian biological corridor (Wing and Viquez, 2003), a corridor that is of critical importance for both biological diversity and the genetic flux (Wing and Viquez, 2003).

PNM is a very dynamic organization which implements a unique management model not utilized by most Panamanian natural parks. One of the key contrasts in its operations is that PNM is not solely under the supervision of ANAM (Autoridad Nacional del Ambiente). PNM is under the supervision of a Board of Representatives from different organizations, both governmental and non-governmental. These organizations are: La Alcaldia de Panama, ANAM, Autoridad de la Region Interoceanica, la Asociación de Investigación para la Propagación de Especies Panameñas (AIPEP), el Instituto Smithsonian de Investigaciones Tropicales (STRI), la Sociedad Audubon de Panamá (SAP), las Asociaciones Cívicas Unidas (ACU) and Soroptimista Internacional Panamá Pacífico (SIPP)(Wing and Viques, 2003). This management method allows the park to remain under the ANAM law, and also to act more quickly in carrying out decisions and taking administrative action (Amelia Munioz 2010).

As a wildlife refuge, the park primarily focuses on both wildlife protection and conservation of the area. The park is home to numerous species (table 1), many of them

native to the locality. Concerning flora, the park is one of the last sites in Panama where it is possible to find the pacific tropical dry forest and its unique vegetation (Parque natural metropolitano, 2010); a forest type that is mainly threatened by urban and rural expansion. PNM also participates in many projects that are concerned with the conservation and reintroduction of native species into the park.

The park is also highly concerned with environmental education and interpretation (Wing and Viquez, 2003). PNM has taken on the view that the best way to transmit positive environmental values is through an interpretative experience in the wild (Parque natural metropolitano, 2010). In the park, there are 4 trails that are designed with the goal of improving environmental consciousness of all visitors of every age, both local Panamanians and international tourists. It is highly evident that the park is so much more than a reserve; it is also an important educational institution. Our project's goals and objectives aim to contribute to both the park's natural features, as well as the ongoing educational efforts.

1.2 History of the Park

The history of the park is one of constant change. The area where the park is currently situated was originally granted to the United States government in 1903 for the construction of the canal. Later, the American army began utilizing the park as a training camp to train soldiers in a tropical environment; in fact, even today the majority of the park's buildings remain as artifacts of that period in history. In 1983, the park territory was declared as a Curundu Recreational area. The region was later proposed as a natural park (1985), and finally in 1988 it was officially inaugurated as such. One year later, the

park was again used as a military training facility, but this time for the benefit of the Panama military force (Parque Natural Metropolitano, 2010).

The park is currently facing new challenges. The Government of Panama is now considering moving the national police headquarters into the protected area of PNM (la prensa 2 de abril 2010). This is the second instance that the government is trying to take over some of the park's land for its own use; the first time the government successfully changed the law in order to be able to construct a highway through the middle of the park. Preserving the integrity of the park is an everyday battle. The park's undeveloped land in the center of an urbanized area is the source of a litany of problems and pressure to try and convert and utilize the park's resources. Fortunately, the many Panamanian environmental groups continue to fight for its preservation (La Prensa, 2 de abril 2010).

1.3 Problems of Focus

Parque Natural Metropolitano is an extremely unique asset to Panama. The rare combination of high-undisturbed biodiversity in a large modern city offers locals the prospect of interacting with nature in an effortless manner. Many travel books, journals, and websites regard the park as one of the top tourist attractions in Panama. As a result, many international visitors come to the park in the hopes of experiencing an enjoyable hike through the unique forest setting, or observing a wide variety of fauna that reside in close proximity to the trail.

Even though the park trails and wildlife are well established and plentiful, PNM lacks the resources to make all of the park features known to its visitors. Currently there is one map of the park inside the visitor center that outlines all the trails in the park, and

there are signs at the beginning of each trail that describe the route and the total distance, but signage throughout the trails are extremely limited. Individuals who visit the park have no way of learning of the park's unique attributes that can be seen from the trails, and those that are aware and hope to view specific flora and fauna currently have no means of knowing where to look for such features.

In addition to serving as a protected natural park, Parque Natural Metropolitano participates in many activities and operations that benefit both the local environment and community. The communication and awareness between the park and its visitors is at present very poor, or virtually non-existent. Unfortunately, visitors that come to the park, both international and local, are ignorant to the park's efforts and pursuits. PNM does hold events and programs that encourage visitation by the local population, however transparency regarding park interests and actions is heavily lacking.

Despite the park's international reputation and all it has to offer to the public, PNM struggles to attract Panamanian visitors. The majority of individuals who come to the park are those that are visiting Panama from other countries and wish to go to one of the most well regarded tourist destinations in the State. 2009 park statistics demonstrated that there were more than double the amount of international tourists (39%) compared to local visitors (18%) (fig.1).

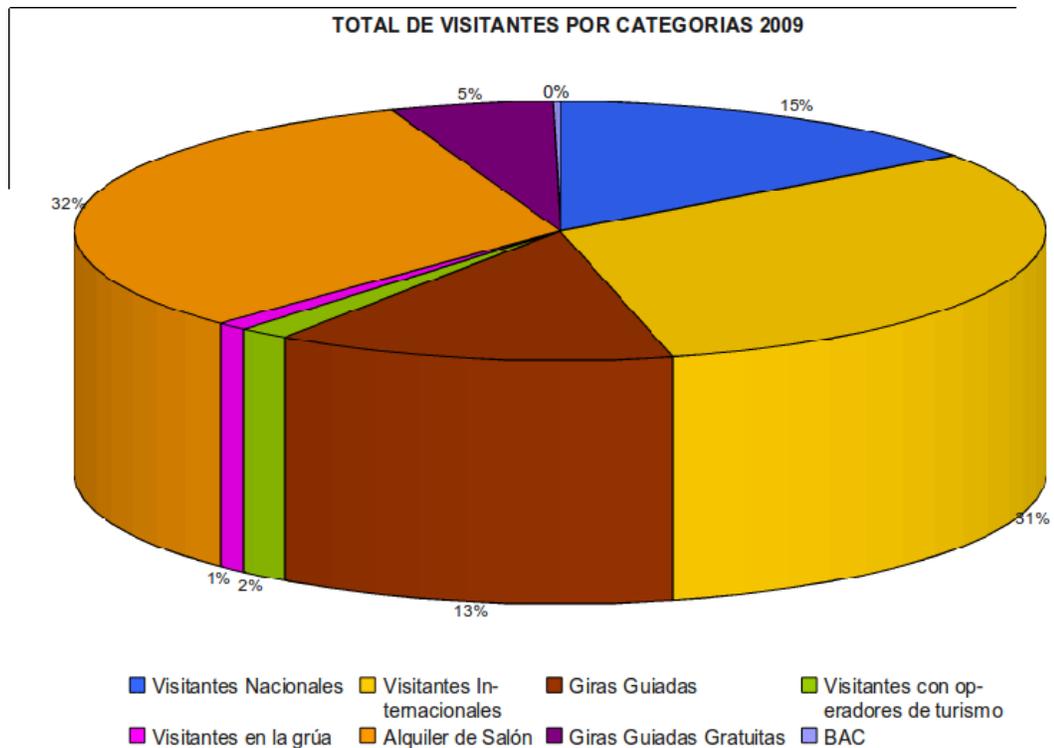


Figure 1: Total of visitors by categories in 2009 (Parque natural metropolitano 2009)

The park is a great resource for Panamanians to interact with the vast quantity of native organisms, yet few locals take advantage of this prospect. The park possesses many features that are attractive to a wide range of individuals, however many people cannot make use of these attributes. The topography and terrain of the trails is highly unstable and can be very challenging for many individuals. Only 10 per cent of the total park visitors in 2009 were above the age of 57 (fig. 2). Elderly or physically challenged persons cannot travel on any of the trails that the park contains, and thus have no way of making use of the park’s offerings. PNM must cope with the challenge of expanding the park traits so that a greater demographic of individuals can access and enjoy all that the park can offer.

TOTAL DE VISITANTES DEL PNM POR EDAD 2009

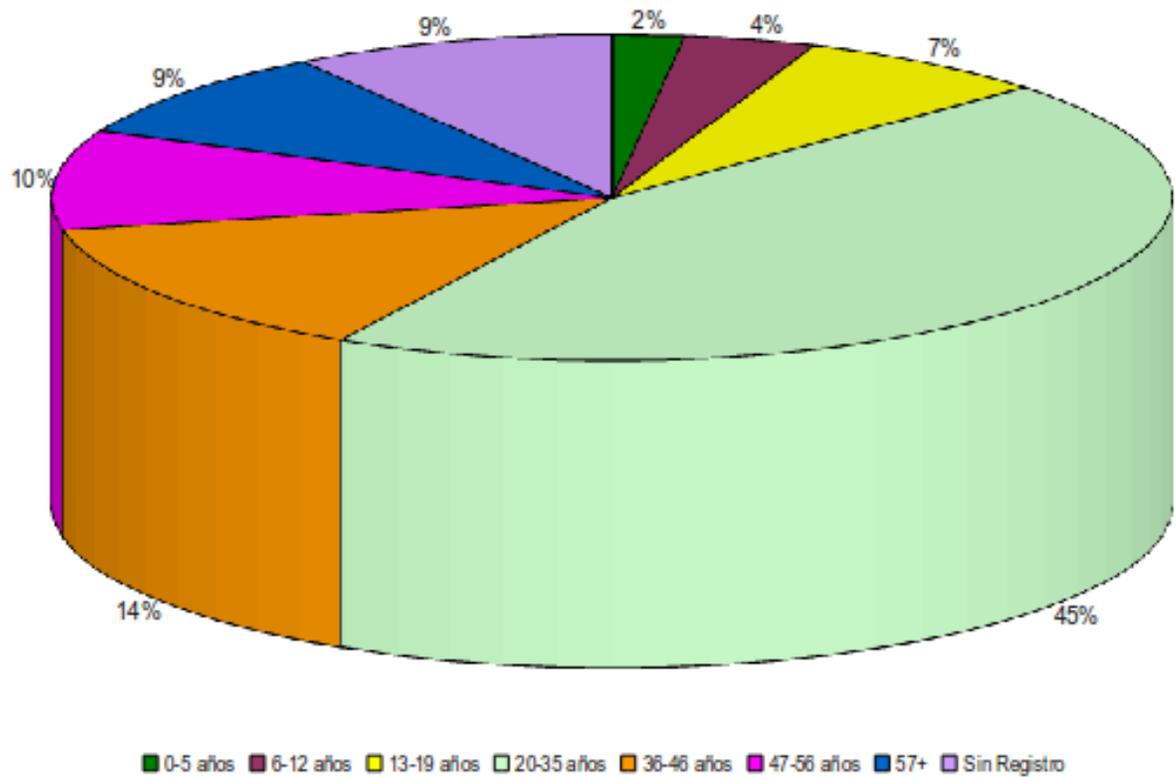


Figure 2: Visitors total by age in 2009(Parque Natural metropolitano 2009)

1.4 Justification for Selecting Project

The park’s many challenges deeply hinder its progress and success within Panamanian society, as well as the international tourism industry. It is essential that PNM focus more time and efforts towards improving the park’s relationship with the public. Increasing awareness of park attributes and activities, as well as developing new features and concepts that allow more people to participate in the park environment will directly result in increased visitation.

A pamphlet designed for people to discover the new plant nursery as well as the informative sign detailing the bonsai nursery is definitely a positive step towards improving public relations and increasing knowledge of park activities. The heliconia and bonsai nurseries are located in high traffic regions; the heliconia nursery is located between the visitor center and a trail entrance, while the bonsai nursery is located alongside a major trail. Currently no signs or literature exist that explains what these structures are or what purposes they serve.

Basic literature explaining what a nursery is and its significance for the park allows visitors to learn more about park initiatives, and also about horticultural practices. The knowledge and understanding created through our project's products translates into an increased appreciation and respect for PNM and their environmental initiatives. The pamphlet and sign also act as an outlet to provide information about the park's characteristics in an attractive and interesting manner to a wide range of visitors. These items draw attention to the park's features, and create interest and enthusiasm as well as education.

The new guayacan trail opens the park up to a completely diverse demographic, which in the past could not partake and enjoy the trails and nature of the protected region. The trail's short distance, easy access, and flat terrain allows individuals who cannot walk the other more challenging trails to still be able to enjoy the park with their companions. Despite the fact that the trail is not situated as deep in the forest as the other trails, there are still a great variety of interesting plants and animals that can be observed. Signs along the trail will inform the hikers what can be seen, and where specifically certain features can be spotted. The signs will ensure that all visitors will be able to take

pleasure in all of the entertaining characteristics of the path. The signs will also present educational material about these elements, providing an easily accessible opportunity for visitors to increase their biological and environmental knowledge.

1.5 Project Concept

Our internship work aims to improve the resources available to people visiting Panama, and in turn strengthen the Panamanian tourism industry. We designed an information pamphlet for the new heliconia nursery at PNM, as well as signs to be placed in front of the bonsai nursery and along the newly constructed guayacan trail. The heliconia pamphlet describes what a plant nursery is, and why they are utilized regularly in horticulture. The pamphlet covers a wide range of abiotic factors that are essential for plant growth and development within a nursery, including sun, soil, water, and air. Plant classifications and types are also described in the pamphlet, distinguishing between fruit plants, ornamental plants, plants used for timber, and wild plants.

The bonsai nursery sign presents information pertaining to bonsai plants and the art of producing and caring for bonsais. The sign also presents information about the history of the practice, as well as several interesting and entertaining facts.

The nursery materials are designed to be both educational and attractive to a wide range of park visitors. The content is extremely interesting and comprehensive so that anyone can access the material and benefit from the knowledge that is available to acquire. The text itself is very basic and simplistic in order to cater to a younger audience of about 8 to 12 years of age. The format of the material is highly variable in order to hold the attention of the reader and keep them interested in the information.

The guayacan trail signs will be strategically placed along the path to create an interactive walking experience for park visitors. The numbered signs will be placed so that they are directly beside the trail features that they are describing. The signs discuss Guayacan Tabebuia, native plant species, introduced plant species, Aracaceae, Bambusaea, and hummingbirds. All of these organisms can be seen on the trail, and the signs are designed to draw visitor attention to these specific and stimulating park flora and fauna. Each sign also includes a question about the subject material discussed on the following sign to try and maintain flow between sign stations, and keep visitors moving through the trail in a methodical manner. The sign text is also aimed to be attractive and understood by both adults and children. The information format is presented in a variety of formats including short sentences, bullet points, and questions in order to create some degree of variability and a high degree of interest.

2. Methodology

2.1 Field investigation

The methodology to accomplish the outlined goals and objectives is straightforward and concise. All of the processes and methods we employed in order to complete our project were in strict accordance with the Code of Ethics of McGill University. The initial stage of our project involved visiting the study sites and evaluating the features of both the nursery and the guayacan trail.



Figure 3: The "las heliconias" nursery

We went to both the heliconia and bonsai nurseries to investigate the interesting aspects of the structures. Because both of us have little knowledge regarding nurseries and how they function, we felt it would be helpful for us to consider what concepts and elements we would like to know more about regarding how a nursery functions and operates within the park. We recorded our curiosities and took note of the interesting characteristics to discuss with our supervisor when it came time to deciding on the interpretation content.



Figure 4: Guayacan Trail

We also went out to the guayacan trail site (fig.4) and took a detailed census of all the trail's interesting features. We mapped the trail and took note of the flora and fauna that was located at set locations along the trail.



Figure 5: A sign in Parque Natural Metropolitano

In addition to looking at the sites of focus, we also surveyed the literature and information on other topics in both Parque Natural Metropolitano (fig.5) and Parque Summit(Fig.6 and fig. 7). We studied how this information was presented, and what methods of publication were utilized. We also looked at trails throughout the park, who was walking on them, and what people were interested in specifically.

Lastly, we did some research on the subject of museums and what tactics are typically implemented to present information to visitors. After learning what the definition of a museum is and what classifies an institution as a museum, we decided that PNM can be categorized as such and it would be useful to investigate how museums educate the public. We accumulated several literary sources on the topic of museums and took note of the various educational strategies that these resources described in great detail.

2.2 Concept development

Following this primary stage of research, we met with our supervisor to discuss the themes that we wanted to include in our interpretative material. Our supervisor gave us specific content that she wanted us to research and write about in the interpretations, and we expressed our opinions and what aspects we thought should be presented in the material. Together we decided on the specific subjects that should be researched and explained for both pamphlets and the guayacan trail.

Considering the many topics we wanted to cover, the informative material we reviewed from both PNM and Parque Summit, and the museum research, we were able to make an informed decision as to how to present our information in a successful and effective manner. The heliconia nursery material consisted of several different topics, so a pamphlet seemed to be the best strategy for presenting a variety of different ideas in a brief and basic template. The information for the heliconia nursery was supposed to be aimed at children between the ages of 8 and 12. The content must be aimed at this age

group, and we also decided that it would probably be beneficial to include games and interactive exercises in order to hold this age group's interest.

The bonsai nursery content was mainly focused on bonsais and different elements of caring and developing these plants. We concluded that an informative sign to be placed on the trail in front of the nursery would be best in order to draw attention to the nursery as visitors walked by. It was decided that the bonsai content should be attractive and interesting to all park visitors.

Regarding the guayacan trail, we had complete freedom in deciding what content to discuss and how to present the information. We were instructed that the trail would be primarily geared towards families, so content should be aimed at all age groups, from the elderly to young children. As a result, we decided that it would be a good idea to present content on informative signs placed along the trail in a methodical way. As part of the material, each sign would contain a question related to the content to be presented on the next sign on the trail in order to keep the visitors interested and informed as they moved along the trail.

2.3 Research

After deciding on the interpretation subject matter and concepts, we began the research phase of the project. We utilized many dependable resources in order to accumulate a thorough cache of information. We began our research at the STRI library to locate sources about the different plants growing in the nursery, bonsais, and the flora and fauna that we successfully identified on the guayacan trail. We also utilized the Internet to search for credible sources, such as on line journals and articles.

After accumulating a wide literary base, we designed an interview guide for our supervisor. We wanted to investigate specifics about park visitors in order to design material for an appropriate demographic. We also wanted to research more into the park's environmental programs and initiatives. We posed questions regarding reforestation and environmental education programs in order to better understand these initiatives, and to ensure that our project will fit in with the rest of the park's activities. We also asked Amelia questions about the nurseries and trail, regarding their purpose and significance to the park and the environment.

2.4 Text Compilation and Organization

After compiling an adequate amount of information relevant to our topics of interest, we summarized and organized the content. We sifted through all the material and distinguished between what points are important to include in the products and what points can be disregarded. After composing a succinct package of information, we organized the content according to the topics to be discussed in the interpretation material.

Once all of the information was organized by topic, we began summarizing the text and writing the pamphlet and sign content. We worked to compile text into a few brief and simple phrases that are interesting and understandable by the target public. After finally compiling all of our information, we handed it into our supervisor for revision and comments. Our supervisor spent lots of time and effort looking through our work and making the appropriate adjustments to ensure that the text was appropriate in every aspect.

2.5 Formatting

Our final phase of the project involved formatting and arranging the text for the interpretations. We worked to come up with numerous different modes to present information, like images, quizzes, games, and interactive educational exercises. We also struggled with the technical aspects of assembling a pamphlet. We learned how to use the computer software program *pages* to design the pamphlet and signs, and *GIMP* (open-source equivalent of Photoshop) to modify the images that we want to include.

Pertaining to the guayacan trail, we presented a sample to our supervisor that included text on a specific trail trait on an esthetically pleasing sign, filled with many attractive colours and images. After handing in the prototype to our supervisor, she decided that the signs would be a great addition to the trail. We continued to produce signs on all of the trail content that we chose to focus on.

3. Description and Discussion of Heliconia Pamphlet

3.1 Format

We chose to utilize the pamphlet format for the heliconia nursery content in order to create a complete and to the point packet of information. The pamphlet format allows the information to be presented in a highly systematized manner, so that text can be easily separated and displayed by topic. The pamphlet material is presented on both sides of a single US letter sized sheet of paper (21.59 by 27.94 cm). Each side of the pamphlet is divided into 3 folds, so there are a total of 6 sections for the entire pamphlet.

3.2 Content Selection

All decisions regarding what information should be discussed in the pamphlet was decided by our supervisor. The nursery pamphlet primarily focuses on biological subject matter that is related to plants and the resources utilized for successful plant growth and development. The literature explains what a plant nursery is, and the significance of water, soil, air, and water for plant life. The text covers the differences between wild plants, fruit plants, timber plants and ornamental plants. The pamphlet also explains the concept of reforestation in order to touch on one of the environmental initiatives carried out in the park.

3.3 Visual Aspects

The pamphlet's physical appearance was of huge importance when designing and developing the product. We worked tirelessly to design a pamphlet that was very attractive and enticing, without being cluttered and overwhelming. We used very neutral colours and subtle colour gradient transitions for the background in order to ensure that the text and pamphlet content would remain the main focus of the viewer. All text was formatted so that the words could be easily viewed and read in a fluid manner. Topic titles were bolded and underlined to make the reader aware of a subject change.

All images were selected and manipulated in great detail. We searched for images that were accurate representations of the ideas we wanted to express, and we also ensured that these images were unlicensed as to not infringe on any copyright laws. Many of the images also include captions in order to prevent confusion or misunderstandings. Some of the pictures were manipulated to be more transparent or to be without a coloured

background so that they wouldn't draw attention away from other neighboring pamphlet elements.

3.4 Layout

The organization and presentation of the pamphlet content is highly important in producing a product that is very ordered and easy to navigate through. The first text presented is very general, explaining what a nursery is and the concept of reforestation. This serves as a broad introduction to the pamphlet before discussing the more specific topics of soil, water, air, sun, and plant types. The first portion of the pamphlet presents the information in the form of full sentences with accompanying images. Some of the text is also presented as succinct bullet points. The second portion of the pamphlet presents new information and also reviews some of the material that was previously presented in the form of games. The final folds of the pamphlet contain a word search and matching game that can be enjoyed by kids while emphasizing the ideas that were introduced in the pamphlet.

3.5 Target audience

The primary demographic that our pamphlet targets is the youth age group of 8 – 12 year olds. All text and pamphlet themes were chosen with the intentions of being very interesting and easily understood by this age group of visitors. The use of games and exercises at the end of the pamphlet aim to hold the interest of the kids, and create learning in a fun and interactive manner. In designing the pamphlet for this specific population of park visitors, we also hope that people who come to the park with kids will

be able to enjoy the pamphlet content as well, and the experience of learning about biology and horticulture with the children during their park visit.

4. Description and Discussion of Signs

4.1 Format

We chose to present the trail and bonsai nursery information in the form of signs. Each station along the trail consists of a single US letter sized (21.59 by 27.94 cm) sheet of paper. These signs will be fastened to some sort of vertical structure in the ground at very specific locations alongside the trail. The bonsai information will be presented on a single sign located directly in front of the nursery.

4.2 Content Selection

In order to decide what content to include along the trail, we went out to the study site and surveyed the surrounding flora and fauna. We identified interesting plant and animal species and took note of their specific position on the trail. The trail content focuses on Guayacan Tabebuias, native plants, non-native plants, Aracaceae (palms), Bambuseae (bamboo), and hummingbirds. Each of these topics is discussed on a separate sign.

For the bonsai sign we focused our material on explaining what a bonsai plant is and the history of this very old artistic tradition. Caring for bonsais in Panama was also described, as well as some fun and interesting facts.

4.3 Visual Aspects

Designing the visual appearance of the signs was a very intricate and time-consuming process. We selected a colour scheme that was attractive without overpowering the other elements presented on the sign. The backdrop, text font, title, and sign number use all the same formatting on all the trail signs in order to maintain consistency and a sense of fluidity among the stations.

All images selected seek to accurately represent the true organisms that can be seen on the trail, and act as a sort of guide that can be easily interpreted by visitors. The magnifying glass images along the trail are supposed to behave as a trigger for a question that is focused on content that is to be presented on the following sign. Content titles are distinguished using bold lettering as to emphasize the change in subject matter for the reader. Other visual elements like coloured squares are aimed to emphasize certain information and make it stand out from the rest of the sign components.

4.4 Layout

Each sign contains a concise amount of information on several different themes. Most of the text is positioned in very restricted locations on each sign in order to emphasize the different topics and content themes that are presented. The clear separations and divisions between different ideas allow visitors to take in lots of knowledge without feeling overwhelmed or stressed.

4.5 Target audience

Both the material and the method of presentation are aimed to appeal to visitors of all ages and intelligence. The images included and sign placement will allow individuals

to make connections between the material presented on the sign and the features that can be experienced on the trail. The text is written so that it can be easily read and understood by anyone who is able and interested to read the signs.

5. Limitations

Overall the assignment was interesting and educational to work on for the 4 month period, however we did experience several challenges and difficulties throughout the project. The primary constraint that hindered our progress and productivity was the time limitation. If we would have had more days allocated to working on the internship we feel that we could have developed and produced additional material for the guayacan trail that would have enhanced the trail experience. Furthermore, we only began work on this internship at the beginning of February; we lost the 9 days available to work in January, including an entire week dedicated to internship work. We originally were supposed to be working at Parque Summit, but due to a personnel change that occurred just weeks before we came to Panama, it proved to be very challenging to communicate with the staff to try and initiate our internship. After losing a month's time of work, we were advised to change our internship to PNM and officially commenced our project the first of February.

In addition, we encountered several challenges during the research aspect of our assignment. Our project focuses on the research of highly scientific and often complex topics, with the goal of presenting these ideas in a simple and interesting format geared to a young demographic. It was often challenging to extract information from the STRI library and Internet resources that was suitable. It would have been much more

beneficial to have had access to literature that was not solely geared to a more academic audience and individuals with a scientific background.

Communicating with our supervisor was also frequently a source of great difficulty. Amelía had many meetings and commitments that she was often preoccupied with regarding the park, and as a result it proved to be very challenging throughout our internship to meet with her and get feedback on the work we had been doing for our project. We would have been able to manage our time more effectively and would have been more continuously productive had we been receiving feedback and maintaining a constant dialogue with our supervisor, instead of only being able to communicate at unpredictable intermittent periods.

The technical aspects of producing publications for the park proved to be challenging as well, especially at the beginning of the creative process. The fact is that we do not have prior experience in creating and designing pamphlets or signs. We also had no experience in the software that was required to create these products (pages and GIMP). A significant amount of time was dedicated to learn how to use the features of the program and to create the products with many of variable features.

The element of designing our products for specific age groups proved to be much more difficult to achieve than expected. Initially we struggled with the process of composing text on highly scientific subjects that would be interesting and easily understood by young children. Even when we thought that we had succeeded in this task, our supervisors felt that the material was far too technical and it had to be further revised. We should have realized that even with our greatest efforts, it is very difficult to disregard the educational training and scientific background that we are equipped with

and really “get into” a youthful mindset in order to succeed at this task. It would have been very helpful had we the opportunity to test our material on our target audience (a focus group format) to assess the response and make appropriate adjustments in order to ensure that our final product would be well received in the future.

Although the freedom to choose the format and layout of our material allowed us to be very creative and involved in the development process, it was also sometimes the source of major frustration. The lack of guidance often resulted in a state of confusion regarding the details of our project. Perhaps if we had been provided with more concrete guidelines and objectives, the project would have been clearer and we would not have needed to meet with our supervisor as frequently.

6. Conclusions

Our internship proved to be a very interesting and valuable learning experience in many different respects. One of the most prominent things that we have learned is the true effort and creative process that is involved in producing different types of publications. The progression from having an idea and implementing the concept into a final written product is incredibly complicated and complex. The numerous phases of research, developing text, and then transforming these elements into an attractive and interesting product was much more difficult and challenging than we initially assumed.

Although the process of designing our products was challenging and often frustrating, creating products that we know will improve the park features, environmental education, and its attractiveness to visitors is incredibly rewarding. We expect that the heliconia nursery pamphlet, bonsai nursery sign, and guayacan trail signs will serve as

useful educational tools for anyone who comes to the park eager to learn about nature and environmental subject matter for many years to come. We hope that the knowledge visitors obtain through our products will spark interest in biological and environmental issues, and perhaps enable individuals to take a more active and responsible role in society in relation to these matters.

The original objectives of the pamphlet and signs were to strengthen the connection between the park and its visitors. This is an important element to focus on, as it is this bond that attracts people to come to the park and enjoy the trails and nature of the institution. This material will enhance the park elements, and the public's overall park experience. We hope that this improved relationship and connection will translate into increased visitation, as well as public support on controversial social and political issues that PNM will face in the future. In designing comprehensive literature and information that can be enjoyed by visitors of all ages, we anticipate that our project will improve the visitor experience, promote scientific and environmental knowledge, and promote PNM's amazing and unique natural characteristics.

7. Acknowledgements

First, we want to thank everyone at Parque Natural Metropolitano for providing us with such an enjoyable work environment, and for all of their hard work and dedication. A special thank you to our supervisor, Amelía Muñoz, jefa de planificación y conservación Ambiental at Parque Natural Metropolitano. Amelia's support, feedback, and constant help were always appreciated throughout the project. We also want to thank Raphael Gomez, Jefe de Educación Ambiental. His revisions of our text and for his

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Appendix I: Guayacan trail map & Census

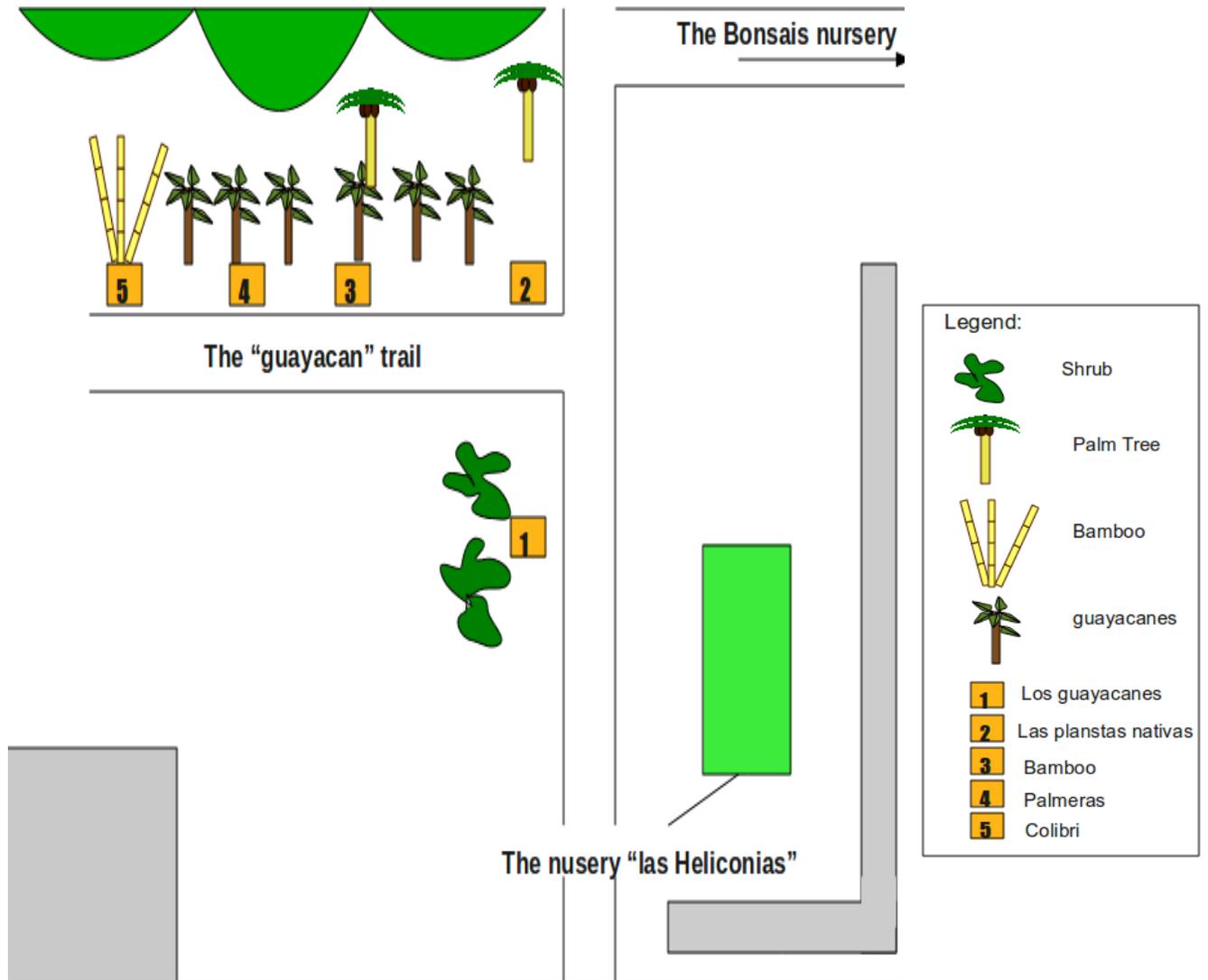


Figure 8: Map of the guayacan trail

Appendix II: Museum Research Results

A museum is defined as “ institutions created in the public interest. They engage their visitors, foster deeper understanding and promote the enjoyment and sharing of authentic cultural and natural heritage. Museums acquire, preserve, research, interpret and exhibit the tangible and intangible evidence of society and nature. As educational institutions, museums provide a physical forum for critical inquiry and investigation (Museum definition, 2010)”.

The important objective of a museum is to maximize the information flow between the tourist and the institution through the medium of the exhibit (Borun, 1997). The effectiveness of that communication (between the institution and the visitor) relies on the ability to construct images, convey information, and engage the visitor, through either social exchange or more traditional textual and usual methods (Goulding, 1999). A good exhibit presents an interesting phenomenon that is usually not accessible to the visitor (Feher and Elsa, 1990), an experience different from a school learning experience. Students often work through explanations before learning from first hand experiences, while modern science museums do exactly the opposite, prioritizing experience above explanations. Museums have to take advantage of the fact that the visitor is in direct contact with what they learning, and for that reason they must be able to have an interactive experience instead of a simple one way learning relationship (Borun, 1997).

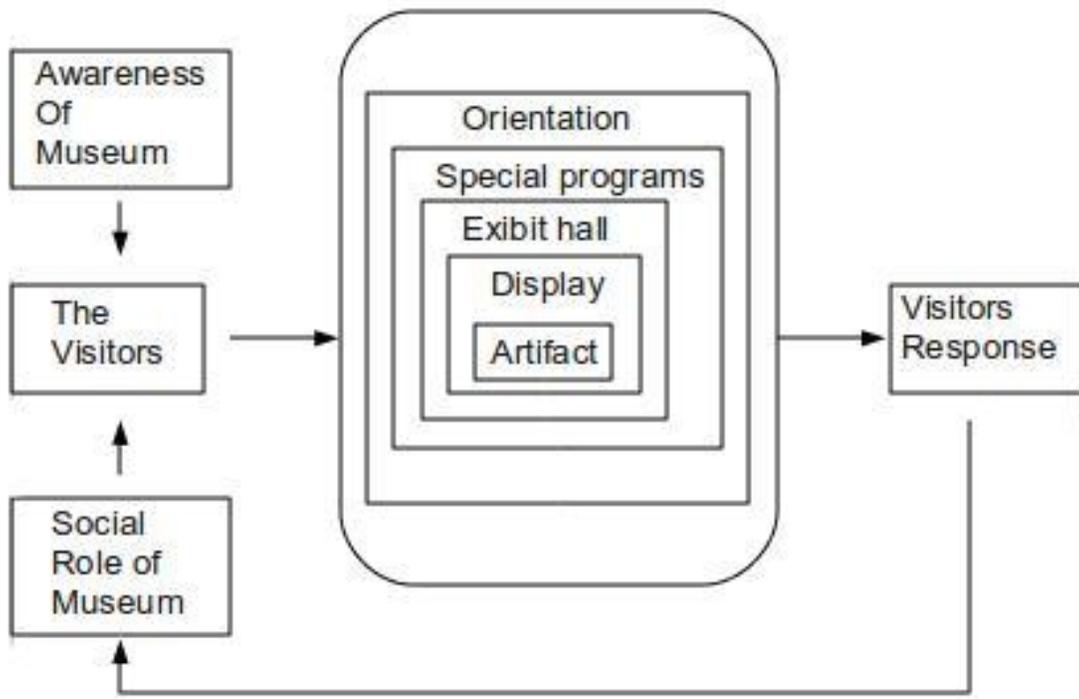


Figure 9: Model of a museum visit from Borun 1997

Appendix III: Interpretation Research Results

Guayacanes

The *Tabebuia guayacan* live for hundreds of years, and they grow slowly to reach heights of up to 50 m and 1.5 m trunk diameter (Forest Generation, 2007). The tree has the hardest, heaviest, and most durable wood of any neotropical tree. For this reason, *T. guayacanes* are a very important resource for the timber industry (Gentry, 1992), and they are one of the most valued plant genres in Latin America. The wood is heavy, dark brown, and extremely hard (Forest Generation, 2007). In the dry season the tree sheds its leaves, but they return again quickly at the start of the rainy season. The yellow trumpet-like flowers open up between February and March, and normally the tree bears fruit 25-60 cm long at the end of March (Forest Generation, 2007).

These beautiful trees originate in Central America, as well as other countries in tropical America (Forest Generation, 2007). *T. guayacans* can be found from Mexico to Peru in lowlands of humid to very humid climates. In Panama *T. guayacans* have been recorded in Colón, Chiriquí, Darien, Panama city, and the canal area. Timbers of these species can be found in the colonial cathedral in Panama Viejo, and almost all the trees that remain standing in Lake Gatun fifty years after flooding from the Panama canal are this species (Gentry, 1992).

Aside from being beautiful and sturdy, they also offer relief for several health problems. Tea made from the tree has been used to treat urine and kidney trouble, and in Latin America the tea has also been used to treat tuberculosis (Forest Generation, 2007).

Bonsais

The art of raising bonsais originated in China 1000 years ago (Menéndez, 2004), and then spread to Japan and ultimately to the rest of the world (Bonsai Trees Beginner, 2006). The literal translation for the word bonsai is tray planting (BonsaiSite, 1997), and this is essentially what is involved in growing and maintaining a bonsai tree. The theory behind the caring and grooming of bonsais comes from the idea that the tree and the pot are two parts of a single unit where the shape, texture and color of either of these elements compliment the other (An introduction to Bonsai, 2010). Bonsai practitioners believe that heaven and earth both exist within one container – the bonsai is physically independent of the earth because the roots aren't planted, but it's still a part of nature (BonsaiSite, 1997).

In order for a tree to be considered a bonsai, three conditions must be met. The first is that the bonsai appearance has to resemble the appearance of the true fully-grown tree (Menéndez, 2004); the bonsai must look natural and not show the intervention of human hand (Bonsai d'intérieur 2010). Second, the bonsai must be beautiful to anyone who views it. Finally, the bonsai must exhibit some sense of maturity, either by simulating age or recreating roots, trunk, or branches (Menéndez, 2004). The art of growing bonsais can be done as an interest, hobby, or profession. Individuals must shape or eliminate every branch and twig until the desired image is achieved, and then continue to maintain and improve the image by pruning and trimming regularly. Most bonsais are over 25 cm tall and up to 1m in height, and if they are given the right amount of water, air, light, and nutrients they can live for hundreds of years; in fact, it is very common for the bonsai to outlive a full size tree of the same species. There are two basic styles of bonsais, classic and informal. In the classic style the trunk of the tree is wider at the base

and tapers off towards the top, and the informal style is the exact opposite of this (BonsaiSite, 1997).

Virtually any plant can be used to create a bonsai, regardless of the size it grows to be in the wild (Basic Requirement Of A Tropical Bonsai Plant.). For tropical native species, these plants grow faster and continuously compared to those in temporal conditions (Menéndez, 2004). Because of these differences, bonsais of these species can be modified during the whole year. The most popular tropical species that are used to produce bonsais are the ficus, bougainvillea, and serissa (Bonsai Trees Beginner, 2006). In Panama, candidate species include macano, espino Amarillo, pitecelobio, caliandra, tamarindo, limoncillo, agallo, podocarpo, and many others (Menéndez, 2004).

Nursery

The first days of a plant's life are most critical in determining its survival. In order to increase a plant's chance of survival into adulthood, seedlings are often grown in plant nurseries. A plant nursery is a structure that provides ideal environmental conditions for the growth and development of plants (Von Humbolt, 2008). A nursery is a place for selecting, producing, and propagating a large amount of plant species. Growing plants in a nursery also allows for effective prevention and control of predators and disease (los viveros, 2010).

When designing a plant nursery, many different factors must be taken into consideration. The site of the plant nursery is of great significance, because this will determine the amount of sun, shade, and wind that will be available to the growing plants (los viveros, 2010). When considering the site where the nursery should be located, the

following aspects must be considered: accessibility into the nursery, water supply, its orientation on the ground, and the topography of the region.

Lots of focus is put on maintaining ideal physical environmental characteristics within the nursery. Plants usually need an abundant and constant supply of water that is readily available (Los viveros, 2010). The water quality is also of high importance in irrigation practices. Other important abiotic factors include soil temperature, amount of light and shade, and climatic conditions (Von Humbolt, 2008).

Plant types

Ornamental plants are those that are typically grown in gardens and homes. They mainly serve some sort of visual purpose, like displaying flowers, leaves, fruit, stems, or bark. This is a typical plant classification used to distinguish this class of plants from utilitarian and crop plants. These types of plants are a common component of adventure parks, children playing ground rest areas, and other social events. The beautiful trees planted along the road provide unquantifiable shade and comfort for pedestrians, while keeping the road intact from solar radiation and other inclement climatic conditions (Baiyewu et al., 2005).

In addition to their visually attractive uses, ornamental plants have a wide spectrum of uses in environmental management. Ornamental plants have been integrated in a variety of different places to help control the fast changing landscape due to a range of processes, such as erosion by wind and water. Ornamental plants can also be used as cover mat on eroded areas, to help eliminate dust, and to reduce glare, air pollution, heat buildup, and noise pollution (Baiyewu et al., 2005).

Fruit producing plants bear fruit that is used or consumed by people. The fruit is the structure of an angiosperm that develops from the ovary and accessory tissues and surrounds and protects the seeds. Flowers are the reproductive organ of the plant that produces fruits and seeds (Baiyewu et al., 2005).

The process of fertilization initiates both seed and fruit development. Seeds develop from the ovules, and simultaneously the ovary tissue undergoes a series of complex changes that results in the development of the fruit. As the ovary develops into a fruit, its walls usually thicken and become differentiated into three distinct layers that are collectively known as the pericarp, and this structure surrounds the developing seeds. The outermost layer is the exocarp, and this structure often is only composed of the epidermis. Next is the mesocarp and this layer varies in thickness, and the innermost layer is the endocarp, which also shows great variation from one species to another (Life Science Reference, 2010).

Fleshy fruits contain sugars that attract animals and disperse the enclosed seeds to different locations once they have passed through the digestive system of the animal. Non-fleshy fruits depend on other seed dispersal mechanisms (FruitsInfo 2010).

All fruits may be classified into three major groups on the basis of the number of ovaries and the number of flowers involved in their formation. Simple fruits develop from a single matured ovary in a single flower. Aggregate fruits consist of a number of matured ovaries formed in a single flower and arranged over the surface of a single receptacle. Multiple fruits consist of the matured ovaries of several to many flowers that are united into a single mass; these are usually accessory fruits. The last type of fruit is accessory fruits, and these are fruits that develop from tissues surrounding the ovary.

Accessory fruits generally develop from flowers that have inferior ovaries, and the receptacle becomes a part of the fruit (FruitsInfo 2010).

Tree species that are used for producing timber have to be marketable, high quality, fast and upright growing, deep rooting, wind firm, and suited to the site . These qualities are not always easy to obtain from deciduous trees due to the fact that most grow with a poor form. The straightest growing deciduous trees without forest shade pressure are those that are most light demanding (Martin, 2010).

There are many different strategies and techniques used to produce timber. Commercial clear-cutting involves the removal of all trees in a forested area; this does not allow for sustainable forestry. Shelterwood cutting removes an entire forest but gradually. Two to four harvests are carried out over a period of ten to twenty years, and in this way tree species can naturally regenerate and grow into the new forest.

Once trees have grown to their maximum height, the process of felling is carried out. Felling is the practice of cutting down trees using a chain saw. The next step is bucking, where the limbs of the tree are removed and the remaining portion is cut into logs. Next is skidding, where the logs are moved along preplanned skit trails to the landing area. At the landing area the trees are sorted into species and loaded onto trucks to go to the sawmill. At the sawmill, the tree can be converted into lumber, pulp and paper products, and wood-based composites.

Sun

Sun is a main factor in determining the growth and development of plants. Usually the amount of light a plant receives will determine the amount of time that the

plant can be active and produce energy. Plants are adapted to the amount of light that they can obtain from the environment. Different plants need different amount of light, but if they do not receive the amount that they require they will not grow optimally and many of their natural features can be altered. Too much light can result in an exaggerated growth of the plant, and an insufficient amount of light can cause a plant to become very thin with large distances between roots. The amount of light available to the plant varies during the day; the plant can take in the maximum amount of light during the first few hours of the morning (Botanical, 2008).

Shade-preferring plants have a smaller quantity of enzymes and chlorophyll, the pigment that captures light. Acclimation is the process of a shade plant slowly adapting to a light-containing environment. Many species of plants are capable of carrying out this transition, but others cannot adapt to these changes and are much more selective towards their environment. In order to protect themselves from the sunlight, many plants have developed defense mechanisms to combat the ultraviolet radiation present in the atmosphere (Deterioro Ambiental).

Soil

Soil is the outer layer of the earth that is formed from erosion of the ground and from the activity of microorganisms. Soil serves as the fundamental base for the growth and development of plants. The type of substrate and structure play a very important role in the development of the plants (Redaccion/facilisimo.com). Soils are dynamic living organisms, as they are a product of their environment and based on the parent material from which they started.

Soil formation begins when the parent material undergoes some sort of alteration as a result of physical and chemical weathering. Weathering is the impact of temperature, rain, vegetation, and organisms on the parent material. The process of weathering works from the top of the soil surface downwards. The more intense the weathering, the greater the depth of the soil and the more different it is from the original parent material below. The microorganisms and plants that appear on the soil surface also alter the soil profile, and at a faster rate than the weathering process (Begg, 2010).

Soils can vary based on the amount of humus they contain, the amount of degraded organic material within the soil, and the pH. High lime content contributes to a basic soil (pH is greater than 7), but soil can also be neutral with a pH of 7 or acidic with a pH below 7. Sometimes if the soil is too acidic, this can be beneficial for maintaining the proper structure and health of the soil, and it also allows for the liberation of nutrients so that they are readily available to the plant (Redaccion/facilisimo.com). Soil of specific characteristics is essential to the proper growth and development of the plant in the region. Many plants are able to adapt to a wide variety of soils, however soil with minerals in the correct proportions and the proper characteristics will provide for the most efficient and successful plant development (Botanical, 1999).

Soil is composed of many different layers; one layer contains non-living material, another layer contains rocks and minerals, and the last layer is composed of microorganisms, small animals, and vegetation. The texture of the soil is determined by the amount of clay, silt, sand, and organic material within the soil (Botanical, 1999).

Native plant species

Native plants are those that were growing naturally in an area before humans introduced plants from distant places to the region. Over the course of thousands of years, native plants have evolved and adapted to local conditions regarding the climate, soil, and rain quantity (Burlington sustainable development committee, 2007). These types of plants are also resistant to most pests and diseases in the area.

Each native plant species is a member of a community among other plants, animals, and microorganisms. The natural balance between all of these different elements in the environment keeps the plant species in check, allowing it to thrive in conditions where its suited while preventing it from becoming invasive. These types of plants provide food and shelter for birds, butterflies, and other desirable wildlife (Burlington sustainable development committee, 2007). Many help to enrich the soil, and others use their root systems to help reduce erosion and runoff by percolating rainfall into the soil, ultimately leading to an improvement in water quality (Encyclopedia Americana).

Another dimension of native plants is their historical and cultural interest. Some plants played an important role in a region's culture or its exploration and settlement. Many species have reported value as food or medicine, while others have been utilized for cordage, textiles, dyestuffs, or other domestic purposes (Burlington sustainable development committee, 2007).

Introduced plant species

Introduced plant species are that were not naturally growing in a region, but were brought to an area by humans at some point in history. Invasive plants are introduced species that can thrive in areas beyond their natural range of dispersal. These plants are

characteristically adaptable, aggressive, and have a high reproductive capacity. Their vigor and lack of natural enemies usually leads to outbreak populations (USDA, 2010). Invasive plant species affect animals native to the region in addition to degrading the local environment. When invasive plants are introduced into an area and are more successful than the native plants, these plants cannot compete for resources and survive, and as a result the plants that once served as the habitats of native animals are destroyed. It is highly important to ensure that no plant species are introduced into functional environments accidentally.

Aracaceae

Palm trees are one of the most abundant tree families in the world (Bernal, 1995). The Aracaceae family is an isolated group within monocotyledones (Dominy et al., 2008). The tree family consists of dozens of genera and hundreds of species that are confined almost exclusively to the tropics (Bernal, 1995). Palm dominated vegetation has existed for at least 71 million years in the Americas, and 75% of all recorded palms can be found in tropical rain forests (Dominy et al., 2008). Approximately 25 genera and 150 species of palms exist in the Central America region (Bernal, 1995) of which 5 genera and 54 species have been reported in Panama.

Palms play a major role in tropical ecosystems (Bernal, 1995) making them a highly valuable and influential family of trees. Aracaceae also provide a variety of resources to many different fauna. The seeds and fruit are important food sources for many vertebrates and invertebrates, and some species are considered keystone species for frugivores (Galetti and Aleixo, 1998). People who live in neotropical rain forests also

utilize palms, most notably for food, thatch, materials for construction and handicrafts, and medicine (Svenning and Macia, 2002).

Bambuseae

Bamboo is a type of plant that belongs to the Gramineae family. Bamboo is native to locations all over the world with the exception of Europe. This type of grass is the fastest growing plant in the world. Many species of bamboo spend the first seven years of their lives growing very little and developing an extensive network of roots below the soil surface (encyclopedia Americana). In the first few months of the seventh year, the completed root system allows the bamboo to grow 60 cm a day, a total of 30 m in only six months. The grass requires very little energy and water in order to grow, and is also able to survive in less than ideal growing conditions (Farely, 1984).

Bamboo is also a very functionally significant plant. Its rapid growth and vast root system enable the plant to reconstruct and clean soil from toxins in a short amount of time. The root structure also helps to reduce water runoff from rainfall, erosion of soil, and decontamination of water. Bamboo is also very helpful in reducing CO₂ gases and air pollution, as it can hold 30% more oxygen than the majority of trees (Encyclopedia Americana). Many individuals use bamboo in hunting and fishing in remote areas as its very flexible and adaptable. It's one of the most durable materials in the world, making it one of the most important woods in many countries.

Hummingbirds

Hummingbirds are a type of nectarivore, but they do not rely on all types of flowers for nutrition. Hummingbirds are selective for ornithophilous flowers, flowers that characteristically display very bright colours such as red, orange, and pink (Hainsworth and Wolf, 2009). Ornithophilous flowers have a very specific way of attracting hummingbirds to pollinate the flower while the hummingbird eats. These birds have an elongated beak structure in order to obtain the nectar from these types of flowers (Chambers, 2009).

Appendix IV: Interview Guide

Entrevista con Amelia Munioz, supervisora

1. Que son los objetivos del parque en los proximos anos?
Sobre la
 - 1.1 conservacion
 - 1.2 educacion ambiental
 - 1.3 repoblacion

2. Como se funciona la administracion del parque?
 - 2.1 Cree que este forma de administracion funciona bien?
 - 2.1.1 Cuales son las diferencias con un parque solamente administrado por ANAM

3. Que son los planes de futuro para el vivo "las Heliconias"
 - 3.1 Que typo de plantas quieren crecen en el vivero
 - 3.2 Que querien hacer con estas plantas
 - 3.3 Cuando piensa que el vivero seria listo

4. Queremos saber si es posible de accesar las statisticas del parque sobre
 - 4.1 los visitantes (edad, sexo, nacionlidad)
 - 4.2 el programa de educacion ambiental
 - 4.3 plan de desarrollo del parque

5. Hay mapas del parque con
 - 5.1 los senderos
 - 5.2 zonificacion
 - 5.3 topographica

Appendix V: Heliconia Nursery Pamphlet

Page 1 of 2

Sopa de letras

S	C	D	Q	U	C	V	R	P	P	W	D
H	A	E	R	I	A	O	A	L	D	B	J
A	M	L	L	K	R	Y	R	A	F	Z	P
Y	Q	U	U	E	J	G	B	N	E	F	F
Q	K	L	V	T	E	H	M	T	A	D	P
M	E	I	S	C	N	W	E	A	B	I	O
S	V	U	N	A	Z	A	S	K	A	T	U
F	R	W	G	S	N	J	L	T	D	E	U
M	M	Z	U	B	S	I	T	P	Z	M	Y
C	Q	E	X	V	H	W	M	G	Q	U	H
T	L	H	O	M	B	R	E	A	D	W	L
O	N	S	J	V	O	L	K	M	L	U	X

Pareo: Une el número con la letra correcta

- nos sirven de adorno o sea para embellecer nuestra plazas, parques y jardines
- son aquellos que son capaces de producir frutas
- son aquellas que se usan como medicinas
- son aquellos que son usando para construir cosas
- son aquellas que crecen de forma natural y espontánea en la naturaleza, y que no fueron sembradas por el hombre
- plantulas
- hombre
- animal
- planta
- sembrar

¿Qué es un vivero?



PARQUE NATURAL METROPOLITANO
PANAMA

1. vivero 6. plantulas

2. suelo 7. hombre

3. aire 8. animal

4. luz 9. planta

5. reforestación 10. sembrar

Pareo Respuestas

1	V
2	S
3	A
4	H
5	L

Page 2 of 2

¿Qué es un vivero?

Un vivero es un sitio destinado a la producción de plantas en donde se les proporciona todos los necesarios para sembrados en un terreno definitivo. Las plantas necesitan del suelo, aire, agua y luz; los mismos elementos que necesita el ser humano para poder sobrevivir; al eliminarle un sólo de ellos mueren.

Reforestación: es sembrar arboles donde no existan o donde queden muy pocos con el fin de aumentar la cantidad.

Beneficios de plantar arboles:

1. Producen oxígeno y purifican el aire
2. Forman suelos fértiles
3. Evitan la erosión
4. Mantienen los ríos limpios
5. Proveen alimento y otros beneficios
6. sirven de refugio para la fauna silvestre
7. Regulan la temperatura del suelo
8. Mejoran el paisaje
9. Reducen el calentamiento global



Aire

En la proximidad de la superficie terrestre, el componente principal del aire es el nitrógeno (78%), le sigue el oxígeno (21%), elemento fundamental para la vida de todos los organismos; el resto (1%) esta formado por otros gases: argón, hidrogeno, helio, y anhídrido carbónico.



Agua

El Agua al igual que el aire, la luz y el suelo constituye otro de los elementos básicos e indispensables para que las plantas germinen y logren el crecimiento deseado. Recordemos que en el suelo se encuentran sustancias como el fósforo, el nitrógeno, el potasio, el calcio y el hierro; pero que estas sustancias no pueden ser absorbidas por la planta en estado solido. Es función entonces del agua disolver los nutrientes que se encuentran dispersos en el suelo para facilitarle a la planta la absorción de los mismos

Suelo:

El suelo es la capa superficial de la corteza terrestre. En él la semilla germina y la planta ahonda las raíces para mantenerse derecha, desarrollarse y nutrirse. En el suelo las plantas encuentran todos los nutrientes indispensables para subsistir. Cada uno de esos nutrientes tiene una función específica:

- el fósforo permite el crecimiento
- el nitrógeno estimula la producción de hojas abundantes
- el potasio y el calcio favorecen el desarrollo armónico de los vegetales y el hierro aumenta la coloración verde

Luz

Todos los seres humanos, animales y plantas necesitan energía para sus procesos vitales. Así como el ser humano necesita de una buena alimentación, además de vitaminas para obtener energía, las plantas verdes utilizan la energía del SOL para subsistir. A partir del sol, fabrican su propio alimento, por eso se les llaman organismos productores, porque producen su propio alimento.

Appendix VI: Bonsai Nursery Sign

Bonsáis

¿Que es un bonsai?

Un bonsai es un árbol en miniatura. Consiste en el arte de cultivar árboles y plantas, reduciendo su tamaño mediante técnicas como la poda de ramas, raíces y nuevos brotes.



? ¿y los bonsáis en Panama?

En Panamá se pueden hacer bonsáis de Macano, pino amarillo, ficus calandra, tamarindo, limoncillo, entre otros



¿Sabías que?

- la palabra bonsai significa árbol en un pote
- un bonsai puede vivir por mas de 100 años!
- Para evaluar un Bonsai hay 3 caractéisticas importantes:
 - 1- Apariencia natural
 - 2-Belleza
 - 3-Madurez



Historia

El cultivo de bonsais empieza en China hace mas de 1700 anos. Los primeros bonsai se originaron de las montañas, y estaban pequeño debido de las condiciones climáticas muy difíciles. Mas tarde la técnica se extendió a Japón y después en todo el mundo.

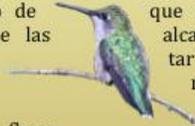
Appendix VII: Guayacan Trail Signs

1

Los Colibríes

Los colibríes son Nectivoros, lo que significa que se alimenta del néctar de flores. Pero el colibrí no se alimenta de cualquier tipo de flores sino de las flores conocidas como ornitofilas. Este tipo de flores tienen colores brillantes como rojo, naranja rosado, etc. Y mientras el colibrí come también esta polinizando la flor. El néctar de las flores es pobre en nutrientes por eso los colibríes también se alimentan de insectos y arañas.

Por otra parte, el colibrí tiene un pico que le permite alcanzar el néctar de las flores.



¡Un animal muy especial!

Un colibrí puede vivir entre 3 y 4 años. Pero, durante estos años, la vida del colibrí es a una alta velocidad. ¡El corazón de un colibrí puede latir hasta 1230 latidos por minuto! (por un humano es normalmente entre 60 y 120) y puede aletear hasta 80 veces por segundo.

¡Prueba aletear tan rápido como un colibrí!

¿Qué tipo de madera fue utilizado para construir la Catedral de Panamá Vieja? Pase a 2 para la respuesta



Sus depredadores

Los depredadores de los colibríes son otras aves más grandes, serpientes, y algunos mamíferos que comen huevos de colibrí.

¿Sabía usted?

La mantis religiosa (un insecto) puede también comer colibríes



2

Los Guayacanes

¿Dónde crecen?

Los guayacanes se distribuyen desde México hasta Perú. Esta especie crece a bajas y medianas elevaciones, en climas secos, húmedos o muy húmedos.



¿Sabía usted?

- La madera del guayacán es pesada y de alta durabilidad.
- Es común y fácil de observar en bosques húmedos de la Isla de Barro Colorado y de la parte central del Canal de Panamá.
- Se piensa que la madera del guayacán se utilizó para construir la Catedral de Panamá La Vieja manteniéndose fuerte por más de 400 años



¿Sabe cuál es la planta que tiene 54 especies que crecen en Panamá? Pase a 3 para la respuesta



¿Cuáles son sus características?

Esta especie pueden alcanzar una altura máxima de 50 metros. Pierde sus hojas en enero y florece entre febrero y mayo. Sus flores son amarillas y en forma de campana.



Las Palmeras

3

Las palmeras son unas de las plantas más abundantes en todo el mundo, y también uno de las más antiguas. No todas las palmeras son árboles; algunas especies pueden clasificar palmeras como árboles, arbustos o lianas.



¿Qué tienen los guayacanes, cacao, marañones, y los heliconias en común?

Pase a **4** para la respuesta



Importancia económica:

Sirven como alimento (los cocos), para hacer casas, barcos, ropa, papel.

El coco está entre las más antiguas plantas útiles y se explota de múltiples maneras. La pulpa seca se llama copra.



Crecimiento

La mayoría de las especies crecen solo en las zonas tropicales y 75% de todas las palmeras se encontraron en selvas tropicales. En Panamá, existen 5 géneros y 54 especies.

Sabía que...

En la antigüedad fueron un símbolo de victoria, paz y fertilidad



Plantas Nativas y Exóticas

4

¿Que es una planta nativa?

Una planta nativa es aquella que crece en el área biogeográfica de donde son originarias. Estas plantas se adaptan a la región, clima, suelo y a la cantidad de lluvia. Estas plantas pueden defenderse eficazmente contra los depredadores y las enfermedades.

¿Porque las plantas nativas son importantes?

Las plantas nativas son importantes debido a su interacción con el medio y con otras especies de fauna y flora. Por ejemplo, hay organismos que utilizan las plantas nativas para alimentarse y refugiarse. De igual manera, la planta también utiliza a los organismos para su reproducción, alimentación, protección, etc. Este tipo de relación, en donde ambos organismos se benefician mutuamente, se llama mutualismo.

Plantas nativas en Panamá:



Guayacán



Cacao



Marañón



Heliconia

¿Qué tipo de planta puede crecer hasta 60 centímetros por día?

Pase a **5** para la respuesta



Las Plantas Exóticas

Plantas no nativas o exóticas son plantas que fueron introducidas desde otros países usualmente por los humanos. Una planta no nativa se convierte en una planta invasiva cuando crece y se extiende muy rápido en un lugar desplazando a las especies nativas. Este proceso causa la degradación del ambiente nativo.



Café



Mango

Bambú (Bambuseae)

Descripción General

Son plantas muy antigua (Mioceno), rústicas y, sobre todo, muy atípicas. El bambú existe en todos los continentes excepto en Europa y además no es un árbol, es un gramínea (hierba). El bambú puede crecer hasta 60 centímetros por día y por supuesto es la hierba que crece



más rápidamente de todo el mundo. Muchas especies no crecen mas durante los seis primeros años de su vida, porque se poseen un sistema de raíces completo que le permiten crecer mas de 30 metros en 6 semanas durante su séptimo año de vida.

Usos:

- Es uno de los materiales más fuerte del mundo y por esta razón el bambú es una madera importante en muchos países.
- Reduce la escorrentía del agua previniendo así la erosión del suelo, y también para mitigar la contaminación del agua

¿Sabías que?

- Los bambú son muy útiles porque ayudan a reducir los gases de CO₂ y limpian el aire.
- Los bambú se descomponen rápidamente: terminan en 90 días y en 3 días en una pila orgánica y por este razón puede avadar con la de-contaminación de los suelos.
- Bambú tiene mas flexibilidad y un capacidad muy bueno de adaptación. Muchas personas en tiempos remotos utilizaban el bambú para la caza y la pesca.



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