December 16, 2005

Mr. Alfonso Alonso
Monitoring and Assessment of Biodiversity Program
Smithsonian Institution
Washington, DC 20005

Dear Mr. Alonso:

Enclosed is the project proposal entitled Smithsonian Global Vegetation Dynamic Website Interface. It was written and completed at the Smithsonian Institution throughout the period of October 24 through December 15, 2005. This initial proposal and work has been accomplished at Worcester Polytechnic Institute in Massachusetts prior to arrival in Washington, DC. The project will be accessible on the web through the Gordon Library Website at WPI. We appreciate the support of you, Jennifer Sevin, and the other SI/MAB employees in helping us complete this project.

Sincerely,

Matthew Basile

Roger Burns

Erin Mazuera

SMITHSONIAN GLOBAL VEGETATION DYNAMIC WEBSITE INTERFACE

Report submitted to:

Tahar El-Korchi and Brigitte Servatius

Worcester Polytechnic Institute

Washington, Project Center

by

Matthew Basile

Roger Burns

Erin Mazuera

In Cooperation With

Alfonso Alonso, PhD, Director of Conservation of MAB

Patrick Campbell, MS, Research Ecologist

Jennifer Sevin, MS, Director of Education and Training

Smithsonian Institution, National Zoological Park

Date: December 12, 2005

ABSTRACT

This report, prepared for the Smithsonian Institution's Monitoring and Assessment of Biodiversity Program (SI/MAB), describes the compilation of internal vegetation plot data into a useable database and the creation of a dynamic website that enables the use of that data. The creation of the website allows for distribution and graphical analysis of the internal vegetation plot data. Included in this report is a procedure for how to maintain the database and suggestions for updating the website.

AUTHORSHIP PAGE

Executive Summary – Matthew Basile

History – Erin Mazuera

Introduction - Matthew Basile

Literature Review – Matthew Basile, Roger Burns

Methodology – Matthew Basile, Erin Mazuera

Results – Matthew Basile, Roger Burns, Erin Mazuera

Discussion – Matthew Basile, Roger Burns, Erin Mazuera

Conclusions – Roger Burns

Recommendations – Erin Mazuera

Glossary – Roger Burns, Erin Mazuera

Appendix A: Liaisons – Erin Mazuera

Appendix B: Conservation Resource Center- Front Royal, VA – Erin Mazuera

Appendix C: Method Flowchart of the project – Roger Burns

Appendix D: Data Handling Manual – Matthew Basile

Appendix E: Quality Control Procedure and Results – Matthew Basile

Appendix F: Focus Group Questionnaires – Roger Burns, Erin Mazuera

Appendix G: Database Visuals – Prepared by: Erin Mazuera, Created by: Matthew Basile

Appendix H: Website Visuals – Prepared by: Erin Mazuera, Created by: Roger Burns

ACKNOWLEDGEMENTS

- Liaisons Alfonso Alonso, Jennifer Sevin, and Patrick Campbell for providing constant assistance and support.

- Rob Madill and Gaby Gollub for helping with the web development, ColdFusion and Dreamweaver software.

- Melissa Bellman for revising our work and being so helpful through the completion of our project.

- Lamine Hamdad for helping us with ColdFusion coding.

- The interns and employees for making the Smithsonian a fun and friendly environment to work.

- Professors Tahar El-Korchi and Brigitte Servatius for their assistance and recommendations with the project.

TABLE OF CONTENTS

Appendix A: Liaisons 70

LIST OF FIGURES

1 EXECUTIVE SUMMARY

This project was proposed by the Monitoring and Assessment of Biodiversity program of the National Zoo through the Smithsonian Institution in order to make the internal vegetation plot data that is located within the MAB externally accessible through the World Wide Web. Currently the MAB program records and collects data from 300+ monitoring plots world wide, and this data is stored in computer files in the MAB office. The information that was used in this project consists of data collected from around 100 plots that the MAB program collects data from. These more than 100,000 lines of individual tree data may not represent all of the 300+ monitoring plots, however this is all the information that is used by the MAB program as a result of this being the only data that has been submitted to them. The result of our methods led to the compilation of a Microsoft Access database, ZOONIGHT. This database was then accessible through the dynamic website which was created by the project group with the help of ColdFusion. This increased accessibility makes the vegetation plot data useable. The information is now available globally through the internet so that researchers and scientists can utilize this information in their studies and efforts to preserve biodiversity.

The dynamic website, which makes the database useable, offers graphical analysis of the vegetation plot data within ZOONIGHT. The website offers the versatility in selecting regions and tree information that is desired. The website takes requested information which is selected by drop down menus and check boxes and searches the database with these queries. The outputs of these queries on the website are graphs of averages and Family, genus, and species information. This information can be interpreted by the scientists thus making the data useable.

In order to ensure that the database was compiled correctly, and the website was connected to the database correctly, a series of quality control tests were run. The results of the database quality control tests returned few errors that consist of decimal points being dropped in the transfer of information from back up (.bak) file to Microsoft Access. These errors are being looked into in order to make the website completely accurate. The results of the website to database connection quality control came back 100% successful. Simple procedures were taken in order to run a quality control. Twenty random points for each data region were selected from the database, including their species code information, and checked against the website outputs. Zero errors were attained through these thorough procedures which included species information. Finally, the quality control that monitored the functionality of the website returned some negative feedback such as graphical errors, mathematical errors, and incorrect coding. These errors were repaired and the corrected version of our website was reviewed by focus groups.

The findings of the focus groups proved that our website was easy to use and very functional. A few errors were detected, including layout problems, labeling problems, and some display issues. All detected errors were fixed. Thus our goal of compiling a useable database was successfully accomplished.

2 HISTORY

2.1 Smithsonian Institution

The Smithsonian Institution was founded by British scientist James Smithson in 1846. The Smithson estate was left to the United States as stated in the will and testament of Smithson, and therefore, through an act of the US Congress, the Smithsonian Institution was born. Smithson's purpose was for the "increase and diffusion of knowledge among men," [1] which he accomplished by donating money to the United States. This is remarkable, since he never visited the US nor had any American friends or relatives.

The first original Smithsonian Institution building, known as the Castle, was constructed in 1855 by architect James Renwick, Jr. in Washington, D.C.

Figure 1: Smithsonian Castle

Presently, the Smithsonian is the largest museum complex in the world with 18 museums, the National Zoological Park, 9 research centers, and 140 affiliated museums in other locations. It is home to over 140 million items and artifacts all over the world. Its exhibits are visited by over 44 million people annually [2].

2.2 National Zoological Park

The Zoo was started as a “little try-out zoo” by William Temple Hornaday in 1887 and was located behind the Castle. Senator James Beck of Kentucky sponsored a bill on the belief that the Zoo would be created for “the advancement of science and the instruction and recreation of the people” [3]. Henceforth, the National Zoological Park was conceived by an Act of Congress in 1889 and was formally named the National Zoo. It was officially integrated into the Smithsonian in 1890. Later contributors to the Zoo included Samuel Langley and Frederick Law Olmsted which furthered its growth [3]. What once started out with a bear, a bison, and an exhibit of a few common animals, today serves as a home to about 2,700 creatures, plants as well as animals, with 435 different species being in the animal collection [4].

The National Zoological Park focuses more on how animals survive in habitats most like their own and how they act and grow with other species, rather than separating the different species and ecosystems to simply display the animals. The main objectives of the National Zoo are to promote the study of different animals in the world, including endangered species, and to learn how to protect them, in order to enable humans to conserve biodiversity.

The National Zoological Park contains a 163-acre urban public park, along with a non-public, 3,200-acre Conservation and Research Center in Front Royal, Virginia [4] [See Appendix B]. The National Zoo does not charge an entrance fee. It obtains its financial support through an organization called *Friends of the National Zoo* (FONZ). FONZ creates revenue through merchandise, concessions, guest services, parking, special events and programs, and especially donations. The National Zoo sees about 1.8 million people a year [4]. Visitors attend special programs offered to further educate themselves on animal life issues. The ecosystems of the National Zoological Park make for a great starting place to monitor and assess biodiversity around the globe.

Figure 2: Tai Shan, 4 mo. 2005
Located at the National Zoo

3 INTRODUCTION

The world is home to millions of species of plants and animals that populate and coexist within nature. The Monitoring and Assessment of Biodiversity (MAB) program at the National Zoo as a part of the Smithsonian Institution, works towards preserving these species by conserving biodiversity on Earth. “Biological diversity, or biodiversity, is a vast and undervalued resource. It includes every form of life-from the smallest microbe to the largest animal, the genes that give them their specific characteristics and the ecosystems of which they are part,” [5]. Biodiversity is considered a precious entity within the scientific community, however the result of human advancement at times reduces certain native and naturally biologically diverse communities. The MAB program, where this project is being completed, works to preserve biodiversity in the world so that biodiversity is allowed to continue to exist and possibly grow. The goal of the MAB program is to collect worldwide data about biodiversity, organize that data, and make that data available to the world so that educated decisions can be made on the future use of resources and impact on the local ecosystems.

This project focuses specifically on the biodiversity of trees. Data are collected from over 300 monitoring plots across the globe spanning five continents. Data collected from these plots get entered into a database, which was reorganized and standardized by efforts from the 2004 IQP group working with MAB. The 2004 IQP group successfully converted all of MAB program’s previous files into one file format, the .bak format. The files are compatible and accessible through the use of the BioMon database, which is the primary database used in MAB. New data is entered into the MAB system by a standardized process designed by the 2004 IQP group.

The ability to display comparative data is the primary goal of this project. The MAB program desires to offer scientists and other privileged users, through a password protected log in, comparative analysis of the data which was collected from the monitoring plots world wide. The MAB program also desires to share its information with the general public. Two web pages are created to separate and address both needs. However, the current project aims to create a dynamic web page that offers as many or as few options that the user may need according to their knowledge and experience in order to search the MAB program's database.

The goal of this project is keeping stride with the Smithsonian Institution's purpose to diffuse knowledge among men. This project will offer information about biodiversity in a finished product that can be directly applied and used in a scientific publication. This increase in the availability of data on biodiversity will help anyone who needs the information or just has a desire to help or understand more about biodiversity.

4 LITERATURE REVIEW

4.1 Monitoring and Assessment of Biodiversity Program

The Monitoring and Assessment of Biodiversity (MAB) Program at the Smithsonian Institution, designed in 1986, was created to promote the conservation of biodiversity [6]. The MAB Program focuses mainly on the vegetation regions of South America and the Caribbean, North America, Africa, and Asia.

4.1.1 MAB Goals & Enforcements

The main objective of the MAB program is to promote biodiversity conservation by working internationally with governments, industries, academia, nongovernmental organizations, local communities, and others to assess and monitor the biodiversity in their regions [6]. The program offers educational courses as well, tailored to scientists, resource managers, and decision-makers around the world. Tree health and status, the current state of life for a tree for example if it is alive or dead, is the data that is collected. This information guides the program in the analysis of human interference in specific areas. The resources offered by MAB are used globally by governments, industries, educators, local communities, and other individuals globally to support the health and safety of these ecosystems.

Two annual courses are offered by the MAB program, the *Biodiversity Assessment and Monitoring Course* and the *Smithsonian Environmental Leadership Course*. The *Biodiversity Assessment and Monitoring Course* teaches biologists, ecologists, resource managers, and environmental planners how to manage their own region's biodiversity monitoring system. The *Smithsonian Environmental Leadership Course* focuses on the skills necessary for communicating and interacting with managers and environmental planners.

4.2 Global Biodiversity Information Management

"Biodiversity – short for biological diversity- is the variety of all living things and their interactions" [7]. Biodiversity includes the entire living world and consists of species that have developed relationships that define the biodiversity of specific regions and provides a high quality of life. Preserving this symbiosis throughout the natural biological world is desired in order to conserve the natural world.

Therefore, in order to conserve the natural world it is essential to observe and monitor biodiversity worldwide to assess and preserve the diversity of species of organisms in their ecosystems. Through the study of different species throughout different regions of the world, ecologists and researchers can determine the changes made within the different organisms through time and continue to discover new species and how they survive in their ecosystem. According to the National Center for Genetic Engineering and Biotechnology and National Science and Technology Development Agency of Thailand, an estimated 1.5 to 1.7 million species have been described while the total number of species in existence is an estimated five to 100 million [8]. There are many studies conducted to find new species, categorize them, and describe their natural habitat.

4.3 BioMon

BioMon, Biodiversity Monitoring Database, is a computer program utilized by the Smithsonian Institution that was put in place to ease the organization and review the data from MAB's 300+ monitoring plot sites worldwide. The primary objective was "managing data, standardizing data analysis and presentations, and assisting with the exchange and publication of the results" [9]. The program is a powerful tool that stores, accesses and adds information to a paradox database. Each tree represents a sliver of information within this growing database. Information inputted includes height, diameter of the tree at breast height (DBH), health of the tree, position of the tree and any notes necessary to describe the tree and its current condition. BioMon can represent the information present at a certain level. Looking at a plot, the program shows graphically the location of each tree. A user can then choose an individual tree to observe and see every data entry concerning that tree. The program does not however provide analysis of the data, which is something this project will address.

The BioMon computer program that is currently used within the MAB program contains information from about 101 of the over 300 monitoring plots worldwide.

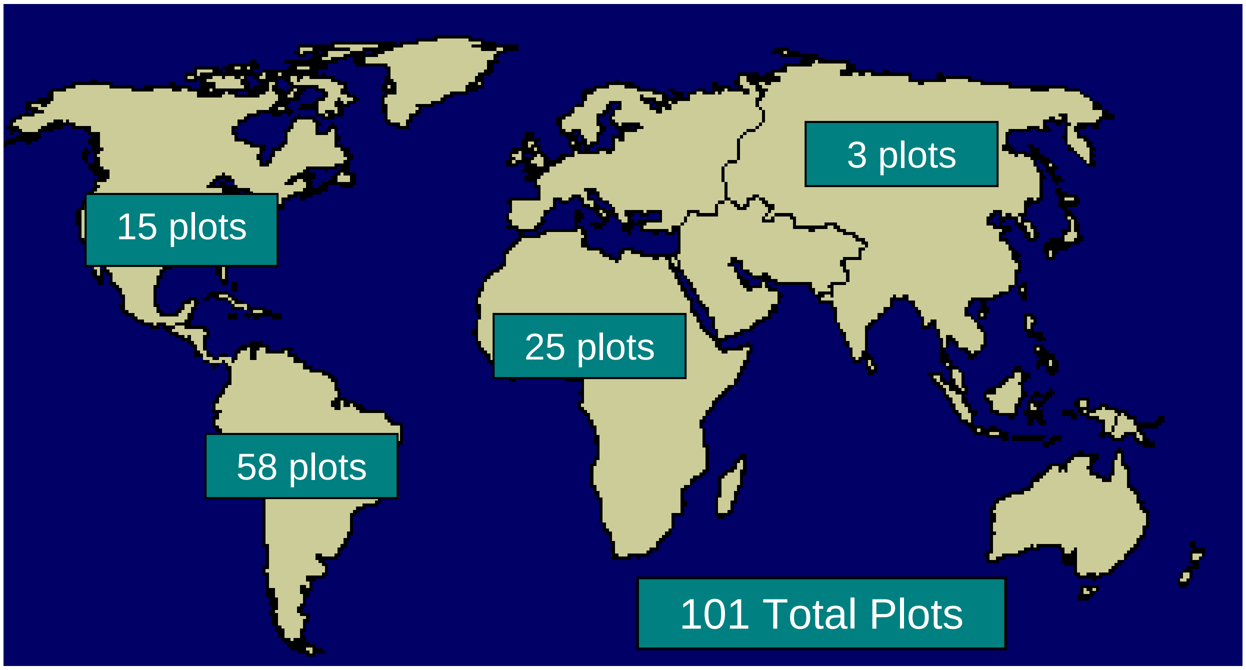


Figure 3: Global Plot Regions within ZOONIGHT database

The first data begins in the year 1987 and spans through 2004. This information also is separated into only 4 regions: Africa, Asia, North America, and South America. The Caribbean is included with the South American region. This was not a decision made by our group or the MAB, however that is simply how the data was organized. Each region consists of a certain number of plots. A single plot is one hectare in size measuring 100m by 100m on each side. These plots are further broken down into 25 quadrats. Furthermore, the BioMon information is present as back up files (.bak) files within the MAB program. These files were all refined through the efforts of last year's IQP group, and the work we did this year was done using these files.

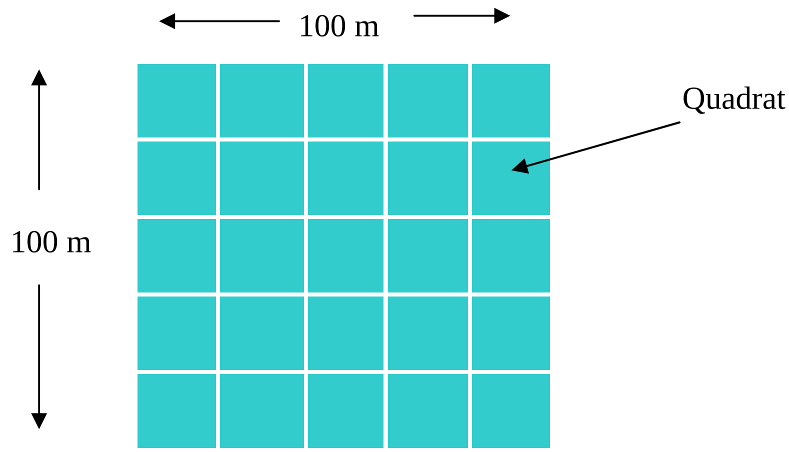


Figure 4: Plot and Quadrat size

4.4 Data Processing

Data processing is the manipulation and representation of data. Analysis and summarization of data are important since a website utilizing the plot and tree information will present graphical representation of that data to the public. Analysis will provide answers to how the data should be summarized, possibly even presented. The parsing of data is a key element to the analysis and presentation. It will break the database into pieces, each piece in this case representing information about a singular tree, where pieces of the same type are compared against each other. These comparisons generate the graphical representation of data the user will see.

4.4.1 Microsoft Access

Microsoft Access is a tool provided by Microsoft that aids in the creation and maintenance of databases. A database is a collection of tables. Each table consists of columns that hold information. A row within a database holds relevant information to each other (i.e. all information about a single tree), while the columns group the type of information (i.e. measurements). Microsoft Access databases are easy to use and implemented by many associations in the organization and storing of their data. Using this format allows others to use and understand the database compiled by the MAB program as well as the continued support of this format by a large and ever-growing company.

4.5 Web Design

Proper utilization of gathering and processing data from the databases will result in a webpage that is easily navigable and understandable for any user. It is necessary to determine which computer language to employ in creating a website that is both easy to implement as a designer, maintain as an administrator and best displays the results and information to the user. The website to be created through this project, which will be displayed on the Smithsonian Institution's National Zoo website, will present data to the general public, be easy to use, and provide an amount of functionality while not being frustrating for anyone using the site.

4.5.1 Dreamweaver

Dreamweaver, a product created and maintained by Macromedia, is a web design program that makes web design simple. The National Zoo uses Dreamweaver as a webpage creation tool. The National Zoo created their website's template with the use of

Dreamweaver, thus, using Dreamweaver in this project allows for the implementation of the National Zoo template, which creates uniformity and a clean, standardized format. In addition to the ability to employ a standard format, Dreamweaver is a useful tool when creating the website, easing the overall process by organizing the files, allowing for quick testing and its compatibility with ColdFusion, discussed in detail later, and HTML. Conclusively, Dreamweaver is a useful web creation tool that will assist in the creation of the website.

4.5.2 ColdFusion

ColdFusion, a product created and maintained by Macromedia, is a powerful application server which is used in parallel with a web host server. ColdFusion intercepts requests for a web page and then processes that page by looking for what is called ColdFusion Markup Language or CFML. It processes requests for information from databases, displays that information, and creates a dynamic page based on the content of any information that the page links to.

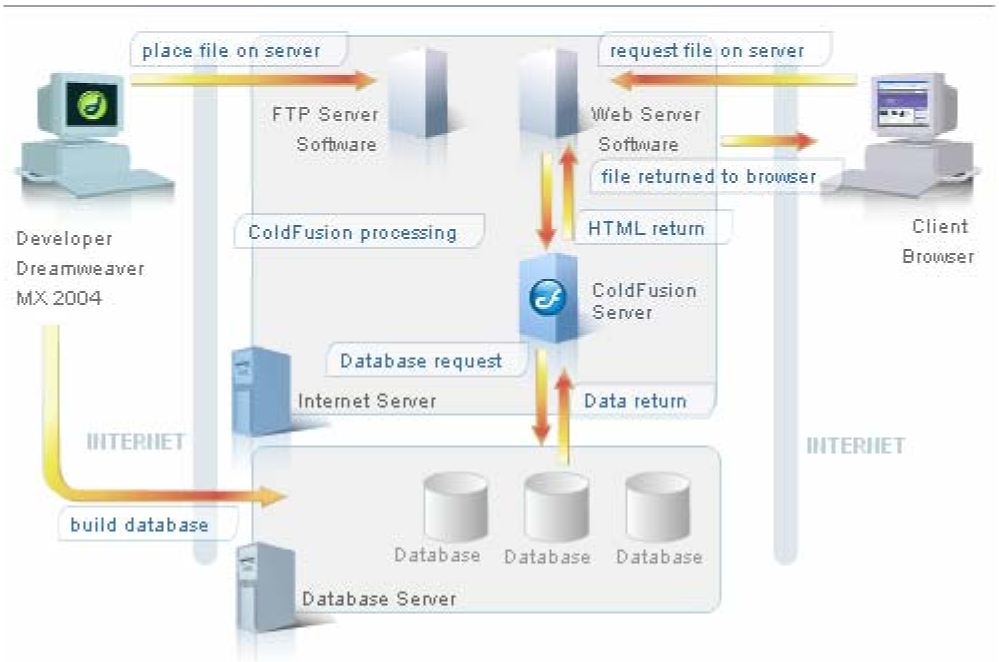


Figure 5: ColdFusion Process

This will create a unique experience for the user, allow for information to be displayed in a graphical manner, and create a dynamic layout that will change as the database, which the page is based on, grows and expands. This is an invaluable tool since the MAB program is continually expanding, repeating censuses and in the process greatly increasing the amount of information within the database.

4.5.3 Computer Languages

The National Zoo's server is based upon ColdFusion technology which is a server side application. It adds greater functionality to static HTML pages. Three languages, HTML, CFML and SQL together will be used to create the web site.

4.5.3.1 HTML

HTML stands for Hyper-text Markup Language, a way of defining how information is displayed. A standard text document can have what are called HTML tags placed throughout which denote style, and other layout options. Layout includes tables, lists, pull down menus, check boxes etc. There are also tags which denote font, font size and style. HTML is a versatile markup system which is interpreted by web browsers. An example of HTML is “bold”, which produces **bold** on a web page. A static, or unchanging, page will be created from the use of the mark up language. HTML will dictate the format and layout of fields containing information and buttons which will submit information. It will also dictate navigation through the site, the look of the requested information, and how the overall page looks. HTML is the backbone of the page, providing the look and feel needed for the user to successfully navigate, use, and understand the site. Used in conjunction with CFML, a truly dynamic page will be produced providing graphs and information grabbed from the database.

4.5.3.2 CFML

ColdFusion Markup Language is similar to HTML. The designer can place tags that describe how to display data from a source, in this case a database. Built into the server-side ColdFusion application are instructions how to deal with the CFML encountered within a HTML page requested by a user. An example would be how the two differ. HTML can only display the information contained within a page, or information that is sent to the page. CFML can ask a database to provide the data that will be displayed. If you were to encounter “#birthday#” within HTML source code, the web page would faithfully display just that: “#birthday#”. If you were to insert CFML around that odd looking sentence, “<cfoutput query=”birthdays”>#birthday#</cfoutput>” then what is printed to the screen is completely different. What you are looking at is an instruction which tells the ColdFusion application to go into a database, grab some information, in this case a list of birthdays, and print them to the screen. This is of course an over simplified example, but it gives an idea of the difference. This would not be possible of course without what is called a query or a question.

4.5.3.3 SQL

SQL, or Structured Query Language, is a powerful tool that is used to request information from a database. Selecting a database, then a table, SQL allows for the request and manipulation of data. It follows a simple form (an example with CFML):

```
<cfoutput query=”database”>
SELECT (columns)
FROM (table)
</cfoutput>
```

This SQL statement looks at the database specified and goes to the appropriate table. All of the information from within the given columns is then grabbed and presented as information, in our case, to provide the graphs with all necessary data points. Imbedding SQL statements within the web pages allows for the grabbing and processing of the information which will be displayed in the graphs by ColdFusion, and is an integral part of the design and implementation of the webpage.

4.5.4 Ease of Use

The idea of ease of use is that a website will include all necessary functions without complicating the procedure of using the website to obtain desired information. Complications that can arise are unnecessary use of color, too many options, and use of colloquial or esoteric terms that may not be understood. To increase the ease of use of this website, the complications must be reduced to their lowest possible level without deterring the function of the actual page. Accomplishing this reduces stress and frustration that will in turn result in proper use of the page by satisfied users.

4.5.5 Representation of Data

In order to effectively and efficiently represent the data that is currently within the database, a working webpage will be created that incorporates a fluid format and simple procedure that will accurately, concisely and precisely represent the data from the database. One idea for representing the data is "a database which shows succinct summary with link to full report," [10] however a link to the full report in this case is not ideal due to MAB's desire to keep their information from being stolen. The result of the webpage's procedure will be graphs, which will properly represent the data from the database.

4.5.5.1 Presentation

The presentation is how the represented data, information on the site, and how well the procedure is displayed. A simple presentation should encompass simple use of color and format. Presentation is accounted for with the webpage template provided by the National Zoo. ColdFusion will allow for graphs to be made, and the procedure will be step wise and easy to follow.

4.5.5.2 Formatting

The correct choice in format is essential to a functional website that can present requested information to its user. Pull down menus and check boxes can be used to increase the ease of use. In this manner, the information which can be analyzed is easily identifiable. The use of a geographical map is also a plausible idea. Presenting a map that offers a user the ability to click on a certain location and retrieve the local data might also be a helpful way to exhibit the database's data. However, a "map could be a limiting factor as primary search source," [10] and the objective is to have a format that easily shares the database's information. The objective is to build a website that is user friendly and effective in portraying the information found within the database.

5 METHODOLOGY

The project of compiling a database and developing a website requires the use of several methods. Interviews, knowledge of Microsoft Access, quality control and focus groups are approaches that are important for learning what information is needed to create the database and website, along with providing information on MAB's requirements and standards and improving them. The implementation of each method increases the efficiency and quality of the project as a whole.

5.1. Interview

Interviews are conducted to obtain information about the project on a more personal level. The questions asked can be easily directed according to the specialty of the interviewee and personalized to his or her profession. An interview is a question-and-answer session between at least one interviewer and one or more interviewees. Interviews are conducted at the beginning of the project in order to receive information that is essential for determining its direction.

The interviewees are chosen according to their department and specialty. Employees of the MAB program are the best candidates for an interview due to their specific knowledge about how the project needs to be accomplished and what steps must be taken. For instance, an interview with MAB liaisons is helpful, since they have the answers as to how they wish the group's work to solve the proposed problem. An interview with a Web Development director provides insight on the restrictions placed on the website created during this project, and also provides templates and further direction in developing the databases, web server, and website interface.

The interview process has several steps in order to be completed properly. To prepare for the interview, a list of questions is developed to extract the information needed from the interviewee. For example, in an interview with a Web Developer, appropriate questions would be that of restrictions on the public website, as well as software and programs needed to develop the website comparisons of the data. Interviews are done in person, informally, with the interviewee encouraged to ask questions and provide additional feedback. Throughout the interview, minutes are carefully taken on every detail mentioned: questions asked and answered, along with general notes and comments. These minutes are then posted and reviewed in order to compile thoughts and information in diving further into the proposed project.

These informal interviews may or may not occur randomly throughout the project, for they do not always need to be extensive and specific. An interview may be as simple as quickly asking opinions on the layout of the web design in the office, or it may be detailed as scheduling a time for requested help on a specific line(s) of code with the Web Development staff at the National Zoo. The interviews with specific directors are used to aid and further the progress of the project, and therefore are necessary to understand and complete specific project goals. Interviews offer the ability to ask certain questions and seek the specific answers of those questions of experienced professionals.

5.2 Microsoft Access

It is important to compile the BioMon vegetation data into a Microsoft Access database so it is easily obtainable from the developed website's queries. The process of compiling the information into the MS Access database is completed easily by following the Data Handling Manual [See Appendix D]. The data are input into the database according to the type of data it is. Separate tables exist for each region and each region's species codes. The organized data are then ready to be utilized. For instance, in a location table, such as Africa, the data are organized alphabetically by region, and within those regions, in ascending quadrat order, where as in the AfricaSPP table (the table containing the species information), the data are organized alphabetically by species code (the code refers to a specific species) and the genus of that species code. With a Microsoft Access database, the data are connected to the website through the ColdFusion program, and therefore can be easily searched by those who desire this information.

5.3 Quality Control

Quality Control is the process of reviewing certain information and procedures in order to make sure they have been preformed properly. Quality control tests need to be run on the process of importing information from BioMon files to Microsoft Access, the connection between the Access database and the website, and making sure the website is functioning properly. These three main aspects must endure the quality control in order to ensure their accuracy and the overall accuracy of this project.

5.3.1 Transfer to Database

Last year's IQP group was able to create those files after they refined the raw data files that were being collected by the MAB program. The refined files were left for us and we were able to further refine and import these files into a Microsoft Access database. Quality control is used to ensure that the files were correctly imported into the database without error. This quality control is implemented by randomly selecting between 15 to 20 data points for each region and matching their text file information with their Access database information [See Appendix E]. The information is then compared according to the fields of the database, such as DBH, height, and Status. In the cases in which the fields are identical, the data has been imported correctly, however if the fields are not identical, there has been an error in the importing and refining process. Each random point that shows an error is looked at individually as well as the file it was imported from. This should effectively determine the correctness of the database. It is important that the files were correctly imported otherwise the database could be incomplete, which would lead to complications in requesting information through the website.

5.3.2 Database Connection

Quality control is also necessary when reviewing the process of connecting the database to the website. First of all, the website must be connected to the correct database, and secondly, the correct database must be connected, in working order, to the website. In order to determine that the database is properly connected, preliminary tests must be run on the websites before sending the website to the focus groups. Tests will include going through the procedure that exists on the website. If subtle problems arise, such as lack of information being present, throughout the running of these tests then there are flaws in the way the database has been connected. Other tests will include running through a certain pre-selected set of data points and obtaining them through the entire website process. The ideal number of data points to run for each region is around 15-20 data points. These two tests should prove to determine whether the database has been correctly connected [See Appendix E].

5.3.3 Website Evaluation

It is important to have proper evaluation over the completed website as a method of quality control. Extensive evaluation of the completed website is essential in order to produce a close to flawless product. With evaluation of the website, errors can be noted so that they may be attempted to solve for a better improved website. The evaluation of the website must be completed before it is shown to focus groups so those in the groups would have the close to finished product with the improvements implemented from the quality control. No specific procedure is followed, however each available function, along with the calculations such as the height and DBH averages and Basal Area, is tested for errors to produce the maximum of success.

5.4 Focus Groups

Focus groups consist of groups of people who possess different levels of knowledge of the biodiversity content of our website. These groups are then used to obtain a variety of extensive feedback about the website. A focus group of MAB staff, such as the liaisons and additional staff is helpful in correcting the content of the vegetation website: what graphs are to be displayed and if the information is portrayed correctly. They also help in providing information about the general layout of the site and proper information to be displayed. Groups of Web Development officers at the National Zoo will provide feedback on code structure and readability, along with recommendations on how the website could be made less confusing. General students, such as classmates, provide feedback on ease of use and the approachability of the website.

Focus groups on the progress of the project are structured and questionnaires are distributed in order to collect results. Questionnaires [See Appendix F] are given to members of the different focus groups to structure the feedback, making it easier to analyze and improve. Three different questionnaires were created which pertain to people who possess specific knowledge, such as a web director opposed to a student. The web directors were asked to answer questions about web options and code. Questions on the ease of use, functionality, and aesthetics of the website are used within all groups. This feedback received from the focus groups can more specifically influence alterations that could make the website easier to use and more aesthetically pleasing. This is a necessary method in creating a website that meets the standards of the National Zoo in order to make it ready for the use of the public.

6 RESULTS

6.1 Database Management

The result of last year's 2004 IQP group that worked in the MAB program was a compilation of files that could be viewed with the use of BioMon including tree vegetation data possessed by MAB. The compilation of these files was just the start of the tree database work MAB desired. This year MAB requested that the tree information be accessible through the Internet. In order to accomplish this task, the BioMon system was reviewed. Upon review of the data and the notes left behind by last year's project group, it was determined, with the help of knowledge gained through interviews with our liaisons and web development directors, that the BioMon compilations of data is more accessible by internet servers as a Microsoft Access database. The new Microsoft database was created from the back up files (.bak) left behind from last year's group, altered to include reserve and year information, and placed into the new Microsoft Access database. This new database includes complete species lists and plot data for all 4 major regions: Africa, Asia, North America, and South America (with the Caribbean plots integrated in South America). The new database is also easily updatable if properly maintained through the use of user manuals left by last year's group.

6.2 BioMon to Microsoft Access

The decision to move the BioMon database to Microsoft Access came from interviews with a National Zoo web developer, Rob Madill. According to Rob, the National Zoo uses ColdFusion server technology, suggesting that the database should be available as an SQL or Microsoft Access database. In addition to this information, the data in the BioMon database is not as easily altered in the BioMon system as it is in a Microsoft Access format. These two factors require the conversion from the BioMon system to a new Microsoft Access database. Last year's group created a procedure to convert all files to one format, and then import the data from those files into the BioMon database. Our project does not make the BioMon database or last year's project obsolete; it combines their efforts in order to make the data available in the BioMon database easily accessible through an internet medium. The conversion to Microsoft Access increases the file format compatibility, which allows for easier sharing of information between MAB programs world wide.

6.2.1 Conversion of Files

The process of transcribing the data from BioMon into Microsoft Access is done by converting file formats supported in BioMon into file formats that could be read in Microsoft Access. Last year's group established a system of transferring all the data files that would be entered into the BioMon database into a single format. The format they chose was the .bak file format. In order to use this format in Access the .bak files need to be converted. The .bak files are comma separated values, therefore easily imported into Microsoft spreadsheets and databases once the format was changed.

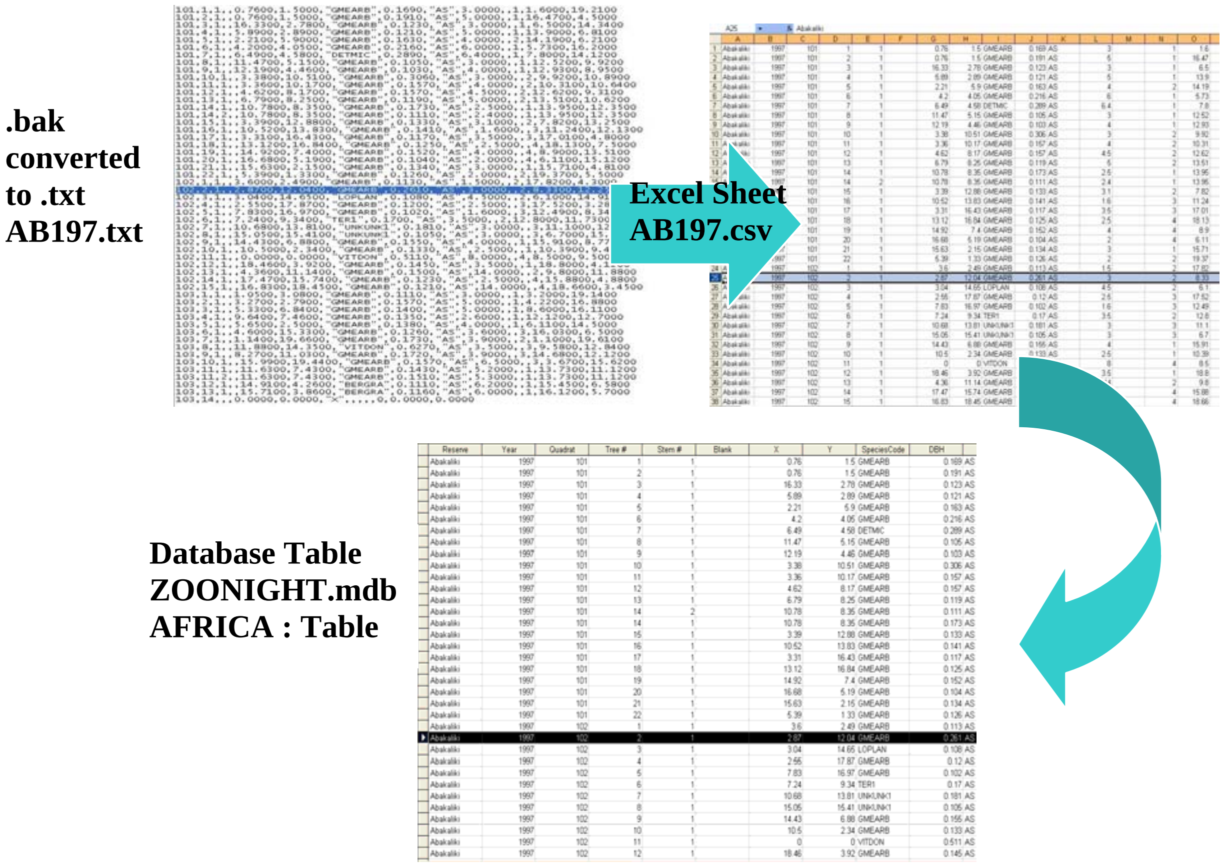


Figure 6: .bak File to Microsoft Access Transfer.

In order to alter the file format the files are simply selected and renamed. The renaming that occurred consists of removing the ".bak" tag at the end of the file name and replacing it with a ".txt" tag. This alters the format and upon alteration a new notepad icon is visible. Once these files are converted to text files, access to all the information with in them is obtained.

The Microsoft Access database offers more information with in its actual database than the BioMon database. The Microsoft Access database is constructed of separate data tables, where as BioMon is built on a paradox format that requires the importing of separate database files to be imported in order to be viewed. In the new database, a single table for each major region is created. In addition to these four tables, four more tables of specific species lists for each region are included in the database.

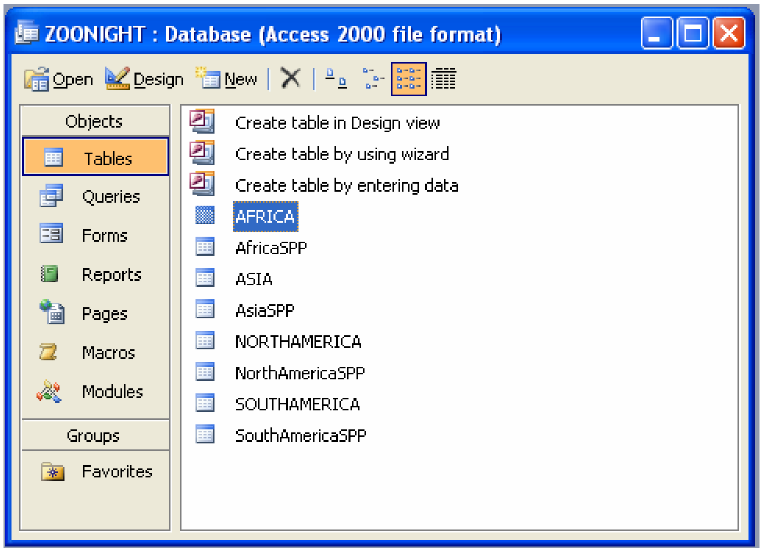


Figure 7: Microsoft Access ZOONIGHT database.

The newly created text format does not display year and reserve information within the file specifically, however it is encompassed in the file name. This is acceptable due to the way BioMon needs files to be imported in order to be viewed, however the reserve and year information must be visible within the file itself so that it can be viewed in the database. To resolve this problem, Microsoft Excel is used to import the text files and add the reserve and year information, which is present in the file names, in the first two columns of the data spreadsheet. Once the information is added in Microsoft Excel, the spreadsheets are saved as Comma Separated Value (.csv) files. This second format change is then implemented only to make the import of these files easier in Microsoft Access. The database is established, and the regional information is imported into region specific data tables in order to complete the database.

6.3 Data Handling Manual

The process briefly described above is recorded in further detail to ensure the proper procedure be taken in order to update and maintain the BioMon and Access databases. The upkeep of the database is pertinent to ensure that the newest information is always available on the webpage at all times. The data handling manual easily directs the user through the process of converting .bak files into .txt files, altering those files in Excel, and then importing the resulting .csv files into Access database tables. This manual retains the work done through this project and allows MAB to have updated information available through the Internet.

Last year's IQP left a hard copy of their manual. The manual that has since been updated is simply a second volume to their manual. This new copy is printed out and bound to the official MAB Data Handling Manual. Additionally, this manual is available online so that researchers and data collectors worldwide are able to sort and maintain their data and send it to MAB in a recognizable format.

6.4 Web Creation

A website is needed to access the information from the newly implemented database. The two tools used by the project in the completion of this goal; Dreamweaver, a web site creation tool and ColdFusion, a web server application create a product webpage that is both easy to use and educational. The creation of this website, comprised using Dreamweaver for the interface with HTML tags, SQL statements and CFML tags, serves as helpful sources for both education and research to all users who have access to the World Wide Web.

6.4.1 Webpage Interface Design

The webpage interface, created in Macromedia's website development program, Dreamweaver, allows the use of CFML, HTML, and SQL statements to connect the Microsoft Access database of tree information to the server. The webpage interface design is a given template from the National Zoo to accommodate the Zoo's standards and restrictions. The manipulation of data from the comparisons made in CFML and SQL then are processed from the server and displayed to the user. The scripts and codes are then inserted into the Zoo's template for a website that is complete and ready for public use.

6.4.2 Database Connection

The database is connected through SQL statements processed by the ColdFusion scripting language. The database is connected within the Dreamweaver program through a series of steps within the ColdFusion server. Once connected, SQL statements such as SELECT and FROM, are used to call the database, then ColdFusion scripts are used to process the query. ColdFusion is a server application which processes and returns requests for online web content from a remote user. It also has the capability of processing HTML pages which contain CFML.

ColdFusion is the program used by the Web Development department of the National Zoo and therefore is necessary for the compatibility of the website. The ColdFusion markup language consists of tags placed within an HTML document. If these tags are present in a HTML document, the ColdFusion server intercepts the page, processes the page and any of the ColdFusion tags first, and then returns it to the user after analyzing the requested information. ColdFusion tags can do functions such as displaying graphs and other data. The CFML, once processed by the ColdFusion server will return information to the user. Working within Dreamweaver the project creates a front end interface based on the ColdFusion capabilities to return the desired queries to the user. Using ColdFusion to create the website and connect the database makes it easier for the National Zoo's web developers to continue updating the database data and code in the future once the project is completed.

6.4.3 Graphical Calculations

Once the database is properly connected through ColdFusion, calculations from the created tree plot database are made through CFML and SQL code that are written into the website. After detailed analysis on the data of vegetation in the given regions, comparisons are generated between different aspects of the particular trees. For instance, the user may be interested in the difference in heights between different species of different regions, and that type of analysis is made available to them upon their request. The result is displayed in the form of several graphs and charts that visibly display the similarities or differences between the users' requested comparisons. These graphs and numerical calculations are produced through the careful webpage processing of the CFML tags. The CFML code, once connected with the database, takes information given to it and manipulates it to produce comparisons between the requested data. The data are then outputted onto the users' screen for their educational use. The use of the graphs makes it easier for one to learn and understand the similarities or differences between the different species of trees in different areas of the world.

6.5 Quality Control

6.5.1 .bak File to Microsoft Access

The quality control that was run on the database to determine if it was imported correctly has been completed. In the process of importing data, errors did occur and Microsoft Access created new data tables for imported files in which errors arose. These data tables include information as to what lines of the imported information was erroneous. Microsoft Excel was used to review these errors and the errors were corrected. These error tables occurred when extra commas appeared in text areas of the files. Most files included a Notes field where researchers or data collectors would note what they saw when collecting tree data. In the Notes field it was not uncommon to observe the use of commas. Since comma separated value files were utilized, extra commas interrupted the designated fields where the data was supposed to be placed within the database. After reviewing the error tables all information in the comma separated value files could be fixed by replacing the extra commas that were found with semi-colons. When these alterations were made, the final database tables were created with the correct forms of the comma separated value files. This resulted in successful completion of an accurate database.

A procedure was created for determining errors that may occur within the data fields themselves. This procedure is marked as an appendix along with its hard results [See Appendix E]. This procedure included selecting 20 random data lines from each region and comparing the .bak/.txt files to the final database files. This would detect errors encountered through the importation of information. Most of the .bak data files were 100% identical to there Microsoft Access database lines. However, in Asia and

South America peculiar problems were discovered. Through out the whole process of importing information Microsoft Access removed all the digits with the value “0” after a decimal place when it was not a significant figure. For example data that looked like “14.0516000” in the .bak/.txt file would appear as “14.0516” in the Microsoft Access database. Furthermore, in Asia, this problem was more severe in the “LengthtoptB” field. All decimal places that existed in this field, of the 20 random points selected, were dropped. Such as, a length of “13.5” in the .bak/.txt file appeared as “13” in the Microsoft Access database. This does not have an immediate or large impact on the information we desire to deliver through our website, however it causes concern that during this importing process Microsoft Access removed decimal places. In addition to the problems that were discovered in Asia, South America revealed similar errors. South America had information in the height field altered during the process of getting the data from .bak file to Microsoft Access database. In the South American database table all the heights of the random 20 points that showed a decimal place also had that decimal place and the numbers behind the decimal removed. For example, a height of “3.5” would appear as “3”. This has a much larger impact on the data that needs to be portrayed through our website than do the Asia data table errors. If all the height information in South America has been altered so that the decimal places have been dropped, then cumulative and average information that is queried from the database is not going to be 100% accurate. This lack of accuracy is undesired. However, the problem may not be as large as the entire South American data table; it might be localized within certain site data that was imported from the same data file. It is important to further determine the cause of this problem and also attempt or suggest attempts to repair the data in the database.

6.5.2 Microsoft Access to Website

Quality control is also necessary to check the success of the connection between the ZOONIGHT Microsoft Access database to the created website. The only way to check this is by testing the website and comparing it to the actual database. Not only does the database need to be checked for proper connections, but also must be checked for graphical errors. Several calculations, such as the average height, average DBH, and Basal Area are made on several pages of the website and must be verified. A resulting graph produced by the website does not ensure its accuracy. Hence quality control is imperative to have a fully functional website.

A quality control procedure similar to that for checking the conversion of .bak file information to Microsoft Access database importing was implanted to determine that the connection of the ZOONIGHT database was made correctly to the website. A review of 20 random points was made with the inclusion of species information, which was added from the species data tables, which was obtained from the species code in the original line of Microsoft Access data, resulted in no substantial errors for the connection between the database and the website. The results were recorded along with the results from the first quality control element for .bak files to database table. These results included one negligible error that produced one data line two times for one query. After further review and alteration of the website this error was corrected and thus is insubstantial. This quality control proved a large success. The correct connection between the ZOONIGHT database and the website which was created allows for making the ZOONIGHT database useable and applicable to the general public, where it had not been before due to the use of BioMon within the MAB program.

6.5.3 *Website Evaluation*

After the completion of evaluation of the global vegetation dynamic website interface, there was success and also problems that were detected. In many cases, there were no errors, such as the actual output of the graphs and calculations to be displayed on the graphs, which was a success. In spite of this, several errors, both major and minor, were noted to be fixed. Once these errors were determined, they were fixed appropriately, making the website more functional, inviting, and easier to use.

6.5.3.1 Discovered Errors

Through browsing of each option on the website from each region, one major error noticed was the difference between the displayed amounts of trees to the actual outputted number of trees in the database table. After checking that information in the actual ZOONIGHT database, it was noted that their may be multiple tree data (such as height, DBH, etc.) for the same tree number because of the stems. Stems of the trees refer to the separate trees growing from one main tree, so therefore they are counted as one tree and given one tree number. However, since they are actually the same tree split into more than one, they each get their own data, causing a problem with the SQL code for counting the trees in the database.

Region: SouthAmerica / Site: Los Llanos / Year: 1994 / Quadrat: 121

Number of Trees within the Quadrat 121: 34 Trees

Reserve	Year	Quadrat	Tree Number	Family	Genus	Species	Height	DBH
Los Llanos	1994	121	1	Meliaceae	Trichilia	unifoliola	9	0.19
Los Llanos	1994	121	2	Polygonaceae	Coccoloba	sp1	5	0.07
Los Llanos	1994	121	3	Erythroxylaceae	Erythroxylum	gracilipes	7	0.13
Los Llanos	1994	121	4	Polygonaceae	Ruprechtia	ramiflora	11	0.23
Los Llanos	1994	121	5	Sterculiaceae	Guazuma	ulmifolia	11	0.31
Los Llanos	1994	121	6	Fabaceae	Lonchocarpus	pentaphyllus	9	0.15
Los Llanos	1994	121	7	Moraceae	Sorocea	sprucei	9	0.24
Los Llanos	1994	121	8	Polygonaceae	Coccoloba	sp1	8	0.13
Los Llanos	1994	121	9	Myrtaceae	Eugenia	sp1	6	0.16
Los Llanos	1994	121	10	Flacourtiaceae	Hecatostemon	completus	8	0.11
Los Llanos	1994	121	11	Flacourtiaceae	Hecatostemon	completus	8	0.1
Los Llanos	1994	121	12	Erythroxylaceae	Erythroxylum	gracilipes	5	0.11
Los Llanos	1994	121	13	Ulmaceae	Celtis	iguanaea	16	0.33

Restart!

Figure 8: Stem/Tree Differentiation

Becoming aware of this problem through the quality control of website evaluation allowed for the attempt to trying to fix this problem before it is made available on the World Wide Web. Now, since this error was noticed, the website has been fixed so that the options count the several stemmed trees as one tree, but output the stems individual information separately in the various graphs.

6.5.3.2 Minor Details

Other problems with layout, color scheme and confusion errors were also noted through website evaluation. For instance, in looking through the different regions, when checking all the options but the “Families” and “Species” boxes (to display all graphs but the Family and Species distribution via pie graphs), the layout of the graphs were skewed improperly, but were fine when “Families” and “Species” were included. This occurred in multiple instances. For example, it is noticeable in region North America, site Long Point, year 1995, quadrat 111, that the graph titles and graphs themselves are skewed. The produced output looked as follows:

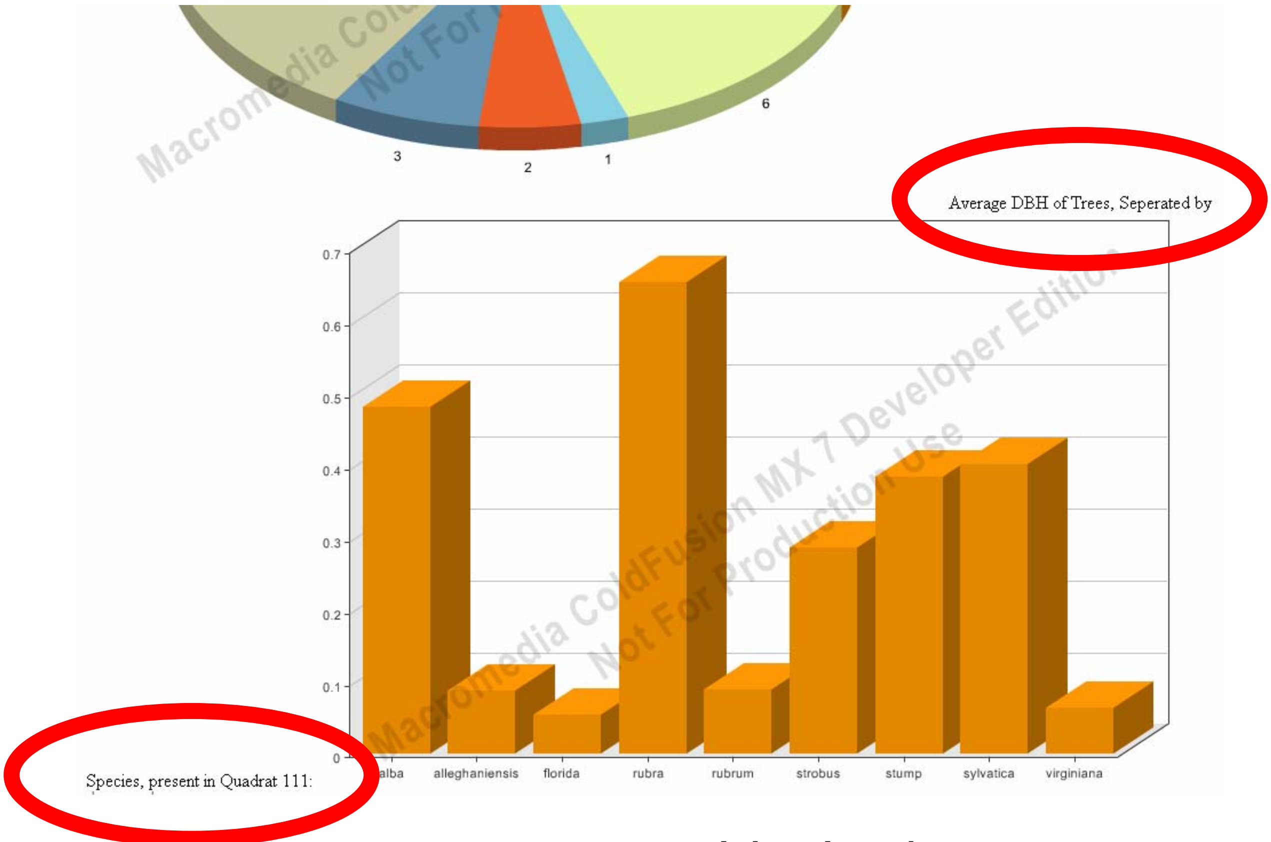


Figure 9: Layout Issues and Skewed Graphs

This error may have occurred because of improper spacing issues in the code, which have since been improved. Also from the image above, it is noted that in some cases, the spacing of the headings of data was off, which another minor detailed that has since been fixed.

Color scheme is also a problem due to the differences in web browsers and individual computer settings. On some computers, in some instances, the tested website produced a graph that was incorrectly colored according to the key, which had all the correct families. When hovering over the discolored data in the chart, it would additionally produce the wrong information. For example, in region Africa, site Campo, year 1997, the “Families” option produced a generated pie chart that showed mostly one type of family, “Vochysiaceae,” and omitted several other families, yet it still produced the correct numbers in the pie chart.

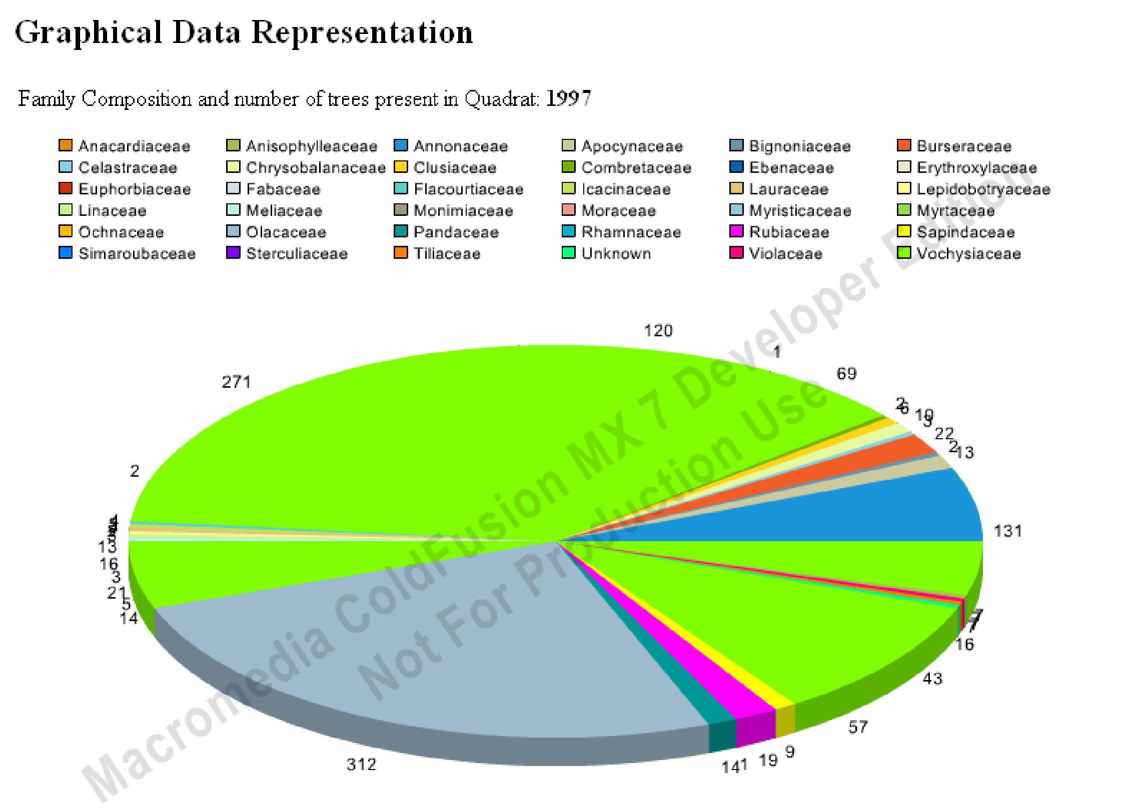


Figure 10: Graph Color Errors

This output was clearly incorrect and misleading. However, when tested on other computers, the pie chart for the exact same information showed up correctly. This may be because of color settings on different computers, or the way browsers work differently. This error is a recommendation to be looked further into.

Additionally, confusion of what to was a general error that was encountered on the website. Buttons were placed for the convenience of the user, however they were placed in a confusing manor. For example, previously on the website users may get confused on what to do next: to submit or to output the graphs. If a user did not click a quadrat before clicking “Submit,” for example, the next page to prompt the Family would appear, however the chosen quadrat would be the first quadrat in the menu, which is a common error that could be made among users unfamiliar with the website. The appropriate solution would be to create an error message if an option was not chosen, such as the error message recently created due to the website evaluation results.

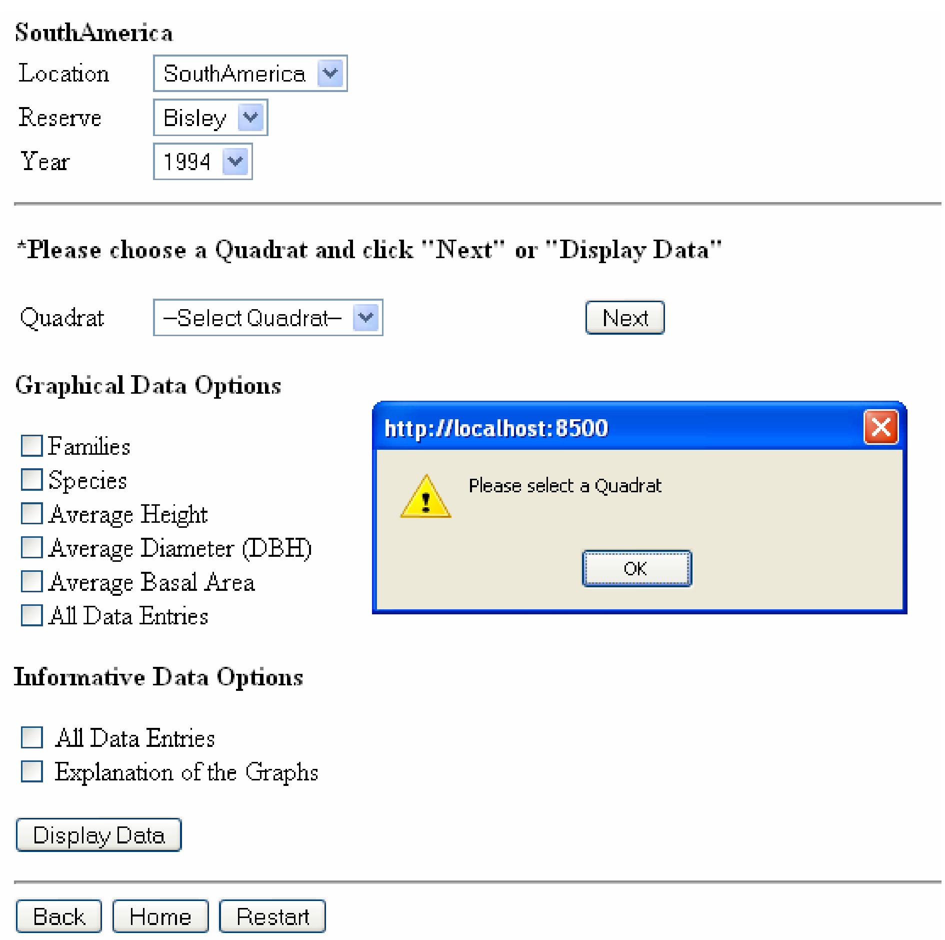


Figure 11: Error Checking Within User Choices

Furthermore, the buttons were located in awkward places and were not very clear (as seen in Figure 12). Not only were the buttons unclear, but the graphs outputted were hard to follow. It was noted by website evaluation that the graphs were unclear with what was outputted and an explanation was needed. Along with that, a lack of clear directions added to the confusion of the website. There were directions on the main page, however they were vague and minimal.

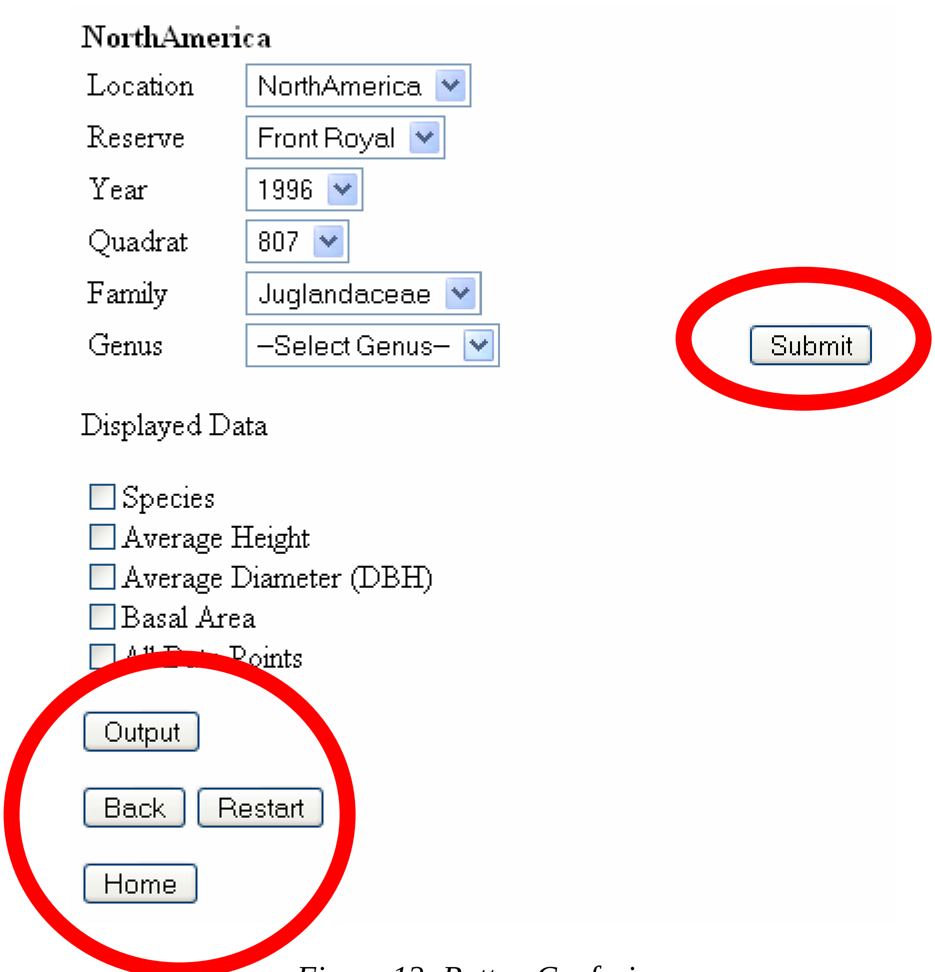


Figure 12: Button Confusion

Through website evaluation, several changes were made to increase the simplicity of use for the website. The buttons have been renamed from “Submit,” and “Output,” to “Next” and “Display Data” to make the outcomes more clear and clearer directions have been posted on the main page of the site for users to easily access during their browsing through the website. Lastly there has been an optional section added for users to choose if they would like to view detailed description on the information displayed in the graphs as shown in Figure 13.

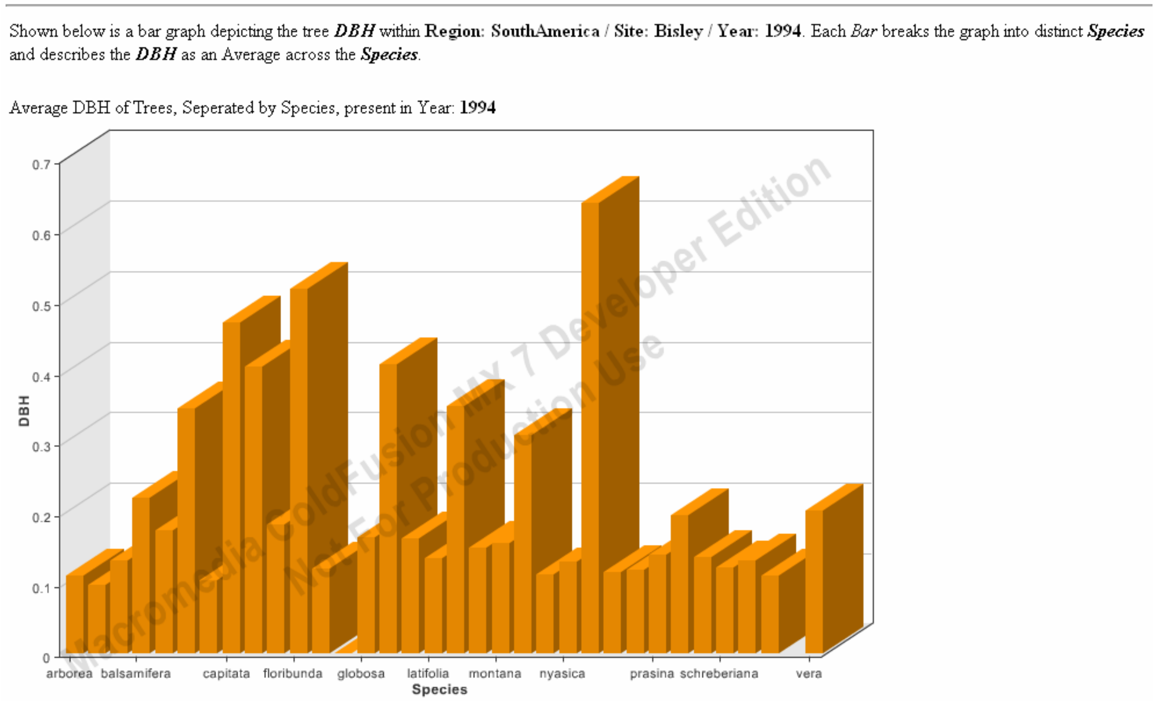


Figure 13: Data Definitions and Graph Explanations

Although layout, color scheme, differences between computers and web browsers, error notifications and directions are all minor things, together their flaws create a problem in the ease of use and visual aspects of the website. By fixing these errors, although small and often tedious, it makes for the website to be more inviting, and therefore more apt to be used by all ages around the world, which would satisfy the MAB program's goals.

6.6 Focus Groups

The focus groups were essential to the success of the website. The purpose of the focus groups is to test the website at various levels. Three groups evaluated their experience that they had while using the website. Web developers at the National Zoo were questioned about the professionalism, usability and functionality of the site. The staff of the Zoo's MAB program was looking at whether the site depicted the required information accurately and correctly. Finally, students were questioned on the ease of use and basic understanding of the data that was presented to them. Questionnaires were used and copies are included [See Appendix F]. The following is the analysis of the website from the responses of the groups mentioned.

6.6.1 Web Developers

The main concerns of the web developers were the general look of the website and how a user would interact with the layout and the different options which were available. One problem stemmed from the use of the pull down menus to retain information from page to page. The pull down menus had been used in order to utilize SQL queries that were dependent upon the information from each previous page used in order to get the necessary information, whether that was outputting data or querying for more specific information. After this was addressed, a concern for labels was expressed. Stepping through the site it was difficult to understand from a glance whether to select "next", which allowed you to select more specific criteria or "Display Data", a button to display graphs and the correlating data. The purpose of these two buttons is not immediately clear due to both their labels and their positions within the page. This of course means the page does not intuitively provide a way to know how to display data versus selecting more specific criteria. Looking past the layout, the SQL statements were examined to see how well they could handle specific events which occur when information within the database is missing or provides us with a “0” value. This is important to consider when taking the average values of heights, DBH and Basal Area. Comments also extended to cover the layout of navigational buttons, the possibility of adding links to the page, and fixing errors in the script. One such bug was found when a criterion was not selected and Display Data was chosen. An error will tell you to select the missing criteria. If at this point you choose to instead choose a criterion and click “next” you would find the next page load graphs instead of the next page in the criteria selection. This poses a problem and is a bug in the programming.

The concerns were countered with positive feedback. The webpage was easy to use. Barring the discrepancies mentioned above it was intuitive and the layout facilitated the usability. The functionality provided was adequate and the users were not overwhelmed by options or poor layout and presentation of the options. After the Web Developers were questioned, the MAB staff was approached with the questionnaire.

6.6.2 MAB Staff

Looking at the information and portrayal of data, the staff was pleased. The page was simple, informative, intuitive and easy to use. Once more the website was deemed easy to use. The functionality was appropriate and the display of information within the database was precise and accurately displayed.

Concerns such as proper labeling were brought up, as well as mathematical procedures used. This concerned the mathematical order of operations which were performed upon stems of the same tree for the average Basal Area per tree. It was determined that the graph representing the average Basal Area was incorrect since each stem was considered an individual tree due to the order that the information was processed. Also, the wish to have a page that addresses the plot area was desired. The jump in information from the reserve to a specific quadrat within the reserve was considered to be too far. Suggestions included numbering the possible steps within any given page. What remains is to question the students.

6.6.3 Students

The students, looking at the general layout and usability had few comments. The site had problems regarding the labeling of data. The instructions that were included with the opening page were too lengthy and were hard to retain. It was suggested to make them shorter to facilitate easy recollection. This included the opening page. The first selection (the location) was not easy to find because it was located at the bottom of the page. The background was also considered to be out of place. The opening page should be devoted to one purpose or the other, not both. Problems with the graphs were also encountered. The students found that when an incredibly large amount of data was shown, the colors of the family composition would overlap and provide incorrect information.

After all concerns were encountered, the students admitted that the site itself was self explanatory, and the data that was represented was clear and explanations were provided for certain words that they didn't know the definition of. The students thought the layout of the site facilitated the functions that it provided, and attested to the fact that for a basic data tool it did what was necessary.

6.6.4 Analysis of Feedback

The data retrieved from the focus groups will provide the results of a thorough testing of the web site. The information can be examined and hence determine what needs to be accomplished before the site can be labeled as a success. From the comments gathered from the questionnaires, results can be formed based upon what was said in conjunction with the comments and Yes/No answers asked for.

Each user that approached the site said that the site was easy to use, and upon further questioning by one of the project members said that they found the site to be intuitive. The layout facilitated the functionality and overall purpose of the site, and aided in the understanding of how to progress through the site, both specifying criteria and requesting graphical representation of the data. The styles used to display the data aided in comprehension of what was being shown. These were the biggest supporters of the site. To summarize what was said, the basic site itself is useful and correctly displays the database information in an accurate manner while providing the functionality that was requested by the MAB program.

While the site successfully does all of the things mentioned, there are things that must be addressed and changed to bring to the web, an easy, accurate and informative site that generates little to no confusion in its use. This will be accomplished by incorporating uniformity across the site through graph labels, concise directions and buttons which describe precisely what their function is. The mathematical functions will be evaluated, and the manner in which they are carried out will also be looked at. Based upon that evaluation, a recommendation will be made on how to best handle the mathematical paradox. Upon review of how to successfully manipulate the data, an answer may be provided regarding the plot as a selectable criterion. A recommendation will also be made about how to implement the use of a plot criterion. Both the mathematical and plot problems will then either be implemented by this project or left as a recommendation for a future use and integration into the web site.

After each issue addressed by the focus groups is provided with a recommendation or is fixed, the website will have undergone the necessary changes in order to be a success. At this point, all issues of confusion, conciseness, mathematical accuracy and plot description will have been handled. If a recommendation must be made it will address how to change and improve the finished website in the future.

7 DISCUSSION

The Monitoring and Assessment of Biodiversity program at the Smithsonian Institution strives to conserve biodiversity and promote its awareness in order to preserve its natural existence. The purpose of this project is to complete the website providing a useable database of vegetation data from around the world and through this, take part in the promotion of biodiversity. Through the website's completion, the website is able to not only help the MAB program analyze and possibly expand their program, but it now can connect people to science by promoting awareness and education of biodiversity, in turn satisfying the MAB program's main mission. The creation of a global vegetation website from data taken from the Smithsonian's MAB program is a good start in the movement of conservation in the future and a healthier environment.

7.1 Helping the MAB Program

With the new global vegetation database website, the information can now be shared on the World Wide Web, providing access to all ages and levels of knowledge. The graphs generated on the website displaying the types of families and species in each location, region, year and quadrat and the differences in heights, DBH, and Basal Area are an excellent visual tool to provide analysis. By being able to visualize this data, it enables the MAB program to see the changes in heights, for example, within a quadrat in a plot, rather than having to look at the raw data and trying to figure it out. It is much easier to see changes through graphs than to simply look at the numbers, which helps MAB staff and other audiences immensely. Through making this data easier to use and analyze, it may stir the interest in many different audiences, spreading more knowledge of the vegetation biodiversity.

Additionally, with all the graphs provided on the website, being able to view this information and learning about how the trees vary may spark an interest in people starting future plots in other locations. Currently, the MAB program has over 300 plots in five regions of the world, however with the constant expansion of the understanding of conservation of biodiversity through this website, people may take up an interest in developing future plots from which tree data could be collected and compared. With the creation of newer plots world wide, in perhaps other regions, vegetation data could be better analyzed since there will be more points to analyze it with, making better judgments about the conservation of these environments.

7.2 Expanding Biodiversity

To possibly promote the interest in starting more plots and obtaining more vegetation information, through the creation of the ZOONIGHT database alone, vegetation data can be shared with other MAB organizations and programs across the world. Since the website is now accessible to everyone, the vegetation data and information from the Smithsonian MAB program can be used for all those who seek it. A good example of the sharing of this database information would be for the SALVIAS program in Arizona. SALVIAS, or Synthesis and Analysis of Local Vegetation Inventories Across Scales, is a web-based program that strives to promote and inform people about biodiversity of all types in a global scope. Through sharing the Smithsonian's newly compiled vegetation database with organizations such as

SALVIAS, the information of biodiversity can spread vastly over people across the world, which will in turn provide for a better future.

Figure 14: Plot 1- Gabon, Africa 2004

7.3 Connecting People to Science

One of the societal impacts of our projects is how our dynamic webpage interface affects everyday life. This is hard to decipher due to the fact that our database is particularly targeting a certain audience of people who desire this information and analysis of the information. However, this project attempts to connect people to science in several ways.

7.3.1 Promotes Awareness

The mission of the MAB program at the Smithsonian Institution is to promote awareness of biodiversity in order to conserve and preserve its natural state throughout the world. This awareness then leads to the increased preservation and conservation of biodiversity, because people will be able to make informed decisions about the environment.

7.3.2 Promotes Education Globally

The promotion of awareness of biodiversity leads to the promotion of education. Once people become aware of biodiversity they request material to learn more about it. By offering tree information that is readily available and understandable to many, the awareness and promotion of the education of biodiversity is accomplished. Several different types of people with different levels of education come into mind of people who would use this website. Students, educators, researchers and scientists, and even hobbyists all could use and learn from this information.

Students may make use of the information available on the website in school through biodiversity projects they are assigned. The website was designed to offer varying levels of complexity, so students of many ages should be capable of using the website. The information they require may not be as extensive as that of a scientist, but it is available to them regardless. The school projects they complete will teach them about biodiversity, and if they need to present this information to classmates and teachers, they are also helping to spread awareness of biodiversity.

Without educators, students would never be able to become motivated to learn about biodiversity. Educators will be able to use the website in order to find information or to navigate it as a preliminary test prior to assigning a project to educate these students. Educators will be able to gather information easily, just as a student or scientist, and they will gain awareness and knowledge from use and implementation of the data. Educators need access to this information in order to increase their awareness and then gain a certain level of knowledge that allows them to suitably teach this information. The ability to give this information to educators is a very valuable key to promoting awareness and sparking education of biodiversity globally.

Scientists and researchers may be able to put the provided vegetation information to use more quickly. These members of society already have the knowledge of biodiversity and are looking for specific information that is available on this website. The data interpretations found on the website can also lend a helping hand to scientists who need to devote most of their time writing a paper, or applying for a grant. These interpretations are given to these scientists and they can be used as hard evidence based on factual data that has been collected. The advantages to having interpretations on hand for a scientist increase his productivity. This increased productivity adds to the available base of biodiversity knowledge and expands its boundaries.

The general public using this website includes a vast variety of people, from scientists who specialize in the tree data information that this project is exhibiting to people such as students working on school projects and avid hobbyists who desire to learn more about this tree data. With the website, these people are now able to broaden their knowledge about the biodiversity of trees and learn about how to preserve that biodiversity.

7.3.3 Applying This Knowledge to Urban Environments

The goal of this project is to make everyone more aware of biodiversity. However, up to this point we have focused more specifically on the educational aspect of spreading knowledge. This is a very important aspect and has been given due acknowledgement, however, it is important to take this knowledge and apply it to their lives in their environments. Through the use of the website, the general public will not only be able to view and learn about trees in different regions of the world, but they will learn to identify theses changes within their own neighborhood. This will give people the feeling of being apart of conservation of biodiversity when people can do things and actually see results.

One example of applying the knowledge of biodiversity to the general users' lives would be in the upkeep of a lawn or local city park. Most people in a society may be more concerned with the way their lawns look, and how these environments look to others, however, through the learning of different trees through the website, people may change their opinion in keeping their lawn and city parks healthy as well to keep them beautiful. By introducing the idea and emphasizing the importance of biodiversity, which this projects attempts to achieve, anyone can utilize their new knowledge into improving their environment by perhaps planting a variety of different trees or plants in order to establish a sector of biodiversity which may in turn be a healthier alternative. Allowing plants and new trees to grow reduces the use of pesticides or harmful chemicals used to maintain a grassy lawn. These chemicals and pesticides have further devastating effects on more than just “weeds” and unwanted vegetation. These pesticides and chemicals can enter the water table and can be ingested by species of birds and other animals that may use the lawn as a feeding area. The effects of these pesticide and harmful chemical ingestions have shown to reduce populations of animals in certain areas.

With a basic knowledge of biodiversity shared and promoted through the website, any harmful effects on the environment can be worked toward the reverse and in the future perhaps all together be avoided. Opening a new forum of biodiversity information, allows the general public to broaden their knowledge and help to create a healthier environment for more than just themselves. The knowledge that this project can potentially bring to the general public allows for a positive impact to take place in an area other than just education. The improved positive impact on the environment through the general public would be due to knowledge and awareness of biodiversity with the help of this project, satisfying the goals of the project and the MAB program at the Smithsonian Institution.

7.4 Monitoring and Conserving Biodiversity

The creation of the ZOONIGHT database and graphical website interface additionally provides hard evidence which documents and displays the several global vegetation species and their progress over time. Through these documents, the database identifies possible trends which allow for scientific intervention. For example, the loss of a species of trees is increasing at a rapid rate. With this information, scientists and researchers will be able to note the changes in these vegetation regions over time and space, and receive warnings as to what could possibly be causing these changes. Through looking at this graphical data on the website from the database, scientists and researchers can prepare to improve these trees, therefore enhancing biodiversity.

8 CONCLUSIONS

8.1 Internal Data Management

Combining the information from all the BioMon database files into a Microsoft Access database increases the speed with which data can be accessed and provides a central single file containing all the information. This file also breaks the data into easily recognizable categories. Regions are specified as tables within the database. Each region contains the reserve and year as well as plot and quadrat information for each individual tree. This information used in conjunction with the specific tree and stem number is used to specify any individual tree within the database. Taxonomic information is included using separate tables specifying the region which each list represents.

Using a defined process, as outlined in the data-handling manual provided in [See Appendix D], data conversion to the Access database could be accomplished speedily and with no loss of data. This procedure also allows for the addition of reserve and year to the tree information contained within the database.

This management should continue as the MAB program increases the amount of information that they obtain. The useful organization of this data will allow for any additions in the future to be added seamlessly creating an ever-growing database containing all information gathered by the MAB in a central file. Successful utilization of this procedure will allow continued use of the database with the website tool provided, and continual communication of data gathered with other organizations.

8.2 External Data Availability

8.2.1 Online Database Summary Tool

With successful implementation of the database file, the web site providing graphical description of the information which was created will provide an invaluable shortcut in the calculation of data. Those within the MAB program may use this tool to summarize areas during a given year such as the reserve, quadrat, family, genus and species. Each area or level of information provides graphical representation of information derived from measurements of each tree.

This tool, while available to the MAB staff to assist in the education of the importance of biodiversity, may also be extended to researchers, hobbyists and educators interested in exploiting this online tool. The availability of this tool on the World Wide Web will allow others to use the information collected by the MAB and gain an overview of biodiversity and how the world changes from year to year. While the database is used in this sense to support the use of a tool, the database may also be shared with different organizations.

8.2.2 Database Availability

This information, not only available from an online tool, may be shared with other organizations worldwide. A goal the MAB program has been trying to implement for some time has been the sharing and diffusion of this knowledge they have gained with other organizations. One organization in particular, SALVIAS, has been in contact with the MAB program and an exchange of information has been attempted before. The lack of a supported database system prevented from a relationship growing between the two organizations. Since the conversion to a single Microsoft Access file, an exchange of information can now be completed successfully. This sharing of information can be applied to other groups and organizations, spreading the information gathered concerning biodiversity and in turn, assist the MAB program's goal of spreading awareness.

8.2.3 Increasing MAB Plot Collection

Increasing awareness, a large part of the MAB program, is accomplished through the data that they have collected from some 300+ monitoring plots worldwide. It is conclusive that the database will continue to grow due to the expansion of information gathered from the plots around the world. This increase in knowledge would then facilitate the continued need to "diffuse" the database to other groups and organizations, fulfilling the goal of the Smithsonian Institution's mission. Utilizing the new database as well as the methods provided to transfer the data, the upkeep and addition of collected information has never been easier, and due to the new tools provided, a database and graphical website, should assist the MAB program in helping governments and peoples around the world to understand the importance of their mission. Ideally this will produce an increased interest in the creation of more sites and monitoring plots around the world.

9 RECOMMENDATIONS

A set of recommendations has been constructed to further the progress of the dynamic website based upon the conclusions drawn from our group and the objectives we established prior to the completion of this project. The recommendations set forth provide the Smithsonian MAB program with continued stability and organization of the data, and increase the productivity of the website, furthering the education and awareness of the conservation of biodiversity.

9.1 Maintain Organization of the Data

With the ZOONIGHT database compiled from the .bak files from BioMon, additional data can be inserted into the table upon collection, allowing the database to expand. With all of this newly collect data from the future along with recently collected data from new plot sites not yet incorporated into the database, the data could get misplaced or unorganized. Therefore, it is recommended that the data continue to be properly input into the compiled ZOONIGHT database. Following the steps provided by the Data Handling Manual, one can easily alter and enter new information into ZOONIGHT. To maintain the latest information, continue to update the database upon retrieving plot information. By constantly updating the database, you are providing your users access to the most recent information, which could prove vital to those accessing it.

In addition, the current ZOONIGHT database consists of four major vegetation regions: Africa, Asia, North America and South America, however the MAB program contains five: the four previously mentioned regions and the Caribbean. At this point in time, the Caribbean plots are mixed in the database table with the South American plots. It would be in the MAB program's best interest to separate out the Caribbean plots because it would provide more correct information and offer the user a more accurate search.

9.2. Database Modifications

When data is input using the Data Handling Manual, there may be errors in the transfer. Developing a system to find errors in the database is a possibility to improve the quality control of the database and website. Currently errors must be checked manually, through selecting a set number of data records in a given table randomly. However, through the development of a quality control system in Microsoft Access time could be saved in the future, and lead to a more successful and accurate website.

9.3 Website Additions

A good recommendation for future IQPs within the Smithsonian's MAB program would be to create password protected web pages to secure, detailed database information. With password protection, the MAB directors can decide who is allowed to access the detailed information. This would be appropriate for scientists and researchers so they can access information an average person may not fully understand or know how to use. Through a password protected page, more scientific data can be displayed so those with access could get exactly what they were looking for. This also protects the privacy of the information. The MAB program labors hard to collect this data and by allowing certain viable scientists to access this information they trust that their information is protected and that due credit will be given.

Along those lines, having a more general, basic page would be helpful for younger students who may not know exactly what they are looking for. Currently, the created website offers detailed information that may not be easy for students to understand, unless they knew exactly what they were looking for. With a more general page, students may be able to read information about the different families, genera or species. The inclusion of visual aids and images can also help tailor the web page to the needs of broader audiences.

However, if pages such as this were not to be created, the current website could be expanded upon. Future additions to the site could make it easier to navigate the different pages to retrieve different types of information from the database. A "Date Range" feature to determine the comparisons of the data across different years would be helpful to see the changes over time. Adding more options to the pages to display further graphs could be helpful to visualize the plots better. Additionally, in the future, options for type of output could be added. For instance, the user may be able to choose what type of graph they would like the data to be output in, be it a scatter plot, line graph, or the default bar graph. Through adding new options, the site will be more inviting to the user, allowing the user to get the most out of the information they seek.

9.4 Aiding the Expansion of Biodiversity

With this newly created database website a great deal of information is now available and obtainable for people of all ages and education levels around the globe. However, since the created website may not be as user friendly to younger students in an elementary level, a good recommendation would be to create and incorporate curriculum learning about biodiversity of different vegetation species through the use of the website. A curriculum for an elementary level could teach students about the different tree species perhaps in their neighborhood and also how to better protect their surrounding environment. The curriculum would include use of the graphical website so that the students would be able to take what they are learning and put it into context by visualizing trees around the world and specific information about those trees. This would make the website more inviting and increase the usage among younger age levels, which encourages greater learning.

REFERENCES CITED

1. Smithsonian. (2005). *History of the Smithsonian.* Retrieved September 18, 2005, from http://www.si.edu/about/history.htm.

2. Annual Reports- Smithsonian. (2004). *Uniquely American 2004 Annual Report*. Retrieved September 20, 2005, from http://www.si.edu/opa/annualrpts/04report/Smithsonian.pdf.

3. Annual Reports- National Zoological Park. (2003) *FONZ 2003 Annual Report.* Friends of the National Zoo, Retrieved September 20, 2005, from http://nationalzoo.si.edu/AboutUs/AnnualReports/FONZ/pdf/2003FONZAnnualReport.pdf

4. National Zoological Park. (2004). *History of the National Zoo*. Retrieved September 14, 2005, from http://nationalzoo.si.edu/AboutUs/History/.

5. A. Alonso, Monitoring and Assessment of Biodiversity Program office poster. Retrieved November 15, 2005.

6. National Zoological Park. (2004). *Monitoring and Assessment of Biodiversity*. Retrieved September 13, 2005, from http://nationalzoo.si.edu/ConservationAndScience/MAB.

7. A. Alonso, F. Dallmeier, E. Granek and P. Raven, 2001. Biodiversity: Connecting with the Tapestry of Life. Smithsonian Institution/Monitoring and Assessment of Biodiversity Program and President's Committee of Advisors on Science and Techniology. Washington, D.C., U.S.A.

8. N. Chin. "Bioinformatics in biodiversity," National Center for Genetic Engineering and Biotechnology & National Science and Technology Development Agency of Thailand. Retrieved September 13, 2005, from http://biohpc.learn.in.th/lecturers/chen/material/bim.htm.

9. National Zoological Park. (2004). *Monitoring and Assessment of Biodiversity – BioMon.* Retrieved September 13, 2005, from http://nationalzoo.si.edu/ConservationAndScience/MAB/biomon/

10. Rulfs, Jill. Personal Interview. 22 Sept. 2005.

BIBLIOGRAPHY

A. Alonso, F. Dallmeier, E. Granek and P. Raven, 2001. Biodiversity: Connecting with the Tapestry of Life. Smithsonian Institution/Monitoring and Assessment of Biodiversity Program and President's Committee of Advisors on Science and Techniology. Washington, D.C., U.S.A.

A. Alonso, Monitoring and Assessment of Biodiversity Program office poster. Retrieved November 15, 2005.

Annual Reports- National Zoological Park. (2003) *FONZ 2003 Annual Report.* Friends of the National Zoo, Retrieved September 20, 2005, from http://nationalzoo.si.edu/AboutUs/AnnualReports/FONZ/pdf/2003FONZAnnualReport.pdf .

Annual Reports- Smithsonian. (2004). *Uniquely American 2004 Annual Report*. Retrieved September 20, 2005, from http://www.si.edu/opa/annualrpts/04report/Smithsonian.pdf.

Berg, Bruce L. *Qualitative Research Methods for the Social Sciences*. New York; Pearson , 2004.

Campbell, Patrick. Personal Interview. 1 Nov. 2005.

ColdFusion MX7 Getting Started Experience. Macromedia, Inc. (1995-2005) Retrieved October 31, 2005 from http://www.macromedia.com/examples/cfgettingstarted/experience/index_content.cfm

ColdFusion MX7 Getting Started Experience Tutorial. *Steps for Building Dynamic Pages.* Macromedia, Inc. (1995-2005) Retrieved on November 1, 2005 from http://www.macromedia.com/examples/cfgettingstarted/experience/docs/steps_for_building_dynamic_pages_en.pdf

Hunter, Ed. "UF, UN AND SMITHSONIAN TEAM UP TO LAUNCH NEW BIODIVERSITY WEB SITE," Source: Lee, Richard. January 28, 2000. Retrieved September 13, 2005, from http://www.napa.ufl.edu/2000news/ecoport.htm.

Itz, Michael; Fernandez, Emmanuel; Sullivan, Cory. (2004). Biodiversity Database Management in Washington, D.C. Unpublished Interactive Qualifying Project. Worcester Polytechnic Institute.

Lindeman, Robert. Personal Interview. 23 Sept. 2005.

Madill., Robert. Personal Interview. 27 Oct. 2005.

Mani, Murali. Personal Interview. 23 Sept. 2005.

N. Chin. "Bioinformatics in biodiversity," National Center for Genetic Engineering and Biotechnology & National Science and Technology Development Agency of Thailand. Retrieved September 13, 2005, from http://biohpc.learn.in.th/lecturers/chen/material/bim.htm.

National Zoological Park. (2004). *History of the National Zoo*. Retrieved September 14, 2005, from http://nationalzoo.si.edu/AboutUs/History/.

National Zoological Park. (2004). *Monitoring and Assessment of Biodiversity*. Retrieved September 13, 2005, from http://nationalzoo.si.edu/ConservationAndScience/MAB.

National Zoological Park. (2004). *Monitoring and Assessment of Biodiversity: Research Network*. Retrieved September 13, 2005, from http://nationalzoo.si.edu/ConservationAndScience/MAB/researchprojects.

National Zoological Park. (2004). *Monitoring and Assessment of Biodiversity – BioMon.* Retrieved September 13, 2005, from http://nationalzoo.si.edu/ConservationAndScience/MAB/biomon/

Rulfs, Jill. Personal Interview. 22 Sept. 2005.

Smithsonian. (2005). *History of the Smithsonian.* Retrieved September 18, 2005, from http://www.si.edu/about/history.htm.

Smithsonian. (2005). *Smithsonian Institution Building, the Castle.* Retrieved September 18, 2005, from http://www.si.edu/visit/infocenter/sicastle.htm.

Sun Microsystems. (2004). *Java Technology.* Retrieved September 13, 2005, from http://java.sun.com.

The SALVIAS Project. (2002). *SALVIAS.* Retrieved September 13, 2005, from http://www.salvias.net/.

US MAB. *BRIM (Biodiversity Resources for Inventorying and Monitoring),* Retrieved September 13, 2005, from http://www.mabnet.org/brim/.

W3C. (2005). *Cascading Style Sheets.* Retrieved September 13, 2005, from http://www.w3.org/Style/CSS/.

W3C.(2005). *Perl.* Retrieved September 20, 2005, from http://www.w3.org.

W3C. (2005). *XHTML, HTML.* Retrieved September 20, 2005, from http://www.w3.org.

Ward, Matthew. Personal Interview. 20 Sept. 2005.

Wilbur, Jayson. Personal Interview. 23 Sept. 2005.

GLOSSARY

.bak – Back up file, compiled and left by IQP 2004. Contains comma separated information on vegetation data. (11)

Basal Area – Cross sectional area of the tree. (24)

biodiversity – Encompasses the entire living world and the interaction between species to maintain an adapted and life sustaining quality of life for all species involved. (6)

BioMon – Biodiversity Monitoring Database, holds information about trees and other vegetation. (10)

CFML – ColdFusion Markup Language, processes requests for information from databases, displays that information, and creates a dynamic page based on the content of any information that the page links to. (14)

ColdFusion – Created through Macromedia, an application server which is used in parallel with a web host server, and processes the ColdFusion Markup Language (CFML) tags to output to the user. (14)

CRC – Conservation Resource Center, 3,200 acre part of the Smithsonian's National Zoo used for research on caring for and preserving endangered species of plants and animals. (72)

.csv- Comma Separated Value, the file format of the .bak file saved into a Microsoft Excel sheet. (29)

database – Holds and organizes information in separate tables. Used in Microsoft Access and BioMon. (1)

DBH – Diameter at Breast Height, diameter of the stem of the tree measured in meters at 4.5 feet above the ground. (10)

Dreamweaver – Created through Macromedia, a web creation program where code can be imputed to display to the user. (13)

focus groups – groups made up of people of different levels of education used to retrieve feedback. (20)

FONZ – Friends of the National Zoo, Zoo's financial support. (4)
HTML – Hyper-text Markup Language. Tags that create standard text documents. (16)

interview – A question-and-answer session between at least one interviewer and one or more interviewees. (20)

IQP 2004 – Emmanuel Fernandez, Michael Itz, Cory Sullivan, started this project by converting all of MAB's previous database files into one file format, the (.bak) format, which are compatible and accessible through the use of the BioMon database. (6)

MAB – Monitoring Assessment of Biodiversity Program, Smithsonian Institution. Designed in 1986, was created to promote the conservation of biodiversity. (6)

Microsoft Access – Program created from Microsoft to create, develop and manipulate data in a database. (12)

National Zoological Park – Started by William Temple Hornaday in 1887 behind the Smithsonian Castle and houses about 2,700 creatures, plants as well as animals, with 435 different species being in the animal collection. (3)

paradox – Type of database used since 1987 to contain the BioMon data which is currently outdated. (10)

plot – 1 hectare in size (100m x 100m) and located in MAB plot regions throughout the world. (1)

quadrat – 100 by 100 foot section of a plot in a reserve location containing examined vegetation. (11)

quality control – The process of reviewing certain information and procedures in order to make sure they have been preformed properly. (22)

query – Call to a certain part of the database. (17)

Smithsonian Institution – Founded by British scientist James Smithson in 1846. Presently, the Smithsonian is the largest museum complex in the world with 18 museums, the National Zoological Park, 9 research centers, and 140 affiliated museums in other locations. It is home to over 140 million items and artifacts all over the world. Its exhibits from are visited by over 44 million people annually. (3)

SALVIAS – Synthesis and Analysis of Local Vegetation Inventories Across Scales, is a web-based program that strives to promote and inform people about biodiversity of all types in a global scope. (49)

SQL – Structured Query Language, or Sequel. Used to generate a query to pull information from the database. (17)

ZOONIGHT – compiled database from BioMon .bak files to be used for the National Zoo. (1)

APPENDIXES

Appendix A: Liaisons

Through the Monitoring and Assessment of Biodiversity program at the Smithsonian Institution, the MAB staff has been very helpful in providing us with materials, direction and support throughout the term of our internship. Our three liaisons, Alfonso Alonso, Jennifer Sevin, and Patrick Campbell have been especially clear in their project requests, always willing to give a helping hand in a friendly and inviting manner. These three individuals were kind enough to take the time out of their busy schedules to accommodate us and make us feel welcome.

Each of our liaisons play an important role at the SI/MAB program. Together our liaisons work to accomplish the main goal of promoting the conservation of biodiversity through different techniques such as organizing education classes, working with the vegetation data and preparing programs. The vegetation website we have created proves useful for our liaisons and all MAB staff to continue toward the MAB program's main goal.

Alfonso Alonso is the Assistant Director of the Conservation of the MAB program. Alonso plans project budgets, writes and reviews scientific papers and educational materials on MAB to develop and carry out strategies for sampling protocols. Jennifer Sevin, the Director of Education and Training, works under the direction of Alonso. She plans professional training courses for international scientists and resource managers and her research is focused on monitoring and analysis of indicator species. Patrick Campbell is a research ecologist who deals directly with the information collected at the sites world wide. He is basically concerned with the analysis and implications of that data. The three often travel (on separate occasions) to sites around the world to encourage people to attend SI/MAB biodiversity classes and spread the promotion of conserving biodiversity.

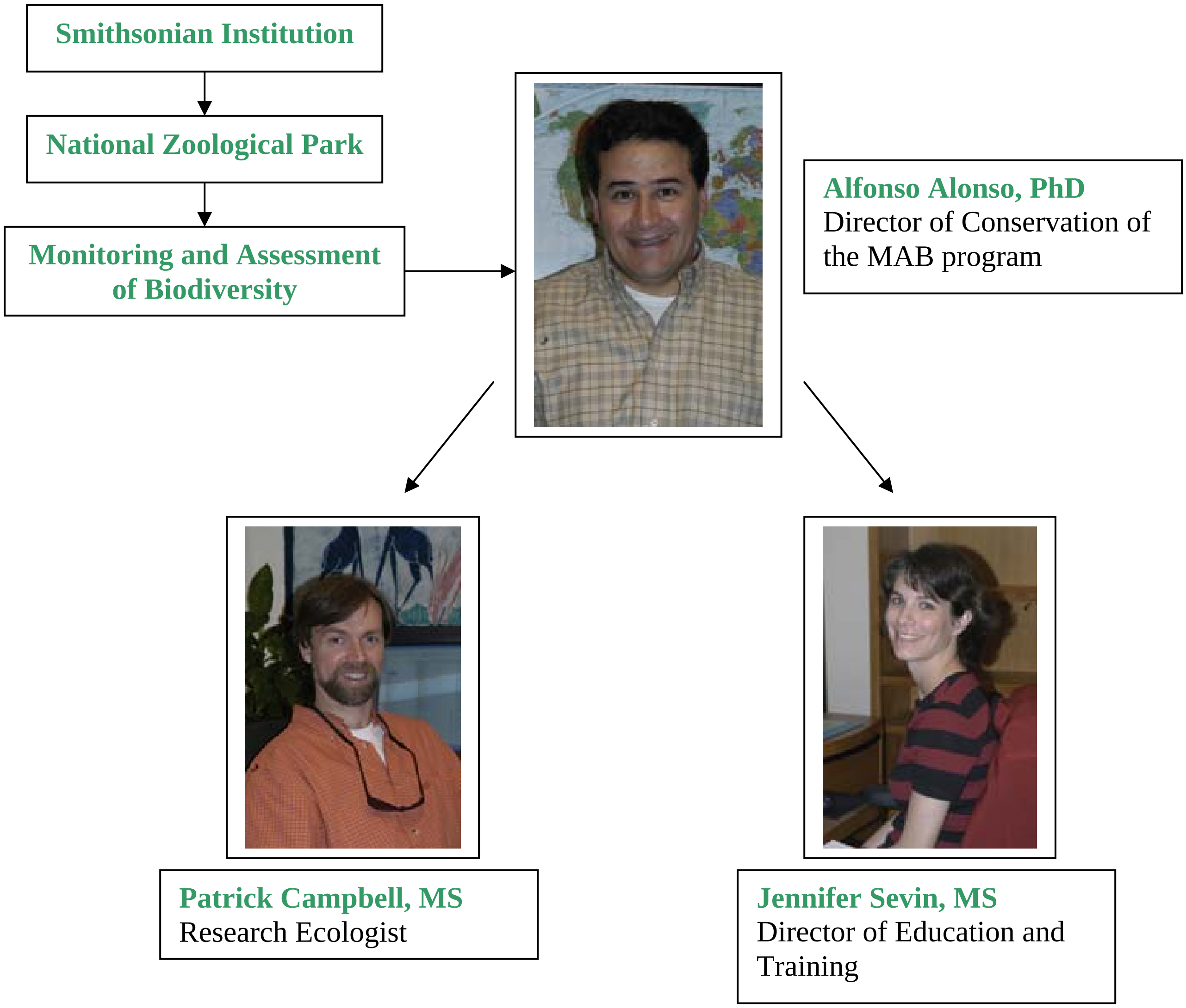


Figure A1: Liaisons at the MAB Program

Appendix B: Conservation Resource Center- Front Royal, VA

The liaisons and MAB staff often go to the MAB plots around the world to collect the vegetation data of which we are working with. The closest plots are in the Conservation Resource Center (CRC) in Front Royal, VA. The CRC is a 3,200 acre part of the Smithsonian's National Zoo used for research on caring for and preserving endangered species of plants and animals. Education courses provided by the MAB program along with several studies occur at the CRC throughout the year as well.

Figure A2: Tagged Trees in Front Royal, VA (CRC)

The CRC in Front Royal is just one of the sites where vegetation data is collected. The Front Royal reserve contains 15 plots with data last collected in 2001. This year, our group had the opportunity of traveling with the MAB program staff to learn how tree data is collected and actually see some of the plots. We were fortunate to witness the trees that are in our ZOONIGHT database, notice where they are located in the plot, their heights and DBH, the difference in tree stems and their status.

Figure A3: Viewing the Plots

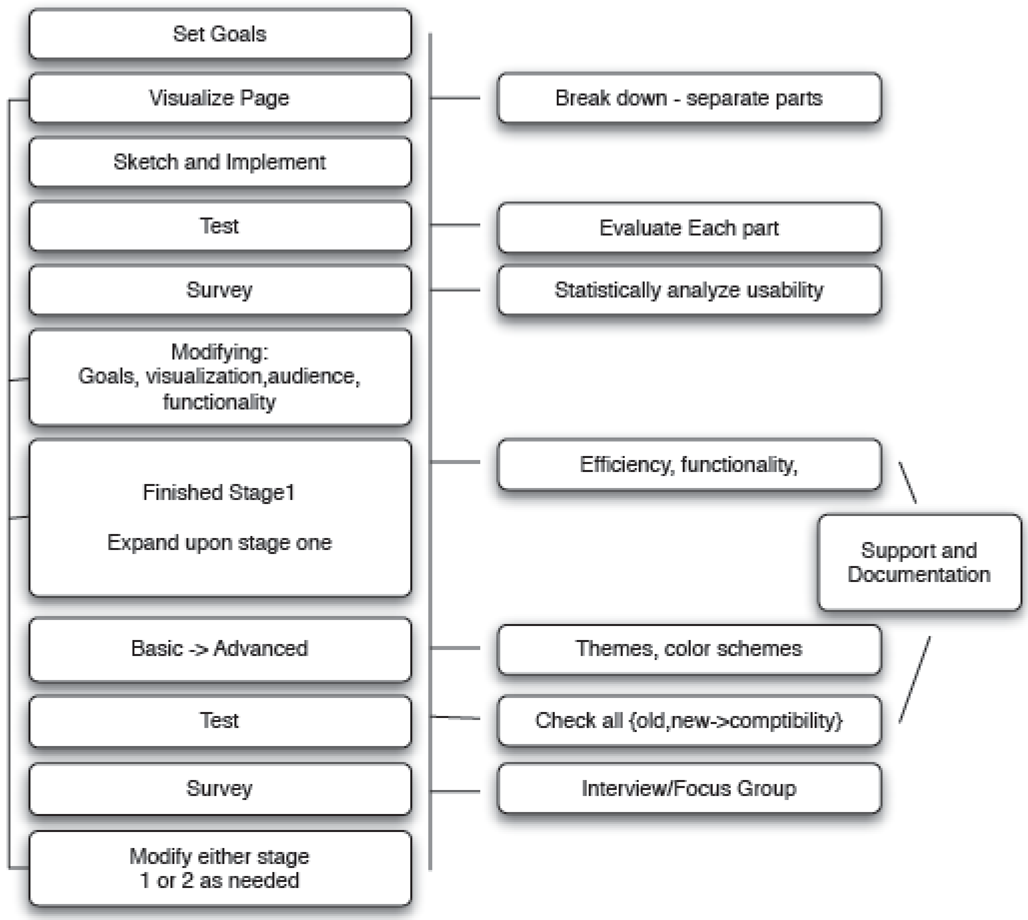
Visiting the CRC was a wonderful experience because it applies the knowledge we gained from creating the database and implementing it onto a website that is accessible for all to use. With this trip, we are now able to fully appreciate all that goes into collecting and working with this global vegetation data.

Figure A4: Group with Tagged Tree

Figure A5: Tagged Tree with Two Stems

Appendix C: Method Flowchart of the project

Created A Term to plan out the methods of approaching the project.



Appendix D: Data Handling Manual

Procedure for Applying BioMon Data to the MAB Website

Completed by:
Matthew Basile
Roger Burns
Erin Mazuera

1 Data Handling Manual

Contents

2 Data Handling Manual

Introduction

The goal of this manual is to augment the current Data Handling Manual in place at the Monitoring and Assessment of Biodiversity (MAB) program at the Smithsonian Institution. This manual intends to convert .bak files into a Microsoft Access format in order to make those files more universal when sharing the database information and more easily read in the Microsoft Access database. This manual includes a stepwise and easy to follow set of instructions that will accomplish the conversion of files.

The following is a generous time estimate for the following conversion and compilation of data. The time will significantly decrease upon the further familiarization that comes from working with the data more frequently.

Start
Current Data Handling Procedure
Locating Files from Step 1
Convert Format
Insertion of Information
Creating a National Zoo Database
Finish

95
5
5
10
+10
125 Minutes

Locating BioMon Database Files

The first step that must be completed is to successfully locate the correct files which need to be entered into the Microsoft Access database. Currently, the files are saved as .bak files, which will most likely be found on the G: drive of the MAB program's computers. The files which were created and saved by the 2004 IQP group were recorded and saved here:
G:\WPI\2004 - Project - Cory, Mike, Emmanuel\Database Final Documents\csv
However, future information may be placed into a more universal folder, hence making the first task a very large one.

Convert Format

This step is broken down into further steps to ensure that conversion occurs properly and also prepares the files to be found and used easily in Microsoft Excel. It is essential that the BioMon database files have been located at this point.

Step 1: Creating a Temporary Folder

On the computer's Desktop:

- Right click the mouse
- Click on New🕓 Folder
- Name Folder "Temporary Database Information"

Return to the folder where the source data was obtained.
Copy all of the source data.
Paste that data into the "Temporary Database Information" folder.
In the "Temporary Database Information" folder:

- Highlight all (.txt) files.
- Delete these files (do not worry they are still in their original location as well as in the temporary folder).
- All remaining files should be (.bak) files, if they are not, remove any other files that are not (.bak) files by deleting them.

Step 2: Converting .bak Files to .txt Files

Select one file in the "Temporary Database Information" folder. To that file:

- Highlight that file by clicking on it
- Right click the mouse button
- Select Rename
- Delete the "bak" portion of the name and replace it with "txt"
    - For example:
    - AS104.bak🕓 AS104.txt
- A notebook icon should appear upon the name being changed

Repeat this procedure for all of the files within the "Temporary Database Information" folder, including the spp-list.bak file.

Insertion of Information

This step is important because in order for the database to be complete, each data file must contain information about the Reserve it was taken from and in what year it was taken in. This information currently appears in the title of each file, however these titles will no longer be visible once the information is stored in a database table.
This step also involves the use of Microsoft Excel. Before this step can begin it is important that this program is located. For the most part, this program can be found by clicking the Start Menu→Programs→Microsoft Office→ Microsoft Office Excel

Step 1: Finding the Files

Open Microsoft Excel, where the following will take place:

- Click on the File button in the Menu Bar
- Select Open
- Go to “Temporary Database Information” folder
- Change the “Files of type” option, under the filename text box, from “All Microsoft Excel Files” to “Text files(*.prn,*.txt,*.csv)”
- Select any file, preferably the first file from the list which should be arranged in alphabetical order.
- Click Open

Step 2: Importing the Data

The previous procedure should prompt a “Text Import Wizard” in which the following steps occur:

- Step 1: Select the Field marked “delimited” in the original data type field.
    - Leave all other options unaltered in their default selections.
- Step 2: In the delimiters field, leave “Tab” selected, but in addition select “comma”
    - Leave all other options unaltered in their default selections.
- Step 3: No further work needs to be done in the wizard.
    - Click Finish

The information from the text file should now appear as an Excel spreadsheet.

Step 3: Inputting Information

Now the file is ready to be altered so that Reserve and Year information can appear in the spreadsheet and thus into the ultimate destination of the database.
To the worksheet:

- On the Menu Bar: Click Insert→Columns

- Repeat step 1
- Now there should appear two new blank columns:
  - Column A and Column B

Now locate the file name in the top of the Window. With this name you will:

- The file name should resemble something like this
  - Microsoft Excel-AB104.txt

Let's break down the filename again(in case you don't remember from first part of manual):

- AB104
- AB= Reserve Code
- 1= Plot Number
- 04= last two digits of the Year

This information must be used and input into the spreadsheet doing the following:

- Once determining the Reserve Code match it to its Full Reserve Name from the table below:

<table>
<tr><th>Africa</th><th colspan="2">Asia</th><th colspan="2">North America</th><th>South America</th></tr>
<tr><td>AB- Abakaliki</td><td colspan="2">CH- Dinghushan</td><td colspan="2">FR- Front Royal</td><td>AG- Aguas Negras</td></tr>
<tr><td>AK- Akampka</td><td colspan="2">JI- Jiangfengling</td><td colspan="2">KJ- Kejimkujik</td><td>BE- Beni</td></tr>
<tr><td colspan="2">CA- Campo</td><td colspan="2">LP- Long Point</td><td colspan="2">BI- Bisley</td></tr>
<tr><td colspan="2">DI- Dikolo</td><td colspan="2">RP- Rocky Point</td><td colspan="2">GA- Guatapo</td></tr>
<tr><td colspan="2">EH- EH</td><td colspan="2">RR- Royal Roads</td><td colspan="2">GR- Grenada</td></tr>
<tr><td colspan="3">EJ- Ejagham</td><td colspan="3">IT- Itaipu</td></tr>
<tr><td colspan="3">OK- Okwangwo</td><td colspan="3">LL- Los Llanos</td></tr>
<tr><td colspan="3">TF- Takamanda</td><td colspan="3">MA- Manu</td></tr>
<tr><td colspan="3">UM- Umukabia</td><td colspan="3">PS- Soberania</td></tr>
<tr><td colspan="6">SJ- St. John</td></tr>
<tr><td colspan="6">UR- Urubamba</td></tr>
</table>

- Now that the proper Reserve Name has been identified, type that full name into cell: (Column A, Row A).
- Deduce the Year, and type that into cell: (Column B, Row A).

Highlight both of the cells with the Reserve and Year information in them. With these cells:

- Copy the content of the highlighted region
- Scroll down to the bottom of the spreadsheet
- Paste the Highlighted region in Column A and B of the last row of data in the spreadsheet.
- Highlight the region between the first row and the last row of Column A and Column B
- Paste the Reserve and Year information in these cells.
    - This makes for easiest and fastest way of data input.

Step 4: Refining the Data

Each column of the spreadsheet has an appropriate label that is not present in the Excel spreadsheet form. These are the proper titles:

Reserve	Year	Quadrat	Tree #	Stem #	Blank	X	Y	Species Code	DBH	Status	Height	Notes	Baseline	Length to pt A	Length to pt B

Notice the column marked "Notes", which after the addition of Reserve and Year should be column M. The Notes column includes notes from different data gatherers that recorded the information. However, these notes may include commas. This file is going to be saved as a comma separated value in order to increase ease of import to Microsoft Access. The additional commas found in the Notes column will hinder this process and result in various errors during the importation process.

Thus, it is important to go through each line of data in the Notes column. When a comma is found:

- Select the Notes section in which the comma has been located
- The comma will be replaced by a semi-colon (;)

Step 5: Properly Saving the Spreadsheet

This task is very important to the compatibility and importability of the file and its data to a Microsoft Access database.

When saving an altered and refined file:

- Click on the File button in the Menu Bar
- Select "Save As"
- Under the file name text box, change the "Save as type" option to "CSV(comma delimited)(*.csv)"
- The name should still remain as the way it was when opened, however if it has been altered save it according to its Reserve Code, Plot Number and Year according to standard procedure of this manual.
- This new file should be saved into your "Temporary Database Information" desktop folder.

When finished with the new files, it is important that they are not open in Excel when attempting to import them in Access. In order to prevent this error, simply exit out of Excel when finished, or exit out of the spreadsheet. When exiting you may be prompted to save all changes, in this case, select Yes. Then another prompt will be made warning you that your file may contain features that are not compatible with CSV format. Select Yes again.

This ends the Microsoft Excel portion of data handling, once all files have been updated.

8 Data Handling Manual

Creating and Updating a National Zoo Database

Since there was currently only a BioMon database present, the creation of a new database in Microsoft Access was necessary to store all the BioMon information. The creation of this database has already been done. Thus, this portion of the manual will lead you to the existing database which has already been created so that it can be updated.

Step 1: Open the Database

To begin, open Microsoft Access. This can be done in similar fashion to opening Microsoft Excel. Click on the Start menu→Programs→Microsoft Office→Microsoft Office Access.

In Microsoft Access:

- Click File, on the menu bar
- Select Open
- When browsing for file location:
    - Select My Computer
    - Then choose (G:) drive “Mab on 'Si-fscl01_pool108_server\Vol108\Ic\Gaia'”
    - In the (G:) drive select the “WPI” folder
    - In the WPI folder choose “2005-Project-Roger, Matt, Erin” folder
    - Then select the “Databases” folder
    - Finally choose the database “ZOONIGHT.mdb”

Upon selection of this database, you may be prompted that the “file may not be safe…”, in this instance Click Open.

A window of the database will appear.

Step 2: Importing Information to the Database

In the database window:

- Select New
- In the List that results from prior selection, Highlight “Import Table”
    - Click Ok
- Locate your “Temporary Database Information” folder
- Change the “files of type” field to “Text files (*.txt, *.csv, *.tab, *.asc)”
- Select the first .csv file in the folder
- Click Import

This should result in an Import Wizard appearing. In the Import Wizard:

- Select the Delimited bubble, or if this is already selected, Click Next

- Select the Comma delimiter, and leave all other fields as they already appear, Click Next
- Select "In an existing table"
    - The existing table to which this information is added depends on what region the information is obtained. The regions are clearly labeled in capital letters, double check the source of the data, select a region, and Click Next
- Click Finish

Most if not all of the information that is being added to the database pertains to Africa, Asia, North America, or South America and Caribbean. However, if there is a new region that is not one of these listed above, then you will need to Create a new Table. Creating a new table is simply done with in the import wizard.

Step 2.1: Creating a New Database Table

In step number three of the Import Wizard:

- Instead of selecting "In an Existing Table" select "In a New Table"
    - Click Next
- Now you must enter data labels into their appropriate fields. Follow the list below for Field Number and their Appropriate Names
- In order to label Field names, click on the appropriate Field and enter the data, according to the table below, into the Field Name text box:

Field	Value
1	Reserve
2	Year
3	Quadrat
4	TreeNumber
5	StemNumber
6	Blank
7	X
8	Y
9	SpeciesCode
10	DBH
11	Status
12	Height
13	Notes
14	Baseline
15	LengthtoptA
16	LengthtoptB

- Once you have entered all the values, exactly as they're shown above, Click Next
- In the next step, Select "No Primary Key", Click Next
- Finally, name the new database table in all capital letters according to its region, for example: "AFRICA" and "ASIA"
- Click Finish

Now the information has been added to the database. However, you may encounter prompts that report errors in that have resulted from importing the table. When this happens a new table will be created with the list of errors that occurred. Most of the time, these errors occur because of the presence of commas in the Notes field. If this is the case, the information that was just imported to the database must be removed, and alterations will need to be made back in Microsoft Excel according to the lines that have been specified in the new error table.

Step 3: Organizing and Sorting the Database

When all the above procedures are complete, and there have been no errors, the database will need to be sorted. Presently the database may appear as if it has no order, this is not a problem.

Open the database table. In the database table:

- Select, and highlight the first three columns of the table (Reserve, Year, Quadrat)
- Go to the menu bar, and click on Records🕘 Sort 🕘 "Sort Ascending"
    - This will order the database alphabetically first, according to Reserve name, then by the year in which the data was recorded in each reserve, and finally in consecutive order of quadrat in each year for each reserve.

This completes the importing of data section. Repeat the steps in order to enter all new data into their respective region tables.

Appendix E: Quality Control Procedure and Results

Quality Control Procedure

The database was compiled from a numerous amount of (.bak) files that were altered to include Reserve Name and Year information. The (.bak) files include all the necessary information for the database, however it is possible and probable to encounter errors through the alteration and importation process. In order to find these errors and correct them, a quality control procedure will be implemented.

Procedure

The procedure needs to examine the original (.bak) files which were converted to (.txt) files, and compare the information from these data files with the lines of data in the database. A step wise process can be completed in order to determine this:

1. Randomly select 20 lines of data from the (.bak/.txt) files from each region (Africa, Asia, North America, and South America).
2. Copy and paste those lines of data into a new data table.
3. Then retrieve the exact same data points from the ZOONIGHT database
4. Copy and paste those data lines underneath their original source files in the data table
5. Compare each category
6. If all the information is identical than a successful transfer has occurred, however if the information is not identical then an error has occurred.
7. In the case of an error the database will need to be reconstructed with the correct information.

Results:

Africa

The first region to be reviewed is Africa. This includes data from 9 different sites.

1. AB197

101,7,1,,6.4900,4.5800,"DETMIC",0.2890,"AS",6.4000,,1,7.8000,14.1200

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Abakaliki	1997	101	7	1		6.49	4.58	DETMIC	0.289	AS	6.4		1	7.8	14.12

2. AB297

216,12,1,,14.9900,4.2500,"GMEARB",0.2000,"AS",3.9000,,4,6.4700,16.4300

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Abakaliki	1997	216	12	1		14.99	4.25	GMEARB	0.2	AS	3.9		4	6.47	16.43

3. AK197

106,8,1,,3.3600,27.0600,"DRE1",0.1280,"AS",8.5000,,2,4.7400,26.5000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Akamkpa	1997	106	8	1		3.36	27.06	DRE1	0.128	AS	8.5		2	4.74	26.5

4. AK297

223,23,1,,17.7200,20.0400,"FUN1",0.1390,"AG",9.0000,,4,20.1000,2.1900

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Akamkpa	1997	223	23	1		17.72	20.04	FUN1	0.139	AG	9		4	20.1	2.19

5. CA197

110,7,1,,13.9700,16.2400,"STRZEN",0.1500,"AS",6.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Campo	1997	110	7	1		13.97	16.24	STRZEN	0.15	AS	6		0	0	0

6. CA202

204,9,1,,6.8300,14.7900,"DICGLA",0.1250,"AS",,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Campo	2002	204	9	1		6.83	14.79	DICGLA	0.125	AS			0	0	0

7. CA302

313,5,1,,6.9200,12.1400,"PORCLA",0.1940,"AS",,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Campo	2002	313	5	1		6.92	12.14	PORCLA	0.194	AS			0	0	0

8. CA397

320,9,1,,17.4500,9.5400,"STRZEN",0.1500,"AS",3.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Campo	1997	320	9	1		17.45	9.54	STRZEN	0.15	AS	3		0	0	0

9. DI196

107,12,1,,4.23,16.86,"UNKUNK",0.335,"AS",17,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dikolo	1996	107	12	1		4.23	16.86	UNKUNK	0.335	AS	17				0

10. EH597

505,8,1,,9.9500,3.2100,"ELAGUI",0.3100,"AS",15.0000,,1,10.3000,10.3900

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
EH	1997	505	8	1		9.95	3.21	ELAGUI	0.31	AS	15		1	10.3	10.39

11. EJ402

419,20,1,,18.8300,1.2300,"POLSUA",0.2800,"AS",,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Ejagham	2002	419	20	1		18.83	1.23	POLSUA	0.28	AS			0	0	0

12. EJ497

409,18,1,,14.3700,1.5200,"TREOBO",0.1800,"AS",13.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Ejagham	1997	409	18	1		14.37	1.52	TREOBO	0.18	AS	13		0	0	0

13. EJ597

507,12,1,,13.9100,18.6900,"TREOBO",0.1600,"AS",10.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Ejagham	1997	507	12	1		13.91	18.69	TREOBO	0.16	AS	10		0	0	0

14. OK397

323,13,1,,13.0400,9.6000,"CELMIL",0.2990,"AS",12.0000,,4,11.7100,12.3600

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Okwangwo	1997	323	13	1		13.04	9.6	CELMIL	0.299	AS	12		4	11.71	12.36

15. TF101

1005,5,1,,1.0749,7.9880,"DACMAN",0.1200,"AS",10.0000,,2,12.0000,8.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Takamanda	2001	1005	5	1		1.0749	7.988	DACMAN	0.12	AS	10		2	12	8

16. TF601

606,6,1,,5.9660,1.1975,"BARFIS",0.1700,"AS",15.0000,,1,6.0000,14.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Takamanda	2001	606	6	1		5.966	1.1975	BARFIS	0.17	AS	15		1	6	14

17. TF701

711,11,1,,0.8000,18.0708,"MAR1",0.1770,"AS",19.0000,,2,2.0000,18.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Takamanda	2001	711	11	1		0.8	18.0708	MAR1	0.177	AS	19		2	2	18

18. TF801

821,5,1,,4.9683,0.9775,"DRY1",0.1270,"AS",24.0000,,1,5.0000,15.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Takamanda	2001	821	5	1		4.9683	0.9775	DRY1	0.127	AS	24		1	5	15

19. TFb01

1208,4,1,,13.0330,1.4188,"STRTET",0.2200,"AS",12.0000,,1,13.0000,7.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Takamanda	2001	1208	4	1		13.033	1.4188	STRTET	0.22	AS	12		1	13	7

20. UM497

418,10,1,,14.5800,15.1700,"X",0.1210,"AS",11.2000,,3,7.2000,15.3000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Umukabia	1997	418	10	1		14.58	15.17	X	0.121	AS	11.2		3	7.2	15.3

Asia

The second region to be reviewed is Asia. This includes data from 2 data sites.

1. CH193

101,6,1,,3.5,4,APOYUN,0.047,AS,5,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	101	6	1		3.5	4	APOYUN	0.047	AS	5				0

2. CH193

101,24,1,,3.2,9.6,PSYRUB,0.019,AS,2.7,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	101	24	1		3.2	9.6	PSYRUB	0.019	AS	2.7				0

3. CH193

103,104,1,,9.4,6.4,SARLAU,0.062,AS,2.7,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	103	104	1		9.4	6.4	SARLAU	0.062	AS	2.7				0

4. CH193

107,173,1,,14.6,10.4,APOYUN,0.012,AS,2.7,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	107	173	1		14.6	10.4	APOYUN	0.012	AS	2.7				0

5. CH193

116,61,1,,14,5.5,MISPEN,0.014,AS,2.4,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	116	61	1		14	5.5	MISPEN	0.014	AS	2.4				0

6. CH293

207,38,1,,,,CRYCHI,0.295,AB,13,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	207	38	1				CRYCHI	0.295	AB	13				0

7. CH293

214,22,1,,,,SYZLEV,0.1128,AS,8.5,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	214	22	1				SYZLEV	0.1128	AS	8.5				0

8. CH293

217,2,1,,,,CRYCON,0.19,AS,12,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	217	2	1				CRYCON	0.19	AS	12				0

9. CH293

218,28,1,,,,CRYCON,0.112,AS,10,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	218	28	1				CRYCON	0.112	AS	10				0

10. CH293

225,39,1,,,,GARMUL,0.1,AS,7,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Dinghushan	1993	225	39	1				GARMUL	0.1	AS	7				0

11. JI190

101,5,1,,18.94,18.03,"NEOCAM",.122,"AS",9.5,,4,18,2.2

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1990	101	5	1		18.94	18.03	NEOCAM	0.122	AS	9.5		4	18	2

12. JI190

103,16,1,,18.11,.95,"XANHAI",.27,"AS",16.5,,1,18,2

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1990	103	16	1		18.11	0.95	XANHAI	0.27	AS	16.5		1	18	2

13. JI190

108,4,1,,2.14,6.25,"SLOOLI",.232,"AS",19,,2,13.8,6.5

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1990	108	4	1		2.14	6.25	SLOOLI	0.232	AS	19		2	13.8	6

14. JI190

110,4,1,,6.86,4.43,"LITTER",.735,"AS",25,"1.7m heoght for measuring DBH",1,7.8,13.5

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1990	110	4	1		6.86	4.43	LITTER	0.735	AS	25	1.7m heoght for measuring DBH	1	7.8	13

15. JI190

112,21,1,,14.04,16.66,"CASJIA",.268,"AS",16,"1.4m height for measuring DBH",3,6.7,14.3

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1990	112	21	1		14.04	16.66	CASJIA	0.268	AS	16	1.4m height for measuring DBH	3	6.7	14

16. JI193

101,10,1,,10,3.44,"ACMACU",.351,"AS",28,,1,10.4,10.4

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1993	101	10	1		10	3.44	ACMACU	0.351	AS	28		1	10.4	10

17. JI193

105,3,1,,17.79,3.99,"LINRAM",.126,"AS",12.5,,4,4.5,16.1

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1993	105	3	1		17.79	3.99	LINRAM	0.126	AS	12.5		4	4.5	16

18. JI193

113,2,1,,1.26,3.97,"LINMAC",.159,"AS",13,,2,16,4.1

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1993	113	2	1		1.26	3.97	LINMAC	0.159	AS	13		2	16	4

19. JI193

118,28,1,,17.05,17.31,"LINRAM",.161,"AS",13,,3,3.91,17.18

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1993	118	28	1		17.05	17.31	LINRAM	0.161	AS	13		3	3.91	17

20. JI193

121,32,1,,2.27,9,"MALHOO",.104,"AS",11,,2,11.18,9.22

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Jiangfengling	1993	121	32	1		2.27	9	MALHOO	0.104	AS	11		2	11.18	9

In 9 cases throughout the Asian data table region, all of the decimal places were dropped from the Length to pt B columns. This does not have a large impact on the functionality on the website, but it does pique some concern as to why it happened and if it will or did happen in many of the files and locally within the Length to pt B column.

North America:

The third region to be reviewed is North America. This includes data from 5 data sites.

1. FR193

104,13,1,,3.9200,10.8800,"CORFLO",0.0530,"AS",3.0000,,2,9.9000,11.5400

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1993	104	13	1		3.92	10.88	CORFLO	0.053	AS	3		2	9.9	11.54

2. FR193

111,8,3,,3.8500,12.3800,"AMEARB",0.0160,"AS",3.0000,,2,8.2300,12.6500

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1993	111	8	3		3.85	12.38	AMEARB	0.016	AS	3		2	8.23	12.65

3. FR195

116,33,1,,18.0800,1.1500,"NYSSYL",0.1010,"AS",11.0000,,1,18.0690,2.2069

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1995	116	33	1		18.08	1.15	NYSSYL	0.101	AS	11		1	18.069	2.2069

4. FR293

216,4,1,,5.4100,4.8700,"JUGNIG",0.2190,"AS",18.0000,,2,15.9600,7.1800

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1993	216	4	1		5.41	4.87	JUGNIG	0.219	AS	18		2	15.96	7.18

5. FR394

309,8,1,,2.9600,10.8600,"CARCAR",0.0850,"AS",4.0000,,1,11.2100,20.1600

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1994	309	8	1		2.96	10.86	CARCAR	0.085	AS	4		1	11.21	20.16

6. FR494

401,7,1,,12.5000,18.9000,"QUEPRI",0.1300,"AB",7.5000,"AL",1,21.0000,22.2300

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1994	401	7	1		12.5	18.9	QUEPRI	0.13	AB	7.5	AL	1	21	22.23

7. FR494

422,31,1,,14.7100,11.3200,"AILALT",0.1580,"AS",18.0000,,1,18.4800,12.4100

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1994	422	31	1		14.71	11.32	AILALT	0.158	AS	18		1	18.48	12.41

8. FR595

513,22,1,,9.1700,11.5700,"HAMVIR",0.0470,"AS",0.0000,,1,14.7300,15.8200

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1995	513	22	1		9.17	11.57	HAMVIR	0.047	AS	0		1	14.73	15.82

9. FR695

601,21,4,,7.5400,3.0600,"CARCAR",0.0280,"AS",6.9000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1995	601	21	4		7.54	3.06	CARCAR	0.028	AS	6.9		0	0	0

10. FR896

804,28,1,,3.8500,11.6200,"ULMRUB",0.1280,"AS",5.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1996	804	28	1		3.85	11.62	ULMRUB	0.128	AS	5		0	0	0

11. FR896

810,23,1,,18.1000,8.6700,"CORFLO",0.0620,"AS",5.5000,,1,20.0400,8.8500

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1996	810	23	1		18.1	8.67	CORFLO	0.062	AS	5.5		1	20.04	8.85

12. FR997

920,31,1,,15.3500,9.6500,"AMEARB",0.1860,"AS",14.0000,,0,0.0000,0.0000\

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Front Royal	1997	920	31	1		15.35	9.65	AMEARB	0.186	AS	14		0	0	0

13. KJ194

101,5,1,,4.1400,9.6500,"PINSTR",0.0530,"AS",3.5000,,2,11.1200,10.4800

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Kejimkujik	1994	101	5	1		4.14	9.65	PINSTR	0.053	AS	3.5		2	11.12	10.48

14. KJ194

118,23,3,,7.8700,16.6700,"AMELAE",0.0370,"AS",7.0000,,2,8.5000,18.3900

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Kejimkujik	1994	118	23	3		7.87	16.67	AMELAE	0.037	AS	7		2	8.5	18.39

15. KJ294

209,22,1,,17.6400,17.3600,"ABIBAL",0.1400,"DS",0.0000,,4,17.4500,3.4700

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Kejimkujik	1994	209	22	1		17.64	17.36	ABIBAL	0.14	DS	0		4	17.45	3.47

16. LP195

103,53,1,,10.8300,5.5900,"FAGGRA",0.1190,"AS",0.0000,,1,12.1300,10.6800

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Long Point	1995	103	53	1		10.83	5.59	FAGGRA	0.119	AS	0		1	12.13	10.68

17. RP195

114,7,1,,19.2700,14.2300,"PSEMEN",0.4320,"AS",32.4600,2,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Rock Point	1995	114	7	1		19.27	14.23	PSEMEN	0.432	AS	32.46	2	0	0	0

18. RR199

103,22,1,,15.3670,6.5072,"ABIGRA",0.1760,"DB",1.6000,,1,16.6000,7.9000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Royal Roads	1999	103	22	1		15.367	6.5072	ABIGRA	0.176	DB	1.6		1	16.6	7.9

19. RR199

122,3,1,,8.5527,16.6250,"ABIGRA",0.6490,"DB",4.7000,,3,11.6100,8.8700

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Royal Roads	1999	122	3	1		8.5527	16.625	ABIGRA	0.649	DB	4.7		3	11.61	8.87

20. RR299

215,13,1,,12.5519,16.6203,"THUPLI",0.1380,"AS",9.6000,,3,8.1100,12.9300

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Royal Roads	1999	215	13	1		12.5519	16.6203	THUPLI	0.138	AS	9.6		3	8.11	12.93

South America

The fourth region to be reviewed is South America. This includes data from 11 data sites.

1. AG194

101,6,1,,14.0700,5.5700,"LAU1",0.2680,"AS",0.0000,,1,15.0000,8.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Aguas Negras	1994	101	6	1		14.07	5.57	LAU1	0.268	AS	0		1	15	8

2. BE191

223,14,1,,19,0,"BROLAC",0.17,"AS",,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Beni	1991	223	14	1		19	0	BROLAC	0.17	AS					0

3. BE194

304,11,1,,8.95,16.7,"CECENG",0.24,"AS",15,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Beni	1994	304	11	1		8.95	16.7	CECENG	0.24	AS	15				0

4. BI188

107,3,1,,13.0500,5.1000,"PREMON",0.1800,"AS",0.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Bisley	1988	107	3	1		13.05	5.1	PREMON	0.18	AS	0		0	0	0

5. BI192

109,1,1,,2.6600,4.2000,"PREMON",0.1430,"AS",10.2500,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Bisley	1992	109	1	1		2.66	4.2	PREMON	0.143	AS	10		0	0	0

6. GA194

111,3,1,,3.9700,11.2300,"SORSPR",0.1160,"AS",8.0000,,2,9.5700,11.8500

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Guatapo	1994	111	3	1		3.97	11.23	SORSPR	0.116	AS	8		2	9.57	11.85

7. GR204

202,12,1,,0.0000,0.0000,"CORCOL",0.1150,"AS",11.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Grenada	2004	202	12	1		0	0	CORCOL	0.115	AS	11		0	0	0

8. GR604

602,215,1,,0.0000,0.0000,"ACRACU",0.2300,"AS",11.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Grenada	2004	602	215	1		0	0	ACRACU	0.23	AS	11		0	0	0

9. GRd04

1301,10,1,,0.0000,0.0000,"LEULEU",0.0150,"AS",2.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Grenada	2004	1301	10	1		0	0	LEULEU	0.015	AS	2		0	0	0

10. IT194

111,3,1,,16.0400,2.8300,"CHRGON",0.1250,"AS",7.0000,,2,10.8000,9.6500

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Itaipu	1994	111	3	1		16.04	2.83	CHRGON	0.125	AS	7		2	10.8	9.65

11. IT395

316,10,1,,5.44,17.99,CHRGON,0.19,AS,10,,3,11.2,9.7

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Itaipu	1995	316	10	1		5.44	17.99	CHRGON	0.19	AS	10		3	11.2	9.7

12. LL194

114,5,1,,3.5600,17.2700,"ZANFAG",0.1100,"AS",8.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Los Llanos	1994	114	5	1		3.56	17.27	ZANFAG	0.11	AS	8		0	0	0

13. LL394

315,10,1,,14.9700,1.7300,"GUAULM",0.2000,"AS",11.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Los Llanos	1994	315	10	1		14.97	1.73	GUAULM	0.2	AS	11		0	0	0

14. MA187

118,7,1,,1.2700,12.6500,"IRIDEL",0.2500,"AS",0.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Manu	1987	118	7	1		1.27	12.65	IRIDEL	0.25	AS	0		0	0	0

15. MA487

412,4,2,,2.9300,5.7900,"PITLAT",0.0000,"AS",0.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Manu	1987	412	4	2		2.93	5.79	PITLAT	0	AS	0		0	0	0

16. PS197

110,18,1,,6.5700,8.3600,"LAEMIC",0.1700,"AS",12.0000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Soberania	1997	110	18	1		6.57	8.36	LAEMIC	0.17	AS	12		0	0	0

17. SJ192

117,82,1,,19.8900,12.6000,"EUGCOR",0.0400,"AS",4.5000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
St. John	1992	117	82	1		19.89	12.6	EUGCOR	0.04	AS	4		0	0	0

18. SJ196

120,38,1,,12.0900,9.7900,"MAYELL",0.1000,"AS",5.5000,,0,0.0000,0.0000

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
St. John	1996	120	38	1		12.09	9.79	MAYELL	0.1	AS	5		0	0	0

19. UR297

210,9,1,,1.34,18.37,"GUAKUN",0.062,"AS",2.5,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Urubamba	1997	210	9	1		1.34	18.37	GUAKUN	0.062	AS	2				0

20. UR797

709,16,1,,13.41,8.22,"SENINC",0.12,"AS",7,,,,0

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	Status	Height	Notes	Baseline	LengthtoptA	LengthtoptB
Urubamba	1997	709	16	1		13.41	8.22	SENINC	0.12	AS	7				0

There were 3 cases in the South American region where a height was given with a decimal place, such as 2.5, in the .bak/.txt file. However, somewhere in the line of importing these files to the database the decimal place was removed from 2.5 → 2. This may have a large impact on the results that the website displays. It simply inaccurately shows the data that was collect, though just by a few decimal places. This problem may occur everywhere there is a decimal place in the height column and if this is the case the cumulative information for height in South America may be skewed.

Appendix F: Focus Group Questionnaires

Students

Directions: Please circle "YES" or "NO" for the following questions after testing the MAB Global Vegetation Database Website. If your answer is "NO" please write why and how it can be fixed in the space below. Please put any comments, questions or suggestions in the space provided below. NOTE: Please do not comment about the difficultly of the content, just the functionality of the website.

Is this website easy to use?
YES NO

Where the instructions clear?
YES NO

Does the way the information is displayed make you eager to learn more?
YES NO

Are the outputted graphs clear?
YES NO

Any suggestions?

MAB Employees

Directions: Please circle "YES" or "NO" for the following questions after testing the MAB Global Vegetation Database Website. If your answer is "NO" please write why and how it can be fixed in the space below. Please put any comments, questions or suggestions in the space provided below.

Does this website provide the necessary information?
YES NO

Is the information portrayed correctly?
YES NO

Is the layout of the information choices appropriate and clear?
YES NO

Does the graphical information fit the MAB standards?
YES NO

Any suggestions?

National Zoo Web Developers

Directions: Please circle "YES" or "NO" for the following questions after testing the MAB Global Vegetation Database Website. If your answer is "NO" please write why and how it can be fixed in the space below. Please put any comments, questions or suggestions in the space provided below.

Is the layout of the website acceptable for the National Zoo?
YES NO

Is the code easy to read and done properly?
YES NO

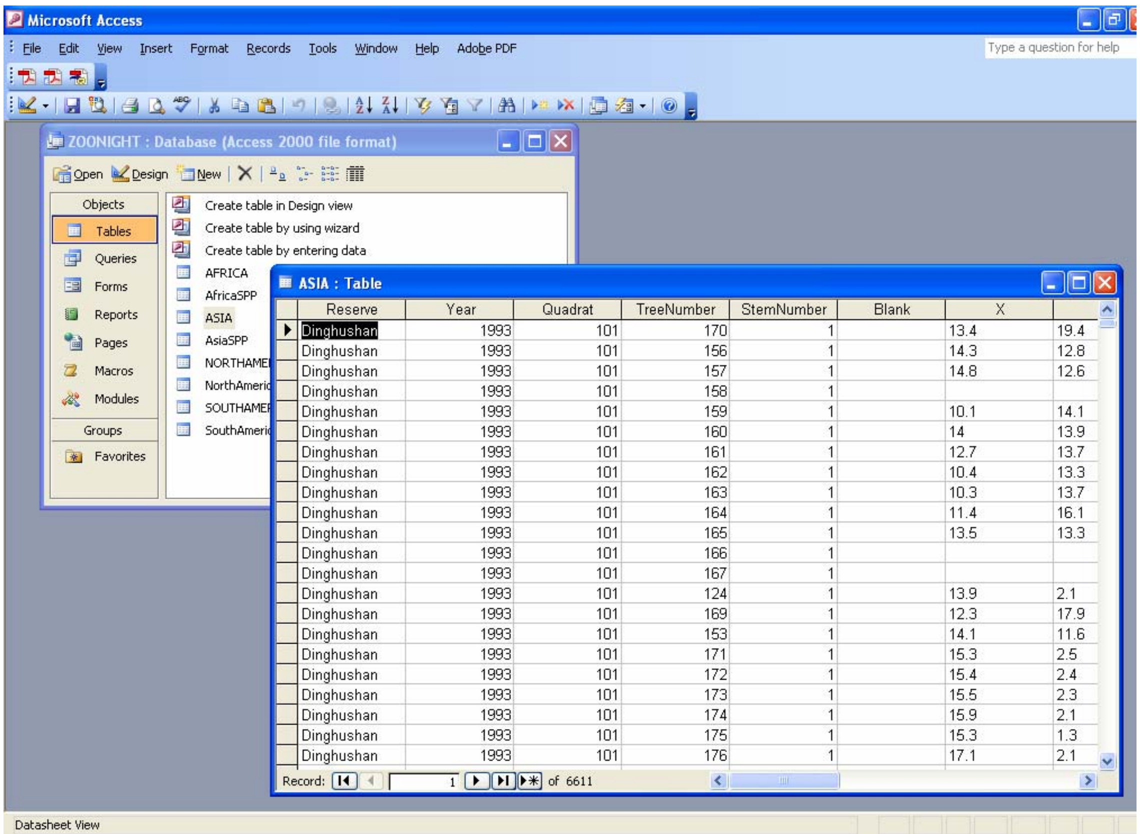
Is the text and instructions for the website clear and correct?
YES NO

Does the graphical information fit the National Zoo's standards?
YES NO

Any suggestions?

Appendix G: Database Visuals

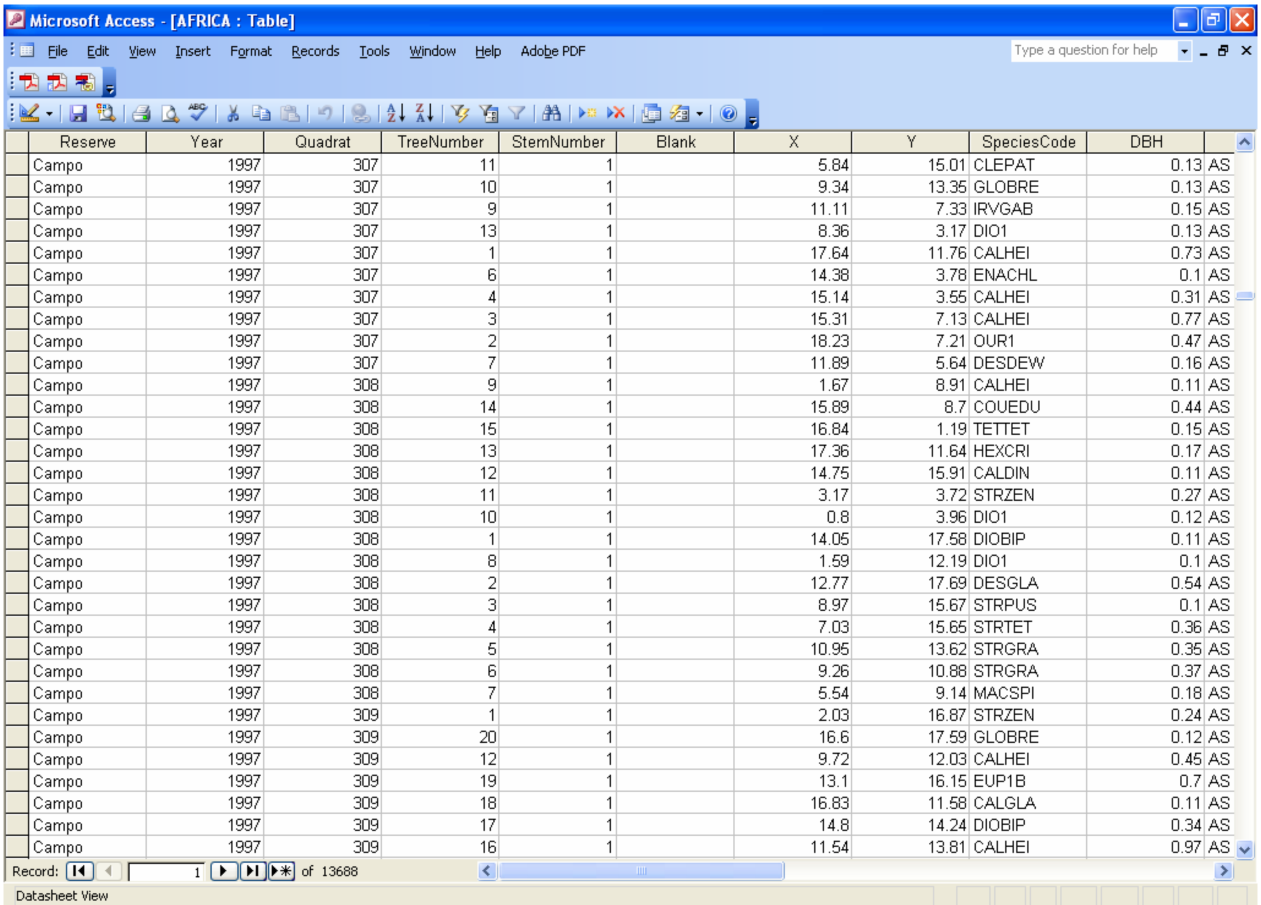
ZOONIGHT Database
ASIA : Table



Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	
Dinghushan	1993	101	170	1		13.4	19.4
Dinghushan	1993	101	156	1		14.3	12.8
Dinghushan	1993	101	157	1		14.8	12.6
Dinghushan	1993	101	158	1			
Dinghushan	1993	101	159	1		10.1	14.1
Dinghushan	1993	101	160	1		14	13.9
Dinghushan	1993	101	161	1		12.7	13.7
Dinghushan	1993	101	162	1		10.4	13.3
Dinghushan	1993	101	163	1		10.3	13.7
Dinghushan	1993	101	164	1		11.4	16.1
Dinghushan	1993	101	165	1		13.5	13.3
Dinghushan	1993	101	166	1			
Dinghushan	1993	101	167	1			
Dinghushan	1993	101	124	1		13.9	2.1
Dinghushan	1993	101	169	1		12.3	17.9
Dinghushan	1993	101	153	1		14.1	11.6
Dinghushan	1993	101	171	1		15.3	2.5
Dinghushan	1993	101	172	1		15.4	2.4
Dinghushan	1993	101	173	1		15.5	2.3
Dinghushan	1993	101	174	1		15.9	2.1
Dinghushan	1993	101	175	1		15.3	1.3
Dinghushan	1993	101	176	1		17.1	2.1

Figure A6: ASIA : Table

ZOONIGHT Database
AFRICA : Table



Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	
Campo	1997	307	11	1		5.84	15.01	CLEPAT	0.13	AS
Campo	1997	307	10	1		9.34	13.35	GLOBRE	0.13	AS
Campo	1997	307	9	1		11.11	7.33	IRVGAB	0.15	AS
Campo	1997	307	13	1		8.36	3.17	DIO1	0.13	AS
Campo	1997	307	1	1		17.64	11.76	CALHEI	0.73	AS
Campo	1997	307	6	1		14.38	3.78	ENACHL	0.1	AS
Campo	1997	307	4	1		15.14	3.55	CALHEI	0.31	AS
Campo	1997	307	3	1		15.31	7.13	CALHEI	0.77	AS
Campo	1997	307	2	1		18.23	7.21	OUR1	0.47	AS
Campo	1997	307	7	1		11.89	5.64	DESDEW	0.16	AS
Campo	1997	308	9	1		1.67	8.91	CALHEI	0.11	AS
Campo	1997	308	14	1		15.89	8.7	COUEDU	0.44	AS
Campo	1997	308	15	1		16.84	1.19	TETTET	0.15	AS
Campo	1997	308	13	1		17.36	11.64	HEXCRI	0.17	AS
Campo	1997	308	12	1		14.75	15.91	CALDIN	0.11	AS
Campo	1997	308	11	1		3.17	3.72	STRZEN	0.27	AS
Campo	1997	308	10	1		0.8	3.96	DIO1	0.12	AS
Campo	1997	308	1	1		14.05	17.58	DIOBIP	0.11	AS
Campo	1997	308	8	1		1.59	12.19	DIO1	0.1	AS
Campo	1997	308	2	1		12.77	17.69	DESGLA	0.54	AS
Campo	1997	308	3	1		8.97	15.67	STRPUS	0.1	AS
Campo	1997	308	4	1		7.03	15.65	STRTET	0.36	AS
Campo	1997	308	5	1		10.95	13.62	STRGRA	0.35	AS
Campo	1997	308	6	1		9.26	10.88	STRGRA	0.37	AS
Campo	1997	308	7	1		5.54	9.14	MACSPI	0.18	AS
Campo	1997	309	1	1		2.03	16.87	STRZEN	0.24	AS
Campo	1997	309	20	1		16.6	17.59	GLOBRE	0.12	AS
Campo	1997	309	12	1		9.72	12.03	CALHEI	0.45	AS
Campo	1997	309	19	1		13.1	16.15	EUP1B	0.7	AS
Campo	1997	309	18	1		16.83	11.58	CALGLA	0.11	AS
Campo	1997	309	17	1		14.8	14.24	DIOBIP	0.34	AS
Campo	1997	309	16	1		11.54	13.81	CALHEI	0.97	AS

Figure A7: AFRICA : Table

ZOONIGHT Database

AfricaSPP : Table

(species list)

SpeciesCode	Family	Genus	species	Authorship	Blank	Spacer	Notes	Specimen
BOSANG	Moraceae	Bosqueia	angolensis	Ficalho				
BRA1	Fabaceae	Brachystegia	sp1	Benth.				Tree
BRAEUR	Fabaceae	Brachystegia	eurycoma	Harms				Tree
BRAKEN	Fabaceae	Brachystegia	kennedyi	Hoyle				Tree
BRANIG	Fabaceae	Brachystegia	nigerica	Hoyle & A. P. D				Tree
BREBRI	Rubiaceae	Brenania	brieyi	(De Wild.) Petit				Tree
BRI1	Euphorbiaceae	Bridelia	sp1	Willd.				
BRI1B	Acanthaceae	Brillantaisia	sp1	P. Beauv.				Herb
BRIGRA	Euphorbiaceae	Bridelia	grandis	Pierre ex Hutch				Tree
BRIMIC	Euphorbiaceae	Bridelia	micrantha	(Hochst.) Baillo				Tree
BRIVOG	Acanthaceae	Brillantaisia	vogeliana	(Nees) Benth.				Herb
CAL1	Flacourtiaceae	Caloncoba	sp1	Gilg				
CAL1B	Fabaceae	Calpocalyx	sp1	Harms				Tree
CALDIN	Fabaceae	Calpocalyx	dinklagei	Harms				Tree
CALGLA	Flacourtiaceae	Caloncoba	glauca	(Pal. or P. Beau				
CALHEI	Fabaceae	Calpocalyx	heitzii	Pellegr.				Tree
CAM1	Ochnaceae	Campylospermu	sp1	Tiegh.				Tree
CAMMAN	Flacourtiaceae	Camptostylus	mannii	(Oliver) Gilg				Tree
CAN1	Rubiaceae	Canthium	sp1	Lam.				
CAN1B	Burseraceae	Canarium	sp1					Tree
CANARN	Rubiaceae	Canthium	arnoldianum	(De Wild. & T. D			Unyumba	Tree
CANSCH	Burseraceae	Canarium	schweinfurthii	Engl.				Tree
CAR1	Meliaceae	Carapa	sp1	Aubl.				Tree
CARALB	Polygalaceae	Carpolobia	alba	G. Don				Tree
CARGRA	Meliaceae	Carapa	grandiflora	Sprague				
CARLUT	Polygalaceae	Carpolobia	lutea	G. Don				Tree
CARPRO	Meliaceae	Carapa	procera	DC.				
CAS1	Flacourtiaceae	Casearia	sp1	Jacq.				Tree
CAS1B	Asteraceae	Cassinia	sp1					Herb
CASBAR	Flacourtiaceae	Casearia	barteri	Aubrev.				Tree
CECPEL	Cecropiaceae	Cecropia	peltata	L.				
CEIPEN	Bombacaceae	Ceiba	pentandra	(L.) Gaertner				Tree

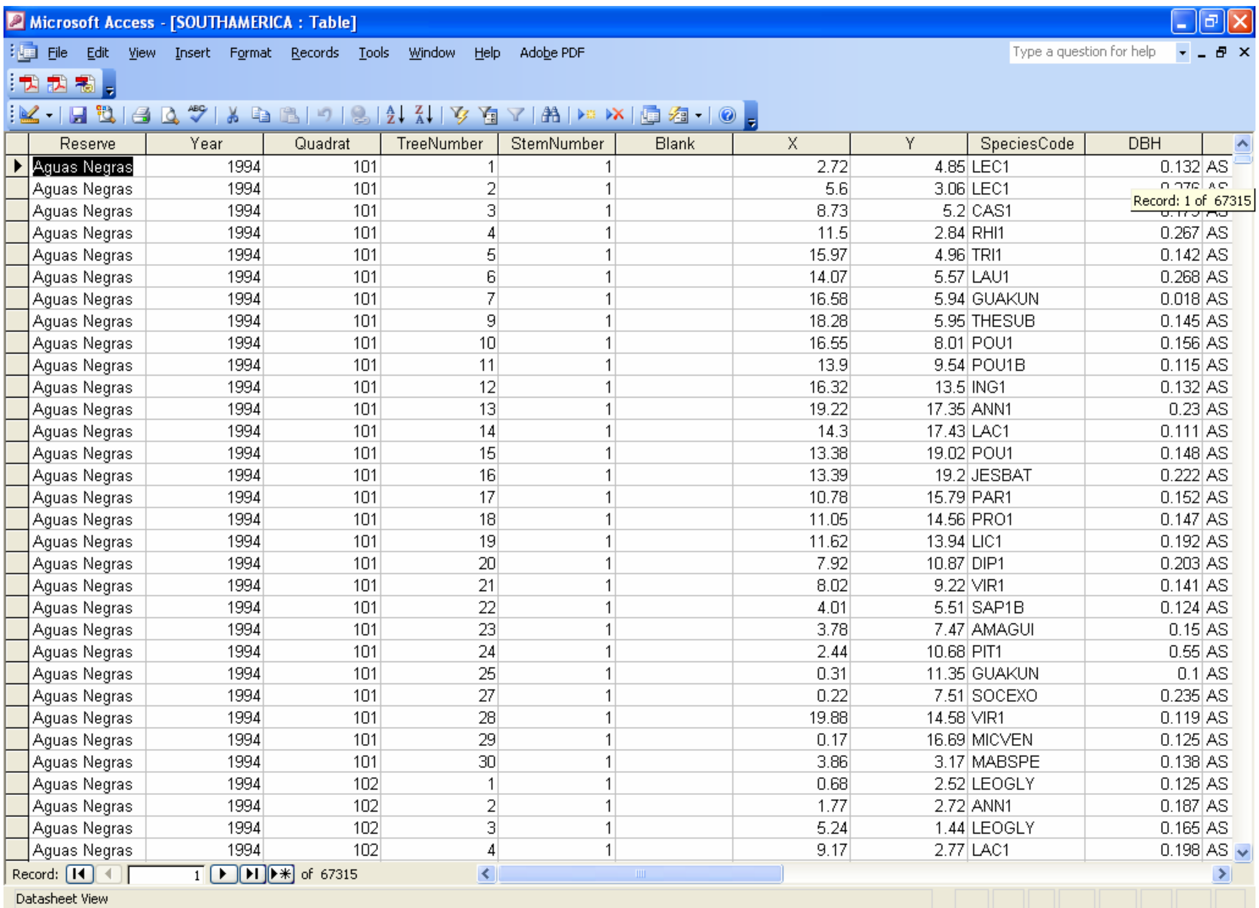
Record: 1 of 764

Figure A8: AfricaSPP : Table

ZOONIGHT Database

SOUTHAMERICA : Table

(Note the number of records: 67,315)



Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	
Aguas Negras	1994	101	1	1		2.72	4.85	LEC1	0.132	AS
Aguas Negras	1994	101	2	1		5.6	3.06	LEC1	0.276	AS
Aguas Negras	1994	101	3	1		8.73	5.2	CAS1	[illegible]	AS
Aguas Negras	1994	101	4	1		11.5	2.84	RHI1	0.267	AS
Aguas Negras	1994	101	5	1		15.97	4.96	TRI1	0.142	AS
Aguas Negras	1994	101	6	1		14.07	5.57	LAU1	0.268	AS
Aguas Negras	1994	101	7	1		16.58	5.94	GUAKUN	0.018	AS
Aguas Negras	1994	101	9	1		18.28	5.95	THESUB	0.145	AS
Aguas Negras	1994	101	10	1		16.55	8.01	POU1	0.156	AS
Aguas Negras	1994	101	11	1		13.9	9.54	POU1B	0.115	AS
Aguas Negras	1994	101	12	1		16.32	13.5	ING1	0.132	AS
Aguas Negras	1994	101	13	1		19.22	17.35	ANN1	0.23	AS
Aguas Negras	1994	101	14	1		14.3	17.43	LAC1	0.111	AS
Aguas Negras	1994	101	15	1		13.38	19.02	POU1	0.148	AS
Aguas Negras	1994	101	16	1		13.39	19.2	JESBAT	0.222	AS
Aguas Negras	1994	101	17	1		10.78	15.79	PAR1	0.152	AS
Aguas Negras	1994	101	18	1		11.05	14.56	PRO1	0.147	AS
Aguas Negras	1994	101	19	1		11.62	13.94	LIC1	0.192	AS
Aguas Negras	1994	101	20	1		7.92	10.87	DIP1	0.203	AS
Aguas Negras	1994	101	21	1		8.02	9.22	VIR1	0.141	AS
Aguas Negras	1994	101	22	1		4.01	5.51	SAP1B	0.124	AS
Aguas Negras	1994	101	23	1		3.78	7.47	AMAGUI	0.15	AS
Aguas Negras	1994	101	24	1		2.44	10.68	PIT1	0.55	AS
Aguas Negras	1994	101	25	1		0.31	11.35	GUAKUN	0.1	AS
Aguas Negras	1994	101	27	1		0.22	7.51	SOCEXO	0.235	AS
Aguas Negras	1994	101	28	1		19.88	14.58	VIR1	0.119	AS
Aguas Negras	1994	101	29	1		0.17	16.69	MICVEN	0.125	AS
Aguas Negras	1994	101	30	1		3.86	3.17	MABSPE	0.138	AS
Aguas Negras	1994	102	1	1		0.68	2.52	LEOGLY	0.125	AS
Aguas Negras	1994	102	2	1		1.77	2.72	ANN1	0.187	AS
Aguas Negras	1994	102	3	1		5.24	1.44	LEOGLY	0.165	AS
Aguas Negras	1994	102	4	1		9.17	2.77	LAC1	0.198	AS

Record: 1 of 67315

Figure A9: SOUTHAMERICA : Table

ZOONIGHT Database

SOUTHAMERICA : Table

(Note “St. John” plots are not SA, but Caribbean)

Microsoft Access - [SOUTHAMERICA : Table]

Reserve	Year	Quadrat	TreeNumber	StemNumber	Blank	X	Y	SpeciesCode	DBH	
Soberania	1997	125	7	2		18.11	15.25	TRI1	0.1	AS
Soberania	1997	125	8	1		16.07	14.6	ANNHAY	0.198	AS
Soberania	1997	125	9	1		13.12	20.02	UNKUNK	0.35	AS
Soberania	1997	125	9	2		13.12	20.02	UNKUNK	0.289	AS
Soberania	1997	125	10	1		18.54	6.53	UNKUNK	0.303	AS
Soberania	1997	125	11	1		19.35	4.19	SCHZON	0.36	AS
Soberania	1997	125	12	1		17.3	6.2	ANDINE	0.226	AS
Soberania	1997	125	13	1		14.92	5.87	ASTGRA	0.161	AS
Soberania	1997	125	14	1		12.55	1.1	ASTSTA	0.151	AS
Soberania	1997	125	15	1		6.14	3.96	GUSSUP	0.112	AS
Soberania	1997	125	16	1		7.56	11.29	UNKUNK	0.643	AS
St. John	1992	101	1	1		1.49	5.28	TABHET	0.19	AS
St. John	1992	101	2	1		3.98	4.86	SABFLO	0.2	AS
St. John	1992	101	3	1		4.54	2.69	BOUSUC	0.12	AS
St. John	1992	101	4	1		7.33	0.74	TABHET	0.13	AS
St. John	1992	101	4	2		7.33	0.74	TABHET	0.09	AS
St. John	1992	101	5	1		8.36	1.13	BURSIM	0.15	AS
St. John	1992	101	6	1		9.28	0.44	BURSIM	0.11	AS
St. John	1992	101	7	1		9.56	0.67	GUAFRA	0.15	AS
St. John	1992	101	8	1		7.63	4.8	MAYELL	0.15	AS
St. John	1992	101	8	2		7.63	4.8	MAYELL	0.06	AS
St. John	1992	101	9	1		11.83	1.95	BOUSUC	0.11	AS
St. John	1992	101	10	1		15.61	2.75	TABHET	0.21	AS
St. John	1992	101	10	2		15.61	2.75	TABHET	0.2	AS
St. John	1992	101	11	1		18.89	3.95	MAYELL	0.11	AS
St. John	1992	101	12	1		19.69	1.34	GUAFRA	0.11	AS
St. John	1992	101	13	1		19.51	5.22	BURSIM	0.27	AS
St. John	1992	101	14	1		14.28	6.47	COCMIC	0.16	AS
St. John	1992	101	14	2		14.28	6.47	COCMIC	0.11	AS
St. John	1992	101	14	3		14.28	6.47	COCMIC	0.1	AS
St. John	1992	101	14	4		14.28	6.47	COCMIC	0.09	AS
St. John	1992	101	15	1		16.42	10.51	TABHET	0.22	AS

Record: 1 of 67315

Datasheet View

Figure A10: SOUTHAMERICA + CARIBBEAN

Appendix H: Website Visuals

Vegetation Website: Main Page

Contains information about the MAB program, directions, site information and global locations to choose from.

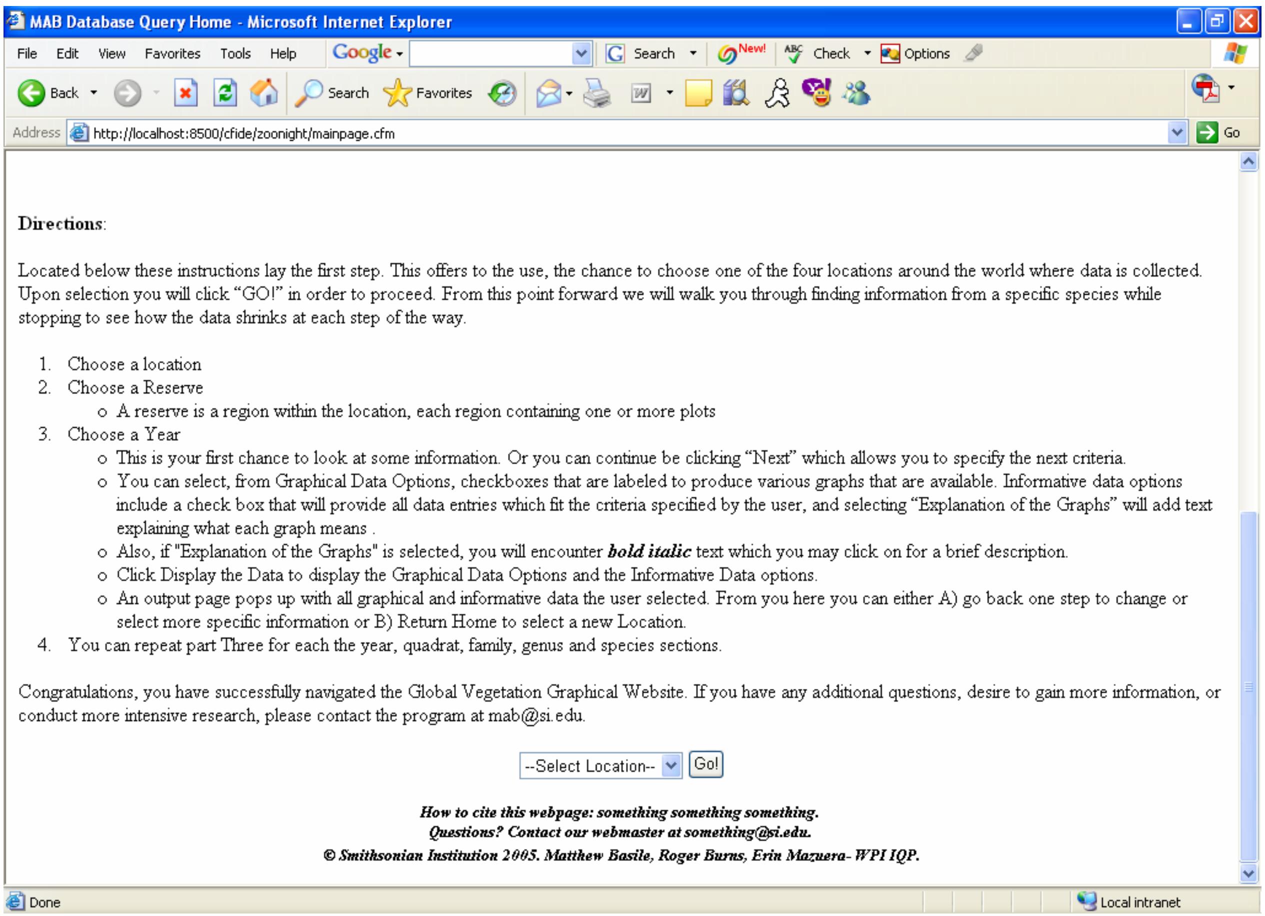


Figure A11: Site Main Page

Vegetation Website: Year Query

Lists all options under "Year" category: options to continue to "Quadrat" by clicking "Next" or to choose data to display.

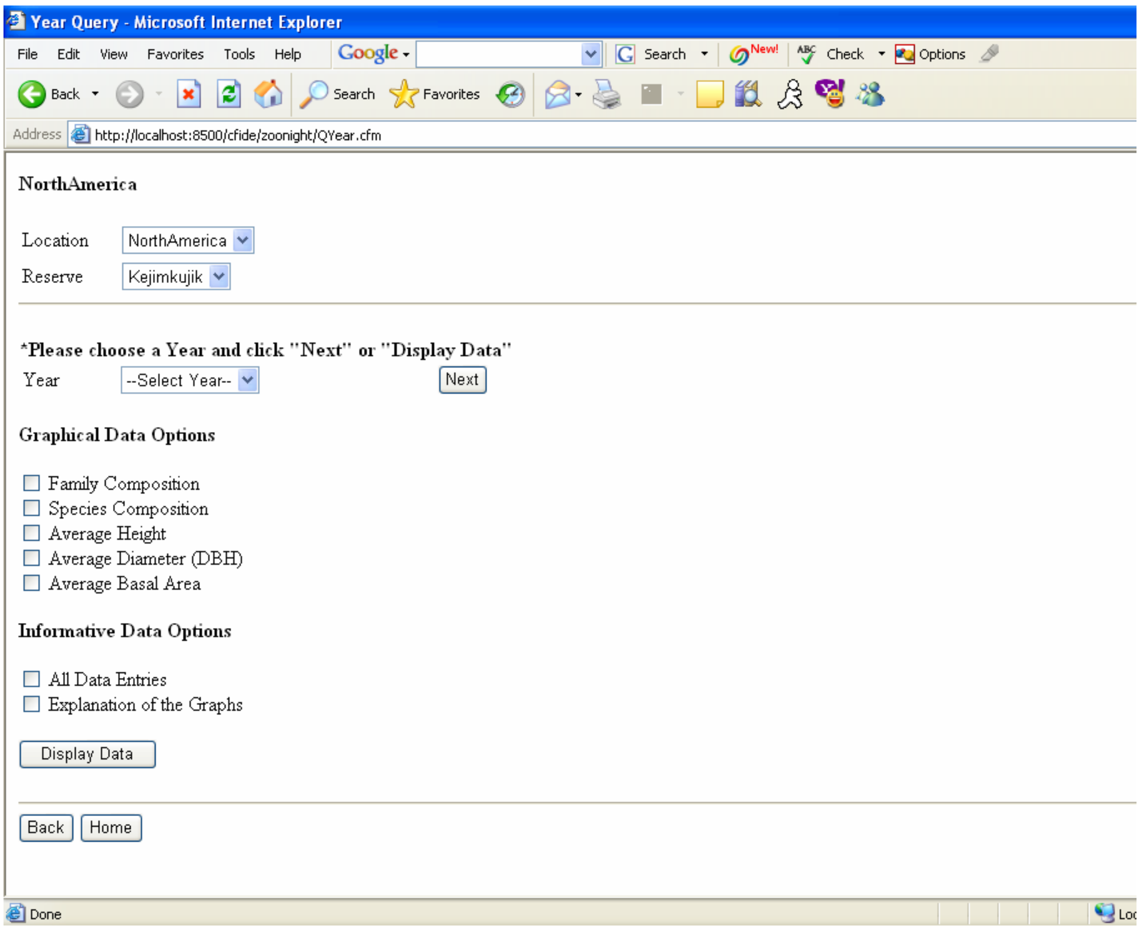


Figure A12: Year Query Page

Vegetation Website: Graphical Data Representation

Shows family distributions graph with titles and explanations. Also displays total number of trees and stems.

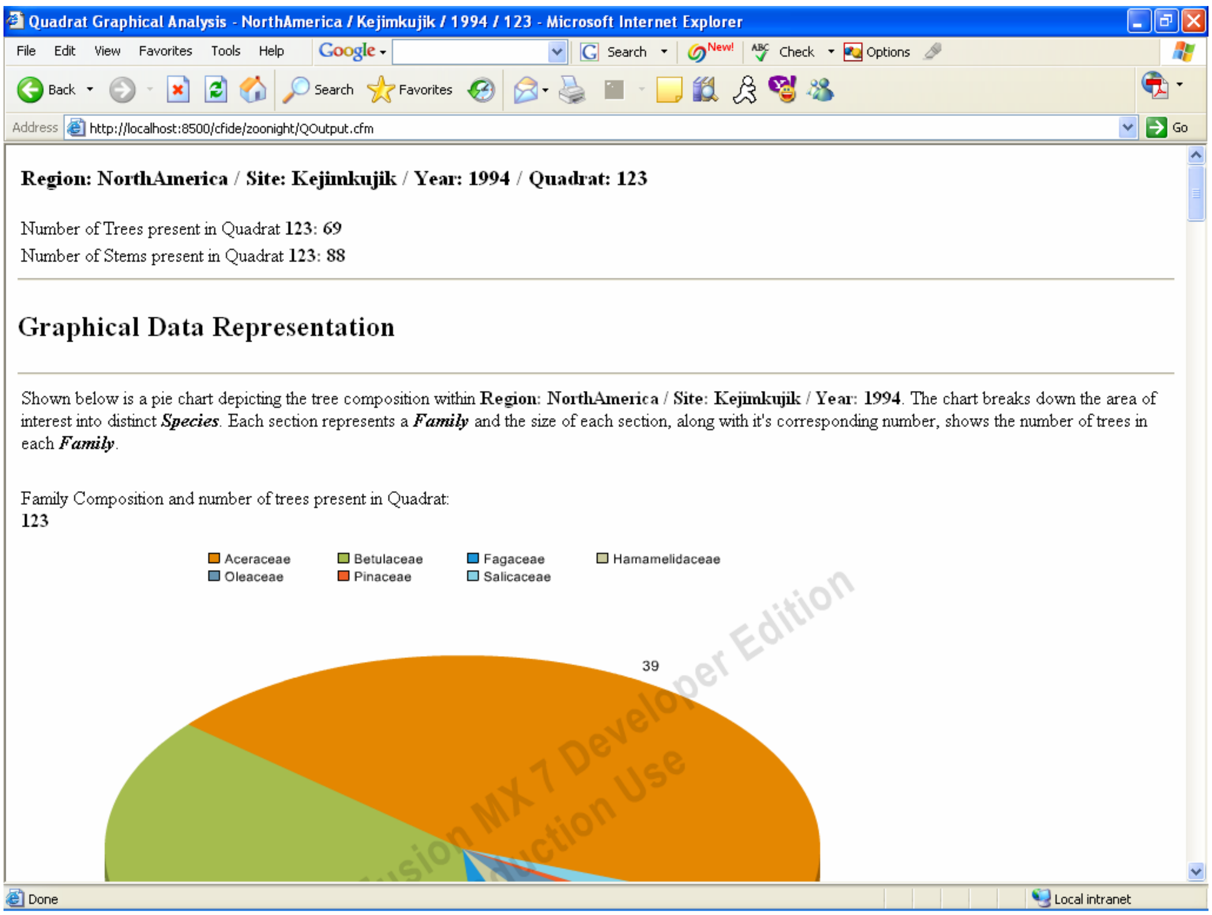


Figure A13: Graphical Data Representation

Vegetation Website: Species Composition

Shows Species graph with explanations. When hovering over section of the graph, species with the amount is displayed

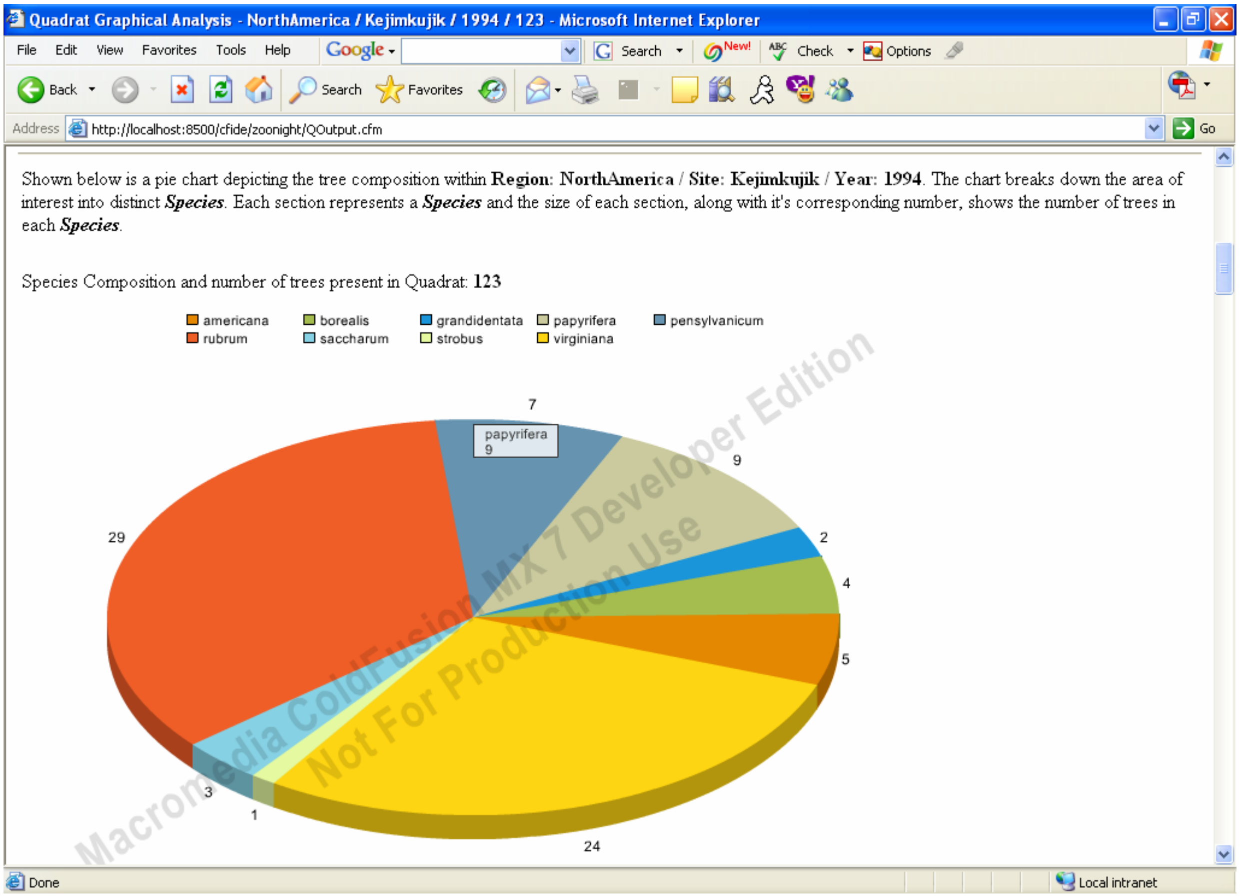


Figure A14: Species Composition

Vegetation Website: Average DBH

Shows the average of the DBHs among a species of trees in a region.

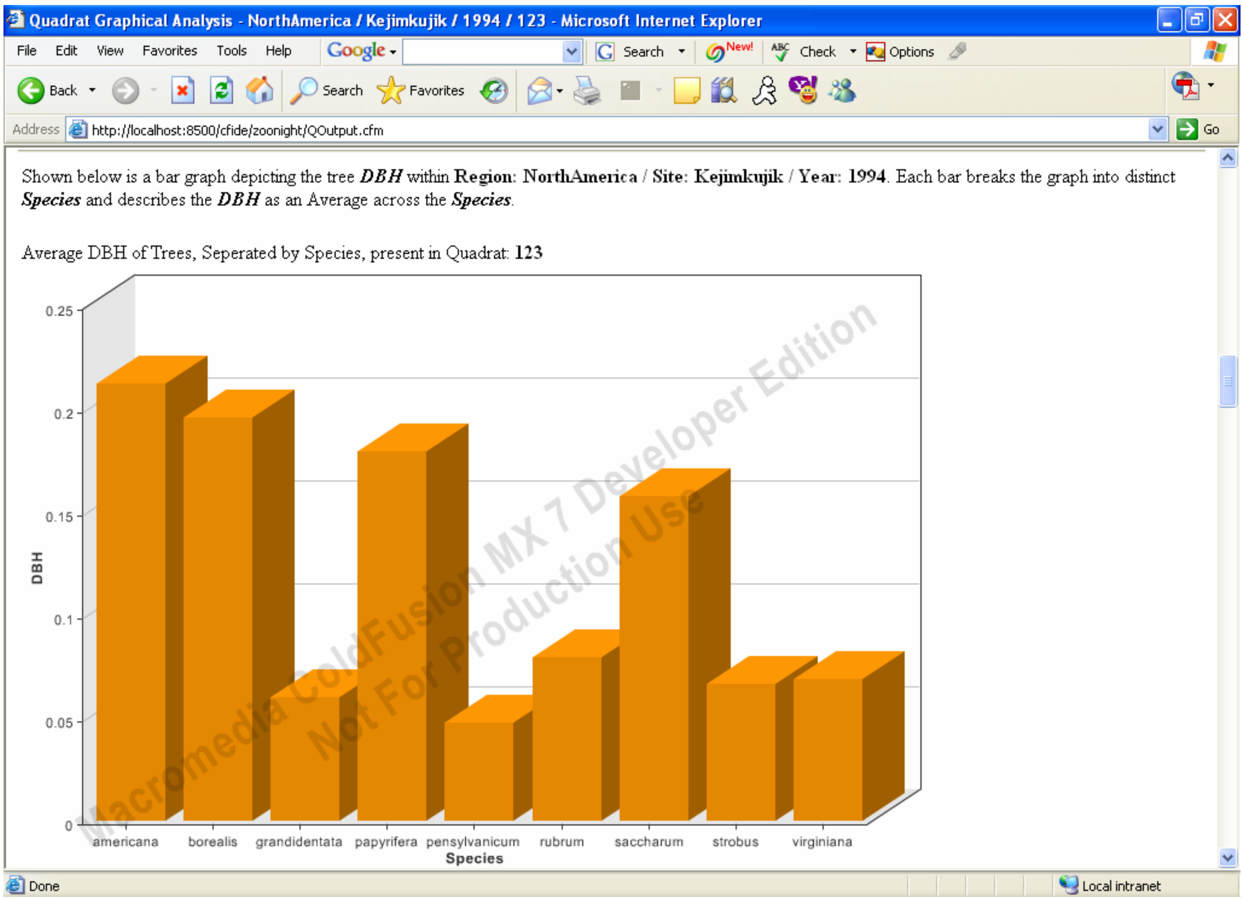


Figure A15: Average DBH

Vegetation Website: Error Message

Displays an error message when something is done incorrectly.

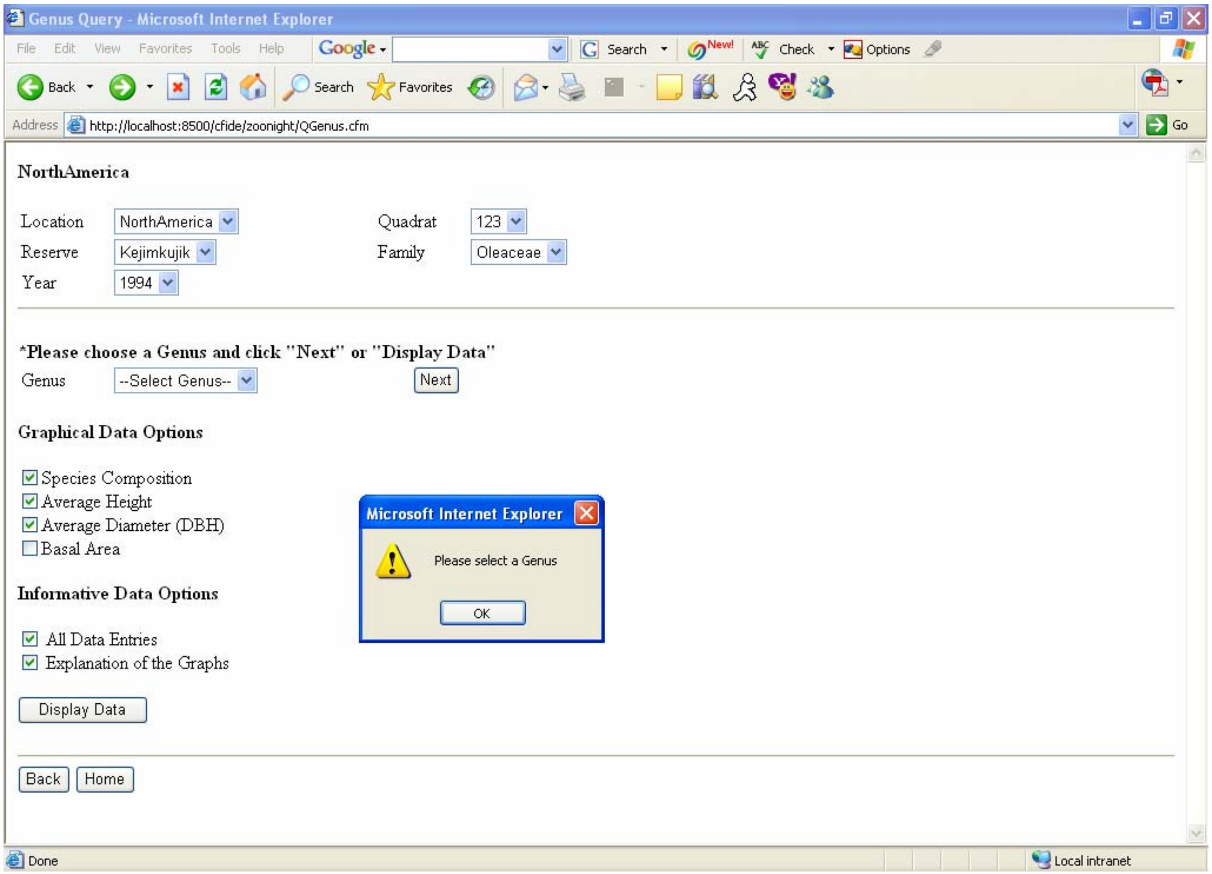


Figure A16: Error Message

Vegetation Website: Basal Area Definition

Words in ***bold italics*** display definitions for the graphs

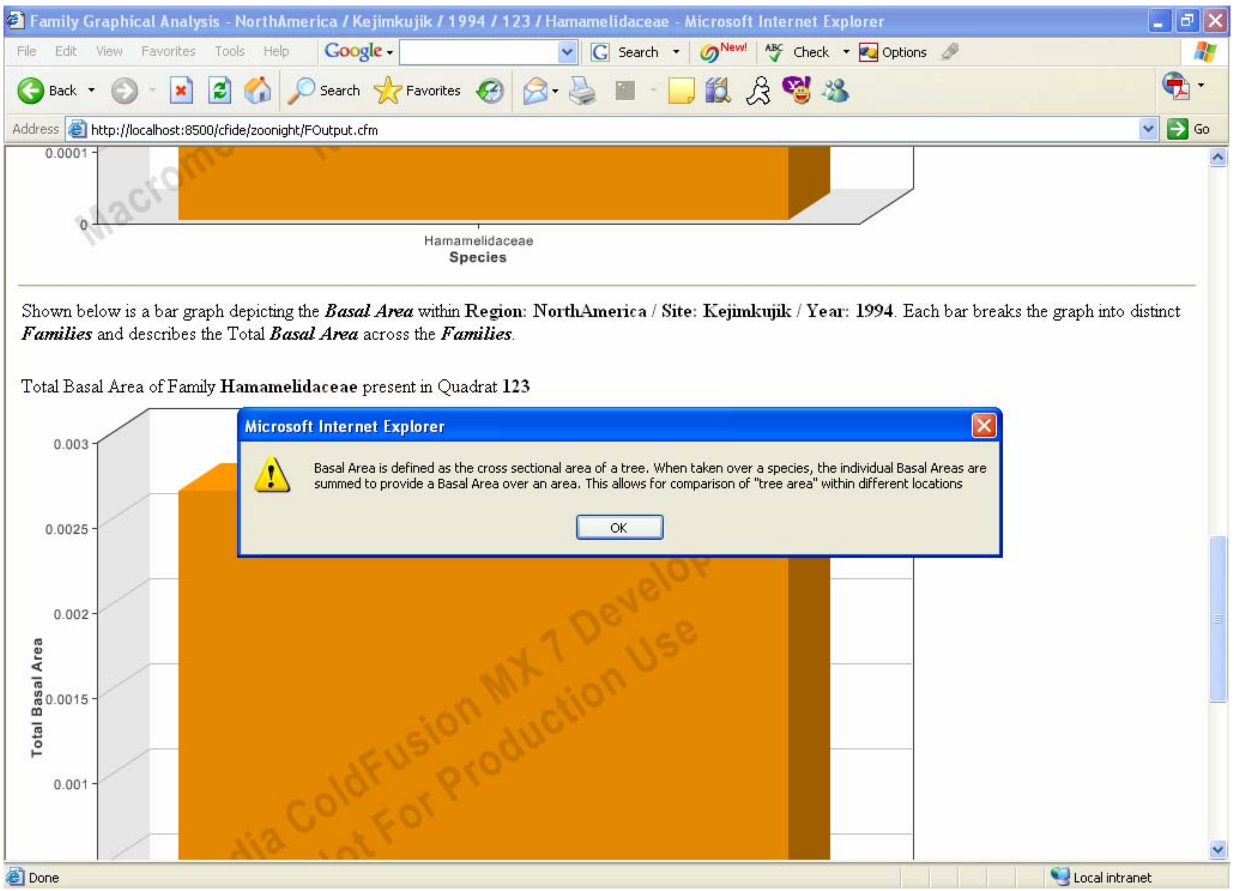


Figure A17: Basal Area Definition