Paul C. Standley Herbarium, a Pan-American Institution

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Abstract. The Paul C. Standley Herbarium (EAP) is a truly Pan-American (EAP) institution whose collections and research have served the countries represented at Zamorano University for seventy years. The botanical specimens housed at EAP represent the flora of all the countries of Mesoamerica and to a lesser extent western South America.

Keywords: BRAHMS, Flora of Mesoamerica, LAPI, type specimens.

El Herbario Paul C. Standley, una Institución Panamericana

Resumen. El Herbario Paul C. Standley (EAP) es una institución Panamericana que por sus colecciones e investigaciones ha servido a los países representados en Universidad Zamorano por setenta años. Las muestras botánicas ubicadas en EAP representan la flora de todos los países de Mesoamérica y en alguna manera el oeste de América del Sur.

Palabras clave: BRAHMS, Flora Mesoamericana, LAPI, muestras de tipos.

Introduction

On the occasion of the 50th anniversary of the journal Ceiba, Abelino Pitty (1999) presented a wonderful summary of the botanists who contributed to the "golden years of systematic botany" at the Pan-American Agricultural School. Simón E. Malo (1999) dedicates many pages to the field collectors and taxonomists who have worked at Zamorano and collaborators who have used our facilities. The result of their efforts and the place where their dedication still resides is the Herbarium Paul C. Standley (Figure 1); a Pan-American institution which represents the vision that Zamorano has maintained since its establishment 70 years ago.

In Latin America there are at least 100 active herbaria that have very good collections from the countries where they are located. Most of these herbaria are located at universities, many collections are made by students of these institutions, and nearly all the collections are local; less than 10% of the specimens in the herbaria are from sites outside of the country where the herbarium is located. The museum specimens that are stored, maintained and studied in the Herbarium Paul C. Standley (EAP *in* Theirs, 2012) are the exception. Specimens at EAP represent the flora of the countries served by Zamorano. Of the 128,198 collections (out of over 200,000 total specimens) that have been digitalized into a database, the proportions, by country, are as follows: Honduras 40%, Guatemala 14%, Mexico 12%, Costa Rica 11%, El Salvador 8%, Nicaragua 8%, Panama 3%, Belize 1%, and others (mostly South America and the Caribbean Islands) 3%. To my knowledge, no other Central or South American herbarium comes close to having collections from such a diverse range of countries in such large numbers. Fully 97% of the EAP specimens represent the natural phytogeographic region known as Mesoamerica which extends from the Isthmus of Tehuantepec to the Panama-Colombia border. It includes the five southern states of Mexico (Tabasco, Chiapas, Campeche, Yucatan and Quintana Roo), Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama. The Herbarium Paul C. Standley has been, and will continue to be, an invaluable resource for the more than 400 collaborators who are preparing the six volumes of the Flora Mesoamericana (UNAM *et al.*, 1994, 1995) where many of our specimens have been cited as representative material for the floristic region.

Each species name, when it is published, is associated with a physical specimen called a type and a description of the plant. Types must be stored in a herbarium for reference so that subsequent collections

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of the species can be compared with the actual plant used for the establishment of the species name. The description of the species must be validly published in a journal or book. The journal Ceiba in its 60 plus years contains several hundred descriptions of new-to-science plant species. Most of the type specimens for these species are in the EAP herbarium. At the moment, we have over 1000 types registered in our data base. No Central American herbarium has more type specimens. Due to their high scientific value these specimens are presently stored in a separate herbarium cabinet. In 2007, with funding from The Andrew W. Mellon Foundation, EAP started to prepare extra high-quality digital scans of our type specimens as part of the Latin American Plant Initiative (LAPI). Many of our types are now available in a digital form via the internet. This facilitates the study of these valuable types for research on the flora of Honduras and Mesoamerica without having to have the specimens leave the herbarium. The digital scans are the equivalent to looking through an eight-power dissecting microscope so minute characters used in plant identification are easy to view. Consulting the LAPI-supported type database also permits investigators to confirm identifications with the original type material.

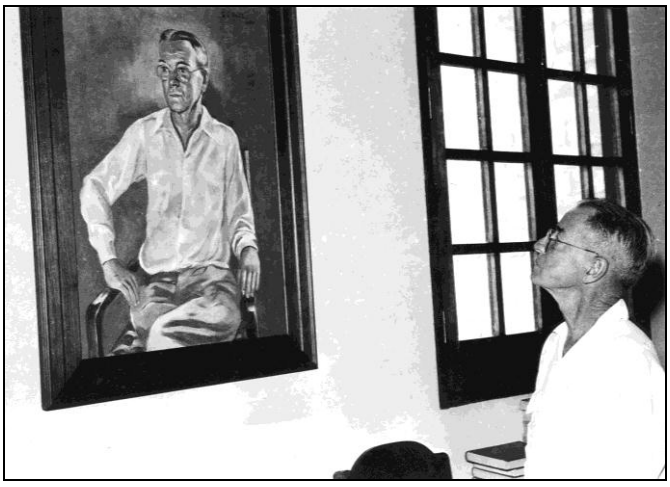

Figure 1. Paul C. Standley, in the former herbarium that has his name, starring at his portrait painted by Leon Wooten in 1955 (Photo by Amado Pelén).

In addition to the types housed at EAP, Louis O. Williams, in 1956, transferred 195 collections representing 219 type specimens to the U.S. National Herbarium for safe keeping (Dorr *et al.*, 2009). Fortunately, duplicate specimens for many of these types were retained at EAP, and we have no plans to repeat this type of transaction.

It would have been impossible to build a regional herbarium without the thousands of collections of Juvenal Valerio Rodriguez, Antonio Molina, Louis O. Williams, Paul C. Standley, Paul H. Allen, Paul J. Shank and Jose L. Linares. These botanists, during their years at EAP, collected large sets of plants with many important duplicates in all the countries of Mesoamerica. The identified duplicate specimens were then exchanged with other herbaria outside of the region that had large holdings of Mesoamerican plants. The herbaria included: Field Museum of Natural History, Chicago (F), Missouri Botanical Garden, St. Louis (MO), Universidad National holdings are a result of these exchange programs where duplicates from these and other herbaria were incorporated into our collection.

Scores of botanists have visited Honduras to conduct botanical investigations including Gerritt Davidse (MO), Alwyn Gentry (MO), Thomas Croat (MO), Mario Sousa (MEXU) and Thomas Daniel of the California Academy of Sciences (CAS). When EAP provided logistic or administrative assistance to these botanists, we have asked them to deposit a set of their field collections to our herbarium. This results in additional specimens for EAP, and also insures that sets of plants remain in the country of origin for study by future taxonomists and botanists.

The exchange programs have had additional benefits. They have allowed EAP to accumulate specimens, previously housed in other herbaria, which were collected before EAP existed. The oldest specimen in the EAP collection, from Mexico, is over 200 years old. Half of the specimens at EAP were collected before 1963, six percent were collected before 1942, and over 1000 specimens were collected before 1900.

Successive curators at EAP have insured that the collection only incorporates quality specimens. With over 200,000 sheets for a Mesoamerican flora of between 18,000 and 24,000 species of flowering plants

in the permanent collection at EAP, some commonly collected species are not mounted for the herbarium. They are stored for student use or become part of the exchange program. One has to be careful here because exchange institutions also do not want to receive large numbers of commonly collected species.

Phases of Development

The Herbarium Paul C. Standley has gone through four distinct periods (Figure 2 and 3). The initial period of establishment, in the early to mid 1940's, was led by Juvenal Valerio Rodriguez. Juvenal and his students, notably including Antonio Molina, contributed the first 5,000 specimens currently housed in the herbarium. The second phase led by Louis O. Williams, Paul C. Standley, Antonio Molina and a dozen other prominent botanists was one of explosive growth in the collection, numerous monographic treatments, publications of hundreds of species new to science, a vigorous exchange program, establishment of the journal Ceiba, and the foundation of an excellent botanical library. One has to wonder how all this was financed, but it was certainly the golden years of systematic botany at EAP. The third phase of consolidation and reasonable growth started with Louis O. Williams leaving for the United States in 1957 and the death of Paul C. Standley in 1963; by the early 1980's over 80% of our current specimens had been incorporated into the collection.

The present phase began in the mid-1980's, and has been pushed by two strong intertwined currents at Zamorano; the addition of a fourth-year of undergraduate education and the adaptation of computer technologies. The fourth-year students were required to do a Special Project; many did what amounted to a senior thesis. The fourth-year students had time to work in the herbarium, ask questions, and plan limited-time research projects. Some of these projects included collection and identification of plants in the surrounding forests and agricultural fields, studies of ecologically sensitive riparian areas, corridors facilitating the movement of wild animals between mountain tops, and the expansion of invasive species, otherwise known as weeds. These student studies were a challenge for the limited herbarium staff and the collections made by the students needed to be stored as vouchers for their published research results. The herbarium, once the reserve of trained taxonomists and researchers, had to open its doors and resources to students with very little training or knowledge of herbarium etiquette.

Figure 2. Buildings that housed the Paul C. Standley Herbarium (right) and Wilson Popenoe Library (left) in 1974 (Photo Amado Pelén).

Figure 3. Building that housed the Paul C. Standley Herbarium since 2002.

The second current was no less disruptive. Computer technology had arrived, and to ignore its potential would have been irresponsible. In the late 1980's, a young, computer-literate botanist, Denis Filer, from the University of Oxford, Plant Sciences, asked if he could come to Zamorano to develop a computer program for use in the herbarium. EAP Herbarium was about the right size for his work, and we were certainly open to his proposal. From this initiative sprang the Botanical Research And Herbarium Management System (BRAHMS) that has been adopted by herbaria around the world. Computer

data bases allowed for storage of data and its retrieval in a myriad of forms that were laborious to the extreme using conventional methods. A project attempting to create a list of the trees of Honduras and their distribution took more than 400 hours of noting data from herbarium specimens at EAP. This now can be done in seconds; one simply strokes "trees" and "Honduras" and the computer program does most of the work. Of course we have spent the past 20 years loading data from the specimens into the BRAHMS database; we may need another few years just to complete the material we have collected.

The years of work has allowed us to ask questions that were difficult to calculate with any accuracy before computer programs such as BRAHMS. Questions like:

- How fast is the latest invasive species moving through Mesoamerica?,
- What *geographical* areas are needed to insure the survival of wild representatives of agronomic species?
- Are certain species endangered of extinction, or just infrequently collected?,
- What geographical areas are species rich and worth protecting?
- What plants will be in flower next month on Mount Uyuca?
- Where are the areas infrequently collected in Mesoamerica?

Making botanical information, stored in herbaria, available on the Internet has changed the way research is conducted. BRAHMS and LAPI are two good examples of botanical information, once only available on the herbarium sheet in a given herbarium, which can now be viewed by researchers around the world simultaneously. No longer does one need to ship large quantities of material to another herbarium for study by a specialist. Electronically the specialist can check to see what you have, and what may be of particular interest. The study of scans of herbarium sheets can answer most questions about the identity of a particular collection. Planning a field trip is made much easier when the flowering/fruiting time of multiple species and their exact location can be determined using collections stored in various herbaria all in a matter of minutes. The Internet, museum databases, and search engines have made available much of the information housed in the irreplaceable specimens of natural history collections, like EAP, to a computer in any part of the world.

The next phase in the evolution of the Paul C. Standley Herbarium as a Pan-American institution is just beginning to form. There are several promising directions in which it may excel, and continue to serve Zamorano University, its students, and the countries they represent. A firm institutional foundation has been laid in the first seventy years.

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