



Panama: The Biological Bridge of the Americas *A History of the Discovery of its Plants*

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Paul A. Schulze Curator of Botany
4 September, 2018

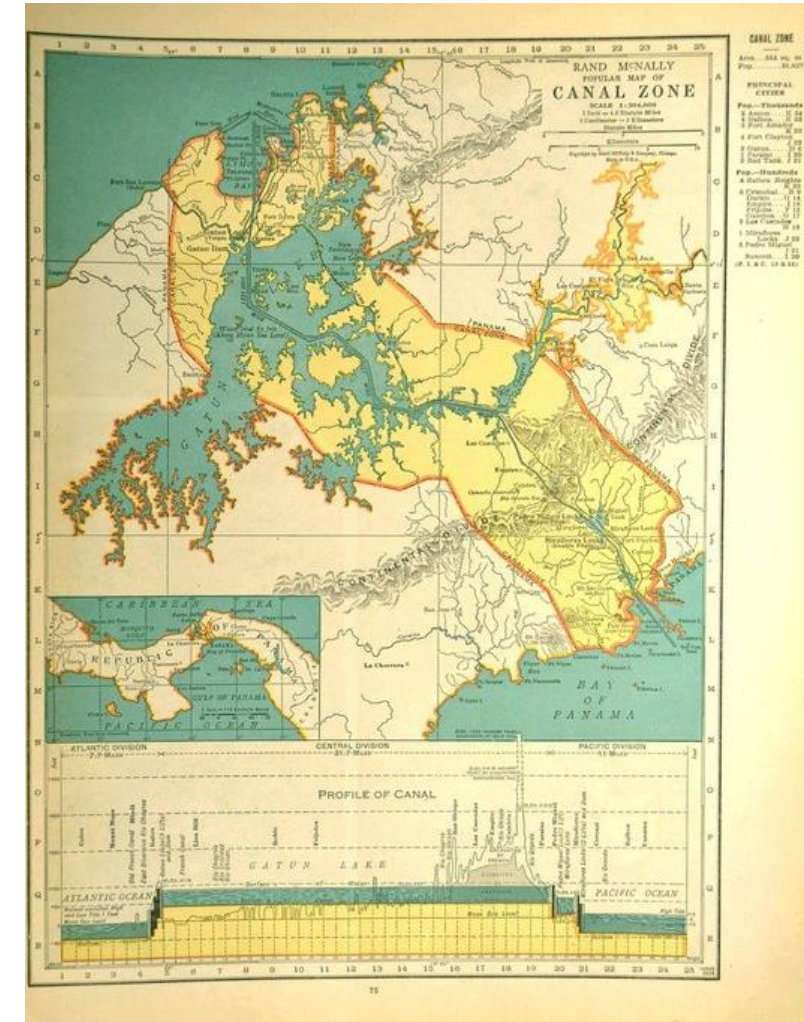
History of Botanical Exploration in Panama

Earliest exploration mostly restricted to the isthmus

- James Wallace (1700)- failed expedition to New Caledonia colony in Darien
- Berthold Carl Seemann (1846-1849)
- P. D. Duchassaing (1849-51)
- Augustus Fendler (1850)
- K. Halsted (1850)
- Sutton Hayes (1860-1863)



Seemann



Early 20th Century Explorers

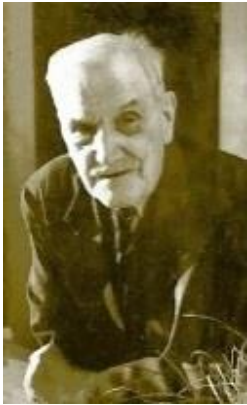
- Robert Statham Williams (1908)
- Charles Wesley Powell (1907-1927)
- Henri Francois Pittier (1911, 1914-15)
- William Ralph Maxon (1911, 1923)
- Ellsworth Paine Killip (1917-18, 1922)
- Charles Vancouver Piper (1923)
- Paul Carpenter Standley (1923-25)
- George Proctor Cooper (1927-28)
- A. M. Chickering (1928)
- Brother Paul (1934)
- Mary Elizabeth Terry (née Spence Davidson) (1938, mainly from Chiriqui & Darien)
- R. A. Terry (late 1930's, mainly from Darien)



Williams



Powell



Pittier



Maxon



Killip



Piper



Standley

Post 1930's

Initiation of Missouri Botanical Garden's *Flora of Panama*

- Robert Everard Woodson, *Flora of Panama* began in 1934
- Robert W. Schery
- Russell J. Seibert
- Julian Alfred Steyermark
- Paul C. Allen
- Abel Aken Hunter
- Carroll William Dodge

Flora initiated too early,
before enough samples were
collected.



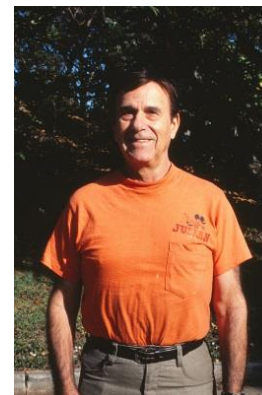
Woodson



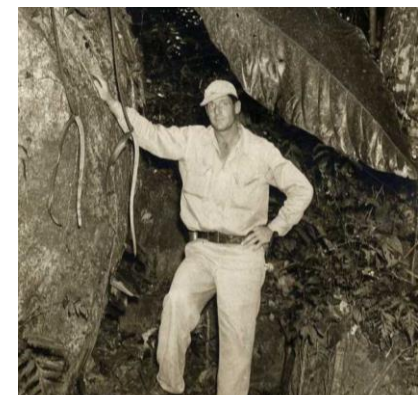
Schery



Seibert



Steyermark



Allen



Dodge

Missouri Botanical Garden staff under Woodson- a powerhouse of talent that vanished on his death

Woodson
B. St. Louis 1904
D. 1963

James Duke



Calloway Dodson



Robert Dressler



Larry Nevling



George Bunting



Yale University School of Forestry 1959– 1990- A search for wood samples



Kenton Chambers

1959



1957

William Stern

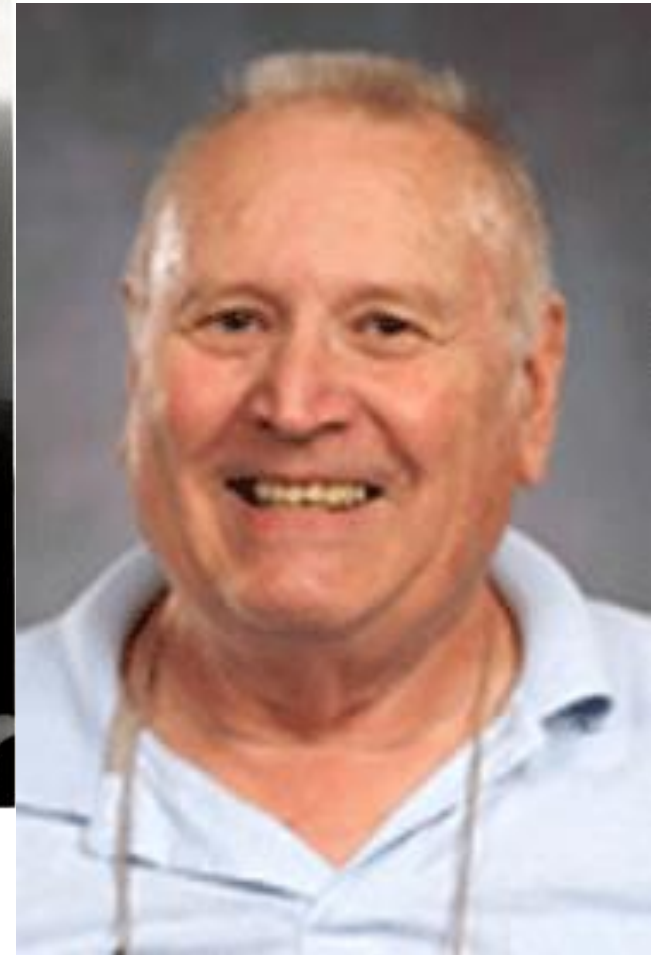


John Dwyer

1962

1960

John Ebinger



Florida State University – 1957 onwards-

Principally a teaching role for military

Professors teaching classes for Army personnel:

- Robert K. Godfrey, Dept. Head
- Edwin L. Tyson
- Horace Loftin

Students collecting in Panama:

- Robert L. Lazor (1969-1971)
- Sydney McDaniel (Aug 1968 – Apr 1984)
- Kurt Blum (Jan 1965 – Aug 1975)



Loftin



Godfrey



Lazor



McDaniel on Franwood II



Blum

Army Tropic Test Center - Miraflores Locks

- Operated at Miraflores Locks 1965-1969
- Edwin Tyson, Florida State University Professor
- Made 6000 collections for Army
- Tyson's first collections in Panama-1962
- Initial specimens for Summit Herbarium
- First to explore Cerro Santiago
- ATTC collection was the first major part of Summit Herbarium (SCZ)



1969 - Walter Lewis Establishes Panama field station at Summit Gardens – A successful and inexpensive strategy

- Trailer home at Summit Garden
- Herbarium SCZ at Summit Garden
- Field Vehicle
- Tom Croat 1st Curator of Summit Herbarium
 - PI for Flora of Panama until 1977, Bill Darcy is next
 - Croat conducts work on Barro Colorado Island
 - Croat writes BCI Flora at Summit Garden
- Fire damages Summit Herbarium building
- Herbarium moved to Gamboa-Dredging Division
- Moved to Ancon- Adopted by STRI

Lewis in the herbarium



Lewis in the field



Flora of Panama Renewal with NSF Funding

- Walter Lewis
- John Dwyer
- Tom Croat
- André Robyns
- Duncan Porter
- Marshal Crosby
- Derek Burch
- John Ridgeway
- Royce Oliver
- Joan Nowicki
- Will Blackwell
- Joseph Kirkbride
- Susan Verhoek-Williams
- John Hawker
- Tom Elias
- Ken Baker
- Bruce MacBryde
- Dan Austin
- Ken Robertson
- Jerry Castilon
- Sr. Victoria Hayden
- Vern Durkee



Burch & Dwyer



Croat



Robyns



Porter



Crosby



Ridgeway

Oliver



Elias



MacBryde





Anderson

Blackwell

Lallathin

Elias

Baker

Austin

Oliver

McBride

Hawker

Kirkbride

Croat

Nowicki

Robertson

Dwyer

Blake

Lewis

Robyns

Sister
Victoria
Hayden

Putnam

Olga
Herrera
(McBride)

Verhoek

Herbarium staff photo taken in early 1969 shortly before the death of Edgar Anderson and before the employment of Porter and Crosby

Summit Gardens at the entrance near the herbarium



Established 1923 at urging
of David Fairchild

Summit Botanical Gardens

- Founded 1923: One of the oldest in Central America
- Many interesting trees
- Original site of Summit Herbarium founded by Walter Lewis
- Flora of Barro Colorado Island was written at Summit
- Marianne Akers and other volunteers working to renew it

Marianne Akers



Summit Gardens Administration Building and Herbarium

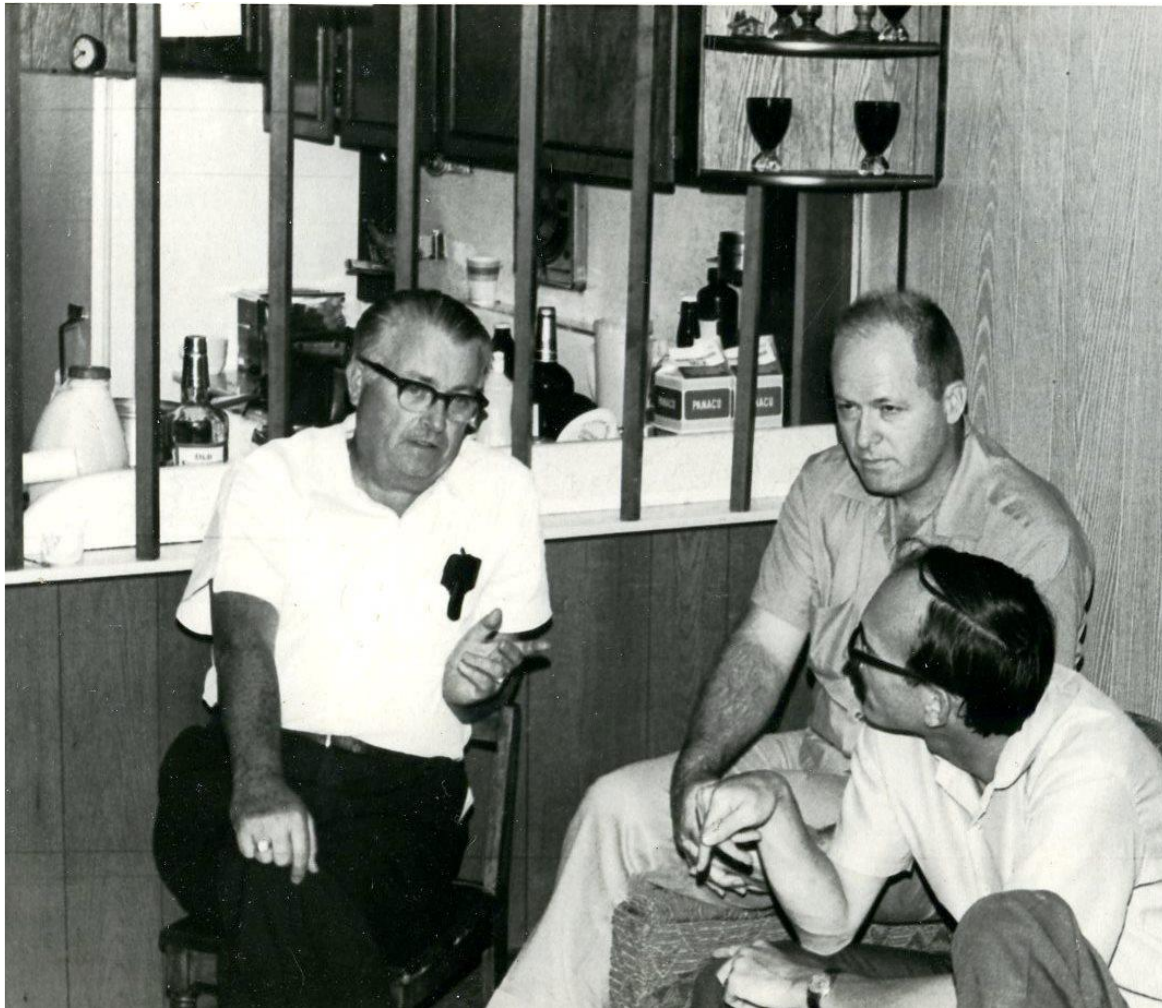
SCZ Herbarium located
on upper floor

MBG trailer house
located behind the
herbarium



Trailer House at Summit Gardens- A meeting place

John Dwyer with Bob Dressler & Bruce MacBryde, 1971



Dave Spellman, Ed Tyson, Joe Vaughn, Al Gentry, Pat Croat, Dick Wunderlin, Carmen Ramírez



The Administration Building at Summit, after the fire which took off the top story and the loss of the herbarium.



Jim Duke and Joseph Kirkbride in Bocas del Toro



Jim Duke
B. Birmingham, 1929
D. 4 April, 2017

First Collection in
Panama 1966

Duke in field camp

Consulting with locals



Preparing to go up river from
the coast, Bocas del Toro



Jim Duke and Joseph Kirkbride in Bocas del Toro

Jim Duke was friendly with all local people everywhere and was much beloved and well known throughout Darién Province



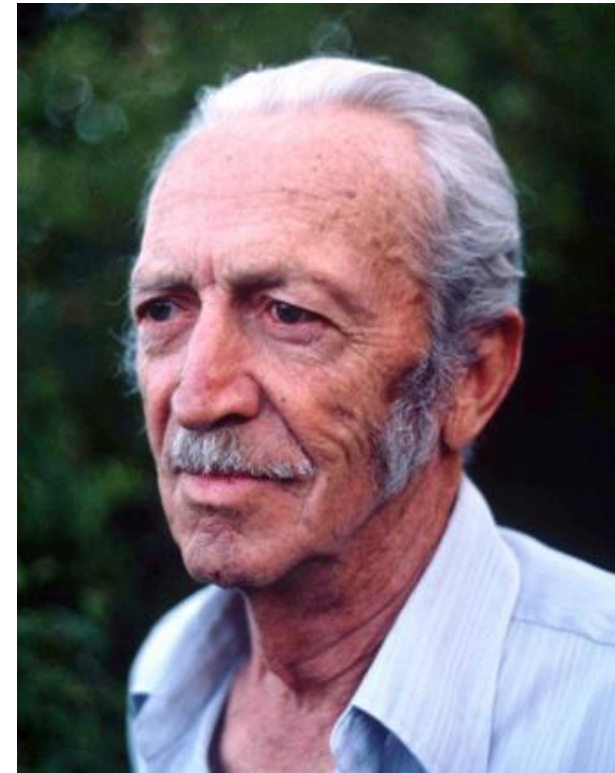
Kirkbride's collections in Panama = 1593
Duke's collections in Panama = 8950



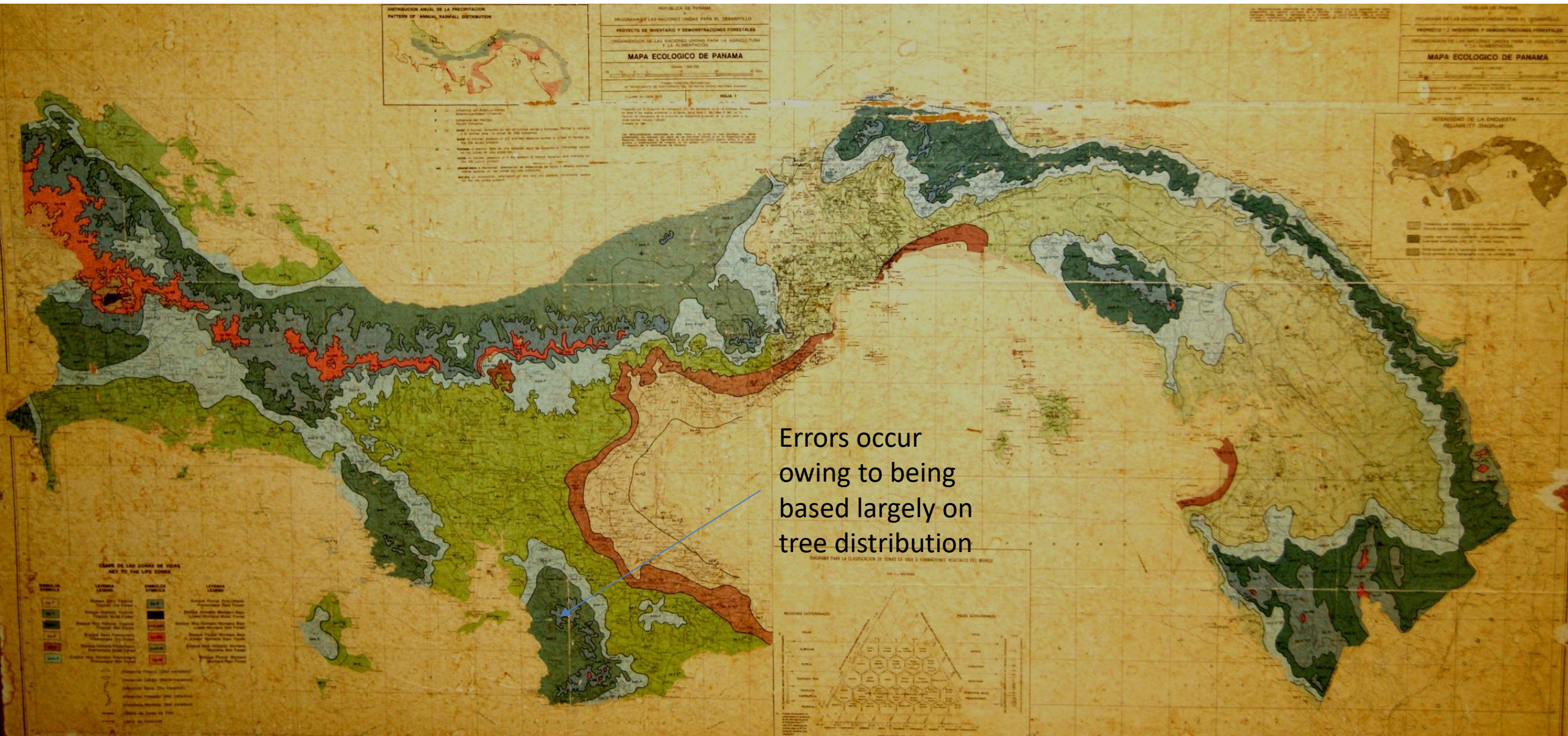
Leslie R. Holdridge & E. A. Lao- 1960's

- Forestry samples in support of Holdridge Lifezone map of Panama
- Developed Holdridge Lifezone map for Panama

1st Panama collection-
April, 1968

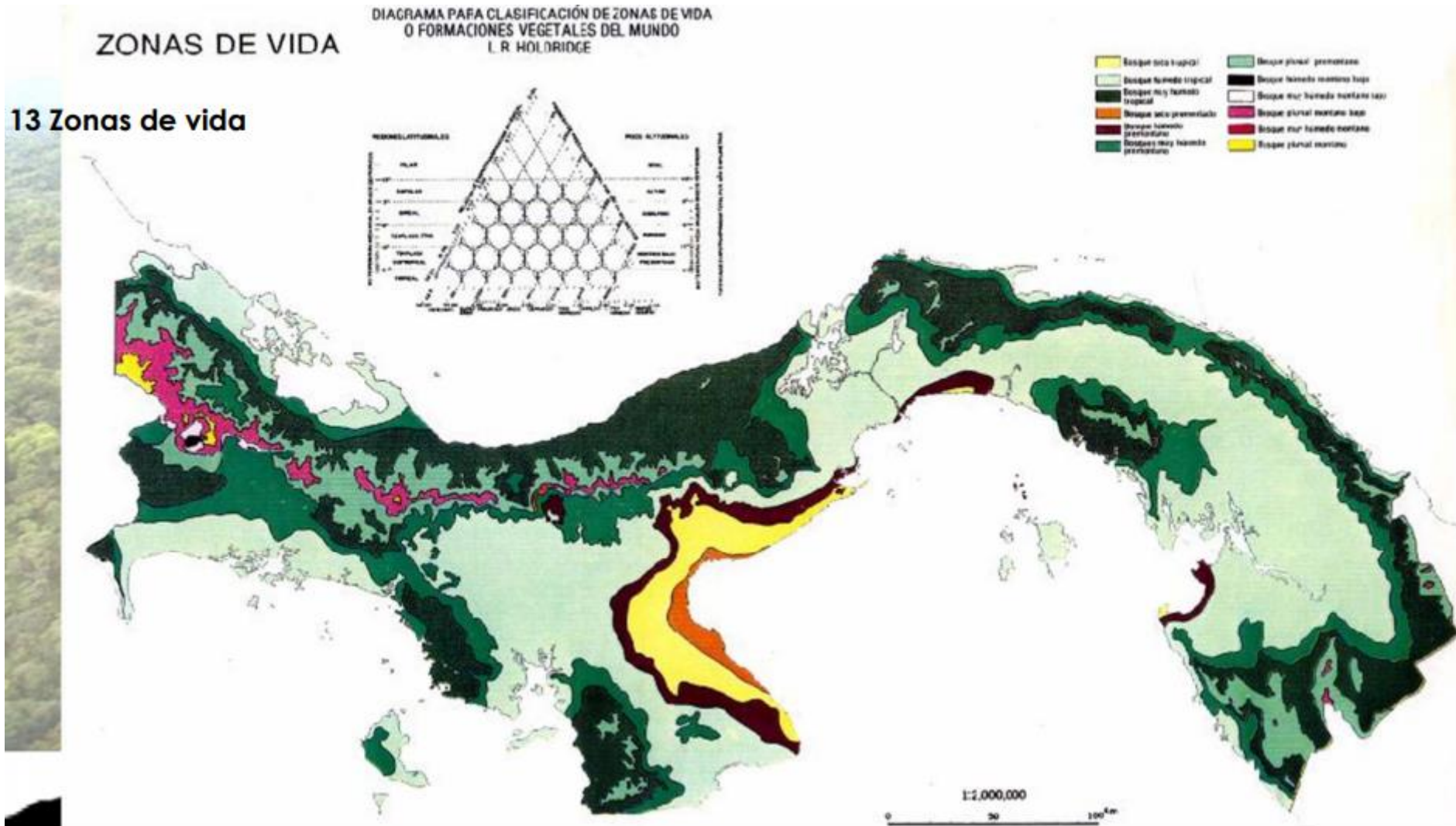


Holdridge Life Zone Map



Holdridge Life Zone Map, Online

<http://www.cnpml.org.pa/images/mesa-de-dialogo/ponencias/sesion5/ponencia-10.pdf>

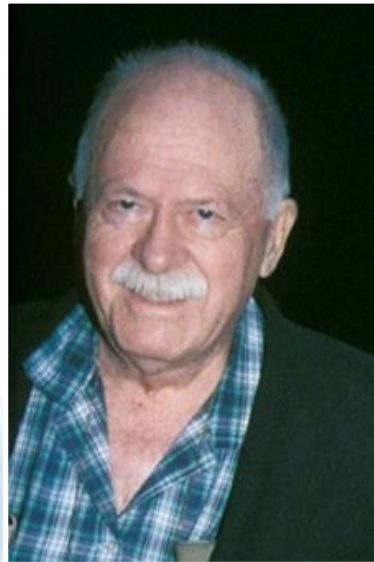


Loss of natural vegetation has been severe



Bob Dressler Smithsonian Tropical Institute (STRI) 1960-1986

1st Collection in
Panama- 1963



Dressler at Harvard



Dressler collecting
pollinators on BCI



Bob Dressler

Premier orchidologist who collaborated
with botanists all over the world

Carl and Bert Luer, Jim
Ackerman, Kerry Radcliffe &
Dressler



Guillermo Mias, Fr. Pedro Ortiz Valdivieso, Dressler & Eric Hågster, 1983 Colombia

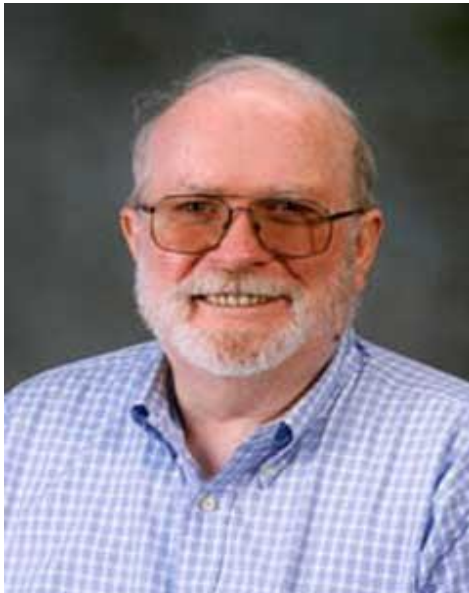
Flora of Panama

Sponsored collecting trips to Panama for

John Dwyer



Duncan Porter



Walter Lewis

1st Panama
collection-
Dec., 1966

Tom Croat



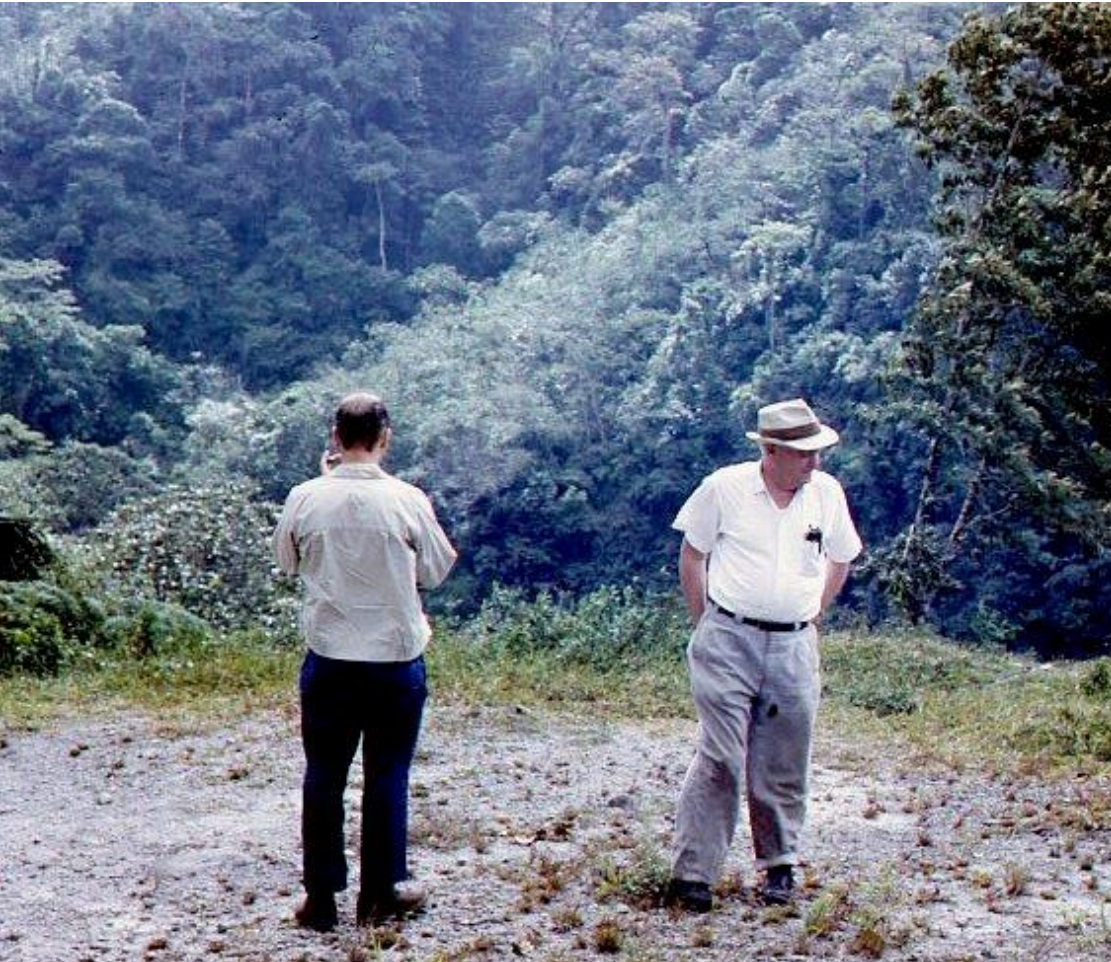
Bill D'Arcy



Second Walter Lewis Expedition to Panama

On of many Dwyer trips to Panama. This one funded by Walter Lewis's Flora of Panama grant.

Jerry Castilon, Duncan Porter, Ken Baker & John Dwyer at Furlong's Finca at La Mesa



Air Force Logistical Support

Trip by helicopter to Cerro Santiago



Mireya Correa & Walter
Lewis boarding helicopter

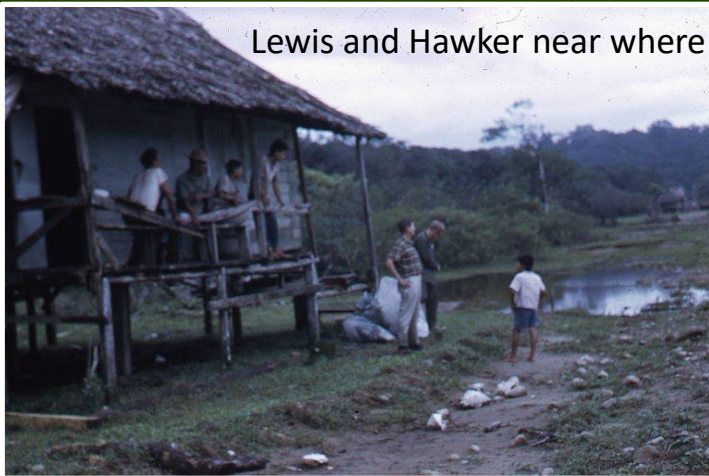


Correa, Lewis & Hawker boarding
helicopter



Lewis and Hawker near where we spent the night

Helicopter abandonment on shoreline near Caloveborita, Panama



1st Expedition post reintroduction of Flora of Panama December 1969

Nowicki, Robyns, Verhoek
visiting ATTC



Blackwell, Ridgway, Correa,
Hawker & Lewis,



Army Tropic Test Center
Herbarium- Miraflores Locks

With landing craft in Panama

It's nice to travel with an army medical team



Arriving on coast
of Panama not far
from where we
were abandoned
in 1967

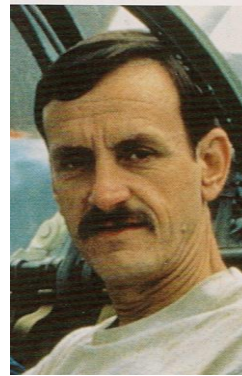
Curators of SCZ and Field Station Managers

15 Curators in 20 years

- Tom Croat (1971)
- Al Gentry (1972)
- Helen Kennedy (1973)
- Michael Nee (Aug., 1973-May, 1974)
- Scott Mori [with Jackie Kallunki] (1975)
- Tom Croat (1976)
- James Folsom (Jan., 1977-Dec., 1977),
- Barry Hammel (ca. 31 Jan. 1978 to May 1979)
- Tom Antonio (1979-1980)
- Ken Sytsma (1980-1981)
- Sandra Knapp (Aug. 1981-July, 1982)
- Clem Hamilton (Aug. 1982-July, 1983)
- Hugh Churchill- (Aug., 1983 – Sept., 1984)
- Greg de Nevers- 1984 (Mar., 1984-July, 1985)
- Gordon McPherson- 1985-1990



Croat



Gentry



Kennedy

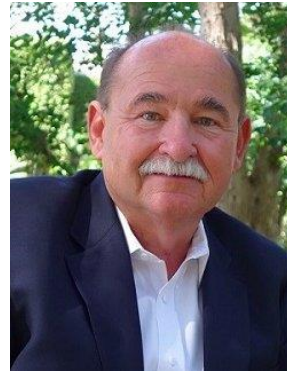


Antonio

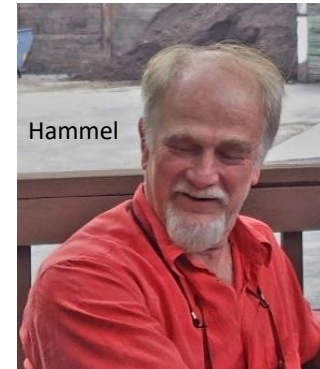
Nee



Mori



Folsom



Hammel

Hamilton



Antonio

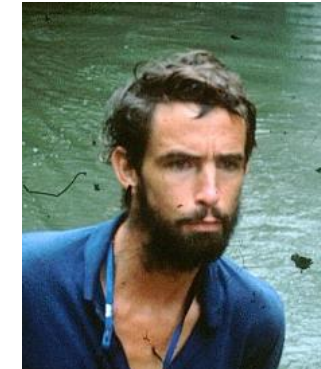
Sytsma



McPherson



Knapp



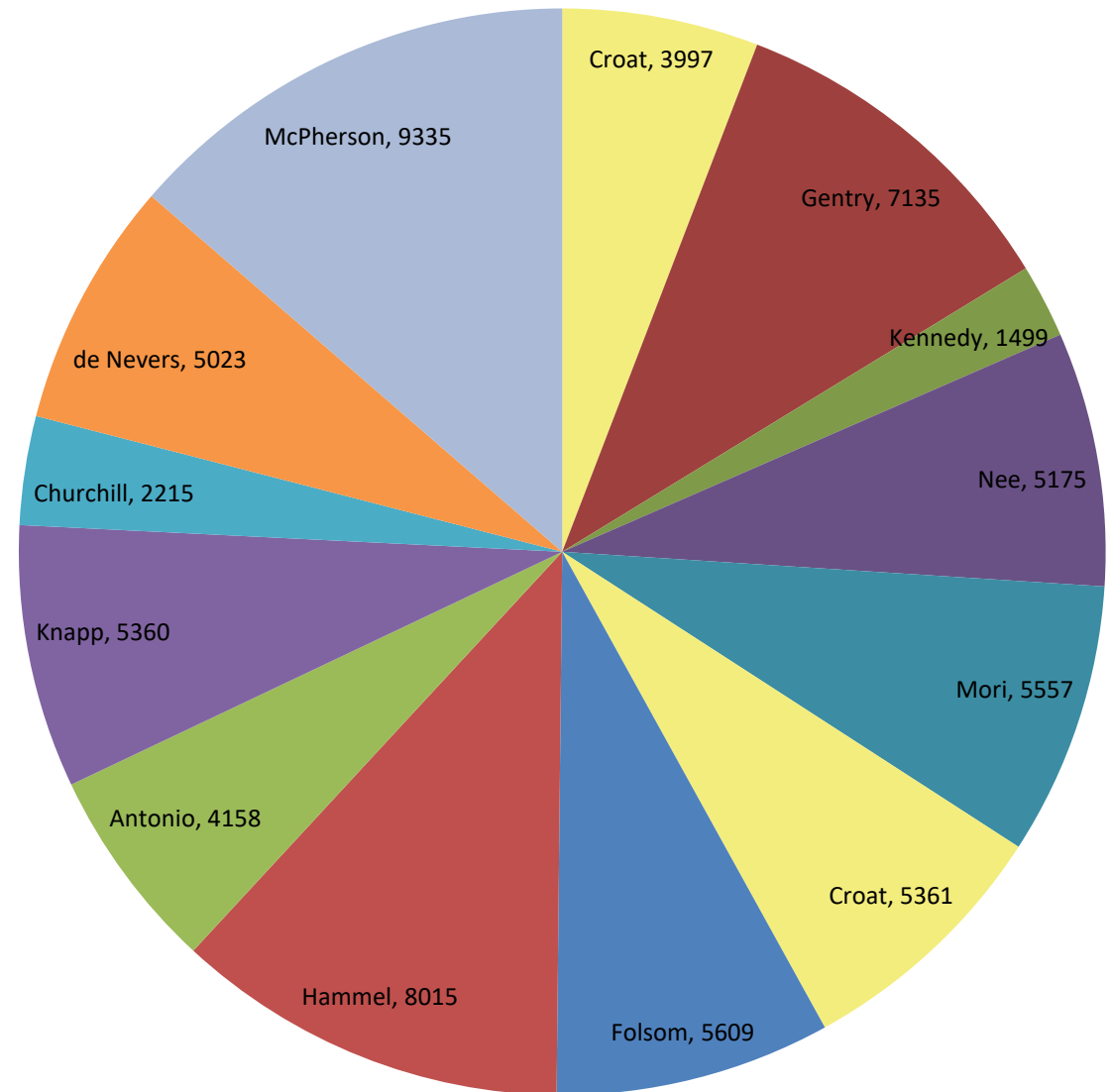
De Nevers



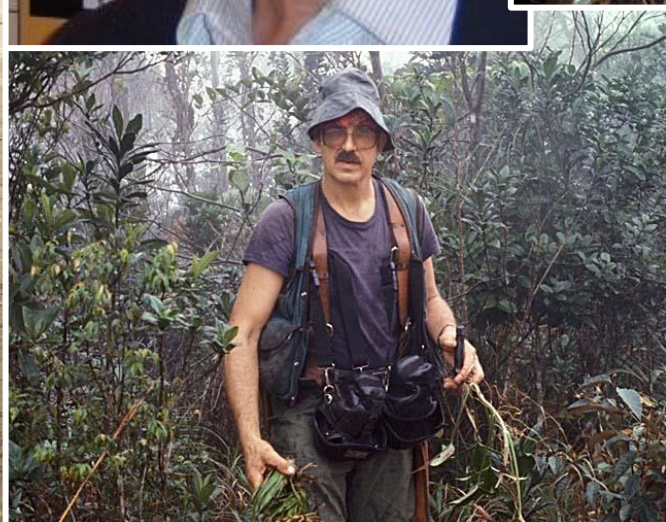
Collections made by SCZ Curators

- Tom Croat (1971) **3,997**
- Al Gentry (1972) = **7135**
- Helen Kennedy (1973) = **1499**
- Michael Nee (Aug., 1973-May, 1974) = **5175**
- Scott Mori [with Jackie Kallunki] (1975) = **5557**
- Tom Croat (1976) 5361 total 1763 CR, 3598 Pan. = **5361**
- James Folsom (Jan., 1977-Dec., 1977) = **5609**
- Barry Hammel (ca. 31 Jan. 1978 to May 1979) = **8015**
- Tom Antonio (1979-1980) = **4158**
- Sandra Knapp (Aug. 1981-July, 1982) = **5360**
- Hugh Churchill- (Aug., 1983 – Sept., 1984) = **2215**
- Greg de Nevers- 1984 (Mar., 1984-July, 1985) = **5023**
- Gordon McPherson- (1985-1990) = **9335**

Total Collections:
64439



Tom Croat – 1971



Al Gentry – 1972

Rosa Ortiz, Al Gentry, Mike Dillon, Mike Melampy



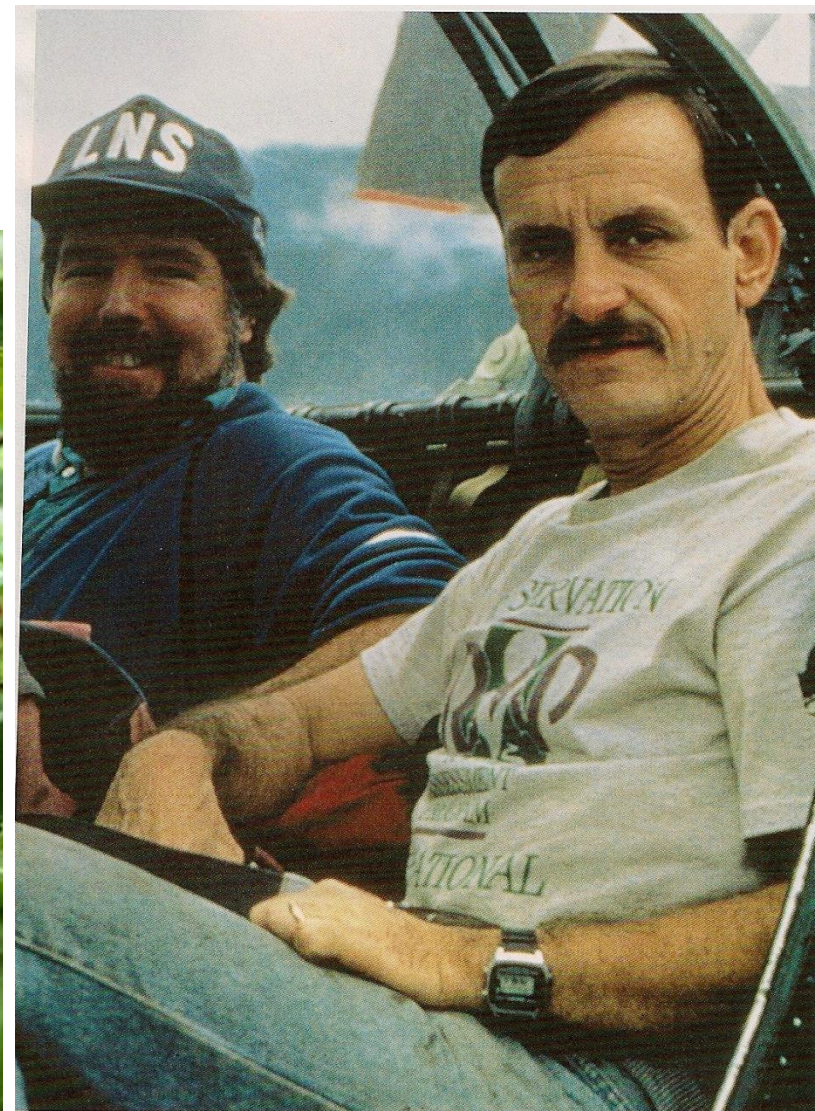
Washington Univ. Class by Croat



Died Aug. 3, 1993

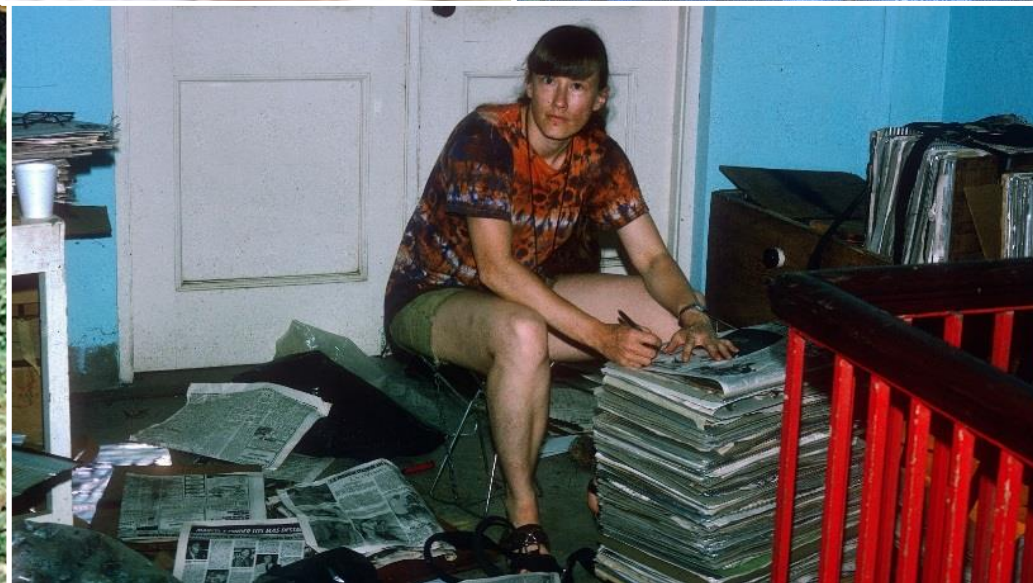


Ted Parker (ornithologist, died in the same plane accident) & Gentry



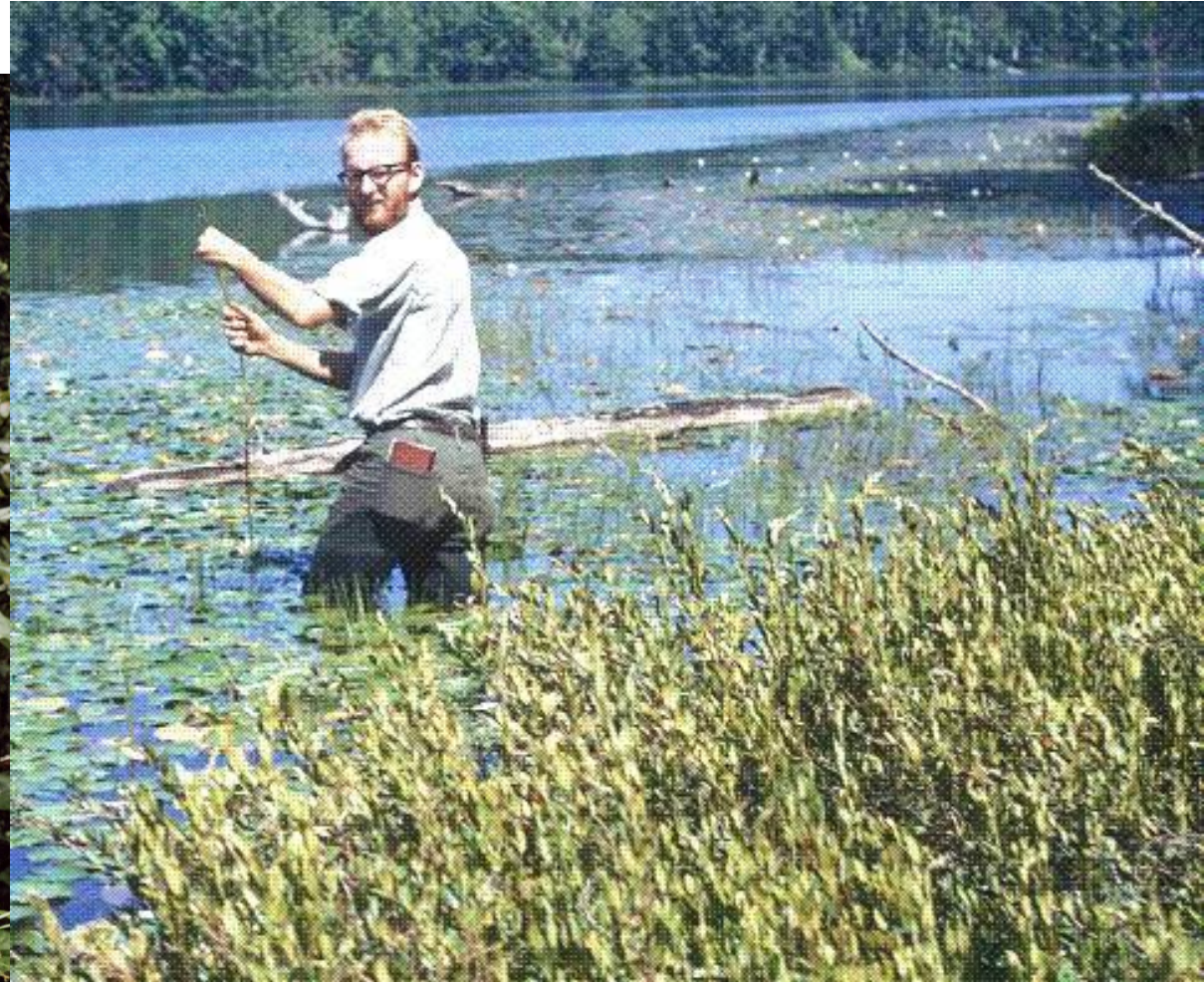
Helen Kennedy – 1973

Helen holding one of the many
Marantaceae she collected and
described.

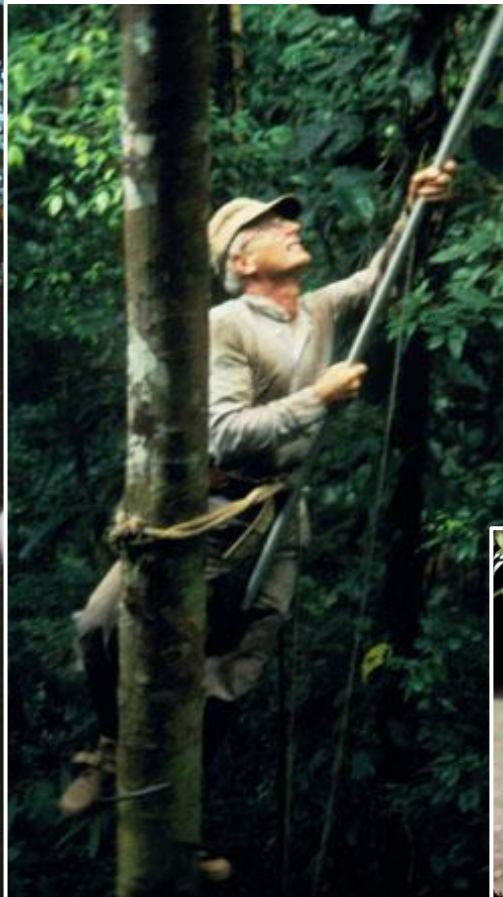


Michael Nee – 1974

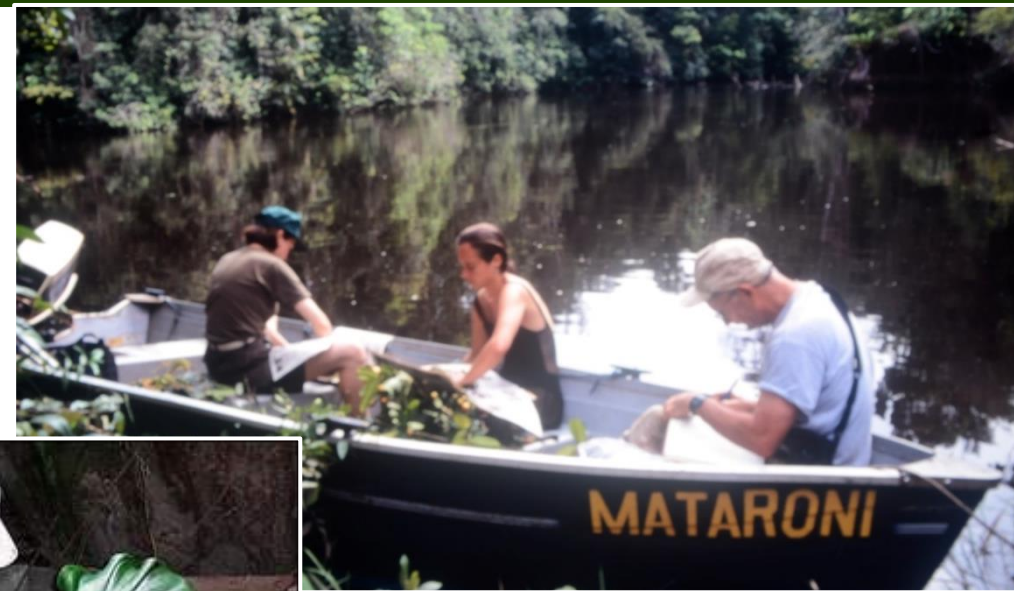
Mike Nee with a group from University of Wisconsin
Ted Cochrane (l), Bruce Hanson, Scott Mori, Jackie Kallunki & Nee



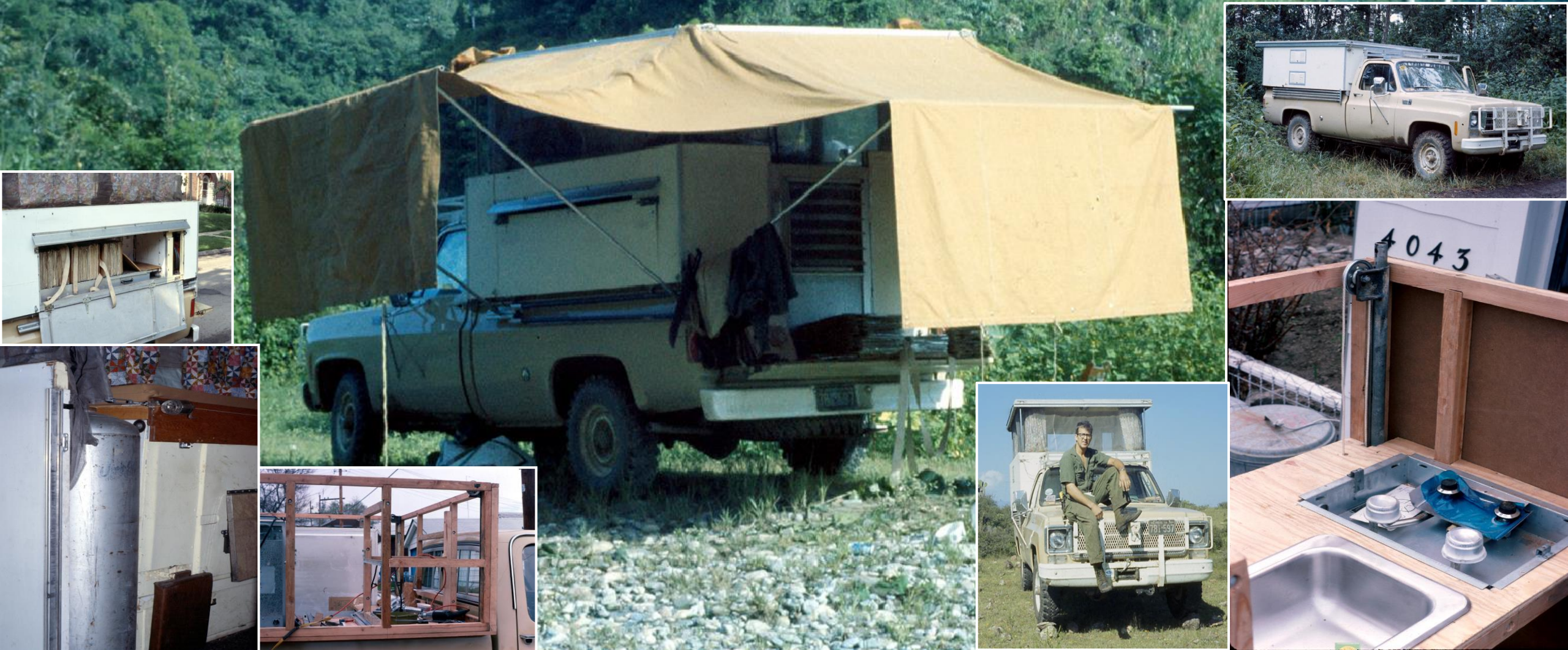
Scott Mori – 1975



Jackie Kallunki



Croat's 2nd term as Curator of Summit Garden brought improvements in collecting ability



MISSOURI BOTANICAL GARDEN

Jim Folsom – 1977

Currently Director, Huntington Botanical Garden



MISSOURI BOTANICAL GARDEN

Barry Hammel – 1978



With Teddy Hammel



MBG staff member since 1984



Croat, Cedeño, Hammel, Blanco



Hammel on Cerro Mali



Fortuna Road



Hammel, Herraclio & Juan Herrera, Cerro Tacarcuna

Tom Antonio 1979 – 1980

Presently Santa Fe Botanical Garden



Old SCZ Herbarium at STRI



Kenneth Systma – Sept. - Nov., 1980

Currently
University of Wisconsin



Sandra Knapp – 1981 - 1982



Favorite places- Darién,
Cerro Pate de Macho and
Fortuna Road in Chiriquí
Province

Director of Herbarium at
British Museum



Hugh Churchill – 1983 - 1984

- Concentrated in the Fortuna Dam area where he collected many new species.
- Overlapped with Greg de Nevers
- Hugh Churchill died July 12, 2014



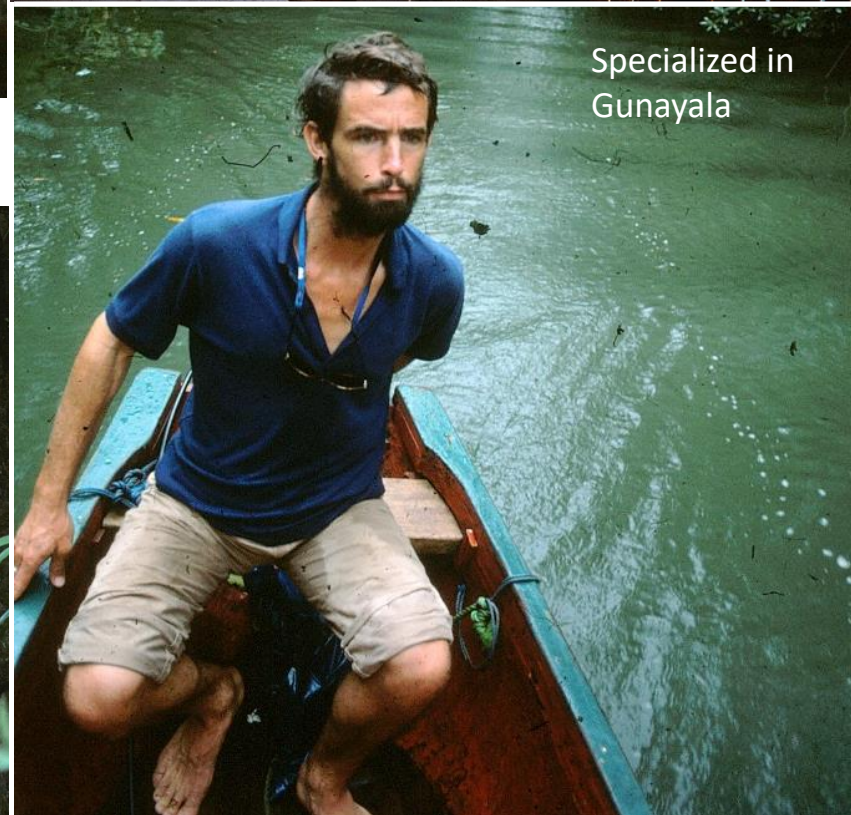


Climbing demonstration for Cuna

Greg de Nevers – 1984-1985



Specialized in
Gunayala



Gordon McPherson – 1985- 1990

Staff member at Missouri since 1985



Zamia pseudoparasitica



With British botanists John McDonagh and Nicola Gumpel on Cerro Jefe



Nicola Gumpel, Beverley Lewis, John McDonagh, Andrew Plumptre on Expedition to Cerro Pirre in Darién

Summit Herbarium Today

- SCZ adopted by Smithsonian Tropical Research Institute
- Mireya Correa and Carmen Galdames



Gerrit Davidse, MOBOT



Later visitors and students

Riccardo Baldini



Guanghua Zhu



Mike Grayum



Marcos Cedeño



Grady Webster



Panamanian Collectors



Alberto Taylor



Norris Salazar

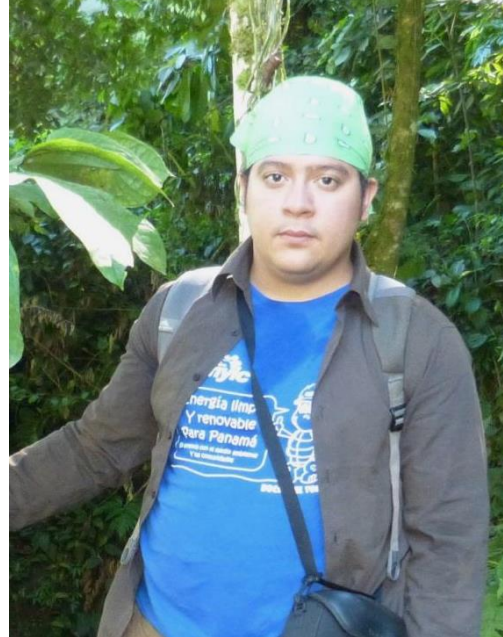
Mireya Correa



Rolando Pérez



Orlando Ortiz



Carmen Galdames



Herracio Herrera



Dr. Mireya, Correa la grand dame de botanico Panameña





Claudia de Peralta (fisiología vegetal), Noris Salazar & Mireya Correa

Universidad de Panama Herbario PMA



Correa with Salazar (I), Dilia Santamaría, Carmen Galdames Jorge Aranda & Jorge Sporle

- Phanerogamic Collection: ca. 135,000 collections; 2200 type collections-began with 5000 fifty years ago.
- FLORPAN: Collections of the Department pharmacology: bioprospecting, phytochemical research; Associated with Faculty of Medicine and bioassays with animals. Mahabir Gupta- International collaboration with (India, USA, Spain, England, Switzerland and Germany).

Mahabir Gupta-





Noris Salazar- Cryptogamic botany

12,000 mosses, ca. ½
collected by Norris

- Cryptogamic Collections
(12,000) (incorporated in
count with higher plants)
Clementina Chung & José
Gudiño



Other important Panamanian botanists

Novecidio Escobar, Professor of Correa



Escobar developed the first
courses for botanist in Panama

Alfredo Laña (Chilean)
Alejandro Méndez Pereira
Director de la Escuela: Dr. Octavio Sousa

Specialist in
Gramineae

Works with
Baldini

Prof. Cristina Garibaldi



Carmen Galdames, Chilean botanist living permanently in Panama



Carmen with Carla Chizmar



Maria de Stapf

Jefe del Departamento de Biología, Curador
del Herbario, Universidad de Panama



Smithsonian
Institution
1995 - 2008



MISSOURI BOTANICAL GARDEN

Alberto Taylor



with Natalia Anaya, Peru



Rolando Perez

- Published more than 100 articles on Barro Colorado trees
- ForestGEO at the [Smithsonian Tropical Research Institute](#)

(2008). Arboles del Canal de Panamá.

(2011). Arboles de Panamá y Costa Rica.

(2015). Lianas y Enredaderas de la Isla Barro Colorado, Panamá

Rolando shooting a line over a high tree branch



Herracio Herrera



Río Pucura, on way to Cerro Tacarcuna foto. G. de Nevers

Herracio Herrera, Barry Hammel & Juan Herrera
Cerro Mali, April, 1988



Rio Pucuro, Herracio Herrera & Greg de Nevers



Greg de Nevers, Barry Hammel & Herracio Herrera crossing Río Tacarcuna



Greg de Nevers & Herracio Herrera on Cerro Mali, April, 1986



Oris Rodríguez

Paleobotany; Ph.D from England;
Member of University of Panama staff





Nayda Flores

A student of Mireya Correa and Noris Salazar; Currently a Professor at the University of Panama and Curator of Cryptogamic Herbarium



José Polanco

Excellent general specialist in plant determination; works especially on floristics of higher elevations, especially Darién; Works for ANCON





Alex Espinoza

Created Nature Trail on
Coiba Island National
Park, 1999

Expert general plant
determinations; Worked with
FLORPAN; Now has his own
plant business





Salomon Aguilar

Scientific research assistant for ForestGEO (formerly CTFS)
at STRI

Assistant professor of Botany, Regional University Centro,
Colón.



Lucila Guillén

Specialist with Podocarpaceae

Has worked at the PMA Herbarium for 25 years



Vielka Murillo

Received BA at Universidad de Panama; MS at Universidad de Concepción, Chile. Has worked for Herbario PMA for 20 years



Rafael Aizprúa

Has his own business involved with bioprospecting
and Environmental Consulting

Rodolfo Flores

MA Universidad
de Chiriquí



Alexandro De Sedas



With Fermin
Hernández and Reyes
Carranza-2007 wrote
“Guide to Trees and
Shrubs of University
of Panama Main
Campus
“Guia folografica de
las plants vasculares
de Cerro Jefe”

Worked at PMA
herbarium;
worked in
phytochemistry at
INDICASAT); now a
Ph.D. Student with
a University in
India



Reyes Carranza-



MISSOURI BOTANICAL GARDEN



Alicia Ramos

Was Assistant to Mireya at
STRI; Now in US

Karina Víquez



Student of Mireya; Worked for
ANCON; Now works for STRI

Jorge Aranda

A good collector and generally knowledgeable
taxonomist
Now working for Repressa CHAN





Laurencio Martinez

Along with
Alejandro De
Sedas assisted in
preparation of
“Guia fotografica
de las plantas
vasculares de
Cerro Jefe”

Worked at Donoso;
Now works with BCG
(Biological
Consultants Group)

Anthurium laurencio Croat &
Ortis is named in his honor.



Carla Chizmar

Rubiaceae-Ecology & Distribution on Coiba
Island, Veraguas Province

Assistant to Mireya Corea; Presently
working for PNUD (Programa de las
Naciones Unidas- Ciudad del Saber



Fátima Rodríguez

Worked 5 years at
PMA Herbarium;
later worked for
Gorgas Memorial
Institute

Graciela Valdespino



Licenciada at University of Panama (Correo)
MA at UTP in Biología Vegetal Ambiente

Nelson Jaén



Works for
Smithsonian Tropical
Research Inst. On BCI



Martín Mitre



Good collector and general specialist; Works for ACP (Autoridad Canal Panama)



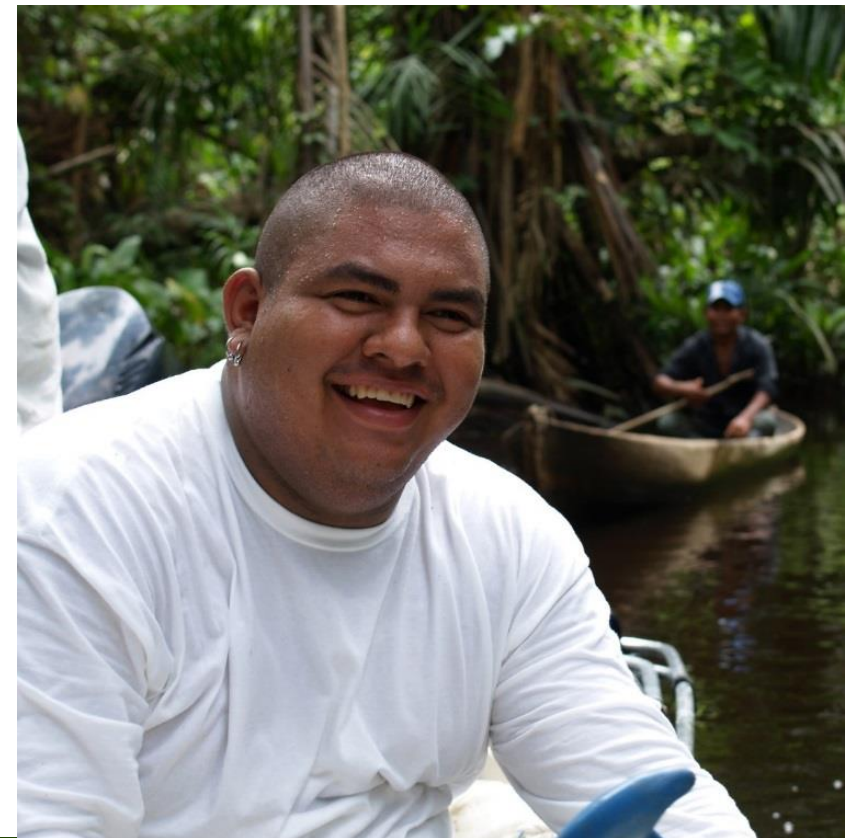
Noris Karina Toribio

Lic. and MA at University of Panama;
Was Director of Parques Regional de
Colón; Presently Assistant to Mireya at
STRI



Roberto Vergara

Student in
Dept. de
Educación;
Currently
works at
Donoso



Christel Ramos



Univ. of Panama;
Worked with
Gordon
McPherson at MO
on Annona; Part
of the Donoso
Team to study
Plants in Colon
Province; Works
at ICAB
(Inst.Ciencias
Ambientales)



Isla Coiba

Fermín Hernández

At Chorago



Univ. Panama;
MA University
of Costa Rica
(Rubus); Guide
to Trees and
Shrubs of Univ.
of Panama
campus



Donoso collecting crew



Inving Vergara, Blanca
Araúz, José De Gracia,
Sumling Castillo, Christel
Ramos

Orlando Ortiz

Smithsonian Research Short term
Fellowship Award for studies at
Fortuna on Araceae
Alwyn Gentry Award-Missouri
Botanical Garden
Master's Thesis on Araceae of Cerro
Pirre



Panamanian Localities where Discovery Occurred

- Collecting began in the immediate vicinity of the Isthmus, Panama City, Portobelo, Colón
- Along original railroad line from Colón to Panama
- Later to major hills and valleys of the interior
- New roads always led to new collecting areas

Collecting Localities- Early Collecting spots and the Hot Spots

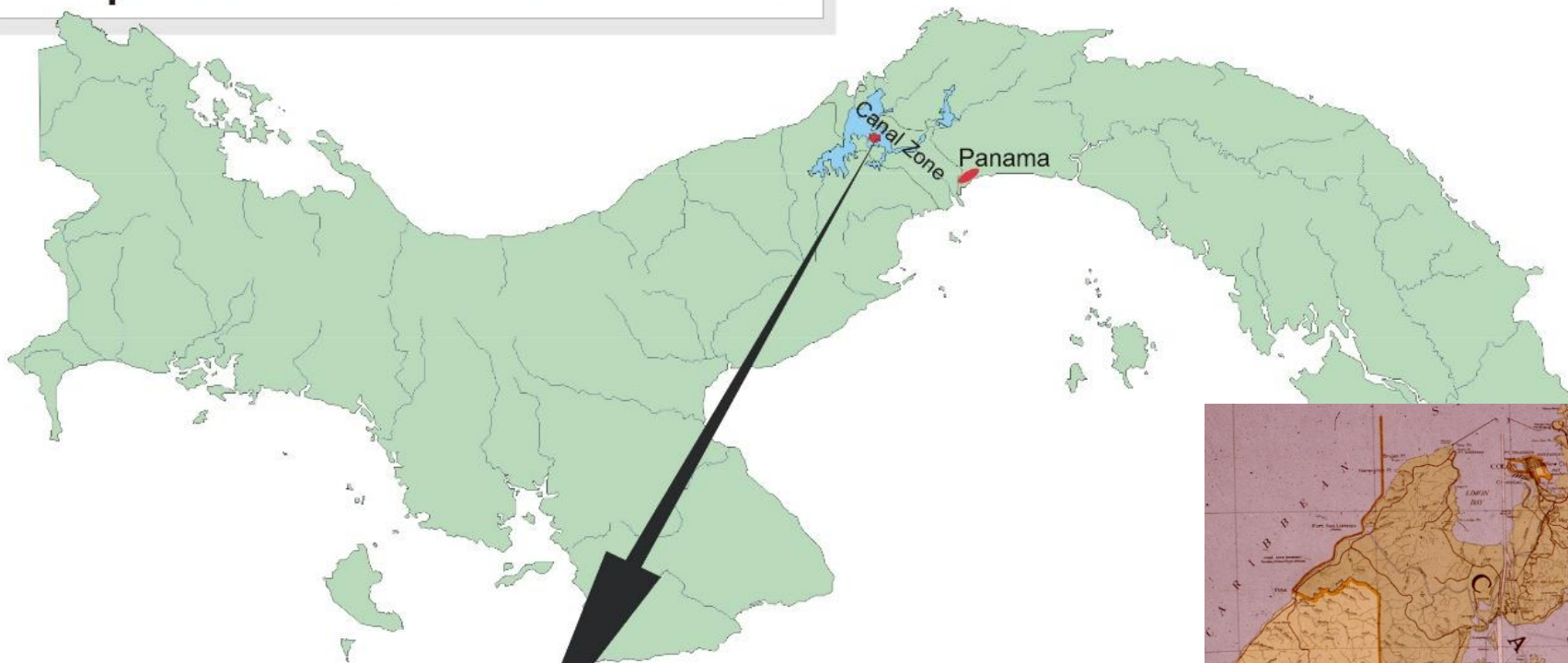
Panama Province – Most of earliest seen localities were near Panama City

- Barro Colorado Island (Man made-shoreline modified)
- Summit Garden
- Cerro Campana
- Cerro Jefe
- El Llano-Cartí Road
- Madden Forest (Parque Nacional Soberanía)
- Pipeline Road

Barro Colorado Island

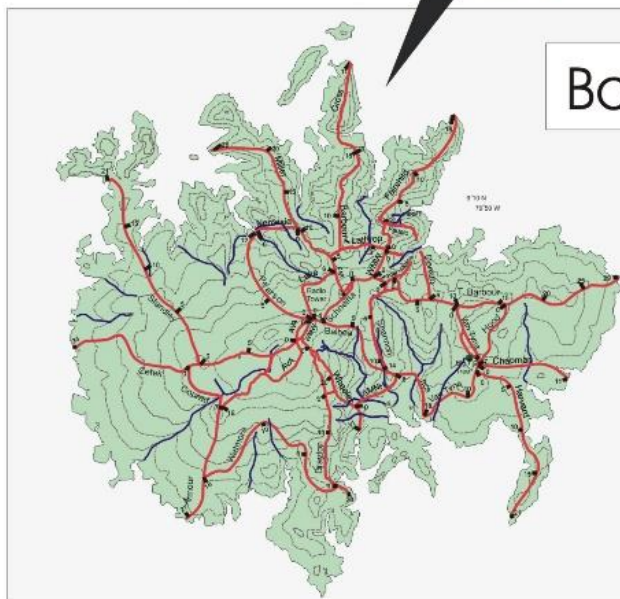
- Field station - Smithsonian Tropical Research Institute (STRI)
- 62 miles of coast line
- Shoreline now greatly modified by hydrach succession
- Croat began work there in Panama in Dec. 1967
- 1 year field work over 24 months
- 6536 collections by Croat
- Phenological studies

Republic of Panama

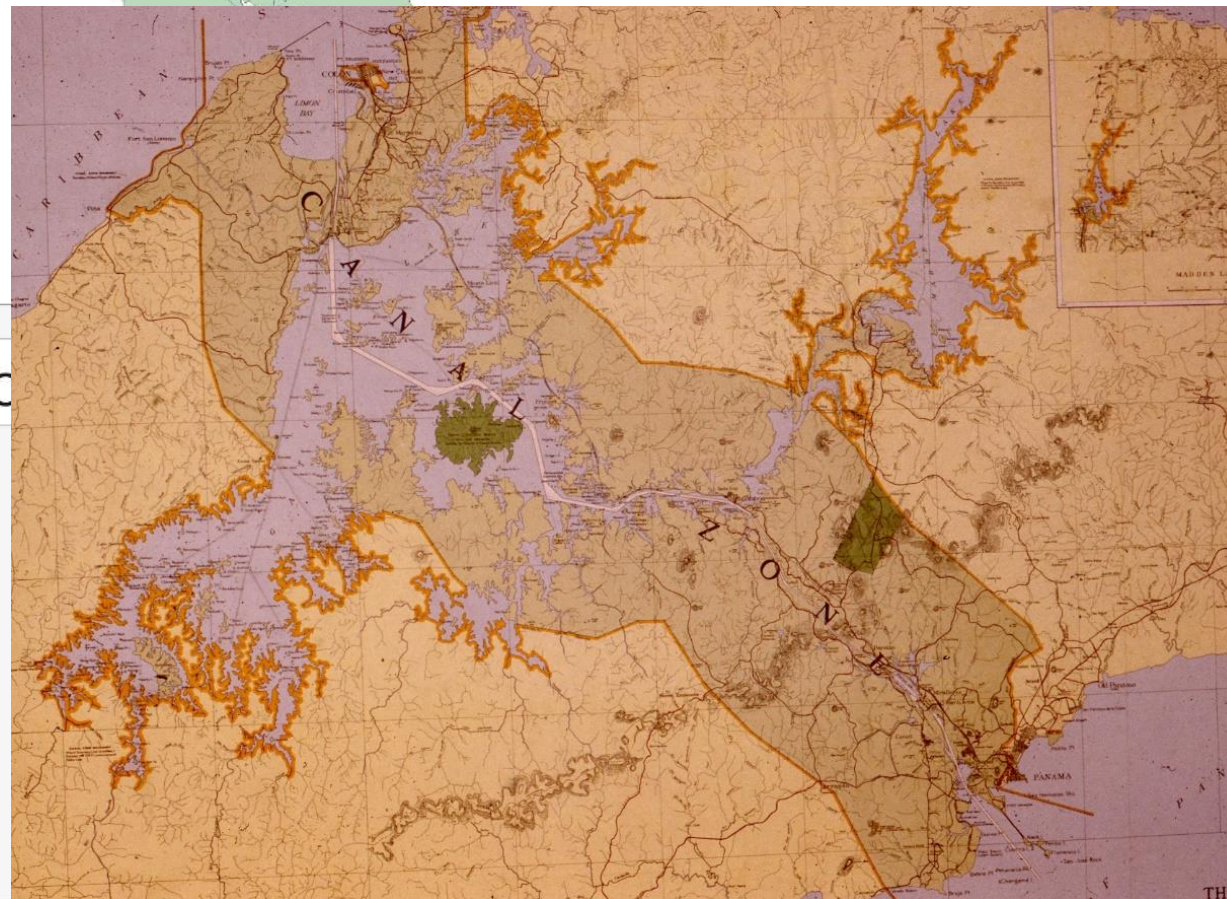


Panama Canal Zone
Barro Colorado Island in green
near middle of lake.

Barro Colorado Island

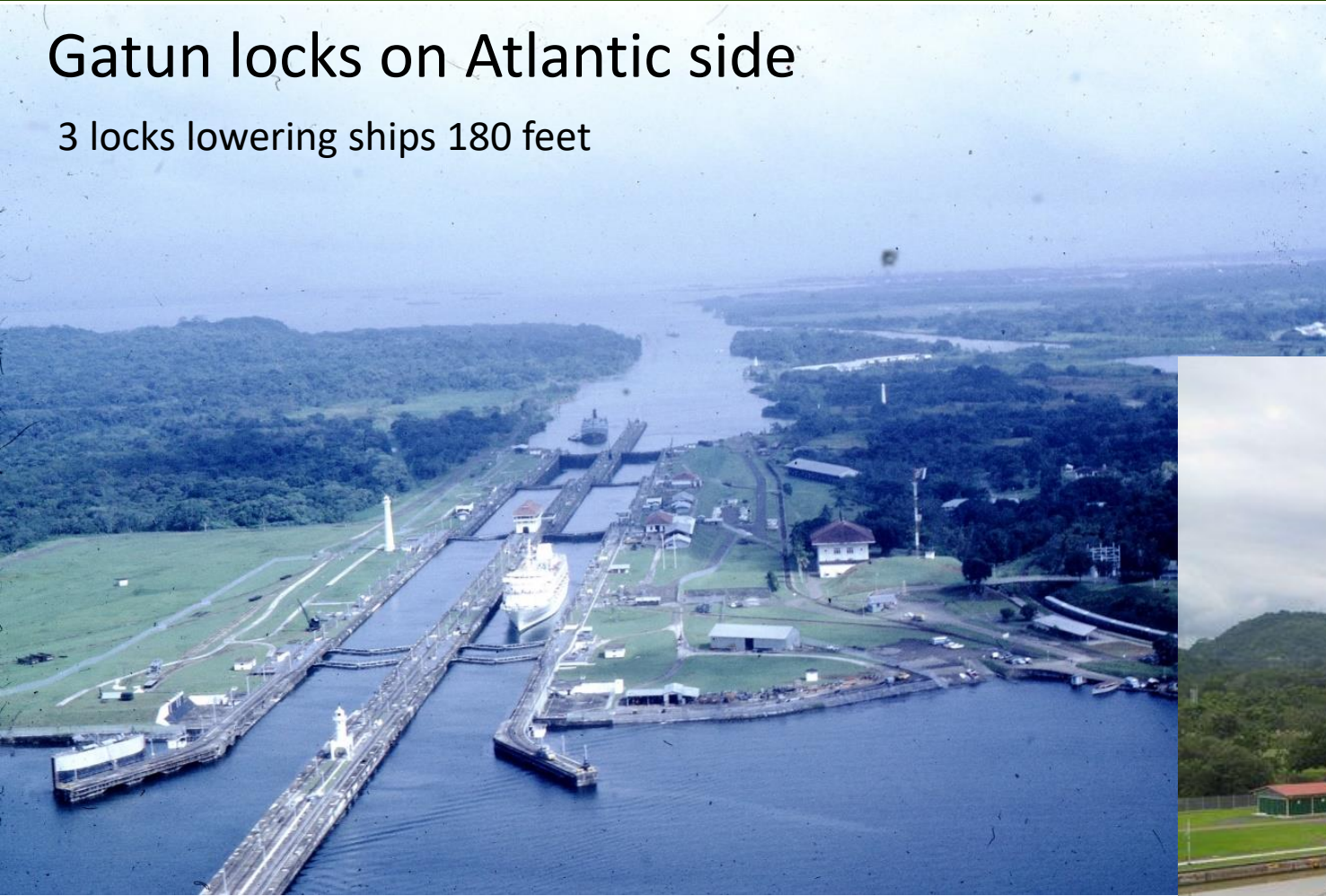


- Stream
- Contour Line
- Trail



Gatun locks on Atlantic side

3 locks lowering ships 180 feet



MISSOURI BOTANICAL GARDEN

Barro Colorado Island, Panama



Barro Colorado Island, lab-clearing harbor



Small winch-driven cart to haul luggage and supplies from boat dock



Smithsonian Tropical Research Institute, Barro Colorado Island, Canal Zone

Some of the earlier
buildings in lab
clearing

View toward Gatun
Lake



Barro Colorado Island laboratory clearing, looking into forest toward Fairchild Point



Administrative Zone of Barro Colorado Island Research Station, current





Tree Climbers

Using a machete to
see the bark type
and sap color

Collecting on Barro Colorado Island

Since no trees could be felled tree climbers were
used to get into the canopy



Climbing trees

- Spikes enables one to go nearly anywhere
- Opportunity to take photos of epiphytes in natural conditions



Near canopy Level

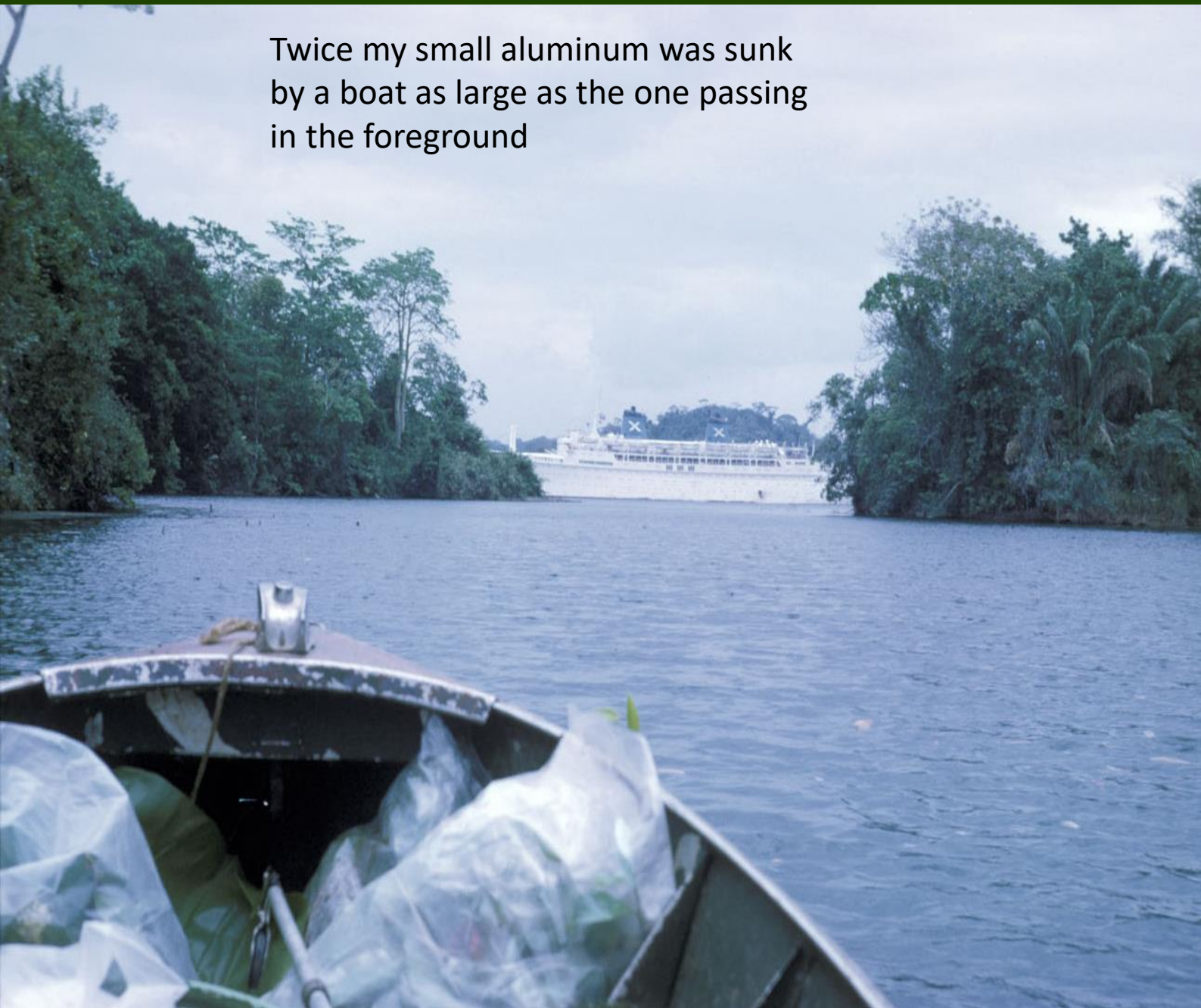


Canopy near laboratory clearing

High up in a
Symphonia
globulifera,
Jacnada copaifera
in rear

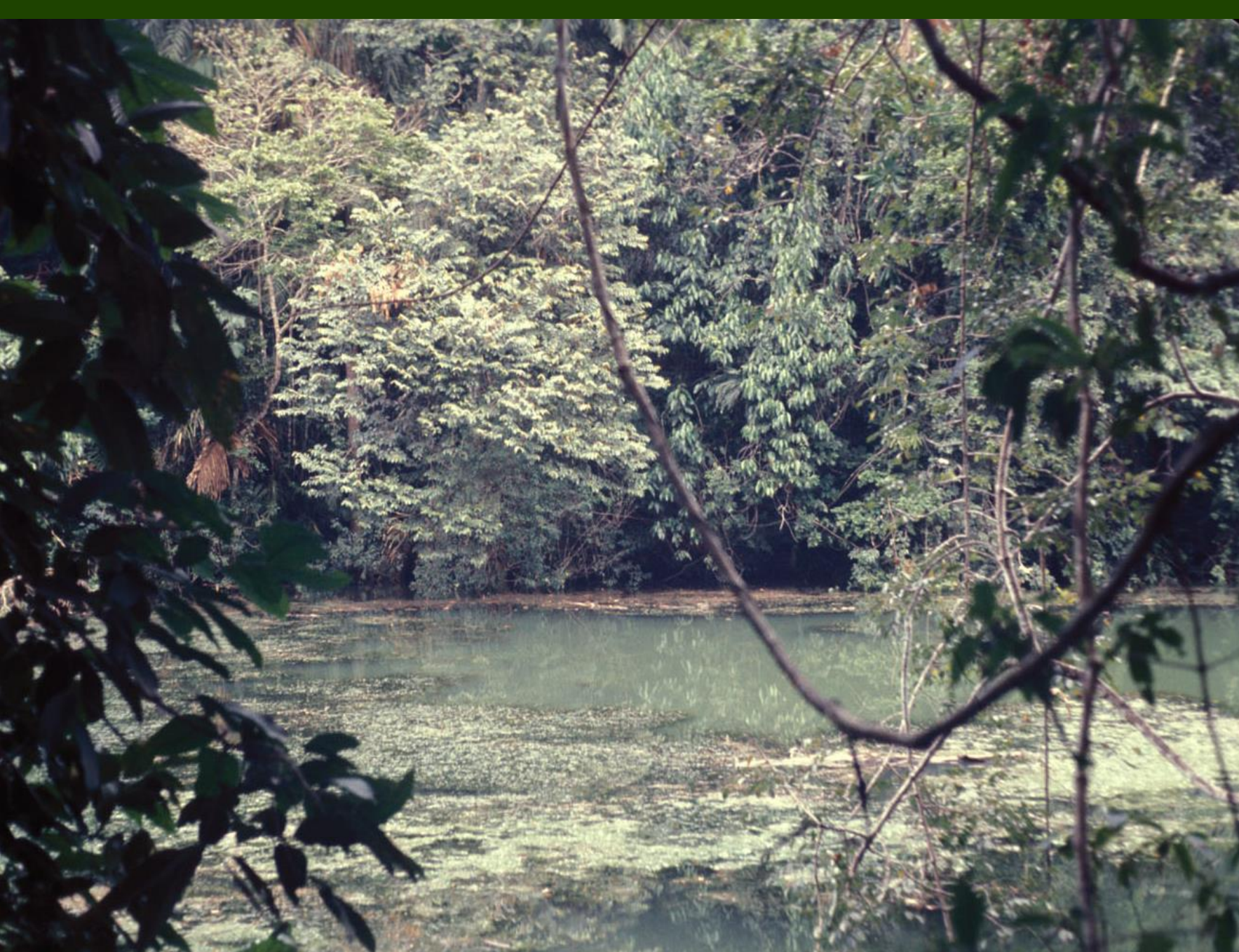


Twice my small aluminum was sunk
by a boat as large as the one passing
in the foreground



Using small aluminum boat to
collect on the shoreline





Narrow tree-lined coves filled with aquatics

Entering the deep coves
required the use of oars
because the propeller would
get wrapped up with Hydrilla

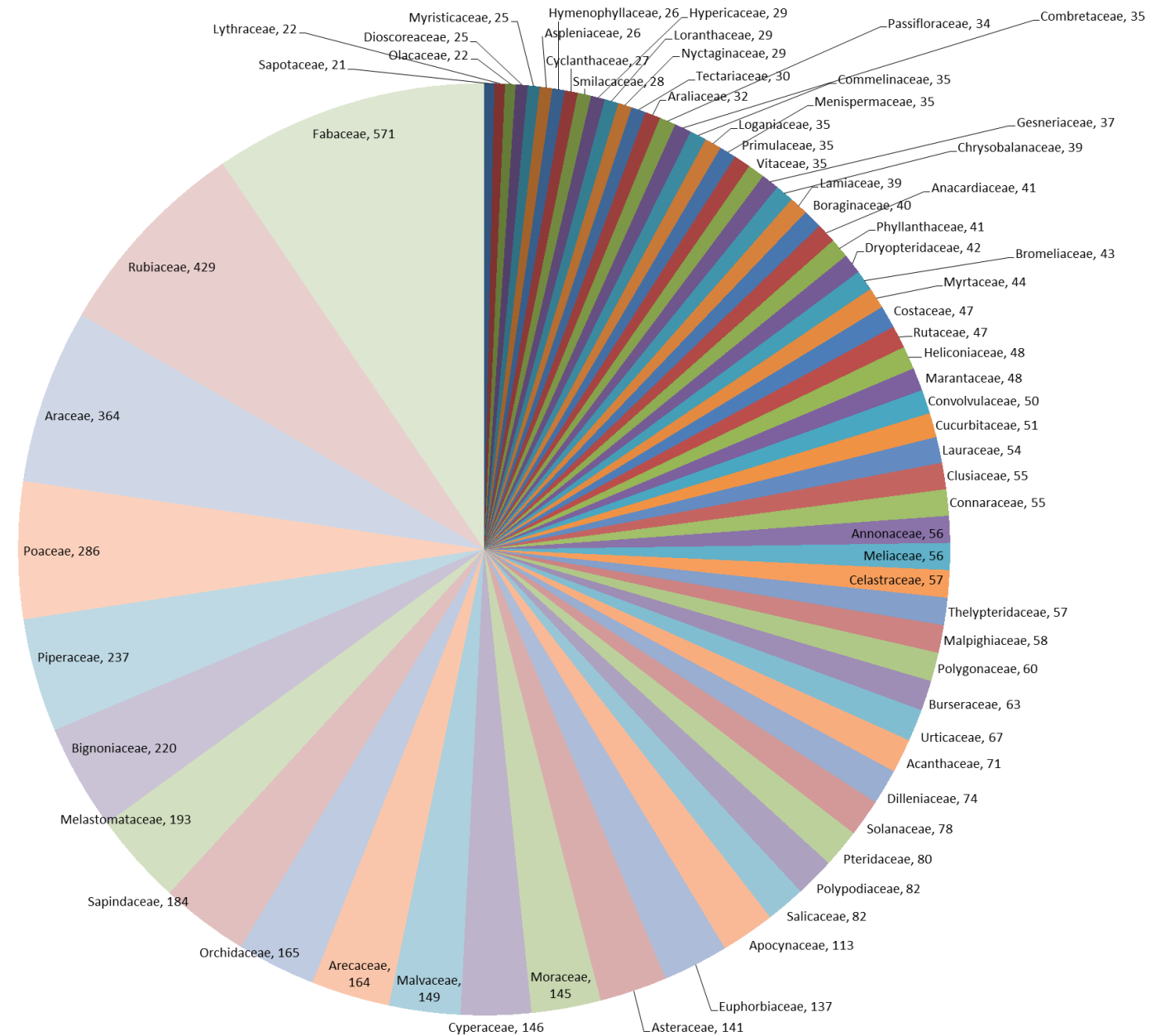


The last stages of hydrarch succession in a cove



Natural deposits of soil eventually close the inlets with a succession of different aquatic stages of vegetation followed by trees. This will soon be a land bridge.

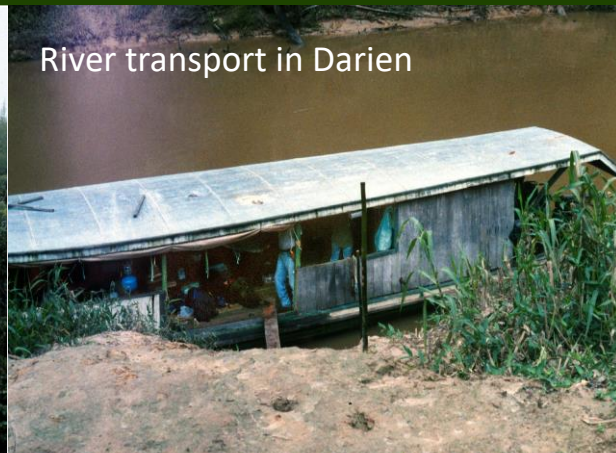
Croat collections by Family on BCI



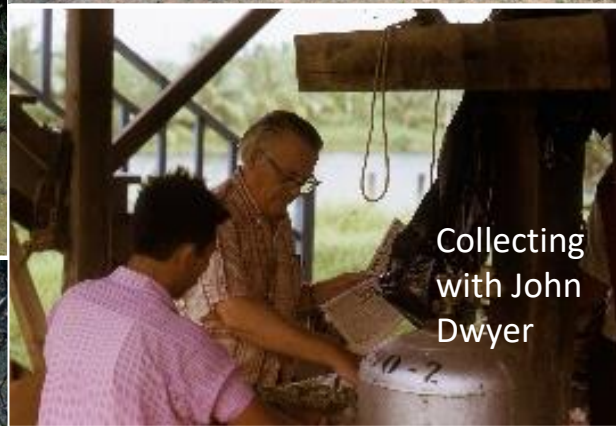
Makeshift campsites



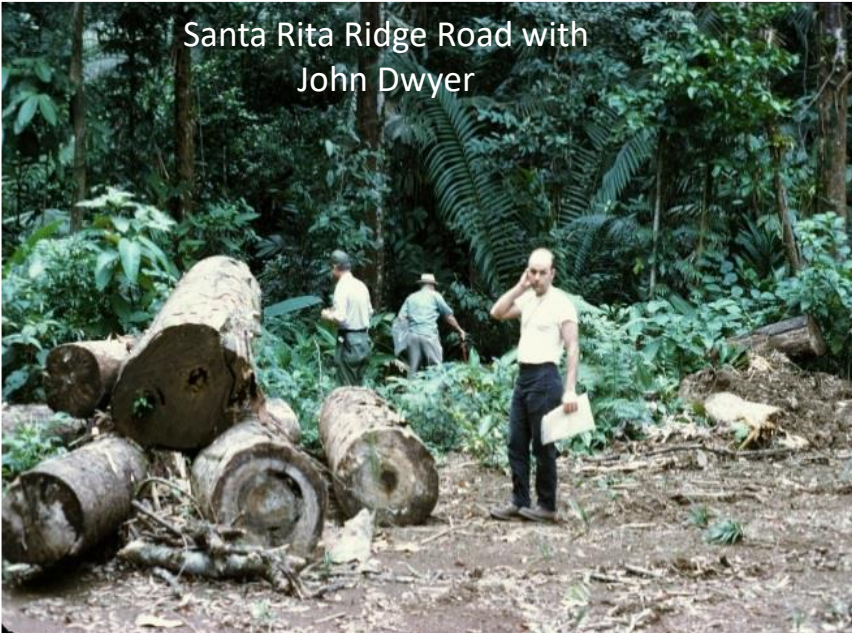
River transport in Darien



Collecting
with John
Dwyer



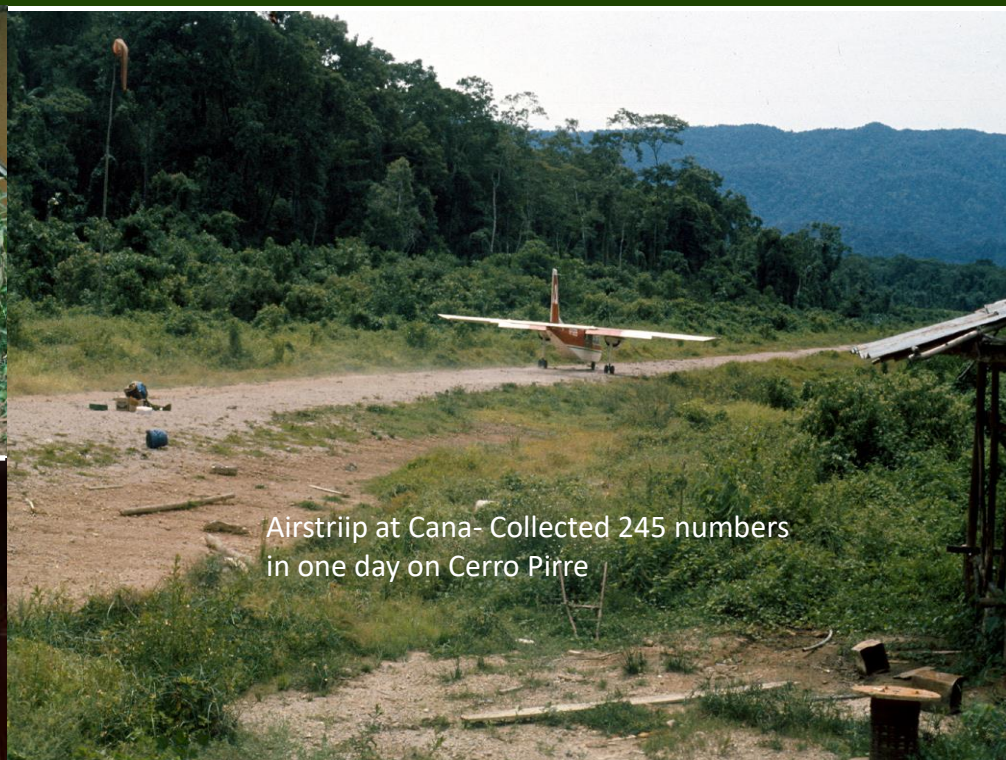
Santa Rita Ridge Road with
John Dwyer



Saving animals with World wildlife
on rapidly filling Bayano Lake



Airstrip at Cana- Collected 245 numbers
in one day on Cerro Pirre

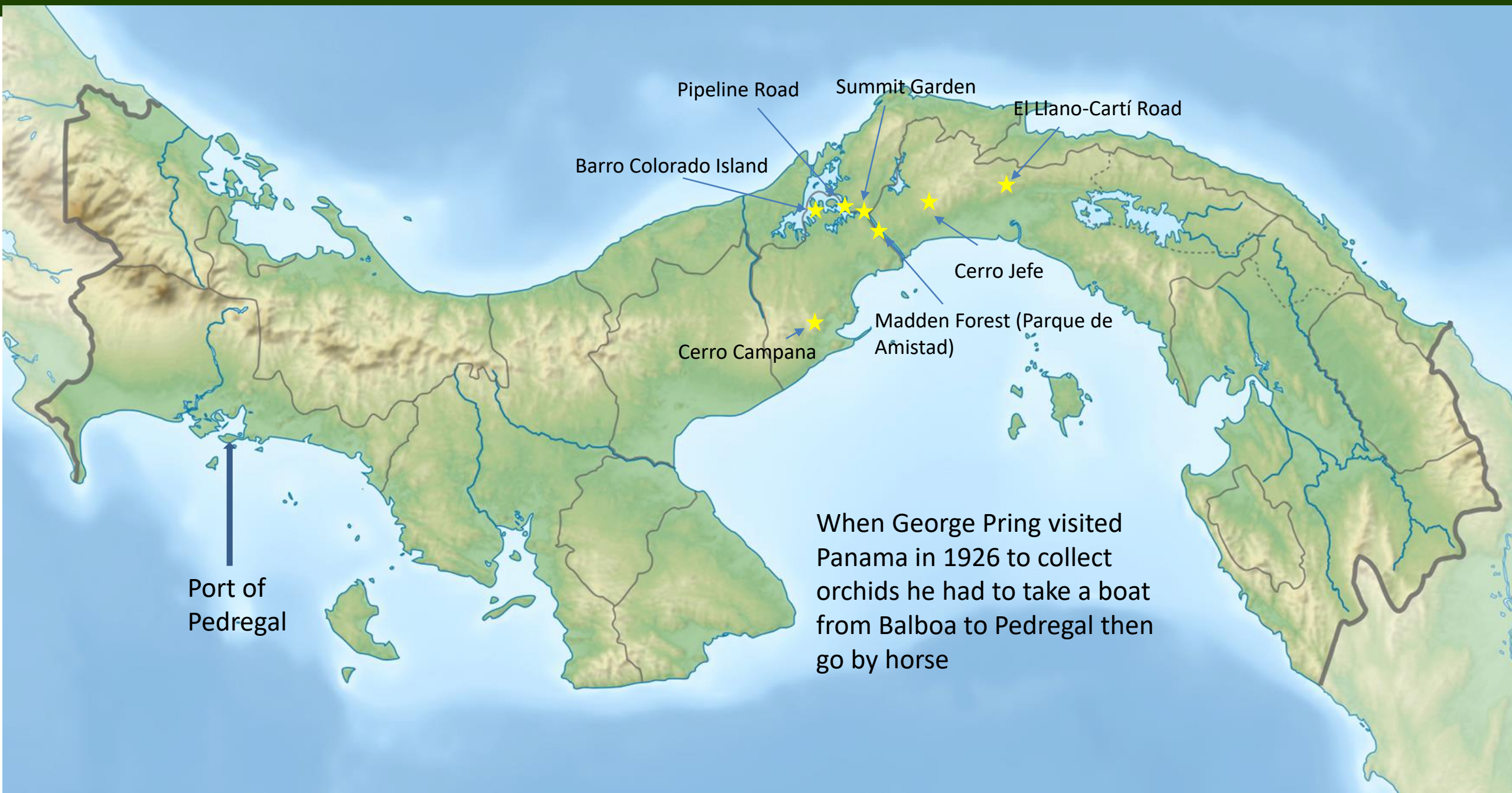


Rio Tuquesa,
Kittridge gold
mine



Panama with changes in Provincial borders





When George Pring visited Panama in 1926 to collect orchids he had to take a boat from Balboa to Pedregal then go by horse



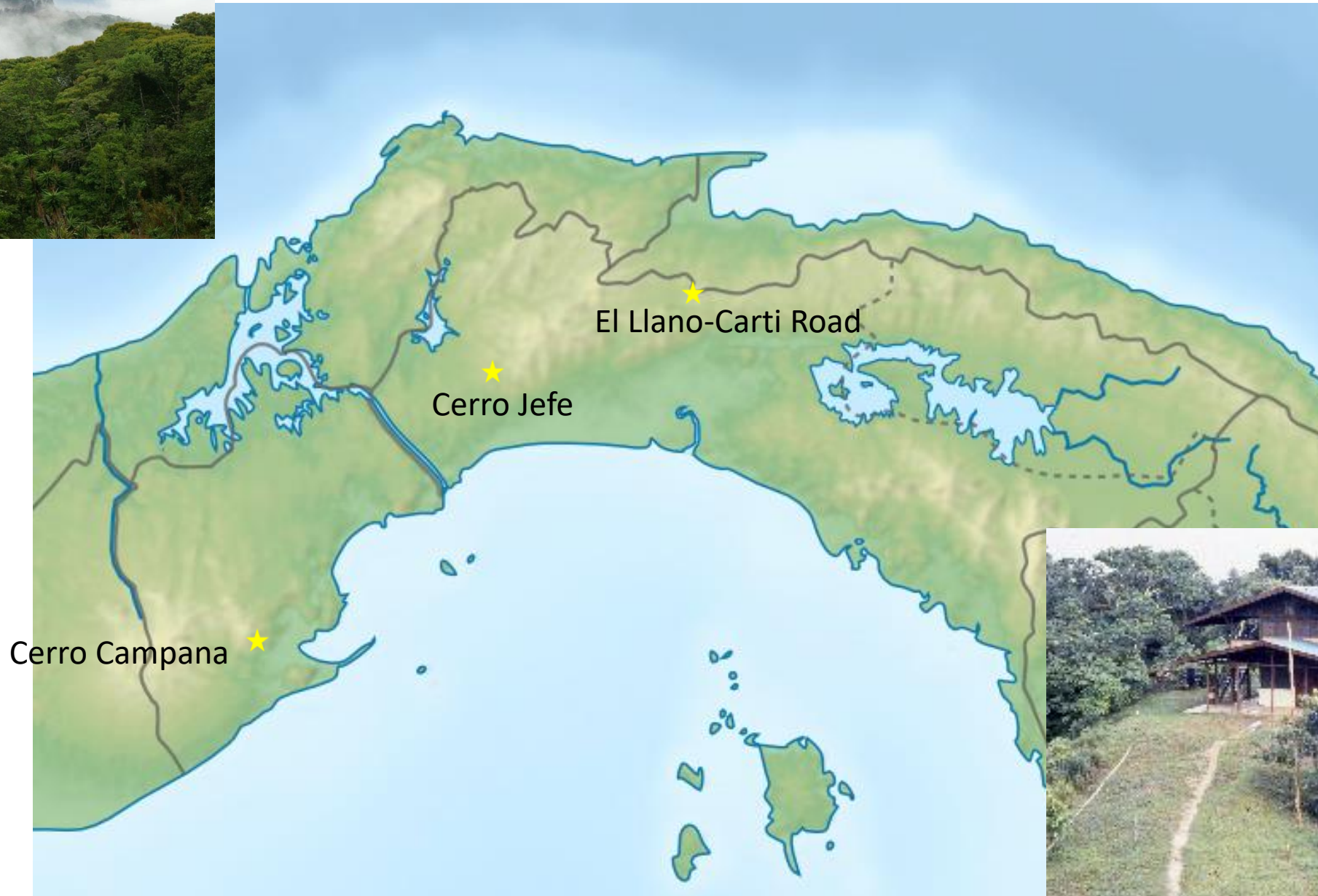
First visits to areas in Panama by Croat

Locality	1st Croat Visit	First Collector	Date of Visit
Bayano Lake	May 1976	James Duke	Sept 1961
BCI	Dec 1967	Sutton Hayes	1859-1860
Burica Peninsula - San Bar	Feb 1973	Croat	Feb 1973
Cerro Azul	Jul 1970	A.G.B.	May 1941
Cerro Campana	Sept. 1970	Paul Allen	Dec 1938
Cerro Colorado	Jul 1976	Leslie Rensselaer	Jul 1938
Cerro Jefe	Jul 1971	Paul Allen	Apr 1946
Cerro Pilon	Jul 1976	James Duke	Aug 1957
Cerro Pirre	Jul 1971	William Stern	Jun 1959
Cerro Punta	May 1970	Russel Seibert	Jul 1925
Cerro Santiago	Nov 1967 *visit to summit	Berthod Seemann	1846-1849
El Copé	Jan 1978	Mirreya Correa	Oct 1967
El Llano-Carti Rd	Mar 1976	Helen Kennedy	Feb 1973
Ft. Sherman-Piñas	Jan 1970	James Duke	Oct 1961
Isla Taboga		George Barclay	Jan 1837
La Mesa	Feb 1971	Paul Allen	Jan 1941
Palo Verde		Gaspar Silvera	Dec 1905
Pate de Macho	Nov 1979	Tom Croat	Nov 1979
Pipeline Road	Jul 1976	Claude Smith	Dec 1957
Rio Guanche	Aug 1974	Bob Dressler	Mar 1973
Rio Indio	Mar 1976	William Maxon	Feb 1911
Rio Tuqueza		Narciso Bristan	Jun 1967
Santa Fe de Veraguas	Jul 1974	Charles Powell	Feb 1924
Santa Rita Ridge Rd	Jan 1971	Robert Dressler	Dec 1964

First to visit important areas based on Tropicos records

Most collections by Croat in Panama were made during 1970-1974

Panama Province- General



Nusigandí Camp along
El Llano-Carti Road



Panama Oeste

Cerro Campana



Cerro Gaital



Coclé Province



Alto Calvario above saw works, above El Copé
Discovered by Jim Folsom, now a National Park



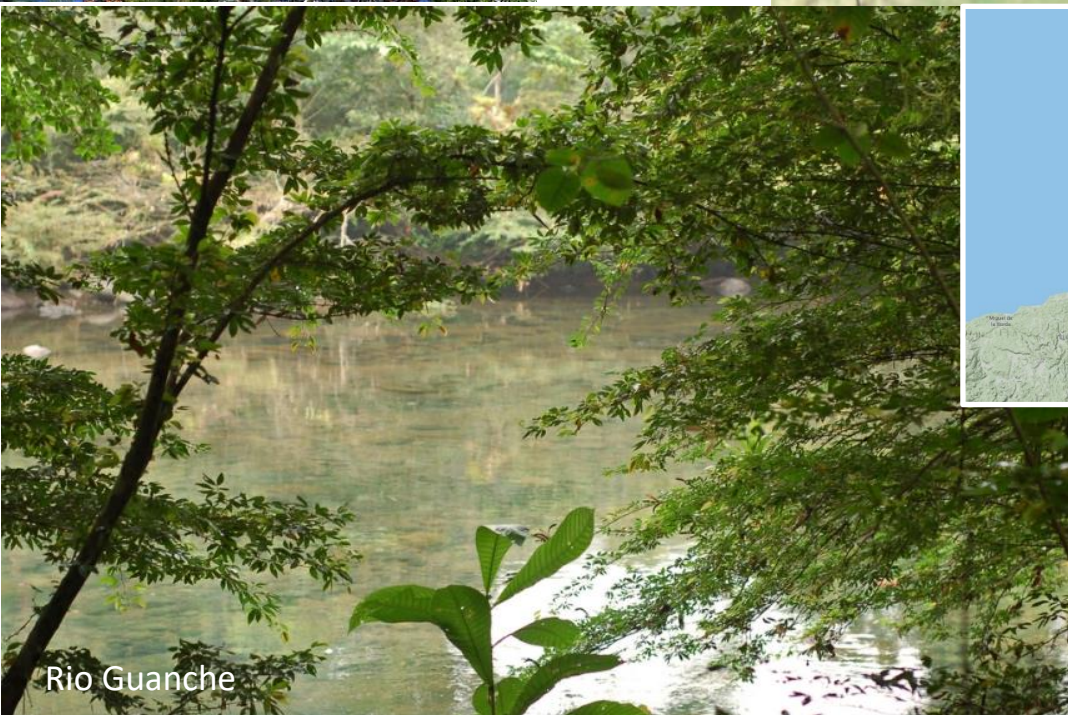
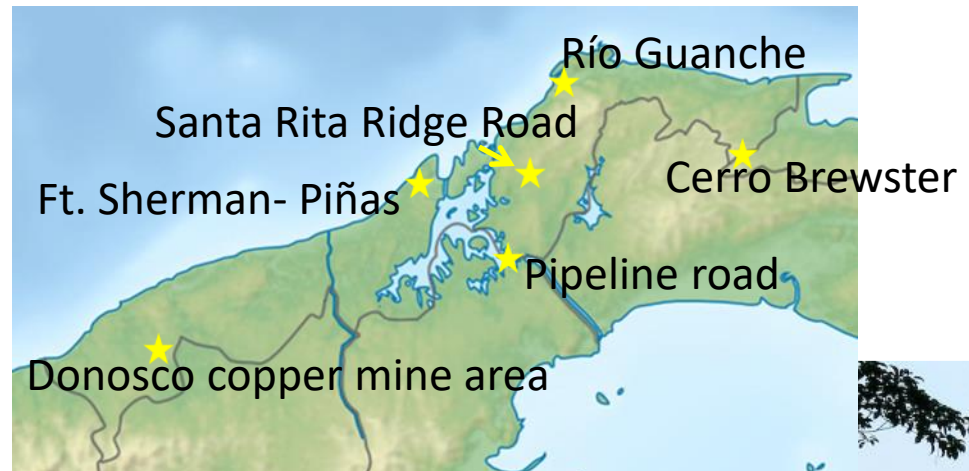
 Areas con Bosques Areas Protegidas

 MISSOURI BOTANICAL GARDEN

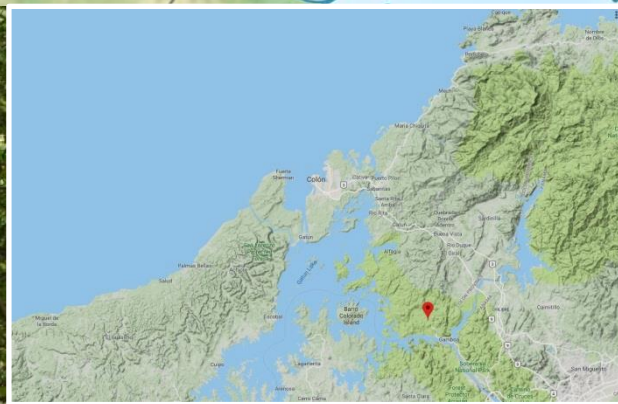
Near end of Pipeline road



Colón Province



Río Guanche



Parque Nacional Chagres



Road to Donoso copper mine area



MBG Fieldwork in Panama on Santa Rita Ridge Lumber Road with Baker, Dwyer & Castillon



Ken Baker

John Dwyer

Jerry Castillon



Volcán-Cerro Punta, Amistad Park
Boquete (Cerro Pate de Macho)

Volcán Barú

Chiriquí Province

Much of lowland Chiriquí is devoted to grazing with annual burning of vegetation

Boquete: Cerro Pate de Macho

Boquete: Monte Rey

Volcán: Amistad Park (PILA)

Volcan Baru



MISSOURI BOTANICAL GARDEN

50,000th collection
Philodendron fortuneense



Fortuna

An area of high species
diversity and endemism





Rodolfo Flores & Ernesto Campos (r). Campos is assistant to Mireya Correa



Working in the forest in El Chorogo (San Bartolo) near Puerto Armuelles



Expedition to Burica Peninsula

Croat, Liesner & Busey collected in San Bartolo limite 45 years ago!

Breakdown near Divisa on way to Panama City



Stuffing the Nissan Patrol with specimens at San Bartolo Limite



Darién Province



Cana Field Station

James Duke- greatest explorer of the Darién



Cerro Pirre

Using mules to get to Cerro Pirre



Cerro Sapo



Cerro Sapo



Trip to Cerro Tacarcuna

First Botanical
Expedition was by
Gentry and Mori-
1975



Greg de Nevers, Barry
Hammel & Herracio
Herrera crossing Río
Tacarcuna

Airing out feet with foot rot
on trip to Cerro Tacarcuna,



Barry Hammel in camp along Río Tacarcuna





Comarca Guna Yala (formerly San Blas)

Still poorly known for the most part

Auraliano, a guide,
Micky Marcos, Heraclio
Herrera, Greg de Nevers

Nusigandí Region



Ca. km 24 Atlantic
slope.

Nusigandi Collecting
Team



Ngäbe - Buglé



Croat's first
visit in July,
1976

Road to Cerro
Colorado



Herrera- Azuero Peninsula

Tom Croat pressing plants- 1976 trip with Bill D'Arcy to the Azuero Peninsula



Veraguas Province

Cerro Tute



Alto de Piedra



Rio Calveborita



Alto Piedra to
Calovebora



Alto Piedra to Calovebora



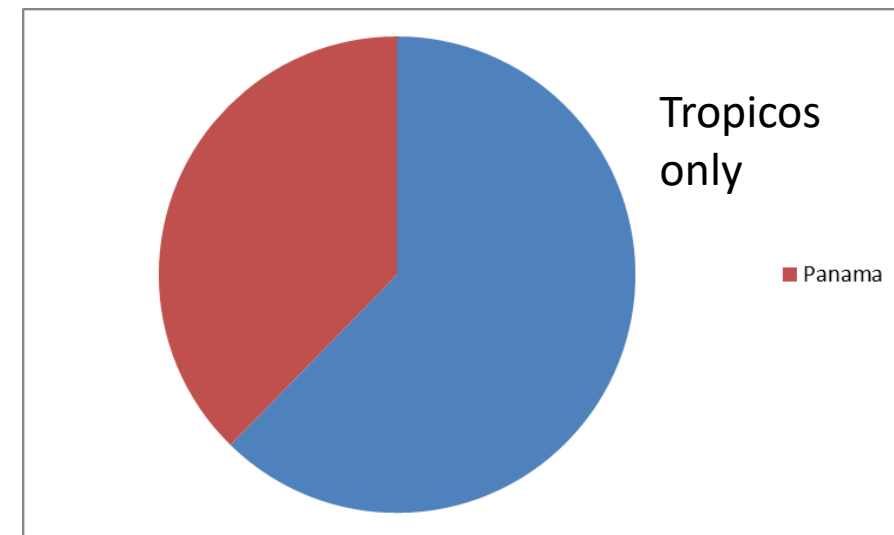
Sante Fe to Calovebora Road, was
nearly impassible in 1994



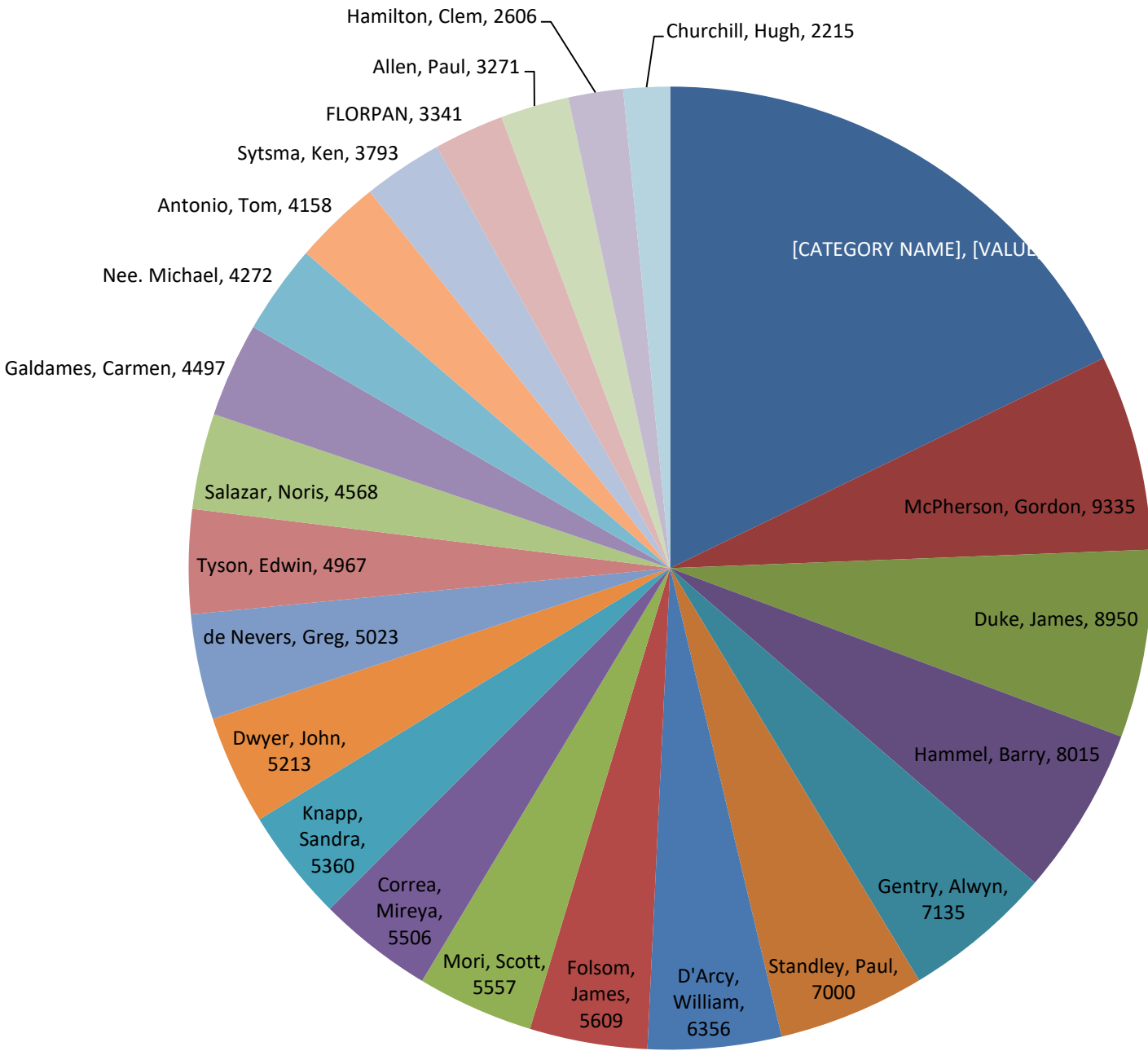
Results of Collecting Program

- 198,355 Collections since Woodson initiated the Program in Panama in 1936
- 1700 Collectors have made specimens in Panama since the year 1700
- 3446 Panamanian type specimens recorded in Tropicos

Type specimens in Central America

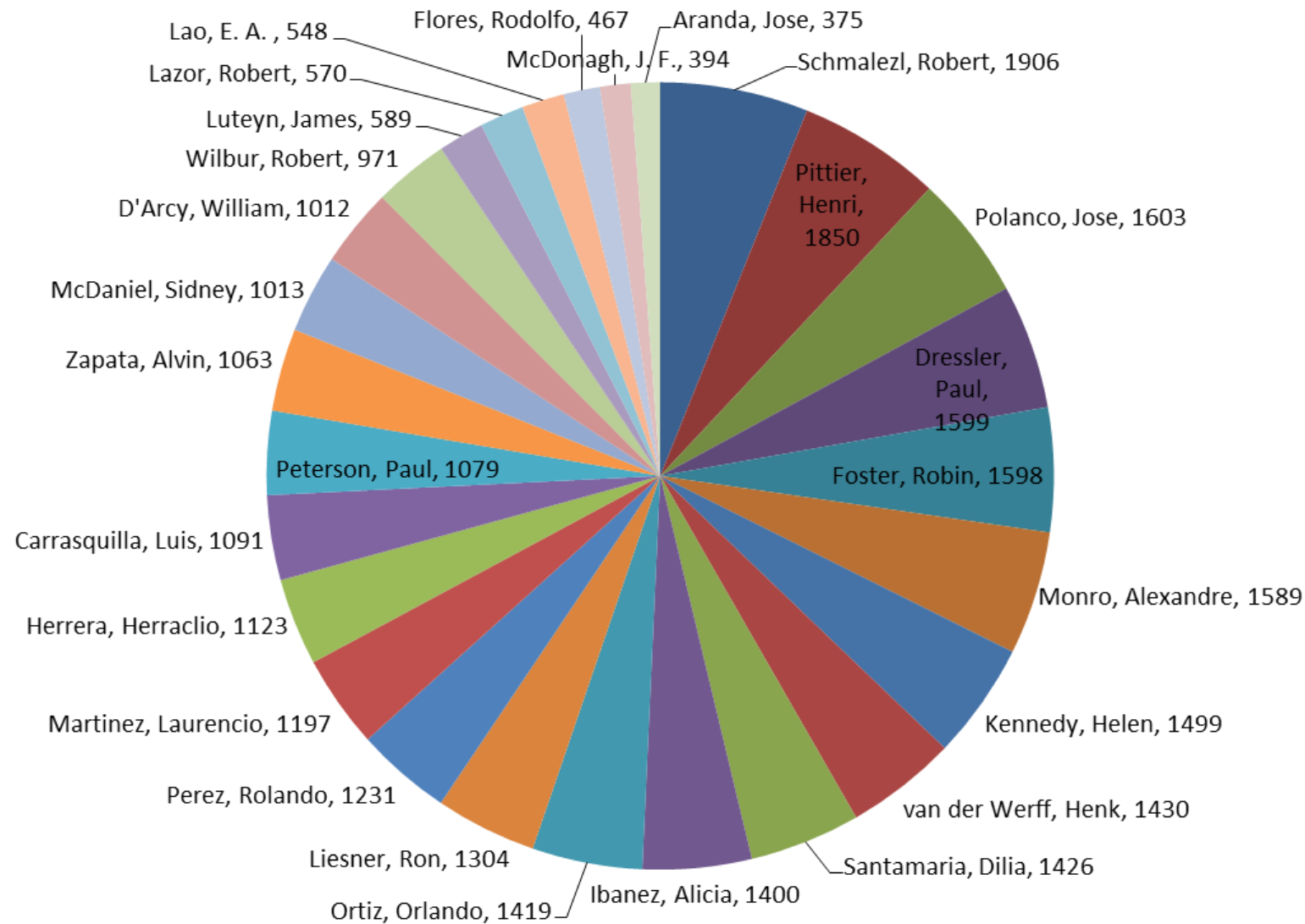


Most Prolific Collectors ranked 1 - 25



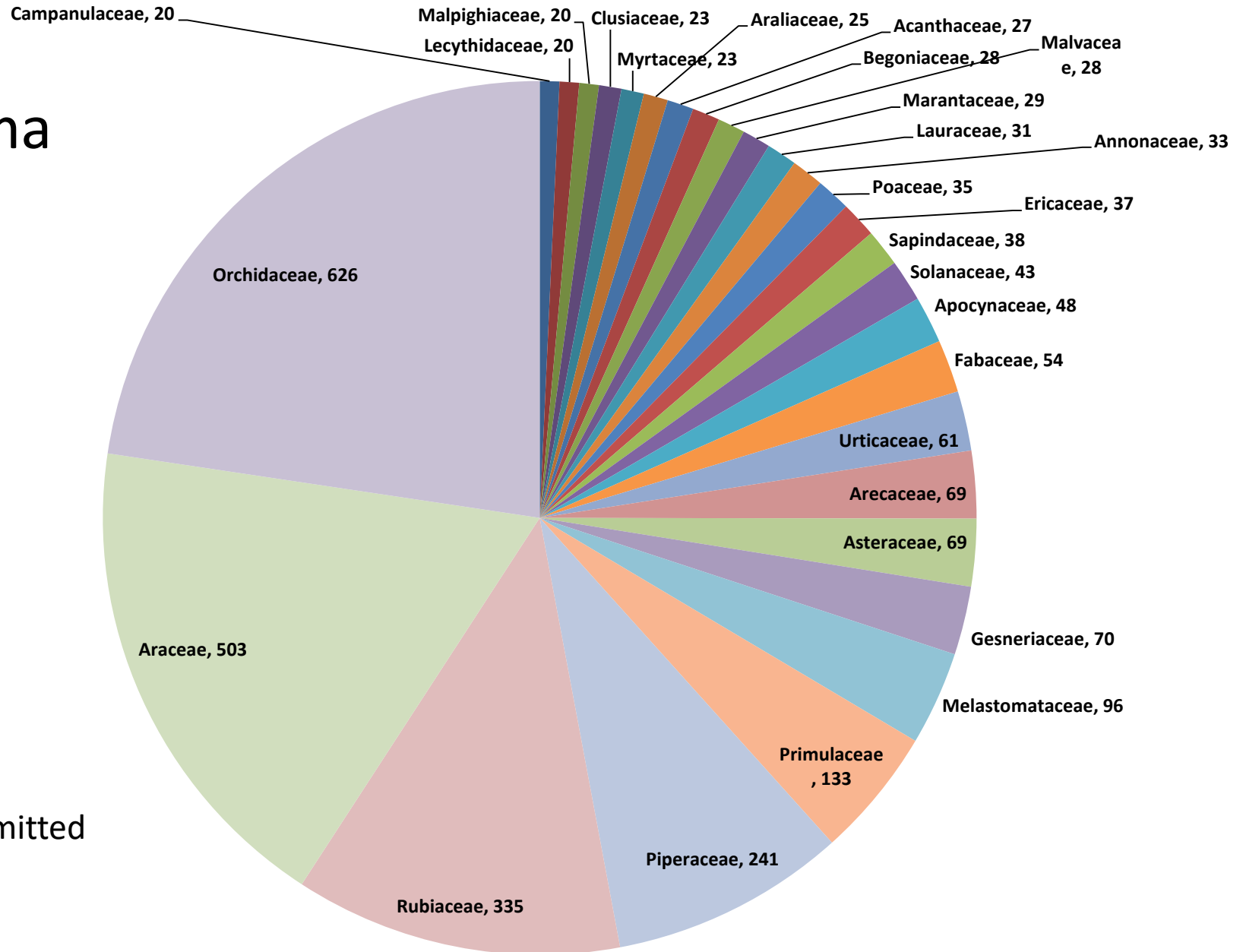
per Tropicos

Most Prolific Collectors ranked 26 – 50



Per Tropicos

Collections by Families in Panama



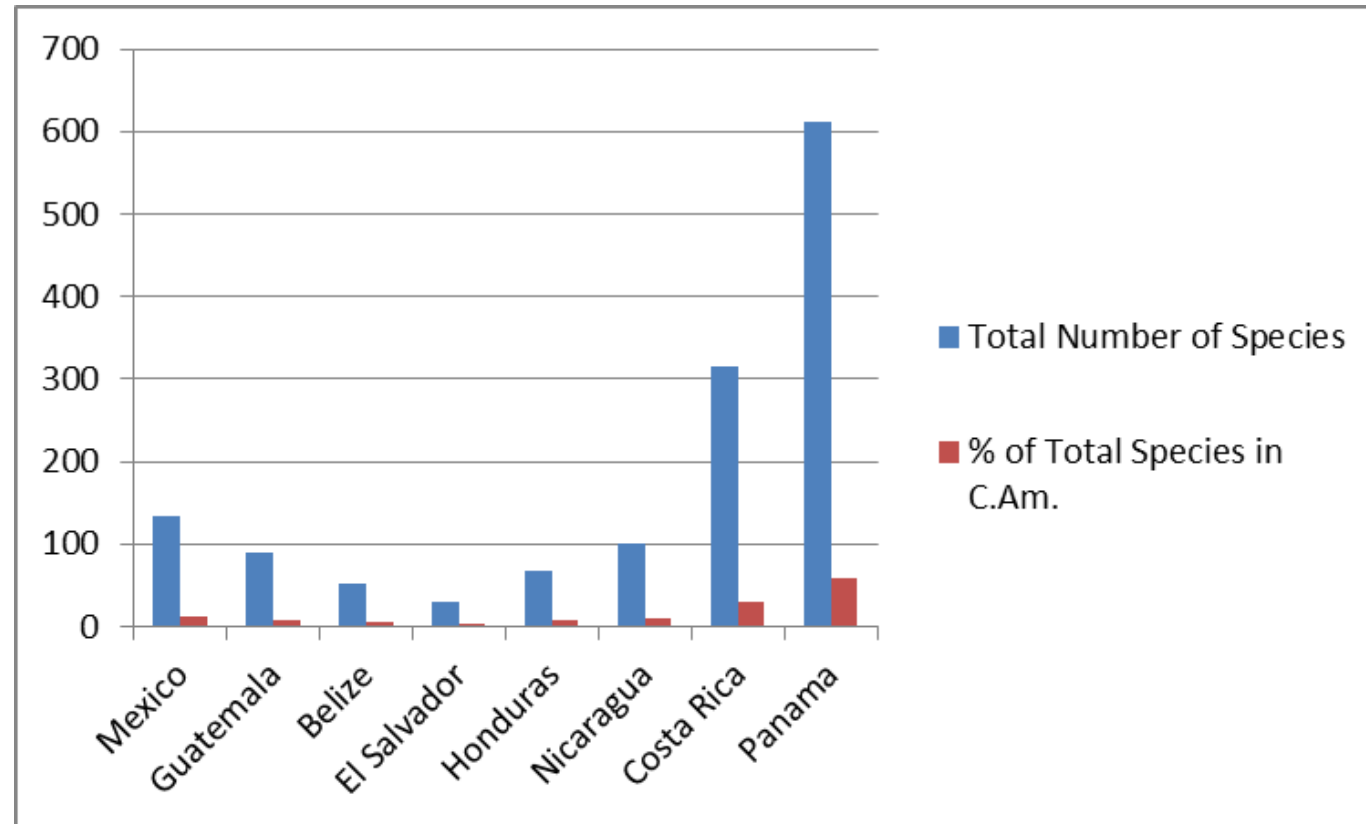
For presentation purposes, all
Families with fewer than 20 omitted
Based on Tropicos

Checklist for Flora of Central America

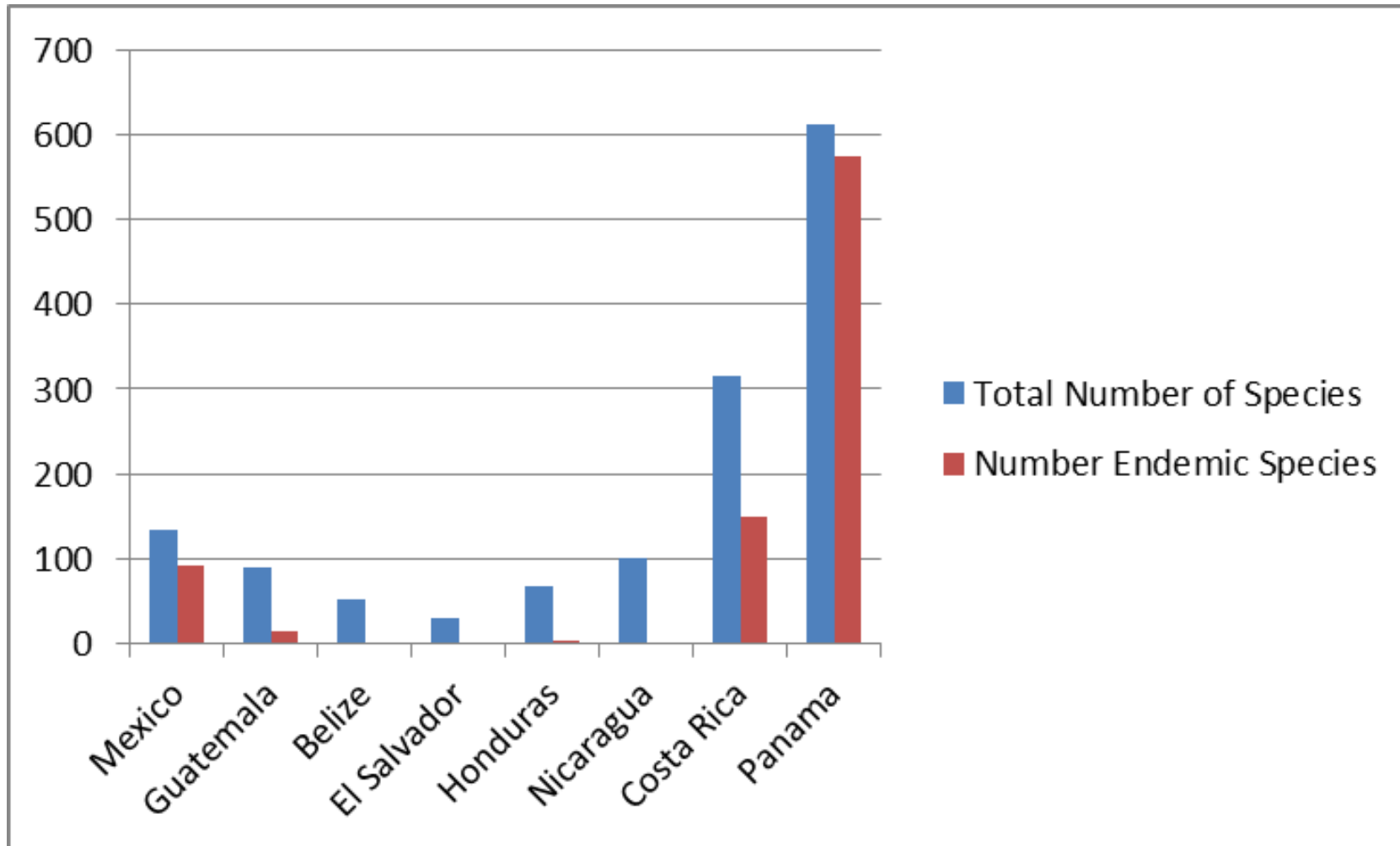
8	X. knappii Croat & Delannay	1									1										1
9	X. laselvense Croat & Delannay	1									1									1	
0	X. mafaffa Schott	1									1										
1	X. mexicanum liebmann	1			1	1	1	1		1	1	1	1								
2	X. ortizii Croat	1										1									1
3	X. petaquillense Croat, Delannay & Ligan	1										1									1
4	X. pringlei Croat	1			1									1							
5	X. robustum Schott	1			1	1	1	1	1	1	1		1								
6	X. sagittifolium (L) Schott Introduced	1			1	1	1	1	1	1	1	1	1								
7	X. cerrosapense Croat & O. Ortiz	1										1									1
8	X. undipes C. Koch	1									1	1	1								
9	X. violaceum Schott	1																			
0	X. wendlandii (Schott) Standley	1			1	1		1	1	1	1		1								
1	X. yucatanense Engler	1			1									1							
2	Total Xanthosoma	18	0	0	6	4	3	4	3	4	8	10	8	2	0	0	0	0	0	2	6
3																					
4	ZANTEDESHIA																				
5	Z. aethiopica										1	1	1								
6	TOTAL ZANTEDESHIA	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
7	Grand Total Species	1014	371		135	89.5	53.5	30	67	102	315	612	323	92	14	2	0	4	2	150	575
8			1385		13%	9%	5%	3%	7%	10%	31%	60%		68%	16%	4%	0%	6%	2%	48%	94%
9	Total Genera	25																			



Number of species and % Total species in Central America



Total number of species and % of endemic species

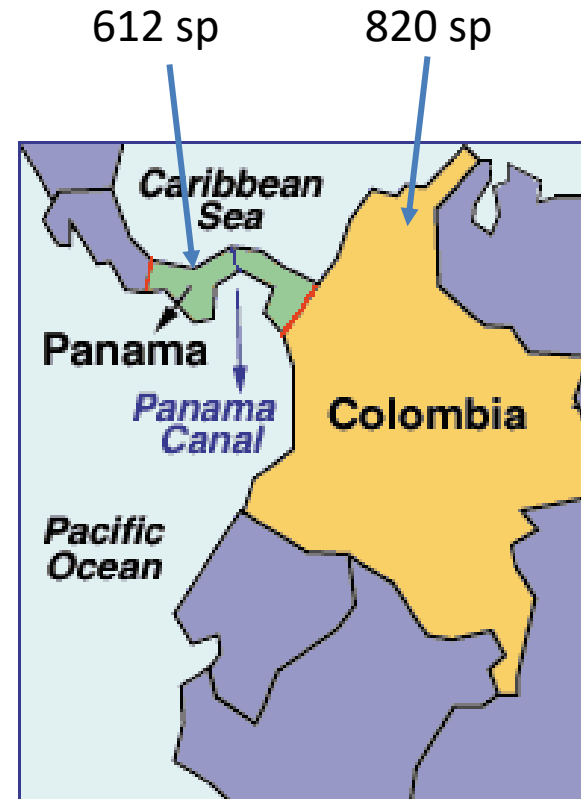


Looking at the now completed Checklist of the Araceae of Central America

- Central America – Araceae has 1014 species versus 820 for Colombia.
- Panama has 612 species, comprising 60% of the total Central American flora.
- Endemism is greatest in Panama with has 94% of its species endemic!

Floristic Comparisons of Central and South America

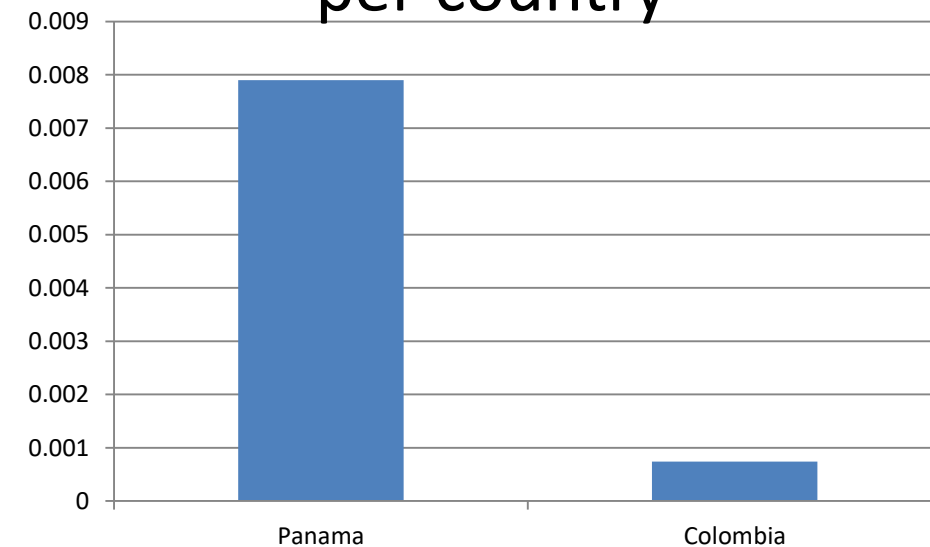
- A complete list of aroid species exists for Central America (**1014** species). Most explored parts of Central America are reasonably well-known [Probably 10% of the flora is still not yet collected].
- Endemism and Species Diversity increases dramatically as one approaches South America.
- Panama (with 60% of all the species in Central America) has 612 species, 94% of them presently believed to be endemic.
- Colombia, **15 times larger** in area and many times more diverse, has only 820 named species.



PANAMA - COLOMBIA

- Species richness in Panama 0.0079 species/km sq.
- Species richness in Colombia 0.00074 species/km sq.
 - Think of this as the equivalent of Panama= 79 and Colombia= 7. That is an 11-fold difference in unit species diversity!

Known species richness
per country



Species richness with Araceae is especially high with newly discovered species.

- Anthurium 110 to 357
- Dieffenbachia 6 to 27
- Monstera 21 to 91
- Philodendron 35 to 123
- Rhodospatha 2 to 12
- Spathiphyllum 8 to 26
- Stenospermation 5 to 53
- Syngonium 12 to 28
- Xanthosoma 9 to 18

Increases in number of species in Aroid Genera in last 30 years, just during the latter half of my career

Conservative extrapolation assures great increases

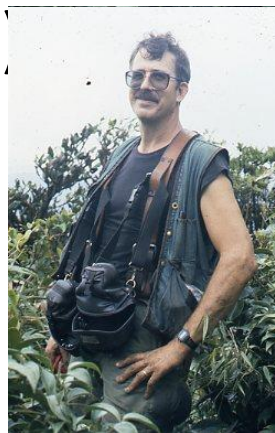
- Colombia alone must have between 8,000 and 12,000 undiscovered species.
- Collecting has essentially stopped or is progressing too slowly to prevent mass extinction before these species are collected, studied and described.
- Experts must be encouraged to collect for greatest efficiency.
 - Jatun Sacha Biological Station: great increases in number of species with less than 6 hours of collecting

Study in England found that most new species were discovered by less than 3% of all collectors.
Megacollectors had 3 characteristics.

- Collected throughout most of their professional lifetime (58 yrs)
- Collected in many different areas (> 5000 localities; 142 countries - collected in 42 of these)
- Have a special taxonomic group that keeps them searching. Keeps them going to the field (Araceae)



Carl Luer
Missouri Botanical
Gardens > 3000 Orchids



Tom Croat,
Missouri
Botanical
Garden >3000
Araceae



Peter Davis
University of
Edinburgh
Collected in
Turkey

Important Need for Inventory Studies

- Unfortunately Collecting is no longer considered important
- Too few students are doing floristic studies where they learn large and complex groups of plants
- Floristic studies are considered unimportant-can't even be published
- However, floristic studies are often the basis for in-depth collecting and understanding
- Without initial collecting activity experts don't even know where to go

Legal and Logistical Impediments to Collecting

- Most countries have serious impediments to collecting
- Some countries allow only experts permission and disallow general collecting despite the inefficiencies
- Requirements for permits discourage all but most persistent from getting permits
- In-country movement of plants is sometimes prohibited creating even more obstacles

Despite our inability to collect incremental removal of forest always leads to the same end- vast areas of poorly used, annually burned pasture with little nutrients

Forest Destruction in the Tropics



A pesar de nuestra incapacidad para recolectar, la eliminación incremental de los bosques, siempre se llega al mismo extremo: vastas áreas de pastos quemados anualmente y poco usados con pocos nutrientes.



Conclusions

- Latin America has **vast potential for new species**, especially in NW South America, Panama, Andean countries of South America but even in mesic and dry habitats not previously studied.
- Panama though enormously rich in species is still not well known but Colombia but contrast is scarcely known at all.
- Efforts should be made to **increase collecting activities**.
- Local **floristic studies should be encouraged** in the tropics and such studies should be published to encourage such studies.
- Tropical **florulas develop expertise**, interest and eventual specialists. These are ideal studies for Latin American students.

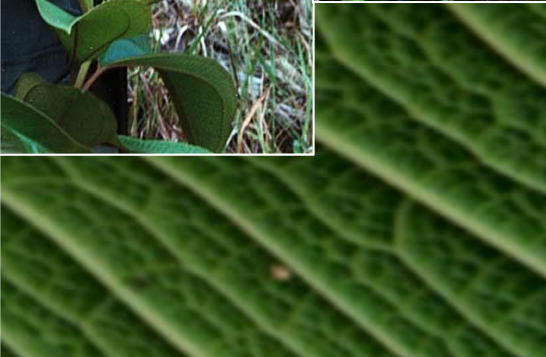
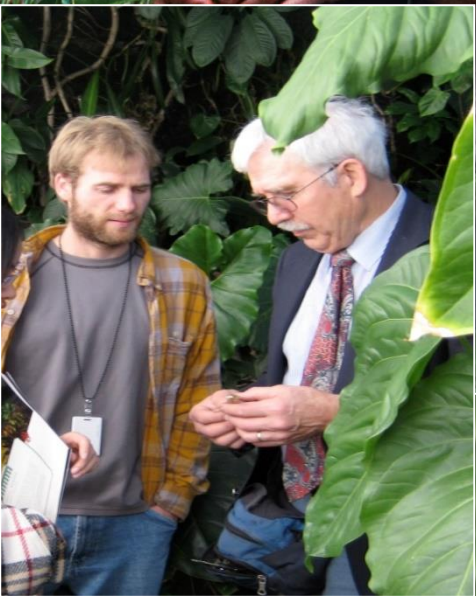
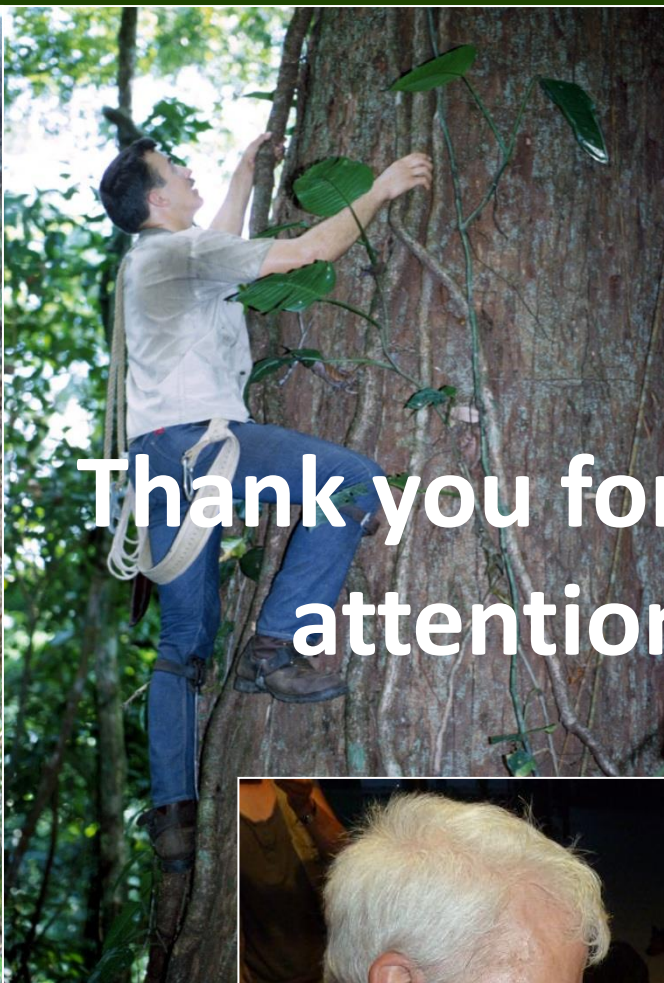


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Gracias, Amigos Panameño.