The International Projection of Institute Research The Role of Research Facilities.

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75th Anniversary
International Institute of Tropical Forestry USDA-Forest Service
May 2014, San Juan, Puerto Rico

INTERNATIONAL ORIENTATION OF THE INSTITUTION

"Primarily established to assist forestry in the American possessions, we are also charged with the duty to serve to the greatest possible extent all of the countries of Tropical America"

Arthur Bevan (1940)
First Director of the Tropical Forest Experiment Station

STATEMENTS FROM THE FIRST DIRECTOR

ARTHUR BEVAN, 1940

"Most of us who are not familiar with tropical conditions visualize tropical vegetation and forests as an almost, impenetrable jungle of lush growth festooned with vines and epiphytic plants of all kinds, the rain forest"

"While such jungles occur in many parts of the tropics such as portions of the Amazon River valley actually this is in no way general"

"Rainfall … varies from desert conditions with little or no rainfall to annual precipitation of between 200 and 300 inches. It is startling to find large areas where irrigation is essential to the growing of crops"

Research facilities are an essential component of the international projection of IITF

- **The well provided library** with internet access to the major sources of scientific literature.

- **The laboratory facilities** for elemental analysis of soil, plant, and water samples.

- **The GIS laboratory** for landscape studies based on remote sensing.

- **The Sabana field station**, a recently up-dated research facility located right at the foot of one of the largest and oldest, fully protected areas of tropical forest at El Yunque (Luquillo Experimental Forest).

Miscellaneous
Report
SA-MR 5

Manual Para El Técnico Forestal Del Caribe

Este manual para el Técnico Forestal del Caribe, contiene tablas, factores de conversión e información técnica básica generalmente usada al trabajar en el campo. Cualquier sugerencia para cambios o adiciones al material aquí presentado puede ser enviada a:

Supervisor Forestal
Bosque Nacional del Caribe
Apartado AQ
Río Piedras, Puerto Rico 00928

Caribbean Service Forester's Handbook

Reimpreso Setiembre 1982

USDA United States Department of Agriculture

Forest Service

International Institute of Tropical Forestry

General Technical Report
IITF-GTR-18
March 2002

Manual de Reforestación para América Tropical

United States Department of Agriculture

Forest Service

Southern Forest Experiment Station

New Orleans, Louisiana

General Technical Report
SO-67

A Technical Guide for Forest Nursery Management in the Caribbean and Latin America

Leon H. Liegel and Charles R. Venator

An Institute of Tropical Forestry publication in cooperation with the University of Puerto Rico

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Training courses at IITF

USDA United States Department of Agriculture

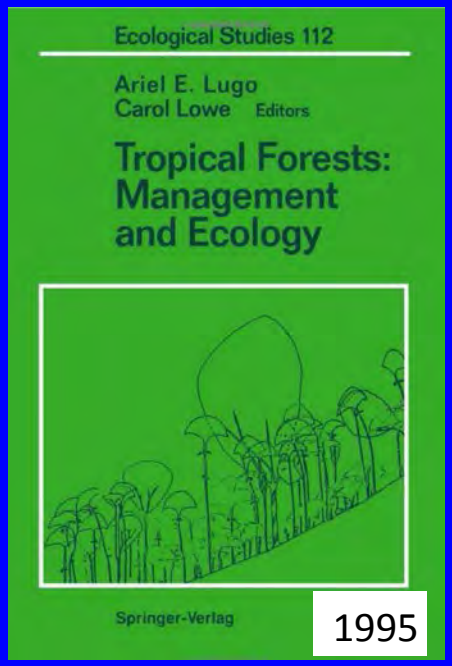
Forest Service

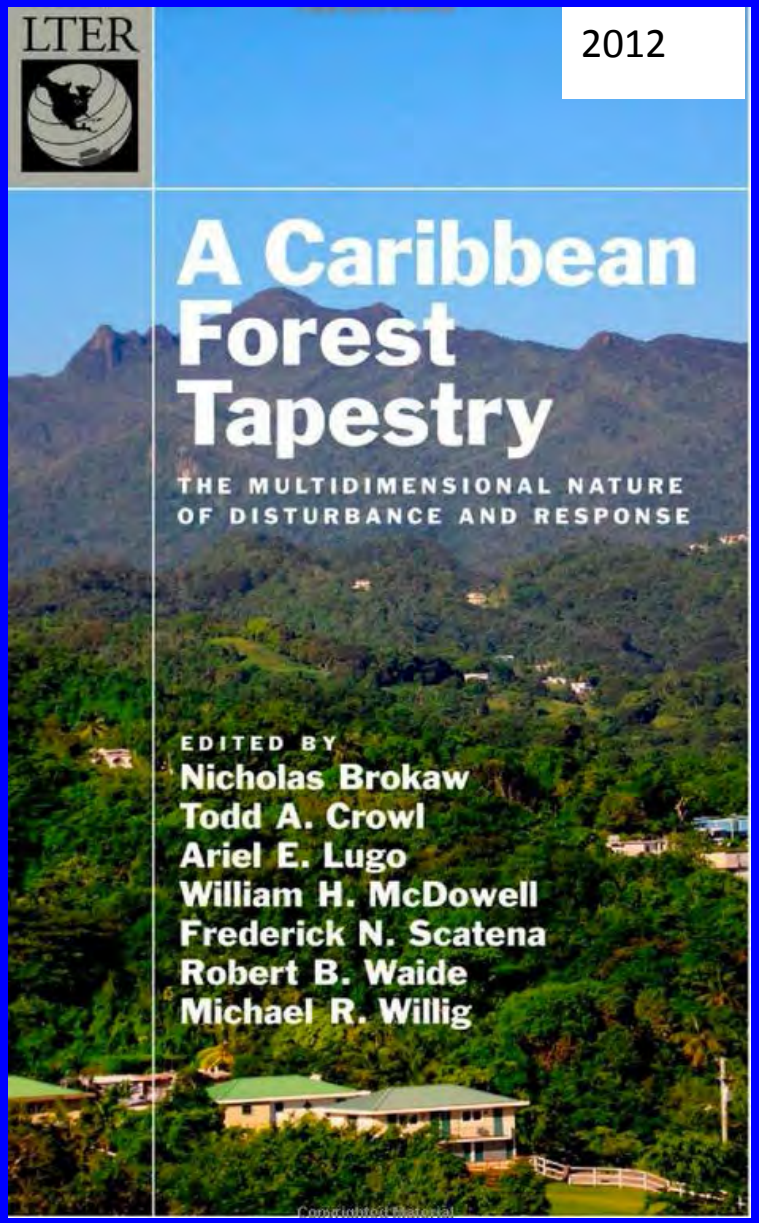
International Institute of Tropical Forestry

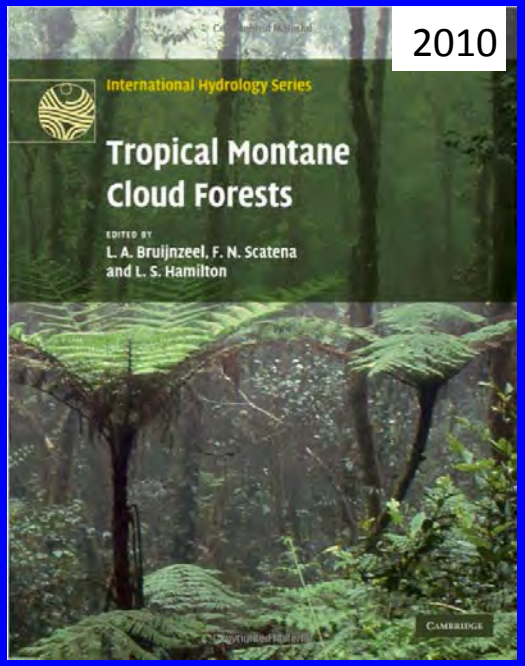
General Technical Report
IITF-GTR-8
April 1999

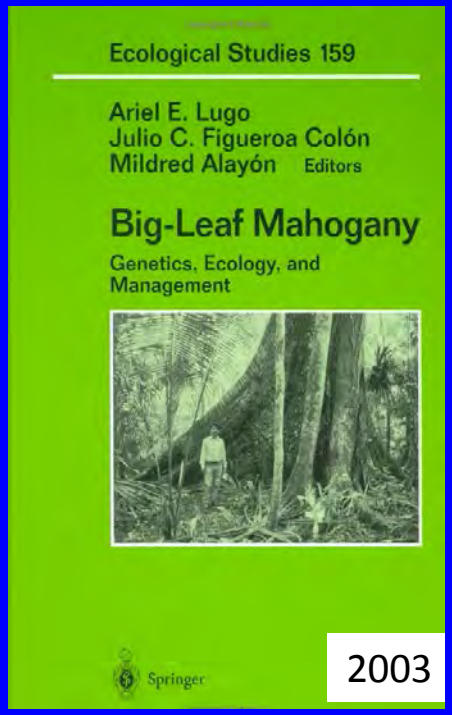
Montane Forest Management in the Insular Caribbean

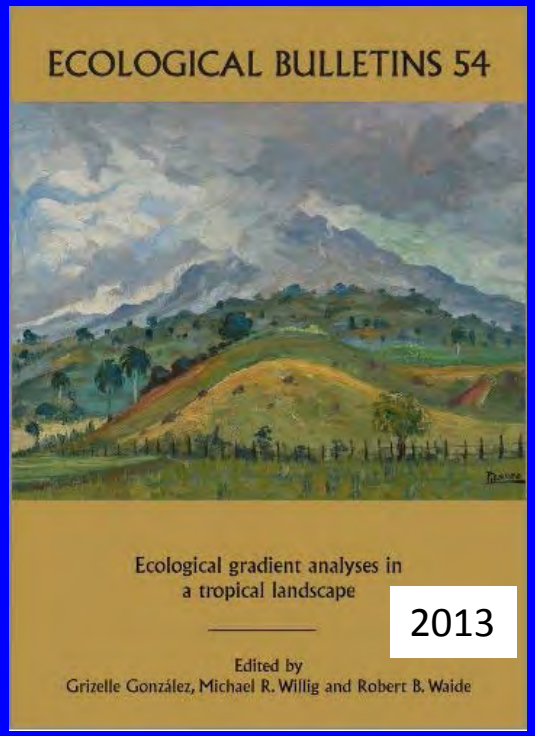
Frank H. Wadsworth


Ecological Studies 112
Ariel E. Lugo
Carol Lowe Editors
Tropical Forests: Management and Ecology
Springer-Verlag
1995


LTER
2012
A Caribbean Forest Tapestry
THE MULTIDIMENSIONAL NATURE OF DISTURBANCE AND RESPONSE
EDITED BY
Nicholas Brokaw
Todd A. Crowl
Ariel E. Lugo
William H. McDowell
Frederick N. Scatena
Robert B. Waide
Michael R. Willig


2010
International Hydrology Series
Tropical Montane Cloud Forests
EDITED BY
L. A. Bruijnzeel, F. N. Scatena and L. S. Hamilton
CAMBRIDGE


Ecological Studies 159
Ariel E. Lugo
Julio C. Figueroa Colón
Mildred Alayón Editors
Big-Leaf Mahogany
Genetics, Ecology, and Management
Springer
2003


ECOLOGICAL BULLETINS 54
Ecological gradient analyses in a tropical landscape
2013
Edited by
Grizelle González, Michael R. Willig and Robert B. Waide

United States Department of Agriculture

Forest Service

Southern Forest Experiment Station

New Orleans, Louisiana

General Technical Report so-44
September, 1983

Research History and Opportunities in the Luquillo Experimental Forest

Sandra Brown, Ariel E. Lugo, Susan Silander, and Leon Liegel

An Institute of Tropical Forestry Publication

1983

Luquillo Experimental Forest: Research History and Opportunities

Editors
Nancy L. Harris[1], Ariel E. Lugo[2], Sandra Brown,[1] and Tamara Heartsill Scalley.[2]

USDA U.S. Department of Agriculture

Forest Service

EFR-1

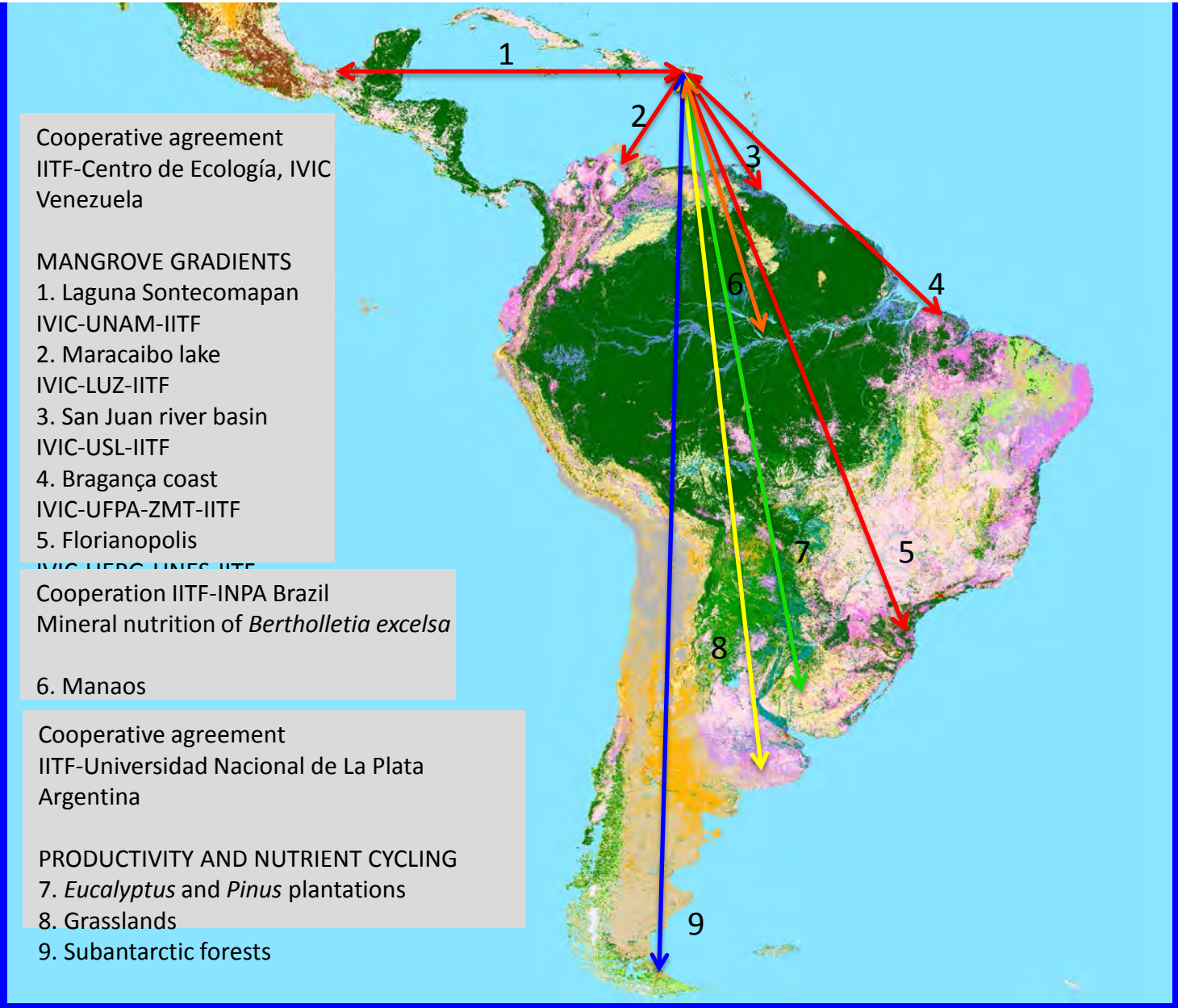
May 2012

2012

[1] *Winrock International, Ecosystem Services, 2121 Crystal Drive, Suite 500, Arlington, VA 22202*

[2] *U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, 1201 Calle Ceiba, Jardín Botánico Sur, Río Piedras, PR 00926–1115*

COOPERATIVE AGREEMENTS WITH SCIENTIFIC INSTITUTIONS IN LATIN AMERICAN COUNTRIES



Cooperative agreement
IITF-Centro de Ecología, IVIC
Venezuela

MANGROVE GRADIENTS
1. Laguna Sontecomapan
IVIC-UNAM-IITF
2. Maracaibo lake
IVIC-LUZ-IITF
3. San Juan river basin
IVIC-USL-IITF
4. Bragança coast
IVIC-UFPA-ZMT-IITF
5. Florianopolis

Cooperation IITF-INPA Brazil
Mineral nutrition of *Bertholletia excelsa*

6. Manaos

Cooperative agreement
IITF-Universidad Nacional de La Plata
Argentina

PRODUCTIVITY AND NUTRIENT CYCLING
7. *Eucalyptus* and *Pinus* plantations
8. Grasslands
9. Subantarctic forests

Universidad de la Plata (LISEA), Argentina – IITF (USDA-FS) cooperative projects

Campo Anexo, Misiones: 20º 04’ S, 53º 45’ W (*Pinus taeda* plantations)

Concordia, Entre Ríos: 31º 23’ S, 58º 02’ W (*Eucalyptus grandis* plantations)

Sierra de la Ventana, Buenos Aires 38º 01’ S, 62º 02’ W (grasslands)

El Bolsón, Río Negro: 41º 56’ S, 71º 33’ W (*Austrocedrus chilensis* forests)

Valle de Andorra, Ushuaia: 54º 09’ S, 68 02’ W (*Nothofagus pumilio* forests)

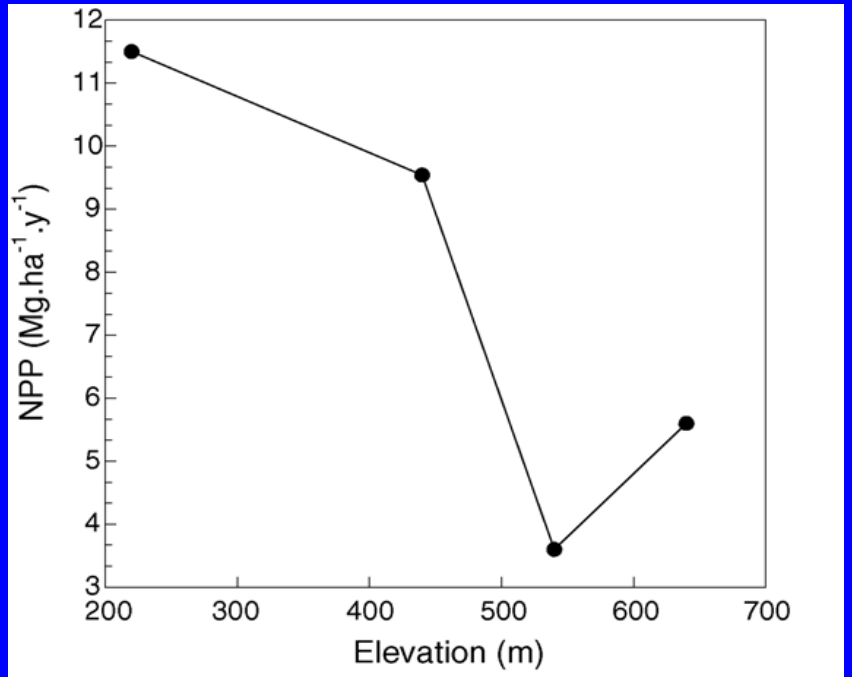
Eucalyptus grandis plantations. Entre Ríos, Argentina (In the picture Sarah Burns)

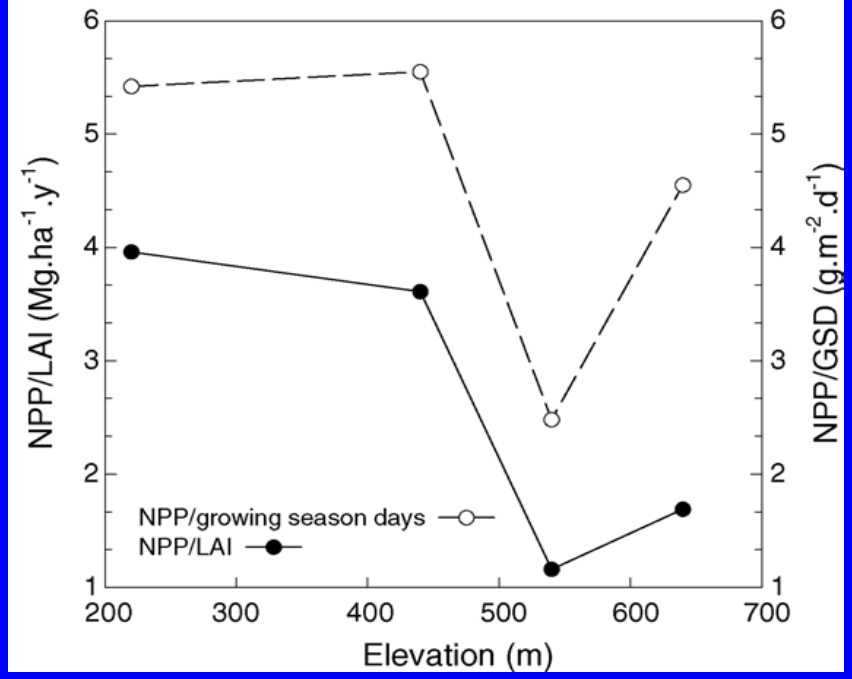
Regeneration of native forest in Misiones forest under old *Araucaria angustifolia* plantations. Misiones, Argentina (2011)

Tierra del Fuego. Valley with water dams built by introduced beavers (*Beaver canadensis*). Year 1992.

Tierra del Fuego. Recent and old landslides on the southern slope of the mountain range.

Tierra del Fuego. Experimental plot within *Nothofagus pumilio* forests with pluviometers and fine litter fall collectors.





Comparison of **tall erect**, **short erect**, **and krummholz*** *Nothofagus pumilio* stands along an elevation gradient (220–640 m) in Tierra del Fuego (Valle de Andorra, 54º9'S, 68º2'W).

*German: krumm, "crooked, bent, twisted" and Holz, "wood"

Functional attributes of krummholz support the notion that this life form has functional advantages at timberline:

- a shift towards fast turnover compartments for nutrient storage
- faster rates of internal nutrient transfer (recycling and retention)
- greater dependence on biotic recycling of nutrients
- Changes in morphological characteristics associated with leaf size, leaf duration, number of leaves, and leaf area to sapwood area ratio.

Centro de Ecología (Instituto Venezolano de Investigaciones Científicas, IVIC) – IITF (USDA FS) cooperative agreement

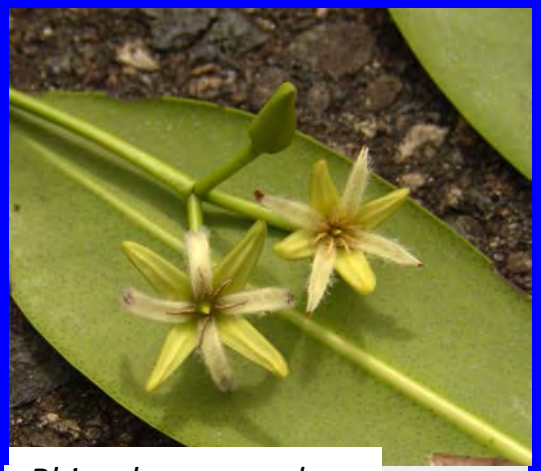
- Sontecomapan lagoon, Veracruz, México: 18º 30.35’ N, 94º 09’ W (IVIC, Universidad Autónoma de México, IITF)

- San Juan river basin, Monagas and Sucre states, Venezuela: 10º 6.93’ N, 62º 37.38’ W (IVIC, University of Louisiana-Lafayette, IITF)

- Maracaibo Lake, Zulia State Venezuela: from 10º 47.46’ N, 71º 35.37 W to 9º 5.39’ N, 71º 42.9’ W (IVIC, IITF, Universidad de Puerto Rico - Rio Piedras, Universidad del Zulia)

- Bragança coast, Brasil: 01º 3.32’ N, 46 46.16’ W (IVIC, Universidade do Para, Bragança, ZMT Bremen, IITF)

- Florianopolis, Santa Catarina, Brazil: 27º 35.63’ S, 48º 32.85’ W (IVIC, Universidad de Puerto Rico - Rio Piedras, Universidade de Rio de Janeiro, Universidade de Itajai)



Rhizophora mangle

Avicennia germinans

Conocarpus erectus

Avicennia schaueriana

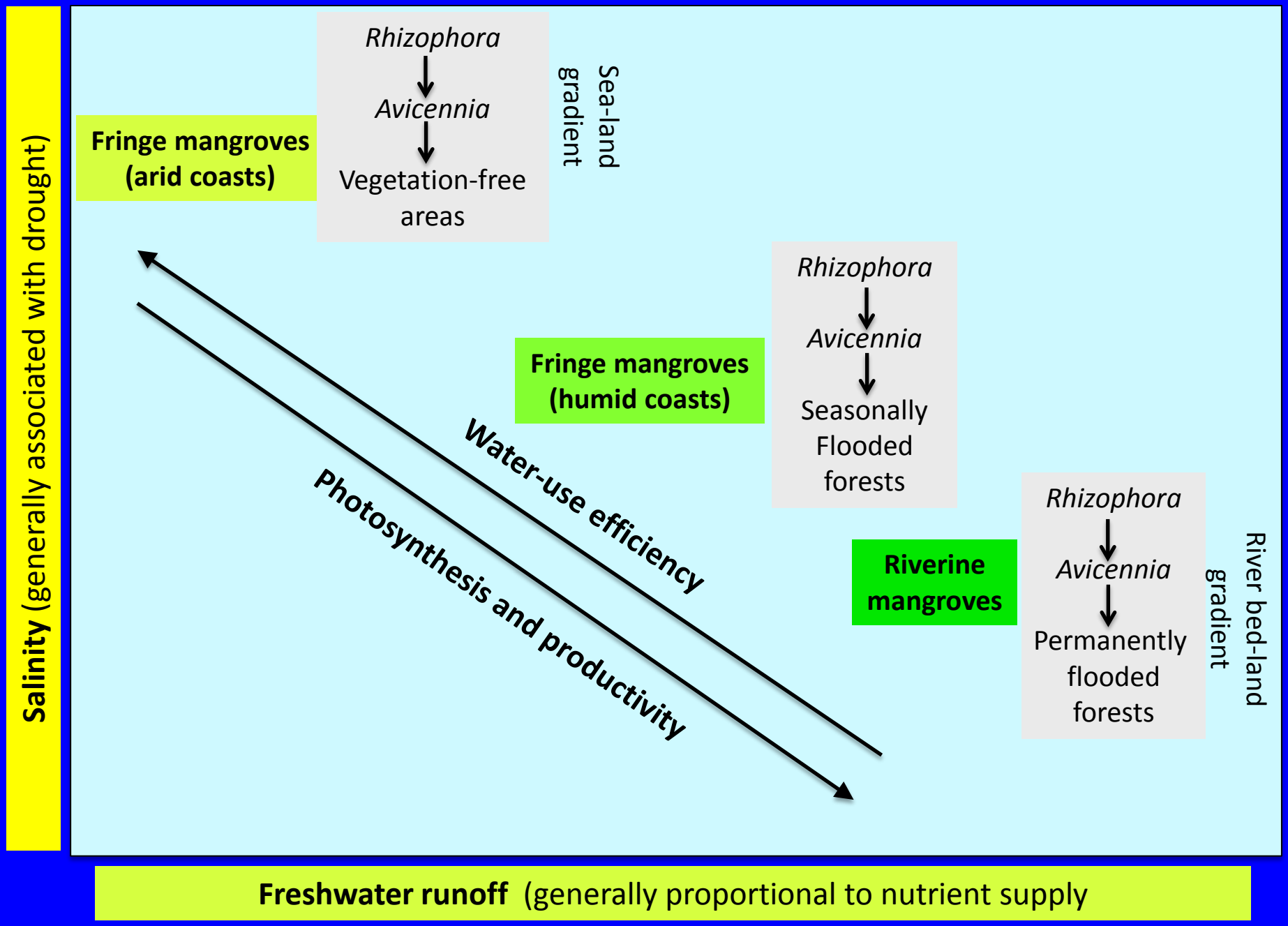
© 2012 Roger Graveson

Laguncularia racemosa

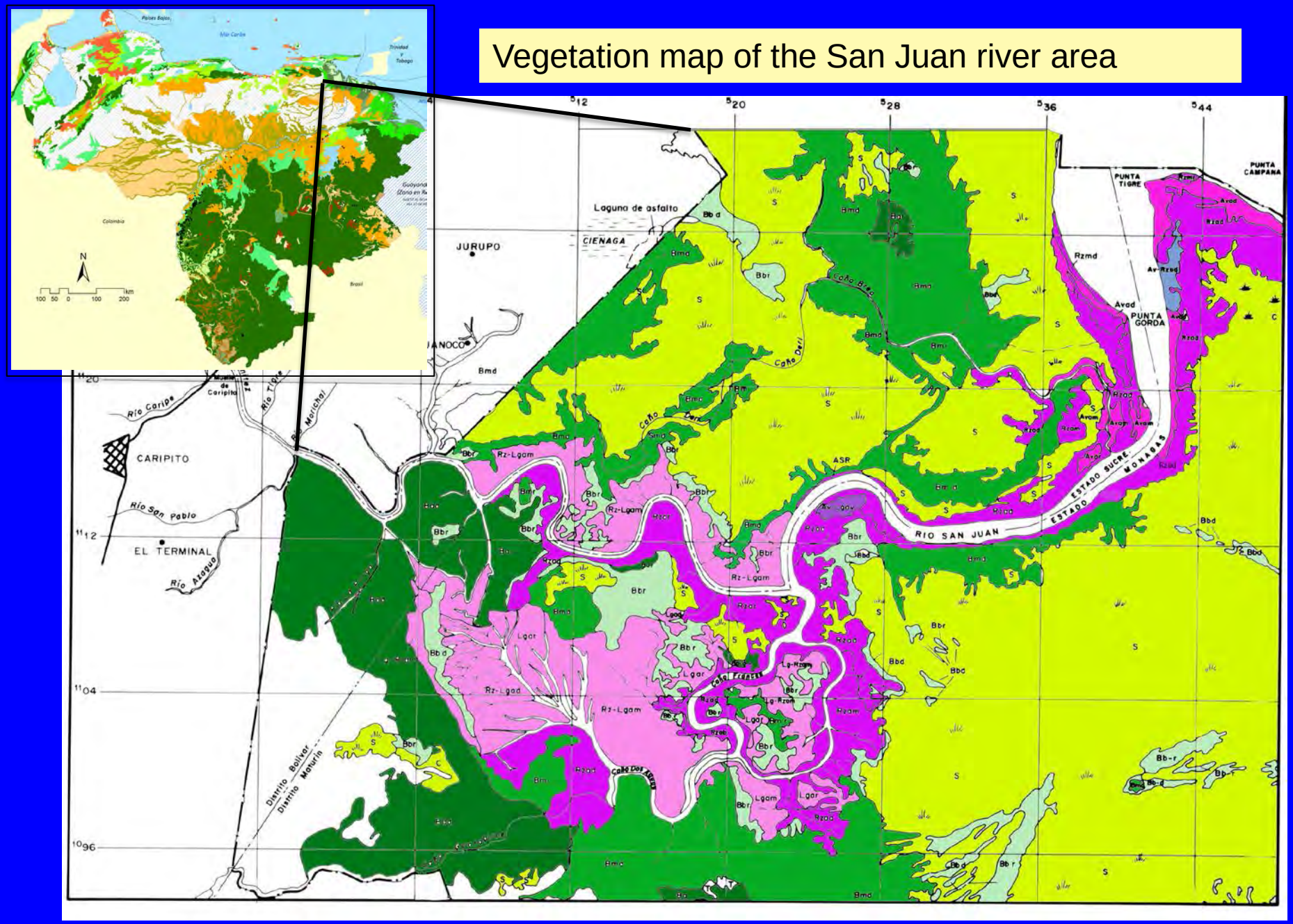
Rhizophora racemosa

Pelliciera rhizophorae

Rolando Perez (perezro@si.edu)

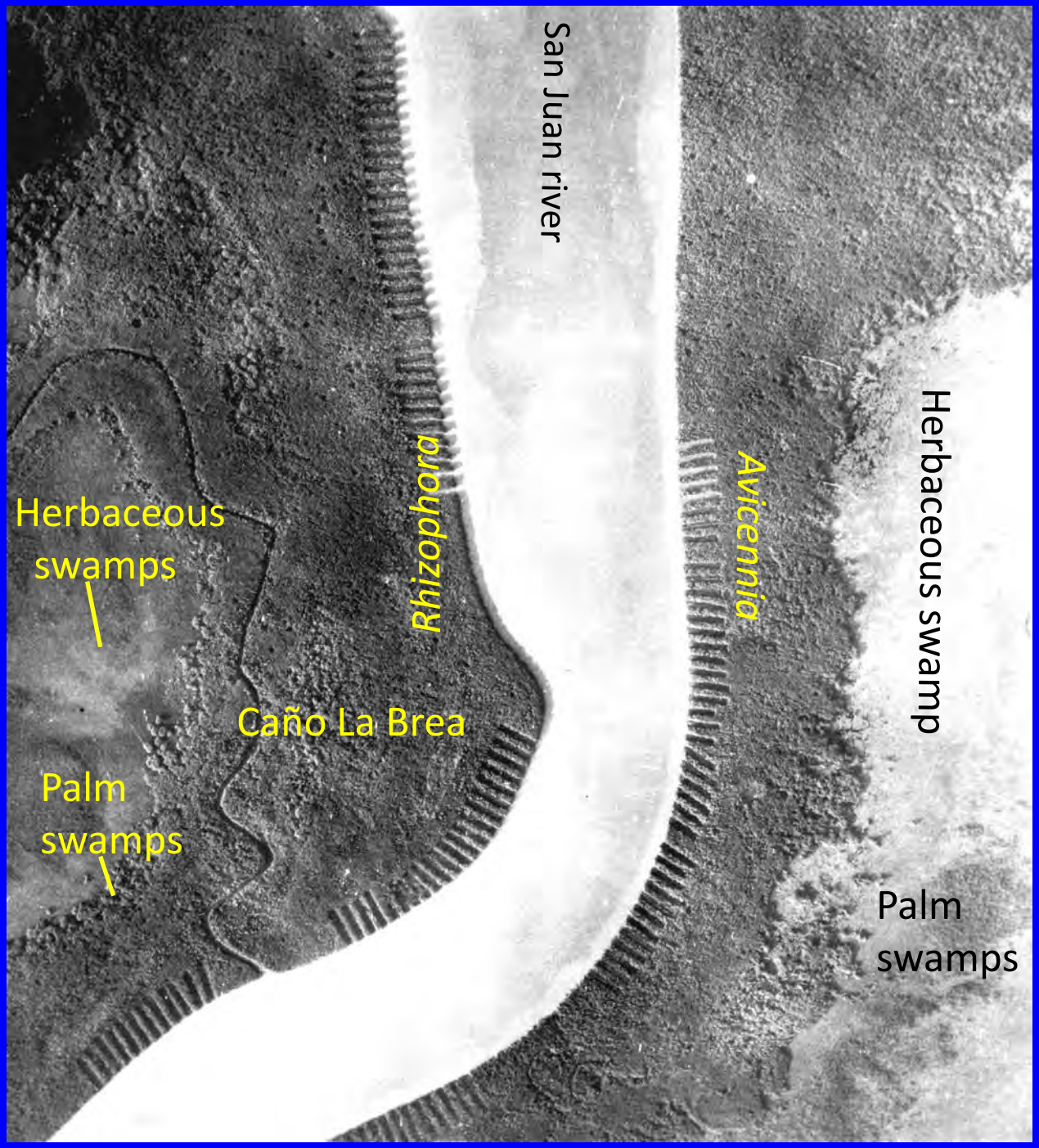

Salinity (generally associated with drought)
Fringe mangroves (arid coasts)
Rhizophora
Avicennia
Vegetation-free areas
Sea-land gradient
Fringe mangroves (humid coasts)
Rhizophora
Avicennia
Seasonally Flooded forests
Riverine mangroves
Rhizophora
Avicennia
Permanently flooded forests
River bed-land gradient
Water-use efficiency
Photosynthesis and productivity
Freshwater runoff (generally proportional to nutrient supply

Vegetation map of the San Juan river area



Canales et al. (1990) MARNR. Sector: Río San Juan, Edo Monagas. (PT) Serie Informes Técnicos DGSIICASV/IT/292. Caracas.

Increasing flood depth and seasonality



Aerial picture of the San Juan river near the Paria Gulf.
Scale ≈ 1:30,000.

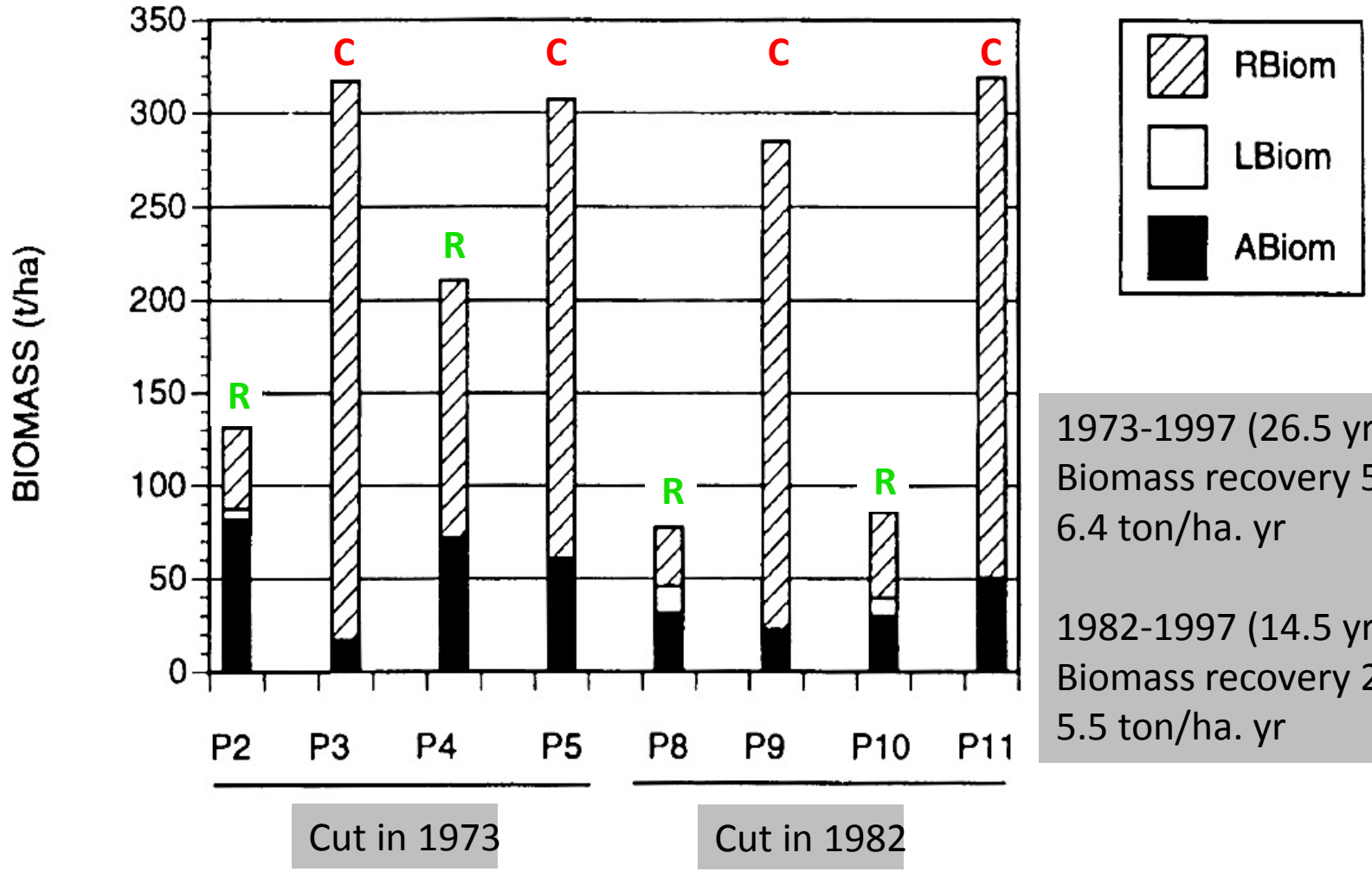
Dense mangrove forests (dominated by *Rhizophora* and/or *Avicennia*) cover the river fringe.

Palm and herbaceous swamp occur behind the mangrove fringe.

Notice the scars from the clear cut of mangroveplots (50 x 300 m)

1973

2002



1973-1997 (26.5 yrs):
Biomass recovery 55%
6.4 ton/ha. yr

1982-1997 (14.5 yrs):
Biomass recovery 26%
5.5 ton/ha. yr

Figure 5. –*Biomass of mangrove trees by species (Rbiom = Rhizophora; LBiom = Laguncularia; ABiom = Avicennia) in the regeneration (P2, P4, P8, P10) and natural plots (P3, P5, P9, P11) in parcels that were harvested in 1973 (B7) and 1982 (B9).*

Concluding remarks

Presently, and considering the increasing pace of climate change, we see a wealth of opportunities to increase scientific understanding on the functioning of terrestrial ecosystems in the intertropical region

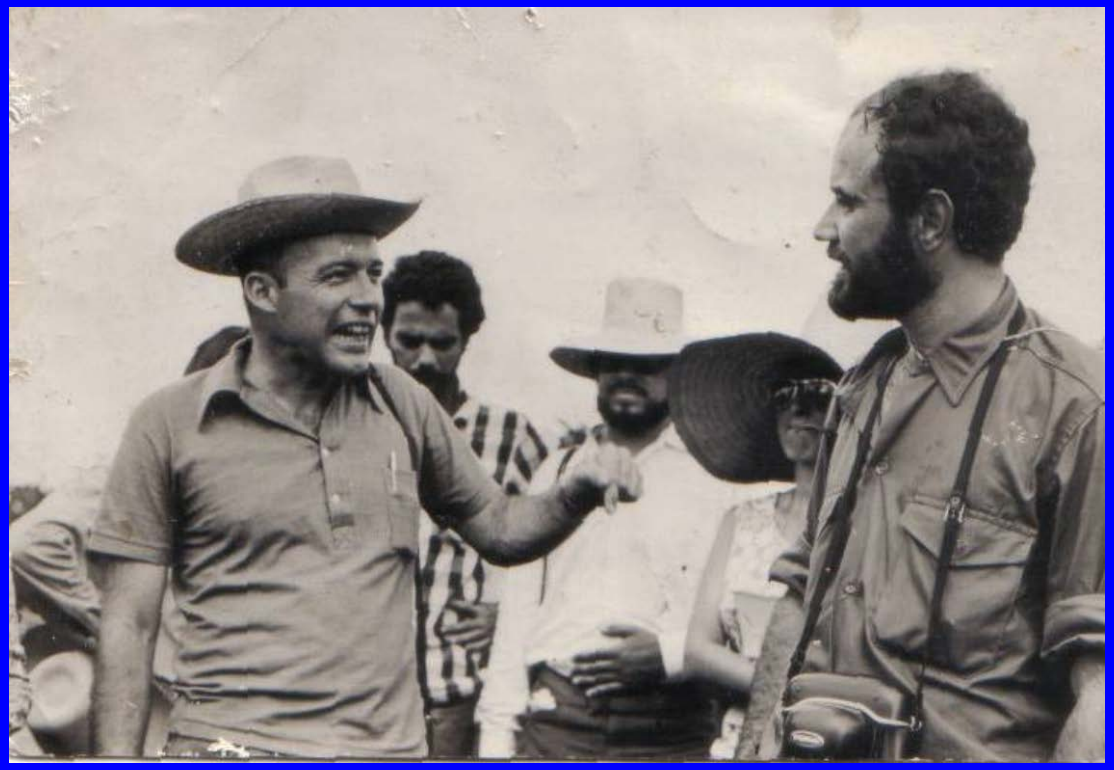
- The long-term study of the biogeochemistry of tropical river basins under the pressure of climate change: temperature increase, changes in rainfall patterns, and above all, the increase in the altitude of cloud formation, are already modifying the patterns of element leaching from both vegetation and soils.

- Keeping up with rates of change requires reinforcement of monitoring of processes of nutrient cycling, retention, and release from montane ecosystems.

- IITF facilities have been instrumental in the study of montane forests on volcanic soils, more energy and resources should be directed to karstic regions, common in the Caribbean. The Forest Service emphasized the importance of these formations in a seminal review (Lugo et al. 2001) that constitute the basis for large-scale scientific projects.

- Establishing the fields of biogeochemistry and nutrient cycling as important objectives within the next decades within an environment of climatic change requires technical improvements such as organic molecules and stable isotopes analyses, and the introduction of efficient techniques for analysis of forest metabolism, particularly gas exchange.

- Collaborative research projects such as cycling and biochemistry of sulfur compounds, the influence of Saharan dust on forest metabolism, and changes in canopy leaching may open a plethora of new insights regarding the fate of montane ecosystems at the short- and medium-term.

- **International collaborations should be a sustained effort.** An approach to make them grow along innovative and creative pathways could include the initiation of a fellowship program open to international competition. The program should be funded by the Forest Service and focused on the study of biogeochemistry of montane ecosystems on different geologies.

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