“Tropical rain forests-their complexities and their tragic demise”

Thomas B. Croat

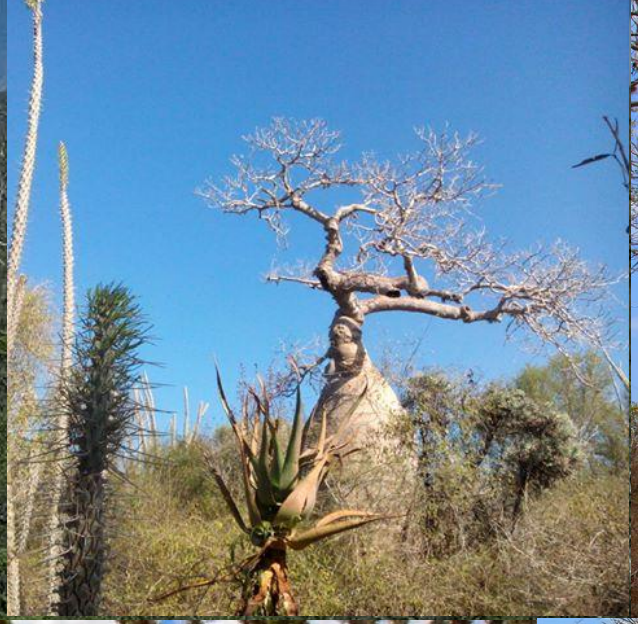
P. A. Schulze Curator

Missouri Botanical Garden

Holden Arboretum Scie
Cleveland Botanical Ga

Collection trip
Kenya, 1975 e
to Madagasca

Trip throug
Central Am
in 1965 en
to OTS cou
Costa Rica



cera (Didieriaceae)
scar

Florida
Everglades

Shruby forest on sandstone near Kaieteur Falls in Guyana

Photo of tepui formations in Guiana Highlands

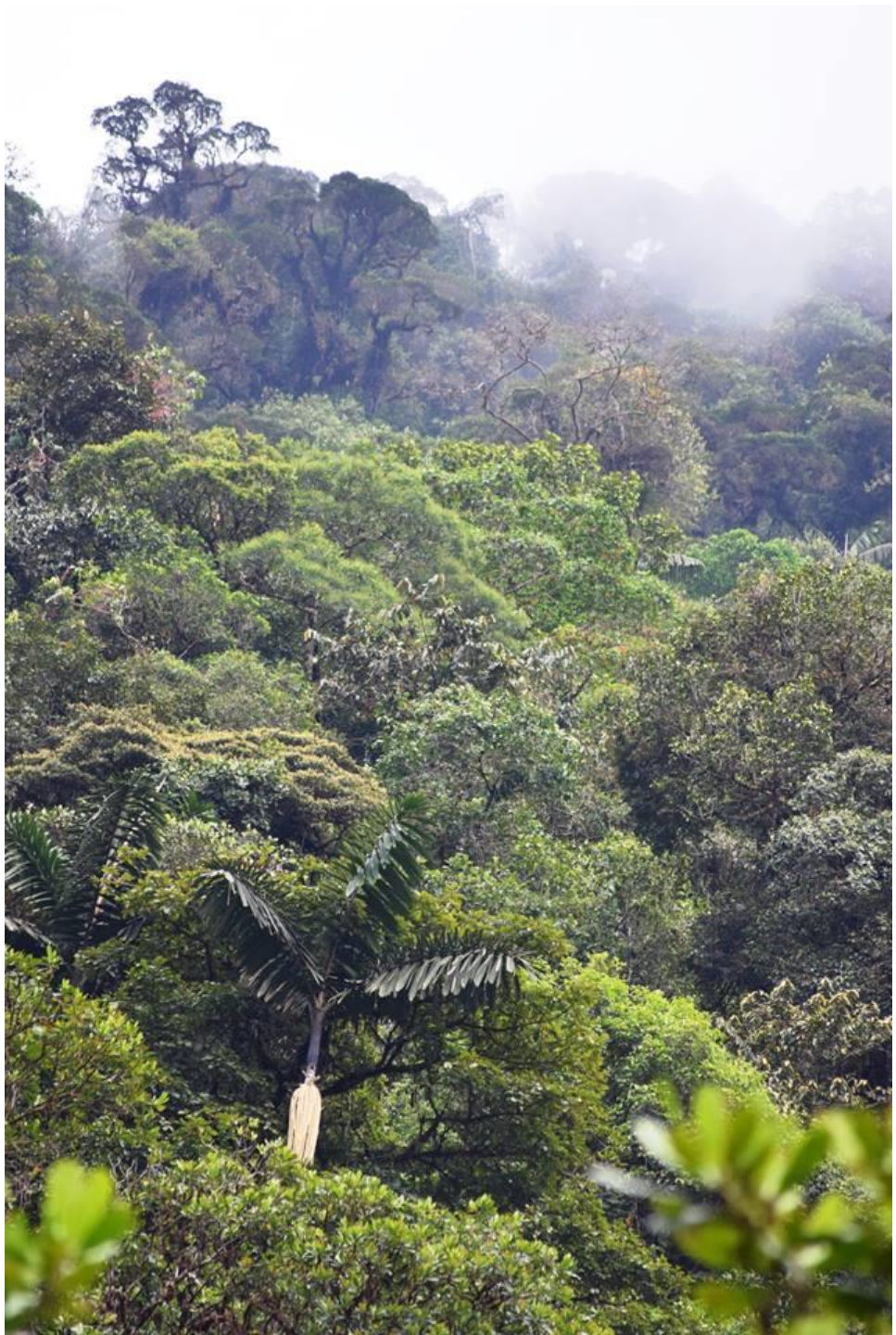
Add photo of Savana in the Guiana Highlands

Photo of Heliamphora bog on Cerro Neblina

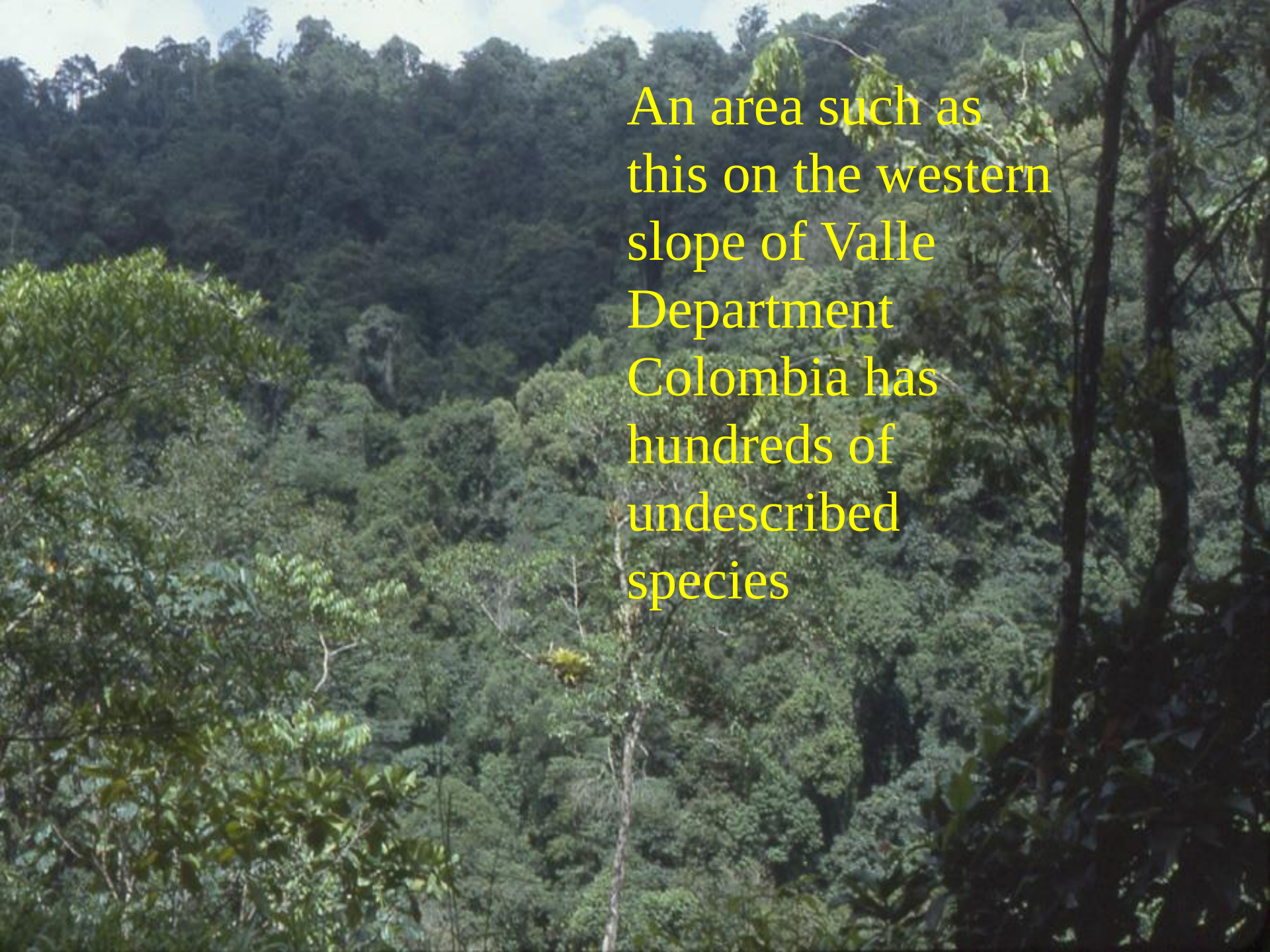
Dense forests in Costa Rica or Panama to show those I work with most

Forest in Northern Trinidad

oud forest
Colombia
oto Emilio
nstantino



Tropical wet forest life zone, Pastaza


An area such as this on the western slope of Valle Department Colombia has hundreds of undescribed species


140 species
Parque Nacional Sangay
Morona-Santiago Prov.


Flora of Guaycuyacu
Pichincha, Province
ca. 80 species

Forest at Mera, Pastaza Province

Valley of Anchicaya & Reposo

Emilio

Constantino

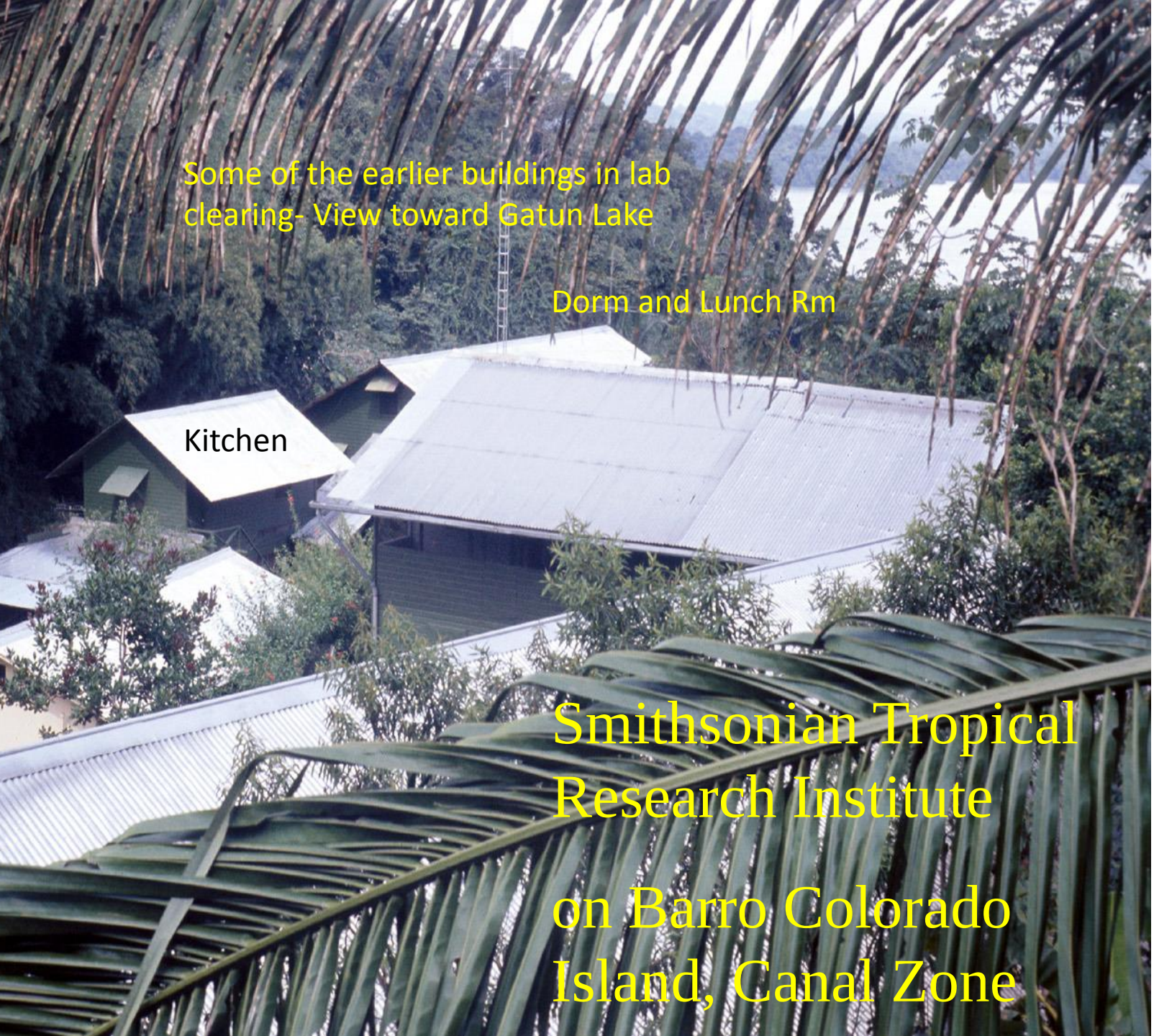
getation on Queremal-Anchicaya Road

Forest edge in Premontane rain forest, Chiriquí Province, Panama near Fortuna Lake

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

Barro Colorado Island, Panama

Barro Colorad
clearing harb


Some of the earlier buildings in lab clearing- View toward Gatun Lake
Dorm and Lunch Rm
Kitchen
Smithsonian Tropical Research Institute
on Barro Colorado Island, Canal Zone

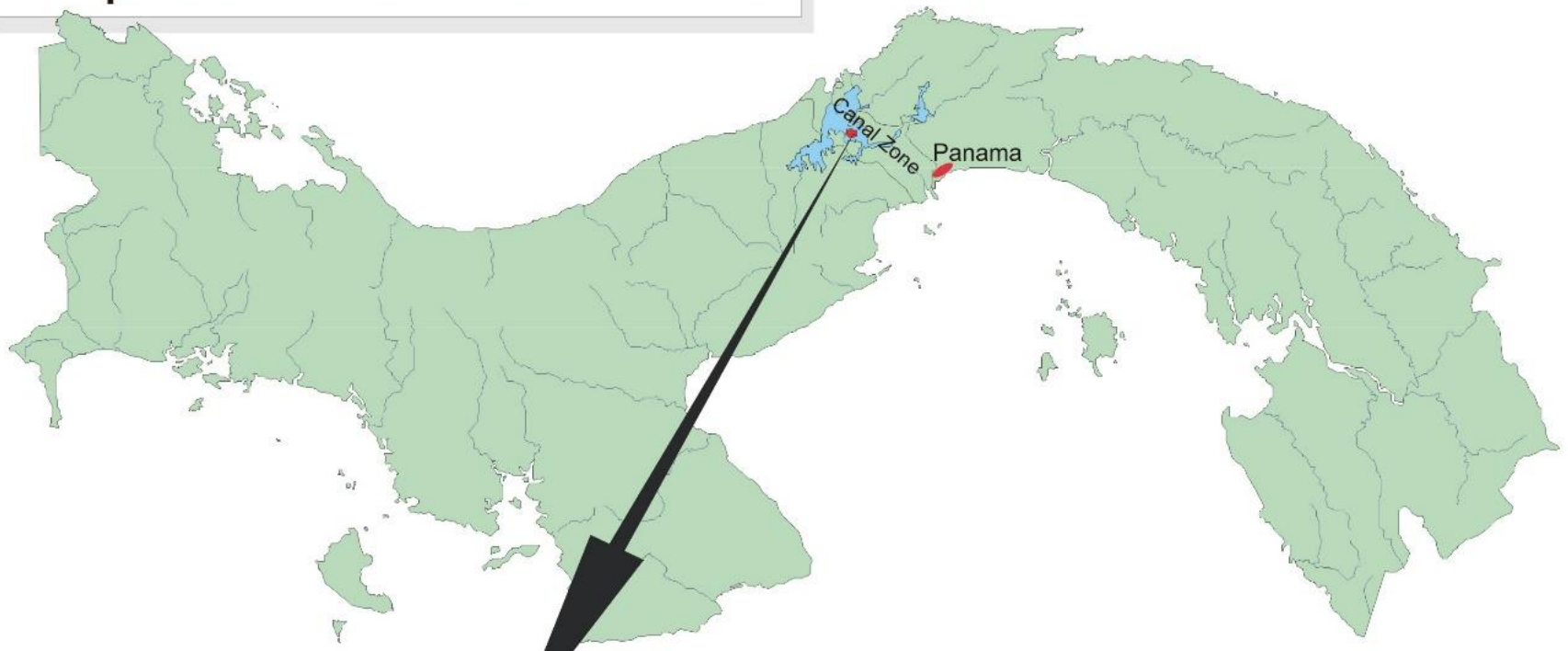
rro Colorado Island-Laboratory clearing oking into forest toward Fairchild Point


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

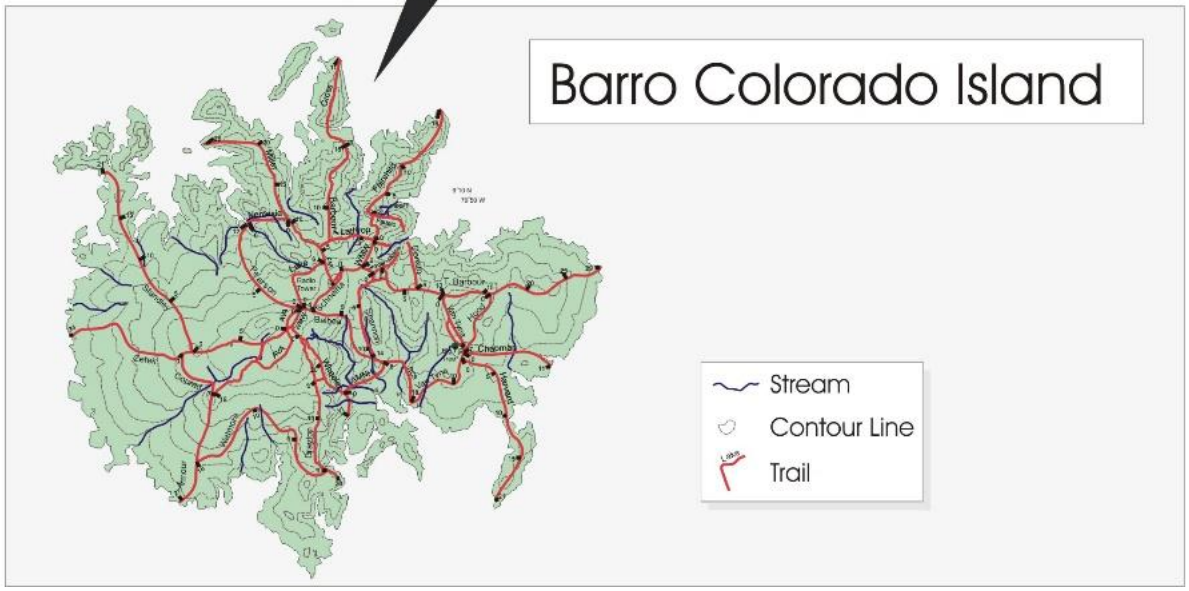
t view of Administrative Zone of Barro Colorado Island Research Station

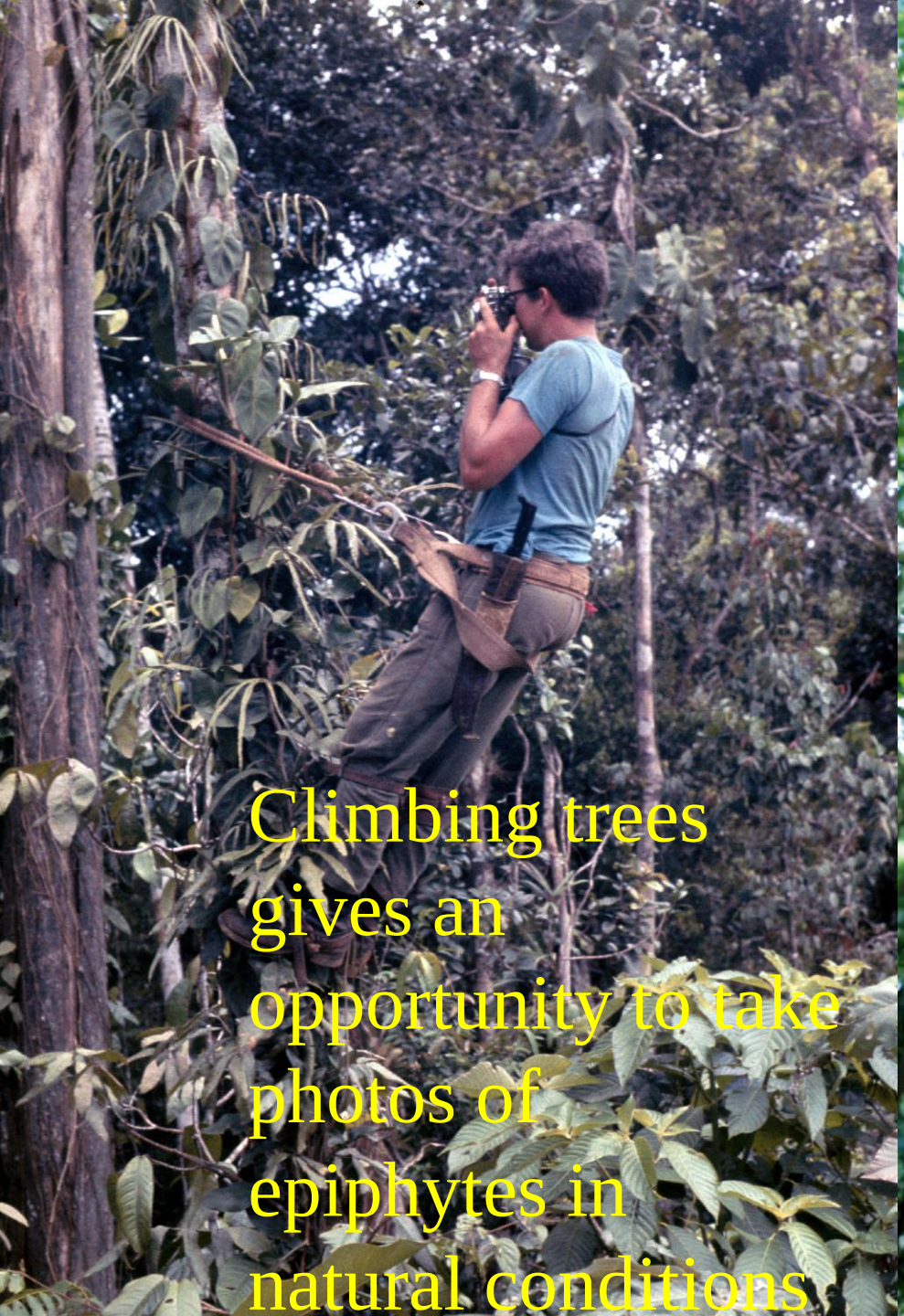
Using small aluminu
to collect on the sho

Republic of Panama

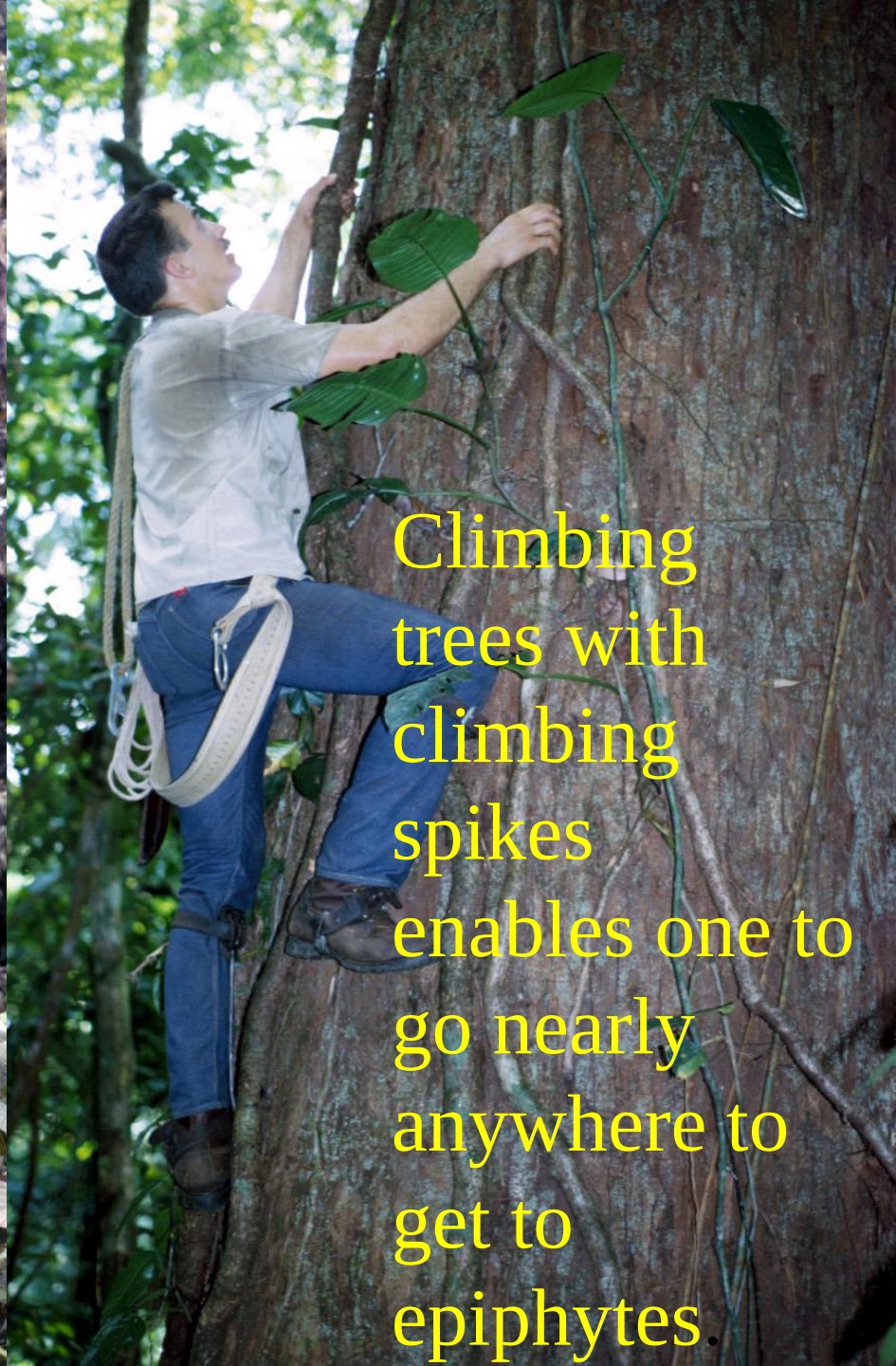


Barro Colorado Island





Climbing trees gives an opportunity to take photos of epiphytes in natural conditions



Climbing trees with climbing spikes enables one to go nearly anywhere to get to epiphytes.

Near Canopy Level

Canopy near laboratory clearing

Characteristics of Tropical Forest

- High Species Diversity
- High Species Diversity
- Poor soils

High Species Diversity

- Isolation by mountain ranges,
- River Valleys
- Soil types
- Pollinator pressures
- Fruit dispersal pressures

High habit diversity

- Habit diversity greater in tropics
  - Broader range of arborescent vegetation
  - Multi-layered arborescent vegetation
  - Buttressed trees
  - Strangler trees
  - Hemi-epiphytic trees
  - Climbing shrubs
  - Palms
  - Lianas
  - Epiphytic plants
  - Parasitic plants
  - Saprophytic plants
  - Broad leaved monocots
  - Free-floating aquatics

High Habit Diversity

- Multilayered arborescent levels
- Palms
- Lianas
- Large leaved monocots
- Epiphytes
- Saprophytes
- Free-floating aquatics
- Mast flowering

Plants which typify tropical forests

mage

Add aroid images

Insert saprophytic plants

Add images of Bromeliaceae

Add images o
leaved Mono
Heliconia, Re
Costus, Musa
Calathea

Unusual tropical forest characteristics

asites

to enter
m


Balanophoraceae- Root Parasite

tletoes (Loranthaceae) are ideally suited ttachment

Mistletoe (Loranthaceae) seed adhering to branch

coniia
gsiana

102862

Heliconiia
rostrata

Heliconia- co
in new clearin
forest margins


102644


97191


97


102291

Other things which characterized Tropical Forests

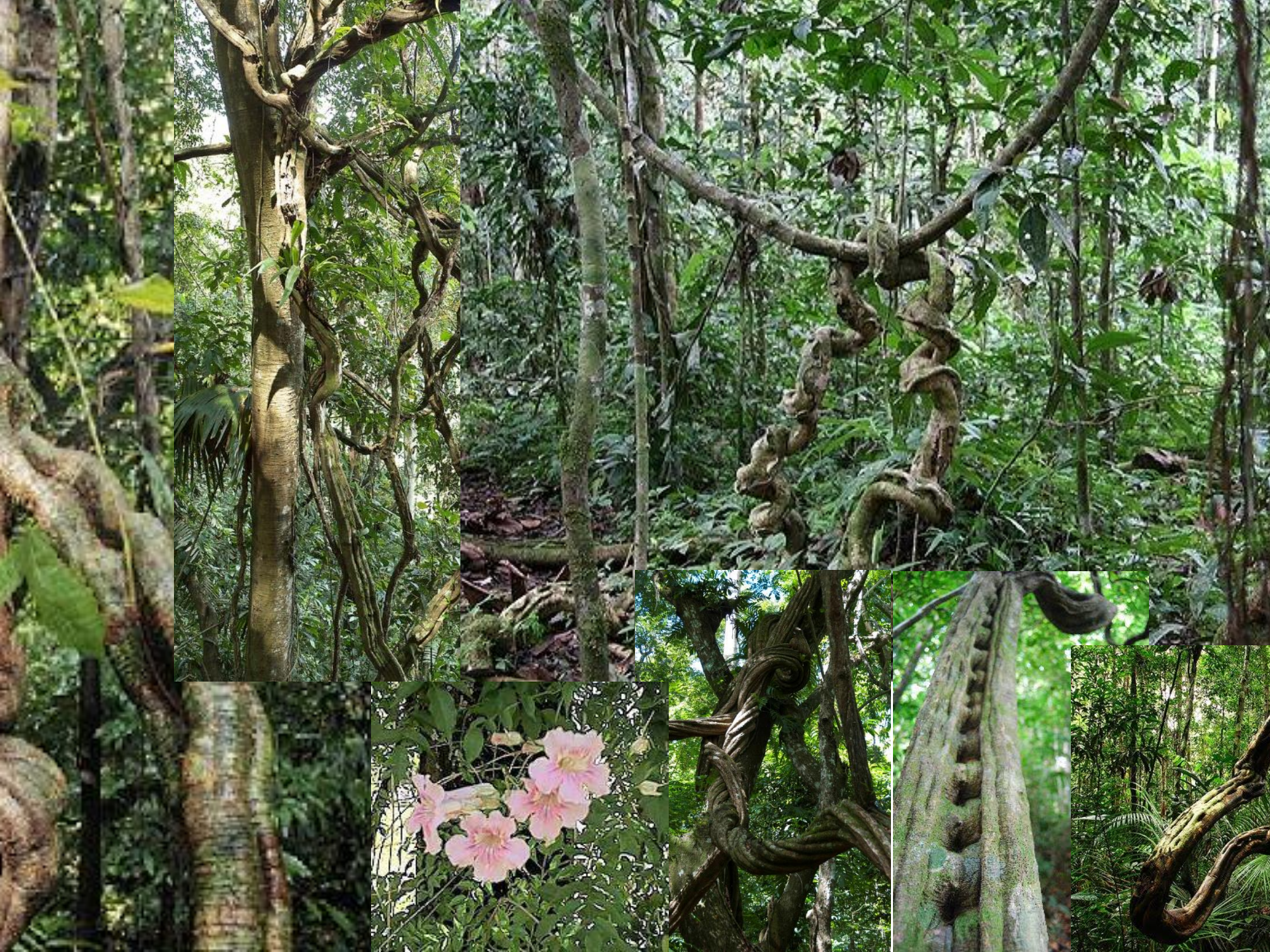
- Araceae, Bromeliaceae, ferns,


26. Barro Colorado, Panama

of side of forest showing different trees

Overstory
Canopy
Understory
Shrub Layer
Floor
50 m
40 m
30 m
20 m
10 m
© Rhett A. Butler / mongabay.com
mongabay.com

Lianas manage to get themselve into the canopy and are often flexible, enabling them to surviv tree falls. Abundant in both old and new world



Climbing shrubs


Petrea volubilis


Combretum coccineum

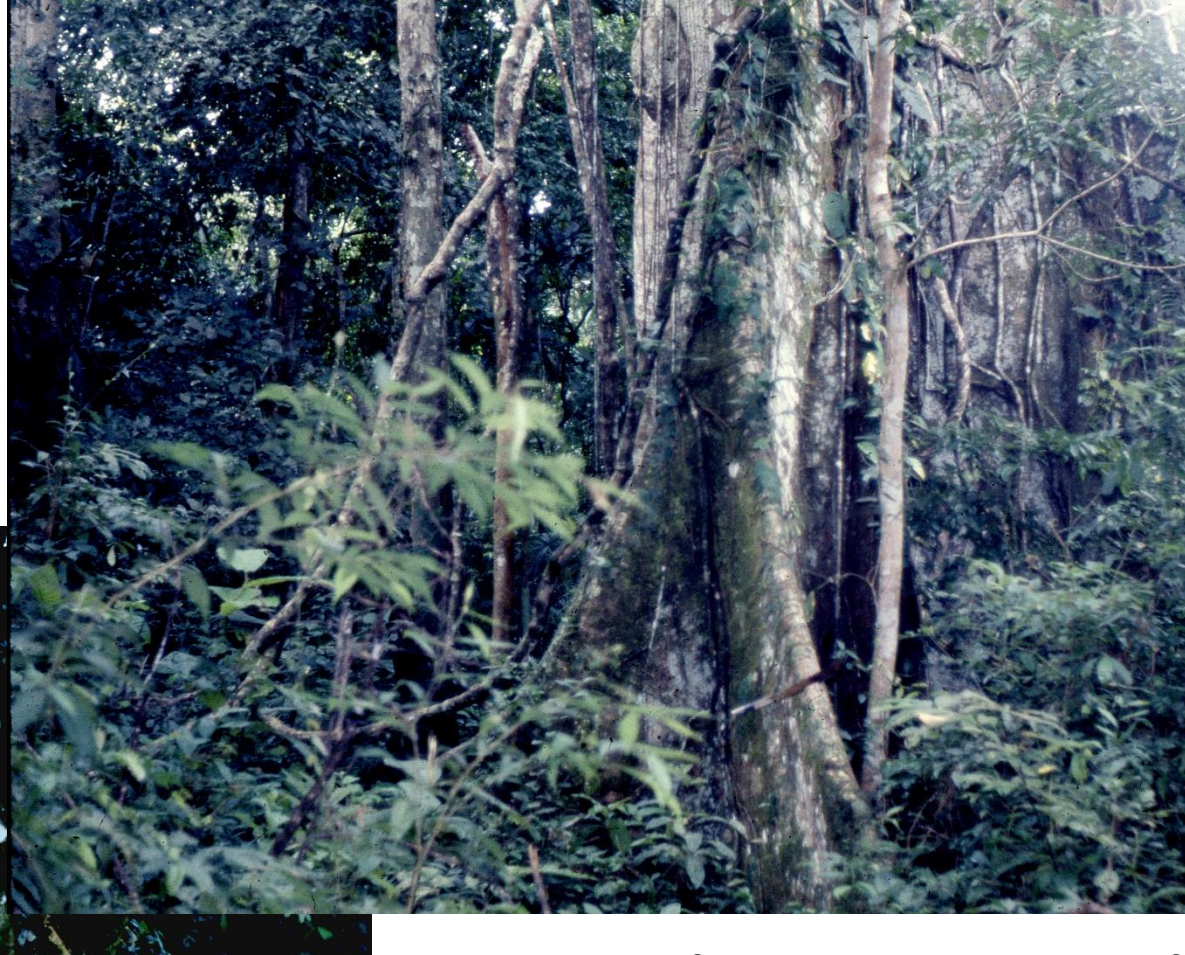
Hemiepiphytic trees require large roots extending to ground

miepiphytic
e

The "stem" in my le
hand was the the
portion of a hemie
tree growing at 30

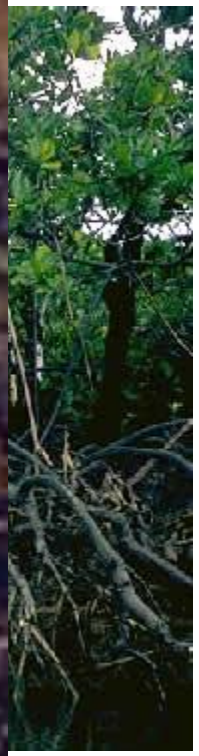

Tree covered
with epiphytes

ee buttressing is
al for support of
gest trees.



Rooting system i
shallow, probabl
owing to lack of
nutrients in the

Stilt-rooting provides for greater support



tic tropical soils

Tropical tree with close to surface roots which make extend out for 10 m on each side of tree

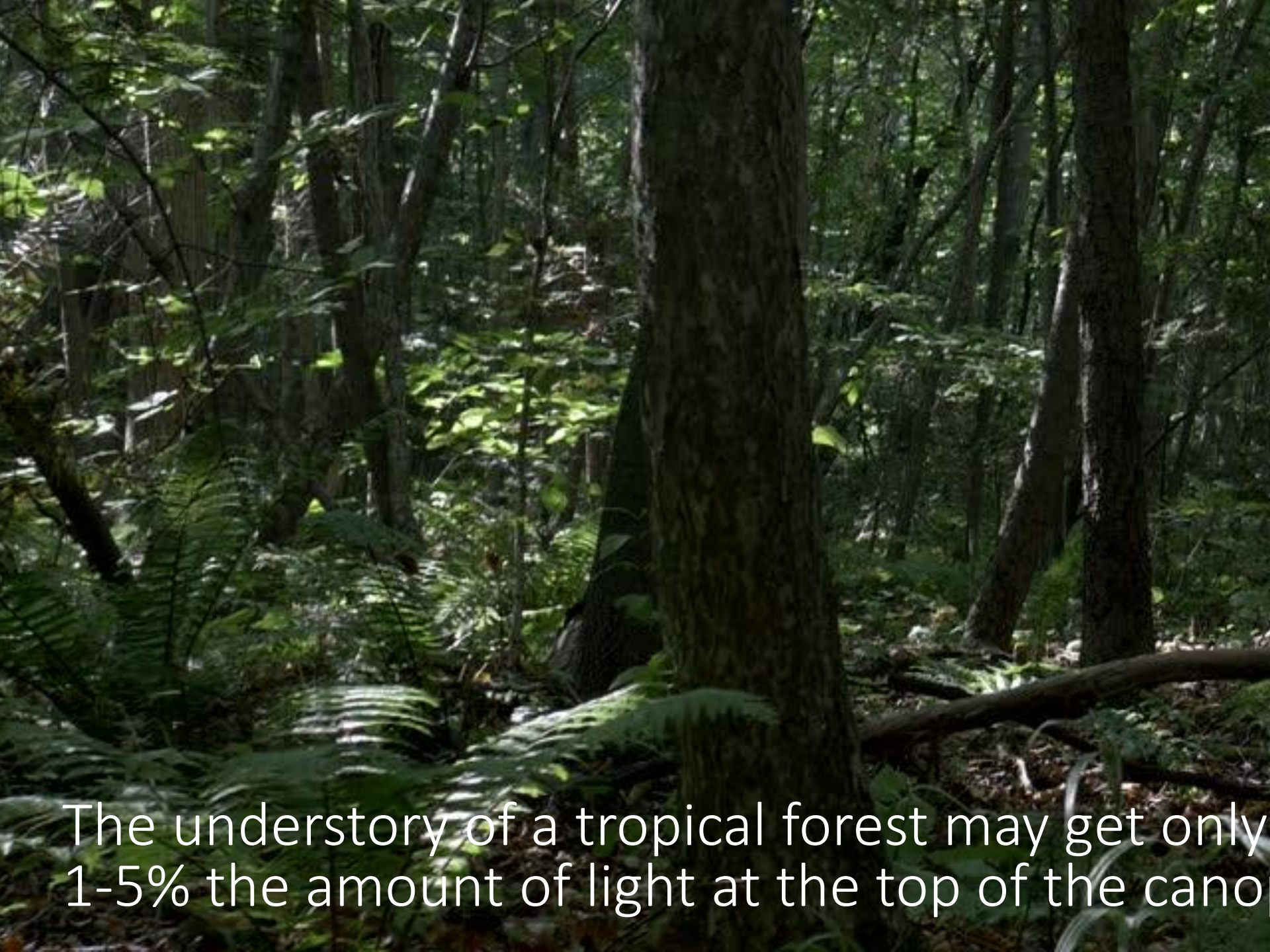
Up-ended trees owing to wind

Epiphytes usually comprise a large percentage of all individual pla[illegible] forest

View of broken branch with epiphytes

Epiphytic Bromeliaceae

Epiphytic Cyclanthac


The understory of a tropical forest may get only
1-5% the amount of light at the top of the cano

Evolutional strategies for getting to light

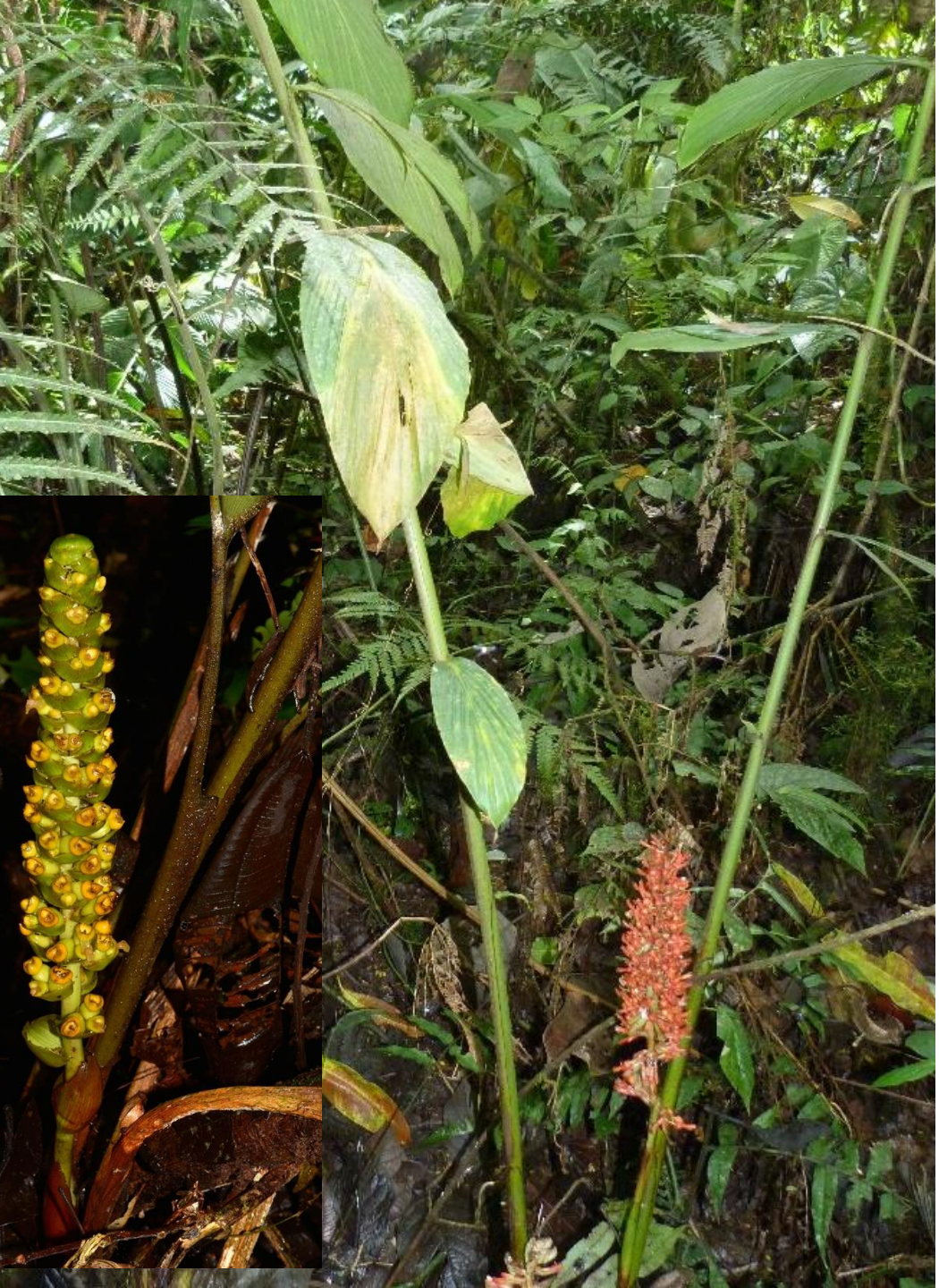
- Don’t compete. Become a weed. Crop weeds. Cecropia. Gleicheniaceae
- Invade open areas of shallow water. Grasses, water lilies, Hydrilla,
- Dormancy. Wait in soil until a tree fall opens up ground to the sun.
- Poison your neighbor and take his place. Coria alliodora
- Climb your neighbor and establish yourself higher in the canopy
- Strangle your neighbor, take his good position. Ficus, strangler figs
- Become an epiphyte. Climb or “fly” to a new position

Some plants, mainly weeds avoid competition for light and nutrients by occurring in areas disturbed by man- Agricultural crops weeds


Narrow tree-lined coves filled with aquatics

The last stages of hydrarc succession in a cove

Treefall clearing quickly open up a new opportunity for dormant seeds, invasive rapidly growing species. Ferns, broad-leaved monocots Cecropia



Renealmia 104

Cordia alliodora (Boraginaceae)- roots secrete substance that kills competing species.

Show growth of lianas ; Flowering Bignons

Young growth terrestrial with long internodes, scototropic growth, followed by creep up, phototropic growth, long internodes

Monstera and Syngonium both show scototropism

Methods of Climbing

- Twining
- Tendrils
- Spines or hooks
- Opposed branching
- Twining branches

Climbing by twining trunks or stems

Climbing by tendrils

Antigonon leptopus
(Polygonaceae)


Bignonia
capreolata


Cuspidaria
subincana


Bignonia capreolata
© Jeremy Stovall


Bignoniaceae-Liana
often coverg canop
Fridericia candicans


Opposing branched stems and tendrils allow Bignons to hold their position in the canopy

Climbing by recurved spines of hooks

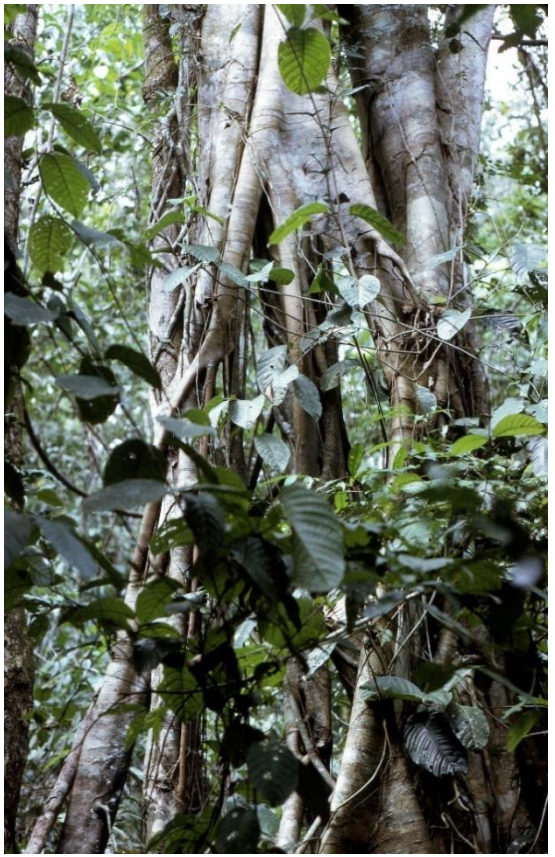
The palm Desmoncus climbs by large recurved spines created by modified leaflets

Climbing by twinging stems- Hippocrateaceae

gle your neighbor and take over his spot

Primary hemiepiphyte- Begins life as a true epiphyte, later sends roots to the ground

Strangler fig surrounding living tree to left, tree dies and is replaced by network of Ficus tree



Become an epiphyte

A True Epiphyte

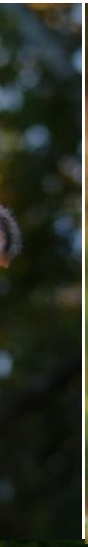
Primary hemiepiphytes

Secondary hemipiphytes

Secondary hemiepiphytes with roots reaching the ground

mals and plants have co-evolved to form tualistic systems for pollination and fruit persal

nd pollinated plants are rare in tropical ests




Steve Shinn Photography


Heliconia
93034


Erythrina
Sacha Wiwa
Reserve


Visiting
Malvaceae


Lobelia
cardinalis


Actual flowers are not
red, only bracts


Flowers not red, only spots on leaves
Gesneriaceae


Flowers a
spathe al
hummer

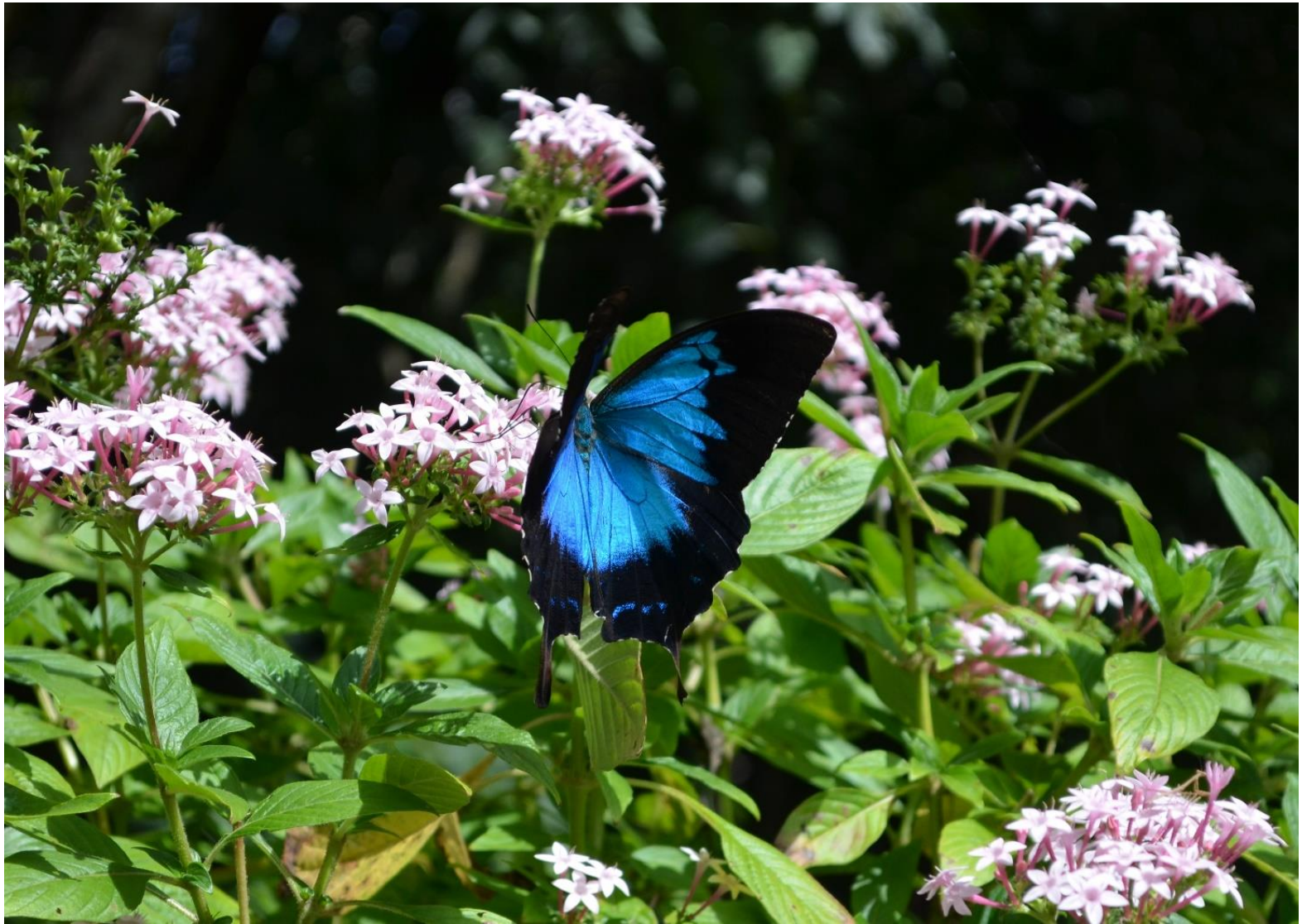
Passiflora

Photos Emilio Constantino


Geseriaceae, Sacha wiwa


Lia
wi
m

Morpho butterfly visiting small tubular flowers

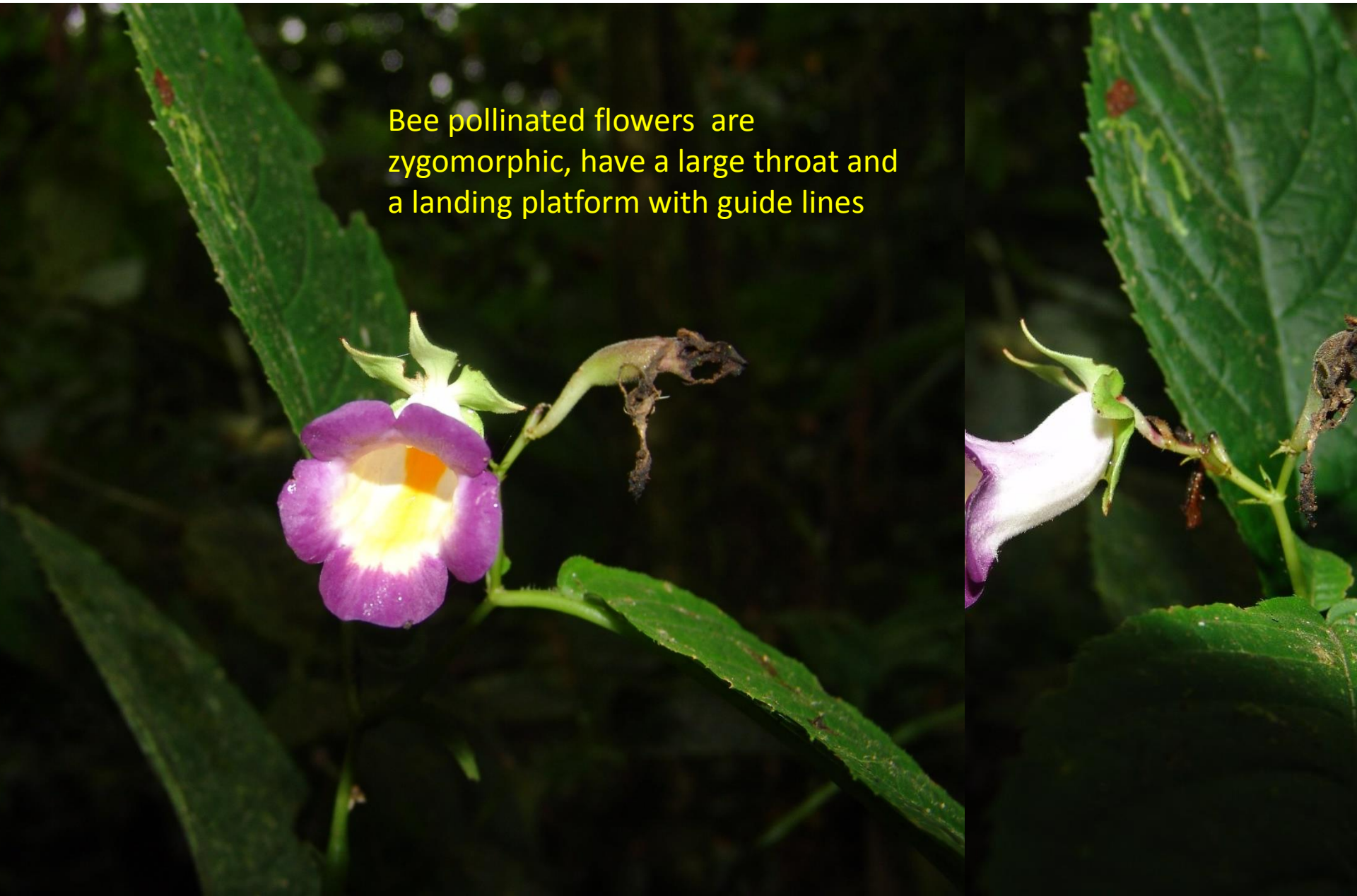



Color of flower deno
Quis


Convolvulus pollinated by hawk moth


Posoque
hawkm

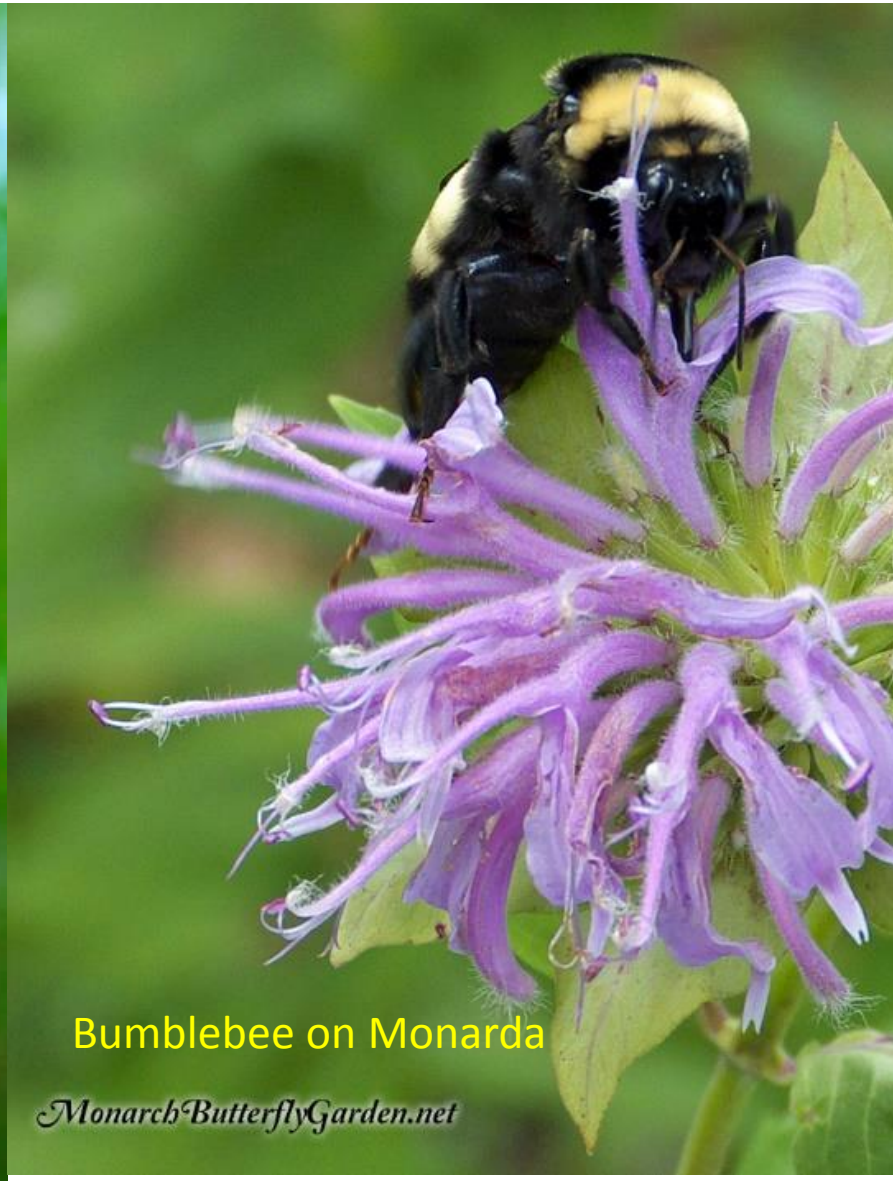
serva Sacha wiwa




Even when
apparently
they have
sexual orga

Passiflora wit
be pollinatior
with the sam
staminal and
movements a
hummingbird
pollinated
Passifloras.

etimes visit and perhaps pollinate flowers that are not typically bee flowers, those with narrow tub



Bumble bees use vibrations to shake pollen out of tubular flower

Bees may be versatile and out of form, here visiting an open flower with small tubular flowers

e bee pollinated flower- narrow
Geseneriace

r pollinated plants often are dark colored
d have foul scents

wasp-pollinated aroid

Anthurium triciafrankia

Orchids are insect pollinated, most by bees but obviously bees of
many different sizes.

Many Anthurium species are bee-pollinated

Plant on left is in male phase with pollen. Bees are collecting pollen which may be carried to a plant in female phase

Plant on right is in female phase with stigmas forming droplets

Beetle-pollinated flowers have sweet scents and more or less closed at the time of flowering

Rhodospatha

Cyclanthaceae and Palmae are often pollinated by beetles

nonaceae are mostly pollinated by small beet
wer scent sweet, pollinated often at night

Guatteria leh
Rio Medellín

bollinated flowers are typically pendent broad-throated

Mammal-pollinated flowers are apparently few

ny species, perhaps most are not known their pollinators

Bird-dispersed fruits are typically colorful but without strong scents

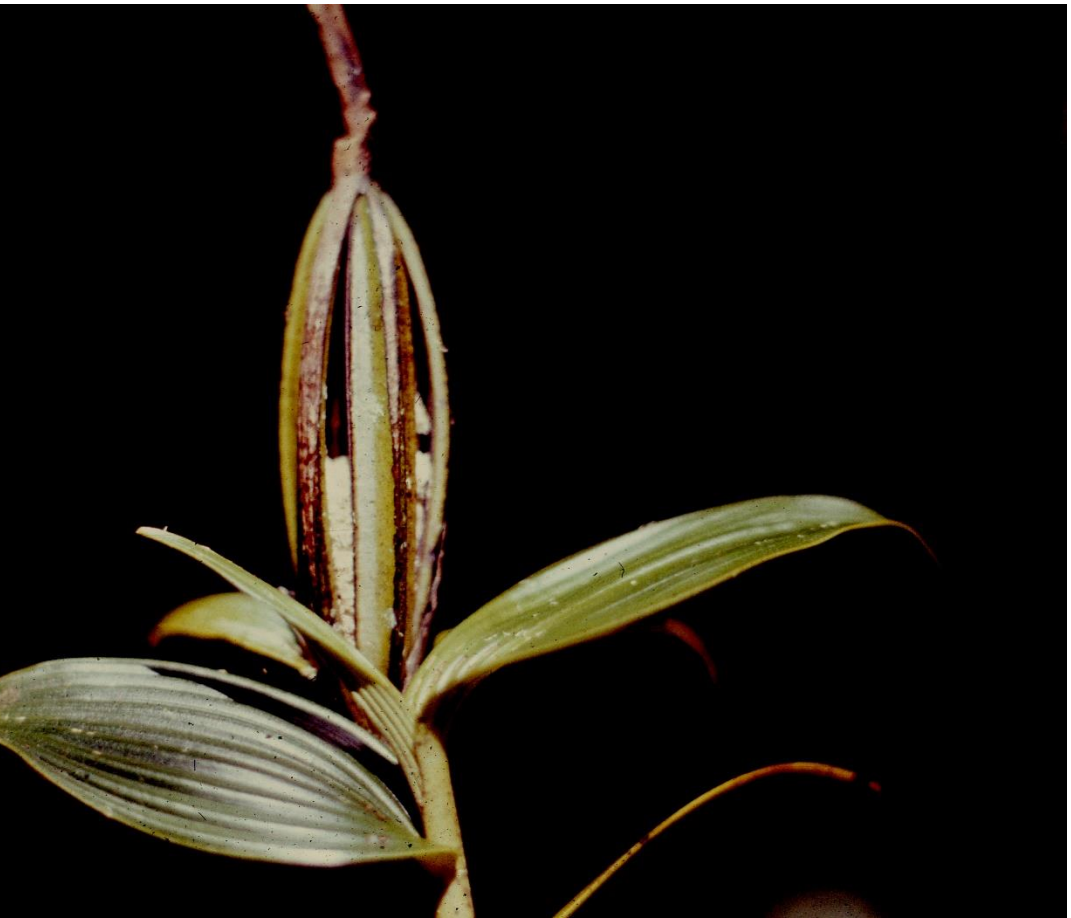
tmeg ready to open showing aril

Birds are probably the principle disperser of Anthurium and may frequently disperse Philodenron

Mammal dispersed fruits are large and usually aromatic when mature.

Nectandra fruits are large and ready to germinate quickly

Alternative extreme strategies.
Lauraceae with a few large fruits.
Orchids with millions of tiny seeds.



Spondias mombin and sca
hoarding agoutis

blosive dispersal of seeds is reasonably comm
ra crepitans with fragments after exploding

eds shake out apex of capsule. Seeds disperse
wly out of pores owing to shaking by the wind
animals.

pical wind-dispersed maroid fruits


ubiaceae with an enlarged
ing on one of the calyx
bes

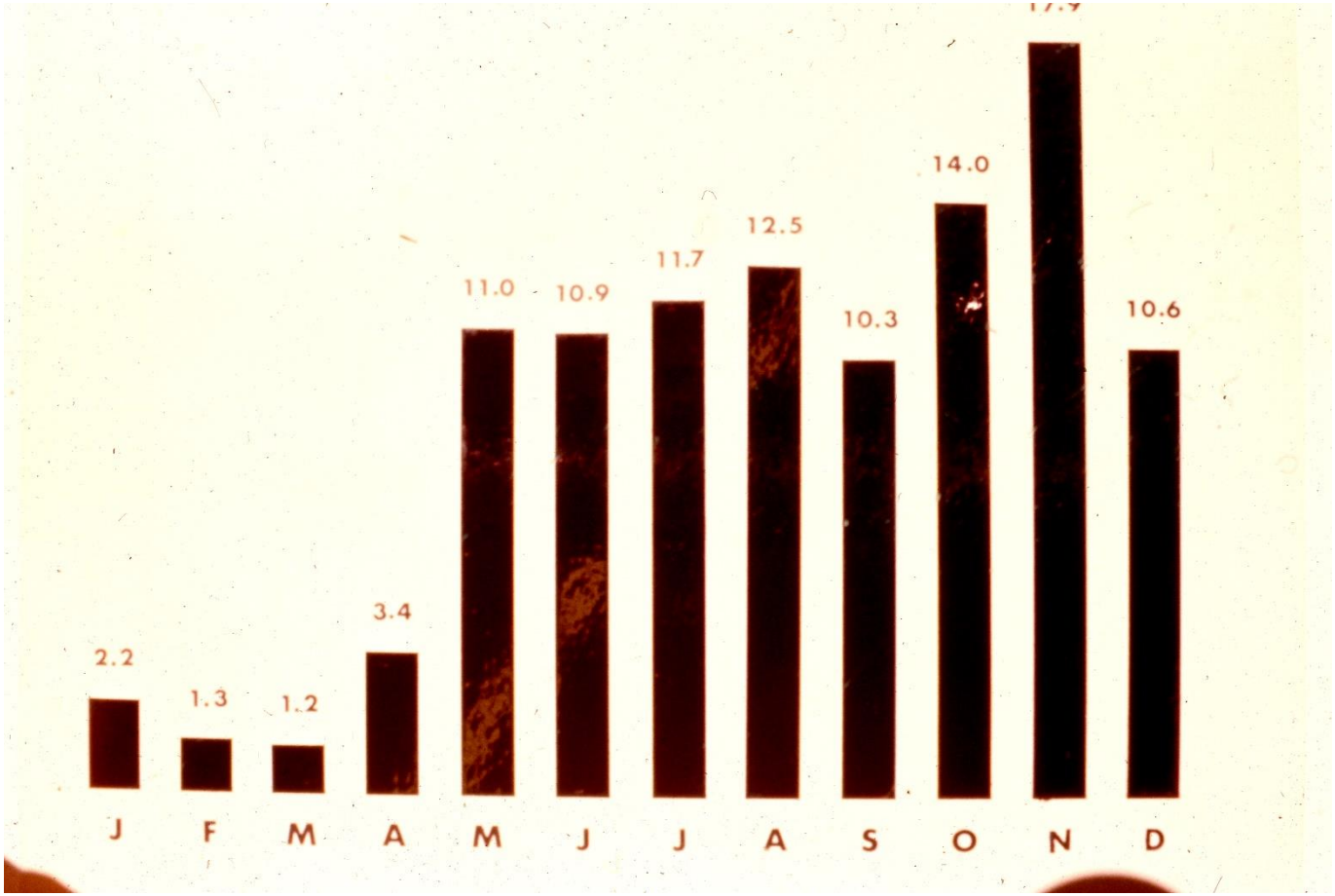
Cochlospermum vitifolium capsules yield a cotton like fuzz with seeds emersed

Pithecoctenium echinatum fruits have flat highly buoyant seeds

Epizoochorous fruits- designed to be carried in fur by animals

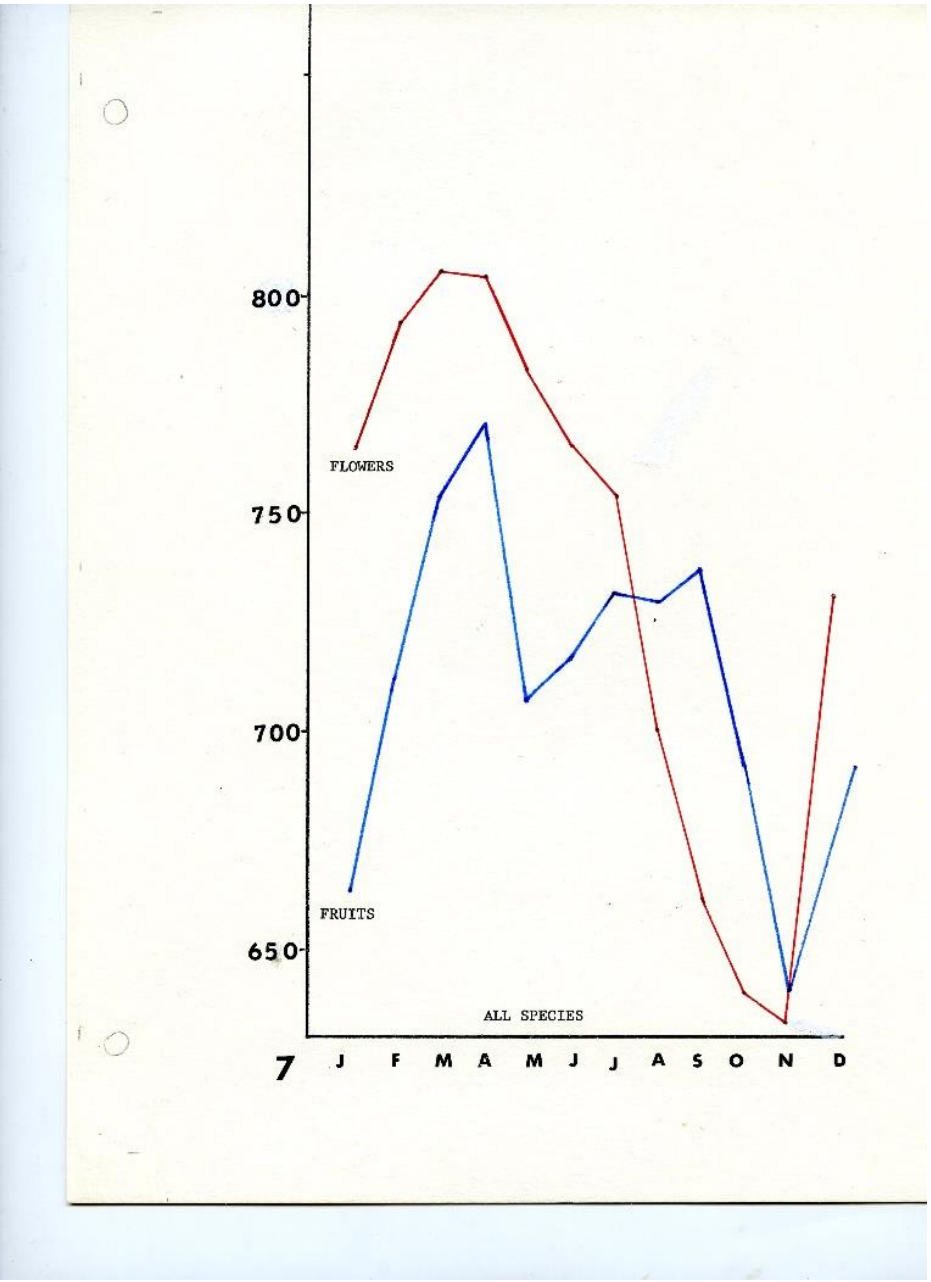
Seeds are forcibly ejected by the violen untwisting of capsule segments

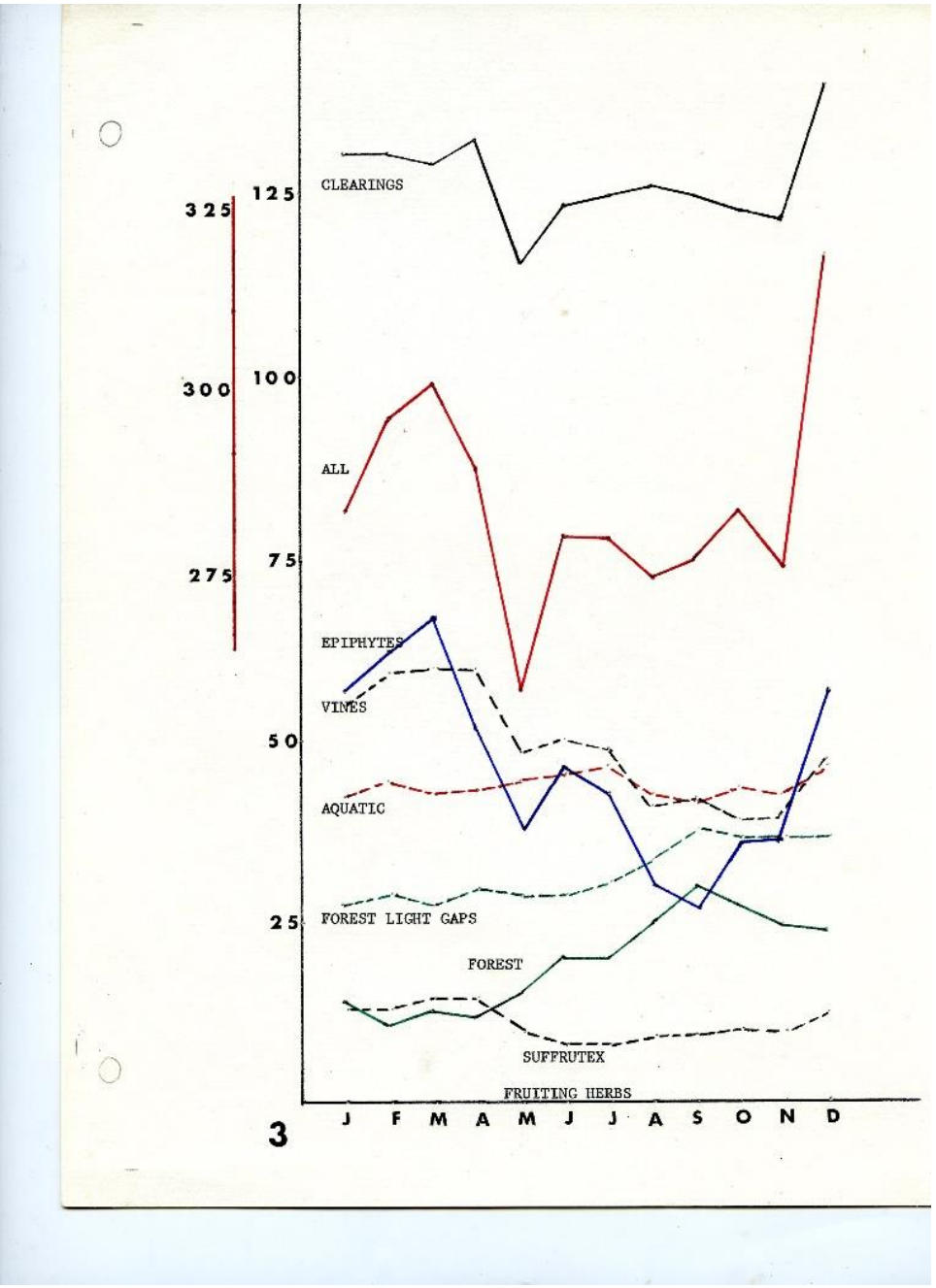
Average rainfall in centimeter on BCI



Drying affect of the trade winds in the early part of the dry season

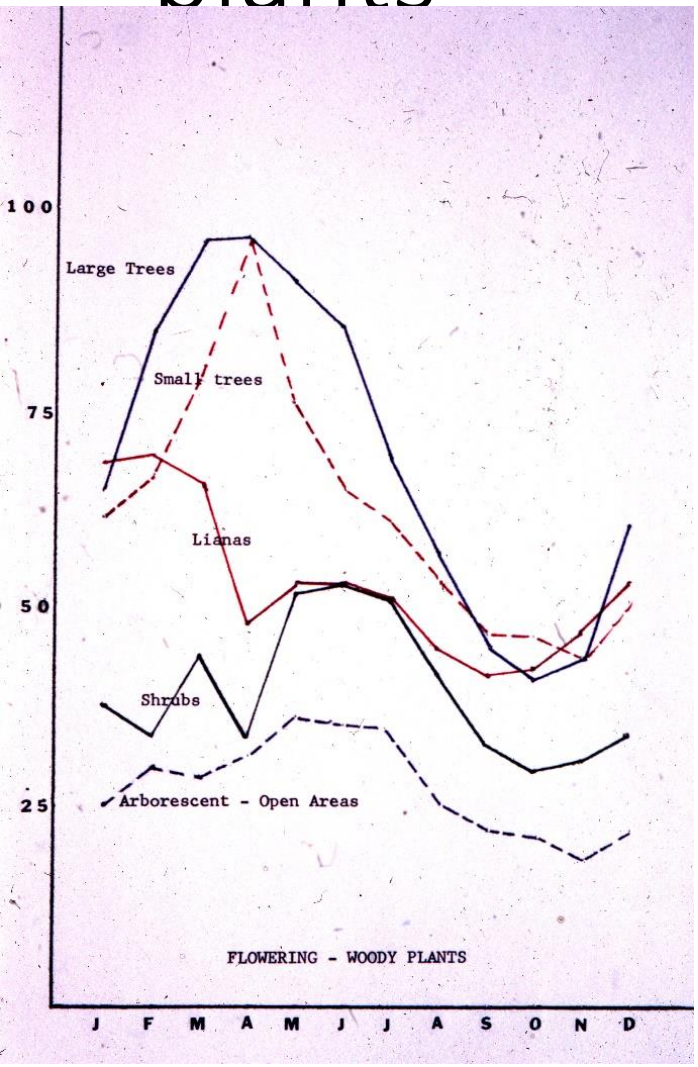
Flowering and fruiting phenology on BCI





Flowering behavior of all habit classes on BCI

Phenology of habit classes of BCI plants



Flowering behavior of woody plants on BCI


Wood decomposing wood fungus

Decomposers work quickly to break down materials into nutrients

Micorrhizal fungi on plant root

Another class of fungi help plants to quickly reabsorb all the newly available nutrients.

Photo- Paula Flynn

Nutrient Recycling is Permanent and has taken place for millions of years.

- An incredible biomass sits atop nearly useless soil
- All nutrients are locked up in the living forest
- What happens when we interrupt this cycle by removing the forest?

Remove valuable big lumber trees

Sliced up wood to form planks

Loggers preparing to haul out cut up logs with pack animal.

Try to burn what is left

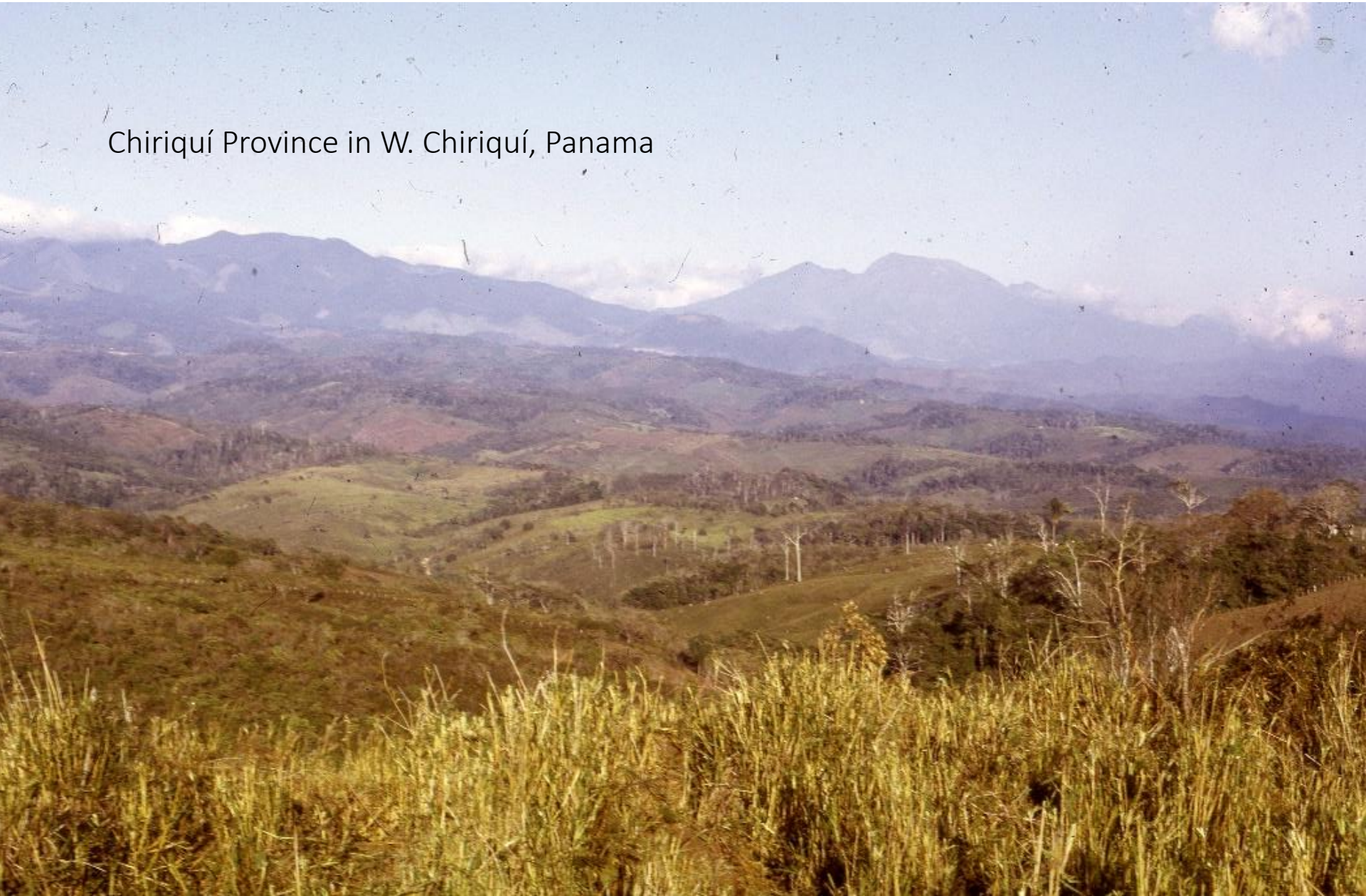
Forest Destruction near Pto. Bermudez, Peru


Forest
destruction
near Pto.
Bermudez

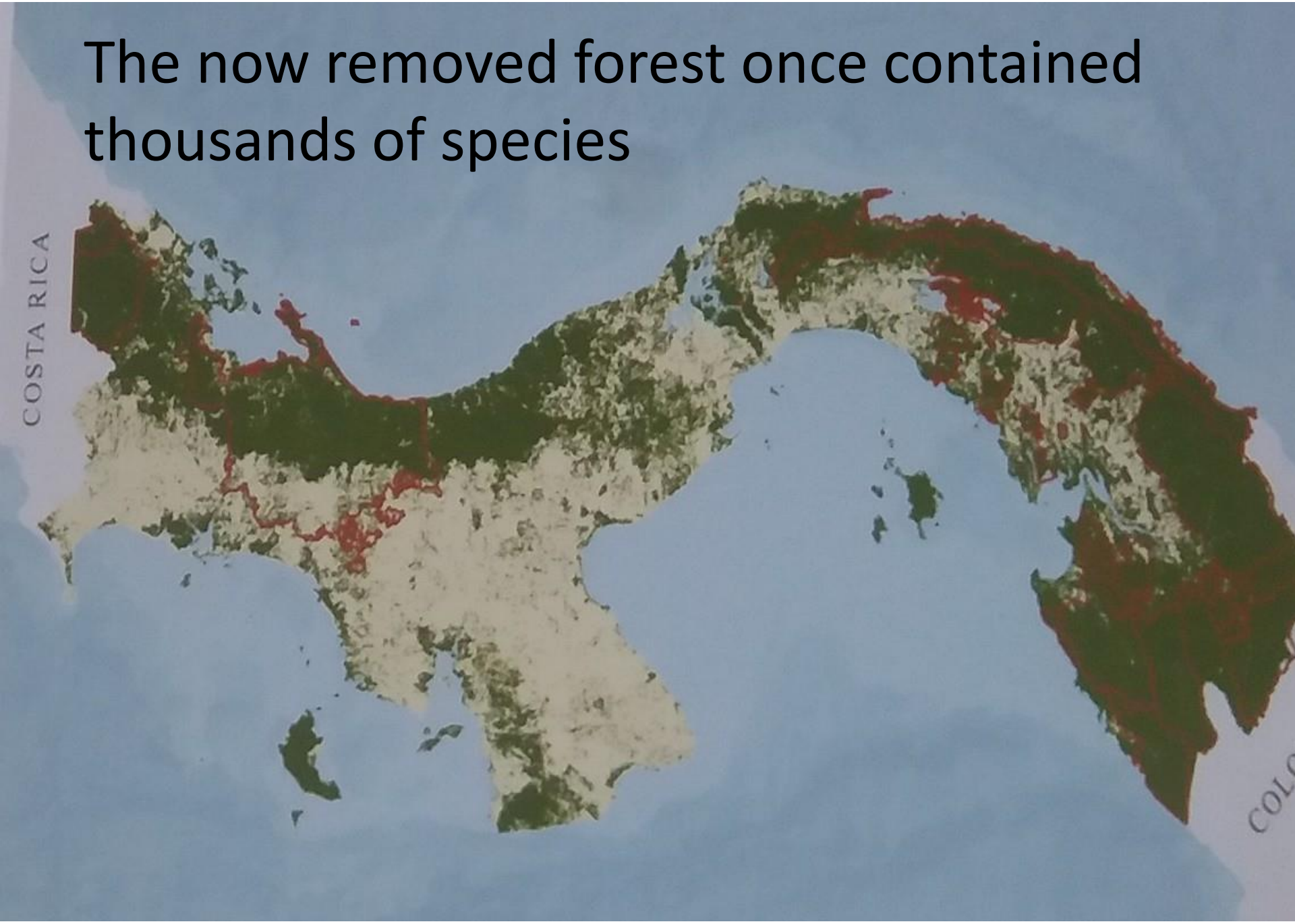
Without tree cover soils quickly erode

Some weedy trees slowly regrow but but most species are lost

Much converted to annually burned pasture



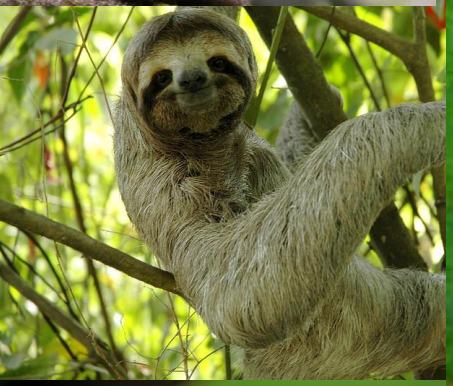
The now removed forest once contained thousands of species




Clear felled forest on border of
Yanachaga-Chemillén Park, Pasco
Department, Peru

Much forest is also lost to road building, often the first openings to colonization

A barren landscape after deforestation








Anacardium excelsum

Sacha wiva Reserve