Ecological Mangrove Restoration (EMR): Hydrologic Restoration is Critical, Planting Mangroves is Not

Roy R. "Robin" Lewis III, MA, PWS

President

Coastal Resources Group, Inc. [501(c)(3) not-for-profit – tax deductible organization]

Salt Springs, Florida, USA

MANGROVE INDONESIA MAP ACTION PROJECT

Oxfam

Canadian International Development Agency

July 31, 2014

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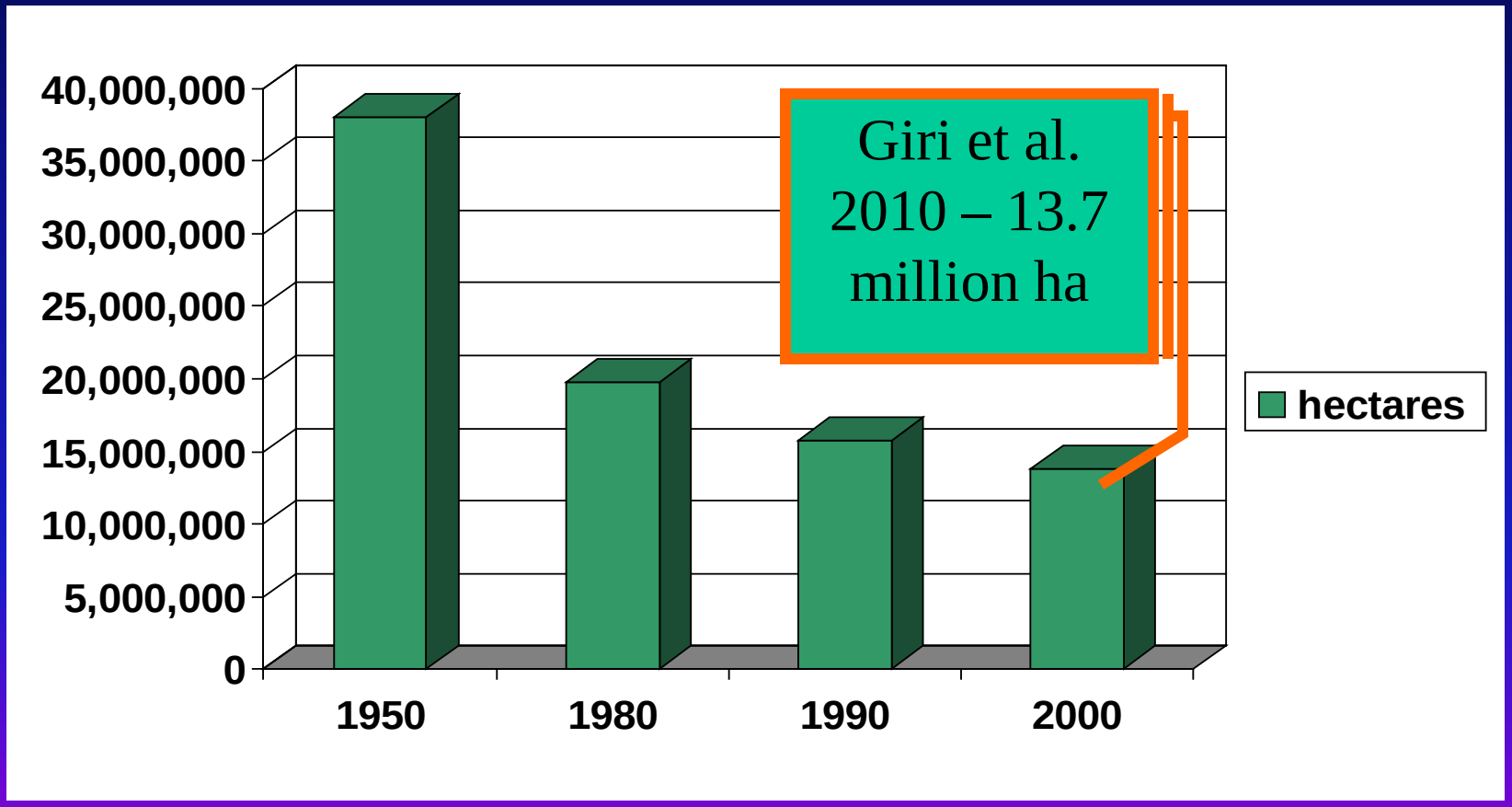
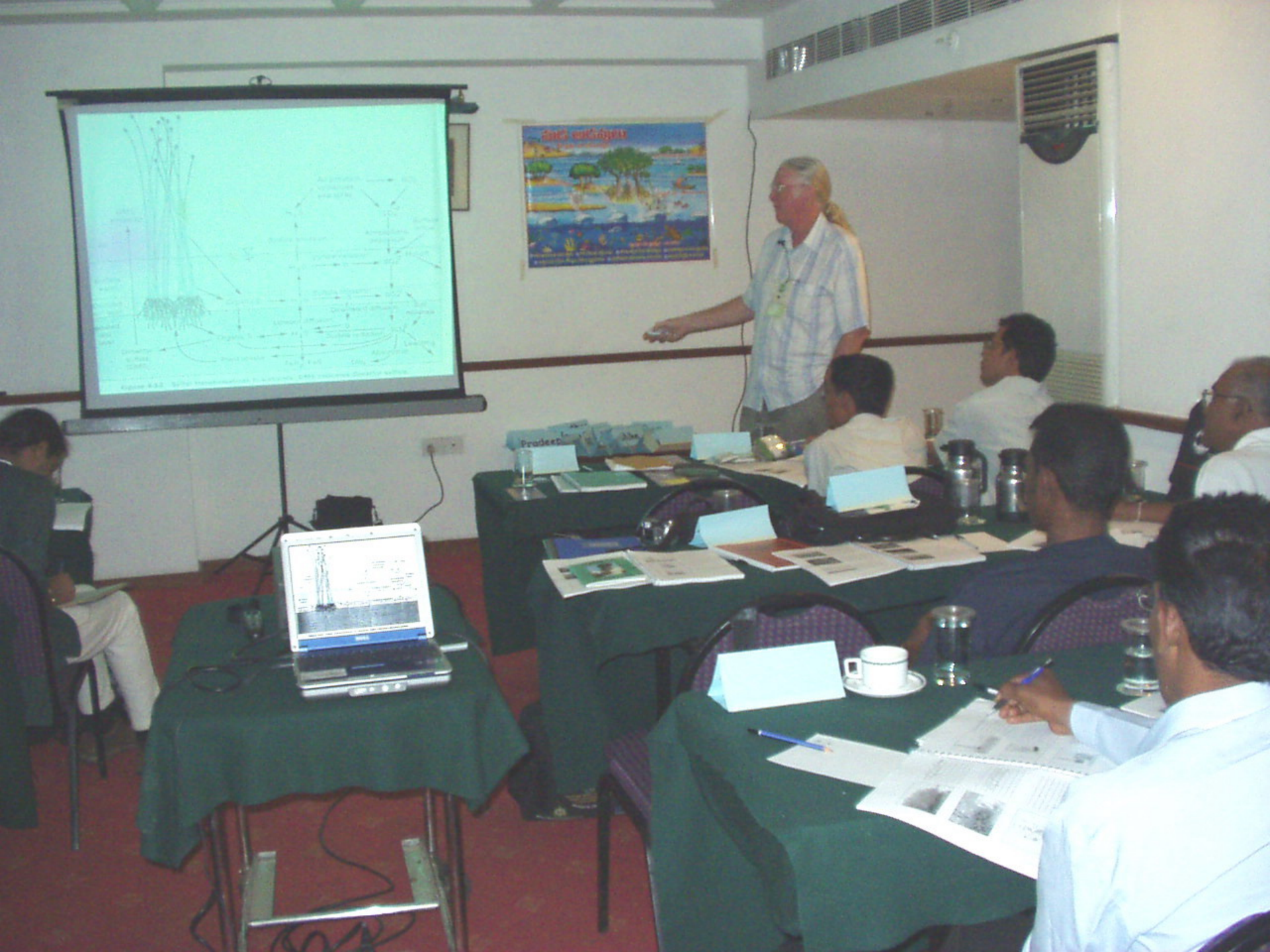
Rookery Bay Fruit Farm Creek USA Proposed Restoration Site – January 21, 2011

Area of Mangroves Worldwide



CURRENT RATE OF LOSS = 150,000 HA/YR



ALTERNATIVE APPROACHES TO MANGROVE RESTORATION

Ecological Mangrove Restoration (EMR) versus Planting Only

1. Understand Autecology and Community Ecology
2. Understand Normal Hydrology of Mangroves
3. Assess Modifications to Hydrology or Added Stress?
4. Select the Restoration Site
5. Restore or Create Normal Hydrology, or Remove Reduce Stress
6. Plant Mangroves Only As Needed

SUCCESS !

1. Build a Nursery, Grow Mangrove Seedlings and Plant Mangroves

(GARDENING)

FAILURE#!!***

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Mangrove Planting (Not Replanting)?

- **Application of the Principles of Ecological Mangrove Restoration Does Not Mean That Planting of Mangroves Has No Role in Restoration.**
- **But it Does Mean That Planting Should be Evaluated Carefully In Advance of Planting to Avoid Common Mistakes Like Planting at the Wrong Elevation, and the Principles of Plant Succession in a Given Area Applied**


This Site Was “Propagule Limited”
Sensu Lewis 2005


Hillsborough Bay, Tampa, FL, USA. Cargill Fertilizer, Inc., Bayside Shoreline, 1980


Hillsborough Bay, Tampa, FL, USA. Cargill Fertilizer, Inc., Bayside Shoreline, 1992


Hillsborough Bay, Tampa, FL, USA. Cargill Fertilizer, Inc., Bayside Shoreline, 2003

Mangrove Planting (Not Replanting)?

- **Application of the Principles of Ecological Mangrove Restoration Does Not Mean That Planting of Mangroves Has No Role in Restoration.**
- **But it Does Mean That Planting Should be Evaluated Carefully In Advance to Avoid Common Mistakes Like Planting at the Wrong Elevation, and Ignoring the Principles of Plant Succession in a Given Mangrove Area**

Mangrove replanting project a bust

Only 9 percent of seedlings placed around Naples Bay since 2000 have survived

By ERIC STAATS
emstaats@naplesnews.com

A pilot project to replant mangroves along Naples Bay has not had much more success than Mother Nature.

Crews from the Conservancy of Southwest Florida planted 1,114 red and white mangrove seedlings at various spots around Naples Bay in two planting cycles between 2000 and 2002.

Of those, only 95 red mangrove seedlings have survived, or about 9 percent, according to monitoring results reported in a December 2005 report to the U.S. Fish and Wildlife Service.

The Fish and Wildlife Service awarded the Conservancy a $25,000 grant in 2000 to conduct the pilot project.

The results illustrate the high hurdles scientists will have to jump to regrow mangroves as part of a larger effort to restore Naples Bay.

It will take more than a green thumb.

Conservancy researchers have estimated that Naples Bay has lost some 70 percent of its mangrove forest to development. Mangrove loss has dealt a significant blow to the bay's ecosystem.

Fish find meals and hide from predators among mangrove roots. The roots keep water clean by holding sediment. Migratory birds roost in mangrove branches. When mangrove leaves fall and rot, they become food for organisms at the base of the food chain.

A healthy mangrove forest can produce millions of floating seeds each year, and a small percentage of them find a place where they can grow on their own, said wetlands scientist and mangrove expert Roy "Robin" Lewis III, president of Lewis Environmental Services in Salt Springs, Fla.

If mangroves have not moved into an area, the problem could be with the site, not necessarily the planter, he said.

On Naples Bay, water along most seawalls is too deep for mangroves to grow, and riprap is placed at too steep an angle in many places.

The solution: Either don't plant mangroves where they won't grow or find ways to revamp the shoreline, Lewis said.

"It doesn't mean you can't correct it," Lewis said.

Restoration also will depend on quelling homeowners' fears that water views and mangroves are not mutually exclusive.

Homeowners volunteered to allow mangroves to be planted on the edge of their lots as part of the pilot project.

Besides inhospitable shoreline structure, boat wakes slamming the shoreline also contributed to mangrove seedlings' failure, according to the Conservancy report.

An unexpected freeze in late December 2000 took a toll on the first planting cycle, according to the report.

Vandalism or honest mistakes by ill-informed gardeners were other problems, according to the report. The report theorizes that misguided shoreline fishermen pulled out seedlings at Bayview Park.

"It's not an easy thing," said Brad Rieck, a Fish and Wildlife Service biologist in the agency's project planning division in Vero Beach.

"You just don't walk up and down the shoreline, plant propagules at the mean high water line, walk away and a couple years later have a nice stand of mangroves."

Although most of the seedlings didn't make it, crews did what they could to give them a leg up when they were planted.

Workers collected about 2,750 mangrove seeds and propagules and cultivated them in a nursery the Conservancy set up.

About 18 percent of the white mangrove seeds and 72 percent of the red mangrove propagules germinated and grew roots for replanting, according to the report.

Monitoring after the planting showed a survival rate of 19 percent for the first cycle and 71 percent in the second cycle, according to the report.

The report attributes the difference to more mature seedlings planted in the second cycle.

In both planting cycles, some of the mangroves were planted inside plastic tubes and the rest were planted directly into riprap.

In the second planting cycle, the root systems of half of the mangroves seedlings were wrapped in cheesecloth filled with soil and then wedged into riprap, packed with more soil and supported with bamboo stakes.

Unwrapped seedlings had a survival rate of 69 percent compared with an 81 percent survival rate of wrapped seedlings, according to the report.

Seedlings planted in riprap had a 56 percent survival rate compared with 36 percent surviving in plastic tubes along seawalls, according to the report.

By the end of the monitoring period in November 2005, though, the overall survival rate had dropped to 9 percent.

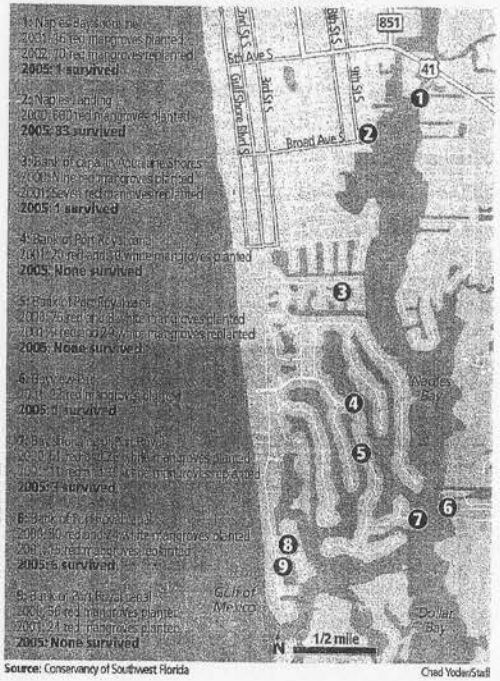
Conservancy biologist Kathy Worley said the results should not discourage future plantings, but the problems that kept mangroves from growing should be fixed first.

"We're not saying it can't be done; it can," she said.

■ Conservancy of Southwest Florida biologist Kathy Worley said the results should not discourage future plantings, but the problems that kept mangroves from growing should be fixed first.

Trouble with mangroves

Less than 10 percent of the mangrove seedlings the Conservancy of Southwest Florida planted along Naples Bay have survived, according to a Conservancy report. The report cites problems with vandalism, water depths and boat wakes. Some 70 percent of the bay's original mangroves have been destroyed by development.



Source: Conservancy of Southwest Florida

Chad Yoder/Staff

NAPLES DAILY NEWS
NAPLES
DAILY - 63,000
Jan 20, 2006

Figure 2. Some examples of the less successful mangrove enhancement initiatives in the Philippines, mainly planting *Rhizophora* at the seafronts: (a) under a prolonged period of immersion, *Rhizophora* seedlings planted at the lower intertidal zone may "drown," causing massive mortalities in Tayabas Bay (16, pers. obs.); (b and e) macroalgae and other debris may cause defoliation of the broad-leafed *Rhizophora*; (c and g) planting between pneumatophores (c) of *Sonneratia* and aided by bamboo stakes (g) did not prevent many *Rhizophora* seedlings from dying (g; i.e., <50 of the ~1000 seedlings planted survived; Agdangan, Quezon); (d and h) part of 10-ha mangrove plantation (carbon-sink) effort in which *Rhizophora* seedlings mostly (i.e., >95% of the seedlings within sampling plots) died after only about 9 months, apparently because of the mechanical stress of wave action and substrate erosion; and (f) seedling stems serving as substrates for oyster colonization.

From Sampson and Rollon 2008

20 Year Failed Effort To Restore Mangroves In The Philippines, USD$ 17.6 Million Spent for 44,000 Ha of Plantings

Figure 2. Some examples o ing *Rhizophora* at the seafronts: (a) under a prolo nay "drown," causing massive mortalities in Taya n of the broad-leafed *Rhizophora*; (c and g) planti vent many *Rhizophora* seedlings from dying (g; i.e., mangrove plantation (carbon-sink) effort in which *Rhizophora* seedlings mostly (i.e., >95% of the seedlings within sampling plots) died after only about 9 months, apparently because of the mechanical stress of wave action and substrate erosion; and (f) seedling stems serving as substrates for oyster colonization.

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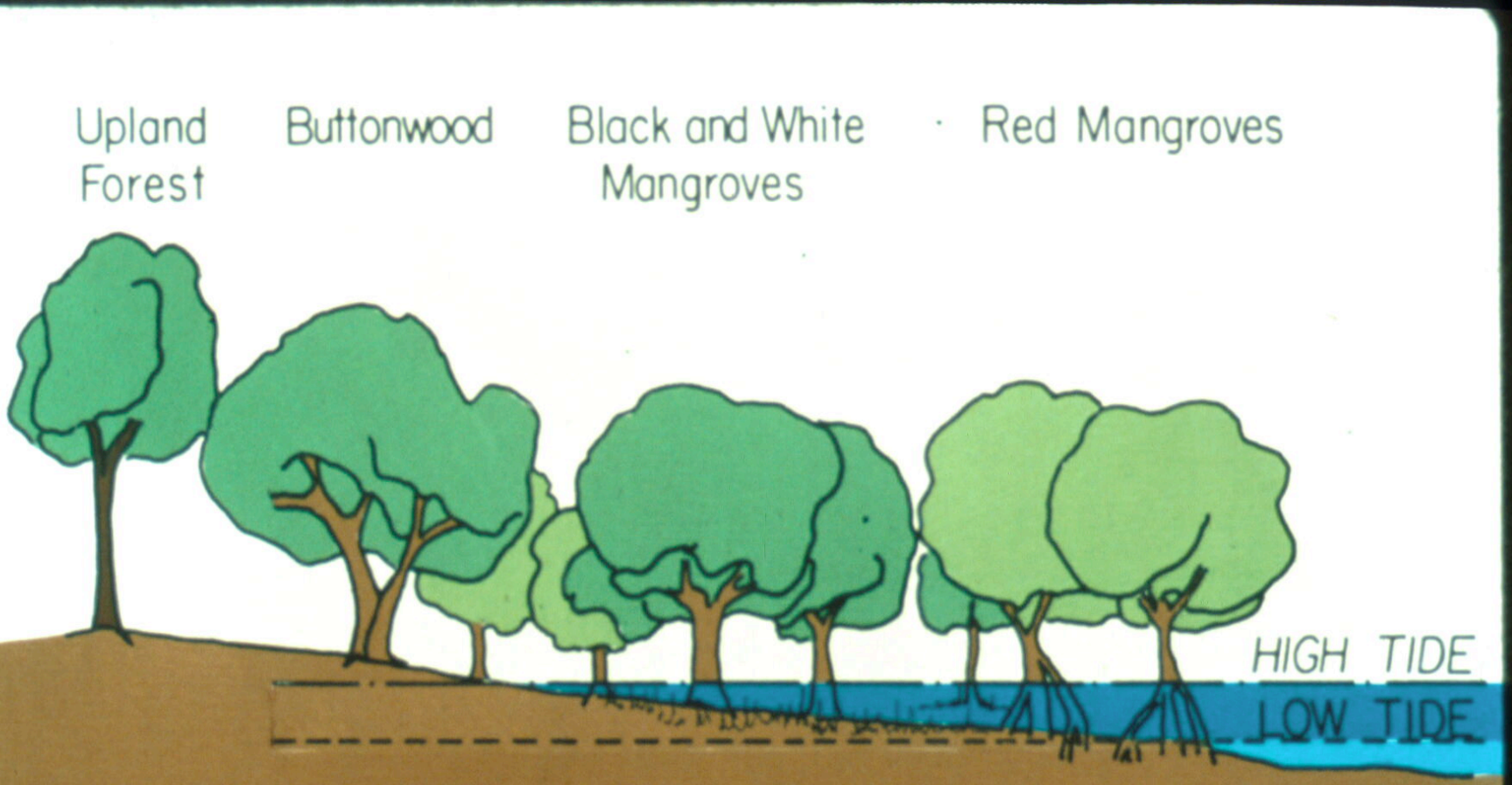

PLANT ZONATION – LOW ENERGY BAY SHORELINE

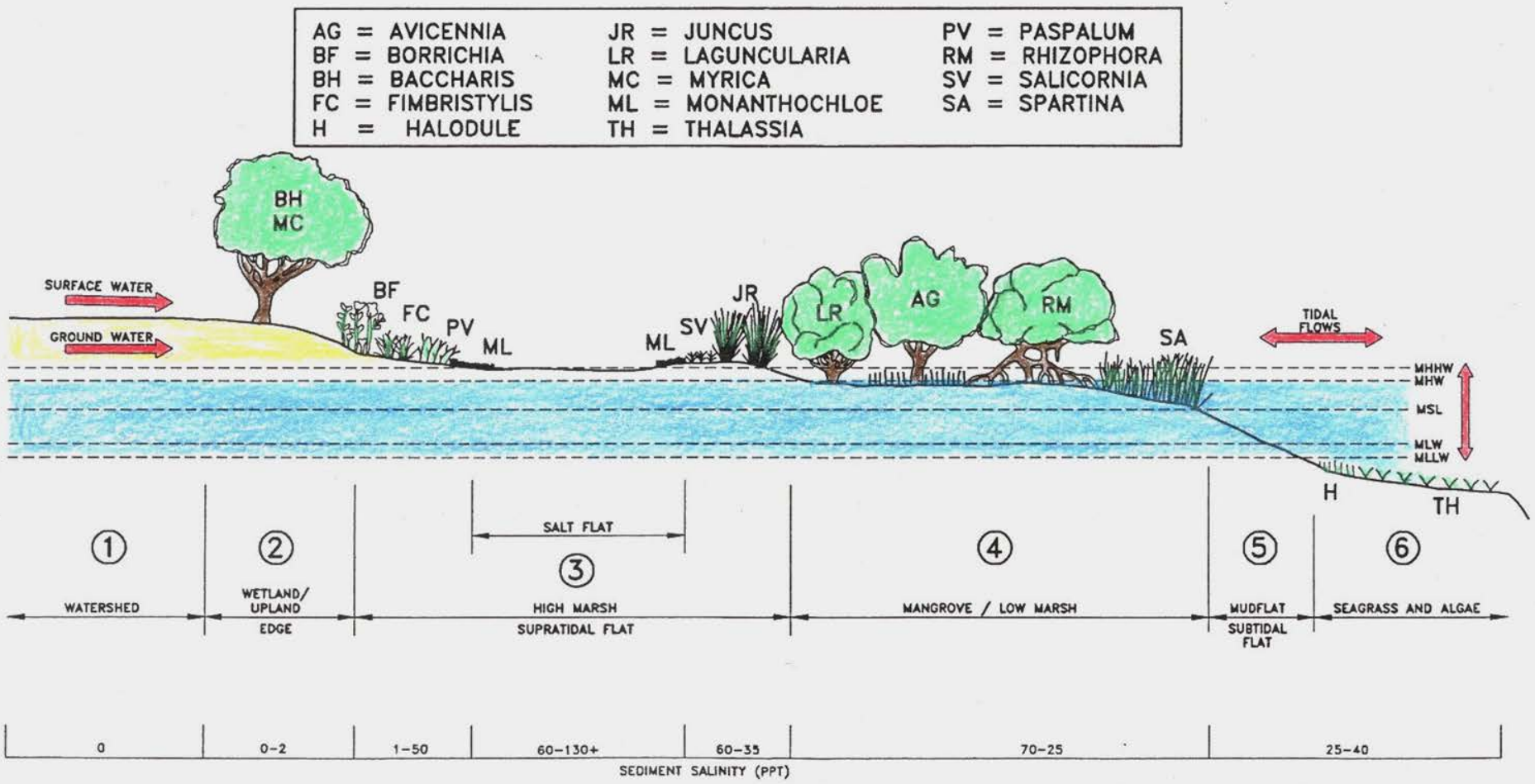

Figure 1. Schematic diagram of the six components of the tropical coastal shelf ecosystem (modified from Crewz and Lewis 1991).


West Lake Mangrove Restoration Project, Ft. Lauderdale, FL, USA, 500 ha of hydrologic and major excavation methods of restoration, cost USD$6 million (1990 costs) and the design and development of the $1 million Anne Kolb Mangrove Park and Environmental Education Center

80 ha of Excavation of Dredged Material Deposits (Spoil) to Restore Mangroves, 420 ha of Hydrologic Restoration Through Channel Restoration


1989

Time Zero – July 1989


Time Zero + 27 Months


Time Zero + 78 months- January 1996

March 5, 1997 (Time Zero + 128 months or 10.7 years)

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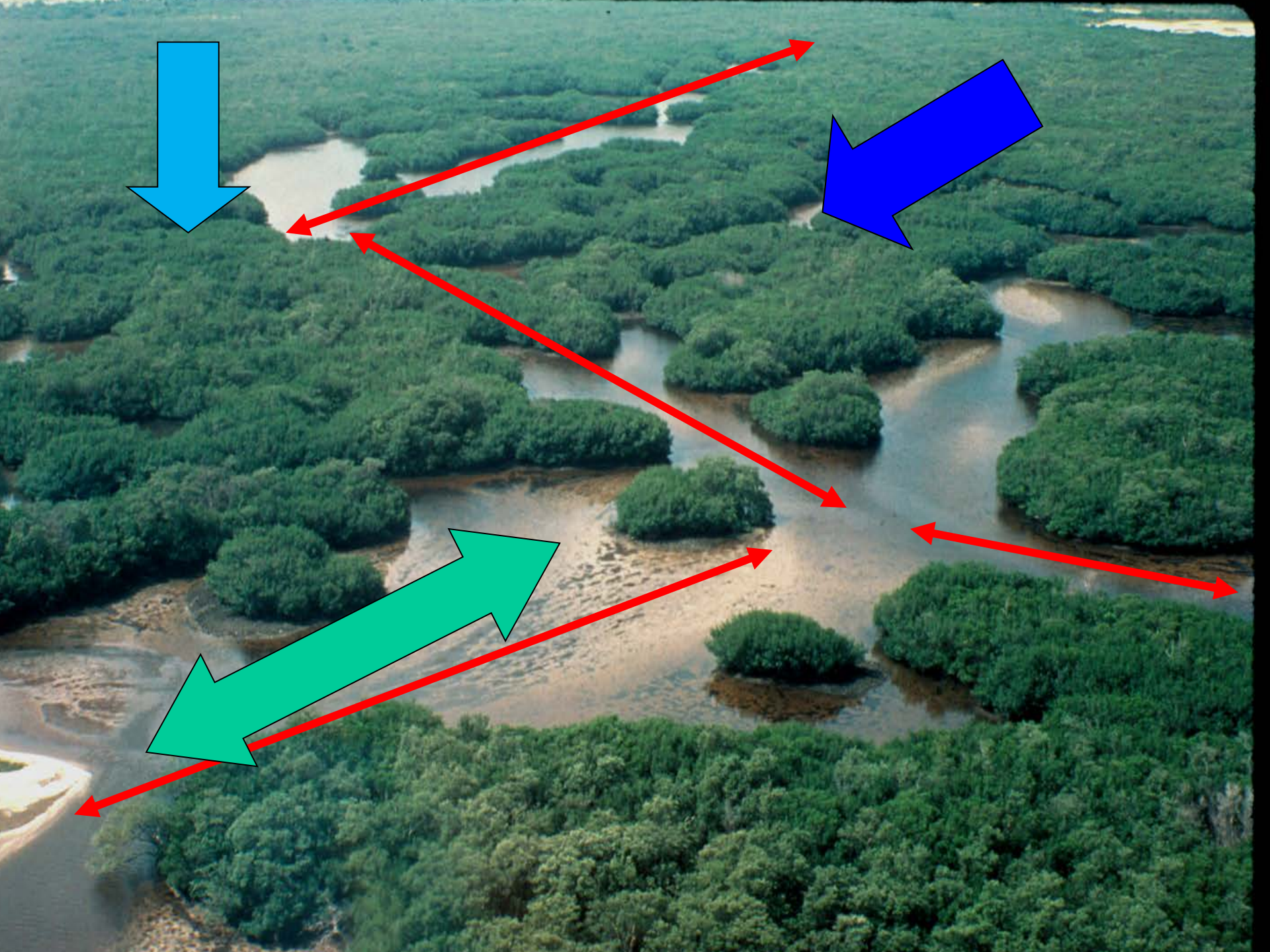
ECOHYDROLOGY



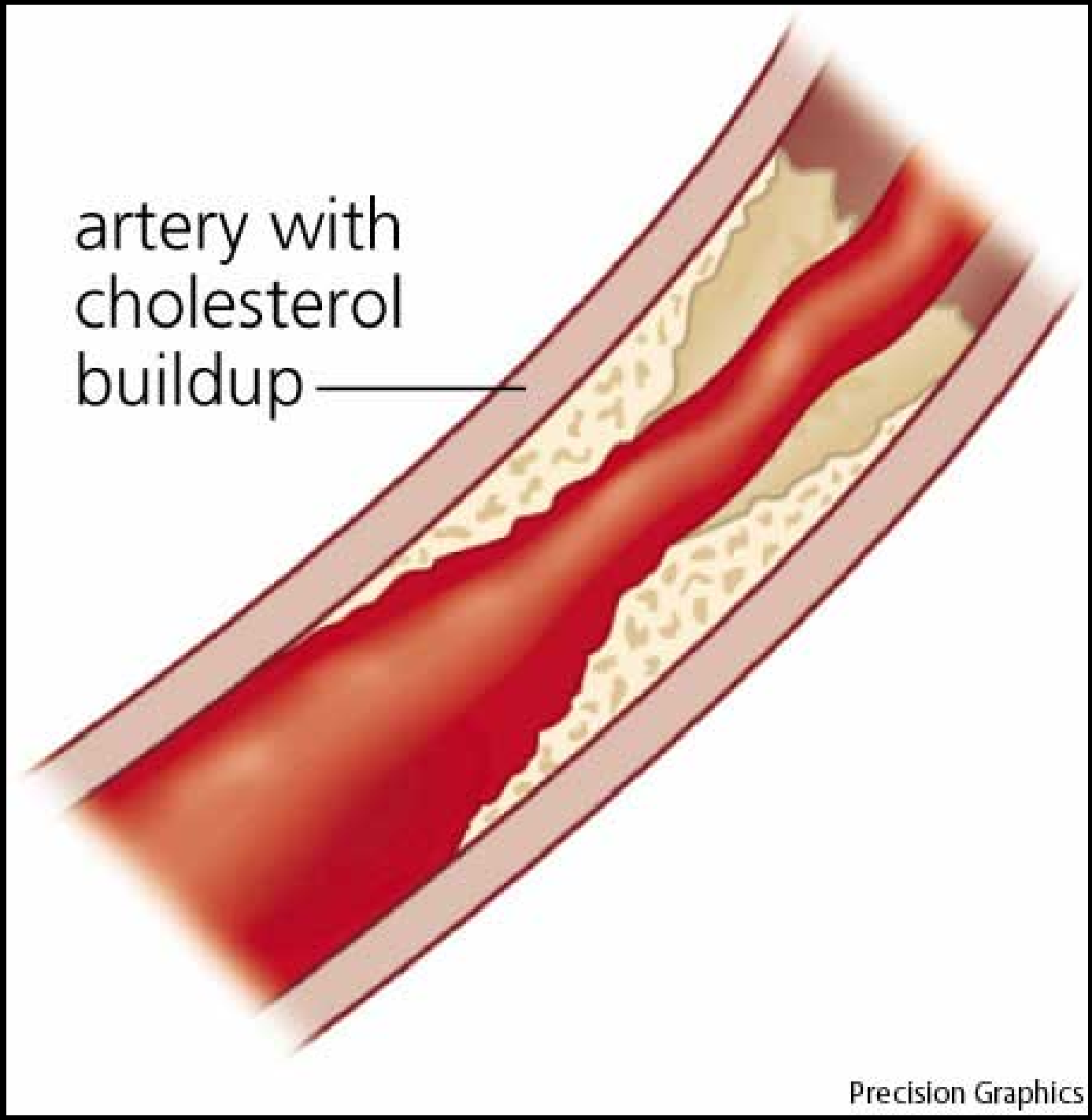
Duration of Flooding as a % of the Tide Cycle?

View of the same part of an inner forest at high tide (*top*) and at low tide (*below*). It is assumed that both regular tidal fluctuations and extraordinary flooding events are vital for mangrove habitats as they wash out or dilute excessive salts, organic debris and toxic substances in the upper soil surface. If inundations are absent for long periods the soil gradually dries out. Then the mangrove area may be colonised by other halophytes that find the conditions favourable.

Duration of Drying as a % of the Tide Cycle?

10 AUG 94

10 AUG 94


artery with
cholesterol
buildup
Precision Graphics

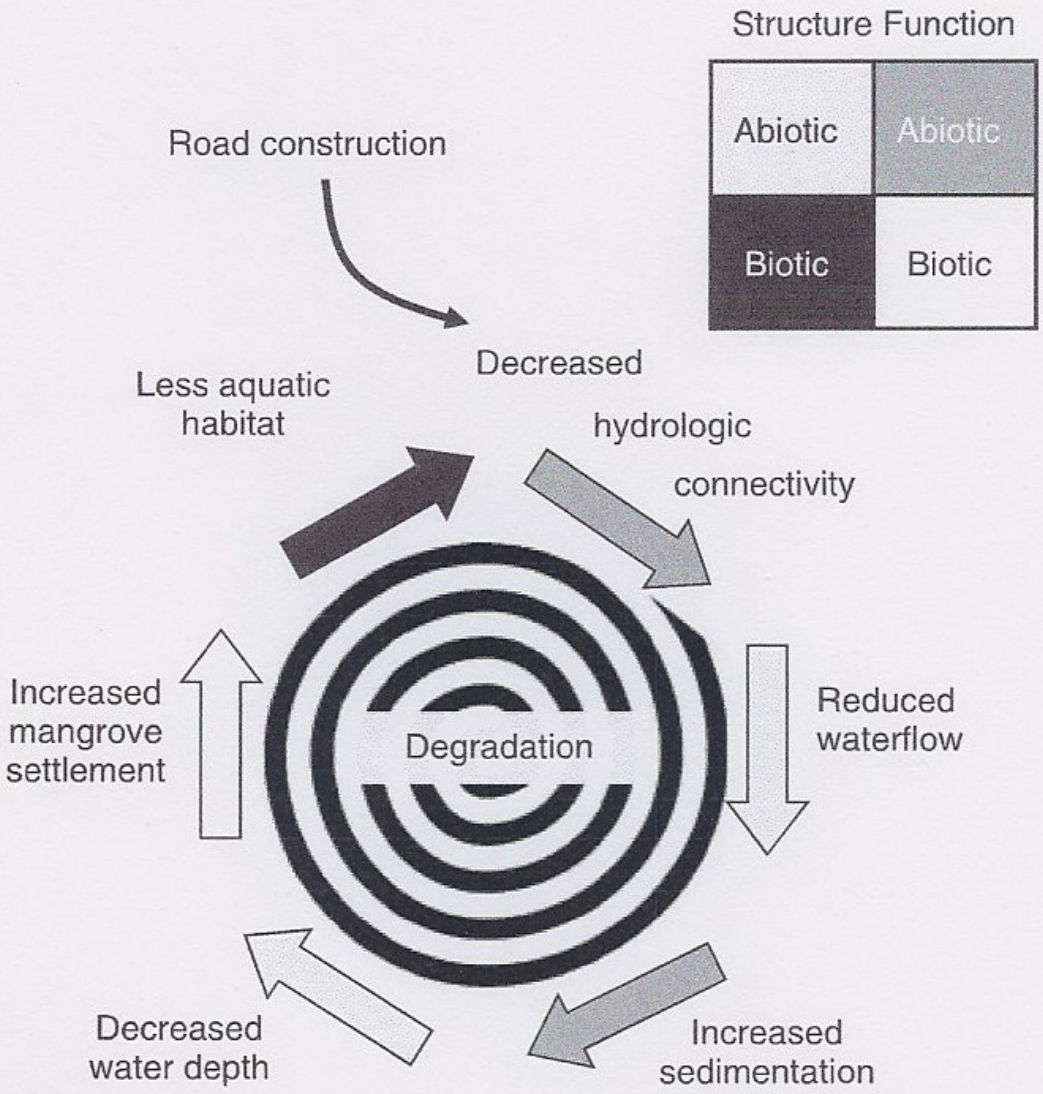


Figure 1. Conceptual model, modified from King and Hobbs (2006) and Whisenant (1999, 2002), demonstrating the degradation feedback cycle following anthropogenic fragmentation of tidal creeks. The shading of the arrows represents the category of the effect following the box in the upper right hand corner.

From Valentine-Rose and Lyman 2011

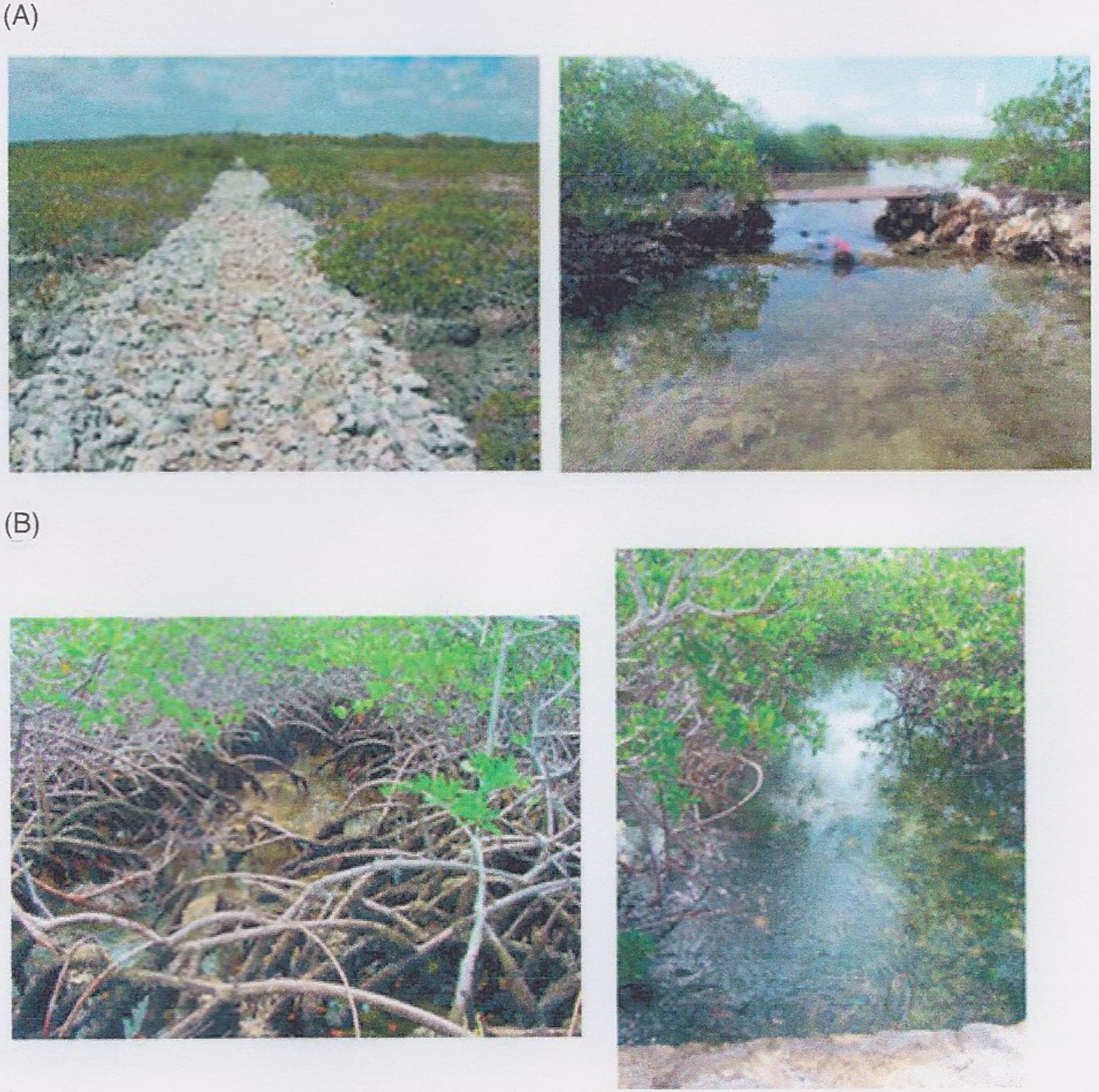


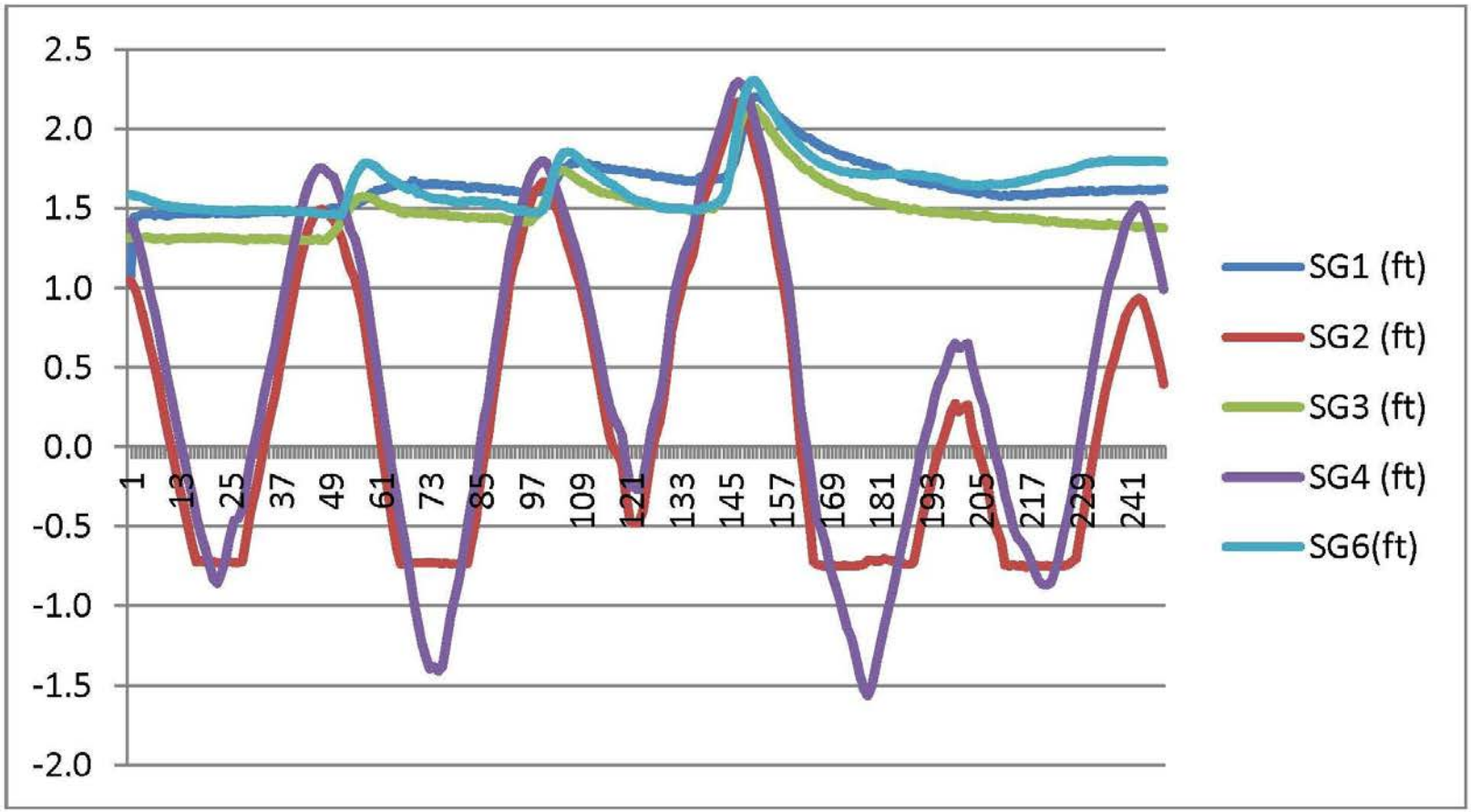
Figure 2. Pre- and post-restoration in (A) MOW and (B) CS.

From Valentine-Rose and Lyman 2011

Rookery Bay Fruit Farm Creek Proposed Restoration Site – January 21, 2011


HOBO Water Level Logger (1" X 6 ")– Titanium - $745 + shuttle and base station $400 = $1145 - www.onsetcomp.com
HOBO
Water Level Logger–Titanium
onset

TIDE (FT NAVD 88) vs TIME (HOURS)



Cross Bayou, Pinellas County, Florida, USA, October 7, 2003

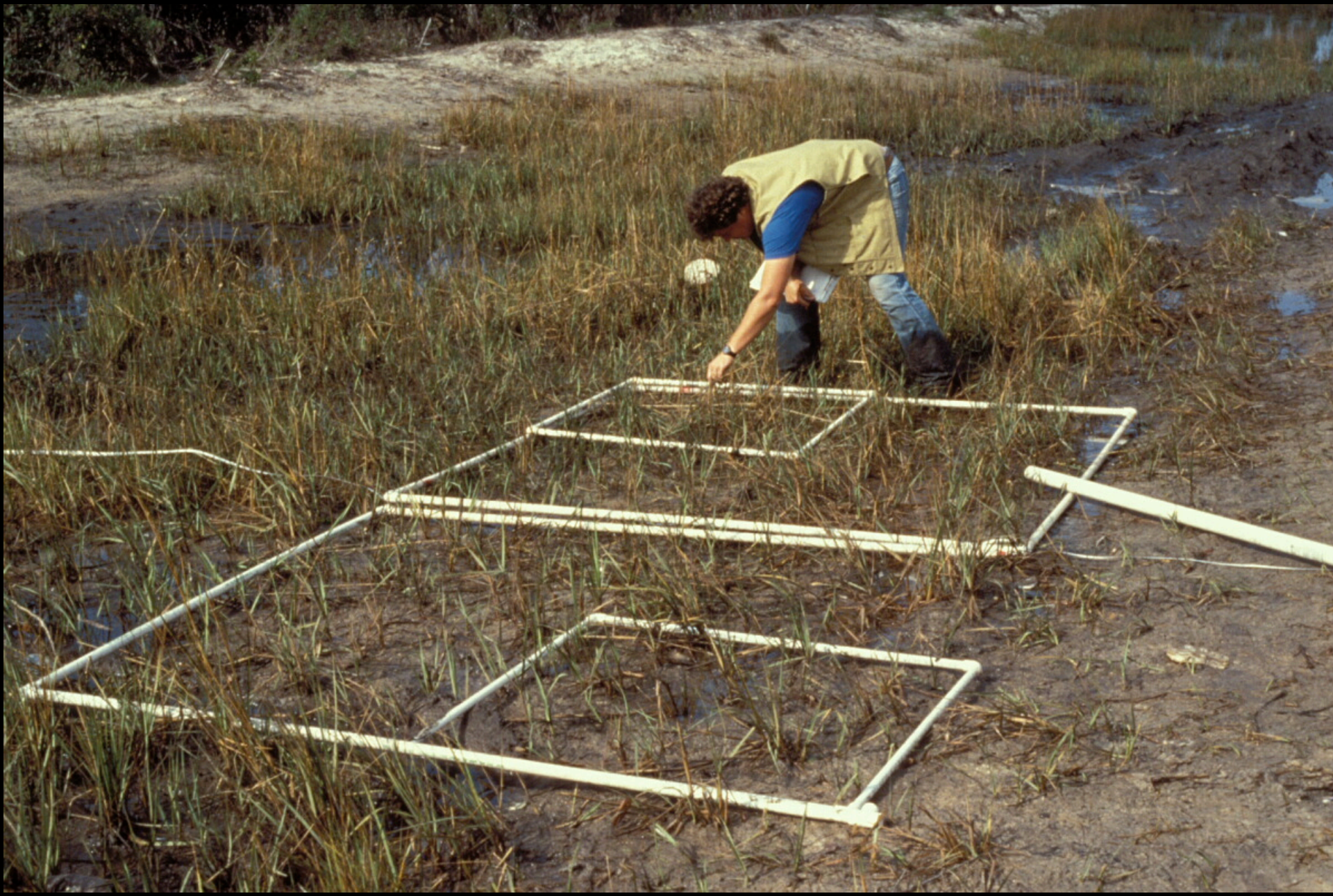
Cross Bayou Site June 9, 1999 Under Construction

Cross Bayou Site September 4, 1999 Time Zero

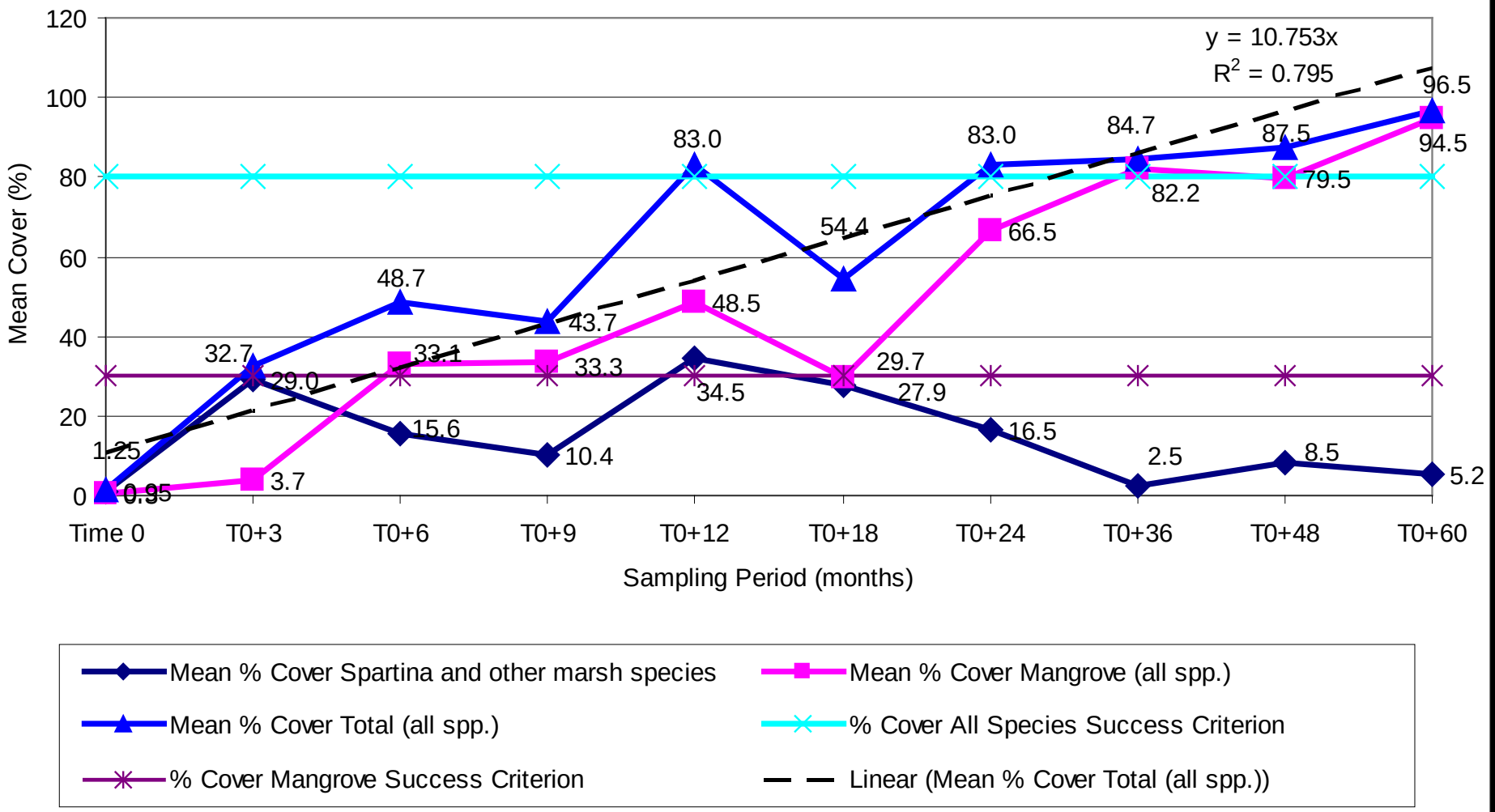
Cross Bayou Site October 1, 2000 Time Zero Plus 13 Months

Cross Bayou September 3, 2002 Time Zero Plus 36 Months


Cross Bayou Site October 1, 2004
Time Zero Plus 60 Months



Mean % Cover – All Species



From Lewis et al 2005