

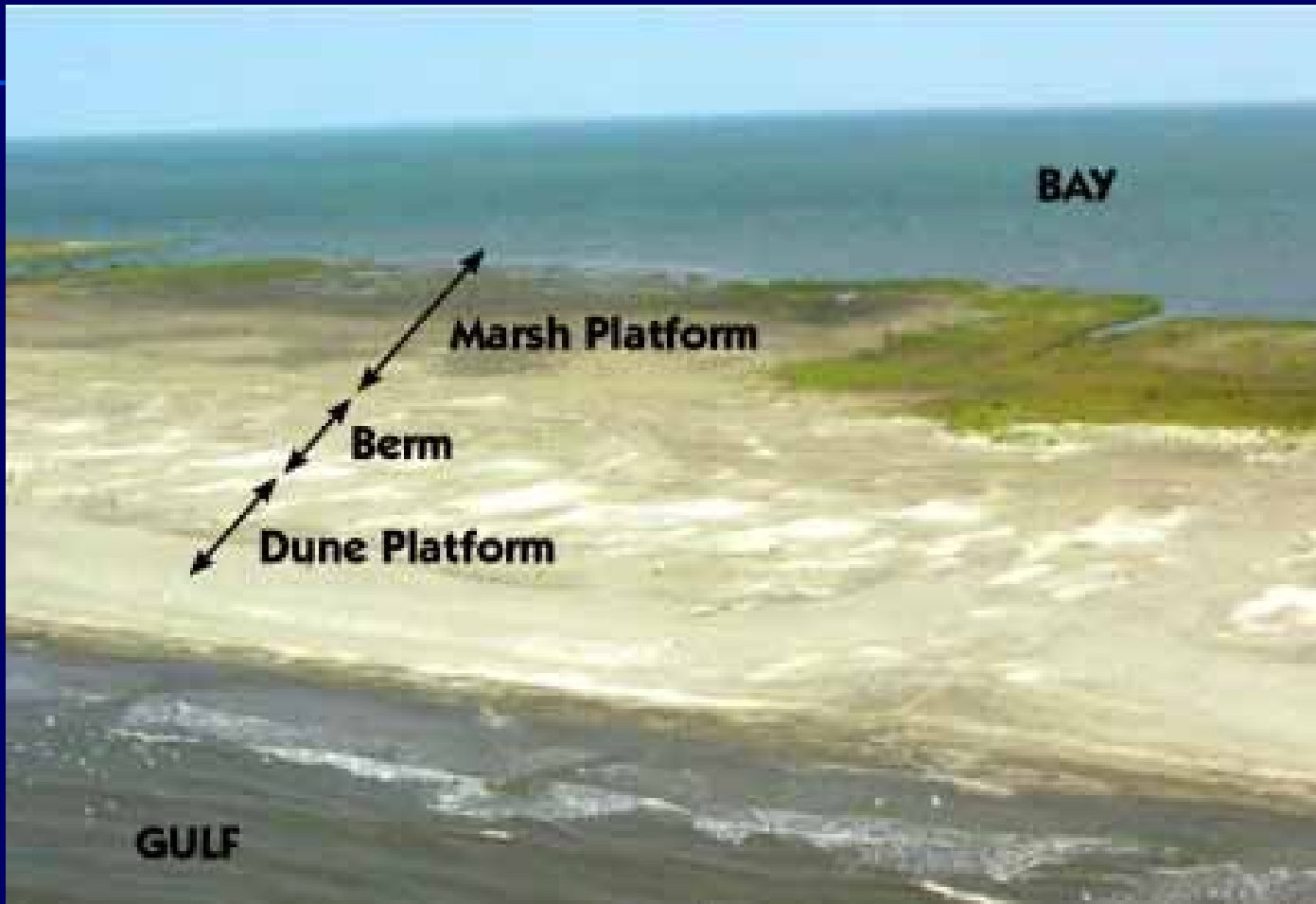
**Restoration Enhancement
of Black Mangrove Establishment in Barrier
Island/Headland Project Design:
Determination of Differential Tolerance
Thresholds of Propagules and Seedlings**

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Source: Lacoast.gov

Avicennia germinans (black mangrove)



If I were a black mangrove, where would I like to live?



OR



PROPAGULES



SEEDLINGS

?

Contract Deliverables

- Propagule production on a per-area-mangrove basis
 - Years of hurricane disturbance and low disturbance years
- Differential physiological tolerances of newly established propagules and different-aged seedlings to:
 - Salinity
 - Sand burial
 - Fluctuating water-tables

Propagule Production Cycles



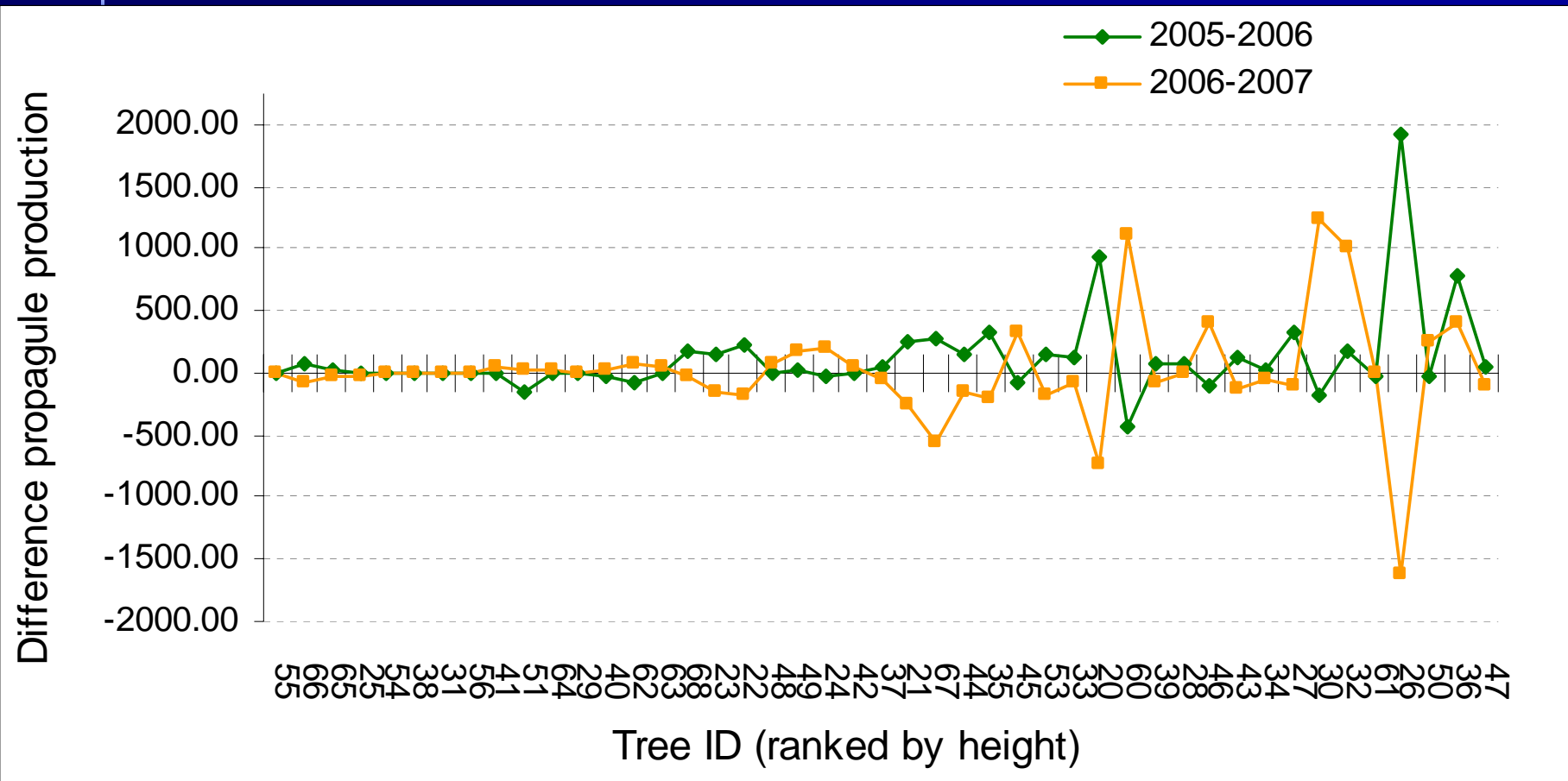
Propagule Production Cycles

- **Major Findings**

- Greatest propagule production in 2006
- Height and area of mangroves increased the most in 2007
- Tradeoffs between growth and reproduction at the population level

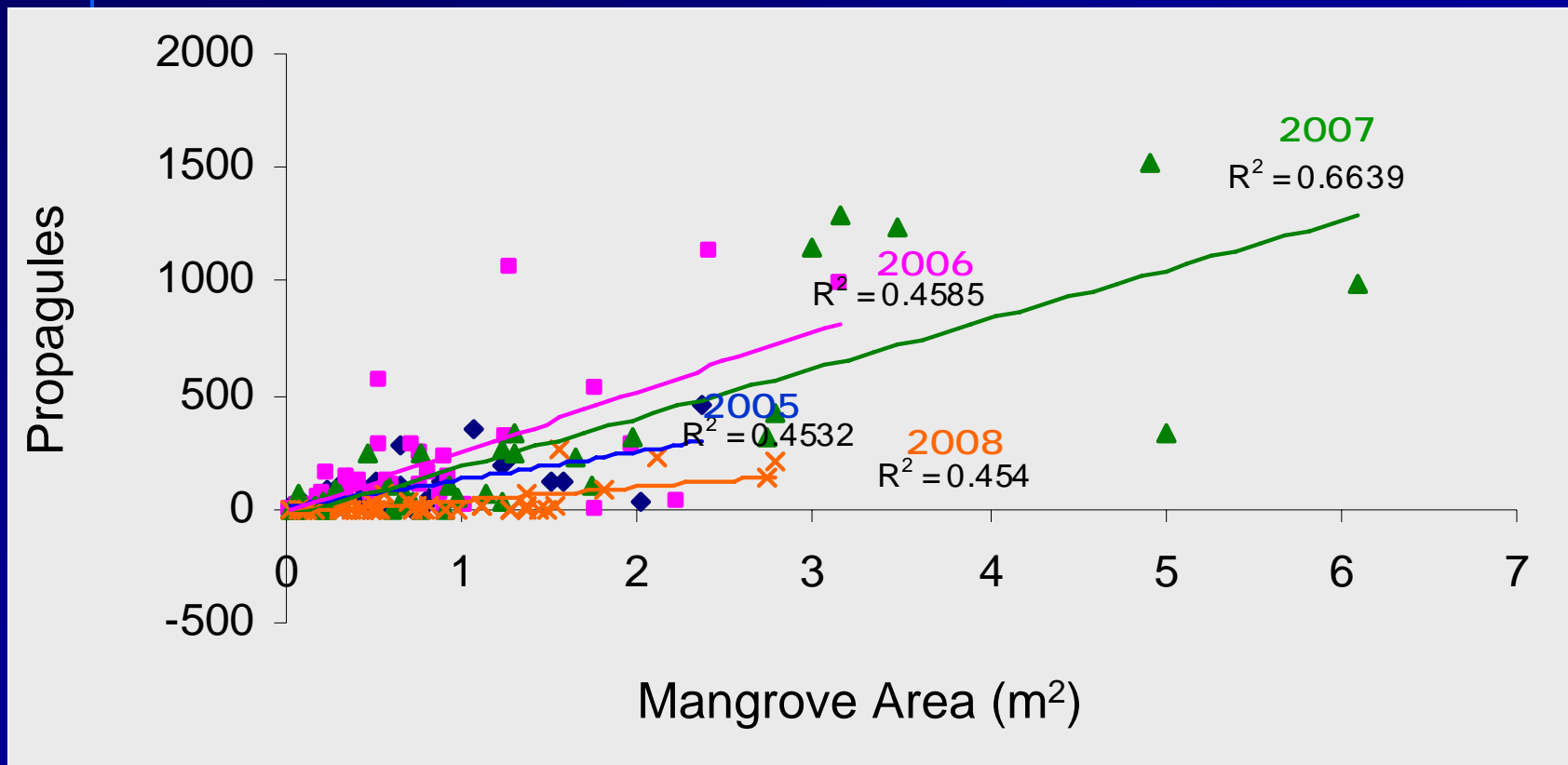
Propagule Production Cycles

Tradeoffs at the level of the individual between consecutive years.



Propagule Production Cycles

Reproductive potential (per-area mangrove habitat)



Salinity

- 2 age classes
 - 12 and 24-month old seedlings
- 5 salinity levels
 - 0, 24, 48, 72, 96 ppt

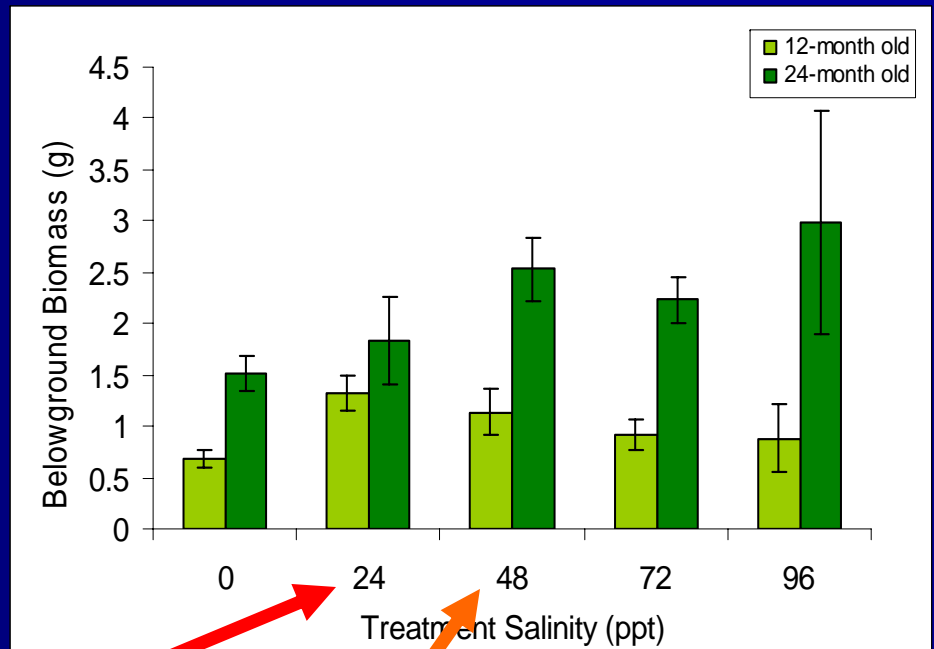
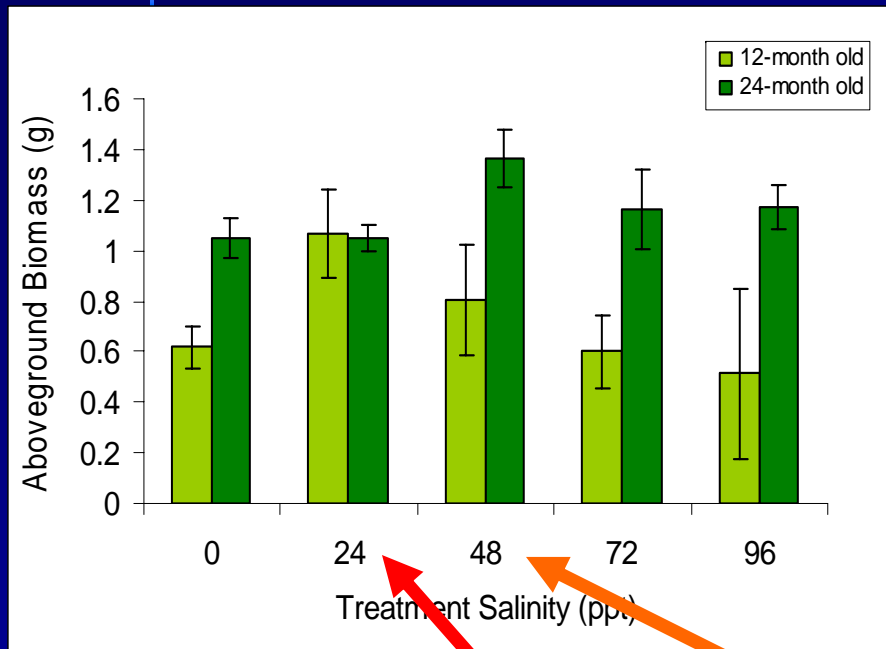


Salinity

■ Major findings

- 24-month old seedlings had a higher salinity tolerance (48 ppt v. 24 ppt)
- 72 ppt = leaf abscission; 96 ppt = lethal
- Both age classes very tolerant of salt, and as such may be suitable for some high marsh planting sites

Salinity



12-month olds

24-month olds

Sand Burial

- 2 age classes
 - 6 and 18-month old seedlings
- 5 burial depths
 - 0, 5, 10, 15, 20 cm



Sand Burial

■ Major Findings

- Seedlings survived whenever photosynthetically active tissue was exposed
- Initial height of seedlings important in this context, so older seedlings may be better...

Post-Hurricane Gustav Sand Burial

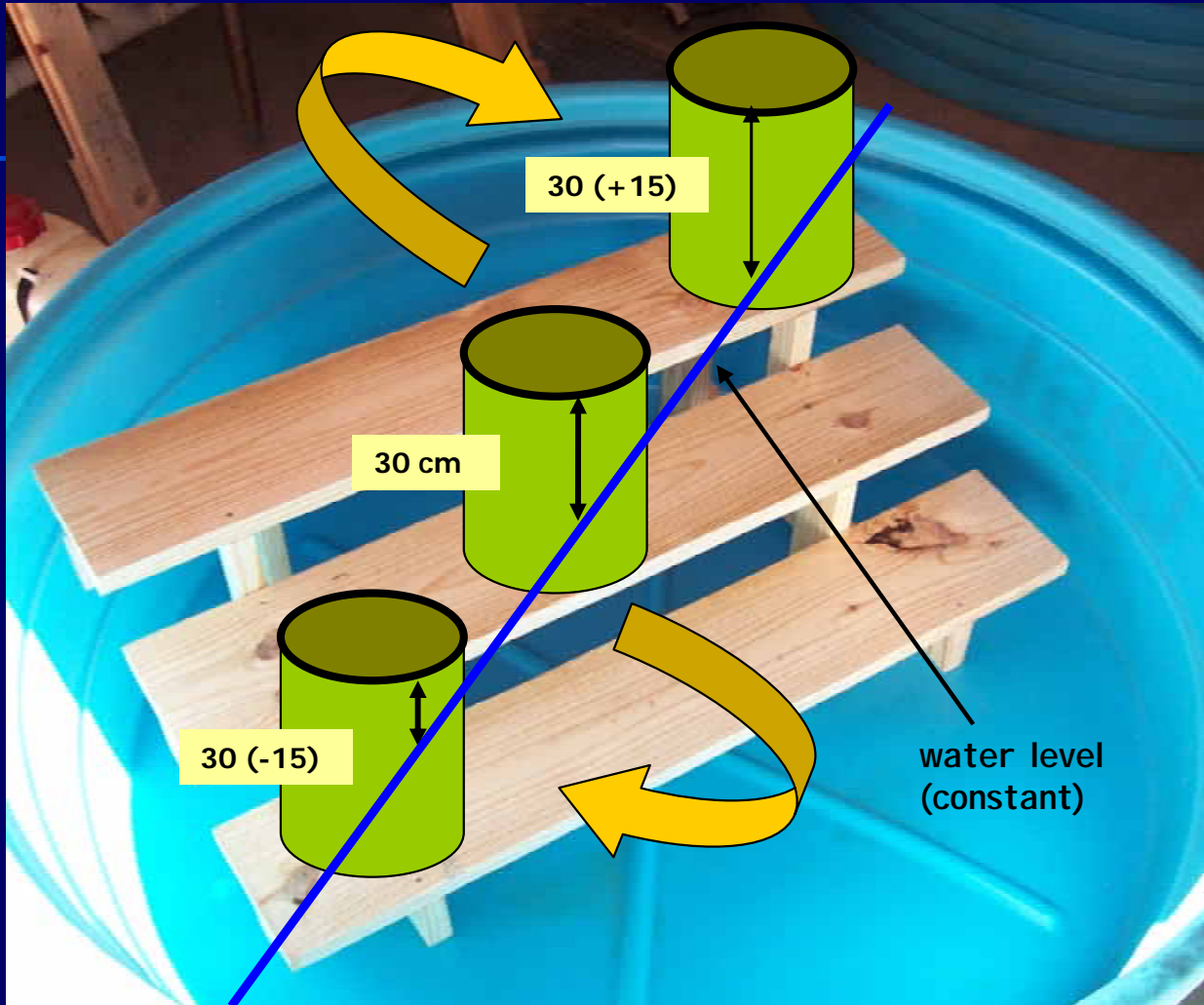




Fluctuating Water-Tables

- 2 age classes
 - 6-month and 18-month olds
- 5 water-table depths
 - -0, -15, -30, -45, -60 cm
- 3 water-table regimes
 - Fluctuating biweekly, fluctuating bimonthly, static





Fluctuating Water Tables

■ Major Findings

- Water-table fluctuations had no significant effect
- Water-table depth
 - -30 cm is optimal for 6-month olds; 10-20% moisture
 - -15 to -30 cm is optimal for 18-month olds; 17-24% and 10-20% moisture

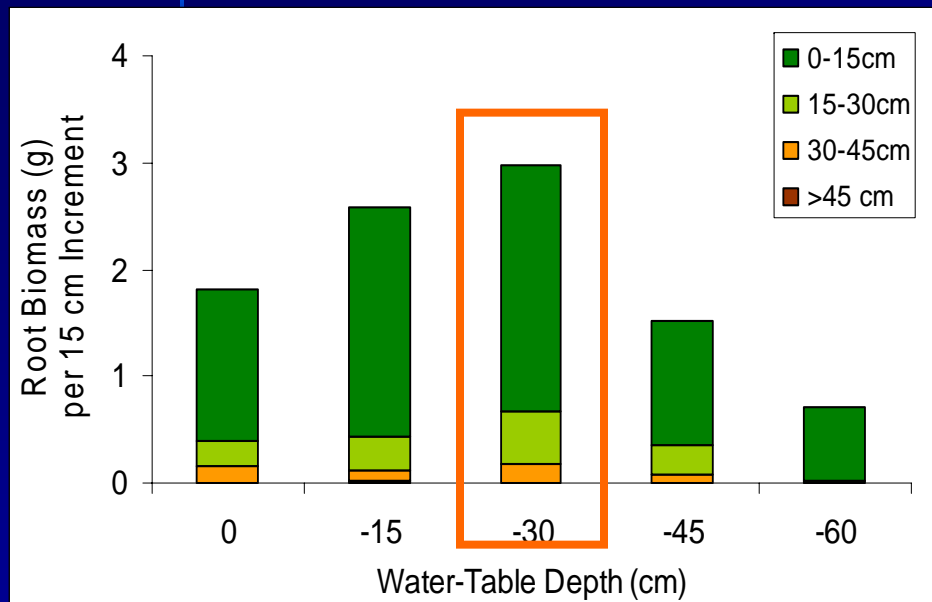
Fluctuating Water-Tables

Harvesting Biomass

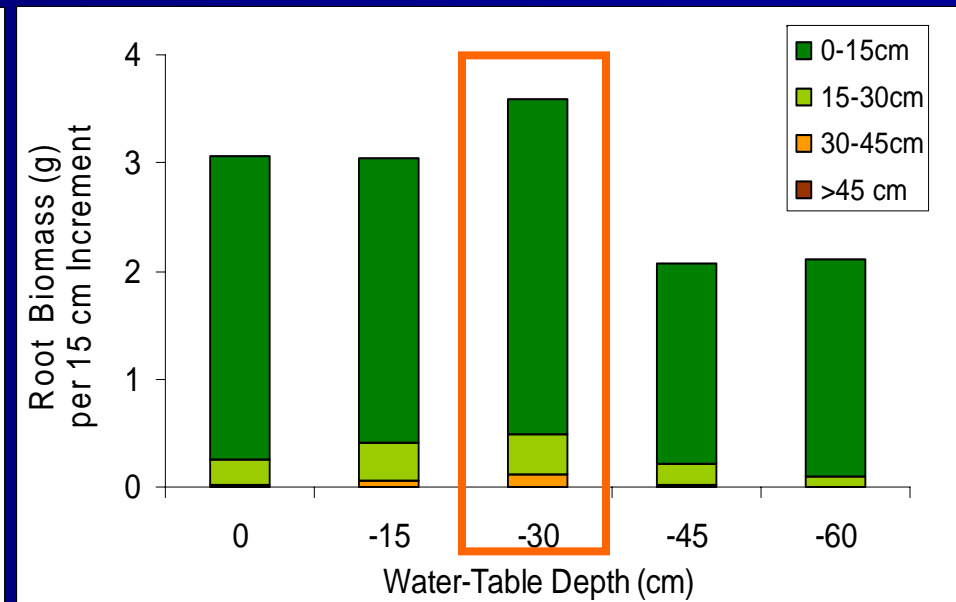


Fluctuating Water Table

Incremental Root Biomass



6-month old seedlings



18-month old seedlings

Fluctuating Water-Table

Leaf Characteristics



6-month old, -30 cm, static



18-month old, -30 cm, static



6-month old, -60 cm, static



18-month old, -60 cm, static

Implications for Management

- How many propagules does the average mangrove produce in a year?
 - Depends.
 - Propagule production is correlated with tree size.
 - In years of major disturbance, propagule production is low.
 - Average across all years = **131-252** propagules per square meter of mangrove canopy.

Implications for Management

- What are the physiological tolerances of newly established propagules and seedlings?
 - **Salinity**
 - 24 ppt optimal for 12-month olds
 - 48 ppt optimal for 24-month olds
 - **Sand Burial**
 - Depends on initial height
 - **Water-Table Depth**
 - Water-table depth of -30 cm is optimal for 6-month olds
 - Water-table depth of -15 to -30 cm is optimal for 18-month olds
 - Water-table depths greater than -30 cm result in desiccation stress

Implications for Management

- Which is better – newly established propagules (6-month olds) or seedlings (18 to 24-month olds)?
 - Depends.
 - Younger seedlings have similar physiological tolerances to salinity and water-table depth.
 - Older seedlings have greater biomass overall, and may be able to withstand greater physical disturbances or environmental stochasticity.

Questions?

