Forest Metrics of Four Atlantic White Cedar Swamp Sites Managed in the National Wildlife Refuge System

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Objectives

Primary objective – to support EPA STAR Grant (R825799), Atlantic White Cedar (AWC) Swamp Restoration: Monitoring Ecosystem Services & Self-Maintenance

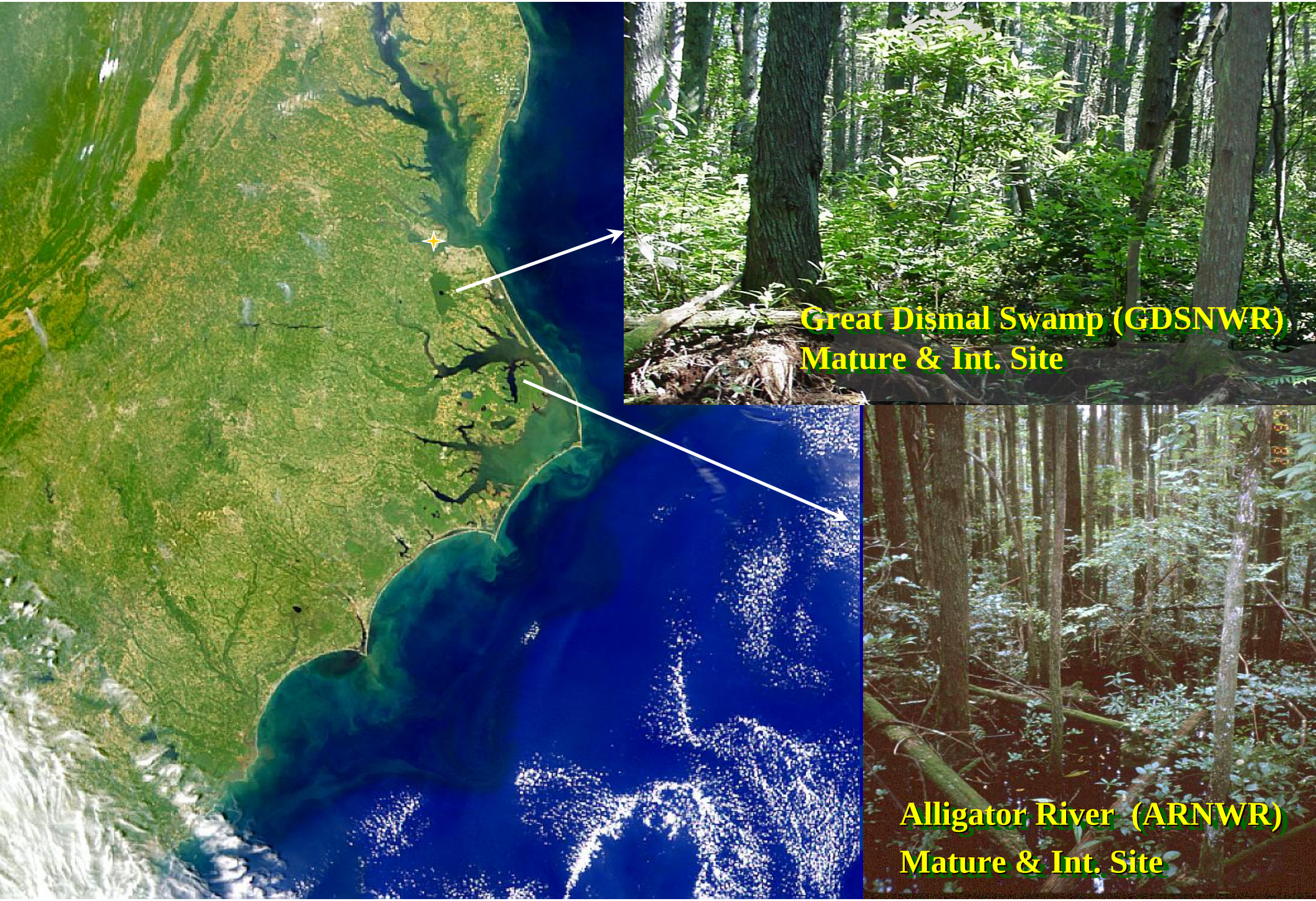
- Provide a basis for process studies and comparison with other natural communities
- Aboveground biomass - input for a carbon model
- Provide baseline information to assist in setting restoration goals

Introduction

- Once common, *Chamaecyparis thyoides* distribution has been reduced by ~ 98% across its range
- Appropriate management of this resource requires ecosystem-level information
- Ecosystem services lost may include water quality, lumber resources as well as floral / faunal biodiversity

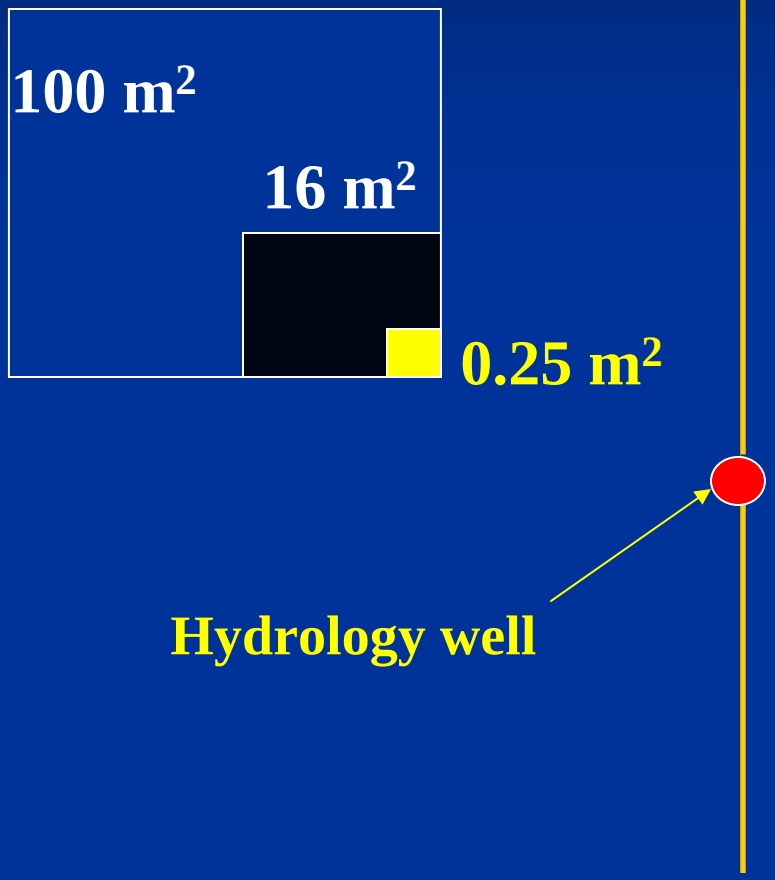
General Methods

- **Site selection:** forest maps, canopy dominance, diameter at breast height (dbh), tree cores, site access for research
- **Plot-based sampling:** ABVGD biomass and structural attributes were measured in plots in close proximity to hydrology wells
- **Structural attributes measured:**
  - Tree stratum- species ID, dbh, density, age (increment borer), basal area, aboveground biomass, canopy closure, canopy height
  - Shrub stratum- species ID, density, aboveground biomass
  - Herb stratum- species ID, aboveground biomass (standing crop)


Great Dismal Swamp (GDSNWR)
Mature & Int. Site
Alligator River (ARNWR)
Mature & Int. Site

Methods: Vegetation Plots

Nested plot design

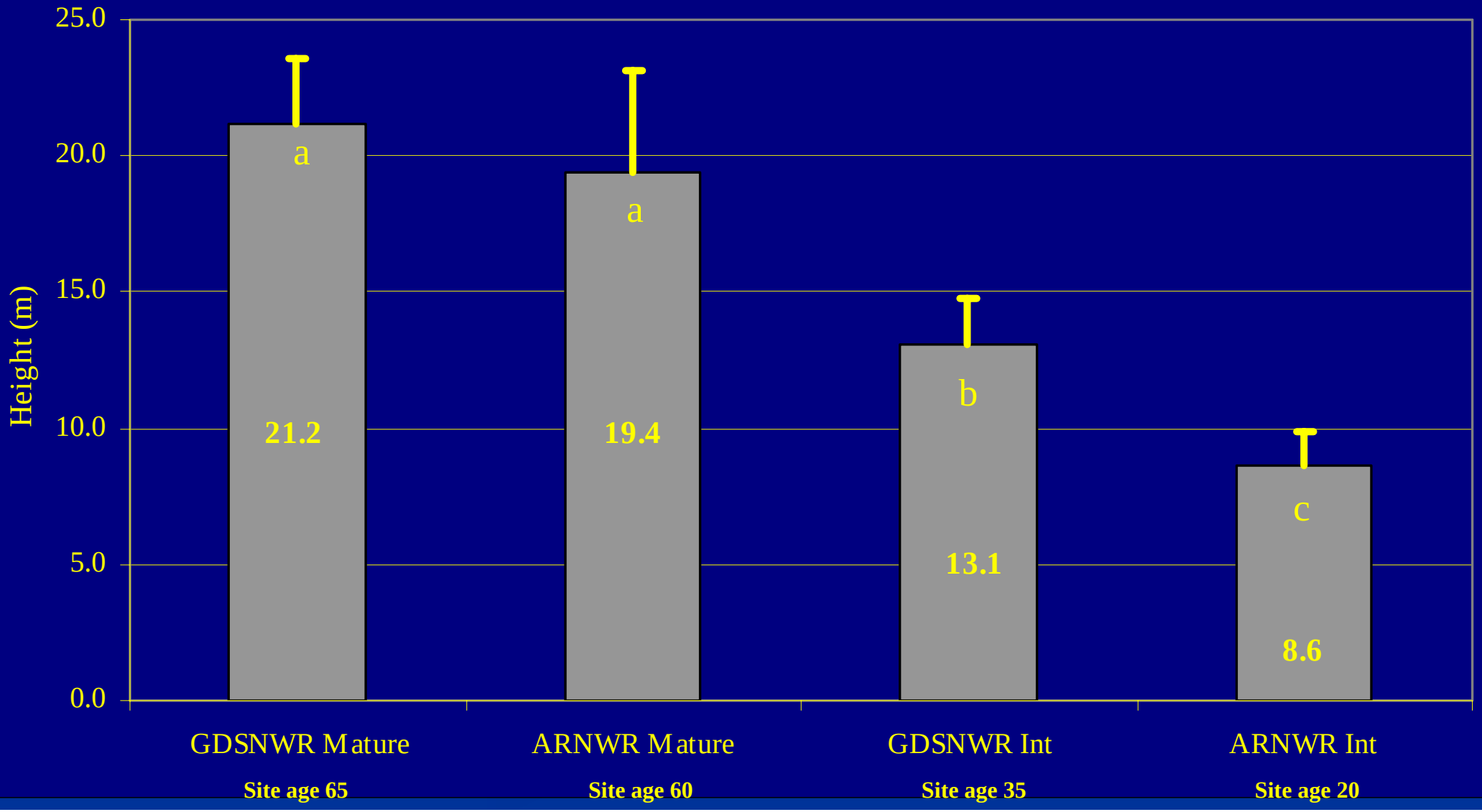


- Growing season of 1999
- 18 plots/site
- Nested plots for
  - Trees
  - Shrub &
  - Herb strata
- Species ID, density, dbh, basal area
- Height – inclinometer methods
- Canopy closure – convex hand-held spherical densiomter methods
- Aboveground Biomass Tree & Shrub – calculated using regression equations (Dabel and Day 1977).

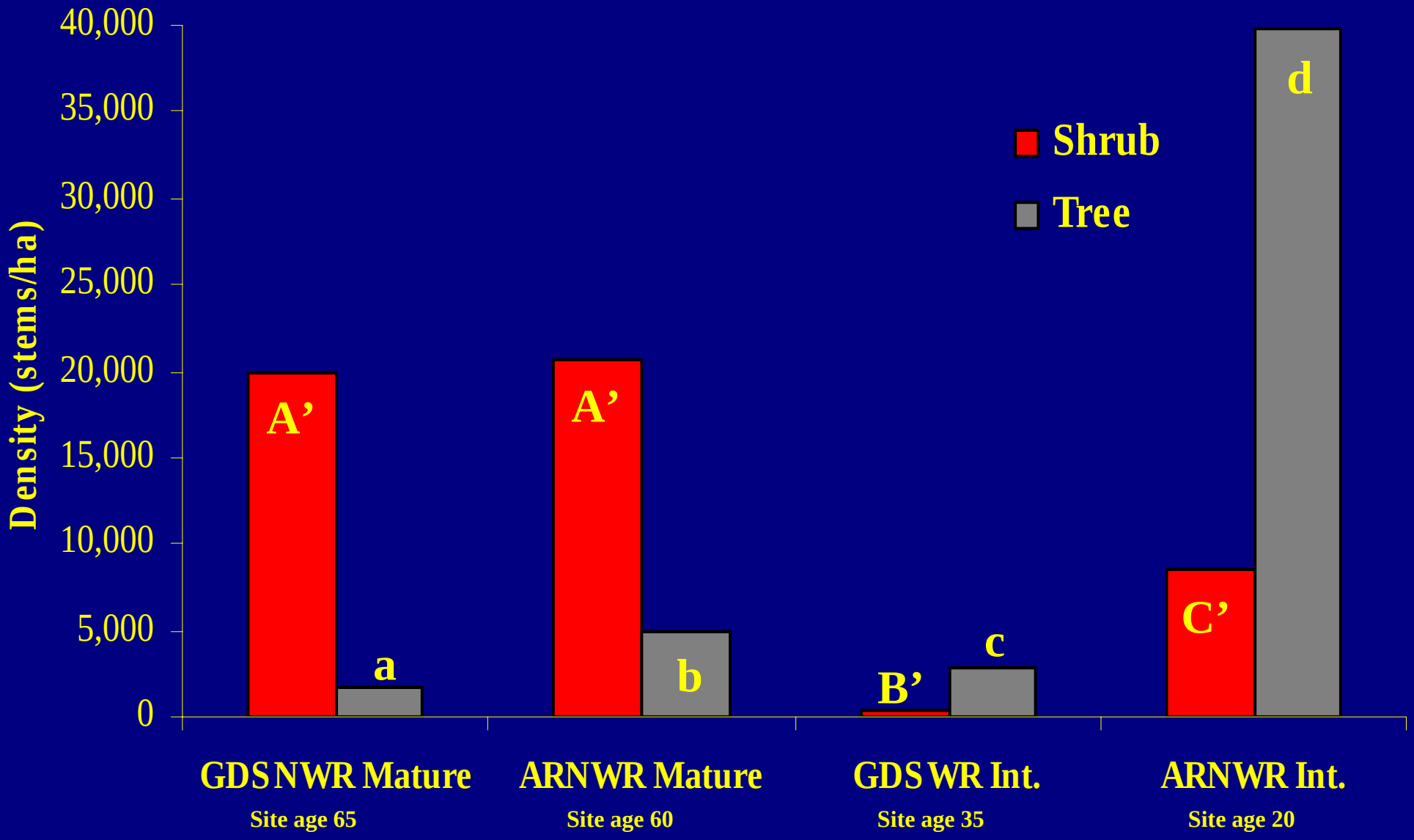
Methods: Hydrology

- 9 hydrologic wells/site
- RDS (1/site): twice daily
- Hand read (8/site): read upon each field visit.
- Well screen installed ~1m in soil with a 1m riser
- Measured elevations in each vegetation plot relative to nearest hydrology well

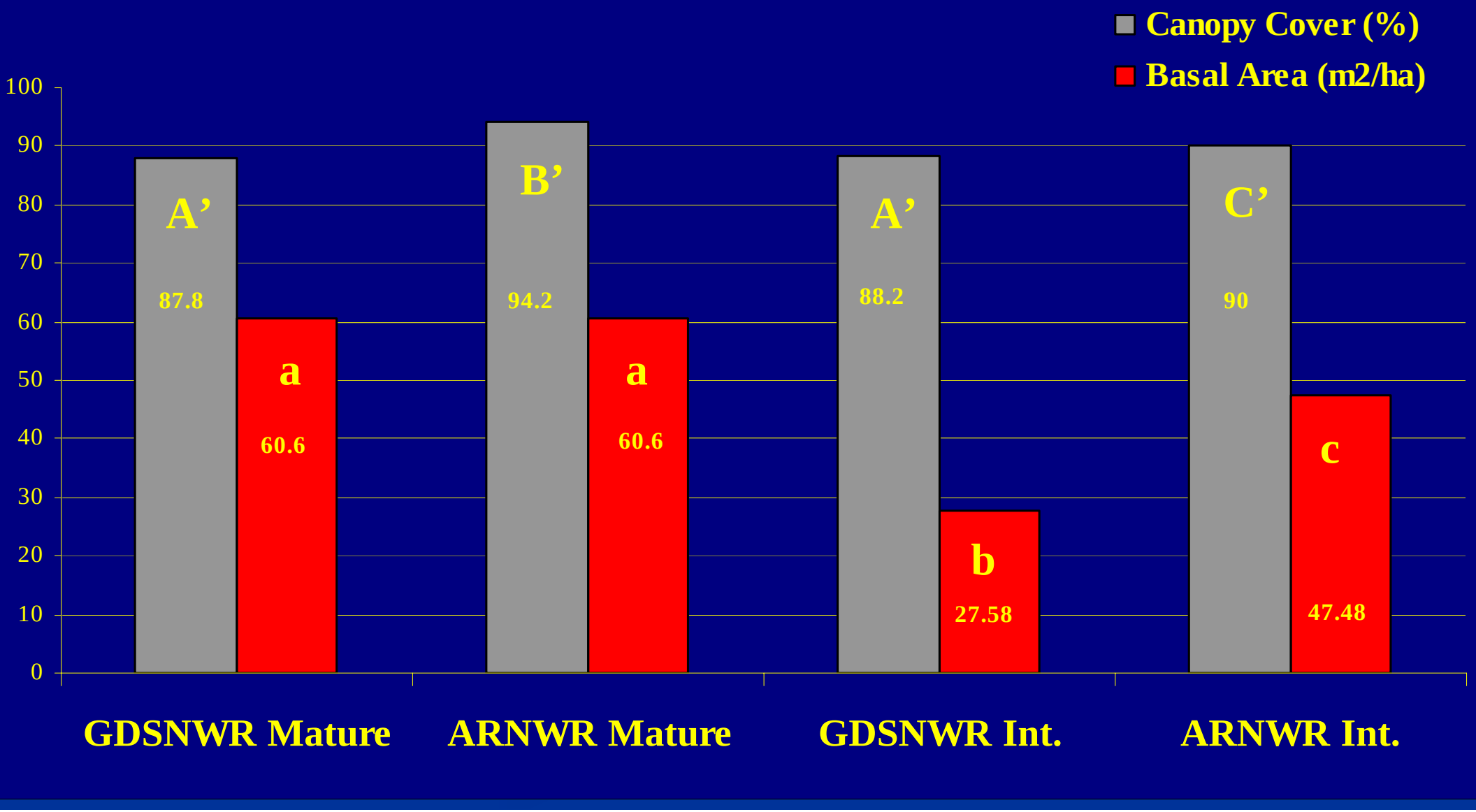
Average Height of Canopy



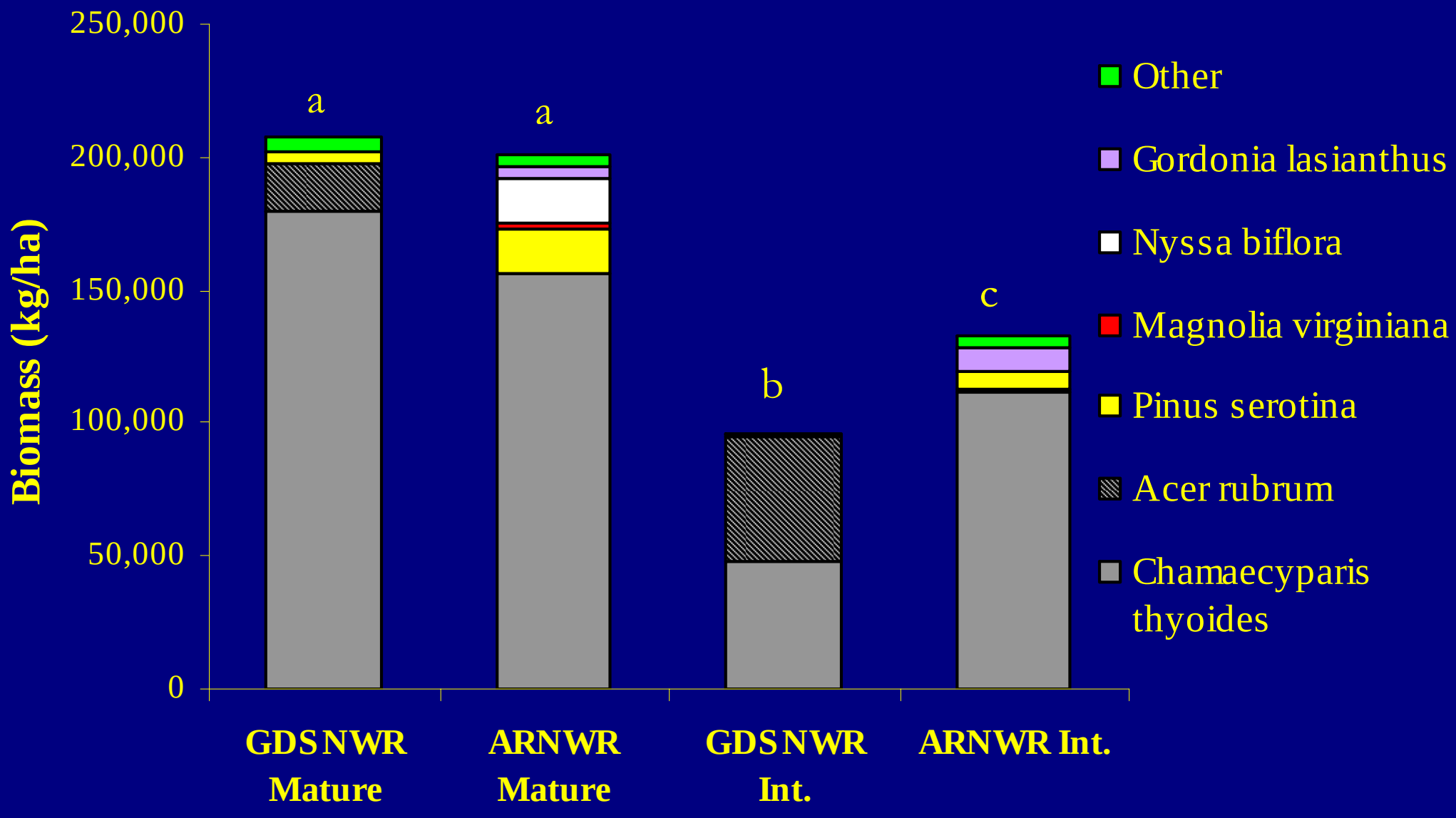
Live Tree and Shrub Stem Density



Canopy Cover and Total Basal Area



Aboveground Biomass Components



GDSNWR and ARNWR Mature Sites

GDSNWR Mature

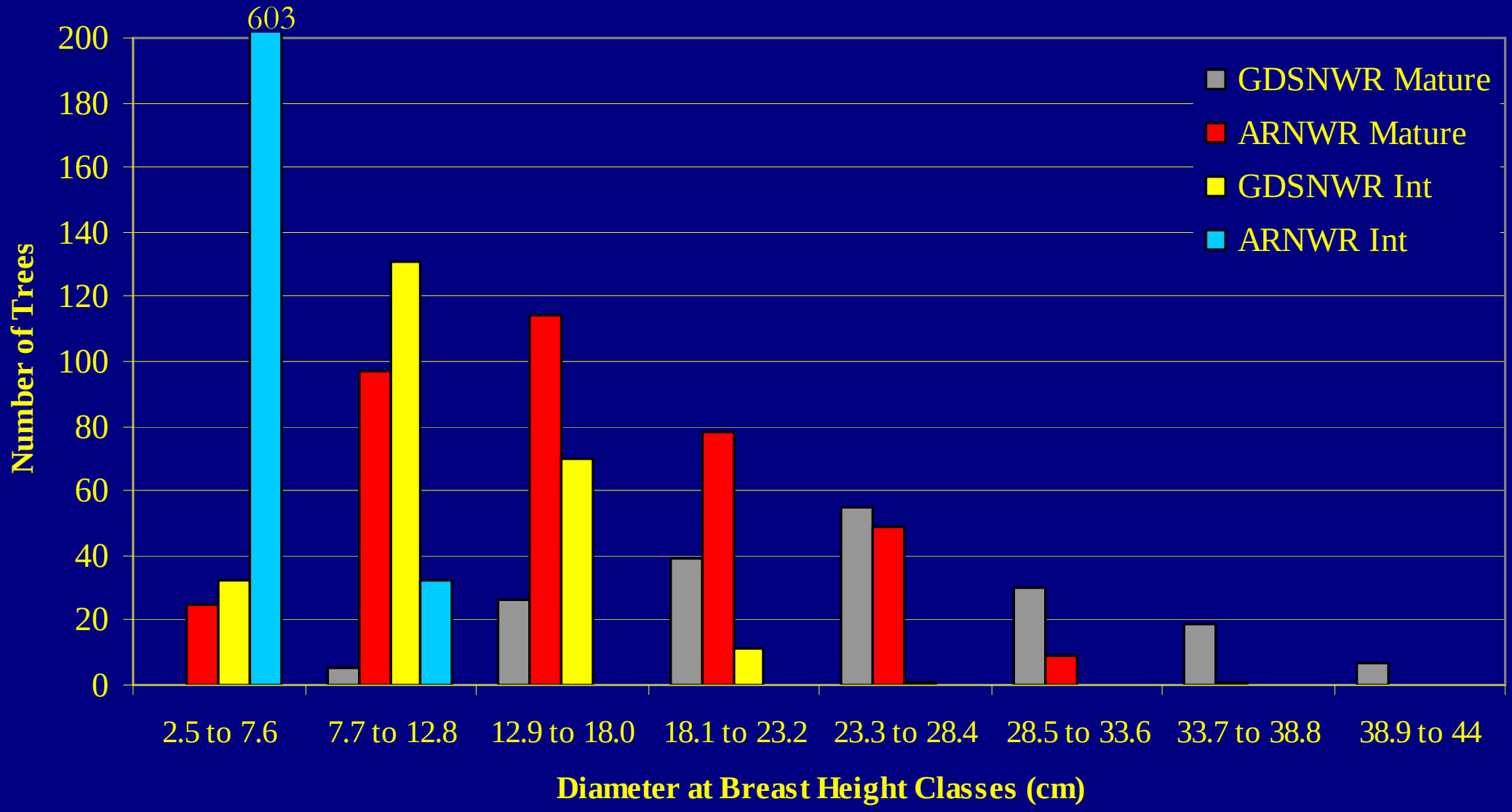
ARNWR Mature

GDSNWR and ARNWR Int. Sites

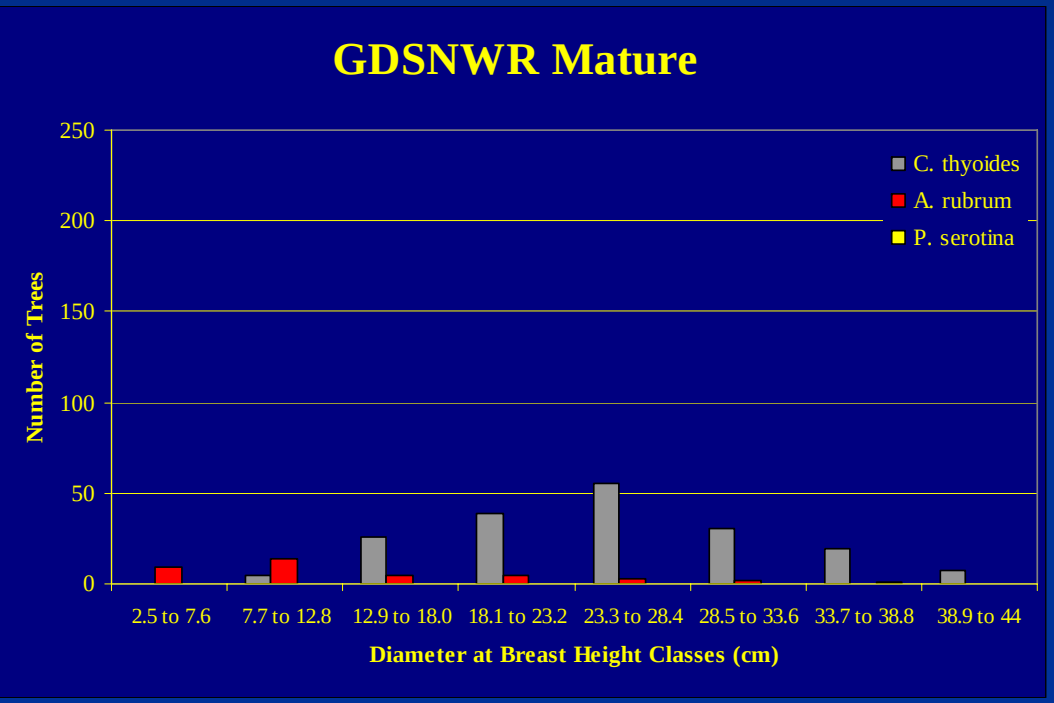
GDSNWR Intermediate

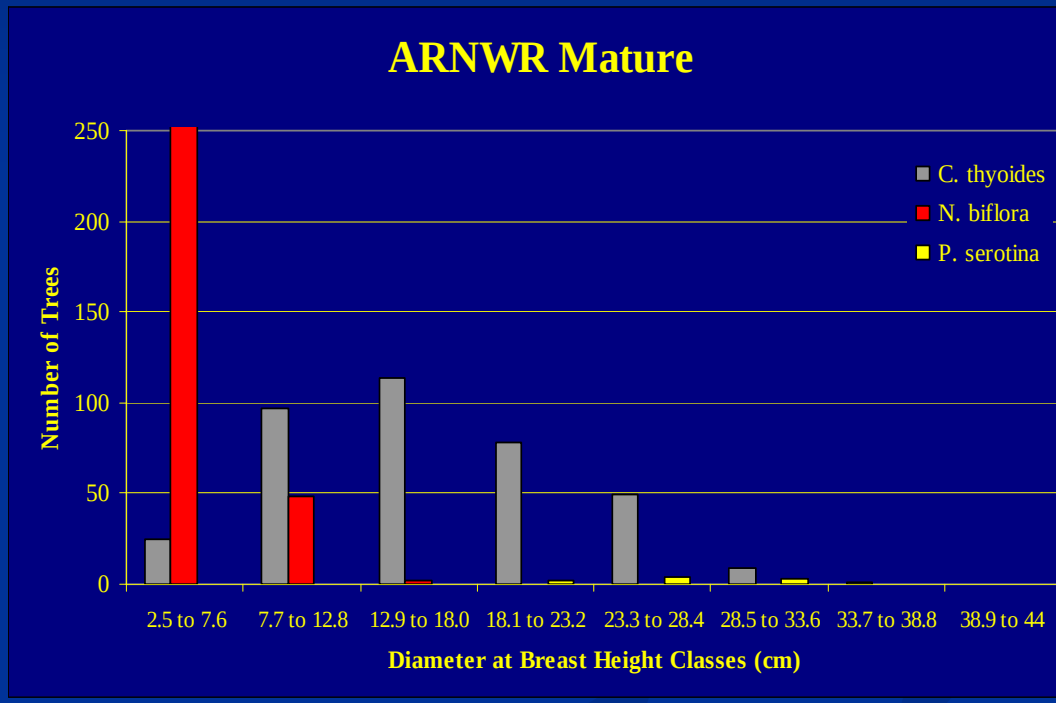
ARNWR Intermediate

Diameter Classes for *C. thyoides*

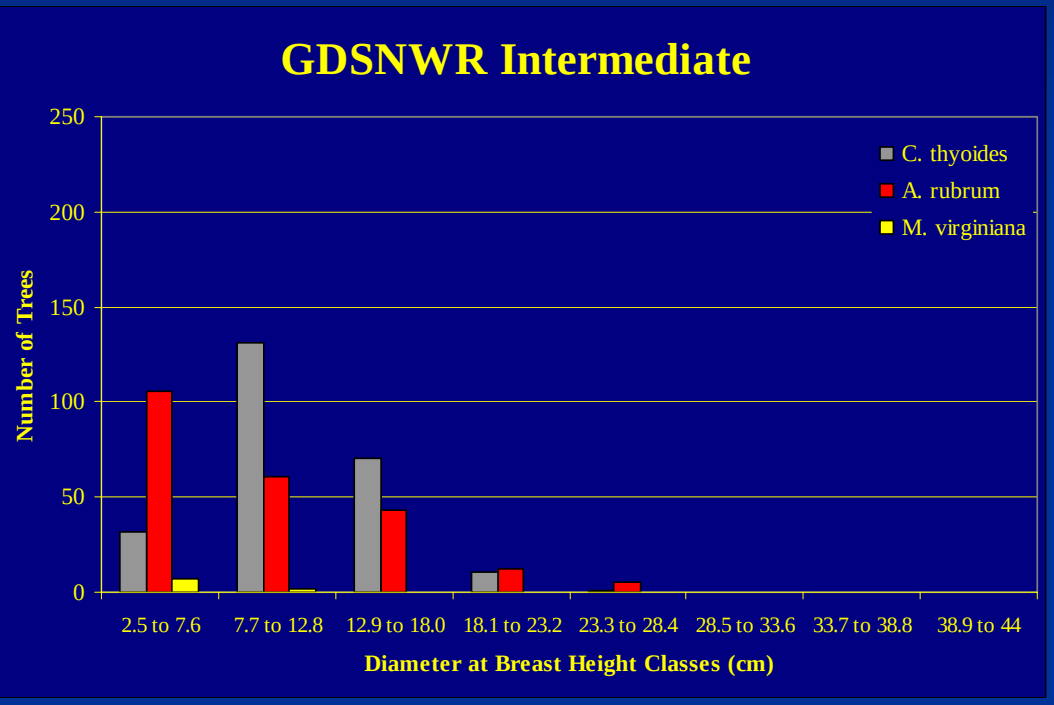


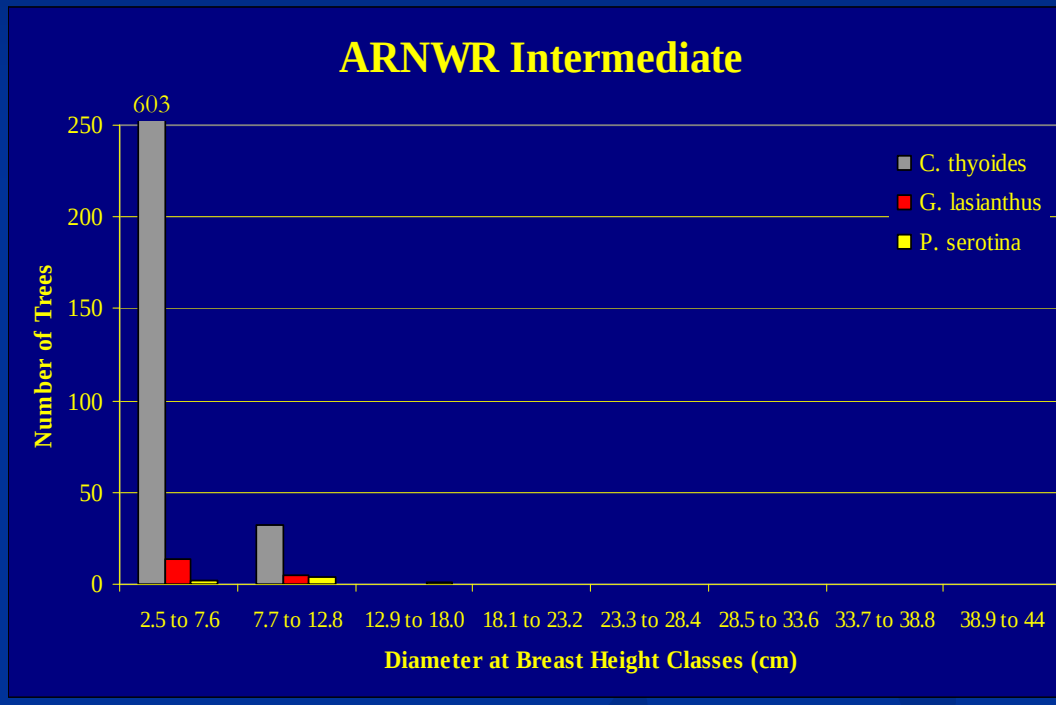
Diameter Classes for Top Three Dominant Species: Mature Sites



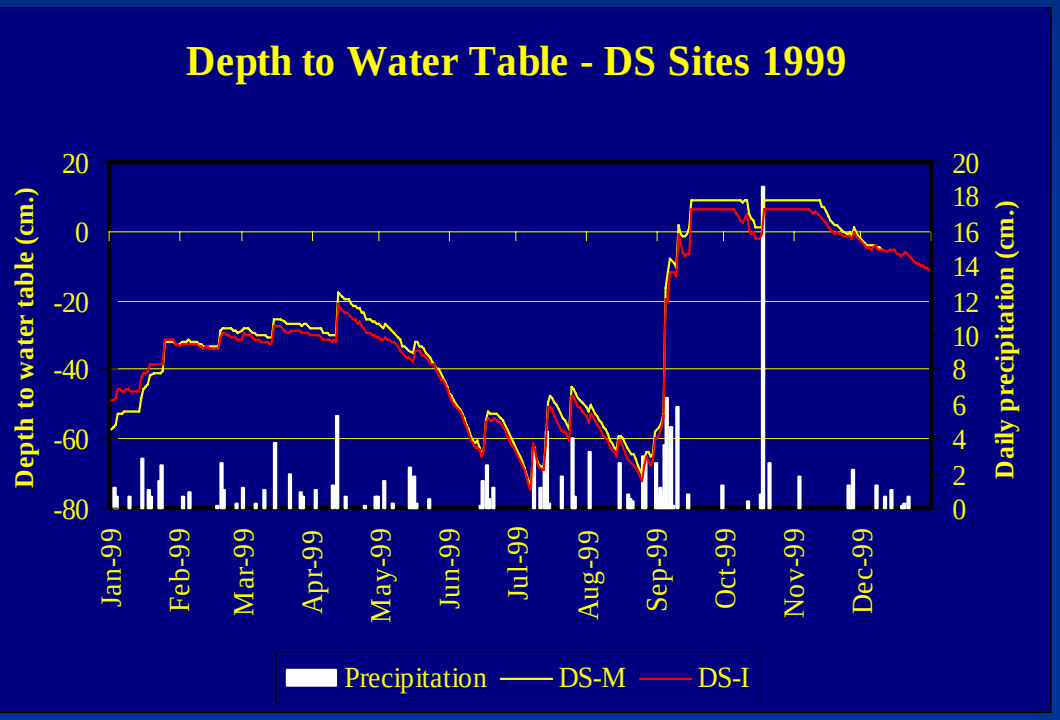


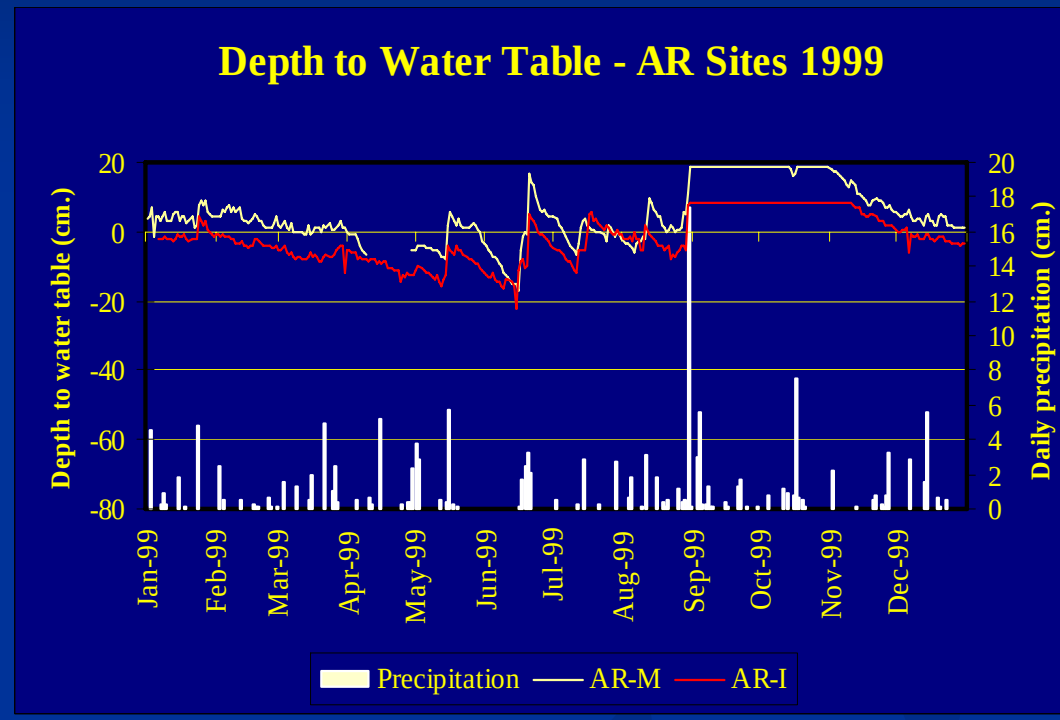
Diameter Classes for Top Three Dominant Species: Intermediate Sites





Results: Hydrology

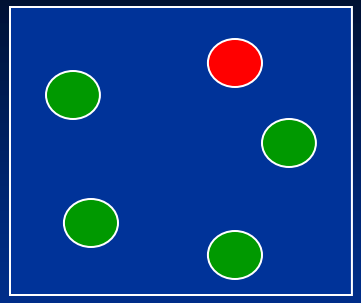


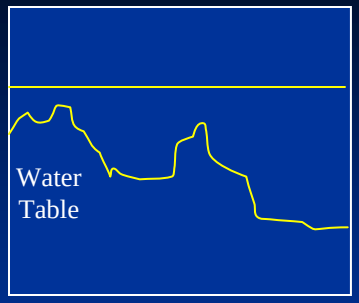


Conclusions

- Total aboveground biomass did not differ among mature sites and were similar to values reported by Dabel & Day (1977) and others for similar systems.
- Intermediate sites differed primarily due to age, but other factors (post logging condition, hydrology) important.
- Water tables at ARNWR sites compare favorably to reported values of 6 cedar swamps studied over 7 years; GDSNWR sites similar to *A. rubrum* sites (Lowry 1984).
- Greater stem density, lower average dbh, and higher water table at ARNWR sites suggests lower site quality for silviculture; however, these characteristics may be critical for self-maintenance and providing ecosystem services.

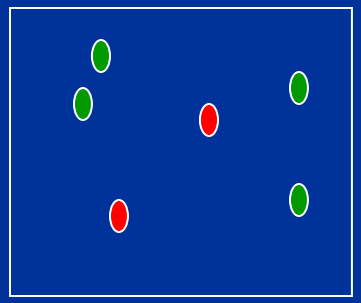
GDSNWR Mature

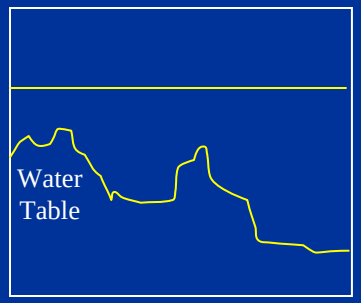




- Greatest avg. dbh
- Greatest ABGD biomass

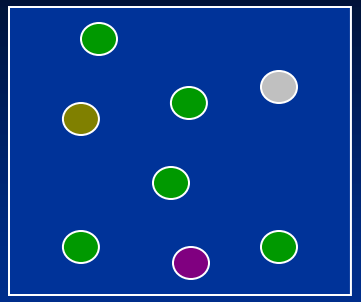
GDSNWR Intermediate

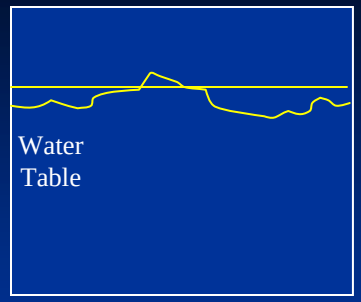




- Greatest *A. rubrum* dominance
- Lowest biomass & basal area
- Lowest water table

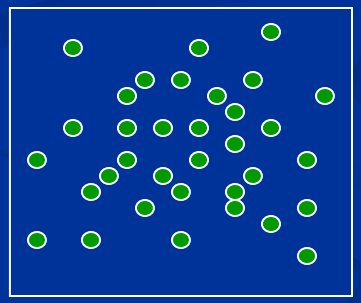
ARNWR Mature

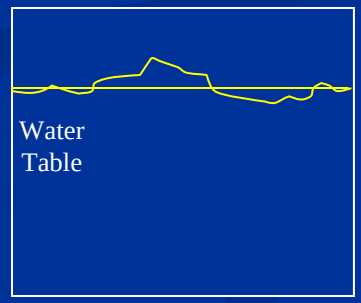




- Greatest % canopy cover
- Greatest # tree species

ARNWR Intermediate





- Greatest total stem density
- Highest water table

Conclusions

- According to the National Wildlife Refuge Improvement Act of 1997 the goal of the refuge systems is "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the US for the benefit of present and future generations."
- Habitat restoration goals for AWC at GDSNWR include restoration of 8,000 acres of AWC habitat utilizing timber harvests, herbicides, and forest management.
- Comprehensive plans include hydrologic management, but there are competing goals (e.g. road safety, adjacent landowner encroachment).
- Although hydrologic management can be a divisive issue, NWR's must continue to evaluate the effects of historic drainage on the long-term maintenance of AWC communities and develop alternatives to achieve management goals.

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