



# Restoration of Disturbed Pond-cypress Savannas, Big Cypress National Preserve

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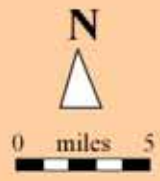
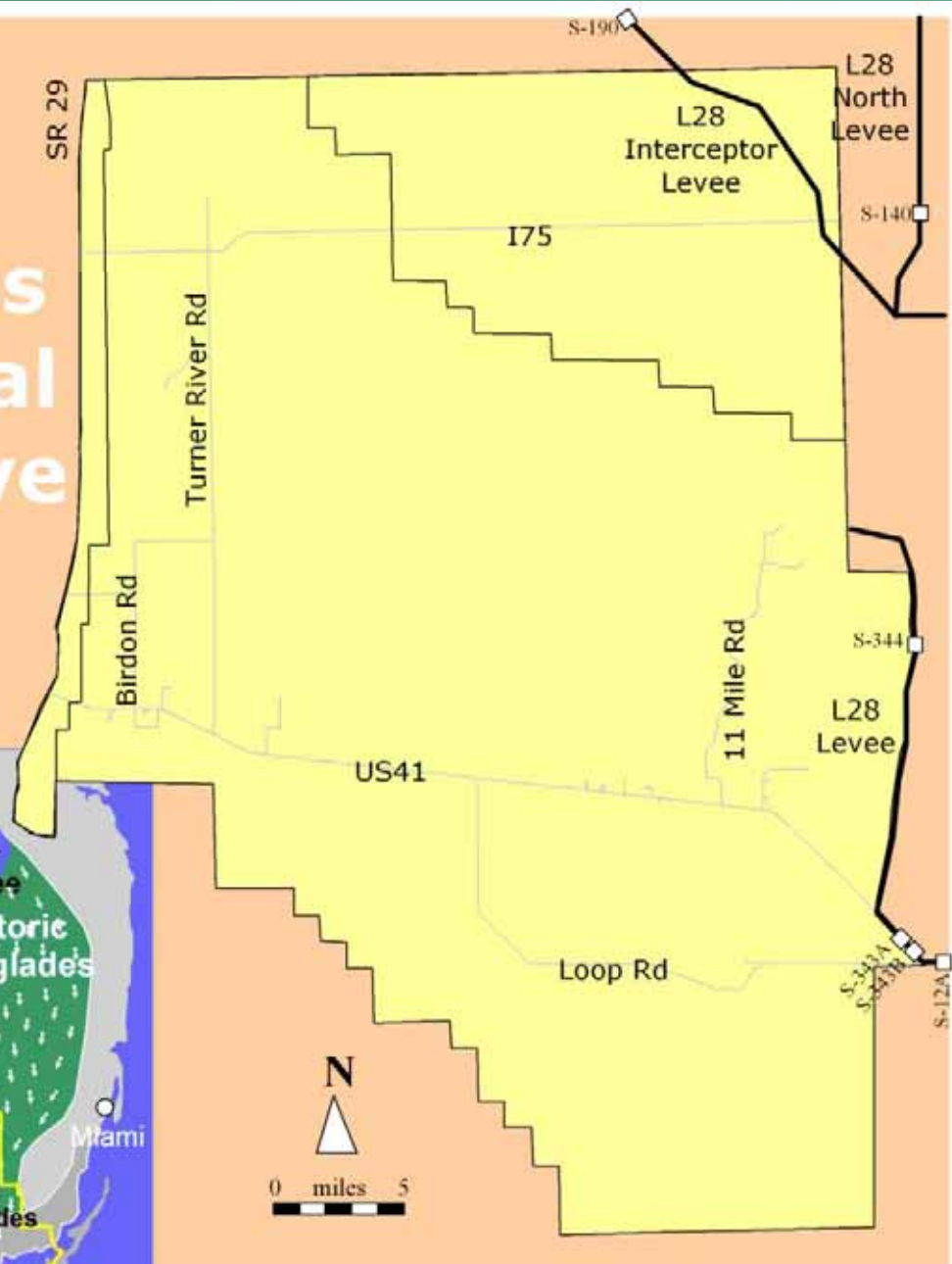
U.S. Department of the Interior  
U.S. Geological Survey

# Big Cypress National Preserve

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- Approximately 730,000 acres in southwest Florida
- Subsurface mineral rights privately owned
- Two active oil fields in Big Cypress and interest in further exploration

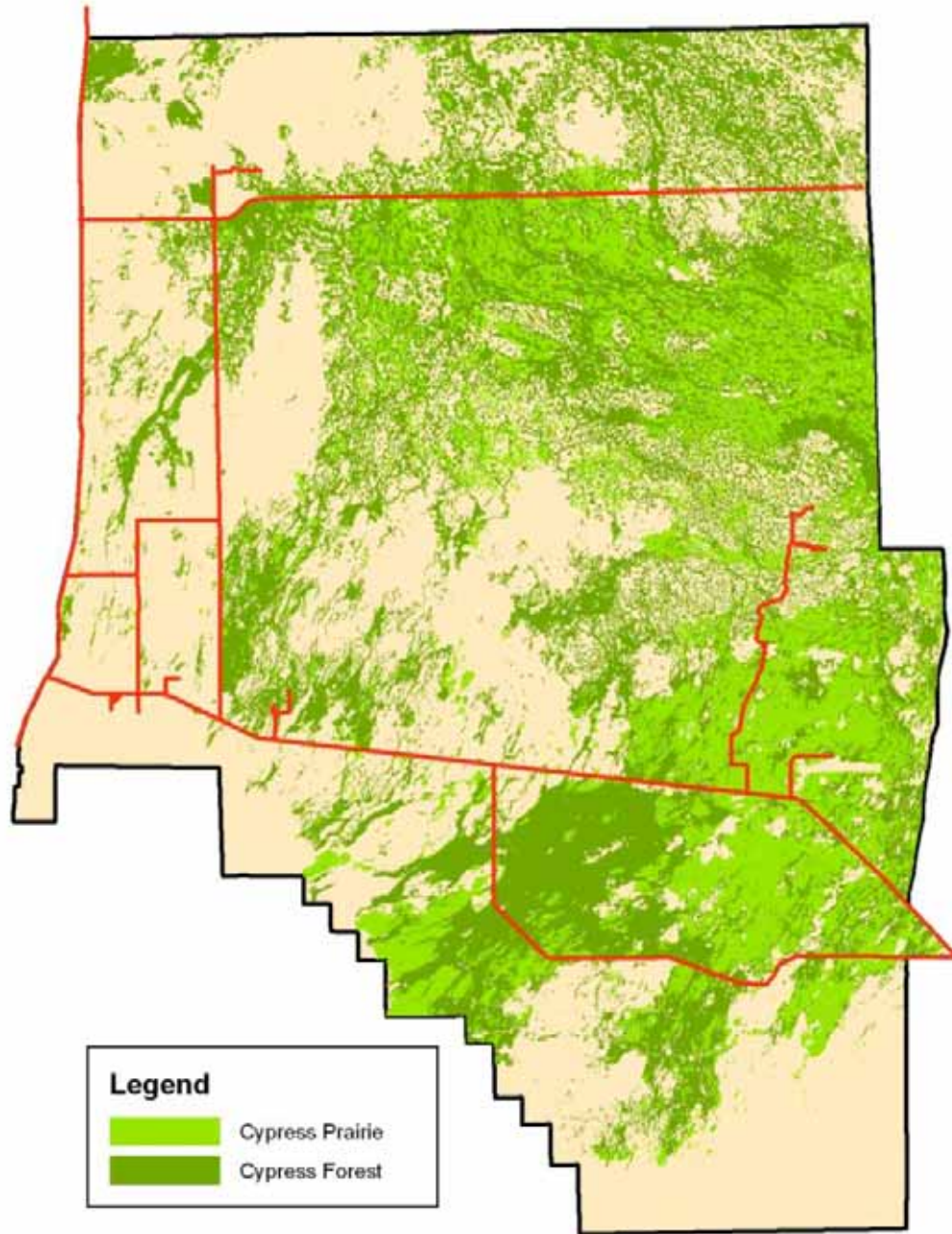
# Big Cypress National Preserve



# Pond-cypress savanna

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- Cypress savanna a common habitat with high likelihood of disturbance
  - Characterized by stands of pond-cypress with well-developed, graminoid herb layer
    - Ranges from very open stands of stunted cypress with sparse herb layer to more dense stands of larger trees
    - Herb layer composed of short-hydroperiod wet prairie species
  - Covers nearly 50% of Big Cypress Nat. Pres.
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**Cypress Savanna**



**Pond-cypress, *Taxodium ascendens***

# Restoration question

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- How to re-establish cypress savanna on sites disturbed by oil development

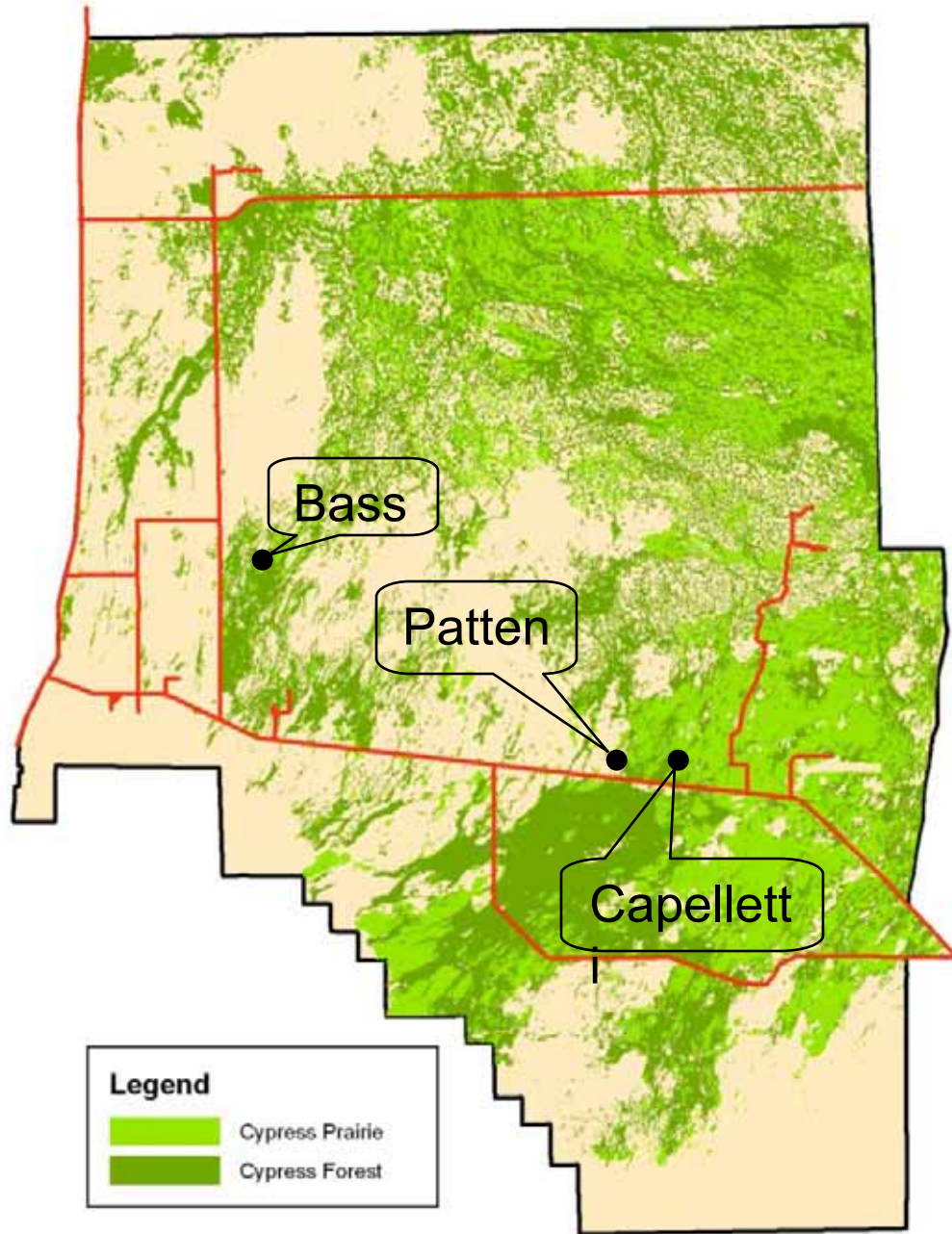


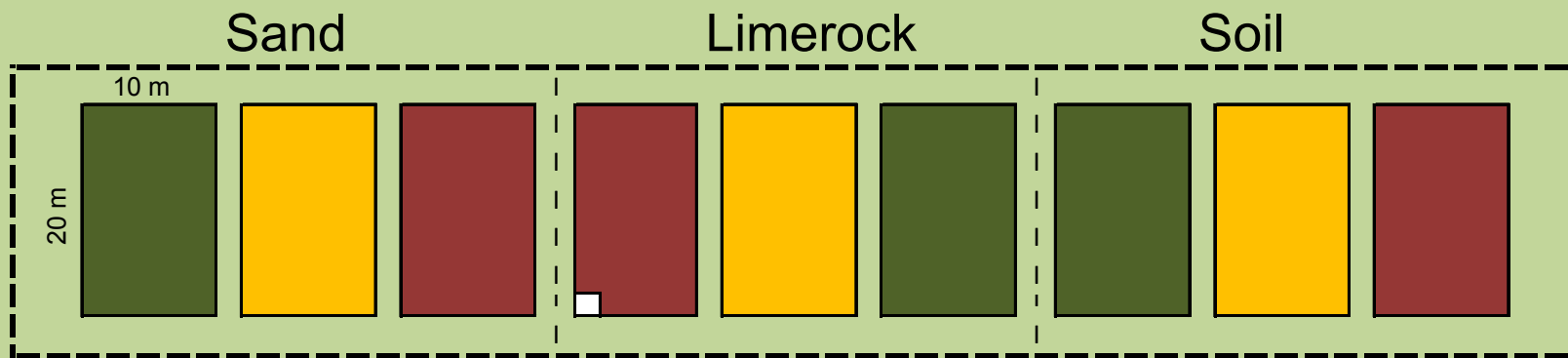
# Experimental design

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- Three substrates
  - Residual **limerock** fill
  - Commercially available **sand** fill
  - Surface **soil** from local quarry operation

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- Three revegetation treatments
    - **Planted** 10 native species
    - Spreading of donor **mulch** material
    - **Control**, or passive revegetation





- Border of substrate
- 2x2m planting and sampling subplot
- Planted
- Control
- Mulch



**Fill pad removal at Capelletti site**



**Spreading sand substrate**

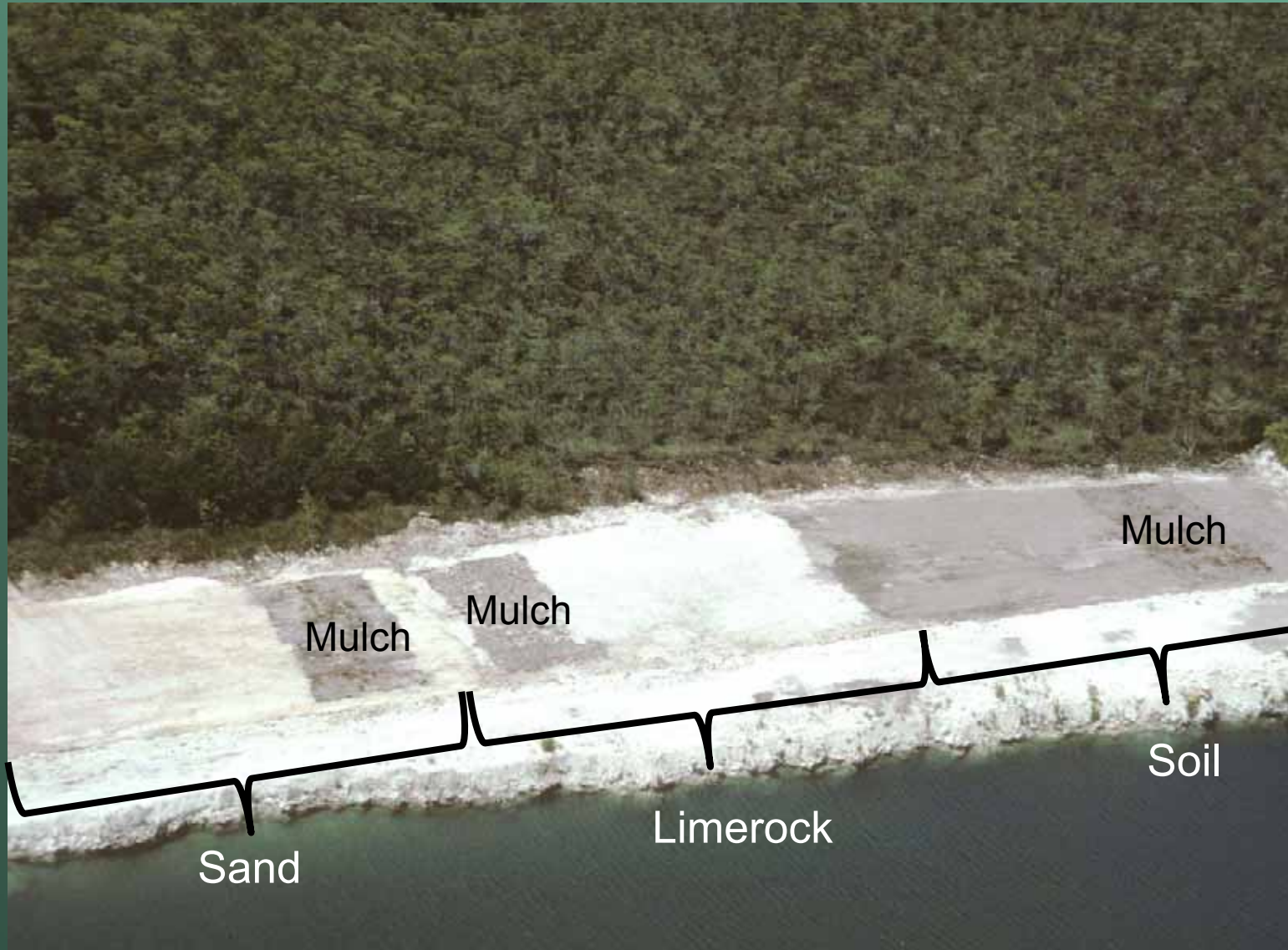


**Site preparation complete**



**Capelletti site after mulch treatment**





Sand

Mulch

Mulch

Limerock

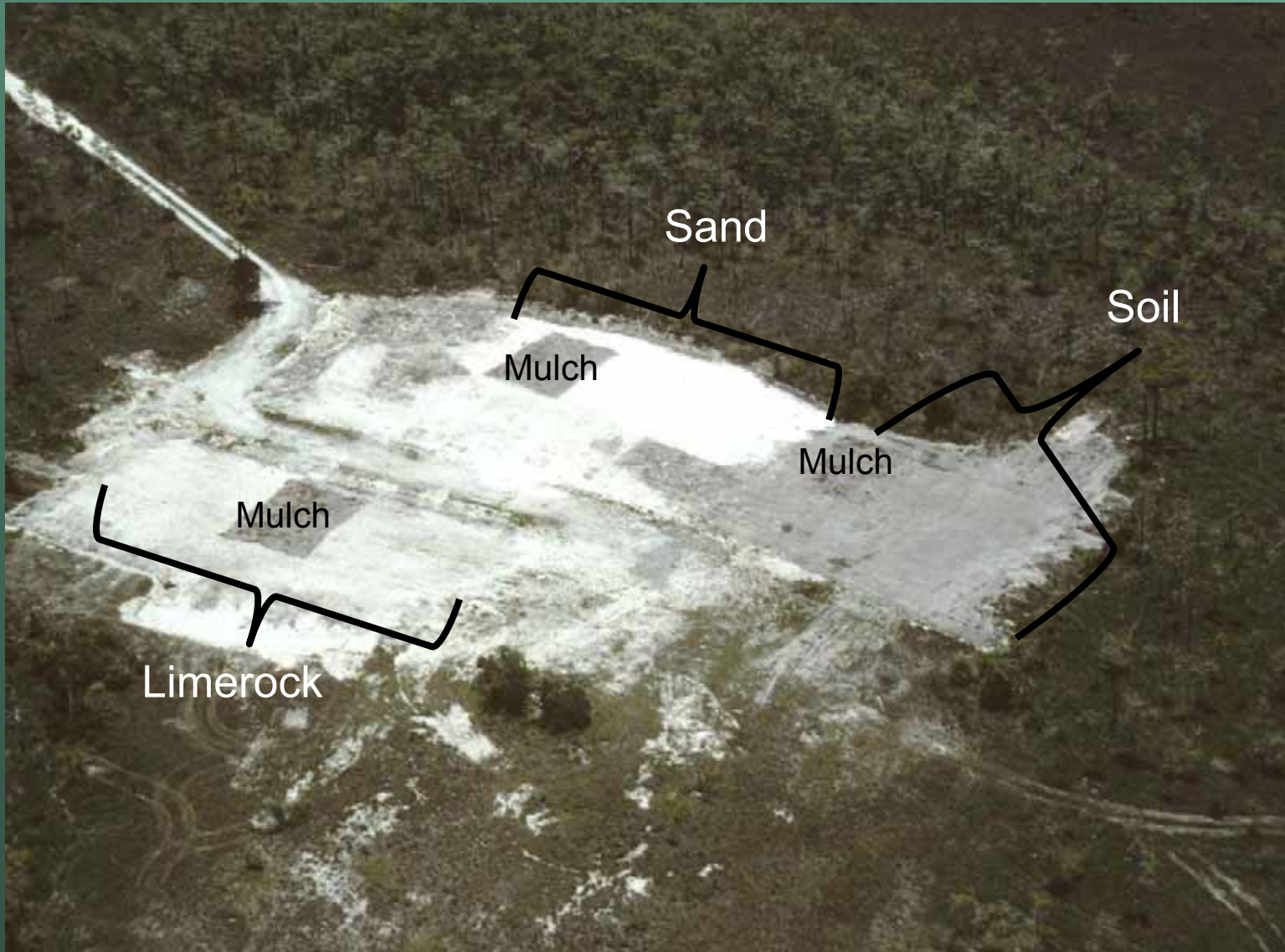
Mulch

Soil

**Capelletti site**



**Patten site**



**Bass 5-2 site**

# Species used in planted revegetation treatment

	Species		Propogation method	Planting density (no./m <sup>2</sup> )
	Scientific name	Common name		
Tree	<i>Taxodium ascendens</i>	Pond-cypress	seed germination	0.25
Shrub	<i>Myrica cerifera</i>	Wax myrtle	seed germination	0.125
	<i>Stillingia aquatica</i>	Corkwood	field collection	0.125
Forb	<i>Pluchea rosea</i>	Rosy camphorweed	field collection	0.25
Grass	<i>Muhlenbergia filipes</i>	Gulfhairawn muhly	vegetative division	1.0
	<i>Paspalum monostachyum</i>	Gulfdune paspalum	field collection	1.0
	<i>Schizachyrium rhizomatum</i>	Florida little bluestem	field collection	1.0
Sedge	<i>Dichromena colorata</i>	Starrush whitetop	vegetative division	1.0
	<i>Rhynchospora divergens</i>	Spreading beaksedge	seed germination	1.0
	<i>Rhynchospora microcarpa</i>	Southern beaksedge	seed germination	1.0



**Planting at Capelletti site July 1989**



**Planting treatment in progress**



**Planting at Capelletti site**



**GEER 2008 Co-chair**





**Capelletti site at establishment, July 1989**

# Sampling effort

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- Species composition and percent cover estimated 1/90, 6/90, 1/91, 5/91, 5/92, and 5/04
  - Sampled one 0.1 m<sup>2</sup> quadrat per 2x2 m cell, 50 samples per treatment
- Cypress heights measured 1/90, 5/90, 1/91, 5/91, 5/92, 7/93, 4/95, 6/00, 6/03, and 5/08
  - DBH measured beginning in 6/03 and trees tagged

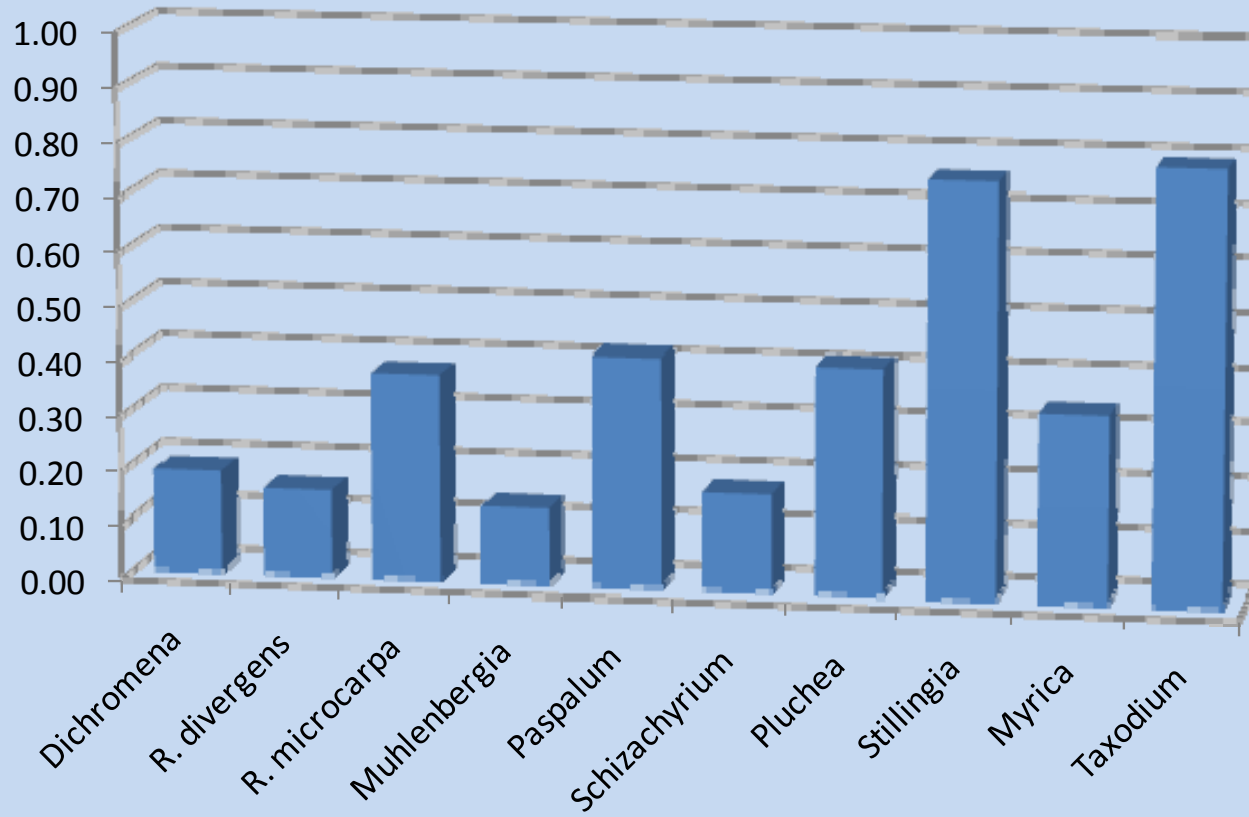


**Preparing to sample at end of first wet season**

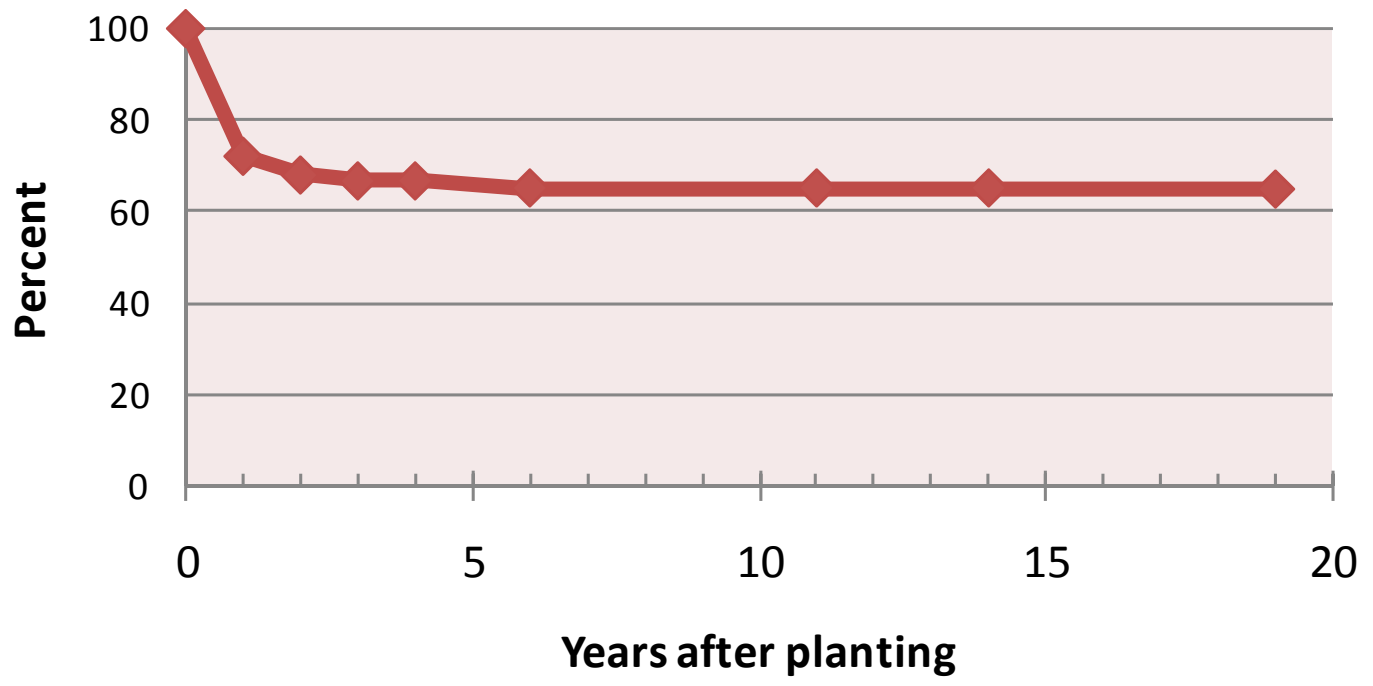


**Capelletti sand planted plot 6 months**

## Mean Survival of Planted Species



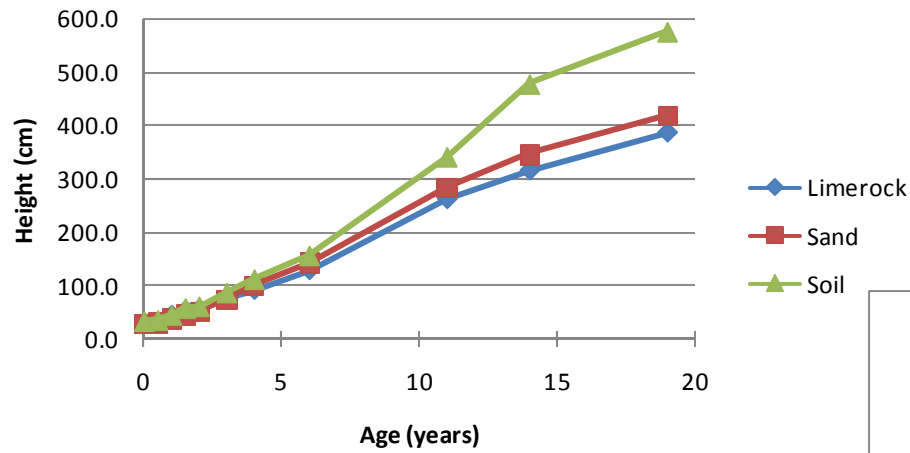
## Planted Pond-cypress Survival



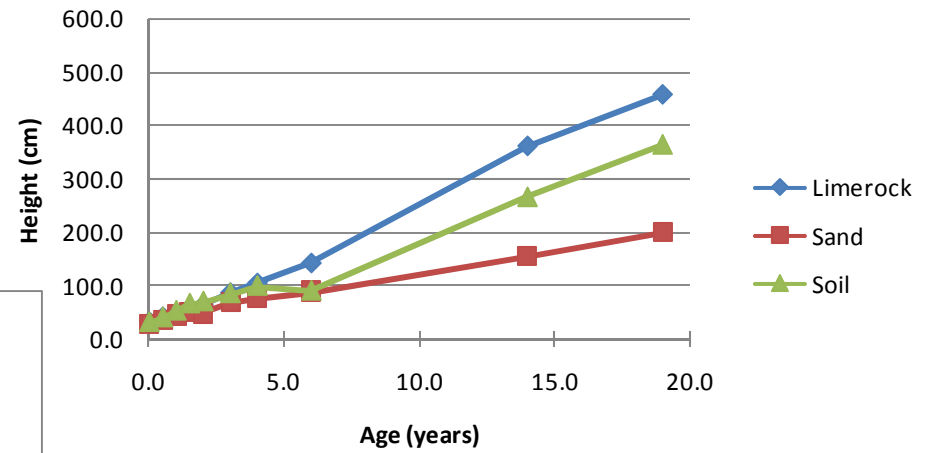
**Survivorship of planted cypress trees**

# Height growth of planted pond-cypress

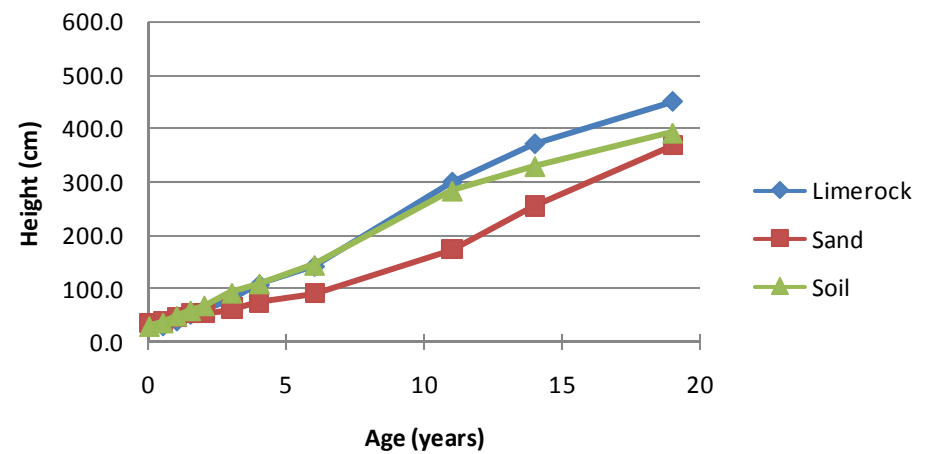
## Patten



## Bass



## Capelletti



# Planted pond-cypress

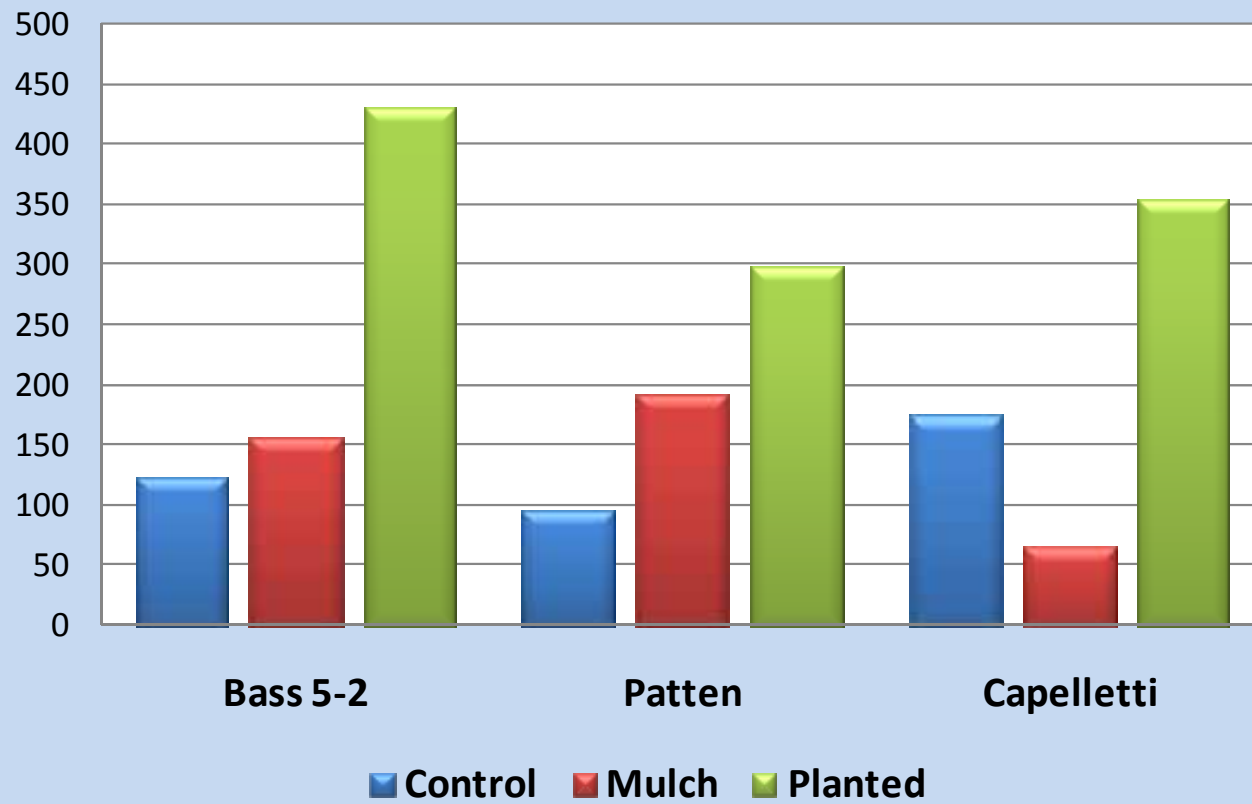
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- Nineteen years after planting, tallest tree just over 7 m tall
- Ten trees had DBH >10 cm
- Largest diameter 14.8 cm
- Best growth in soil substrate at Patten site



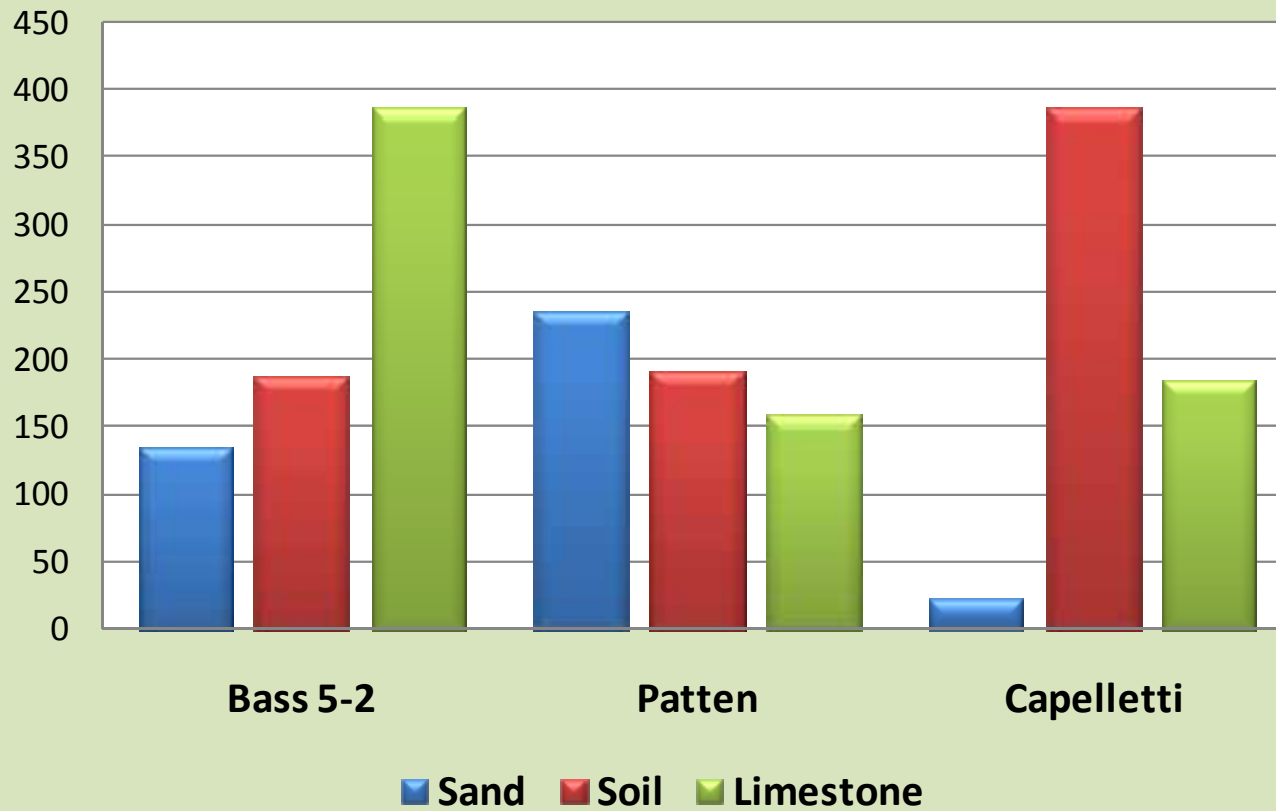


### Cypress recruitment by treatment



**Recruitment of pond-cypress after 14 years**

### Cypress recruitment by substrate



**Recruitment of pond-cypress after 14 years**



Capelletti sand planted  
treatment year one, 6/1990



Capelletti sand planted  
treatment year three, 6/1992



Capelletti sand planted  
treatment year fifteen, 6/2004



Capelletti limerock planted 2008



Bass soil planted 2008

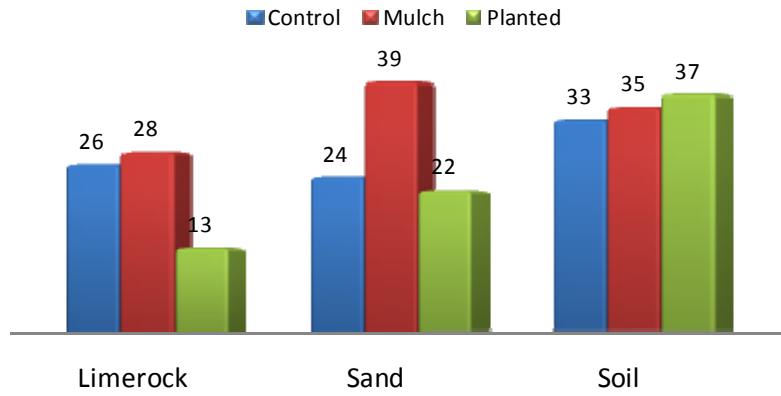
# Undisturbed cypress savanna

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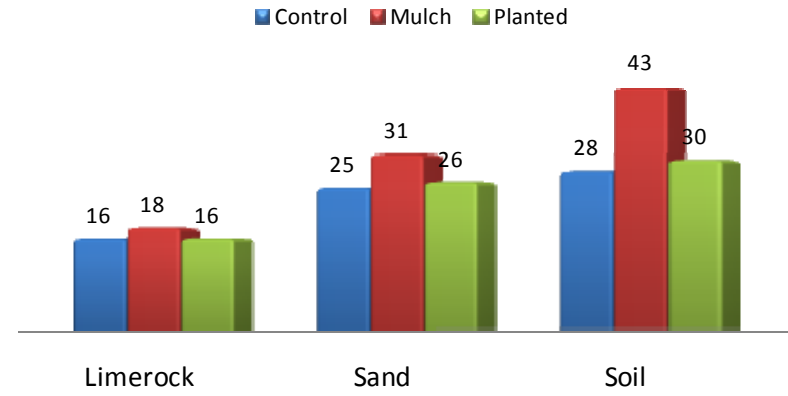
- Number of species in herb layer ranged from 22 to 40 at the three sites and averaged 29 species
- Cover ranged from 20.5 to 41.2 and averaged 30.4 %



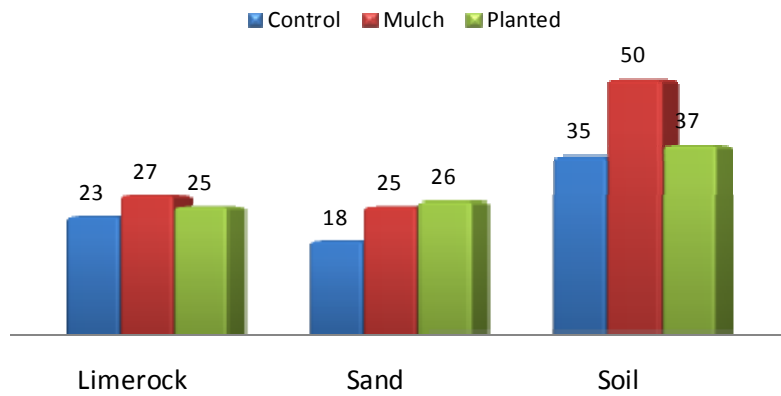
### Bass



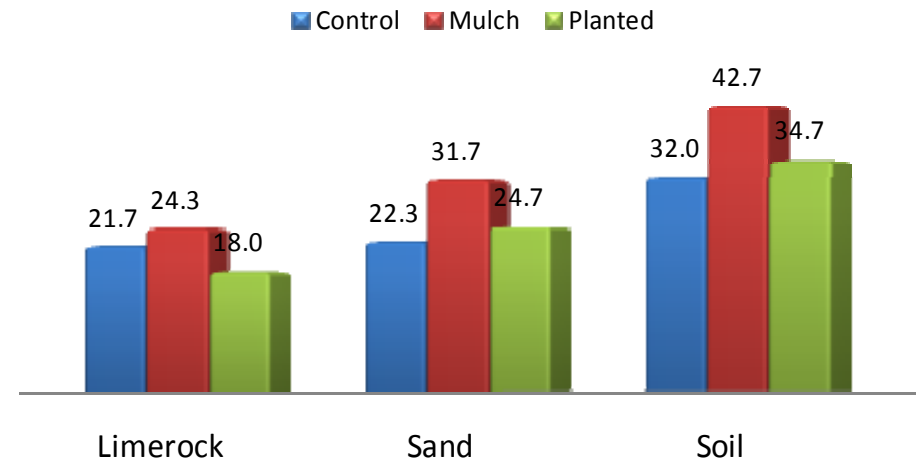
### Patten



### Capelletti

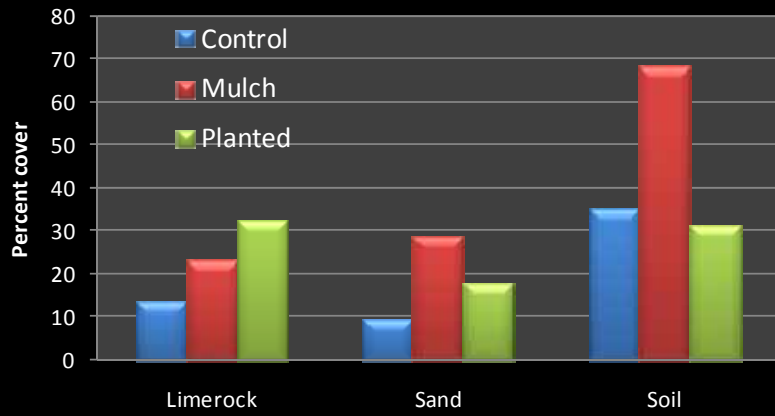


### Mean all sites

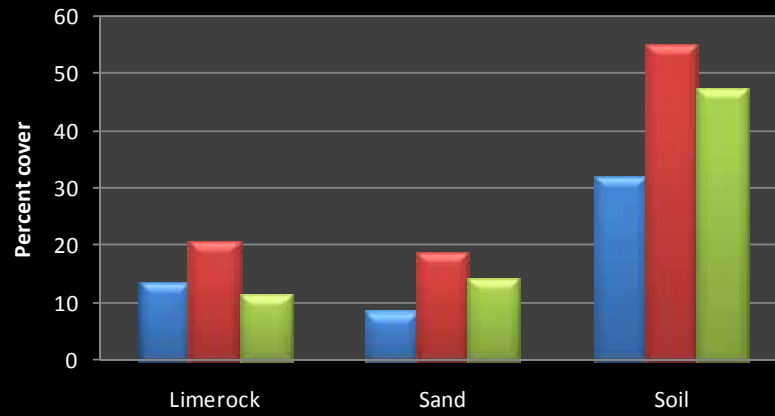


**Number of species year 15**

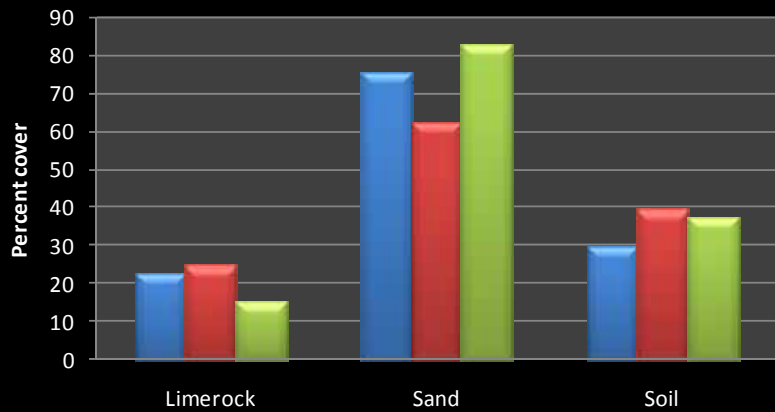
### Bass



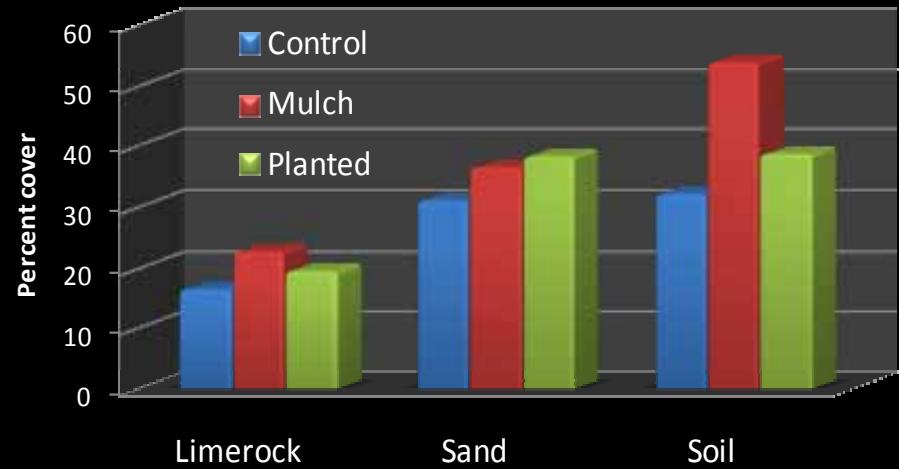
### Patten



### Capelletti



### Mean all sites



**Percent cover of all treatments year 15**

# Winners and losers after 15 years

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- **Fate of planted species mixed**
    - **Some disappeared**
      - Muhly and bluestem grasses gone
      - Wax myrtle nearly absent
    - **Some did very well**
      - Paspalum was a dominant species in the planted treatments but uncommon elsewhere
      - Cypress and corkwood were common on all treatments
  - **Pluchea had greater frequency in mulched plots than planted plots**
  - **Sedges variable and not restricted to planted plots**
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- **Several species are common on study plots but not in undisturbed cypress savanna**
    - *Bacopa caroliniana*, *Eleocharis baldwinii*, and *E. cellulosa* are good examples
    - *Phragmites australis* on soil at Patten site
    - Many introduced via mulch or substrates
  - **Only one non-native species significant**
    - *Panicum repens* on sand at Capelletti

# How to restore?

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- Fifteen years after treatments applied, all fall within range of native cypress savanna in terms of cover and species richness

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- **“Best” method not clear**
    - **Planting clearly established some of the dominant species**
    - **Mulch treatment introduced high diversity of species but not necessarily local dominants**
    - **Passive revegetation worked reasonably well but benefited from proximity to seed sources**
    - **Soil substrate was best but others were satisfactory**
    - **Pending multivariate analyses will help clarify trajectories of species composition**
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# Acknowledgements

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- **Pete Sleszynski** did the plant propagating and seed bank work among other things
  - **Pete Roth**, NPS, was the master heavy equipment operator who set up plots
  - Numerous field assistants from UF Center for Wetlands helped with planting
  - **Lisa Spier, John DeLapp, Renee Beymer, Sara Robinson, Robin Keith, and TJ Hilton** assisted with data collection
  - Funding was provided by the National Park Service
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**Capelletti site three years after establishment**



