Biophysical Indicators of Longleaf Pine Sandhill Change

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Sandhills

- Species
  - Long-leaf pine
  - Turkey oak
  - Wiregrass
  - Extremely rich herbaceous layer
- Soils
  - Sandy entisols
  - Leached

Source: http://www.southernsustainableforests.org/restore/longleaf.html

Sandhills

- Naturally burn every 1 – 10 years
  - Especially adapted to fire
    - Longleaf pine grass stage
    - Masting
    - Wire grass
- Management is a key goal
  - Endangered species
    - Gopher Tortoise
    - Red Cockaded Woodpecker

Savannah

- Open canopy
- Relatively open mid-story
- Wiregrass groundcover

Photographed in Croatan National Forest, North Carolina on October 23, 1995 **Source:** http://persweb.direct.ca/blevins/savannah.htm

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Longleaf regeneration
in the "grass" stage.

Source: http://www.forestry.auburn.edu/samuelson/dendrology/pinaceae_pg/longleaf_pine.htm

Grass Stage

Fire

- Periodic, recurring fires, represent a major selective force on plant characteristics, community structure, and function
- Surface Fires
  - Relatively Cool, fast-moving fires, where lightweight fuels are available and O_2 supply is high.
  - Damage to mature trees is usually minimal

Fire

- Brush burns intensely
- Longleaf pine (both the larger trees and younger ones) barely get scorched

Source: http://www.southernsustainableforests.org/restore/longleaf.html

After Fire

Source: http://www.southernsustainableforests.org/florida/florida.html

Source: Sherpa Guides

Sandhill Succession

- Without regular fires sandhills generally succeed into hammocks
  - 10 years without fire
- Leaf Area Index (LAI) and productivity increase
  - Healthy sandhill LAI 0.5 to 2.0
  - LAI could be indicator of succession
- Soil fertility and CEC increase

2 years

7 years

18 Years

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Sandhill Succession

- In addition to fire suppression
  - Habitat fragmentation
  - Plantation forestry – conversion to other southern pines
  - Logging
  - Clearing for crops
- In Florida and Georgia
  - 90% of sandhill area lost in last 65 years

Prescribed Burns

- Officially, “it is the careful application of fire to vegetative fuels according to a written prescription and under specified environmental conditions” Florida Statutes (FS) Section 590.125
  - Reduces the risk of wildfire by decreasing shrub and herbaceous vegetation and accumulated dead fuels,
  - Improves wildlife or grazing habitat,
  - Promotes successful forest regeneration,
  - Cycles nutrients for healthy ecosystems, and
  - Maintains fire-dependent species.

Florida's Prescribed Fire Act

- Prescribed burning reduces naturally occurring vegetative fuels
  - Reduces the risk of catastrophic wildfire
- Public education program in necessary to make citizens aware
- As Florida's population grows, pressures from liability issues inhibit prescribe burning
  - Greater liability protection

Florida's Prescribed Fire Act: Liability Protection

"No property owner or his/her agent, conducting a prescribed burn pursuant to the requirements of this subsection, shall be liable for damage or injury caused by fire or resulting smoke, unless negligence is proven. "

Media Reaction

- For the first time in **Florida** history, the state wants to mandate that some landowners burn brush on their property every few years - a key to preventing the wildfires that scorched homes this summer.
  --*St. Petersburg Times*, Aug 6, 1998

Consequences

Source: Orlando Sentinal

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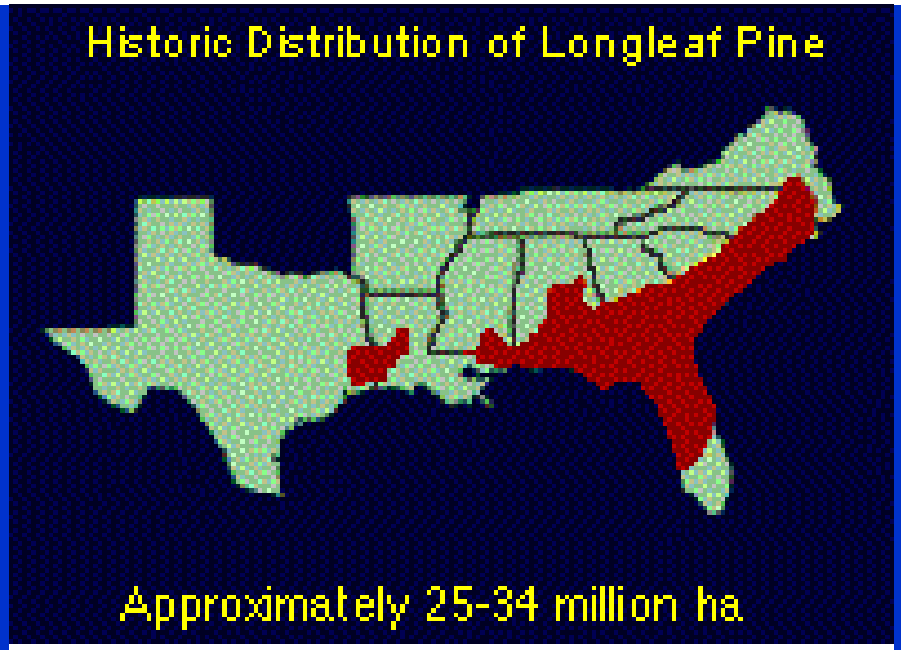
Sandhill Habitat

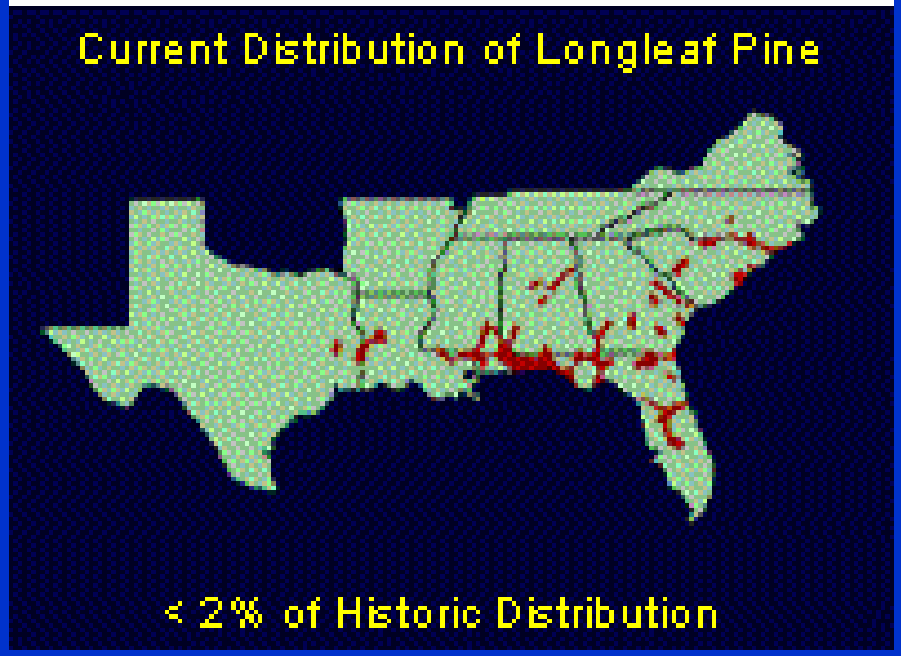
- USGS critically endangered ecosystem
- Covered up to 34 million hectares
- Stretched from southern Virginia to eastern Texas
- Only about 2% remain

Native range

Source: http://www.forestworld.com/wow/wowonline_home.html

Sandhill Area

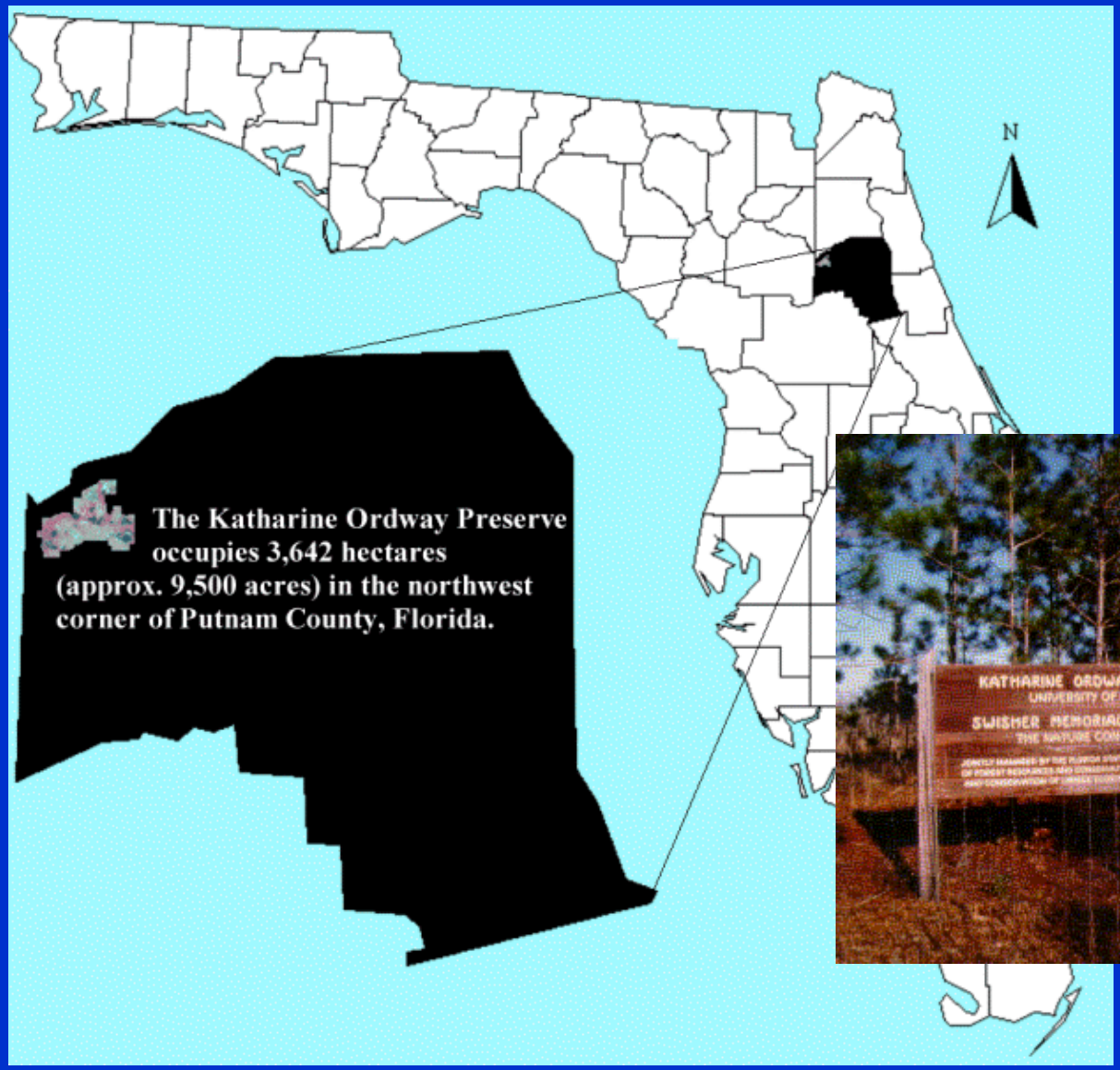




Longleaf Pine Sandhills **Source: Longleaf Pine Restoration Project** 16 October 2002

Katherine Ordway Preserve

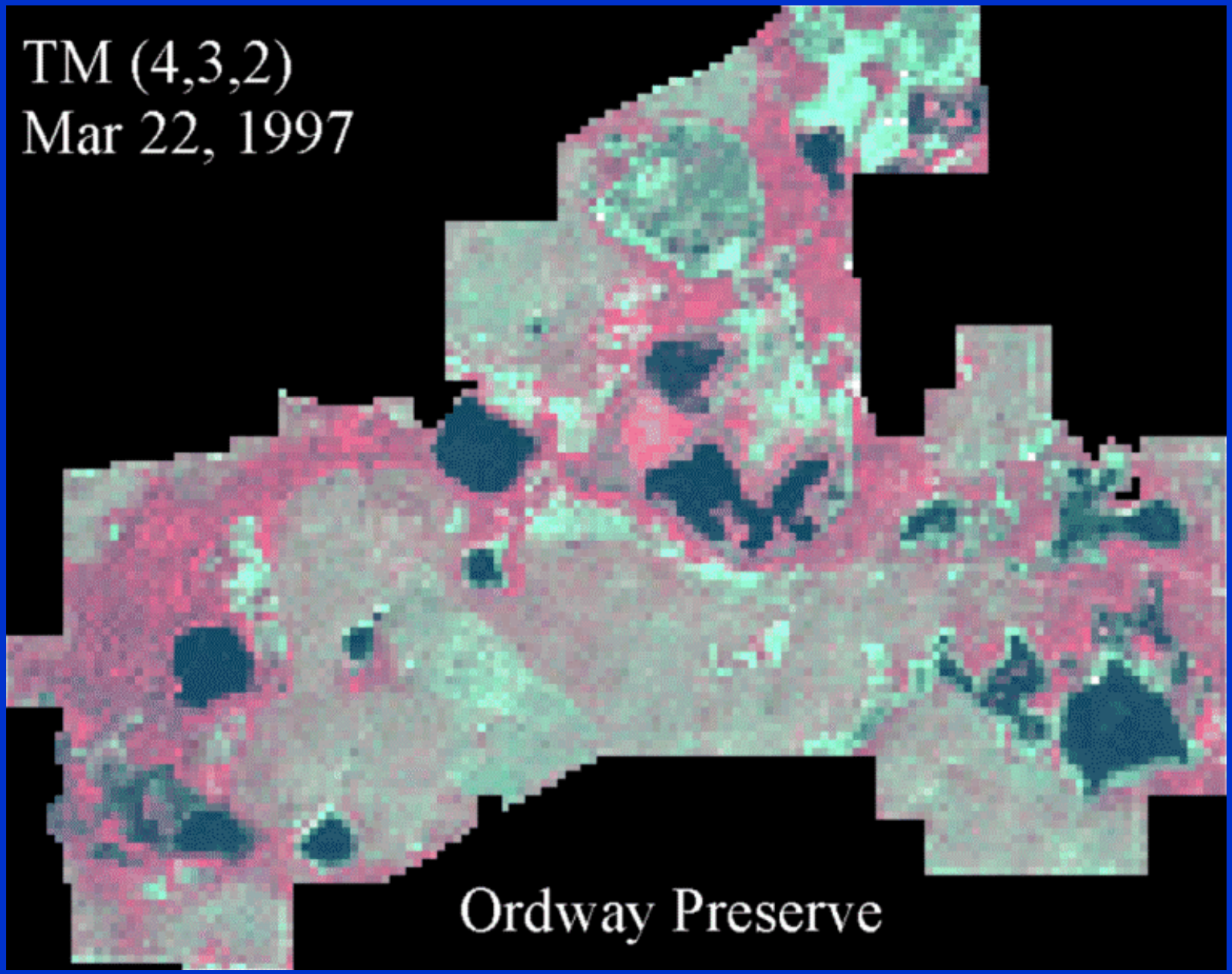
- 3,694 ha (9,500 acres)
- 42 km east of Gainesville, Florida
- Funded by $5.25 million grant in 1980
- Maintained by University of Florida to conserve native ecosystems, promote ecological knowledge


N
The Katharine Ordway Preserve occupies 3,642 hectares (approx. 9,500 acres) in the northwest corner of Putnam County, Florida.


KATHARINE ORDWAY PRESERVE
UNIVERSITY OF FLORIDA
SWISHER MEMORIAL SANCTUARY
THE NATURE CONSERVANCY

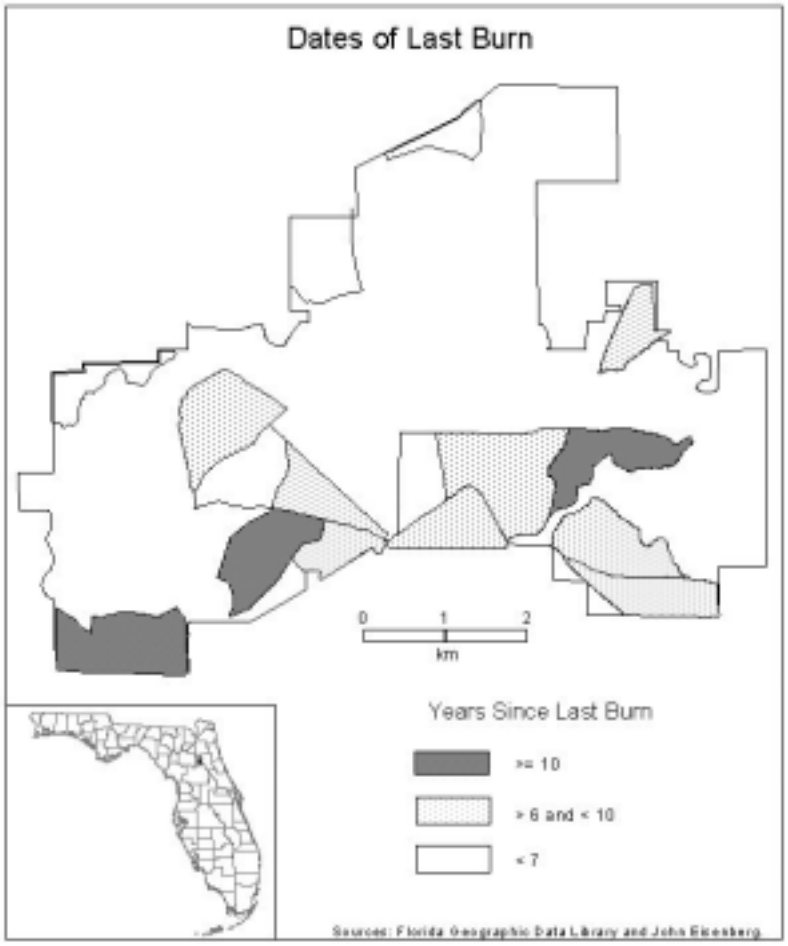
Remotely sensed data

- Landsat Thematic Mapper (TM; WRS 17/39)
  22 March 1997


TM (4,3,2)
Mar 22, 1997
Ordway Preserve

Methods

- Burn map
  - Digitized into GIS
- Two categories
  - Frequency of burns in previous ten years
    - Two, one, zero burns
  - Years since last burn
    - 0 – 6, 7 – 9, and >= 10 years

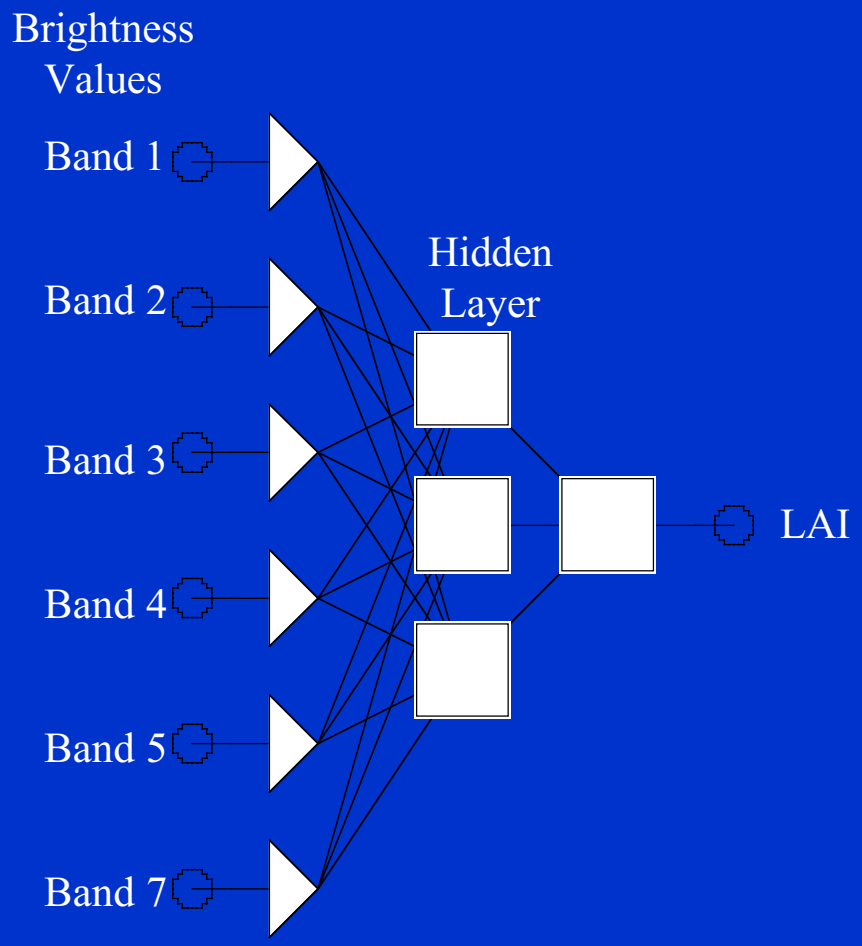

Dates of Last Burn
0
1
2
km
Years Since Last Burn
>= 10
> 6 and < 10
< 7
Sources: Florida Geographic Data Library and John Eisenberg

Methods

- Random points generated using GIS
  - Program to extract weighted brightness values
- LAI computed with ANNs
- Anova
  - Tukey's post-hoc test

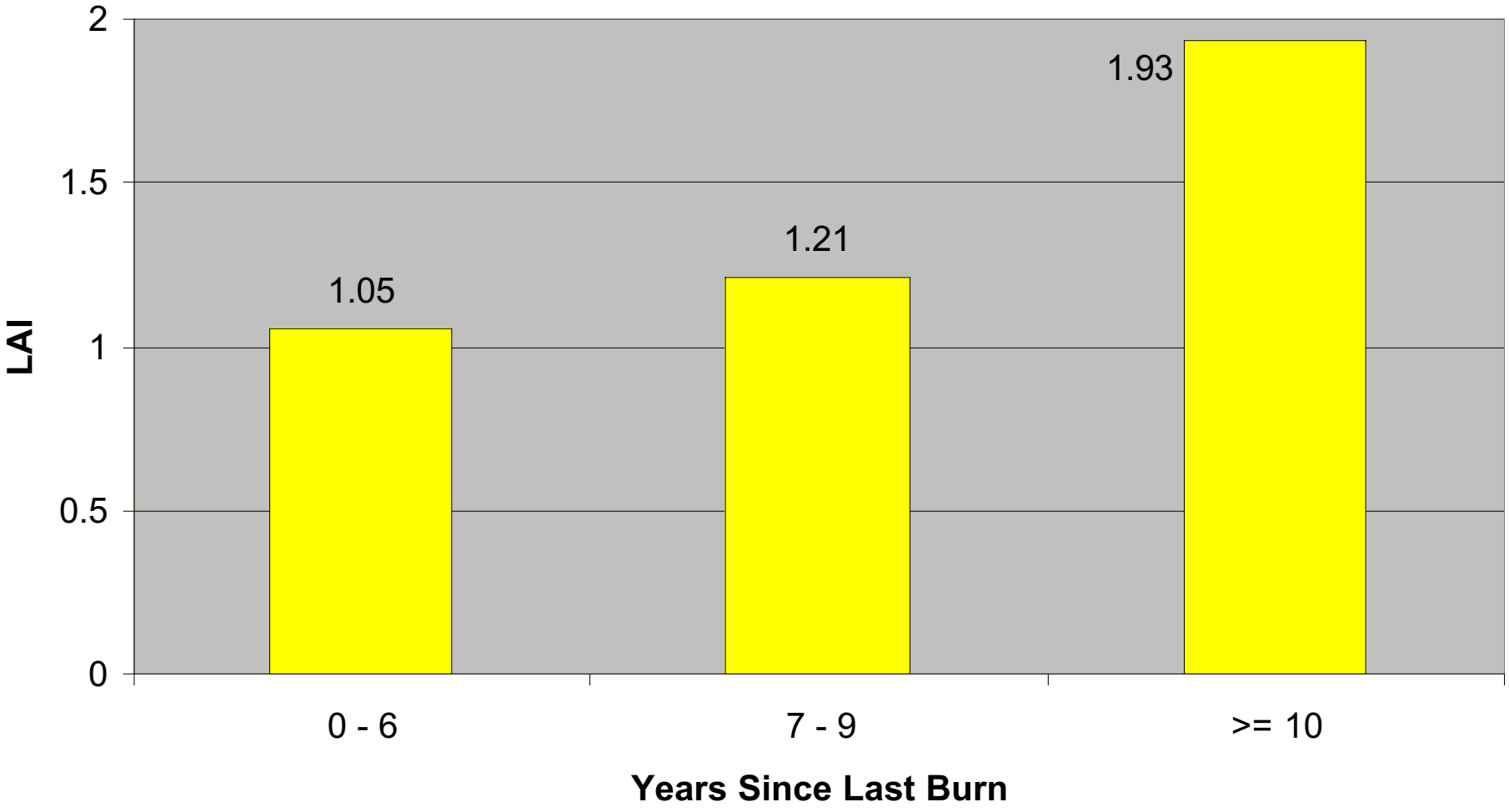
Methods

- Artificial Neural Network
  - Backpropagation



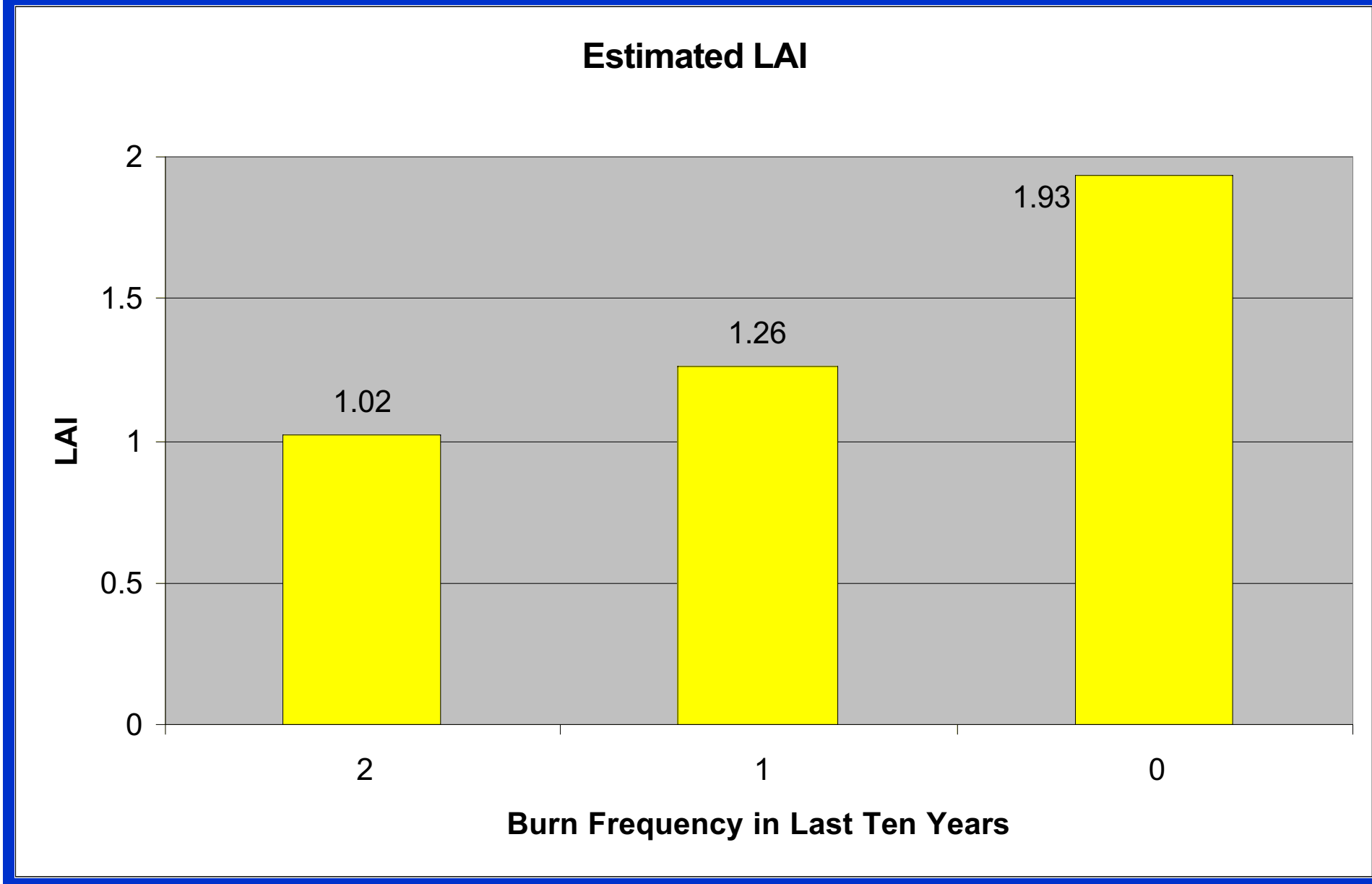
Time Since Last Burn

Time since last burn (years)	# points	Average estimated LAI	Standard deviation
0 – 6	159	1.05	0.66
7 – 9	367	1.21	0.52
>= 10	197	1.93	1.18


Estimated LAI
LAI
2
1.5
1
0.5
0
1.05
1.21
1.93
0 - 6
7 - 9
>= 10
Years Since Last Burn

Frequency of Burns

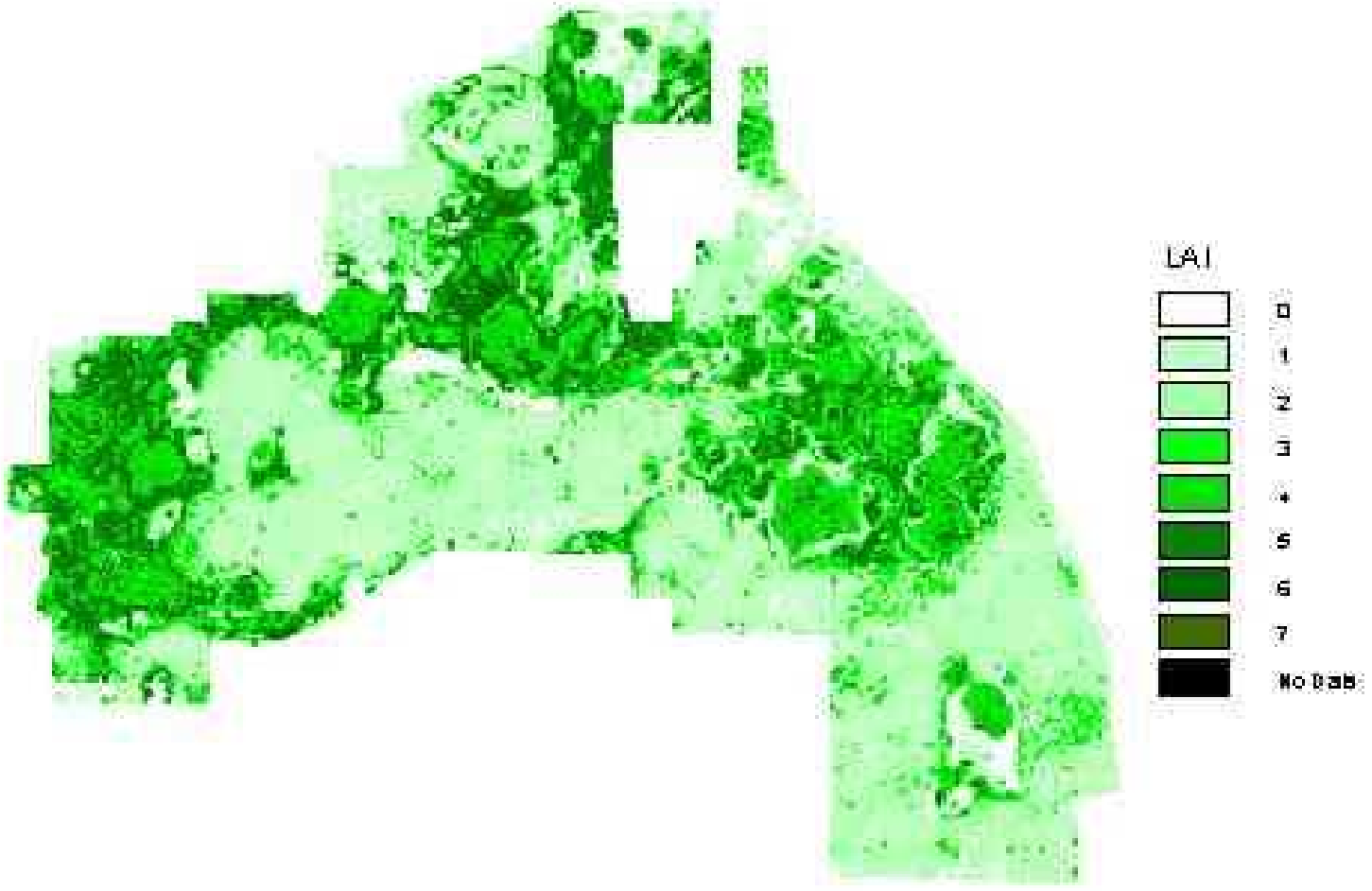
Frequency of burns in last 9 years	# points	Average estimated LAI	Standard deviation
2	113	1.02	0.71
1	250	1.26	0.62
0	197	1.93	1.18


Estimated LAI
LAI
2
1.5
1
0.5
0
1.02
1.26
1.93
2
1
0
Burn Frequency in Last Ten Years

Post-Hoc

- Years since last burn
  - Differences between
    - 0 – 6 and >=10
    - 7 – 9 and >=10
  - No difference between
    - 0 – 6 and 7 – 9
- Frequency of burns
  - Differences between all groups

LAI Map of Ordway



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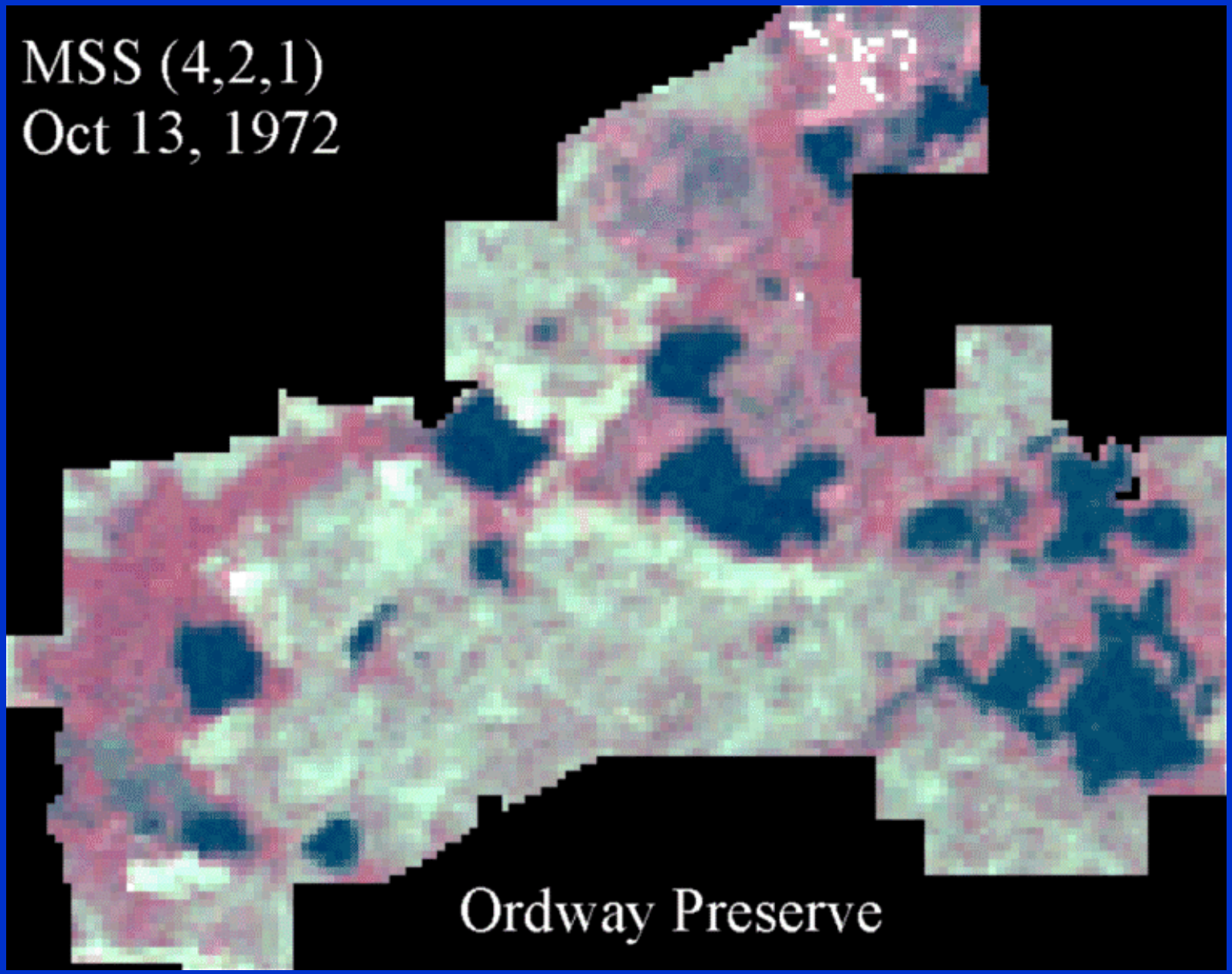
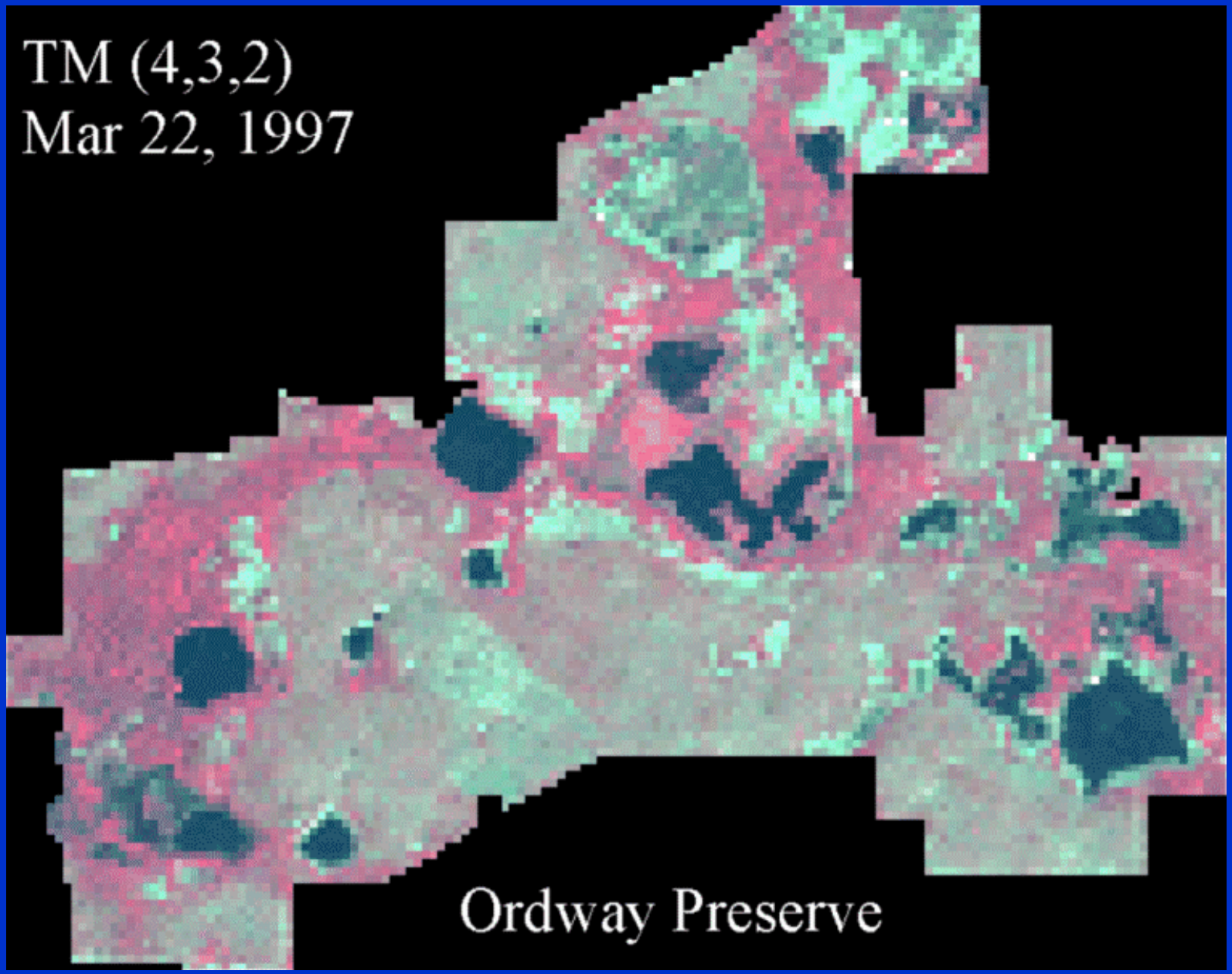
Post-classification change detection

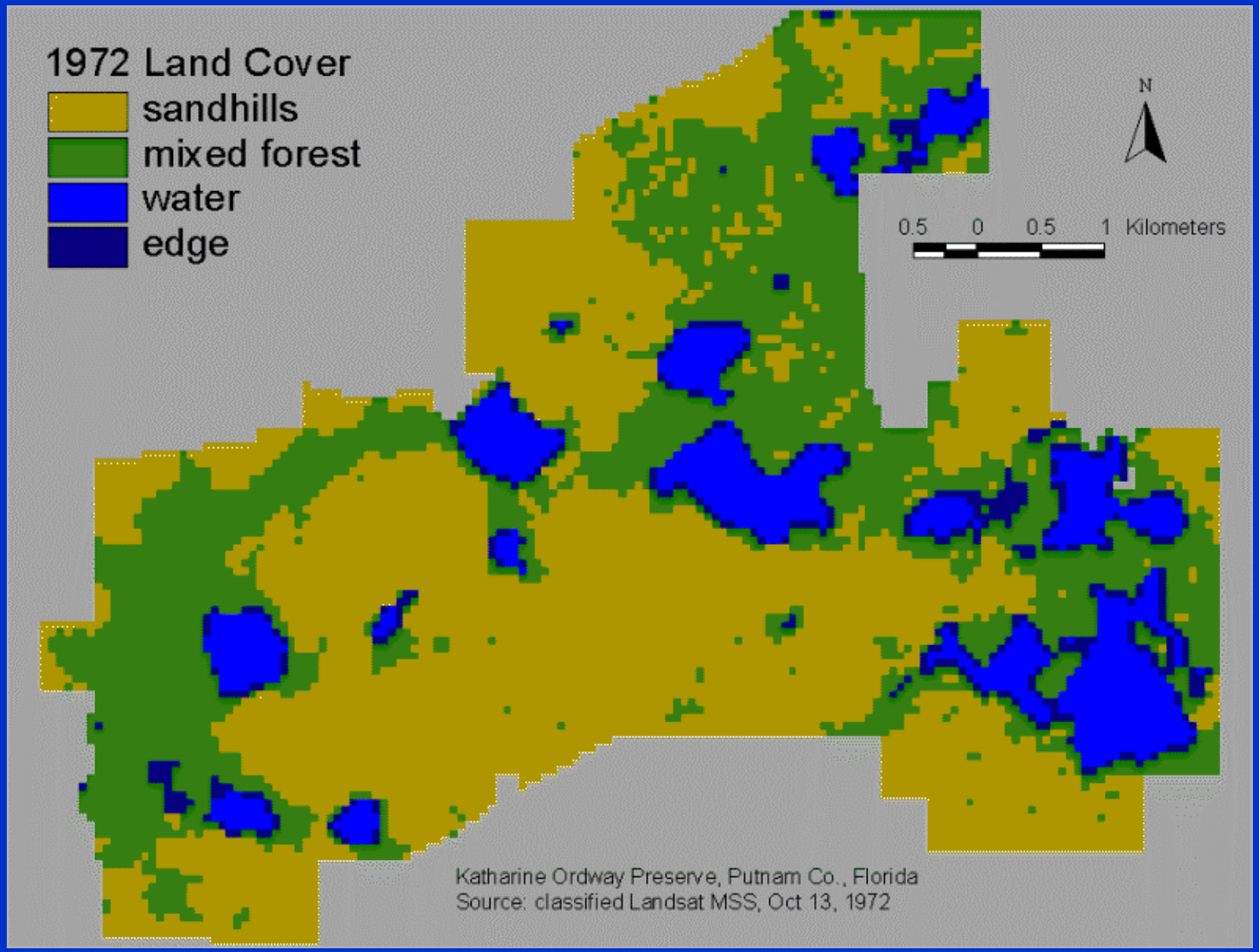
- Land cover classification of two images into four spectrally-similar feature classes
  - Landsat Multispectral Scanner (MSS; WRS 16/39) 10 October 1972
  - Landsat Thematic Mapper (TM; WRS 17/39) 22 March 1997

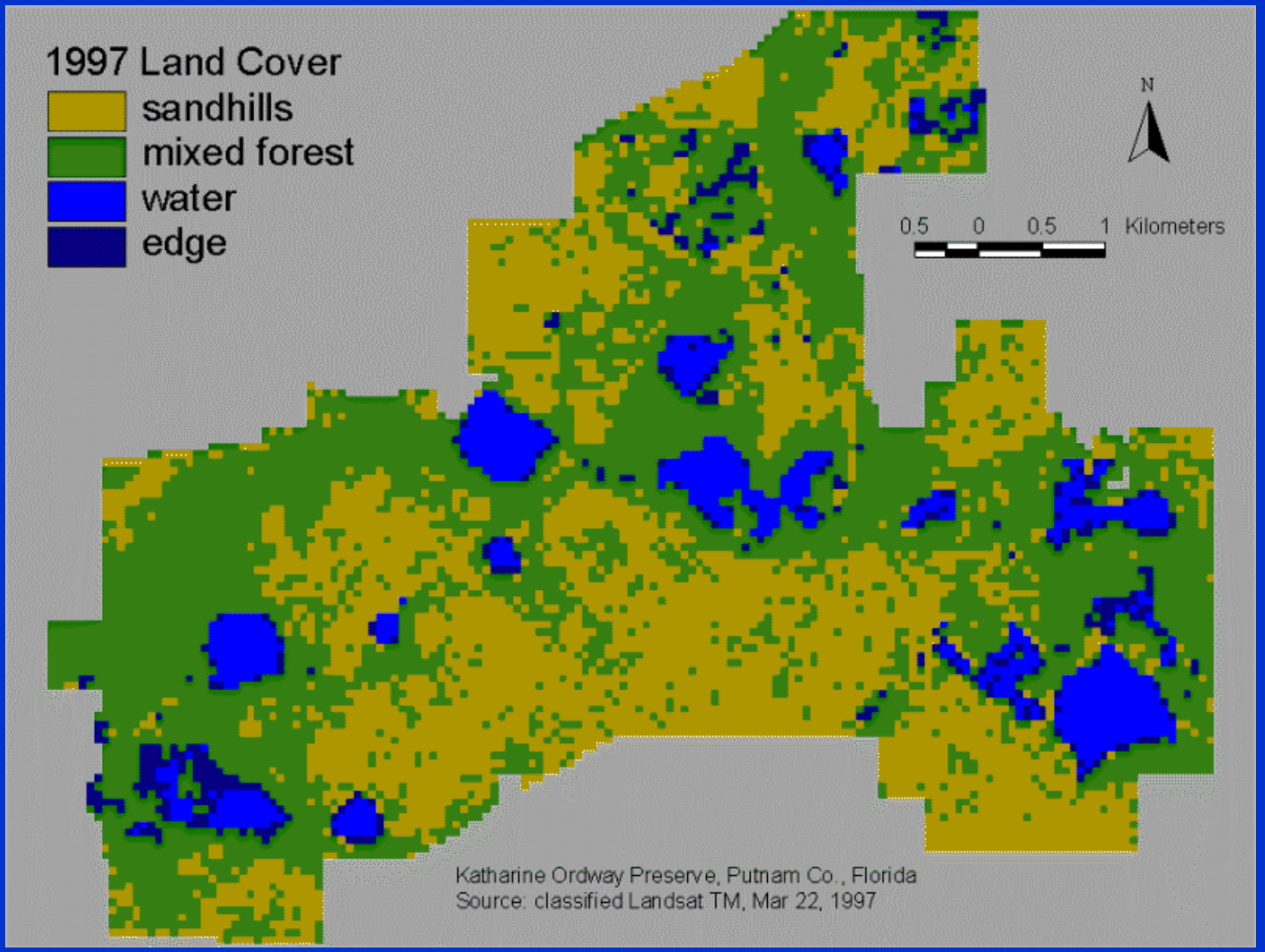

MSS (4,2,1)
Oct 13, 1972
Ordway Preserve


TM (4,3,2)
Mar 22, 1997
Ordway Preserve

Land cover classification

- Sandhills (longleaf pine forest)
- Mixed hardwood forest
- Water
- Edge


1972 Land Cover
sandhills
mixed forest
water
edge
N
0.5 0 0.5 1 Kilometers
Katharine Ordway Preserve, Putnam Co., Florida
Source: classified Landsat MSS, Oct 13, 1972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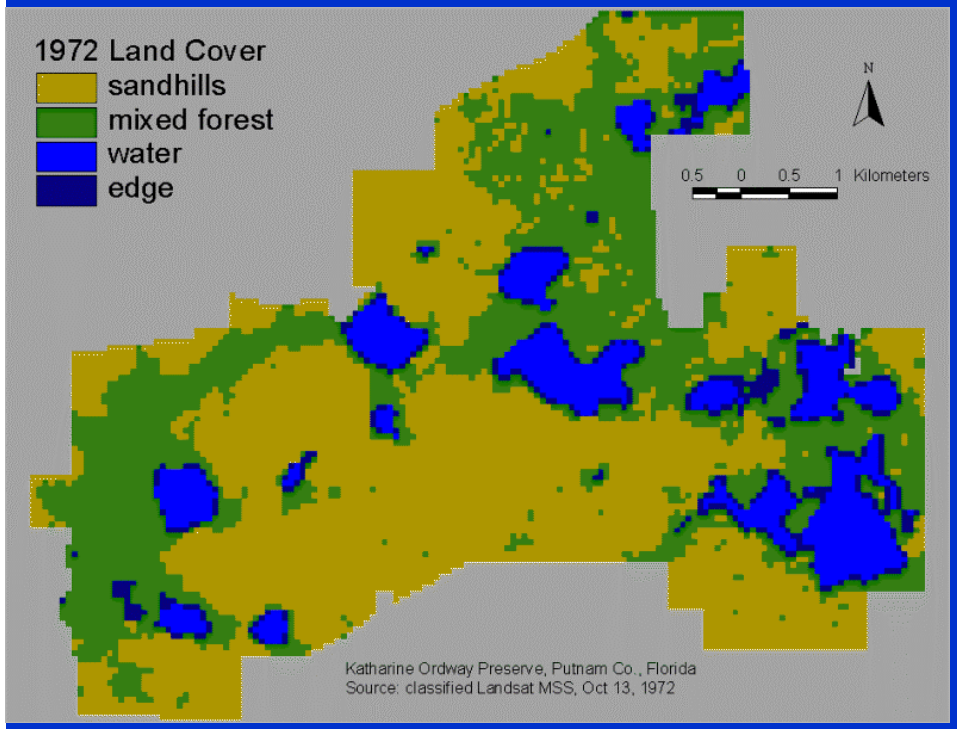
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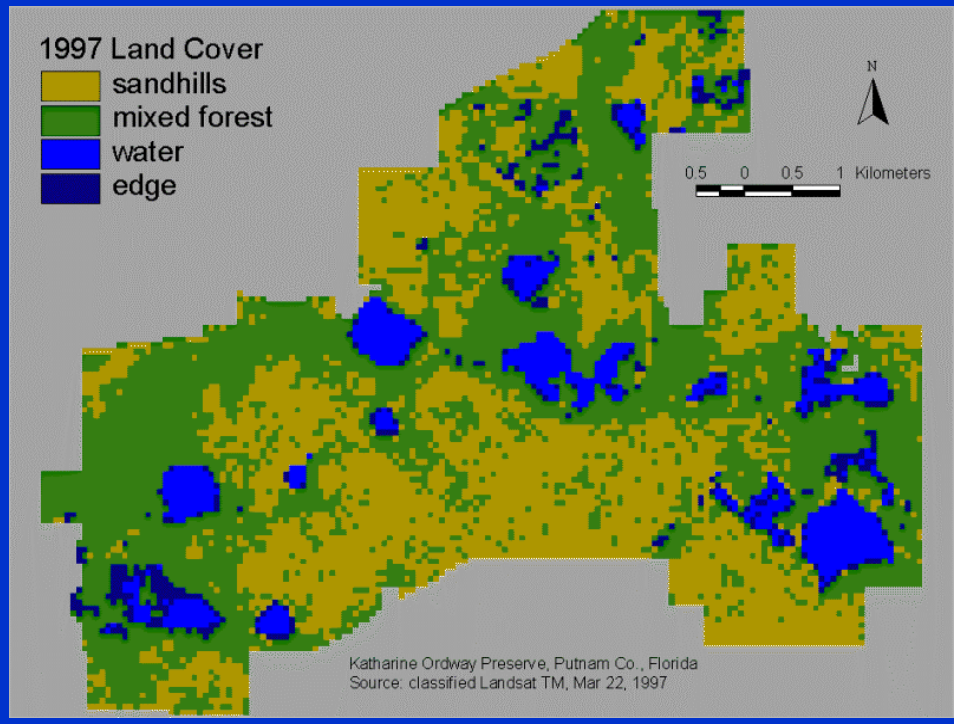
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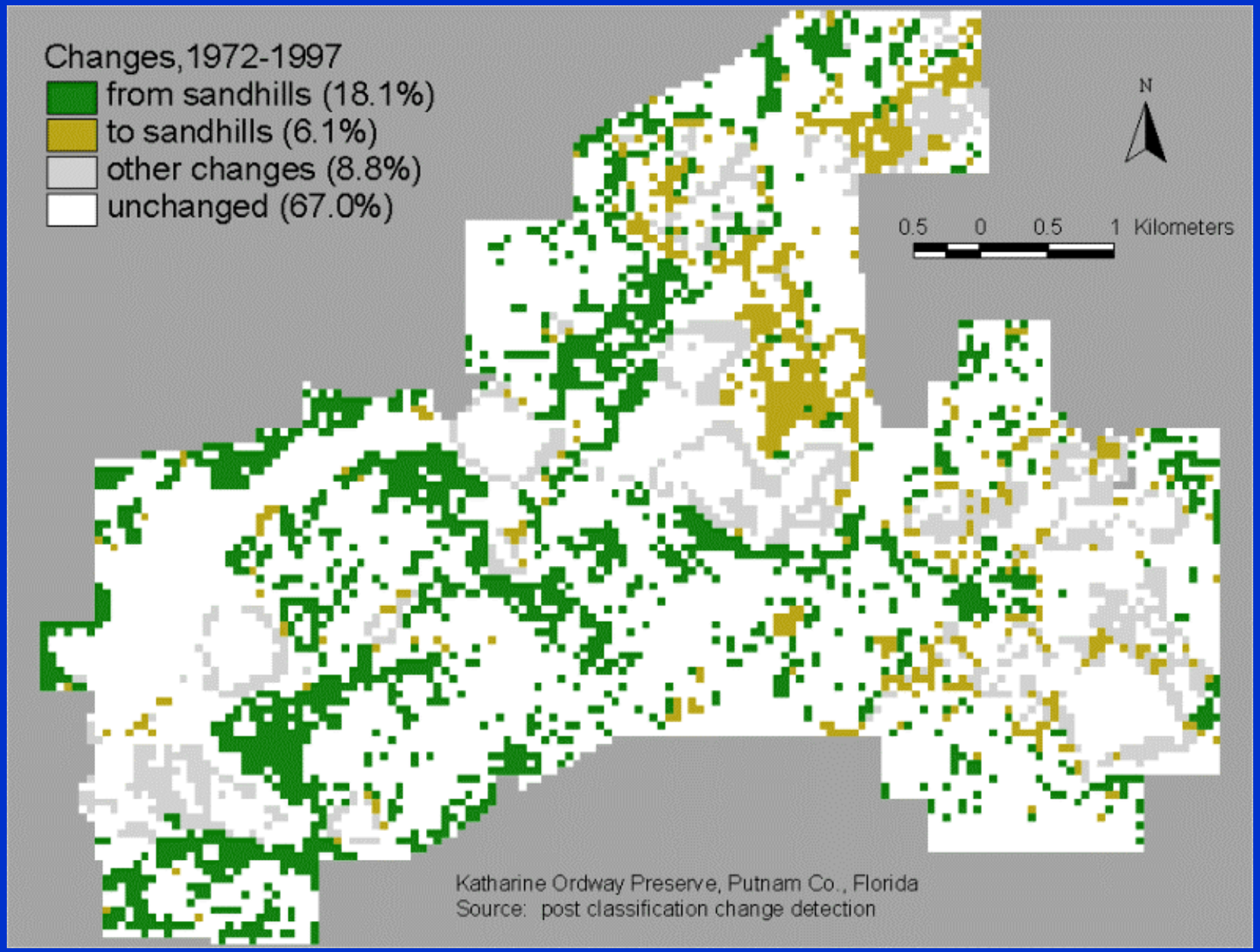
N
0.5 0 0.5 1 Kilometers
Katharine Ordway Preserve, Putnam Co., Florida
Source: classified Landsat TM, Mar 22, 1997

Results

- Changes from longleaf pine almost three times greater than changes to pine
- 18.1% of 1972 pine area lost in 25 years



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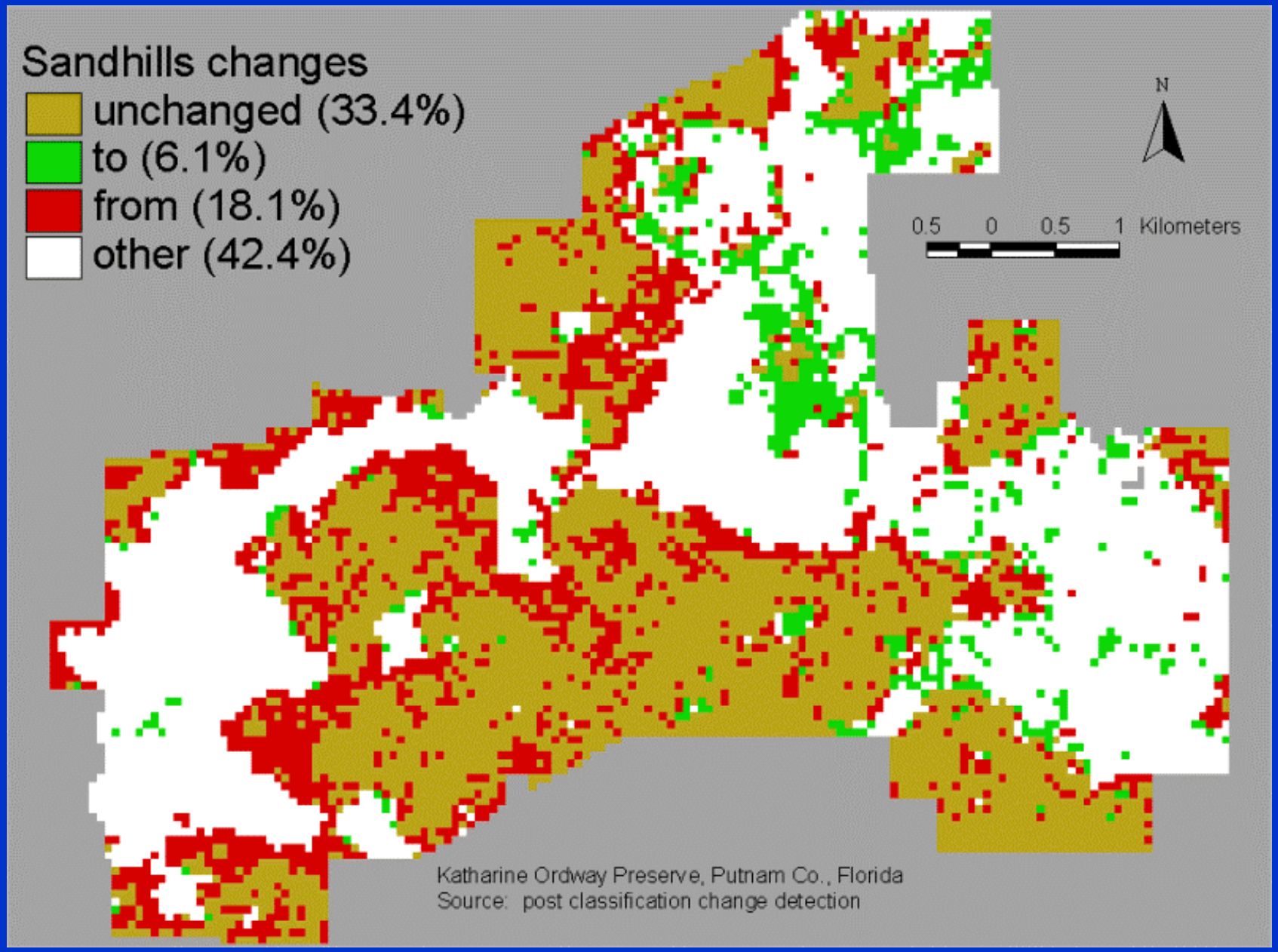
Matrix of land cover change (hectares), 1972 - 1997

		1997					
1972	**Class**	**Sandhills**	**Mixed forest**	**Water**	**Edge**	**Total**	**Total Losses**
	Sandhills	1,233	660	1	6	**1,900**	**667 (18.1%)**
	Mixed forest	190	980	10	72	**1,252**	**272 (7.4%)**
	Water	13	71	238	55	**377**	**139 (3.8%)**
	Edge	23	91	28	23	**164**	**142 (3.8%)**
	Total	**1,459**	**1,802**	**277**	**156**	**3,694**	
	Total Gains	**226 (6.1%)**	**822 (22.3%)**	**39 (1.0%)**	**133 (3.6%)**		**1,220 (33.0%)**



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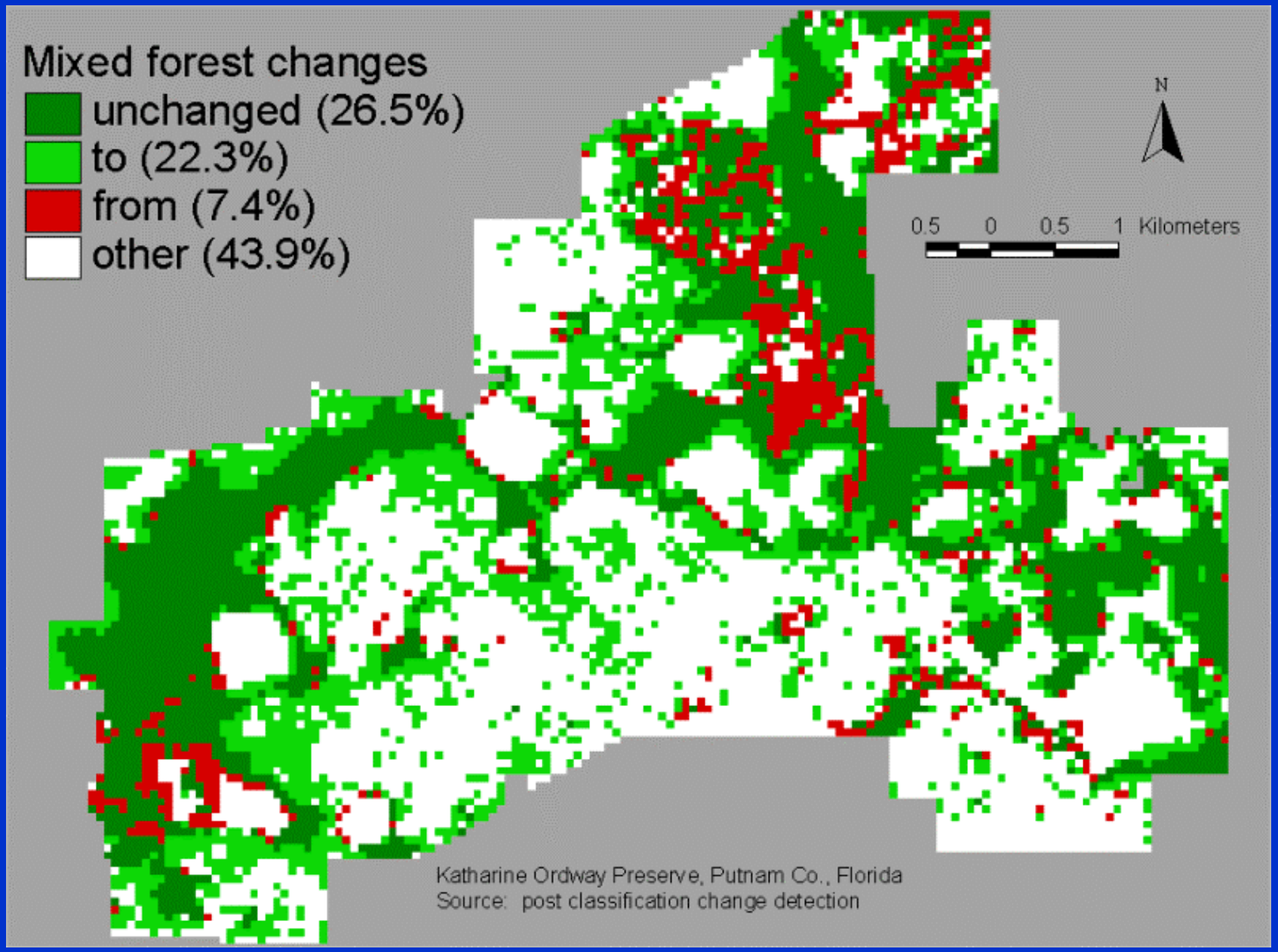

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Changes

- Longleaf pine decreased, fragmented
- Mixed hardwood forest encroached

Possible causes

- Misunderstanding
- Delay in application and policy to catch up with knowledge
- High-profile failures

Media coverage

- Burning plans must be published
- Failures to control, damages reported
- Successes not reported

Public perception

- Fire in natural settings is always bad
- Controlled burns aren’t controlled

Los Alamos Fire

Source: http://www.disasterrelief.org

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First Poster


Smokey Bear
Only you can prevent wildfires!
Ad Council
SMOKEY
CLICK HERE TO ENTER!
BOBBY v3.2 APPROVED

Smokey

- Enormous advertising success
- Name and image recognition second only to Santa Claus
- Fire suppression is his only message

Future Research

- Sandhill study sites
  - South Carolina
  - North Carolina
  - Alabama
- Other variables
  - # of hardwoods
  - Proximity of hardwood ecosystems
  - Landscape structure

References

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