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The Hole-in-the-Donut Wetland Restoration Project

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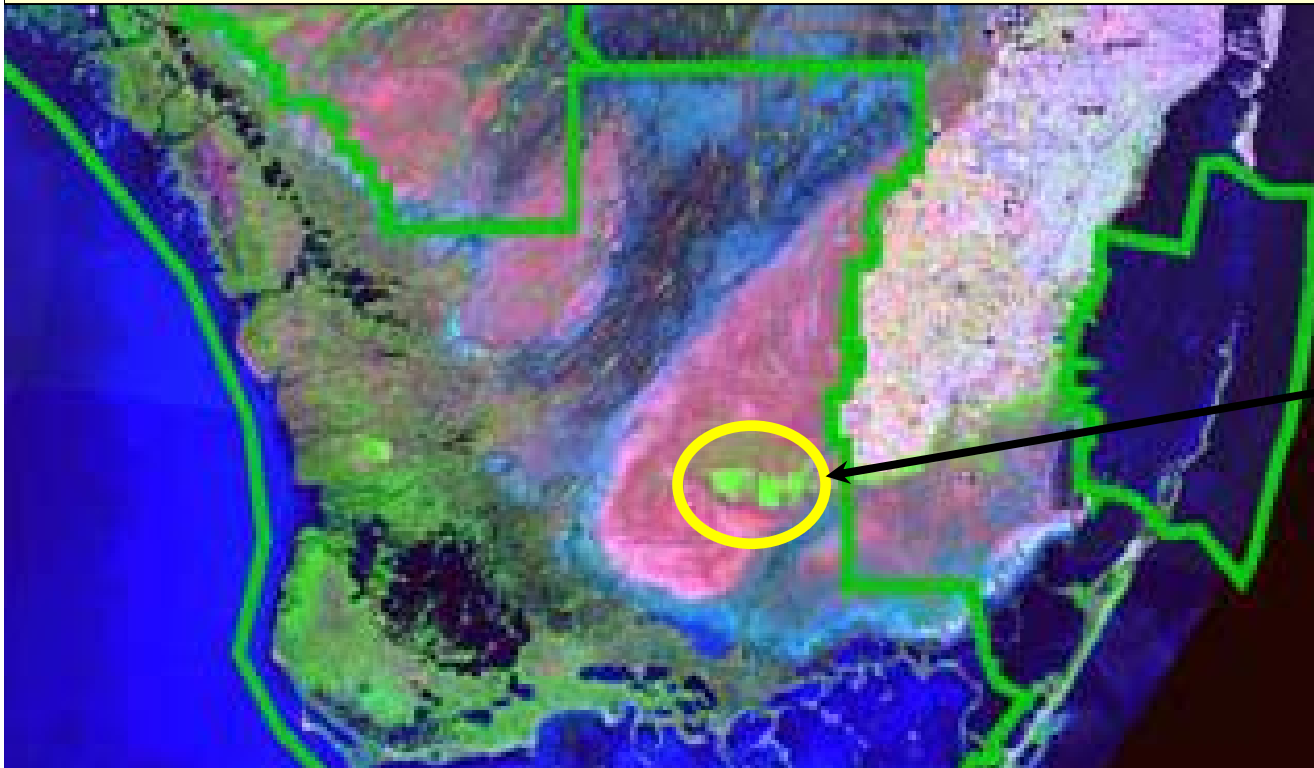
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The Hole-in-the-Donut Restoration

- 6,600 acres of previously farmed land
- Added to Everglades N.P. in 1970's
- Restoring natural vegetation communities



Hole-in-the-Donut

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Farming altered soils

- Furrows, fertilization, rockplowing
- Outcome is a variety of disturbed communities
 - Monoculture of Brazilian pepper (*Schinus terebinthifolius*)
 - Dense native shrub community
 - Relatively natural vegetation on a furrowed landscape 40 yrs later
- Goals
 - Restore natural communities
 - Support natural landscape processes (fire, sheetflow, etc.)



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Pre-Farming Land Cover

- Most of HID marl prairie
- ~15% pine rockland
- Few sloughs, hammocks



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HID Farming History

- Farming begun before 1940
- First farmed deeper marl
 - Irregular fields in finger glades
 - Large marl areas in SE HID
- Rockplowing moved farming to higher rocky areas
- Farmland abandoned from pre-1940 to 1975



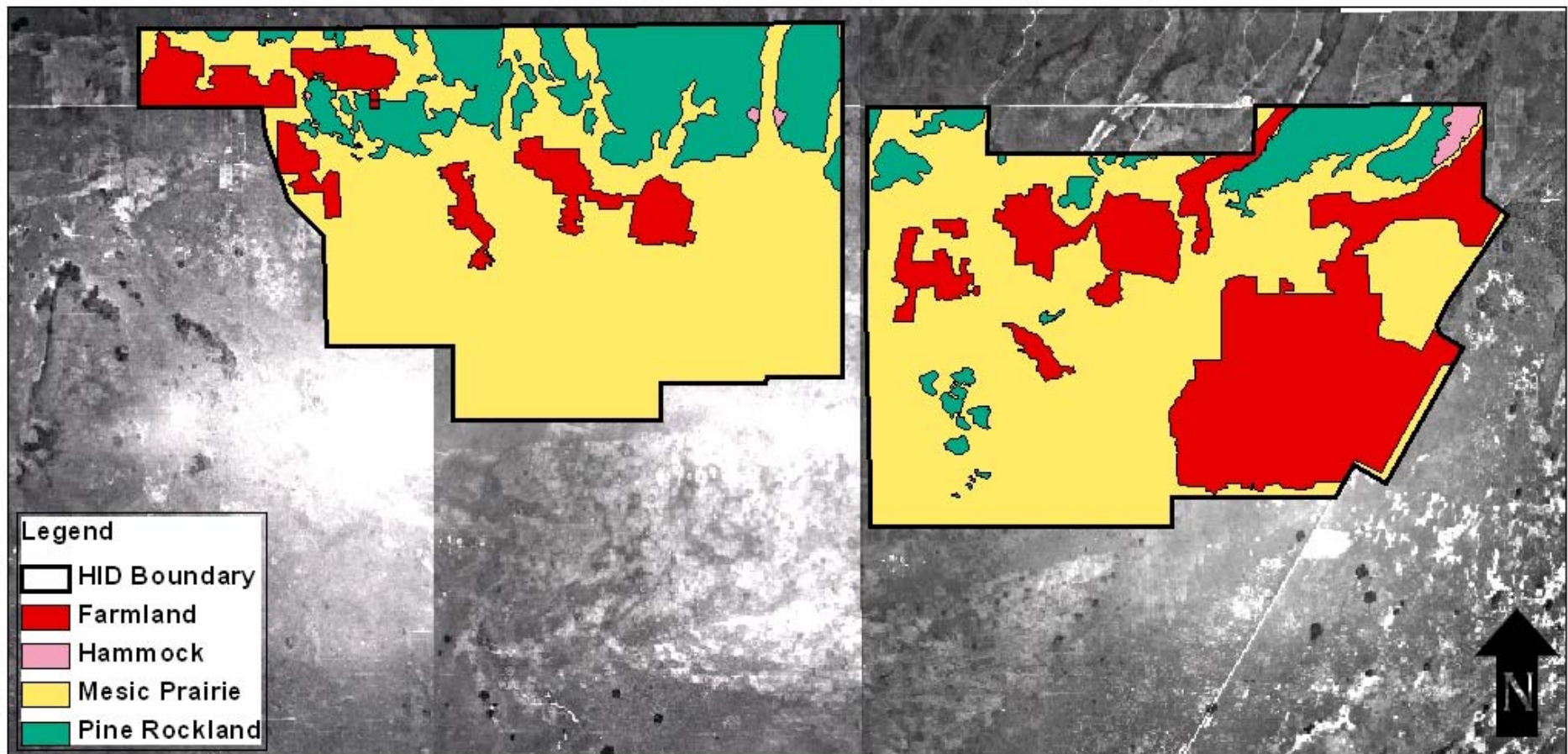
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Hole-in-the-Donut 1940's Aerial Interpretation by Vegetation Cover



0 1,500 3,000 6,000 9,000 12,000 Meters

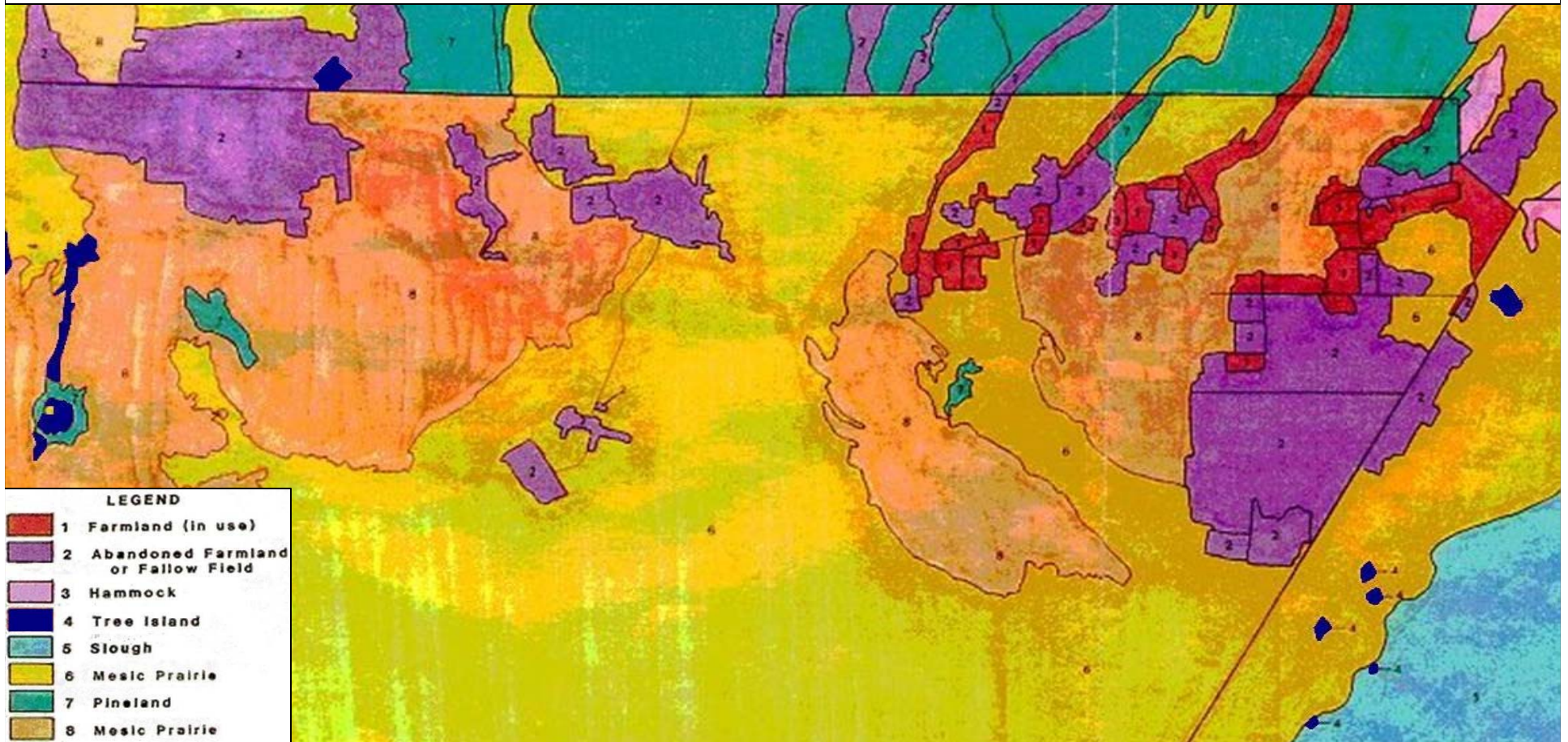
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Hole-in-the-Donut 1952 Aerial Interpretation by Vegetation Cover



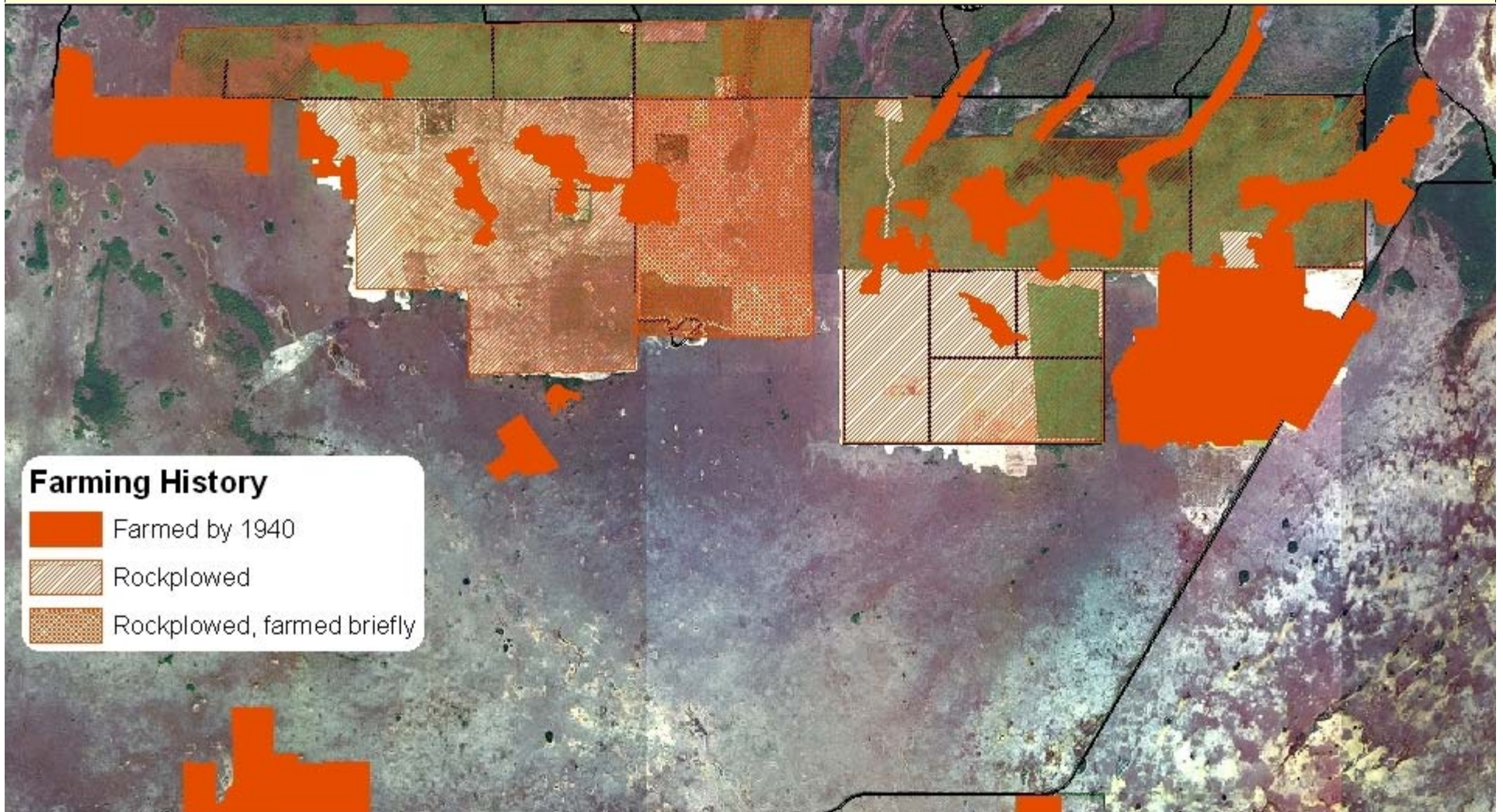
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Post-Rockplowed Map



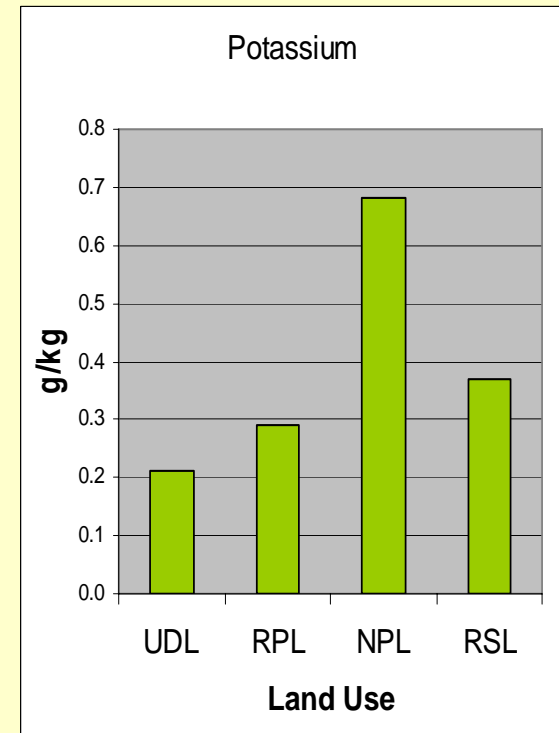
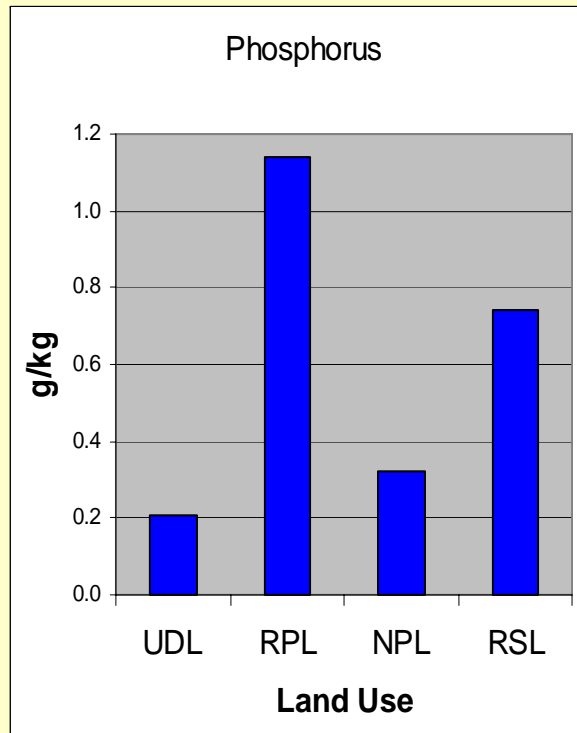
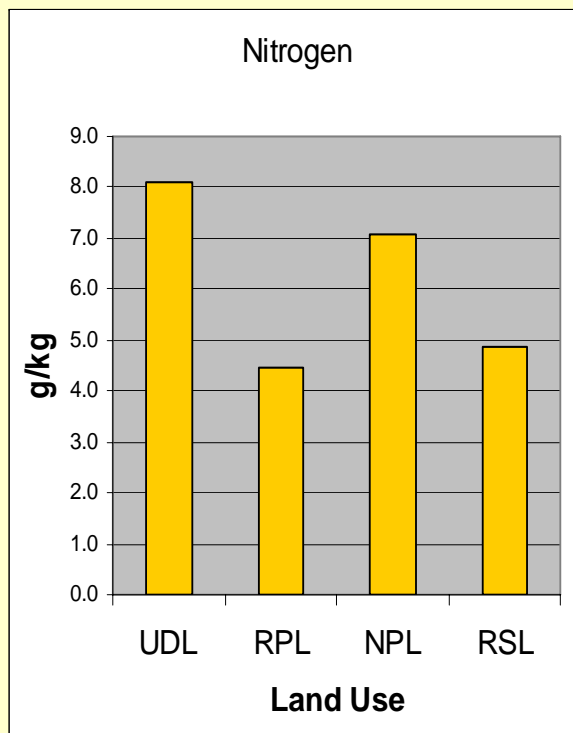
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Soil Nutrients



KEY: UDL = undeveloped, RPL = rockplowed, NPL, NPL = not rockplowed, RSL = restored

From: Li, Yuncong and Michael Norland. 2001. The role of soil fertility in invasion of Brazilian pepper (*Schinus terebinthifolius*) in Everglades National Park, Florida. *Soil Sci.* 166:400-405.

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Rockplowed Brazilian Pepper





Brazilian Pepper pre-restoration



- 95% *Schinus* cover
- Dense, monospecific
- Rockplowed soils
 - P-enrichment
 - Lower N
 - Similar K

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Previous attempts to restore the Hole-in-the-Donut (1972-1989)

- Planting pine and hardwood seedlings
- Direct seeding of pines and hardwoods
- Transplants (plugs) of native grasses and sedges
- Mowing
- Disking
- Bulldozing and other mechanical methods
- Controlled burning
- Herbicide treatments
- Partial Substrate removal

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Only Successful Treatment

COMPLETE SOIL REMOVAL

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Step 1: Cutting



Step 2: Windrows



**Step 3: Material Hauled to
Soil Disposal Mound**



Step 4: Final Scrape



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Recently Restored



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Restoration Outcome

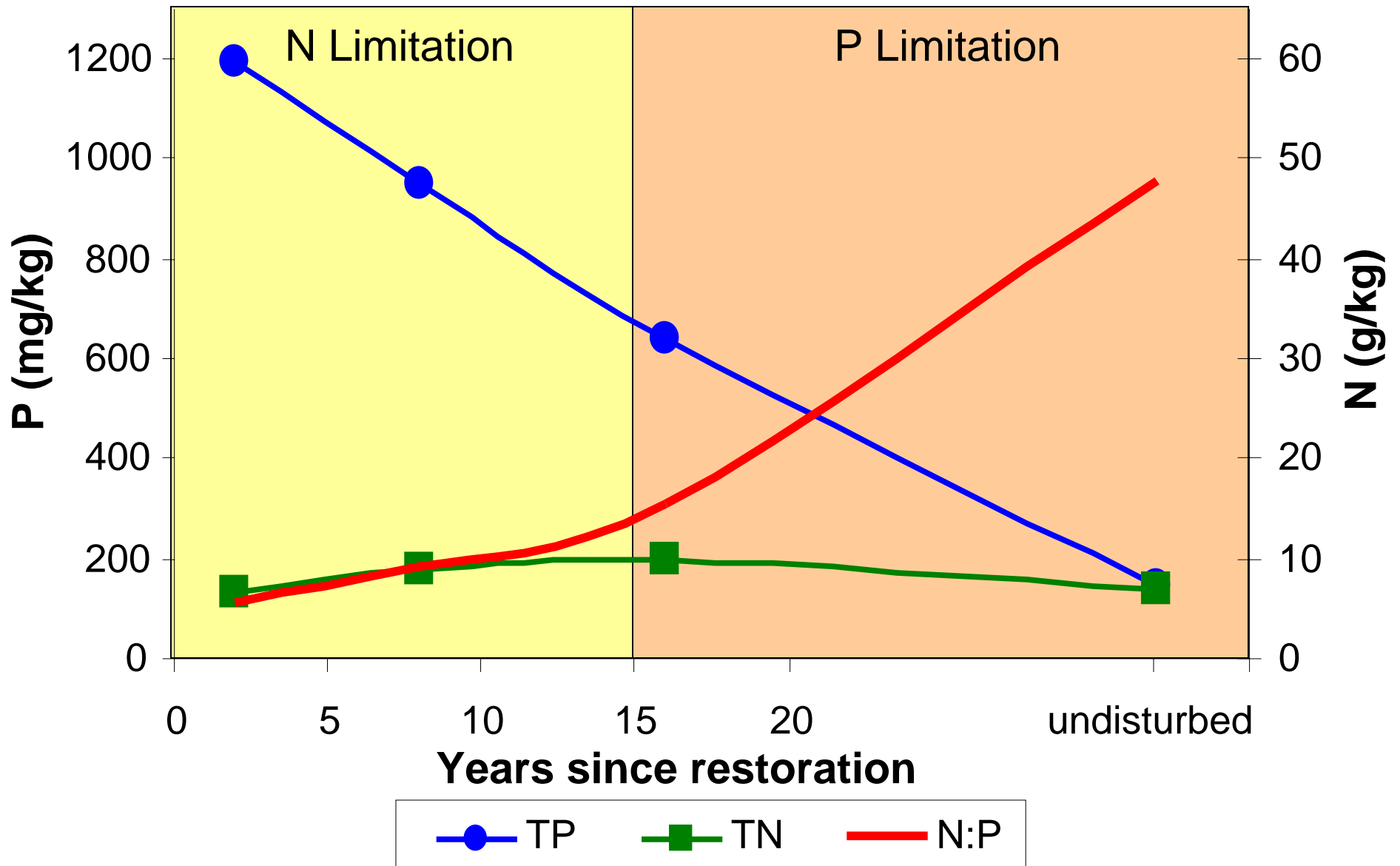
- Native plant community
- Initially N – limited
- Shift to P-limitation over time
- Soil accumulation



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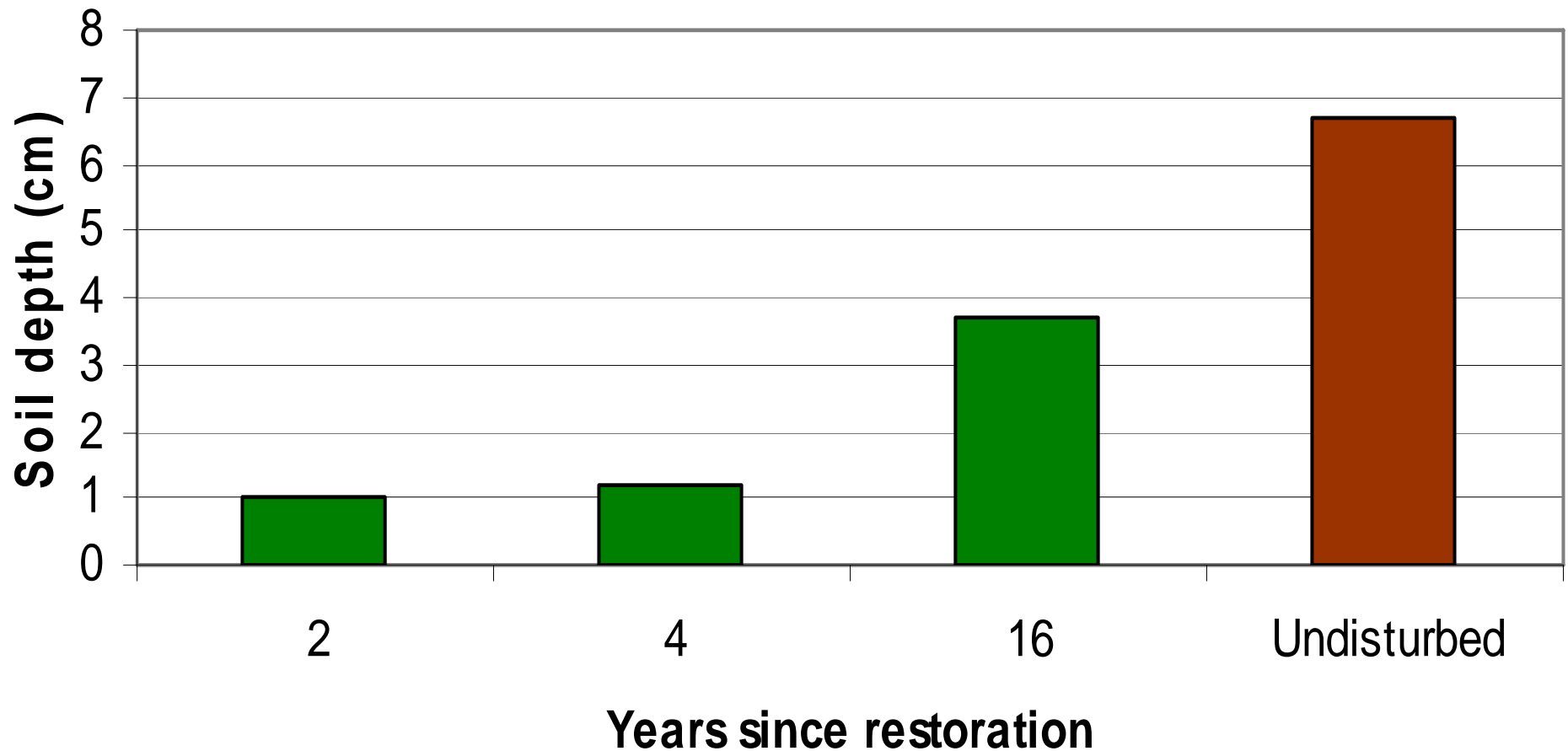
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Soil depth as a function of time since restoration



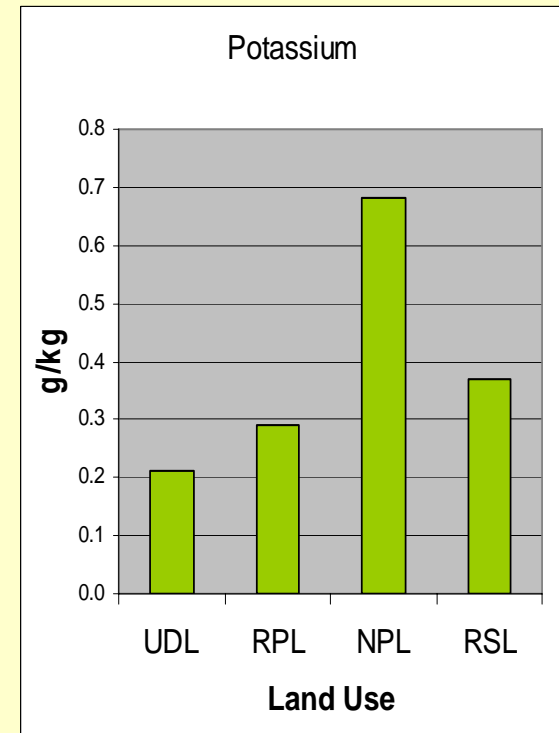
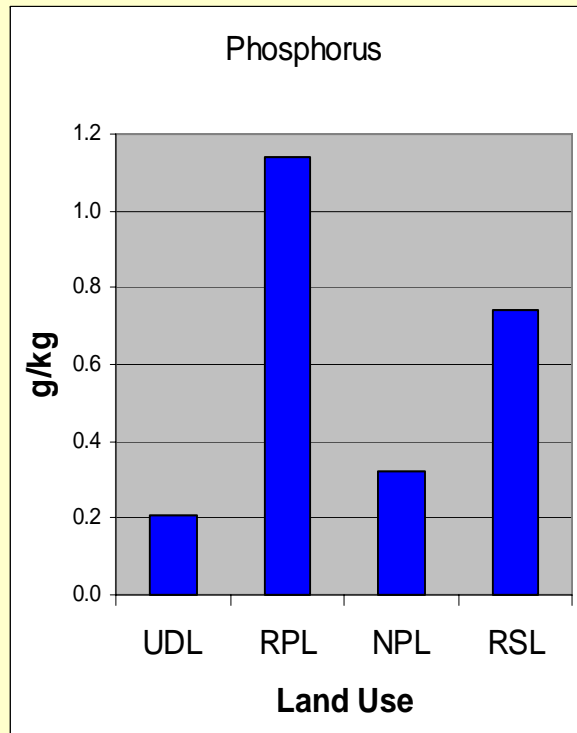
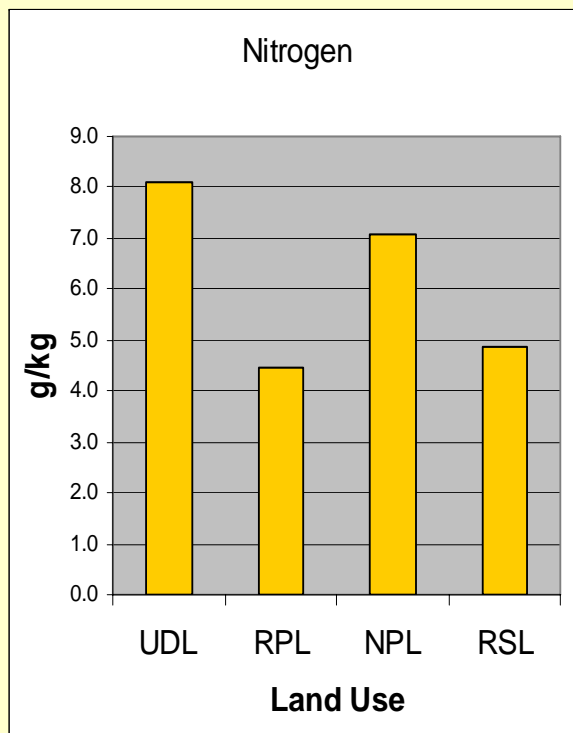
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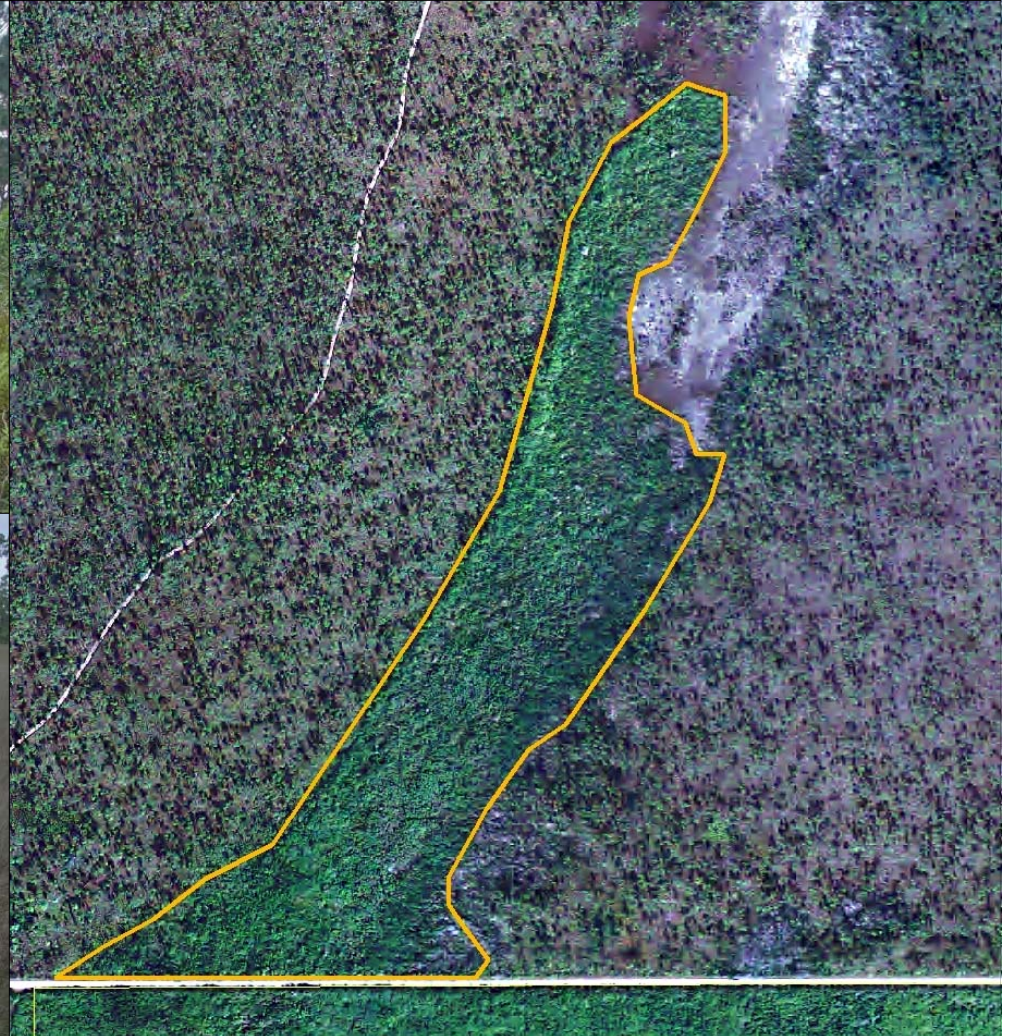
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Non-Rockplowed Finger Glade



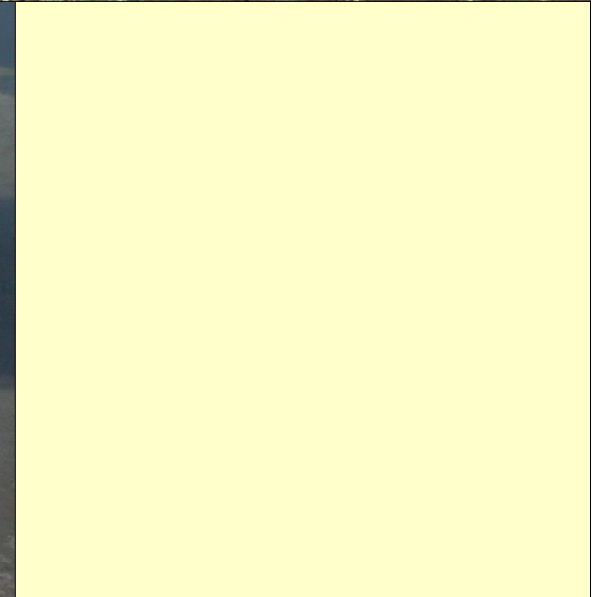
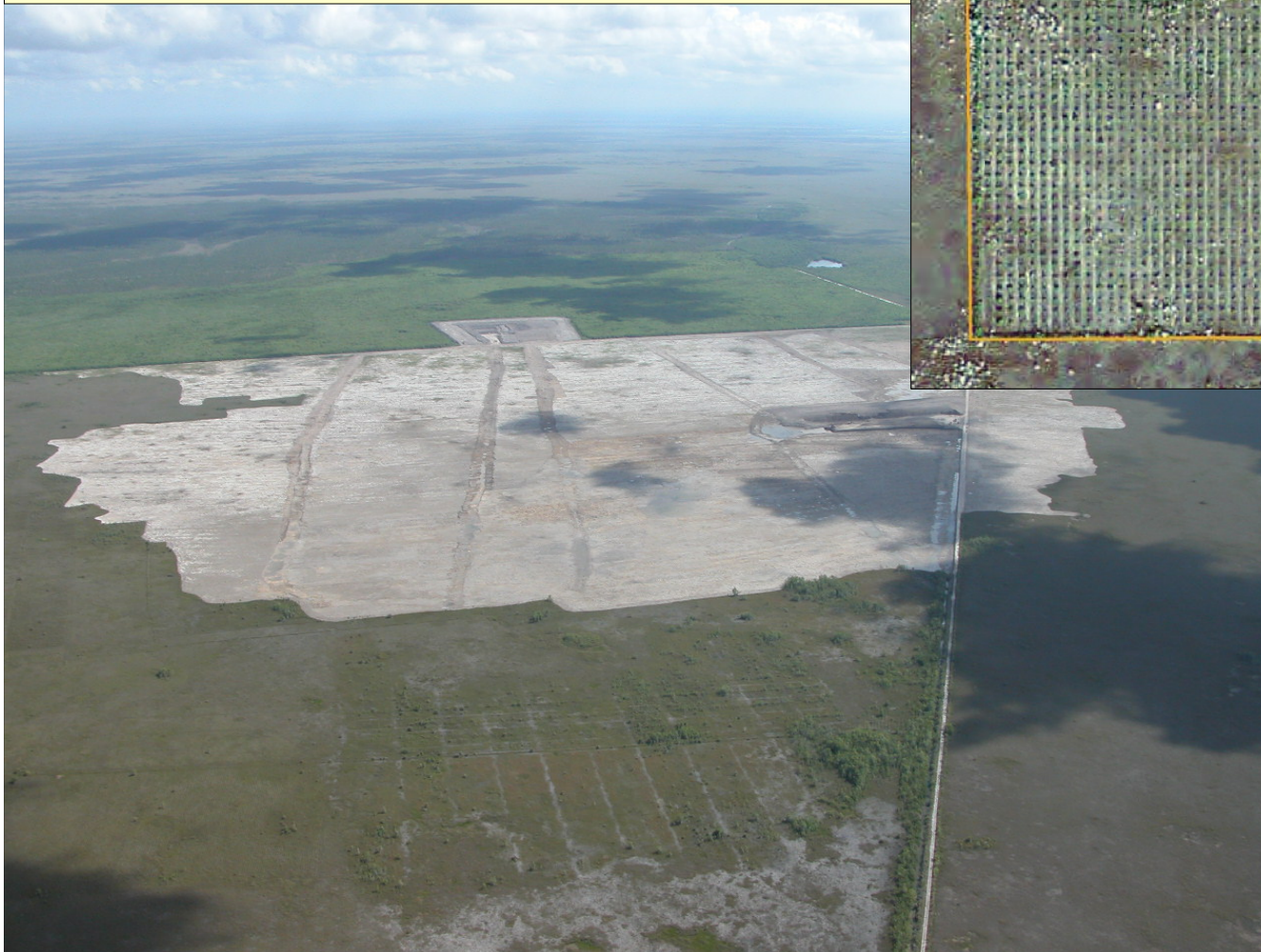
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Non-Rockplowed Furrows



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Conclusion

- Rockplowing and fertilization altered HID soils
- Phosphorus-rich farmland was invaded and dominated by Brazilian pepper
- Successful restoration of Brazilian pepper-dominated areas requires complete soil removal
- Shift from N to P-limitation following restoration
- Need additional data on soil nutrient levels, particularly P, in non-rockplowed areas

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THANKS!

