Effect of hydrology and fire on vegetation species composition within the Ridge and Slough landscape across the Everglades ecosystem

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1. Introduction

- Wetlands are diverse ecosystems that provide critical ecological and economic functions such as wildlife habitat and water source.
- Anthropogenic activities such as hydrologic alteration and eutrophication (nutrient enrichment) cause wetland degradation and loss by changing water quality, quantity, flow-rates, and promoting the proliferation of invasive or aggressive native plant species.
- Similar trends have been documented in the Florida Everglades ecosystem, which comprises a mosaic of flow-oriented sawgrass **ridges** and **sloughs** with tree islands interspersed throughout the landscape.
- Previous studies show that change in hydrology and nutrient enrichment from agricultural areas resulted in vegetation shifts from sawgrass (*Cladium jamaicense*) dominance to cattail (*Typha domingensis*).
- However, the extent to which variability in hydrology, soil depth, and fire legacies influence **overall** vegetation species composition across the Everglades freshwater ecosystem has received little attention.

2. Objectives.

- The objective of this study was to assess how fire legacies (fire frequency and return intervals) interact with hydrology and soil depth to explain plant community assembly at different spatial scales within the historic ridge and slough landscape in the Everglades National Park (ENP) and Water Conservation Areas (WCAs) (Fig. 1).

3. Study Area

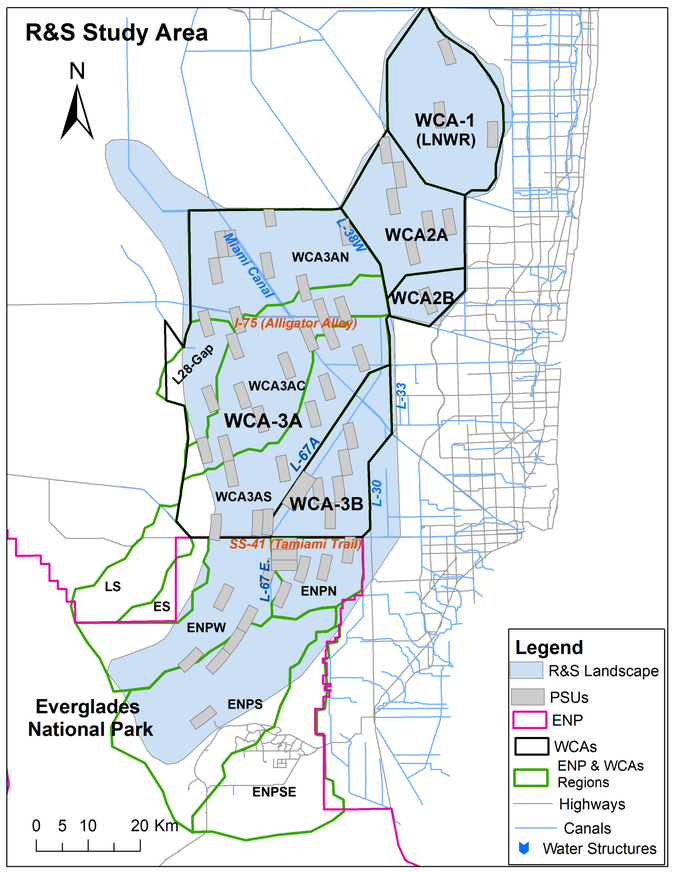
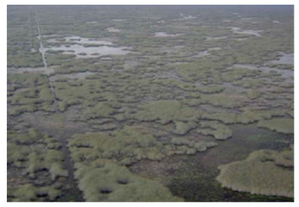


Fig. 1 Map showing the location of PUSs within the historic ridge and slough landscape of the Everglades National Park and Water Conservation Areas.

4. Methods



- **Data collection:** We conducted a system-wide landscape monitoring campaign covering the greater Everglades Ecosystem (Everglades National Park, and the Water Conservation Areas (Fig. 1) at fifty-eight 2×5 km permanent sampling units (PSUs), each containing up to 135, 1×1 m quadrats.
- Within each quadrat, vegetation characterization consisted of identifying all taxa present to species level and estimating the abundance of each species as a percentage (%) cover of the plot area.
- **Water depth** was measured using a meter stick, and **soil depth** data was collected by probing to the bedrock using a 1-cm diameter metal rod.
- We used expert knowledge to classify landscape as **ridge**, **slough**, and **transition**.
- We used the water depth data to quantify mean daily water levels over time at each location using EDEN data (https://sofia.usgs.gov/eden/).
- We obtained fire data for the ENP from 1948 to the present and WCAs from 1997 to the present and then calculated fire frequency and fire return intervals as Time since the Last Fire (years)
- **Data analysis:** We analyzed vegetation community composition and performed community-environment relationships with NMDS and linear mixed models.

5. Results

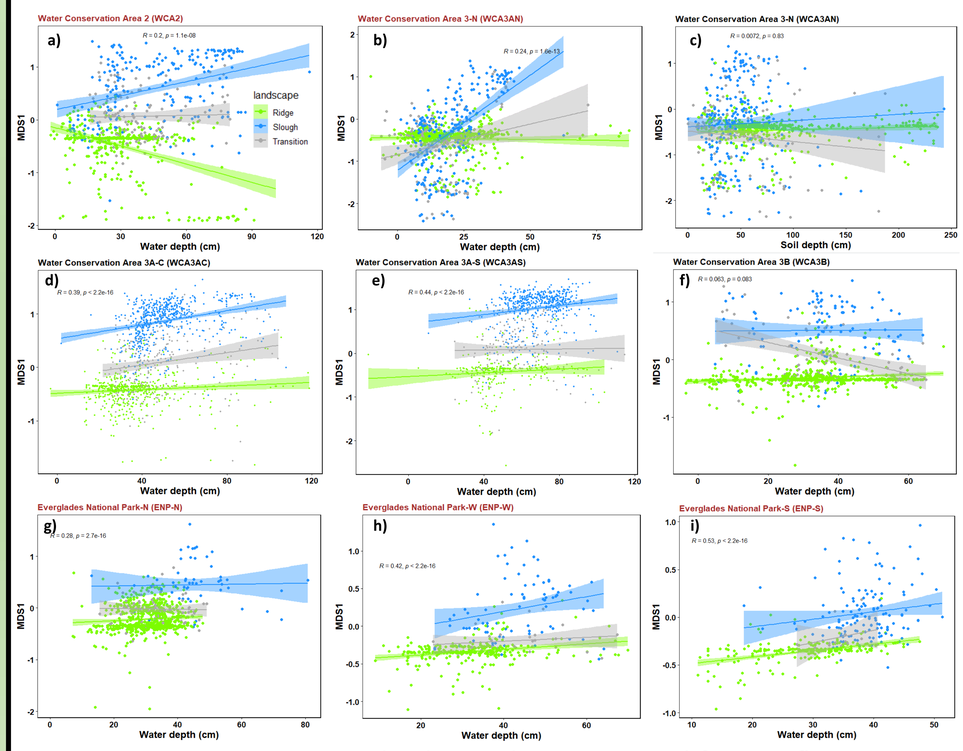


Fig. 2 Long-term mean water depth was the most critical factor influencing species composition patterns, and it varied by landscape classification. The interactive effect of fire return intervals (TSLF) and fire frequency was more substantial in northern WCAs and non-existent from the central WCAs to southern ENP.

6. Results

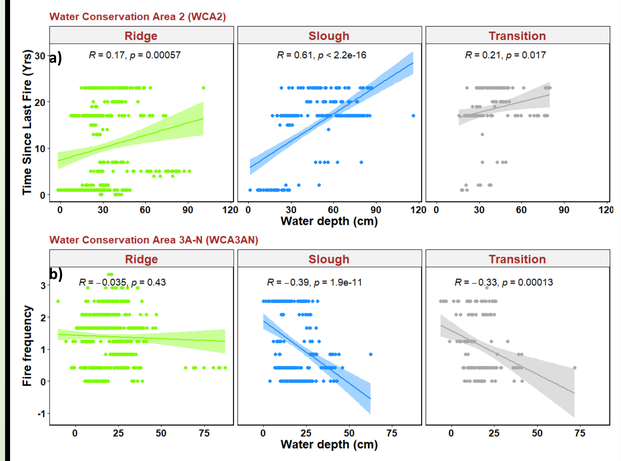


Fig. 3 The relationship between water depth and (a) time since the last fire in WCA2A and (b) fire frequency in WCA3A-N.

7. Discussion and conclusions

- Fire return interval and water depth interactively affected species composition in WCA2.
- The effect of fire frequency on species composition was significant in WCA3A-N and was regulated more by soil depth than the water depth.
- Long-term mean water depth was the most critical factor influencing species composition patterns across the ecosystem, and the effect varied by landscape classification.
- The interactive effect of fire return intervals (TSLF) and fire frequency was more substantial in the northern part of the ecosystem and dwindled southward from the central WCAs to southern ENP.
- Future studies should investigate how hydrology and fire alter soil and water nutrients to influence vegetation species composition

8. Acknowledgements

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9. References

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