Optimizing Fire Regimes In Everglades Fire-Dependent Ecosystems

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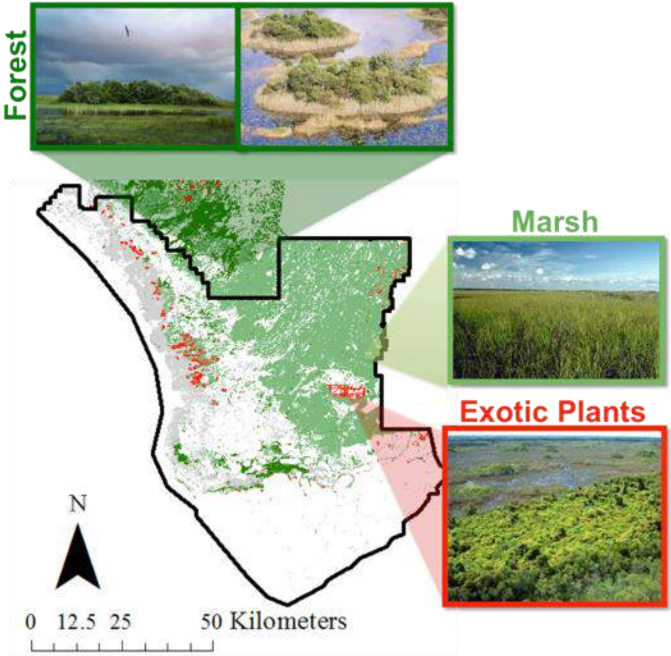
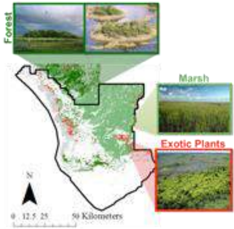
Fire is a driver of Ecosystem Change

Fire plays an important role in controlling the distribution and composition of communities in south Florida.

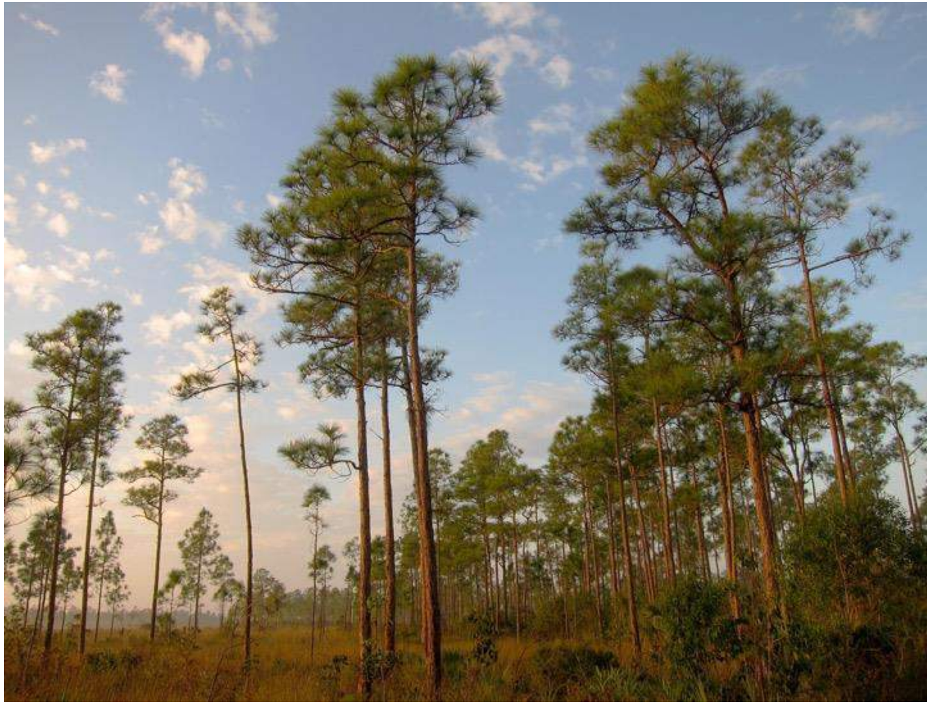


Florida’s Fire Maintained Communities



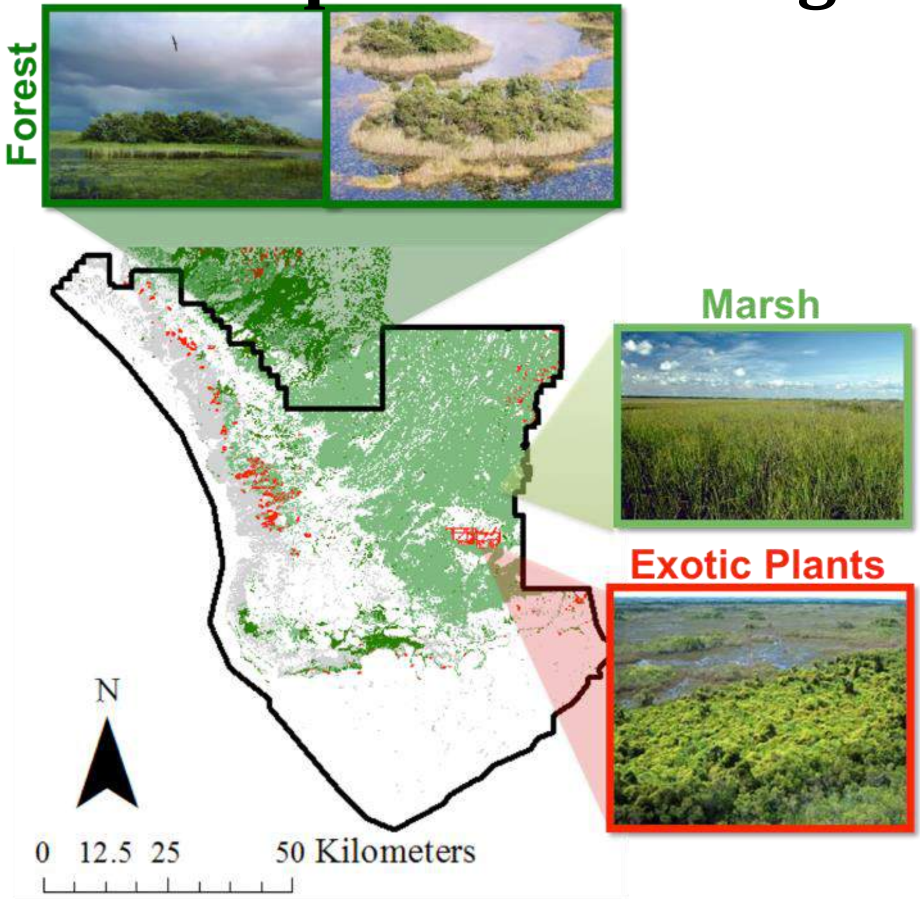
- Fire is required for endemic plants, especially in pine rocklands.

- Within a few decades of fire exclusion, pinelands succeed to closed hardwood hammocks.



(Robertson 1953, Alexander 1967, Loope and Dunevitz 1981)

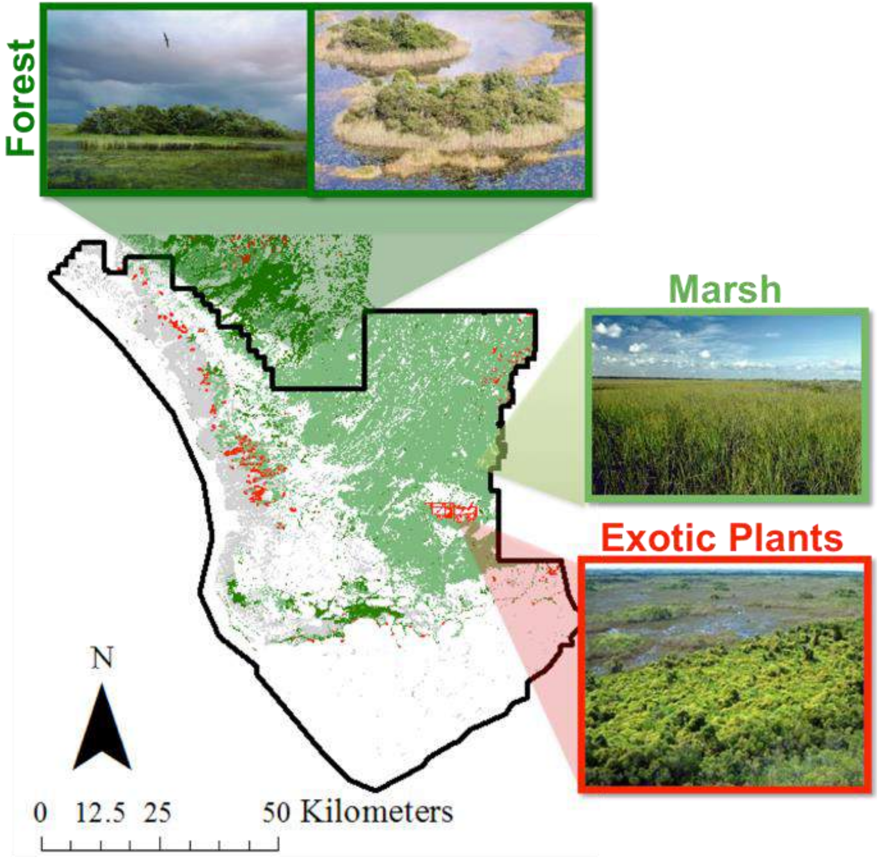
Fire is important in sawgrass dominated communities



Fire reduces the buildup of dead biomass that shades living photosynthesizing material.

Vegetation resprouts after fire rapidly returning to prefire composition and biomass.

Fire is a driver of ecosystem change

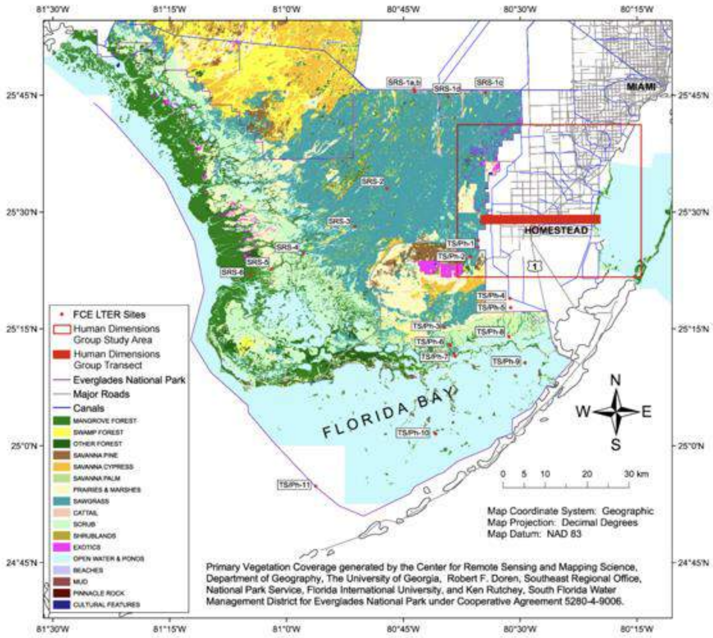


Flooding following fire can also lead to a change from sawgrass dominated to spikerush marsh

(Davis and Ogden 1994)

Determine the fire regime necessary to support the complex network of wetland ecosystems

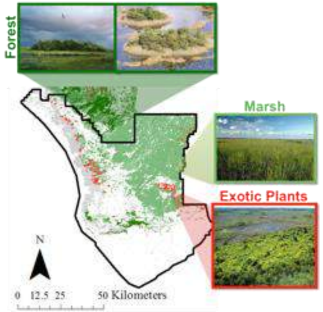
Evaluate patterns in community composition, fire regime, and hydrology.



Recovery

A key feature of ecosystem resilience to fire is the time required to return to a pre-fire state or level of function.

$$R_{ecotype} = Hydrology + Climate + Fire\ Regime$$

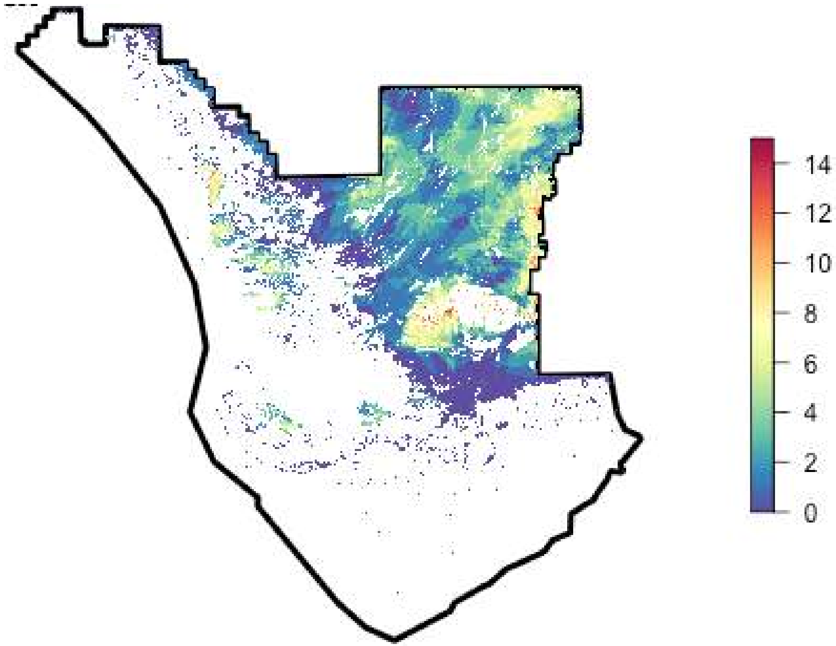


Everglades National Park

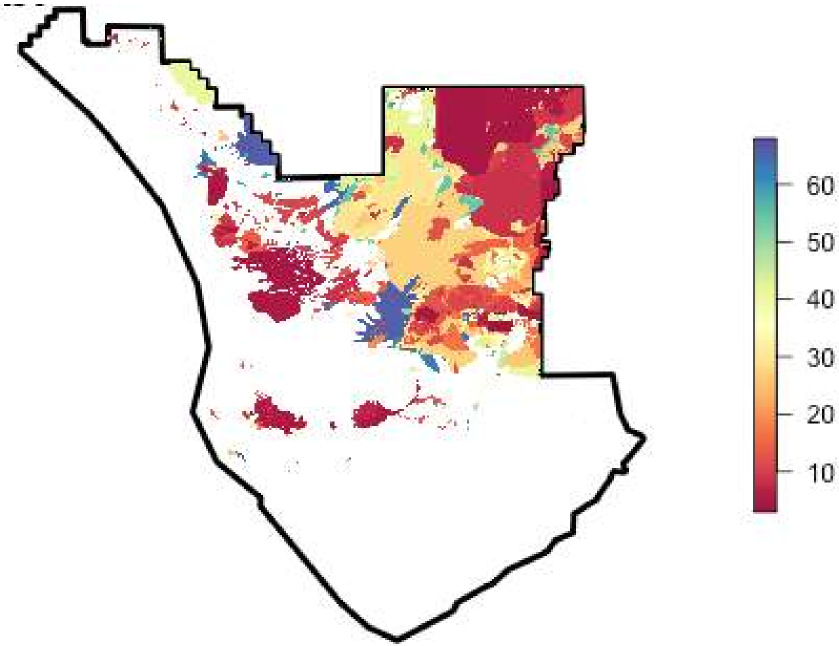
Rx + Wildfire

The fire records of Everglades National Park go back to 1948.

The total number of fires since 1948



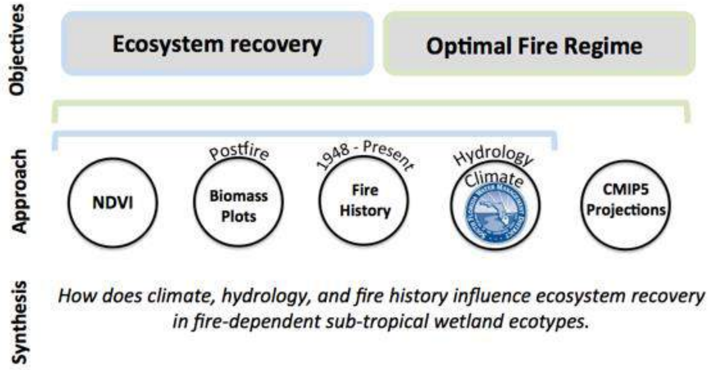
Number of years since the last fire



Determine how and why recovery rates vary and estimate how they are likely to change in the future.

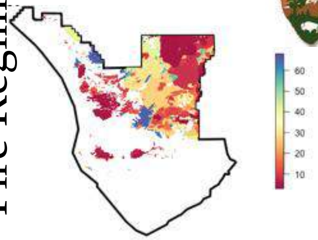
Objective 1: *Estimate post-fire recovery time (years) for Everglades ecotypes and evaluate spatial and temporal drivers (climate, hydrology, fire history) of ecosystem recovery rates (ΔNDVI).*

Objective 2: *Determine the optimal fire regime for Everglades fire-maintained ecosystems and evaluate how and why regimes are likely to change over time.*

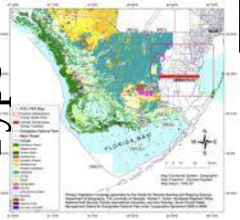


Year 1

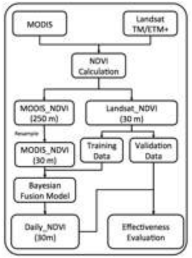
Fire Regime



Community Type

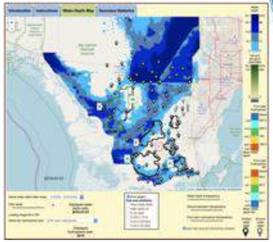


NDVI



Year		YR 1			YR 2			YR 3		
		2018		2019			2020			2021
Month		**May-Aug**	**Sep - Dec**	**Jan-Apr**	**May-Aug**	**Sep - Dec**	**Jan-Apr**	**May-Aug**	**Sep - Dec**	**Jan-Apr**
Obj	**Study Element**									
1-2	Data pre-processing and layer development	●	●	●						
1	Model development: post-fire recovery rates/ recovery time			●	●	●	●			
2	Model development: optimal fire regimes						●	●	●	
1-2	Synthesis Reports and Workshops				●			●		●

Hydrology

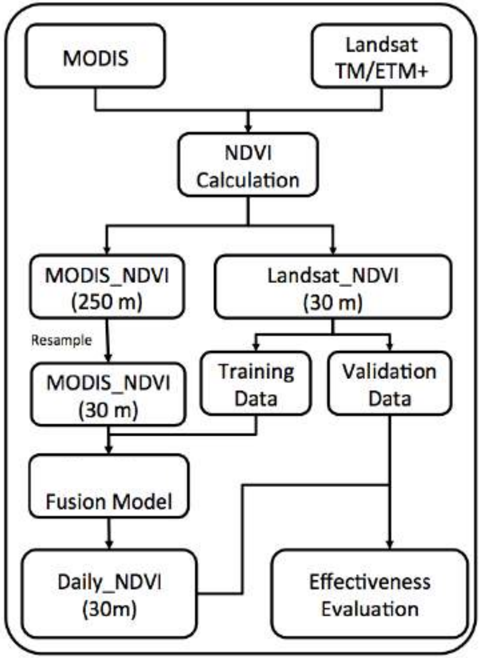


Climate Data

1948 - 2018

Year 2

NDVI-Fusion Model



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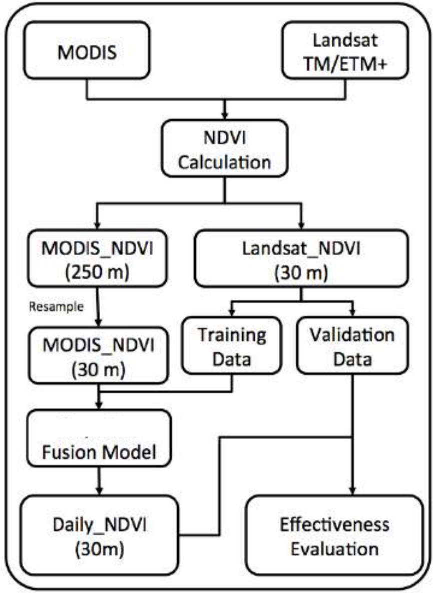
Year 2: 30m daily NDVI

Random forest downscaling (RFD)
Estimating daily NDVI (30 m resolution) using multivariate relationships with Landsat NDVI.



$$NDVI_{DAILY} = NDVI_{MODIS} + \text{Water Depth} + \text{Community TYPE}$$

- Non-burned (> 5 years sawgrass): (Baseline)
- Burned areas: + Fire History

Root Mean Square Error (RMSE) and the Mean Absolute Error (MAE) between the dataset and Landsat NDVI.

Time to return to pre-fire NDVI

Recovery

$$R_{ecotype} = Hydrology + Climate + Fire\ Regime$$

- Observed Fire Effects (Landsat NDVI)
- Expected Fire Effects ($NDVI_{DAILY}$)

Courses and Workshops

		YR 1			YR 2			YR 3		
Year		**2018**		**2019**			**2020**			**2021**
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1-2	Synthesis Reports and Workshops				●			●		●

- Disturbance Ecology (Spring 2019, 2020, 2021)
- Ecological Modeling Workshop Spring 2020
- Ecology (Fall 2018, 2019. 2020)

Development of New Research Lines

Venus Garcia

Tiany Hernandez

Jenisha Oli

Questions