

Probabilistic Simulation Of Vegetation Dynamics In The Everglades Vegetation Succession Model (ELVeS)

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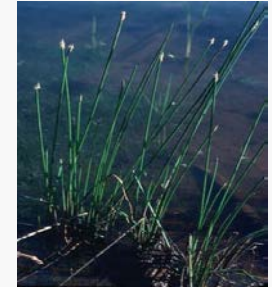
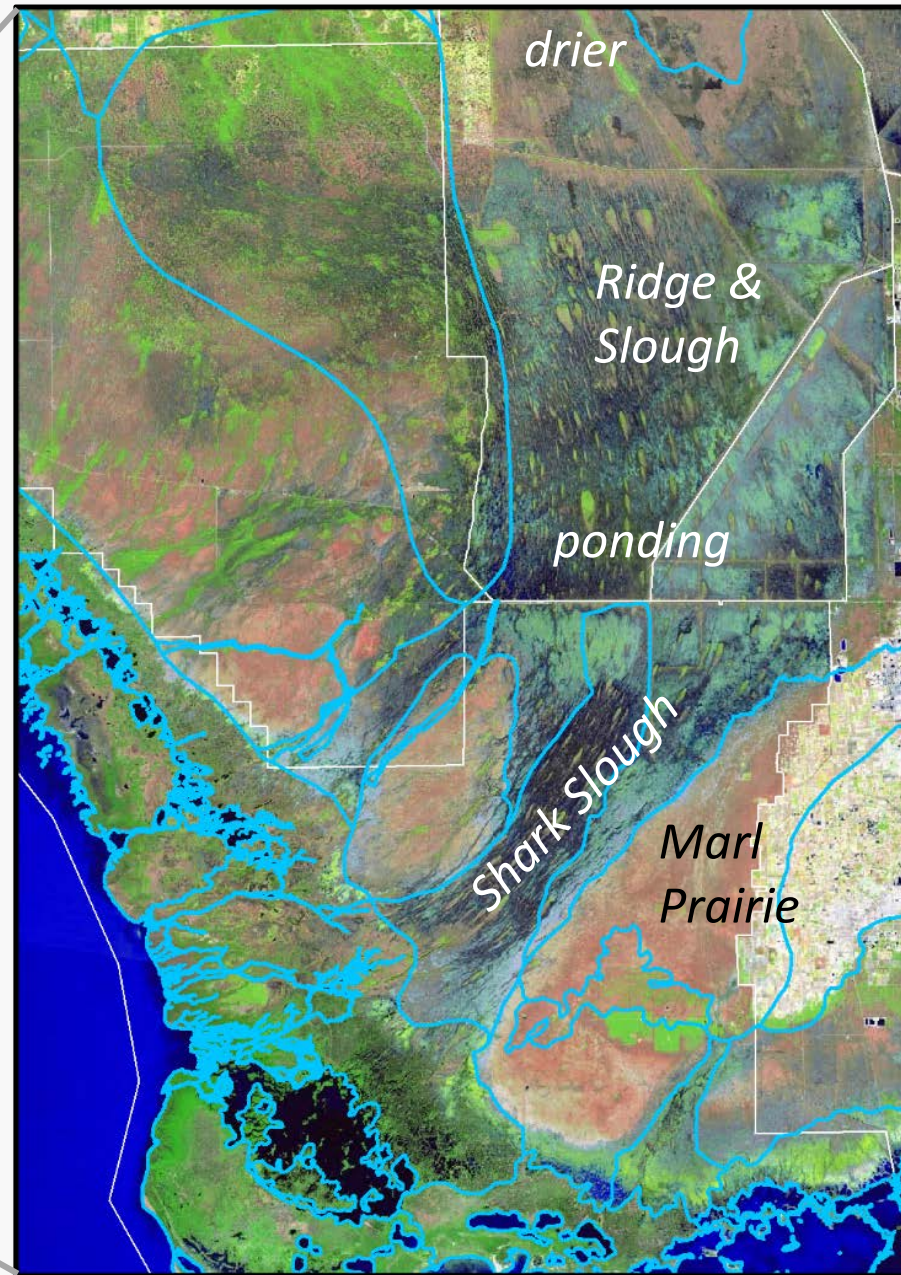
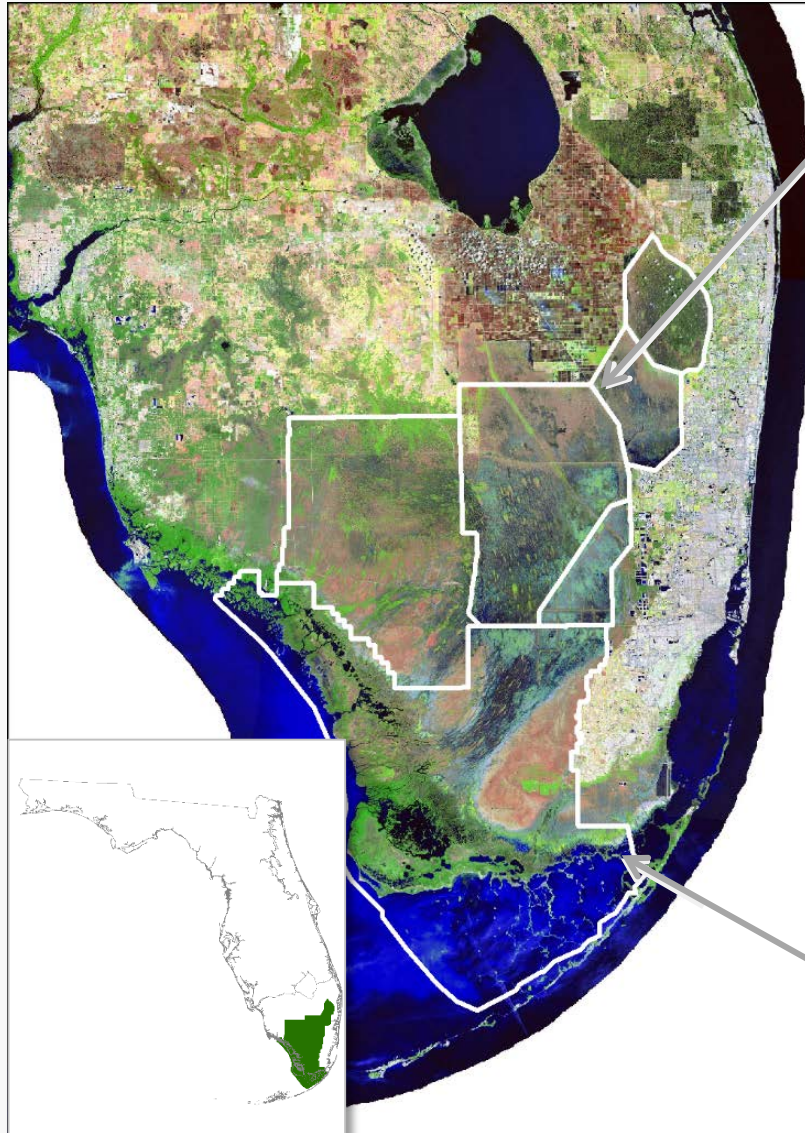


Everglades Landscape Vegetation Succession (ELVeS)

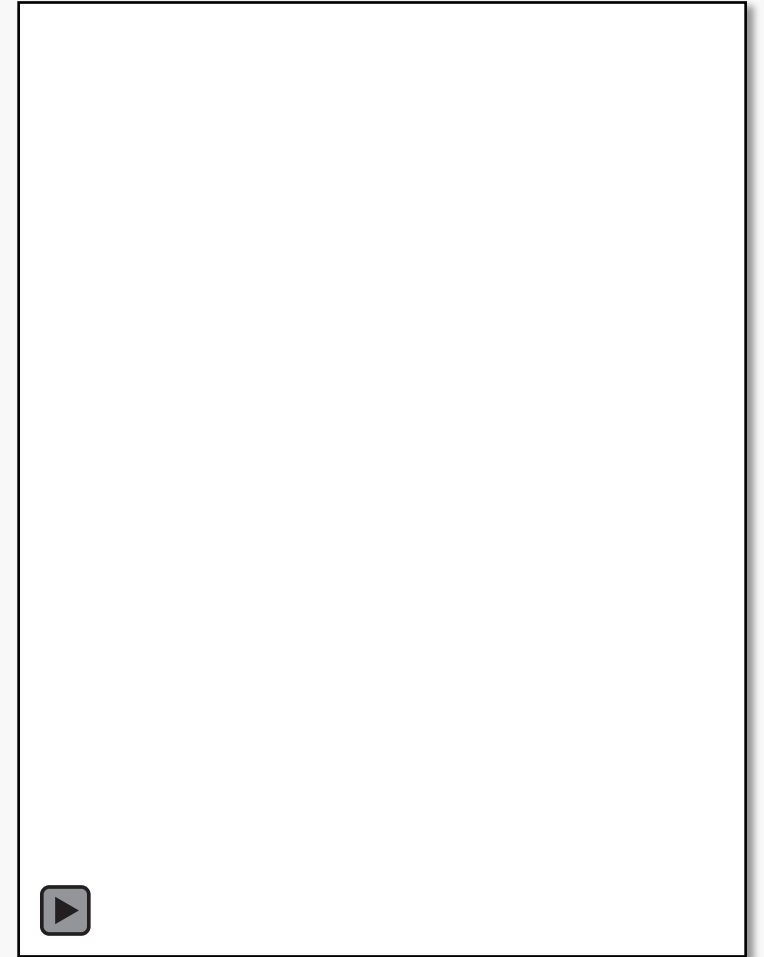
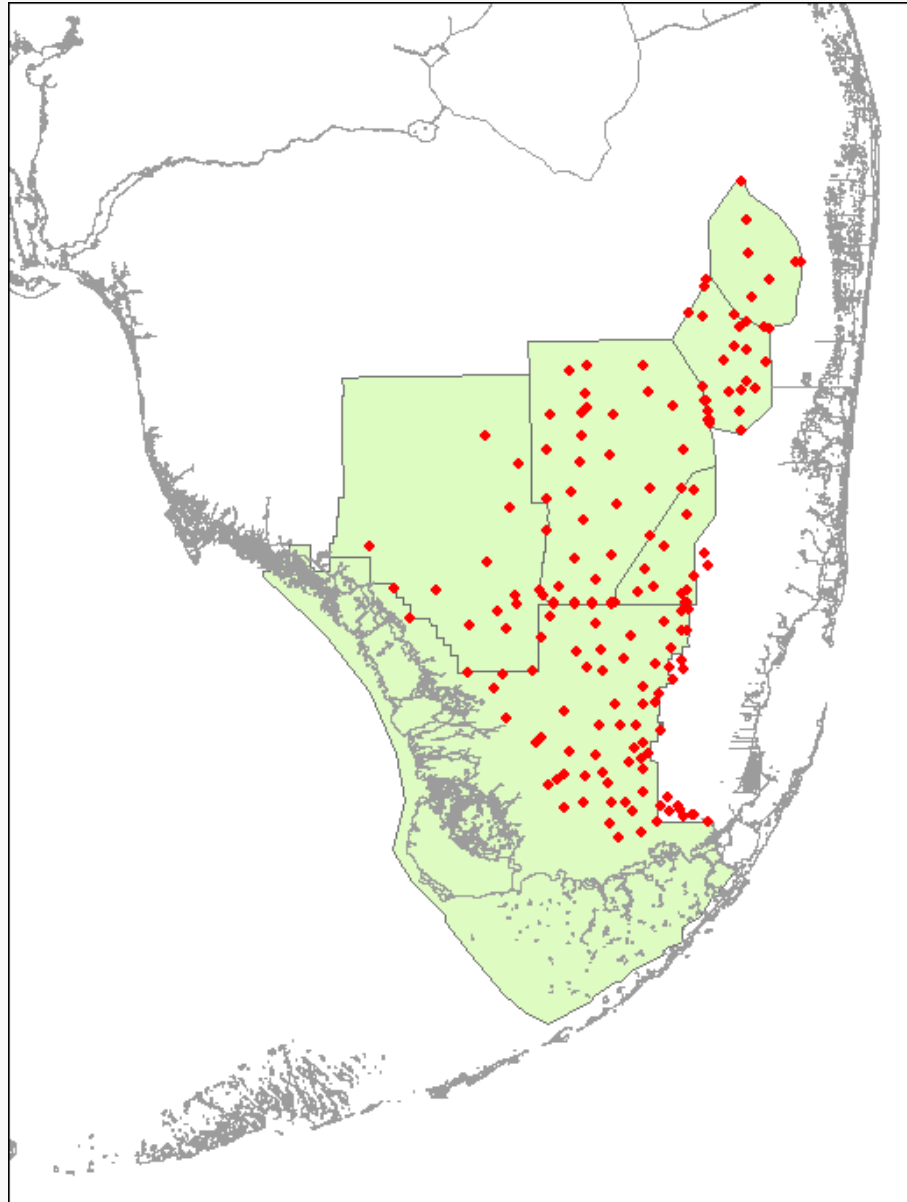
- A spatially explicit cell-based probability model to predict the likelihood of specific vegetation communities given a set of specific environmental conditions
- Links response of vegetation to underlying hydrologic models
- Evaluation of alternatives based on projected ecological outcomes and tradeoffs between restoration goals and targets.



Model Domain



Daily Water Depth 1991 to present



Vegetation Community Observations

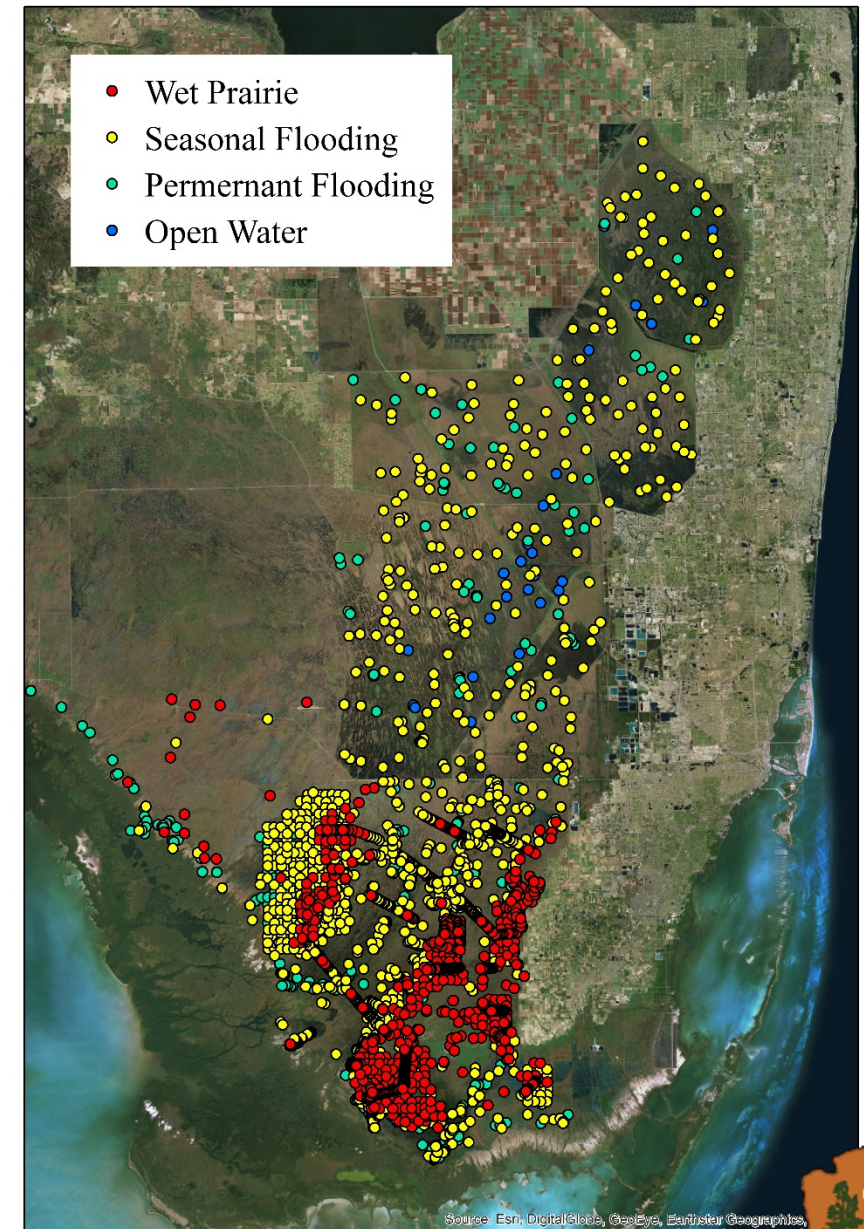
Sah *et al.*, Richards *et al.* and others:

1. 17 vegetation survey projects from 1996
2. 3601 observations
3. 40 communities

9 major communities

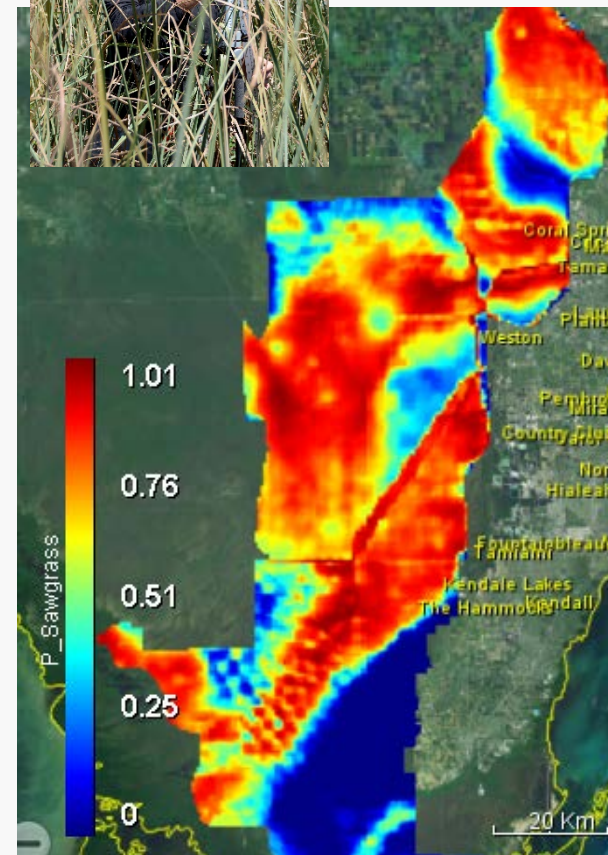
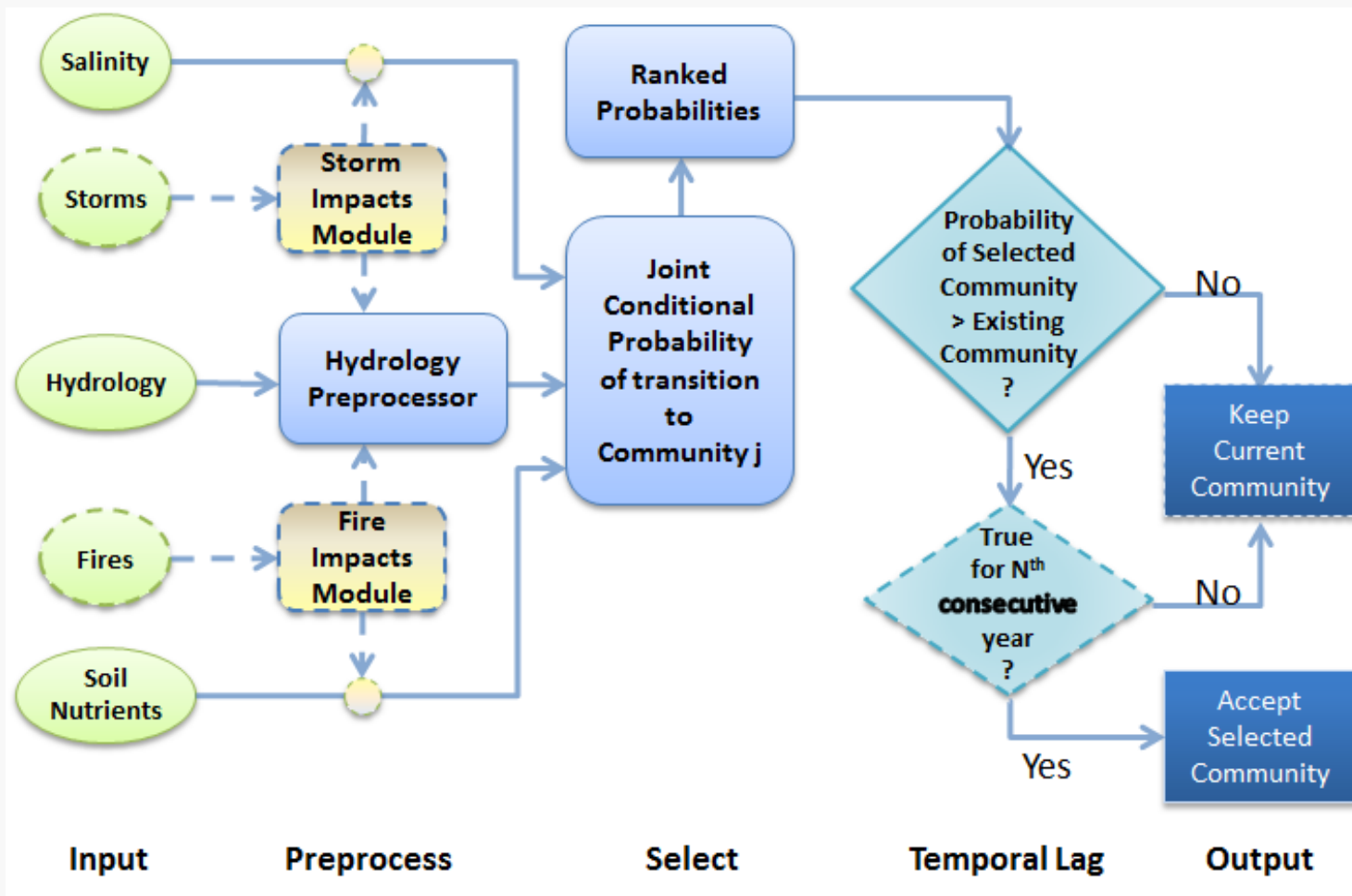
in our current modeling work

1. Beakrush
2. Blackrush-Bluestem
3. Cattail
4. Muhly
5. OpenMarsh-Waterlily
6. Sawgrass, Sparse
7. Sawgrass, Tall
8. Sawgrass, Marl Prairie
9. Spikerush-Sawgrass



Vegetation Succession

Everglades Landscape Vegetation Succession (ELVeS)



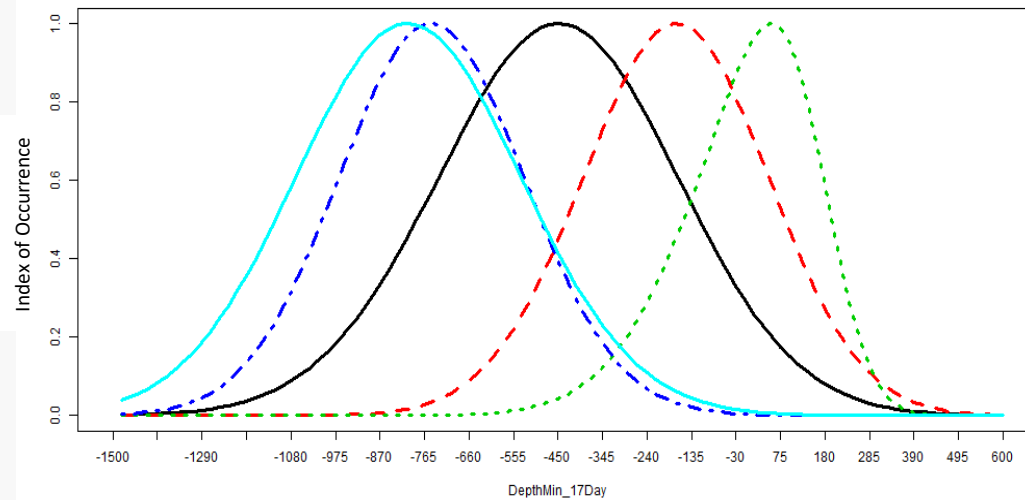
Sawgrass probability



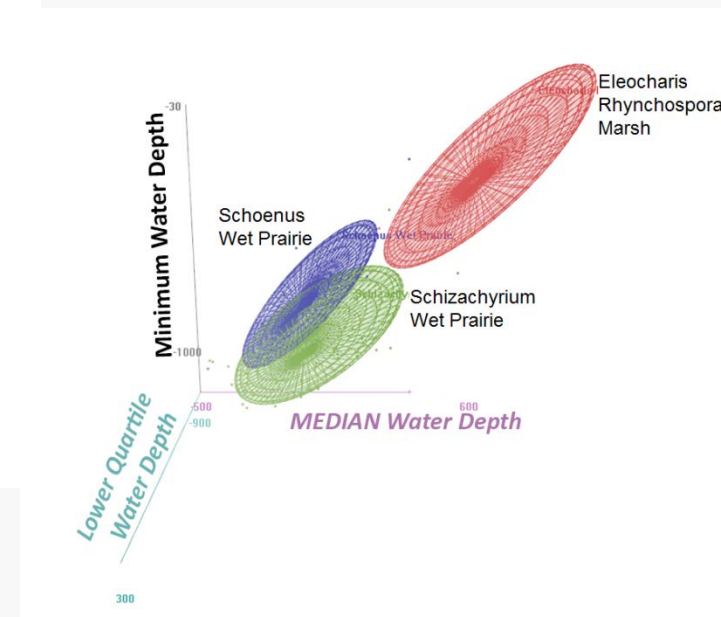
Vegetation Community Succession

Explore models that discriminate vegetation assemblages

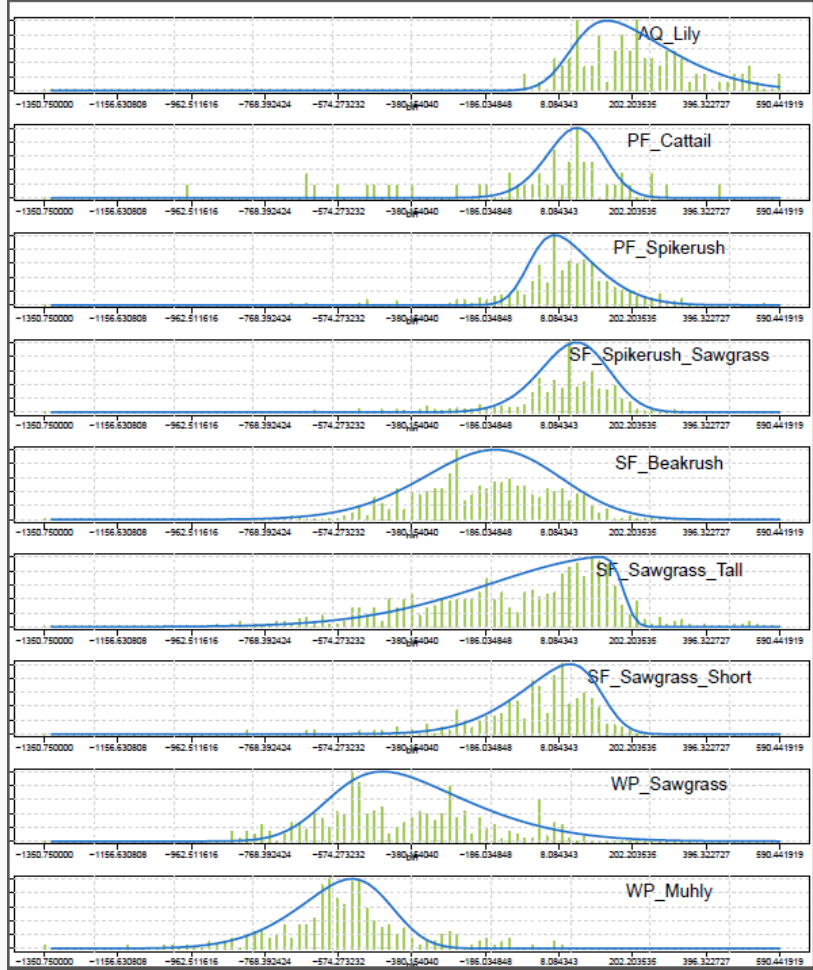
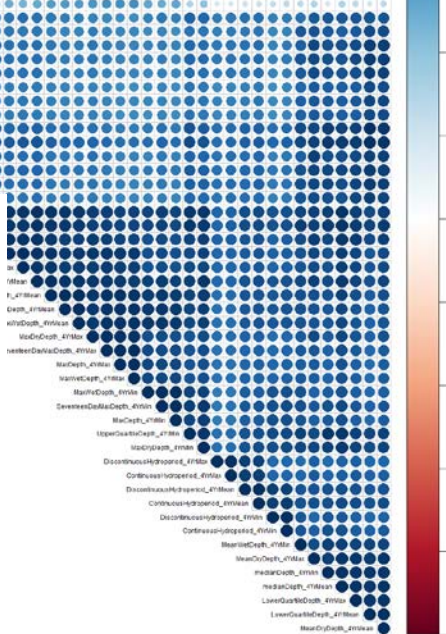
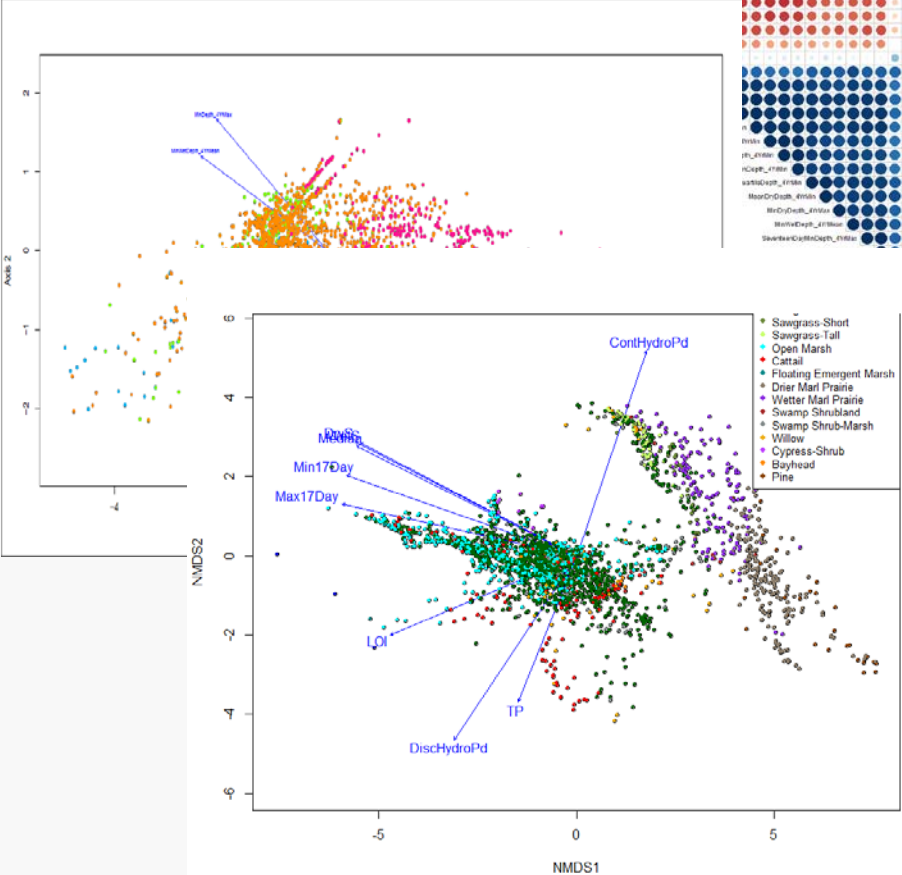
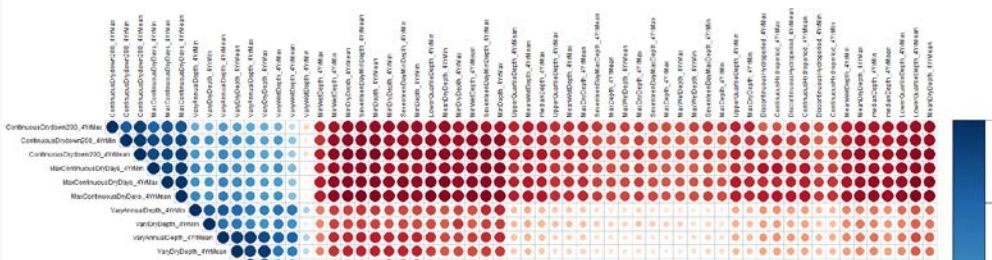
- along **hydrologic** gradient,
- **soil** characteristics,
- **fire** occurrences and fire history



<i>Muhlenbergia</i> + <i>Schizachyrium</i> + <i>Schoenus</i> Wet Prairie	<i>Cladium</i> Wet Prairie	<i>Cladium</i> Marsh	<i>Cladium</i> - <i>Rhynchospora</i> Marsh	<i>Rhynchospora</i> - <i>Eleocharis</i> Marsh
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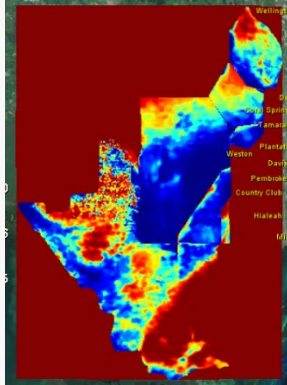
Metric Evaluations



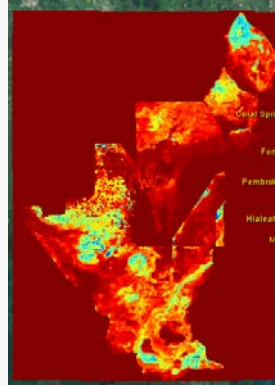
Annual minimum depth in wet season
Four-year mean



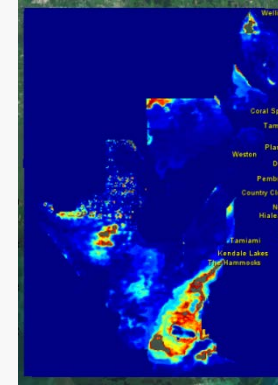
Selected Variables



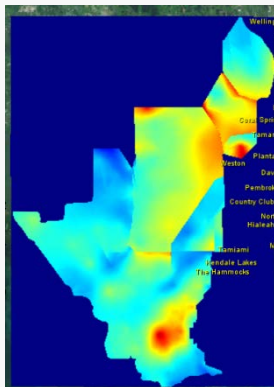
MaxContDays > 200cm



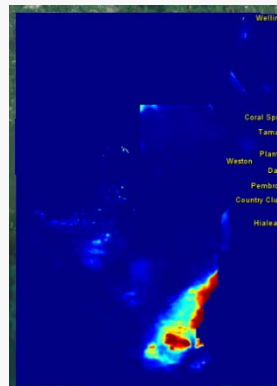
MaxContDays 0 - 5cm



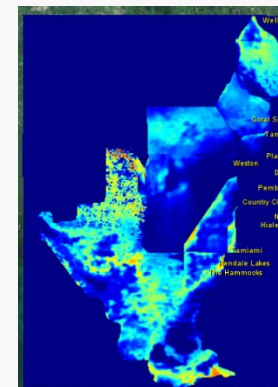
Days -20 - -10cm



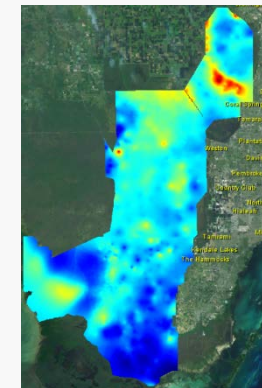
Depth Std Dev



Days < -20cm



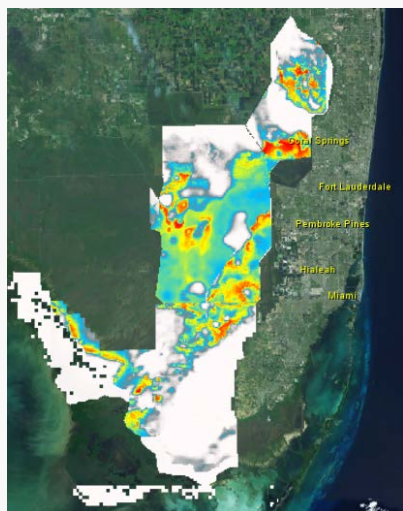
Days 10 - 25cm



Soil TP

All layers are from 1995

Joint Instantaneous Probability Index



Joint probability index for Spikerush-Sawgrass

$$= \sqrt[3]{\text{Map 1} \times \text{Map 2} \times \text{Map 3}}$$

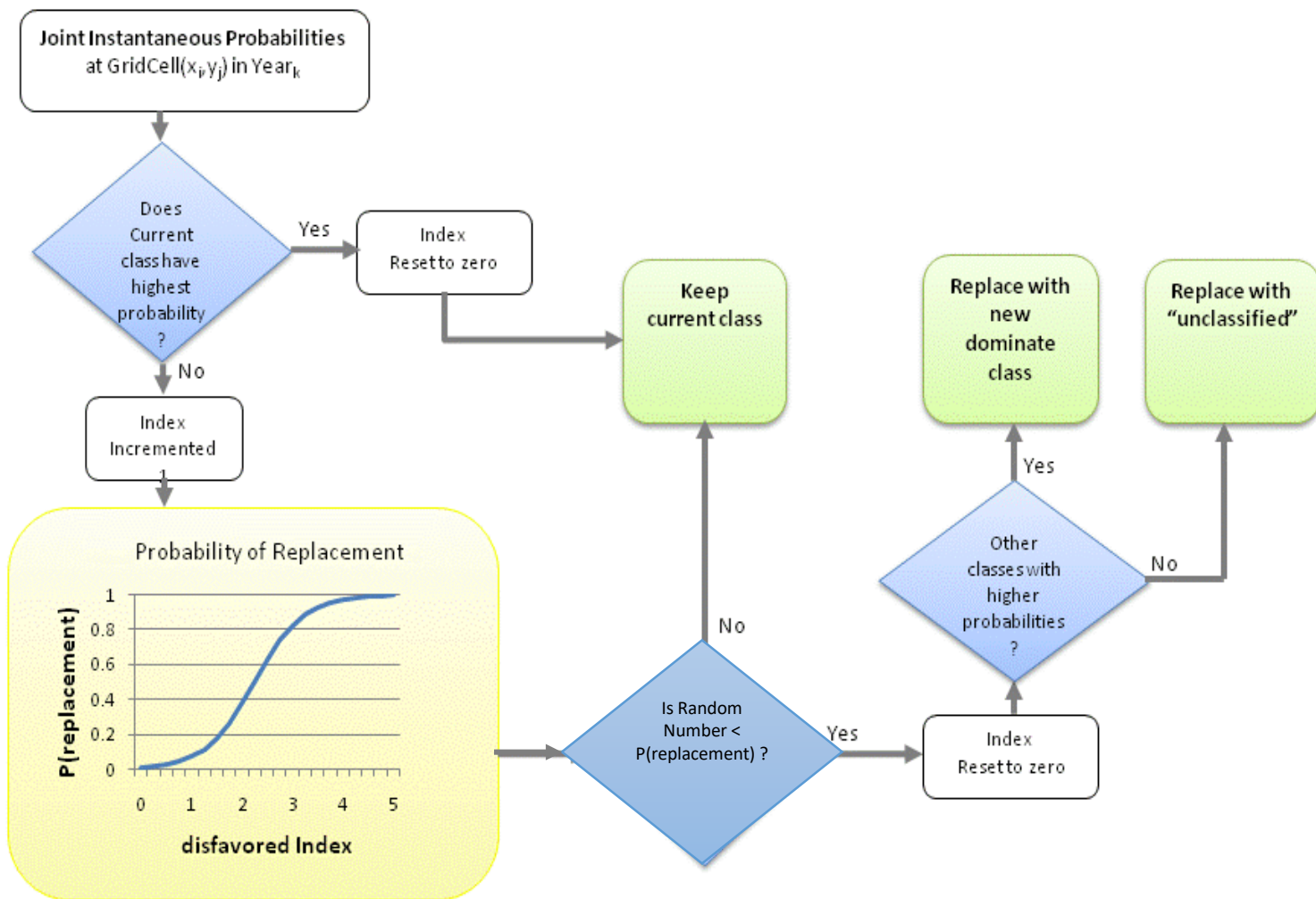
P(Spiker-Sawgr | Days -20 to -10cm)

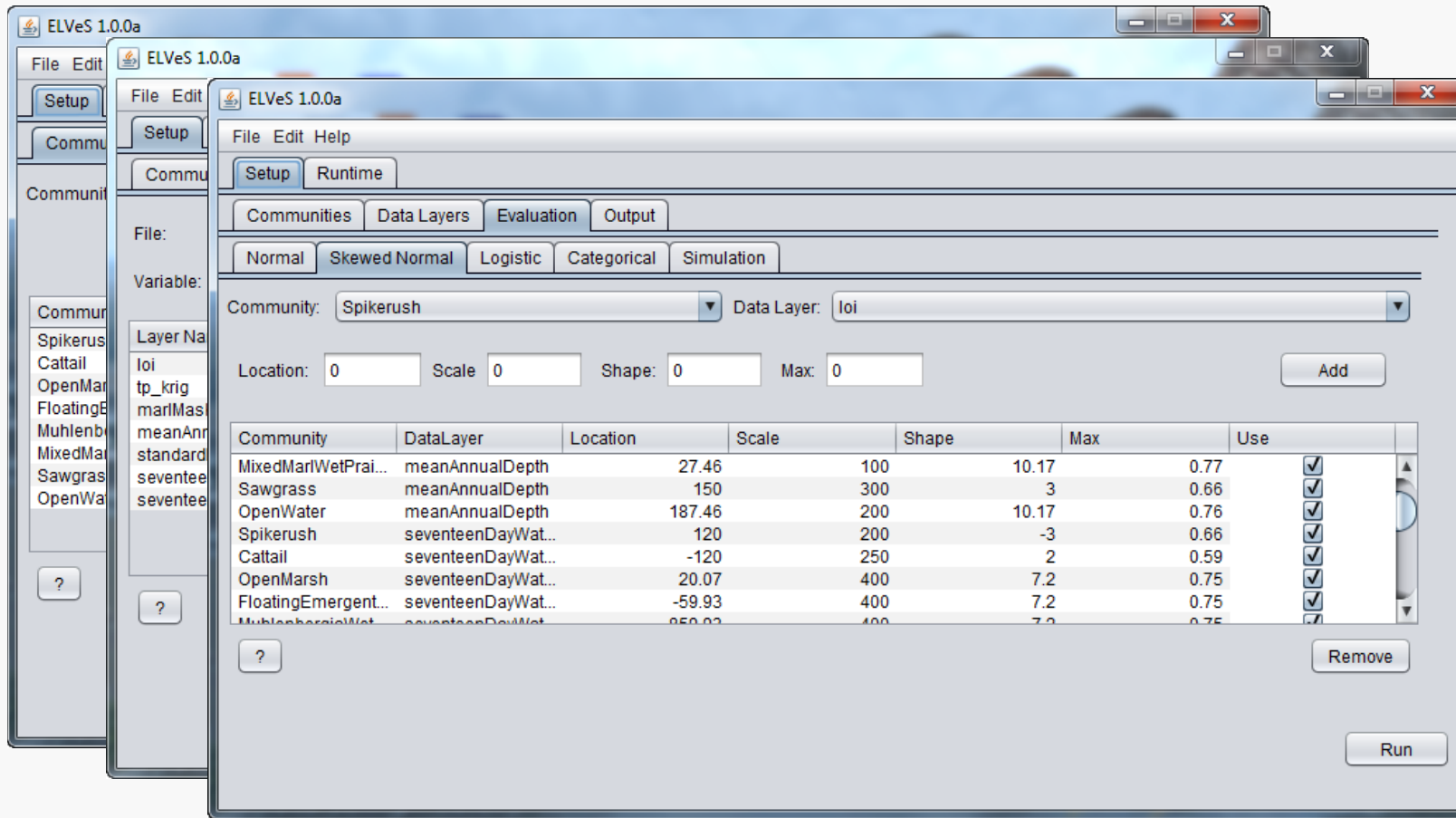
P(Spiker-Sawgr | Days 0 to 50cm)

P(Spiker-Sawgr | TP)

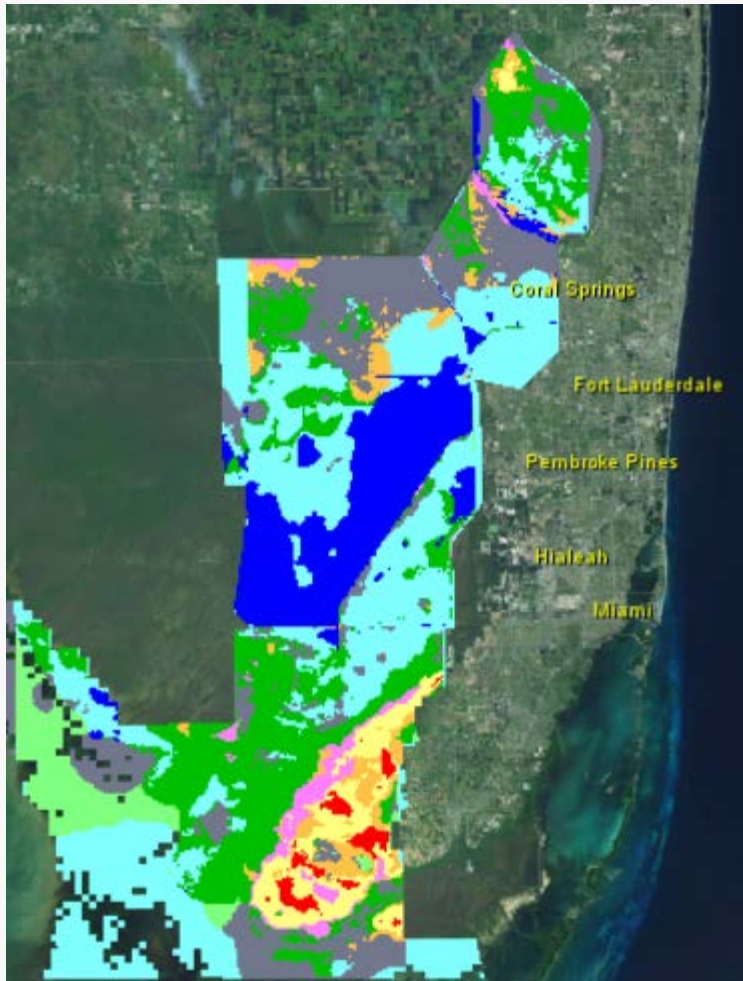


Temporal Lag Routine

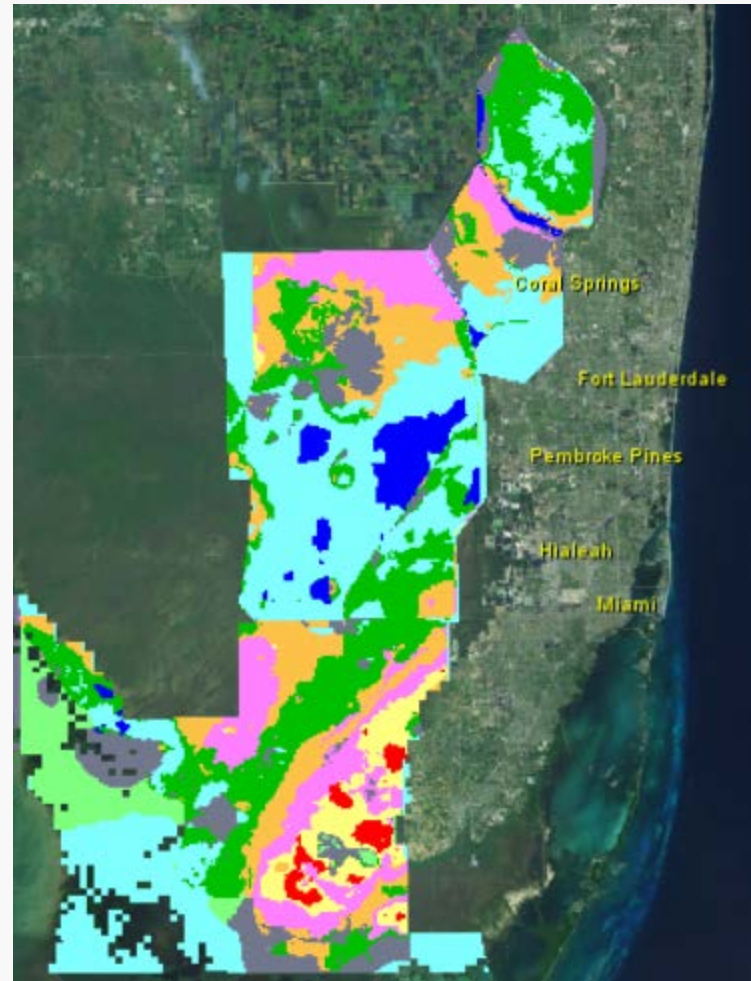




Dominate Vegetation Community



1995

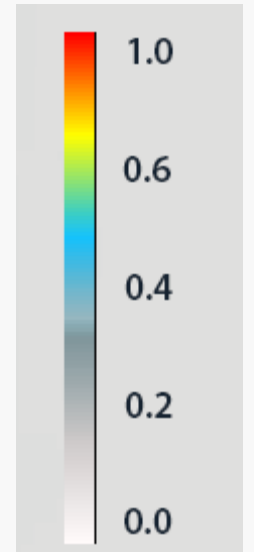
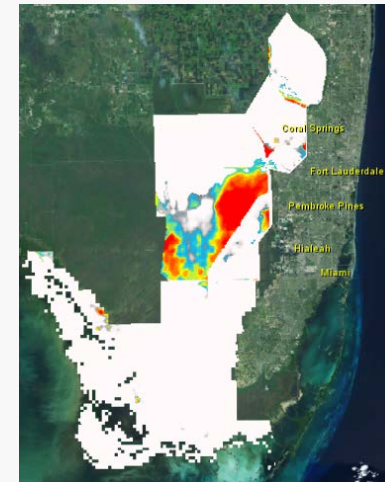
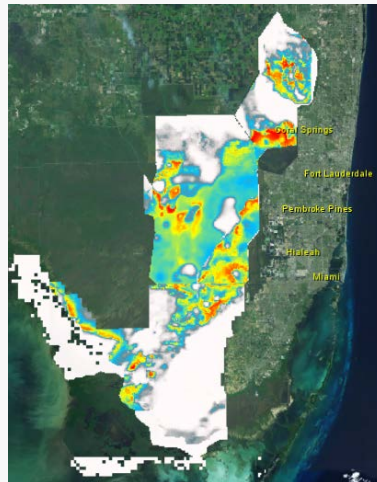
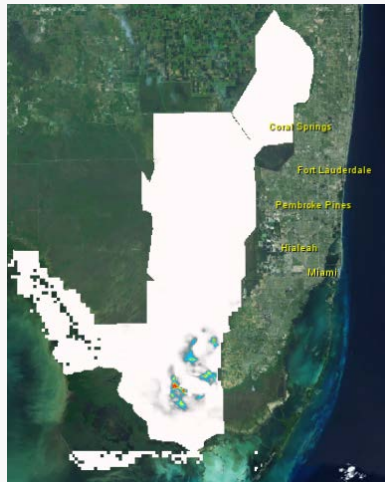


2011

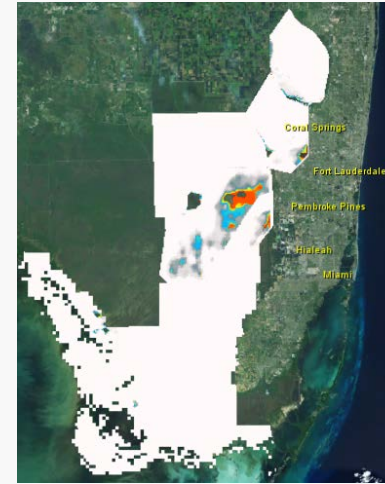
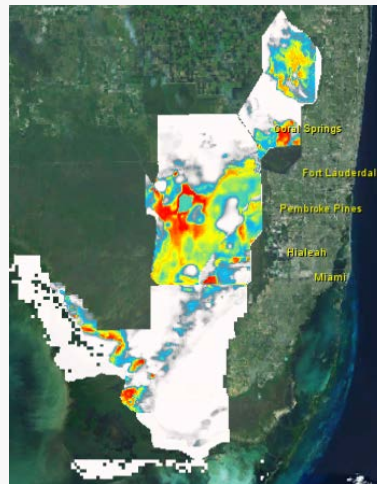
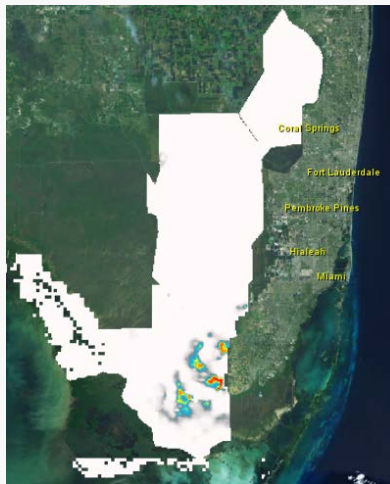


Individual Community Probability Indices

1995



2011

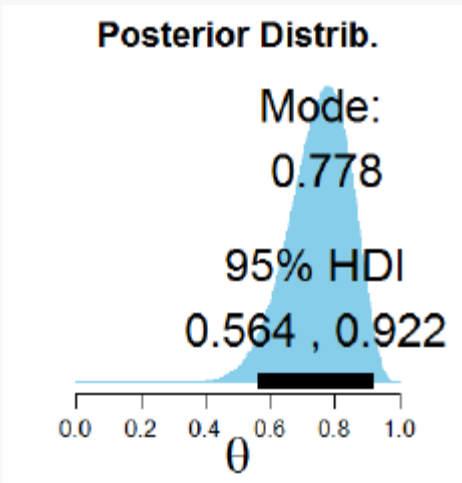
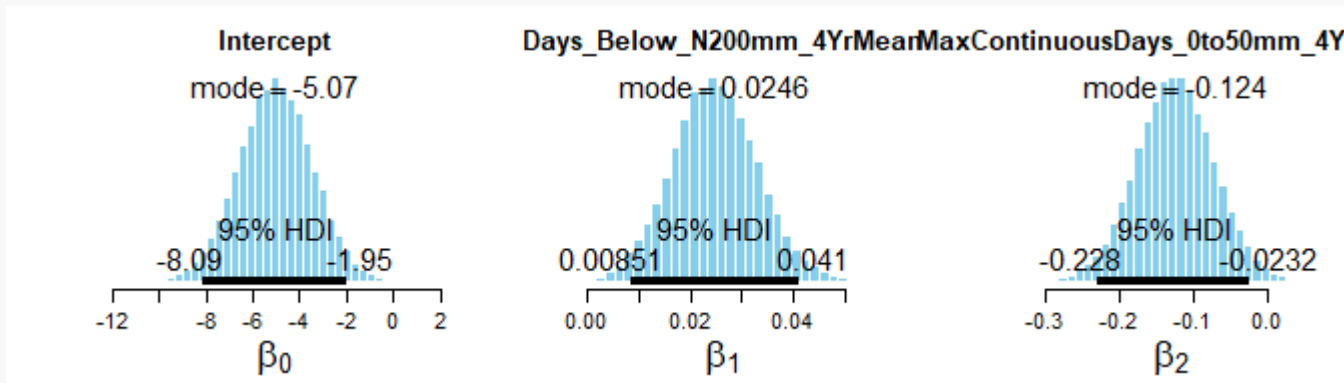


Muhly Grass

Spikerush - Sawgrass

Open Marsh & Lily

Bayesian Regression

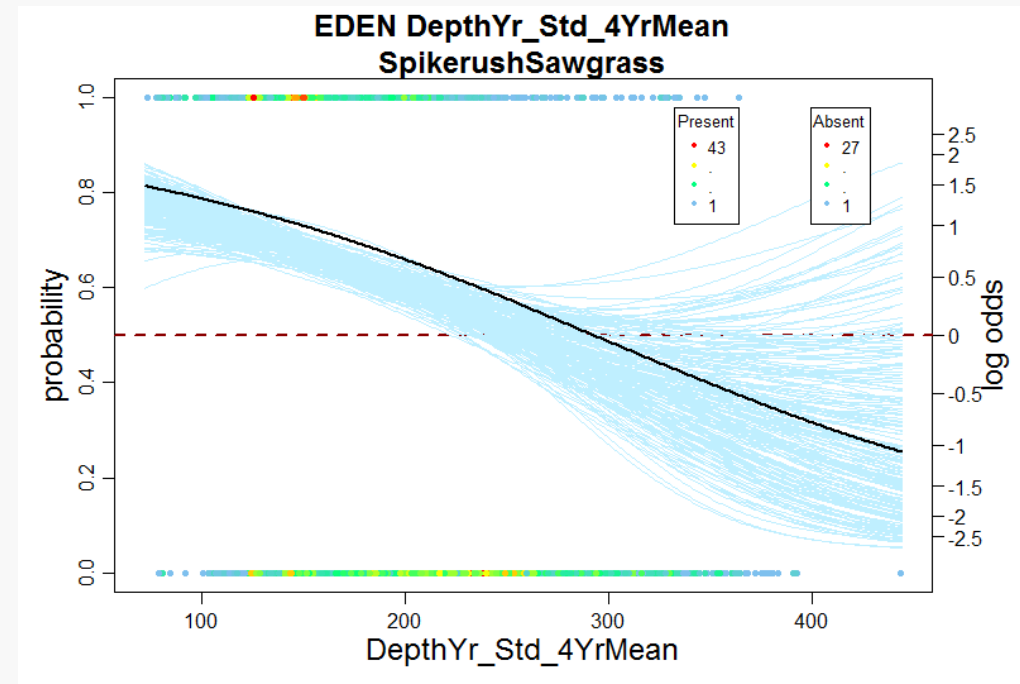
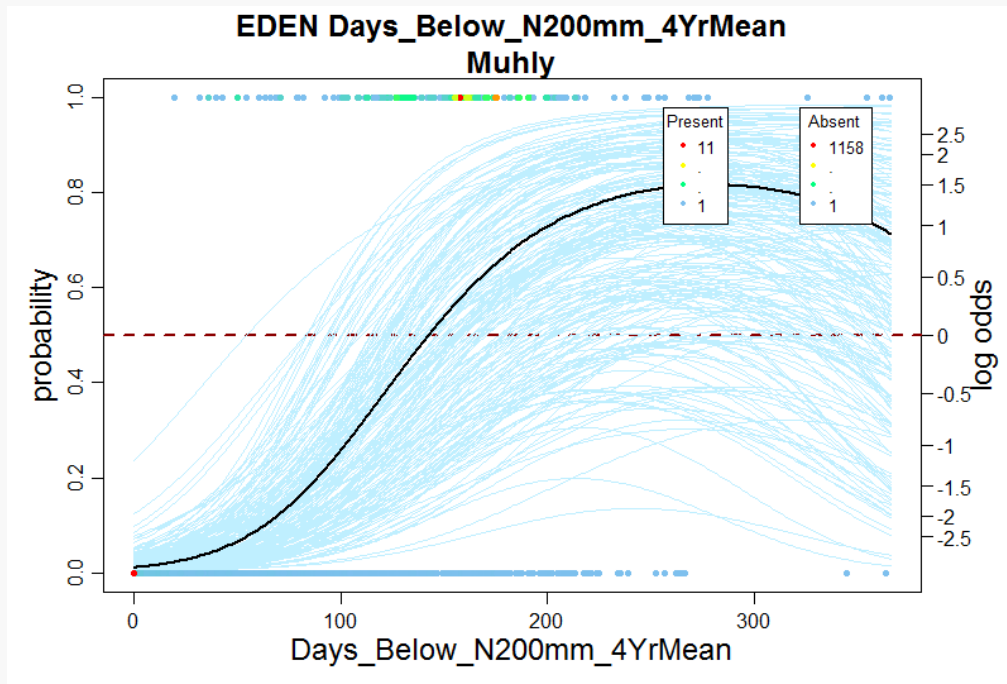


$$y = \beta_0 + (\beta_1 * x_1) + (\beta_2 * x_2) + \dots + e$$



Bayesian Multiple Logistic Regression

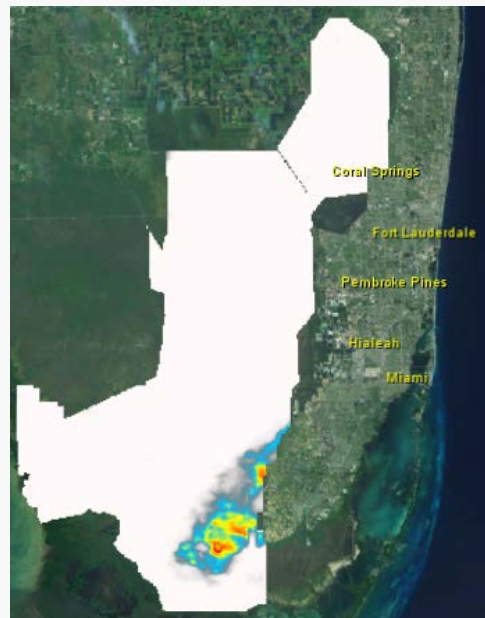
Applied to the same vegetation community data and variables



ELVeS and Bayesian Comparison

First DRAFT!

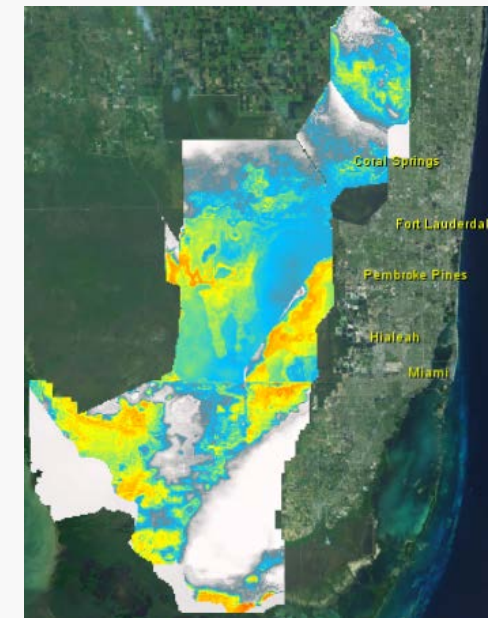
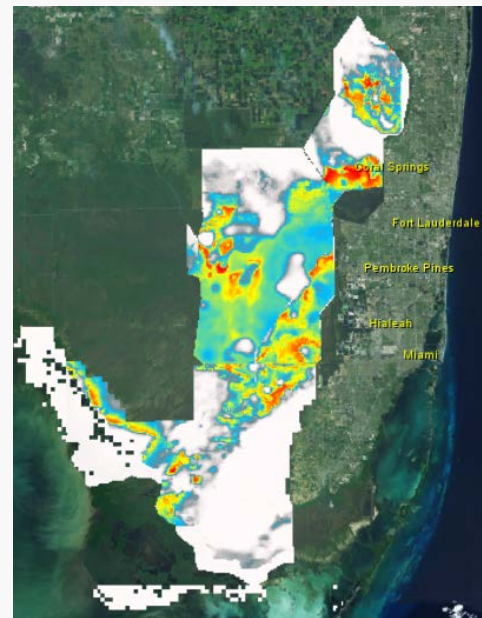
Muhly Grass



Current ELVeS

Bayesian Multi-Logistic

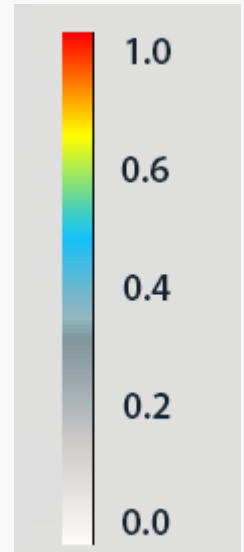
Spikerush & Sawgrass



Current ELVeS

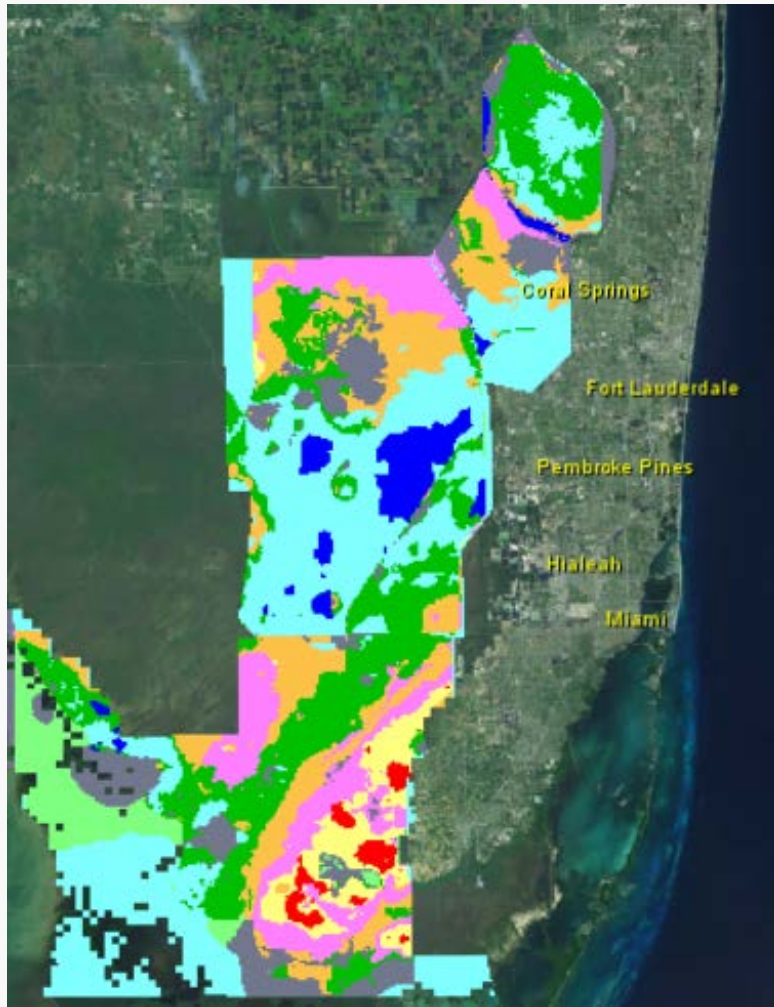
Bayesian Multi-Logistic

1995

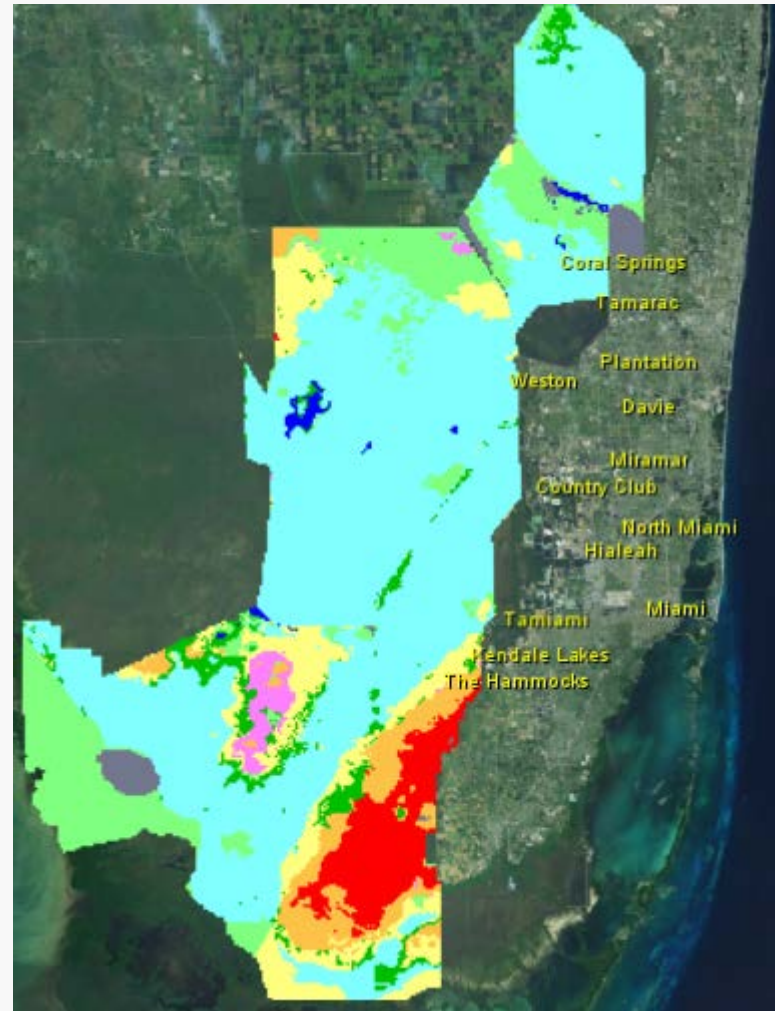


ELVeS and Bayesian Comparison

First DRAFT!



Current ELVeS 2011



Bayesian Multi-Logistic 2011



National Academy of Sciences, Committee on Independent Scientific Review of Everglades Restoration Progress, 2016.

The capacity to identify achievable goals and objectives is much improved since CERP authorization due to advances in modeling, especially in the development of systemwide ecological models.

[Hydrological and ecological modeling provides the capacity to establish] clearly defined goals and quantitative objectives involving evaluation of tradeoffs among various hydrologic and ecological objectives, and perhaps some rethinking of priorities, especially with respect to expectations for particular species.

Ecological models also can be used to explore the implications of climate change and sea level rise, changes in CERP project feasibility, and the improved understanding of the pre-drainage.



