Development of a sampling prioritization model to optimize the selection of tree islands in the Central Everglades for surveying of *Lygodium microphyllum*

Erik G. Noonburg
Dept. of Biological Sciences
Florida Atlantic University

John C. Volin
Dept. of Natural Resources Management and Engineering
University of Connecticut

Lygodium microphyllum

Objectives

- Prioritize tree islands for monitoring to detect *L. microphyllum* infestations
  - Which islands are most likely to be (or become) infested?
  - Use EDEN output as predictor for existing presence/absence data?
- Assess alternative monitoring strategies

Tree island invasion
Hypotheses

- Random: spores are everywhere, establishment occurs by chance
- Spatial spread: probability of establishment increases with proximity to an infested island
- Environmental effects: probability of establishment depends on tree island characteristics (hydrology, plant community, etc.)
- Some combination of the above
- Others?

Tree island surveys
(Volin lab)

- 109 islands surveyed in WCA-3A
- Transects 20m apart: *L. microphyllum* presence/absence
- Elevation at peak and 8 other points
- GPS location

Statistical analysis

- Logistic regression: *L. microphyllum* presence/absence
  - Spatial trend
  - Hydrological variables derived from EDEN as predictors of de-trended data
    - Average depth
    - Average min. depth
    - Average max. depth
    - Average hydroperiod

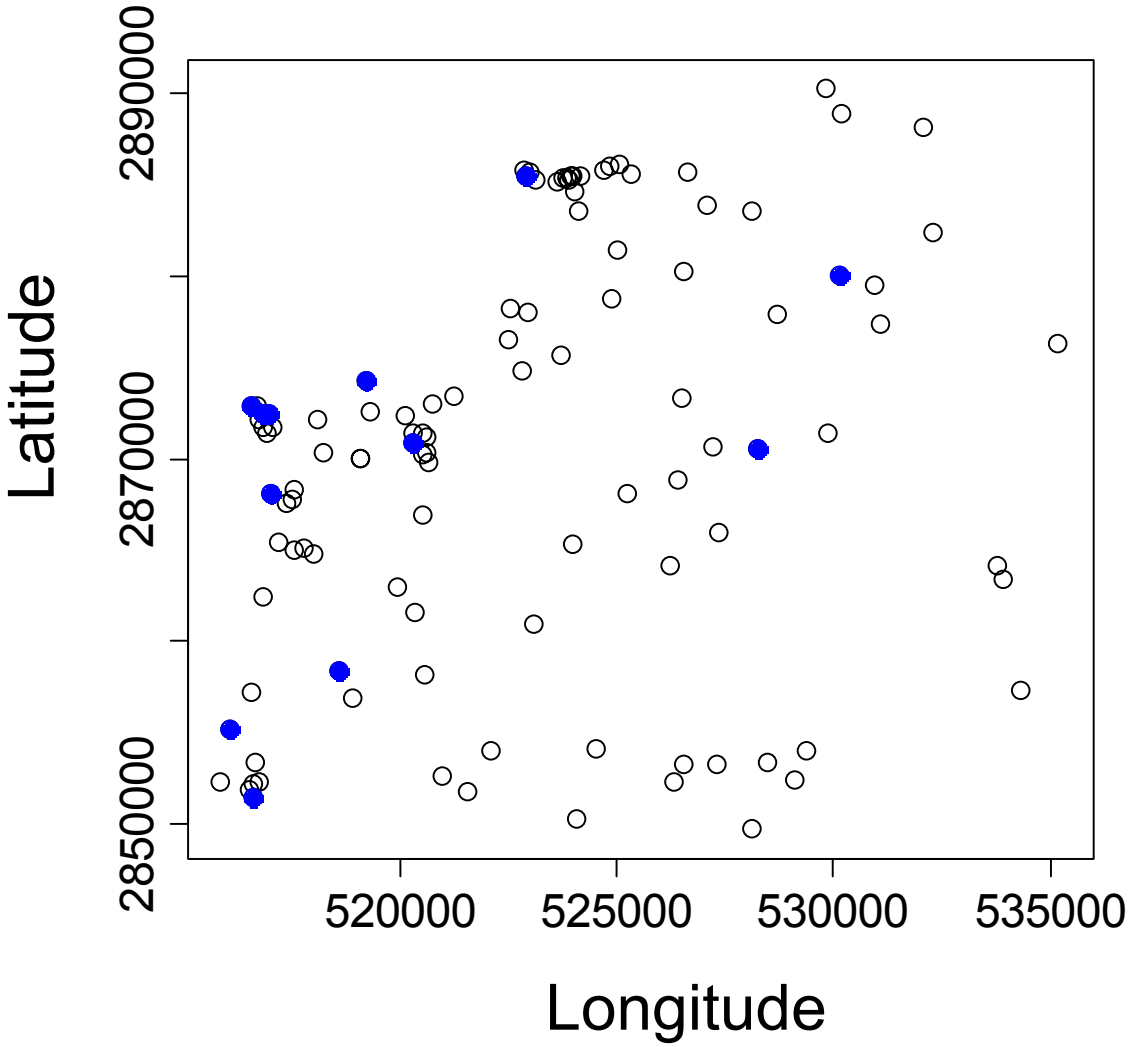
Results

Statistical model

- Significant spatial trend: decreasing probability of *L. microphyllum* presence from west to east (p=0.034)
- No significant hydrological predictors

Results

Spatial trend



Power analysis

- Monte Carlo simulation of the logistic model with spatial trend
- How large would the effect of hydrology have to be to have >50% chance of seeing it in the statistical analysis?

➔The odds ratio would have to vary by ~1 order of magnitude across the hydrological gradient in WCA-3A (= 0.25× the effect size of the spatial gradient).

Monitoring strategy

If we can prioritize islands,
how should we monitor them?

Prioritized monitoring

"Exploratory" monitoring

Simulated invasion & monitoring

Invasion pattern

1) Islands infested at random
2) Islands infested by neighbors
3) Islands infested according to hydrology
4) Hydrology & proximity affect probability of infestation

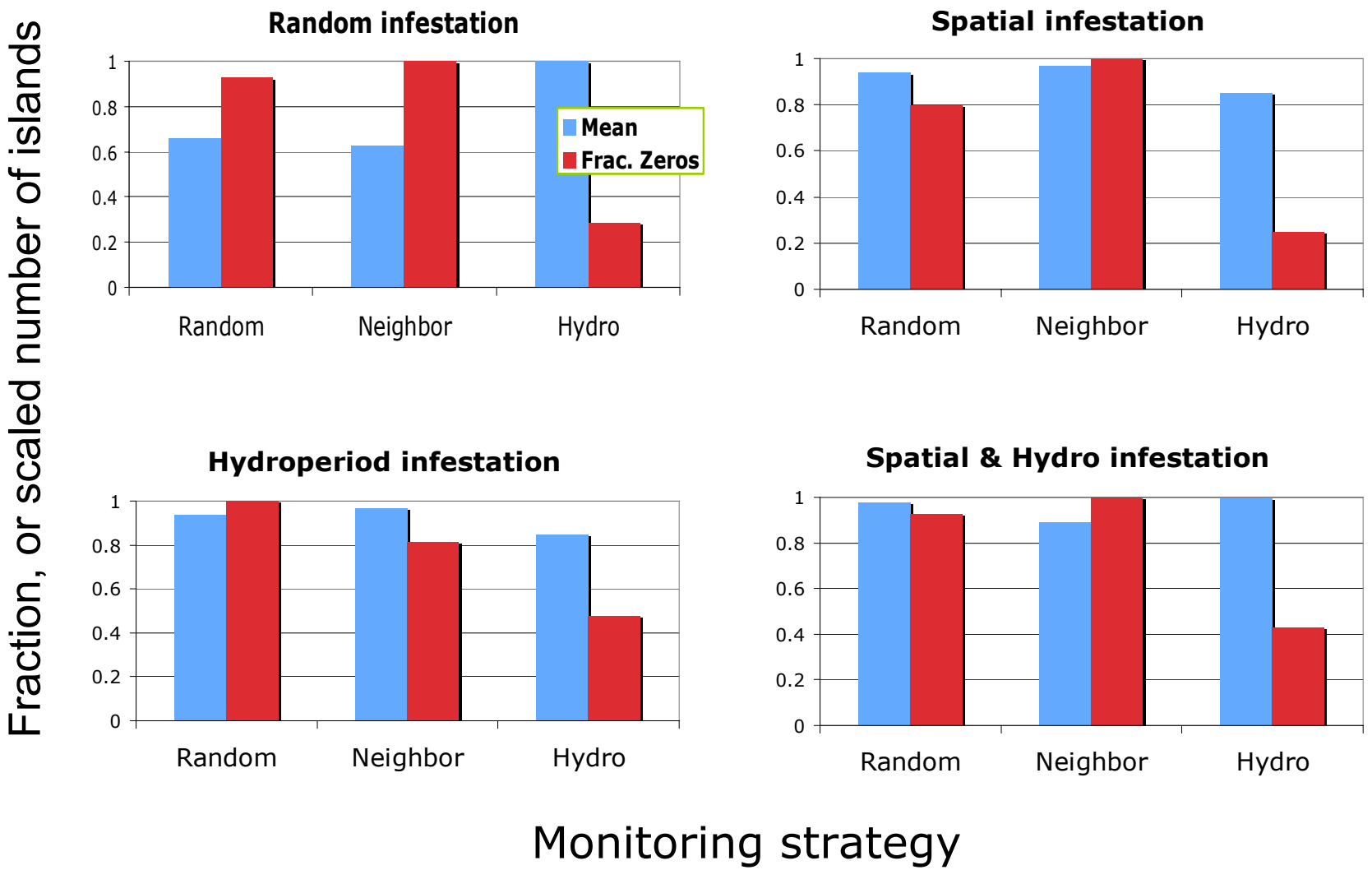
Monitoring strategy

1) Random monitoring
2) Select one island near each infestation discovered
3) Select islands with highest ranked hydrological characteristics
4) Others?

Simulation

1) Initialize a small number of islands with *L. microphyllum* present.
2) Generate new infestations at random, via proximity and/or hydroperiod preference.
3) Select islands to survey, eradicate any infestations on those islands.
4) Repeat 1-3, count number of infestations at end of time period.

Simulation results



Conclusions

- Evidence for spatial trend in *L. microphyllum* invasion in WCA-3A
  - No detectable hydrological pattern (EDEN output)
- Simulation of invasion/monitoring process to assess control strategies
  - What are the key parameters to measure?

Acknowledgements

- J. Allen & the field crew
- J. Ketterlin, Florida Fish and Wildlife Conservation Commission
- D. Owen, Dept. of Biological Sciences, FAU