Developing an occupancy model for a declining nesting population of Bald Eagles in Florida Bay, Everglades National Park



Jason W. Bosley, John D. Baldwin, and Erik G. Noonburg
Department of Biological Sciences, Florida Atlantic University,
Davie, Florida

FAU
CHARLES E. SCHMIDT
COLLEGE OF SCIENCE
Florida Atlantic University

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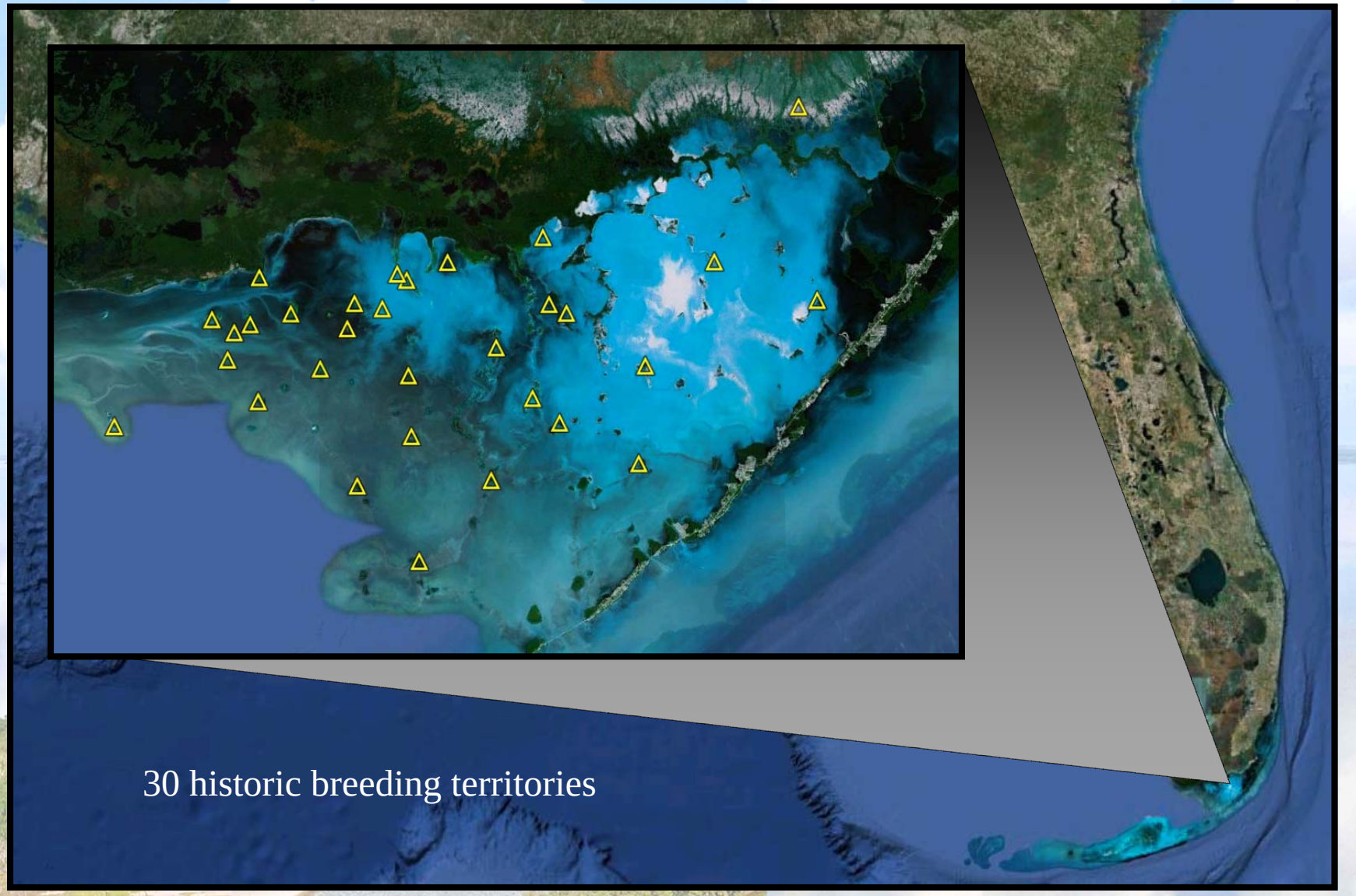
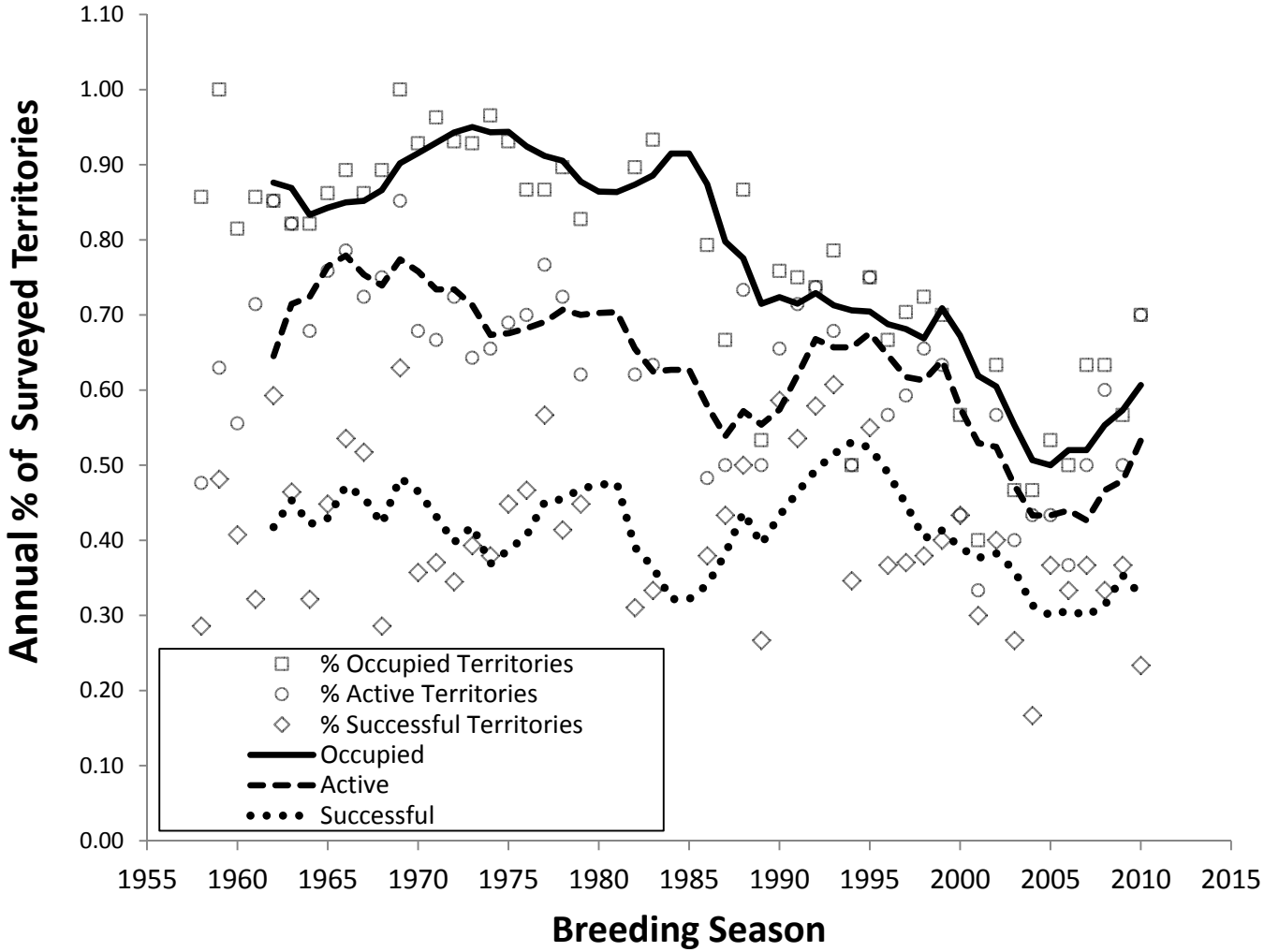
Territory Distribution – Florida Bay

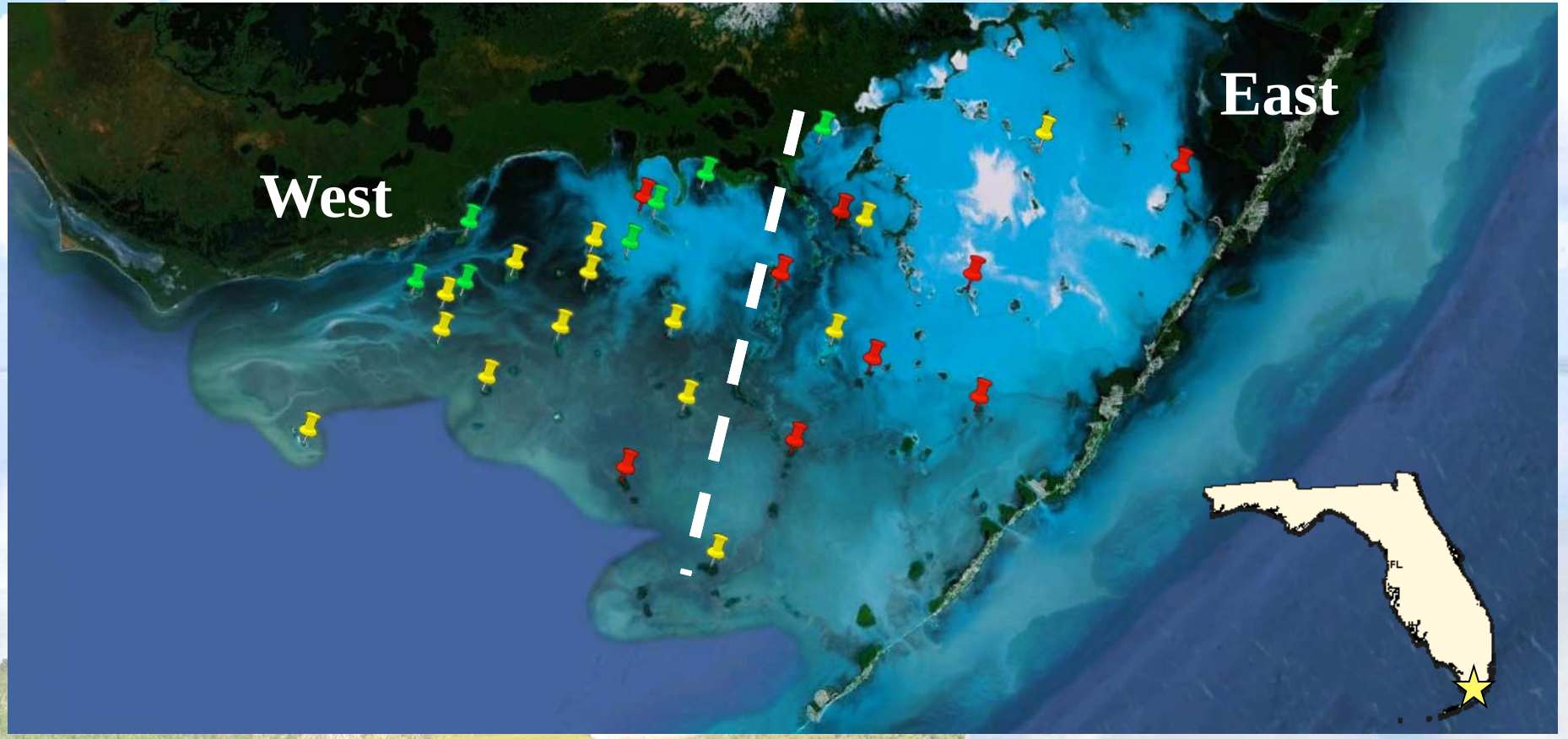


30 historic breeding territories

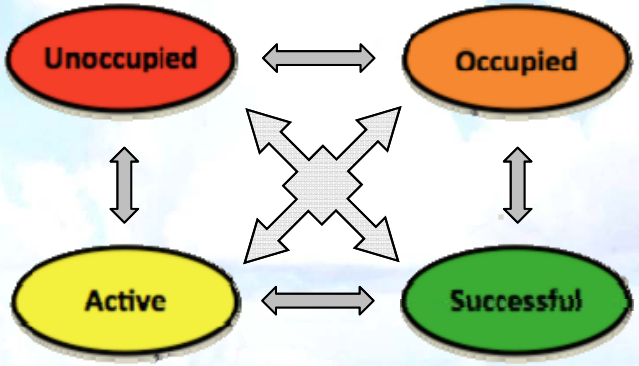
Shifting Territory Use



Spatial Variation in Territory Use



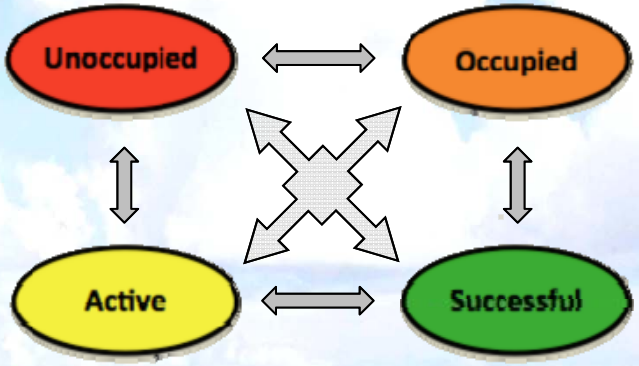
Markov Chain Model



"Transition Matrix"

$$\begin{vmatrix} P_{UU} & R_{OU} & R_{AU} & R_{SU} \\ G_{UO} & P_{OO} & R_{AO} & R_{SO} \\ G_{UA} & G_{OA} & P_{AA} & R_{SA} \\ G_{US} & G_{OS} & G_{AS} & P_{SS} \end{vmatrix}$$

Markov Chain Model



"Transition Matrix"

RECEED

PAUSE

GROW

Stable State Distribution (SSD)

Comparison between “Then” and “Now”

Year *t*+1	Year *t*			
	Unoccupied	Occupied	Active	Successful
1960-1975				
Unoccupied	0.710	0.086	0.017	**0.012**
Occupied	0.104	0.350	0.163	0.128
Active	0.106	0.321	0.432	0.263
Successful	0.081	0.242	0.388	0.597
1995-2010				
Unoccupied	0.681	0.421	0.162	**0.118**
Occupied	0.083	0.277	0.061	0.050
Active	0.080	0.109	0.373	0.223
Successful	0.156	0.192	0.404	0.609
Difference				
Unoccupied	-0.029 (-4.04%)	0.336 (390.76%)	0.145 (852.92%)	**0.106 (888.21%)**
Occupied	-0.021 (-20.26%)	-0.073 (-20.78%)	-0.103 (-77.25%)	-0.078 (-61.21%)
Active	-0.026 (-24.33%)	-0.212 (-65.96%)	-0.059 (-16.11%)	-0.04 (-15.22%)
Successful	0.076 (93.74%)	-0.051 (-20.92%)	0.016 (4.11%)	0.013 (2.16%)

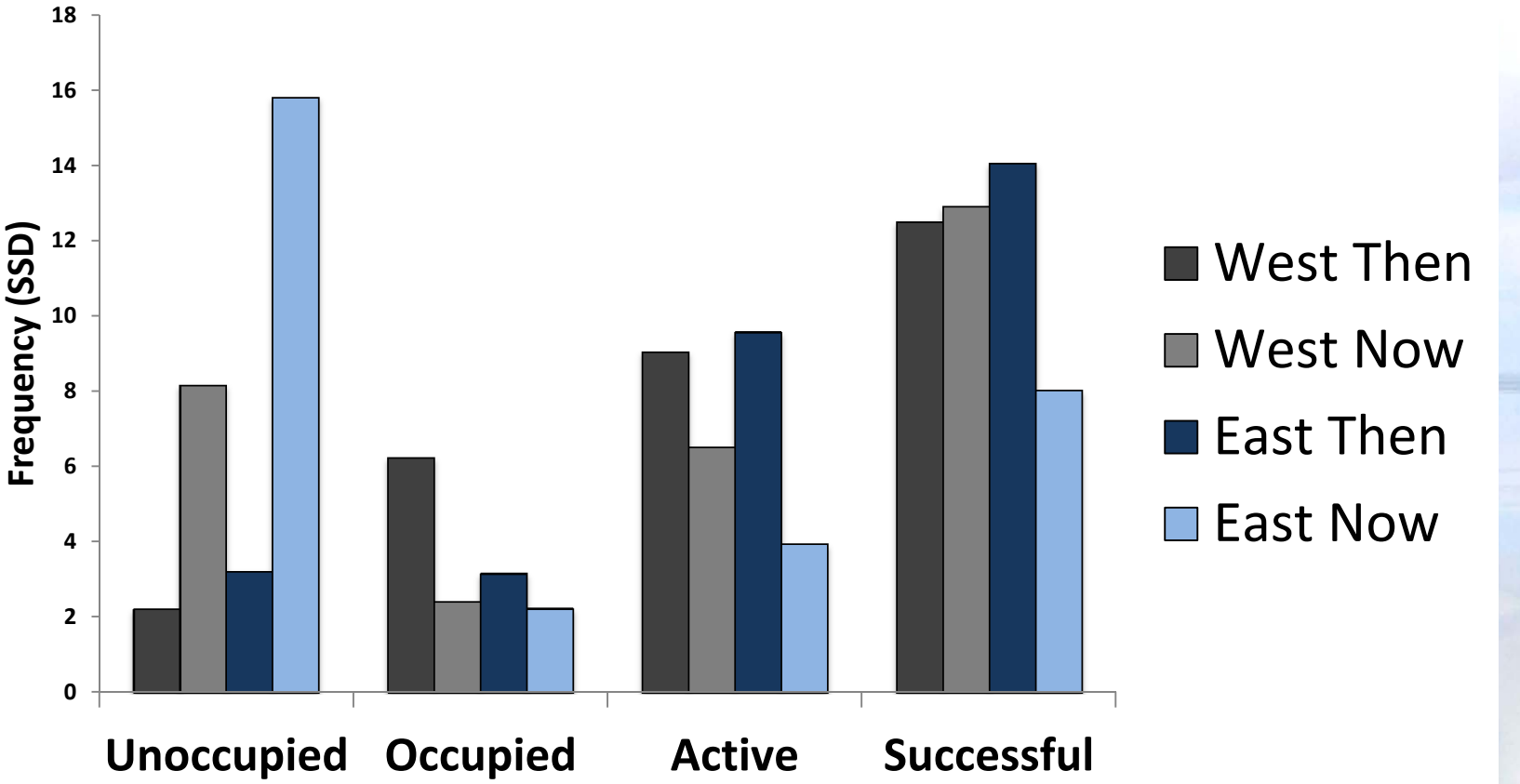
Fewer Occupied Territories

Table 2: Stable State Distributions (SSD) for all territories (n=30) between periods, 1960-1975 and 1995-2010

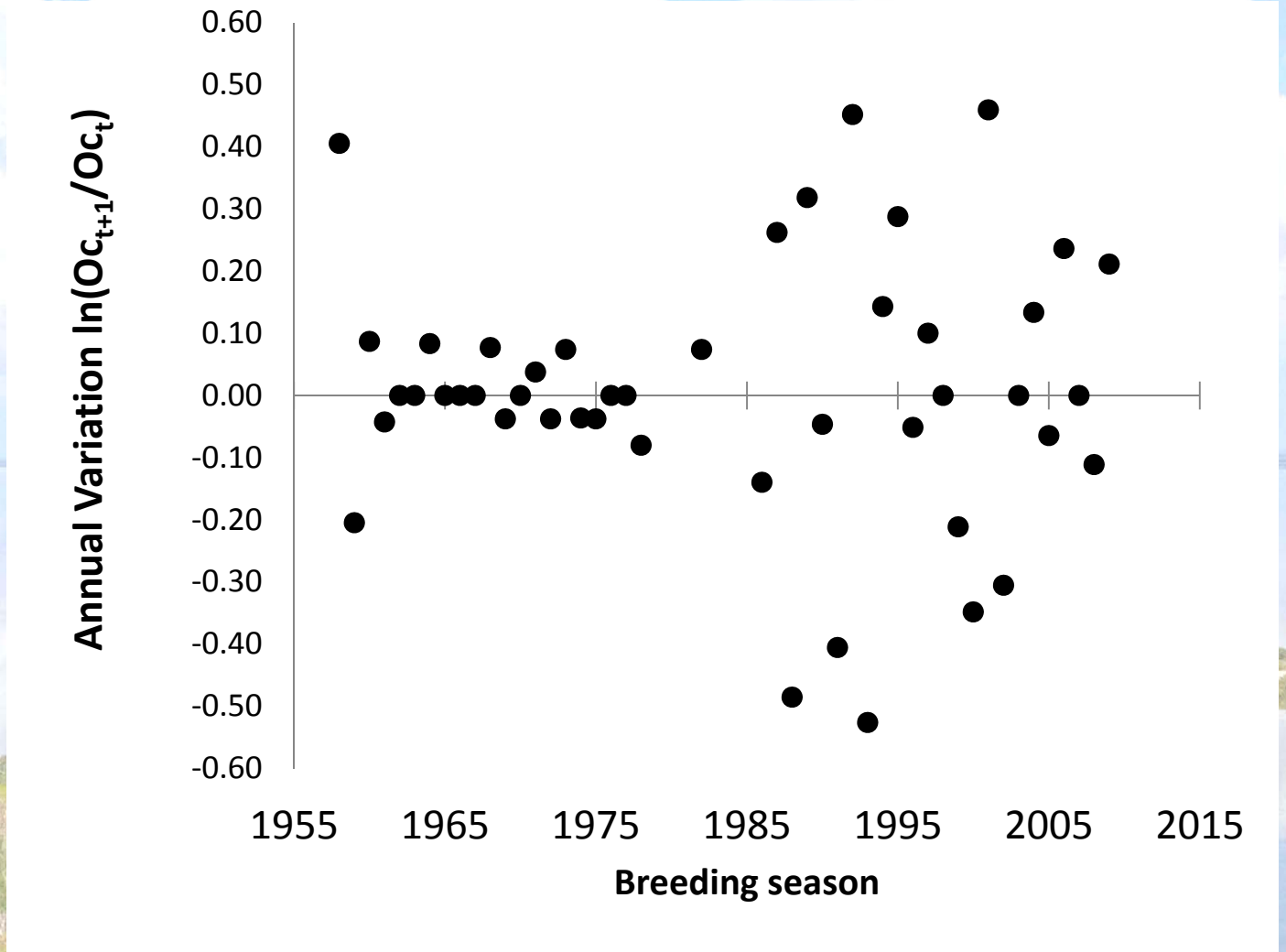
Period	Unoccupied	Occupied	Active	Successful
1960-1975	0.09	0.18	0.31	0.42
1995-2010	0.35	0.08	0.19	0.38
Difference	**0.26**	**-0.10**	**-0.12**	**-0.04**

“Then”: 10% Unoccupied, 90% Occupancy
“Now”: 35% Unoccupied, 65% Occupancy

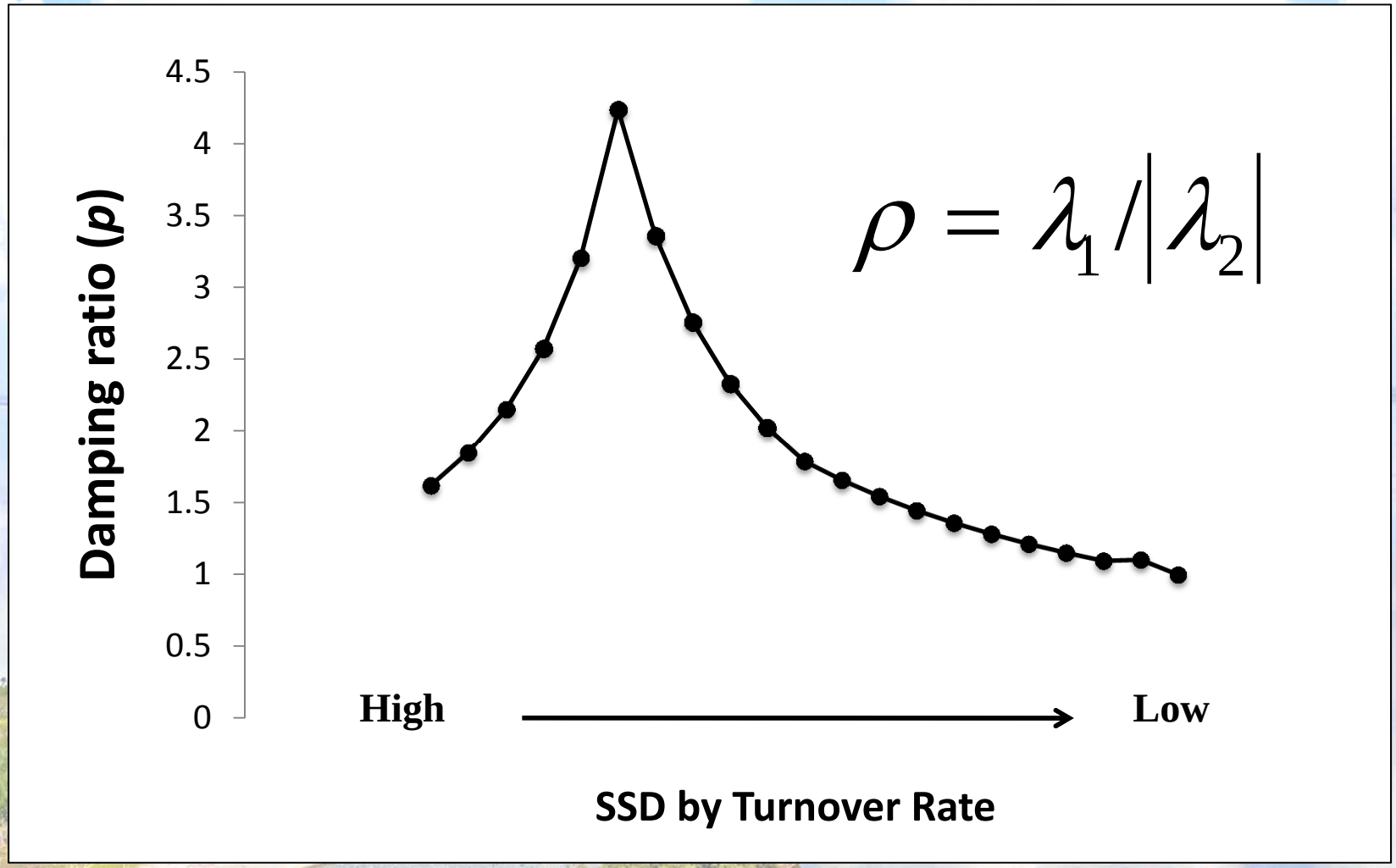
Stable State Distributions



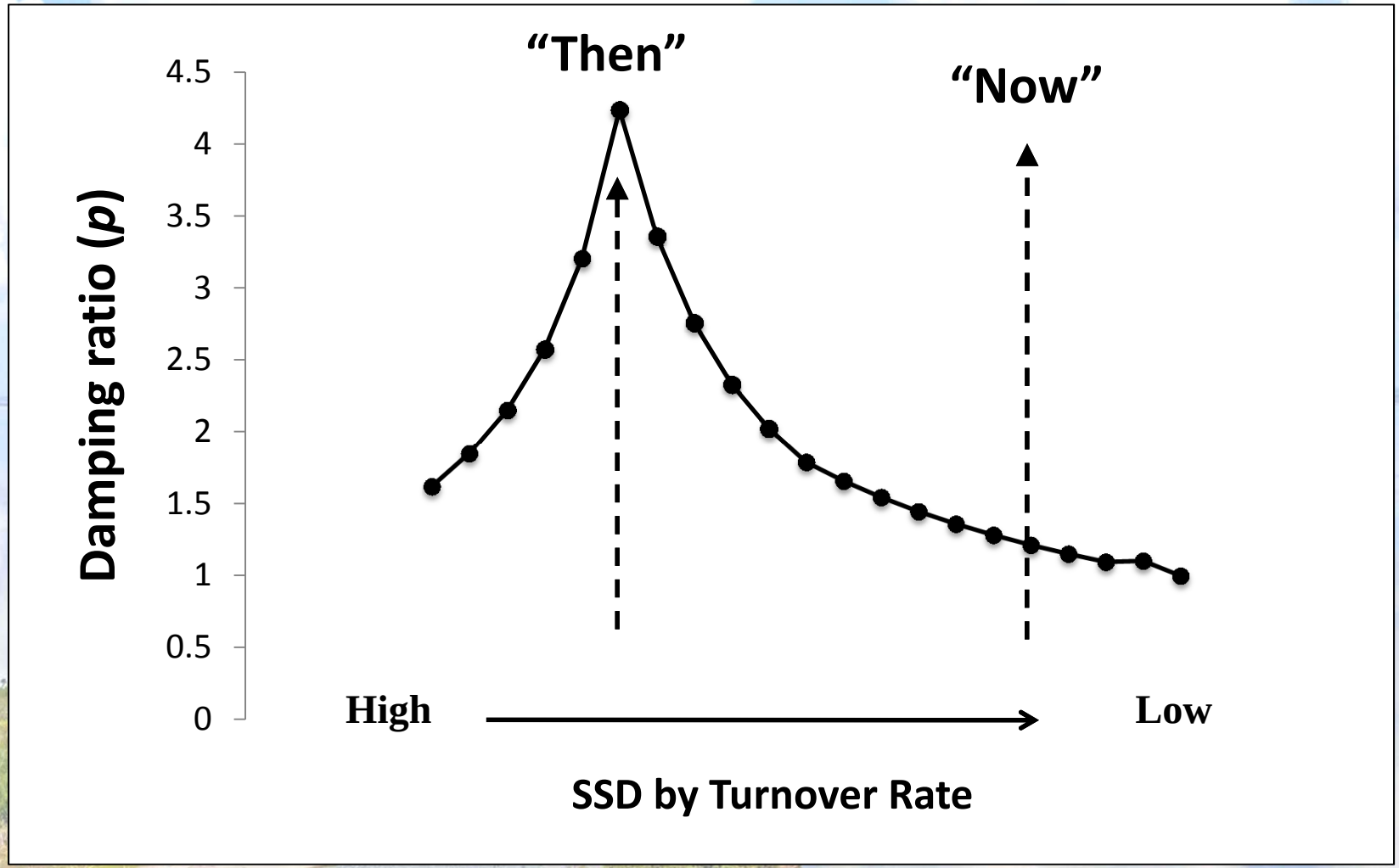
Greater year-to-year Variation



Measures of Convergence and Turnover



Measures of Convergence and Turnover



Next steps…



- Loss of occupied territories by as much as 43%
- Effects of Time and Location contributing to decline
- Decision to nest most effected by change
- Current population unstable/susceptible perturbations

- Incorporate landscape heterogeneity
- Determine the scale at which the habitat influences nest success
- Estimate the effect size of non-breeding season dynamics locally