LANDSCAPE FEATURES AFFECTING NORTHERN BOBWHITE PREDATOR-SPECIFIC NEST FAILURES IN SOUTHEASTERN USA

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Predation and Birds

- Predator – prey dynamics
  - Interesting
  - Challenging
- Predation = leading cause of nest failure
- Potential to limit populations?
- Role in ecosystem
- Complex set of interactions
- Need to understand process

The Bobwhite (*Colinus virginianus*)

Bobwhite Nest Ecology

Bobwhite Nest Predators

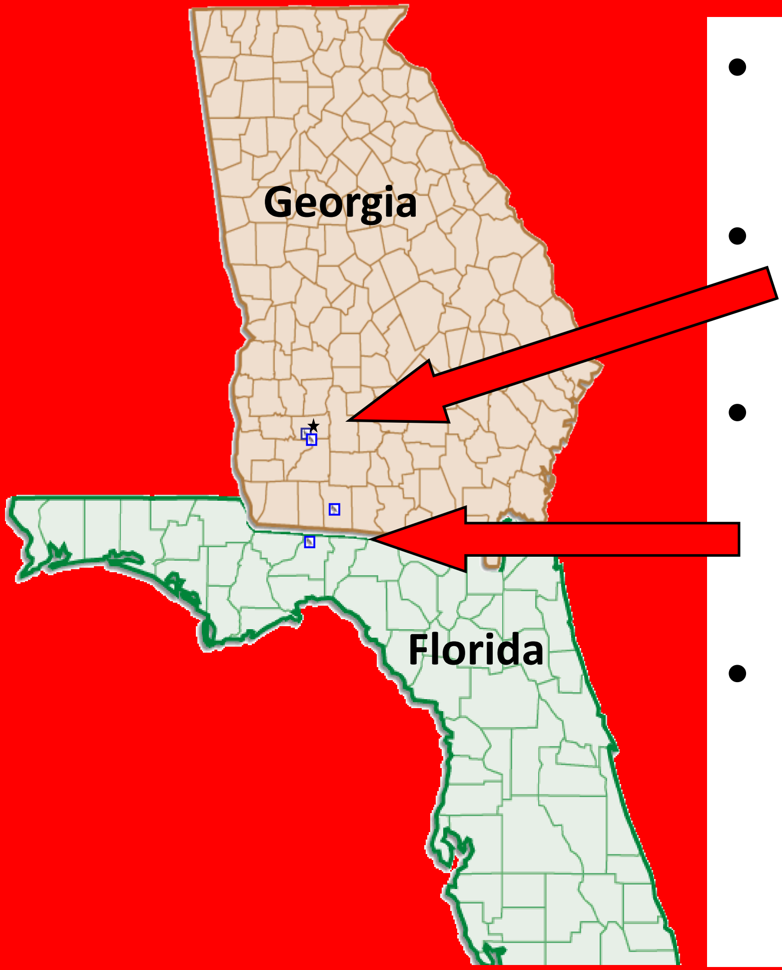
Predator Control

- Predator control controversy
- ↑ game/ imperiled species, ↓ damage to livestock
- Public divided
  - Need solution to ↓ wildlife damage
  - Predators valuable to society and ecosystem
- Conflicting results for bird species enhancement
- The "predator context"

Objectives

1) Determine the landscape composition and configuration features important to nest fate
2) Determine specific predators responsible for nest failures across spatial scales.
3) Determine underlying spatial relationships to the predation process, and potential management that may minimize nest predation.

Study Sites



- 4 sites in S. GA and N. FL
  - 1300-1400 ha each
- Albany (Upper Coastal Plain)
  - Pinebloom East and Pinebloom West
- Thomasville (Red Hills Region)
  - Tall Timbers Research Station
  - Pebble Hill Plantation
- Managed to maintain open pine savannah

Experimental Design

- Two sets of similar areas, cross-over predator removal experiment
- 1 year baseline (2000) + 6 years manipulation (2001-2006)
- Years 2001-2003 predators removed on 2 sites. Years 2004-2006 predators reduced on paired sites.
- Reduction of meso-mammalian predators – fox, armadillos, coyotes, bobcats, raccoons, opossum
  - Conducted by 4 full-time USDA-WS personnel
  - During bobwhite breeding season

    (1 March to 30 September)

Bobwhite Nest Monitoring

- Radio-tagged ~ 100 bobwhites each year on each area.
  - Located birds ≥ 5 times/week during nesting season
  - Birds in same location on 2 consecutive days → nesting
  - Capture nesting at approximately same time, incubation only

- Nesting – 746 nests across 4 study sites
  - Monitored with 24-hour continuous near infrared video cameras
  - Nests checked daily until hatch or failure
  - Video viewed to confirm nest fate and identify predators



Near-infrared Nest Cameras

What landscape features influence predator-specific nest failures?

Habitat Features: Background

- Habitat features thought to drive predator foraging, movement (e.g. edges)
- Composition of landscape features may attract predator use
- Cameras enable identification of predators to species (or guild)
- Use of natural nests rather than artificial - ↓ bias

Habitat Features: Methods

- Monitored nests: 7 years, 4 sites
  - Camera data
  - Categorized failures: MM, Snakes, Ants, Other
  - Recorded nest locations in ArcMap
- Landcover
  - Digitized using DOQQ, Aerial imagery, GPS
  - Metrics: % composition, proximity, edge density
- 3 Scales: constructed buffers (3.1-, 19.6-, and 50.3-ha)

Habitat Features: Statistical Analysis

- Multinomial models conditioned on nest failures
  - Meso-mammal, Snake, Ant, or Other
- Evaluated *uncorrelated* habitat predictors that might influence predation
  - % Field (fallow, ragweed), % Hardwoods, % Wetlands, Edge Density
  - Proximity to Fields, hardwoods, wetlands, roads, feed lines
- Model Selection using AIC
- Conduct at each spatial scale and across scales
- Evaluated spatial autocorrelation using Moran’s I

Habitat Features: Results

- Excluded abandoned (29), unknowns nests (35)
- 217 nests with known locations and failure causes
  - 92 meso-mammals
  - 67 snakes
  - 28 ants
  - 30 other

Habitat Features on Nest Success: Model Selection

Model	K	AIC_c	ΔAIC_c	Weight
Int + Field Distance + Field Composition (50.3ha)	3	914.52	0.00	0.352
Int + Field distance + Field Composition (50.3ha) + Wetland Distance + Hardwood Distance	5	915.03	0.50	0.274
Int + Hardwood Distance	2	915.05	0.53	0.270
Int + Wetland Distance + Hardwood Distance	3	916.96	2.44	0.104

Take Home:

- Best models describing nest success included metrics associated with old/fallow fields and hardwood drains.

Model-Averaged Parameter Estimates

Parameter	Estimate	SE	95% LCI	95% UCI	Unit Scalar	Scaled Odds Ratio	Scaled LCI	95% CI UCI
Intercept	-0.0481	0.40251	-0.837	0.6121				
Distance to fields	-0.0021	0.00094	-0.004	-0.0006	50	0.8998	0.8208	0.9719
Field Composition (50.3ha)	-0.0488	0.01917	-0.0864	-0.0174	10	0.6138	0.4215	0.8405
Distance to wetlands	-0.0001	0.00028	-0.0007	0.0003	50	0.9936	0.9666	1.0166
Distance to Hardwoods	0.0004	0.00018	0	0.0007	50	1.0181	1.0000	1.0336

Take Home: Probability of nest failure is **less** likely with increasing distance to fields, proportion of field composition, & distance to wetlands.

Landscape Metrics and Nest Fate

	Distance to Field (m)			% Field Composition (50.3 ha)			Distance to Wetland (m)			Distance to Hardwood Drain (m)		
Nest Fate	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Success	122	0	473	7	0	24	417	0	1,701	329	0	2,442
Fail	112	0	470	6	0	21	389	0	1,364	439	0	2,174

Take Home: Summary statistics showing that while these metrics were important, there were not dramatic differences in between successful and failed nests!

Landscape Metrics and Failure Cause
Who was the predator?

Model	AIC	ΔAIC	Weight
Int + Field composition (3.1-ha)	549.75	0.00	0.700
Int + Field composition (3.1-ha) + Feed line Distance	551.97	2.22	0.231
Int + Feed line Distance	556.30	6.55	0.026
Int + Field composition (19.6-ha)	556.57	6.82	0.023
Int + Hardwood composition (50.3ha)	556.91	7.16	0.019

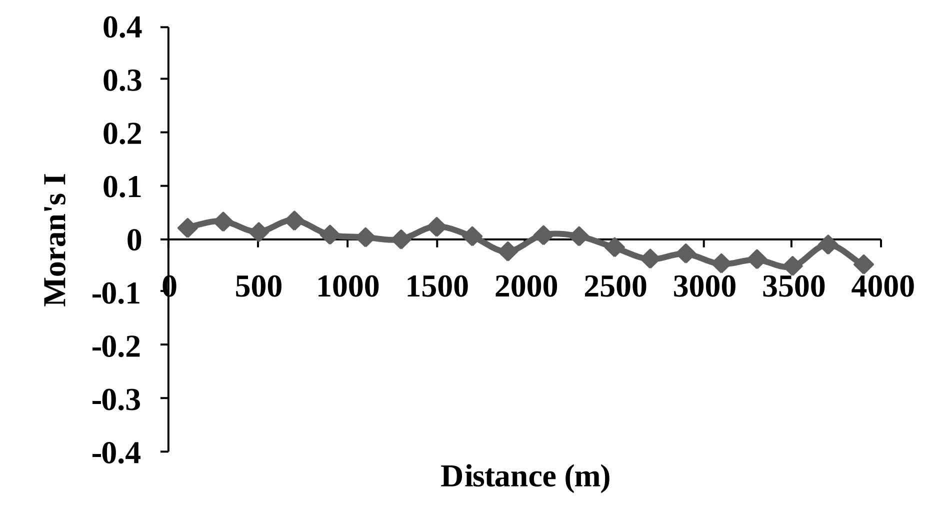
Take Home:

- Field composition at smallest scale playing an important role in which predator was responsible for nest failure.
- For every 10% increase in field composition, other predators/failures causes were 2.2 times LESS likely than meso-mammals.

Landscape Metrics and Nest Fate

	% Field Composition (3.1-ha)			% Field Composition (19.6-ha)			R Hardwood Composition (50.3-ha)			Distance to Feed line (m)		
Nest Fate	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Meso-mammal	7	0	53	7	0	26	8	0	53	374	0	1999
Snake	8	0	42	6	0	22	7	0	44	403	0	1511
Ant	10	0	39	8	0	27	12	0	39	624	0	2043
Other	2	0	19	4	0	29	8	0	40	388	0.8	1909
Successful	6	0	80	7	0	37	9	0	55	414	0	2102

Spatial Autocorrelation



Take Home:

- Predict that nests closer to one another would have similar fates.
- Did not observe that pattern across the landscape using residuals from our top model across all years (Moran's I ~0).
- Moran's I < 0.2 for all comparisons of meso-mammal failures to all others collectively and individually!

Habitat Features: Conclusions

- Field Composition
  - Increased nest success w/ ↑ composition but also distance to the fallow fields
  - Alternative prey = cotton rats
  - Good to have areas for them, but not right next to nesting area
- Failures causes
  - Higher mammal predation with increased field composition relative to other nest failure events
  - Higher mammal predation near feedlines relative to ants
- Spatial autocorrelation
  - Fate of nest independent of neighboring nest fate!
  - Predators do not appear to be returning to area where nest was found
  - Incidental predation!

What have we learned?
Where do we go from here?

- Predation = natural ecosystem process
- Driving force in community ecology
- Modern landscape very different from historical
- Predation process → altered form
  - E.g. Meso-mammals at historically high densities
- Complex interactions among generalist predators, prey, and the modern landscape?
  - Lack of independence among nest predators
  - “Compensation”
  - Challenges even the way we measure processes!

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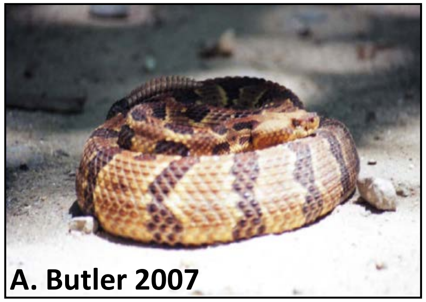

- Manage habitat = managing predators
  - %fields, %hardwoods,
  - Supplemental feed lines

- Predation management
  - Indirect Methods: habitat, alternative prey
  - Direct: Predator reductions - ↓ predator use

- Goals
  - Historically: Eradication
  - Current: Minimize interactions with imperiled and game species

- Requires extensive reevaluation of the community

- Managing human-wildlife interactions, results of human-influences

Acknowledgments

Research Partners: TTRS, Albany Quail Project, & USDA- Wildlife Services

Predator Project Team: Shane Wellendorf and Clay Sisson, many technicians, & graduate students

Warnell staff, faculty, and friends: Too many of you to list!

Funding: Warnell School of Forestry and Natural Resources, UGA Graduate School, Direct Congressional Appropriation, Northeast Chapter of QU [*Rex Johnson*], Shikar-Safari Club, AAUW


Questions?