# Understanding how cattle management strategies influence vegetative heterogeneity and grassland avian species occupancy.

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Photo Credit: Wendy Ambrefe, Bachman's Sparrow at Kissimmee Prairie Preserve State Park

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# Grasslands


The extensive coverage of grasslands throughout the southeast are classified as longleaf pine savannah, pine flatwoods, dry prairie, and wet prairie habitats.

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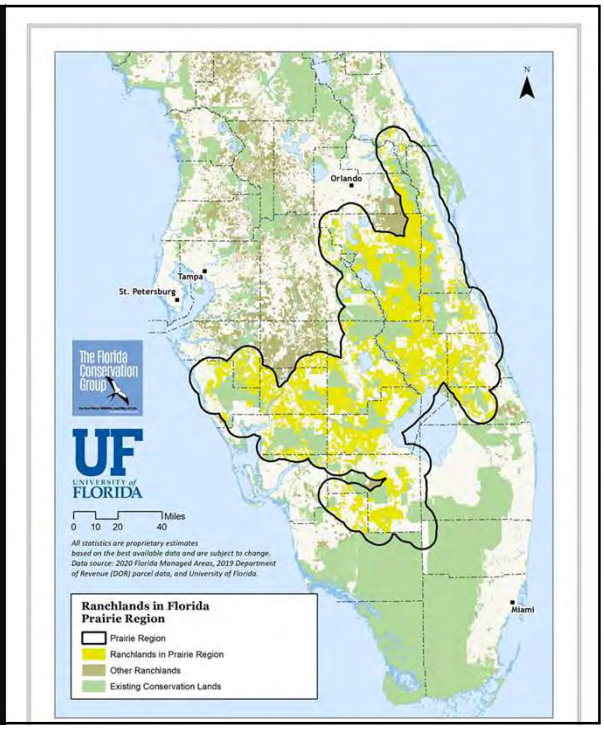
# Historic Grassland Systems

Florida grasslands were estimated to have once covered approximately 2 million acres in the form of dry and wet prairie

Conversion of grassland systems has predominately been in the form of cow-calf operations.

Noss 2013

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# Unique historic grassland systems

- Prairie systems are a treeless, and sometimes shrubless, landscape
- Wildlife are adapted to vegetation characteristics in a disturbance reliant systems
- Dry and wet prairie of Florida are reliant on fire and seasonal inundation

Dixon et al. 2014; Photo Credit: Friends of Kissimmee Prairie Preserve

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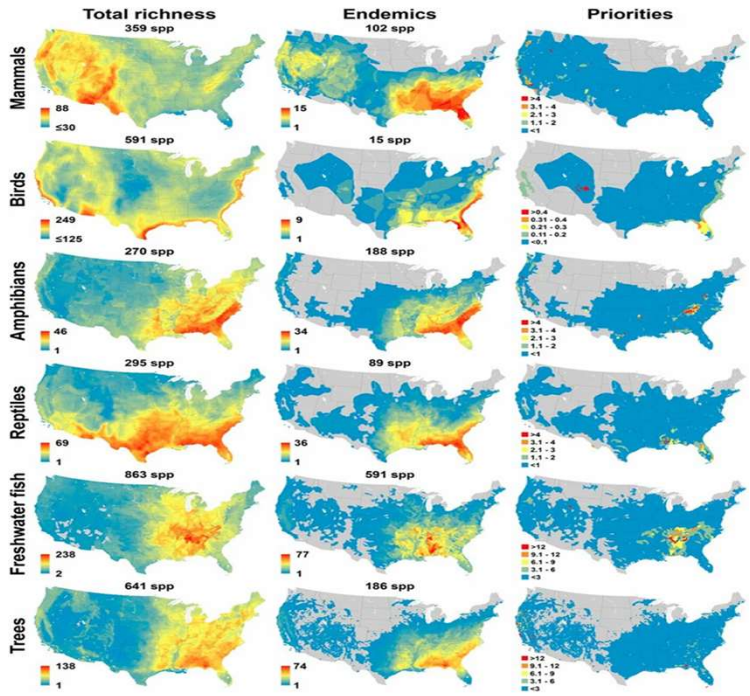
Southeastern Coastal Plain is a Biodiversity Hotspot




Jenkins et al. 2015

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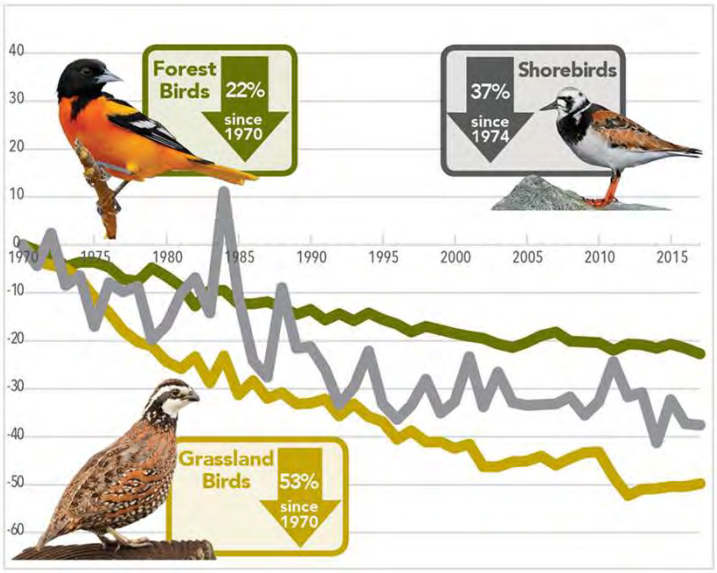
# Grassland Bird Decline




Cornell Lab of Ornithology 2022

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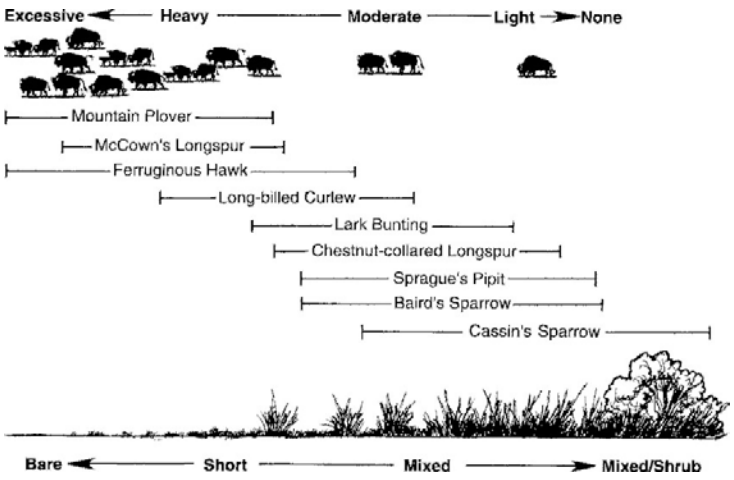
There is an important relationship between vegetation and grassland avifauna.




(Skowno and Bond 2003; Coppedge et al. 2001; Gennett et al. 2017; Karr and Roth 1971; Madden et al. 2000; Davis et al. 2013; Davis 2004) Photo Source: Derner et al. 2009

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# Project Goals and Objectives

| | |
|---|---|
| Goal | To be able to provide management recommendations to private and public land managers, to aid the long-term conservation of the Florida grassland avifauna community. |
| Objective 1 | Describe and differentiate potential pasture types in working rangelands based on vegetative composition and structure. |
| Objective 2 | Understand the relationship between grassland avifauna community composition and active and passive management strategies. |

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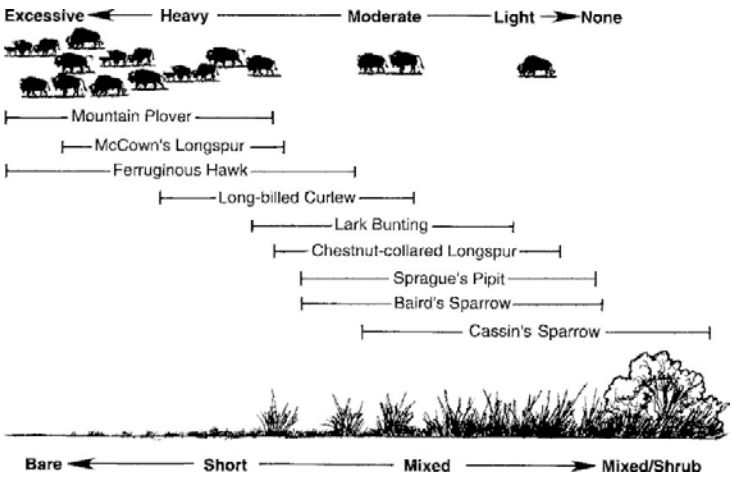
## Understanding Vegetation Characteristics Drives Niche Availability

- Florida grassland vegetation are impacted by seasonal disturbances such as fire and inundation
- Vegetation composition and structure have high predictive power on grassland avifauna success
- Vegetation structure and composition provide necessary resources




(Skowno and Bond 2003; Coppedge et al. 2001; Gennett et al. 2017; Karr and Roth 1971; Madden et al. 2000; Davis et al. 2013; Davis 2004) Photo Source: Derner et al. 2009

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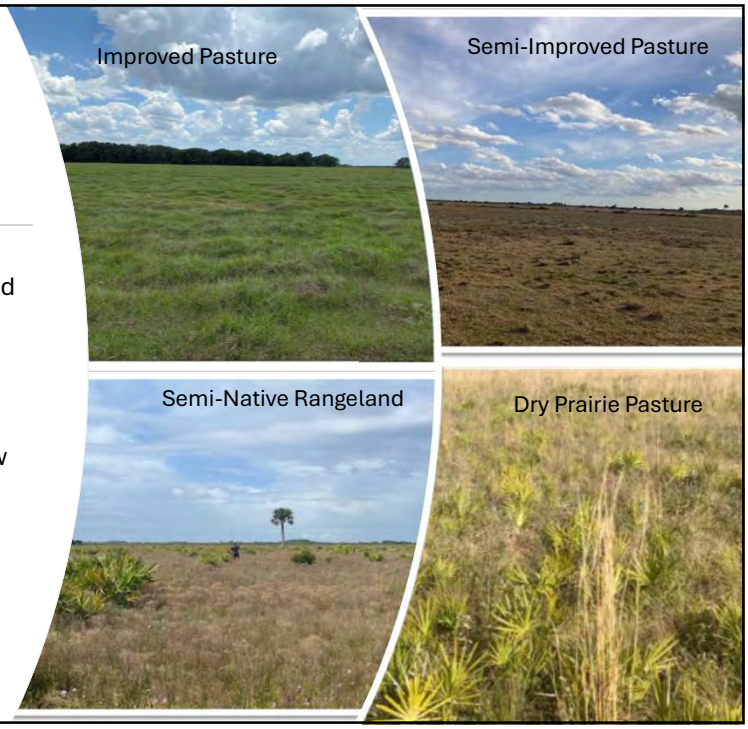
## Observed Pasture Types

Pasture types can differ based on observed changes in vegetation composition and structure

Given that vegetation characteristics can drive niche availability, understanding how vegetation differs across the landscape can help predict occupancy patterns.

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# Chapter 1

**Objective**: To describe and differentiate the four pasture types that occur on working rangelands in our study system, based on the vegetative community composition and structure

Vegetation Structure
Species Richness
Heterogeneity

**Prediction:**

Dry Prairie Pasture
Semi-native Rangeland
Semi-Improved Pasture
Improved Pasture

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Chapter 1

**Objective**: To describe and differentiate the four pasture types that occur on working rangelands in our study system, based on the vegetative community composition and structure

**Prediction 3:**

Hydrophilic vegetation types drive pasture type differences based on climatic seasonal shifts.

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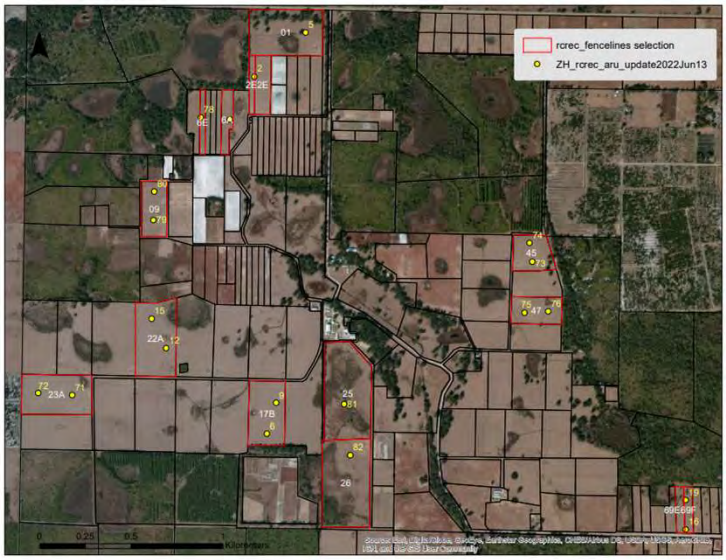
# The Range Cattle Research and Education Center

2,840 acres with ~1,200 head of cattle

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# DeLuca Preserve

27,000 acre property, 18,000 of which is leased for 1,500 head of cattle


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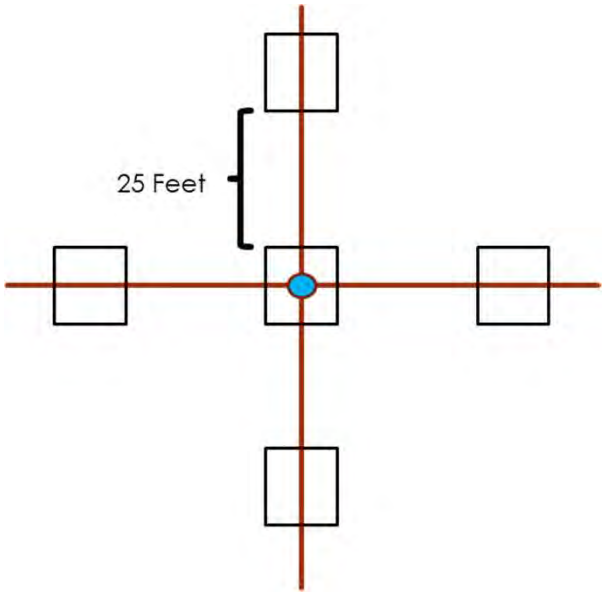
# Vegetation Data Collection

Vegetative Structure:

- Vertical Stem Density
- Average Vertical Height
- Percent Composition of each Vegetative Class (Bare Ground, Water, Shrub, and Groundcover)

Vegetative Composition:

- Species Richness
- Percent Composition of each Species, then combined by like vegetative types (Forage Crop, Native Grasses, Forbs, Graminoids, Invasive Species, and Woody Species)

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# Vegetation Data Collection

- ~1,400 Vegetation Quadrats
- 4 Sampling Events, 5 quads per site, 70 sites in total
- By Season: 700 Individual Quads
- By Pasture Type: 400 Quads for Improved, Semi-Improved, and Semi-Native Pasture and 200 for Dry Prairie
- 169 Total Species

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# Vegetation Data Analysis

- Generalized Linear Models for proportional coverage estimates and vertical stem density
- Linear Regression Models for average height
- We assessed five models per vegetation covariate

| Models | Proportion of | | | | | | | | | Vertical stem density | Average height |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Forage | Native grasses | Forbs | Graminoids | Woody species | Invasive Species | Groundcover | Shrubs | Open Water | | |
| Null | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.57** | 0.00 | 0.05 | 0.23 | 0.00 | 0.00 |
| Pasture | 0.00 | 0.00 | 0.33 | 0.12 | **0.74** | 0.16 | 0.00 | **0.67** | **0.57** | 0.00 | 0.00 |
| Season | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.21 | 0.00 | 0.02 | 0.05 | 0.00 | 0.00 |
| Pasture + Season | 0.00 | **0.75** | **0.65** | **0.81** | 0.25 | 0.06 | 0.01 | 0.25 | 0.13 | 0.00 | 0.00 |
| Pasture * Season | **1.00** | 0.25 | 0.02 | 0.05 | 0.01 | 0.00 | **0.99** | 0.01 | 0.01 | **1.00** | **1.00** |

**Table 1-1.** Support for models (AICc weights) of vegetation composition and structure metrics across study sites at the DeLuca Preserve, Osceola County, Florida and the Range Cattle Research and Education Center, Hardee County, Florida. Top models (AIC weight > 0.50) are bold.

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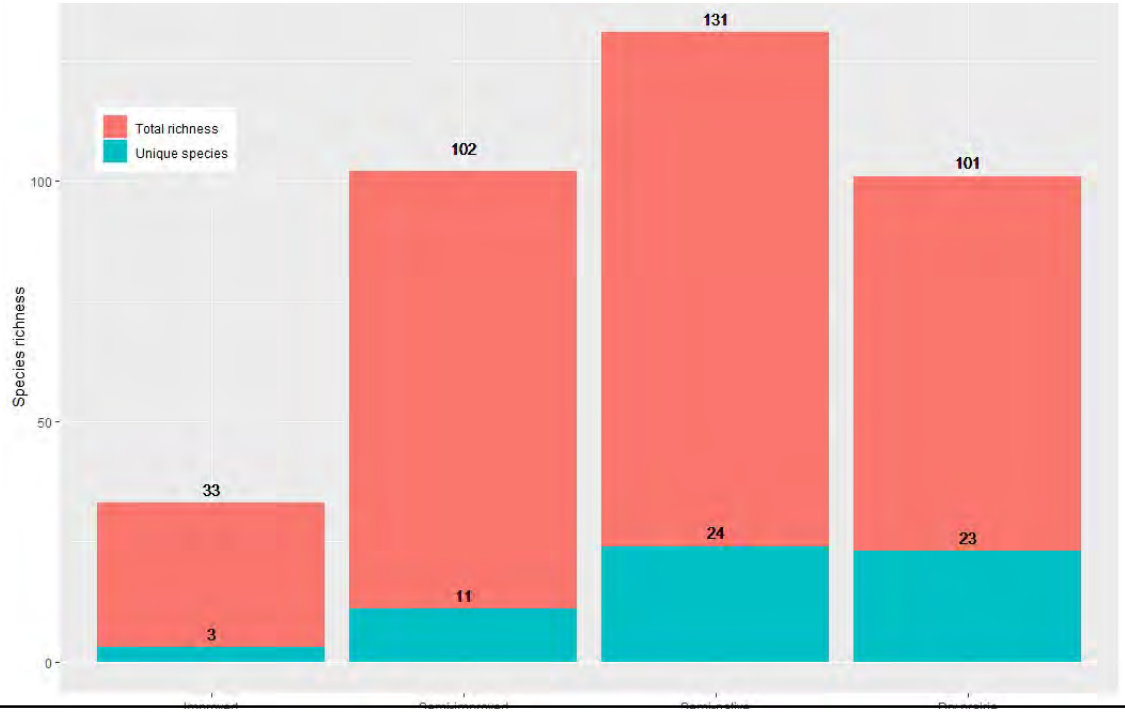


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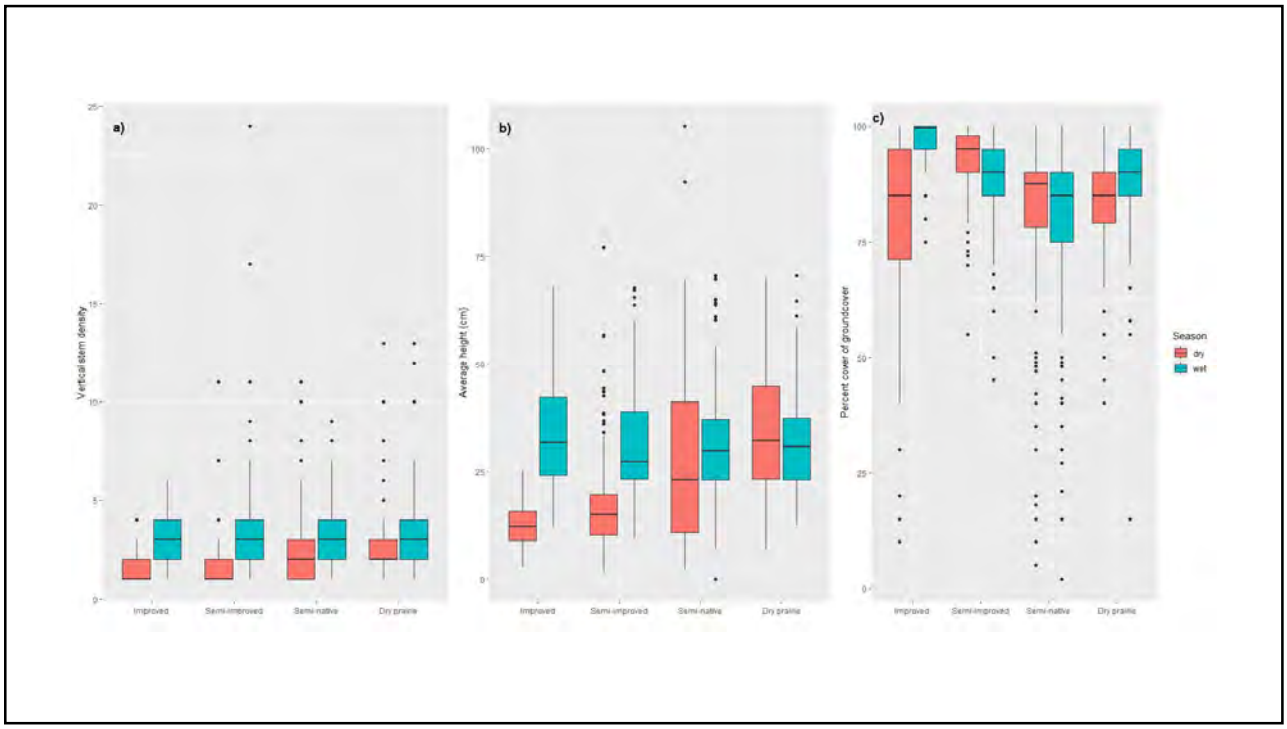
a)
b)
c)
Vertical stem density
Average height (cm)
Percent cover of groundcover
Improved
Semi-improved
Semi-native
Dry prairie
Season
dry
wet

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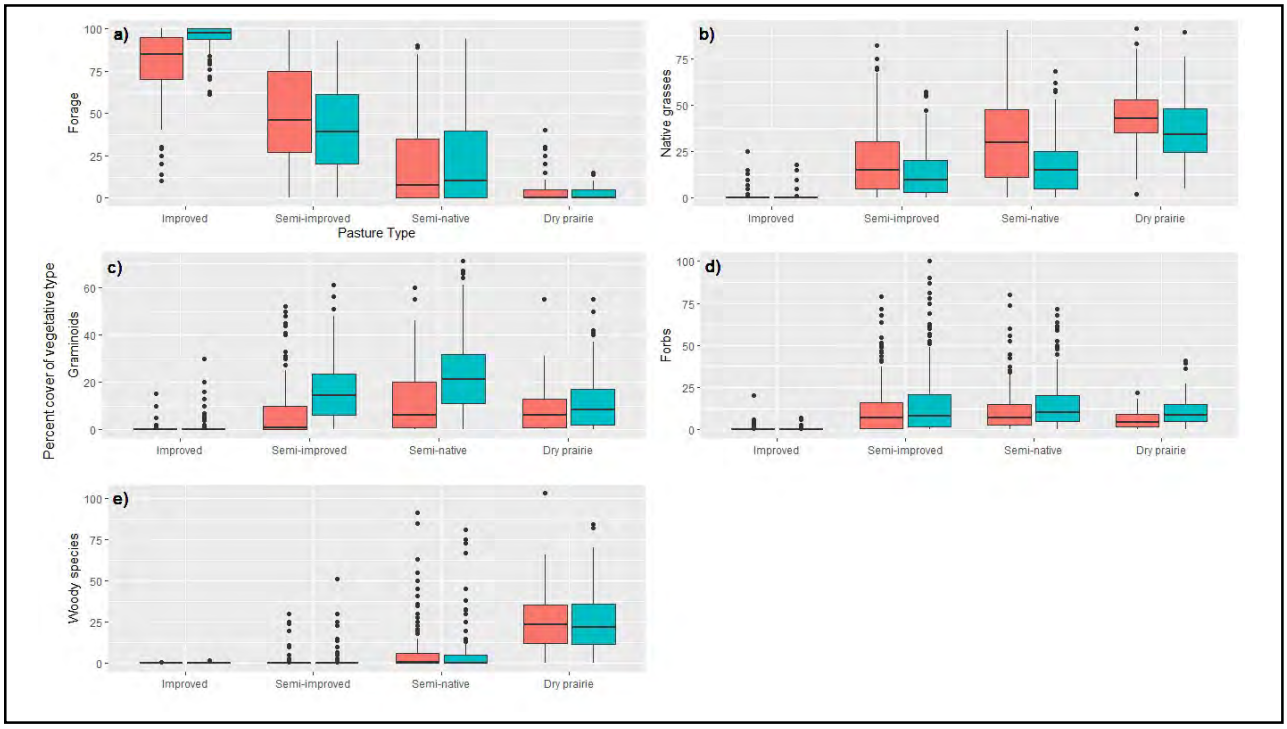
a)
b)
c)
d)
e)
Forage
Native grasses
Percent cover of vegetative type
Graminoids
Forbs
Woody species
Improved
Semi-improved
Semi-native
Dry prairie
Pasture Type

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# Ecological Implications and Future Research

- Season is one of the strongest predictors for vegetation structure and composition in converted grazed systems in Florida, but not only for hydrophilic plant groups.
- Non-native forage crop can drive both vegetation structure and composition, and drives pasture type designation
- 6 primary vegetative covariates that differentiate pasture types
- Future analysis will show the vegetative characteristics that can be used to validate pasture type classifications

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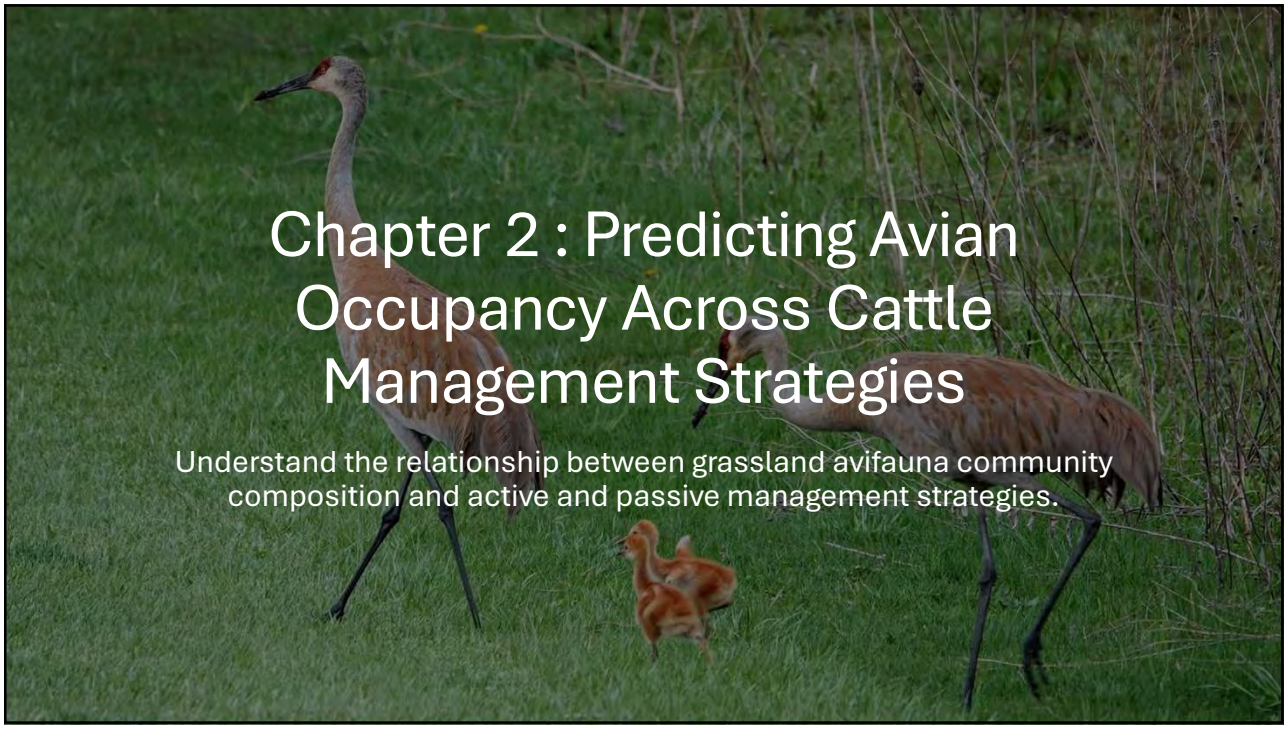


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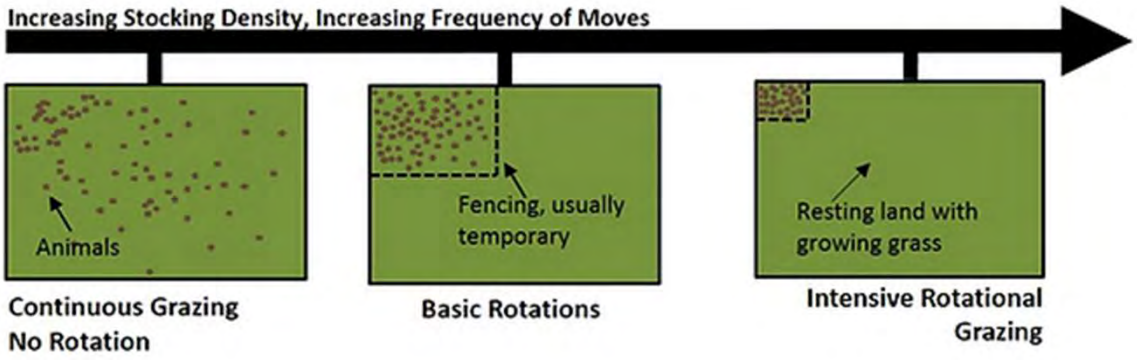
## Cattle Management Strategies

- Stocking Density (Number of Animal Units/Acre)
- Rotational Schedules Increase Operation Productivity

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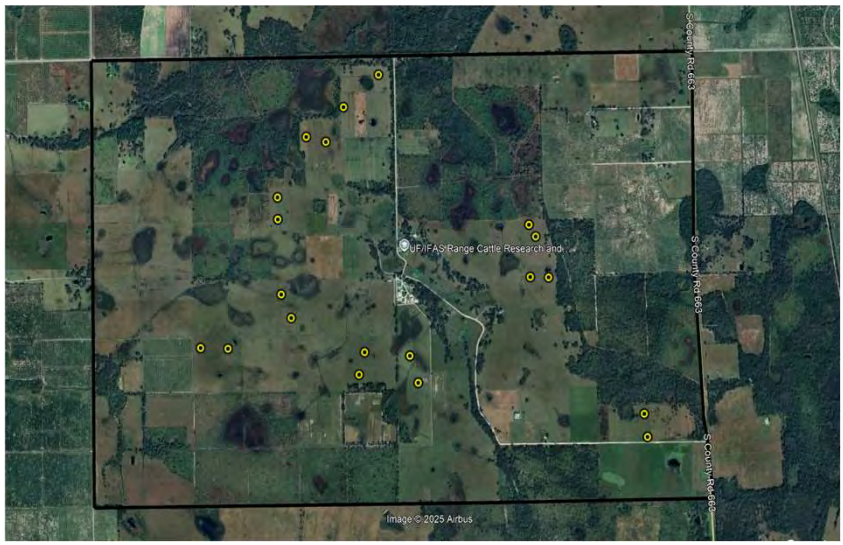
## The Range Cattle Research and Education Center

2,840 acres with ~1,200 head of cattle

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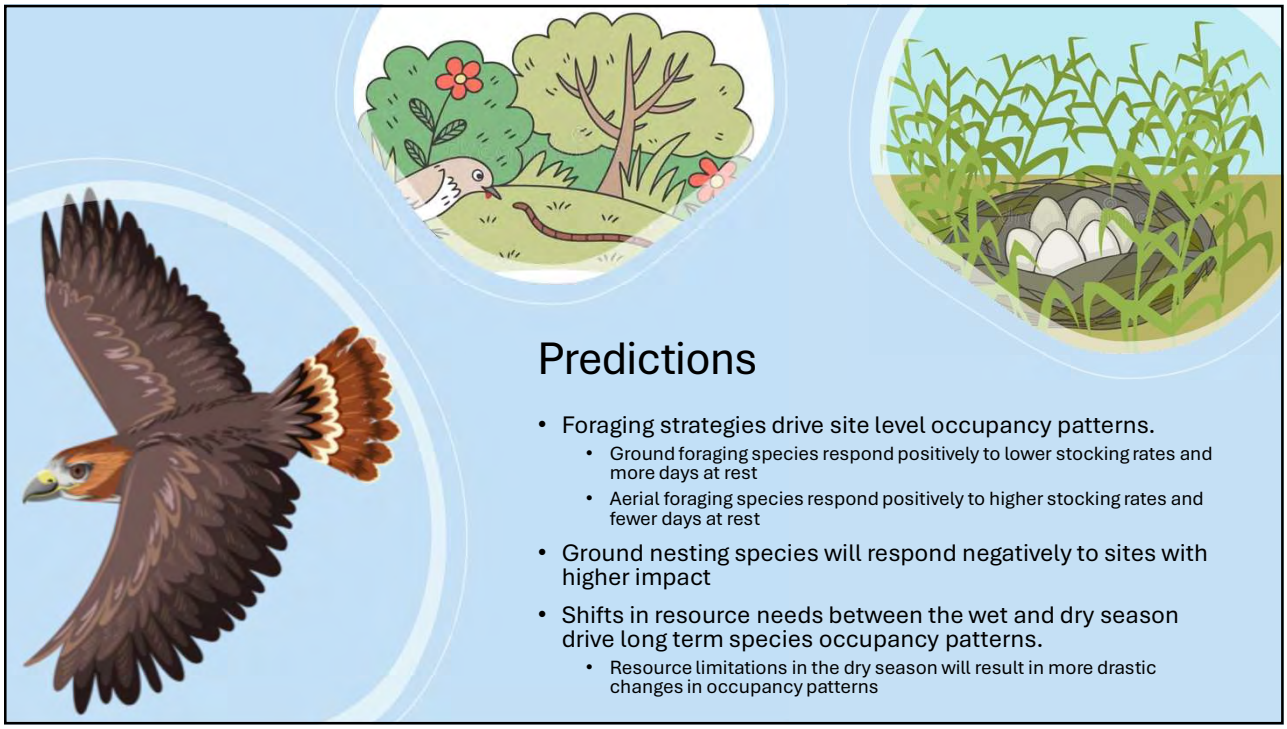

## Predictions

- Foraging strategies drive site level occupancy patterns.
  - Ground foraging species respond positively to lower stocking rates and more days at rest
  - Aerial foraging species respond positively to higher stocking rates and fewer days at rest
- Ground nesting species will respond negatively to sites with higher impact
- Shifts in resource needs between the wet and dry season drive long term species occupancy patterns.
  - Resource limitations in the dry season will result in more drastic changes in occupancy patterns

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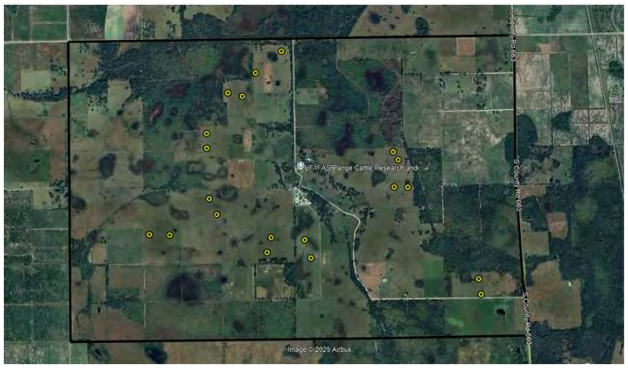
## ARU deployment and Data Collection

- Systematically selected pastures and locations for coverage of site and management strategies
- Deployed from March 2022 through August 2023
- ~51,000 hours of recording in total

NHBS at https://www.nhbs.com/song-meter-micro

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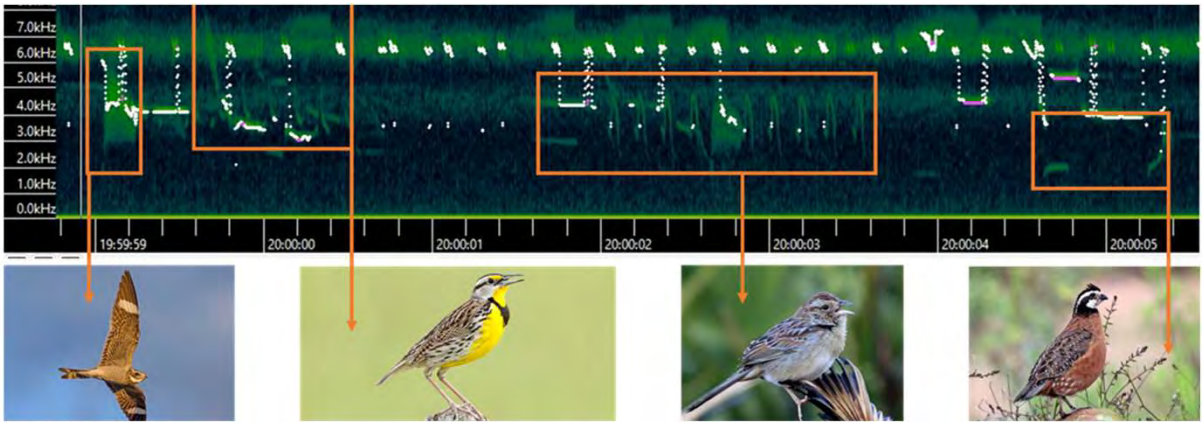
## Avian Sampling: Passive Acoustic Monitoring

No study has assessed avian occupancy on grazed systems with passive acoustic monitoring in Florida




Images Source: MaCaulay Library; eBird

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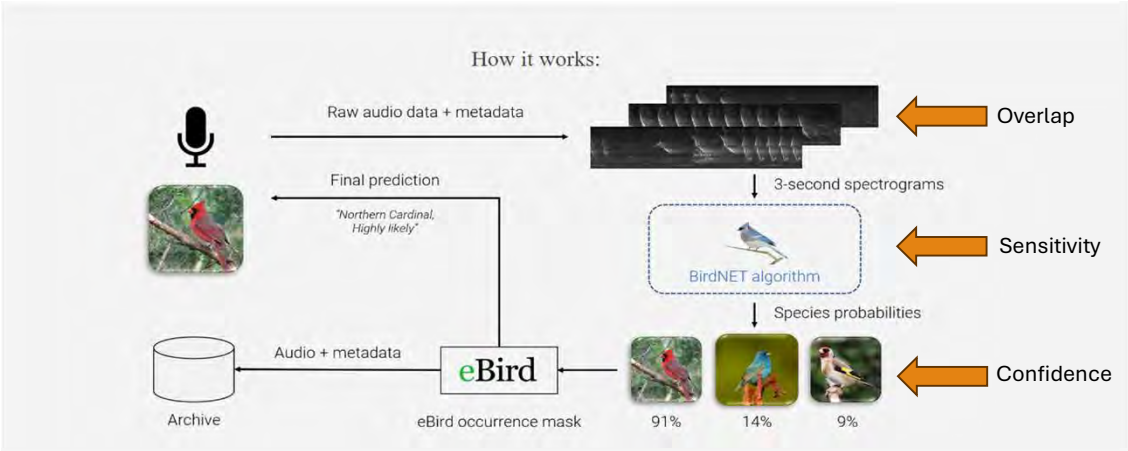
## Acoustic Analysis: BirdNET

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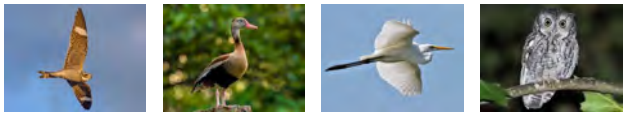
# BirdNET Performance Test

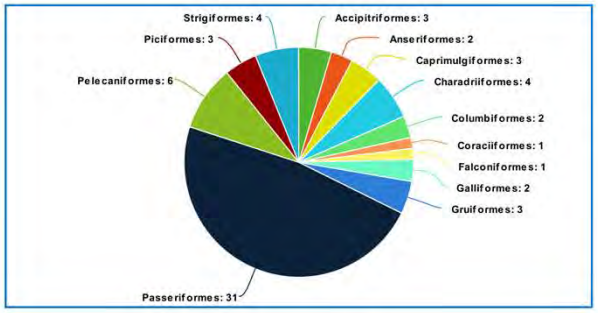
To test BirdNET's proficiency we randomly selected files across four variables that might impact success:

- Location: 20 ARU Sites
- Distance to Road
- Time of Day: Dawn, Dusk, Day, Night
- Time of Year: Breeding, Non-Breeding

A total of 420 files were selected with dual observation methods

- 65 Species Identified





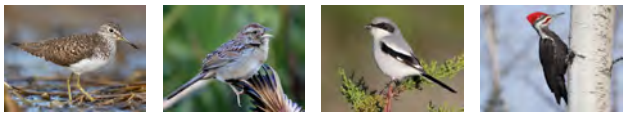



Image Sources: eBird - Macaulay Library

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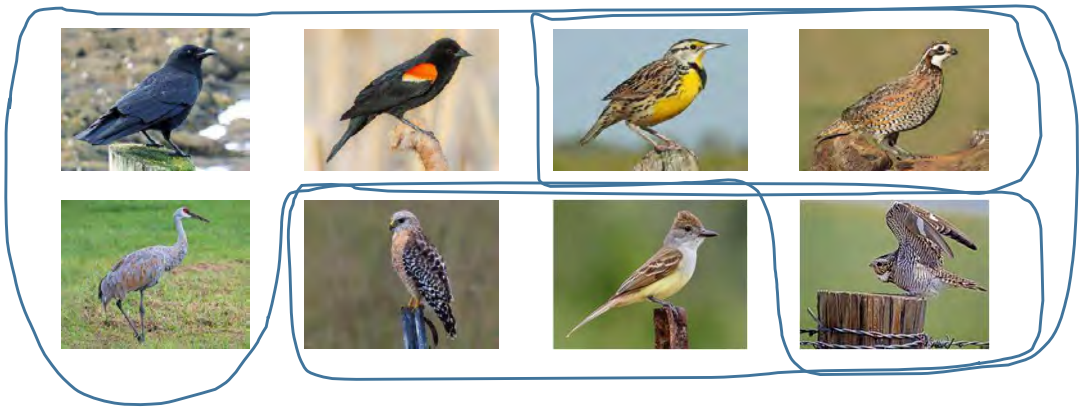
# Species Selection

**Ground Foraging Species**

**Aerial Foraging Species**

**Ground Nesting Species**



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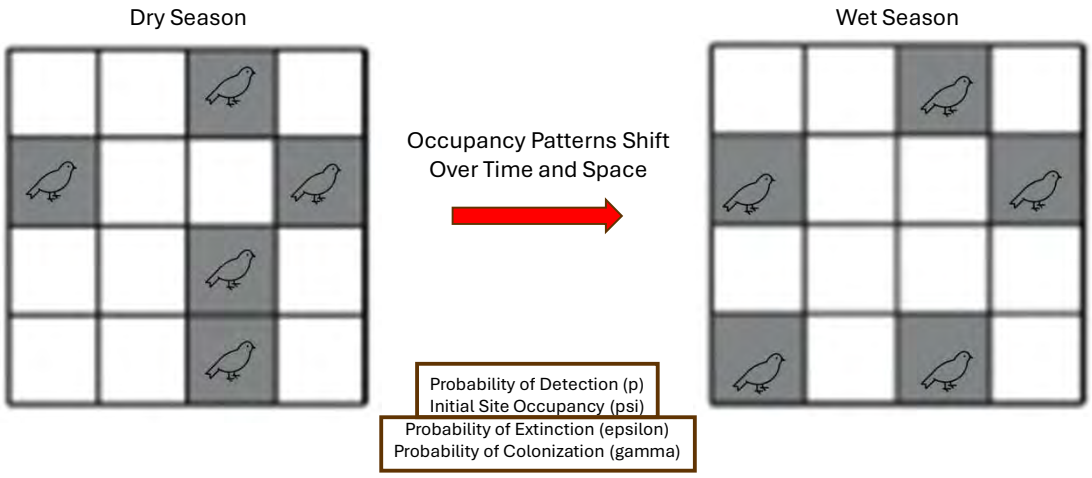
# Analyzing predictions with Single-Season Dynamic Occupancy Models

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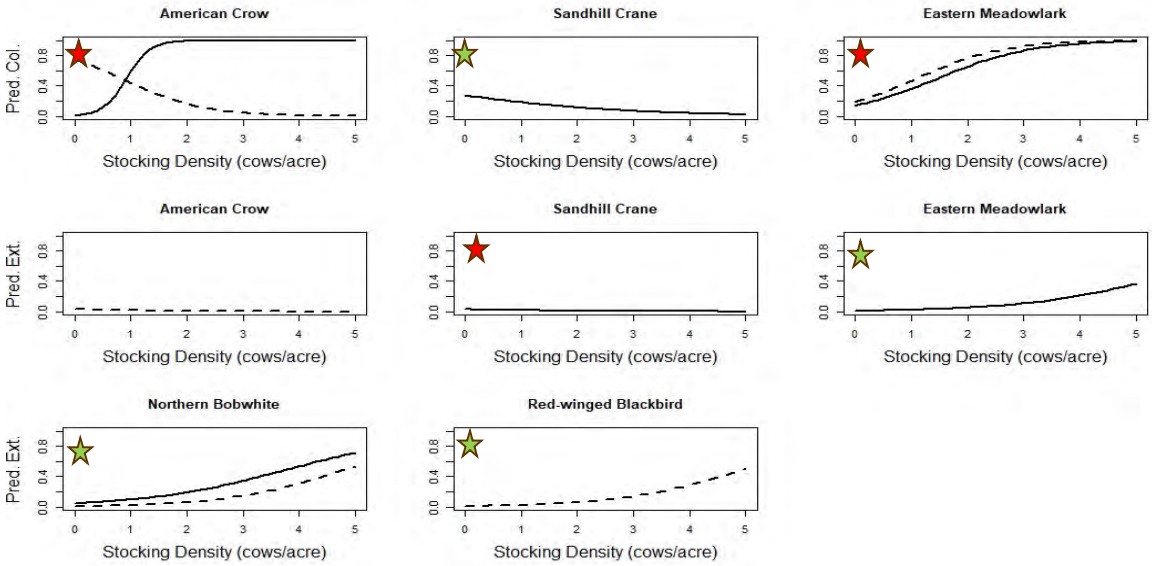
## Results: Ground Foraging Species

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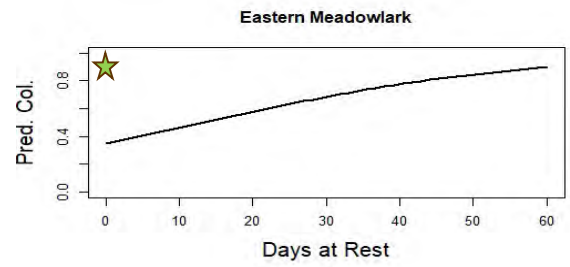
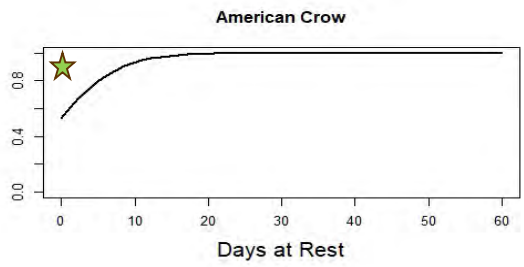
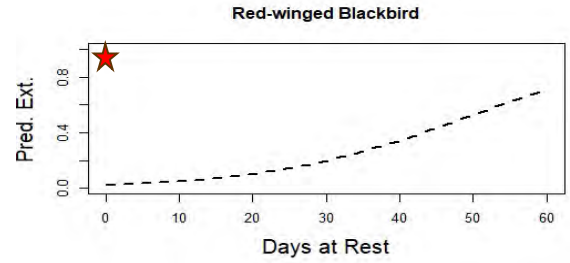
## Results: Ground Foraging Species

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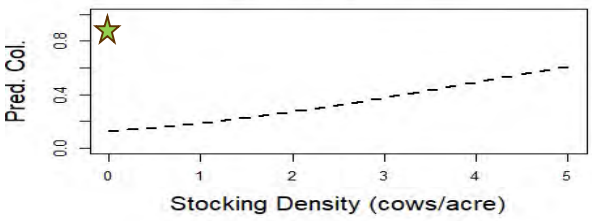
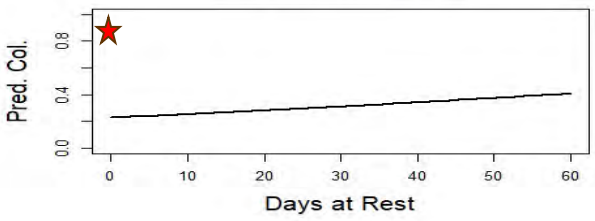
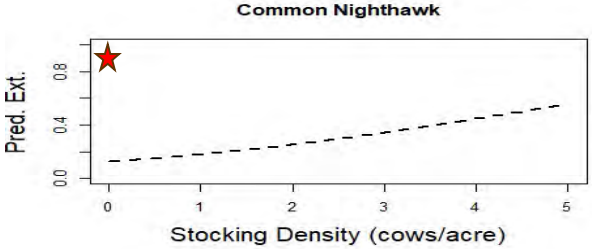
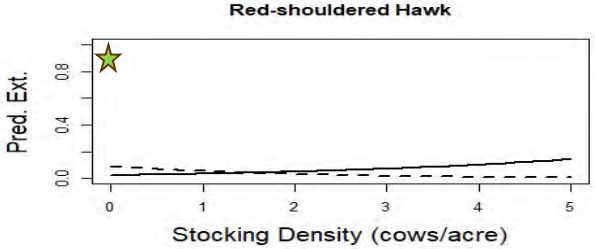
## Results: Aerial Foraging Species

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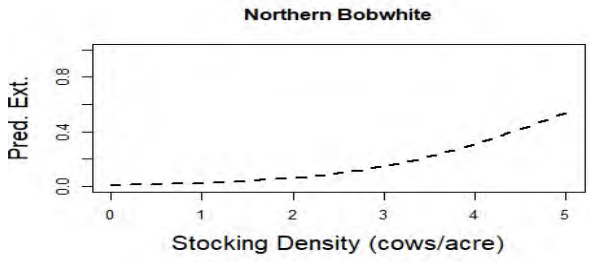
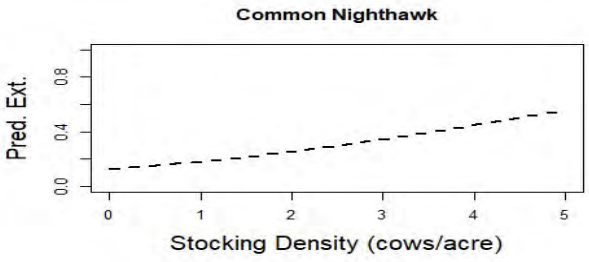
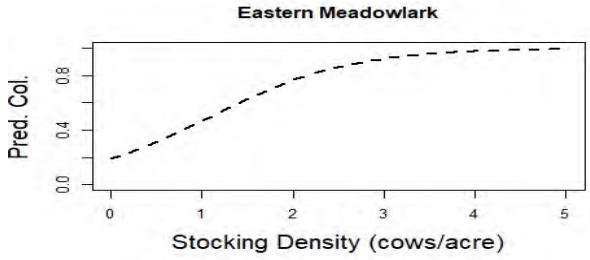
## Results: Ground Nesting Species



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# Ecological Significance and Implications

- Ensuring identification validity is still the biggest challenge when using passive acoustic monitoring at the community scale
- Identifying avian calls from acoustic recordings still requires further real-world testing and truthing
- As predicted species-specific relationships exists between cow-calf operation management strategies and grassland avifauna occupancy.
- Sustainable grazing practices such as pasture rest and appropriate stocking density increase grassland avifauna occupancy, but vary considerably
- Moderate support of our predictions shows that further research is needed to clarify these relationships

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# Where research can be expanded…

- Increasing BirdNET identification proficiency and accuracy
- Broaden the analysis to include additional species that represent unique foraging and reproductive strategies, and over multiple seasons.
- Future studies should attempt to control management actions in a structured experiment

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# Thank you!

Committee: Dr. Hance Ellington, Dr. Marcus Lashley, Dr. Karl Miller, and Dr. Jose-Miguel Ponciano

Lab Members: Brier Ryver, Alex Furst, Bethany White, Samantha Nunn, Edder Antunez, Peyton Niebanck, Nicole Rita, Jake Gerardi, and Taylor Golden

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- Florida Wildlife Federation
- Florida Vegetation Management Association
- Archbold Biological Station
- Live Wildly Foundation

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