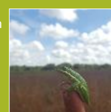



Impacts of wild pigs on wetlands and aquatic communities across a Florida rangeland

Wesley M. Anderson
Department of Wildlife Ecology and Conservation
Range Cattle Research and Education Center
University of Florida

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Introduction – Wildlife & Agriculture

- Where does wildlife conservation and management occur?
- 38.4% of world's land under agriculture
- 26.3% is rangeland
- In Florida, rangeland is 12 million ac or 1/3 of land area
- Florida's population may double by 2060
  - 3 million ac ag, 2.7 million ac natural habitat converted
- Wildlife conservation and management in agricultural lands is **critical**

Introduction – Why Amphibians?

- Frogs
  - Important prey
  - Consume ***lots*** of insects
  - Energy flow from aquatic to upland habitats
- Salamanders
  - Sirens and amphiumas
- Global amphibian declines
  - "Canaries in the coal mine"

Introduction - Wild Pig (*Sus scrofa*)

Introduction – Objectives

1. Wild pig diet
2. Drones and rooting
3. Impacts on salamanders
4. Impacts on tadpoles

Introduction - Study Site

Buck Island Ranch
- 10,500 ac ranch in Highlands Co., FL
- Full-scale commercial operation
- Over 600 wetlands
- Hundreds of miles of ditches
- Selected thirty-six 1-3 ac. seasonal wetlands
- Data collection from June 2016 - present

1 – Wild pig diet

Past studies have used DNA metabarcoding to examine seasonal shifts in diet (Bergmann et al. 2015)

Studies have also examined wild pig diet using this technique (Robeson et al. 2017)

However, none have examined seasonal shifts in diet of wild pigs

Objectives:

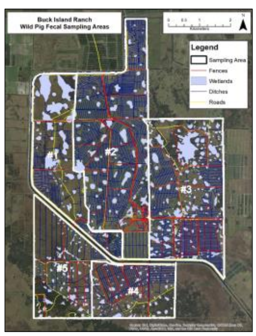
1. Inventory diet items
2. Compare diet shifts across an entire year
3. Evaluate impacts on wetland species with an emphasis on amphibians

1 – Wild pig diet

March 2016 – February 2017

Ranch divided into 5 sampling areas

≥ 5 fecal samples every 2 months

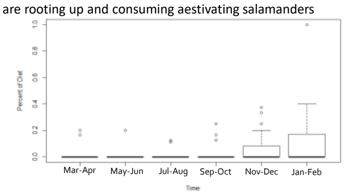


TOTAL.COUNT	Consensus Lineage
1698747	d__Viridiplantae; k__Streptophyta; p__rosids; c__Fagales; o__Fagaceae; f__; g__Quercus; s__
416924	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Poaceae; f__Panicoideae; g__Paspalum; s__Paspalum_notatum
276918	d__Viridiplantae; k__Streptophyta; p__; c__Caryophyllales; o__Amaranthaceae; f__; g__Alternanthera; s__
249051	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Poaceae; f__Oryzoideae; g__; s__
127806	d__Viridiplantae; k__Streptophyta; p__Pinidae; c__Pinales; o__Pinaceae; f__; g__Pinus; s__
115224	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Poaceae; f__Panicoideae; g__; s__
114524	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Commelinales; o__Commelinaceae; f__; g__Commelina; s__Commelina_erecta
98936	d__Viridiplantae; k__Streptophyta; p__; c__Caryophyllales; o__Amaranthaceae; f__; g__Alternanthera; s__
85961	d__Viridiplantae; k__Streptophyta; p__rosids; c__Fabales; o__Fabaceae; f__Papilionoideae; g__Trifolium; s__
80368	d__Viridiplantae; k__Streptophyta; p__asterids; c__Gentianales; o__Rubiaceae; f__Rubioideae; g__Spermacoce; s__Spermacoce_filituba
78939	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Arecales; o__Arecaceae; f__Arecoideae; g__; s__
66043	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Poaceae; f__Panicoideae; g__; s__
61979	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Poaceae; f__Panicoideae; g__; s__
58173	d__Viridiplantae; k__Streptophyta; p__rosids; c__Rosales; o__Rosaceae; f__Rosoideae; g__; s__
51611	d__Viridiplantae; k__Streptophyta; p__rosids; c__Fabales; o__Fabaceae; f__Papilionoideae; g__Desmodium; s__
49019	d__Viridiplantae; k__Streptophyta; p__asterids; c__; o__; f__; g__; s__
46852	d__Viridiplantae; k__Streptophyta; p__; c__Caryophyllales; o__Polygonaceae; f__Polygonoideae; g__Persicaria; s__Persicaria_amphibia
31460	d__Viridiplantae; k__Streptophyta; p__asterids; c__Apiales; o__Araliaceae; f__; g__Hydrocotyle; s__
29982	d__Viridiplantae; k__Streptophyta; p__; c__Caryophyllales; o__Amaranthaceae; f__; g__Alternanthera; s__
24455	d__Viridiplantae; k__Streptophyta; p__; c__Ceratophyllales; o__Ceratophyllaceae; f__; g__Ceratophyllum; s__Ceratophyllum_demersum
23671	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Poaceae; f__Panicoideae; g__; s__
21738	d__Viridiplantae; k__Streptophyta; p__rosids; c__Malvales; o__Malvaceae; f__Malvoideae; g__Gossypium; s__Gossypium_hirsutum
20325	d__Viridiplantae; k__Streptophyta; p__; c__; o__; f__; g__; s__
18934	d__Viridiplantae; k__Streptophyta; p__rosids; c__Fagales; o__; f__; g__; s__
18142	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Poaceae; f__; g__; s__
16715	d__Viridiplantae; k__Streptophyta; p__rosids; c__Myrtales; o__Onagraceae; f__; g__; s__
16430	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Poaceae; f__Panicoideae; g__Paspalum; s__
16253	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Commelinales; o__Pontederiaceae; f__; g__Pontederia; s__Pontederia_sp__A2-006
15956	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Cyperaceae; f__Cyperoideae; g__Fuirena; s__Fuirena_ciliaris
15872	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Cyperaceae; f__Cyperoideae; g__Rhynchospora; s__Rhynchospora_brownii
14857	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Poales; o__Poaceae; f__; g__; s__
14139	d__Viridiplantae; k__Streptophyta; p__rosids; c__Fabales; o__Fabaceae; f__Papilionoideae; g__; s__
13981	d__Viridiplantae; k__Streptophyta; p__commelinids; c__Commelinales; o__Pontederiaceae; f__; g__Pontederia; s__Pontederia_cordata
12865	d__Viridiplantae; k__Streptophyta; p__; c__; o__; f__; g__; s__
12649	d__Viridiplantae; k__Streptophyta; p__asterids; c__Asterales; o__Asteraceae; f__Asteroideae; g__; s__

1 – Wild pig diet

Wetland animal taxa across time
- Percent of diet differs with peak in January-February

3 amphibian taxa consumed
- Eastern narrow-mouthed toad
- Siren (4) and dwarf siren (2)
  - Only in January-February
- Pigs are rooting up and consuming aestivating salamanders



2 – Drones and rooting

1 - Develop rooting analysis protocol
- Obtain UAV-derived imagery for study wetlands
- Mosaic imagery to create a single georeferenced image
- Perform spatial analyses on mosaicked image to quantify extent of rooted areas

2 – Examine the impacts of swine removal on wetland damage across a dry season

2 – Drones and rooting

Drone – DJI Phantom 4

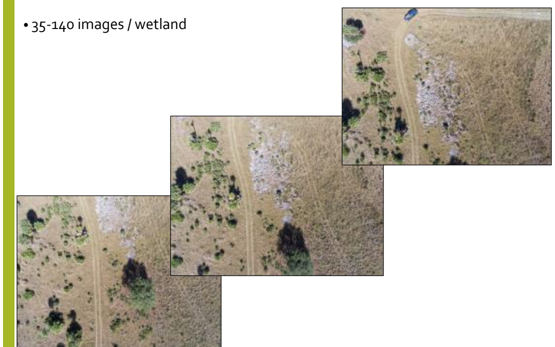
Map Pilot for DJI App

Open app in field

Input flight parameters

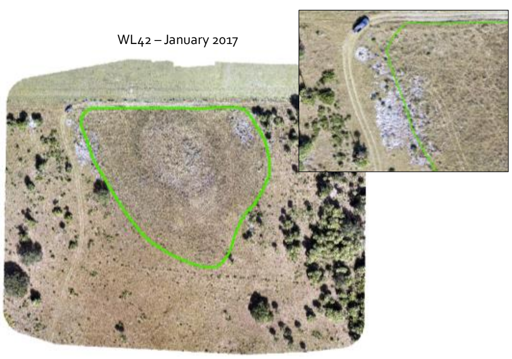
2 – Drones and rooting

- 35-140 images / wetland



2 – Drones and rooting

WL42 – January 2017

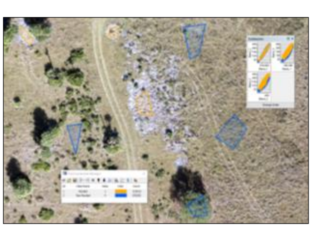


2 – Drones and rooting

Classify Raster

Train ArcGIS by classifying a subset of pixels

Perform a Maximum Likelihood Classification analysis

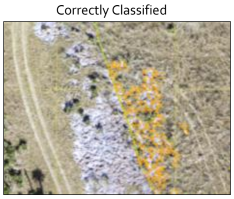


2 – Drones and rooting

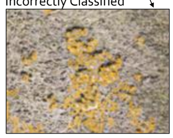
Delete incorrectly-classified polygons

Create fishnet to form grid

Delete incorrectly classified polygons



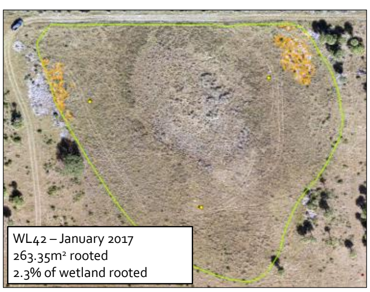
Correctly Classified



Incorrectly Classified

2 – Drones and rooting

Calculate Extent of Rooting Damage



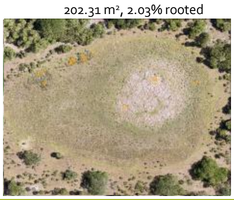
2 – Drones and rooting

- Fall 2016 – Removal effort for pigs south of canal
  - Removed ~ 100 pigs
- How quickly will pigs recolonize???
- Analyzed rooting across entire 2017 dry season
  - 11 (all) in the south, and 10 in the north

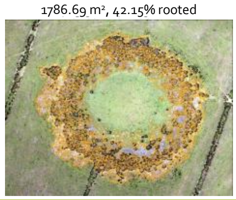
2 – Drones and rooting

- 2/11 wetlands in south had rooting
- 9/10 wetlands in north had rooting
- Extent of rooting varied between areas

WL599 – 2017
202.31 m^2, 2.03% rooted



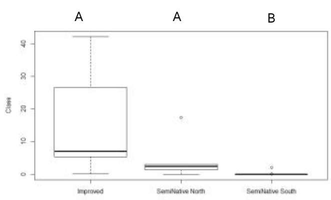
WL186 – 2017
1786.69 m^2, 42.15% rooted



2 – Drones and rooting

Improved: mean = 16.23, sd = 17.62, min = 0.09, max =42.15
Semi-Native North: mean = 4.83, sd = 7.10, min = 0.00, max = 17.36
Semi-Native South: mean = 0.19, sd = 0.61, min = 0.00, max = 2.03

- Conducted Kruskal-Wallis Test
  - chi-squared = 13.12, df = 2, p-value = 0.0014



3 – Impacts on salamanders

Does rooting in wetlands impact aquatic salamanders?

Trapped salamanders from 2016-2018
July-November (varied by conditions)

15 crayfish traps randomly placed in each study wetland, checked once a day for 5 days

Salamanders collected and returned to lab
Measured, marked, and released

3 – Impacts on salamanders

84 greater sirens

8 lesser sirens

and 16 two-toed amphiumas captured

Different distributions across ranch

3 – Impacts on salamanders

> 7,500 trap checks over 3 years

All taxa, not just salamanders, recorded

Large data set on fish, snakes, turtles, and invertebrates

4 – Impacts on tadpoles

Is pig rooting indirectly affecting tadpole growth, survival, and species richness?

Dip netted 36 wetlands for tadpoles from 2016-2018

For each dip, the number of tadpoles and developmental stage were recorded

For non-rooted wetlands: 25 dips

For rooted wetlands: 50 dips (half in rooted areas)

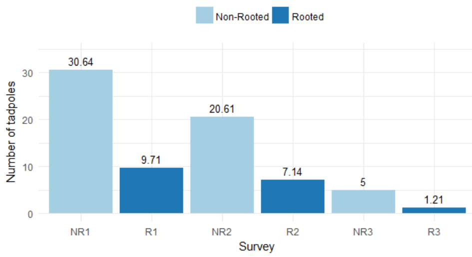
Dips in 4-16 inches of water

4 – Impacts on tadpoles

In 2018 1,968 tadpoles captured across 36 wetlands

14/36 wetlands had rooting

Significantly more tadpoles in non-rooted areas



4 – Impacts on tadpoles

Other patterns –

Squirrel Treefrogs (n = 983)

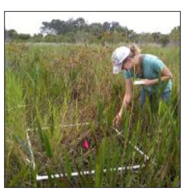
Pine Woods Treefrogs (n = 155)

Barking Treefrogs (n = 7)

Southern Cricket Frogs (n = 341)

Future analyses –

Incorporate water quality and vegetation data



Conclusions

Pig Diet

Eating amphibians, consuming salamanders in winter

Drones & Rooting

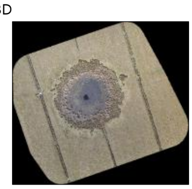
Developed efficient method to measure rooting

Impacts on Salamanders

Factors impacting occupancy and detectability TBD

Impacts on Tadpoles

Significant effect within wetland, landscape effect TBD




Acknowledgements:
USDA APHIS WS, Prairie Biotic Research, Inc., SWS SAC
MacArthur Agro-Ecology Research Center, Archbold Biological Station
Tyler Buckley, Christy Larkins, and Noah Davidson
Thank you!
For more information please contact me at wesleymanderson@ufl.edu
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