Multi-scale Assessment of Wildlife Sustainability in Switchgrass Biofuel Feedstock Production

Christopher M. Lituma

Department of Forestry, Wildlife and Fisheries

The University of Tennessee-Knoxville

Tuesday, June 29, 2015

Opportunities Threats?

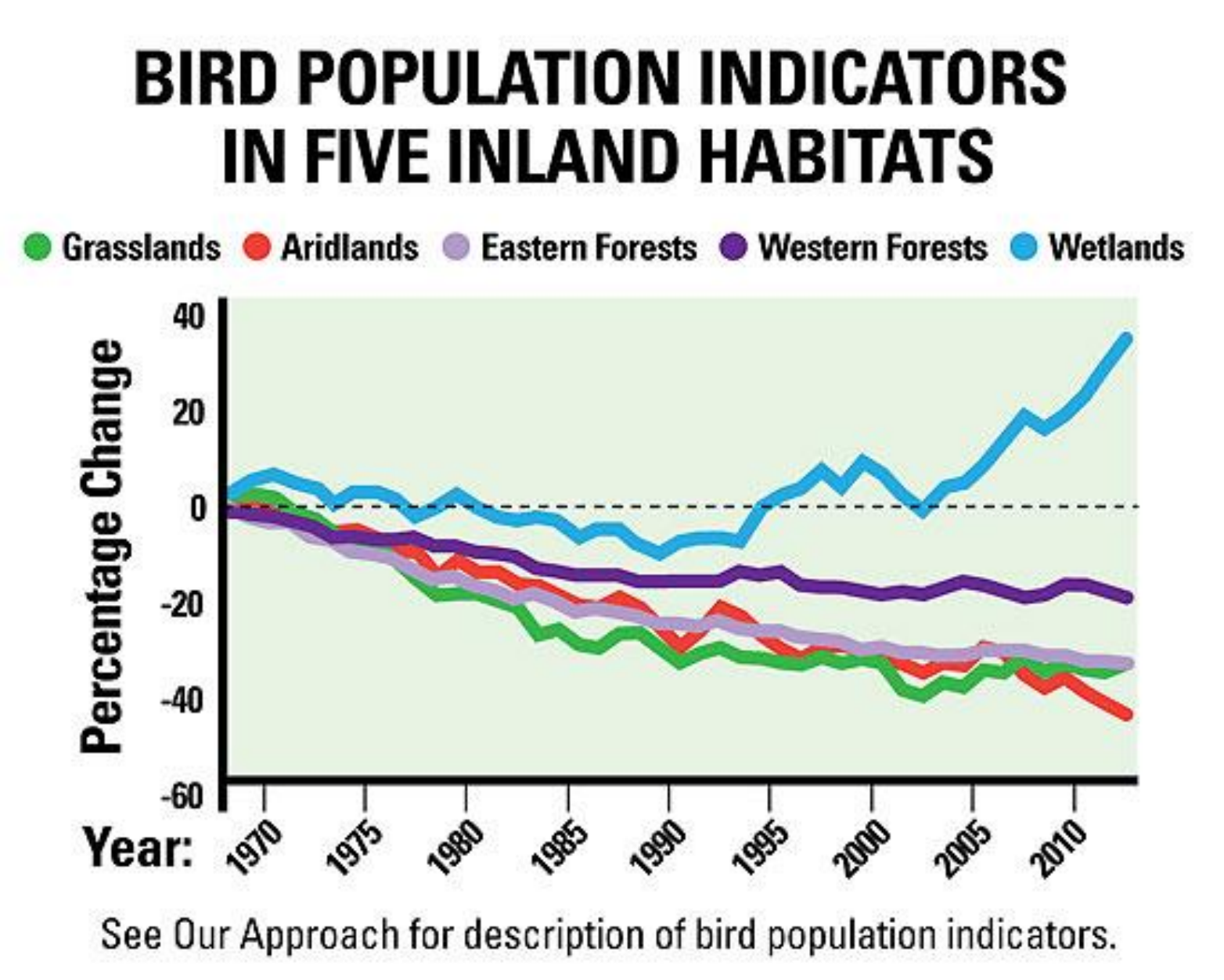
Background

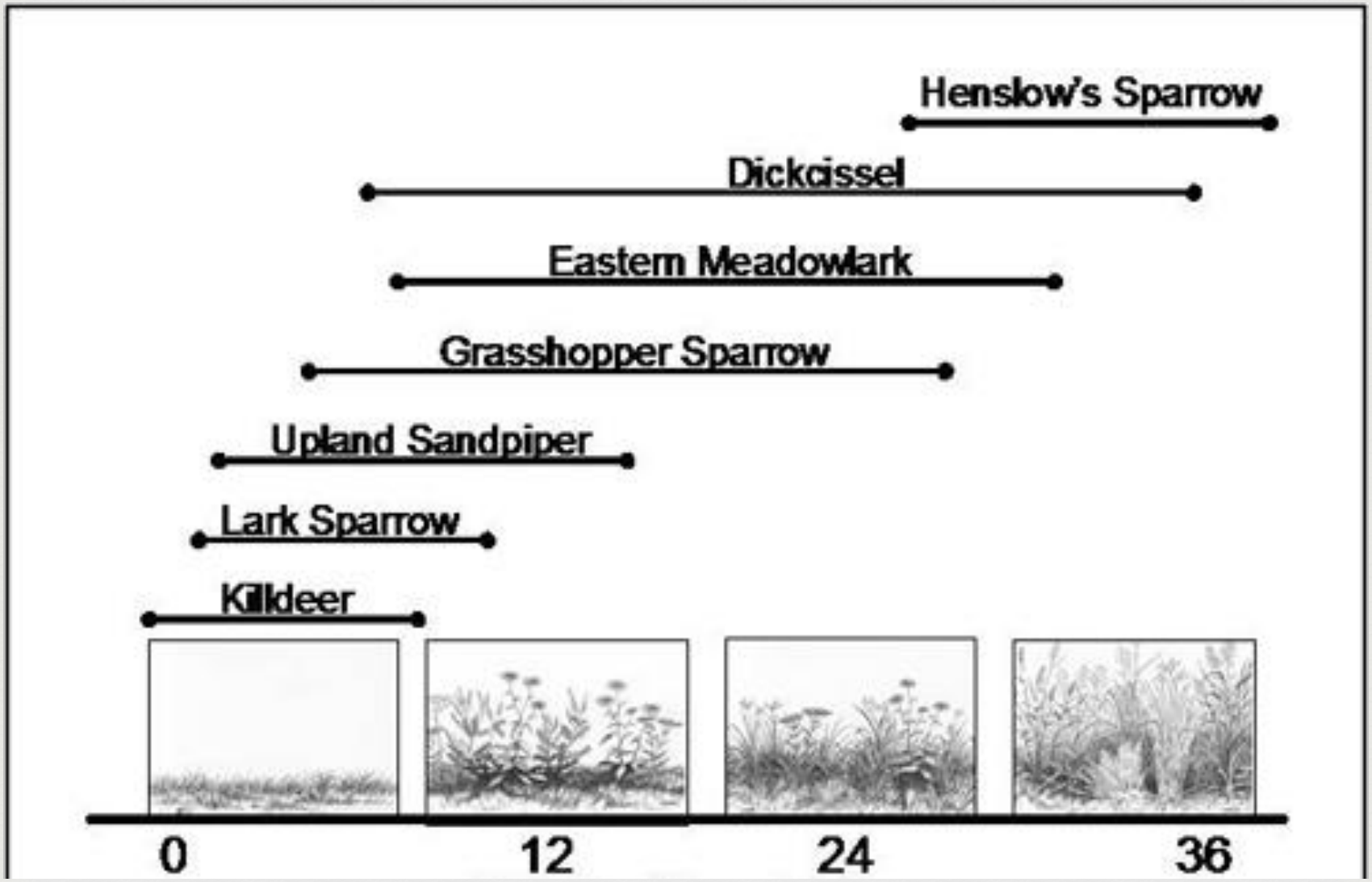
- Grassland and early-successional birds (Peterjohn and Sauer 1999; Brennan and Kuvlesky 2005)
- NBCI (Dimmick et al. 2002)
- CNGM

Center For Native GRASSLANDS Management

NBCI National Bobwhite Conservation Initiative

Grassland birds




Henslow's Sparrow
Dickcissel
Eastern Meadowlark
Grasshopper Sparrow
Upland Sandpiper
Lark Sparrow
Killdeer
0
12
24
36

File Edit View History Bookmarks Tools Help

Pollinator Health Strategy 2015.pdf | Pollinators Home Page - U.S. ...

www.fws.gov/pollinators/

Search

U.S. Fish & Wildlife Service

Pollinators

Search

- Pollinators Home Page
- Featured Pollinator
- Threats to Pollinators
- How We Help Pollinators
- What You Can Do to Help
- Pollinator Gardens & Trails
- More About Pollinators
- Outreach and Educational Materials
- Podcasts and Videos
- Watch Our Gardens Grow!

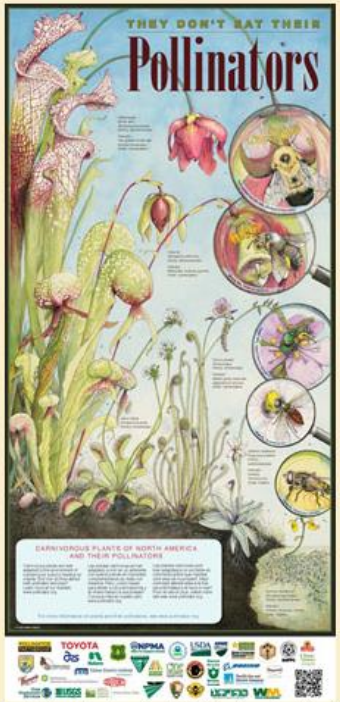
Southwest Region pollinator home page

USFWS Alaska pollinators home page

Kofa National Wildlife Refuge Pollinators Page

Panama City Ecological Services Office/Fish and Wildlife Conservation Office Pollinator Page

Celebrate National Pollinator Week, June 15 - 21, 2015!



"They Don't Eat Their Pollinators", 2015 Pollinator Poster, Credit: Teri Nye.

News and Activities:

Photo by Mark Musselman/National Audubon Society.

Learn more about monarchs:

The Interior Indian Craft Shop will be highlighting pollinators depicted in American Indian Art from June 15 through 26 in recognition of Pollinator Week.

Find Pollinator Events being hosted by USFWS (select "pollinator events")

Check out our Spotlight on *Saving the Monarch*.

WHITE HOUSE BLOGS

Biofuel Production

- Provide scientific information about biofuel fields
- >30 Million Acres

nativegrasses.utk.edu

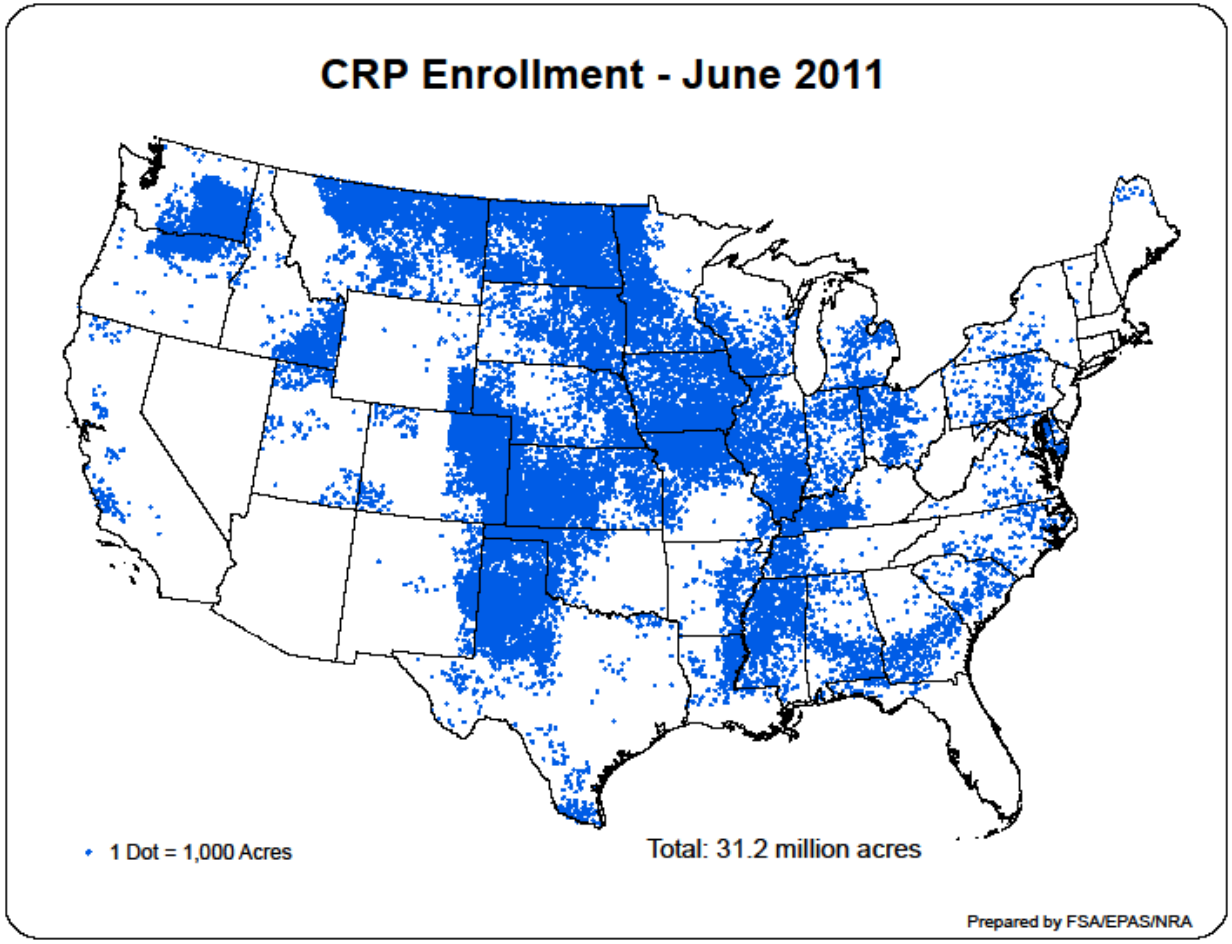
- Make information available to **land managers** and **producers**
  a) Training
  b) Publications
  c) Workshops
  d) Field Days

Center For Native GRASSLANDS Management

Center for Native Grasslands Management

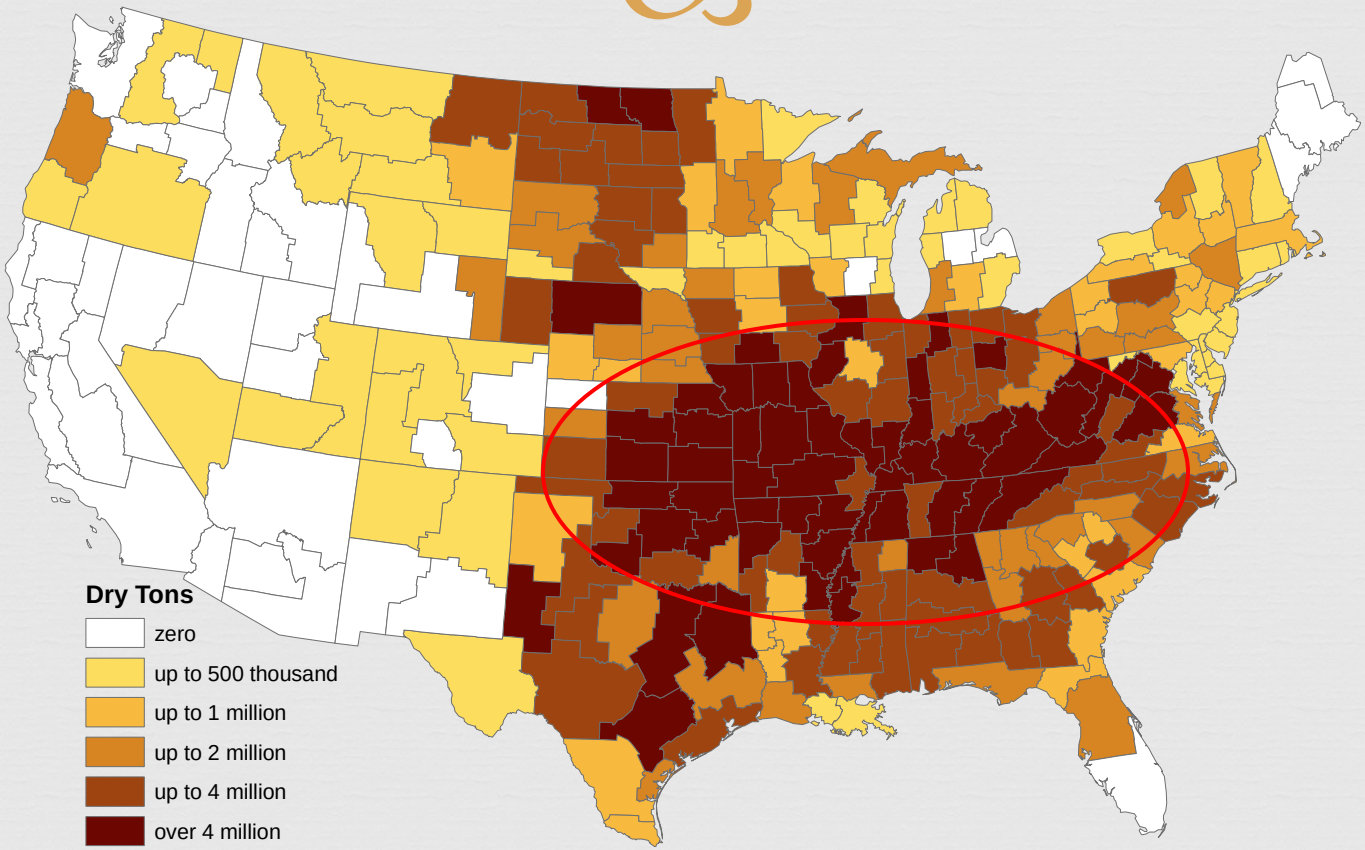
- What are the opportunities for wildlife?
- What is the role of switchgrass biofuel?
- How will biofuels affect grassland bird and pollinator species?

Status quo for Grassland Conservation



CRP– 31 MM Ac Footprint

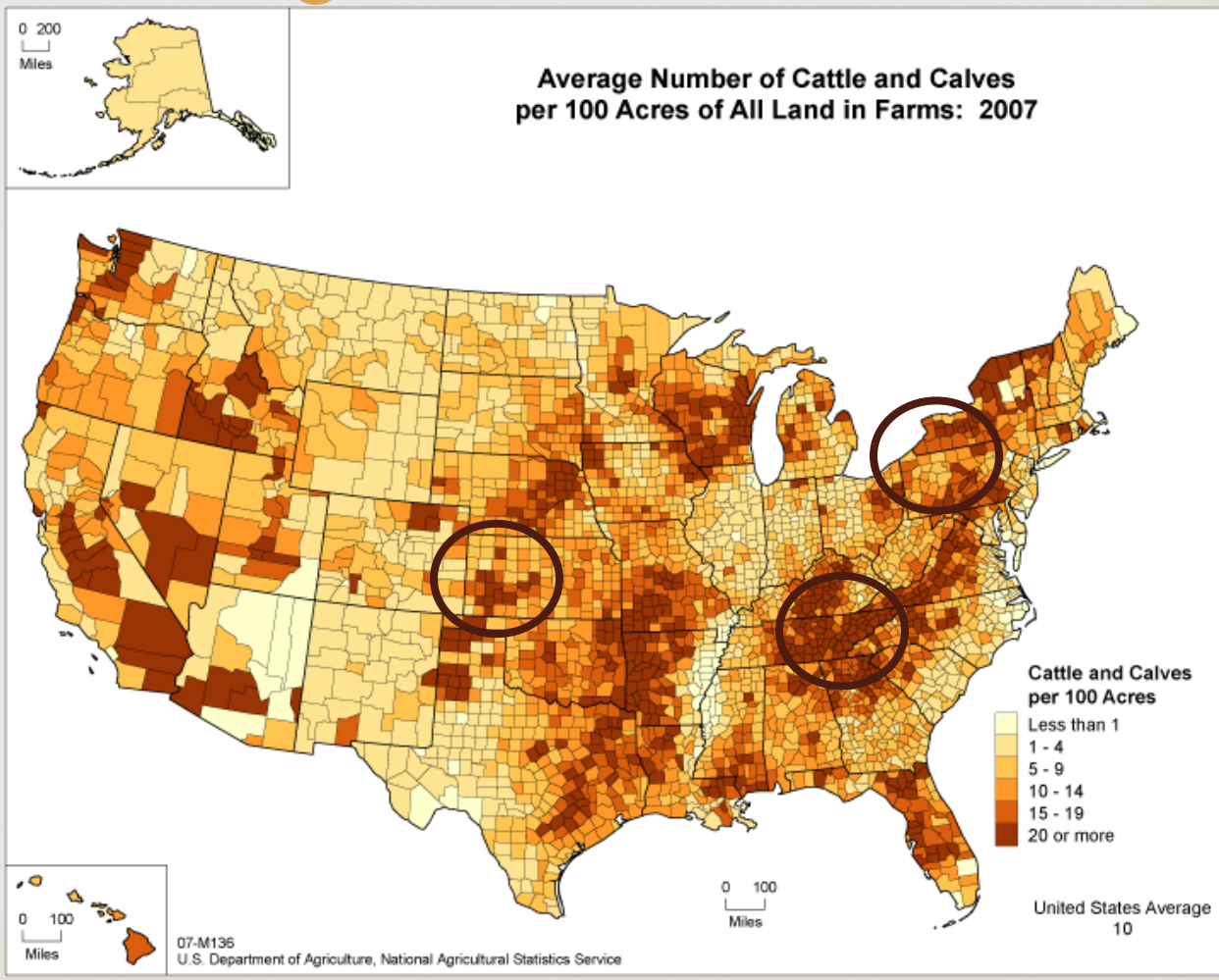
Conservation in a Production Setting



- 35 - 55 MM ac by 2025

Where to conserve grassland birds?

- Conserve grassland birds in grass-dominated landscapes
- Production landscape



Switchgrass production fields

11 May

5 June

18 April

late-June

Consider the Alternatives…

- Corn – Gulf hypoxia, replacing native prairie, poor net energy and carbon balances

- Exotics:
  - Miscanthus
  - Napiergrass
  - Others?

(Courtesy of the University of Illinois)

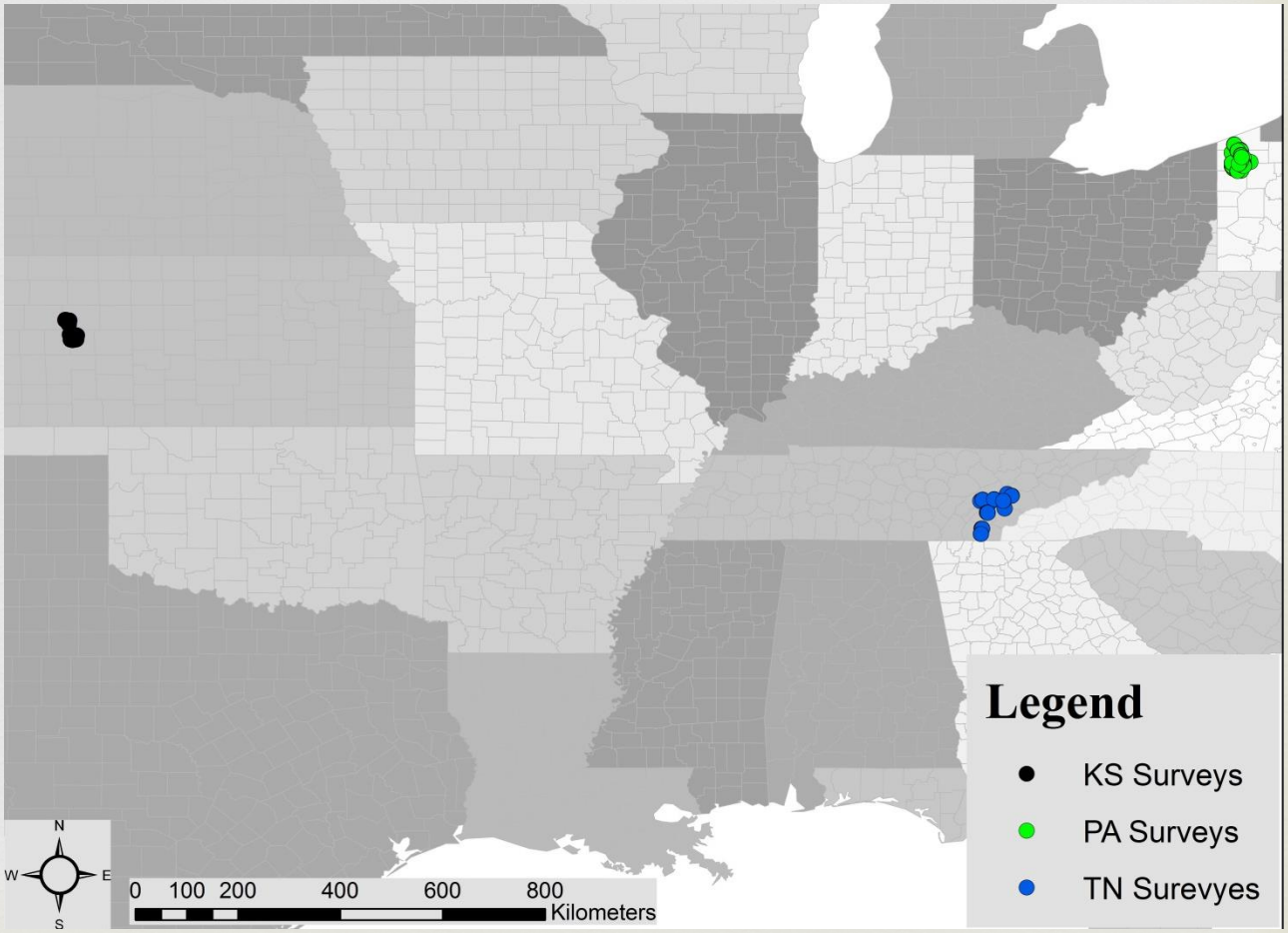
- What do we know about their impact on wildlife?
- What about other biota?
- What about spread?

Biofuels

- Switchgrass Monoculture Biofuel Fields
- Matrix Fields
  - KS-CRP
  - PA-Orchard Grass Pastures
  - TN-Tall Fescue Pastures
- Avian occupancy and abundance
- Avian nest success
- Pollinator richness and abundance

Study Areas

- KS-Sharp Seed, 15 Fields
- PA-Ernst Seed, 20 Fields
- TN-Private Landowners,20 Fields



Methods

- Fixed Radius Point Counts
- 3 Visits per year
- 3 min, removal
- Distance Bands
- Nest Searching

Methods (cntd)

- Vegetation Sampling
- Pollinator Sampling

Bird Analyses

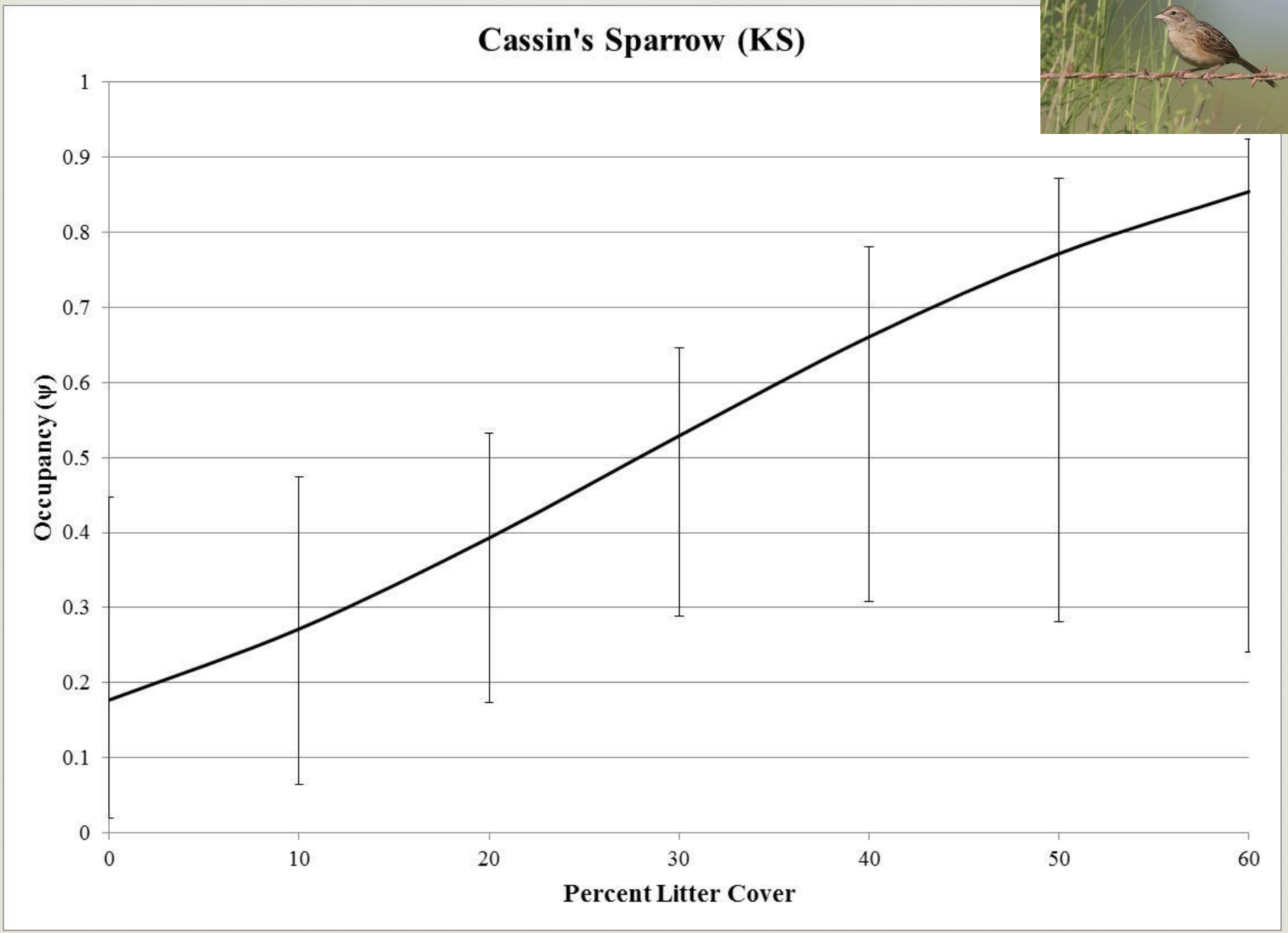
Maximum Liklihood (AIC)

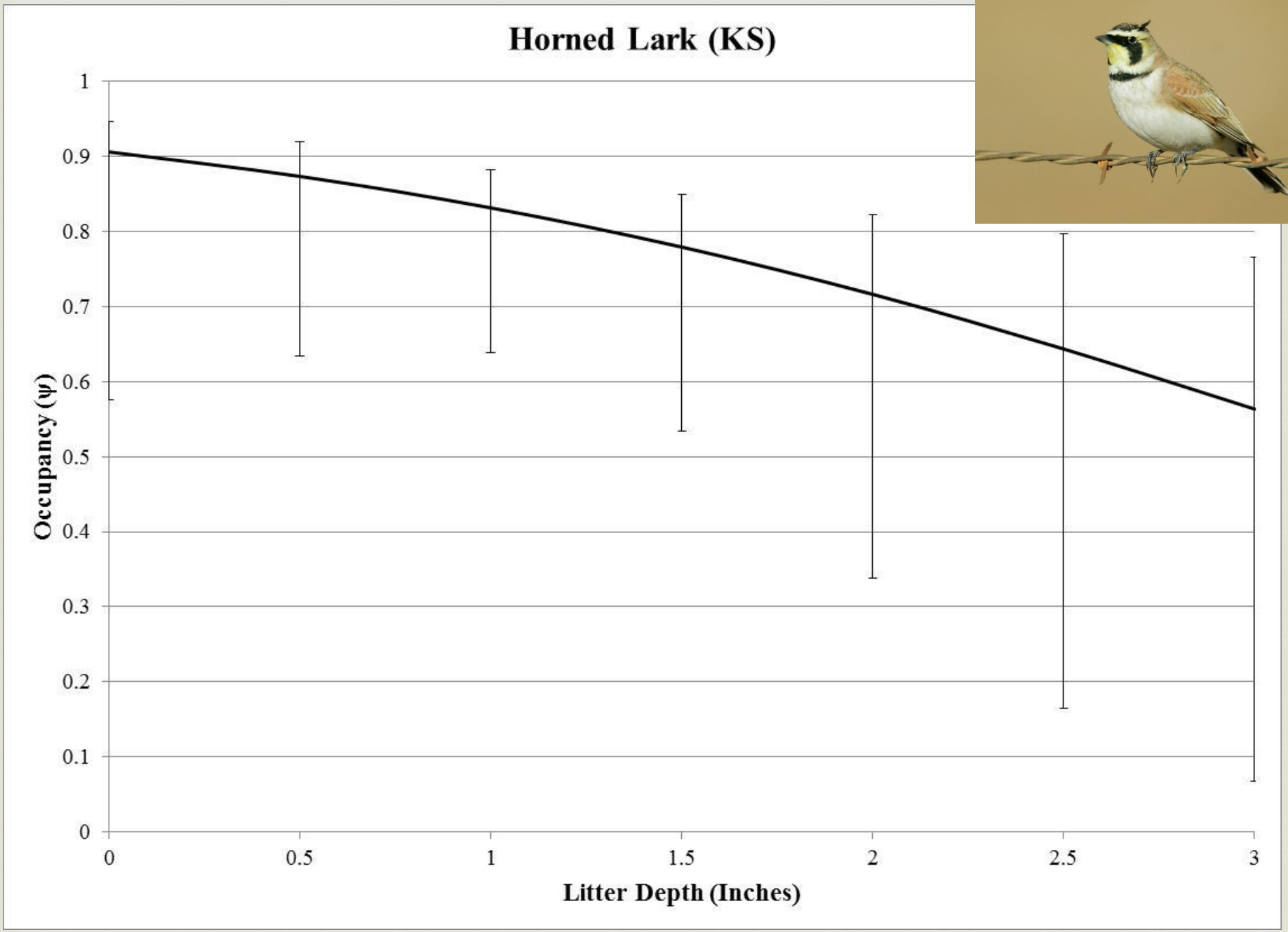
- Occupancy Models: Program MARK
- Abundance Models: Program R package unmarked
- Nest Survival Models: Program MARK
- Covariates
  - Temporal
  - Landscape
  - Field Level Vegetation

Covariates
Grass Cover
Forb Cover
Litter Cover
Bare Ground Cover
Vegetation Height
Litter Depth

Occupancy (ψ)

Species (KS)	Matrix	SE	Mono	SE
Cassin's Sparrow	0.32	0.16	0	0
Grasshopper Sparrow	1	0	0	0
Red-winged Blackbird	0.18	0.07	1	0
Dickcissel	0.60	0.11	1	0
Horned Lark	0.83	0.07	1	0
Western Meadowlark	1	0	1	0


Cassin's Sparrow (KS)
Occupancy (ψ)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
Percent Litter Cover

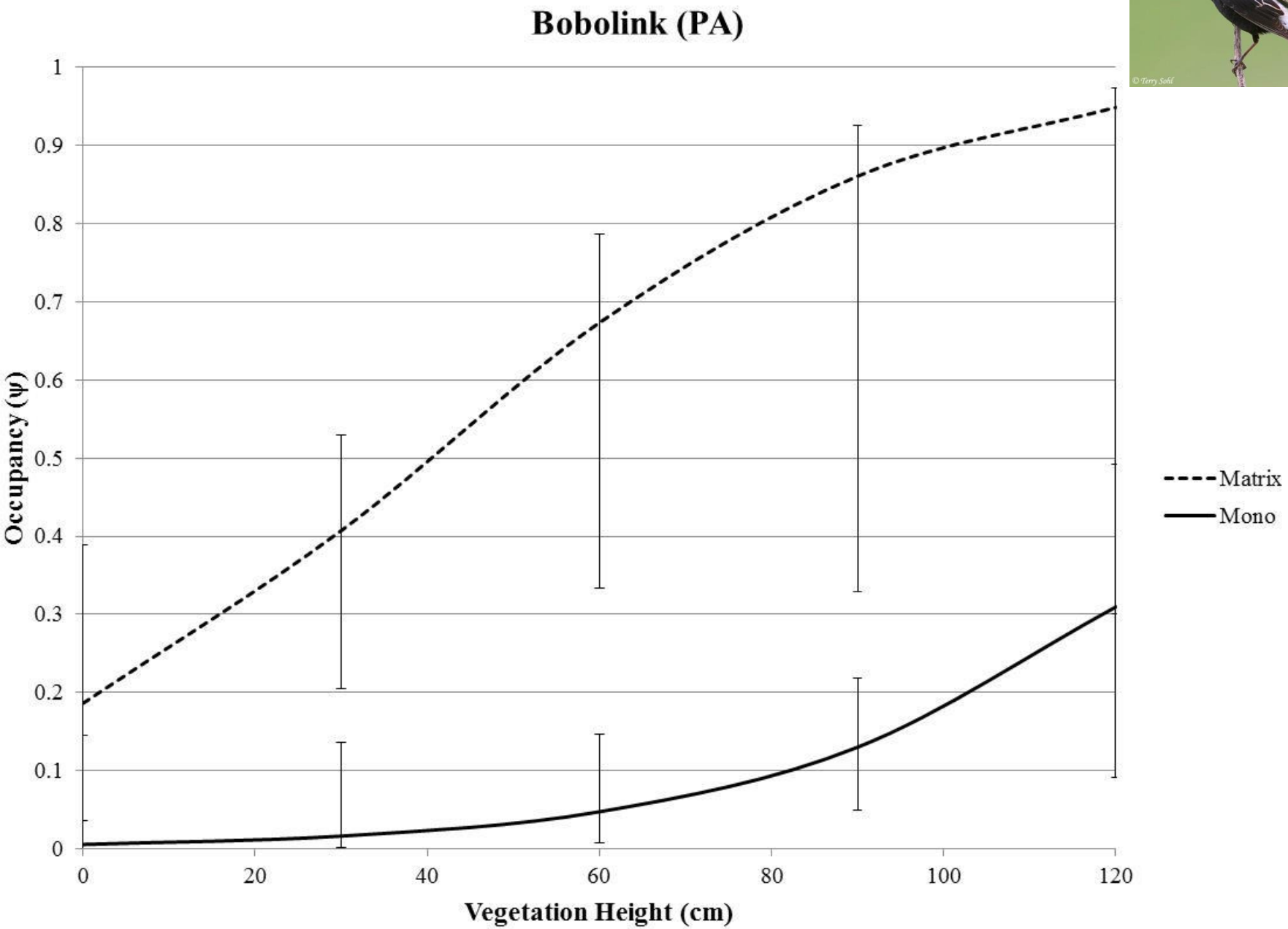

Horned Lark (KS)
Occupancy (ψ)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.5
1
1.5
2
2.5
3
Litter Depth (Inches)

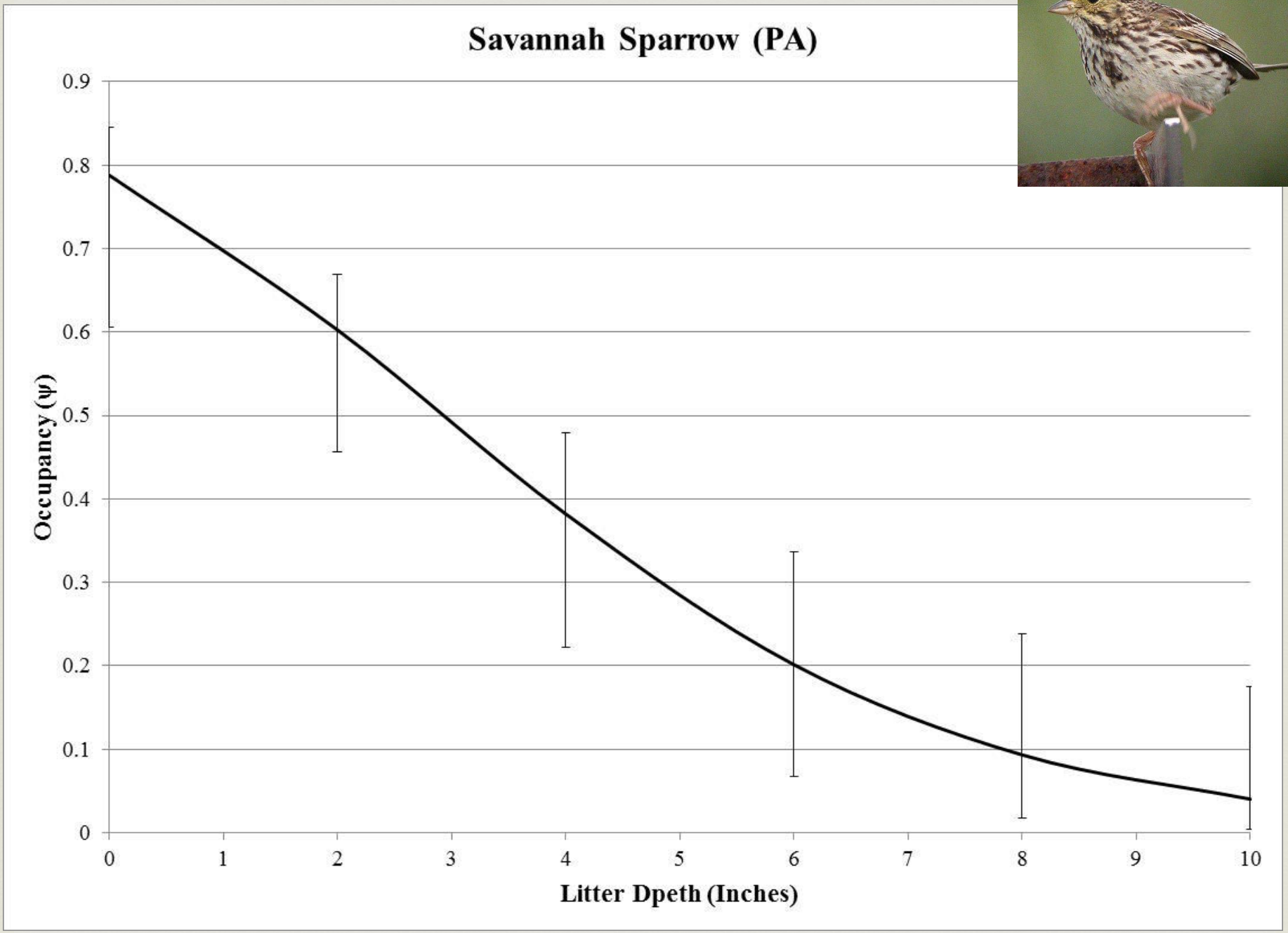
Occupancy (ψ)

Covariates
Grass Cover
Forb Cover
Litter Cover
Bare Ground Cover
Vegetation Height
Litter Depth

Species (PA)	Matrix	SE	Mono	SE
Eastern Meadowlark	0.96	0.07	0	0
Bobolink	0.75	0.17	0.07	0.05
Savannah Sparrow	0.57	0.07	0.57	0.07
Indigo Bunting	0.31	0.16	0.76	0.20
Common Yellowthroat	0.23	0.12	1	0
Red-winged Blackbird	1	0	1	0

© Terry Sohl

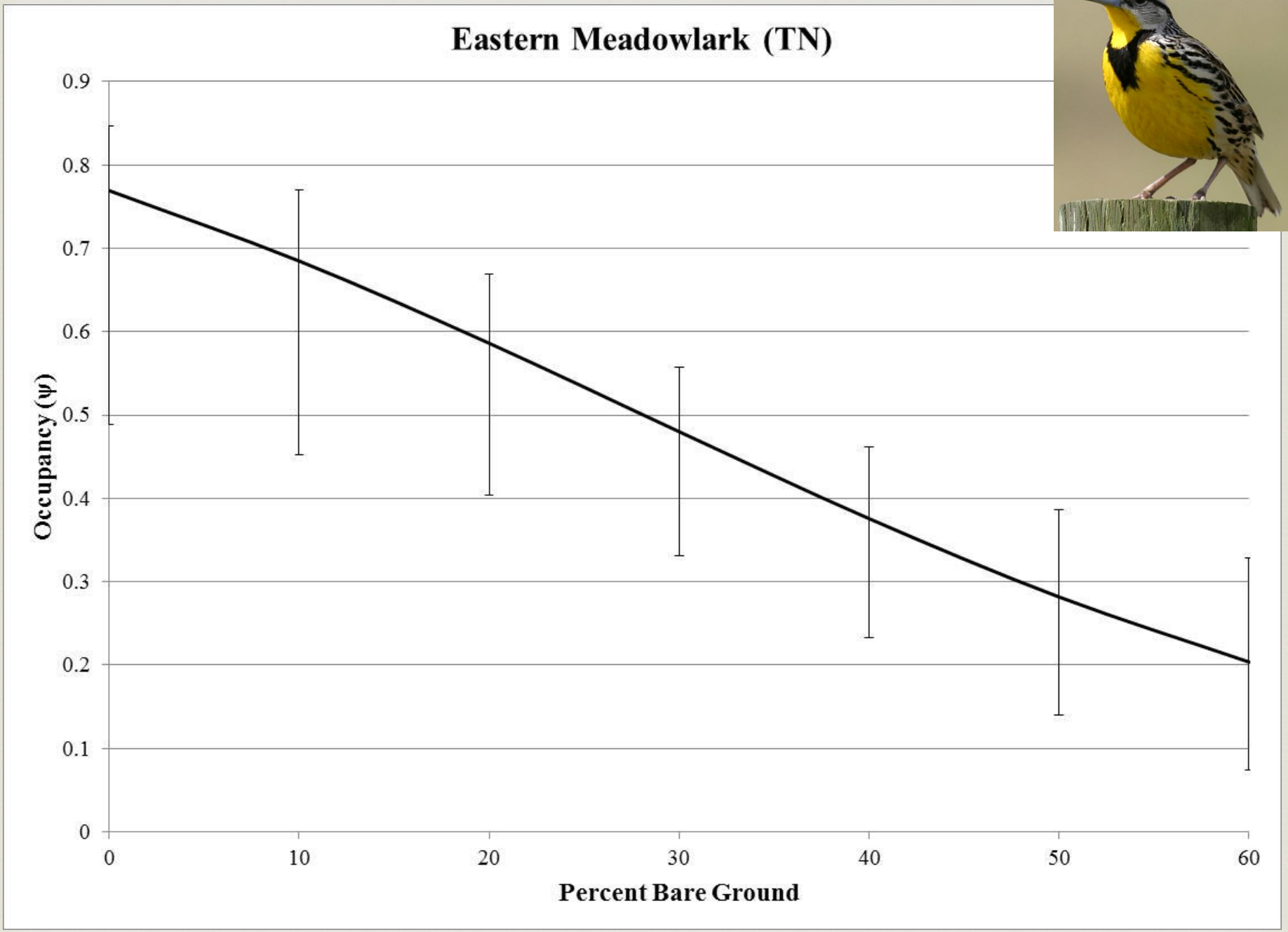

Bobolink (PA)
Occupancy (ψ)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
20
40
60
80
100
120
Vegetation Height (cm)
Matrix
Mono

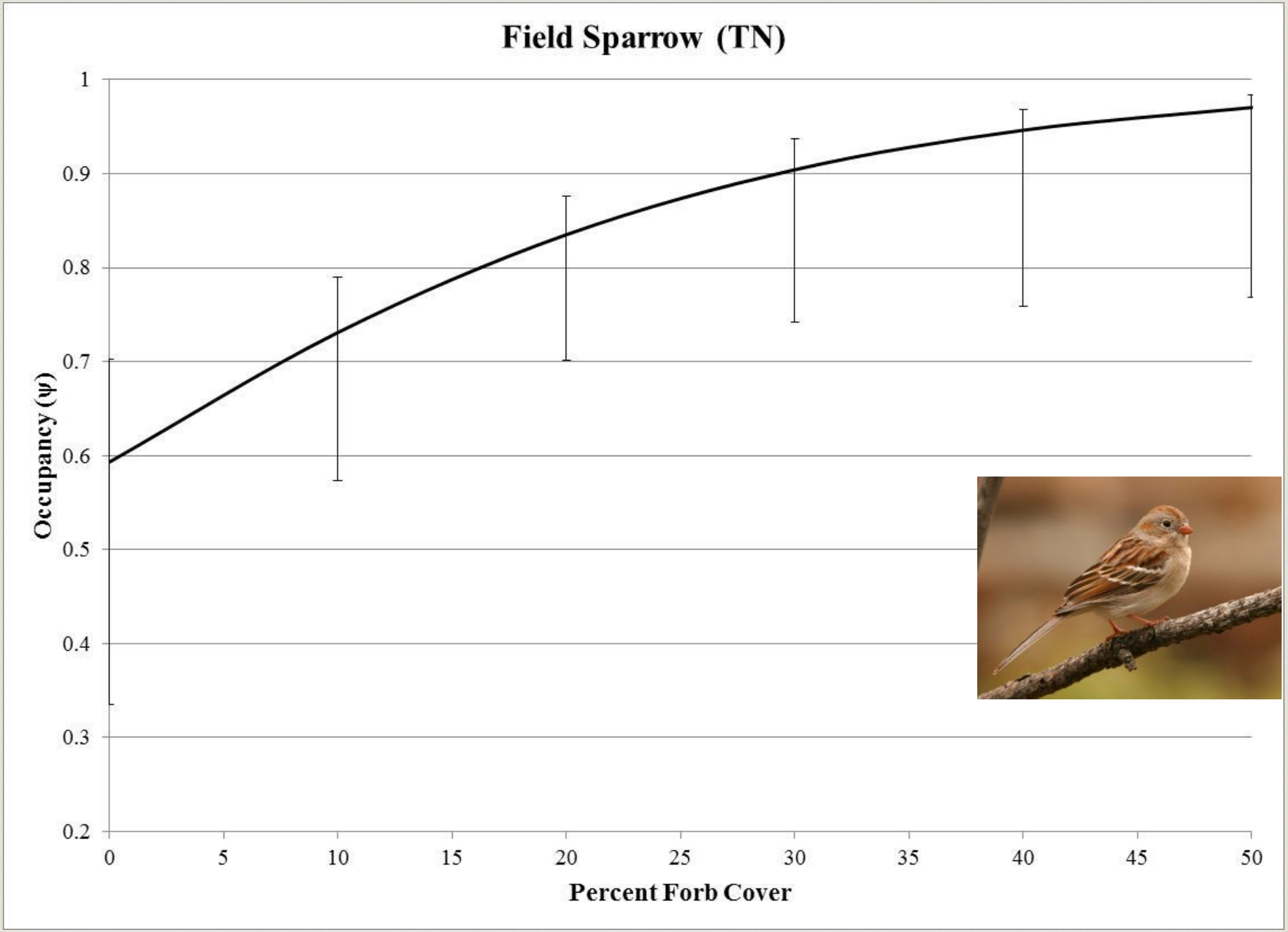

Savannah Sparrow (PA)
Occupancy (ψ)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6
7
8
9
10
Litter Dpeth (Inches)

Occupancy (ψ)

Covariates
Grass Cover
Forb Cover
Litter Cover
Bare Ground Cover
Vegetation Height
Litter Depth

Species (TN)	Matrix	SE	Mono	SE
Dickcissel	0	0	0.29	0.12
Grasshopper Sparrow	0.19	0.10	0.56	0.14
Eastern Meadowlark	0.47	0.08	0.47	0.08
Northern Bobwhite	0.61	0.20	0.61	0.20
Red-winged Blackbird	0.66	0.10	0.66	0.10
Field Sparrow	0.85	0.05	0.85	0.05
Indigo Bunting	0.96	0.04	0.96	0.04


Eastern Meadowlark (TN)
Occupancy (ψ)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
Percent Bare Ground

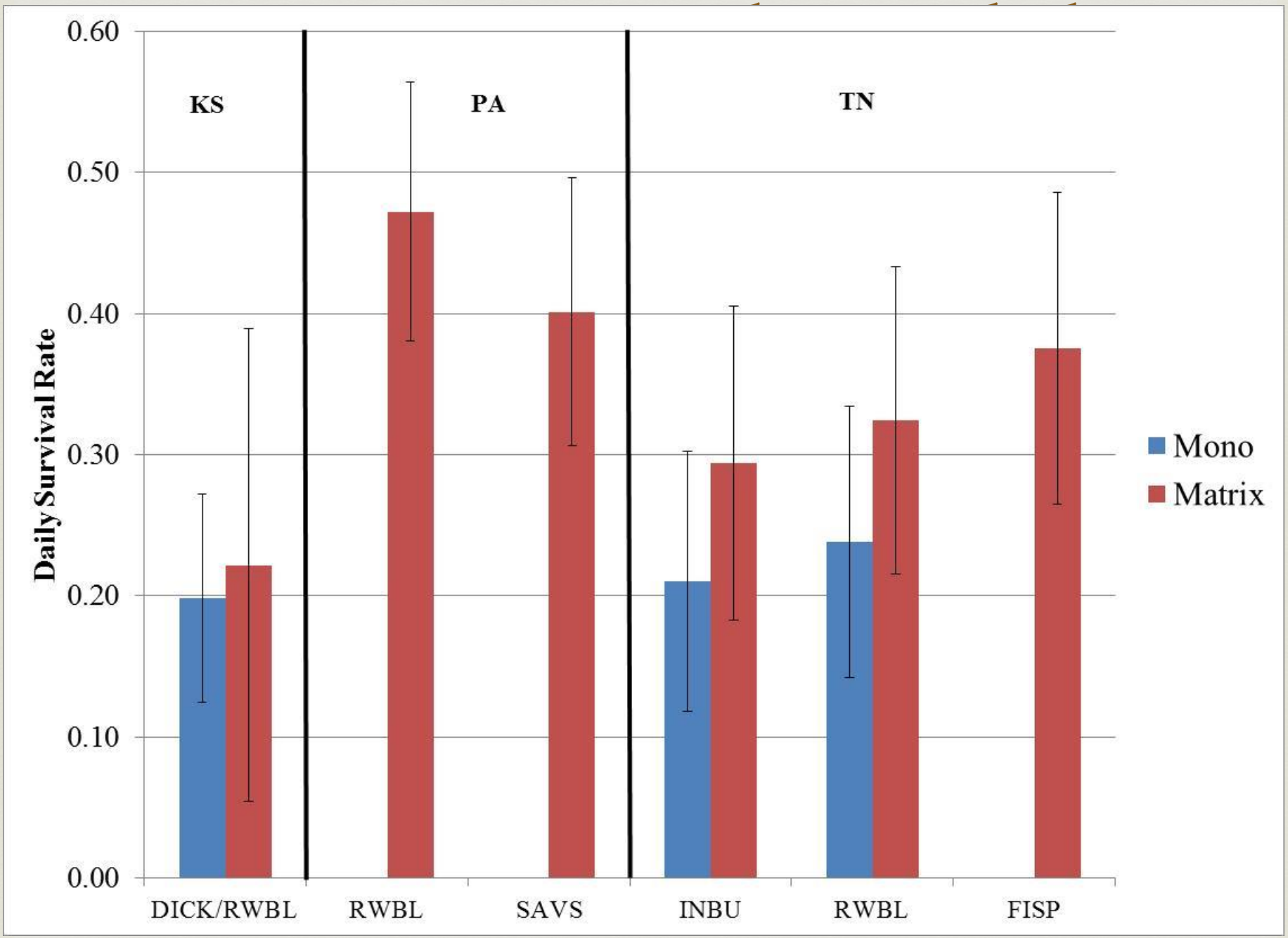

Field Sparrow (TN)
Occupancy (ψ)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
5
10
15
20
25
30
35
40
45
50
Percent Forb Cover

Nests

- 2014: 107 Nests from 12 species; Mono, n = 45; Matrix, n = 62
- 2015: YTD 120 Nests from 15 species; Mono, n = 68; Matrix, n = 52

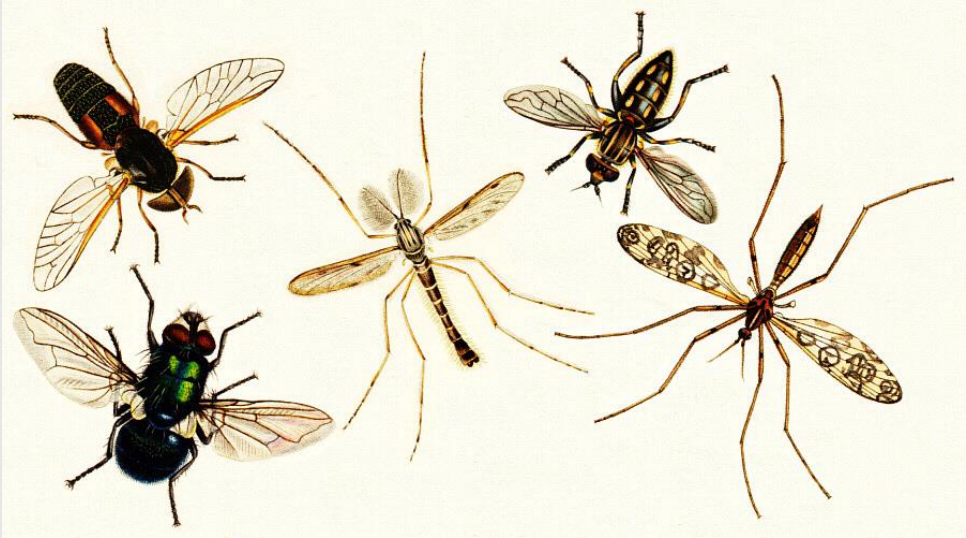
Species	KS	PA	TN	Total
Red-winged Blackbird	18	31	12	61
Indigo Bunting	0	0	12	12
Field Sparrow	0	0	10	10
Dickcissel	7	0	1	8
Savannah Sparrow	0	6	0	6
Horned Lark	2	0	0	2
Grasshopper Sparrow	1	0	1	2
Common Yellowthroat	0	0	2	2
Western Meadowlark	1	0	0	1
Eastern Meadowlark	0	1	0	1
Blue Grosbeak	0	0	1	1
Chipping Sparrow	0	0	1	1
Total	29	38	40	107

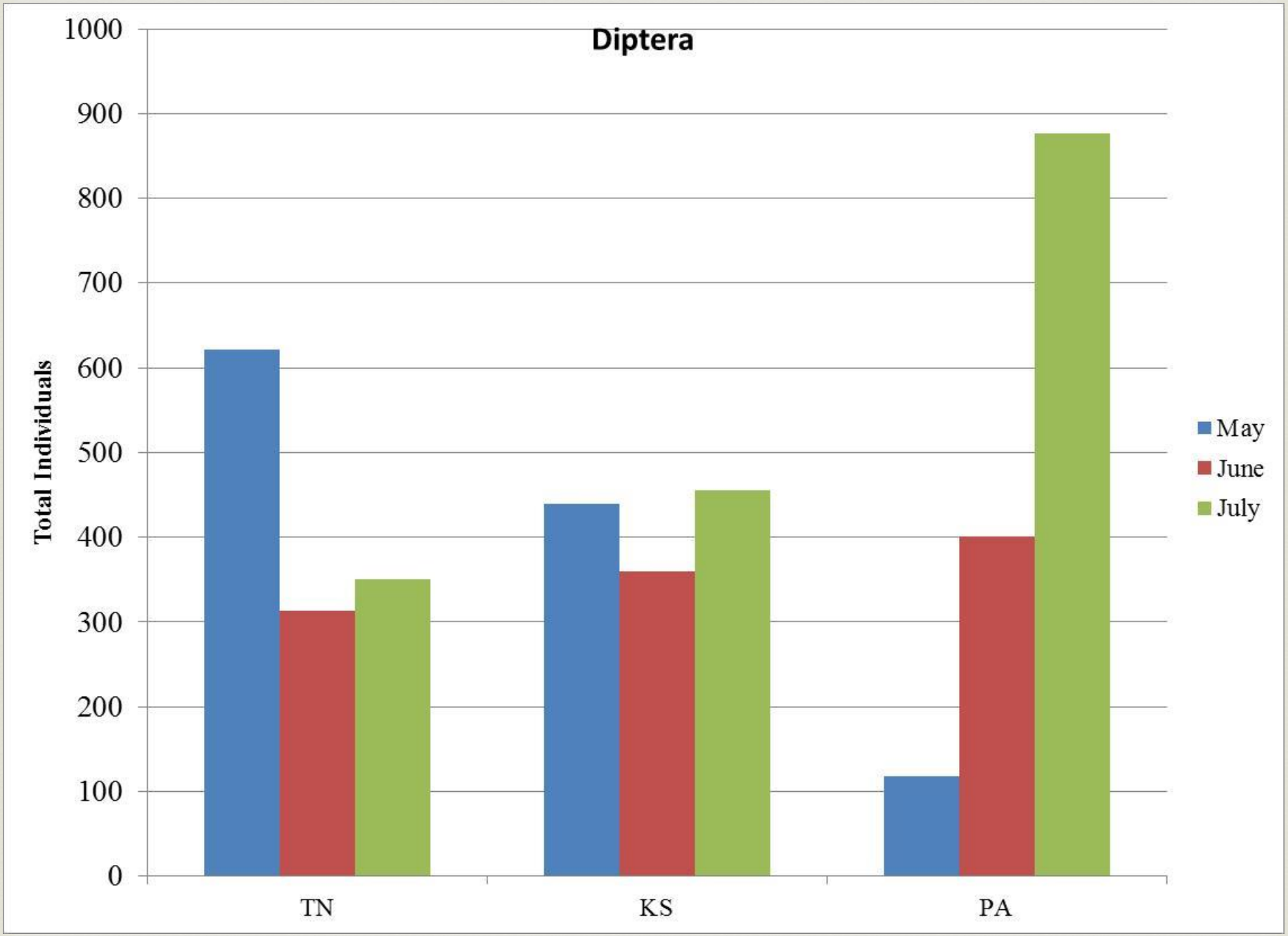
Species	KS	PA	TN	Total
Red-winged Blackbird	32	27	4	63
Mourning Dove	14	0	0	14
Western Meadowlark	7	0	0	7
Dickcissel	1	0	6	7
Field Sparrow	0	0	6	6
Grasshopper Sparrow	5	0	1	6
Horned Lark	5	0	0	5
Eastern Meadowlark	0	0	3	3
Song Sparrow	0	2	0	2
Savannah Sparrow	0	2	0	2
American Woodcock	0	1	0	1
Brown Thrasher	0	0	1	1
Killdeer	0	0	1	1
Wild Turkey	0	0	1	1
Ring-necked Pheasant	1	0	0	1
Total	65	32	23	120

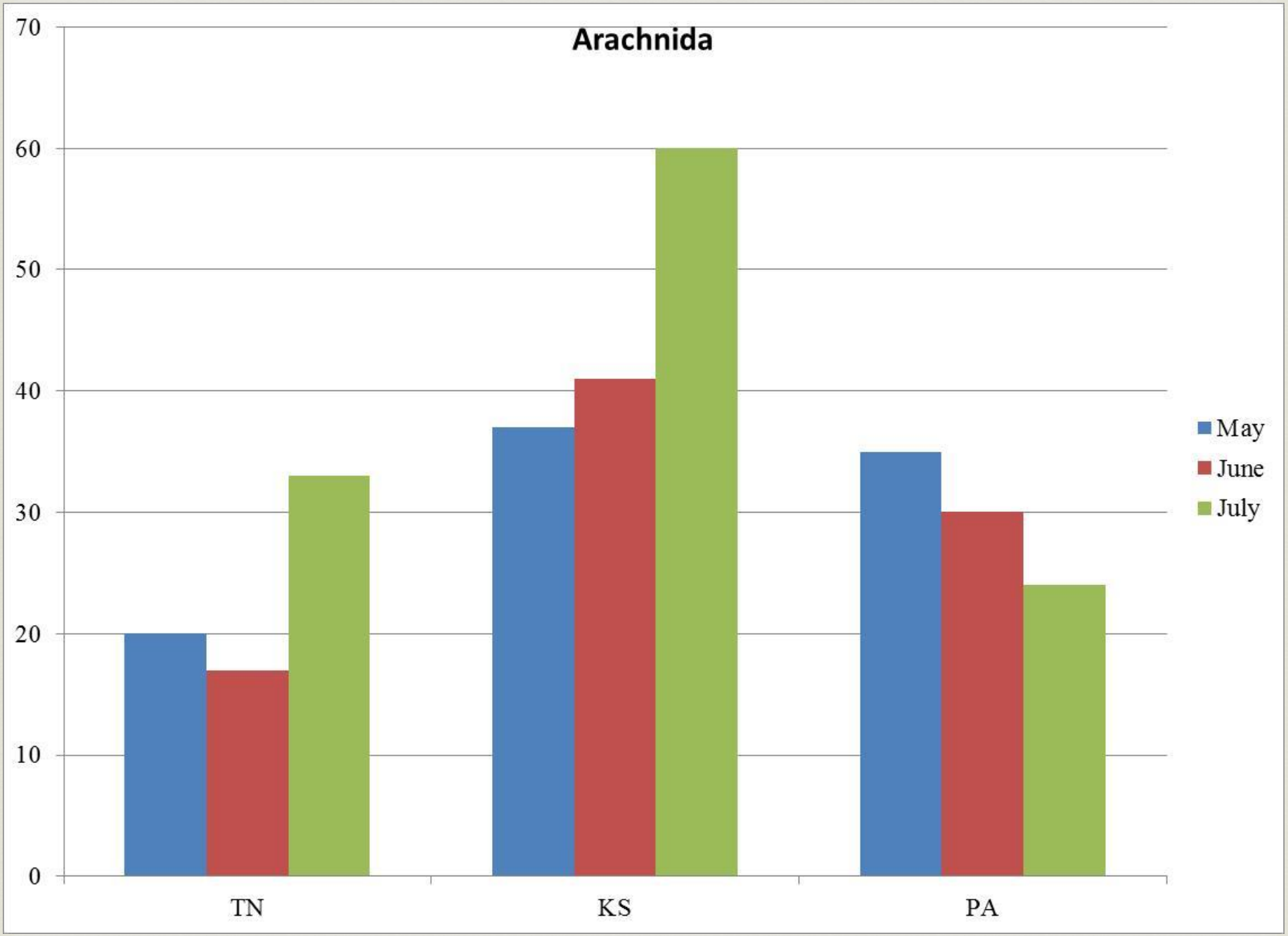

0.60
0.50
0.40
0.30
0.20
0.10
0.00
Daily Survival Rate
KS
PA
TN
DICK/RWBL
RWBL
SAVS
INBU
RWBL
FISP
Mono
Matrix

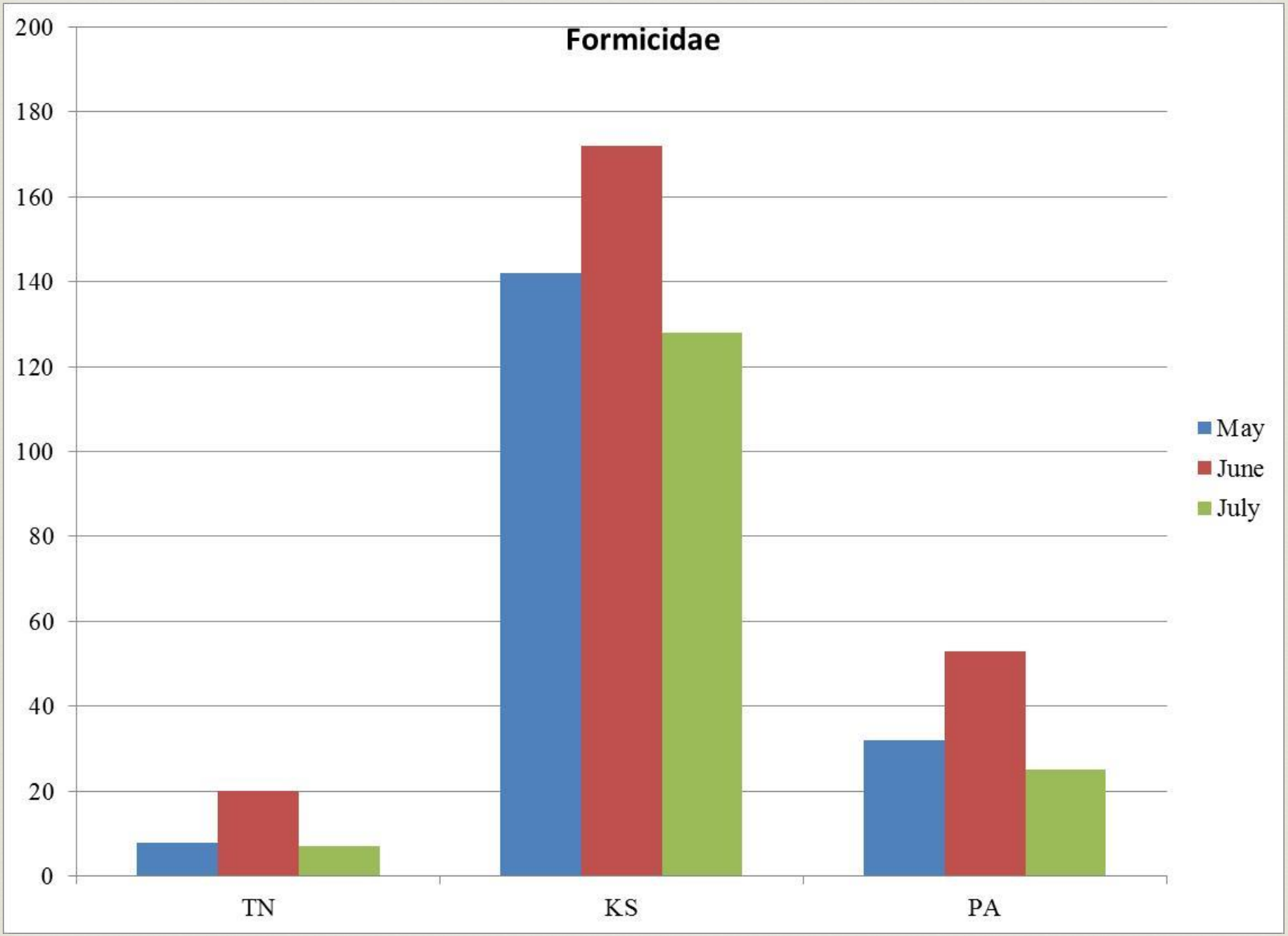
Pollinators?

- May, June, July
- Bees sent for ID
- Species Richness and Abundance among biofuel and reference fields




Diptera
Total Individuals
1000
900
800
700
600
500
400
300
200
100
0
TN
KS
PA
May
June
July


Arachnida
70
60
50
40
30
20
10
0
TN
KS
PA
May
June
July


Formicidae
200
180
160
140
120
100
80
60
40
20
0
TN
KS
PA
May
June
July

Discussion

- One Year (2014)
- Occupancy differs greatest between KS field types, and least between TN field types
- Species and Site Specific differences between field types
- Currently collecting 2015 data
- Daily Survival Rate greater on matrix fields
- Did not check for differences among species

Project Support
Thanks to the following!

- Patrick D. Keyser, Charles Kwit, Joseph D. Clark, Craig Harper, and Elizabeth D. Holcomb
- Funding Agency-USDA National Institute of Food and Agriculture
  - Agriculture and Food Research Initiative (AFRI)
- Sharp Bros. Seed Company
- Ernst Conservation Seeds
- Private Landowners in TN
- Ken Goddard
- Dairy Research and Education Center-Hugh Moorehead
- University of Tennessee

Genera energy

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

FORESTRY WILDLIFE FISHERIES

Questions?