

A landscape photograph showing a wide, flat field under a dramatic, cloudy sky. A vibrant rainbow arches across the sky, its colors clearly visible. In the foreground, there's a line of green trees and a small, white, rectangular building. The overall scene is serene and evocative, suggesting a rural or agricultural setting.

Essential conversations:  
Using collaborations with farmers to  
build strong conservation research

**Anna Mangan**  
**Center for Collaborative Conservation**  
**Cohort 6 Fellow**

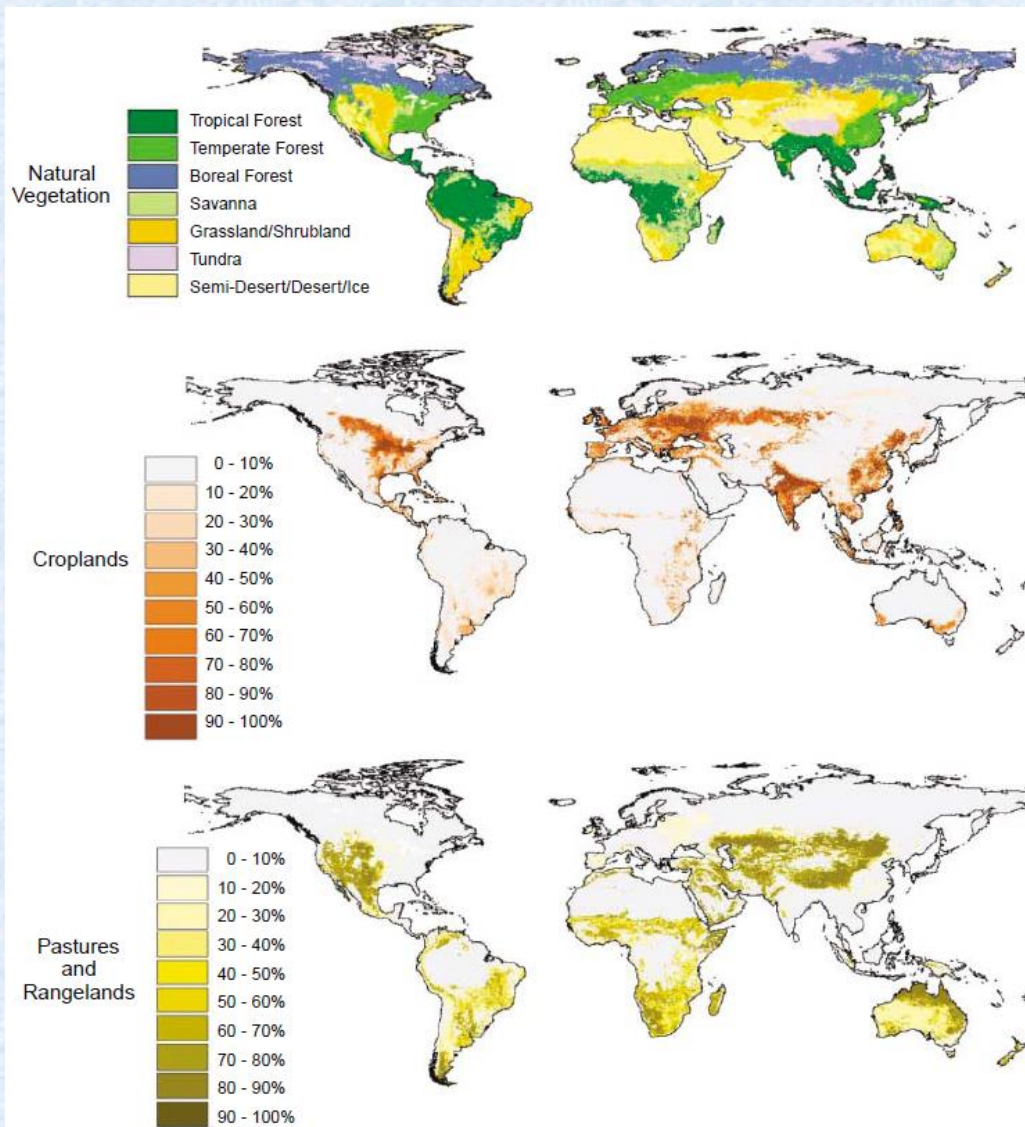
Conservation

Research

Collaborations

Challenges &  
Opportunities

# Introduction



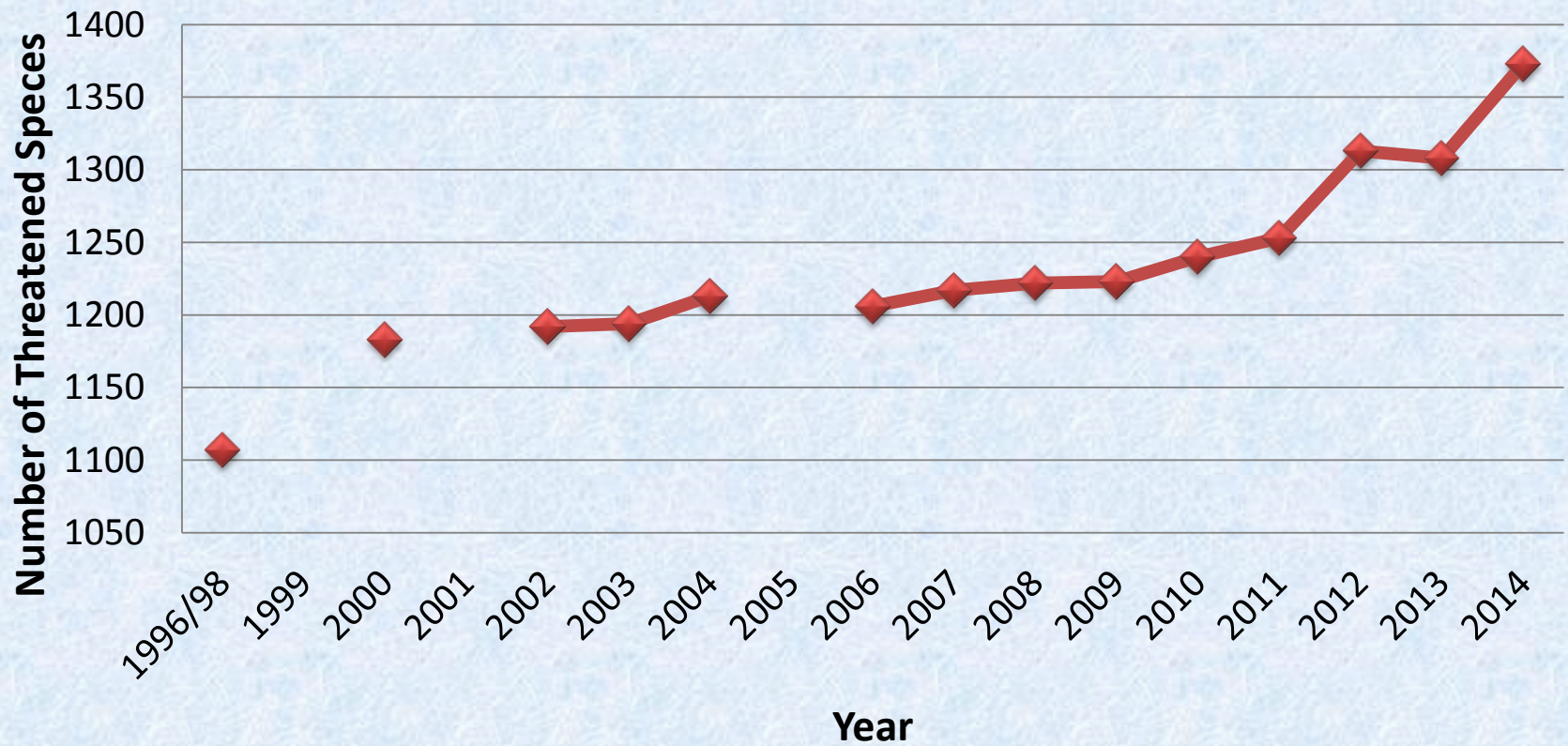
← Potential  
vegetation

← Actual extent





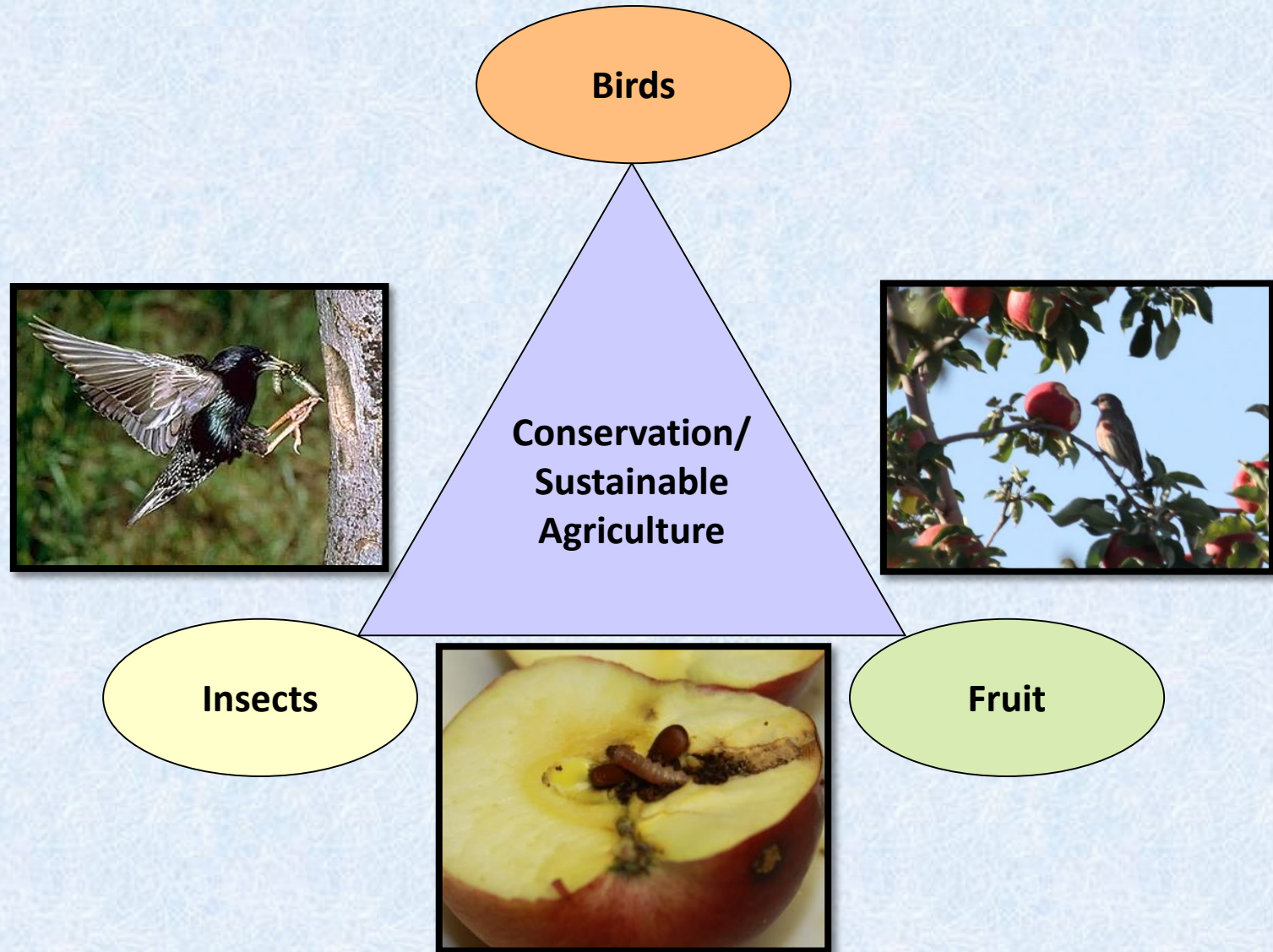
## IUCN Red List of Threatened Bird Species



Data from IUCN 2014

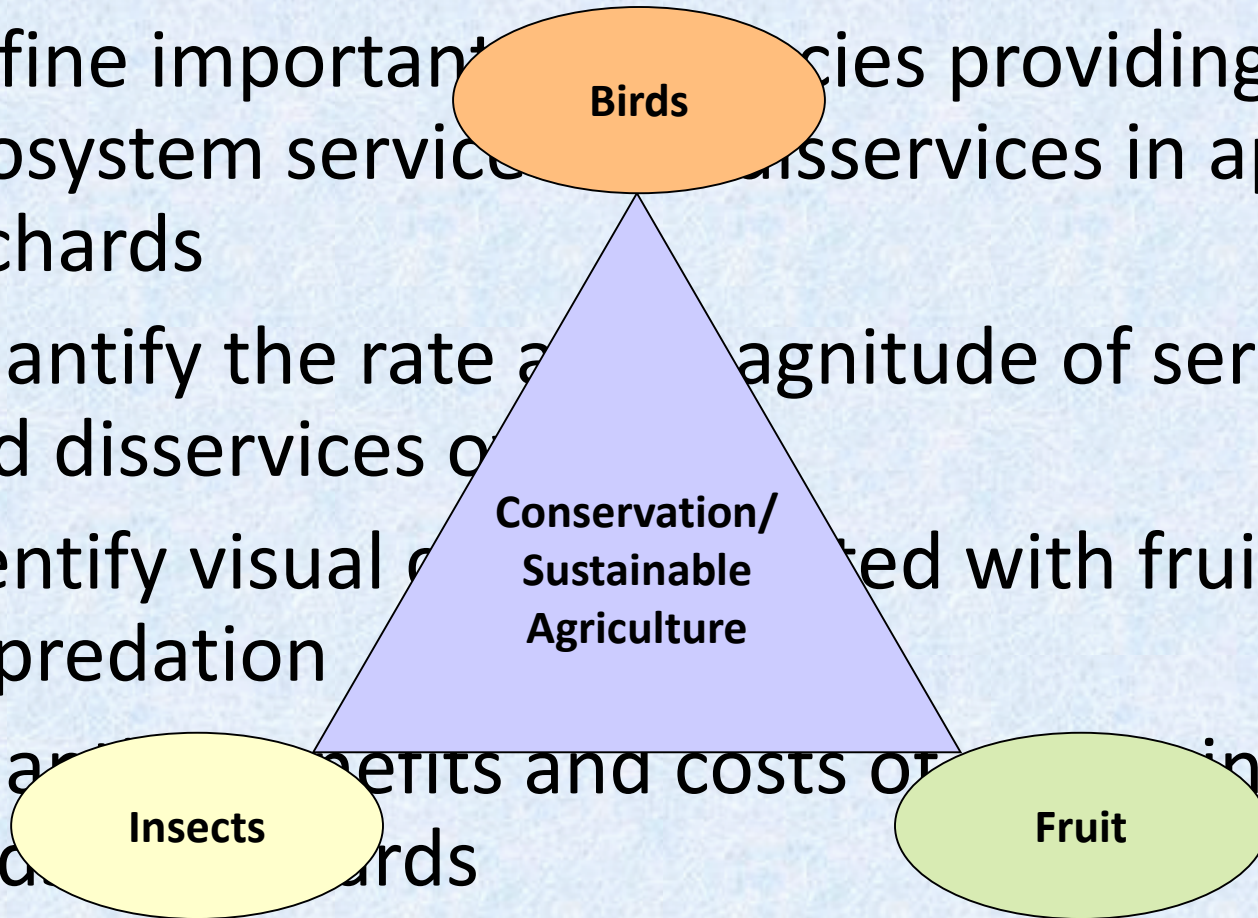


# Project Overview



# Objectives

1. Define important species providing ecosystem services and disservices in apple orchards
2. Quantify the rate and magnitude of services and disservices of
3. Identify visual damage associated with fruit depredation
4. Quantify benefits and costs of



# Objectives

1. Define important bird species providing ecosystem services and disservices in apple orchards
2. Quantify the rate and magnitude of services and disservices over time
3. Identify visual cues associated with fruit depredation
4. Quantify benefits and costs of maintaining birds in orchards<sup>1</sup>



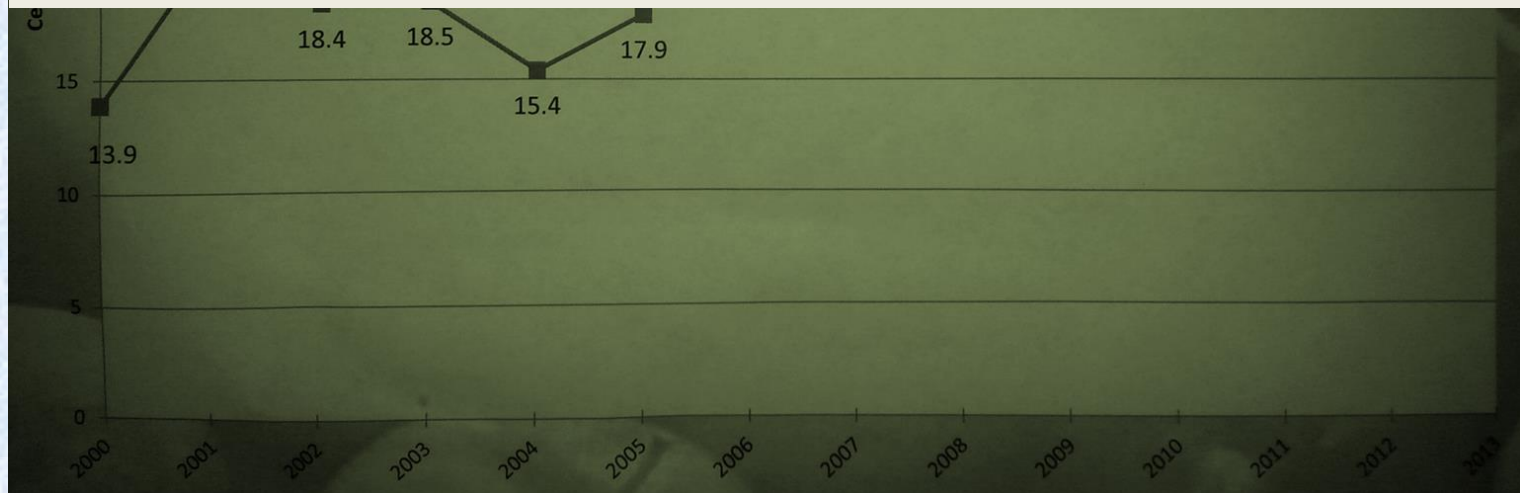
# Site Selection

Colorado Apples - Historical Prices

2000-2013

## Criteria for site selection

1. Sufficient fruit, bird and insect presence
2. Minimal use of bird control techniques and pesticides
3. Producer willingness to participate



Data from National Agricultural Statistics Service 2015

# Field Methods

- Transects
- Mist-nets
- Behavioral observations
- Exclosures and paired controls









# Collaborators

# First Fruits Organic Farms



Images courtesy of S. Werner, S. Bombaci and First Fruits Organic Farms Facebook



# Mesa Winds Farm and Winery



Images courtesy of [www.mesawinds.com](http://www.mesawinds.com)



# White Buffalo Farm



Image courtesy of [www.whitebuffalofarm.org](http://www.whitebuffalofarm.org)

# National Wildlife Research Center & Arkion® Life Sciences

## NWRC Mission

***Apply scientific expertise to resolve human-wildlife conflicts while maintaining the quality of the environment shared with wildlife***



## Arkion® Life Sciences Mission

***To discover, develop and successfully market innovative products in the animal and human food industry, that enhances the quality of life. We also want to build a reputation for being creative and employing cutting edge technologies for developing bioactive products.***



# Preliminary Results

Species Code	Apples	Insects	Total Detections
EUST	1	3	57
LEWO	1		6
HOFI	*	1	227
PIJA	*		20
AMRO		83	32
BRBL		25	10
BCHU		18	73
CHSP		16	11
LAZB		16	10
RCKI		12	
BLGR		2	1
WEKI		1	9
CORA		1	1
DEJU		1	
BARS		*	14
CONI		*	
VGSW		*	

Species Code	Apples	Insects	Total Detections
MODO			33
AMGO			22
WEME			20
AMKE			13
LEGO			13
CEDW			12
EUCD			11
BUOR			8
WEWP			7
BBMA			6
YWAR			6
BHCO			5
TUVU			4
YRWA			4
AMCR			3
NOFL			3
BAWW			1
BTHU			1
DOWO			1
HAWO			1
KILL			1
RBNU			1
RTHA			1
RWBL			1
WESJ			1



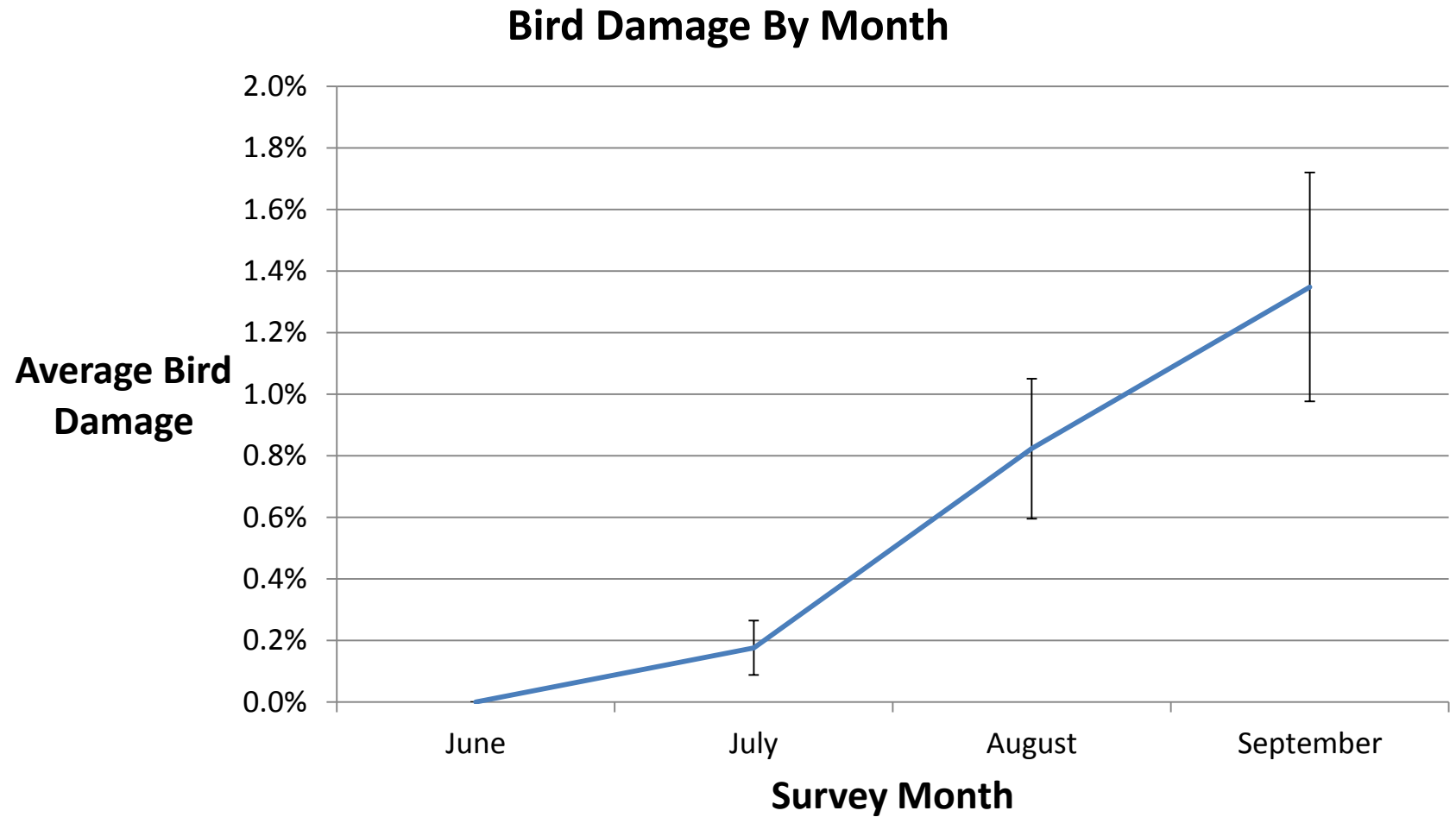


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BARS		*	14
CONI		*	
VGSW		*	

# Mist-Netting Results

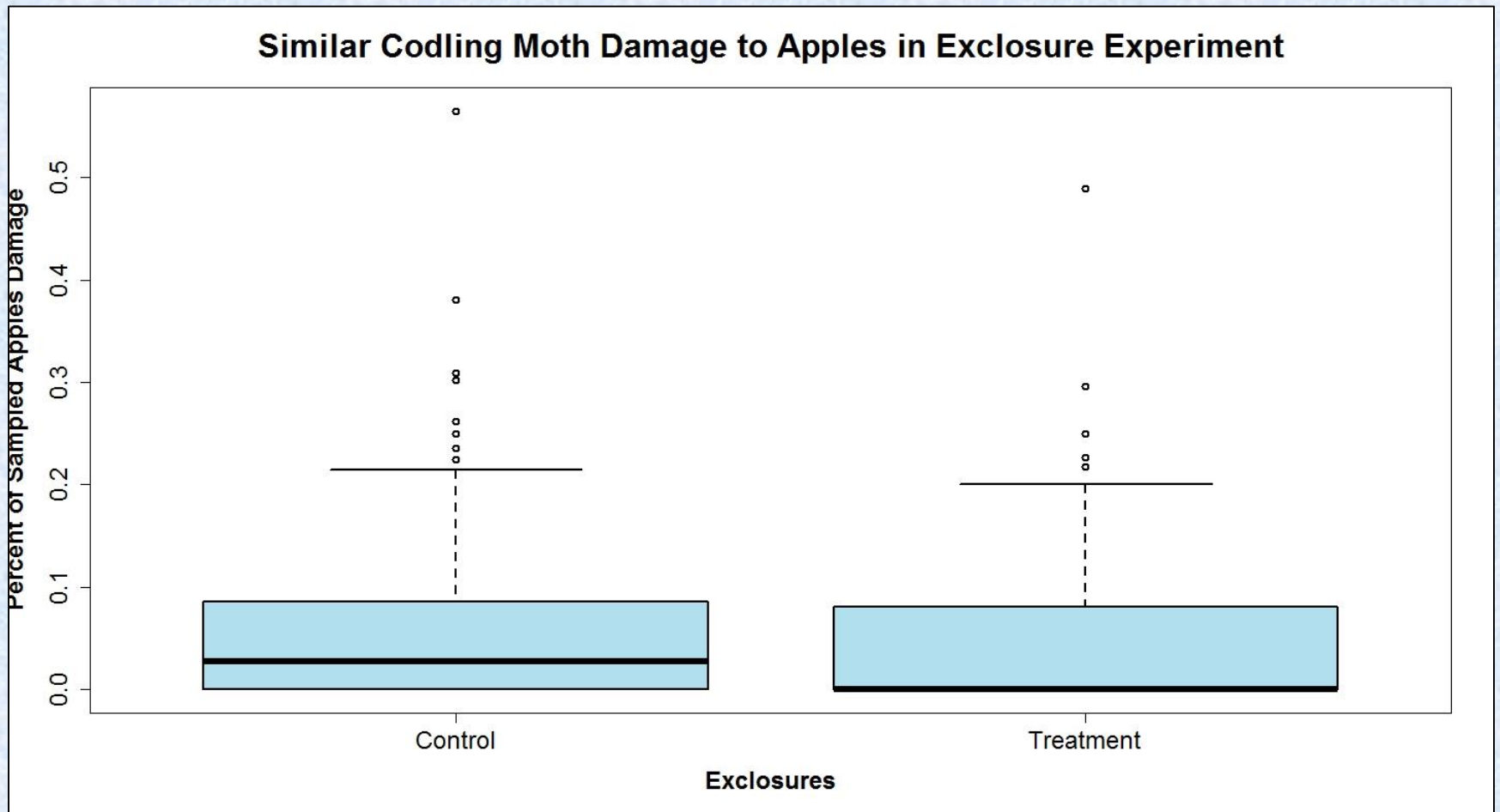
Species Code	Fecal Samples
AMGO	3
AMRO	17
BARS	1
BCHU	5
BHCO	5
BHGR	2
BRBL	1
BUOR	8
CHSP	6
DUFL	1
GRCA	1
GTTO	1
HOFI	9
LAZB	1
LEGO	4
RCKI	1
RNSA	2
RWBL	1
SOSP	1
WAVI	3
WEWP	1
YWAR	6

# Exclosure Experiment Results





# Exclosure Experiment Results



# FIRST FRUITS

# FIRST FRUITS

## MESA FARMS

### Paonia Site

American crow  
American goldfinch  
American kestrel  
American robin  
Black-billed magpie  
Black-chinned hummer  
Brewer's blackbird  
Brown-headed cowbird  
Bullock's oriole  
Cedar waxwing  
Common raven  
Downy woodpecker  
Eurasian collared-dove  
Green-tailed towhee  
House finch  
House sparrow  
Lesser goldfinch  
Mourning dove  
Northern flicker  
Pinyon jay  
Red-winged blackbird  
Say's phoebe  
Violet-green swallow  
Warbling vireo  
Western meadowlark  
Western wood-pewee  
Yellow warbler

\*These lists include all birds

### Rogers Mesa Sites

American crow  
American goldfinch  
American kestrel  
American robin  
Barn swallow  
Black-billed magpie  
Black-capped chickadee  
Black-chinned hummingbird  
Blue grosbeak  
Brewer's blackbird  
Broad-tailed hummingbird  
Brown-headed cowbird  
Bullock's oriole  
Cedar waxwing  
Chipping sparrow  
Common nighthawk  
Common raven  
Dark-eyed junco  
Downy woodpecker  
Eurasian collared-dove  
European starling  
Hairy woodpecker  
House finch  
Killdeer  
Lazuli bunting  
Lesser goldfinch

\*These lists include all bird species

American crow  
American goldfinch  
American kestrel  
American robin  
Barn swallow  
Black-chinned hummingbird  
Brown-headed cowbird  
Brewer's blackbird  
Bullock's oriole  
Cedar waxwing  
Chipping sparrow  
Common raven  
Downy woodpecker  
Dusky flycatcher  
European starling  
Gray catbird  
House finch  
Lesser goldfinch  
Lewis's woodpecker  
Mourning dove  
Pinyon jay  
Red-winged blackbird  
Swainson's hawk  
Violet-green swallow  
Western meadowlark  
Yellow warbler



\*This list includes all bird species that were

American robin  
Black-and-white warbler  
Black-billed magpie  
Black-chinned hummingbird  
Black-headed grosbeak  
Bullock's oriole  
Common raven  
Downy woodpecker  
Eurasian collared-dove  
House finch  
Lazuli bunting  
Lesser goldfinch  
Violet-green swallow  
Warbling vireo  
Western kingbird  
Western scrub-jay  
Yellow warbler



American robin  
Black-billed magpie  
Black-capped chickadee  
Black-chinned hummingbird  
Black-headed grosbeak  
Brewer's blackbird  
Bullock's oriole  
Common raven  
House finch  
Mourning dove  
Northern flicker  
Pinyon jay  
Red-naped sapsucker  
Ring-necked pheasant  
Rufous hummingbird  
Violet-green swallow  
Western kingbird  
Western scrub-jay  
Western wood-pewee  
White-crowned sparrow

### Statistics



234K / 17K

birds are killed by wind turbines annually



1.6M / 26.5M

birds are killed by power lines and electrocution annually

data by Smithsonian

that were seen, heard or captured during our 2014 field season\*



# Challenges and Opportunities



Images from The National Science Foundation, The Salt Lake Tribune and The Research Ambassador Program

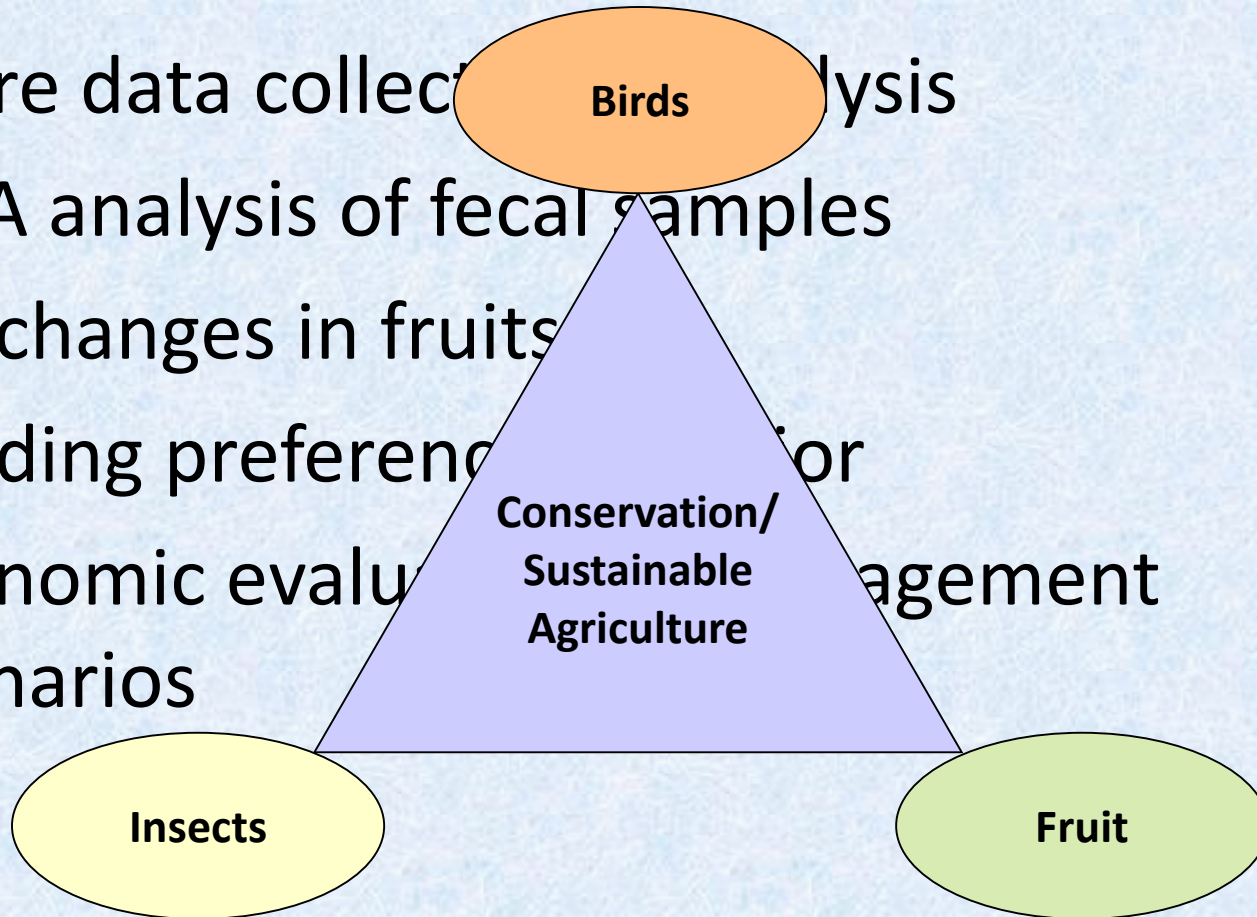






# Moving Forward

- More data collection and analysis
- DNA analysis of fecal samples
- UV changes in fruits
- Feeding preferences for
- Economic evaluation of management scenarios



# Acknowledgements

**Advisor:** Liba Pejchar

**Committee Members:** Scott J Werner, Bill Kendall, Paul Ode

**Field Technician:** Michael C. Novak

**Volunteers:** Karen LaBlanc, Deedra Murrieta, Beth Romero



MESA WINDS  
FARM & WINERY





# Resources

- Foley, J., R. Defries, G. Asner, C. Barford, G. Bonan, S. Carpenter, F. S. Chapin, M. Coe, G. Daily, H. Gibbs, J. Helkowski, T. Holloway, E. Howard, C. Kucharik, C. Monfreda, J. Patz, I. C. Prentice, N. Ramankutty, and P. Snyder. 2005. Global consequences of land use. *Science* 309:570-574.
- IUCN. 2014. The IUCN Red List of Threatened Species Version 2014.3.
- The Smithsonian Institution. 2014. Bird mortality Its causes and ways to reduce it.
- USDA. 2014. 2012 Census of agriculture Colorado State and County Data. United States Department of Agriculture, National Agricultural Statistics Service.

# Thank You!



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