

Thank you for signing in early

The webinar will begin promptly at
12:00 pm ET, 9:00 am PT



SERDP and ESTCP Webinar Series

- The webinar will begin promptly at 12:00 pm ET, 9:00 am PT
- Options for accessing the webinar audio
 - Listen to the broadcast audio if your computer is equipped with speakers
 - Call into the conference line
 - (669) 900-6833 or (929) 205-6099
 - Required webinar ID: 473-969-404
 - YouTube live stream
 - <https://www.youtube.com/user/SERDPESTCP>
- For questions or technical issues, please email serdp-estcp@noblis.org or call 571-372-6565

Addressing Threatened and Endangered Species on DoD Lands

August 20, 2020



Welcome and Introductions

Rula A. Deeb, Ph.D.
Webinar Coordinator



Webinar Agenda

- **Webinar Logistics** (5 minutes)
Dr. Rula Deeb, Geosyntec Consultants
- **Overview of SERDP and ESTCP** (5 minutes)
Dr. Herb Nelson, SERDP and ESTCP
- **A Multi-disciplinary Assessment of Habitat Crediting Programs for Threatened and Endangered Species** (25 minutes + Q&A)
Dr. Liba Pejchar, Colorado State University
- **BeeDNA: eDNA Microfluidic Metabarcoding Reveals Pollinator Communities** (25 minutes + Q&A)
Dr. Mark A. Davis, University of Illinois Urbana-Champaign
- **Final Q&A session**

Zoom Instructions

- Download Zoom
 - <https://zoom.us/download>
- If you cannot download Zoom, you can view the slides using an internet browser
 - Create a free Zoom account (<https://zoom.us/signup>)
 - Use a compatible browser (Firefox, IE or Edge)
 - View the webinar at <https://success.zoom.us/wc/473969404/join>
- If the material is not showing on your screen or if screen freezes
 - Key in Ctrl + F5 to do a hard refresh of your browser

Zoom Instructions (Cont'd)

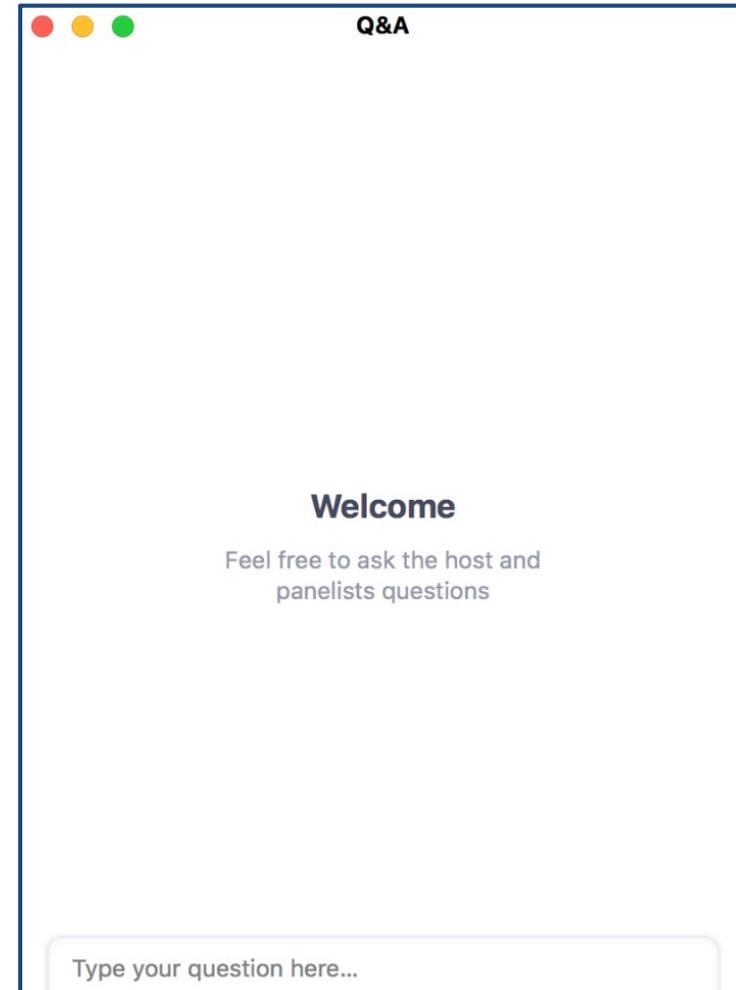
- If you are connecting to computer audio
 - Click the arrow next to the “Join Audio” button
 - Select test “Speaker and Microphone”
 - Follow prompts
- If you experience difficulties with the audio, call into the conference line
 - (669) 900-6833 or (929) 205-6099
 - Required webinar ID: 473-969-404

In Case of Continued Technical Difficulties

- Download a PDF of the slides at <https://serdp-estcp.org/Tools-and-Training/Webinar-Series/08-20-2020> and call into the conference line
 - (669) 900-6833 or (929) 205-6099
 - Required webinar ID: 473-969-404
- We will also be live streaming the webinar on the SERDP and ESTCP YouTube channel
 - <https://www.youtube.com/user/SERDPESTCP>

How to Ask Questions

- Find the Q&A button on your control bar and type in your question(s)
- Make sure to add your organization name at the end of your question so that we can identify you during the Q&A sessions



SERDP and ESTCP Overview

Herb Nelson, Ph.D.
SERDP and ESTCP



SERDP

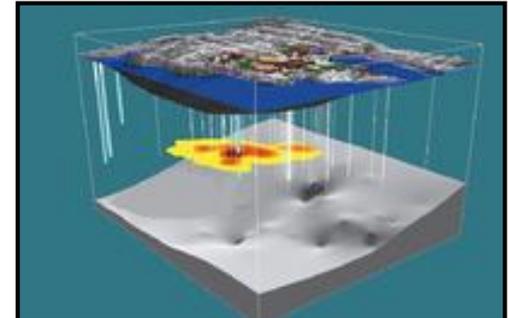
- Strategic Environmental Research and Development Program
- Established by Congress in FY 1991
 - DoD, DOE and EPA partnership
- SERDP is a requirements driven program which identifies high-priority environmental science and technology investment opportunities that address DoD requirements
 - Advanced technology development to address near term needs
 - Fundamental research to impact real world environmental management

ESTCP

- Environmental Security Technology Certification Program
- Demonstrate innovative cost-effective environmental and energy technologies
 - Capitalize on past investments
 - Transition technology out of the lab
- Promote implementation
 - Facilitate regulatory acceptance

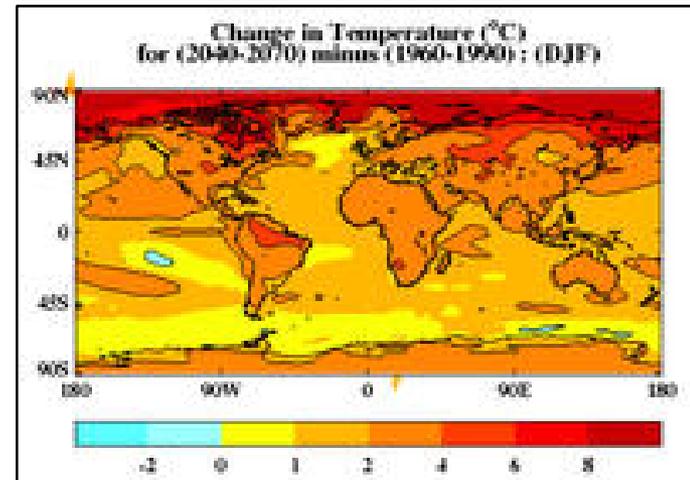
Program Areas

- Environmental Restoration
- Installation Energy and Water
- Munitions Response
- Resource Conservation and Resiliency
- Weapons Systems and Platforms



Resource Conservation and Resiliency

- Natural resources
 - Ecological forestry
 - Arid lands ecology and management
 - Cold regions ecology and management
 - Pacific island ecology and management
 - Coastal and estuarine ecology and management
 - Living marine resources ecology and management
 - Species ecology and management
 - Watershed processes and management
- Resilience
 - Vulnerability and impact assessment
 - Adaptation science
 - Land use and carbon management
- Air quality
 - Wildland fire dynamics
 - Fugitive dust



SERDP and ESTCP Webinar Series

Date	Topic
September 10, 2020	Reducing Hazardous Materials in Weapons Systems: Advances in Waterjet Applications and Cold Spray Technologies
September 24, 2020	Munitions Mobility and Burial in Underwater Environments
October 8, 2020	Managing AFFF Impacts to Subsurface Environments and Assessment of Commercially Available Fluorine-Free Foams (Part 1)
October 22, 2020	Managing AFFF Impacts to Subsurface Environments and Assessment of Commercially Available Fluorine-Free Foams (Part 2)
November 5, 2020	Pathways under Non-Stationary Conditions and Their Implications for Wildlife and Human Exposure on Department of Defense Lands

For upcoming webinars, please visit

<http://serdp-estcp.org/Tools-and-Training/Webinar-Series>



Save the Date

SERDP • ESTCP SYMPOSIUM

A three-day symposium showcasing the latest technologies that enhance DoD's mission through improved environmental and energy performance

December 1-3, 2020

Registration for virtual event is open!

SERDP & ESTCP Webinar Series

A Multi-Disciplinary Assessment of Habitat Crediting Programs for Threatened and Endangered Species

Liba Pejchar, Ph.D.
Colorado State University



Agenda

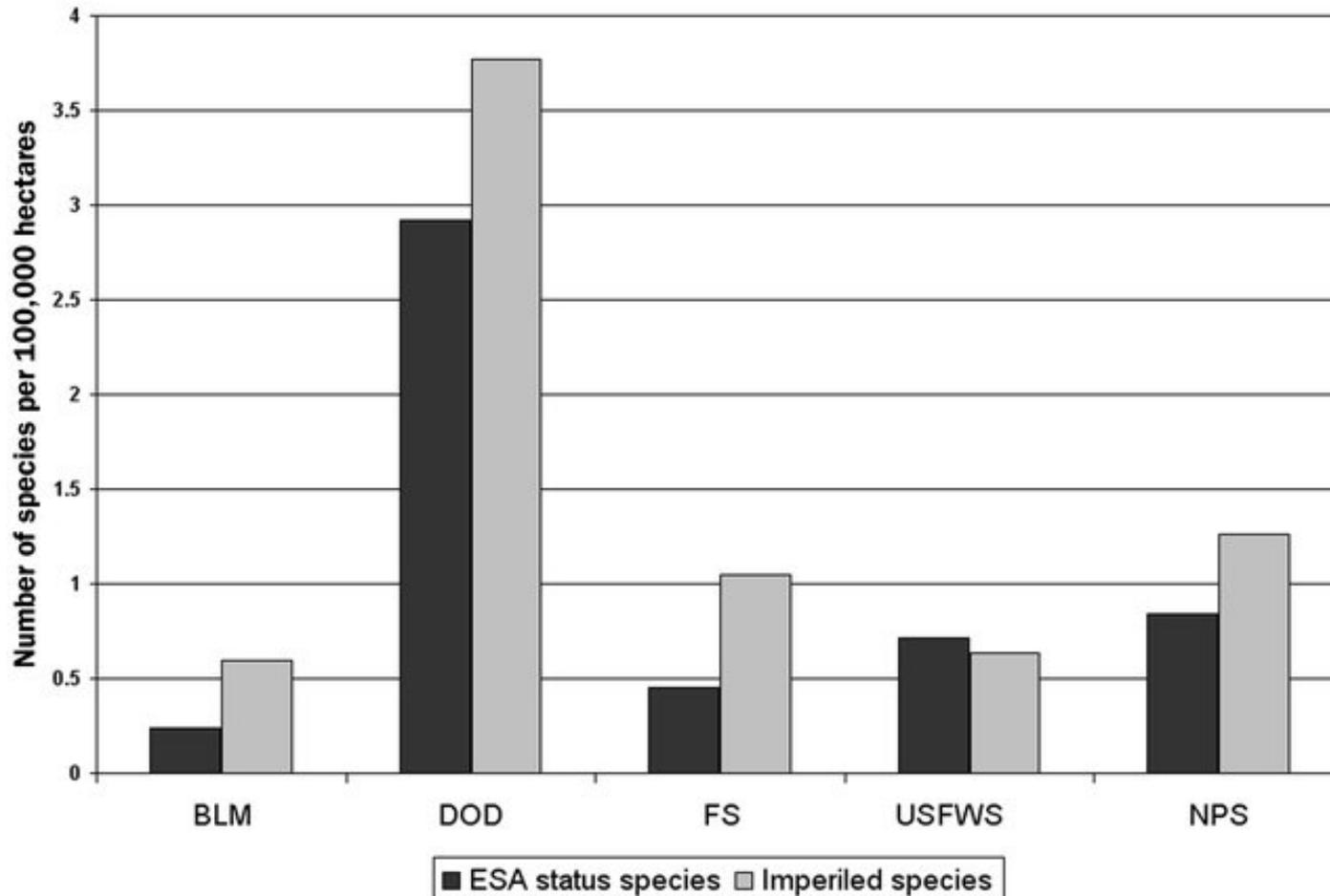
- Introduction
- Objectives
- Approach
- Results and discussion
- Conclusion
- Benefits to DoD

Introduction

- DoD's mission is to deter war and to ensure national security
- Training requires access to diverse lands and waters
- DoD has a strong commitment to environmental stewardship



A Disproportionate Number of Rare Species Occur on DoD Lands



Conservation of Rare Species Can Occur Within or Beyond Installations

- Preserving species and their habitats supports mission readiness
- Negative effects on imperiled species occasionally are unavoidable
- Cross-boundary partnerships can provide flexibility and positive outcomes



Cross-Boundary Habitat Conservation

- Innovative tools gaining traction in the United States and globally
- Consistent with priorities to strengthen alliances and attract new partners



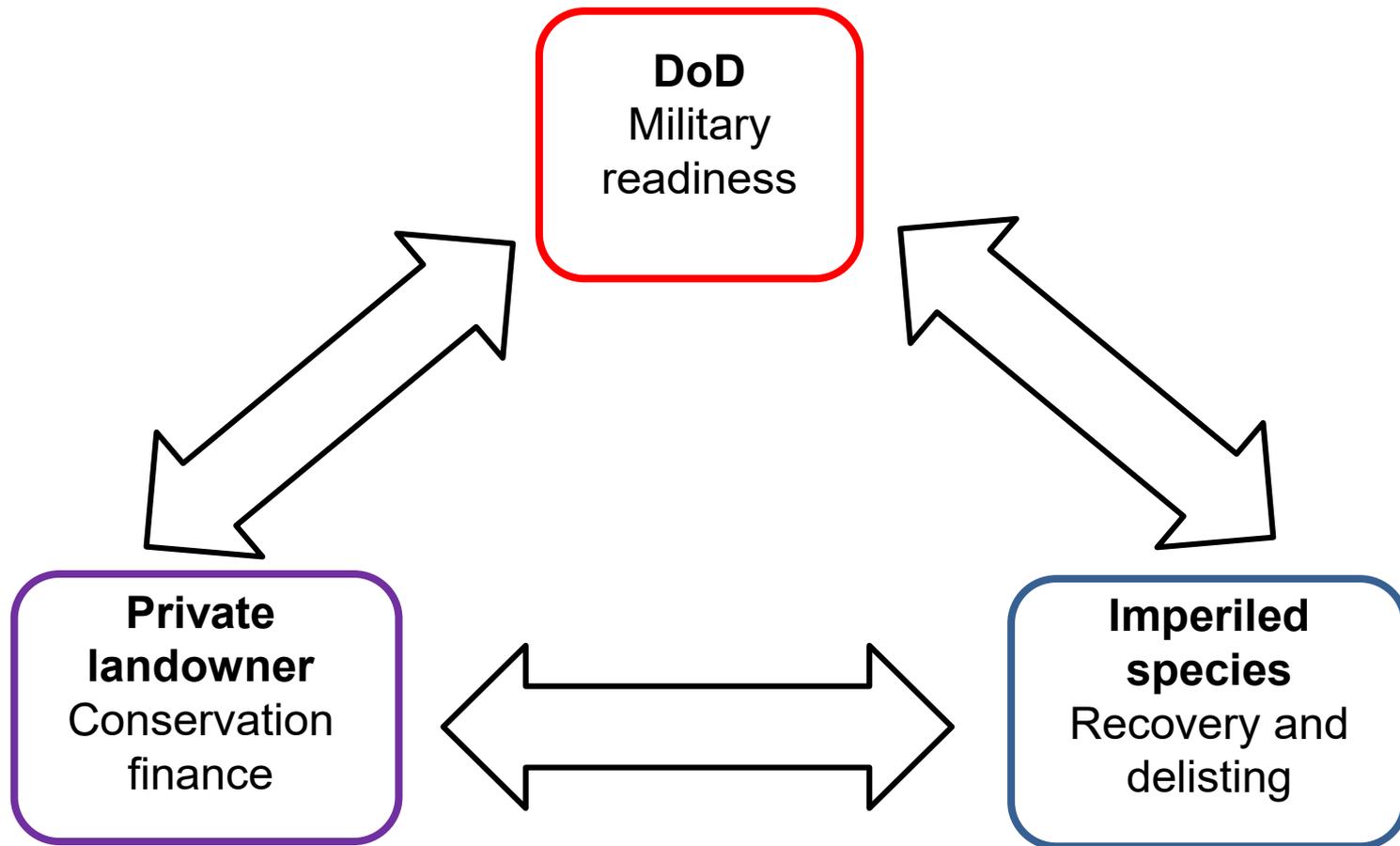
Habitat Crediting Programs Hold Promise but are Poorly Understood

- Cross-boundary habitat crediting defined as:
 - Voluntary programs
 - Provide incentive in return for specific and quantifiable management actions that:
 - Mitigate current or future impacts to the habitat of TES or candidate species across jurisdictional boundaries.



Neornithes

Habitat Crediting Programs Are Intended to Provide Multiple Benefits



Objectives

- Identify and characterize habitat crediting programs
- Assess program goals and how success is evaluated
- Synthesize stakeholder perceptions of strengths and shortcomings
- Examine whether programs account for ongoing environmental change



Approach

1. To **identify habitat crediting programs**, we searched literature and consulted websites
2. We used these sources to identify **ecological and institutional attributes** of each program

Approach

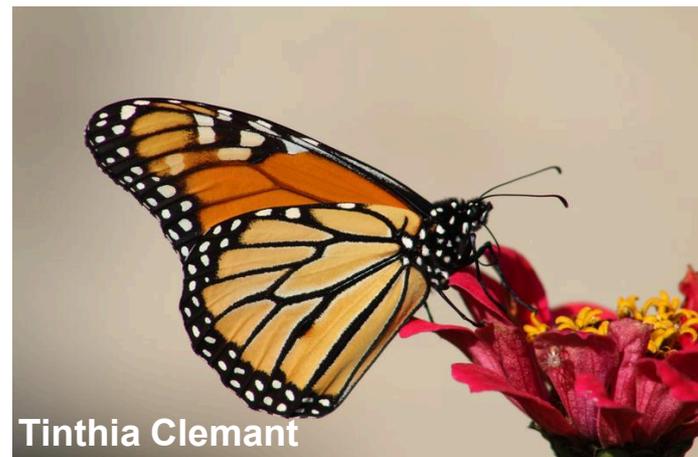
3. To assess **goals, outcomes, strengths,** and **shortcomings**, we surveyed individuals engaged in these programs
 - Type and frequency of data collection
 - Duration of program enrollment
 - Cost structure for credits
 - Institutional incentives and barriers

Results: Habitat Crediting Programs

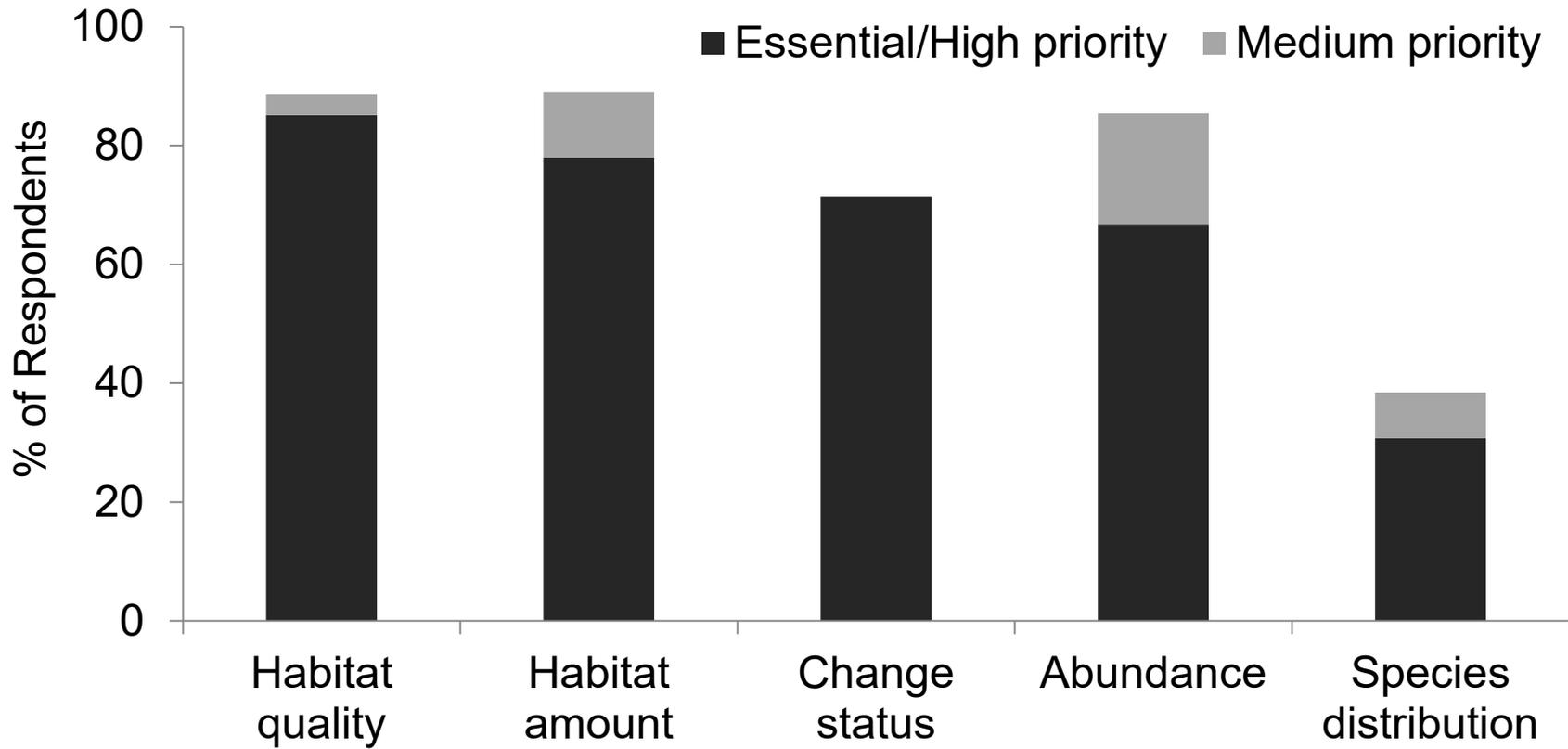
- Fort Hood Recovery Credit System (**Golden-cheeked Warbler**)
- **Utah Prairie Dog** Habitat Credits Exchange
- **Gopher Tortoise** Conservation and Crediting Strategy
- **Red-cockaded Woodpecker Recovery Plan**
- **Lesser Prairie-Chicken** Habitat Exchange
- **Dunes Sagebrush Lizard** Conservation Recovery Award System
- Nevada Conservation Credit System (**Greater Sage-Grouse**)
- Colorado Habitat Credit Exchange (**Greater Sage-Grouse**)
- **Monarch Butterfly** and Central Valley Habitat Exchange

Key Findings from Survey

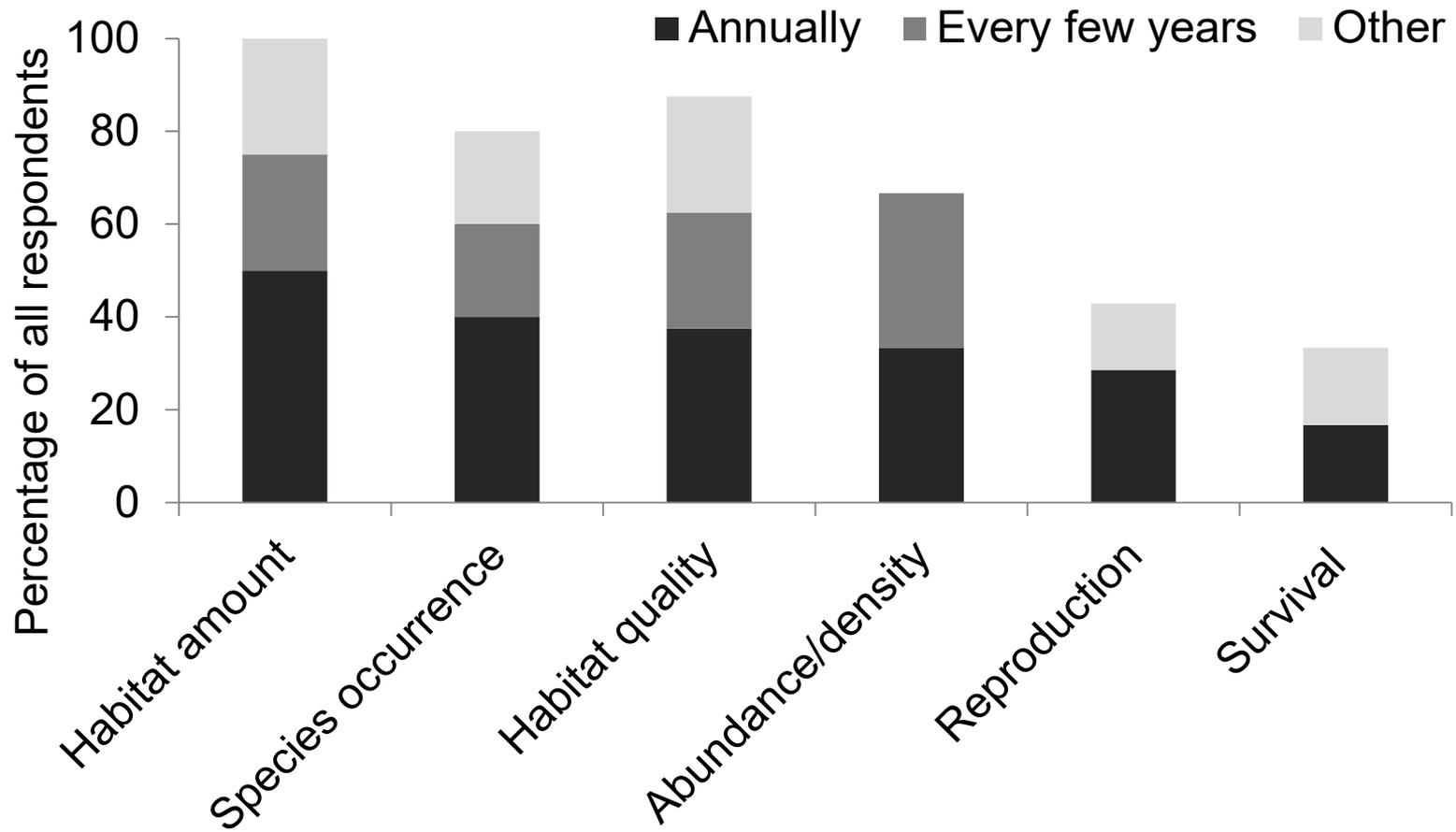
- Programs enhance military readiness (100%)
- Investment in programs yields positive returns for DoD and partners (64%)
- Ecological goals clearly defined (85%), and likely to be met (54%)
- Programs responsive to environmental change (53%)



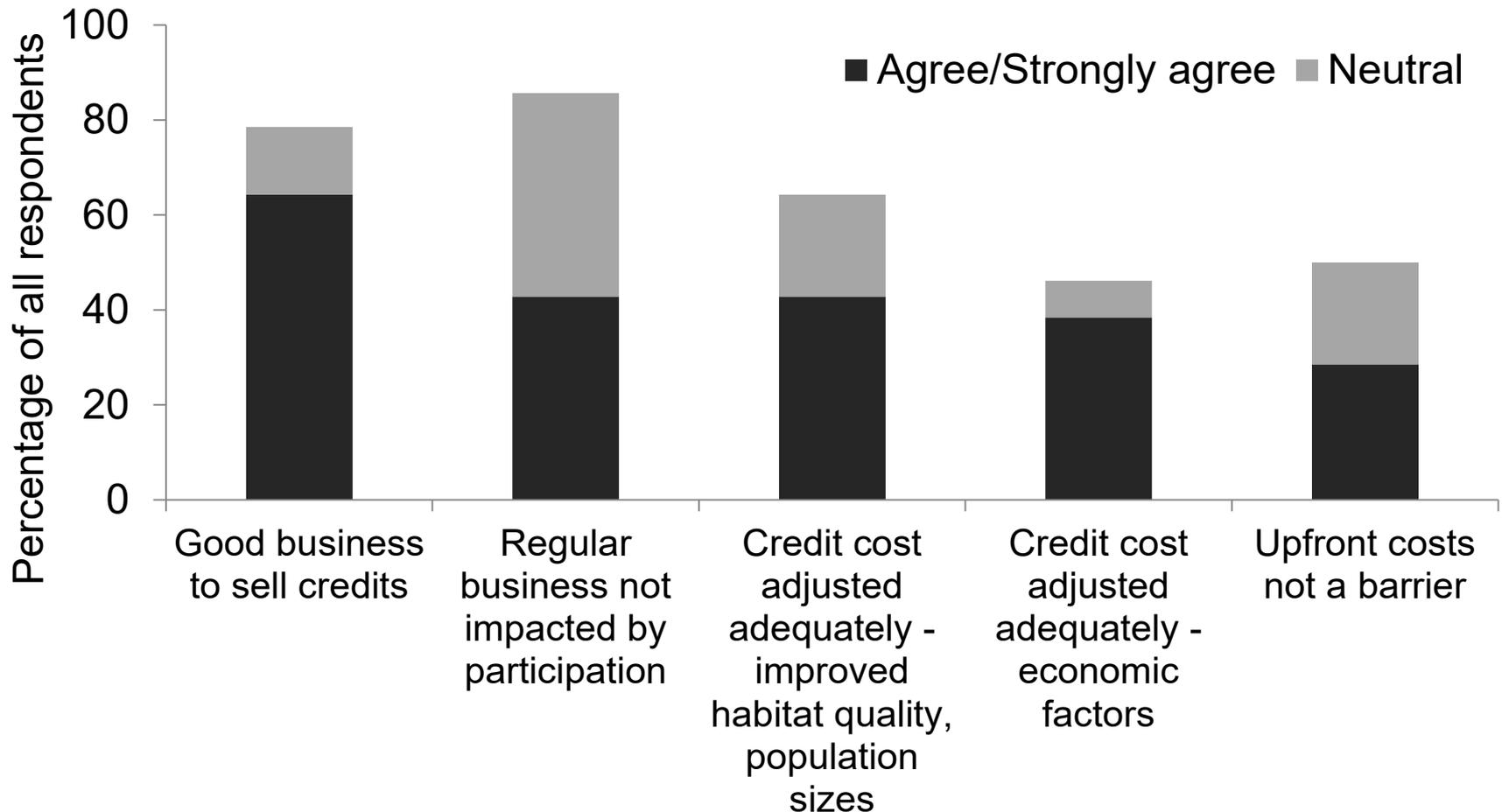
Program Goals Focus on Increasing Habitat Quality and Amount



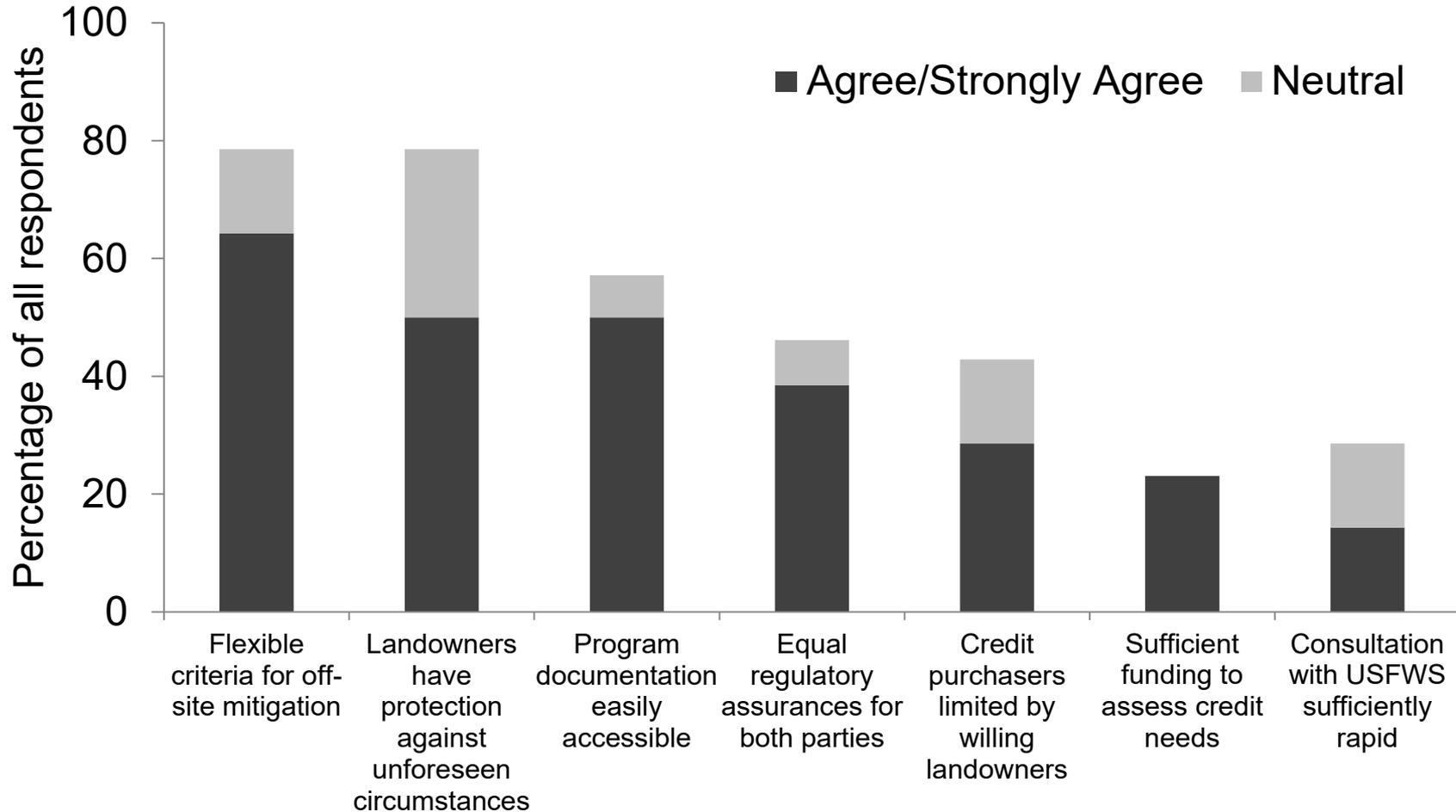
Monitoring Limited in Scope and Frequency



Mixed Perceptions on Economic Viability of Habitat Crediting Programs



Programs Offer Flexibility but Face Institutional Barriers



Conclusions

Strengths

- Habitat crediting programs enhance military readiness
- Positive investment for DoD and partners
- Program goals well defined

Shortcomings

- Up-front costs can limit engagement
- Credit purchasers and providers disagree on in perpetuity
- Monitoring insufficient to evaluate ecological outcomes

Benefits to DoD

- Are Habitat Crediting Programs a good investment for DoD?
 - They can provide regulatory relief but are not effective in all contexts



- Habitat Crediting Programs are most likely to be viable if...
 - On-site mitigation incompatible with military readiness
 - Future activities in installations dynamic and uncertain
 - Installations in a mosaic of rural/undeveloped lands
 - Target TES habitat well-known and compatible with working lands

Next Steps

What else does DoD need to know to make informed decisions?

- Improve monitoring to better assess ecological outcomes
- Focus on multiple species to reduce transaction costs
- Create a decision-support tool for cross-boundary conservation



SERDP & ESTCP Webinar Series

For additional information, please visit
<https://serdp-estcp.org/Program-Areas/Resource-Conservation-and-Resiliency/Infrastructure-Resiliency/Vulnerability-and-Impact-Assessment/RC18-1209>

Speaker Contact Information

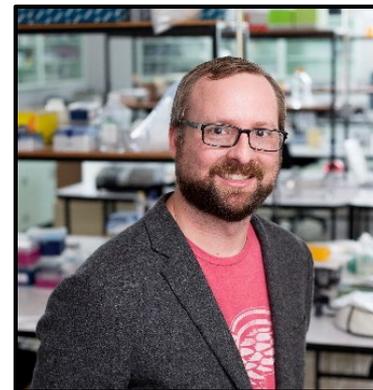
Liba.Pejchar@colostate.edu; 970-491-1819



Q&A Session 1



BeeDNA: eDNA Microfluidic Metabarcoding Reveals Pollinator Communities



Mark A. Davis, Ph.D.
University of Illinois Urbana-Champaign



Agenda

- **WHY** → Rapid pollinator community assays
- **HOW** did we assay communities?
- **WHAT** is the efficacy?
- **WHERE** is the approach viable?
- **WHEN** won't it work?
- **WHY** use it on DoD Lands?



Why?

**Global
arthropod
population
declines**

**Pollinators hit
particularly
hard**



Why?

- Pollinators provide critical ecosystem services
- Estimated > \$24 billion to U.S. economy annually
- Pollinators → increasing conservation status
- What are impacts of increasing ESA listings?



Why?

- Conventional monitoring IS effective
- Also time consuming and expensive
- Exacerbated by “taxonomic impediment”
- Challenges to DoD
 - Increased ESA burden
 - Decreasing expertise
 - Mission readiness/lethality impacts → increased range closures



Why?



Can eDNA provide a faster, more cost-efficient means of rapidly documenting pollinator communities, particularly in remote locations?

How?

Objectives

- Evaluate existing metabarcoding primers (in silico and in vitro)
- Assess efficacy of eDNA to detect pollinators (greenhouse and field)
- Optimize workflow for detecting pollinators



How?

- Established a flowering plant community
- Introduced Common Eastern Bumblebee (*Bombus impatiens*)
- Phased flower introduction
- Multi-method eDNA sampling procedure
 - N = 25 eDNA samples after observed visit
 - N = 25 eDNA samples after 24 unobserved hours



Our Approach → Field Study

- eDNA sampled from focal flowerbeds
- N = 25 for each species after observed bee visit
- N = 25 for each species at 9:00 AM CDT



Results → Greenhouse

Species Detected in the Greenhouse



common eastern
bumblebee



western flower thrips



silverleaf whitefly



cotton aphid



yellow garden
spider

Results → Field

Species Detected in the Field



two-spotted
bumblebee



brown-belted
bumblebee



half-black bumblebee



white-lined sphinx



two-spotted
longhorn bee



common whitetail
dragonfly

Results → Field

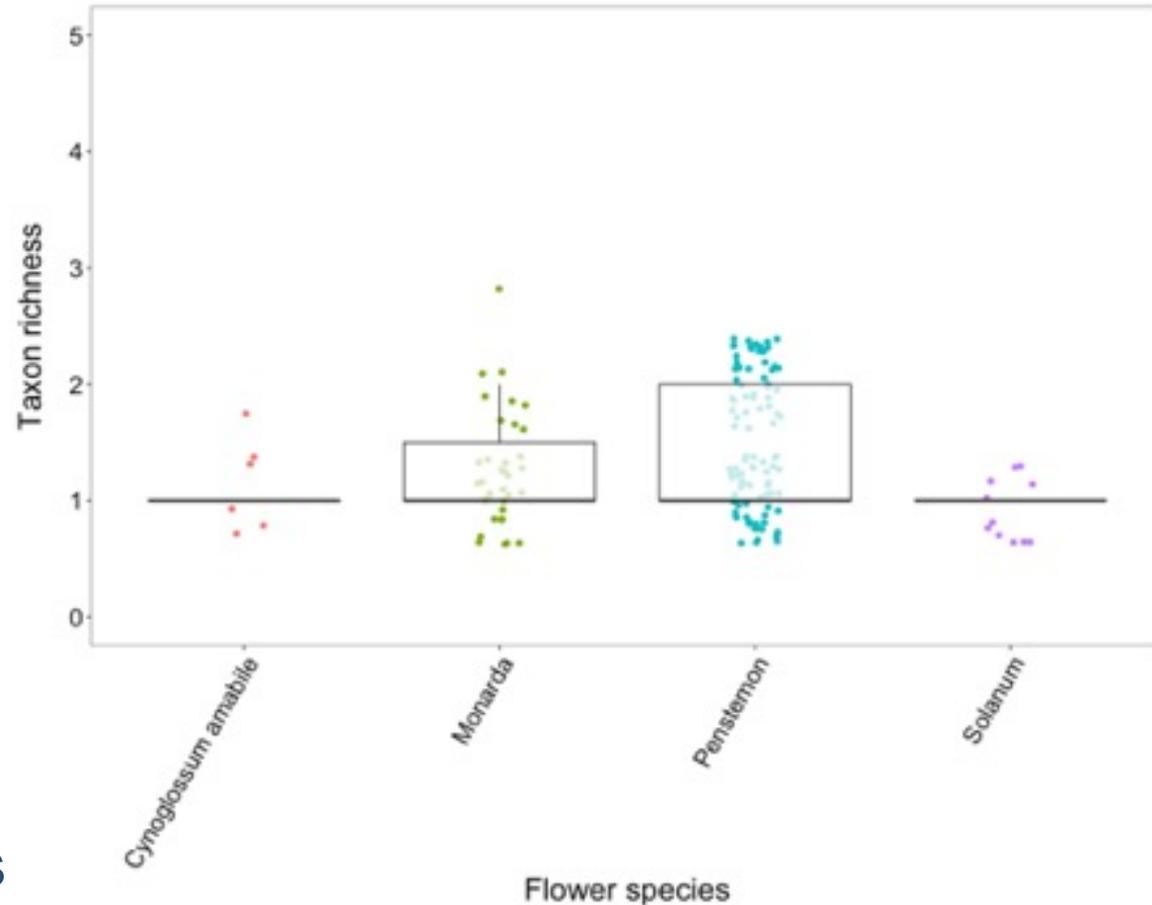
The Curious Case of the Carpenter Bee

- Carpenter bees (*Xylocopa virginica*) widespread
- Most flowers showed evidence of nectar robbing
- ZERO detections of carpenter bees!
- Detection probability is imperfect



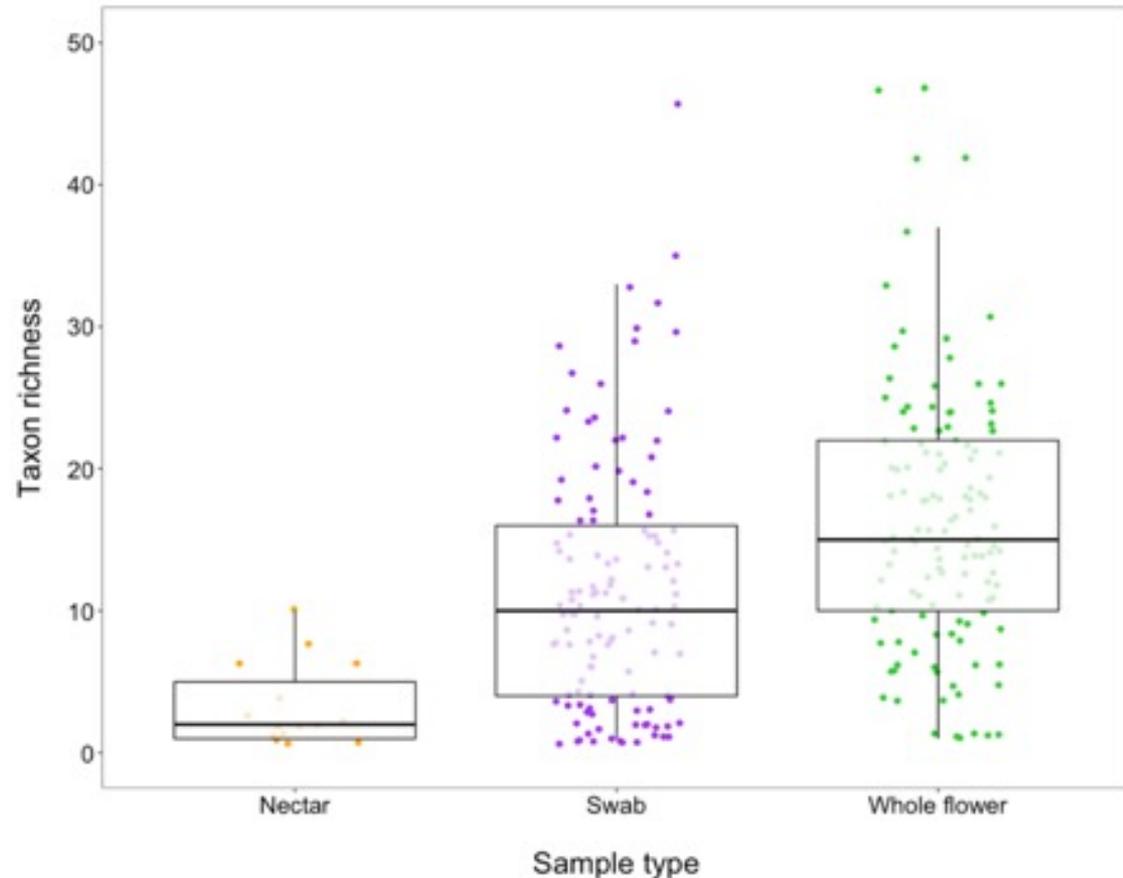
Results → Methodological Comparisons

- Flower morphology
 - Penstemon yielded numerically greater community
 - Monarda also had a diverse community
 - Different flowers = communities



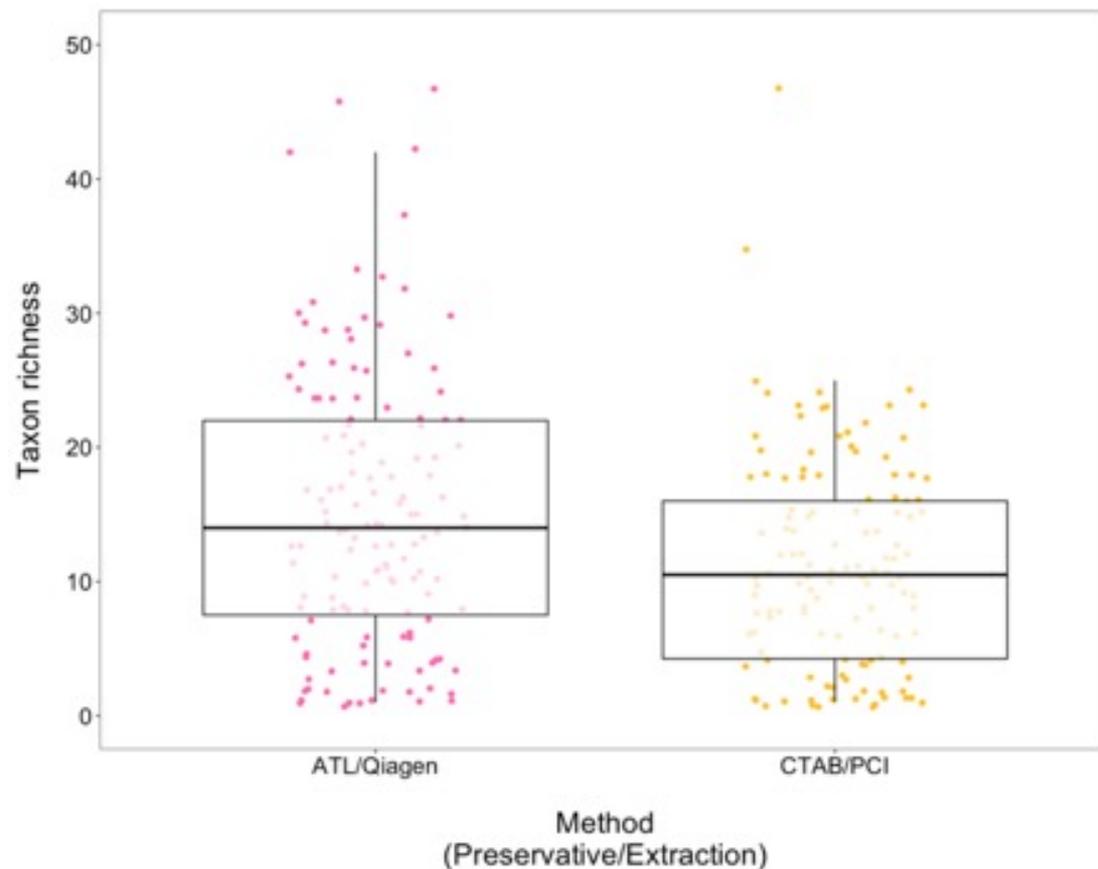
Results → Methodological Comparisons

- Sampling methodology
 - Whole flower sampling = more diverse community
 - Swabs also effective
 - Nectar performed poorly



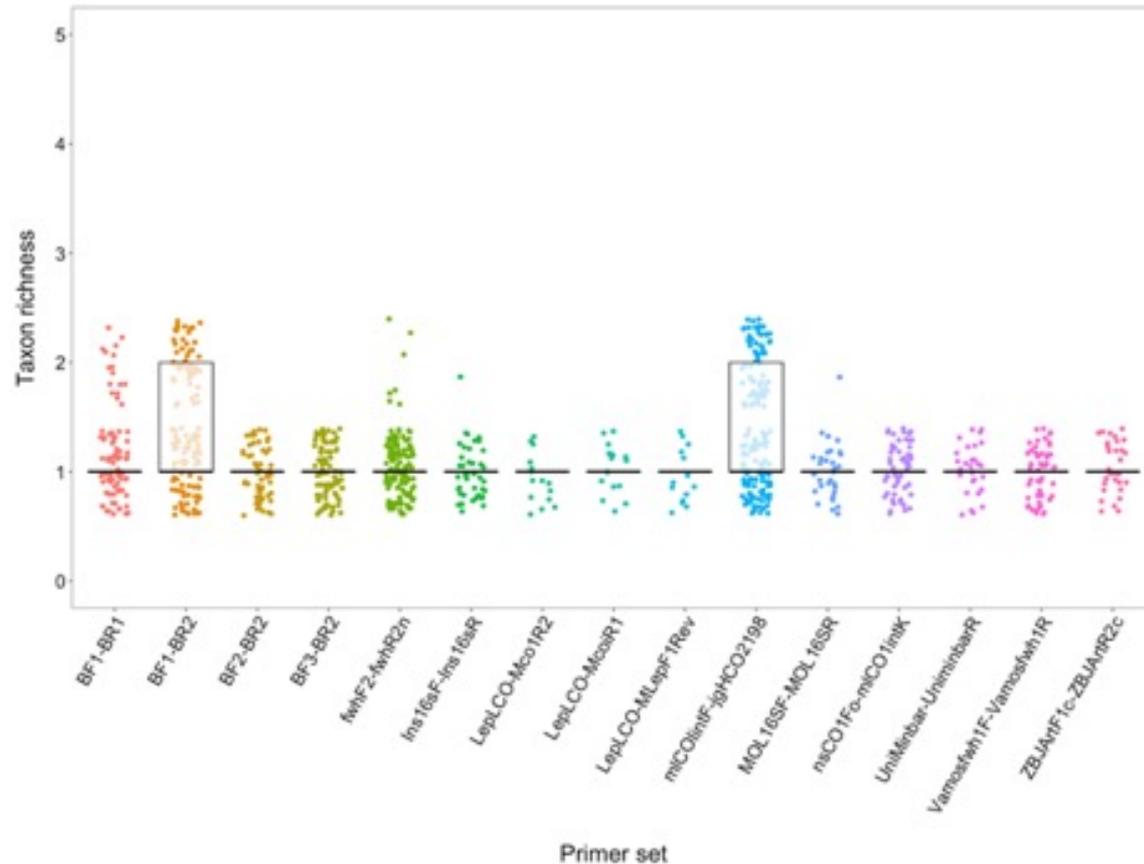
Results → Methodological Comparisons

- Preservation and extraction
 - ATL/Qiagen = greater diversity
 - CTAB/P-C-I, less diverse, still effective
 - ATL/DNEasy approach has additional advantages



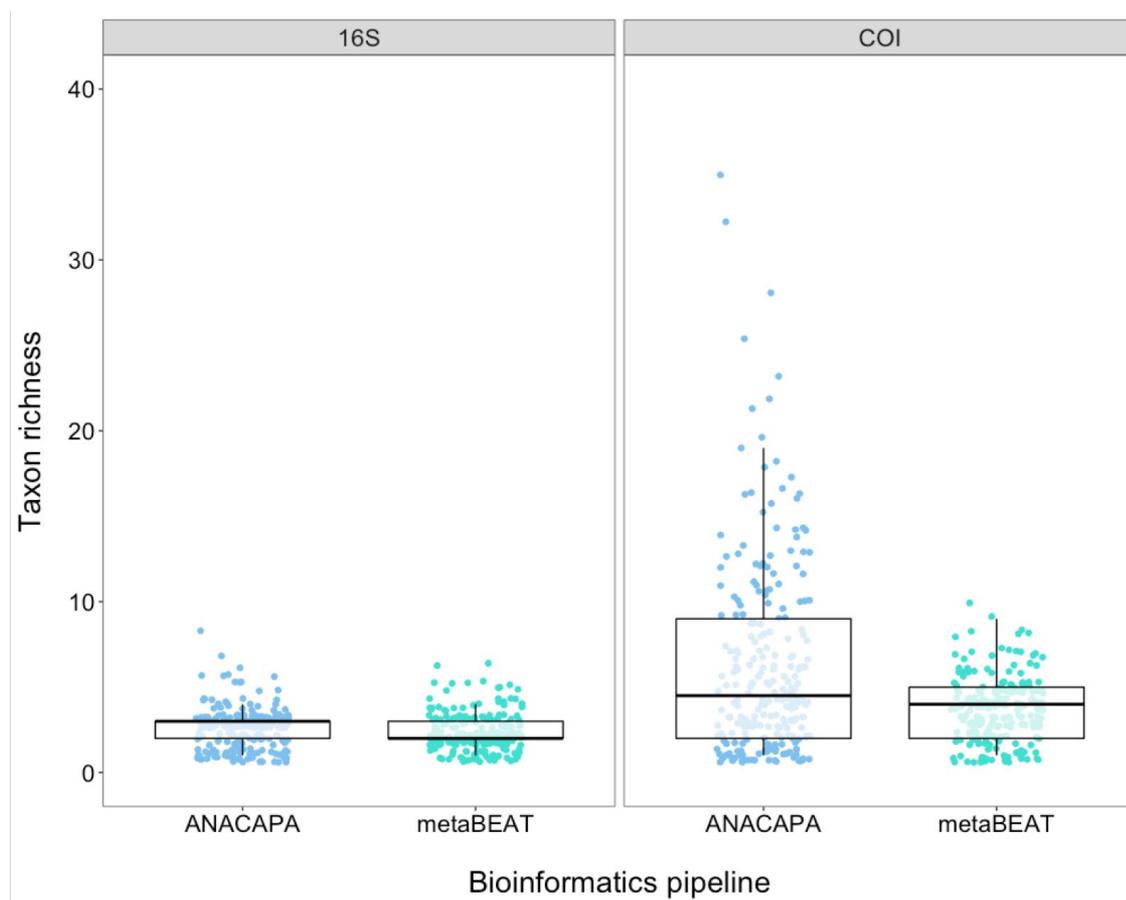
Results → Methodological Comparisons

- Primer comparisons
 - COI communities >>> than 16S
 - Substantial variance within COI primer sets
 - For arthropods, COI appears effective
 - May hold for vertebrate pollinators



Results → Methodological Comparisons

- Bioinformatics pipelines
 - ANACAPA >>> metaBEAT under identical parameterization
 - Less variance in metaBEAT



Conclusions

- Our approach revealed pollinator communities in both controlled and uncontrolled conditions
- Observed and unobserved species effectively detected
 - Validating potential of approach
- We propose a comprehensive work-flow to maximize communities revealed and minimize false negatives
- Many factors influence pollinator communities revealed
 - Biotic, abiotic, and technical

A Proposed Workflow

	FLOWER MORPHOLOGY	SAMPLING METHODS	PRESERVATION/ EXTRACTION	PRIMER SET	BIOINFORMATICS PIPELINE
OPTIMAL WORKFLOW	 Monarda* <small>*Ideally, a diverse array of flower species with a robust sampling design would be implemented to maximize likelihood of capturing a diverse pollinator community</small>	Whole Flower Harvesting	ATL + Modified Qiagen DNEasy	COI	ANACAPA + metaBEAT
	APPROACHES EXAMINED	Monarda	Whole Flower harvesting	CTAB + Phenol-Chlorform-Isoamyl	COI
	Penstemon			16S	metaBEAT
	Solanum	Flower Swabbing	ATL + Modified Qiagen DNEasy		
		Nectar Extraction			

Benefits to DoD

- Speed
 - Reduction in range closures
- Technological advances = decreased taxonomic expertise
- Cost efficiency
 - Reduced field time = savings
- Flexibility
 - Merging pollinators and pollen

Broad Applicability on DoD Installations

- Preliminary RTE screening → strategically targeted surveys
- Opportunities beyond arthropods
 - Bats in desert southwest (Fort Huachuca)
 - Birds in Hawaii (U.S. Army Garrison, Hawaii)
 - Couple w/ RTE and invasive flowering plants
- Opportunity to elucidate plant/pollinator networks



Acknowledgments

- Patricia Dickerson
- Evelyn Knittle
- Lauren Paddock
- Rosalie Metallo
- Montgomery Flack
- Clinton Shipley
- Mark Band
- Alvaro Hernandez
- Chris Wright
- Emily Curd
- Danielle Ruffatto
- Tiffany Jolley
- Joe Spencer
- Katie Dana
Tara Hohoff
- Tommy McElrath
- Angella Moorehouse

SERDP & ESTCP Webinar Series

For additional information, please visit
<https://serdp-estcp.org/Program-Areas/Resource-Conservation-and-Resiliency/RC19-1102>

Speaker Contact Information

davis63@illinois.edu; 217-300-0980



Q&A Session 2



The next webinar is on
September 10, 2020

*Reducing Hazardous Materials in
Weapons Systems: Advances in
Waterjet Applications and Cold Spray
Technologies*



Survey Reminder

Please take a moment to complete the survey that will pop up on your screen when the webinar ends

