Thank you for signing in early

The webinar will begin promptly at
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SERDP and ESTCP Webinar Series

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    - Required webinar ID: 388-158-785
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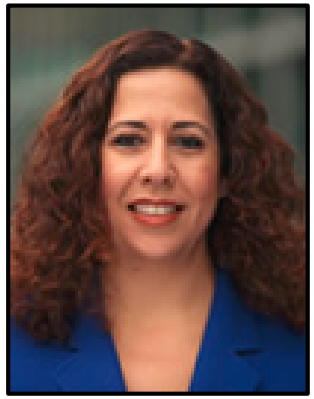
Variation in Phenological Shifts: How do Annual Cycles and Genetic Diversity Constrain or Enable Responses to Climate Change?

October 3, 2019

Welcome and Introductions

Rula A. Deeb, Ph.D.
Webinar Coordinator



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Webinar Agenda

- **Webinar Logistics** (5 minutes)
  Dr. Rula Deeb, Geosyntec Consultants
- **Overview of SERDP and ESTCP** (5 minutes)
  Dr. Kurt Preston, SERDP and ESTCP
- **Partnerships Enhance Scope and Scale of Phenology Research** (25 minutes + Q&A)
  Dr. Julie Heath, Boise State University
- **Full Annual Cycle Framework for Forecasting Species Response to Climate Change** (25 minutes + Q&A)
  Mr. Jason Winiarski, Boise State University
- **Final Q&A session**

In Case of Technical Difficulties

- Use a compatible browser (Firefox, IE or Edge)
- If material is not showing on your screen or if screen freezes
  - Key in Ctrl + F5 to do a hard refresh of your browser
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  - Select test "*Speaker and Microphone*"
  - Follow prompts
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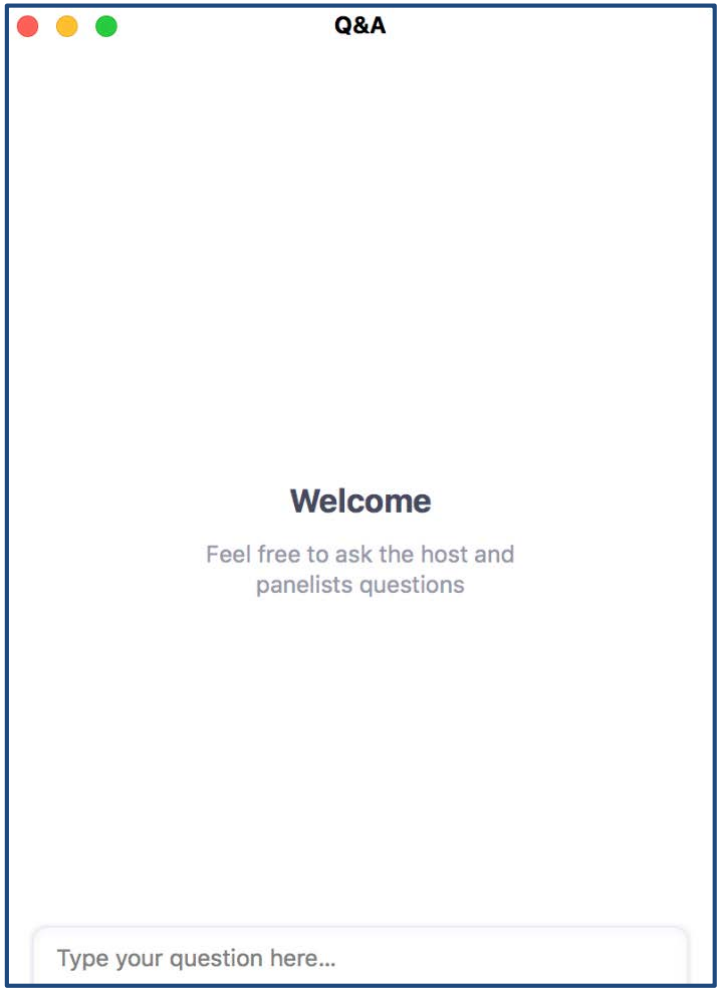
- Find the Q&A button on your control bar and type in your question(s)
- Make sure to add your organization name at the end of your question so that we can identify you during the Q&A sessions



SERDP and ESTCP Overview

Kurt Preston, Ph.D.
Resource Conservation and Resiliency Program Manager

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SERDP

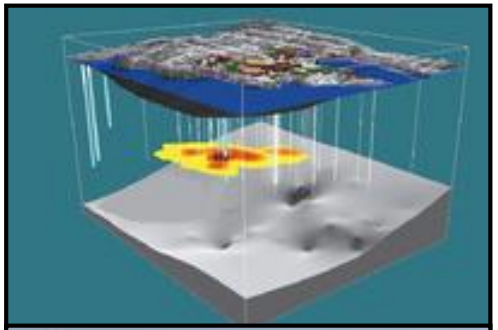
- Strategic Environmental Research and Development Program
- Established by Congress in FY 1991
  - DoD, DOE and EPA partnership
- SERDP is a requirements driven program which identifies high-priority environmental science and technology investment opportunities that address DoD requirements
  - Advanced 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

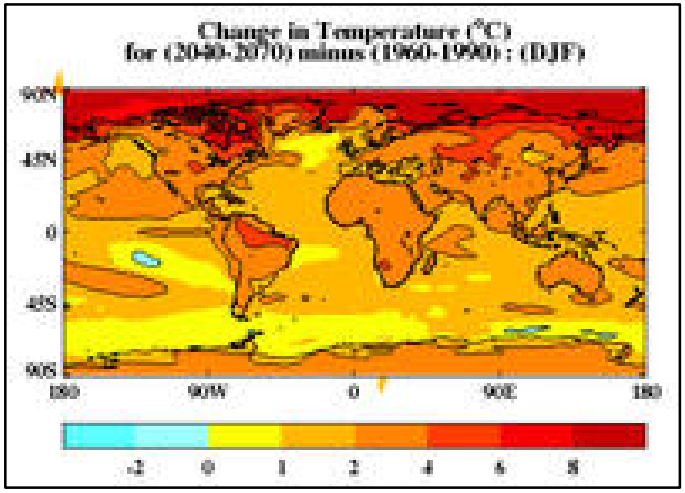
1. Environmental Restoration
2. Installation Energy and Water
3. Munitions Response
4. Resource Conservation and Resiliency
5. Weapons Systems and Platforms





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
October 17, 2019	Managing Aqueous Film Forming Foam (AFFF) Impacts to Subsurface Environments and Assessment of Commercially Available Fluorine-Free Foams
October 24, 2019	Advances in Managing Contaminated Groundwater Using High Resolution Site Characterization and Contaminant Mass Flux Reduction
October 31, 2019	Developing and Demonstrating Non-Toxic and Sustainable Coating Systems for Military Platforms
November 7, 2019	Overview of SERDP and ESTCP Efforts on Developing and Demonstrating PFAS Treatment Technologies
November 21, 2019	Battery Energy Storage Modelling

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 3-5, 2019

Washington Marriott Wardman Park

Registration is open

Partnerships Enhance Scope and Scale of Phenology Research

Julie Heath, Ph.D.
Boise State University

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Agenda

- Why build research partnerships?
- Full Cycle Phenology project
- Approach for network development
- Results and product demonstration
- Conclusions
- Benefits to DoD

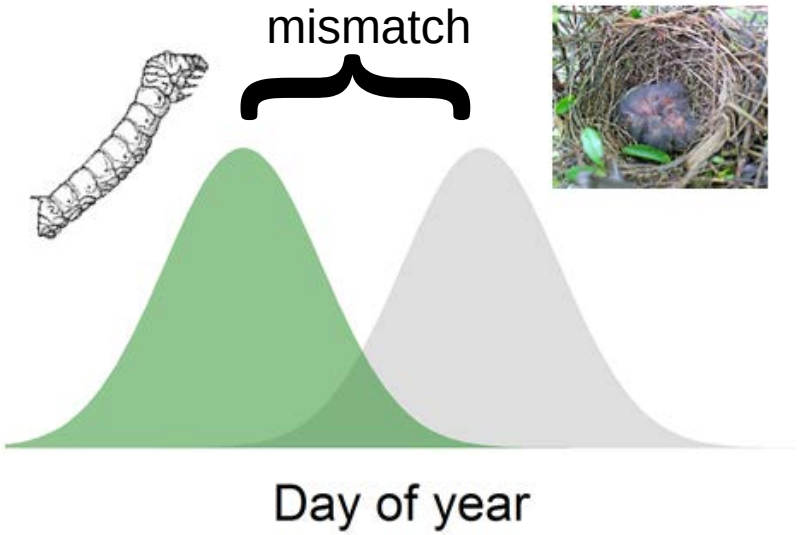
Migratory Birds and DoD Lands

- INRMPs supports training and testing mission
- DoD PIF expertise
- >70 migratory birds of conservation concern
- Found on >300 installations
- Proactive conservation precludes listing of additional birds as T&E

Notes:
INRMPs = Integrated Natural Resources Management Plans
PIF = Partners in Flight
T&E = threatened and endangered

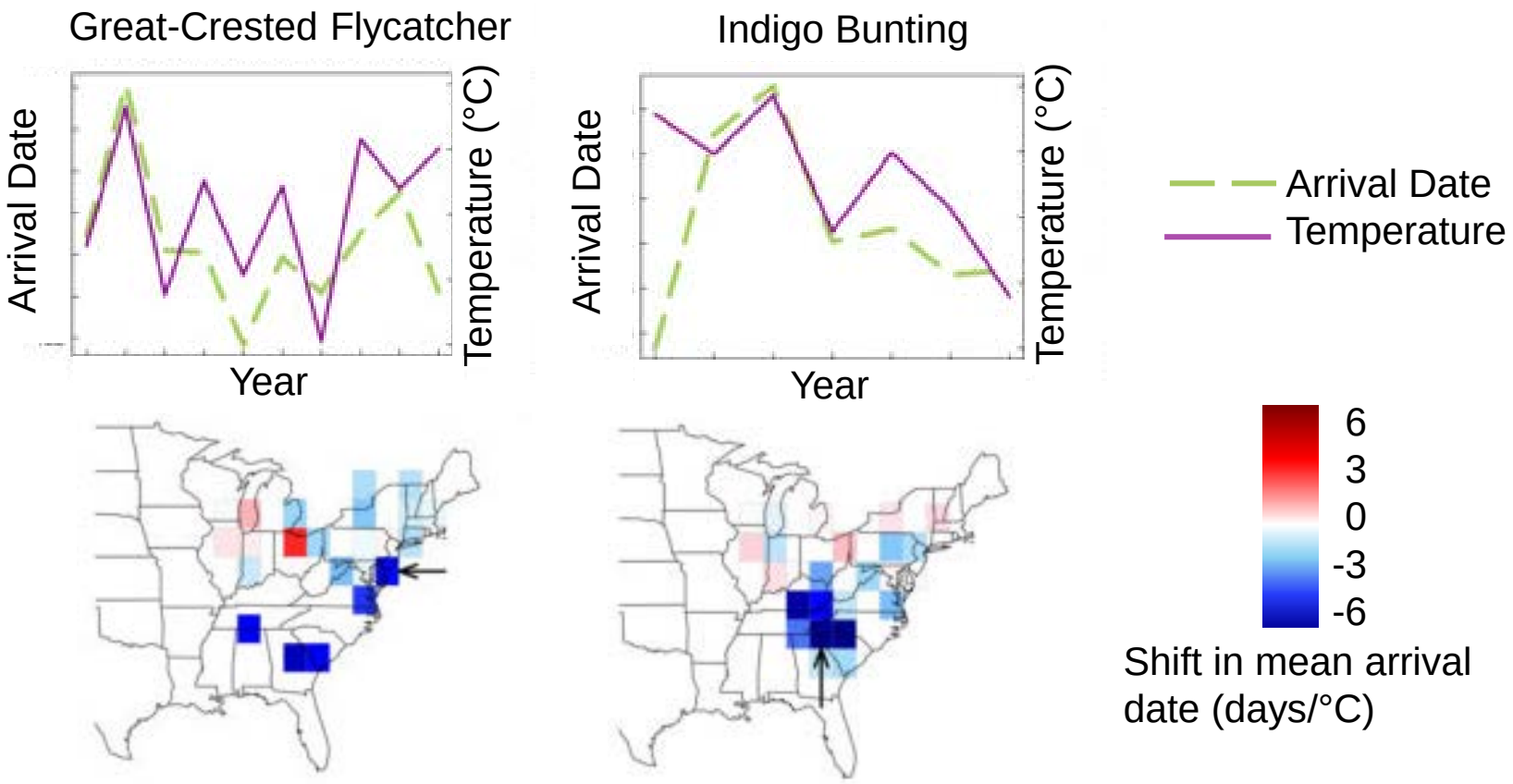
Source: Bart et al. 2012, Coordinated Bird Monitoring

Phenology Mismatch



Climate Change and Vulnerability

Strong Climate and Life History Relationships

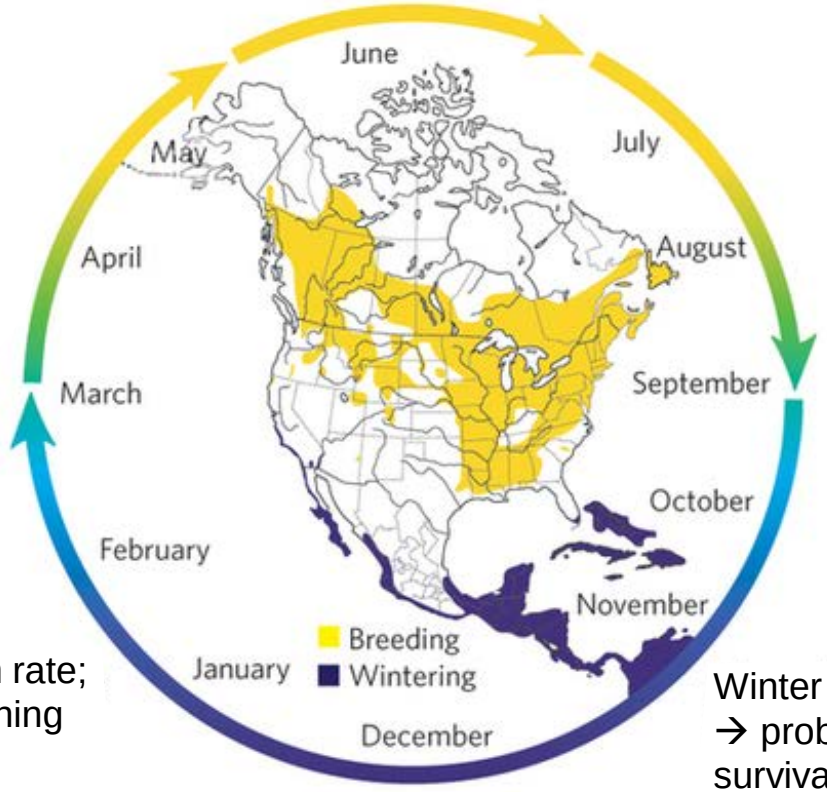


Source: Hurlbert and Liang 2012

Full Annual Cycle

Breeding habitat quality + winter climate → reproductive success

Spring climate → migration rate; limits number of birds reaching breeding grounds



Migration stop-over sites → energy on way to wintering grounds

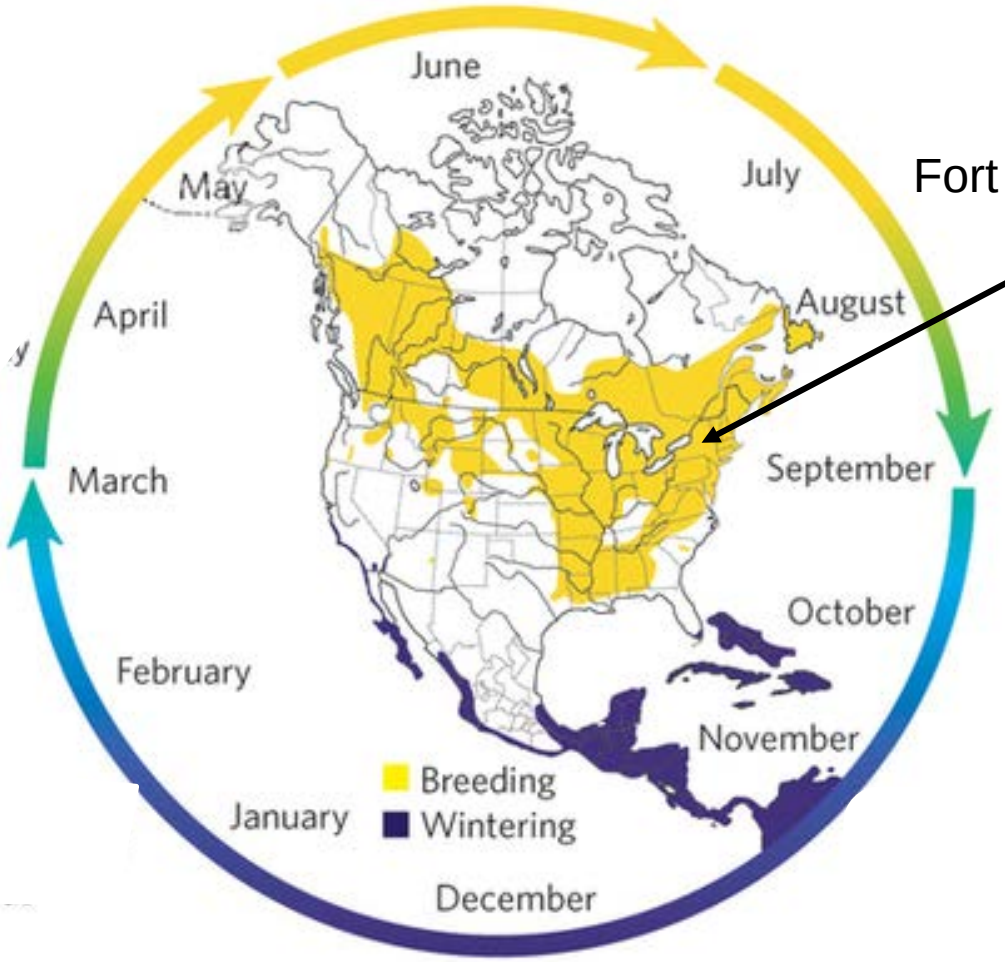
Winter climate and habitat quality → probability of spring migration survival into next breeding season

Events occurring during one period influence individuals and populations during subsequent periods

Source: Small-Lorenz et al. 2013

Research Locations

Large Spatio-temporal Scale



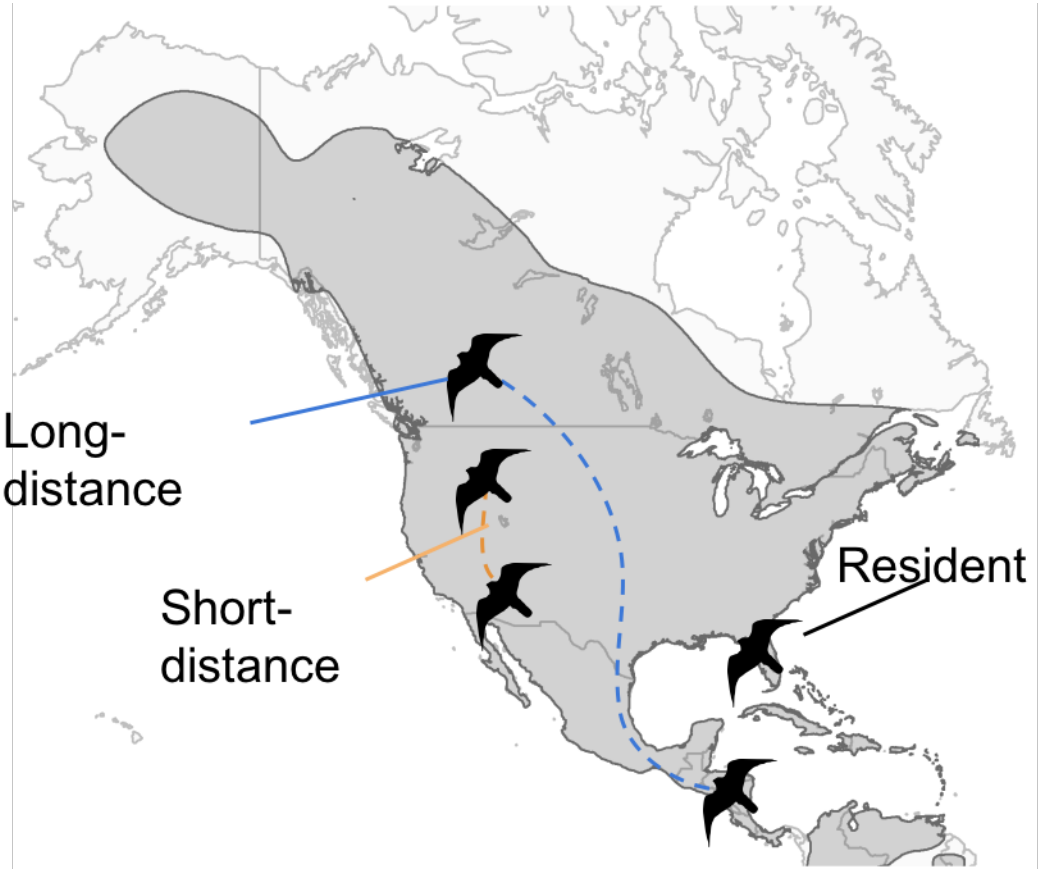
Fort Drum, New York

Full Cycle Phenology Project

- How do genetics and annual cycles of migratory birds affect phenological responses to climate change?

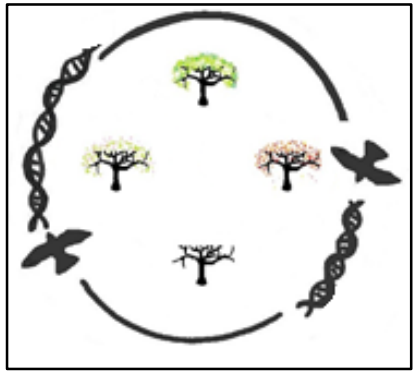
American Kestrels and Climate Change

- Generalist predator
- Diverse migration strategies
- Widespread, experiencing differential climate change



Approach: Full Annual Cycle Biology

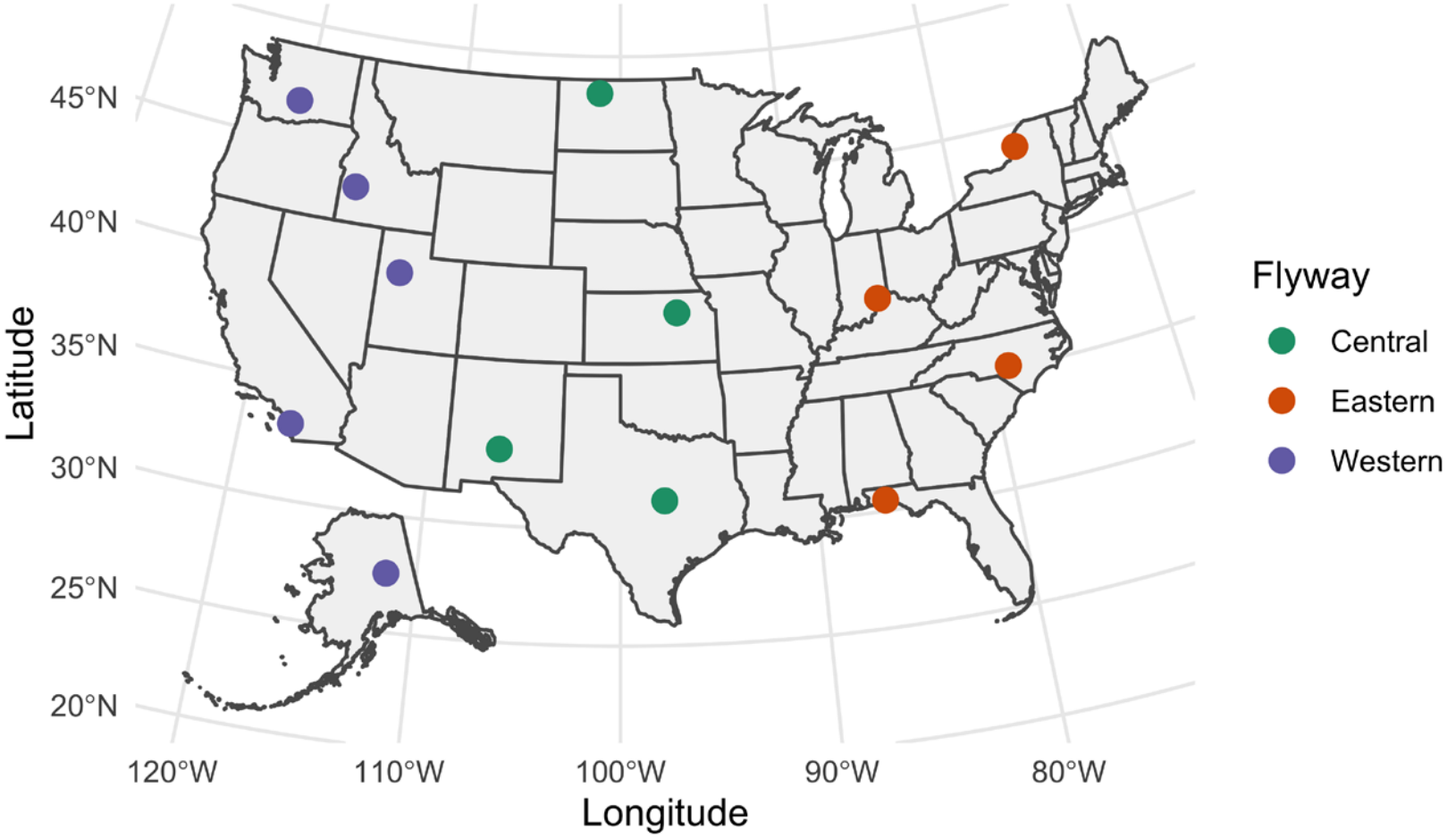


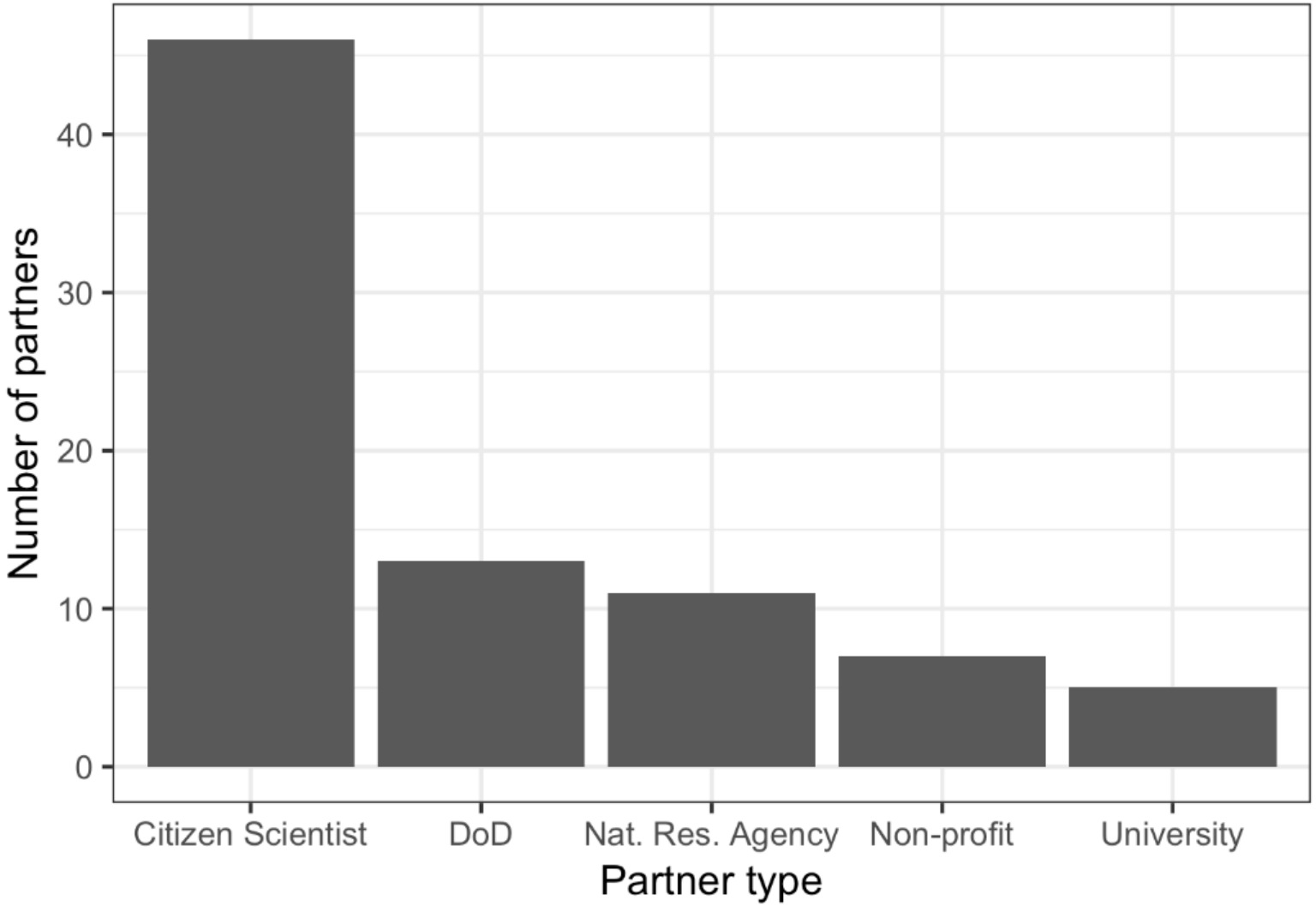

Network Development

Multiple Outreach Methods

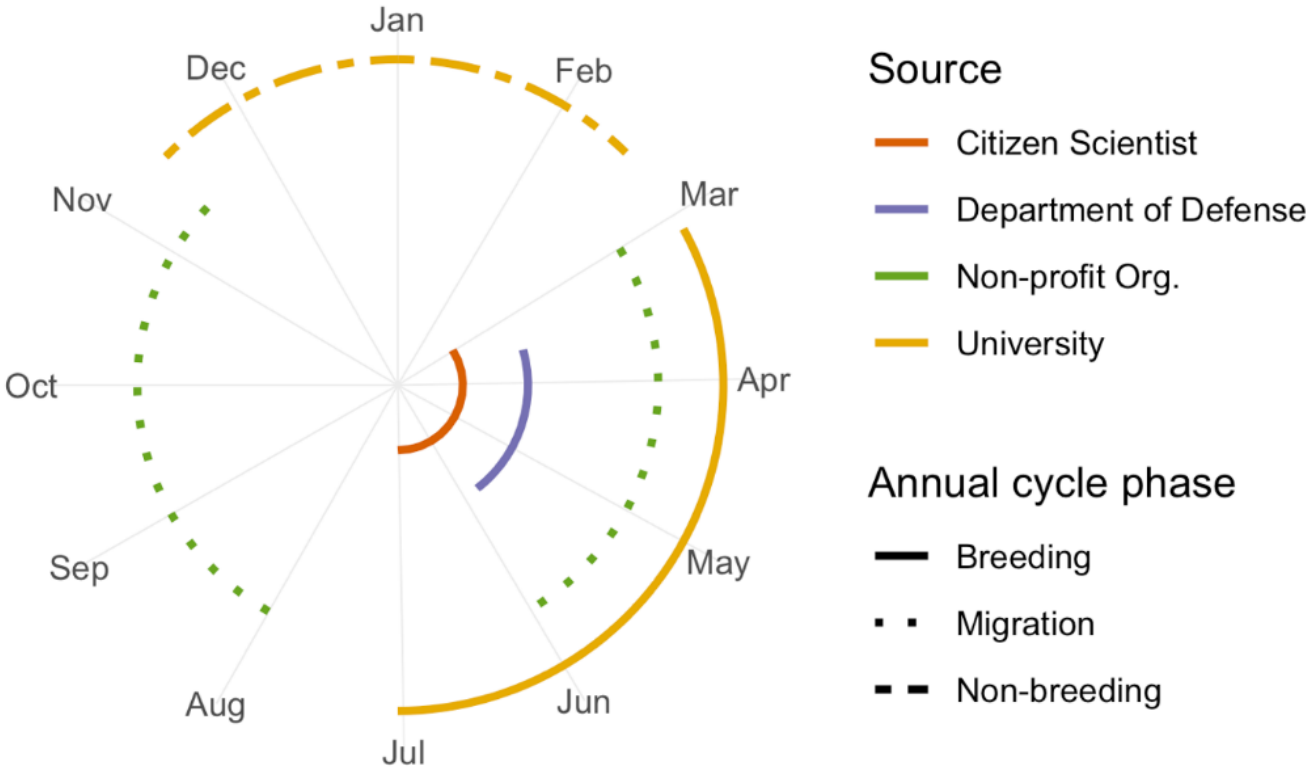
DoD Sites within Network



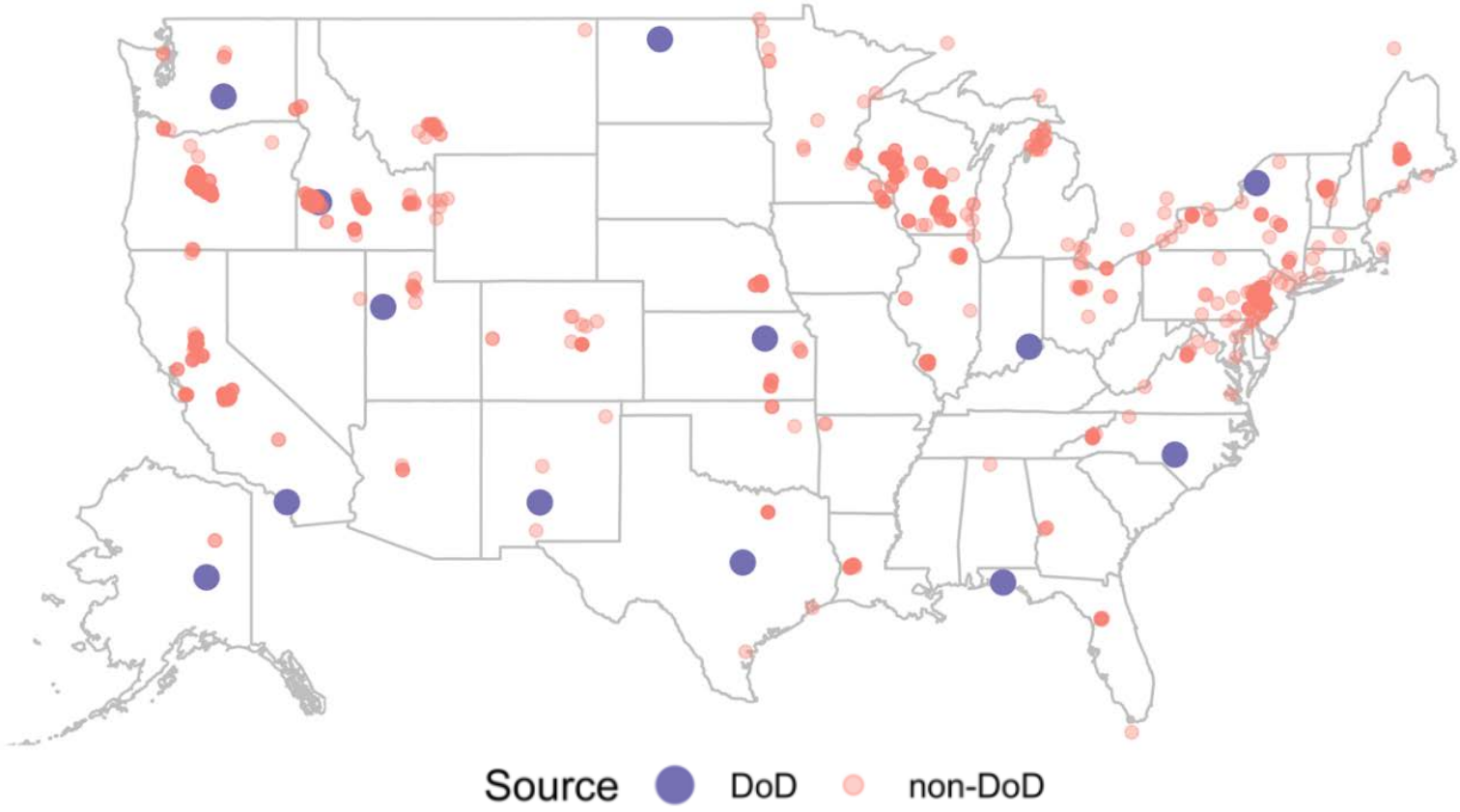
Network Composition



Results: Monitoring

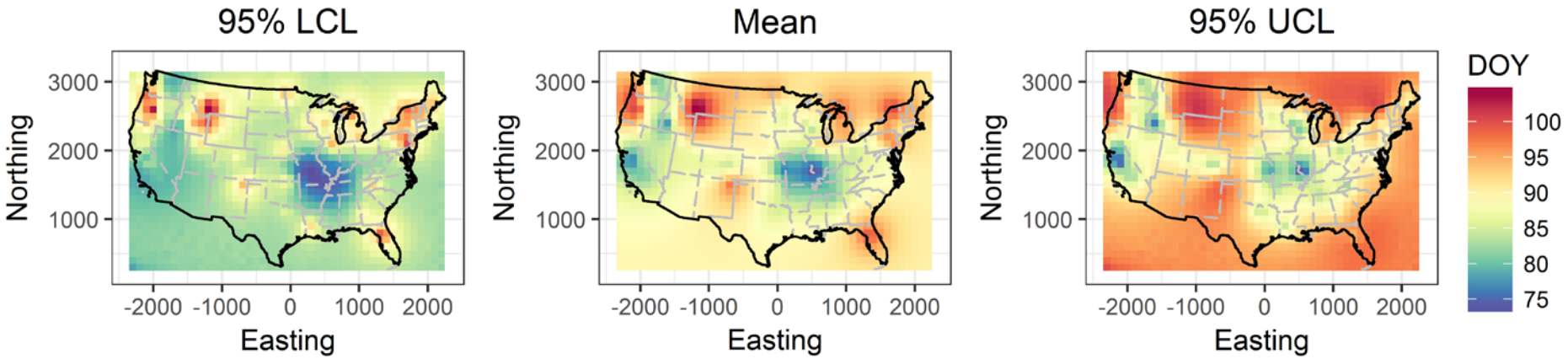


Results: Monitoring



A network approach creates a dataset at a unique spatial and temporal scale

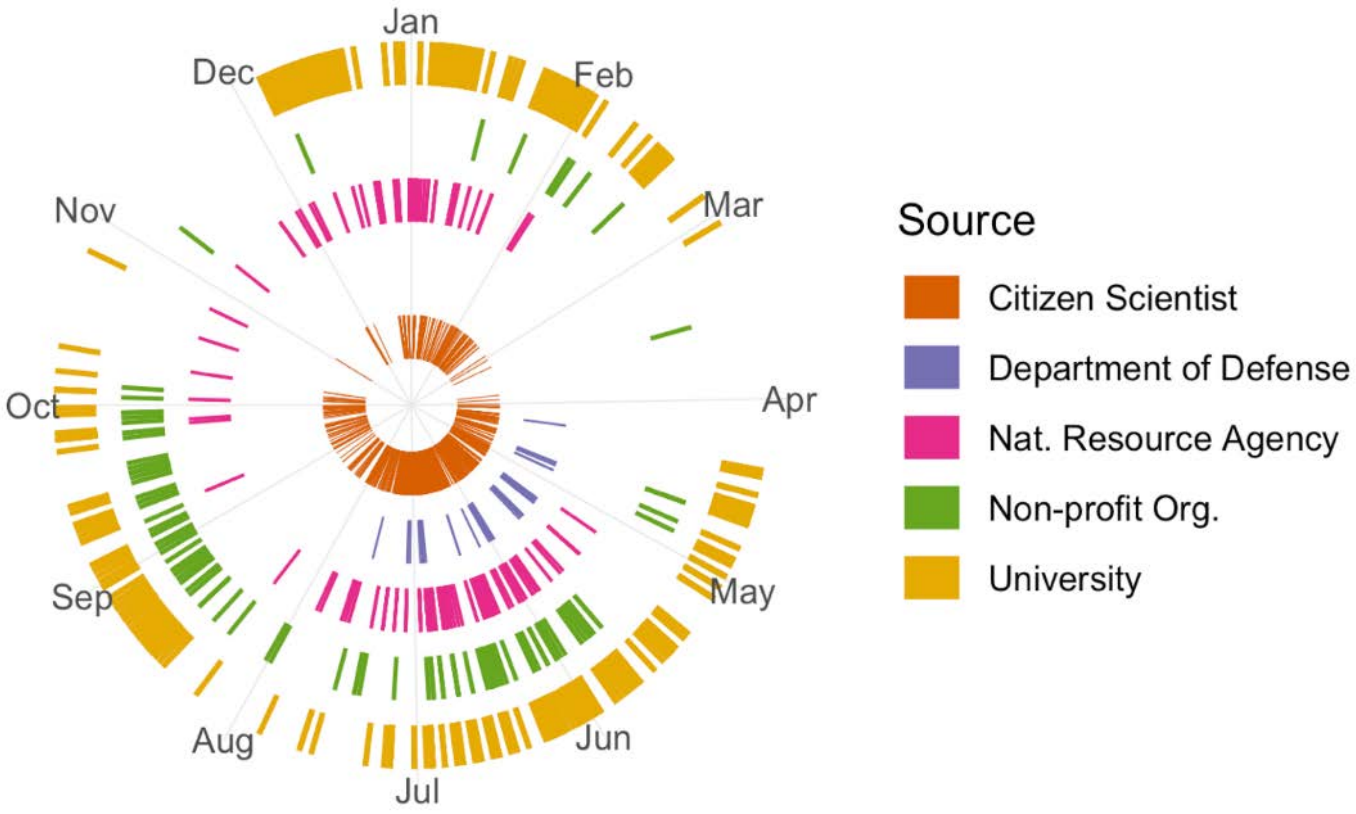
Demonstration: Breeding Phenology



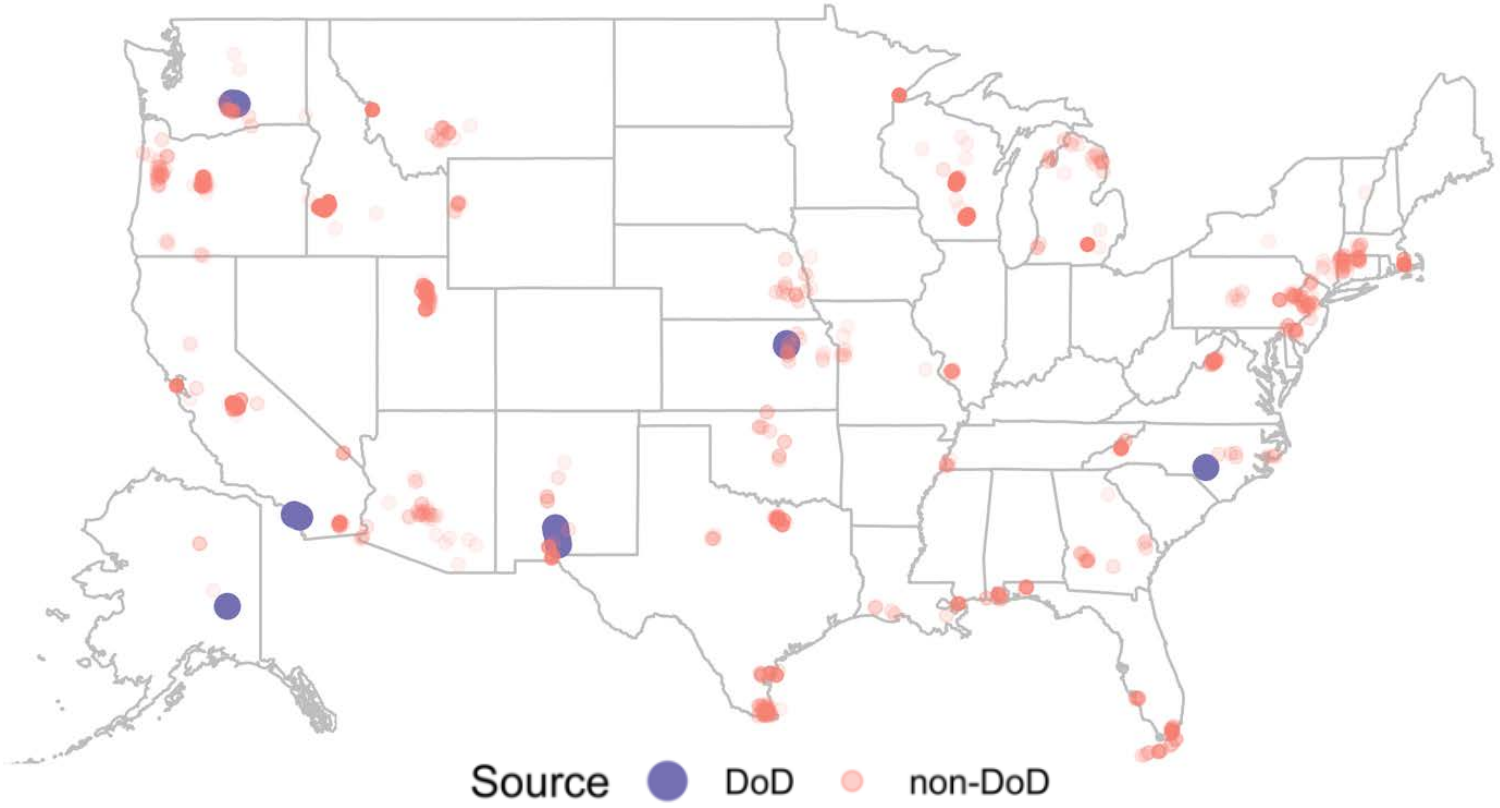
Timing of nesting correlated with start of growing seasons

Note: DOY = day of year; LCL = lower confidence limit; UCL = upper confidence limit

Results: Sampling



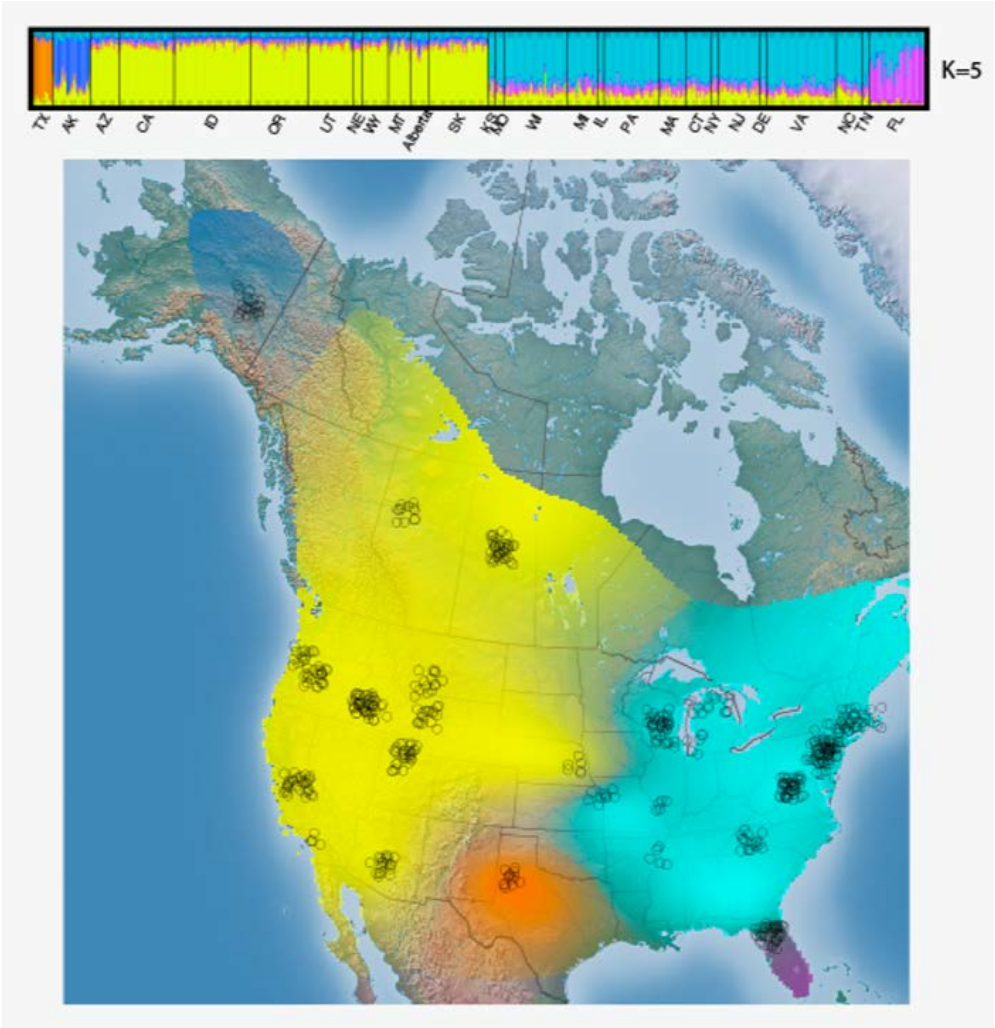
Results: Sampling



The network contributes biological samples at a unique spatial and temporal scale

Demonstration: Genoscape

- Spatially-explicit map of genetic structure in American kestrels



Note: K = genetically distinct group

Network Maintenance

- Important to have personnel to:
  - Manage permit applications and reports
  - Maintain personal communication and social media

Conclusions

- Full annual cycle research necessary to understand climate change effects
  - Challenging for migratory animals
- One approach: Large-scale network of partners
  - Demonstrated contributions to monitoring and sampling across the annual cycle of American Kestrels

Benefits to DoD

- Address research needs on appropriate scale and scope
  - Informs models for forecasting (next presentation)
- Support the objectives of the DoD Coordinated Bird Monitoring Plan
- Leverage other projects to inform species management on DoD lands
- Build relationship for collaboration on other projects

Partners

US Army Corps of Engineers

UCLA
Institute of the
Environment and
Sustainability

GOLDEN GATE
RAPTOR
OBSERVATORY

MONTCLAIR STATE
UNIVERSITY

For additional information, please visit

https://www.serdp-estcp.org/Program-Areas/Resource-Conservation-and-Resiliency/Infrastructure-Resiliency/Vulnerability-and-Impact-Assessment/RC-2702

Speaker Contact Information

julieheath@boisestate.edu; 208-426-3208

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Q&A Session 1

Full Annual Cycle Framework for Forecasting Species Responses to Climate Change

Jason Winiarski
Boise State University

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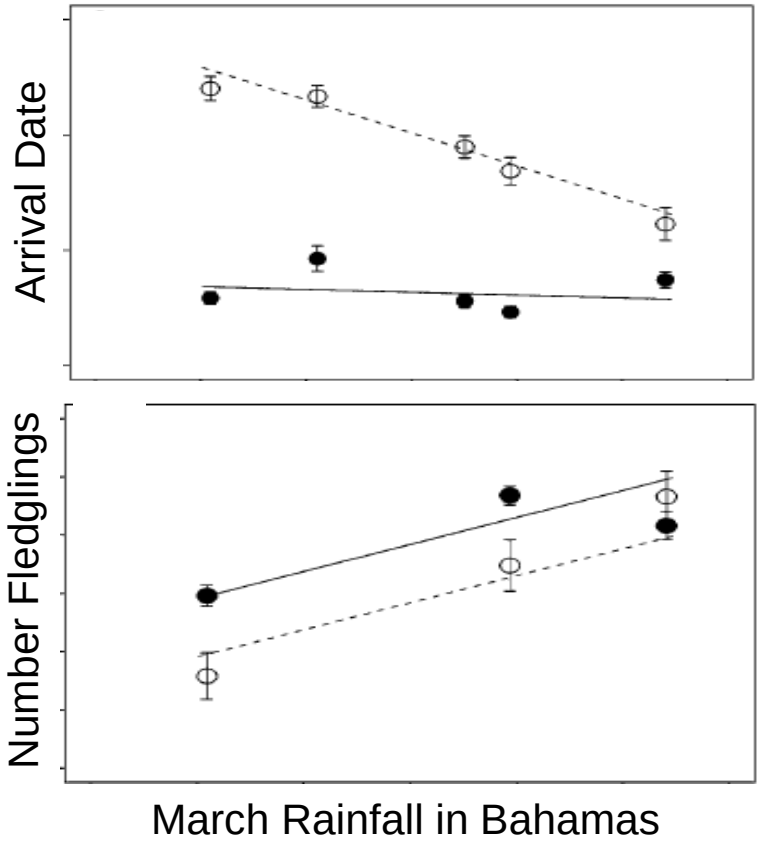
Agenda

- Need for phenology model framework
- Project objectives
- Demonstration of a full cycle model
- Overview of the SCOPE model
- Conclusions
- Benefits to DoD

Note: SCOPE = Simulation of Carry-Over Effects on Phenology

Migratory Birds

Adaptations to Climate Change



Source: Rockwell et al., 2012

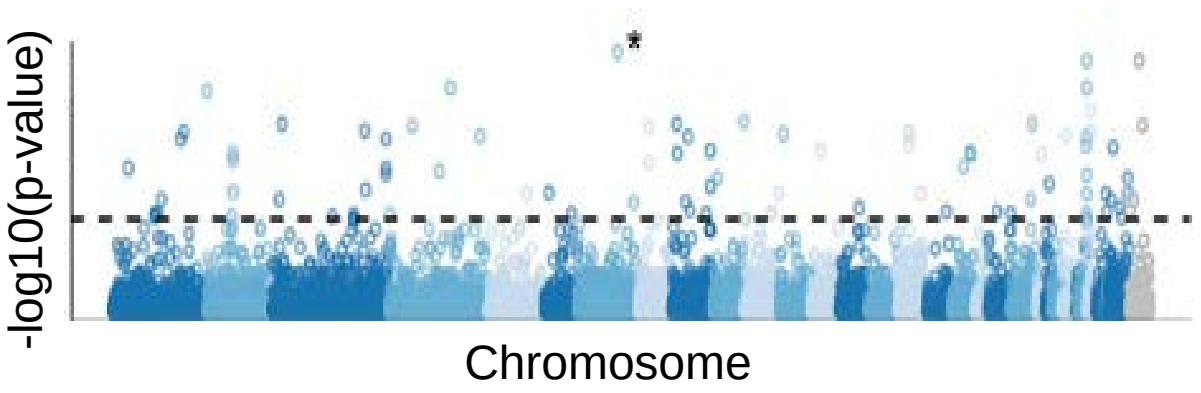
Climate influences biology year-round; effects carry-over to different seasons

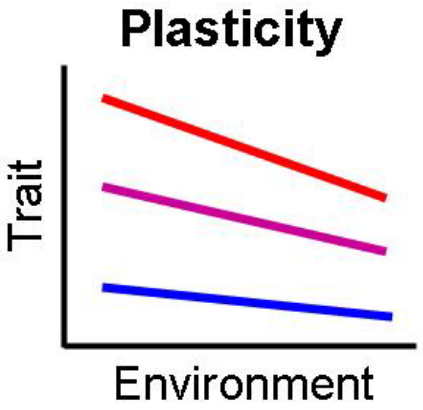
Challenges to Annual Cycle Approach

- Data from single-season studies
- Many species difficult to track across:
  - Seasons
  - Vast geographic areas
- Events beyond installation boundaries
- Unable to manipulate field conditions

Challenge of Integration

- Response to climate change also likely depends on:
  - Genetic variation
    - Population-level changes over generations
  - Phenotypic plasticity
    - Individual-level response over lifetime





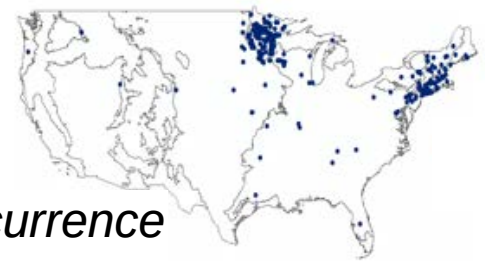
Current Approaches

Species Distribution Models

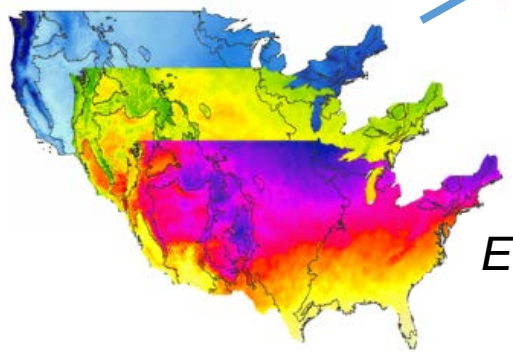
Data Collection

Modeling

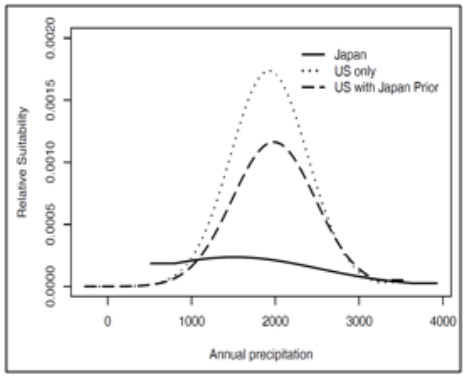
Prediction Map



Occurrence Data



Environmental Data



Mechanisms shaping responses often lacking
Ignore seasonal interactions

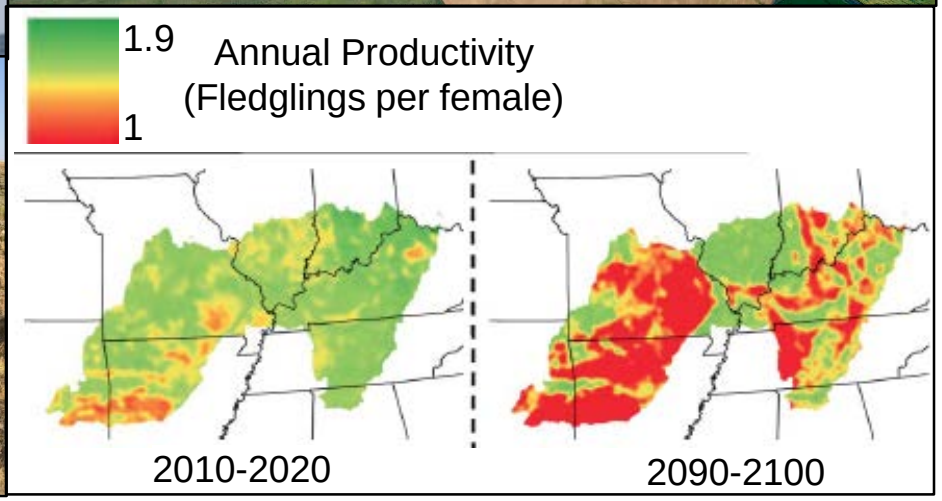
Figure credit: New York Invasive Species Research Institute

What is an Individual-Based Model?

- Simulated individuals interact with one another and virtual environment
- Decisions made to maximize fitness
- Basic ecological rules lead to emergent, complex patterns
- Allow for manipulative ‘experiments’

Note: IBM – Individual-Based Model

IBM Applications

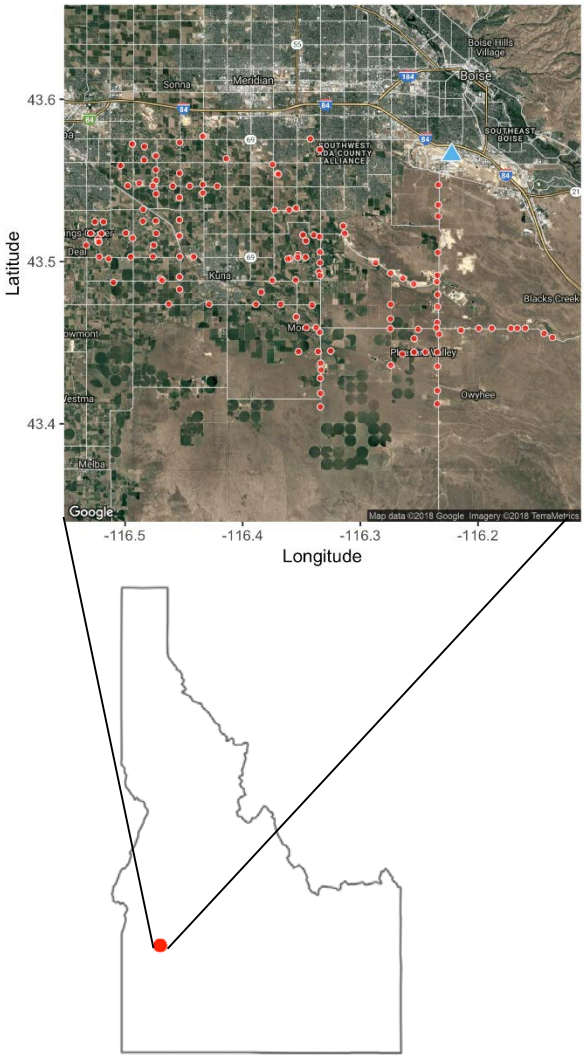


Project Objectives

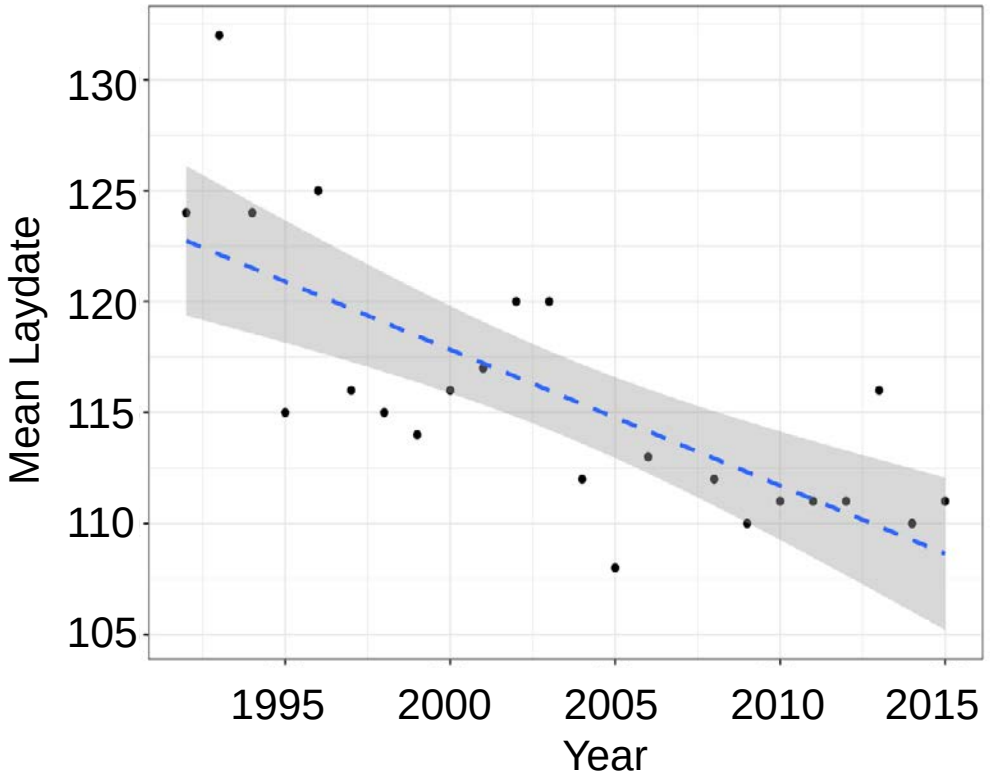
- Develop full annual cycle IBM for the American kestrel
- Test mechanisms underlying phenological shifts
- Forecast future climate change impacts
- Apply IBM to DoD species of conservation concern

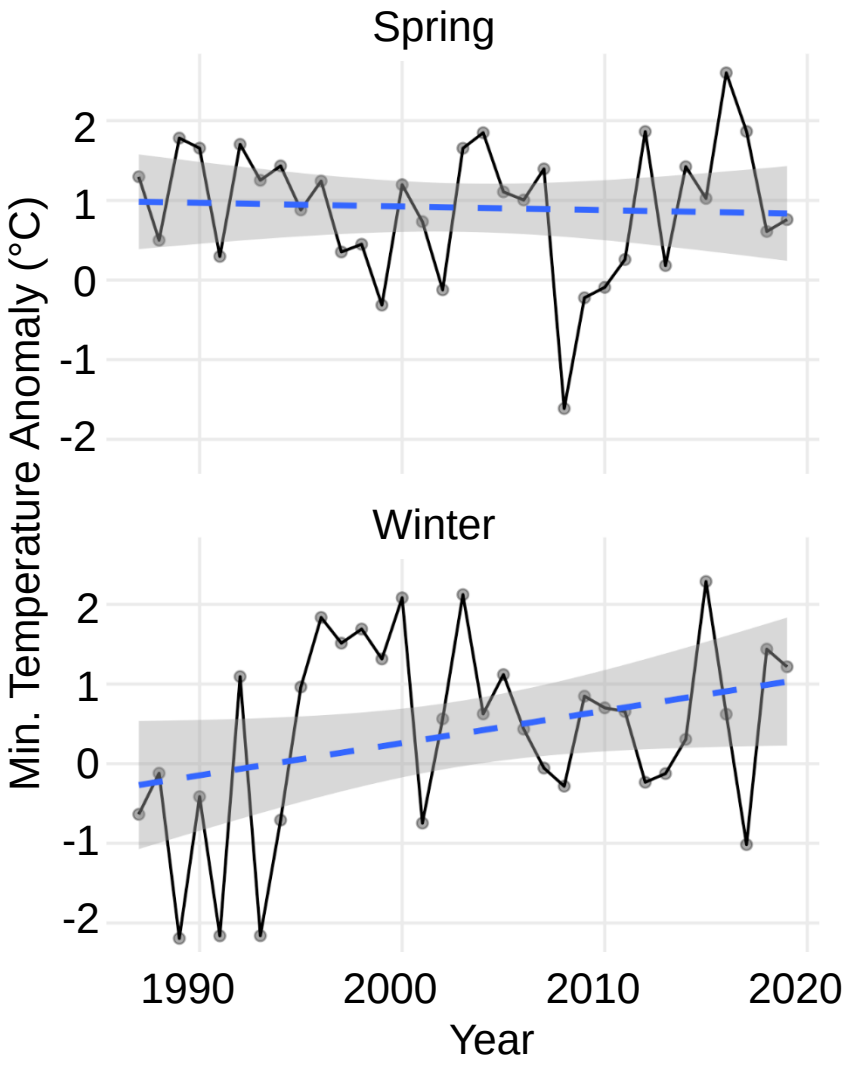
Case Study

Kestrels in Southwest Idaho



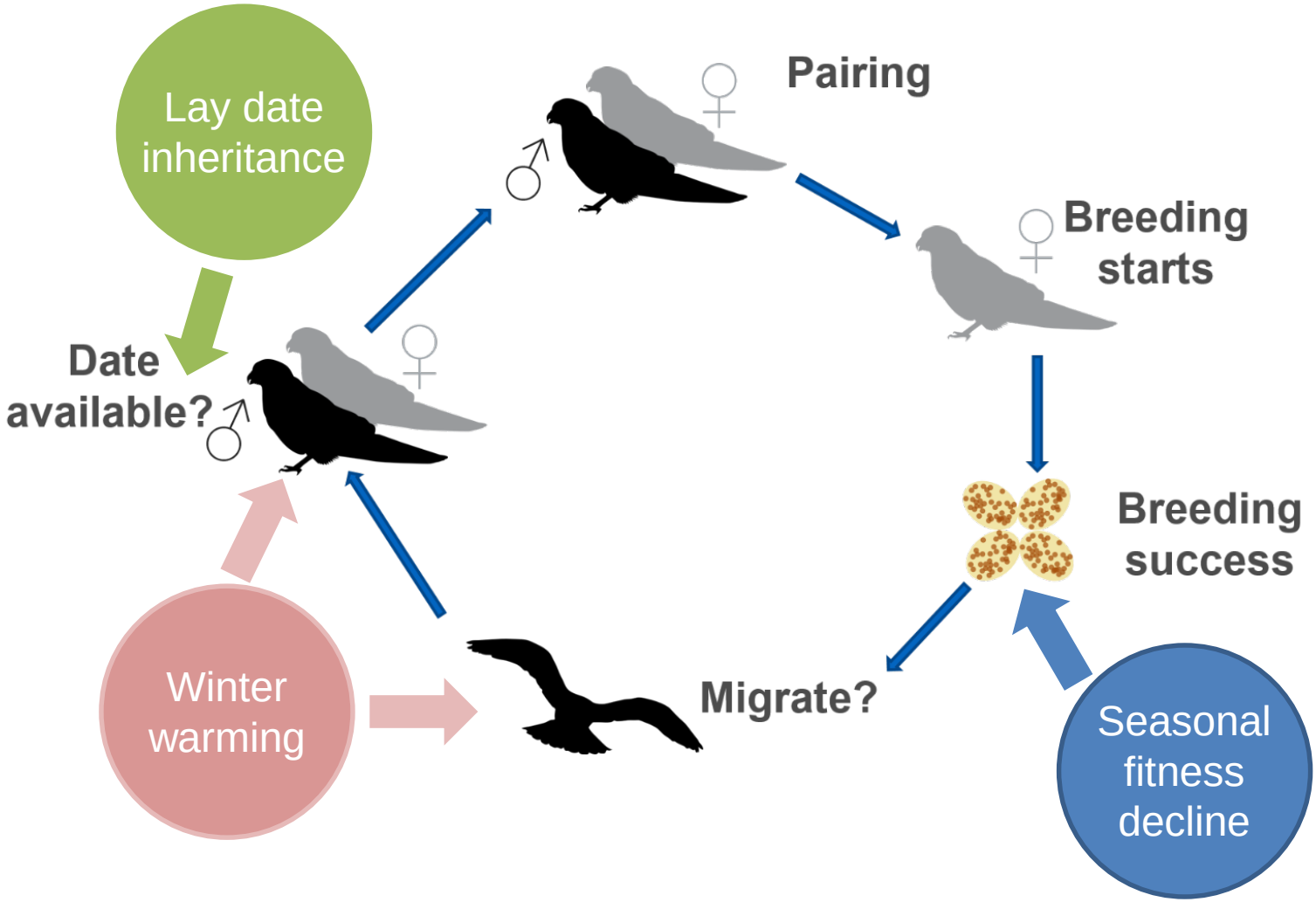
Advancing Laydates and Winter Warming?



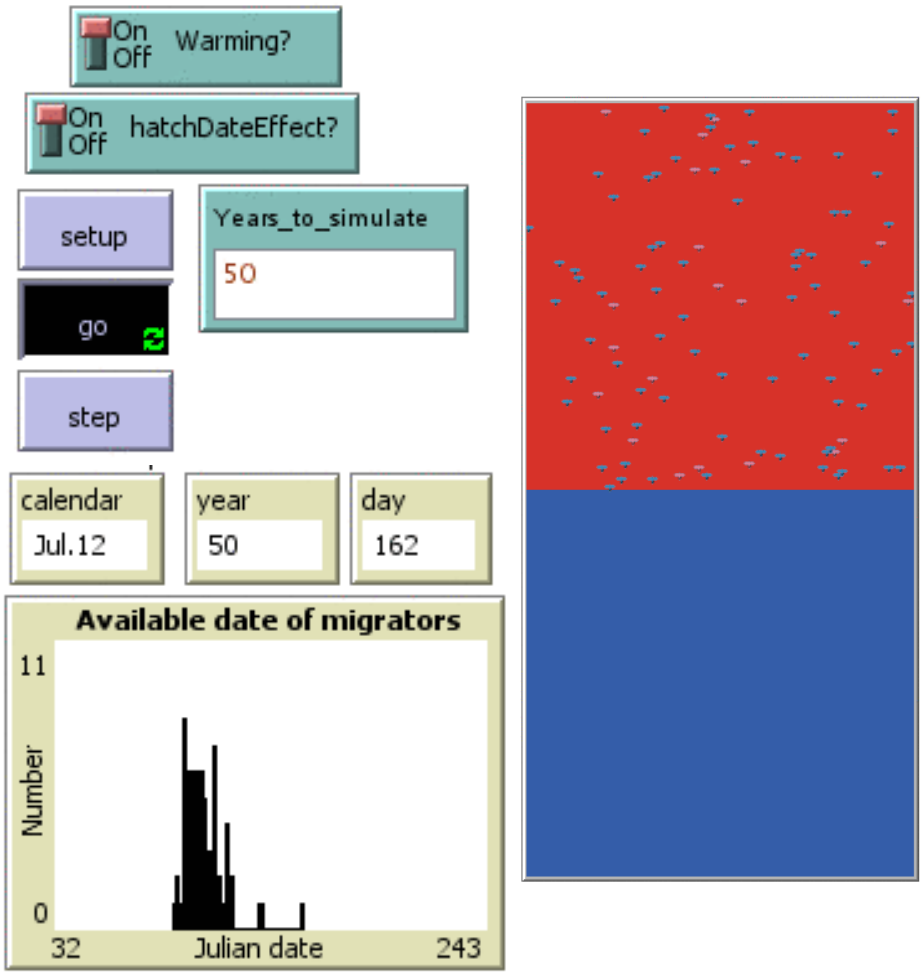


Note: °C = degrees Celsius

Testing Mechanisms Underlying Shifts

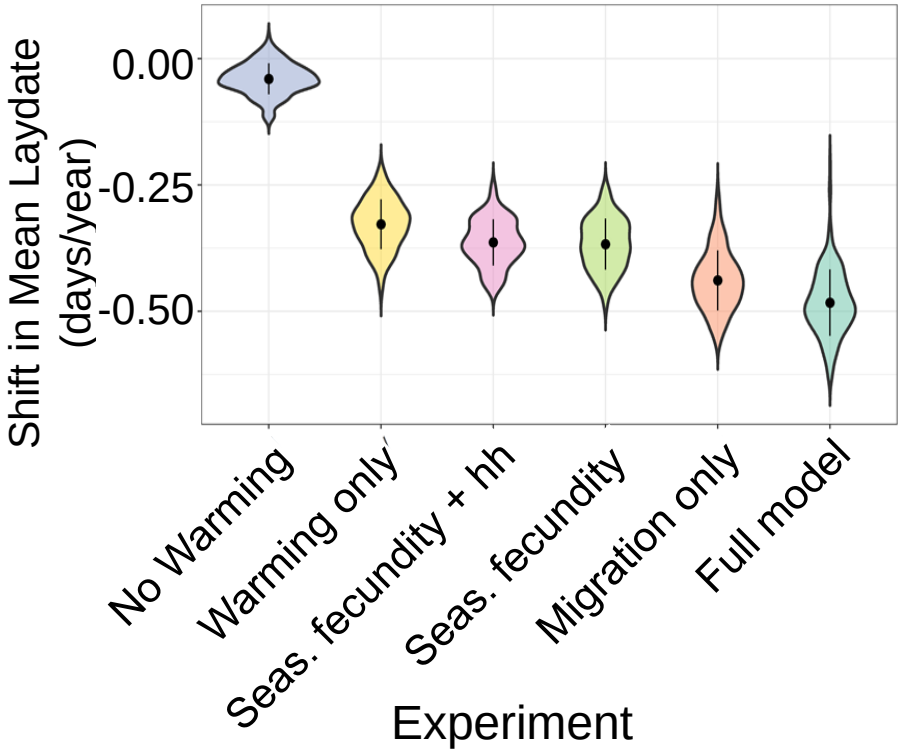


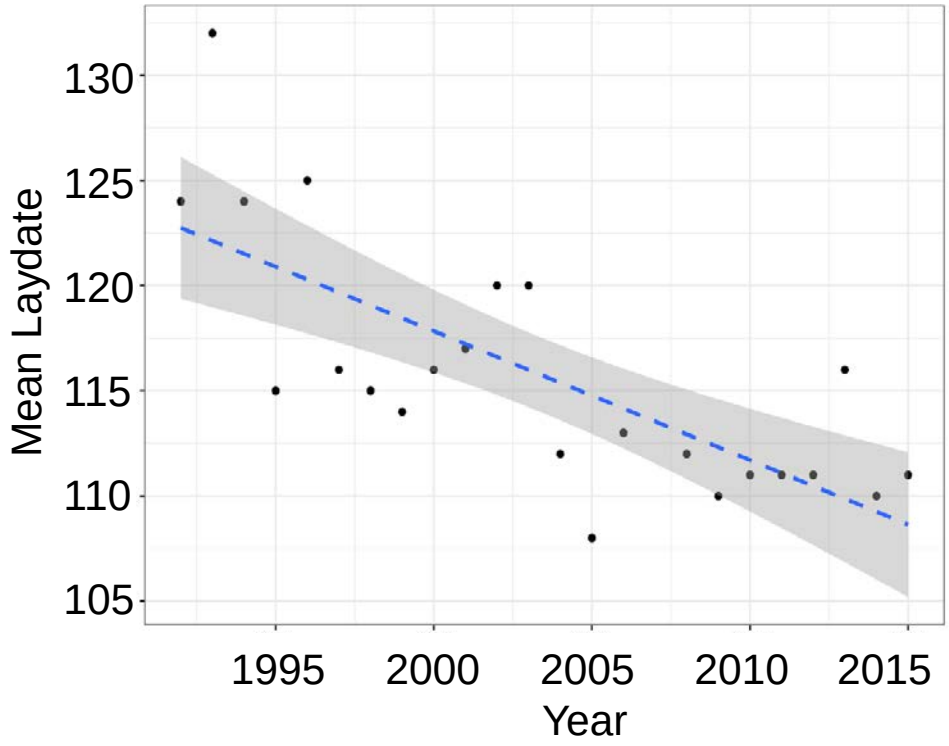
Kestrel IBM in NetLogo



- Other Data
  - Date of non-migrators
  - Migration distance
  - Hatch date
  - Nest date
  - Origin mating proportion
  - Strategy mating proportion
  - Etc…

Results





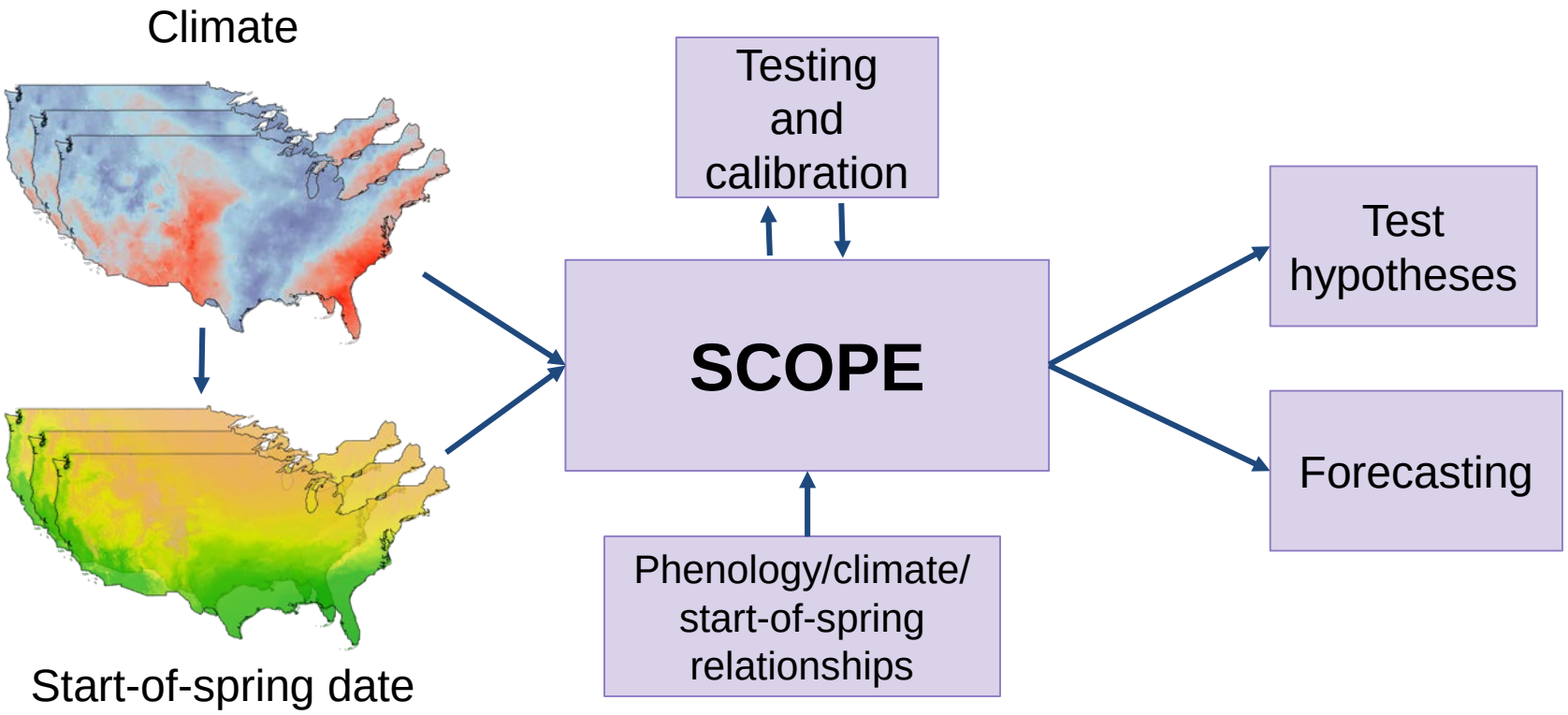
Warming winters release former constraints that drive advancement in laydate

Note: hh = high heritability

Scaling up our Full Cycle IBM

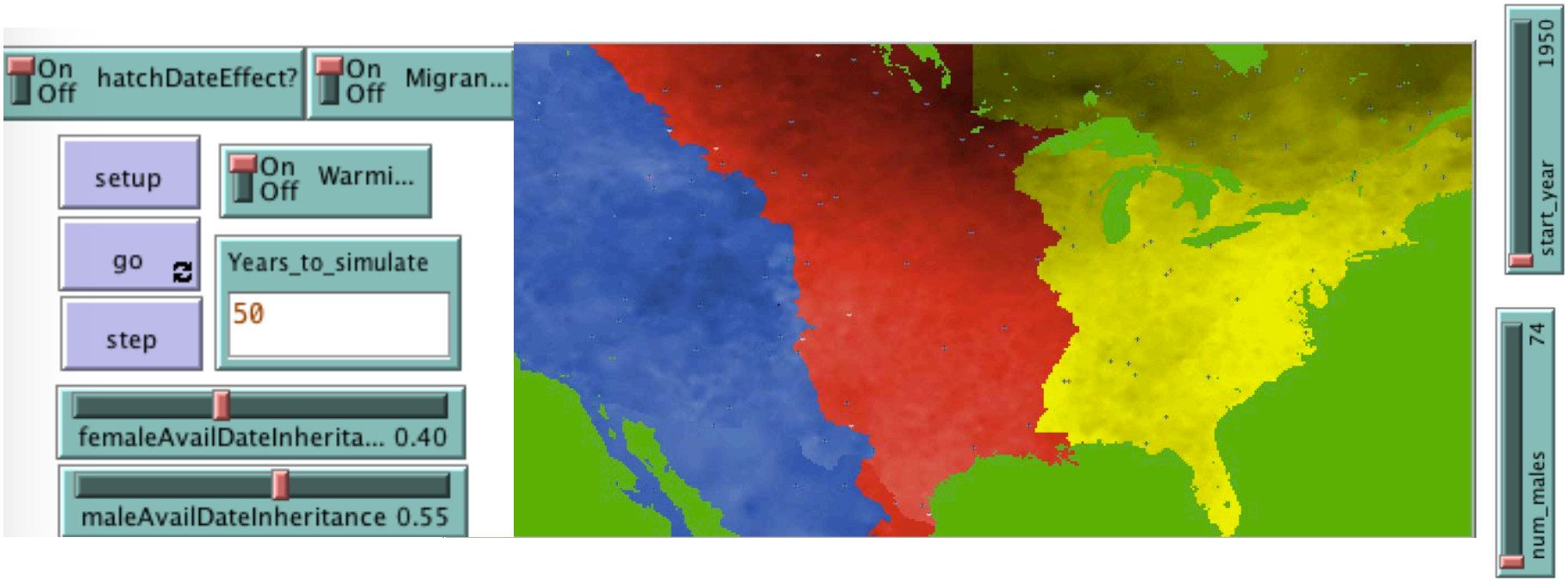
Note: Red circles represent DoD study sites

Overview of SCOPE



Next Steps

- Simulating populations across flyways



Conclusions

- Tools to realistically forecast population responses to climate change
  - Benefit to DoD managers
- Individual-based models
  - Help identify mechanisms underlying phenology shifts and forecast changes
- Better understand which species and populations can shift their timing

Benefits to DoD

- Forecasting tool for DoD Mission-sensitive Species
- Identify species with potential to constrain military training and readiness
- IBMs can inform more cost-efficient and effective management



Acknowledgments

- Dr. Ben Pauli
  - St. Mary's University of Minnesota
- Anjolene Hunt, Katie Callery, Hanna McCaslin
  - Boise State University
- HawkWatch International, The Peregrine Fund, UCLA, Environmental Laboratory
  - US Army Corps of Engineers
- DoD Natural Resources Managers!
- DoD Partners in Flight
- Images - Creative Commons license (unless otherwise noted)

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Speaker Contact Information

jasonwiniarski@u.boisestate.edu; 401-965-7030

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Q&A Session 2

The next webinar is on October 17, 2019

Managing Aqueous Film Forming Foam (AFFF) Impacts to Subsurface Environments and Assessment of Commercially Available Fluorine-Free Foams

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Survey Reminder

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