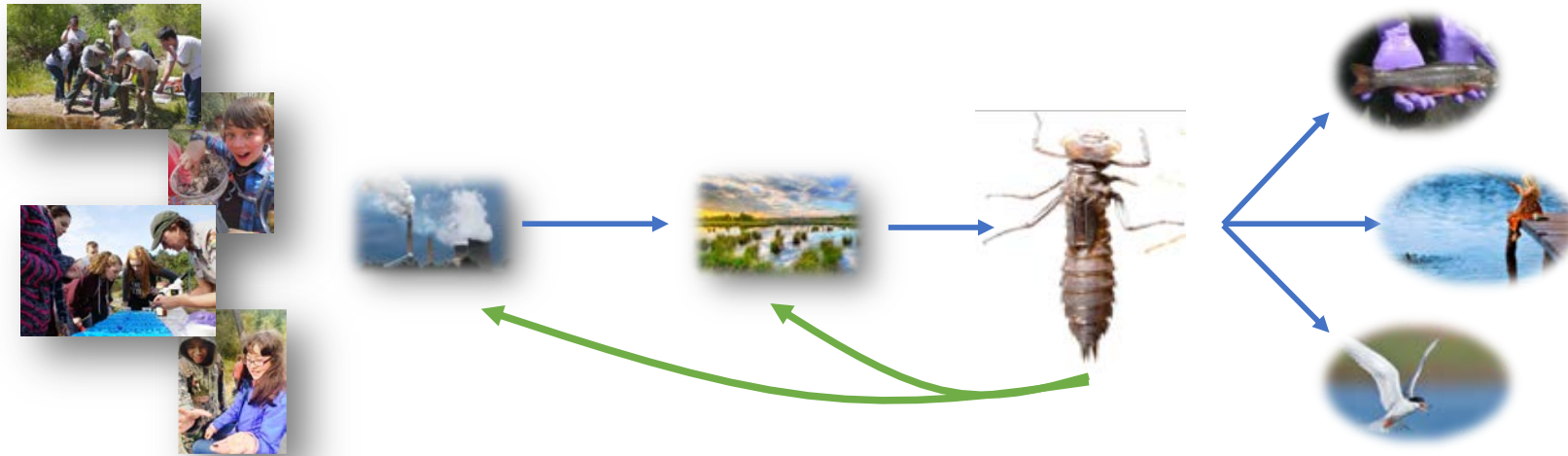


# The Dragonfly Mercury Project



A national-scale community science program for monitoring mercury risk to ecosystem and human health



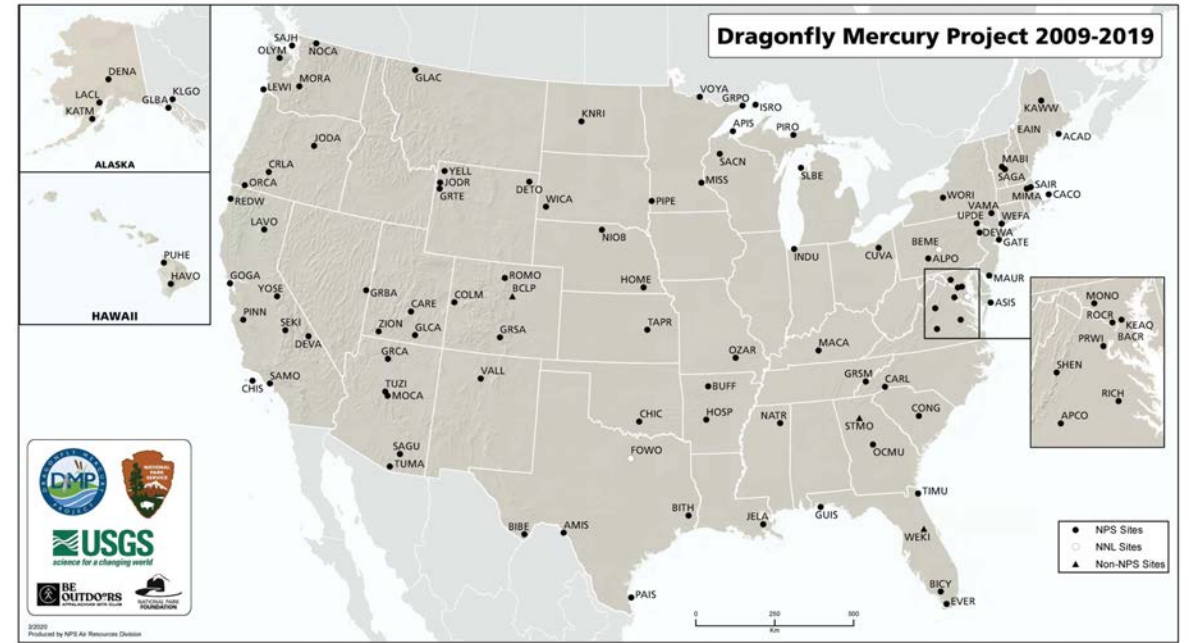
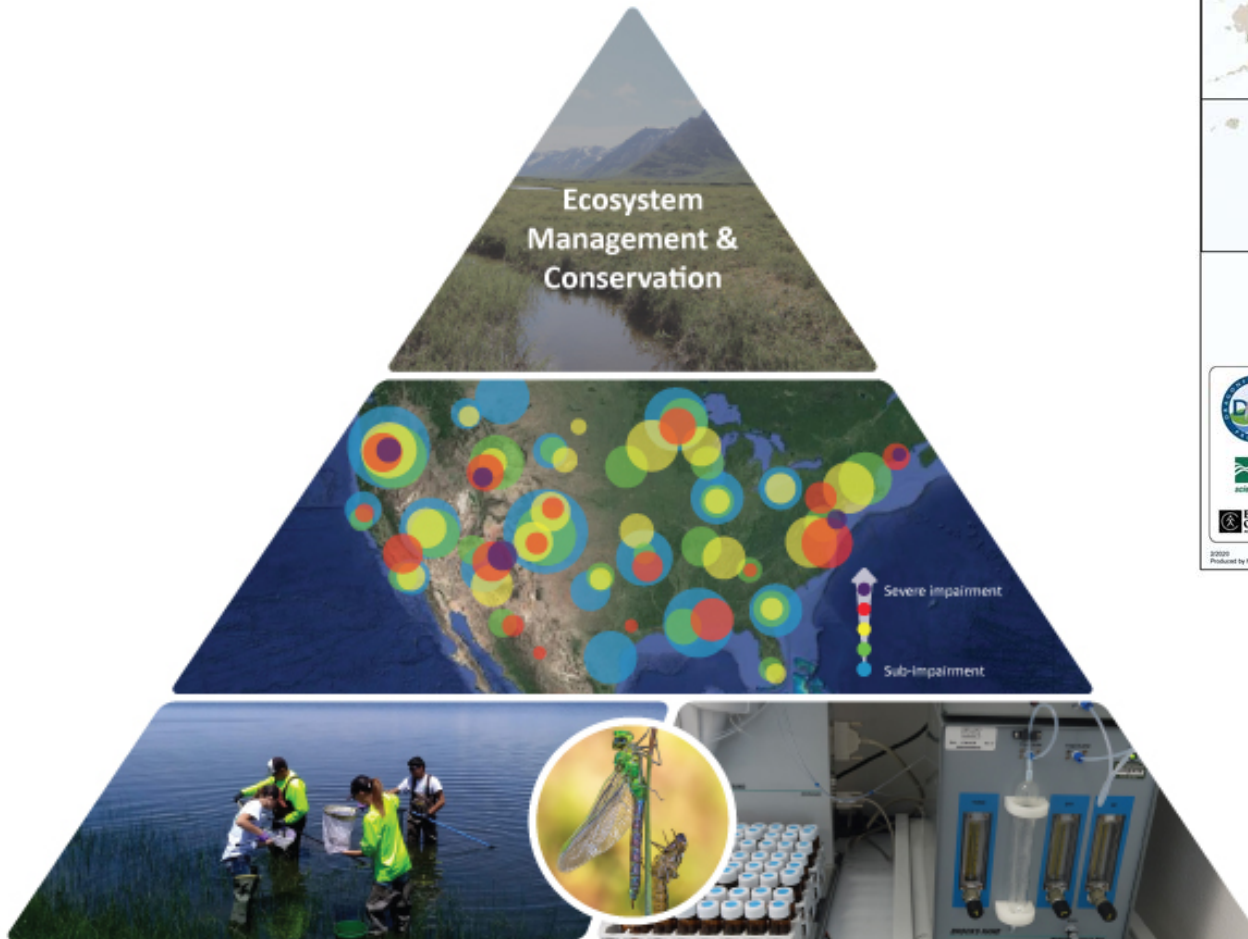
Collin Eagles-Smith, USGS Forest and Rangeland Ecosystem Science Center

Colleen Flanagan Pritz<sup>1</sup>, Sarah Nelson<sup>2</sup>, James Willacker<sup>3</sup>, Dave Krabbenhoft<sup>3</sup>, Celia Chen<sup>4</sup>

<sup>1</sup>National Park Service, <sup>2</sup>Appalachian Mountain Club, <sup>3</sup>US Geological Survey; <sup>4</sup>Dartmouth University

# The Dragonfly Mercury Project

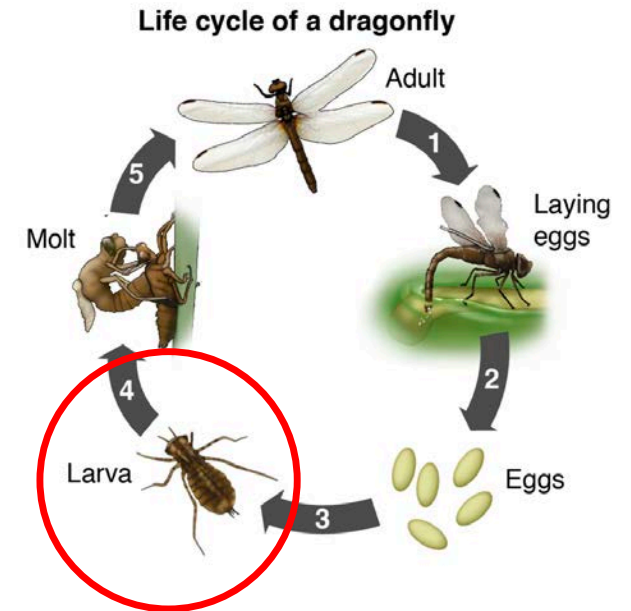
-A citizen/community science program for monitoring mercury in the environment-



The Dragonfly Mercury Project is a landscape-scale surveillance study that links scientific efforts to understand the risks of mercury pollution with public engagement and management actions.

# Dragonfly larvae as biological mercury indicators

- High site fidelity
- Common and widespread
  - Most freshwater habitats
  - 6 continents
- Can inform fishless waters
- Link in food web
  - Voracious predator
  - Common fish prey
  - Vector to terrestrial habitats
- High %MeHg
- Large body size
- Easily sampled





## Dragonfly Mercury Project: Goals

- Increase the understanding of mercury (Hg) contamination across the US using dragonfly larvae as biosentinels
- Engage citizen scientists in the collection of dragonfly larvae, and enhance science literacy
- Inform resource management decisions





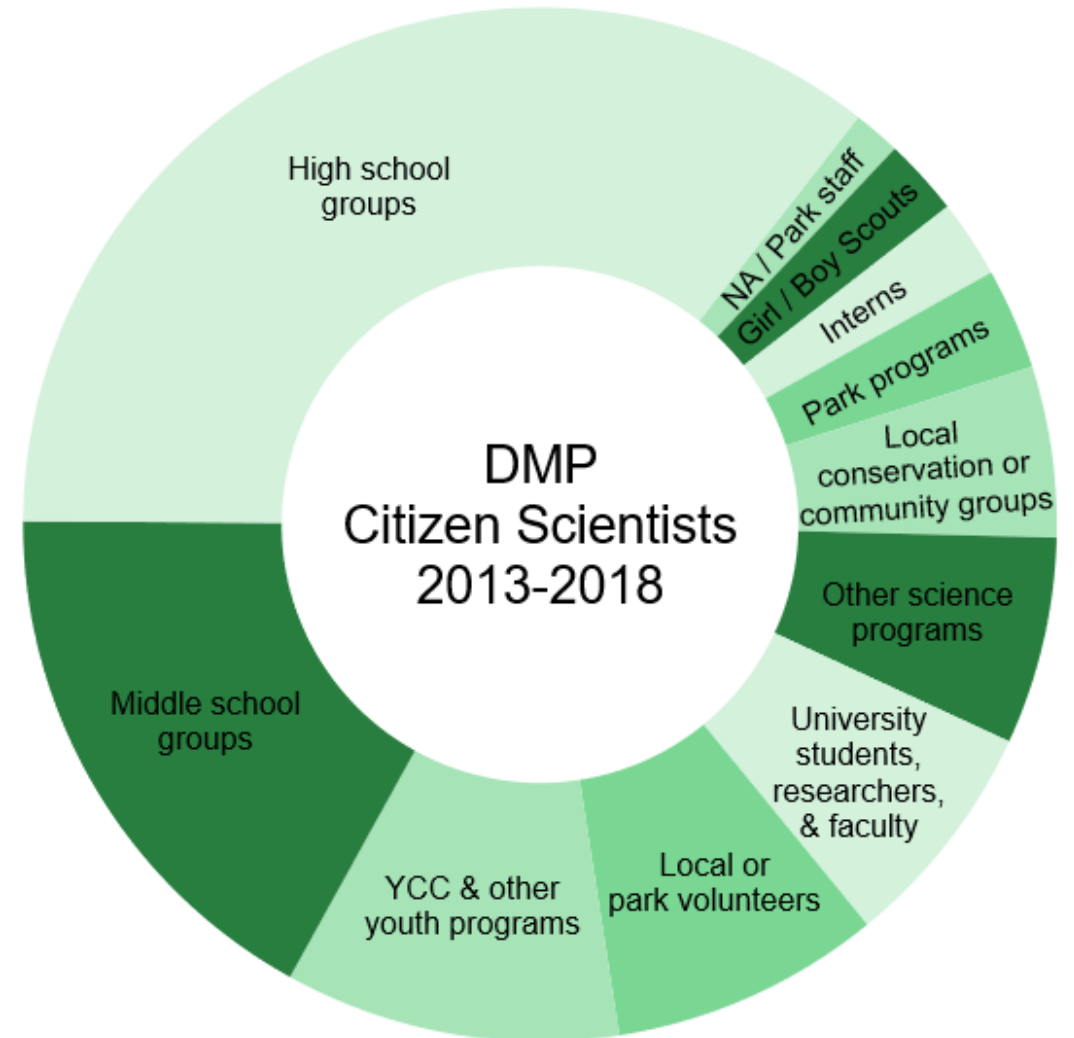
# Program Design





# Public Participants contribute to the Project's Success

Nearly *two-thirds* of the DMP citizen scientists are *youth*!





# COMMUNITY ENGAGEMENT: GIRL SCOUTS

GLEN CANYON NRA – AZ



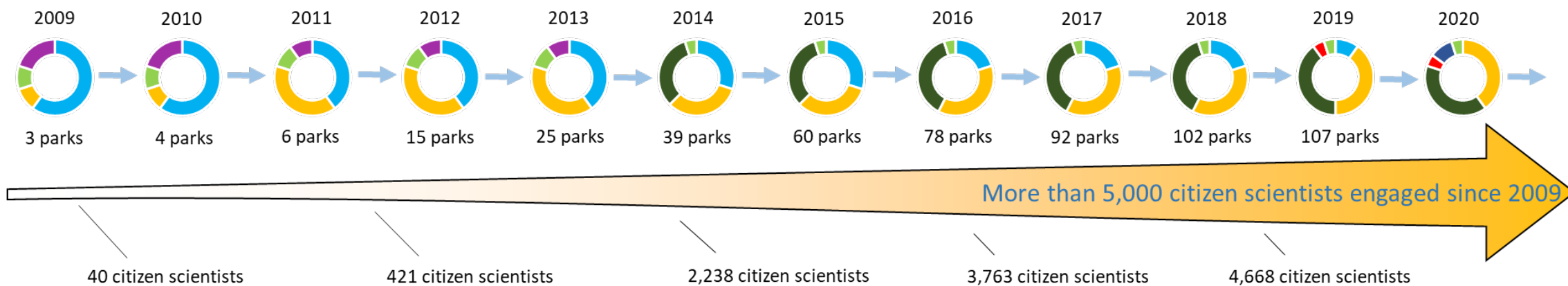




# COMMUNITY ENGAGEMENT: URBAN GROUNDWORKS

SHENANDOAH NP – VA





■ UMaine 
 ■ NPS 
 ■ USGS 
 ■ NPF 
 ■ AMC 
 ■ Dartmouth 
 ■ Schoodic



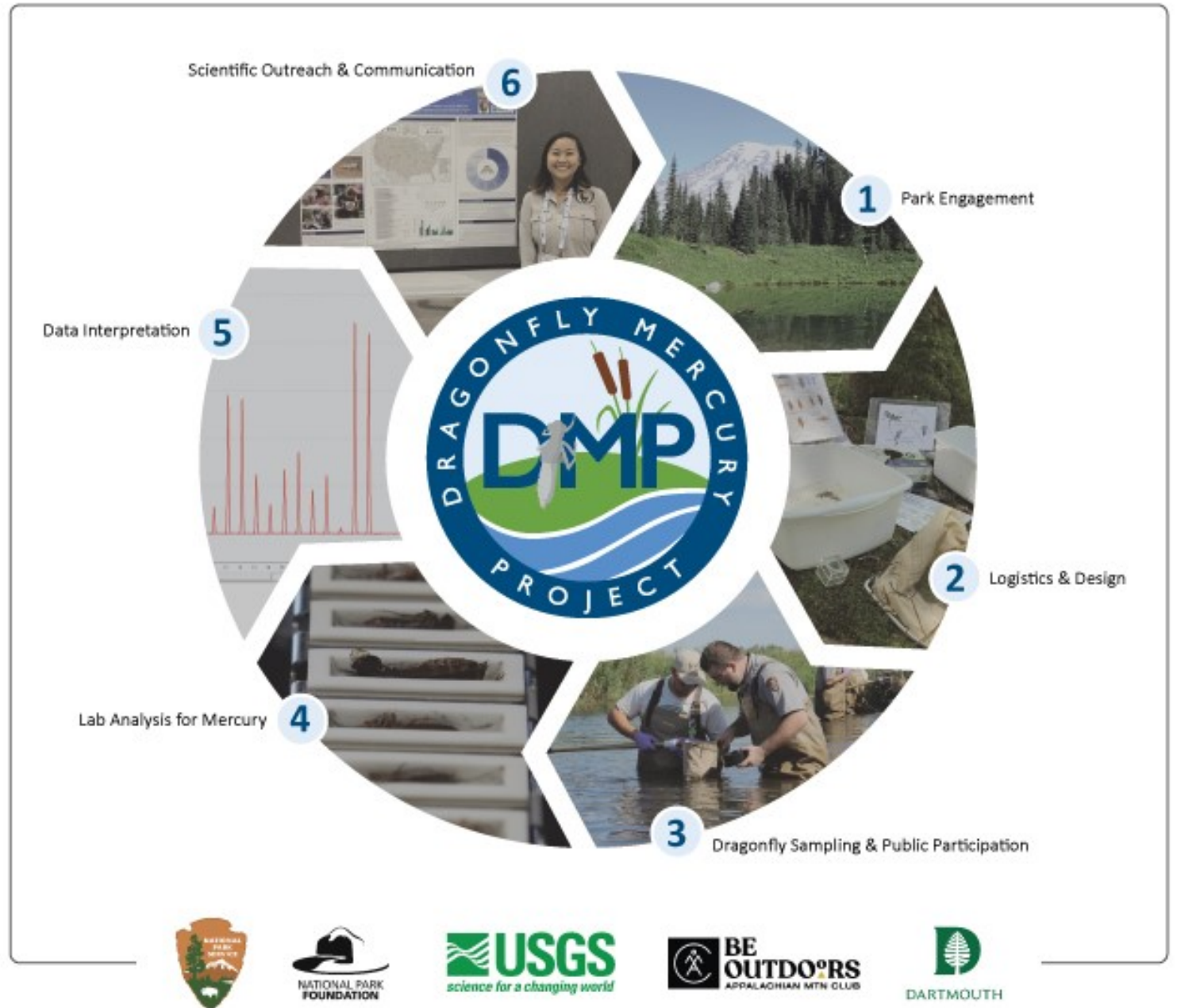
# Developmental Timeline

Demonstrates growth in citizen engagement and partnership institutions over time.



# DMP Process and Information Flow Pathways

*Each step communicates directly with all the others to produce robust data products for science applications, resource management, and community education.*





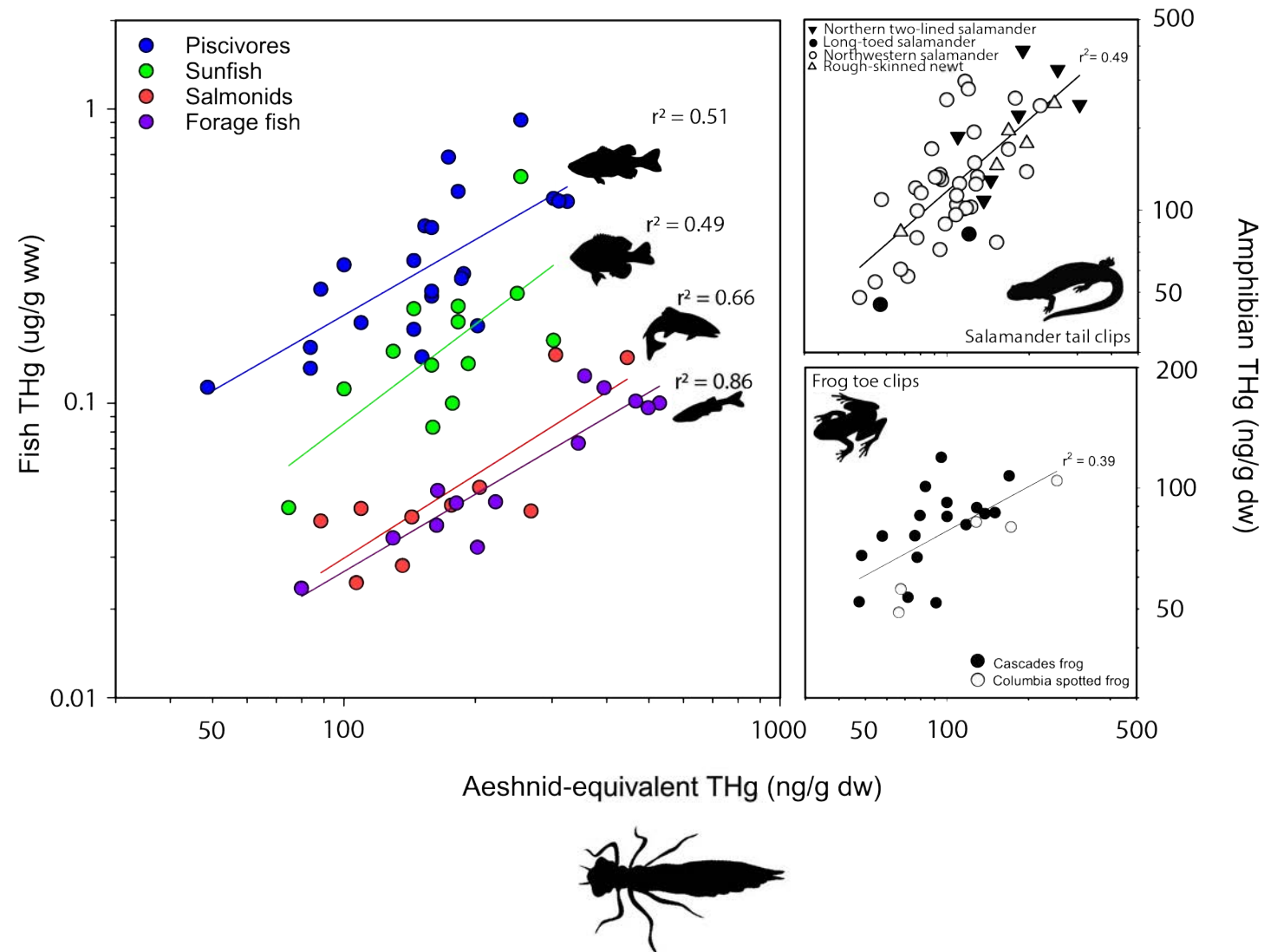
# A National-Scale Assessment of Mercury Bioaccumulation in United States National Parks Using Dragonfly Larvae As Biosentinels through a Citizen-Science Framework

Collin A. Eagles-Smith,<sup>\*</sup> James J. Willacker, Sarah J. Nelson, Colleen M. Flanagan Pritz, David P. Krabbenhoft, Celia Y. Chen, Joshua T. Ackerman, Evan H. Campbell Grant, and David S. Pilliod

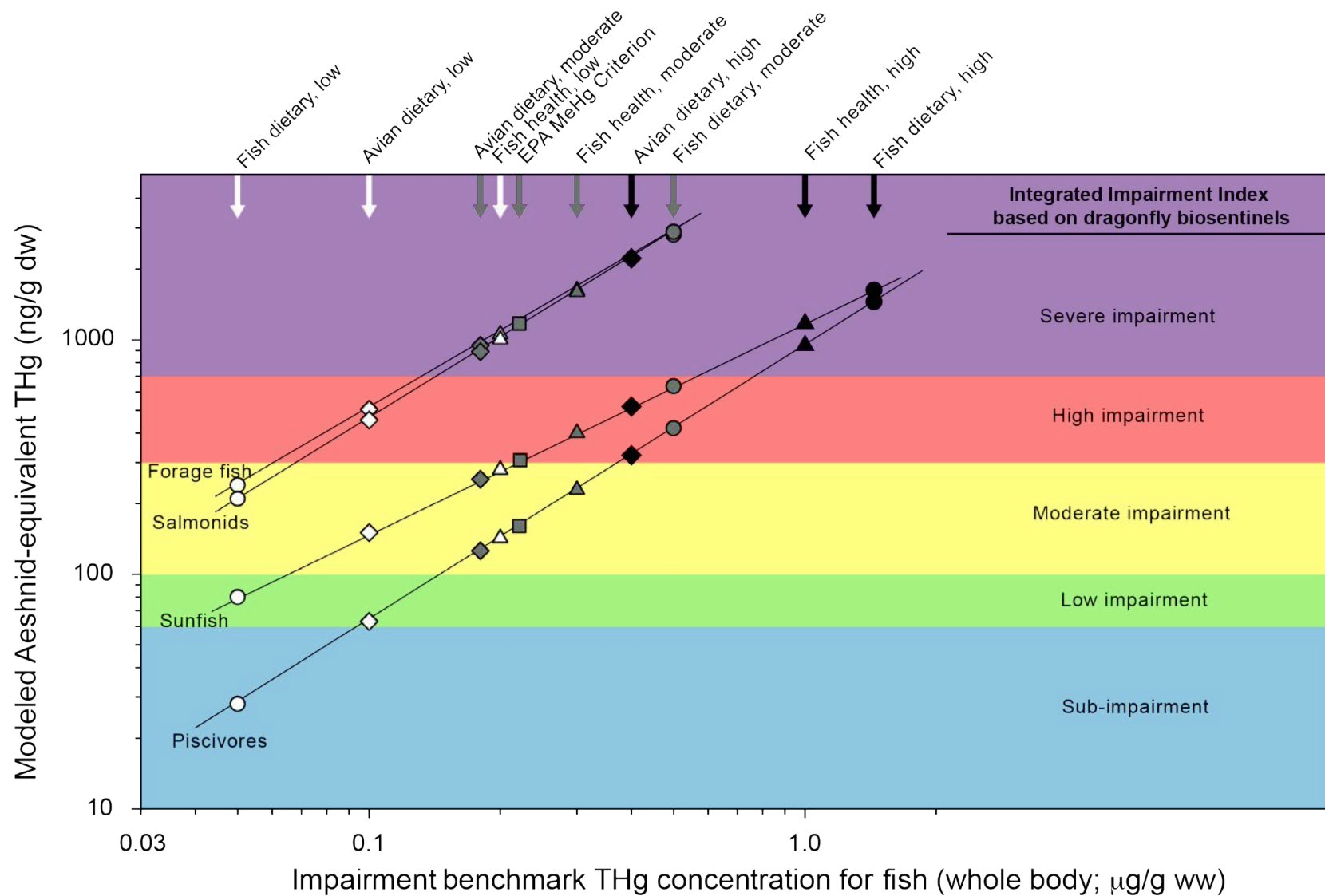




# Dragonfly Hg correlated with fish and amphibian Hg

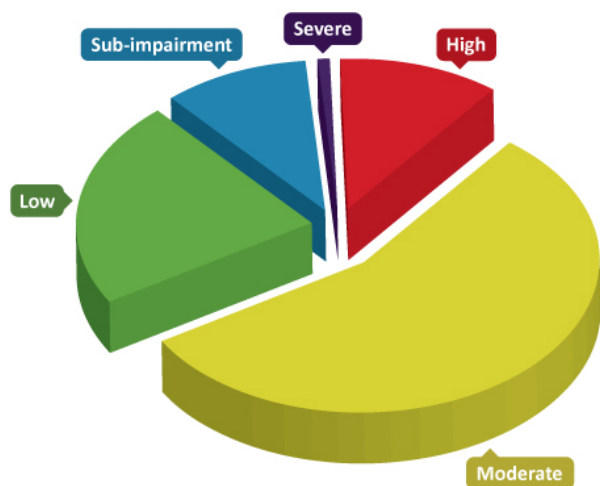


# Integrated Impairment Index

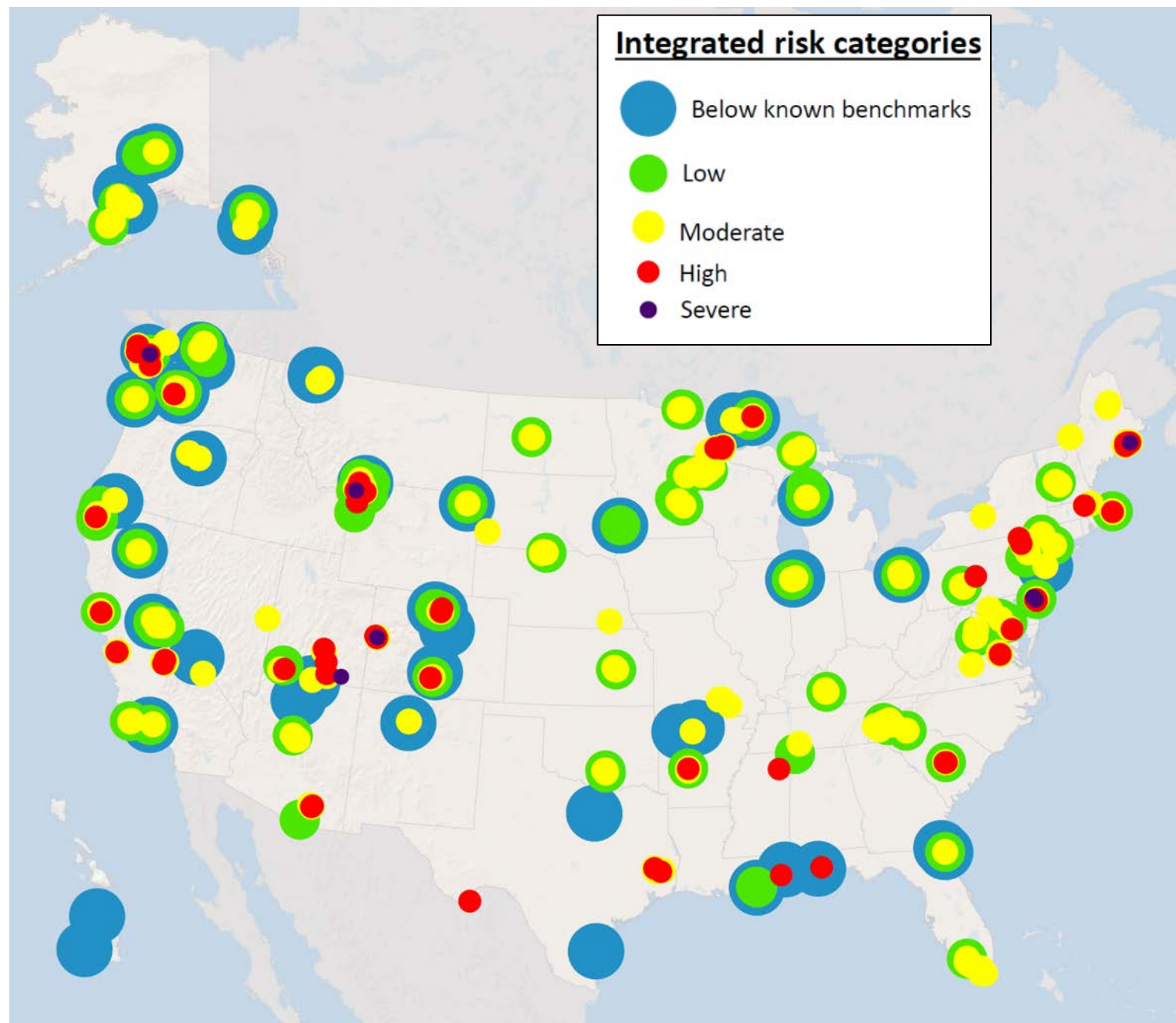




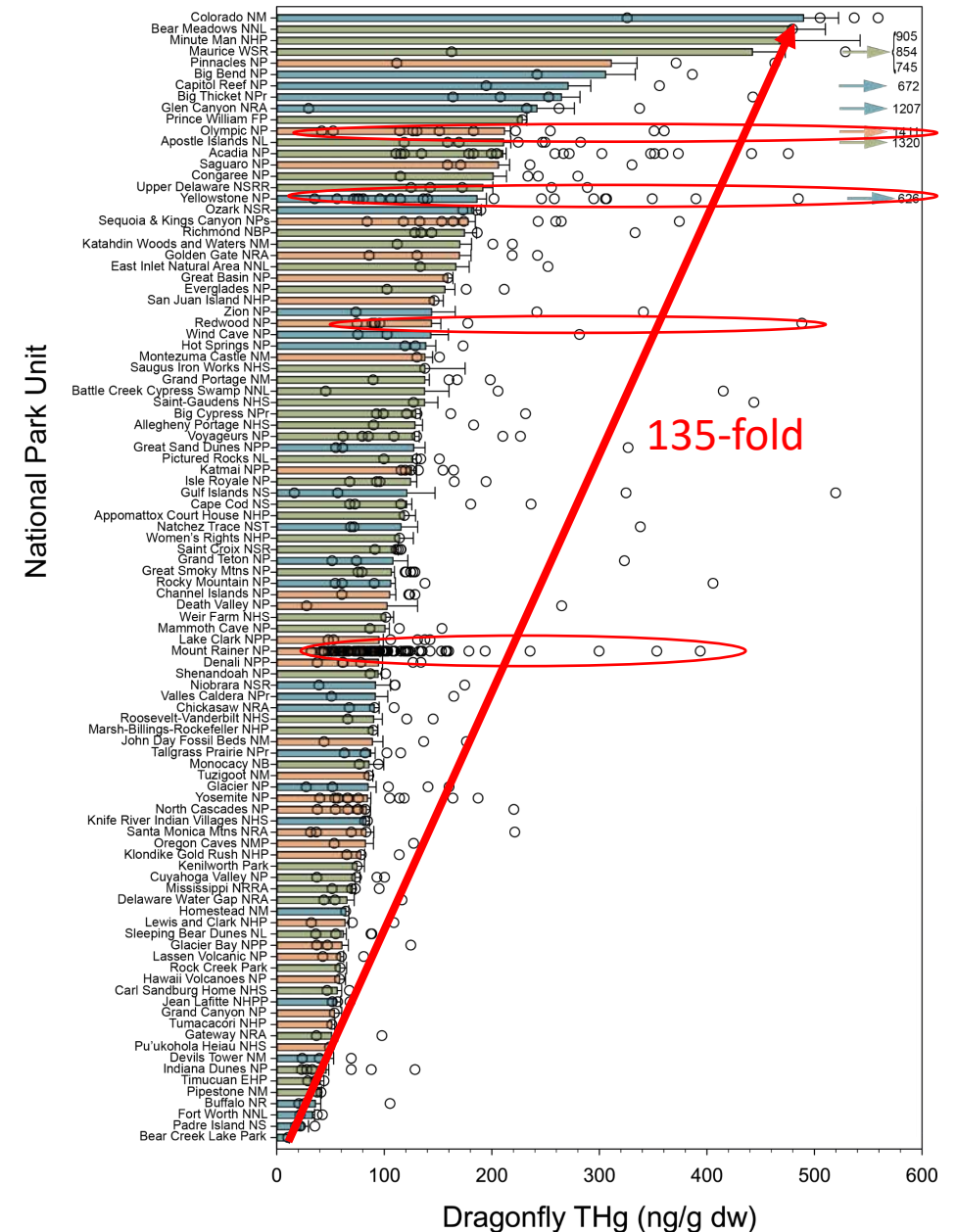
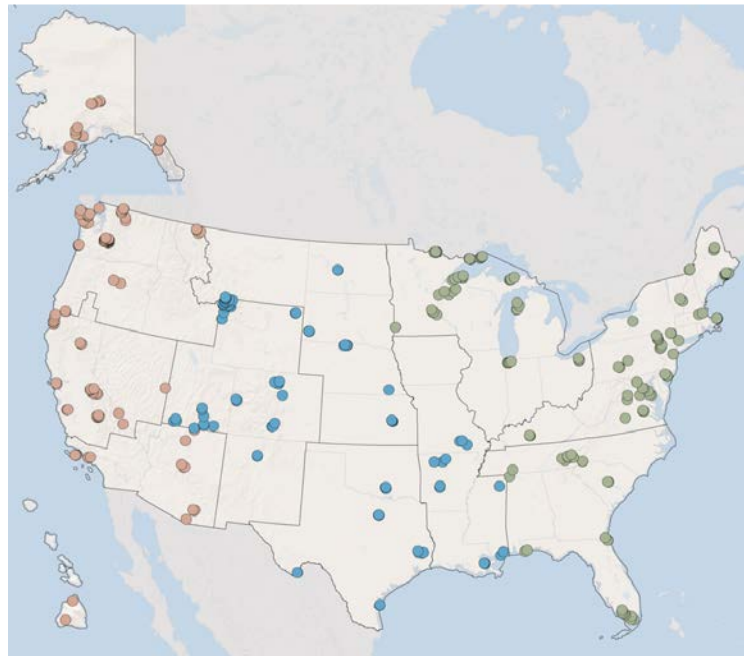
# SITE-SPECIFIC INTEGRATED HG RISK ESTIMATES



*Percentage of sample sites with dragonfly mercury concentrations that correspond with defined risk categories of ecosystem health.*

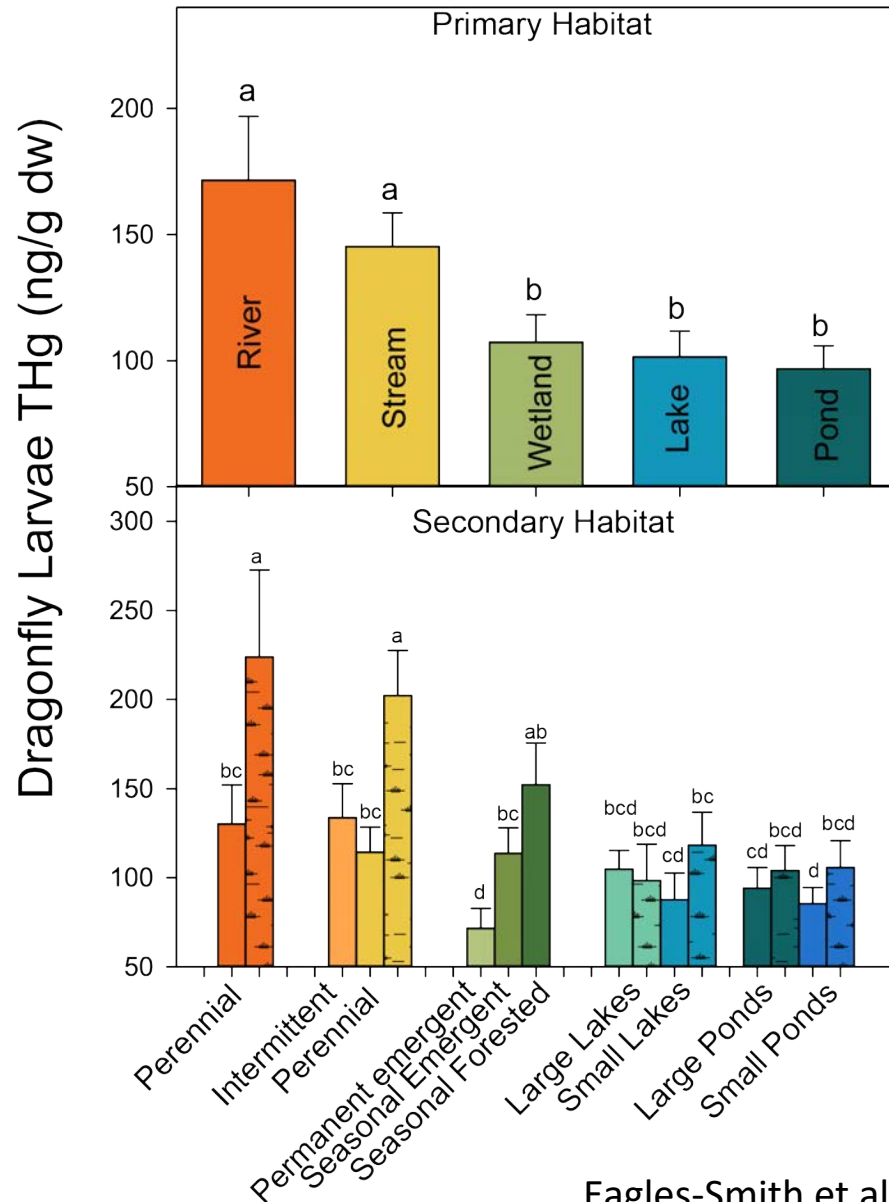


# SPATIAL VARIATION EVIDENT BOTH AMONG AND WITHIN PARKS





# Mercury variation among habitats



Eagles-Smith et al. 2020; 10.1021/acs.est.0c01255



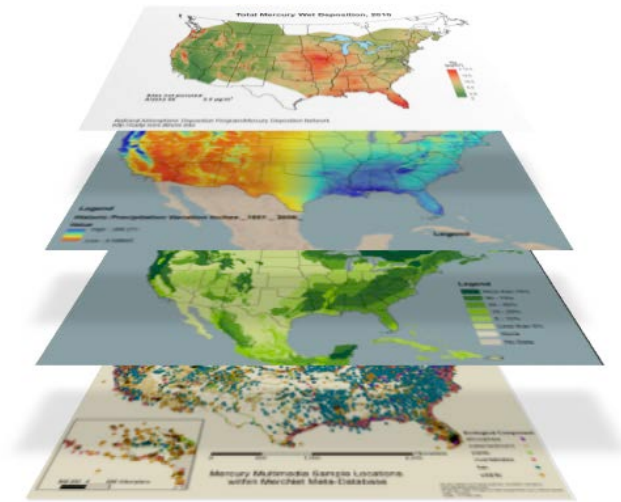
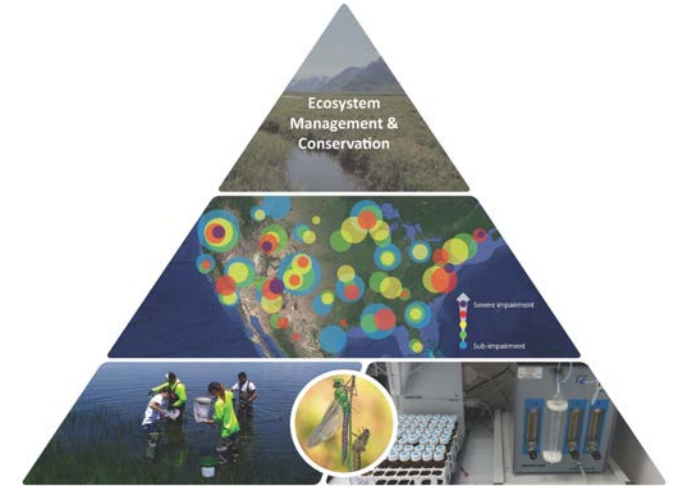
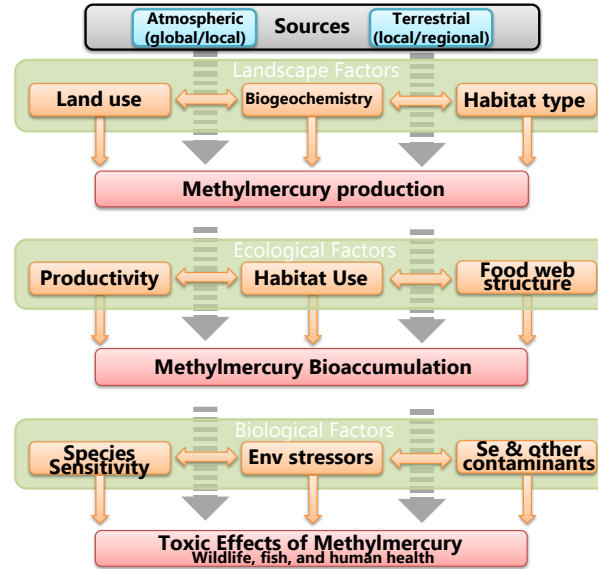
# 5 CORE ELEMENTS FOR ENGAGEMENT AND RELEVANCE





# Predictive models, quantifying drivers, informing management

- Habitat replication across the landscape
  - Site replication within habitats
- Ancillary parameters
  - Existing geospatial layers and new data collection
- Time-series at select locations





Interactive Story Map:  
<https://wim.usgs.gov/geonarrative/dmp/>

