

# National Mercury Monitoring Workshop

## Identifying and Characterizing Mercury Monitoring Sites

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# Goals

- Identify mercury monitoring sites
  - Where has sampling of mercury and related ancillary measurements occurred?
  - Focused on sites where multiple ecosystem compartments were measured (e.g., air, water, fish, sediment, etc).
- Preliminarily characterized each site based on:
  - What has been measured?
  - What siting criteria are met?
  - What are the major data gaps?

# Process

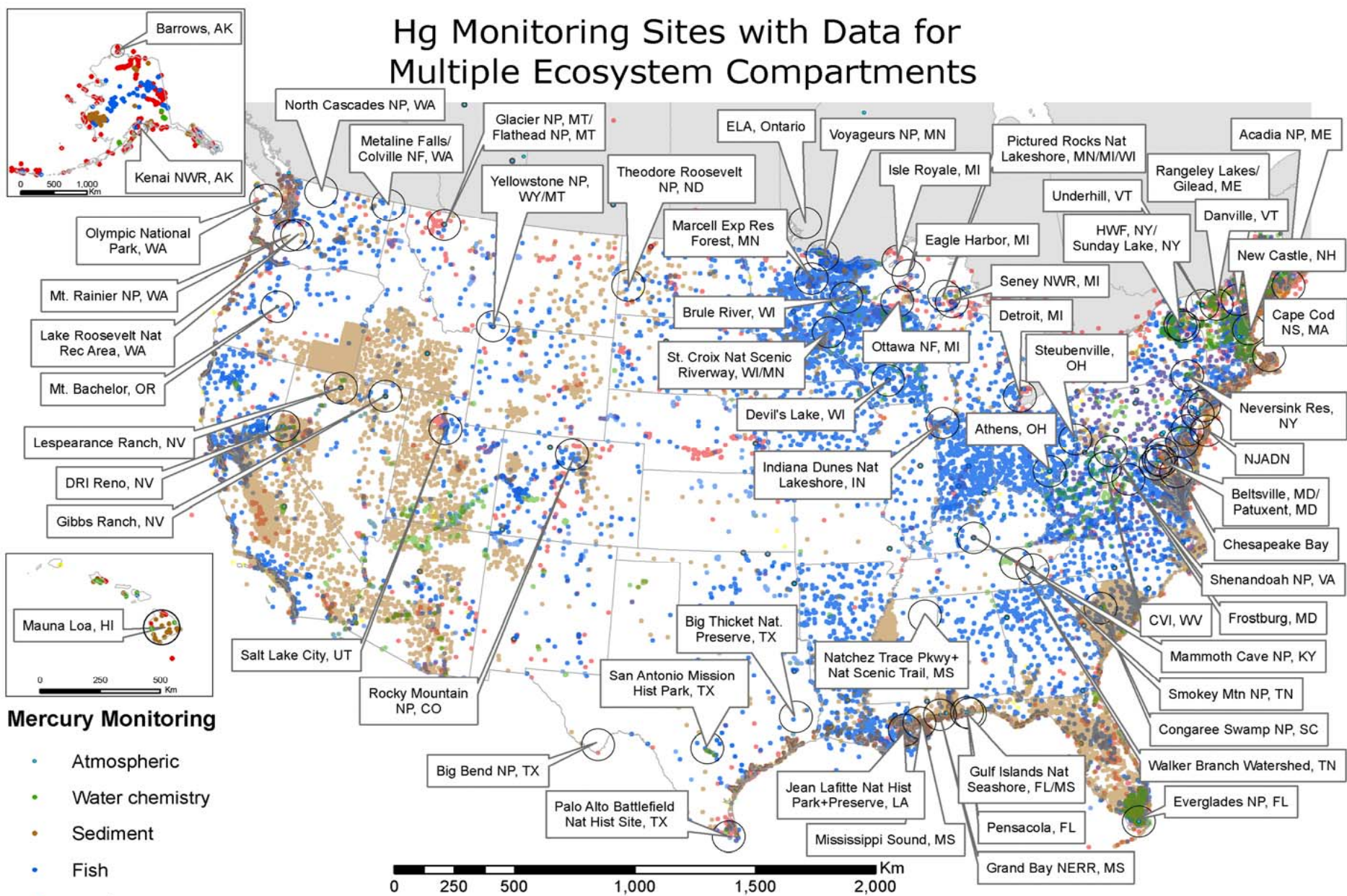
- Starting point was the Harris et al., 2007 book
  - Provides a list of intensive and cluster site indicators, ancillary parameters, and siting considerations for integrated Hg monitoring
- Information about sites was collected from:
  - Mining the primary literature (~120 scientific journal articles read)
  - Known networks (e.g., NADP, CASTNET, TIME/LTM, etc)
  - Expert input
- Steering committee presented additional siting criteria
- Identified 69 sites where data have been collected for multiple ecosystem compartments
  - Emphasis on intensive indicators

# Caveats

- List is incomplete
- Relied heavily on the scientific literature
  - In most cases, we do not yet know the extent to which data are still being collected, how good the data are, whether or not the data are accessible, and whether there is an existing baseline
- Assessment is semi qualitative
- All sites are not fully characterized

Northeast	Midwest	South	West
Acadia NP, ME	Athens, OH	Canaan Valley Institute, WV	Barrow, AK
Barnegat Bay, NJ	Brule River, WI	Chesapeake Bay, MD	Big Bend NP, TX
Cape Cod Nat. Seashore, MA	Detroit, MI	Congaree Swamp NP, SC	Big Thicket Nat. Preserve, TX
Delaware Bay/Alloway Creek, NJ	Devil's Lake, WI	Everglades National Park Research Center, FL	Desert Research Institute/Reno, NV
Delaware River/Camden, NJ	Eagle Harbor, MI	Fort McHenry Nat. Hist Site, MD	Gibbs Ranch, NV
Huntington Wildlife Forest/Newcomb, NY	Indiana Dunes Nat Lakeshore, IN	Grand Bay NERR, MS	Glacier National Park/Flathead National Park, MT
Neversink Watershed, NY	Isle Royale, MI	Gulf Islands Nat Seashore, FL/MS	Kenai National Wildlife Refuge, AK
New Castle, NH	Marcell Exp Res Forest, MN	Jean Lafitte Nat Hist Park+Preserve, LA	Lake Roosevelt Nat Rec Area, WA
Newark Bay/Jersey City, NJ	Ottawa National Forest, MI	Mammoth Cave NP, KY	Lespearance Ranch, NV
Rangeley Lakes/Gilead, ME	Pictured Rocks Nat Lakeshore, MN/MI/WI	Mississippi Sound, MS	Mauna Loa, HI
Raritan Bay/New Brunswick, NJ	Seney Nat Wildlife Refuge, MI	Natchez Trace Parkway+Nat Scenic Trail, MS	Metaline Falls/Colville National Forest, WA
Sleepers River watershed/Danville, VT	St. Croix Nat Scenic Riverway, WI/MN	National Capital Parks-East, DC	Mt. Bachelor, OR
Sunday Lake, NY	Steubenville, OH	Patuxent National Wildlife Refuge/Beltsville, MD	Mt. Rainier NP, WA
Underhill, VT	Theodore Roosevelt NP, ND	Patuxent River, MD	North Cascades NP, WA
	Voyageurs NP, MN	Pensacola, FL	Olympic NP, WA
		Piney Reservoir/Frostburg, MD	Palo Alto Nat Hist Site, TX
		Shenandoah National Park, VA	Rocky Mtn NP, CO
		Smokey Mountain National Park, TN	Salt Lake City, UT
		Walker Branch Watershed, TN	San Antonio Mission Hist Park, TX
			Yellowstone NP, WY/MT

# Hg Monitoring Sites with Data for Multiple Ecosystem Compartments



## Mercury Monitoring

- Atmospheric
- Water chemistry
- Sediment
- Fish
- Birds
- Invertebrates

○ 100 km radius circles

## 69 Mercury Monitoring Sites

Source: US EPA-OAR-OAP-CAMD, NADP/MDN, NADP/NTN, other sources  
 Projection: USA Contiguous Albers Equal Area Conic  
 USGS Version  
 Date: 4/30/2008  
 Scale: 1:20,000,000

# Characterize multiple sites

## Level I (Omernik) Regions:

1. Arctic Cordillera
2. Tundra
3. Taiga
4. Hudson Plains
5. Northern Forests
6. Northwestern Forested Mountains
7. Marine West Coast Forests
8. Eastern Temperate Forests
9. Great Plains
10. North American Deserts
11. Mediterranean California
12. Southern Semi-Arid Highlands
13. Temperate Sierras
14. Tropical Dry Forests
15. Tropical Humid Forests

## Site type:

- T = trend
- C = causality
- A = assessment/modeling

## Site measurements:

- A = atmospheric
- W = water chemistry
- S = sediment
- F = fish
- B = birds
- I = invertebrates

## Site conditions/criteria:

1. Site has longer-term mercury data
2. Site is sensitive to mercury inputs
3. Site is expected to exhibit large changes in response to changes in mercury deposition
4. Site has existing facilities and infrastructure to support the monitoring program
5. Site is expected to have a range of characteristic response times to changes in deposition
6. Site is a good background site for characterizing global mercury inputs
7. Site would be a useful testbed for evaluation of atmospheric mercury models
8. Site would be a useful testbed for evaluation of ecosystem mercury models
9. Site is near emission sources and may receive elevated mercury deposition
10. Site is anticipated to exhibit a clearly defined response to changes in mercury emissions and deposition
11. Site within common loon breeding range
12. Site with endangered, threatened or candidate species at risk to Hg

# Characterize multiple sites - Example

	Site name	Ecoregion	Site type	Site conditions/criteria met												Site measurements							
	<b>Northeast</b>																						
1	Huntington Wildlife Forest, NY	5	T	C	A	1	2		4	5		7	8			11	12	A	W	S	F	B	I
2	Acadia National Park, ME	8	T	C	A	1	2		4			7	8			11	12	A	W	S	F	B	I
3	Proctor Center, Underhill, VT	5	T	C	A	1			4	5		7	8		10	11		A	W	S	F	B	I



# Summary

- Sixty nine Hg monitoring sites identified
- Site information derived from ~120 scientific journal articles, known monitoring networks, and expert input
- A subset of the 69 sites preliminarily characterized based on criteria from Harris et al., 2007 book and steering committee input

If you have additional information – please contact:  
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# Appendix

## I. Intensive Trends Indicators & Parameters (based on Harris et al., 2007 book)

### Indicators

- Soil solutions (THg and MeHg)
- Sediment (THg and MeHg)
- Percent MeHg in sediment
- Instantaneous methylation rate
- Surface water (THg and MeHg)
- Stream
- THg in prey fish
- THg in mammal blood and fur
- THg in bird blood, feather, and egg

### Ancillary Parameters

- Water chemistry (pH, DOC, sulfate, TSS, chlorophyll, temperature, ANC, color, nutrients, DO, stratification status)
- Characteristics of fish (size, age, stomach contents, sex, condition)
- Characteristics of mammals (size, age, sex, condition) and tissues for nonlethal sampling (fur and blood) and lethal sampling (fur, brain, muscle, liver)
- Characteristics of birds (size, age, sex, condition) and tissues for nonlethal sampling (blood, feathers, eggs) and lethal sampling (feathers, brain, muscle, liver, eggs)

# Appendix

## II. Intensive Causality Indicators & Parameters (based on Harris et al., 2007 book)

### Indicators

- Atmospheric Hg
- Wet deposition (THg)
- Throughfall (THg and MeHg)
- Litterfall (THg and MeHg)
- Soil (THg and MeHg)
- Soils solutions (THg and MeHg)
- Forest floor surveys
- Sediment (THg and MeHg)
- % MeHg in sediments and soils
- Instantaneous sediment methylation rate
- THg accumulation in cores (THg and MeHg)
- Groundwater (THg and MeHg)
- Surface water (THg and MeHg)
- MeHg/THg ratio in surface waters
- Mink
- Common Loon
- Belted Kingfisher
- Tree Swallow

### Ancillary Parameters

- Atmospheric deposition of sulfate
- Rainfall
- Watershed area
- Land cover
- Percent wetlands in watershed area
- Lake morphometry
- Water chemistry (pH, DOC, sulfate, TSS, chlorophyll, temperature, ANC, color, nutrients, DO, stratification status)
- Characteristics of fish (size, age, stomach contents, sex, condition)
- Characteristics of mammals (size, age, sex, condition) and tissues for nonlethal sampling (fur and blood) and lethal sampling (fur, brain, muscle, liver)
- Characteristics of birds (size, age, sex, condition) and tissues for nonlethal sampling (blood, feathers, eggs) and lethal sampling (feathers, brain, muscle, liver, eggs)

# Appendix

## III. Other site selection considerations (Steering committee)

1. Site has longer-term mercury data
2. Site is sensitive to mercury inputs
3. Site is expected to exhibit large changes in response to changes in mercury deposition
4. Site has existing facilities and infrastructure to support the monitoring program
5. Site is expected to have a range of characteristic response times to changes in deposition
6. Site is a good background site for characterizing global mercury inputs
7. Site would be a useful testbed for evaluation of atmospheric mercury models
8. Site would be a useful testbed for evaluation of ecosystem mercury models
9. Site is near emission sources and may receive elevated mercury deposition
10. Site is anticipated to exhibit a clearly defined response to changes in mercury emissions and deposition
11. Site within common loon breeding range
12. Site with endangered, threatened or candidate species at risk to Hg<sup>12</sup>