THE SIERRA FUND

Headwater Mercury Source Reduction Strategy

Restoring Ecosystem and Community Resiliency in the Sierra Nevada

January 14, 2020

Headwater Mercury Source Reduction

RESILIENCY

INVESTMENT

360 UNDERSTANDING

Scoping:
Mining's Toxic Legacy (2008)

ENGAGE PROBLEM SOLVERS

Working Group of Advisors

EXPLORE SOLUTIONS

Pilot projects:
Malakoff Diggins; *Humbug Creek Watershed Assessment* (2015)
Combie Reservoir Sediment and Mercury Removal (2009-present)
Tippecanoe and Grizzly Creek (2018- present)
Fish Tissue Sampling and Advisories (2011-present)

KNOW BETTER, DO BETTER

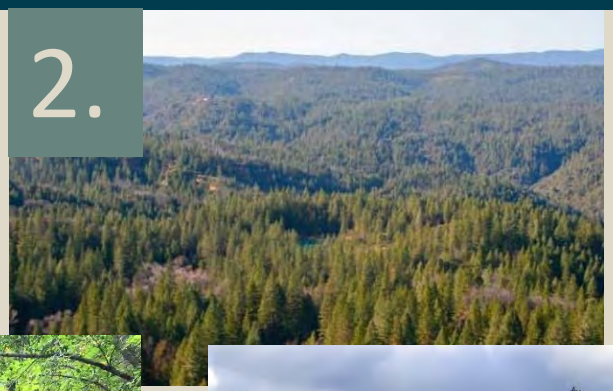
Best Management Practices for Assessment

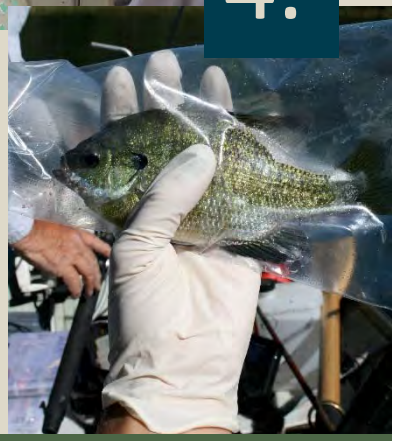
SUSTAIN THE CHANGE

Regional Strategy:
Headwater Mercury Source Reduction Strategy (2018)

Headwater Mercury Source Reduction Strategy

Four Targets

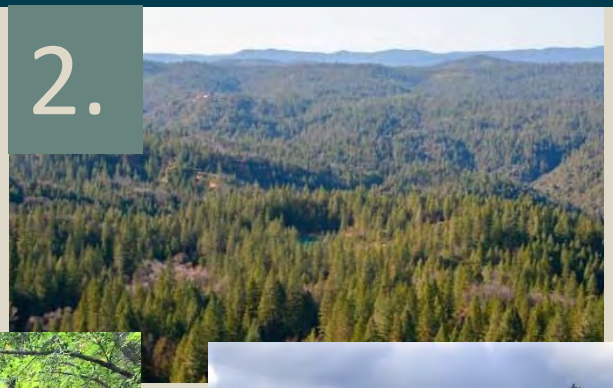


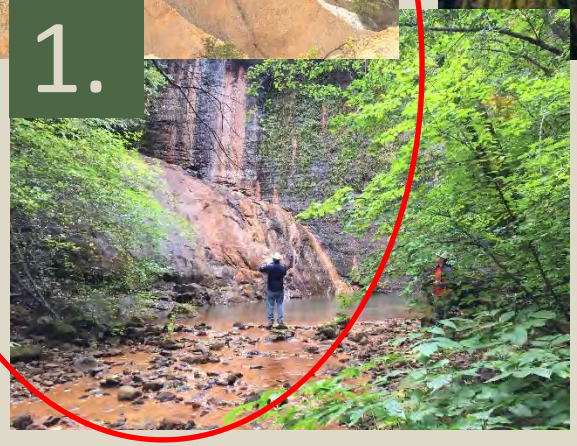


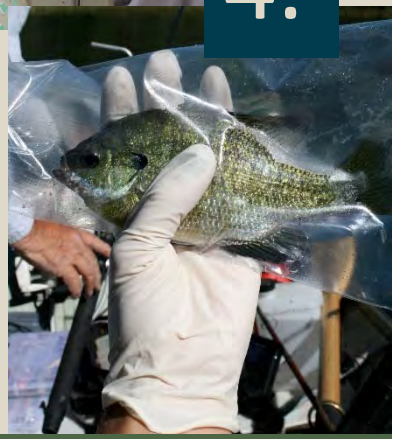
1. Hydraulic Mines and Mine Features
2. Mercury in Forest and Land Management
3. Mercury-Contaminated Sediment in Reservoirs
4. Mercury Exposure via Fish Consumption

Headwater Mercury Source Reduction Strategy

Four Targets







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Actions

Hydraulic Mines and Mine Features

Strategy for Remediating Mercury Sources: Hydraulic Mines and Mine Features:

Action 1: *Develop inventory and database of hydraulic mines and mine features.-Update*

Action 2: *Ground-truth features in the Hydraulic Mines and Mine Features Database.-Protocol development*

2a: *Physical Hazards Inventory*

2b: *Chemical Hazards Inventory*

Action 3: *Develop pilot projects and evaluate mine remediation treatments.*

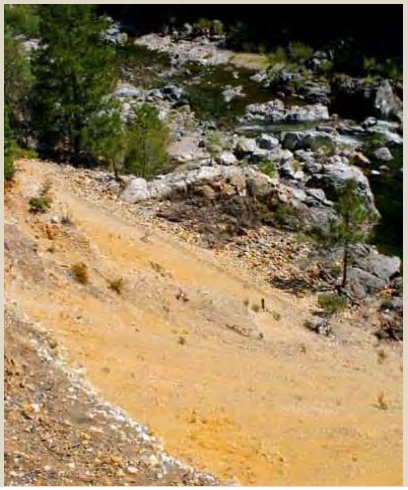
Actions

Hydraulic Mines and Mine Features

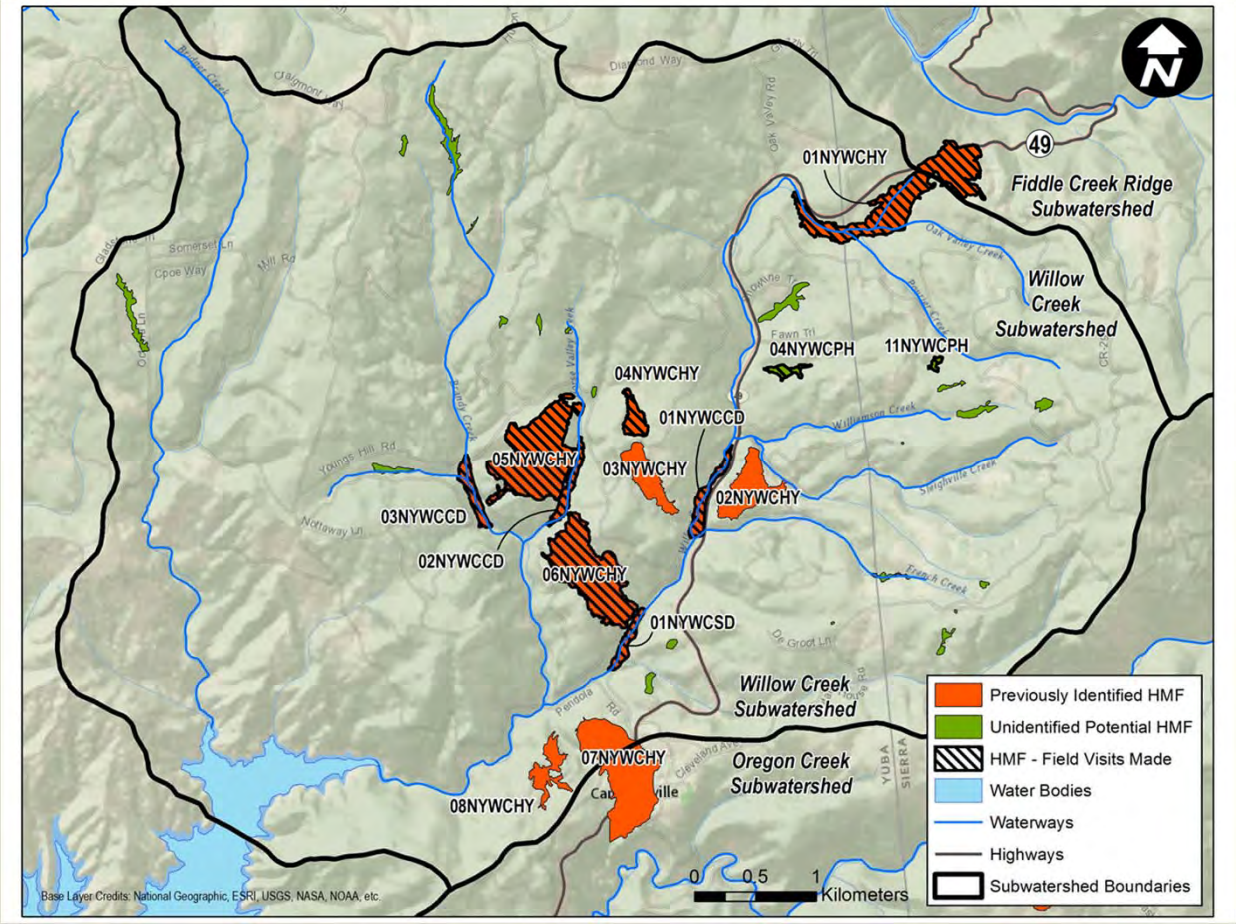
Action 4: *Rank and prioritize hydraulic mines and mine features for remediation.*
-Define selection criteria for projects

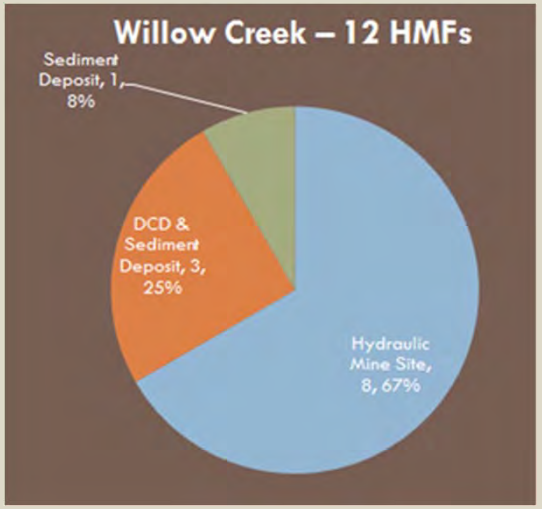
Action 5: *Make recommendations and evaluate best-practices for remediation.*
BMP 1: Mines: Minimize erosion of contaminated material
BMP 2: Mines: Minimize contaminated material contact with water



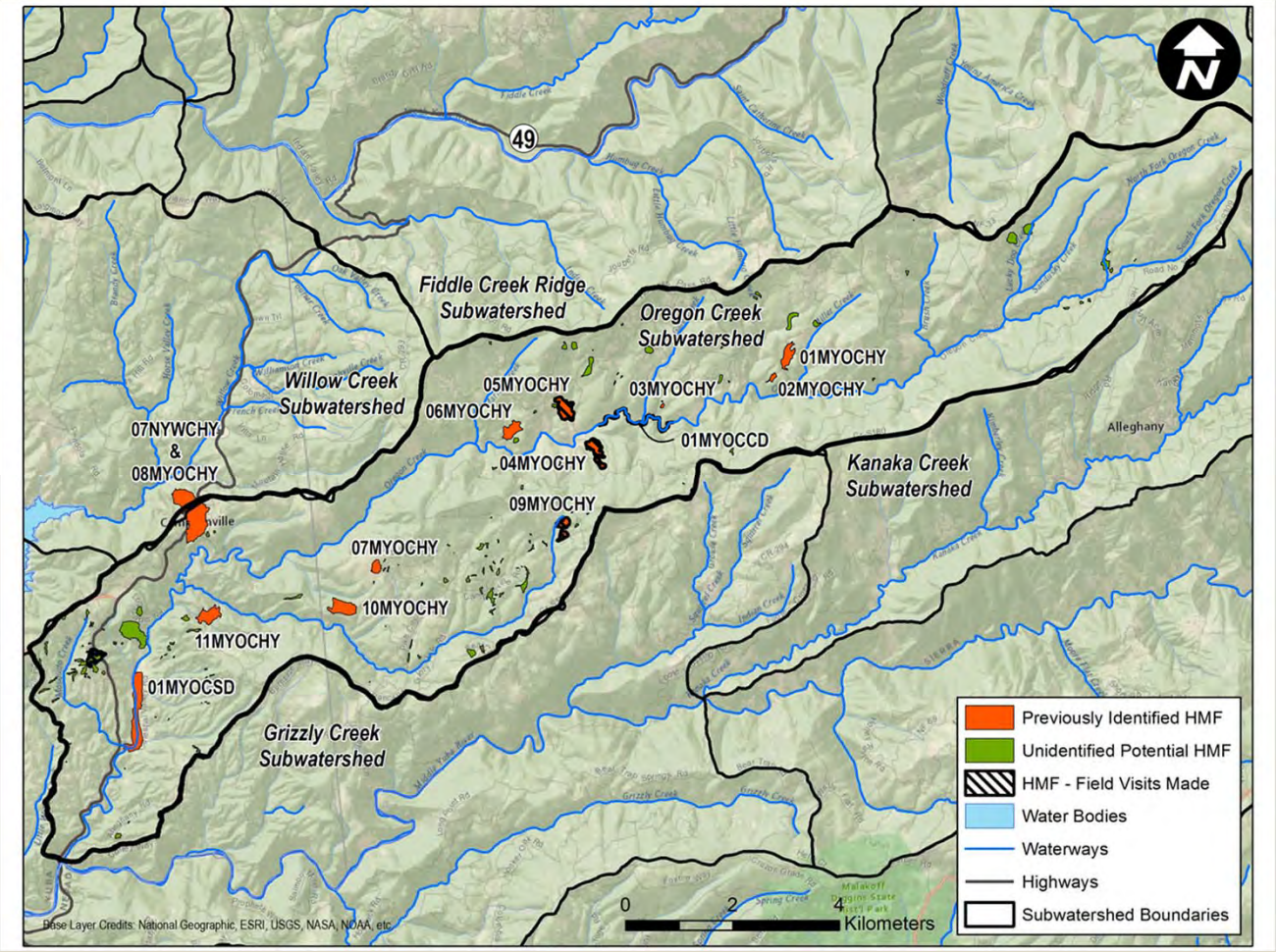


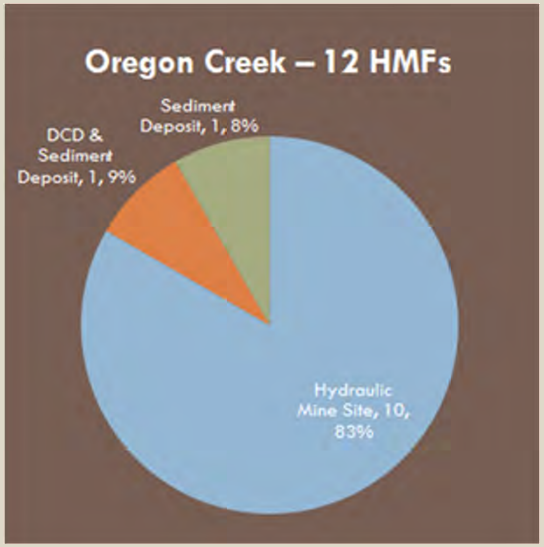

Willow Creek Sub watershed Inventory



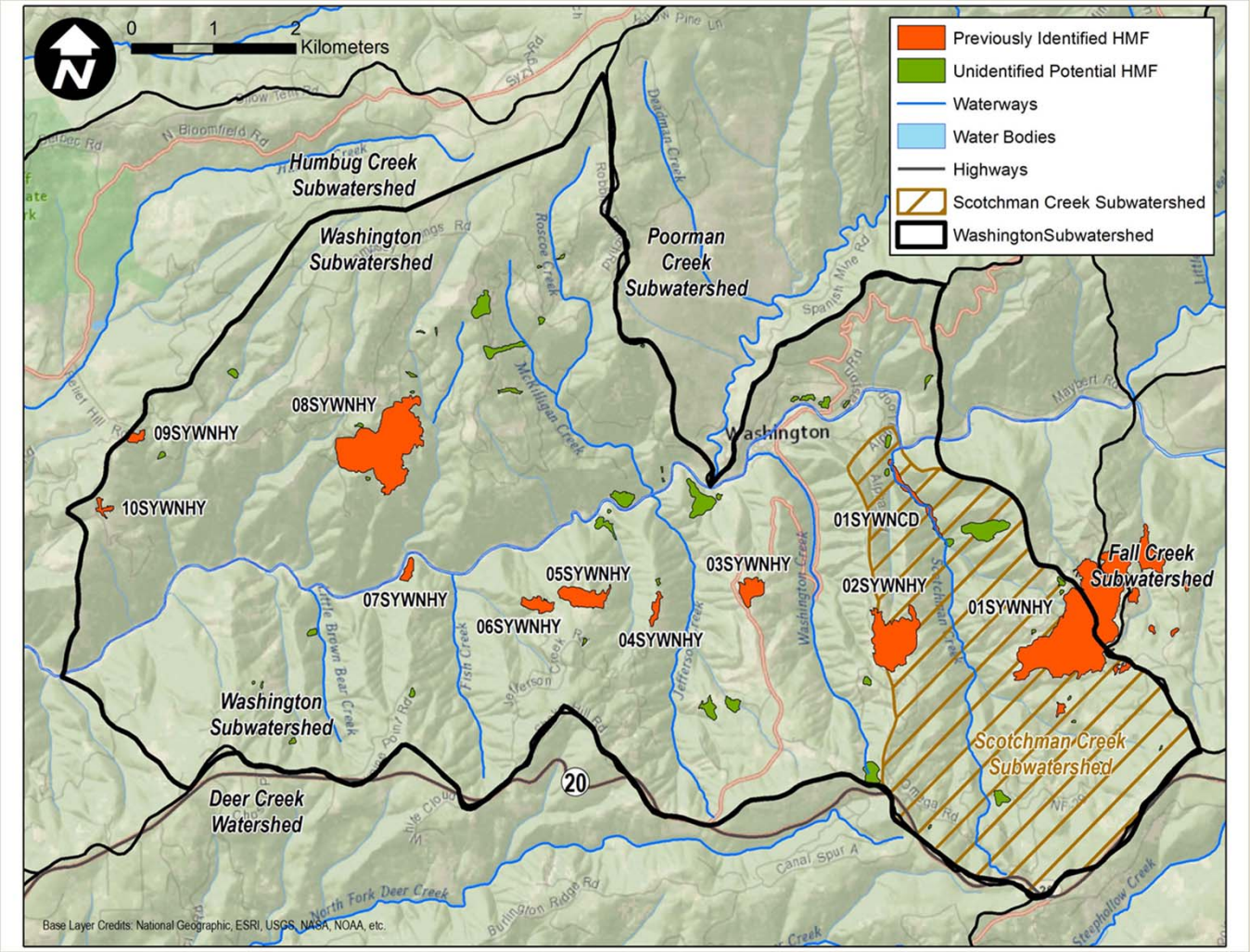


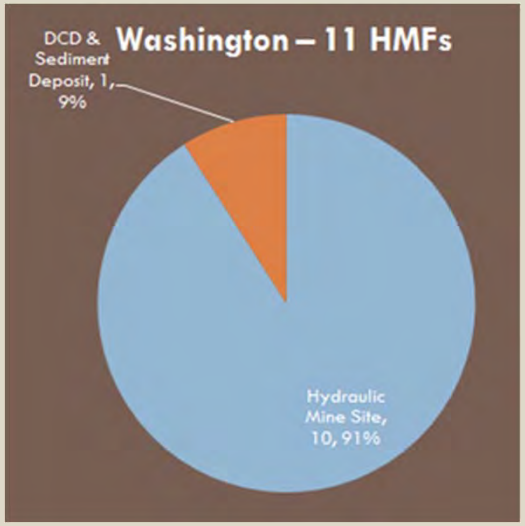
Oregon Creek Sub watershed Inventory





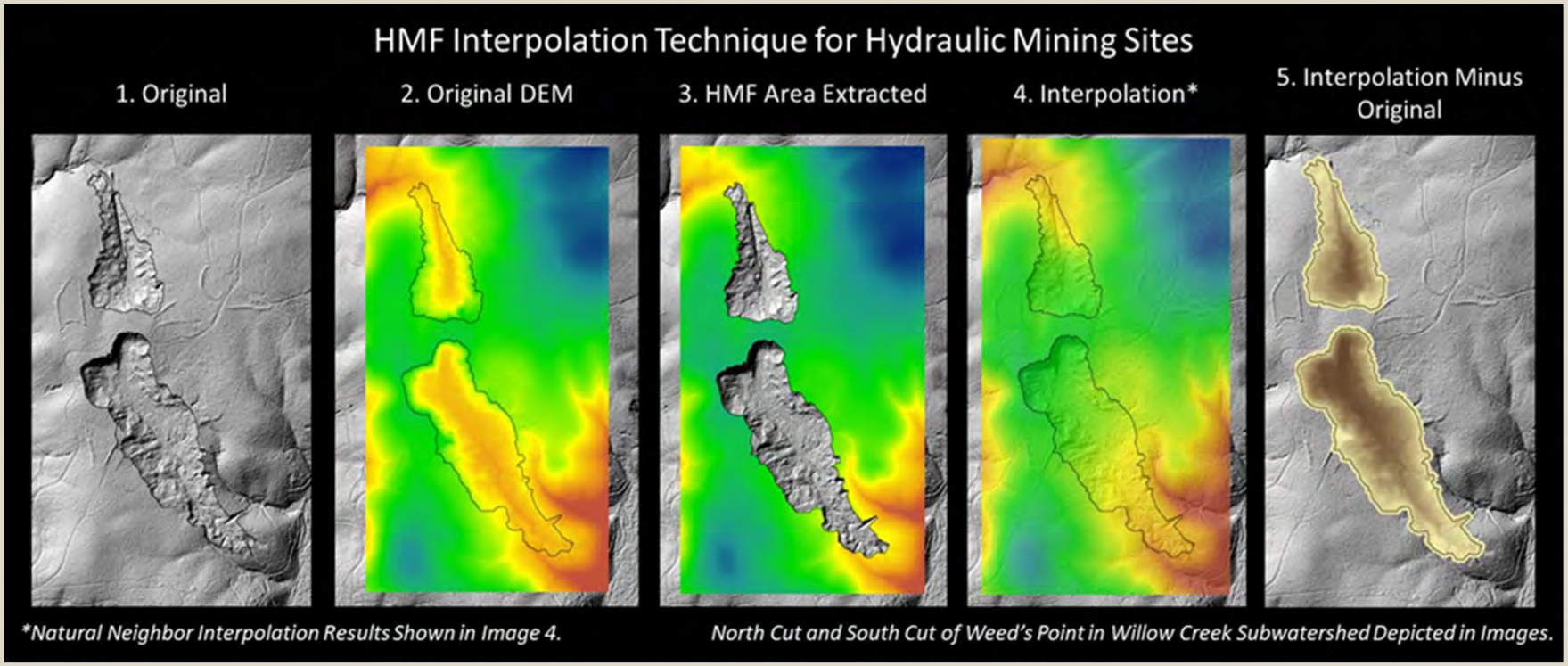
Washington HUC Inventory





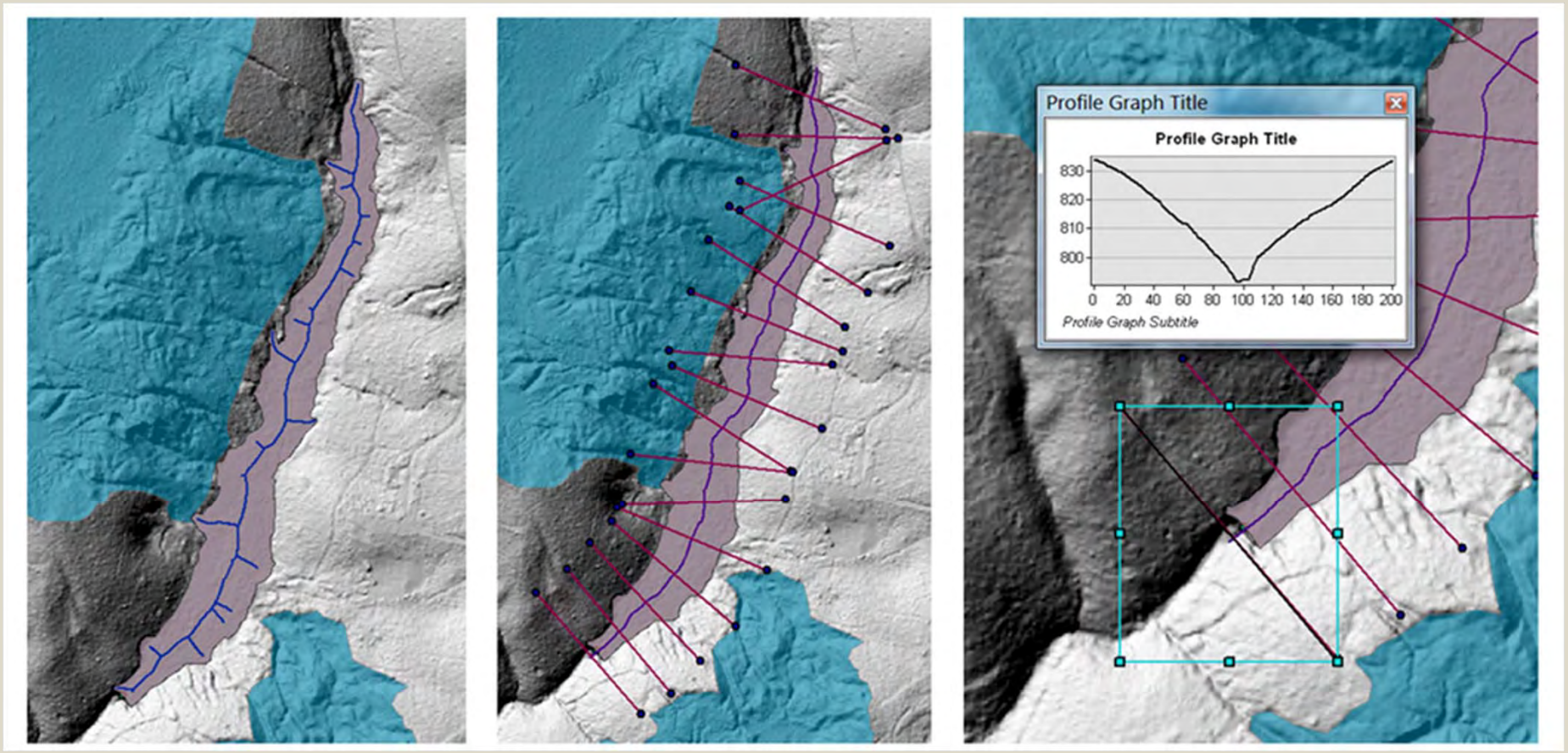
Sediment Volumes from Hydraulic Mine Sites

Method of determining Volume Exhumed from Hydraulic Mine Sites



James, A., C. Monohan, B. Ertis, 2018. Long-term hydraulic mining sediment budgets: Connectivity as a management tool. Science of the Total Environment. STOTEN-D-18-06719R1. 28 September 2018. 10.1016/j.scitotenv.2018.09.358.

Sediment Volumes from Debris Control Dams



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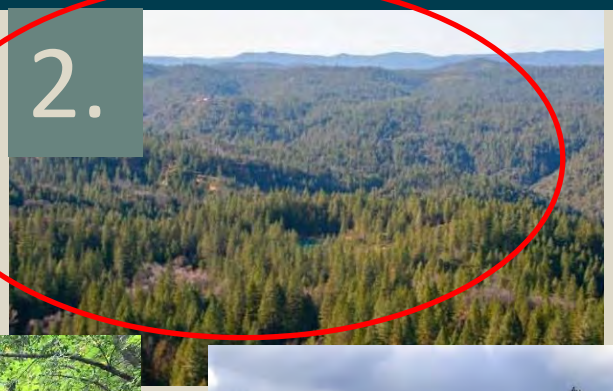
Strategy Implementation Evaluation Criteria

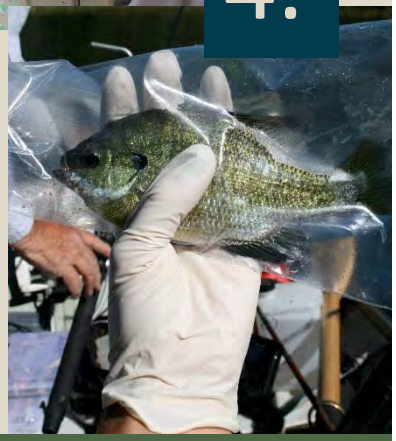
Hydraulic Mines and Mine Features

- **One sub-watershed per year** assessed in partnership with United States Forest Service, Tahoe National Forest.
- **One hydraulic mine site remediated per year** in partnership with United States Forest Service, Tahoe National Forest, or the State of California
- Coordination of best-practices into **regional regulatory and planning efforts** such as the Statewide Reservoir Mercury Total Maximum Daily Load (TMDL).

Headwater Mercury Source Reduction Strategy

Four Targets





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Actions

Mercury in Forest and Land Management

Strategy for Mercury in Forest and Land Management: *Identify and prioritize the location of fuels reduction projects that use best available technologies and management practices to reduce wildfire risk in the vicinity of hydraulic mines.*

Action 1: *Develop a database of mine-impacted forests.*

Action 2: *Ground-truth areas identified in the mine-impacted forests database.*

Action 3: *Rank and prioritize mine-impacted forests for fuels reduction.*

Action 4: *Develop pilot projects and evaluate treatments in mine-impacted forests.*

Action 5: *Make recommendations and evaluate best-practices for forest management in mine-impacted landscapes.*

Strategy Implementation Evaluation Criteria

Mercury in Forest and Land Management

- Development of a Sampling and Analysis Plan that can be used for evaluation of forest management activities that reduce headwater sources of mercury.

-Database development of forested areas with high fuel loading and high abandoned hydraulic mine densities using Tahoe National Forest LiDAR data and Cal Fire Very High Fire Hazard Severity Zone maps.

Strategy Implementation Evaluation Criteria

Mercury in Forest and Land Management

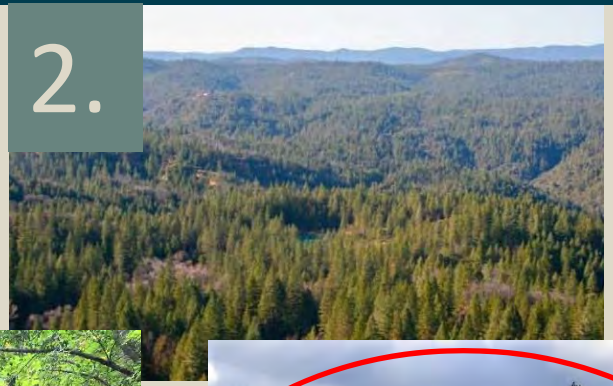
- Successful design and implementation of a pilot program that integrates fuels reduction with mine remediation activities.

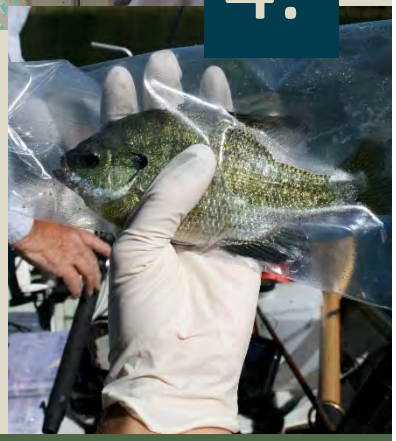
Fuels treatments to reduce fire severity
-Apply woodchips to denuded areas to reduce erosion
-Apply bio char to contaminated soils to reduce Hg transport

- Development of best-practices for fire-safe revegetation of mine-contaminated soils.

Headwater Mercury Source Reduction Strategy

Four Targets





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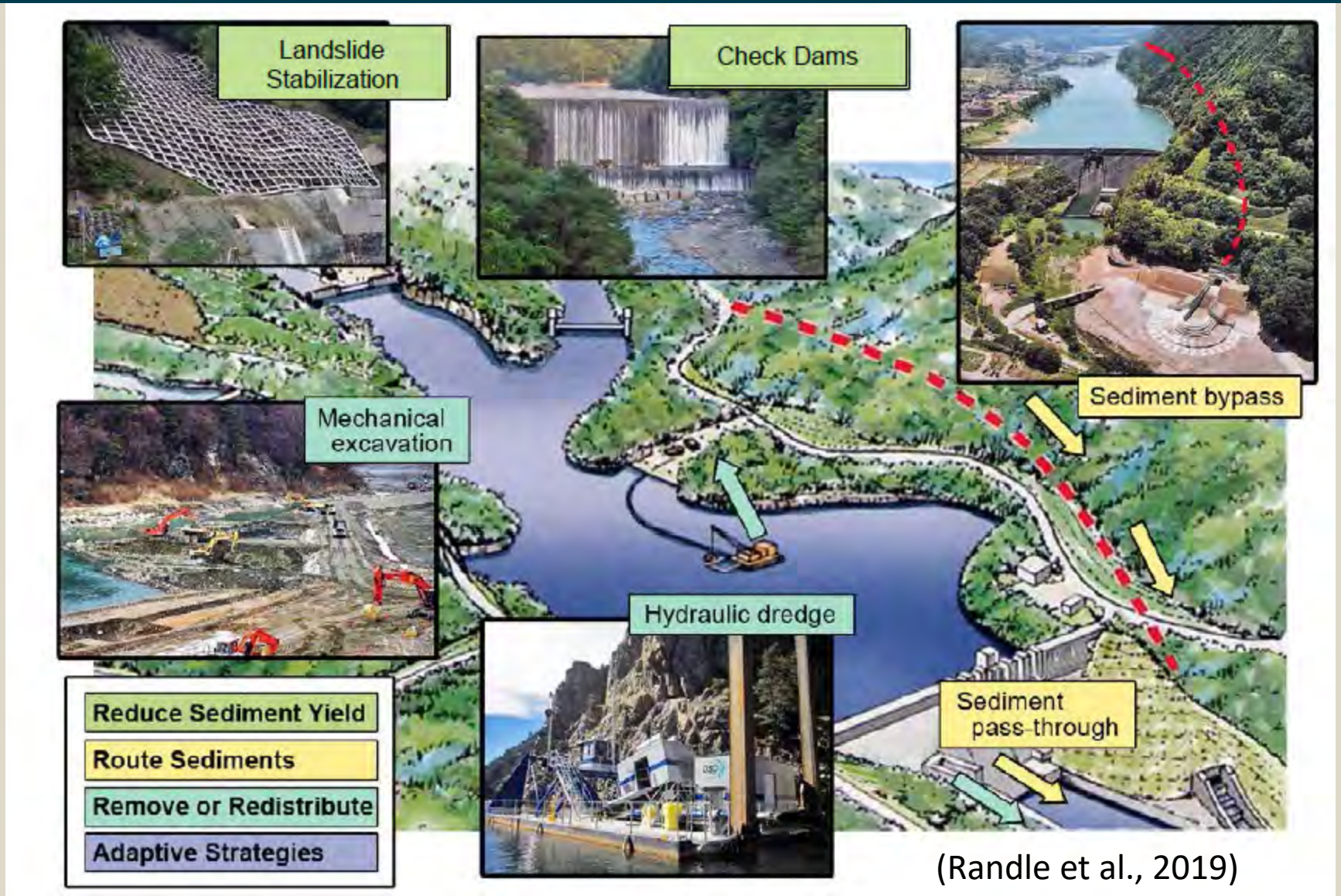
Reservoir Sediment Management Activities: Building a Legacy of Sustainable Water Storage Reservoirs



(Randle et al., 2019)

Actions

Mercury-Contaminated Sediment in Reservoirs

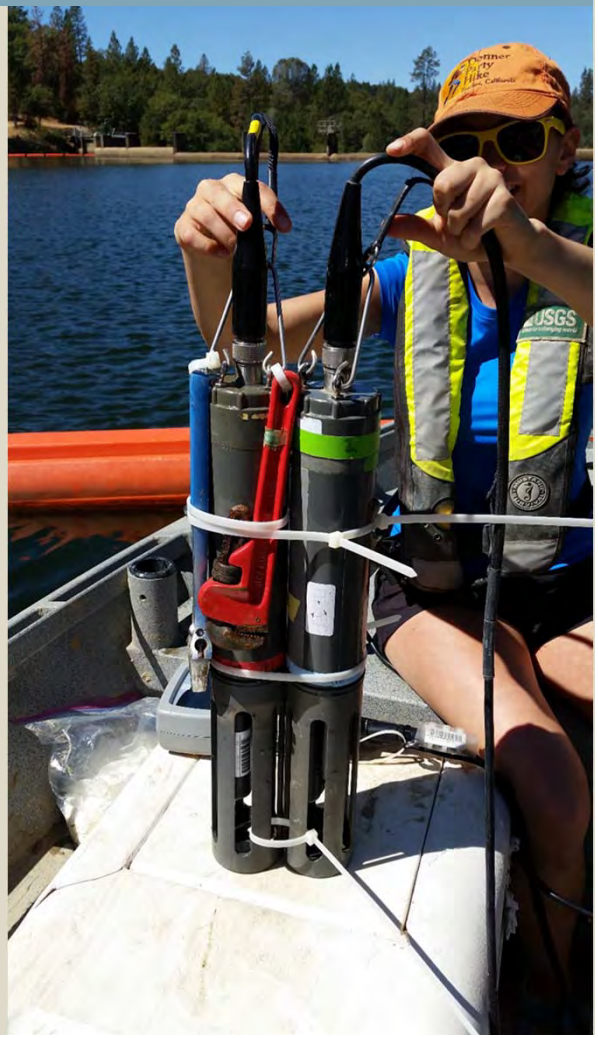
Strategy for Removal of Mercury-Contaminated Sediment from Reservoirs: *Develop and apply best-available technologies and methods to prioritize and remove mercury-contaminated sediment from reservoirs.*

Action 1: *Develop database of reservoirs impacted by mercury-contaminated sediment.*

Action 2: *Conduct baseline sampling for mercury (sediment, water, pore water, biota).*

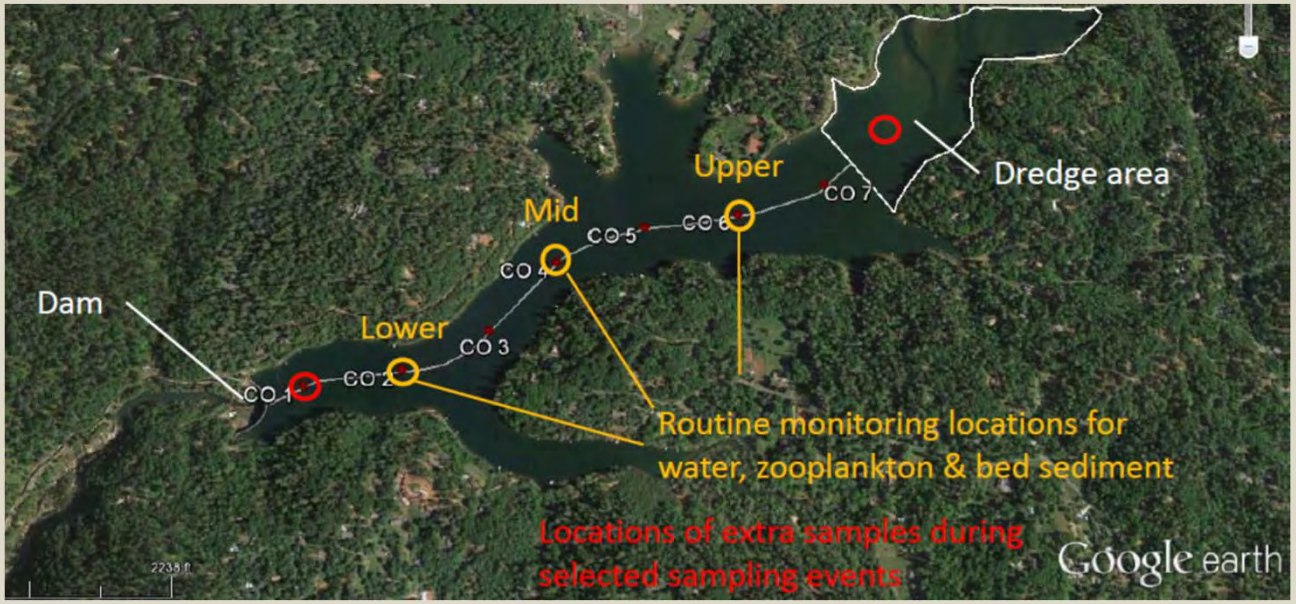
Action 3: *Rank and prioritize reservoirs for remediation and for pilot projects.*

Action 4: *Make recommendations and monitor implementation of best-practices for reservoir remediation.*



Baseline Monitoring at Combie

- Fish tissue (THg) Bass, Sunfish, Brown Trout, Pike minnow, and sucker
- ~Bi-monthly vertical profiles (T,DO, pH, EC, Turbidity)
- Water THg, MeHg, (filtered and non-filtered) RHg(II), DOC, nutrients, anions, alkalinity, Chl-a
- Periphyton
- Sediment (THg, MeHg, (filtered and non-filtered) RHg(II), TRS, Fe species, LOI)
- Pore water (THg, MeHg, DOC, H_2S, nutrients, anions)
- Real Time Monitoring Model-future DTMC presentation idea



Key Actions Mercury Contaminated Sediment in Reservoirs

Action 1: Develop Inventory and Database of Reservoirs Impacted by Mercury-Contaminated Sediment

Action 2: Baseline Sampling

-Sediment, water, pore water, and biota sampling for Hg analysis to quantify contamination.

Action 3: Rank and Prioritize Reservoirs for Remediation Pilot Projects

-Develop criteria for the selection and prioritization of reservoirs for comprehensive assessment and remediation.

Action 4: Make Recommendations and Evaluate BMPs for Reservoir Remediation

BMP 1:Minimize sediment disturbance during warm season

BMP 2: Avoid creating low oxygen conditions/stagnant water

Strategy Implementation Evaluation Criteria

Mercury-Contaminated Sediment in Reservoirs

- Support the **development of at least one sediment removal project per year** in partnership with reservoir managers.
- Develop **monitoring plans for reservoir sediment** removal projects led by irrigation districts and others.
- Identify and characterize mercury-reduction **best-practices** for reservoir maintenance activities including sediment removal.
- Support reservoir sediment removal efforts in other mining-impacted regions by **sharing monitoring strategies** and best-practices.
- Coordinate best-practices into **regional regulatory and planning** efforts such as the Statewide Reservoir TMDL for mercury.

Headwater Mercury Source Reduction Strategy

Four Targets

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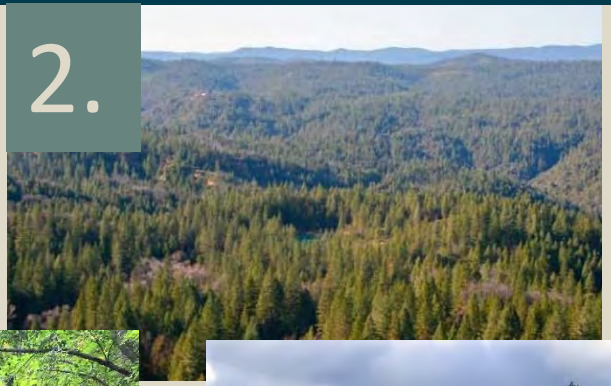

1.

3.

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Actions

Mercury Exposure

Strategy for Mercury Exposure: *Increase the amount and accessibility of information about mercury in locally caught fish.*

Action 1: *Collect Regional Angler Survey Data.*

Action 2: *Collect Regional Fish Tissue Data.*

Action 3: *Use Angler Survey and Fish Tissue Data to Identify Water Bodies with High Risk of Exposure.*

Action 4: *Post State-Issued Fish Consumption Advisories at Water Bodies.*

Action 5: *Utilize Angler Survey and Fish Tissue Data to Inform Targeted Outreach and Regulatory Actions.*

Geographic Location

Waterbodies Selected for Analysis

Lakes and Reservoirs

1. Upper Scotts Flat Lake
2. Rollins Reservoir
3. Lake Clementine
4. Combie Reservoir
5. Camp Far West Reservoir
6. Englebright Reservoir
7. New Bullards Bar

Stream and River Segments

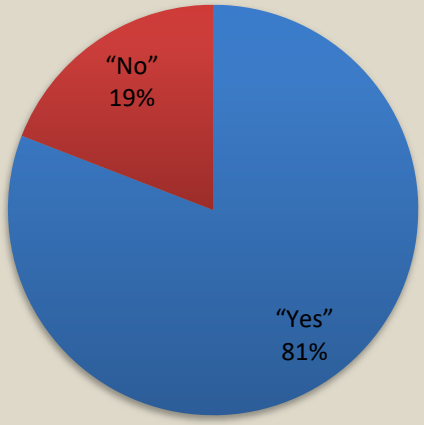
7. Deer Creek
8. Bear River
9. South Yuba River

Anglers and Risk Assessment

Updated Angler Survey 2018

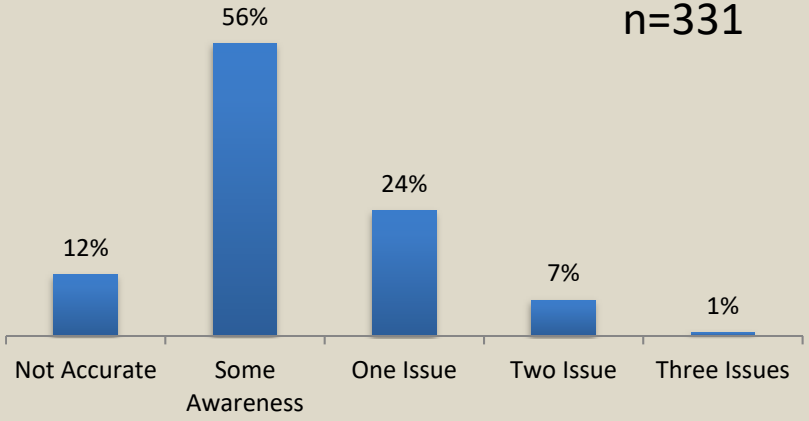
Have you ever heard or seen any health warnings about eating fish?

n=429



If "Yes," Accuracy of Exposure Risk Awareness

n=331



- Do anglers make accurate statements about the information contained in fish advisories?
- Do their responses indicate comprehension of information communicated in advisories?
- Are anglers able to articulate information about the three components of fish consumption advisories?

Strategy Implementation Evaluation Criteria

Mercury Exposure

- Fish tissue data gaps identified and filled and data provided to OEHHA.
- Fish consumption advisories posted in Spanish at CABY region waterbodies and posted in additional languages as identified through analysis of Angler Survey data.
- Outreach strategy developed for vulnerable communities as identified based on angler activity and high fish tissue mercury levels.
- Follow-up outreach to local public health officials to ensure that they are aware of the need to provide information about mercury in fish to the Sierra Nevada populations they serve.
- Angler survey data collection effort expanded to the mercury-impacted Feather River watershed (n=30).

The HMSR TAC

You are invited

WHEN: The Mercury Forum has met **quarterly since 2014**

WHERE: The primary geographic scope for the implementation of the HMSR Strategy is the **22 counties of the Sierra Nevada** region.

WHY: To facilitate a **regional strategy** built on best available science by providing a platform for technical experts to share, revise, and integrate best-practices for the assessment and mitigation of mercury.

NEXT:

Hydraulic Mines and Forests TAC May 2020-need sponsors

Reservoirs and Fish Exposure TAC Oct 2020-need sponsors

Contact Us!

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Questions About the TAC?
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