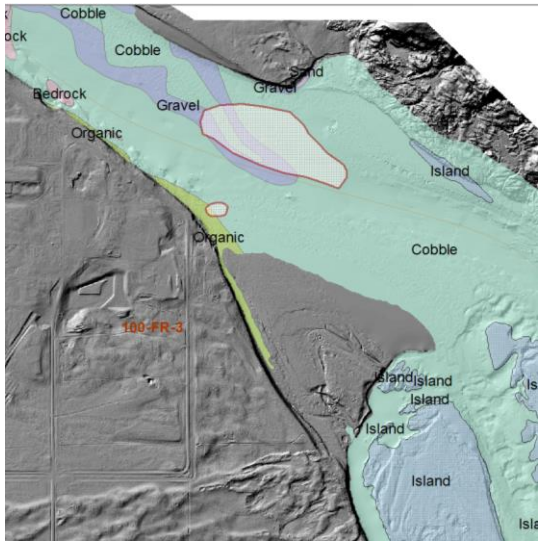
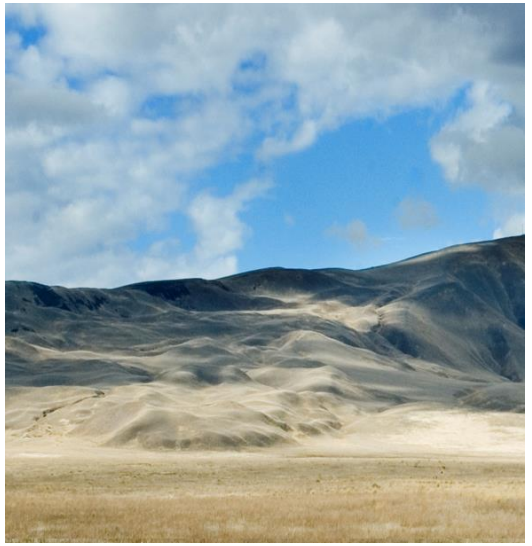
Oregon Department of **ENERGY**

Natural Resource Damage Assessment at Hanford

Sara Lovtang
November 4, 2019





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OUTLINE OF PRESENTATION

- Brief explanation of Natural Resource Damage Assessment
- Focus on river and groundwater
- What work remains
- NRDA focus on restoration
- Can NRDA be used as leverage in cleanup?
- Questions

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NATURAL RESOURCE DAMAGE CLAIMS

- NRD claims are brought by governments on behalf of their public for harm to natural resources

- Hanford trustees use CERCLA guidelines to determine injury:
  - From exposure to contaminants;
  - From physical damage caused by cleanup;
  - From time of release (or 1980);
  - Until ecosystem services are restored.

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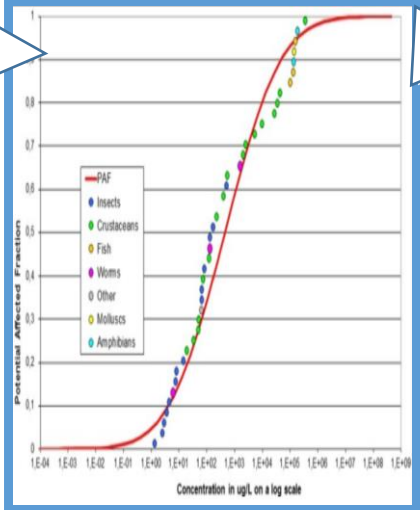
NATURAL RESOURCE DAMAGE CLAIMS

Source **Release**

Pathway **Migration**

Quantify exposure **Receptor**

Dose estimate **Risk/Injury**



$ damages **Restoration**

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NRDA AT HANFORD

Eight trustees in the Hanford Natural Resource Trustee Council

- 2 states (Oregon and Washington)
- 3 Native American tribes (Confederated Tribes of the Umatilla Indian Reservation, Nez Perce Tribe, Yakama Nation)
- 3 federal agencies (US Department of Energy, US Fish and Wildlife Service, National Oceanic and Atmospheric Administration)

TRUSTEE COUNCIL TASKED WITH:

- Restoration is the goal: ensure habitat and resources are restored to pre-spill state (baseline).
- Define the scope and scale of restoration through scope and scale of injury.
- Work cooperatively, but be prepared for litigation.

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NRDA AT HANFORD

- 1993: HNRTC trustee organizations invited by DOE
  - Advise in cleanup and future use of Site
- 2007: legal settlement requires DOE to fund trustees
  - HNRTC becomes more active
- 2007: Pre-assessment screen and determination
  - Decision to proceed with formal NRDA
- 2012: Injury Assessment Plan complete

WORKING GROUPS FOCUSED ON INJURY

- Groundwater
- Aquatic/near-shore
- Terrestrial
  - Sampling of soil in non-process areas
  - Mapping terrestrial disturbance
- Debiting/crediting systems
- Tribal service loss

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GROUNDWATER CLAIM

Completed 2017

- Total unconfined aquifer at Hanford Site
  - volume = 3.5 km^3 (2.84 million acre-ft.)
- 2014 contaminated aquifer
  - volume = 0.55 km^3 (445,890 acre-ft.)
  - 0.04 km^3 in the 100 area
  - 0.51 km^3 south of 100 area
- 17% of aquifer contaminated above thresholds in perpetuity
- Assumes production of weapons grade plutonium with “no release” (baseline)

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GROUNDWATER CLAIM

- Under a “no release” scenario:
  - 1989 federal regulations & policies direct DOE to dispose of land no longer needed for original mission.
  - Would have disposed 266 mi^2 (~170,000 acres) that could be used for industry, residential, or agriculture.
- Estimated annual recharge is 6,000-18,000 acre-feet per year
  - 21.8 sq. miles of agricultural irrigation area
  - 51.3 sq. miles of residential area (32,161 households)
- All of it would have been used “but for the release.”

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AQUATIC WORKING GROUP

Building on past work

- Studies funded by HNRTC:
  - 2 lab studies on juvenile salmon exposure to contaminated groundwater seeping into Columbia River
  - Fall Chinook parr ability to detect/avoid chromium
  - Western pearlshell mussels tested in lab
- Expert panel narrowed focus
- Pressure on US DOE to test groundwater upwelling in river

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AQUATIC WORKING GROUP

Building on past work

- Council identified contaminants of concern for plants and animals
- Toxicologists from OSU and elsewhere developed site-specific injury thresholds, and estimated background levels
- Toxicologists advise on how to estimate injury of mixture
- Groundwater/surface-water group using past work to identify where contamination is entering river

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AQUATIC WORKING GROUP

Current focus

- Modelling Chinook salmon population to assess impacts of historical chromium contamination
- Mapped suitable habitat using:
  - Depth of water, from Lidar
  - Substrate, from maps generated by USGS
  - Flow rates across river
- Almost done gathering existing data and assessing quality

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AQUATIC WORKING GROUP

Future work: Past projects fitting together

- Develop tissue thresholds
  - Plant/animal injury (growth, reproduction, etc)
  - Advisories for human consumption
- Hiring a geo-statistician
- Maps of contaminants in sediment
  - Bioassays show sediment samples from river had toxic effect
  - Samples along river show contaminants above thresholds

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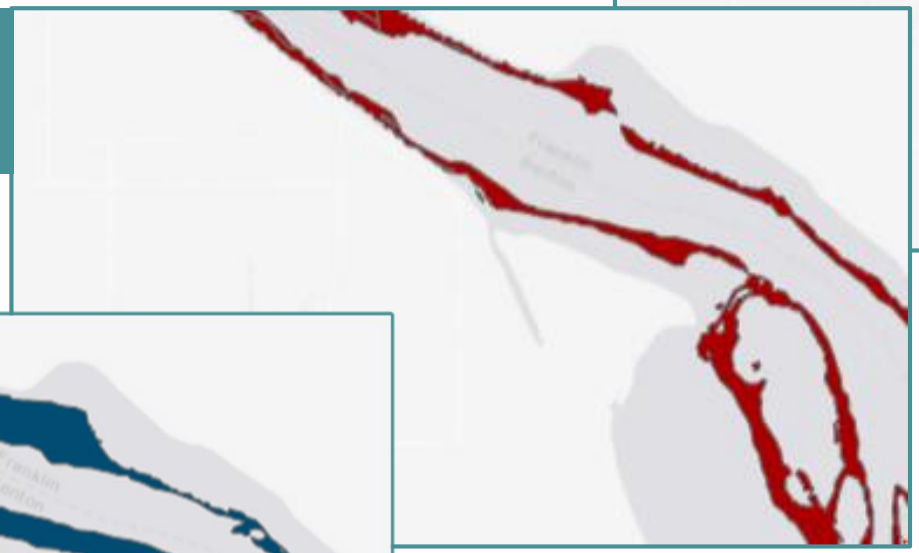
Suitable habitat for different species at 100 kcfs river-stage.

Adult sturgeon

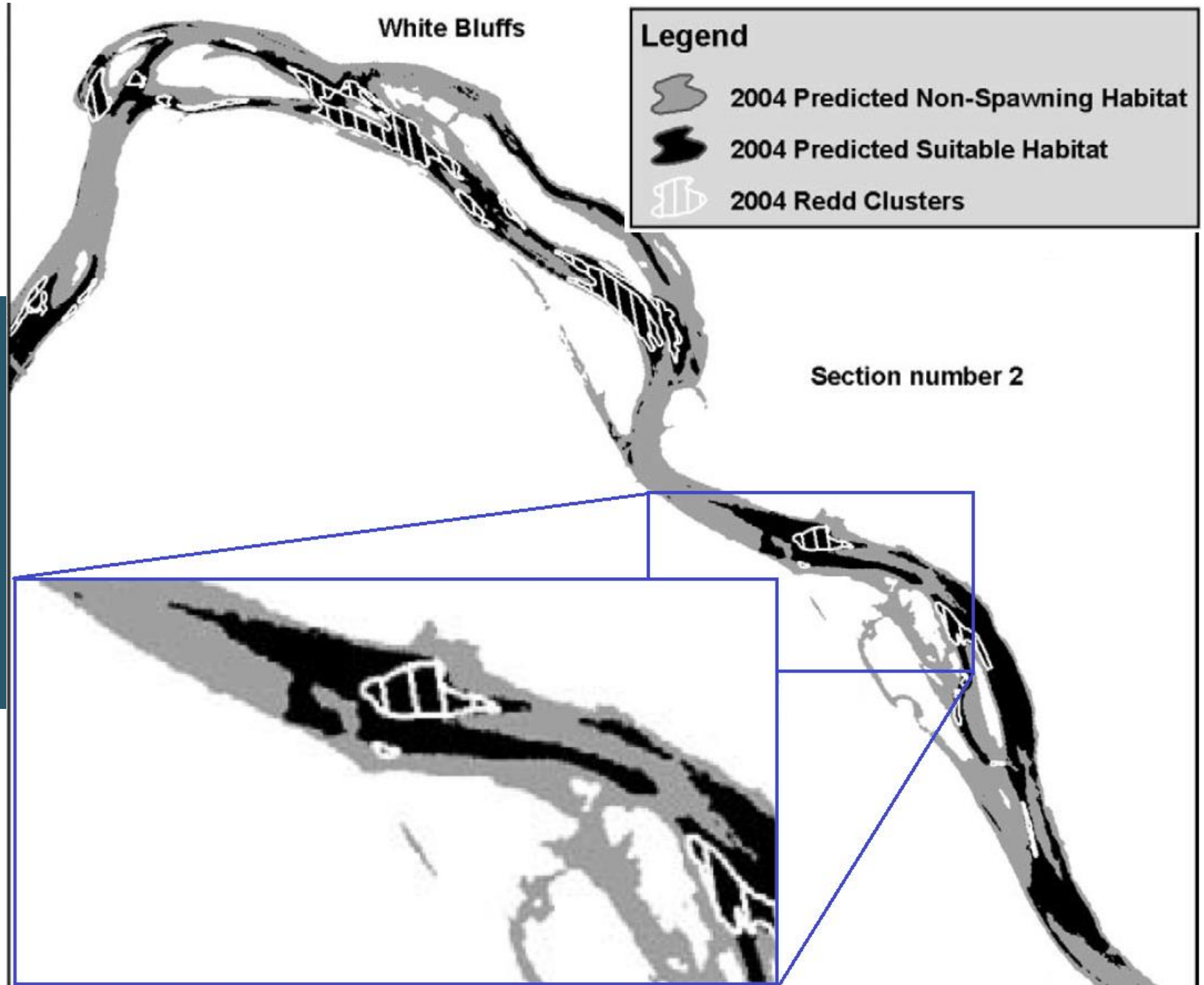
Adult sculpin

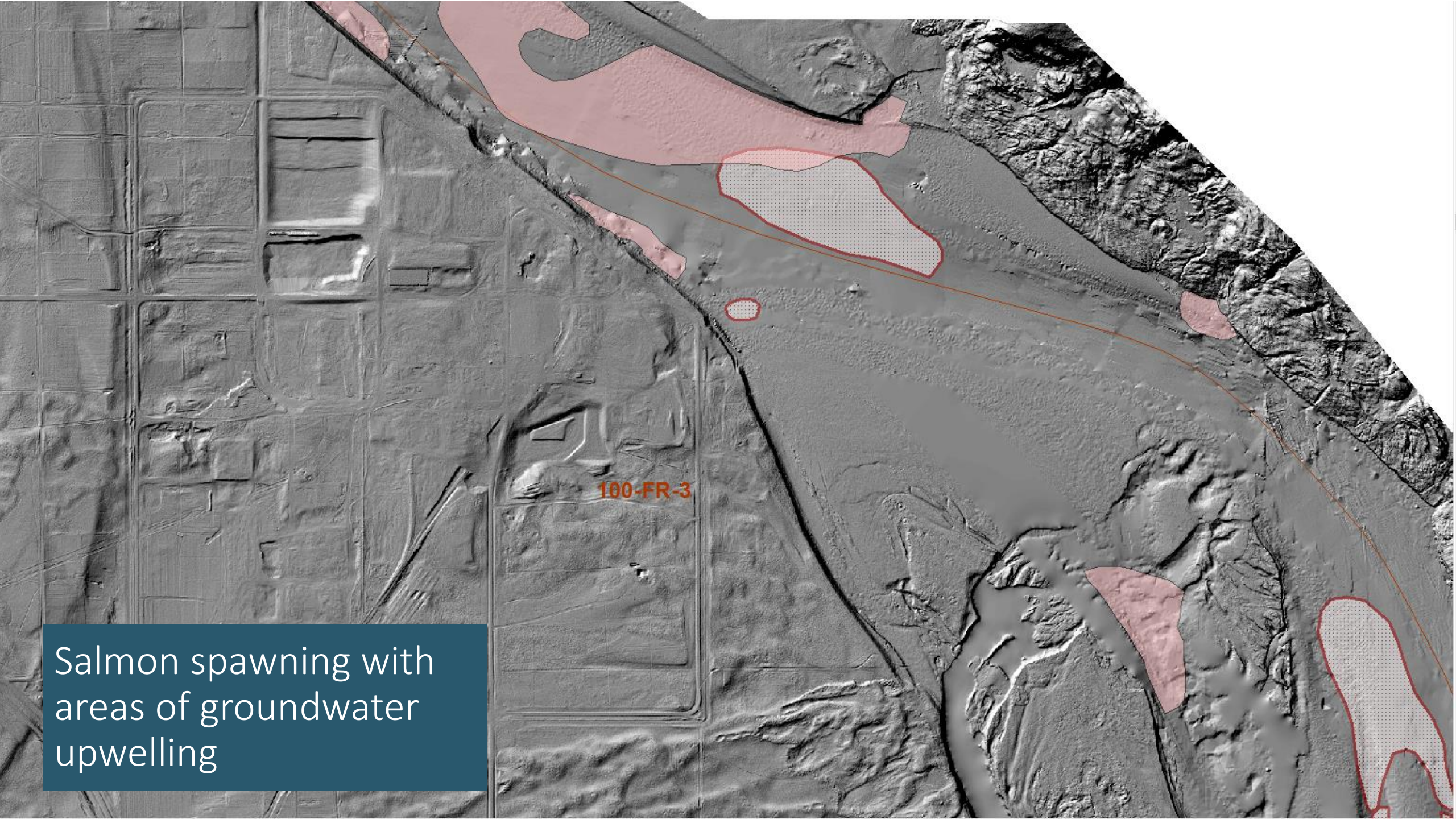


Larval lamprey

Adult lamprey

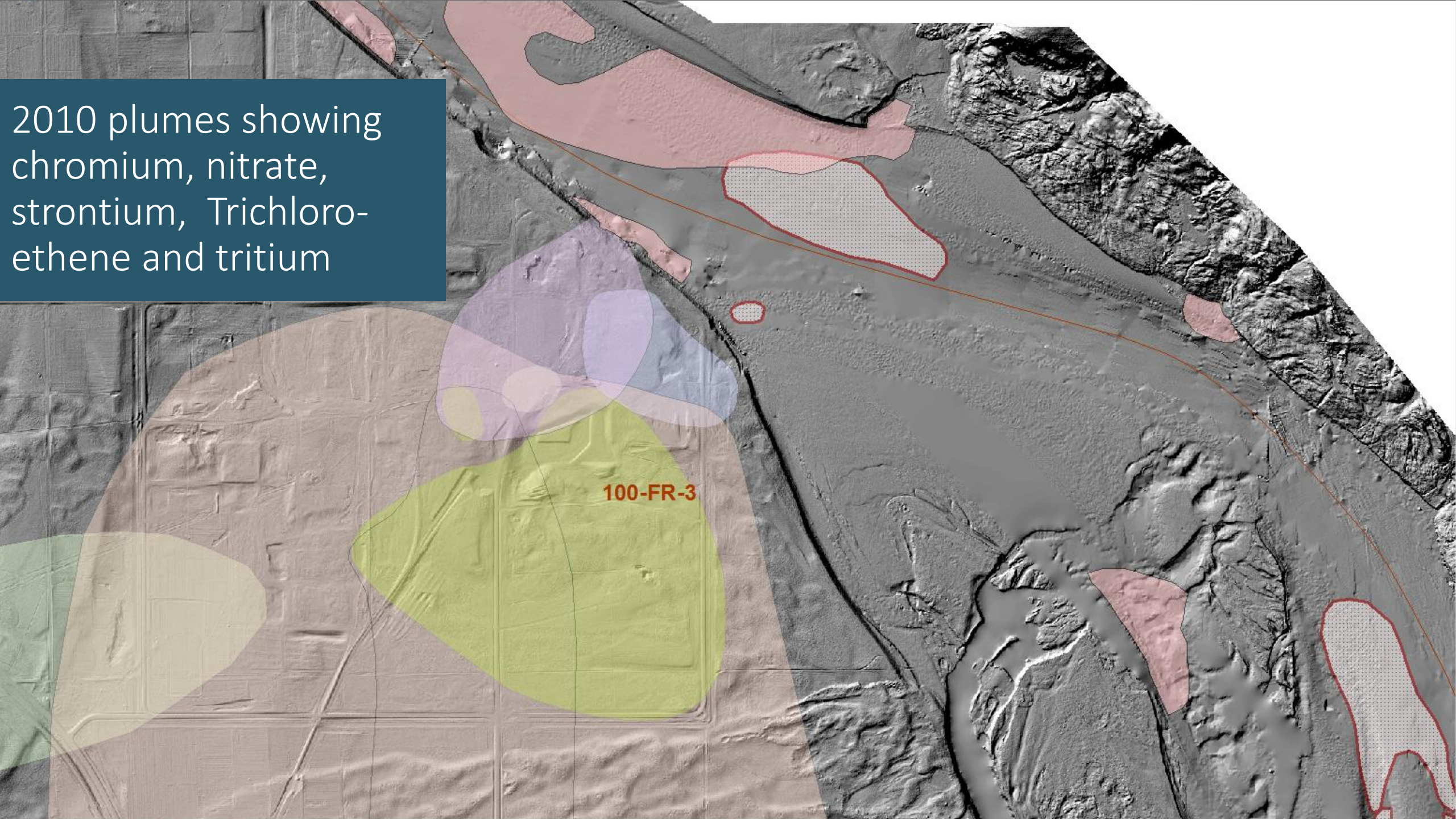
Mapping of fall Chinook salmon spawning habitat on Columbia River





Salmon spawning with areas of groundwater upwelling

2010 plumes showing chromium, nitrate, strontium, Trichloro-ethene and tritium



NEXT STEPS

- Have analyst use spatial data to show where injury is/was
  - Story changes over time, but we have to work with existing data
- Identify significant contaminants and species
  - Complications: mixtures, dam-releases, agriculture in area
  - Simplify the case being built
- Developing credit-system for restoration projects
- Assess mixtures of contaminants

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NEXT STEPS

- Providing a quick-and-dirty example became cumbersome:

Contaminant	Site Concentration (100-F Area plume)	Injury thresholds (from OSU & others)	Toxic effect (needed for equation)
Cr(VI)	20-50 µg/L	1.7 µg/L (NOEC)	LC25 = 124 µg/L (invert) LC50 = 30 µg/L (amphib)
NO3	45-100 mg/L	2 mg/L (recommend max)	LC10 = 10 mg/L
TCE	1-5 µg/L	210 µg/L	120 day LOEC
Strontium 90	8 pCi/L	Total rads: 1 mGy/d (terrestrial)	Modeled NOEC
Tritium	2000 pCi/L	Total rads: 1 mGy/d (terrestrial)	Modeled NOEC

$$\frac{\text{Site concen}}{\text{EC20 for } \mathbf{Cr}} + \frac{\text{Site concen}}{\text{EC20 for } \mathbf{NO_3}} + \frac{\text{Site concen}}{\text{EC20 for } \mathbf{TCE}} + \frac{\text{Site concen}}{\text{EC20 for } \mathbf{Sr90}} \text{ if } \geq 1 \text{ then likely to have toxic effect at EC20}$$

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* EC20 is the concentration producing an effect in 20% of exposed individuals

ESTIMATING INJURY COMPLICATED

- Challenges in:
  - Getting data
  - Estimating past injury
  - Estimating future injury (cleanup is not complete)
  - Estimating recovery time to pre-spill state
  - Simplifying complicated injury in large legal settlement
  - Trusting responsible party, who controls data

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Can NRD be used as leverage in cleanup?

- 1996 Council on Environmental Quality report estimates DOE's liability for NRD
  - $159 to $611 million (in 1995 dollars) of restoration projects
  - For all nuclear weapon complex sites (including Oakridge and Los Alamos)
- 1996 GAO report warns: DOE's potential liability for NRD
  - $2.3 - $20.5 billion (in 1995 dollars) of restoration projects
  - Corrects the CEQ report, for errors found
- 2019 Hanford Lifecycle Scope, Schedule and Cost Report claims:

  "Remaining costs for completion of the NRDAR process range from $5 million to $10 million…."

  "Any significant settlement funds for the NRDAR case would be obtained through the U.S. Department of Justice and the U.S. Judgement Settlement Fund."

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METHODS FROM 1996 GAO REPORT

Hanford Site's estimated cost of cleanup, from 2019 Lifecycle report's low-range cost: $323.2 billion

Hanford liability, using GAO ratios:

$19.3-30.4 billion

Table 3: GAO's Estimates of DOE's Potential Liability for Natural Resource Damages

Dollars in billions

Ratio of damages to cleanup costs at private sites	Potential liability based on DOE's modified contain-ment scenario	Potential liability based on DOE's base case scenario	Potential liability based on DOE's modified removal scenario
5.95% (reflecting cases with and without monetary damages)	$2.3	$2.8	$13.0
9.41% (reflecting cases with monetary damages only)	3.6	4.5	20.5

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QUESTIONS FOR THE OHCB

- Suggestions for restoration projects for the river?
  - Trustee council just beginning to consider this
- Suggestions for restoration project for shrub steppe?
  - Site restoration a priority
  - However, public/tribal use also a priority
- Ground water aquifer recharge restoration likely not an Oregon claim, but probably a Umatilla claim
- State of Oregon and Umatilla work together closely (MOA)

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SHRUB STEPPE RESTORATION IDEAS

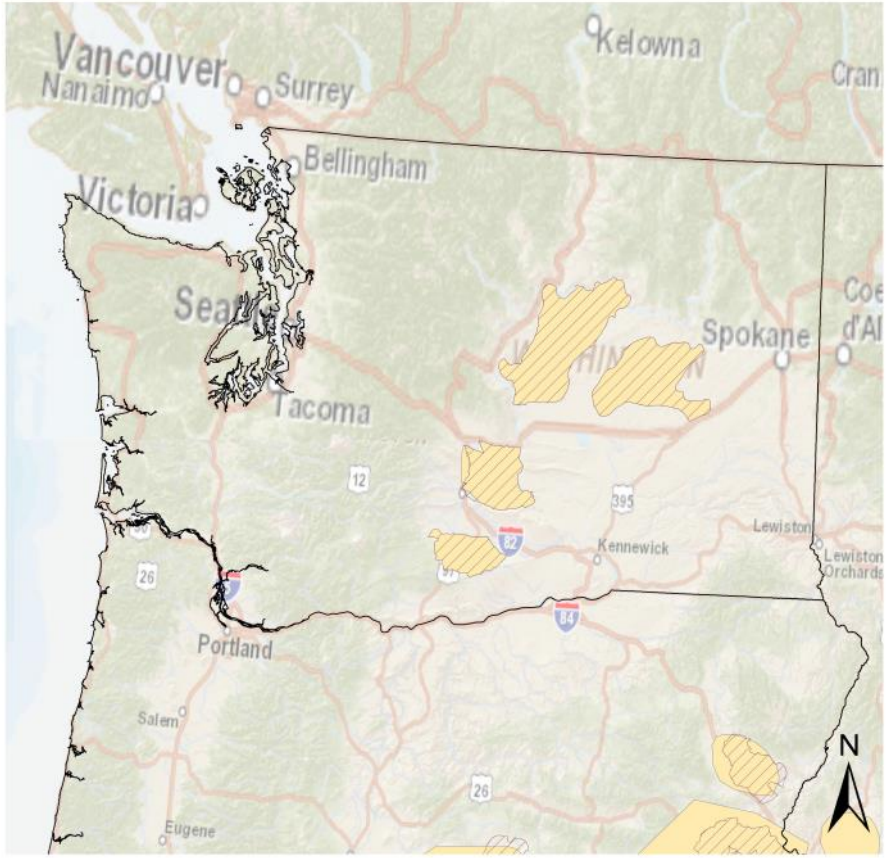
Greater Sage-Grouse PACs and COT Populations - Washington

Sage-Grouse PACs

GSG COT Populations

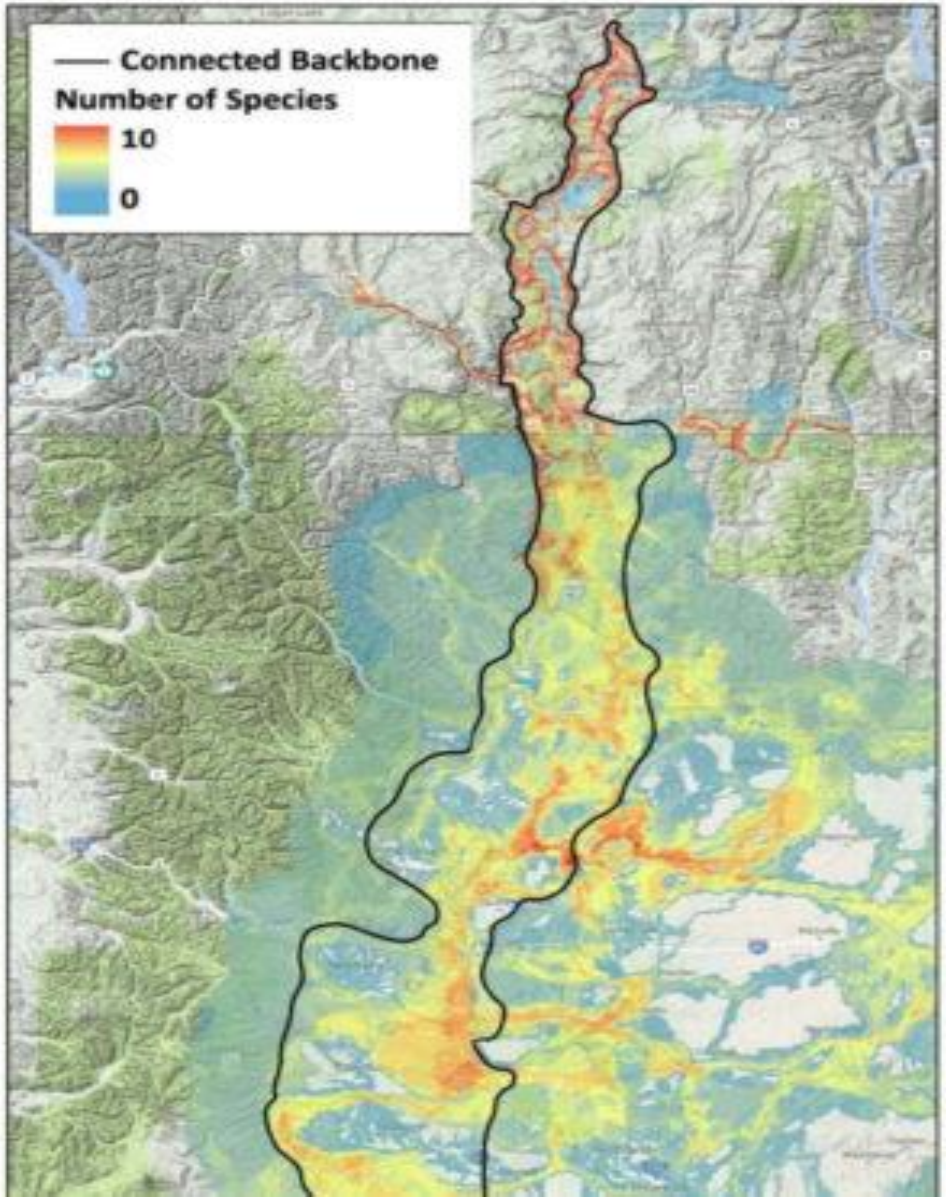
***PACs:** *Priority Areas of Conservation*

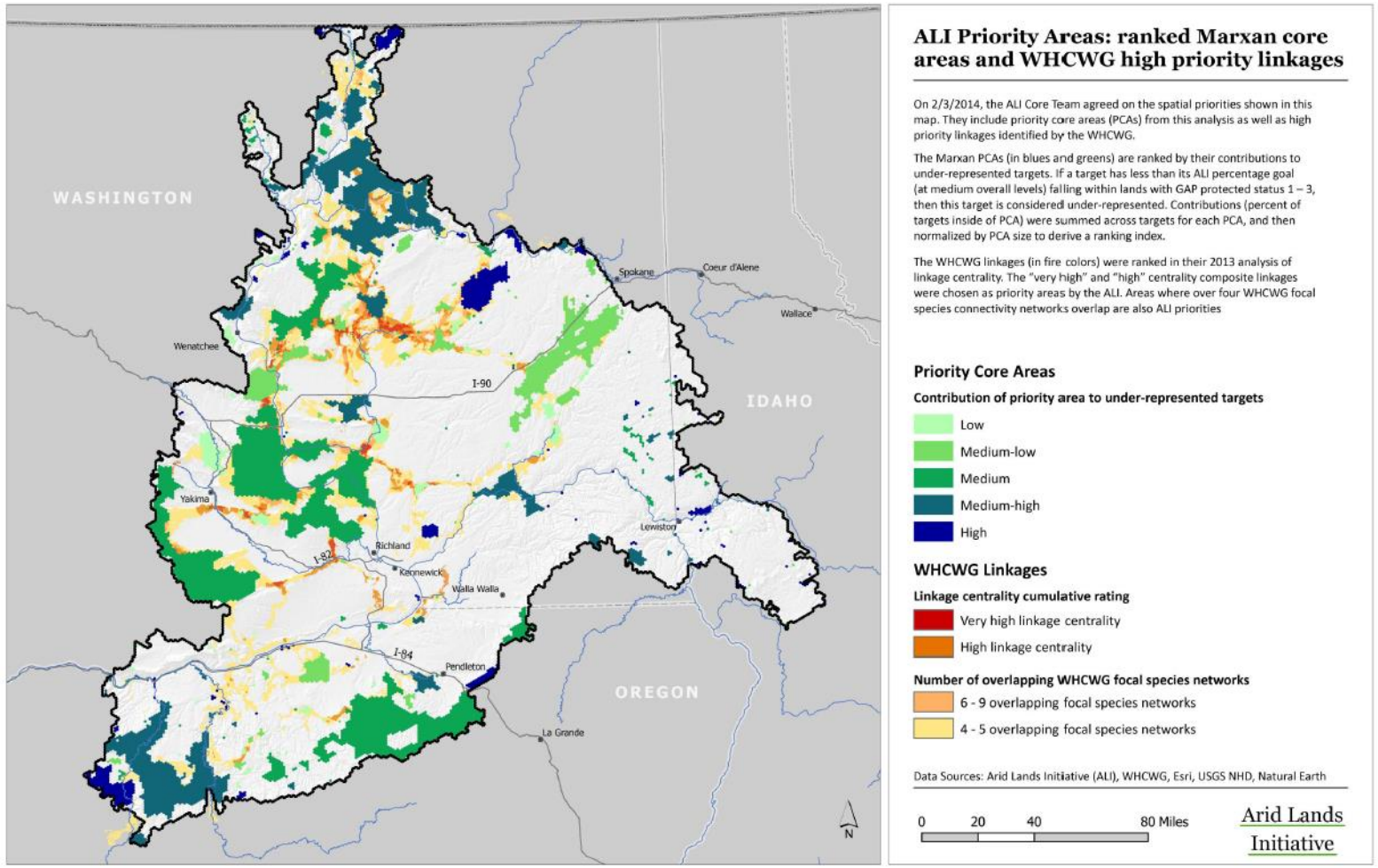
***COT:** *Conservation Objectives Team*



- Currently reviewing shrub steppe plans:
  - US Fish and Wildlife Service Critical Habitat
  - WA Wildlife Action Plan
  - Hanford Reach National Monument Comprehensive Conservation Plan

SHRUB STEPPE RESTORATION IDEAS





Arid Lands Initiative

Conservation Northwest

- **Hanford Natural Resource Trustee Council**

  www.hanfordnrda.org

- **U.S. Dept. of Energy Hanford web site**

  www.hanford.gov/page.cfm/HNRTC

WHY HNRTC HASN'T MOVED FASTER

- Under-funded: 2014 Project Execution Plan forecasts completion of Restoration Plan in 2024 – if fully funded.
  - PEP budget estimated NRDA cost of $85 million, resulting in an annual average cost of $ 8.5 million.
  - Budget allocations by the DOE for the NRDA have averaged $3.1 million/year.
- All data/analyses must go through quality control
- Contracting through DOE is slow (sometimes dodgy)
- The HNRTC operates under consensus

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