

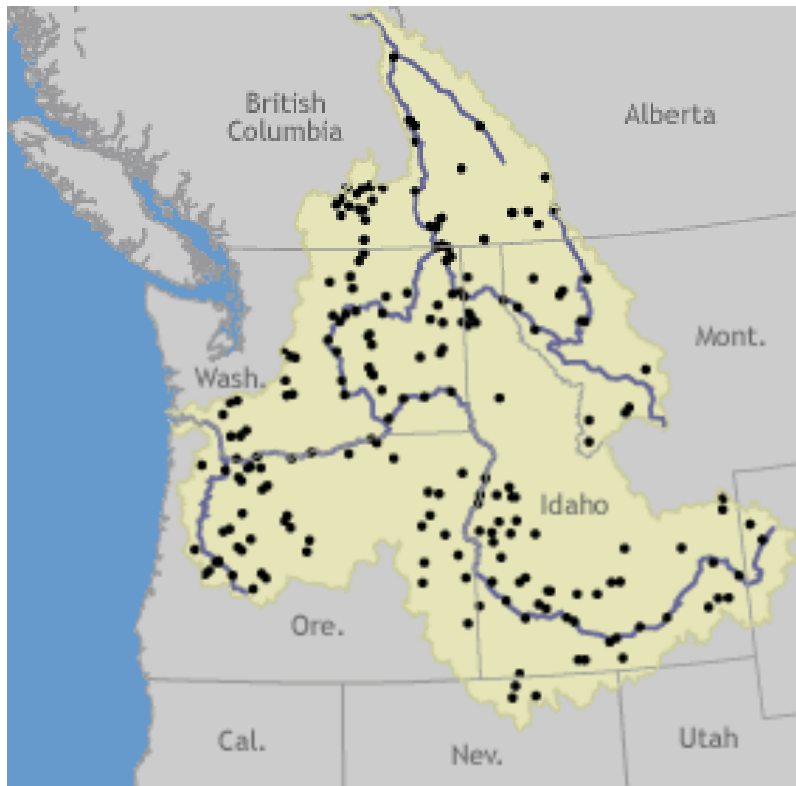
Principles for the Proactive Conservation of Aquatic Resources



Jack E. Williams
Trout Unlimited



The causes of salmon decline in freshwater systems are well understood - science alone is not the answer



Major dams in the Columbia River Basin

- Dams
- Water diversions
- Overfishing
- Hatchery impacts
- Water pollution
- Climate change
- Habitat degradation
- Exotic species

Despite substantial capital investment and increasing scientific knowledge, much of the remaining salmon resource is threatened with extinction or likely to be threatened in the near future



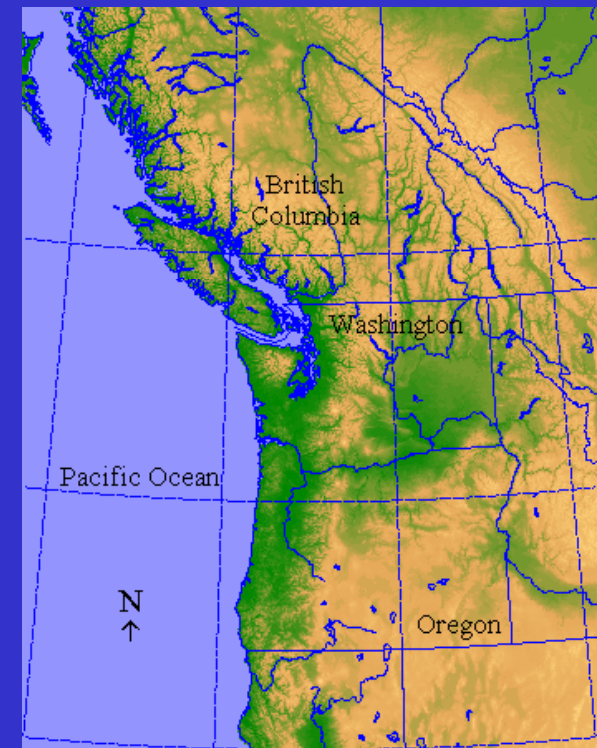
“We have an ‘environmental crisis’ because we have consented to an economy in which by eating, drinking, working, resting, traveling, and enjoying ourselves we are destroying the natural, God-given, world.”

--Wendell Berry, 2003



The predicted future may not be kind to salmon...

- More people and larger urban areas
- More demands for clean water
- Less snowpack, earlier peak flows, reduced base flows
- Increasing severity and frequency of flooding
- Increasing severity and frequency of droughts
- Increasing wildfire
- More exotic, invasive species



What we need to do...

1. Save all the pieces
2. Protect and secure our strongholds
3. Protect-Reconnect-Restore
4. Respond to climate change and human population growth
5. Manage in an ecosystem context, with less reliance on artificial methods
6. Improve monitoring to distinguish responses among ocean, estuarine and freshwater habitats

"The first rule of intelligent tinkering is to save all the pieces." --Aldo Leopold

Estimating lost diversity within 6 salmon species within Pacific Northwest and California

- 29% of 1400 populations are extinct
- 27% of genetic diversity
- 15% of life history diversity
- 33% of ecological/spatial diversity



Gustafson et al. 2007. Pacific salmon extinctions: quantifying lost and remaining diversity. *Conservation Biology* 21:1009-1020.

Biocomplexity and fisheries sustainability



- Several hundred discrete spawning populations of sockeye salmon in Bristol Bay streams
- Each population displays diverse life history and local habitat adaptations

“This biocomplexity has enabled the aggregate of populations to sustain its productivity despite major changes in climatic conditions affecting the freshwater and marine environments.”

--Ray Hilborn et al. 2003 PNAS 100:6564-6568



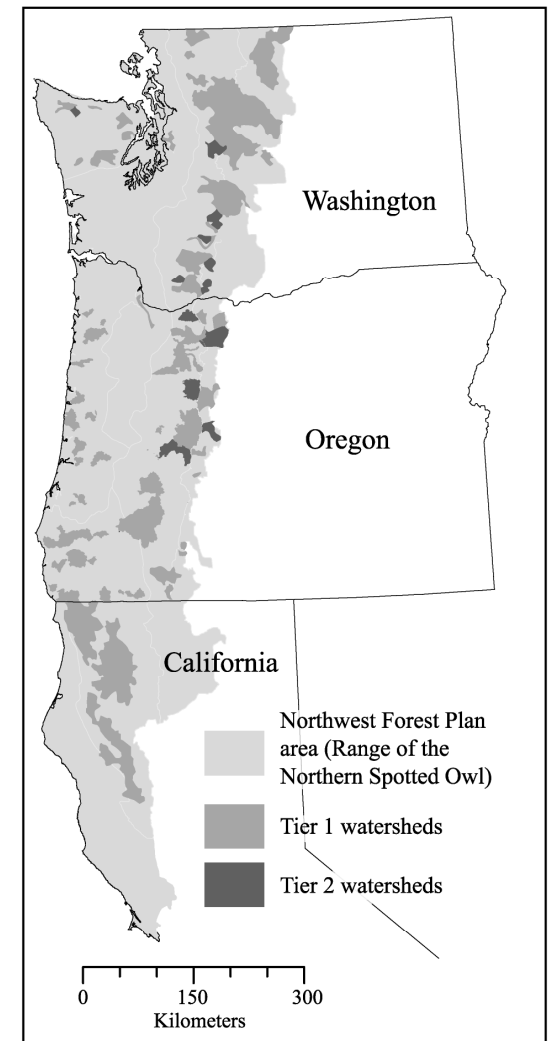
Protect best remaining habitats and strongholds: Proposed Copper-Salmon Wilderness in headwaters of Elk River, Oregon

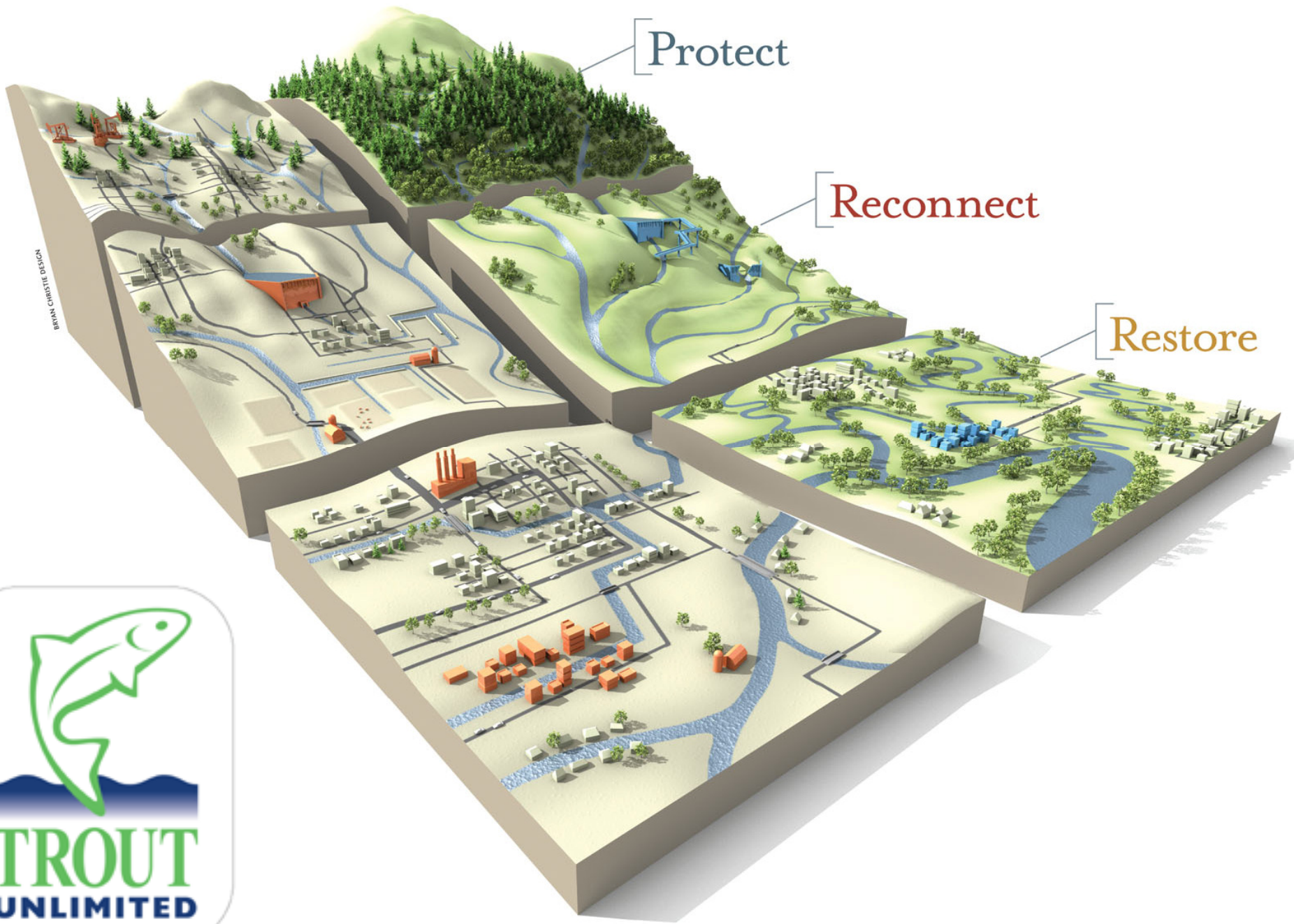
Highest densities of salmon
redds in coast-range
river systems



What are the characteristics of a network of salmon strongholds?

- How are they selected?
- Where are they located?
- How are they connected?
- How are they managed?
- How will they be funded?



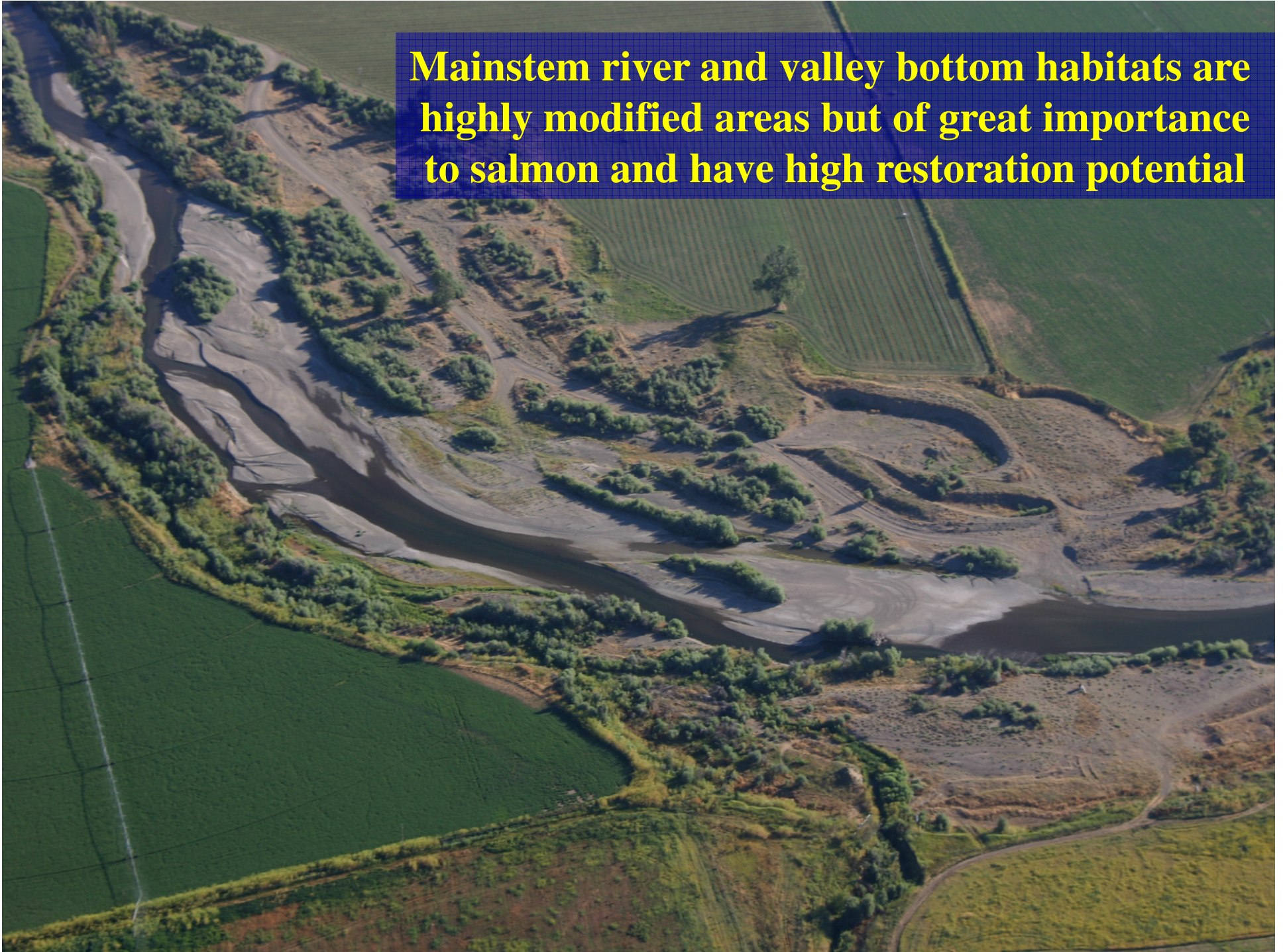


Reconnect....

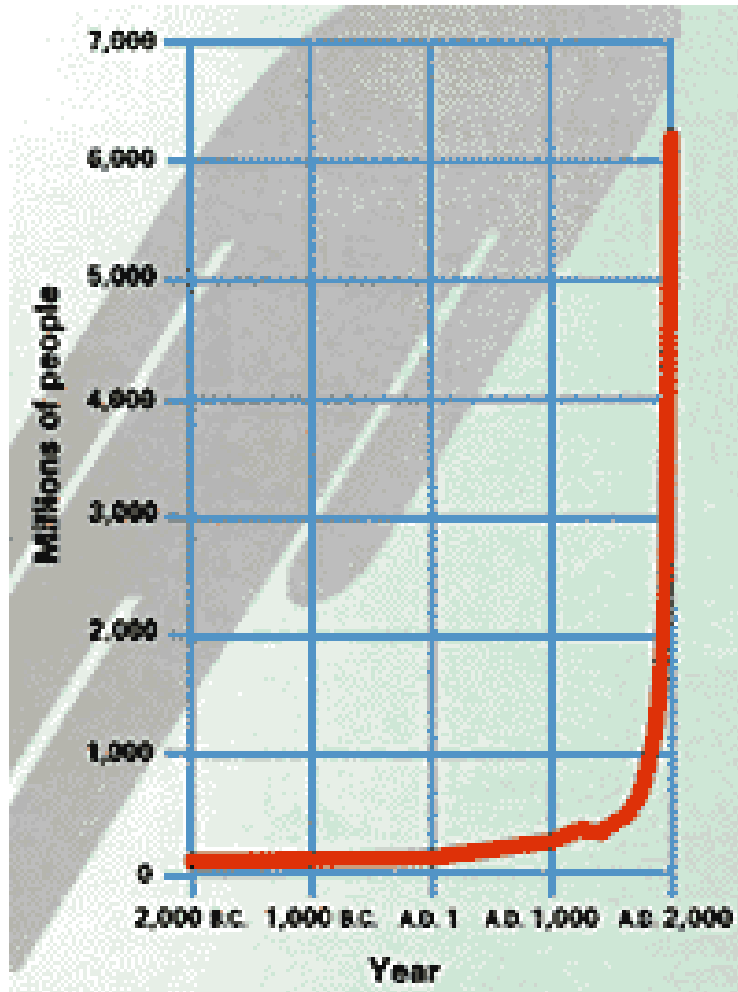
- Rivers to floodplains
- Headwaters to mainstems
- Freshwaters to estuaries
- Aquifers to rivers



Mainstem river and valley bottom habitats are highly modified areas but of great importance to salmon and have high restoration potential



Can we deal with major stressors of 21st Century?



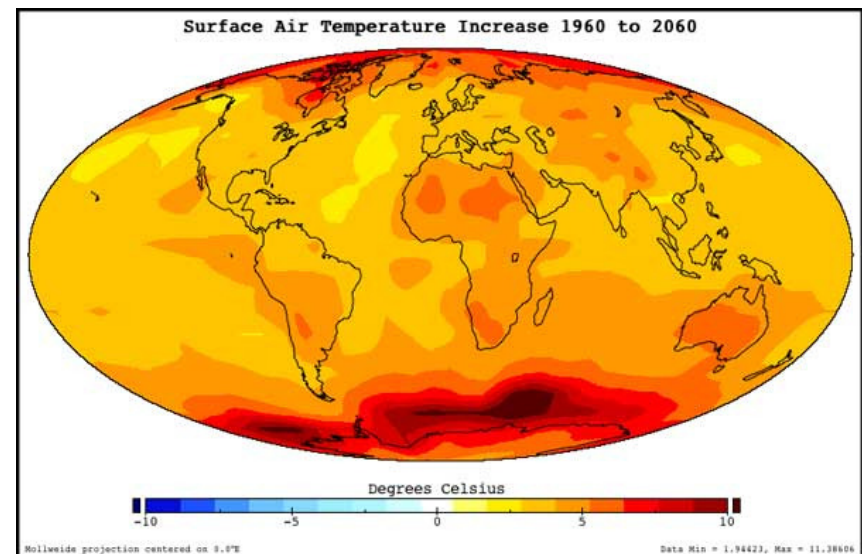
Human population growth



Per capita resource consumption rates



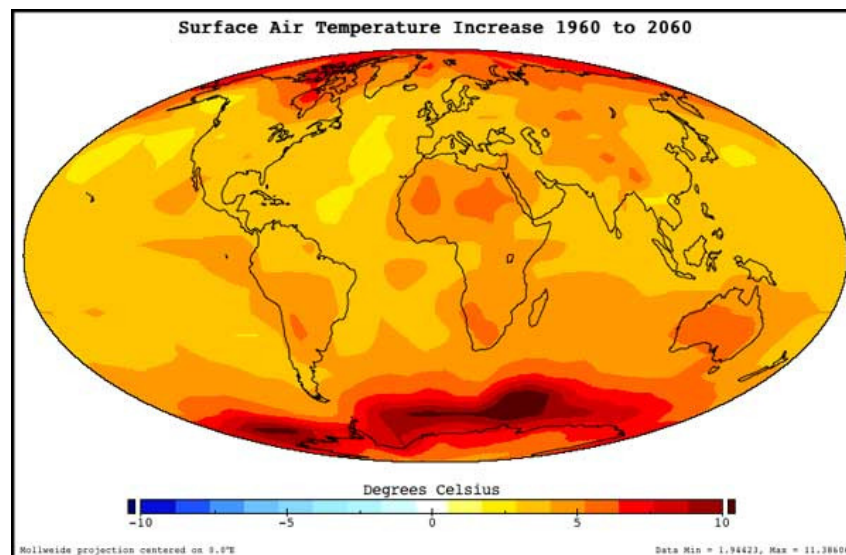
Exotic species



Rapid climate change

Commonly predicted effects of climate change to salmon watersheds

- Increased water temperature
- Increased evaporation rates
- Earlier spring runoff
- Reduced snowpack
- Higher winter flows
- Lower summer flows
- Greater variability in extreme temperatures
- Greater storm intensity
- Increased frequency of flooding
- Increased frequency of drought



- Increased wildfire
- Increased forest insect pests
- Saltwater intrusion from rising sea levels

Can we restore stream systems and watersheds that are resistant and resilient to disturbances?



"A management strategy that has as a centerpiece artificial propagation and restocking of a species that has declined as a result of environmental degradation and overexploitation, without correcting the causes for decline, is not facing biological reality."

--Gary Meffe (1992)



Unintended consequences of barging salmon around dams in the Snake River

- Barged fish had approximately 3x higher straying rates compared to in-river migrants
- 1.7 - 3.4 times more likely to fall back
- Multiple fall backs more likely
- Disrupts juvenile imprinting



Matthew Keefer et al. 2008
Ecological Applications 18:1888-1900.

Lower Snake River Compensation Plan: authorized in 1976 to mitigate Snake River Dams

Summary of
smolt-to-adult survival

Basin	Objective	Actual
Grande Ronde	0.65%	0.05%
Upper Salmon	0.87%	0.10%
Imnaha	0.65%	0.30%



1998 Lower Snake River hatchery mitigation program review: Science Panel summary findings

- Under existing conditions, many populations of salmon and steelhead in the Snake River system will be extinct by 2025
- Substantial improvements in smolt-to-adult survival are needed.
- Hatcheries alone cannot solve the problem
- Must see improved survival/habitat conditions outside of hatchery system

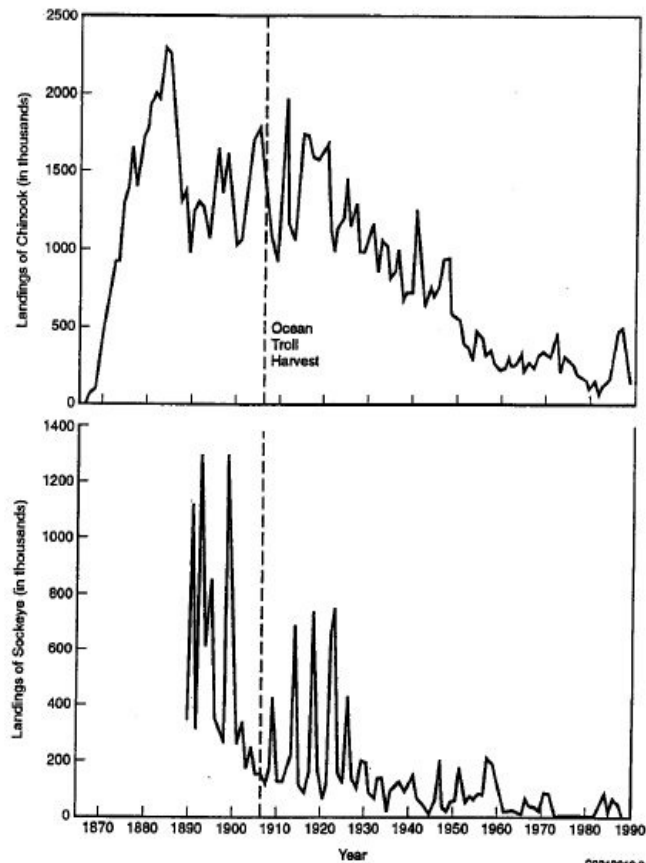
How can we reform the management of hatcheries to help restore habitat and recover wild stocks?



Monitoring and evaluation:

the value of cross boundary and long-term data sets to distinguish oceanic, estuary, and freshwater responses

Summary of Factors Causing Decline



How we need to do it...

- 1. Solve for pattern**
 - a. Address major stressors**
 - b. Work across multiple scales and political boundaries**
 - c. Pay attention to context**

- 2. Create an ethic for salmon restoration**
 - a. Restoration economy**
 - b. Understanding impacts of our “ecological footprint”**
 - c. Foster a land ethic**

The Art and Practice of Solving for Pattern

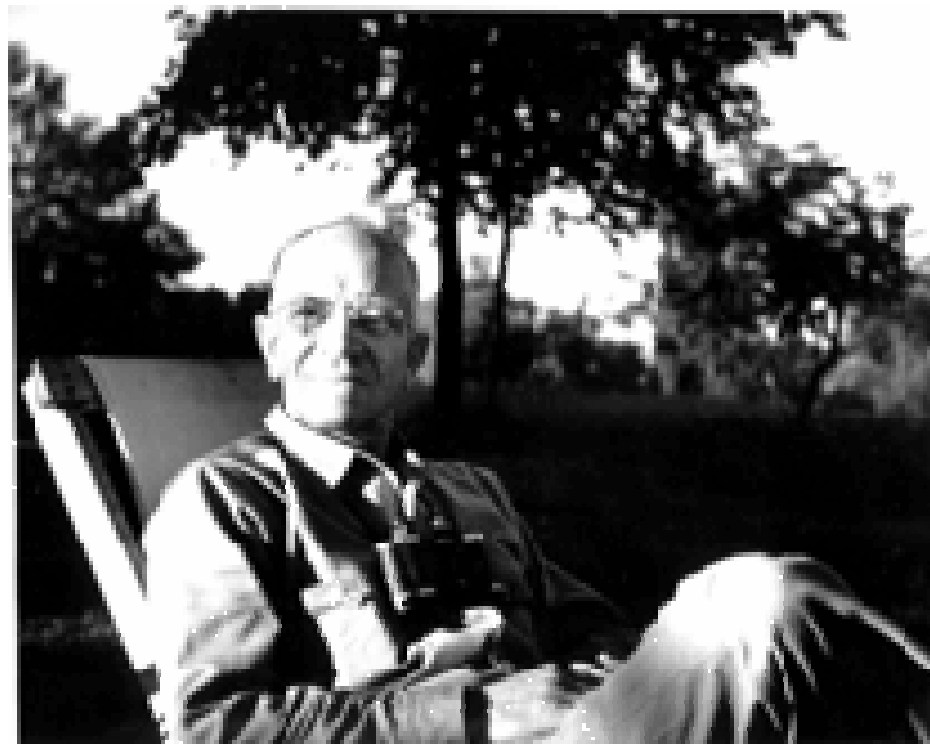


Wendell Berry, 1980

"The whole problem must be solved, not just some handily identifiable aspect of it."

The Land Ethic

“In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such.” --Aldo Leopold, 1949



How do we convince society of the benefits of protecting and restoring salmon?

"No important change in ethics was ever accomplished without an internal change in our intellectual emphasis, loyalties, affections, and convictions."

--Aldo Leopold, 1949

