



# **Incorporating Native American eco-cultural systems and First Foods into exposure and impact analysis**

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**International Society of Exposure Science  
Seattle**

**October 31, 2012**



**Tribal lifestyles are not historical anachronisms. They are real, current, and protected by constitutional law (inter-governmental treaties) and/or federal trusteeship obligations.**



**Tribes are buying back their land and restoring the resources.  
Tribes are encouraging traditional practices and original healthier diets.**



**MONTANE  
RESOURCES**

**RIPARIAN  
RESOURCES**

**WETLANDS  
RESOURCES**

**DESERT RESOURCES**

**AIR AND DUST  
INHALATION**

**CULTURAL  
ACTIVITIES**

**PROCESSING**

**DIRECT SOIL  
EXPOSURE**

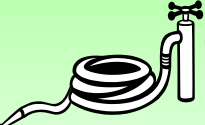
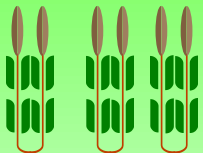
**GARDEN PRODUCE**

**GROUNDWATER**

**AQUATIC  
FOODS**

**GATHERED  
FOODS**

**GAME**

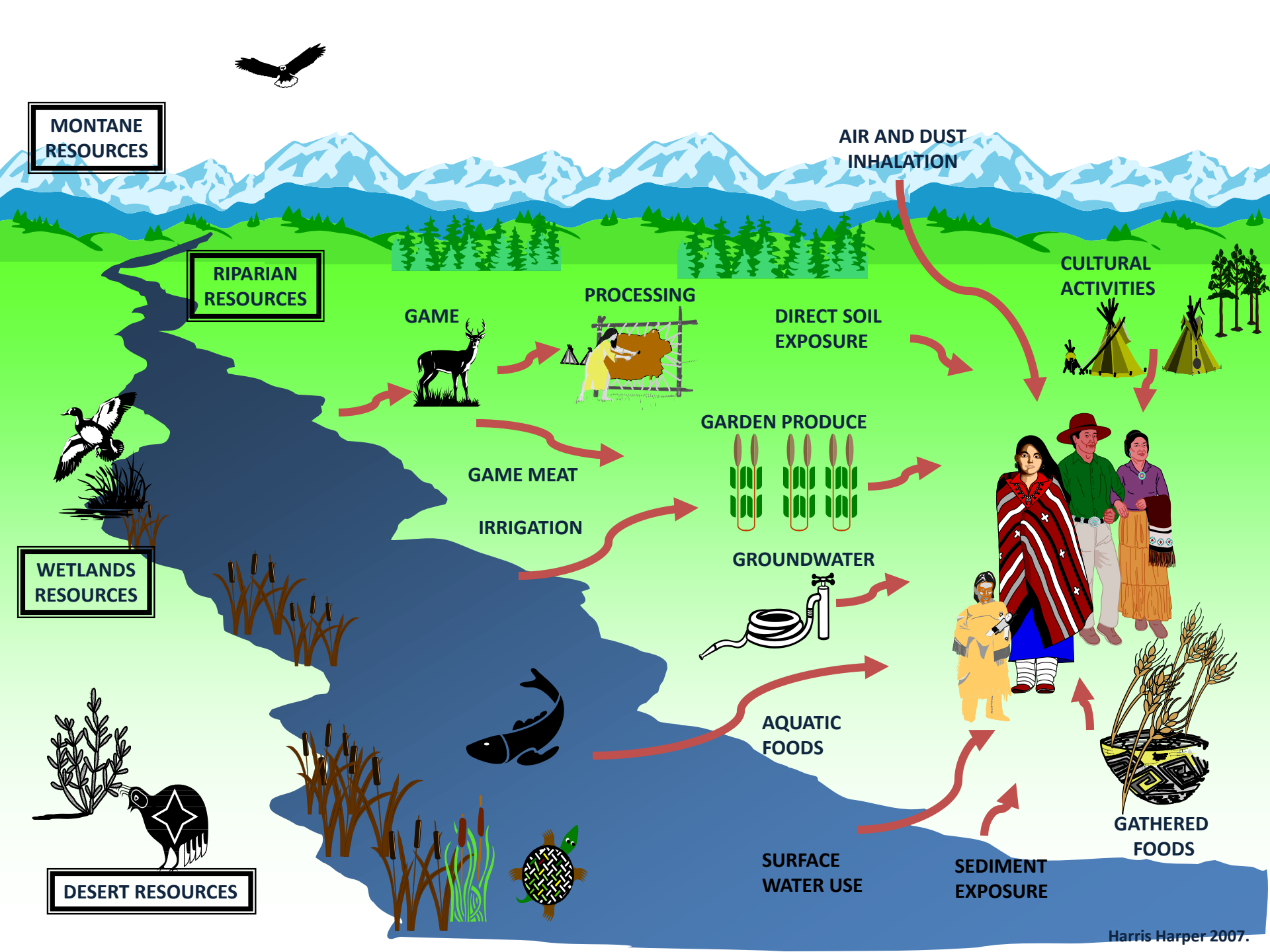


**GAME MEAT**

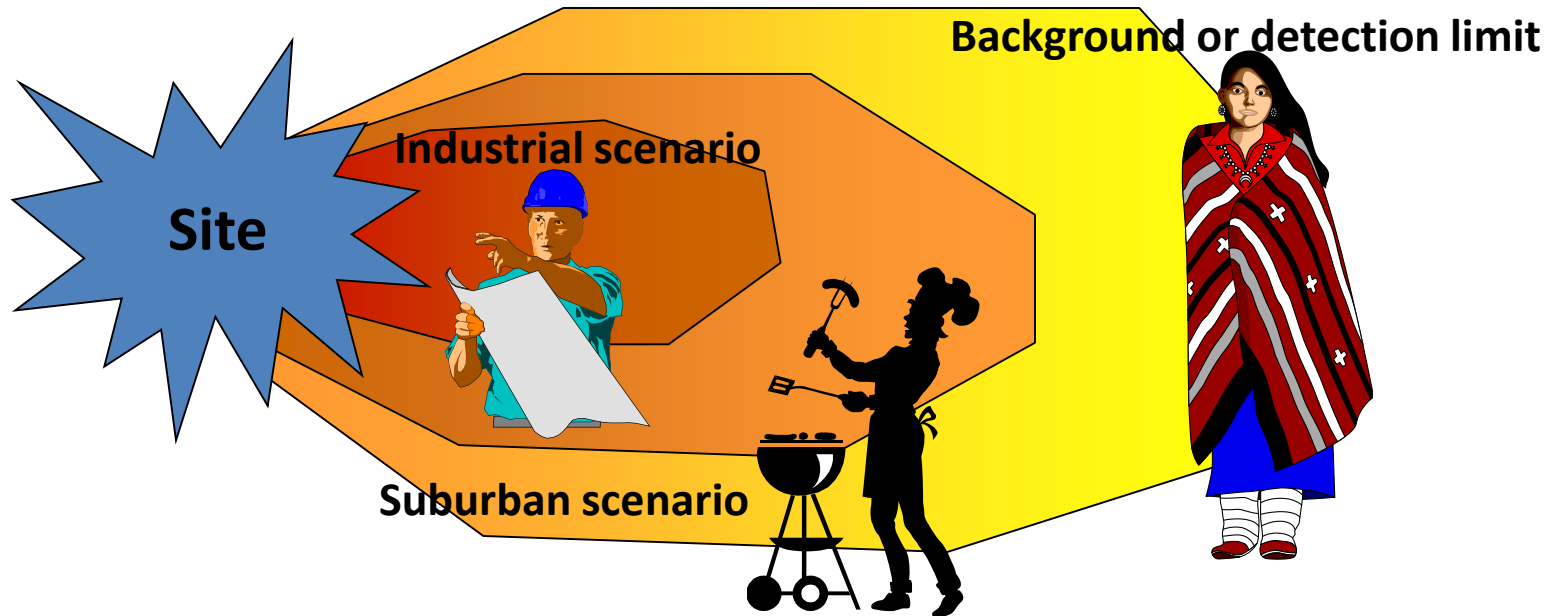
**IRRIGATION**

**SURFACE  
WATER USE**

**SEDIMENT  
EXPOSURE**



# Exposure Scenarios in Site Assessment: Defining the “Zone of Risk” or “Nature and Extent of Contamination”





# What Assumptions about Baseline?

Good resource quality and traditional resource use patterns?

OR

Hybrid part-traditional resource use, global contaminants, non-point source pollution, degraded habitat?

*Every tribal member has the right to follow their heritage, by Treaty and by natural law, even if not everyone does so all the time. Which assumption is used for regulation?*

**Baseline**

Environmental conditions  
Unrestricted access and use



**Fully traditional, heritage**



**Hybrid**



**Suburban + camping and more fish**



**Urban; away from home**



# Subsistence Hunting and Gathering

Restricted access is not a “baseline” assumption even if it is current condition







**Traditional resource management used prescribed burns to increase food and medicinal plants.**

**Today's equivalent is transmission line rights of way with early-successional plant communities, more browse for game, better berries.**

**These areas are not remote areas; they are subsistence grocery stores without re-entry time limitations.**

**Pesticide registration needs to incorporate traditional environmental knowledge.**





# Contemporary Fish Surveys

Asking people what they eat now simply measures the effectiveness of fish advisories. Almost every water body has mercury-based restrictions.



**Choose Fish Low in MERCURY**

Mercury in fish can harm your family. Even small amounts of mercury can damage a brain that is starting to form or grow. Pregnant women and children under 8 should only eat fish low in mercury.

Use this chart to quickly identify which fish are low and which fish are high in mercury. For detailed Safe Eating Guidelines you can download a brochure from our website at: [www.state.ma.us/ohs/step4a.htm](http://www.state.ma.us/ohs/step4a.htm)

Fish You Buy		Fish You Catch	
Atlantic Salmon	Shellfish	Atlantic Mackerel	Brook Trout
Low Mercury Level	Low Mercury Level	Low Mercury Level	Low Mercury Level
Bluefish, Haddock, Pollock, Cod	Striped Bass	Landlocked Salmon	Striped Bass
Low Mercury Level	Low Mercury Level	Low Mercury Level	Low Mercury Level
Red 'White' Tuna	Brown Trout	Brown Trout	Lake Trout
High Mercury Level	Low Mercury Level	Low Mercury Level	Low Mercury Level
Hallbut	Largemouth Bass	Largemouth Bass	White Perch
High Mercury Level	Low Mercury Level	Low Mercury Level	Low Mercury Level
Shark	Smallmouth Bass	Smallmouth Bass	Pickereel
High Mercury Level	Low Mercury Level	Low Mercury Level	Low Mercury Level

**CATCH AND RELEASE FISHING ONLY**

All fish must be returned to the water immediately, without unnecessary injury. No baitfish or fish for bait are permitted.

*Fish from these waters have high levels of chemical contaminants (PCBs) that may cause reproductive and developmental effects and cancer.*

**DO NOT POSSESS, REMOVE OR EAT FISH FROM THIS WATER**

NYS Department of Environmental Conservation  
NYS Department of Health

you - mercury!  
Eating Guidelines.





**Contemporary suppression of resource use.** Contemporary uses may be restricted due to contamination (e.g., fish advisories, contaminated sites), legal limbo (rights of access), etc.



PAST & FUTURE. Do you want to know what risks would be if people used the resource in an unrestricted manner (e.g., a baseline CERCLA risk assessment; heritage & Treaties)?

Search of Anthropology, Ecological, Biomedical literatures for natural resource use, with confirmatory interviews for accuracy;

PRESENT. Do you want to know current exposures for public health reasons?

Contemporary resource use surveys, dietary diaries, questionnaires, interviews.

**Do you know if your Tribe is bimodal? Multiple Tribes forced onto single reservations? Status of fishing rights? Policies? *Cross-sectional data are modern statistical averages, not a cultural description of either a traditional or current subsistence lifestyle or diet.***

# CTUIR First Foods



Choosh



Choosh



Salmon



Huckleberry

Elk



Chokecherry

Deer



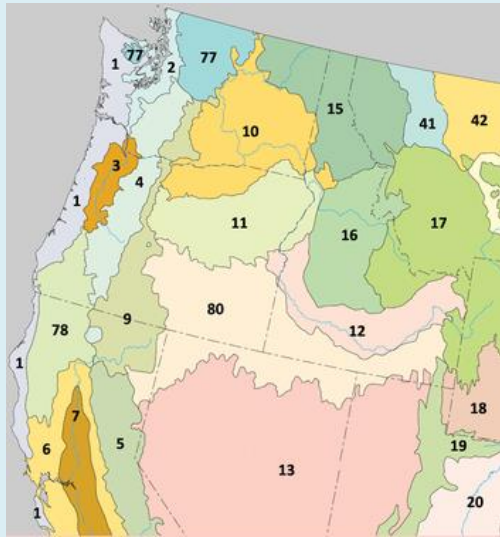
Bitterroot

Cous, roots

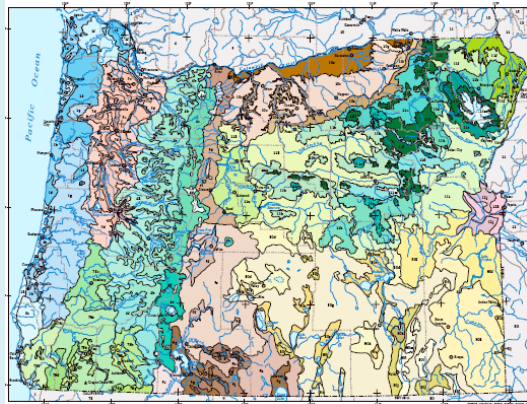




# Scenarios based on Local ecologies, Natural resource use, Seasonal Rounds



EPA Level III Habitat types



EPA Level IV Habitat types



Umatilla multi-habitat Seasonal Round

# Elements of an exposure scenario

1.

Ecology

Walla Walla, Umatilla  
(River peoples)



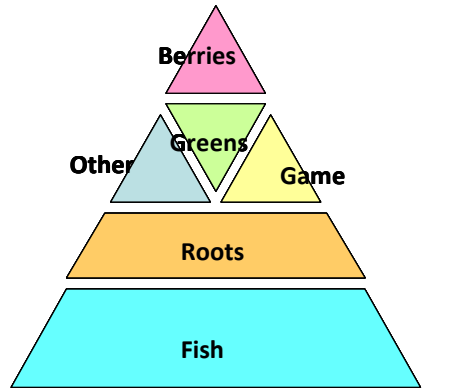
Cayuse  
(Upland peoples)



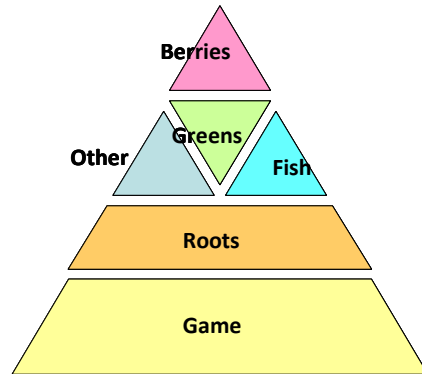
2.

Traditional diet

Staple foods in food groups  
Calories-Vitamin-Mineral .



Calories, Nutritional content, Daily intake



3.

Direct exposures

First Foods

- WATER
- AQUATICS
  - Salmon – chinook, coho, sockeye, steelhead
  - Lamprey, Sturgeon
  - Mussels
  - Trout, Whitefish, Suckers
- LAND MAMMALS
  - Mule deer, Elk, Whitetail deer, bighorn, mountain goat, bison, moose
- ROOTS
  - Cous, Camas, Celery, Carrot, Bitterroot (also moss, greens)
- BERRIES
  - Chokecherry, Huckleberry

Exposure Factors

- Daily sil ingestion rate based on terrain and activities;
- Daily water intake rate;
- Daily inhalation rate
- Residential (24/7/365/70), Self-sufficient.



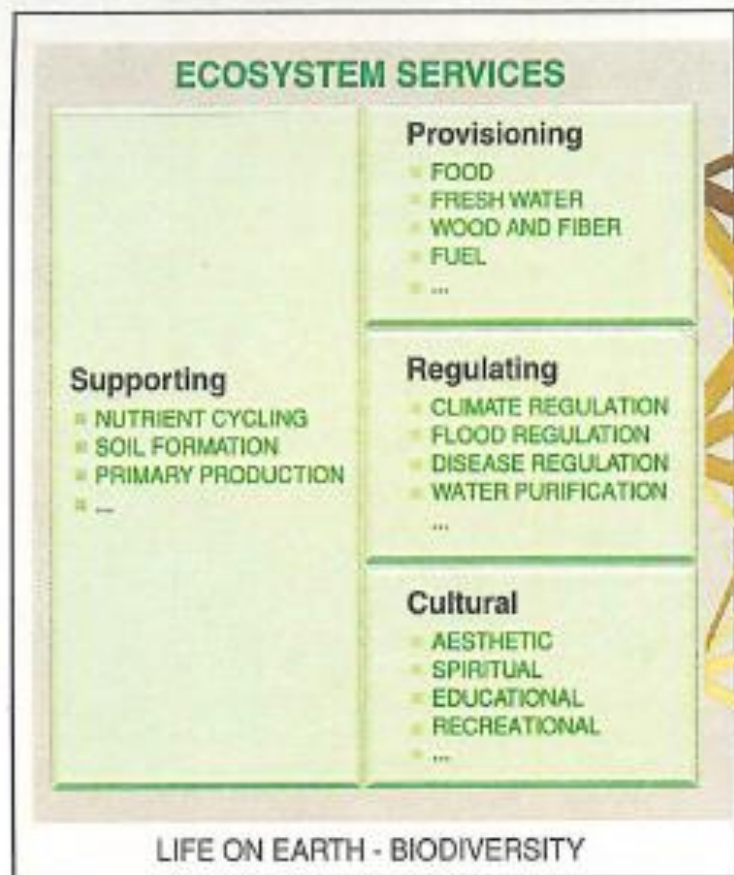
# Cultural Importance of Natural Resources



**We are wild salmon people**

**“Every acre of land lost is like a page ripped out of the Bible.”**

Gabe Bohnee, Nez Perce Tribe



**CONSTITUENTS OF WELL-BEING**



Source: Millennium Ecosystem Assessment

**ARROW'S COLOR**  
Potential for mediation by socioeconomic factors

- Low
- Medium
- High

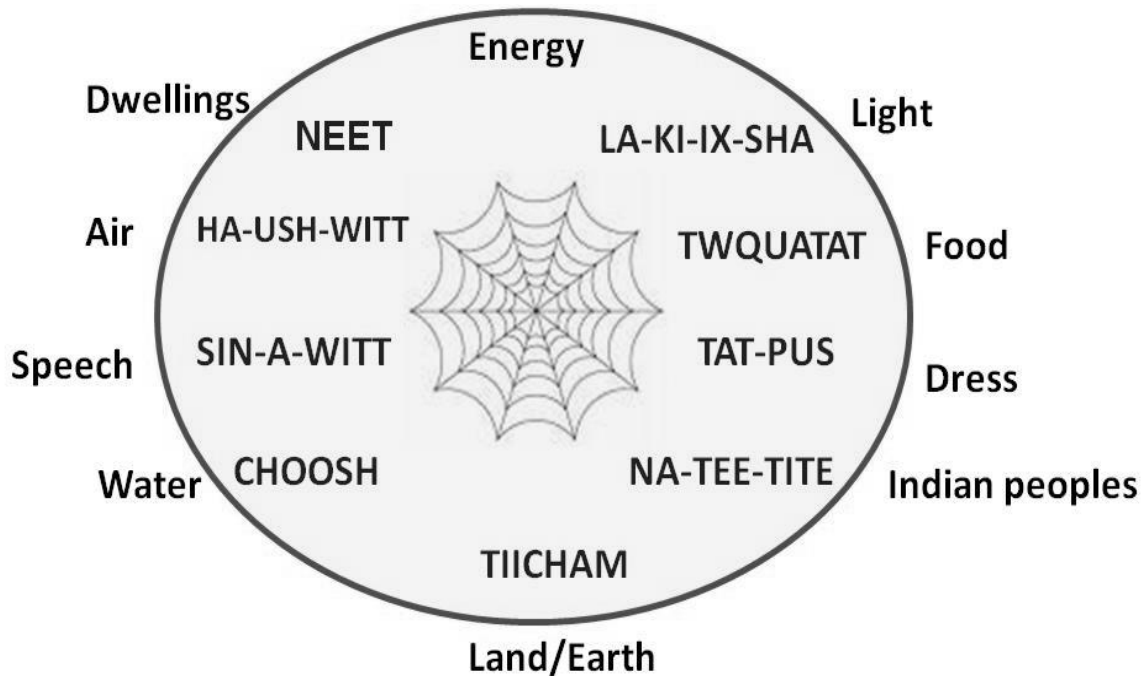
**ARROW'S WIDTH**  
Intensity of linkages between ecosystem services and human well-being

- Weak
- Medium
- Strong



# Tamánwit (natural law - CTUIR)

- Ties First Foods and serving order to the landscape
  - Reflects explicit Treaty-identified resources
- Guides research into ecological process and restoration
  - World View – TEK – Ways of knowing and relating,
    - Ways of valuing and establishing worth



Cultural keystone species are not simply nutritious. They feed the body & feed the spirit

## First Foods

### Water

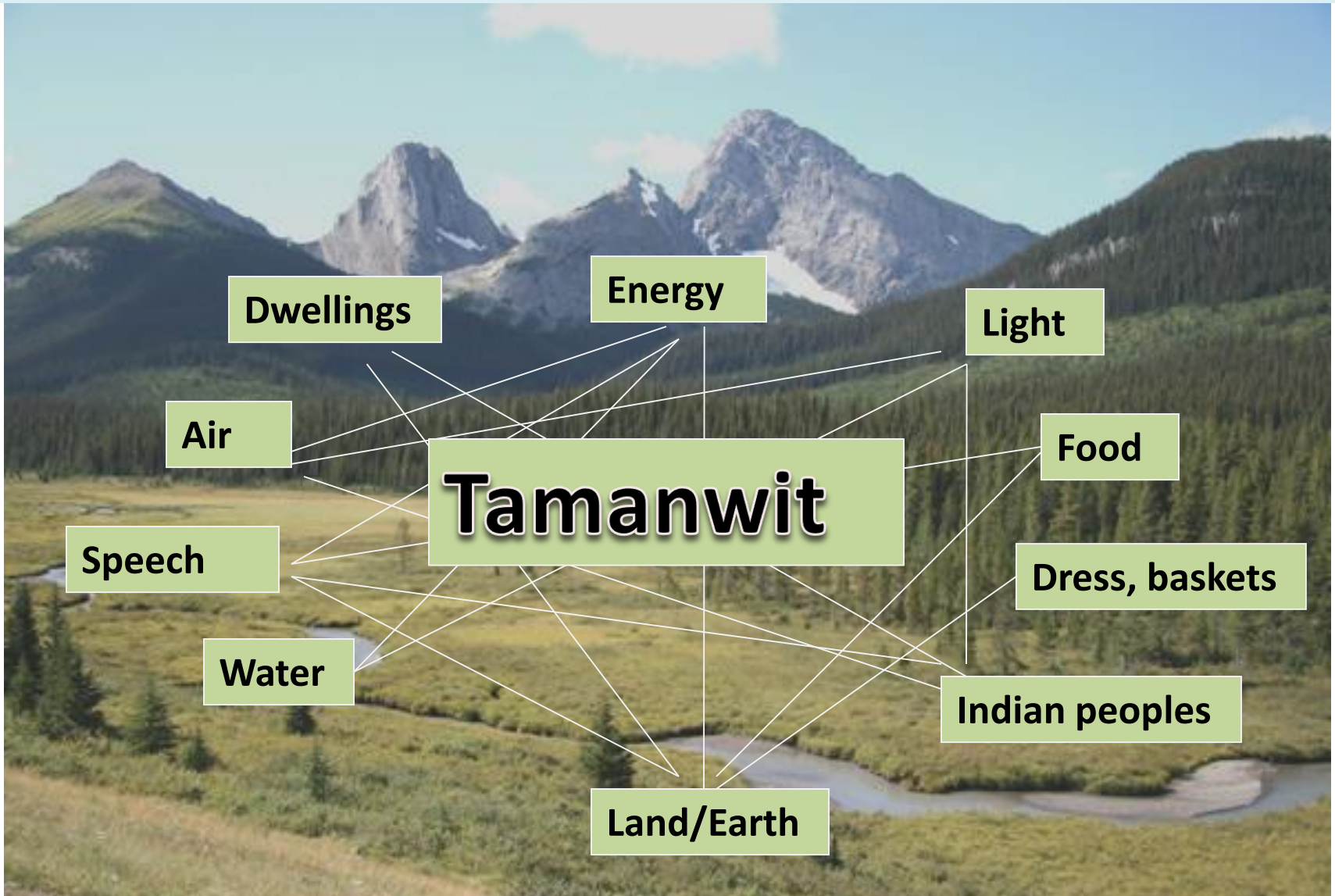
Fish (salmon, lamprey, mussels)

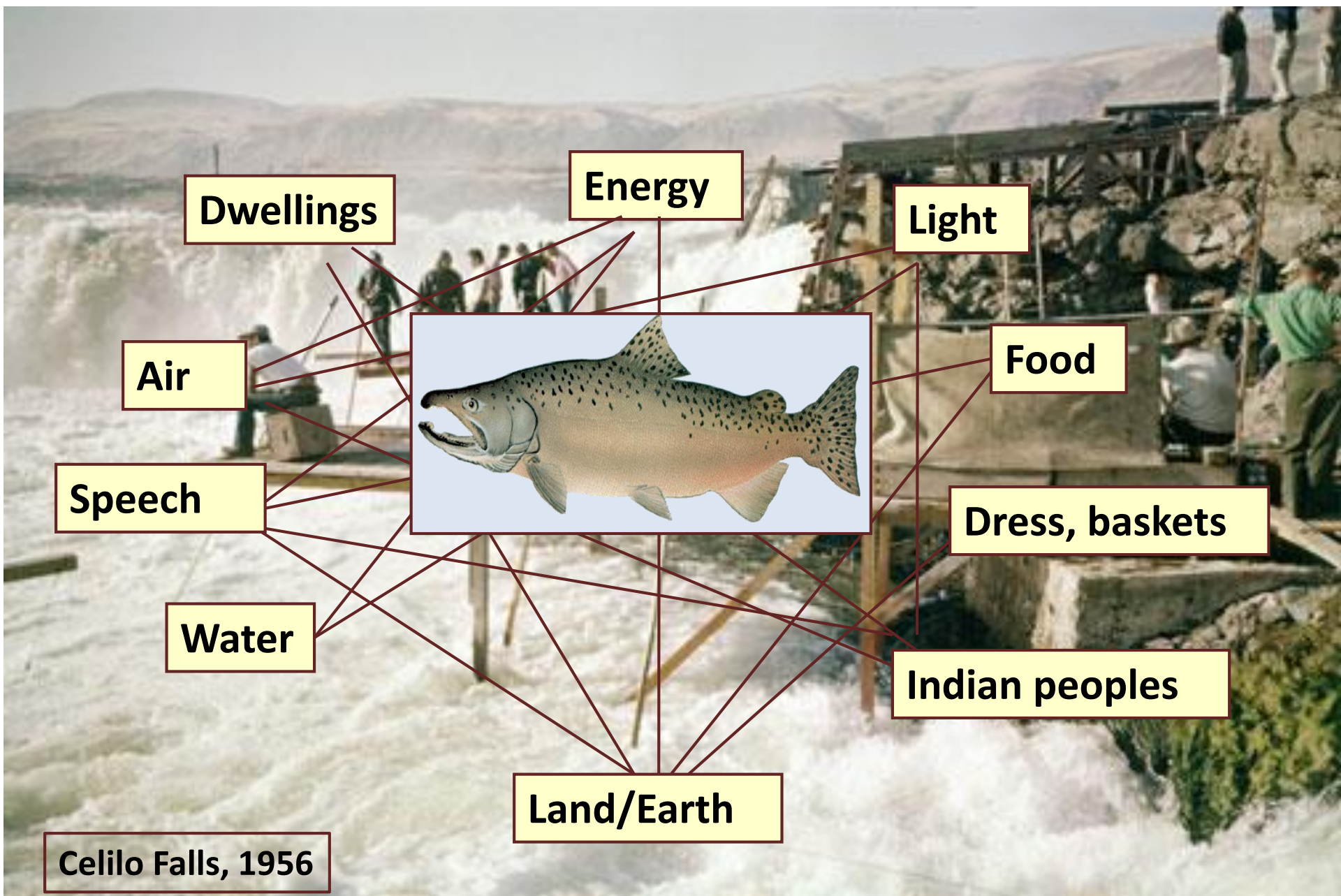
Game (elk, deer)

Roots (cous, camas, bitterroot)

Berries (huckleberry, chokecherry)

**Health means healthy people in a healthy environment participating with the community in an eco-cultural system following natural laws in seamless cycles. Ecosystems and natural resources have many eco-cultural attributes.**





**Dwellings**

**Energy**

**Light**

**Air**

**Food**

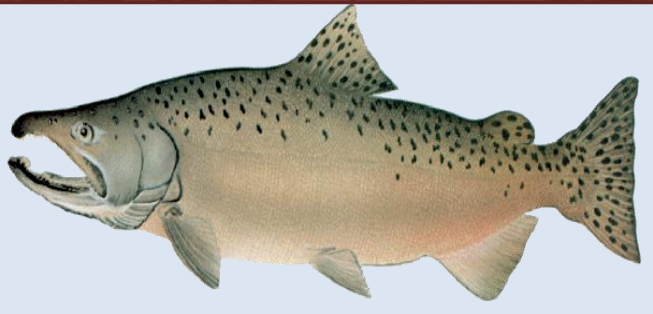
**Speech**

**Dress, baskets**

**Water**

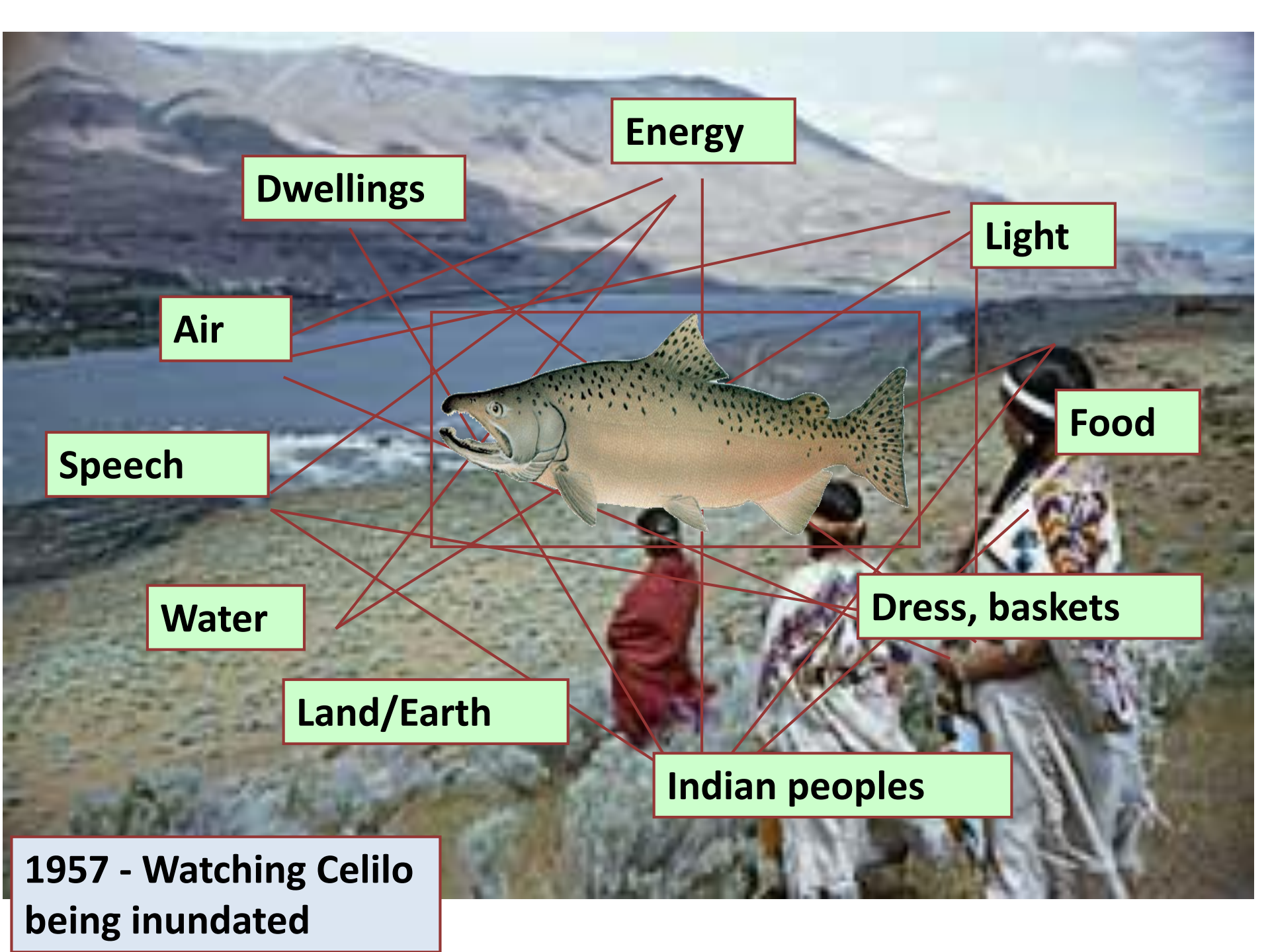
**Indian peoples**

**Land/Earth**



**Celilo Falls, 1956**





Energy

Dwellings

Light

Air

Food

Speech

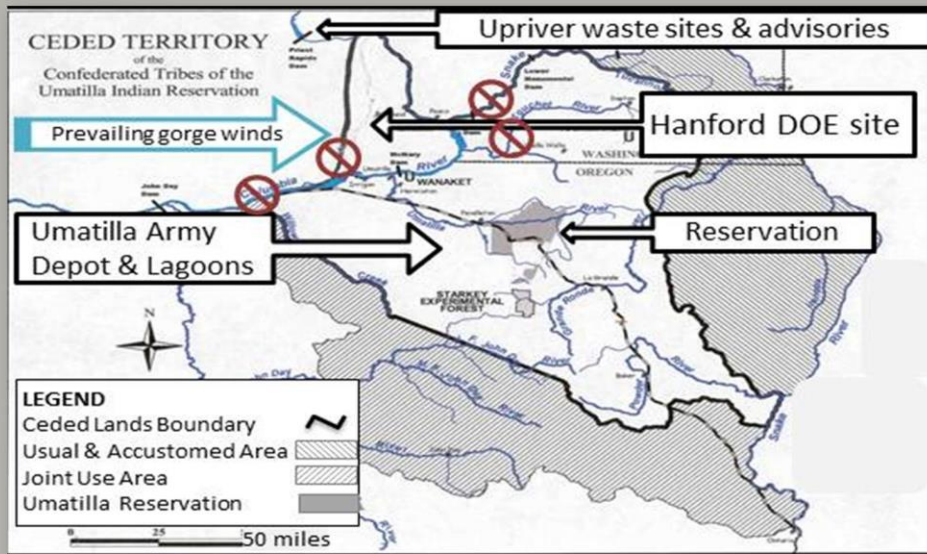
Dress, baskets

Water

Land/Earth

Indian peoples

1957 - Watching Celilo being inundated

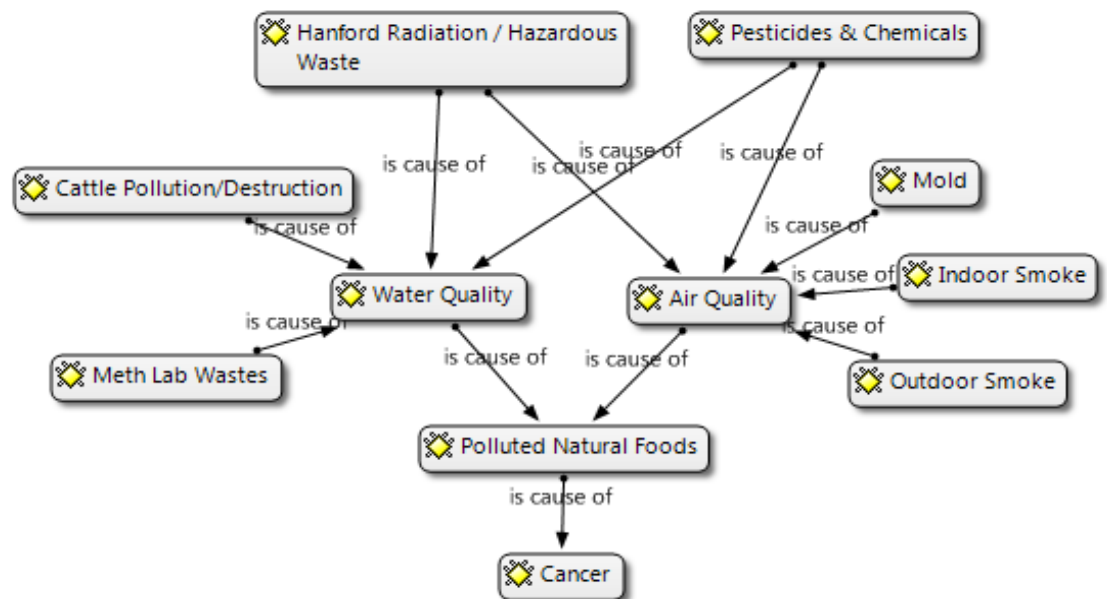


**Figure 1.** Map of CTUIR reservoir and pollution sources. The red crossed circles are where fish advisories are in place.

## Examples of ongoing research

Detailed technical analysis of cumulative risks and impacts from multiple contamination sources, both identified sites and regional non-point sources.

Focus group results from the general tribal membership about causes of environmental health effects. Research is carried out with Oregon State University College of Public Health.



# Analysis of PAHs from Traditional Smoking of Fish & Game

- **PAHs were analyzed in salmon before and after they have been preserved using indigenous smoking methods.**
- **About 5 food samples were tested for 9 parent PAH compounds found in CDC Human Exposure Study**
- **Conduct archival review at Tamástslikt Cultural Institute to determine other food preservation/preparation methods for future studies (ongoing).**

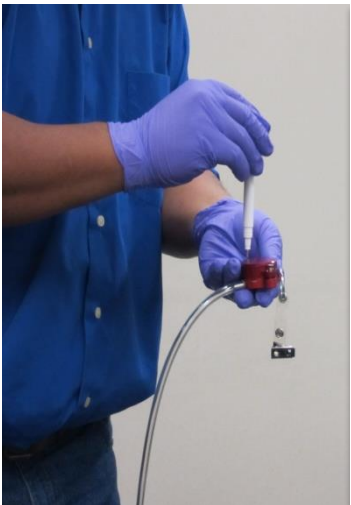




# Personal Exposure Monitoring

CTUIR and OSU collected ambient air samples during smoking of fish and game using a small Leland personal monitoring system

CTUIR and OSU also collected urine samples from non-cigarette smoking Tribal members who were smoking food (before-after activity) using an isotope-dilution GC/HRMS method





***For as long as...***

***... the grass grows***

***the wind blows***

***the river flows***