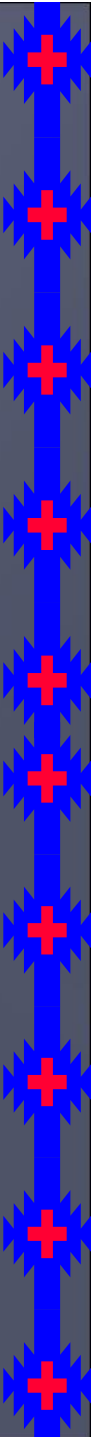




Tribal Ecosystem Services

Barbara Harper
CTUIR - Dept. Science & Eng.
Tribal NRDAR Conference
Soaring Eagle Casino and Resort
Mount Pleasant MI
July 20, 2011



Services refer to the physical and biological functions performed by the resource and ecosystem, including human uses of those resources and the human benefits of those ecological functions. These services are the result of the physical, chemical, or biological quality of the resource.

Tribal Use / Cultural Use/ Cultural Resources



CERCLA – NRDA (when not integrated)

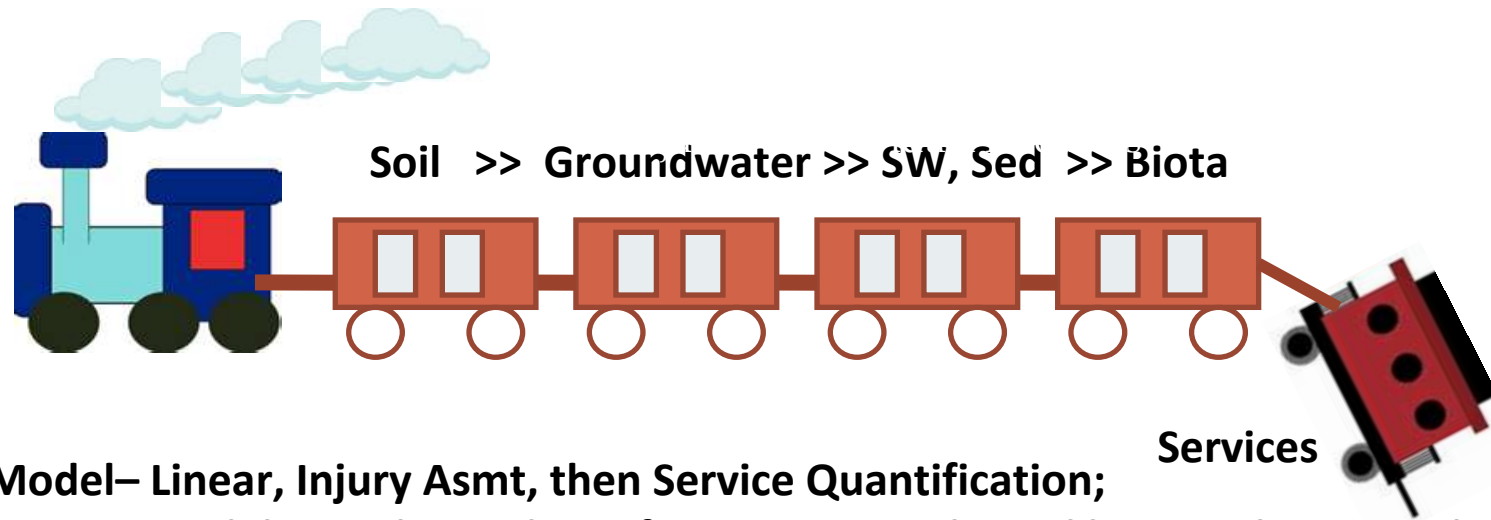


Primary Restoration:

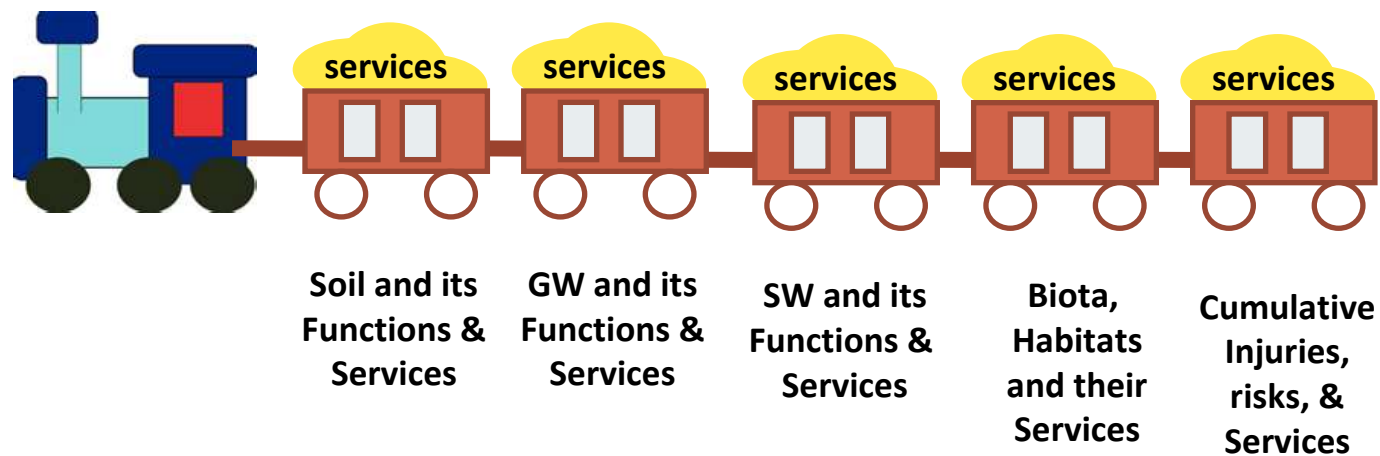
- Is the site **CLEAN** enough? *(information needed)*
 - Has the *baseline risk assessment* included tribal use scenarios?
 - Do site *remedial goals* “protect human health”
 - Is multi-contaminant & multi-pathway risk acceptable?
 - Are individual ARARs met (e.g., drinking water standards)?
- Is the site **RESTORED** enough?
 - Has the *ecorisk assessment* and *injury assessment* included both biotic and human impacts relative to *baseline*?
 - Has any habitat loss been mitigated (repaired or replaced)?
 - Are agreements for preservation and access in place? Are there management plans in place? Monitoring and LTS plans?

Compensatory Restoration for interim lost use

- What services were interrupted?
- Has the area under the recovery curve been quantified?

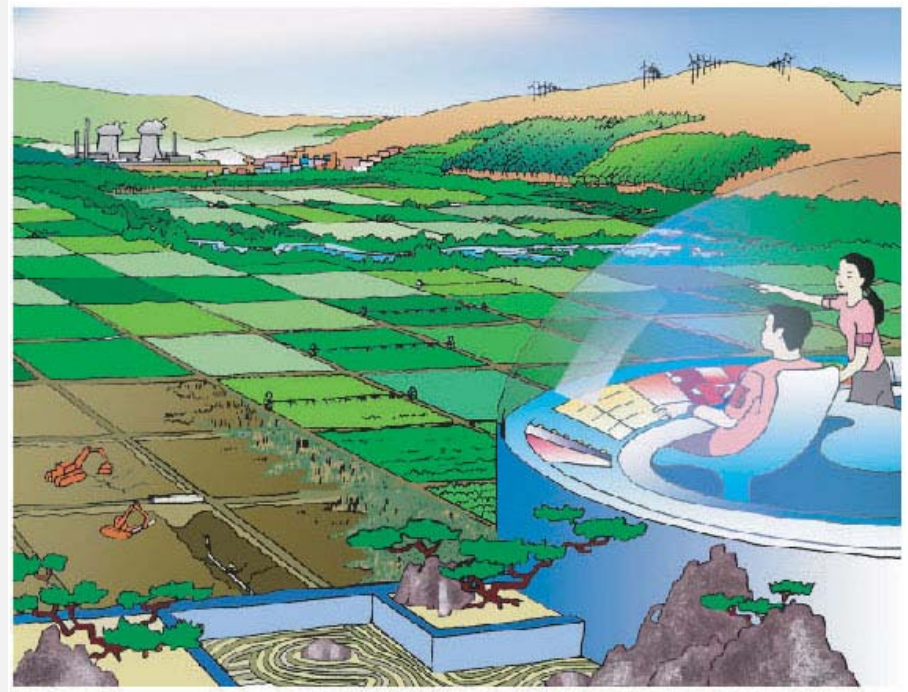
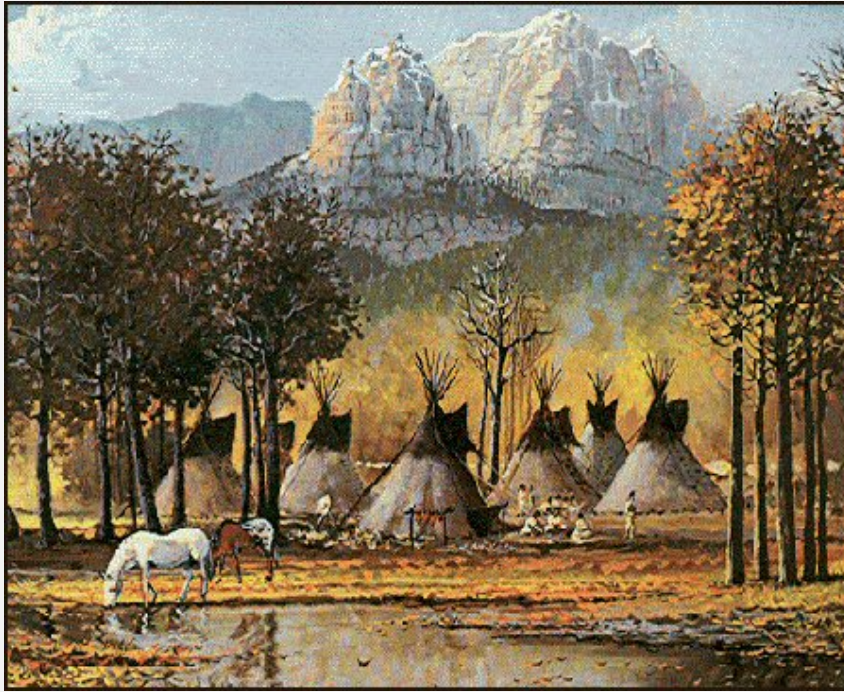


**Old Model– Linear, Injury Asmt, then Service Quantification;
 Services seen solely as a byproduct of resources; evaluated later and separately.**



What the regulations actually say

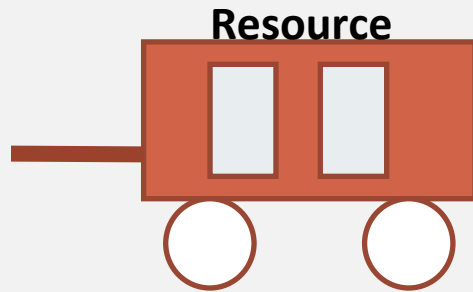
**Revised guidance emphasizes assessing and restoring
“resources and their baseline levels of services” together.**



Ecosystem Services == People IN the ecology or just remotely extracting its services?

Injury Determination. The revised regulations encourage the definition of baseline services before extensive quantification and valuation.

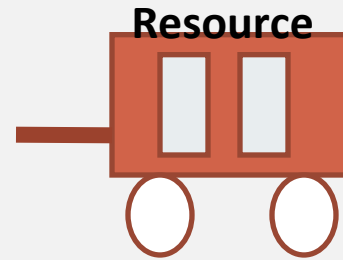
Three Models of Restoring Resources and Services



Restore the resource

Services

Services restore themselves

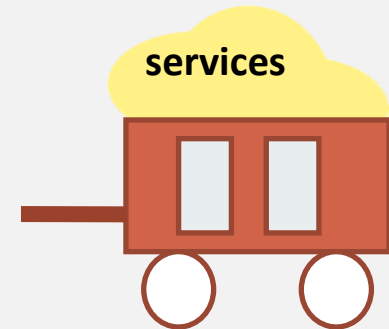


Evaluate and Restore the resource

Services

Restore the service(s) separately

Do separate projects
"Make the public whole" (?)



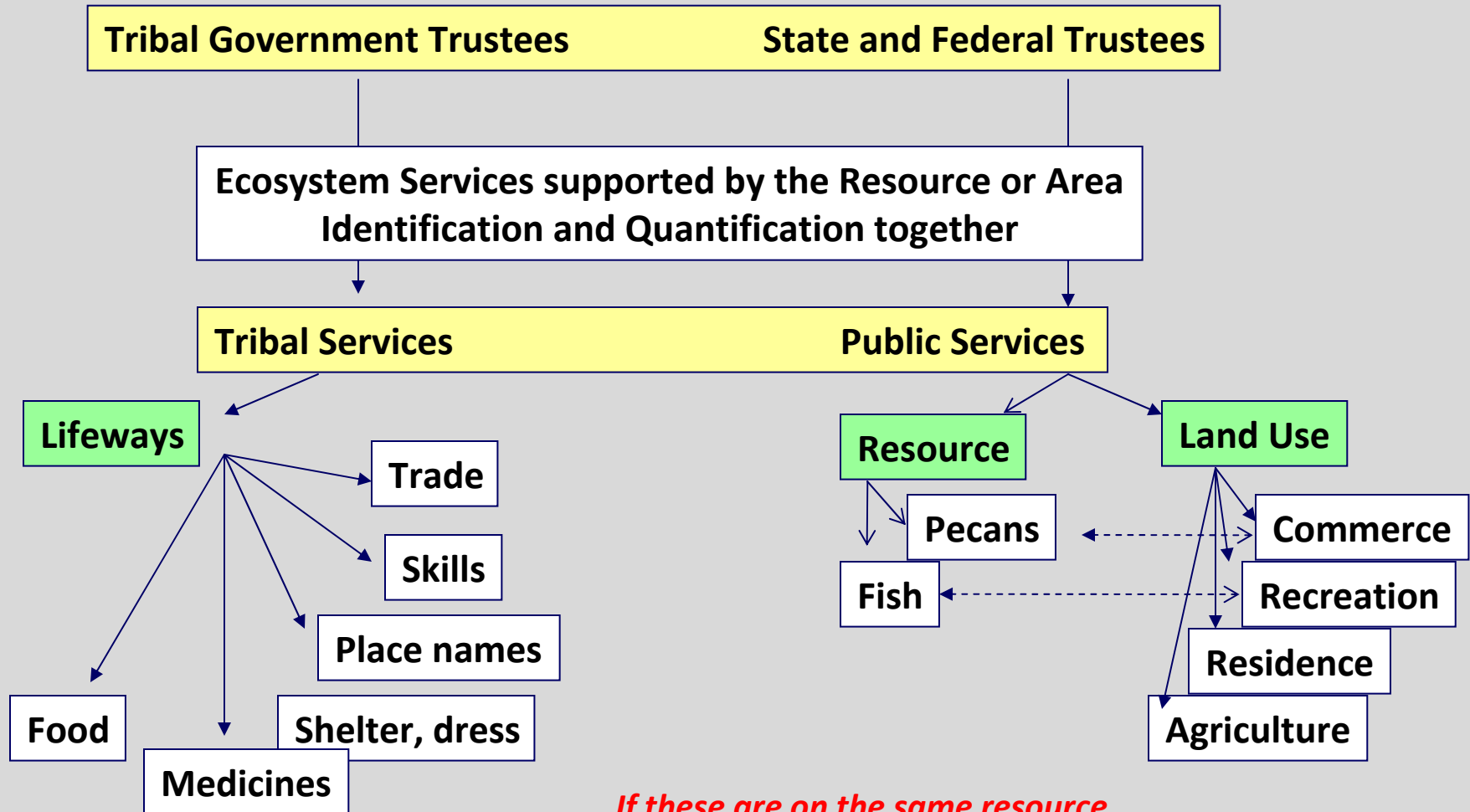
Identify Resources and their services; Quantify both.

Restore both together

**Revised guidance emphasizes restoring
“baseline levels of services.”**

“Services include provision of habitat, food and other needs of biological resources, recreation, or other products or services used by humans. They may be quantified by directly measuring changes in services provided by the resource, instead of quantifying the changes in the resource itself, when it is determined that the extent of change in the services resulting from the injury can be measured without also calculating the extent of change in the resource; and the services to be measured are anticipated to provide a better indication of damages caused by the injury than would direct quantification of the injury itself.” (43 CFR 11, various sections).

Trustee GOVERNMENTS have a duty to “make their publics whole.”



*If these are on the same resource,
there are competing future uses*

Examples of service loss (43 CFR 11.62 and .71)

- Exceedance of human health/risk-based standards such as drinking water standards or ambient water quality standards. (43 CFR 11.62(b))
- Exceedance of human health/risk-based action or tolerance level [most common example is a fish advisory; tribal uses of NR are more intensive and require specific CERCLA exposure scenarios].
- “use is restricted as a result of the discharge or release.”
[also a health/risk-based CERCLA determination.]
- “Determine the services normally produced by the injured resource, which are considered the baseline services or without-a-discharge-or-release condition.”
- “Identify interdependent servicesto discover significant secondary services that may have been disrupted by the injury.”

Language from rulemaking (73 FR (192): 57259ff)

“Restoration is an umbrella term for all types of actions, including restoration, rehabilitation, replacement, or acquisition of equivalent resources.”

“As the revisions make clear, one metric for evaluating natural resource conditions for baseline restoration is the availability of the baseline level of services.”

“Services are a metric for measuring resource conditions and resource restoration.”

“Cultural, religious, and ceremonial losses that rise from the destruction of or injury to natural resources continue to be cognizable under the revisions.”



CONSTITUENTS OF WELL-BEING



Source: Millennium Ecosystem Assessment

ARROW'S COLOR
Potential for mediation by socioeconomic factors

- Low
- Medium
- High

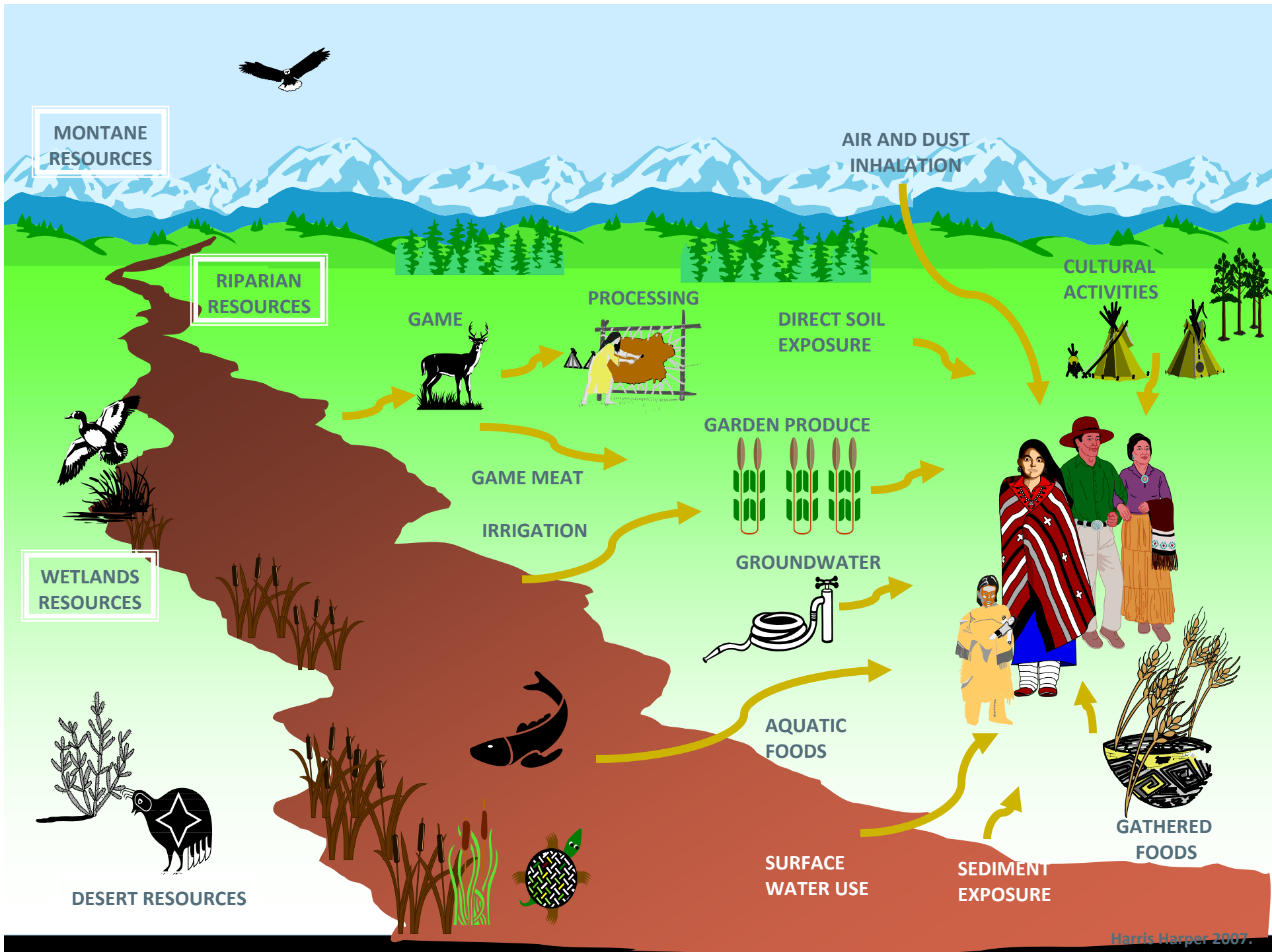
ARROW'S WIDTH
Intensity of linkages between ecosystem services and human well-being

- Weak
- Medium
- Strong

Regional Tribal subsistence exposure scenarios

(Approved by Board of Trustees; several applications)

- (1) Describe how resources would be used if uncontaminated and fairly undegraded. Not contemporary average. BASELINE**
- (2) Describe eco-cultural zones (the environmental setting, EPA Ecoregion levels of PNV) and natural resource usage patterns;**
- (3) Reconstruct the original local subsistence diet;**
- (4) General and unique tribal exposure pathways such as hunting, gathering, making material items, fishing;**
- (5) Identify direct exposure factors (activities and their frequency, duration and intensity, and resource use) in a CERCLA-style format for use in baseline risk assessment (absent restrictions).**
- (6) Follows Rules of Evidence, Daubert, peer-review, IRB, informed consent, confidentiality, research ethics.**
- (7) Confirmatory interviews, not statistical surveys**
 - CTUIR, Spokane, Wabanaki (Maine), Washoe, Quapaw, Swinomish (in prog)**



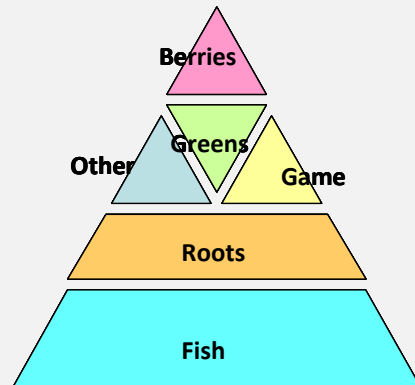
Elements of an exposure scenario

1. Ecology ----- 2. Traditional diet ----- 3. Direct exposures

Walla Walla, Umatilla
(River peoples)



Staple foods in food groups
Calories-Vitamin-Mineral .



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

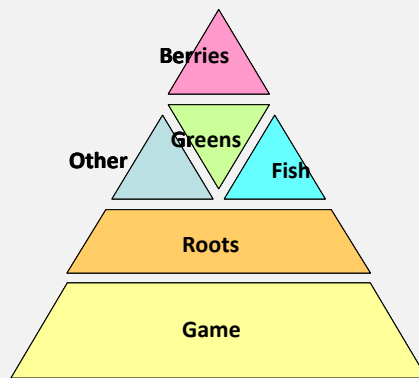
- Chokecherry, Huckleberry

Daily soil ingestion rate based on terrain and activities;

Daily water intake rate;

Daily inhalation rate

Cayuse
(Upland peoples)



Residential (24/7/365/70) or Intermittent and localized?

Scenario Approaches



CTUIR

- **27/7 residential subsistence scenario**
- **Physiologically coherent; calorically balanced**
- **Ecology-based; resource-usage documentation**
- **Representative of traditional lifestyle**
- **CERCLA-format per Exposure Factors Handbook**



Yakama Nation

- **Survey-based; current membership**
- **Maximum of each individual pathway (max fish, max sweatlodge use, max roots) to protect the maximally exposure a person could receive within each pathway.**

Local ecologies, Natural resource use, Seasonal Rounds

CERCLA is non-spatial. Do not confuse land use (defines WHO does WHAT) with mobility or carrying capacity.

Hanford application: The original seasonal round is compressed into each Exposure Point. People obtain all their natural resources from the assessment area, same as suburban residential scenarios even if we have to substitute resources.

This is a RESIDENTIAL, not a VISITOR scenario.

No nomadic assumption – full scenario is applied to the assessment area or study area. The lifestyle collapses into the study area.



Umatilla multi-habitat Seasonal Round

First Foods



Choosh



Choosh



Huckleberry



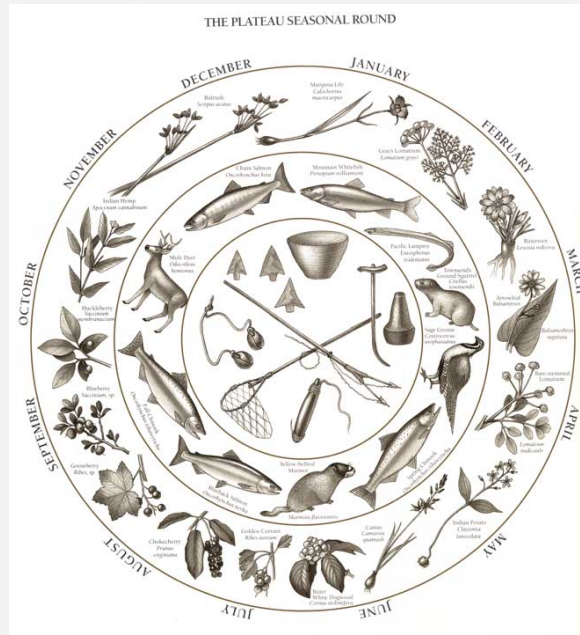
Chokecherry



Bitterroot



Cous



Salmon

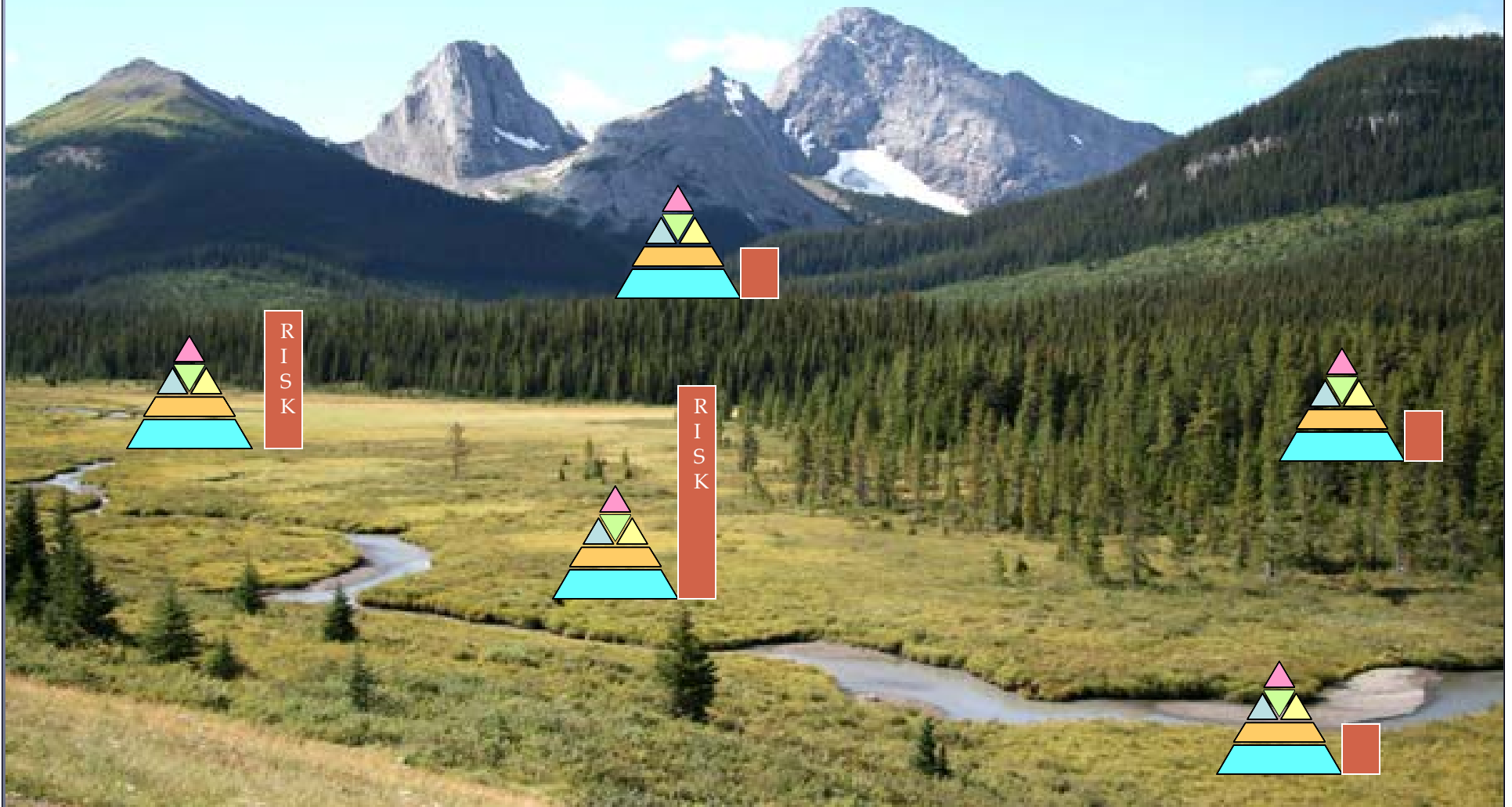
Elk



Deer



Scenarios are applied uniformly across the landscape
Differences in risk are due to differences in contaminants, not because the
scenario changes from location to location



**There is a smorgasbord of potential injury studies,
not neatly laid out and organized for you**



My Study!



No! MY study!



Possible Metrics for Quantifying Loss of Human Services and (there are lots of things to count)

- **In addition to economic methods such as conjoint etc-----**
- **Risk-acres (target risk level plus Tribal exposure scenarios)**
- **Spatial service-acre-years (weighted by importance) or gallon-yrs or acre-ft or viewshed degrees or habitat level, etc. Non-discounted depending on duration of injury (e.g., 10,000 years).**
- **Landscape ecology, large-scale metrics, indices for fragmentation and diversity related to human utility. Cultural HEA. Equity analysis to regain parity and reduce disparities in impacts.**
- **Constructed scales based on surveys (numbers of lost visits to TCP, many methods for social impact asmt, community impact asmt, env health asmt, PACE-EH, other community health & welfare asmt tools, etc.)**
- **Tribal QALY-DALY-QOL, cultural keystone species**
- **Dependency webs to identify users, uses, and linkages**

Injury Category

Method of Analysis of Lost Use

Regulatory Effect

Risk-based

Lifeways Exposure Scenario

Known concentration

Excess Risk

Remediation to UU/UE or Bkg or de minimis risk

Restriction

Presence/Absence of contam.

Interviews

Pure or Impurity threshold

Full use

Complete loss

Stigma, Prudence

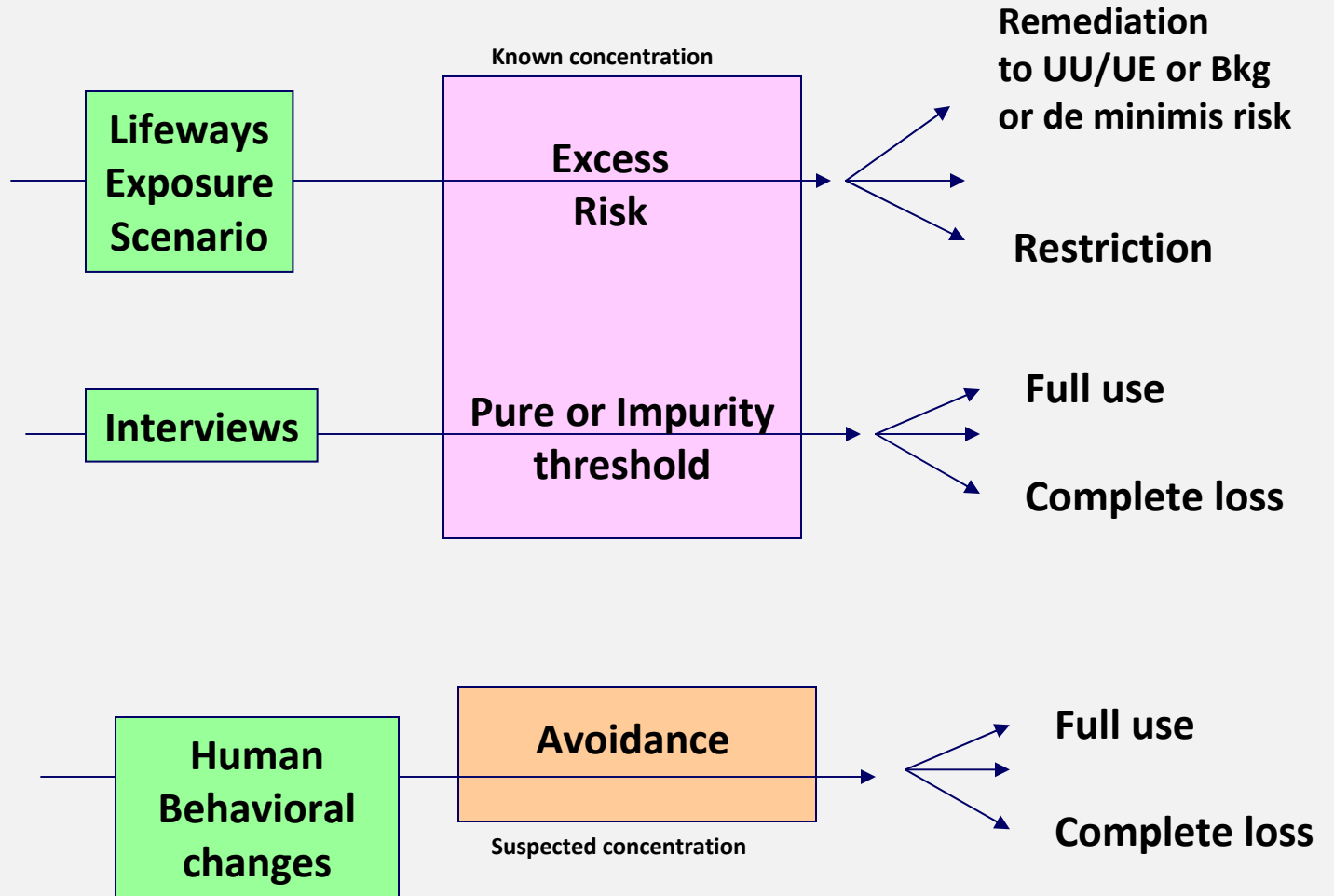
Human Behavioral changes

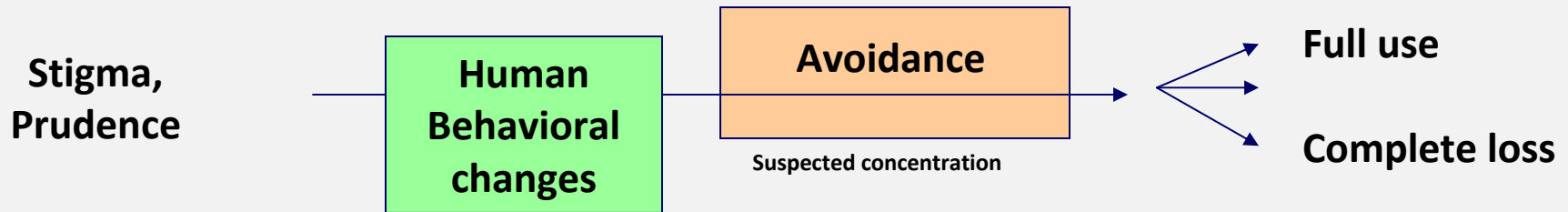
Avoidance

Suspected concentration

Full use

Complete loss





1. Avoidance based on suspicion rather than knowledge of risk is difficult to prove unless there is a singular event with a clear before and after within short-term memory (e.g., an oil spill).

2. If a tribal scenario has been developed, the traditional uses should have been identified and quantified as services. Service loss can be quantified as:

- 100% loss and replacement of equivalent land (incl. land-into-trust issues), or
- % loss due to residual risk from residual contamination or unrestored resources
- % loss due to harm to resources.

Pitfalls of human behavioral avoidance surveys

Reasons why answers may be imprecise:

- **Wrong population subset was surveyed**
- **People did not want to reveal information**
- **People answered what they thought was the 'right' answer, particularly if they know there is a fish advisory in effect**
- **People have learned to conceal, dissemble, deflect, mislead**
- **Too few people were surveyed, outliers eliminated; statistical issues .**

Ramifications of false negatives:

- **You gave up your cultural activity willingly; you don't eat (and don't want to eat) very much fish;**
- **The culture is already degraded for other reasons, or people had already stopped going there or eating the fish, or the fishing was already decimated, or baseline had already been altered, etc.**
- **Therefore, there was no impact; no lost services; nothing to restore**
- **Only x% or # of people are affected; only x mg/d were lost or restricted, so percent loss is very small.**

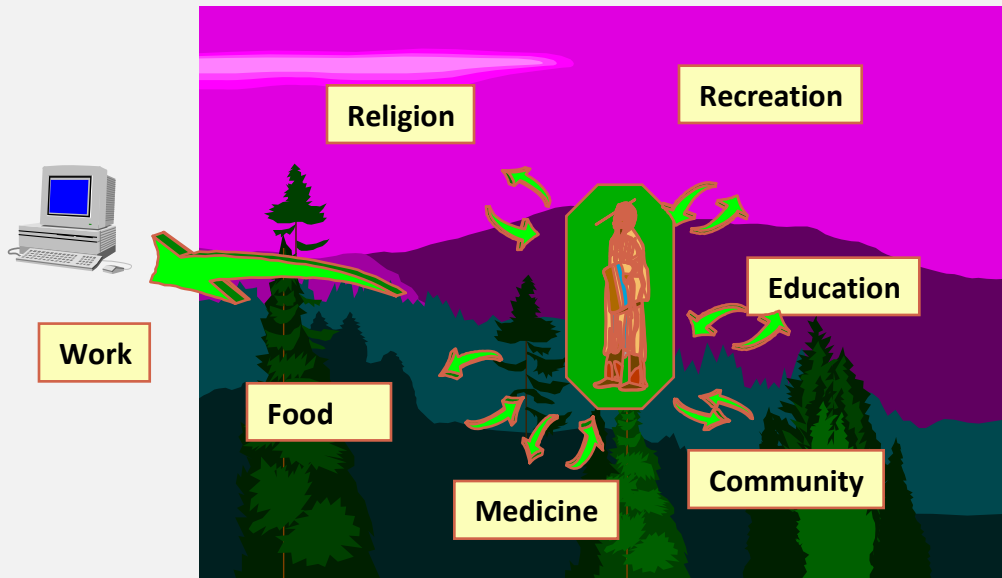
Cultural Importance of Natural Resources; Role of TEK



We are wild salmon people

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

Gabe Bohnee, Nez Perce Tribe



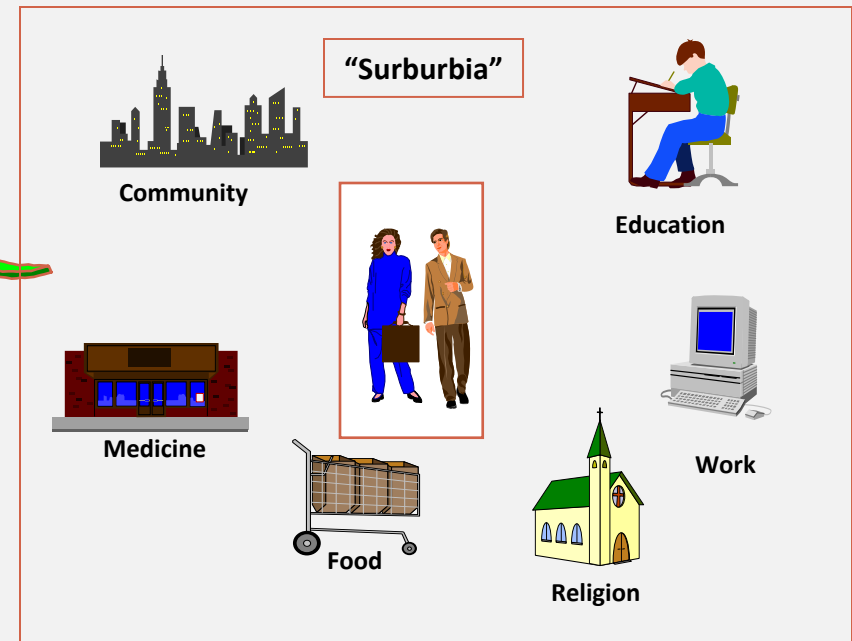
Basic Concept - Relation to Environment

Indigenous people live embedded within the environment and derive many services from it. They may leave it only to visit “suburbia” to obtain money.



Recreation

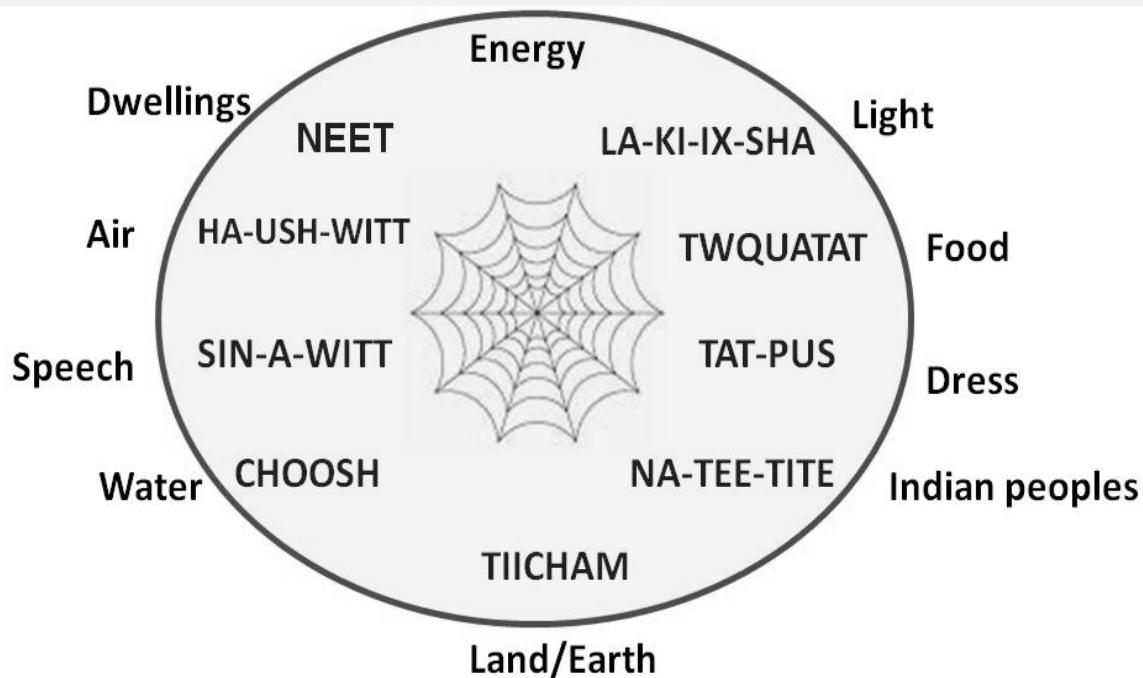
Suburban dwellers consider the “environment” as something to be visited during recreation, and derive most of their services from other suburban locations.



Can't just add some wild food

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

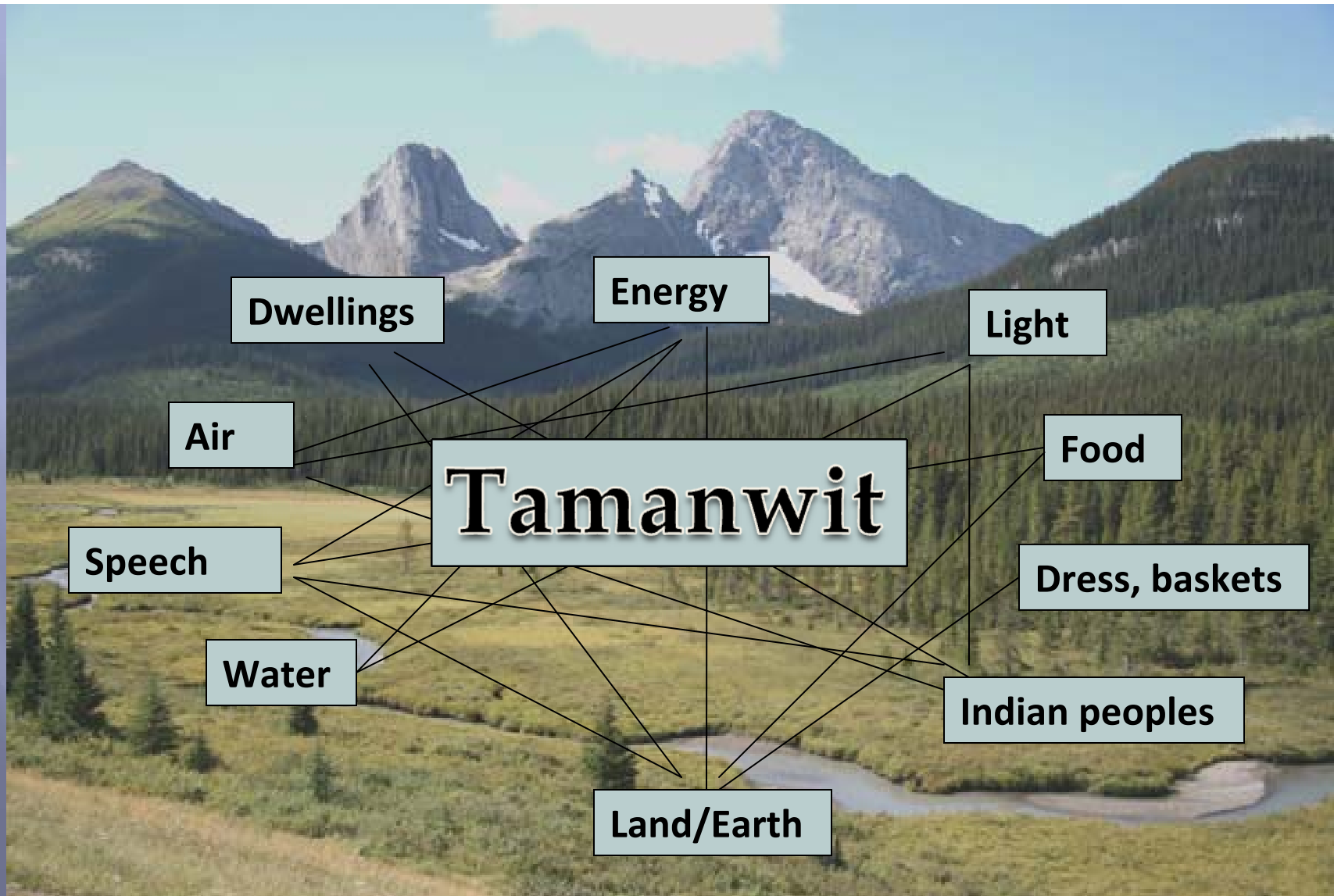
Fish (salmon, lamprey, mussels)

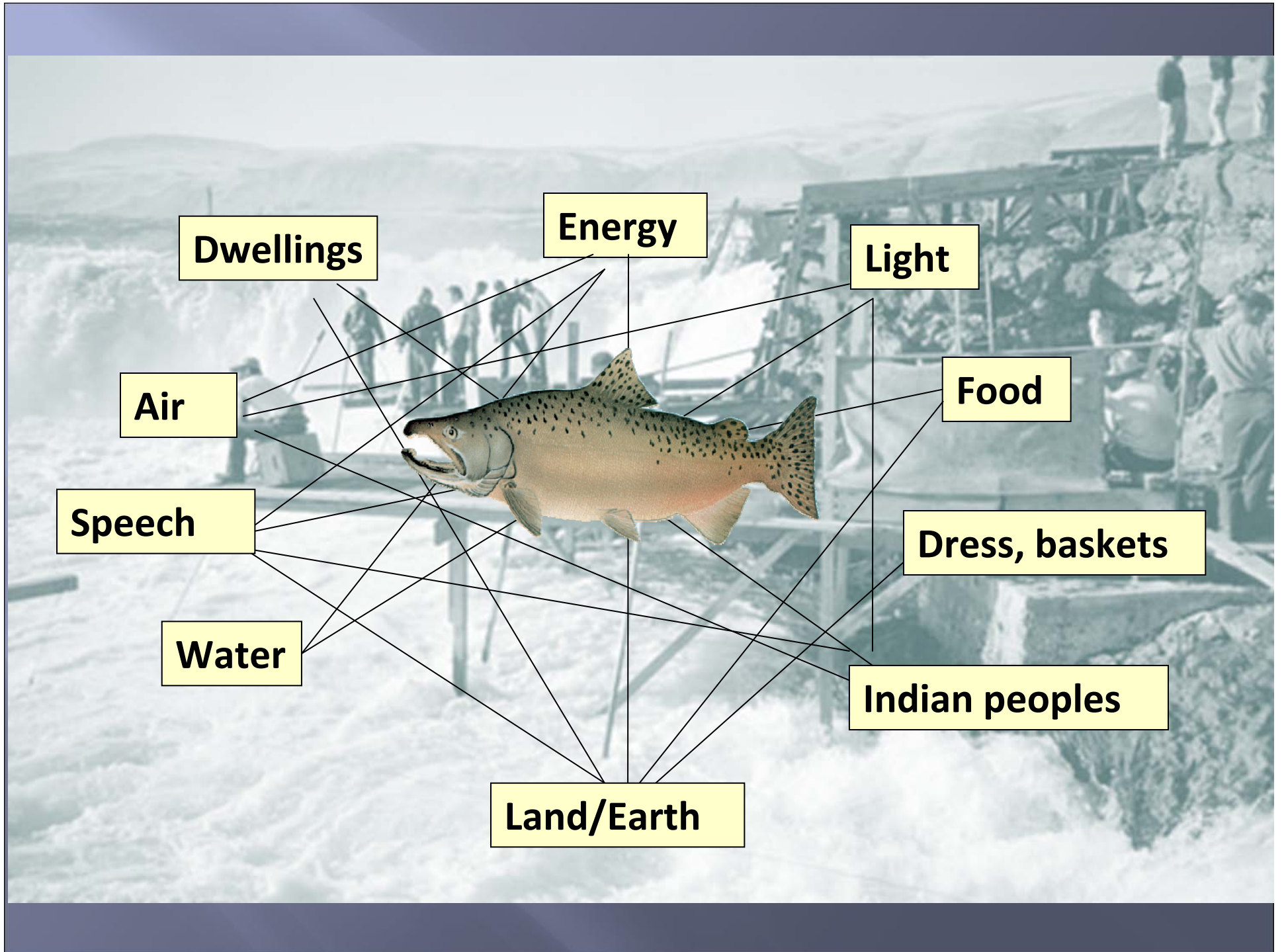
Game (elk, deer)

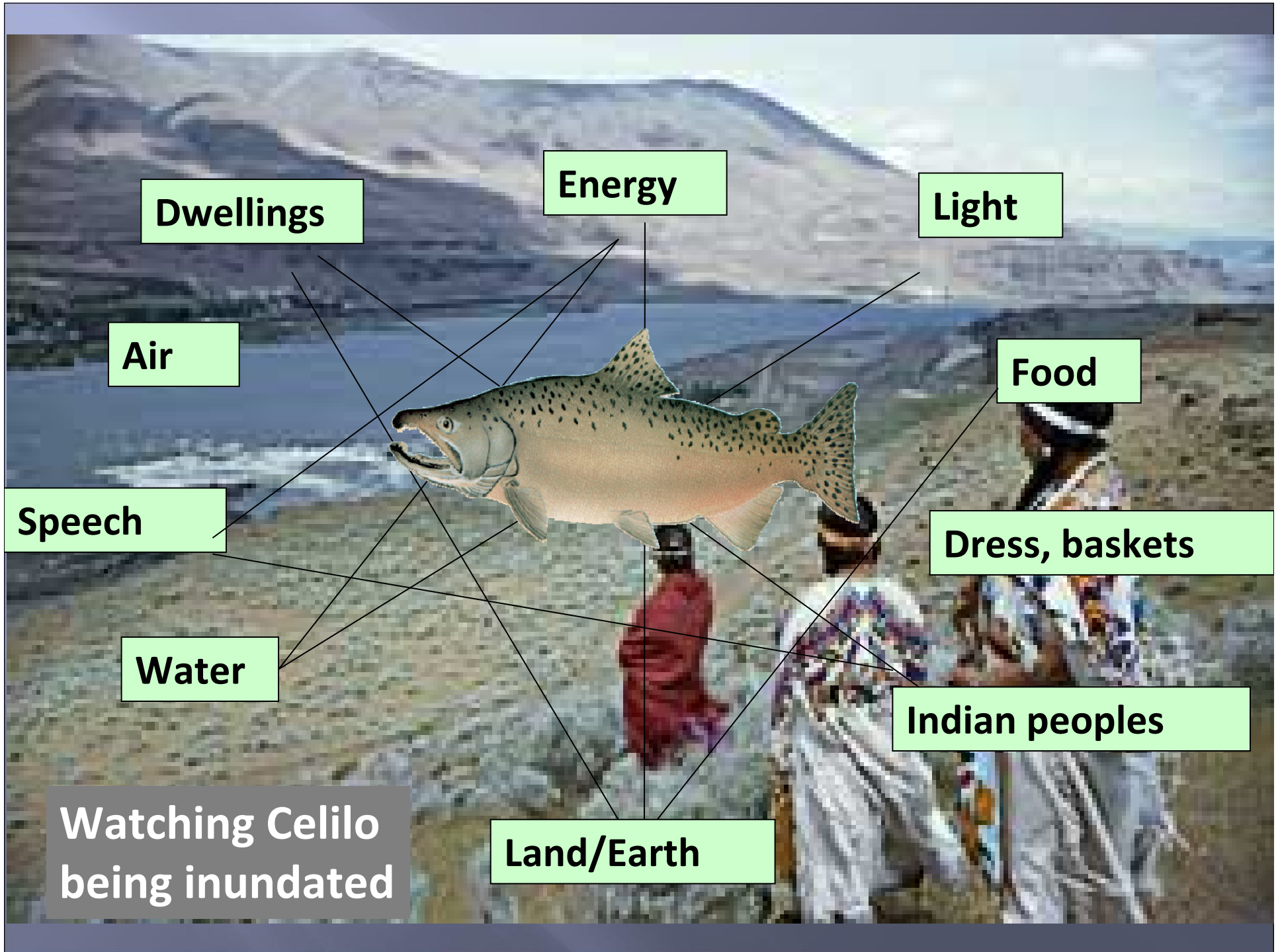
Roots (cous, camas, bitterroot)

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

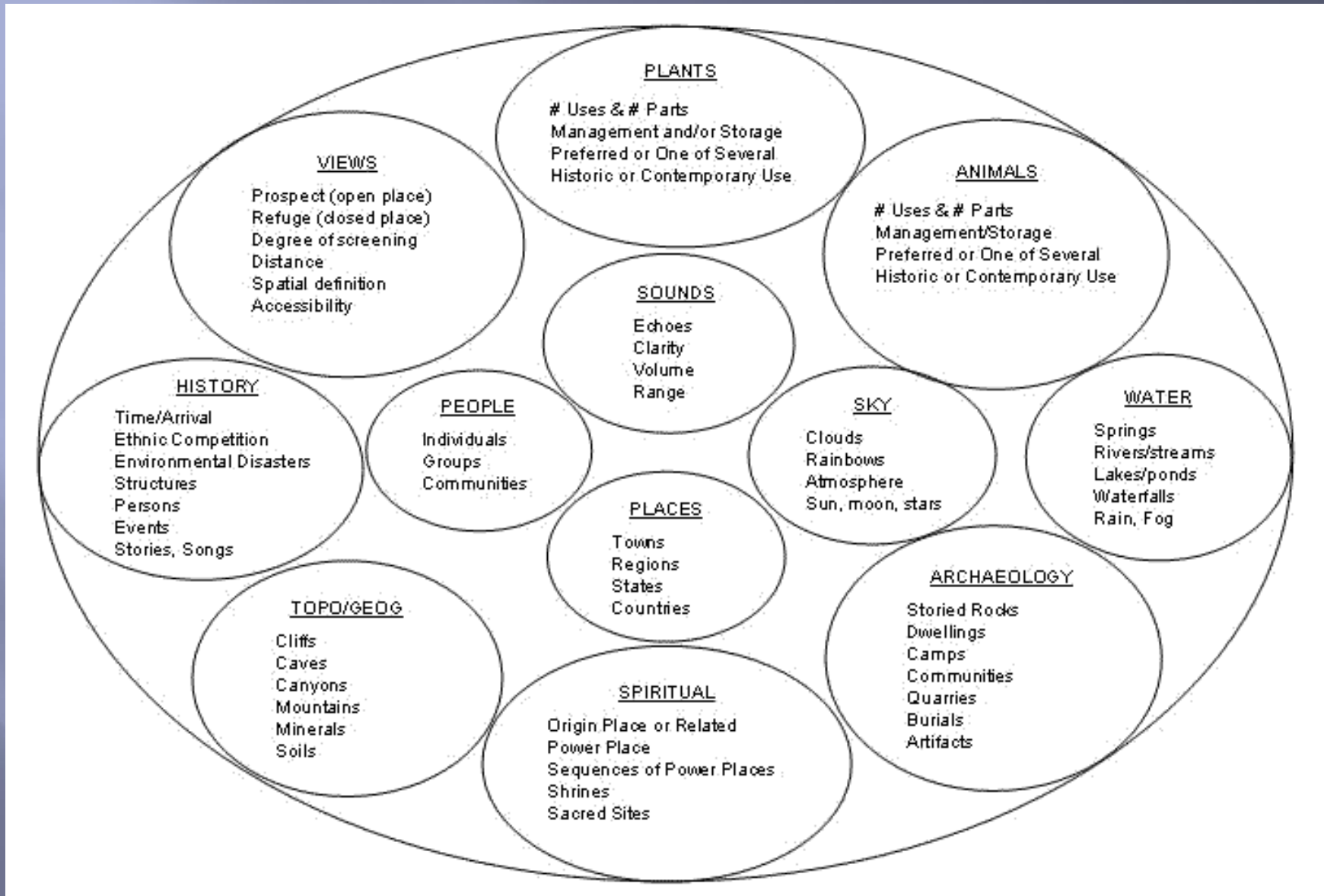
Water

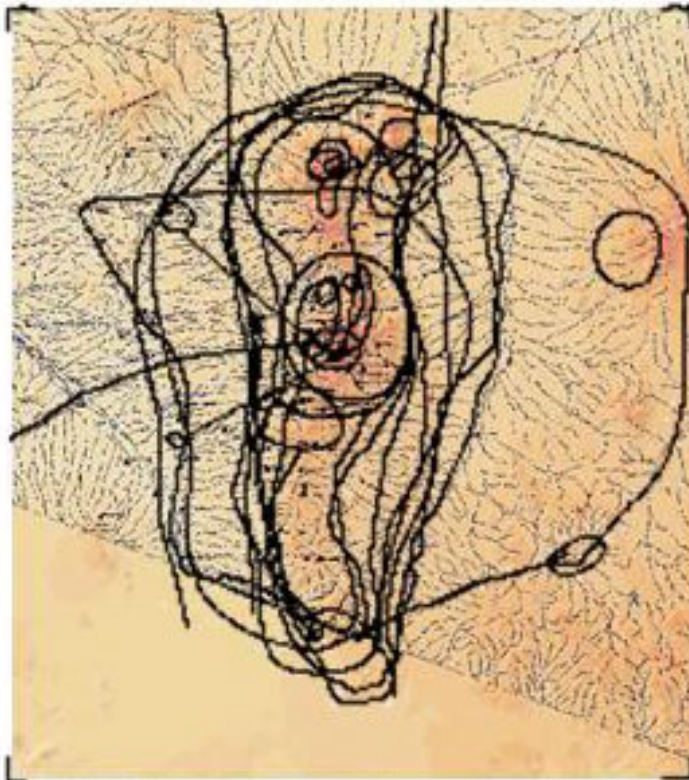
Indian peoples

Watching Celilo
being inundated

Land/Earth

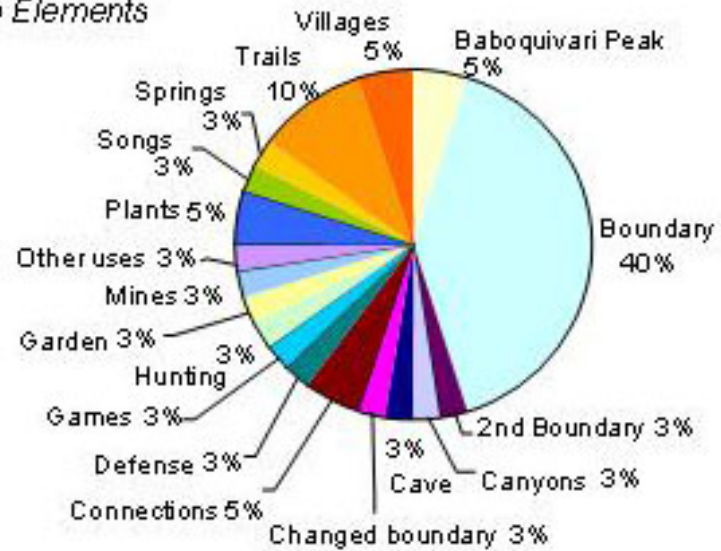
Resource Maps and Cultural Landscapes





Composite of 16 Maps

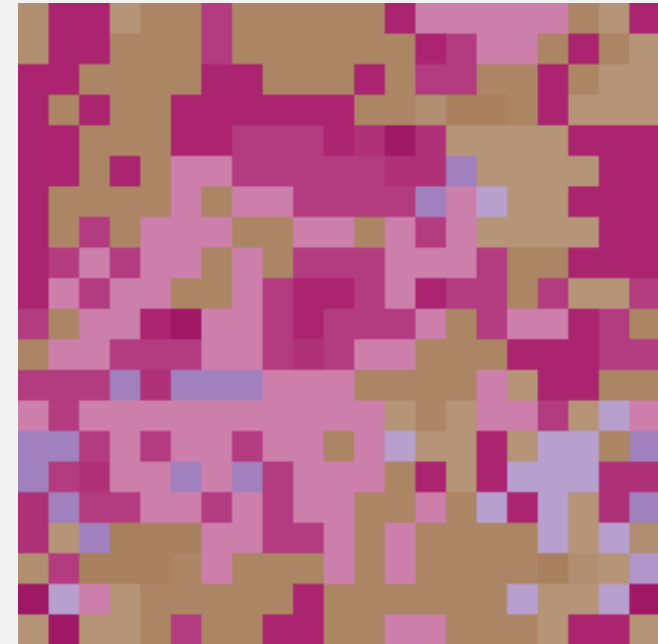
Map Elements



View from the west



Tohono O'odhams' Baboquivari landscape
<http://www.ecologyandsociety.org/vol7/iss1/art12/inline.html>



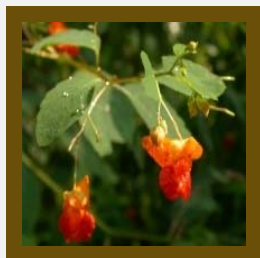
Acres graded by:

- Floristic Quality
- Ethnobotanical map
- Ethnohabitat,
- Eco-cultural attributes,
- Cultural index,
- Endangered species,
- NHPA sites, etc.

Alternative is 100% loss, full replacement with a culturally equivalent area (no such thing).

Cultural Resource Quality Index

Meredith Garvin



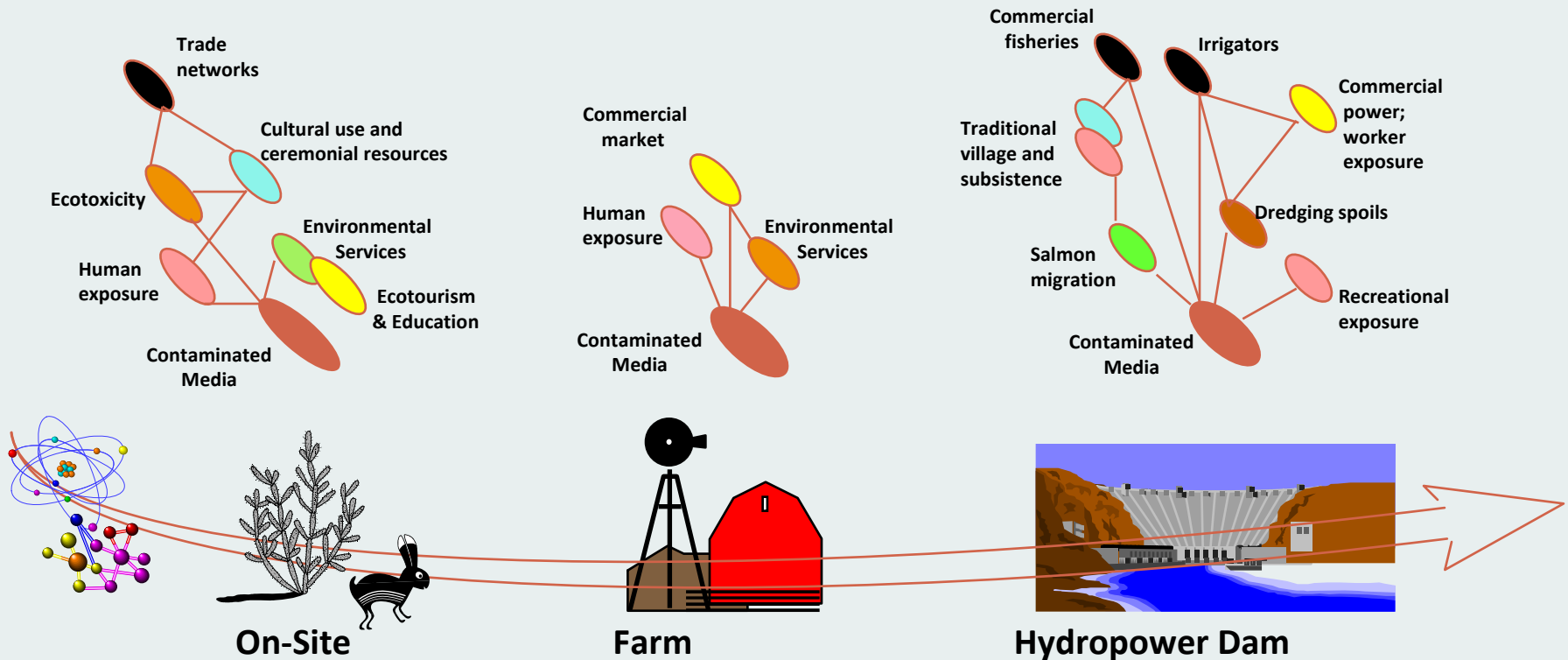
**Hundreds of plants used for food,
ceremonies, medicine, and crafts.
Are they contaminated?**

**Floristic Quality Index
Cultural Resource Index**

CONCEPTUAL MODEL

Relational Resource/Use Webs for major contaminated areas.

As contamination moves through different areas, different resources are affected, different impacts happen, and different people will be concerned. Dependency webs help tell the whole story about what will happen if different locations are contaminated, and provide a way to organize the risk metrics.



**Not clear how place-specific service injuries will have to be,
or if specific locations/activities/resources have to be identified**



A scenic landscape featuring a range of mountains under a blue sky with light clouds. A river flows through a valley in the foreground, surrounded by green grass and some trees. The overall scene is bright and clear.

How to make respect for the environment relevant and “worthwhile” in the NRDAR process...

We can articulate the importance of annual cycles in unbroken sequence through the years. May be like weaving a perfect basket each year, or making a pot without cracks – everyone contributes; without the whole community the product does not function.

Activities might be proprietary, but 100% of the community is adversely affected if one segment cannot perform its role.

Can we make TEK and cultural knowledge important to the general public or to the fed/state government)?

Contaminated human remains or Section 106 resources?

There are many approaches:

- Ecosystem Services
- Risk Scenarios
- Tribal Narratives
- Indigenous valuation
- Indices, Surveys, Assessments, cultural landscapes, Section 106 documentation, ethnobotanical surveys, eco-indicators, etc.



But think it through first –

Do you have a larger strategy (do you know the target)?

Do you know what you need to know? Confidentiality?

How will the data be used?

Do you know the risks of misuse?

What if results are negative?

Could it undermine sovereignty or rights?



