

*Fire, Water, Salmon and Indigenous Kincentric Ecology and Economics*  
*in*  
*Pacific North America*

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*and*

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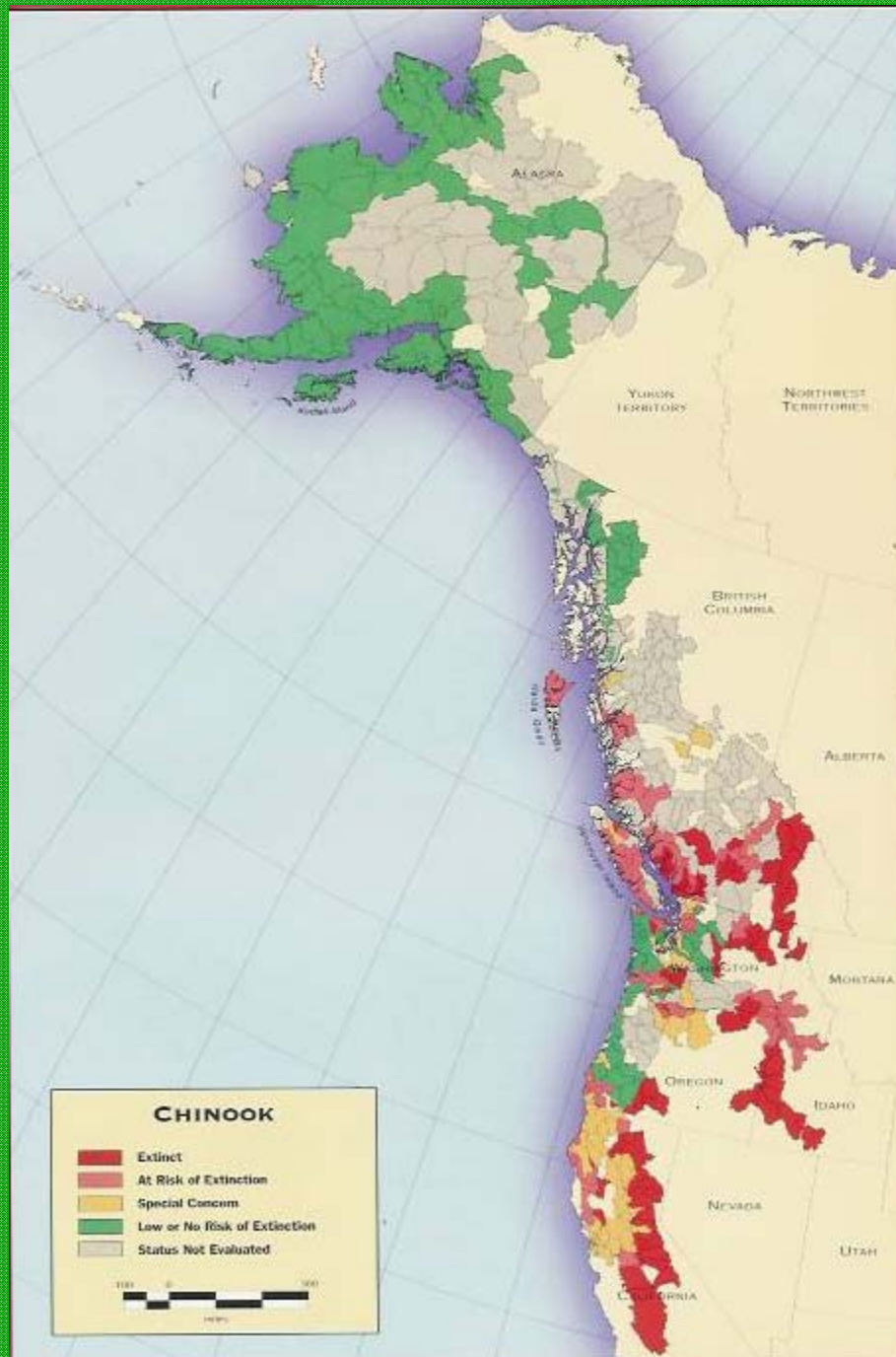
**Ecotrust Map Showing in Red Where  
232 Salmon Stocks are Known to  
Have Been Lost During the 20<sup>th</sup>  
Century in the Southern and  
Eastern Regions of Pacific North  
America**

*Salmon Nation, Ecotrust*

**Ecotrust Map Showing  
in Red, Pink, and Yellow  
the Endangerment Status of  
Chinook [King] Salmon in  
Pacific North America**

The Columbia River was *once* noted for its runs of 8 to 10 million Chinook, historically producing more Chinook, Coho, and Steelhead than any other river in the world. Chinook runs are now down to less than half a million.

*Salmon Nation, Ecotrust*



# Salmon is an Eco-Cultural Keystone Species and is a Prime Indicator of Ocean, River, Estuary, and Watershed Health

- Thousands of salmon stocks have been cared for sustainably by Indigenous peoples since time out of mind
- Salmon Homecoming Ceremony celebrates social harmony between humans and salmon—and ritually symbolizes the enduring connection between Ocean and Forest
- Smoke from Quexim (*Lomatium nudicaule*), for the Nuu-Chal-Nulth of Vancouver Island, was the original Salmon food, and is burned in their Salmon Ceremony—a Plant Nation of the Forest and Salmon Nation of the Ocean

Photo Courtesy of Craig Jacobson

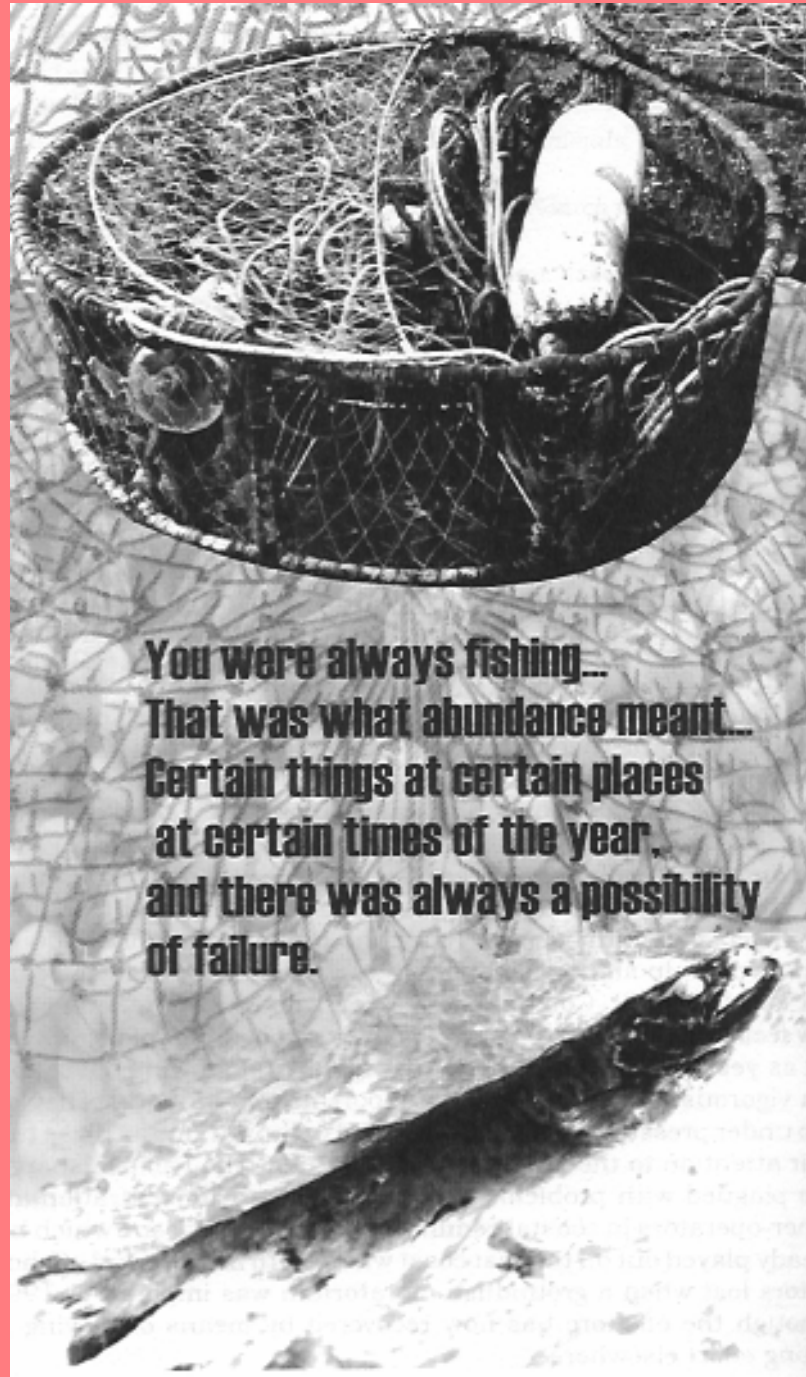


**First Salmon Homecoming Ceremony Performed in Over 150 Years on the Applegate River in Southwestern Oregon, 1993** Photo: Dennis Martinez



## **A Kincentric Relationship Between Salmon and Native People Was Based on A Gift Economy that Treated The Salmon Visitors With Respect For Giving the People Their Lives For Food and in Hopes for Their Continued Return**

- **Gifts cannot be owned—they must be passed on, E.g. Potlatch Ceremony which redistributed wealth within the society and region**
- **In the same way—The Salmon redistributed ocean nutrients to the rivers and the land**
- **Native people and salmon together maintained a relatively stable gift economy in an environment that fluctuated widely from time to time.**
- **As the peoples of Pacific North America learned how to dry and smoke the salmon, how to work together in the salmon ceremony and harvest, and how to regulate salmon harvest during numerous environmental changes and resource ebbs and flows—even the deliberate spread of salmon and sophisticated river and fish care—Wealth accumulated, complex social customs evolved, and peoples prospered**



**You were always fishing...  
That was what abundance meant...  
Certain things at certain places  
at certain times of the year,  
and there was always a possibility  
of failure.**

*Just Fish*, Ed. Coward, 2000



## To Avoid Failure, Native Peoples Cared for Salmonid Freshwater Habitat— Given the Uncertainty of Oceanic Conditions

- Changes in ocean currents can reduce abundance of phytoplankton that support fish species that salmon prey on. Phytoplankton are at the base of the Ocean Food Chain and are over 90% of all oceanic biomass.
- E.g., if springtime ocean currents change, the advantages of mixing shallow warmer surface waters with cold deeper waters that bring up nutrients to phytoplankton will be lost and salmon health will deteriorate.
- Global warming/El Niño events can shift fish runs to the north, as may have happened with the unusually high numbers of sockeye in 2010 returning to the Fraser River (Canadian northern route) and bypassing the US southern route. Ten thousand Sockeye were found in one net in the Arctic Ocean instead of on the Washington and Oregon coasts.
- In our times, ocean acidification caused by absorption of CO<sup>2</sup> emissions is causing shell thinning and poor bone development of some marine species.

## Caring for Salmonid Freshwater Habitat

- Spawning beds were cleaned and log jams removed following large storms.
- Sandspits blocking late summer/fall chinook runs were opened.
- Trees were felled to divert stream water into side channels creating backeddies for overwintering coho or to flush sediment from spawning beds.
- Salmon spawn were transplanted in damp moss to streams with no or few salmon.
- Salmon were flumed or carried around landslides or ice blockages (this happened most recently in 1914 following the huge slide on the Fraser River at Hell's Gate Canyon—saving sockeye runs).

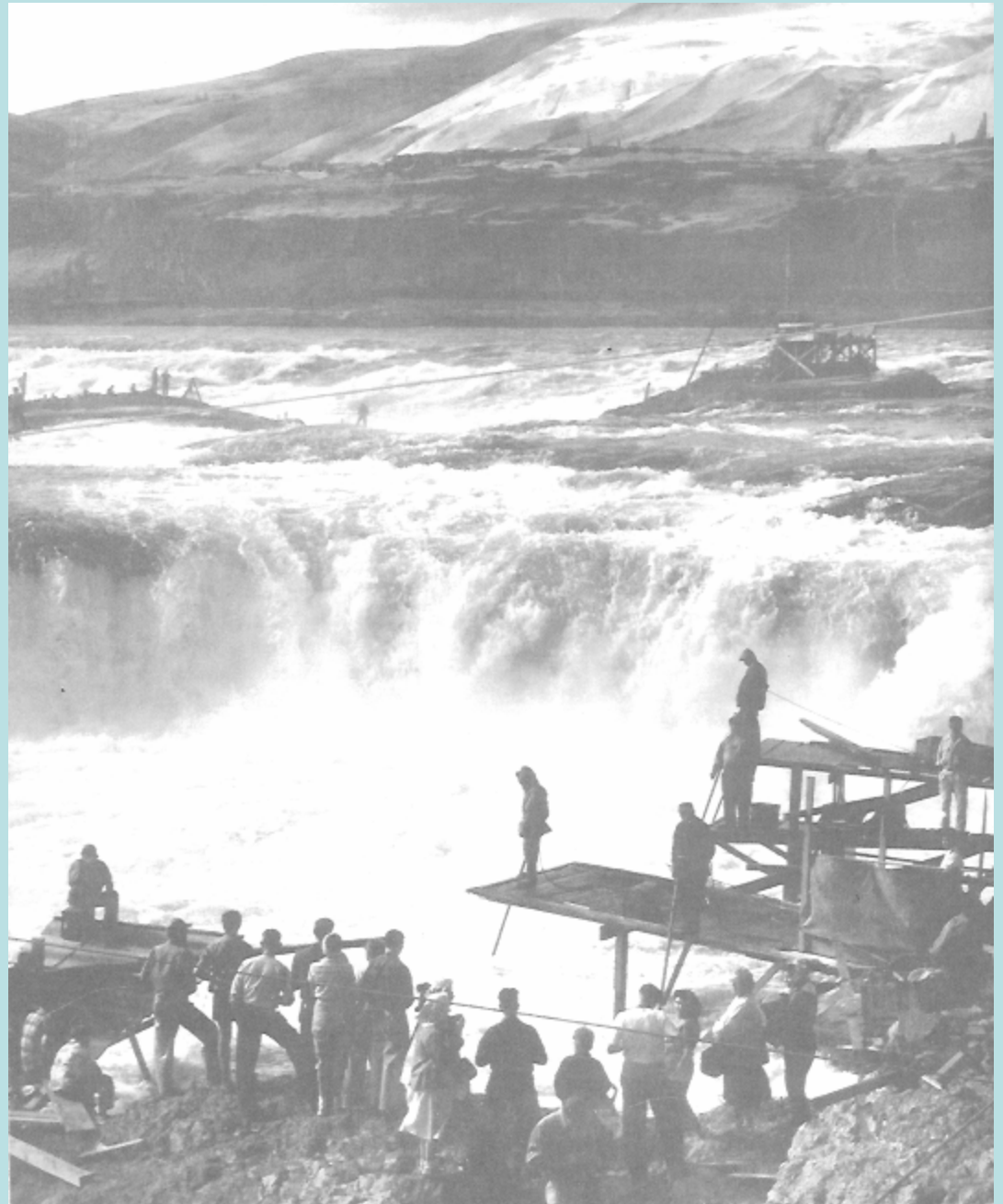
Photo: Dennis Martinez

## Avoiding the “Tragedy of the Commons” : Local Control Over Local Resources and the Traditional Indigenous Regulatory Structure

- These and other conservation measures were sustainably maintained by a land tenure system that divided fisheries and other marine resources (e.g. farmed clam beds) into units of local responsibility and harvesting rights by individuals, families, and clans nested within a larger, collective band authority structure through which experienced knowledge specialists had the last word on harvest regulation and rights during times of regional or seasonal shortages of particular runs.
- Fishing at the mouths of rivers and streams allowed accurate fish counts, with quotas for use based on the relative abundance of different fish runs.
- Trading between families of different salmon species ensured a diverse food supply and good nutrition.

**Celilo Falls  
on the  
Columbia River  
Now Under  
Dammed Water**

**Photo: Courtesy Ecotrust, USA**



# Traditional Fishing Technology and Mariculture

- Intertidal Fish Trap at Evans Inlet, King Island, BC.
- Fish traps became Clam Gardens when sediment substrate built up over time.
- Clam Gardens were also enclosed with stone walls with clams exposed only during lowest tides.

Photo: Anthony Pomeroy  
Department of Archaeology Simon Fraser University



# Indian Fishing Weir on the Cowichan River



- Use of Weirs at river mouths facilitated estimating the size of salmon runs.
- Weirs were opened daily to allow salmon upriver to their natal spawning streams and to upriver tribes.
- Weirs were closed temporarily in order to harvest salmon.
- The construction and operation of weirs were under the control of a medicine person.

# Seining at Namu Creek



Royal **BC** Museum  
Courtesy of British Columbia Archives collection

# Bountiful Oyster Harvests



Royal **BC** Museum  
Courtesy of British  
Columbia Archives  
collection



### **Fire Can Assist Water Conservation and Salmon**

Indian Rx Fires like this low intensity one done in the mid 1990s in Oregon are now done frequently since Western fire ecologists finally recognized its ecological [and for some, cultural] importance beginning in the 1980s.

Photo: Dennis Martinez

**Although Indigenous Rx Fire Was Nearly Universal, This Important Fact Was Ignored Until Recently**



FRONTISPIECE. This 1903 photo, described as a “mock-up of starting a prairie fire,” shows Blackfoot Indians near Calgary, Alberta. From the Provincial Archives of Alberta, Edmonton.

*Forgotten Fires*, Omer C. Stewart, edited by Henry T. Lewis and M. Kat Anderson, 2002

**Stewart was not able to get his controversial original work on Indian burning published until after his death—50 years later—when Lewis and Anderson published *Forgotten Fires* in 2002.**

## Yosemite Valley in 1880s Showing Extensive Indian Rx Fire Maintained Meadows



### Restoring Historic Indian Rx Fire Regimes

- Balance historic structural & compositional fidelity with building resilience to present & future environmental change driven by climate destabilization/weirdness. **Looking at past and future environmental conditions simultaneously.**
- One way to do this is by **Assisted Regeneration** of individuals and populations with proven adaptation to very warm or harsh conditions and propagating them in order to build future landscape **Refugial Capacity**
- Another way is to get Rx fire back in the system and restore **Relative Stability** by restoring function: **Water Cycle/Nutrient cycle/Carbon Cycle/and other cycles.**

**Yosemite Valley in 1960s Showing Extensive Tree Invasion—Pine and Other Conifers into Meadows and Shade Tolerant White Fir/Incense-cedar into the Understory of Established Forest Stands— Due to Removing Ahwaneeche Indian Stewards and Suppressing Fires**



- Establish restoration reference ecosystem models or baselines within historical ranges of variability—As *starting points* for restoration
- Restore as much of historical structure and composition anchored in real ecohistorical time as is still recoverable—Avoids problem of shifting baselines.
- Approaching historic structure, composition, and processes like historic Rx fire is important because it is the environment in which species have co-evolved and have *ecological familiarity*
- E.g., Restoring Indigenous fire regimes in their intensity and frequency/spatial configuration and extent/selectivity/seasonality—while leaving many places unburned but protected from fire by the surrounding more open mosaic forest structure and strategically-placed fuel breaks

**These Small Densely Crowded Trees are Depleting Groundwater  
Through Evapotranspiration which is Also Depriving Salmon and Other  
Aquatic Species in Streams Below of Sufficient  
Water Quantity and Quality.**



**Stem-exclusion stand with stocking rate of  $> 3700 \backslash \text{ha}$  ( $1500 \backslash \text{ac}$ ).  
Virtually no understory herbaceous vegetation. Photo: Dennis Martinez**



**Before**  
Variable Density  
Thinning



**After**  
Thinning,  
Rx Fire, and  
Seeding  
Understory  
with Native  
Bunchgrasses  
in the Ashes



Photos: Dennis Martinez

**Ecocultural Restoration: Employing Indian Cultural Rx Fire  
to Modify an Important Cultural Species for Use—*Bear Grass*  
for Baskets**



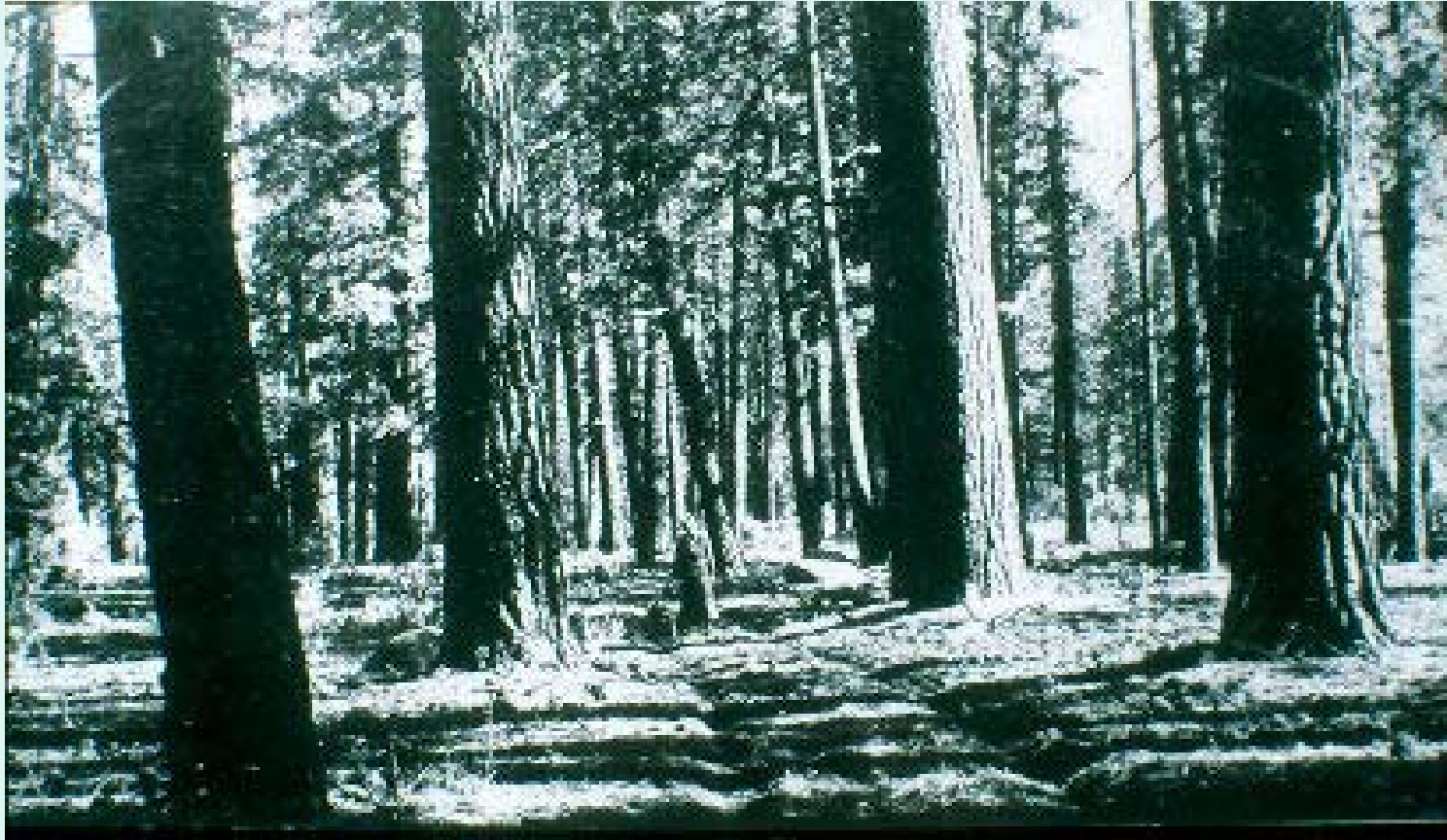
Photo: M. Kat Anderson

# Fire, Water, and Salmon: Restoring Sustainability and Resilience in the Drier Southern and Eastern Regions of Pacific North America

- Fire suppression has led to dense young forest stands that deprive salmon of large quantities of cool groundwater and is exacerbated by a warming climate.
- Restoration of Indian Rx fire—following *variable density thinning*—designed to restore forest elders [old-growth] plus all tree ages and species—with lower fuel-loads.
- Taking a ridge-to-ridge and shore-to-mountain top watershed level restoration perspective that unites Forest and Ocean—*As in the way territories of Indigenous peoples in Pacific North America [and in Hawaii with the A’Hua’Pua system] included all ecological zones between shore and mountain top.*

Photos: Dennis Martinez

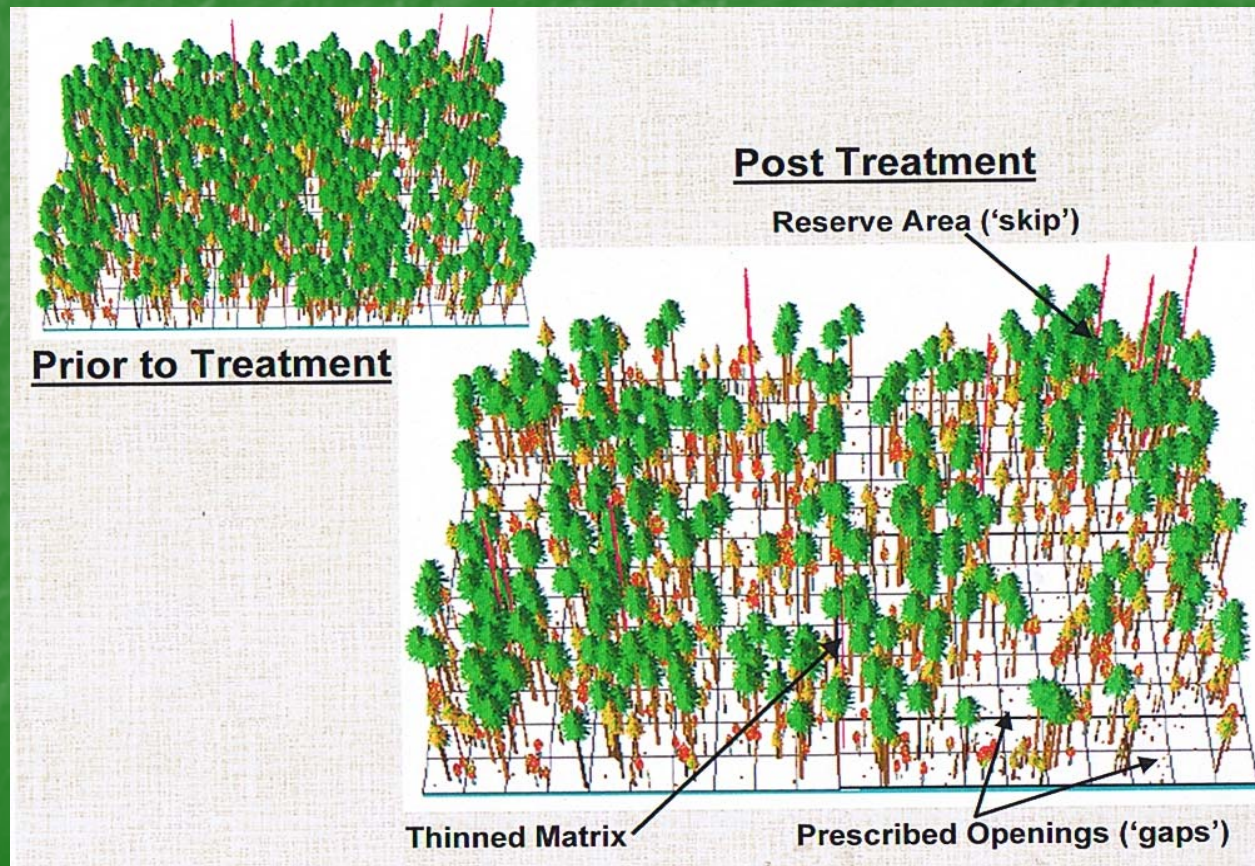
## Lassen NP in the 1870s



**“Restoration is not a snapshot in time. It is resetting the evolutionary clock” [Restoration Ecologist, Don Falk] so that fire can once again play its functional role in determining—to a large extent—forest integrity, *relative* stability [“dynamic disequilibrium”—forest ecologist Ariel Lugo/“steady-state shifting mosaics”—forest ecologist Dave Perry/“Flux of Nature”—Indigenous Philosopher, LeRoy Little Bear], resilience, structure, and composition. *One must look backwards and forwards at the same time.***

# Variable Density Thinning [VDT]/Green Retention/Skips-and-Gaps Ecological Restoration Approach Diagrammatic Model [Lindenmayer & Franklin]

## First Entry



- An important guiding principle for VDT is Risk-spreading: Creating and maintaining a perforated landscape of ample redundancy in open – dense/light-shade and other diverse stand conditions
- As in good engineering—if any given system component type fails or is lost, others of the same type will still perform their function and pick up the slack. An important outcome is a heterogeneous and biodiverse forest

- **Maintaining Variable Density Thinning's Perforated Structural/Compositional Diversity By Favoring Early & Mid-Successional Dominant and Co-Dominant Tree Species Through Arrested Succession with Rx Fire—WHERE APPROPRIATE**
- **Advantages of Favoring Earlier Successional Tree Species [E.g., Pine/Douglas-fir] in Reducing Crown Fire Potential, Conserving Nutrient Stores, and Increasing Biodiversity in Dry Mixed Conifer Forest Types**
  - Lower crown bulk density
  - Greater tendency to self-prune
  - Thicker-barked for greater fire resistance
  - Deeper-rooted tree species
  - Allows Rx fire to reduce ground/ladder fuels more effectively and safely
  - More disease resistant tree species
  - Greater separation of tree crowns & breaking up contiguous fuels
  - Shade intolerant/moderately tolerant tree species allow greater diversity in hardwoods/understory forbs and grasses

# Skips and Gaps creating the desired End Result



Compliments of Lomakatsi Restoration Project



**Mosaic Pattern of Ignitions**

## **Modified Group Selection for Hardwood Survival**

Small diameter Douglas fir is removed from around Black Oaks to enhance species diversity in the stand, reduce ladder fuels and utilize biomass.



# Global Warming Induced Changed Weather and Oceanic Conditions in Pacific North America

## Current Ecohydrologic Conditions

- Winter season reduced by roughly 2 months and extending wildfire season by weeks
- Longer warm fall rains and shorter spring snowmelt
- More precipitation falls as rain than snow, reducing snowpack
- Snow melts more rapidly and earlier in spring, resulting in higher peak flows--causing water to be available—and then gone up to ~ 2 months before the normal times of salmon arrival
- Increased rapid earlier flows cause erosion and floods that deliver higher sediment loads, burying small salmon spawning gravels
- Ocean acidification is reducing available calcium for shellfish and juvenile bone development of some fish species and may be contributing to massive phytoplankton die-offs—especially when combined with *eutrophication* [= *heavy nitrogen loading from run-off and atmospheric deposition leading to oxygen-deprived “dead zones”*].

**GHG Emissions Are Setting in Motion a *Positive Feedback Loop* That—Especially When Combined with Slash Left On-Site from Industrial Logging Practices—Increasingly Exacerbates Climate Disruption and Affects the Health of Watersheds, Salmon, and Native Peoples**

- GHG emissions are causing a longer warm season that increases likelihood of catastrophic wildfires
- More frequent larger wildfires release more GHG emissions
- Increased GHG emissions dry still more forest fuels that increase wildfire frequency and size that release still more GHG emissions—in an ever tightening positive feedback loop [= noose]
- Unintended consequence of outlawing Indigenous Rx Fire that may cause ecosystems to flip to novel unstable states that are irreversible—As for example the catastrophic wildfires happening now all over the world

Photo: Dennis Martinez

# Warming Air and Water Temperatures Combined With Industrial Logging Practices and Lack of Indian Fire Directly Harm Salmon Wellbeing

- Loss of old-growth forest cover has resulted in less stream shading and faster spring runoff; removal of large logs has resulted in poor stream structure—with few or no deep pools for summer cooling
- Warm water induces whirly disease in salmon and increases their susceptibility to other aquatic diseases—and is exacerbated by dams and reservoirs.
- Loss of groupings of tall old-growth trees has reduced humidity in forests with increased drying of forest understories, overstocked smaller trees and ladder fuels resulting in increased fire hazard
- Fewer salmon carcasses deprive forests of an important nutrient source.

Photo: Dennis Martinez

## Addressing Climate Warming/Disruption with Ecosystem-Based Adaptation and Eco-Cultural Restoration

- **Aim High:** Avoid the limitations of **Shifting Baselines** by using historical Indigenous landscape reference models as an initial restoration guide.

**Avoid “No Net Loss” Metrics of Sustainability**

- **Adapt historical model** to changed modern environmental conditions through **Assisted Regeneration** of climate-adapted culturally important plant populations and individuals [= **Ecosystem-Based Adaptation**]
- So-called “**Novel landscapes**” are often degraded cultural landscapes
- **Restore maximum Landscape Diversity/Heterogeneity** for maximum **Genetic Diversity** and **Climate Refugial Capacity** with **Indian Rx Fire Regimes**

**Will we see this size of  
salmon again?**

**Photo: Courtesy of Nigel Haggan**



The **Conservative Nature** of Traditional Indigenous Landcare:  
Maintaining Surplus Biodiversity with Limits Always in Mind  
and People and Resources in Balance.

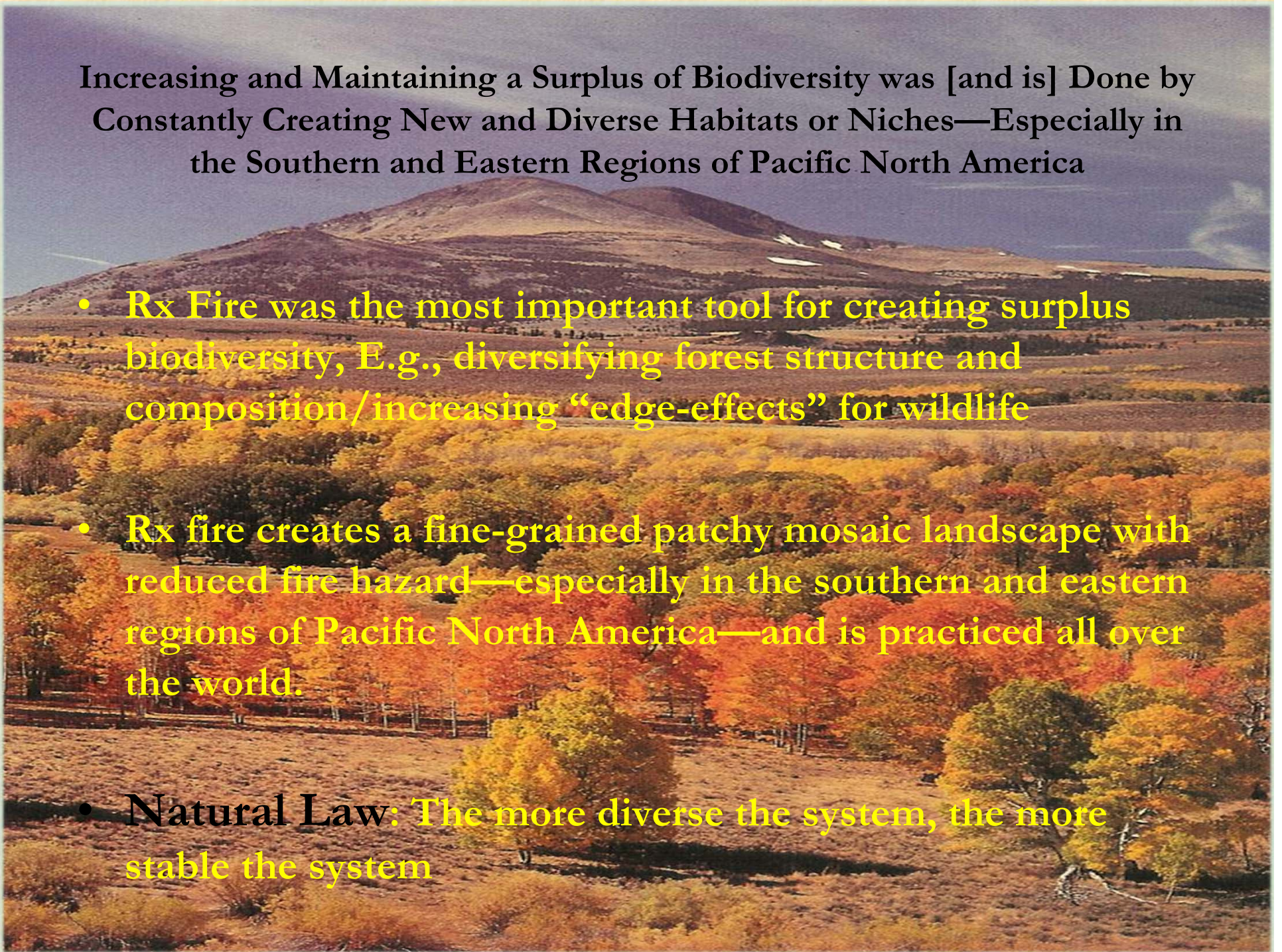
Indigenous peoples' rates of resource use are limited by social  
choices—not technology

Contrasting Western Industrial and Traditional Indigenous Economic Models

- “**Ownership**” of resources means river and land care and taking on conservation responsibilities with sharing possible in time of need
- Minimum necessary yields [= **leaving surplus**] trump so-called maximum “sustained” yields [= **oxymoron**]
- **Natural Law**: Forced growth risks loss of longterm stability and productivity as well as species extinctions
- **Incentives for wealth redistribution** = Potlatch Ceremony, sharing, kinship, taboos, shame for the greedy, spiritual retribution [= **Kincentric Ecology**]
- “**Sustainability**” = leaving surplus/creation of diverse econiches and habitats via Rx fire/risk averse/planning for worst year—not average year/ growth not a stabilizing force

Increasing and Maintaining a Surplus of Biodiversity was [and is] Done by  
Constantly Creating New and Diverse Habitats or Niches—Especially in  
the Southern and Eastern Regions of Pacific North America

- Rx Fire was the most important tool for creating surplus biodiversity, E.g., diversifying forest structure and composition/increasing “edge-effects” for wildlife
- Rx fire creates a fine-grained patchy mosaic landscape with reduced fire hazard—especially in the southern and eastern regions of Pacific North America—and is practiced all over the world.
- **Natural Law:** The more diverse the system, the more stable the system



Creation of Surplus Biodiversity Promotes Stability and Diverse  
Production in Constantly Changing Ecosystems

[= *Sustainability*]. Indigenous Knowledge-keepers and Modern  
Ecologists Alike Recognize This Natural Law:

**The More Diverse the System, The More Stable the System.**

Too much growth risks loss of both *longterm* stability and  
productivity.

*Why?*

When native plants are forced to grow faster or produce  
more—as in GMOs—the natural cycle of growth balanced  
by rest is interrupted, creating an imbalance between  
growth and decomposition.

- **E.g., Researchers are genetically modifying wild rice to produce abundant crops every year instead of once every 4 or so years. Forcing yearly abundant growth of seeds also forces growth of root-masses. Decomposing bacteria then must use up all of the available nitrogen just to break-down huge root-masses. In a few years, lack of nitrogen will indirectly stop most seed production. Genetically modified wild rice populations will then crash and seed production will cease.**
- **Marsh restoration speeded up by applying large quantities of Nitrogen—Disintegration of Marsh due to too fast growth**
- **Similarly, frequent low intensity Rx Fire prevents surplus vegetative growth that will use up available nitrogen as it is decomposed by bacteria and blocks the sun from regenerating new growth necessary for cultural items and wildlife.**

# GMO Salmon

## Human Genes Now Approved for Insertion into Salmon to Increase Rate of Growth

- Causes 1/3 greater mortality
- If only 60 salmon escape into contact with wild populations, the Gene could reproduce in that population to 60,000 GMO salmon
- Causing extinction in 40 generations

*Another example of the unintended consequences of speeding up growth and production of living organisms in violation of Natural Law*

**Salmon Are The Product of 55 Million Years of Mountain-Building,  
Downcutting, Volcanic Explosions, Ice Ages, Super-Droughts,  
Sediment-Overloading, Wildfires, Landslides, Gigantic Floods,  
Food-Failures, and Drying Rivers—**

## **Salmon Are Survivors**

- Salmon evolution is the result of adaptation to a diversity of habitats and the maximization of traits that allowed each species to survive and reproduce in different parts of rivers and tributaries: E.g. Chinook in mainstems, Coho in upper tributaries, Sockeye in lakes, Pink and Chum in lower stream reaches, etc.
- Each particular wild stock within the 5 salmon species is adapted to a particular kind of stream habitat
- Multiple survival strategies through life history diversity has prevented loss of whole populations in constantly changing environments and habitats
- Artificial hatchery reproduction totally ignores this evolutionary key to salmon survival, treating all stocks as interchangeable—*Resulting in only 5% of wildstocks left in the southern part of the PNW*

## **Secure Land Tenure—as the Key to Sustainable Indigenous Earth-Care Just Described—Is Now Increasingly Threatened By:**

- **Land Grabs at an historically unprecedented rate and scale**
- **Rapid land privatization and commodification of nature—now supported by the United Nations and World Bank**
- **Secure Indigenous land tenure threatened by Big Environmental NGOs (BINGOs)—Persuading states to evict IPs from their homelands and justified by Western science in the name of conservation**
- **Indigenous land tenure insecurity is now a Human and Cultural Rights issue**

## **Key to Meeting Challenges of Evictions, Insecure Land Tenure and Commodification and Loss of Homelands has been Addressed by the International Indigenous Commission [IIC] at the Rio Earth Summit**

- ❖ “Pristine” ecosystems are a Western myth
- ❖ Secure Land Tenure is Key to sustainable and competent stewardship and that knowledge is at least the equal to Rights
- The Global Western conservation community [BINGOS] placed Rights ahead of Knowledge/Competency at the World Parks Congress in 1993 at Caracas and again in 2003 at Durban
- Indigenous peoples were accused of “hi-jacking” the conservation agenda

## Clash of Conservation Models:

- The International Indigenous Commission [IIC] and others developed “Stewardship Community Conservancies”

### BINGOs used a New Business Model:

#### “Integrated Conservation and Development Projects”

- The New Business Model exemplified by the “Africa Parks Foundation” funded by grants
  - Operating costs in 2006: US \$9,548,000  
Raised US \$10,345,000 in grants
  - Revenues generated directly from parks: US \$209,000 = 2.2% of grant amount = **50:1 ratio between subsidies and revenues**
- Another bubble poised to burst in the global casino economy could be devastating to maintaining protected areas

## **REDD+: 15 UN-World Bank Pilot Projects Operate in a USD \$20 Billion Global Carbon Market**

- **But: 60% of commercial value goes to “intermediaries”**
- **Only 3% goes to Indigenous communities**
- **The remaining value goes to commercial carbon traders**
- **With carbon prices now falling [Law of supply and demand]: USD \$20 billion bubble may well burst—like the 2007-2008 subprime bubble**

# **Indigenous Peoples Can Protect Nature for Far Less Money Than BINGOs By Orders of Magnitude as High as 500:1**

- **Achieving secure land tenure under REDD+ 3.50 EURO/ha compared to 2000 EURO**
- **In Amazonia: US \$ 1.6 billion against US \$17 billion**
- **Locally Managed Marine Areas [LMMA] in Indo-Pacific: 400 marine reserves after 5 years—US \$1.00/acre**
- **In the same area and on the same island nations in Indo-Pacific: Conservation International [CI] spent USD \$30 million over 20 years with no measurable outcomes**
- **Northern Rangeland Trust [NRT] in Kenya: IPs manage 3 million acres @ US \$0.25/acre**

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