Economic Studies of the Value of Fishery Restoration: Benefits of Passage and Reintroduction

Dr. John Duffield
University of Montana & Bioeconomics, Inc.

Future of Our Salmon Technical Workshop:
Restoring Historical Fish Passage
Spokane, WA
March 19, 2014

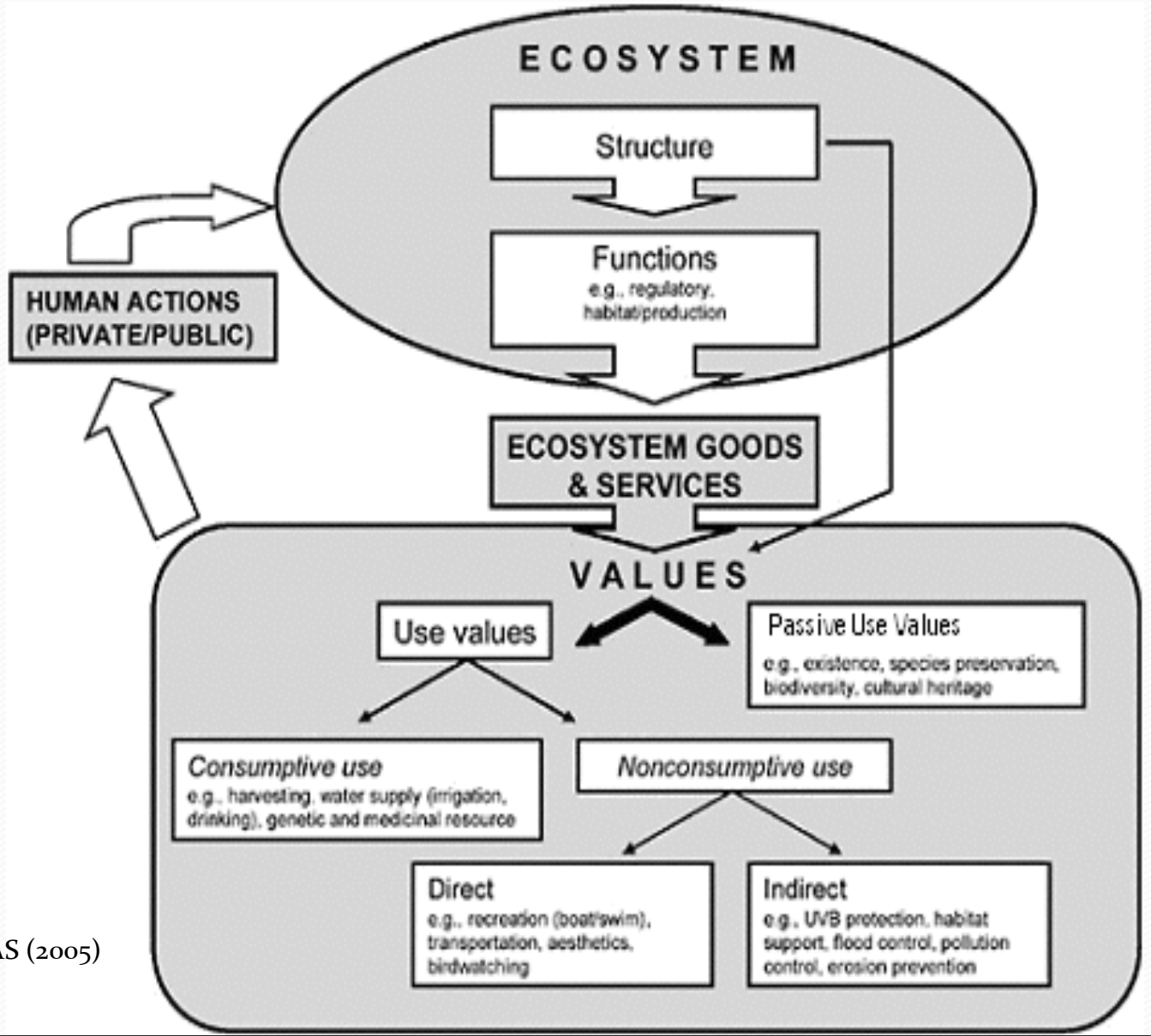
Outline

- Salmon economics ca. 1950 - Celilo Falls, Kettle Falls
- Current Methods for Valuing Fishery Restoration
- Contemporary cases:
- 1) Bristol Bay Wild Salmon Ecosystem (2014)
- 2) Elwha Dam Removal (1996 study)
- 3) Dam Removal on the Klamath River (2012)
- 4) Grand Canyon/ Glen Canyon Dam (1994, 2014)
- Conclusions

Salmon economics ca. 1950s & 1970s focus on Kettle Falls/Colville

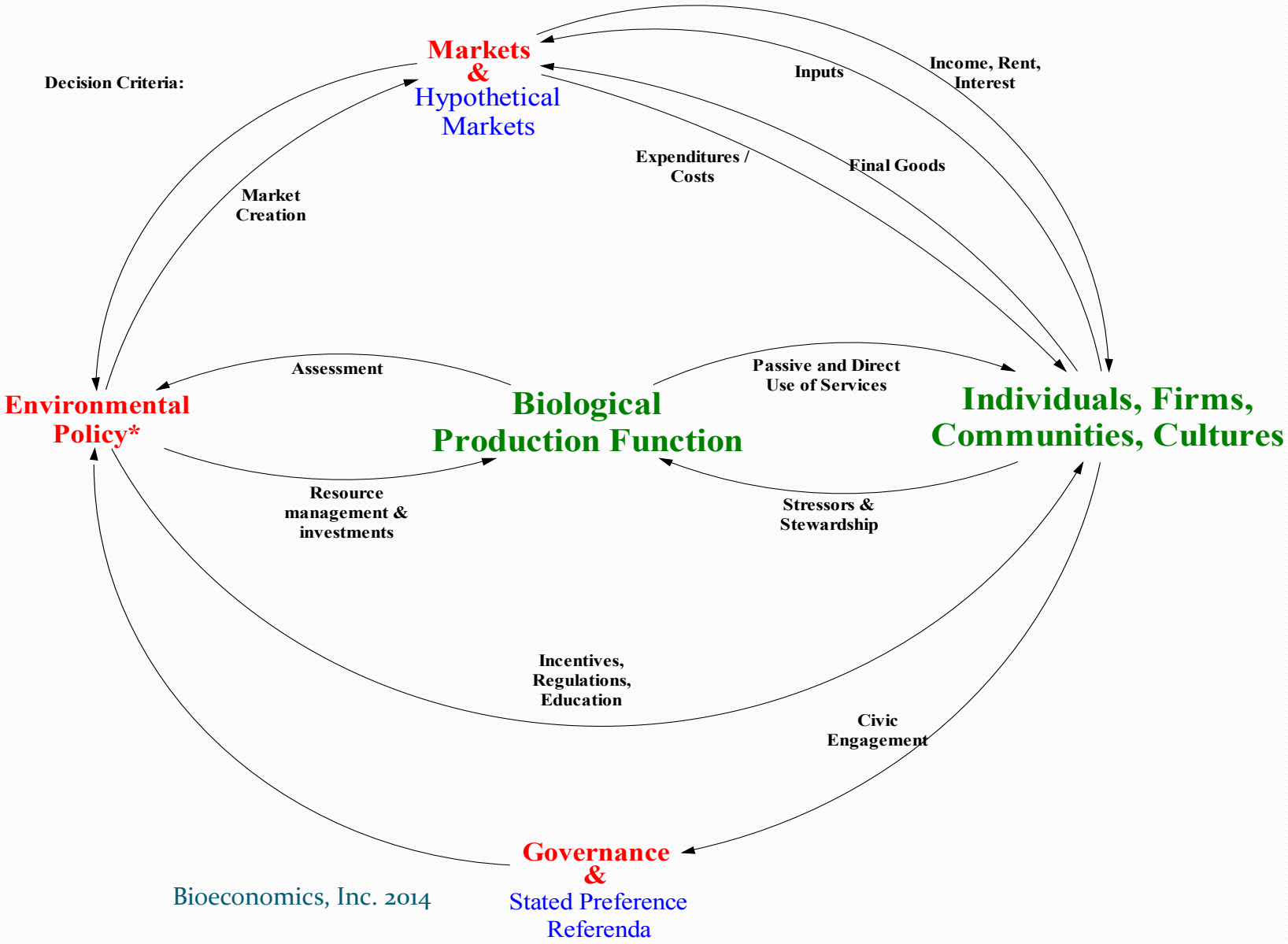
- Indian Claims Commission outcome in 1955 and 1978 for Celilo Falls and Kettle Falls (Colville – Grand Coulee)
- Replace cost of wholesale canned salmon, 1 lb/person-day use, Colville population of 2,677, 6% discount rate.
- Loss computed in 1939 prices of $0.20/lb. Total loss $3,257,083 paid in 1978 or $1,217 per capita for loss in perpetuity
- Correcting for price inflation (paid in dollars worth about $0.14 cents compared to 1939) and using 3% and correcting for lost use of money (interest) to 1978 – value should have been at least $140.3 million or $52,409 per capita.
- Takeaway – method understates + big errors in application.

Connections between ecosystem structure and function, services, policies and values (source, NAS 2005)



Adapted from NAS (2005)

COSERA General Implementation Model: Environmental Economics Layer

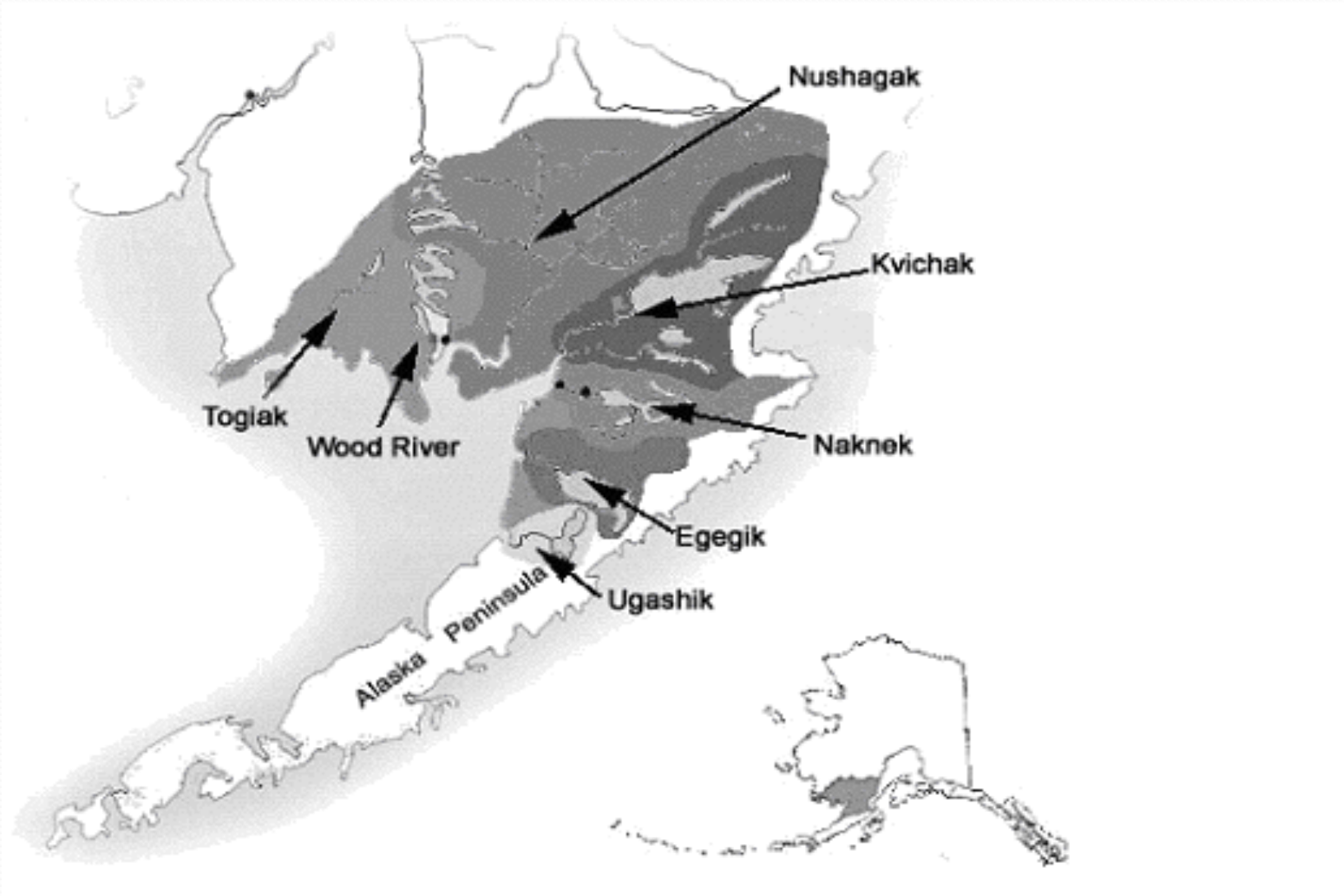


U.S. Regulatory Guidance on Types of Approved Methods

- Approved methods based on 43 CFR part 11 include:
- Revealed preference methods: market, appraisal, factor income, travel cost, hedonic price, random utility model
- Stated preference methods: contingent valuation, conjoint analysis, random utility model
- Benefit transfer: unit day value method
- Equivalency Methods: HEA, REA, conjoint analysis
- "Other valuation methodologies that measure compensable value in accordance with the public's willingness to pay, in a cost-effective manner, are acceptable methodologies to determine compensable values .." (43 CFR 11.83 (e)(3))

Application 1: Valuation of Bristol Bay Wild Salmon Ecosystem – direct use

Bristol Bay Study Area



Bristol Bay

- EPA's Watershed Assessment (2014)
- EPA initiates 404c action under Clean Water Act, potentially preclude mining development
- Population is 70% Alaska Native, about 25 villages
- World's largest sockeye salmon fishery – sustainable

Source: Duffield et al. 2014. "Bristol Bay Wild Salmon Ecosystem: Baseline Levels of Economic Activity and Values U.S." Appendix J in, EPA. *An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska.* U.S. Environmental Protection Agency, Washington, DC.

Ecosystem services included

- Commercial salmon fishing and processing
- Recreational (sport) fishing
- Subsistence harvest
- Sport hunting
- Wildlife viewing (non-consumptive use)

Bristol Bay Estimated Direct Use Net Economic Values

Ecosystem Service	*Low estimate*	*High estimate*
Commercial salmon fishery		
Fishing Fleet	$30.4	$55.9
Fish Processing	$30.4	$55.9
Sport fishing	$12.2	$12.2
Sport hunting	$1.4	$1.4
Wildlife viewing / tourism	$8.1	$8.1
Subsistence harvest and activity	$154.4	$220.6
Total Direct Use Value	$236.90	$354.10

Net Present Value of Bristol Bay Direct Use Net Economic Values

Estimate	Annual Value	Net Present Value (million 2009 $)			
		7% Discount	3% Discount	1.75% Discount	1% Discount
Low Estimate	*$236.9*	*$3,384*	*$7,897*	*$13,537*	*$23,690*
High Estimate	*$354.1*	*$5,059*	*$11,803*	*$20,234*	*$35,410*

Bristol Bay: Take-away points

- Multiple services have quantifiable economic values.
  - Not just from commercial fishing
  - Subsistence values relatively significant
- Nonmarket values are significant relative to market values.
- Policy and decisions based on just market values lead to allocation error.
- Ecosystem services values can make a difference as they increasingly have traction with policy decision makers.

Application 2: Elwha Dam Removal – passive use values

Elwha River


Strait of Juan de Fuca
Lower Elwha Klallam Reservation
N
112
Elwha Dam
PORT ANGELES
101
Indian Creek
Lake Aldwell
101
Lake Sutherland
Glines Canyon Dam
Lake Mills
Elwha River
OLYMPIC NATIONAL PARK
0
5
MILES


CANADA
Seattle
WASHINGTON
N
OREGON
Sources: ESRI, TeleAtlas, USGS

Elwha River Issues

- System has/had two outdated hydroelectric dams which blocked anadromous species migration within the system.
- Elwha is located in a relatively pristine riparian corridor; Olympic NP is the headwaters.
- Historically important for Lower Elwha Klallam Tribe
- Restoration will benefit Tribe, sportsfishery, and commercial fishery.

Elwha River Passive Use Study

- Study undertaken to measure values to nonusers who may care about and value fishery restoration.
- Total of 2,500 surveys to county, state, national strata
- Response rate 55% (national) to 77% (county)
- Annual payment for 10 years – yes/no format
- Source : John Loomis. 1996. "Measuring the economic benefits of removing dams and restoring the Elwha River: Results of a contingent valuation survey>
- *Water Resources Research*, 1996

Elwha Passive Use Study Results

Mean annual value per household for dam removal	Aggregate 10-year benefits	Survey population
$59 (90% confidence interval is $21 to $222)	--	*Clallam County*
$73 (90% confidence interval is $60 to $90)	*$138 million*	*Rest of Washington state*
$68 (90% confidence interval is $56 to $82)	*$3 to $6 billion*	*Rest of United States*

Current status of Elwha River Restoration

- Started September 2011
- Elwha Dam completely removed, Lake Aldwell reservoir drained, restoration underway
- Glines Canyon Dam 50% removed, Lake Mills reservoir drained
- Elwha River is free flowing for the first time in 100 years
- Scheduled completion September 2014

Take-away from Elwha

- Passive use values may be very significant, even for a relatively small fishery.
- Underscores that salmon and other unique or endangered native fisheries are nationally significant resources
- Elwah in part a special case because the restored passage is to a pristine ecosystem that is part of Olympic National Park.
- There remain many dams in the NW where services associated with hydroelectric development may outweigh values of a fishery restored through dam removal.

Application 3: Valuing Dam Removal to Protect Native Fish—Klamath River

Klamath River

Klamath River Issues

- Formerly 4th largest producer of western US salmon
- Home to endangered and culturally important sucker and bull trout species
- Has a unique and outstanding recreational whitewater reach
- Agricultural water withdrawals compete with both fish species and recreation
- Dams block free passage of migratory fish species

Klamath River Passive Use Study

- Prepared for US Bureau of Reclamation by RTI International in 2012
- Utilized a regional and national household survey to estimate passive use values associated with dam removal, fisheries restoration and a water sharing agreement with agricultural interests.
- Employed a "choice experiment" contingent valuation question design:
  - Attributes included species extinction risk, salmon population levels, and cost.

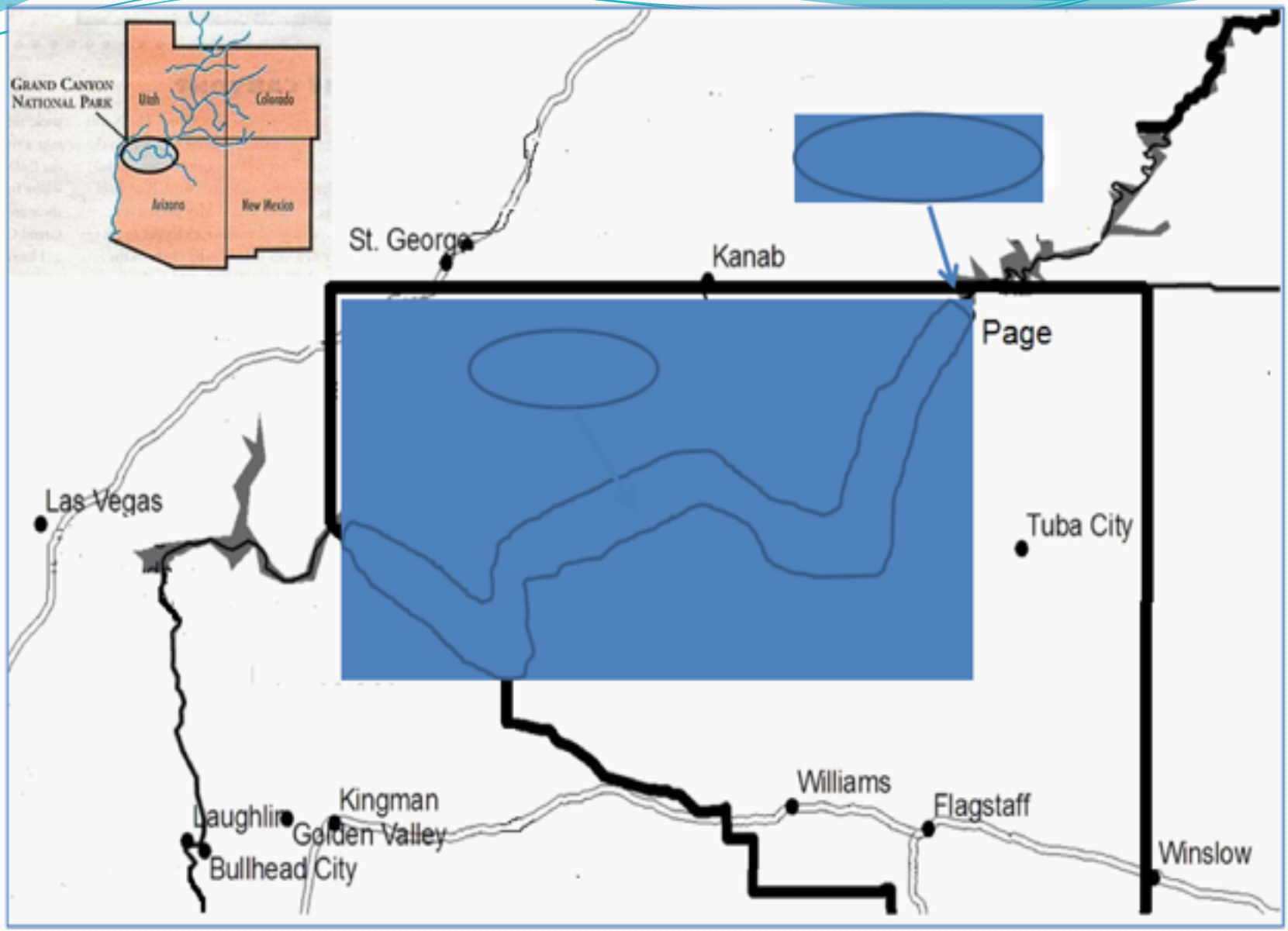
Klamath Passive Use Study Results

Area	Annualized Household	Aggregate PV of 20-Year Annual WTP for Action
12-county Klamath area	*$68*	*$0.217*
Rest of Oregon and California	*$118*	*$9.071*
Rest of the United States	*$118*	*$74.98*
Total	*--*	*$84.271*

Current Status of Klamath Restoration

- Ongoing negotiation/litigation
- Any dam removal restoration is likely 20 years out

Application 4: Grand Canyon of the Colorado / Glen Canyon Dam


Grand Canyon National Park
Utah
Colorado
Arizona
New Mexico
St. George
Kanab
Page
Las Vegas
Tuba City
Williams
Flagstaff
Winslow
Kingman
Laughlin
Golden Valley
Bullhead City

Grand Canyon Ecosystem Economic Studies

- Issue: management of Glen Canyon Dam for peaking operations, studies began in early 1980´s
- Economics focus on direct recreation use values as function of flow & ecosystem service values for sediment conservation and endangered species (humpback chub recovery)
- EIS process resulted in a new Record of Decison in 1995 that reduced daily allowable fluctions for peaking power from historical 25,000 plus-minus to 6,000 to 8,000 daily

Key previous studies of Grand Canyon of the Colorado resources

- Direct use values- Bishop et al 1987
- Nonuse values- Welsh et al 1995
- Studies were in context of Glen Canyon Dam operations
- Focus was Grand Canyon river corridor below the dam

Annual Values Associated with Alternative Dam Operations ($ millions)

Flow Scenario	Power	Recreation	Nonuse Values	
			National	Marketing Area
Moderate Fluctuating Flows	-36.7 to -54.0	+0.4	+2,286.4	+52.2
Low Fluctuating Flows	-15.1 to -44.2	+3.7	+3,375.2	+50.5
Seasonally Adjusted Steady Flow	-88.3 to -123.5	+4.8	+3,442.2	+81.4

Reliance on Passive Use Values by U.S. Dept. of the Interior 1996 ROD

Although there would be a significant loss of hydropower benefits due to the selection of the preferred alternative (between $5.1 and $44.2 million annually) a recently completed non-use value study conducted under the Glen Canyon Environmental Studies indicates that the American people are willing to pay much more than this loss to maintain a healthy ecosystem in the Grand Canyon. “

(Record of Decision, Operation of Glen Canyon Dam Final EIS, October 1996. Bruce Babbitt, Secretary of the Interior

Conclusions:

Conclusions

1. Economics depends totally on biology and physical sciences
2. It is not just direct use values that matter; passive use, or existence value may be a large component.
3. Most approaches to valuing subsistence use understates real values.
4. Results are sensitive to how we weigh the future (choice of a discount rate)

Citations

- U.S. Environmental Protection Agency. 2014. "Bristol Bay Wild Salmon Ecosystem: Baseline Levels of Economic Activity and Values U.S." in, EPA. *An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska*. U.S. Environmental Protection Agency, Washington, DC.
- Duffield J, C Neher, and D Patterson. 2014. "Oil Spill in Northern Waters: Trial Outcomes and the Long-Term in Case of the Exxon Valdez." *Arctic Review on Law and Politics* vol. 5, 1/2014 pp. 39–75.
- Mansfield, C *et al.* 2012. "Klamath River Basin Nonuse Value Study." Report for U.S. Bureau of Reclamation, Sacramento, CA.
- Loomis, John B. 1996. "Measuring the economic benefits of removing dams and restoring the Elwha River: Results of a contingent valuation survey" *Water Resources Research*, 32(2): 441-447;
- Duffield, J. 2011. "The Political Economy of Hydropower and Fish in the Western U.S.". Chapter 8, pp 127-171 in Per-Olav Johansson and Bengt Kristrom, eds., *Modern Cost-Benefit Analysis of Hydropower Conflicts*, Cheltonham & Northhampton: Edward Elgar. July 2011.