Oregon State University
College of Agricultural Sciences

Ecosystem Services Valuing (Part II): A Framework for Including Ecosystem Services in Decision-Making, and an Example

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Background Presentation to Oregon Board of Forestry

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Ecosystem Services

Ecosystem services – benefits that people derive from functioning ecosystems

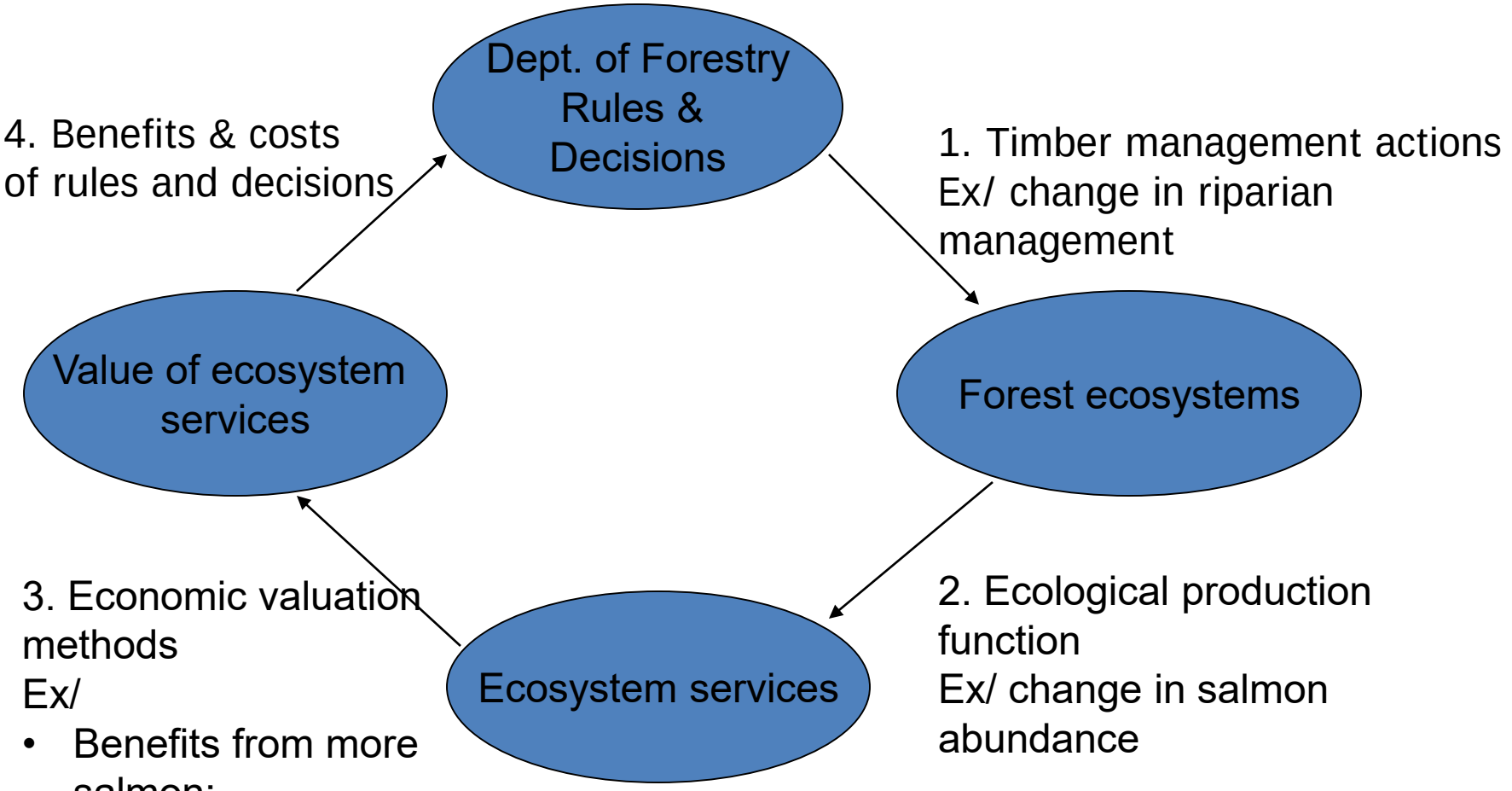
Examples on Oregon timberland/

- Provisioning: Douglas-fir trees for timber.
- Regulating: carbon sequestration.
- Cultural: mountain biking trails.
- Supporting: habitat for birds.

Ex/ Starker Forest Timberland, west of Corvallis

Photo: David Lewis

A Framework for Including Ecosystem Services in Decision Making



An Example of #3 – Estimating the value of more Oregon Coast Coho

Key challenge: benefits are non-market and are likely non-use => need stated preference methods

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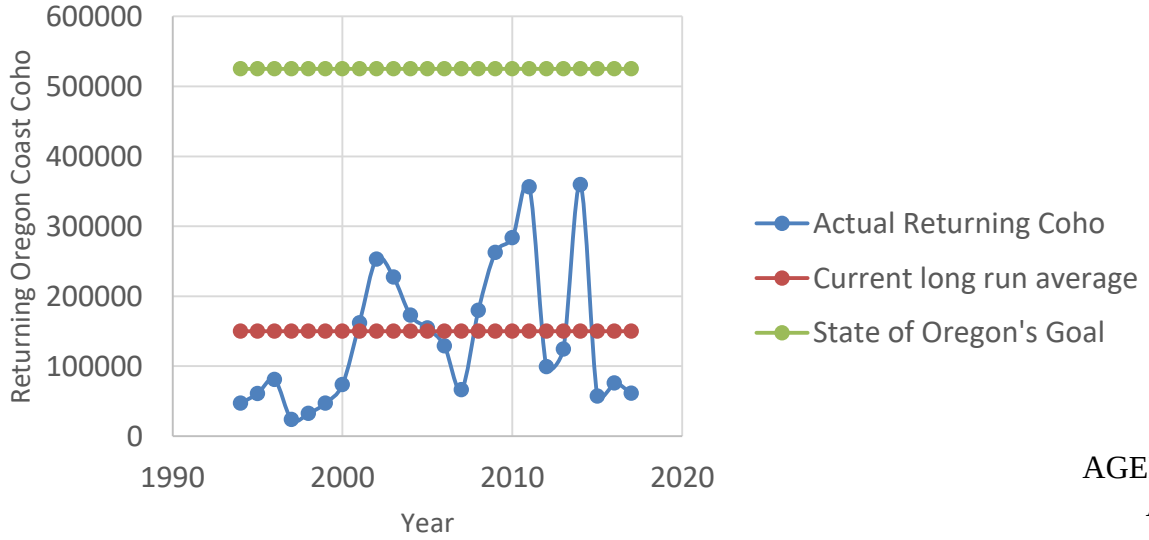
Estimating the value of improvements in Oregon Coast Coho

Basic steps in conducting a stated preference choice experiment.

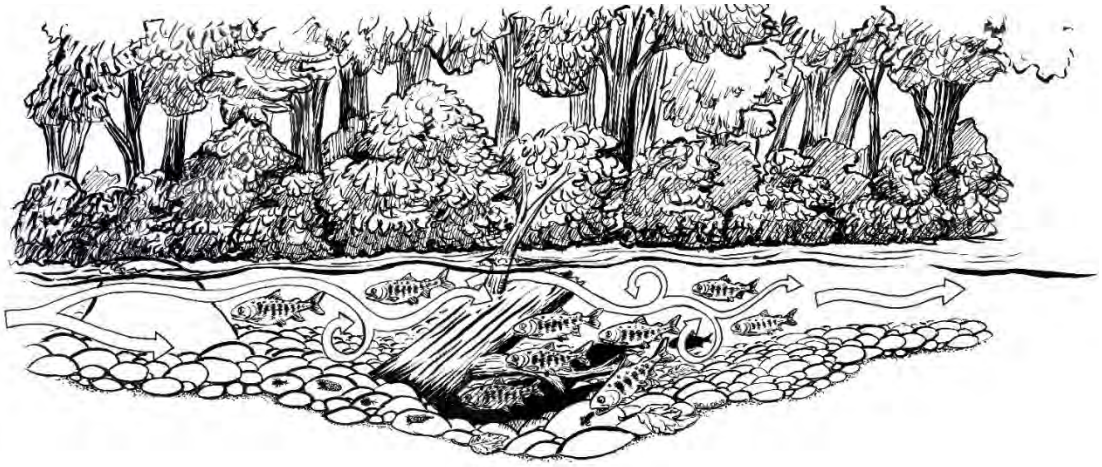
- Define the change in an ecosystem service to be valued.
  - Status quo – current long-run average number of returning fish.
  - Upper bound conservation scenario – defined using the State of Oregon's goal.



Estimating the value of improvements in Oregon Coast Coho

Basic steps in conducting a stated preference choice experiment.

- Inform survey respondents about the ecosystem service.

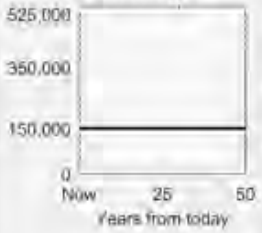
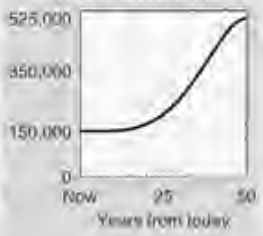
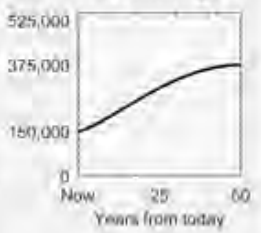


Estimating the value of improvements in Oregon Coast Coho

Basic steps in conducting a stated preference choice experiment

- Define attributes.
- Define scenarios with changes in the service.
- Scenarios include costs to households.
- Survey respondents choose a scenario.

Figure S1. Example choice card - this is one of 60 unique choice cards used in the design, where the levels of attributes vary across the choice cards

	Results in 50 years		
	Status Quo	**Alternative A**	**Alternative B**
Population Status	**Threatened**	**Recovered**	**Recovered**
Population Size	**150,000 fish**	**525,000 fish**	**375,000 fish**
Population over Time	**No Change** 	**Slow Change** 	**Quick Change** 
Recreational Fishing (# of fish that can be kept)	**Periodically Closed** **5 fish/year**	**Open Every Year** **10 fish/year**	**Open Every Year** **5 fish/year**
Added cost to your household each year for 10 years	**$0**	**$100/year**	**$350/year**
Which alternative do you prefer? *(Choose One)*	○1 **Status Quo**	○2 **Alternative A**	○3 **Alternative B**

Estimating the value of improvements in Oregon Coast Coho

Basic steps in conducting a stated preference choice experiment

- Experimental design.
  - Define attribute levels: ex/ Population size is 150k, 250k, 325k, 375k, or 525k fish.
  - Attribute levels are randomly varied with imposed correlations.

Figure S1. Example choice card - this is one of 60 unique choice cards used in the design, where the levels of attributes vary across the choice cards

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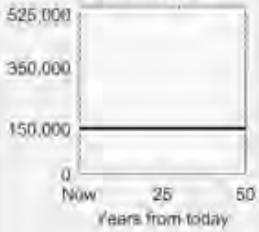
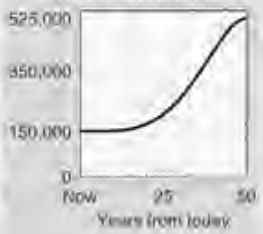
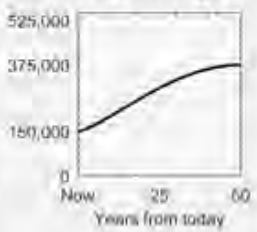
Population over Time	**No Change** 	**Slow Change** 	**Quick Change** 
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Estimating the value of improvements in Oregon Coast Coho

Basic steps in conducting a stated preference choice experiment.

- Analyze the data with econometric methods and estimate mean household willingness-to-pay (WTP) for scenarios with improvements in the ecosystem service.
  - Preliminary results from our study (2,734 choice card responses from 926 unique households):

ESA Status	Change in Final Population Size	Speed of Population Change	Mean Household WTP ($/year)	95% Confidence Interval
Threatened	100,000 more fish	Slow	$59.75	[$36.66, $82.84]
Recovered	375,000 more fish	Quick	$179.19	[$131.91, $226.46]

Estimating the value of improvements in Oregon Coast Coho

Basic steps in conducting a stated preference choice experiment.

- Aggregate household WTP numbers to the population of interest.
  - Preliminary results from our study using a lower bound approach:
    - Assumes that the response rate (21%) indicates the proportion of the population with non-zero WTP.
    - The rest are assumed to have zero WTP.

ESA Status	Change in Population Size	Speed of Population Change	Population benefits ($/year) – PNW region	95% Confidence Interval
Threatened	100,000 more fish	Slow	$107 million	[$66 million, $149 million]
Recovered	375,000 more fish	Quick	$321 million	[$237 million, $406 million]

- A good upper bound estimate accounts for sample selection bias – ours is in progress.

Final thoughts on choice experiments for changes in ecosystem services

- Only method used for services that have non-use values (e.g. threatened species).
- Implementing original methods requires highly specialized skills.
- Conducting an original study takes time and money.
  - Design of Coho study commenced in winter of 2016. Study results are in revision at a journal now (summer 2019).
  - To design and run another choice experiment like our Coho study would probably cost approx. $200,000 to $300,000.
- Ideally the valuation exercise is paired with an ecosystem production function.

An Idea for the Board to Consider

Invest in knowledge for a small subset of ecosystem services that may be affected by Board rules and decisions.

- Focus on 3 to 5 distinct ecosystem services (including timber).
- Develop original knowledge specific to Oregon forests (ecological production functions, economic valuation functions).
- The Board can draw on this knowledge as needed, and it could be updated over time.
- China's Gross Ecosystem Product (GEP) accounting is an example of focusing on a small set of ecosystem services.

A Framework for Including Ecosystem Services in Decision Making