Ecosystem Services and Economics

David Lewis, Professor, Department of Applied Economics
Randy Rosenberger, Assoc. Dean, College of Forestry

Background Presentation to Oregon Board of Forestry
11/7/18

Ecosystem Services

- Ecosystem services – benefits that people derive from functioning ecosystems
  - Provisioning services: raw materials, such as timber products or food production.
  - Regulating services: pollination, soil formation, climate regulation.
  - Cultural services: a place for recreation, aesthetics.
  - Supporting services: habitat for wildlife.

Costanza, R., de Groot, R., Braat, L., Kubiszewski, I., Fioramonti, L., Sutton, P., Farber, S. and Grasso, M., 2017. Twenty years of ecosystem services: how far have we come and how far do we still need to go?. *Ecosystem Services*, *28*, pp.1-16.

Ecosystem Services

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

Ecosystem Services

What does the market pay Starker to provide?

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

Ex/ Starker Forest Timberland, west of Corvallis

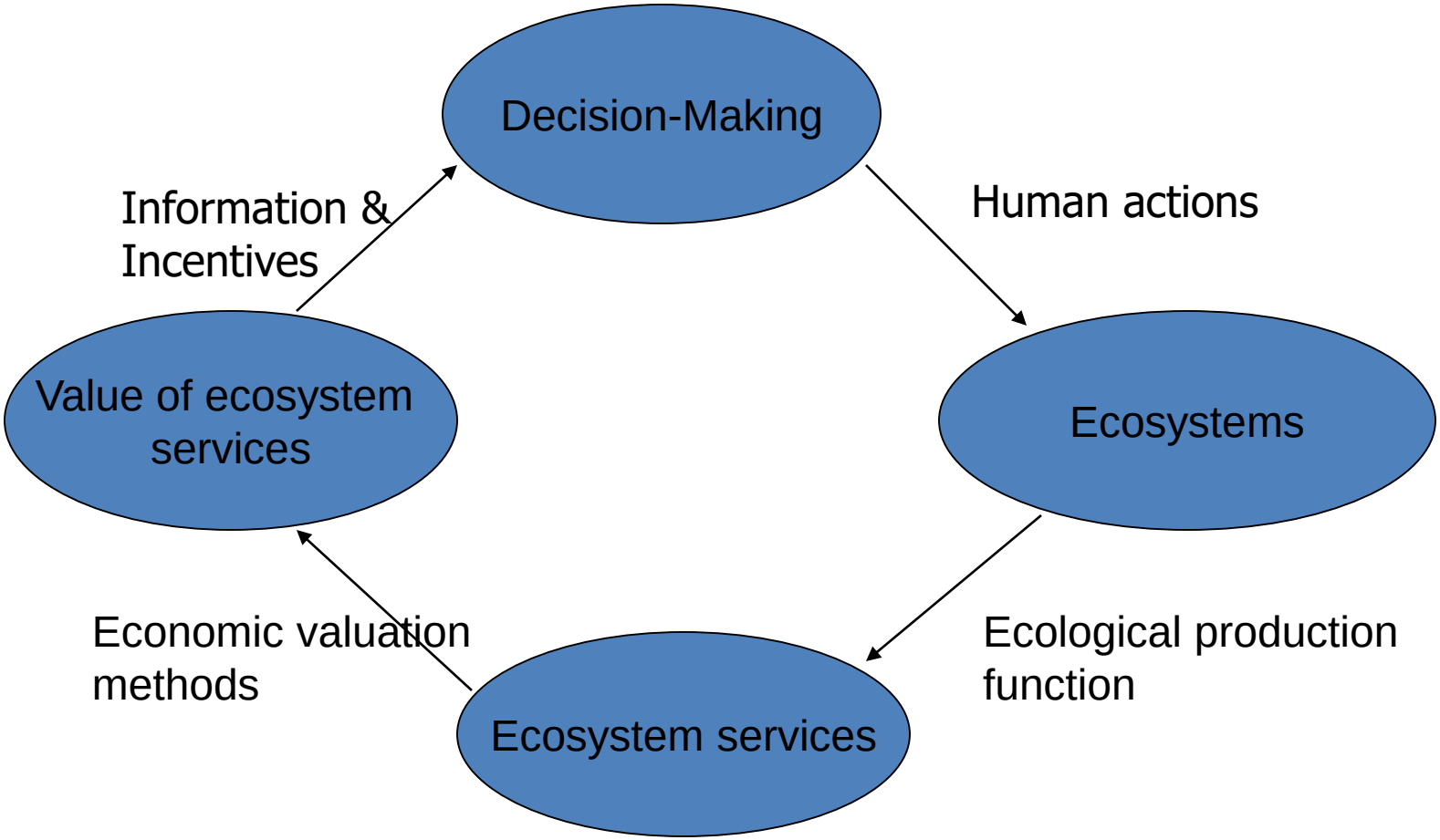
Photo: David Lewis

Ecosystem Services

Excludable? \ Rival in consumption?	Yes	No
Yes	**Private goods** • Fiber (Timber) • Food (Crops)	**Club goods** • Patentable information
No	**Common resources** • Harvestable species (e.g. fish)	**Public goods** • Wildlife existence • Water quality

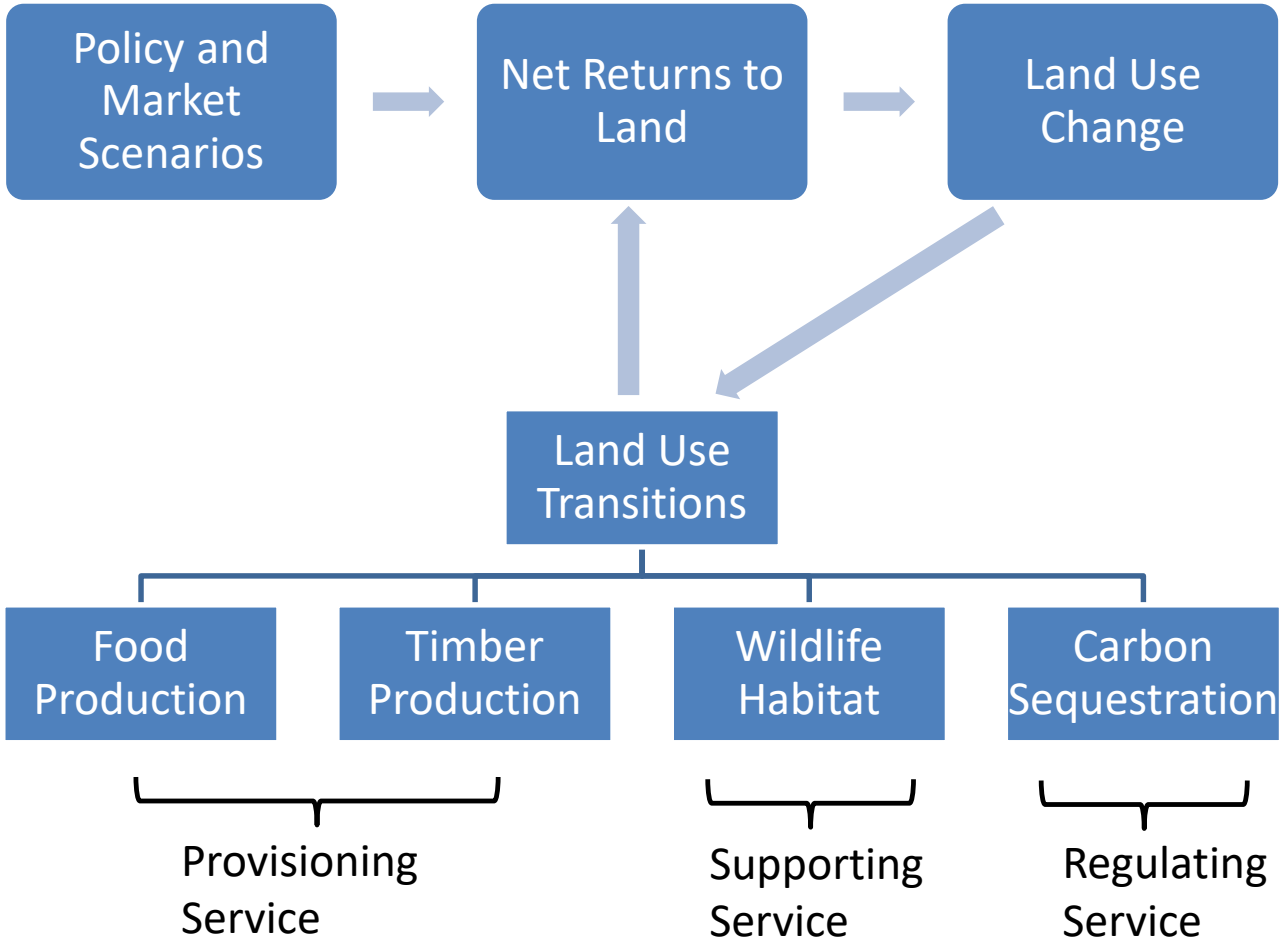
Private markets are better at providing excludable rather than non-excludable goods and services.

Decisions, ecosystem services, and values



Credit for figure: Stephen Polasky, University of Minnesota

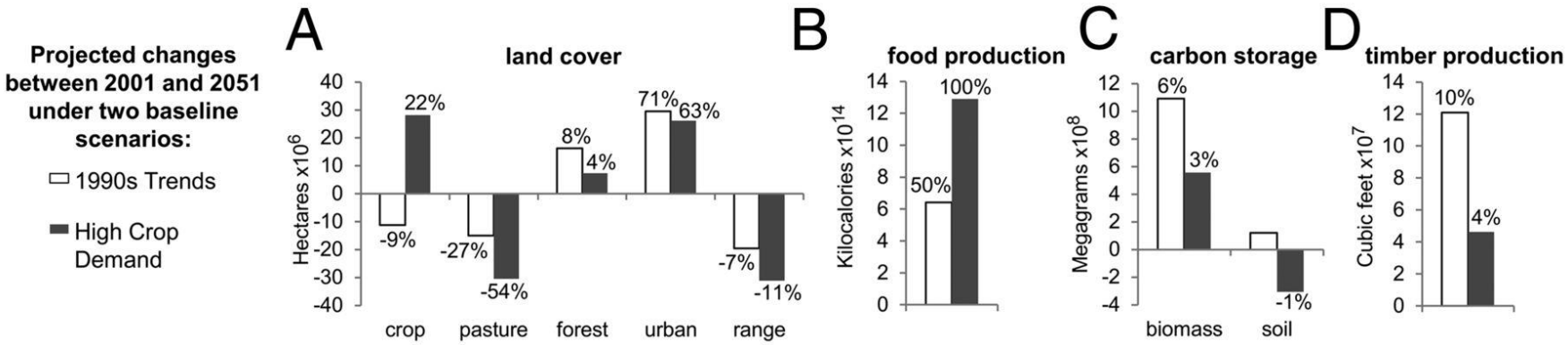
Land-use change is a human action that alters ecosystem service provision



Lawler, J.J., Lewis, D.J., Nelson, E., Plantinga, A.J., Polasky, S., Withey, J.C., Helmers, D.P., Martinuzzi, S., Pennington, D. and Radeloff, V.C., 2014. Projected land-use change impacts on ecosystem services in the United States. *Proceedings of the National Academy of Sciences*, p.201405557.

Land-use change is a human action that alters ecosystem service provision

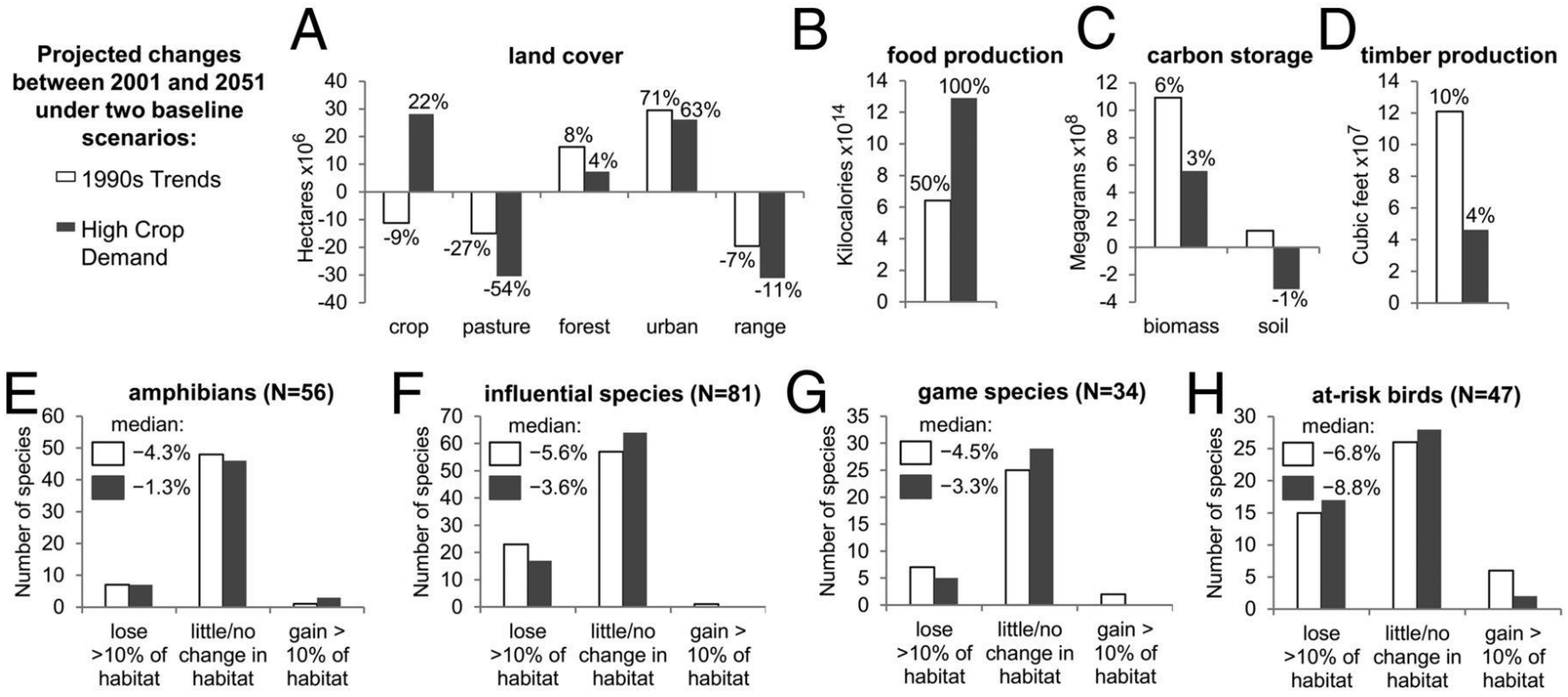
- Ex/ Modeled land-use change impacts on U.S. ecosystem services out to 2050



Lawler, J.J., Lewis, D.J., Nelson, E., Plantinga, A.J., Polasky, S., Withey, J.C., Helmers, D.P., Martinuzzi, S., Pennington, D. and Radeloff, V.C., 2014. Projected land-use change impacts on ecosystem services in the United States. *Proceedings of the National Academy of Sciences*, p.201405557.

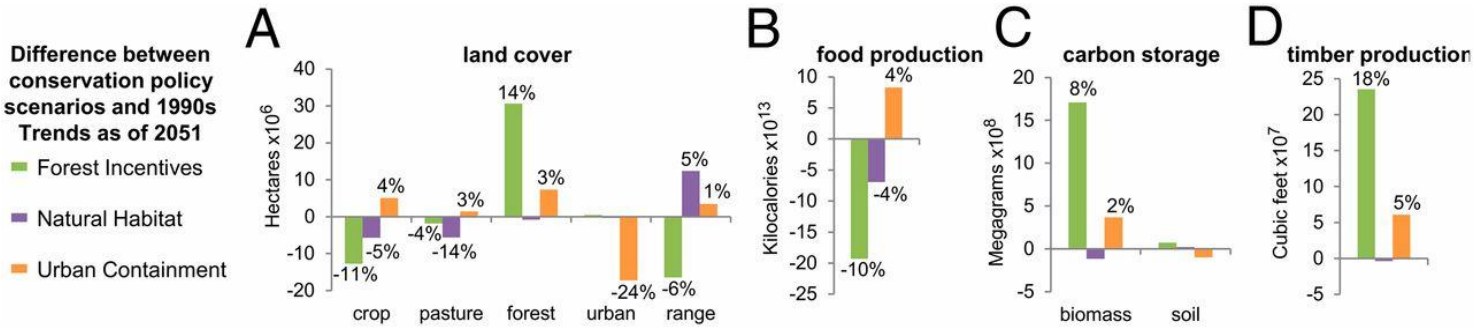
Land-use change is a human action that alters ecosystem service provision

- Ex/ Modeled land-use change impacts on U.S. ecosystem services out to 2050



Lawler, J.J., Lewis, D.J., Nelson, E., Plantinga, A.J., Polasky, S., Withey, J.C., Helmers, D.P., Martinuzzi, S., Pennington, D. and Radeloff, V.C., 2014. Projected land-use change impacts on ecosystem services in the United States. *Proceedings of the National Academy of Sciences*, p.201405557.

Policy can alter ecosystem service provision



Policy scenarios

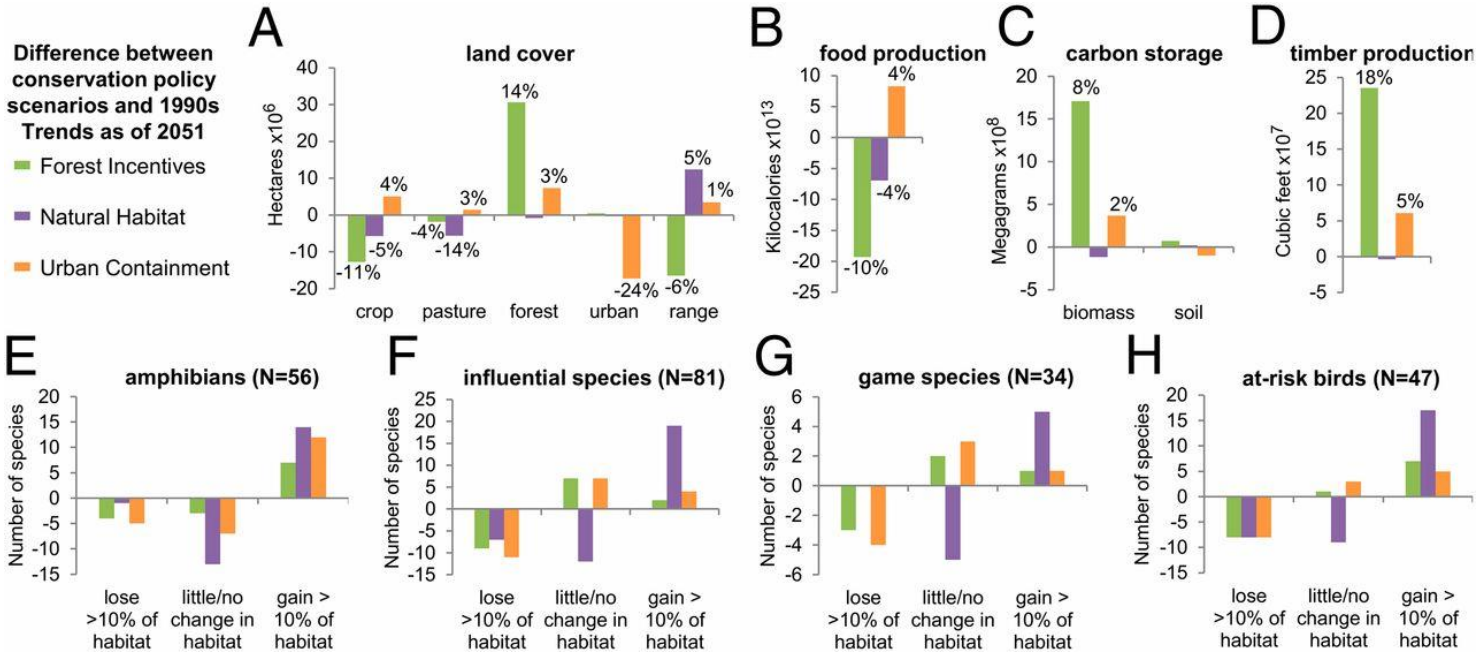
Forest incentives: pay for afforestation

Natural habitats: conserve forests and rangeland

Urban containment: limit development outside of metro regions

Lawler, J.J., Lewis, D.J., Nelson, E., Plantinga, A.J., Polasky, S., Withey, J.C., Helmers, D.P., Martinuzzi, S., Pennington, D. and Radeloff, V.C., 2014. Projected land-use change impacts on ecosystem services in the United States. *Proceedings of the National Academy of Sciences*, p.201405557.

Policy can alter ecosystem service provision



Policy scenarios

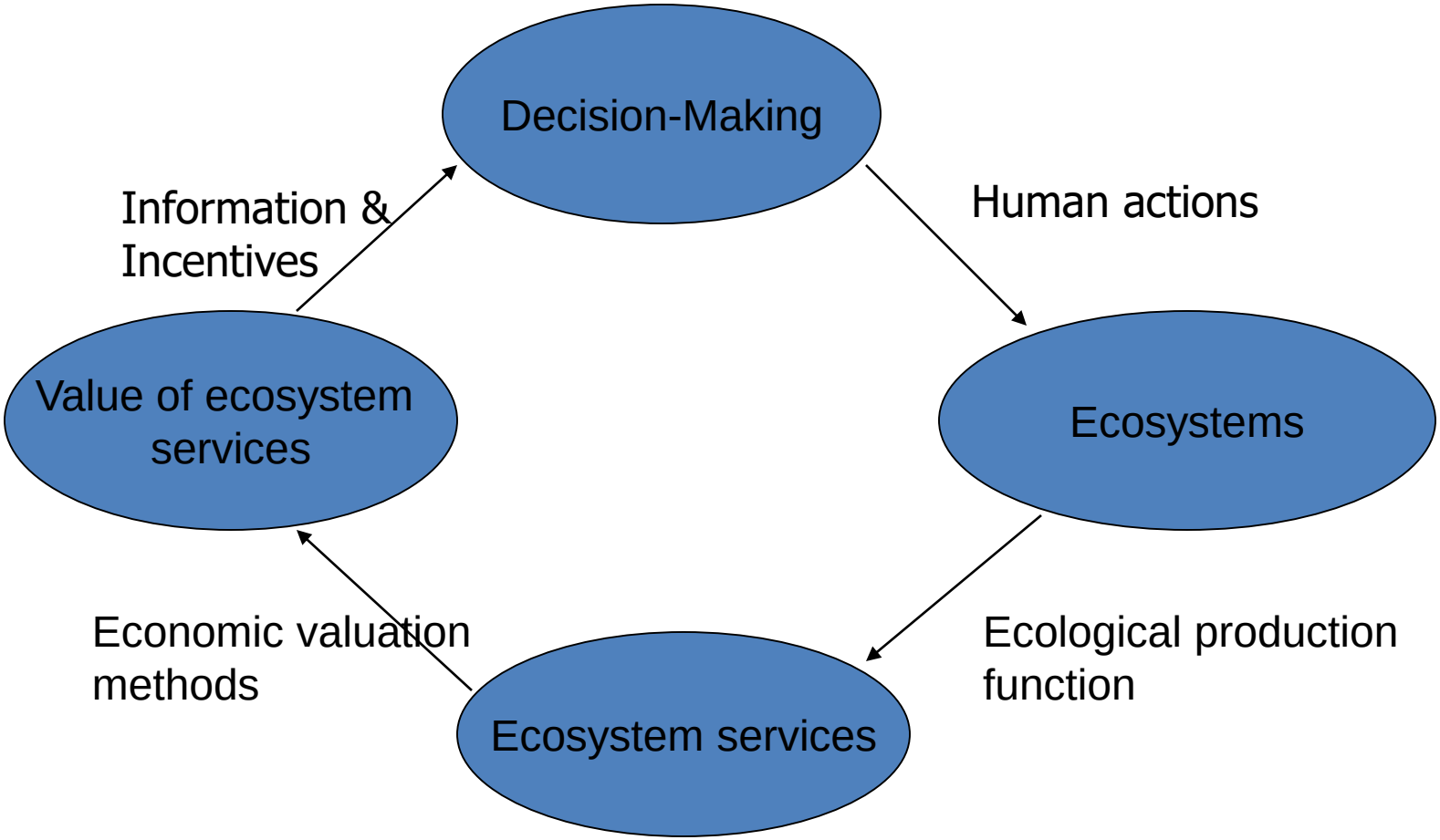
Forest incentives: pay for afforestation

Natural habitats: conserve forests and rangeland

Urban containment: limit development outside of metro regions

Lawler, J.J., Lewis, D.J., Nelson, E., Plantinga, A.J., Polasky, S., Withey, J.C., Helmers, D.P., Martinuzzi, S., Pennington, D. and Radeloff, V.C., 2014. Projected land-use change impacts on ecosystem services in the United States. *Proceedings of the National Academy of Sciences*, p.201405557.

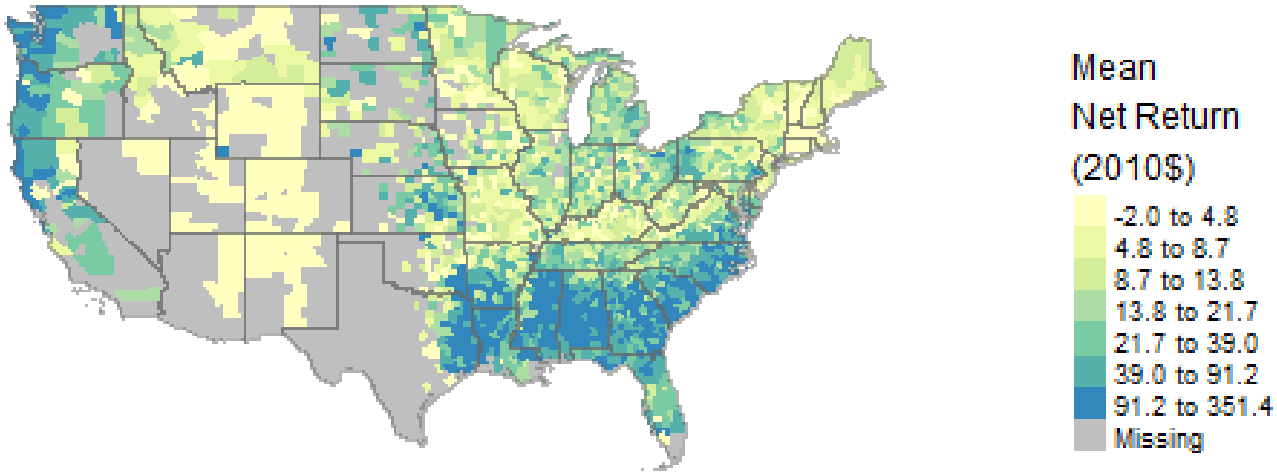
Decisions, ecosystem services, and values



Credit for figure: Stephen Polasky, University of Minnesota

Valuing ecosystem services – market methods

- Private goods / services have market prices
- Ex/ county-average annualized net economic return to private timberland ($/acre)



Mihiar, C., and D.J. Lewis (2018). "Climate, adaptation, and the value of forestland: A national Ricardian analysis of the U.S." Working Paper. Department of Applied Economics, Oregon State University.

Valuing ecosystem services – non-market methods

- Revealed preference => measures “use” values
  - Hedonic approach (e.g. property prices)
  - Travel cost (e.g. recreation decisions)
- Stated preference => measures “use” and/or “non-use” values
  - Contingent valuation
  - Choice experiments
- These approaches typically used to value a change in an ecosystem service

Valuing ecosystem services – non-market methods

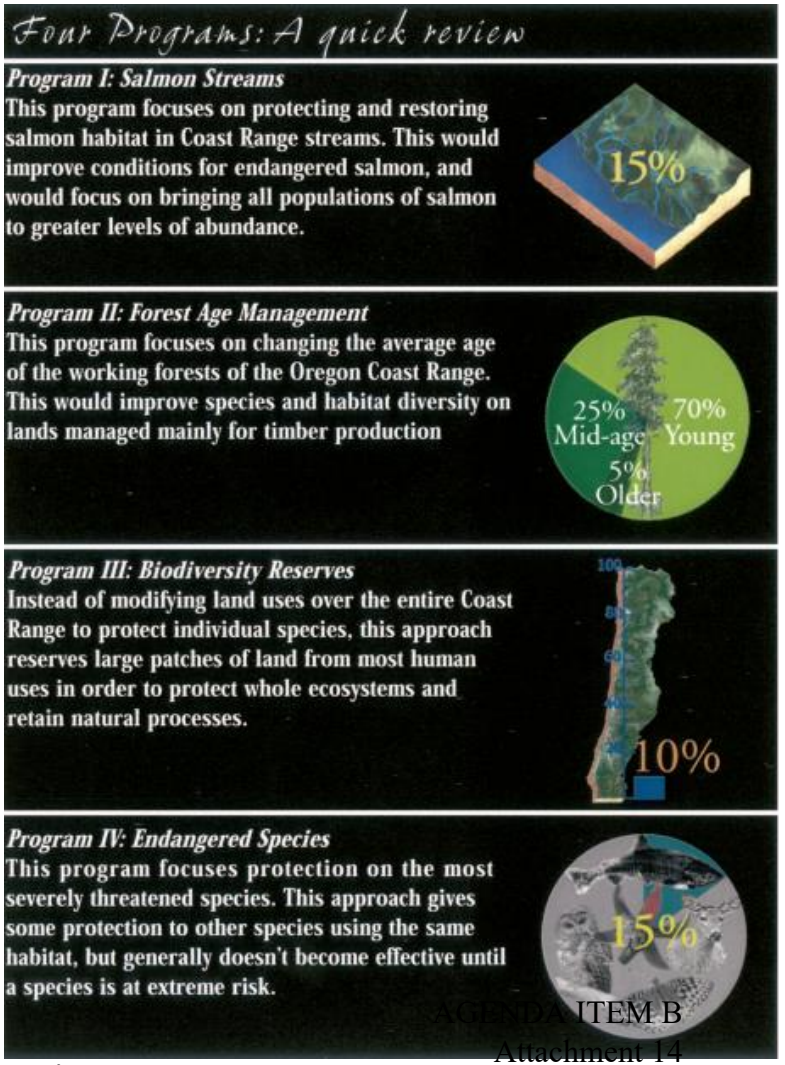
- Revealed preference example: hedonic pricing
  - Property values reflect the value of many attributes of the property.
    - Structure: size of house, age of house, etc.
    - Local built environment: school quality, neighborhood amenities, etc.
    - Natural environment: proximity to conserved forest, air quality, etc.
  - How does a change in the natural environment affect property values?
    - Ex/ numerous studies find that residential property values are higher when near conserved forest.
    - Ex/ aquatic species invasions lower lakeshore property values.

Valuing ecosystem services – non-market methods

- Revealed preference methods
  - Advantages: values based on revealed behavior of people.
  - Disadvantages:
    - Covers a small subset of ecosystem services (e.g. recreation)
    - Challenging to disentangle environmental attributes from other property attributes.

Valuing ecosystem services – non-market methods

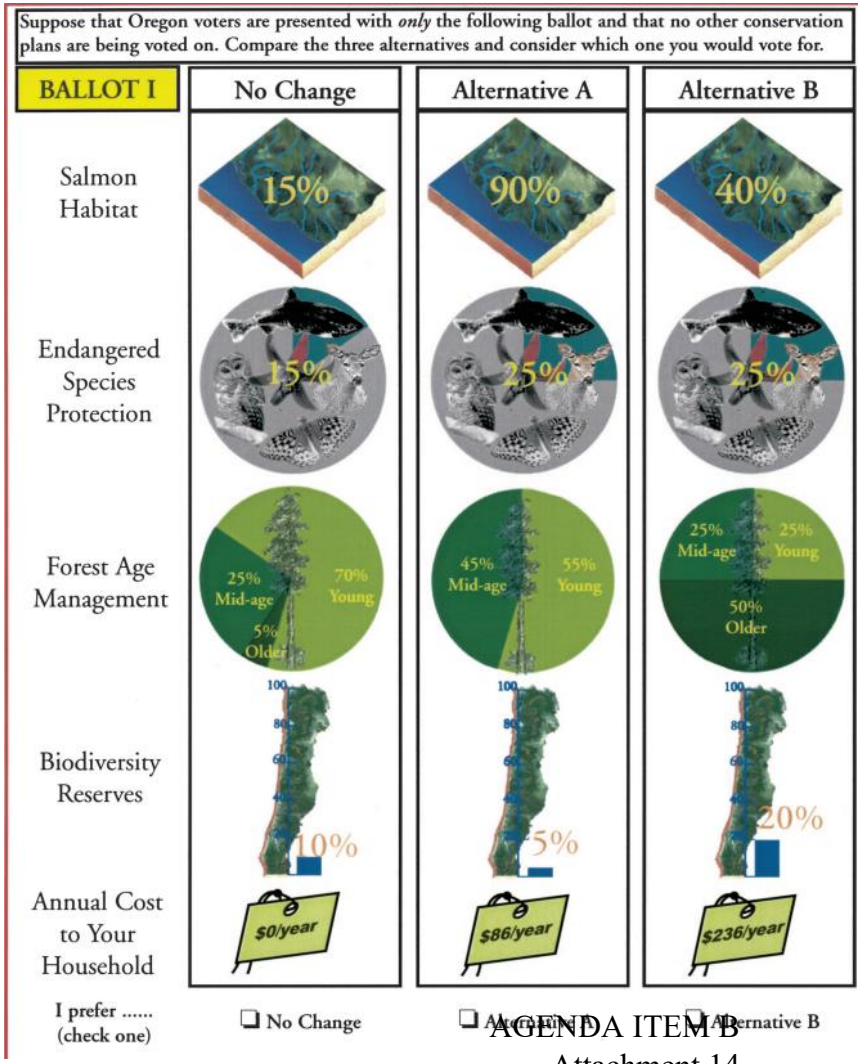
- Stated preference example: choice experiment
  - Use surveys to ask people to make choices across bundles of services and prices.
  - Key task: describe actions that affect a set of ecosystem services.



Garber-Yonts, B., Kerkvliet, J. and Johnson, R., 2004. Public values for biodiversity conservation policies in the Oregon Coast Range. *Forest Science*, *50*(5), pp.589-602.

Valuing ecosystem services – non-market methods

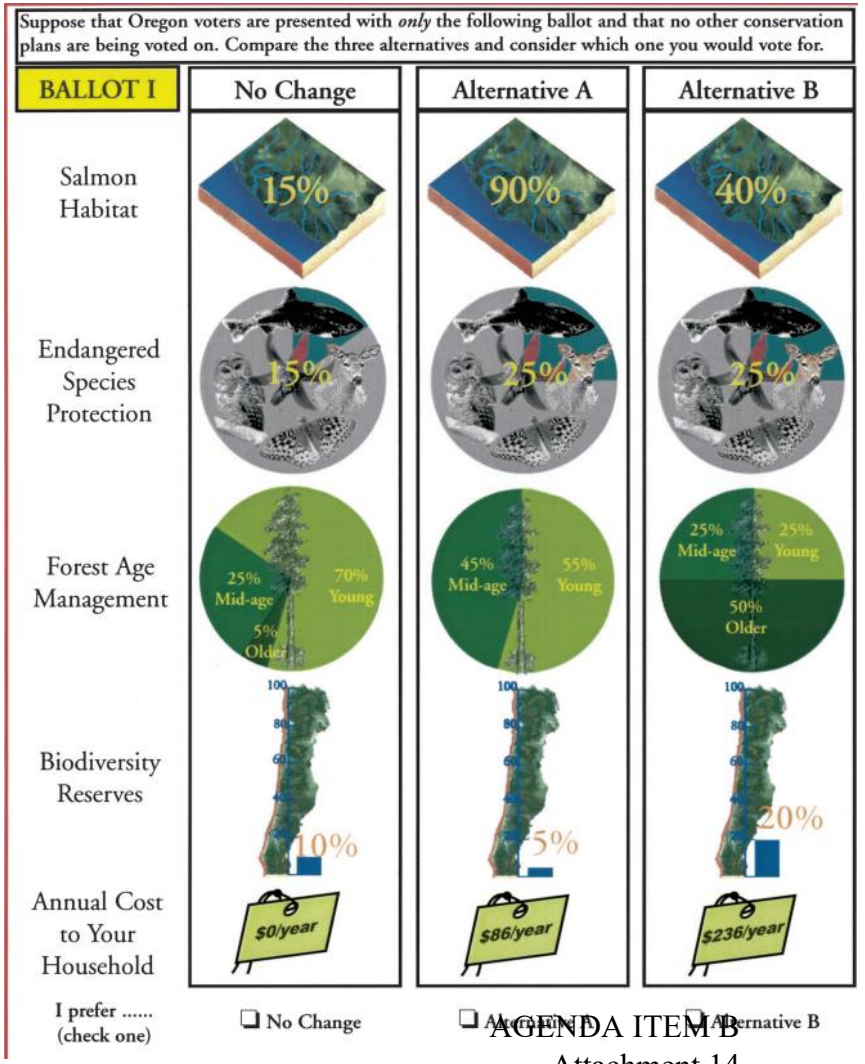
- Stated preference example: choice experiment
  - Use surveys to ask people to make choices across bundles of services and prices.
  - Key task: describe actions that affect a set of ecosystem services.



Garber-Yonts, B., Kerkvliet, J. and Johnson, R., 2004. Public values for biodiversity conservation policies in the Oregon Coast Range. *Forest Science*, *50*(5), pp.589-602.

Valuing ecosystem services – non-market methods

- Average annual willingness-to-pay (WTP) for 10% increase in:
  - Salmon habitat:
    - $60/household;
    - $79 million statewide.
  - Old growth management:
    - $201/household;
    - $264 million statewide.

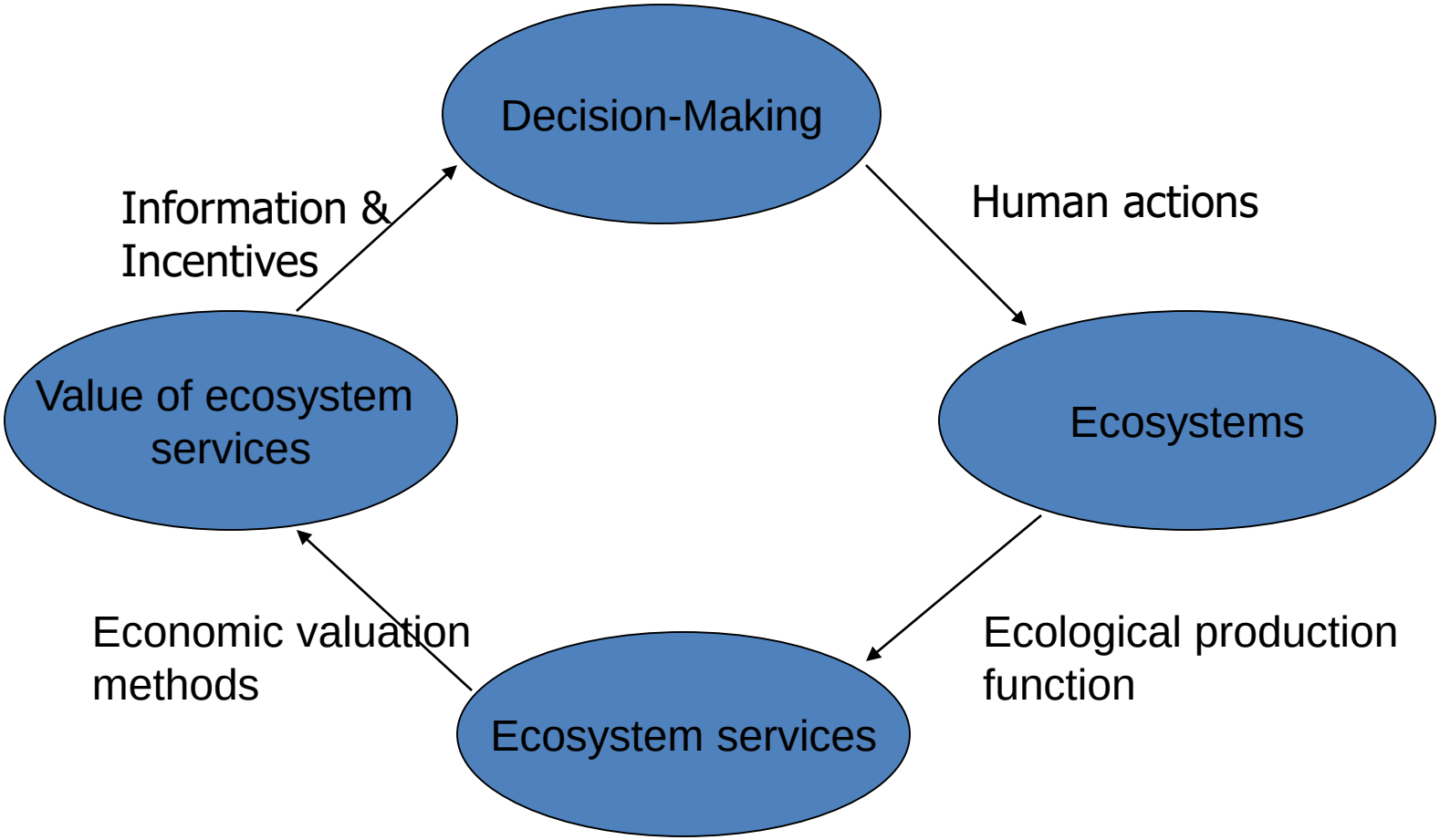


Garber-Yonts, B., Kerkvliet, J. and Johnson, R., 2004. Public values for biodiversity conservation policies in the Oregon Coast Range. *Forest Science*, *50*(5), pp.589-602.

Valuing ecosystem services – non-market methods

- Stated preference methods
  - Advantages:
    - Direct questions about values of interest.
    - Can capture “non-use” values.
  - Disadvantages:
    - Hypothetical rather than revealed.
    - Requires high skill in survey design.

Decisions, ecosystem services, and values



Ideally, valuation of ecosystem services helps improve decision-making.

Credit for figure: Stephen Polasky, University of Minnesota

Contact Information

David Lewis, Professor, Department of Applied Economics, lewisda@oregonstate.edu, 541-737-1334

Randy Rosenberger, Assoc. Dean, College of Forestry, R.Rosenberger@oregonstate.edu, 541-737-4425