ECOLOGICAL RESEARCH PROGRAM

ERP: Willamette-Ecosystem Services Project

"Conserving ecosystem services through proactive decision-making"

Presented by
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Ecological Research Program Goal

To transform the way we* understand and respond to environmental issues by making clear the ways in which our choices affect the type, quality and magnitude of the services we receive from ecosystems -- such as clean air, clean water, productive soils and generation of food and fiber.

"we" = decision-makers at all levels of governance: local, state, Tribal, regional, national

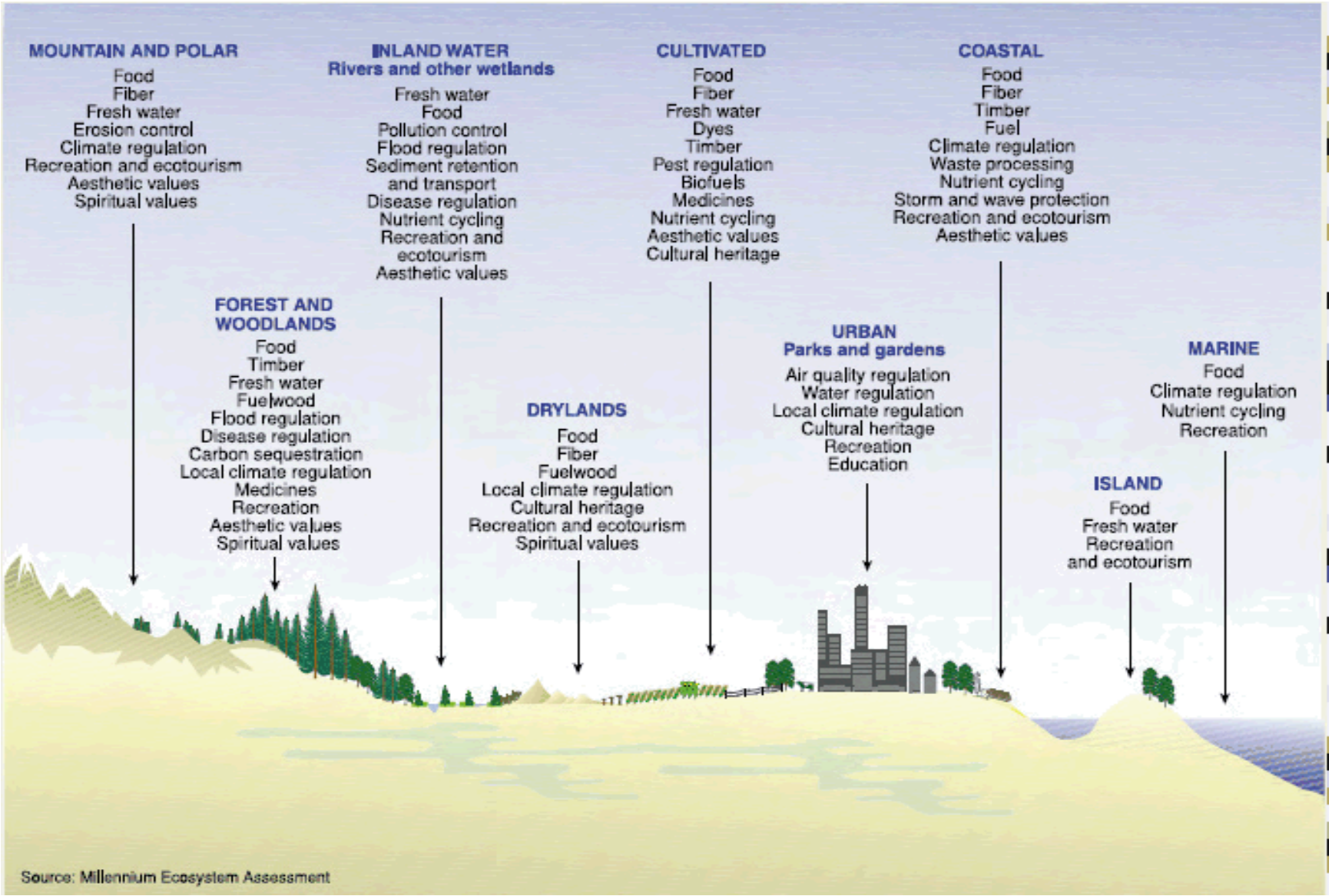
Ecosystem Services: contributions to sustainable practices

ERP goal is to sustain flows of ecosystem services via:

- **Providing analytical framework for assessing big-picture, systems view of issues related to sustaining ecosystem services**
- **(Especially critical for services for which there are few technological substitutes over the required spatial and temporal domains)**
- **Using principles of landscape ecology to restore and enhance ecosystem services under scenarios of increasing demands on a fixed resource base**
- **Enhancing ecosystem resilience through understanding interactions -- anticipate and avoid "tipping points" and regime shifts**

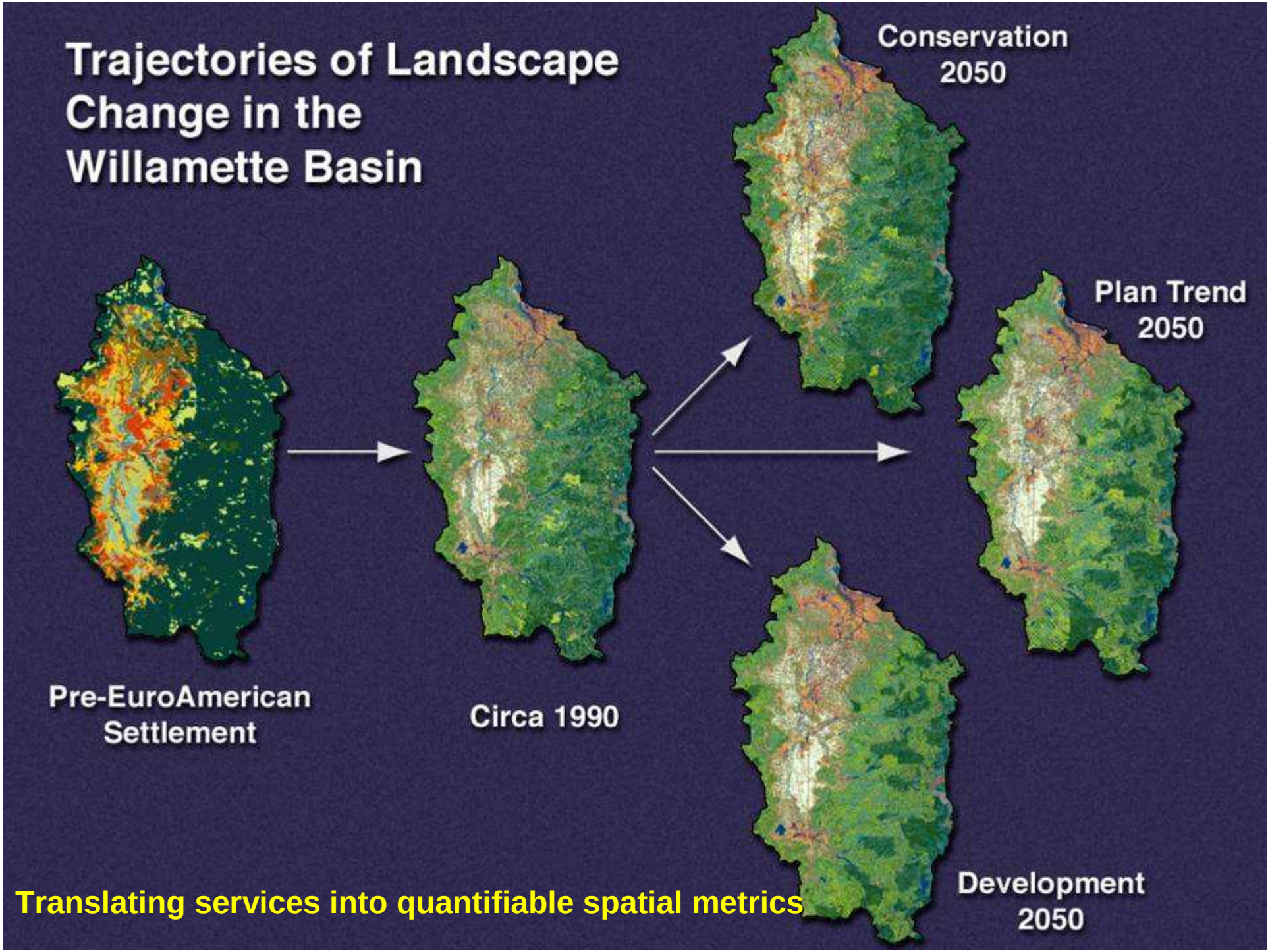
ERP Eco Services: three-prong approach

- by pollutant: (reactive nitrogen)
  - How does a regulated pollutant affect -- positively or negatively -- the “bundle” of ecosystem services over multiple scales?
- by ecosystem type: (wetlands)
  - How does the bundle of ecosystem services provided by a single ecosystem type change under alternative management options at multiple scales?
- place-based:
  - How does the bundle of ecosystem services within an “ecosystem service district” change due to natural / human stressors or under alternative management scenarios?


MOUNTAIN AND POLAR
Food
Fiber
Fresh water
Erosion control
Climate regulation
Recreation and ecotourism
Aesthetic values
Spiritual values
INLAND WATER
Rivers and other wetlands
Fresh water
Food
Pollution control
Flood regulation
Sediment retention and transport
Disease regulation
Nutrient cycling
Recreation and ecotourism
Aesthetic values
CULTIVATED
Food
Fiber
Fresh water
Dyes
Timber
Pest regulation
Biofuels
Medicines
Nutrient cycling
Aesthetic values
Cultural heritage
COASTAL
Food
Fiber
Timber
Fuel
Climate regulation
Waste processing
Nutrient cycling
Storm and wave protection
Recreation and ecotourism
Aesthetic values
FOREST AND WOODLANDS
Food
Timber
Fresh water
Fuelwood
Flood regulation
Disease regulation
Carbon sequestration
Local climate regulation
Medicines
Recreation
Aesthetic values
Spiritual values
DRYLANDS
Food
Fiber
Fuelwood
Local climate regulation
Cultural heritage
Recreation and ecotourism
Spiritual values
URBAN
Parks and gardens
Air quality regulation
Water regulation
Local climate regulation
Cultural heritage
Recreation
Education
MARINE
Food
Climate regulation
Nutrient cycling
Recreation
ISLAND
Food
Fresh water
Recreation and ecotourism
Source: Millennium Ecosystem Assessment

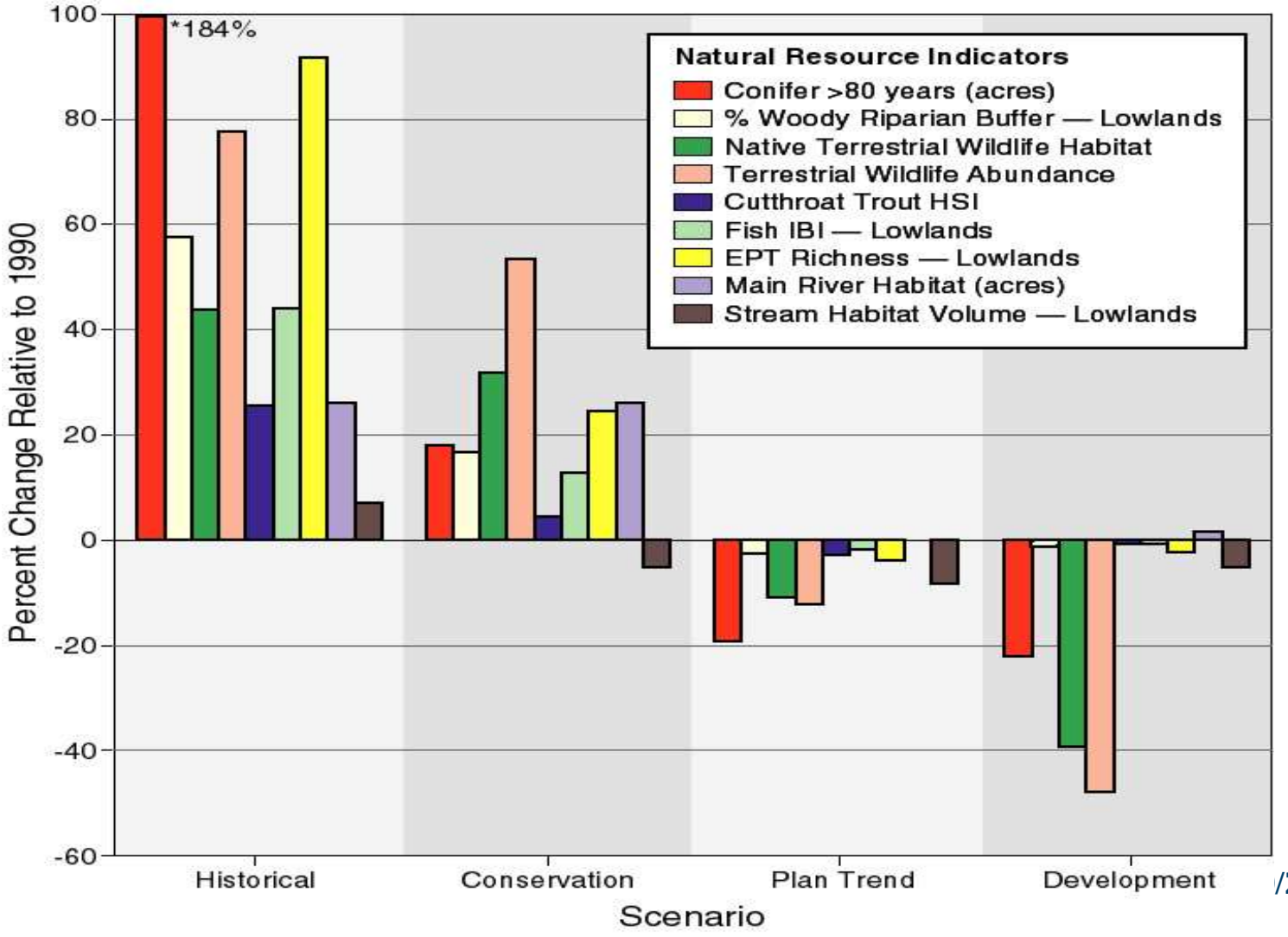
How can ecology help?

- Create geo-spatial products that characterize the distribution ecosystem services over space and time, and at multiple scales.
- Develop ways to envision alternative combinations of services and to assess trade-offs.
- Identify, quantify, and predict ecological “tipping points” that threaten loss of services.
- Develop methods to restore and enhance ecosystem services through restoring or creating new ecological production functions.
- Provide information to catalyze innovations in policies and the private sector.


Trajectories of Landscape Change in the Willamette Basin
Conservation 2050
Plan Trend 2050
Development 2050
Pre-EuroAmerican Settlement
Circa 1990
Translating services into quantifiable spatial metrics

ECOLOGICAL RESEARCH PROGRAM

Willamette Basin Alternative Futures
Scenario Evaluations



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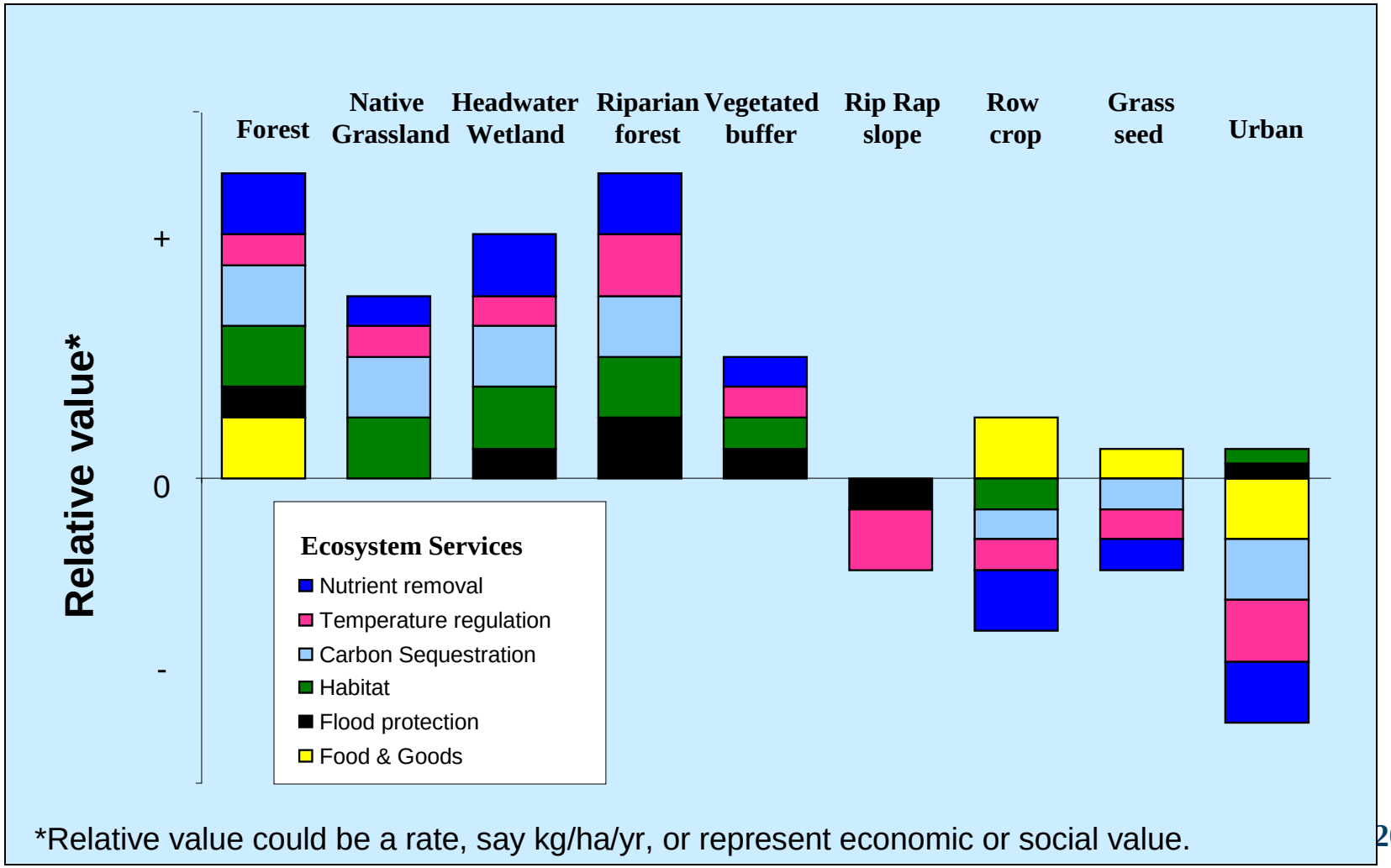
Hypothetical ecosystem service values:

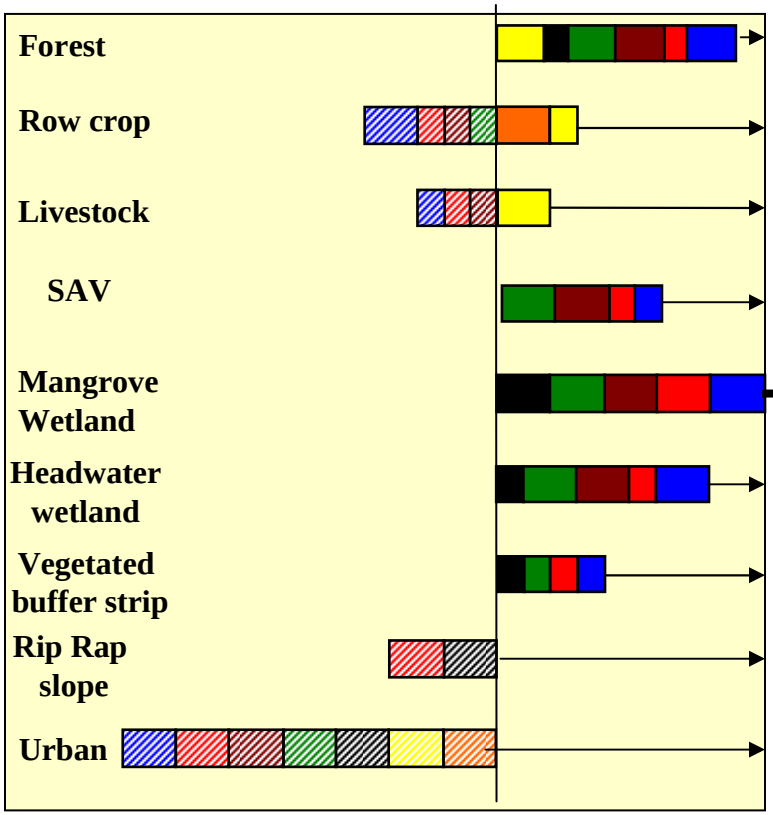
Bundled by land use in the Willamette ESD



*Relative value could be a rate, say kg/ha/yr, or represent economic or social value.

End Product

Relative Ecosystem Services Within an Ecosystem District



Scaling and Aggregation Under Alternative Management Scenarios

Options

A

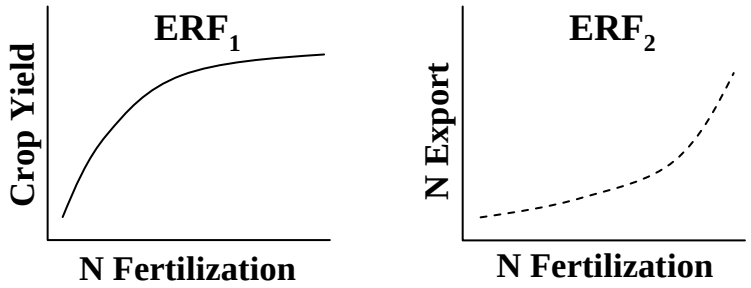
B

C

Net Value of Services

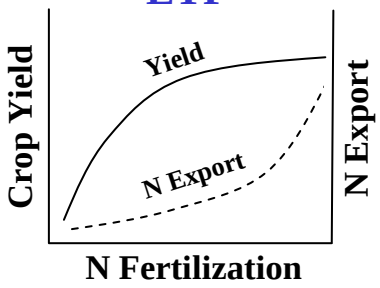
Management Option X

Ecosystem Service vs. Forcing Variable = ERF



$ERF_1 + ERF_2$

ETF



Socioeconomics

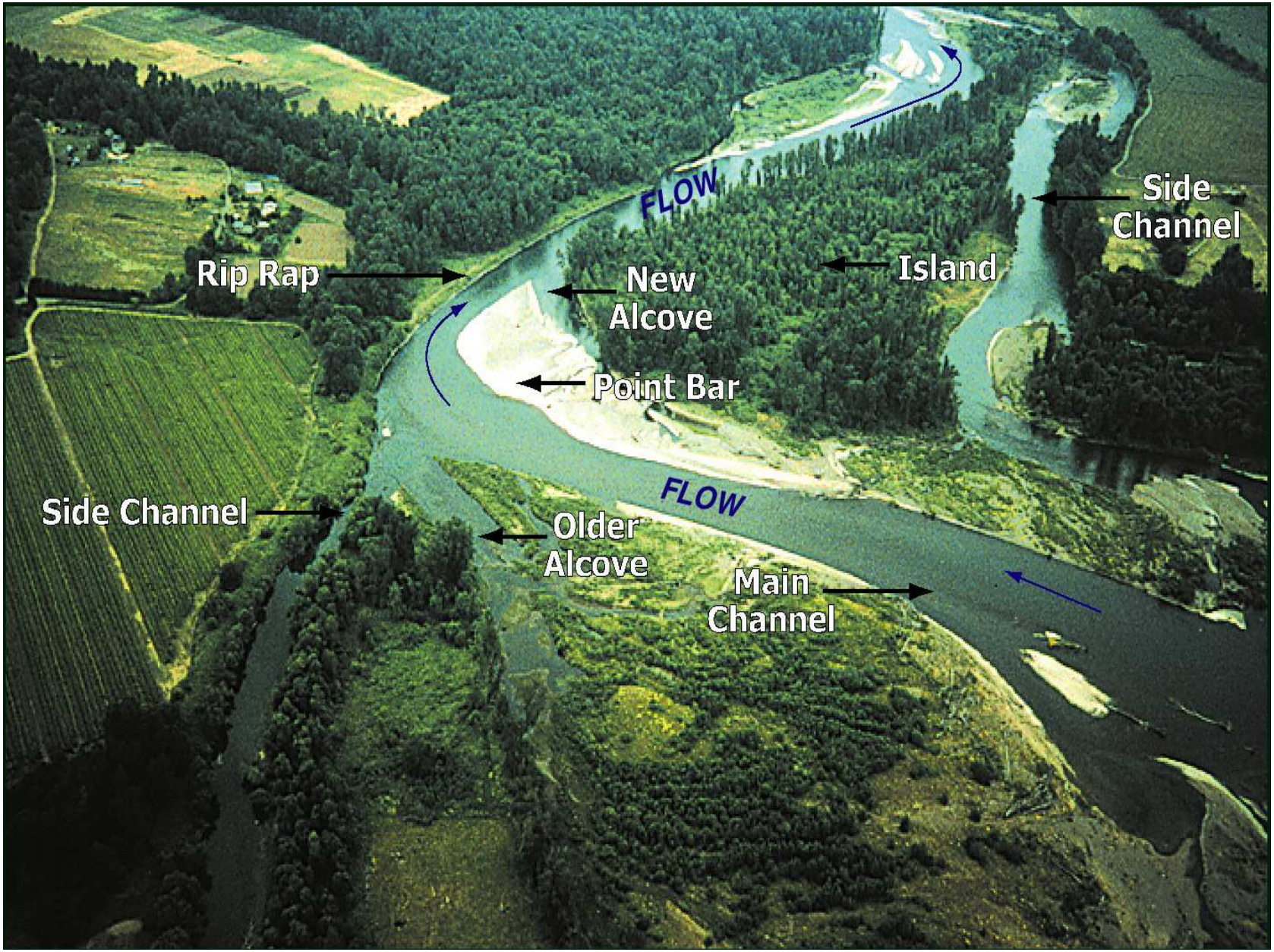
Assessing trade-offs
Assessing values

ERF Y-axis: Ecosystem Services

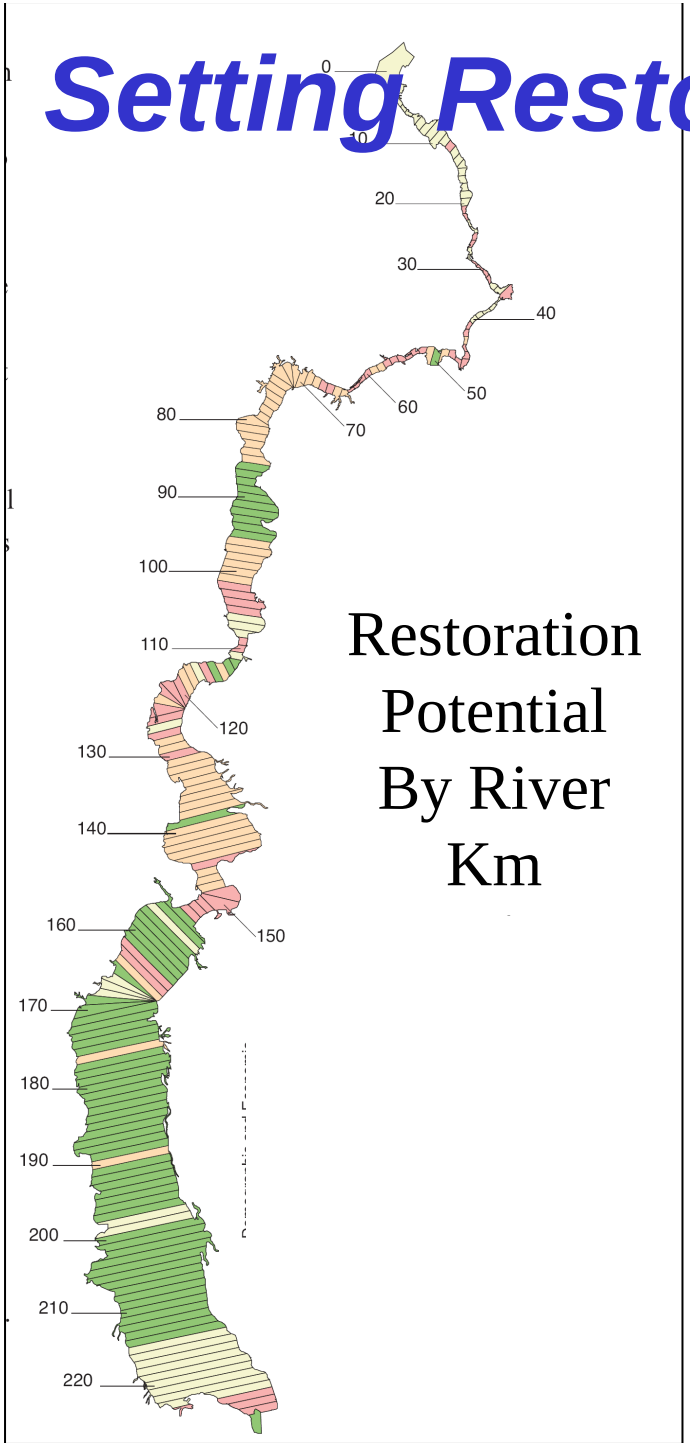
- Crop Yield
- Water Quality
- Water Quantity
- Carbon Sequestration
- N_2O, NO_x, CH_4

ERF X-axis: Forcing Variables

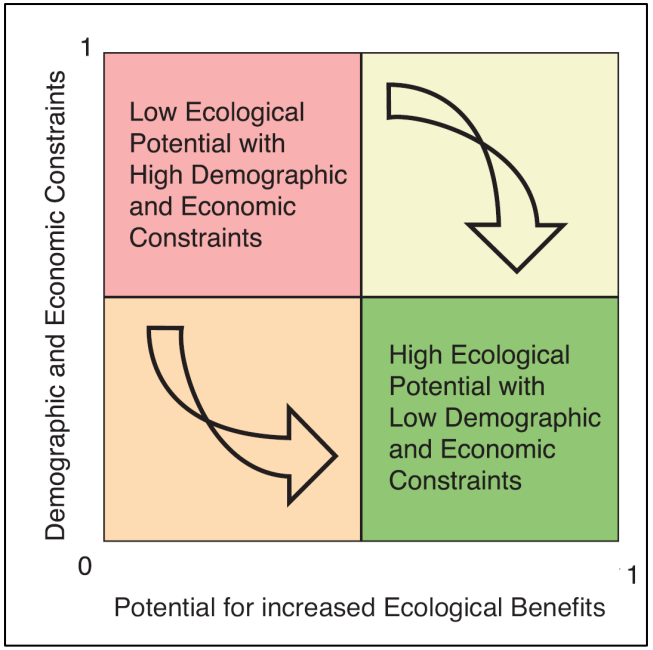
- N Fertilization (amount, timing)
- Harvest (interval, intensity, residues)
- Climate (Temp, Precip, Light, CO_2)
- Cover type (% landscape coverage)
- Riparian buffers (width, age, species)

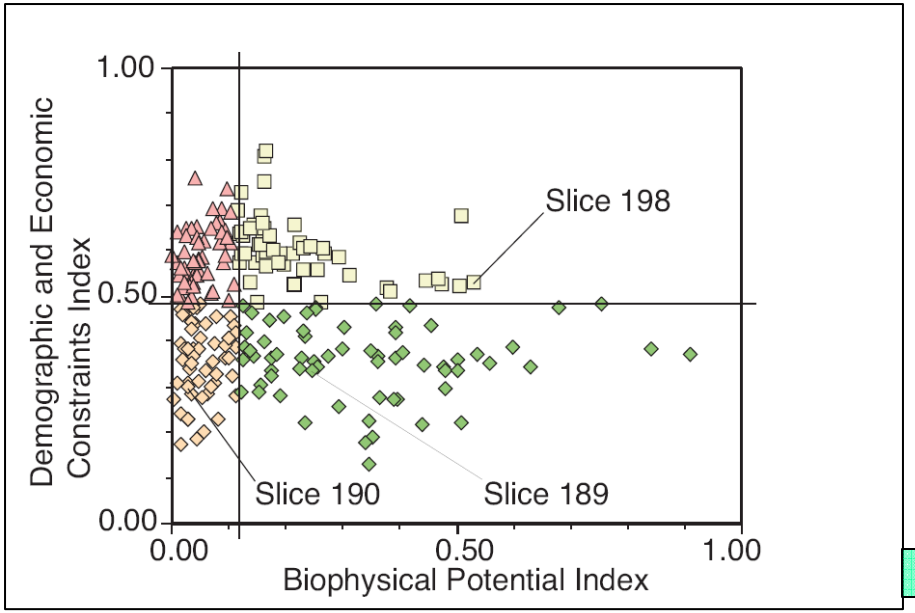

FLOW
Side Channel
Rip Rap
New Alcove
Island
Point Bar
FLOW
Side Channel
Older Alcove
Main Channel

Setting Restoration Priorities



Restoration Potential By River Km





Poster


Building a scientific foundation for sound environmental decisions

Building a scientific foundation for sound environmental decisions

Providing information that catalyzes innovation in the public and private sector

Takes a collaborative effort:

- Municipalities (e.g., Eugene)
- Industry (e.g., PG&E, thermal discharges)
- Regulatory agencies (e.g., ODEQ and EPA Region 10)
- Community stakeholders
- Ecologists, hydrologists, social scientists. (In-house scientists and extramural grantees)

Recognize that different decision-makers need different types of information (e.g., cultural v. regulatory v. investment issues)

Present technical results in compelling ways

-- investigate how new information influences decisions

Results from Willamette River Floodplain restoration study, to date

- Findings have created strong likelihood for river restoration providing multiple services and benefits (e.g., non-structural flood control, increased habitat, increased recreational opportunities).
- River restoration may be self-financing may come from cost savings provided by natural cooling.
- Additional funding now being provided by Willamette Partnership, an NGO.
- Restoring natural hyporheic cooling functions being investigated as a way to meet TMDL via EPA's water quality trading policy.