Eco-Logical
Webinar Series

Eco-Logical Crediting and Ecosystem Services

Presenters:

Lydia Olander, Duke University, National Ecosystem Services Partnership & Nicholas Institute for Environmental Policy Solutions

Jimmy Kagan, Institute for Natural Resources, Portland State and Oregon State University

October 7, 2015

(Learn more about Eco-Logical at the FHWA website)

U.S. Department of Transportation
Federal Highway Administration

Steps to Ensure Optimal Webinar Connection

This webinar broadcasts audio over the phone line and through the web room, which can strain some internet connections. To prevent audio skipping or webinar delay we recommend participants:

- Close all background programs
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- Do not us a Virtual Private Network (VPN), if possible
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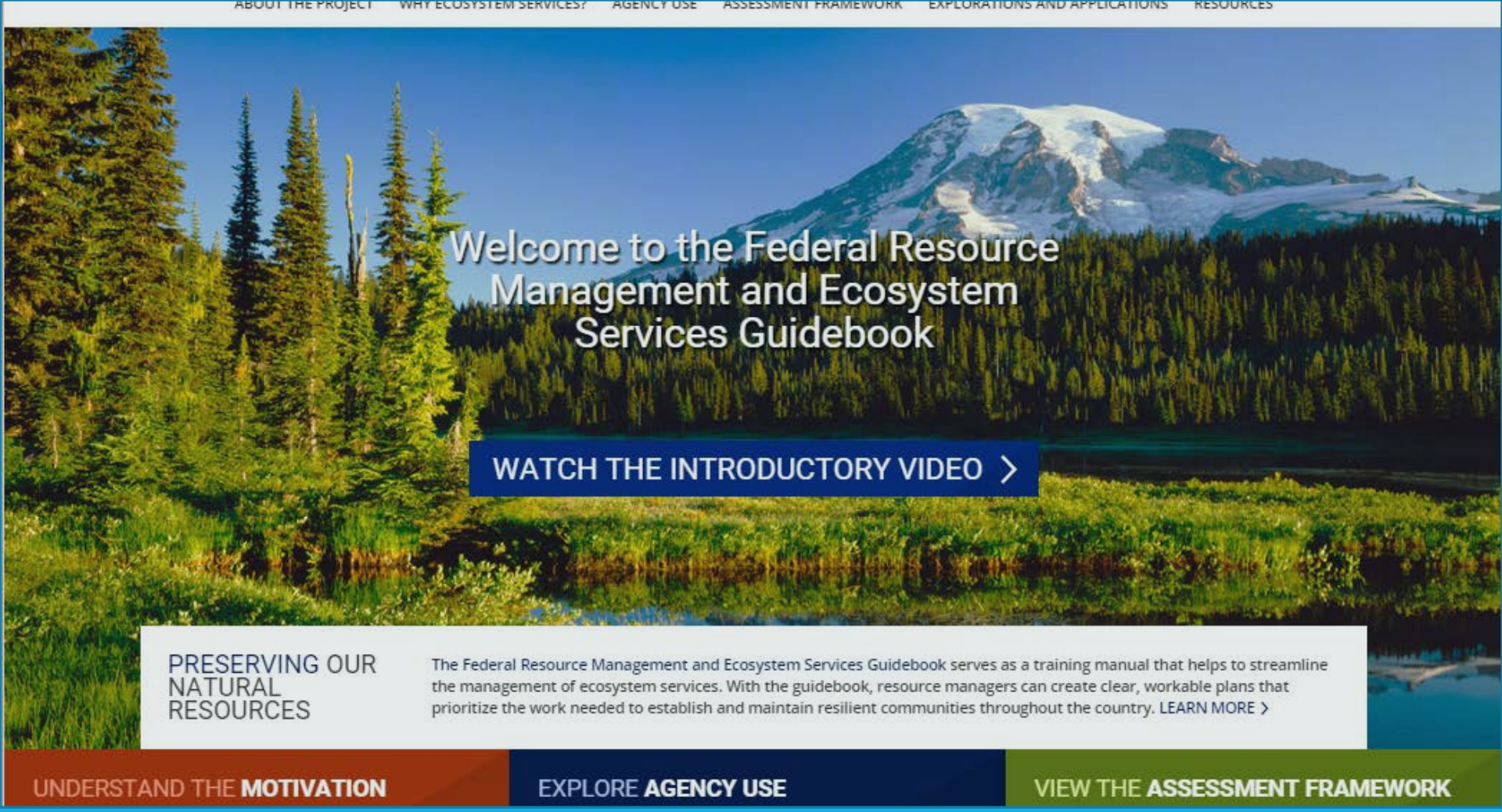
Eco-Logical On Call Technical Assistance Tool

The Eco-Logical On-Call Technical Assistance Tool is available for agencies to

- Request responsive, individualized guidance on Implementing Eco-Logical
- Submit ideas for webinars or other Eco-Logical Activities



Ecosystem Services in Federal Decision Making

***Lydia Olander**, Duke University, National Ecosystem Services Partnership & Nicholas Institute for Environmental Policy Solutions*
***Jimmy Kagan**, Institute for Natural Resources, Portland State and Oregon State University*

Ecological Webinar September 2015

Duke
NICHOLAS INSTITUTE
FOR ENVIRONMENTAL POLICY SOLUTIONS

What are Ecosystem Services?

Millennium Ecosystem Assessment

Provisioning
Goods or products produced by ecosystems

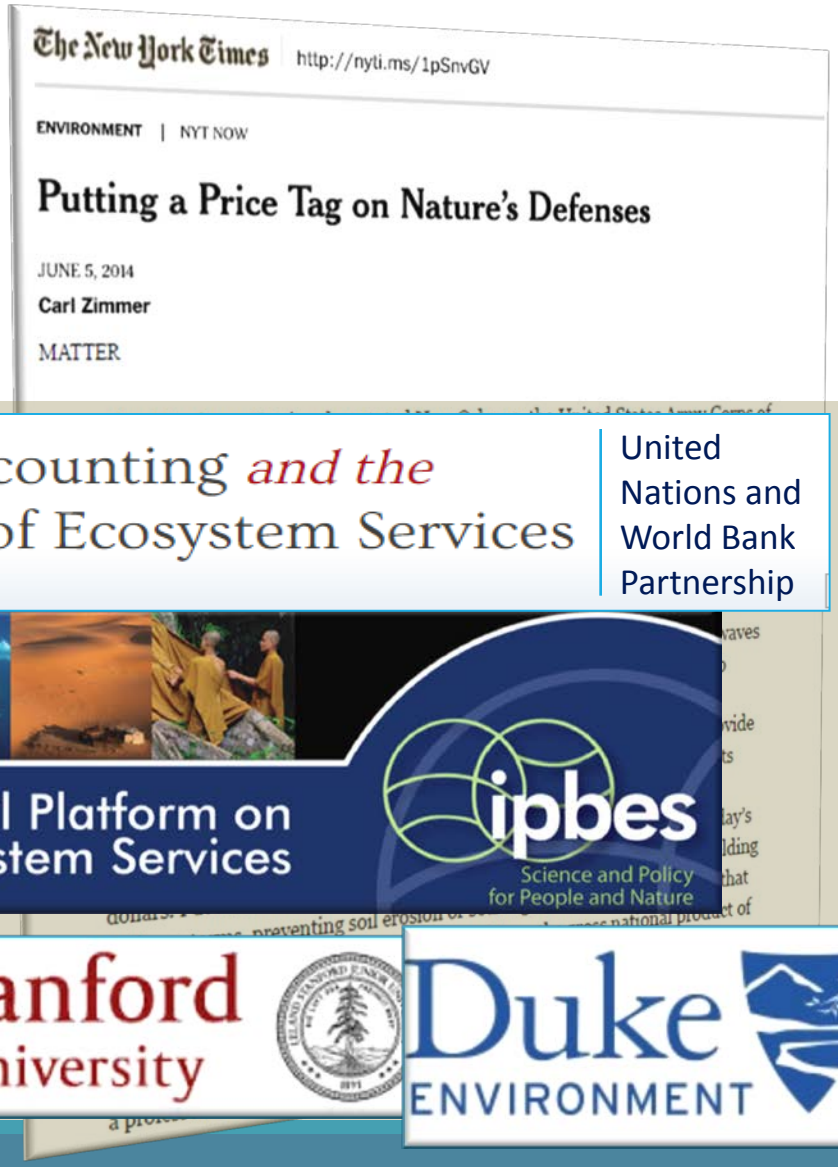
Regulating
Natural processes regulated by ecosystems

Cultural
Non-material benefits obtained from ecosystems

Supporting
Functions that maintain all other services

Source of slide: Businesses for Social Responsibility

Growing Use of Ecosystem Services



WAVES

Wealth Accounting *and the* Valuation of Ecosystem Services

United Nations and World Bank Partnership

Intergovernmental Platform on Biodiversity & Ecosystem Services

ipbes
Science and Policy for People and Nature

The Nature Conservancy
Protecting nature. Preserving life.

Stanford University

Duke ENVIRONMENT

How are ES useful?

Communicating benefits ecosystems provide to people

Constructive engagement of stakeholders before decisions are made

Communicating and explicitly considering trade-offs that involve ecosystem services

More systemic comparison of alternatives (such as greener vs grayer infrastructure options)

Determining monetary values for important but often undervalued benefits

What about limitations to their usefulness?

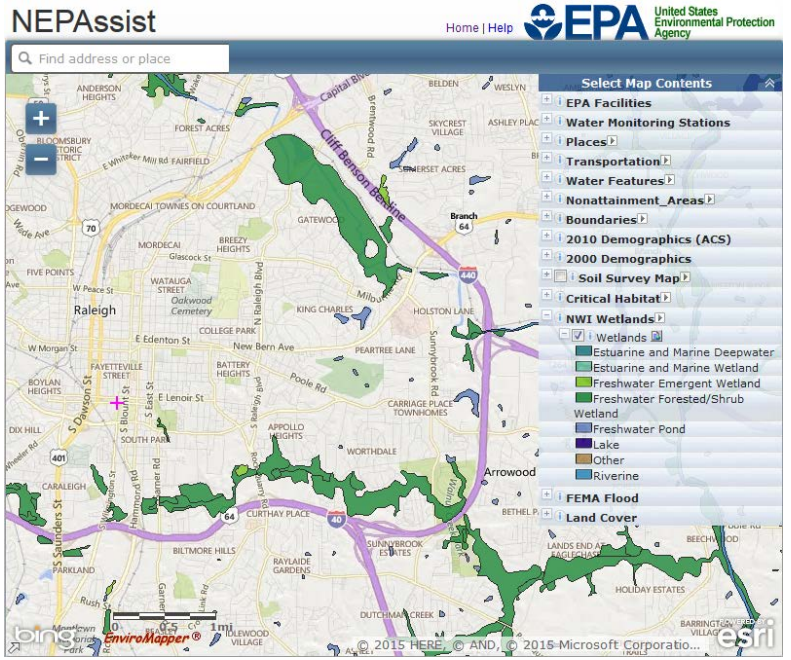
Where could DOTs use ES?

State and regional transportation plans

- NEPA – avoiding and minimizing impacts to wetland, stream and other important resources and services
- Adds ES to steps 3 and 4 in Ecological Framework

Mitigation planning

- Developing the crediting strategy in step 6 of the Ecological Framework
- Partnering on advanced mitigation – maximizing benefits



National Ecosystem Services Partnership (NESP)

NESP engages both public and private individuals and organizations to enhance collaboration within the ecosystem services community and to strengthen coordination of policy, market implementation, and research at the national level

- Quarterly newsletter
- NESP Community of Practice
- Federal ES Community of Practice
- FRMES Online guidebook
  nespguidebook.com
- Best Practice Guidance
  nicholasinstitute.duke.edu/sites/default/files/publications/es_best_practices_fullpdf_0.pdf

https://nicholasinstitute.duke.edu/focal-areas/national-ecosystem-services-partnership

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Goals of our current efforts

Help to fill the gap between concept and practice

Educate newcomers & managers on the ground

Shared learning across agencies

Connect ecological and social methods for ES evaluation

Common framework that spans decision contexts, geography, and capacity

Bring together agency and academic experts to bring credibility while remaining practical

Why now?

1998 — **PCAST report** -
Teaming with Life: Investing in Science to Understand and Use America's Living Capital

2005 — **Millennium Ecosystem Assessment**

2008 — **Farm Bill**
Establishment of **USDA Office of Ecosystem Services and Markets**
Wetlands Compensatory Mitigation Rule

2010 — **Inter-agency dialogue** on payments and markets for ecosystem services

2011 — **PCAST Report** -
Sustaining Environmental Capital: Protecting Society and the Economy

2012 — **Forest Service Planning Rule**
International Platform on Biodiversity and Ecosystem Services

2013 — **CEQ Principles and Requirements for Federal Investments in Water Resources**

2015 — **CEQ new guidance?**

Online Guidebook

Understand the Motivation for Ecosystem Services Approaches

History, definitions, benefits, limitations, FAQs

Explore Agency Use of Ecosystem Services

Agency decision contexts and examples

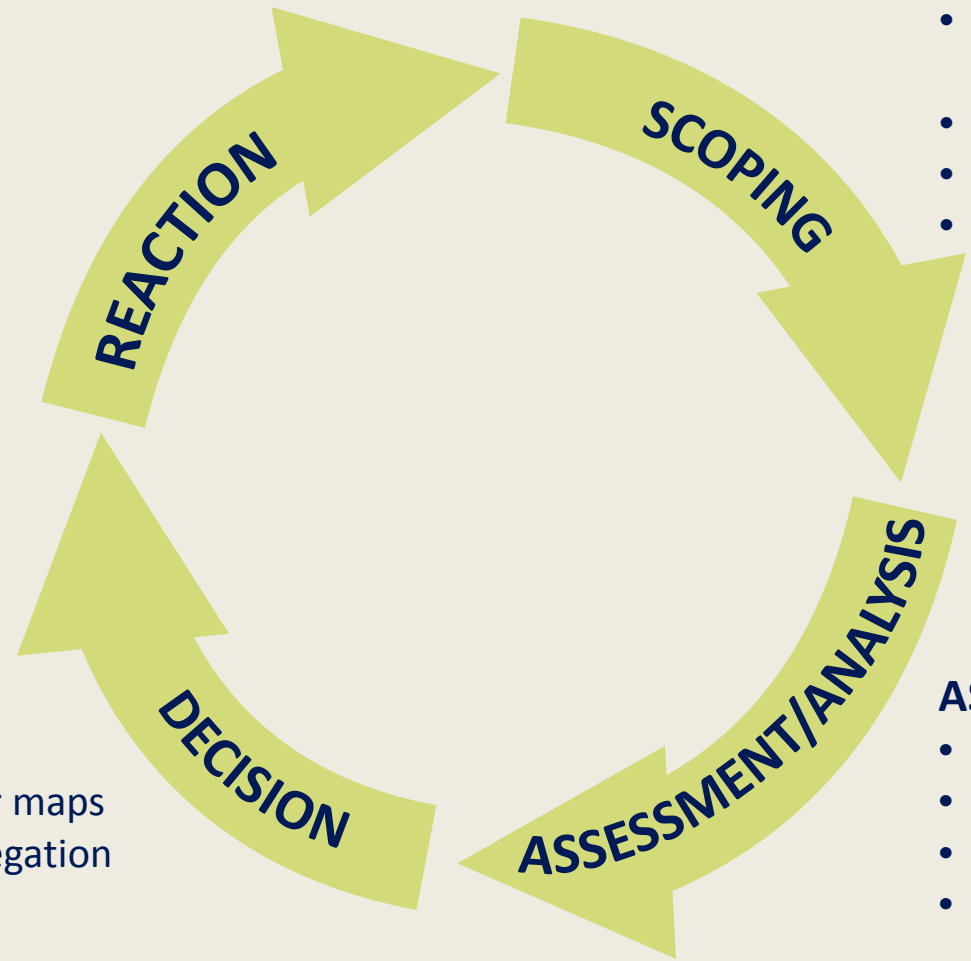
The Assessment Framework for Ecosystem Services

Methods for connecting ecological and social analyses

Assessment Framework

REACTION
- Monitoring BRIs

SCOPING
- Understanding socio-cultural context
- Engaging stakeholders
- Conceptual mapping
- Identifying services
  Identifying alternatives



DECISION
- Displaying results-alternative matrix or maps
- Weighting and aggregation

ASSESSMENT/ANALYSIS
- Causal chains
- Selecting services
- Quantifying BRIs
- Social evaluation (Monetary or non-monetary)

Over 150 People Participated

Project Leads

Lydia Olander, Dean Urban, Tim Profeta *(Duke University)*
Lynn Scarlett *(The Nature Conservancy)*
Jim Boyd *(Resources for the Future)*
Sally Collins *(Consultant, Formerly USFS and USDA OEM)*

Funders

Gordon and Betty Moore Foundation
National Center for Ecological Analysis and Synthesis
National Socio-Environmental Synthesis Center
Duke University
USDA Office of Environmental Markets
Seed funding from several agencies

Universities & Consultants

Clark University
Colorado State University
Duke University
University of Maryland
Ohio University
University of Wisconsin
Vanderbilt University
The New School
Institute for Natural Resources
Parametrix
Spatial Informatics Group

Agency Partners

U.S. Forest Service
U.S. Bureau of Land Management
U.S. Fish and Wildlife Service
U.S. Geological Survey
U.S. Department of the Interior
U.S. Environmental Protection Agency
National Oceanic and Atmospheric Administration
U.S. Army Corps of Engineers

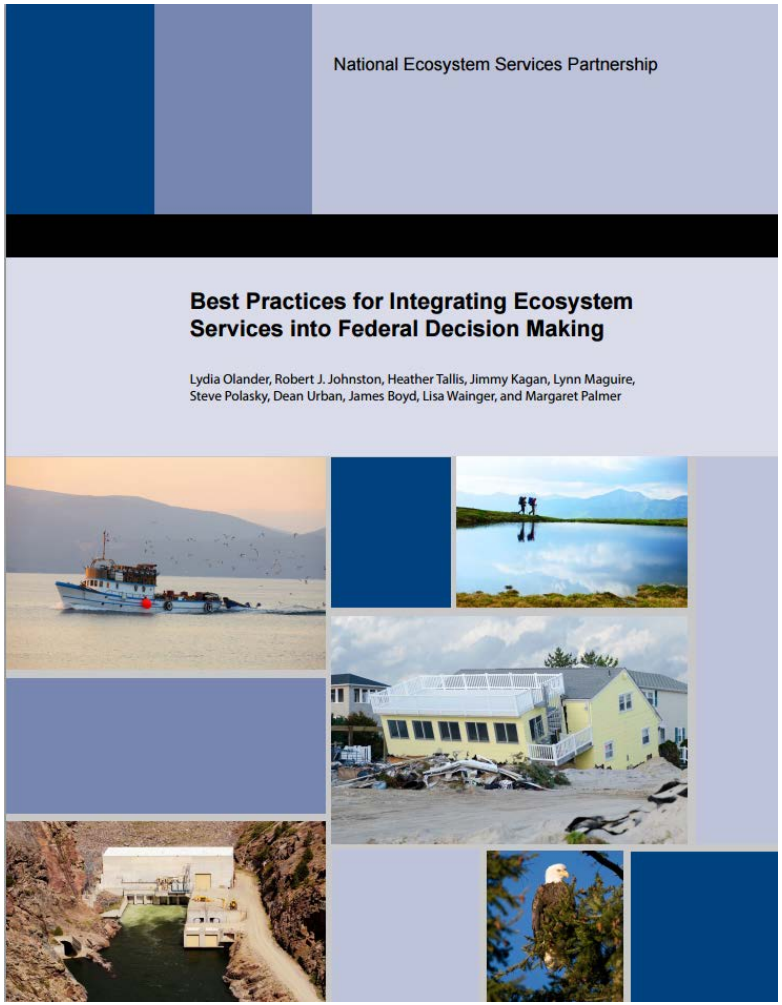
Agency Observers

Council on Environmental Quality
Office of Science and Technology Policy
Office of Management and Budget
USDA Office of Environmental Markets
U.S. Department of State

NGOs

Compass
Defenders of Wildlife
Conservation Science Partners
NatureServe
Resources for the Future
The Nature Conservancy
United Nations Environment Programme

Best Practices for Integrating Ecosystem Services into Federal Decision Making



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Guided by input and advice from
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Duke Nicholas Institute for Environmental Policy Solutions
The Nature Conservancy
Duke Nicholas School of the Environment
University of Minnesota Driven to Discover℠
SESYNC
Clark University
University of Maryland
University of Maryland Center for Environmental Science

How are the GB and BP being used?

Co-development of methods
- Informing Forest Service process
- Parallel development with USACE framework

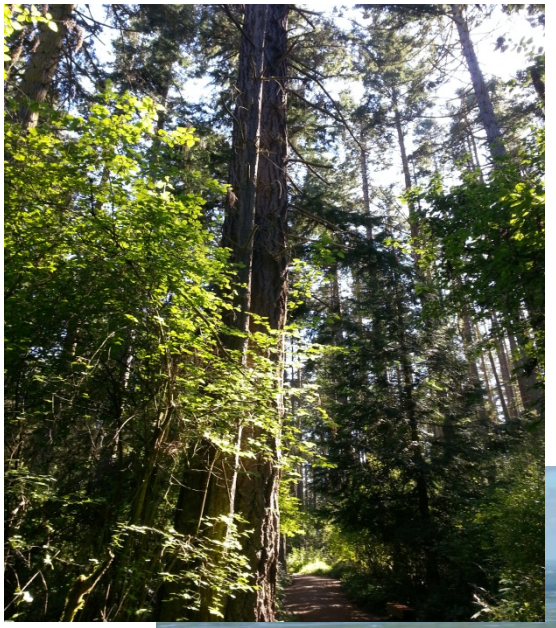
Working with the agencies as advisors
- USACE, DOT, NOAA, EPA, USGS

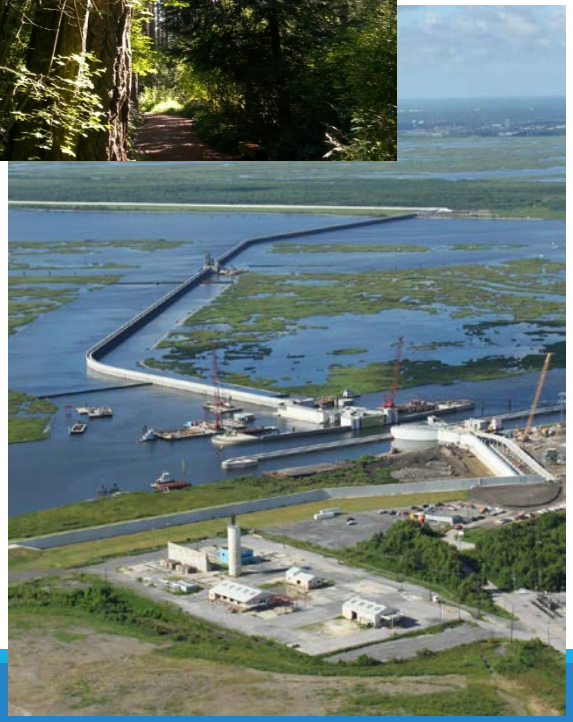
Informing metrics/indicator development (BRIs)

Training
- ACES workshop
- TNC training

Keeping up with the Jones's
- Finding out what other agencies are doing

Exploratory conversations -
- RESTORE council;
- USGS building ES resources;





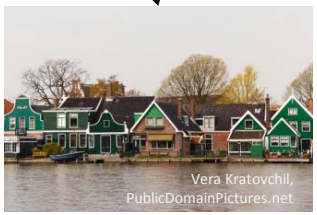
Key ES concepts that everyone needs to understand

Key ES concepts

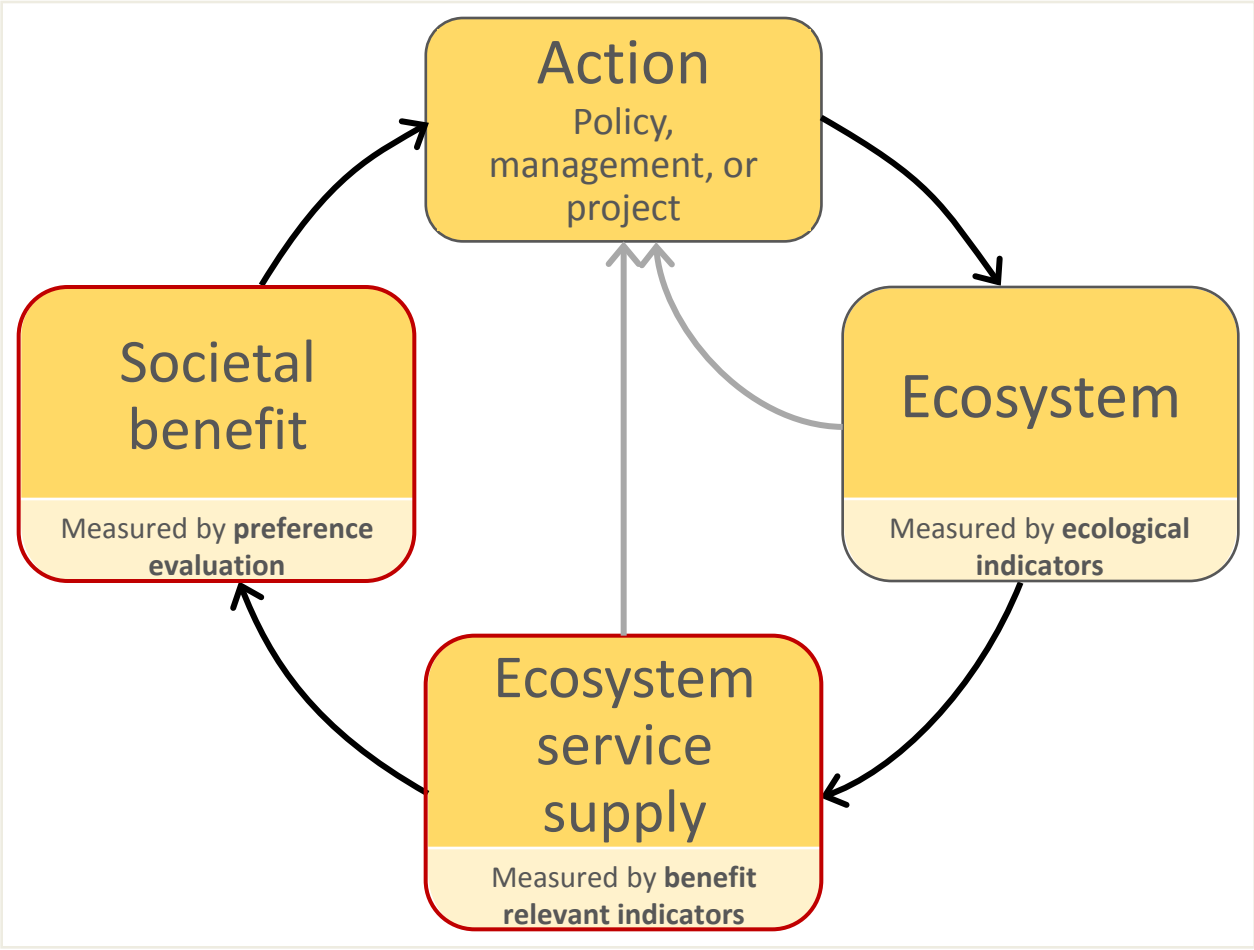
What distinguishes an ecosystem approach from an ecosystem *services* assessment

- Connection to people

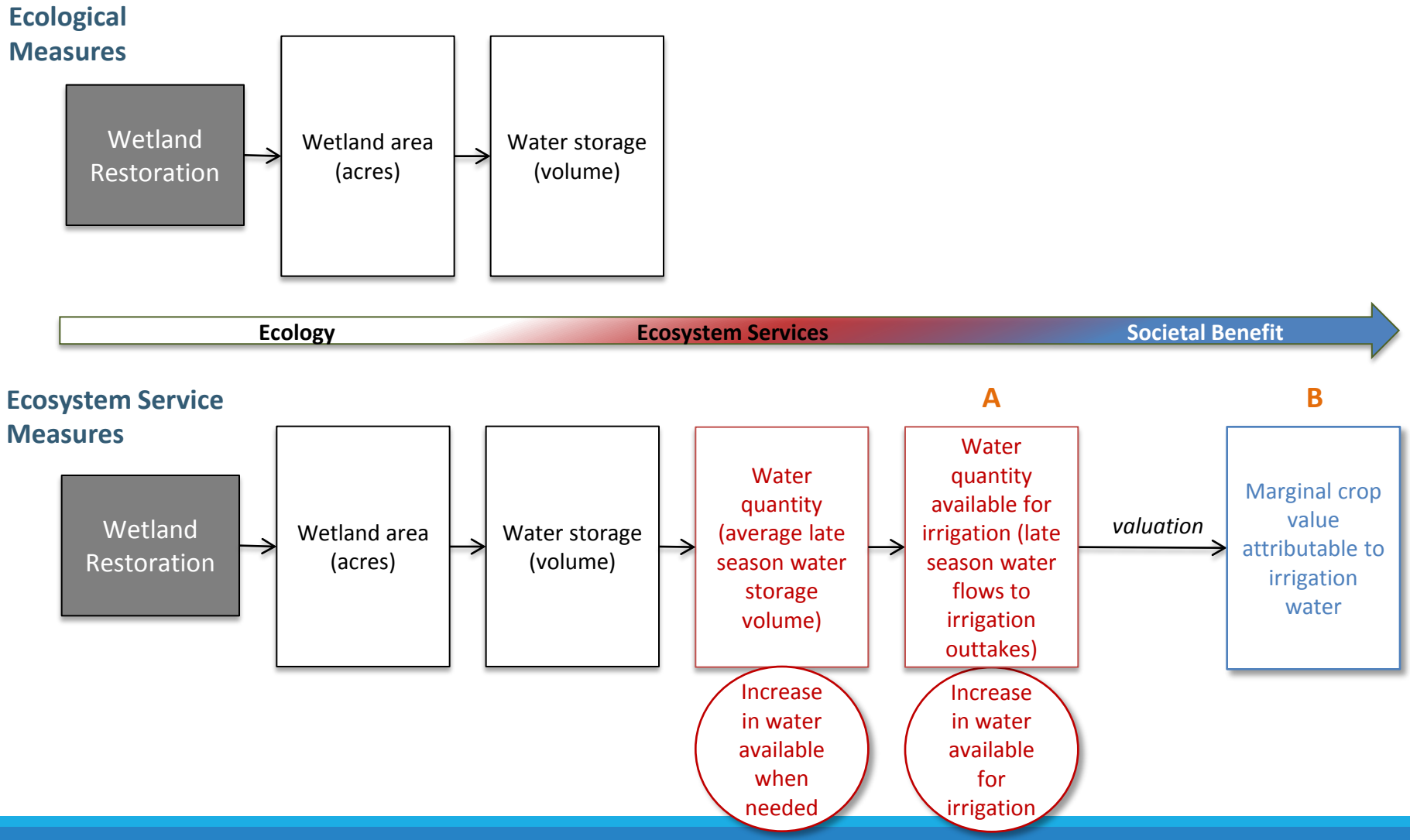
An Ecosystem Services Approach



Action – Ecosystem - Benefit



Causal Chain



Key ES concepts

What distinguishes an ecosystem assessment from an ecosystem *services* assessment?

- Connection to people

What are well-defined measures of ecosystem services?

- Benefit Relevant Indicators (BRIs)

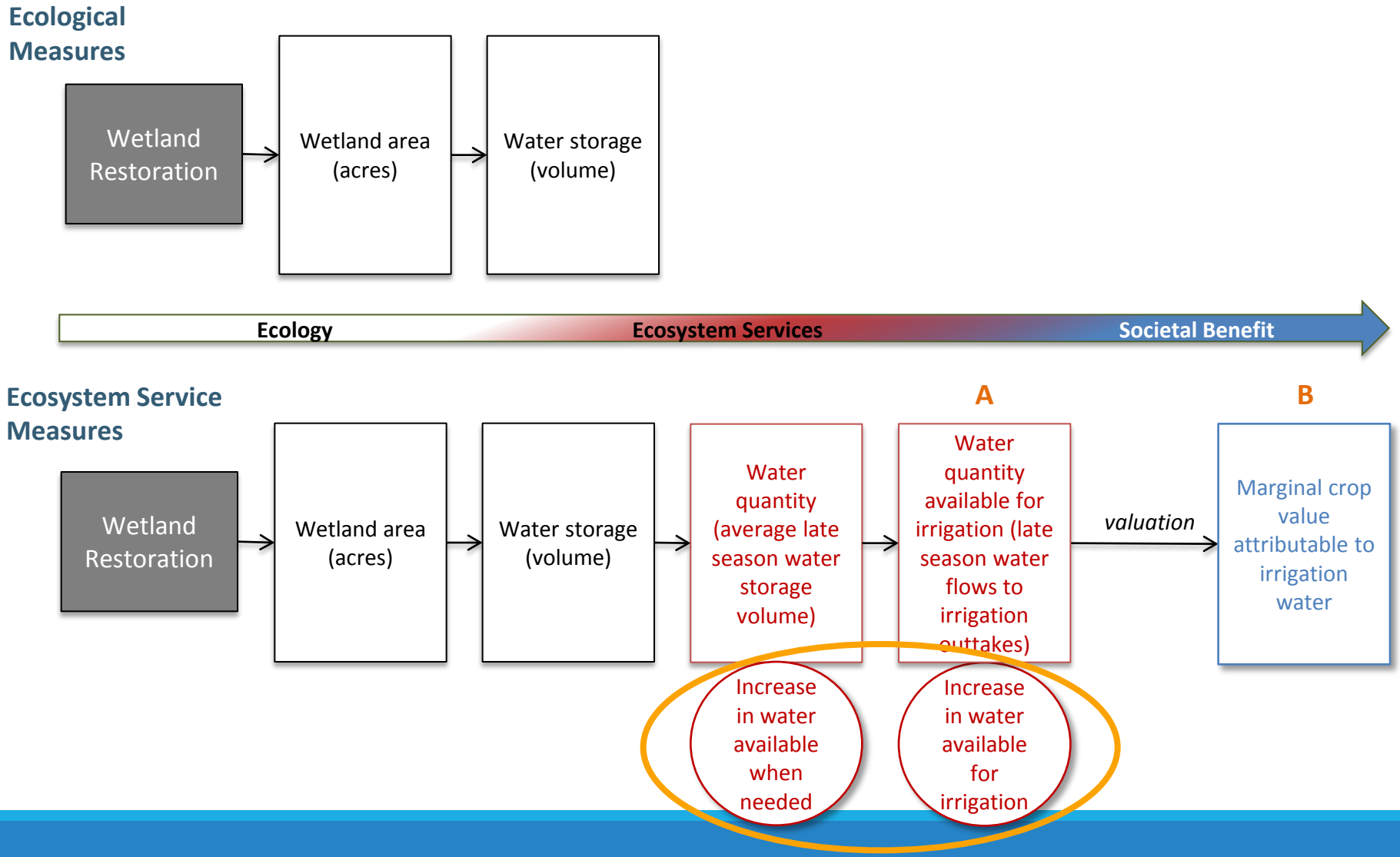
What are BRIs

Benefit-relevant indicators (BRIs) are measurable indicators that capture the connection between the ecosystem and its affect on people.

Ecological indicators are not BRIs unless there is a connection to people

BRIs are not monetary values or preference rankings of the societal benefits.

Causal Chain



Key ES concepts

What distinguishes an ecosystem assessment from an ecosystem *services* assessment?

- Connection to people

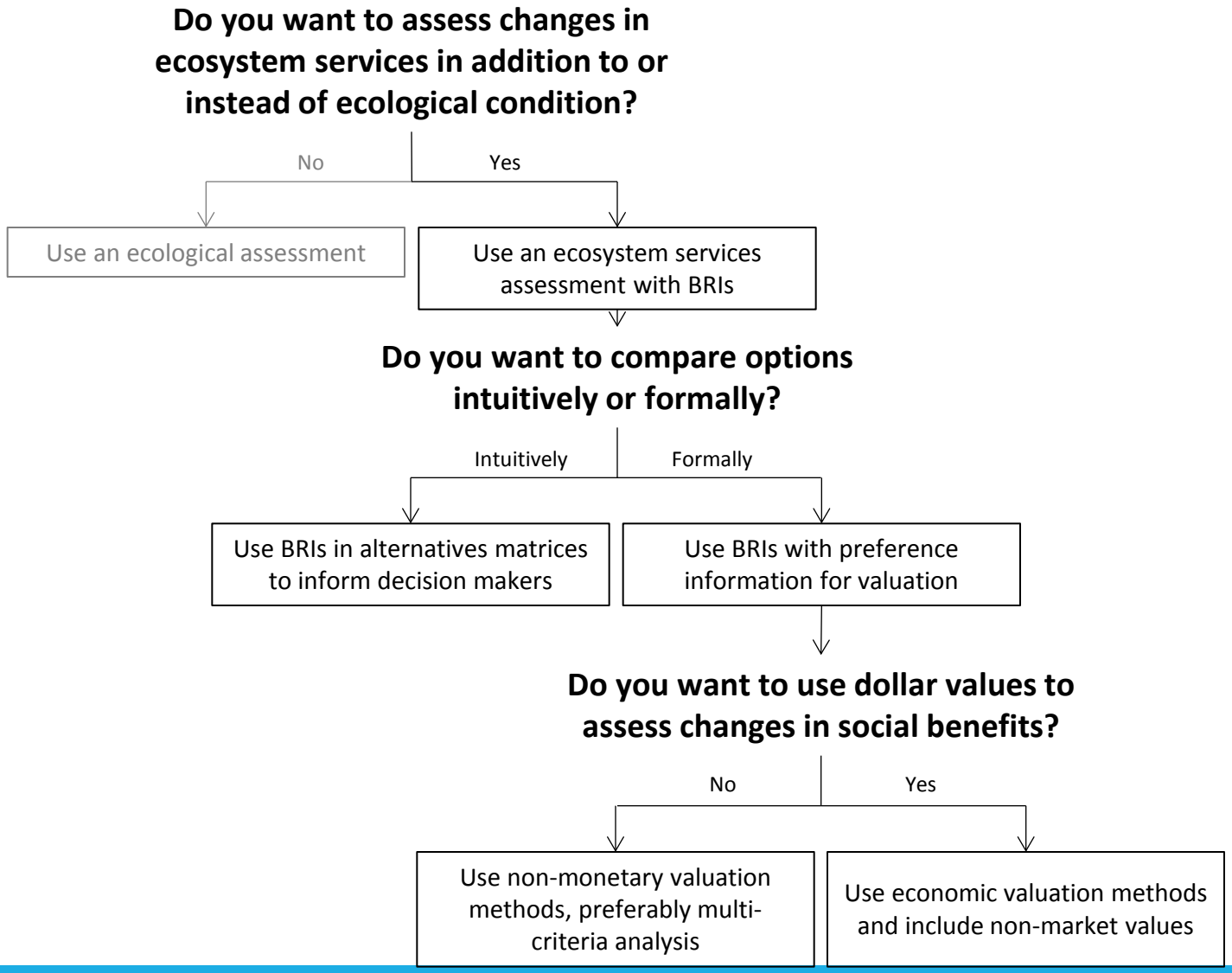
What are well-defined measures of ecosystem services?

- Benefit Relevant Indicators (BRIs)

What are the different ways to quantify ES and what can they do (and not do) for you?

- When are BRIs alone sufficient, versus preference evaluation/societal benefits (monetary / non-monetary valuation).

Overview of ES assessment process

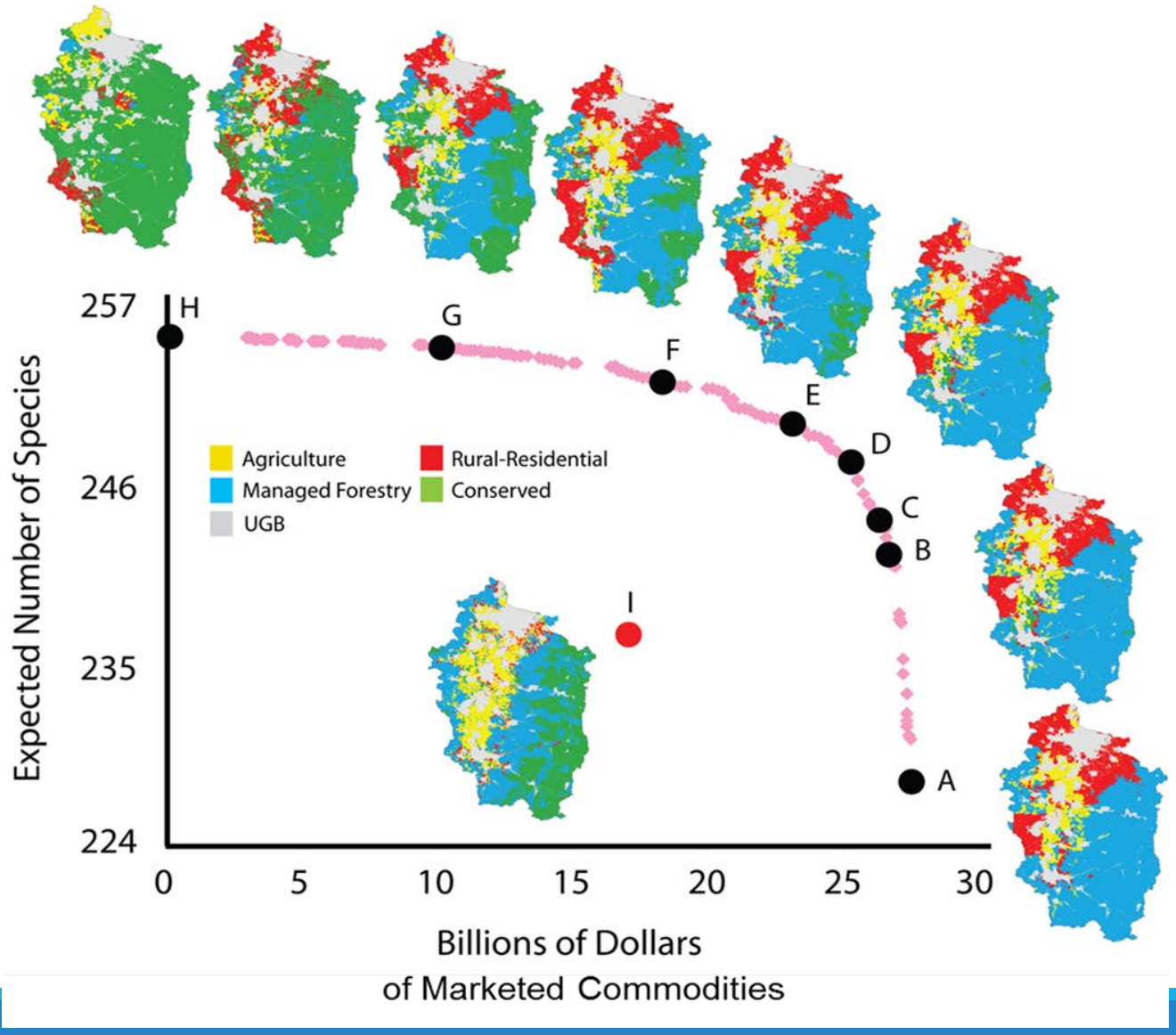


BRIs in intuitive decision making

ALTERNATIVES MATRIX FOR CONSIDERING ECOSYSTEM SERVICES IN INTUITIVE DECISION MAKING

Policy or Management Alternative			Option A	Option B	Option C
Ecosystem Service Benefit Relevant Indicator	BRI 1	Vegetation density in areas upstream of flood prone area with people or property of interest			
	BRI 2	Aquifer volume accessible by households			
	BRI 3	Amount of fish landed commercially			
	BRI 4	Acres of wetland habitat supporting recreationally important bird or fish species			

Evaluating trade-offs with BRIs



Preference Evaluation

BRIs measure *what is valued*, but do not measure *values*. When is preference evaluation required?

An evaluation of preferences (monetary or non-monetary valuation) is needed if:

1. service provision varies substantially across different stakeholder populations, i.e., there are tradeoffs across groups; or
2. changes in services in response to management or policy vary in direction (or magnitude) across services, i.e., there are tradeoffs across services.

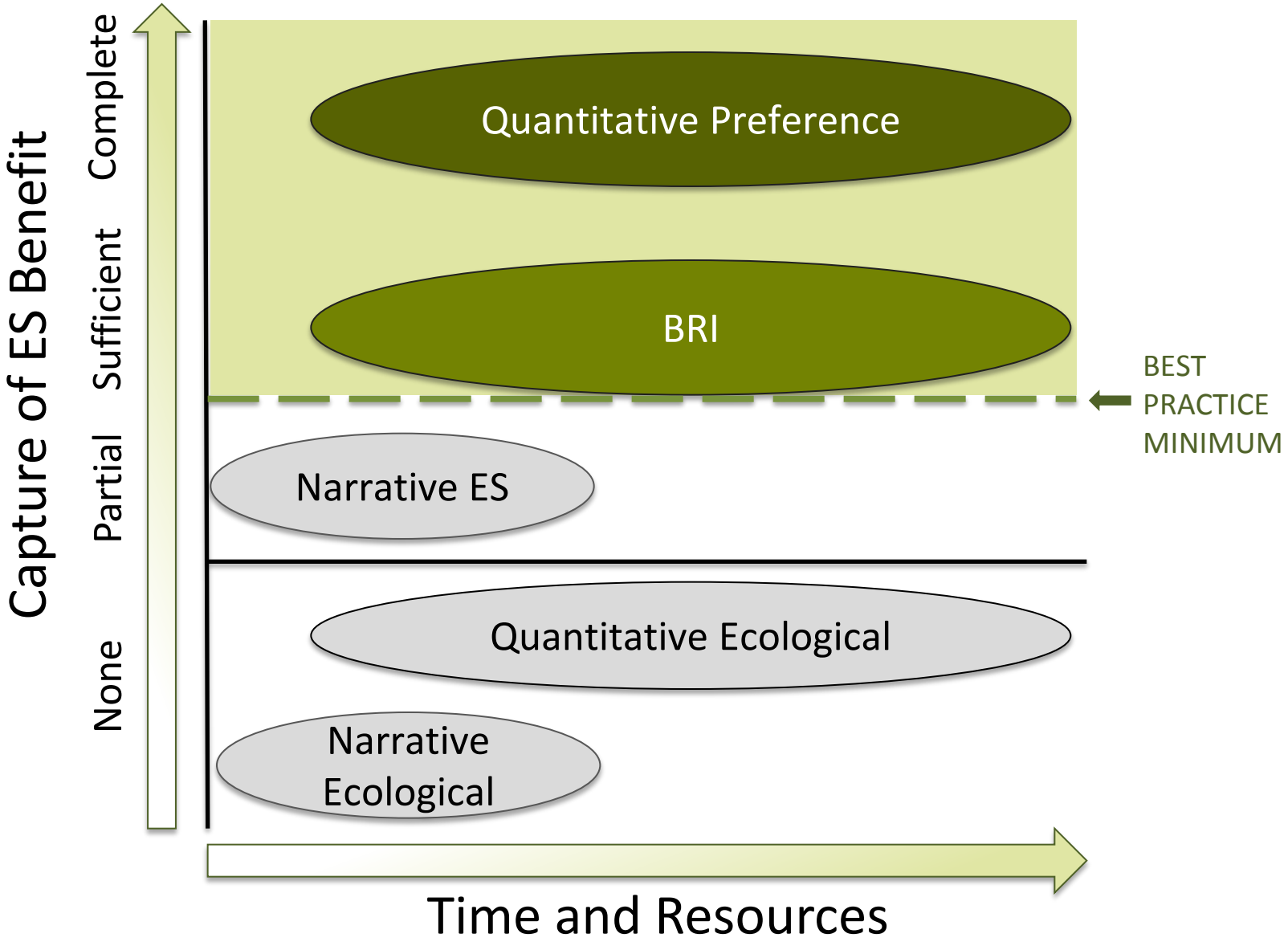
Two main approaches

1. Monetary valuation
2. Non-monetary multi-criteria analytical methods

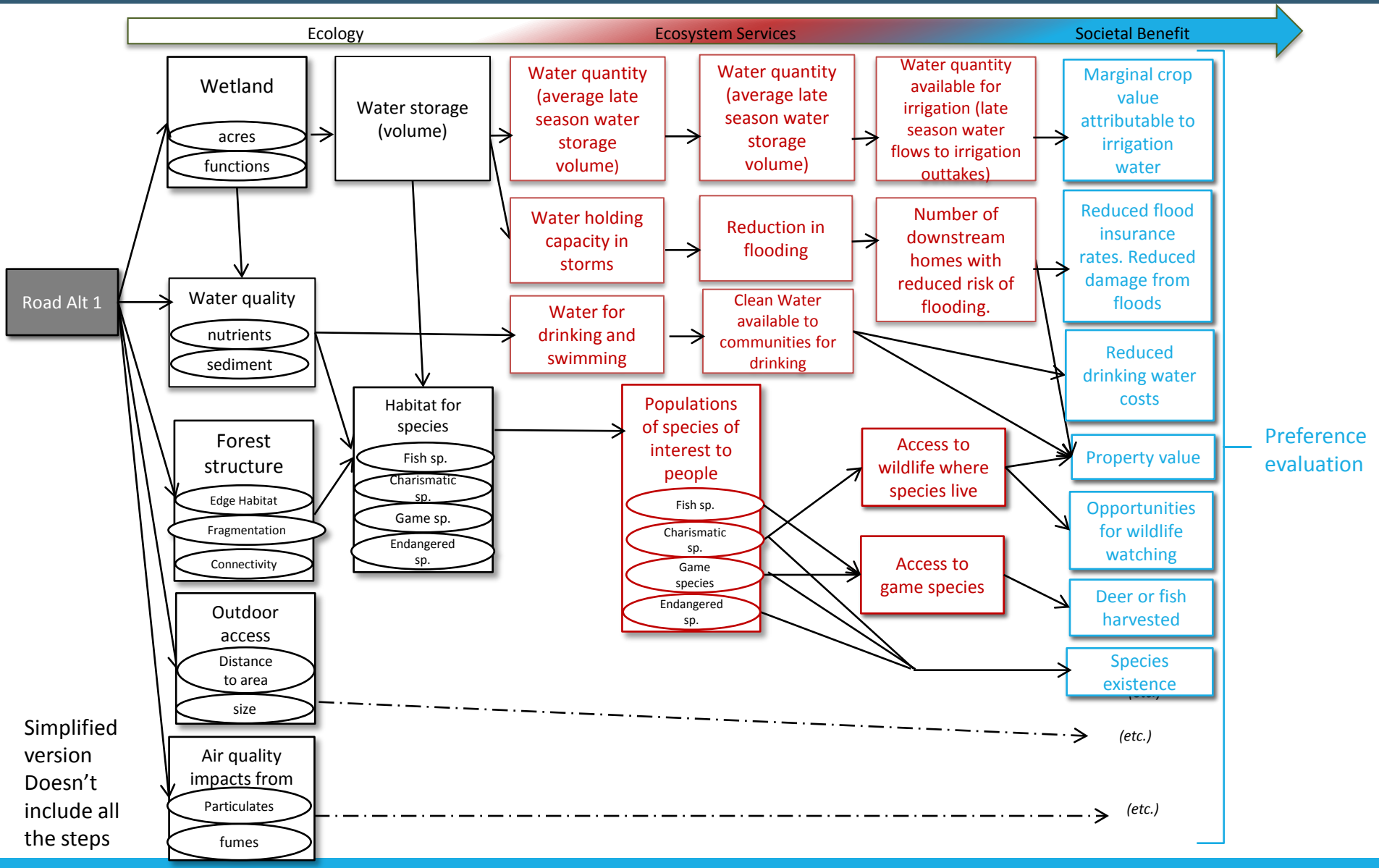
Best Practices for ES Assessment

1. **Extend assessments beyond purely ecological measures that are not explicitly tied to people's values to measures of ecosystem services that are directly relevant to people.**
   - ES values or preferences – OR – Benefit Relevant Indicators
2. **Assess these services using well-defined measures that go beyond narrative description and are appropriate to the analyses, even when data, time, or resources are limited.**
   - Narrative descriptions or ambiguously-defined categories do not meet best practice
3. **Include all important services, even those that are difficult to quantify**.
   - For consideration if not assessment

Best Practices



Conceptual map or diagram



We recommend that:

Ecosystem services be brought into a decision processes using causal chains and conceptual mapping to inform the way options are considered.

All important services be considered (even if not fully evaluated) in an assessment.

The use of BRIs go beyond narrative description with well-defined measurement scales that are compatible with valuation and decision analysis methods, and that this be the minimum standard for ecosystem services assessment.

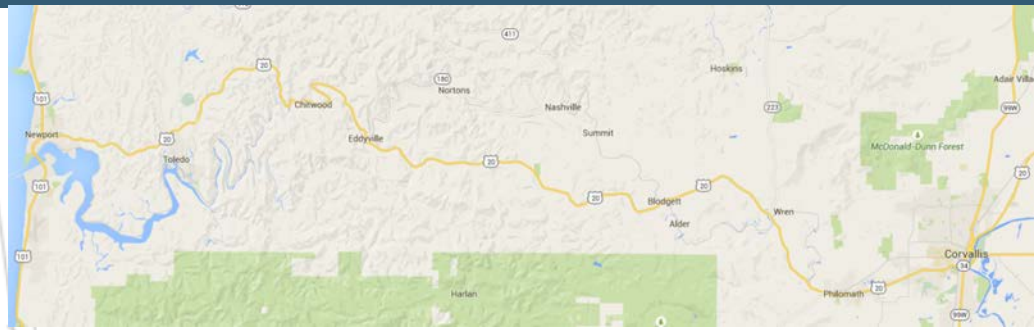
Using monetary or non-monetary valuation methods are the best practice and should be used where possible.

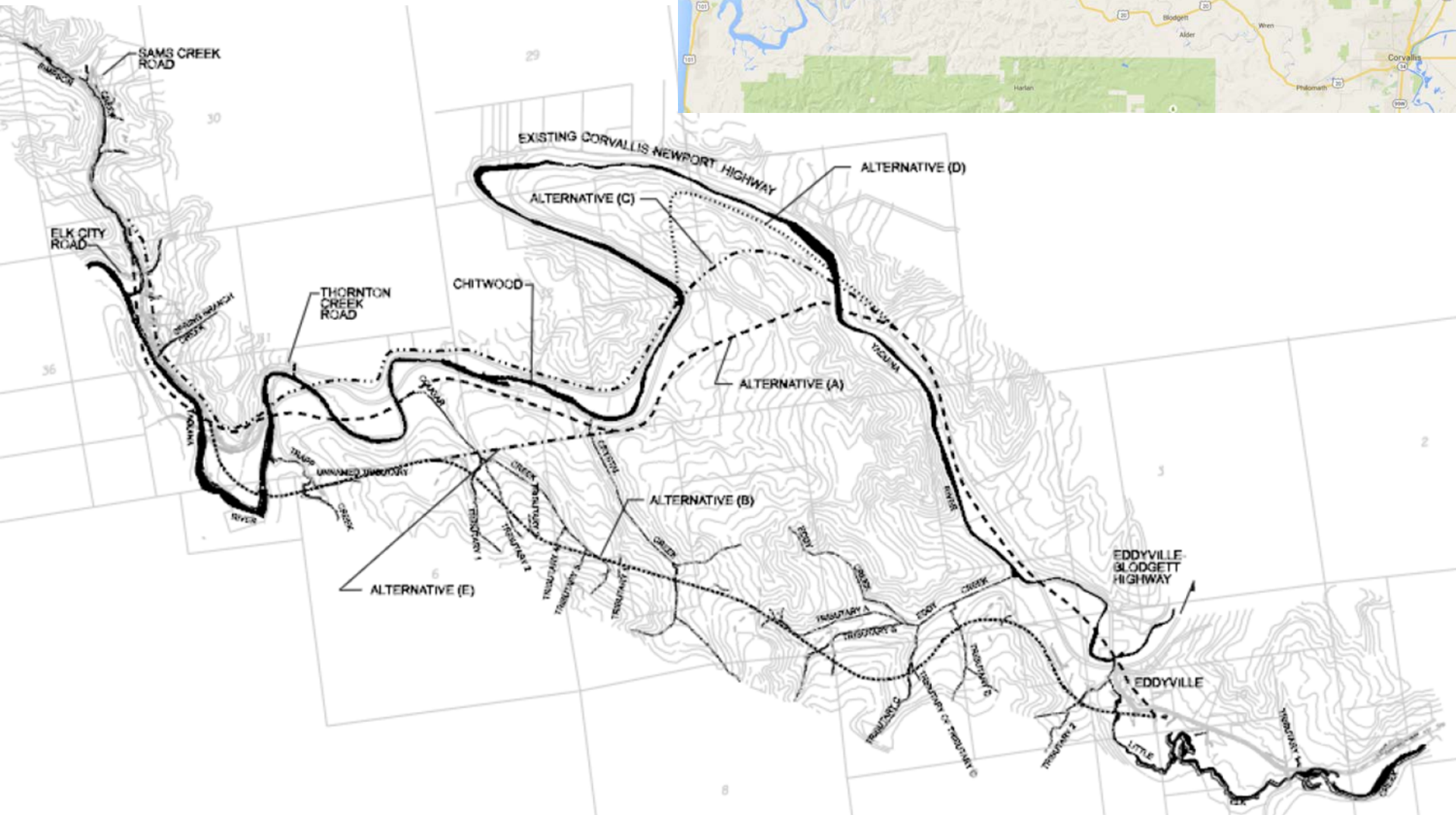
Examples of how ES can be incorporated into transportation decision making

1. Impact Assessment under NEPA
2. Programmatic Mitigation for Impacts to Wetlands and Streams
3. Environmental Performance Measures
4. Restoration Funding Allocation
5. Corridor Alternative Analysis
6. Culvert Replacement Prioritization

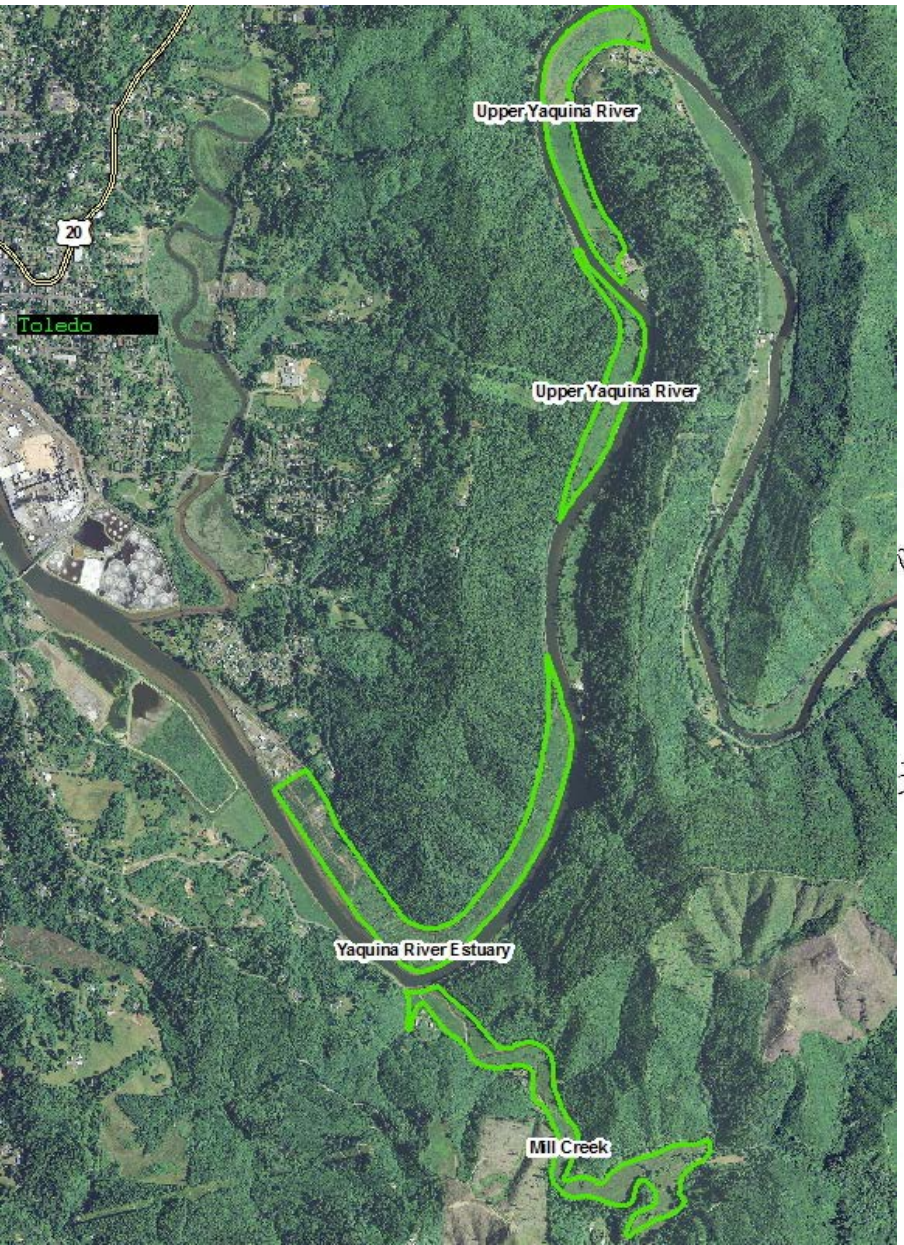
Impact Assessment under NEPA

US Highway 20 re-alignment EIS



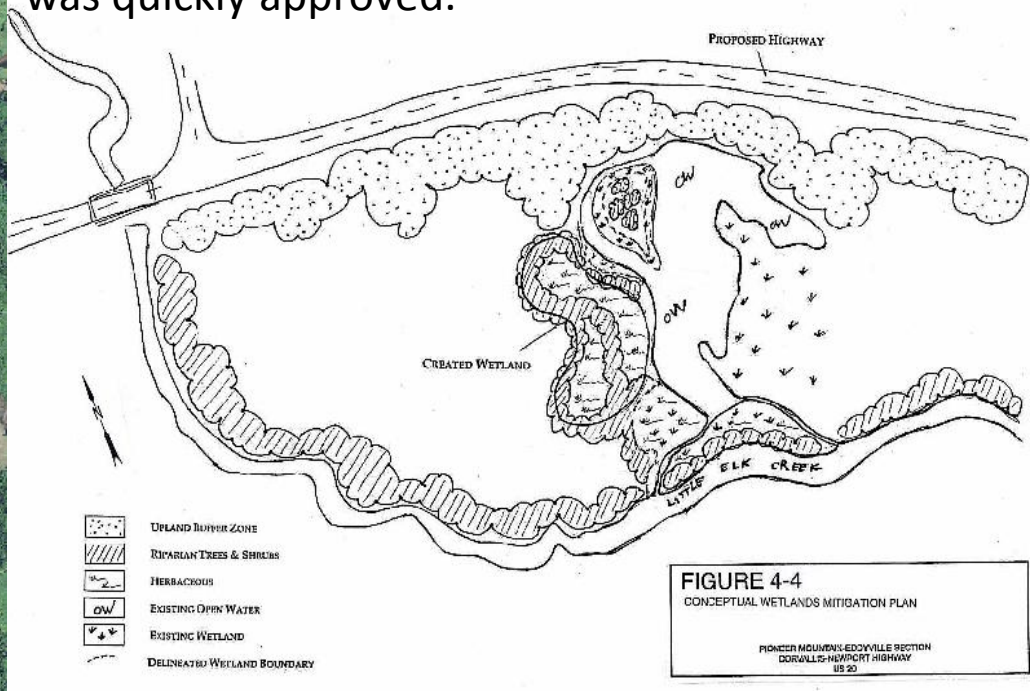


US Highway 20: Pioneer Mountain – Eddyville Project: Proposed Mitigation and Yaquina Priority Mitigation Areas



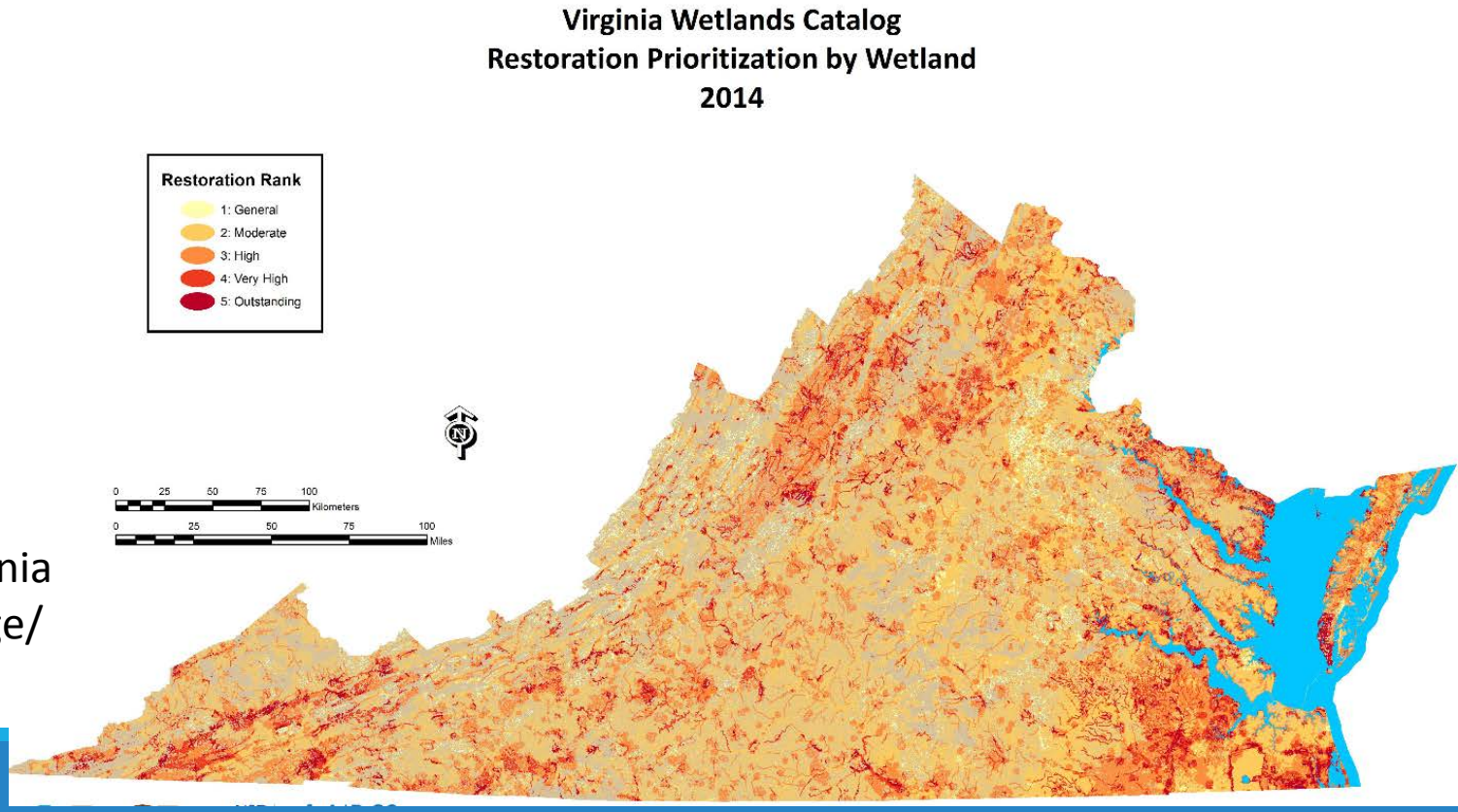
Even though very few wetlands were impacted, the proposed typical mitigation from the EIS (see below) caused significant problems for the wetland regulators.

A priority mitigation area (see left) provided opportunities for long-term restoration, salmon habitat, and downstream flood protection, and was quickly approved.



Wetland Mitigation Priorities

- Virginia Wetlands Mitigation and Restoration Catalog
  - Virginia Natural Heritage Program developed, using the state wetlands map and available data, a prioritized catalog of wetlands suitable for mitigation, restoration, and conservation, using ecosystem services analysis. These mirror wetland "functions", and assist in mitigation approvals.



http://www.dcr.virginia.gov/natural_heritage/wetlandscat.shtml

Environmental Performance Measures

- Maryland Department of Transportation
  - Maryland State Highway Administration develops Environmental Objectives and Performance Measures to assist in developing MDOT's Annual Attainment Report on Transportation System Performance
  - Maryland's Watershed Resources Registry provides information across agencies on many ecosystem services.

- Oregon Department of Transportation
  - The OTIA Bridge Project – used environmental performance measures as the basis for a programmatic agreement for over a billion dollars of bridge maintenance and repairs.
  - ODOT is developing performance measures at the request of the Oregon Legislature, for environmental stewardship and project delivery.

Maryland's Environmental Stewardship Performance Measures and the Maryland Watershed Resources Registry

GOAL:

Environmental Stewardship

Objectives

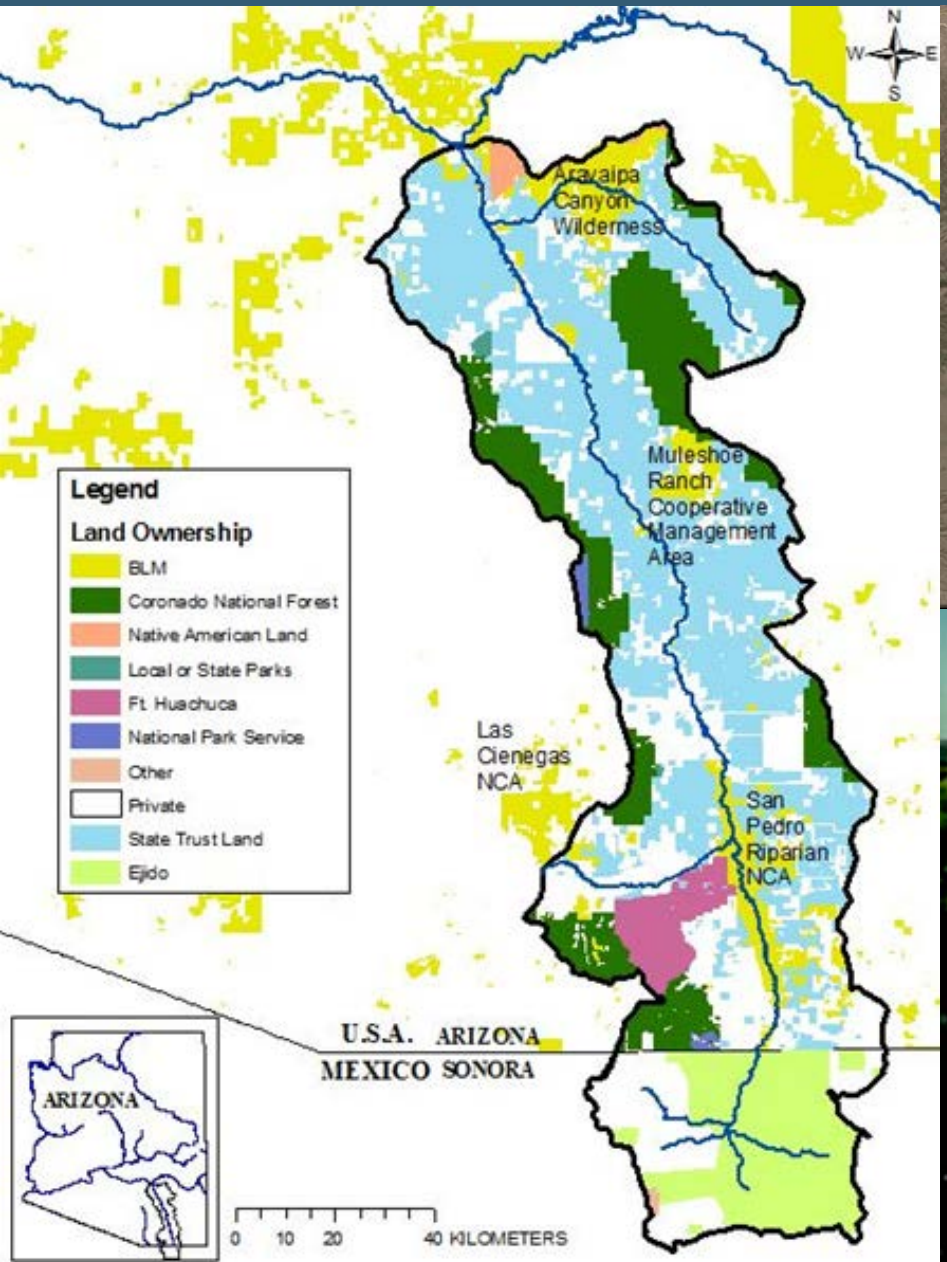
- **Coordinate land use and transportation planning to better promote Smart Growth**
- **Preserve and enhance Maryland's natural, community and historic resources**
- **Support initiatives that further our commitments to environmental quality**

Maryland's transportation agencies organize internal operation through environmental and energy management systems and prioritize investments to promote good stewardship of Maryland's environment while keeping our people and our economy moving. Approaches include using recycled materials in construction, actively managing stormwater from transportation facilities, and offering incentives for truck fleet owners to replace older, more polluting vehicles.

Performance Measures

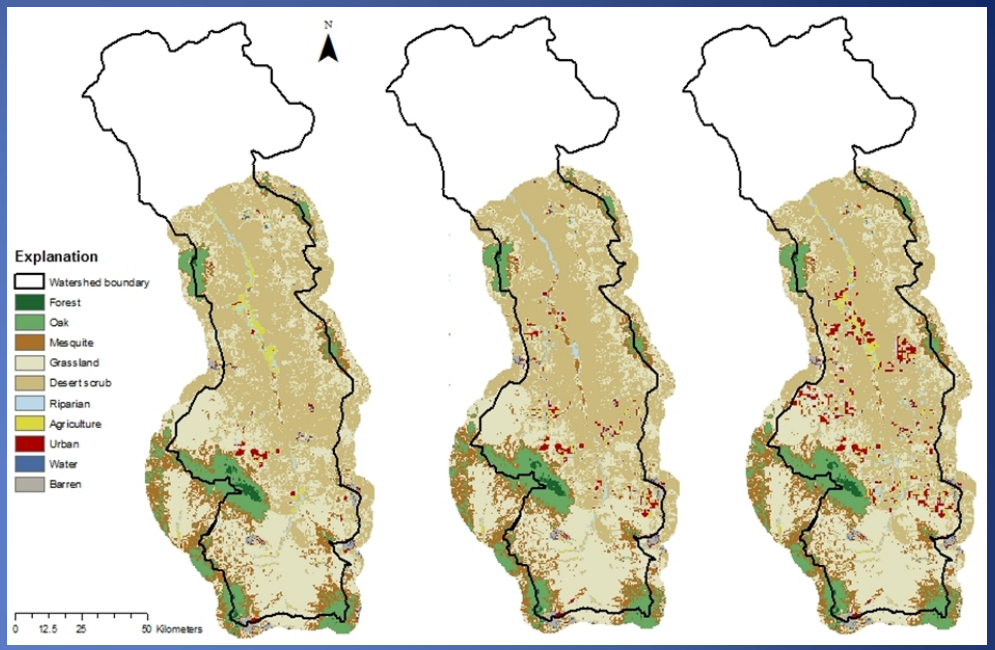
MONITORING AGENCY	PERFORMANCE MEASURE	PAGE
MDOT	Transportation-related emissions by region	38
MDOT	Transportation-related greenhouse gas emissions	39
MDOT & MTA	Transportation Emission Reduction Measures (TERMs)	42
MPA	Acres of wetlands or wildlife habitat created, restored, or improved since 2000	37
MVA	Compliance rate and number of vehicles tested for Vehicle Emissions Inspection Program (VEIP) versus customer wait time	38
SHA	Acres of wetlands restored and miles of streams restored	37
SHA	Total fuel usage of the light fleet	40
SHA & MTA	Travel Demand Management	40-41

Restoration Funding Allocation

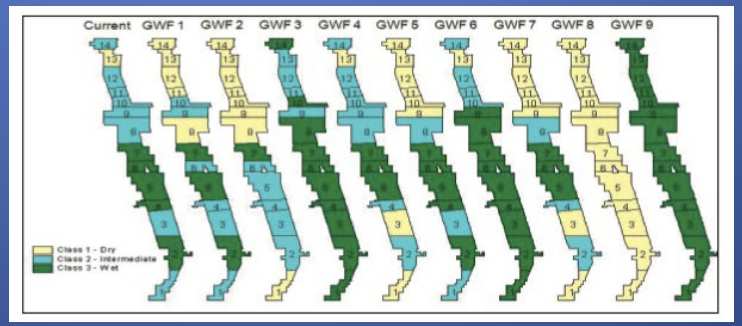


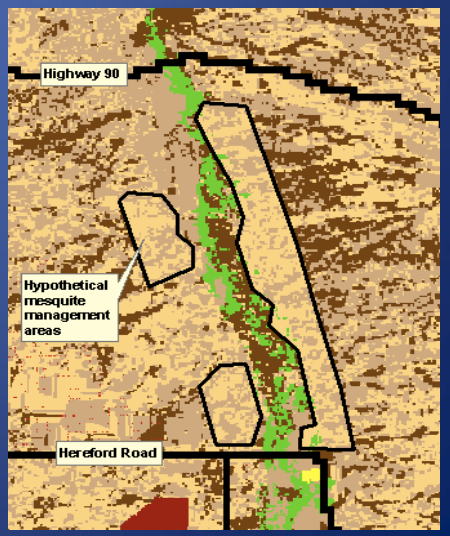
Scenarios

- Urban growth (Steinitz et al. 2003)
- Mesquite management/ grassland restoration
- CAP water augmentation (Brookshire et al. 2010)



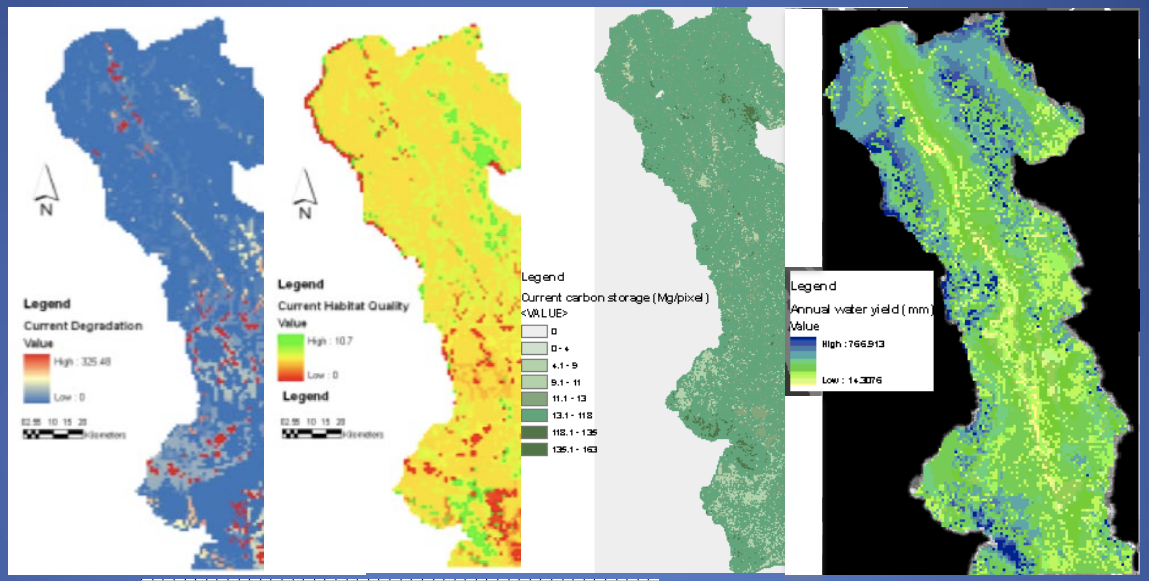
2000 2020 – constrained 2020 – open



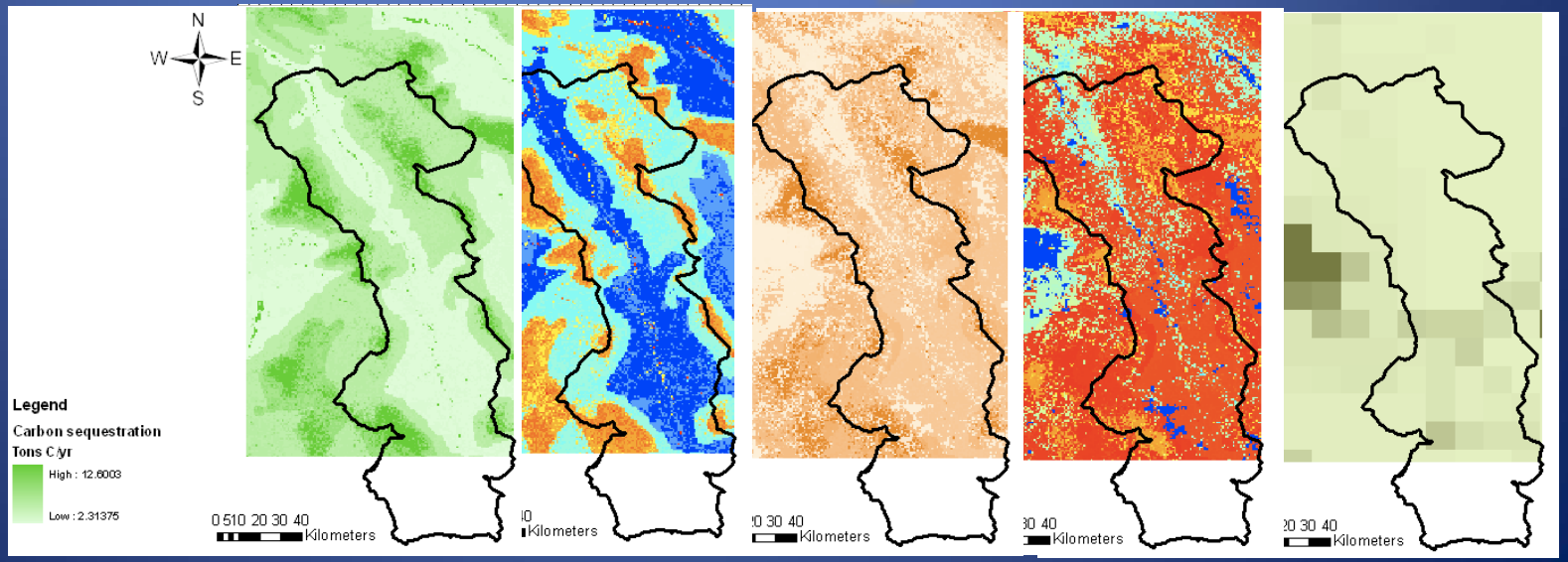


Results: ARIES & InVEST models

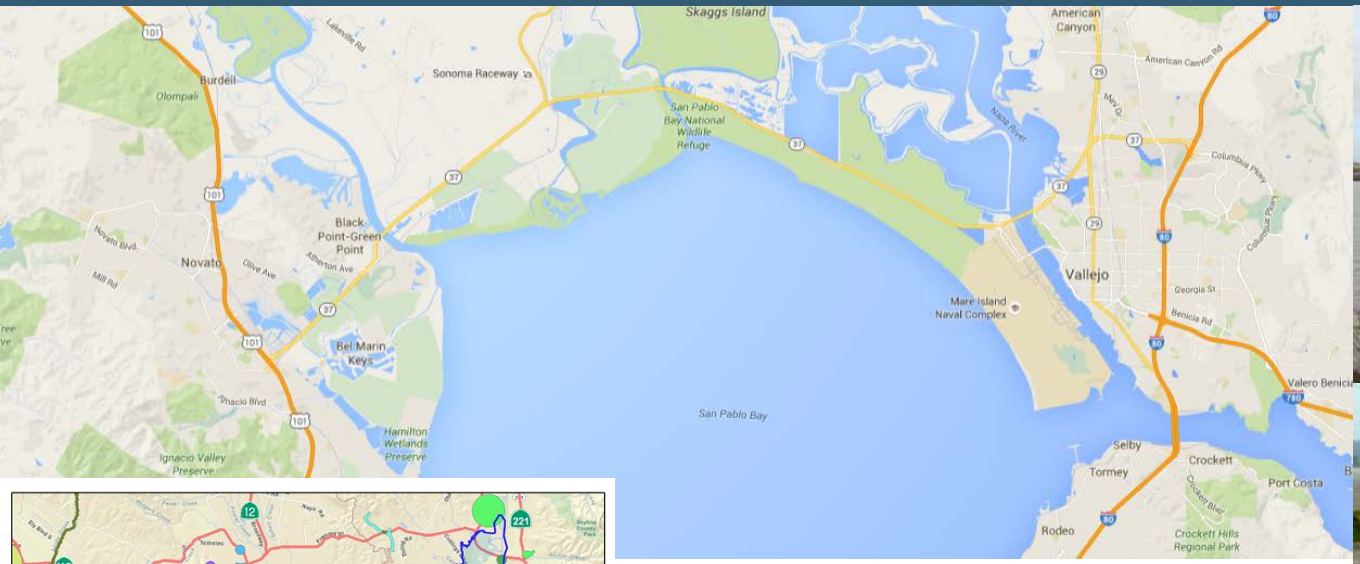
InVEST biodiversity, carbon, water yield results

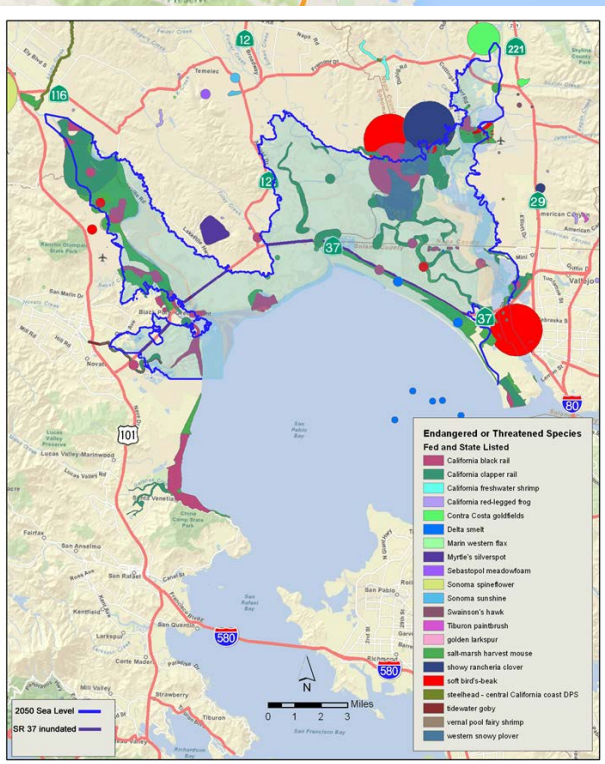


ARIES carbon results, incl. uncertainty maps



Corridor Alternatives Analysis





Listed Species Map

California Highway 37 Corridor Analysis

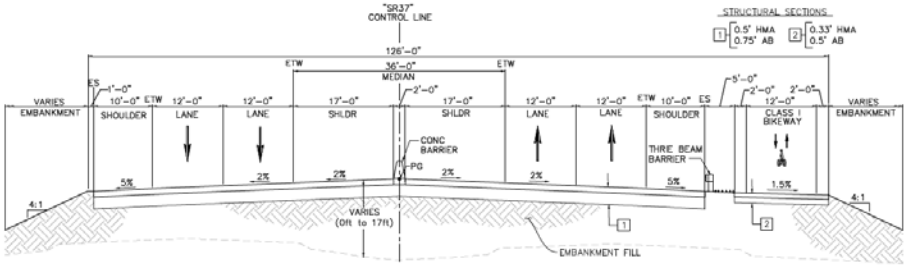
Traffic flow – Napa and the other adjacent communities didn't want any option that would reduce traffic. (so removing highway was not an option).

Normal analysis would evaluate traffic and regulated resources (here, wetlands and endangered species)

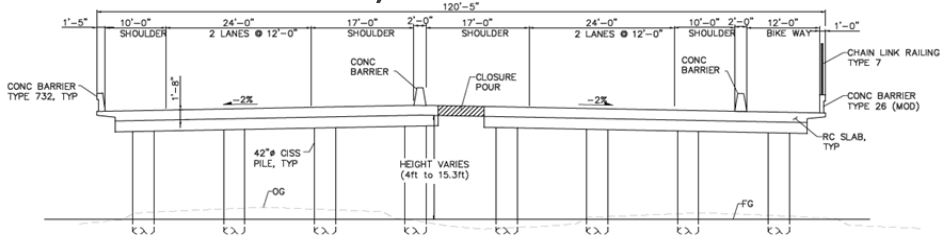
Highway 37 Alternatives Analysis

1. Included polling adjacent communities to access their interest in transportation, and various natural resources and environmental benefits.
2. Determined that wetlands and habitats were as important as access. The survey did not ask why, but they did not want the environment benefits to go away.
3. Considered climate change vulnerability.

REACH	ALTERNATIVE	
	1 – Levee	2- Slab Bridge Causeway
A	$300	$1,100
B	$470	$1,600
TOTAL	$770	$2,700



1) Levee



2) Slab-bridge causeway

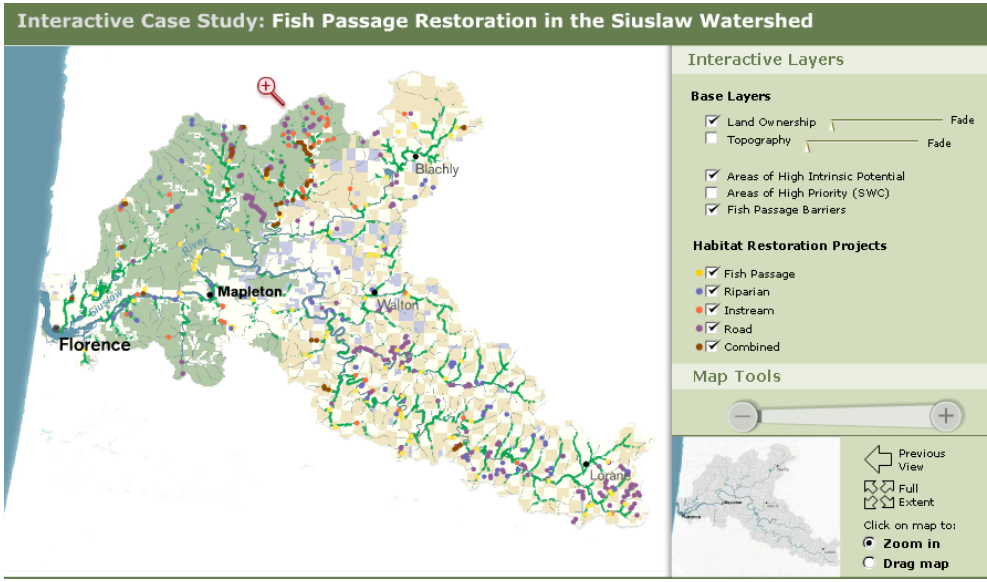
Culvert Replacement Prioritization

Millions of culverts need to be replaced across the country, far exceeding the resources available to DOTs and restoration groups.

Most prioritization focuses on a single issue (fish passage)

Culverts influence multiple services:

- clean water for drinking or swimming
- riparian conditions for wildlife
- aquatic conditions for at-risk mussels
- scenic quality of streams



A number of recent studies have developed tools and models to help evaluate multiple ecosystem services while developing priorities that key priorities, such as fish passage and road stability, are properly identified.

Online guidebook
nespguidebook.com

Best Practice Guidance
nicholasinstitute.duke.edu/sites/default/files/publications/es_best_practices_fullpdf_0.pdf

National Ecosystem Services Partnership (home)
nicholasinstitute.duke.edu/focal-areas/national-ecosystem-services-partnership

To sign up for NESP email list and newsletter
e-mail to nesp@duke.edu

FHWA Ecological Step 6 Crediting Webinar:
http://orbic.pdx.edu/transfer/2014-10-16_Transportation_Crediting_Webinar.wmv

Transportation Crediting final reports (interim link while FHWA codes them to the Environmental Review Toolkit):
http://orbic.pdx.edu/transfer/Transportation_Crediting_Final_Report.pdf

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What about intrinsic value?

Concepts of value not linked to humans and not susceptible to measurement are not relevant to analyses of ecosystem services.

A broad range of values can be incorporated as ecosystem services, including many types of non-use values (e.g., existence, aesthetic, spiritual, educational) that include some, but perhaps not all, of the types of value that some authors describe as “intrinsic.”

Non-use values are captured by BRIs; purely “intrinsic” values are not.

Funding allocation USFS

EXAMPLES OF WHAT WOULD AND WOULD NOT QUALIFY AS A BRI

Ecosystem Service	Not BRI	BRI
Existence or abundance of wolves	People donating to general conservation organizations*	Numbers of wolves x Number of people holding existence value for wolves
Ecological production of recreationally harvested fish	Fish abundance	Abundance of recreationally targeted fish, in areas used by recreational anglers
Flood regulation	Flood frequency	Number of vulnerable people (elderly, ESL) in areas with flood risk reduced by management action
Water quality regulation	Nitrogen concentration (proxy measure)	”swimmable days” x number of people with ready access to the swimming sites