National Ecosystem Services Partnership **Webinar**

The Conceptual Model Series

Presented by:

Lydia Olander, Sara Mason, and Katie Warnell

Nicholas Institute for Environmental Policy Solutions, Duke University

September 28, 2018

ACES 2018


JOIN US in our nation's
CAPITAL
for an interdisciplinary forum to share experiences, methods, and tools for assessing and incorporating ecosystem services into public and private decisions.
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NESP ACES Events:

Dec 3: Half day workshop (registration required)

Methods for Incorporating Ecosystem Services into Decision Making

Dec 3: Pollinator Workshop

Mapping pollination services in the southeast

Dec 5: Talk

Building Ecosystem Service Conceptual Models for Federal Decision Making

Dec 5: Panel

Getting to Why Ecosystem Services Matter

Dec 5: Town Hall

Increasing Opportunities for Private Investment on Public Land

Dec 5: Session

Law and Ecosystem Services

Dec 5: Talk

Incorporating Ecosystem Services into Natural Capital Accounting

Dec 6: Talk

Linking Restoration Impacts to Economic, Health, and Wellbeing Benefits for People in the Gulf of Mexico

Presenters

Lydia Olander is the director of the Ecosystem Services Program at the Nicholas Institute for Environmental Policy Solutions at Duke University, and the head of the National Ecosystem Services Partnership (NESP)

Sara Mason and **Katie Warnell** are policy associates in the Ecosystem Services Program at the Nicholas Institute

Frank Casey is an agricultural and natural resources economist and serves as the Ecosystem Services Theme Lead for the Science and Decisions Center at the US Geological Survey. His responsibilities include incorporation of ecosystem services and their valuation (including market mechanisms) in adaptive management research and planning for resource conservation on both public and private lands.

Pete Wiley is an Economist with NOAA's Office for Coastal Management. Mr. Wiley has worked on a wide variety of issues including estimating market and non-market values in support of National Marine Sanctuary Regulations and research to better understand the link between the economy and environment in coastal areas. Recently, Mr. Wiley's work has concentrated on the role of ecosystem services in coastal management decision-making.

Rebecca Moore is an economist at the Bureau of Land Management**.** Rebecca’s expertise covers a range of environmental and natural resource economic topics, including ecosystem services valuation, conservation incentive programs, and spatial and dynamic decision making.

Evidence-Based Ecosystem Services Conceptual Models

Lydia Olander, Sara Mason, and Katie Warnell Nicholas Institute and NESP, Duke University

With support from Frank Casey USGS, Pete Wiley NOAA, Rebecca Moore BLM

NESP Webinar – September 26, 2018

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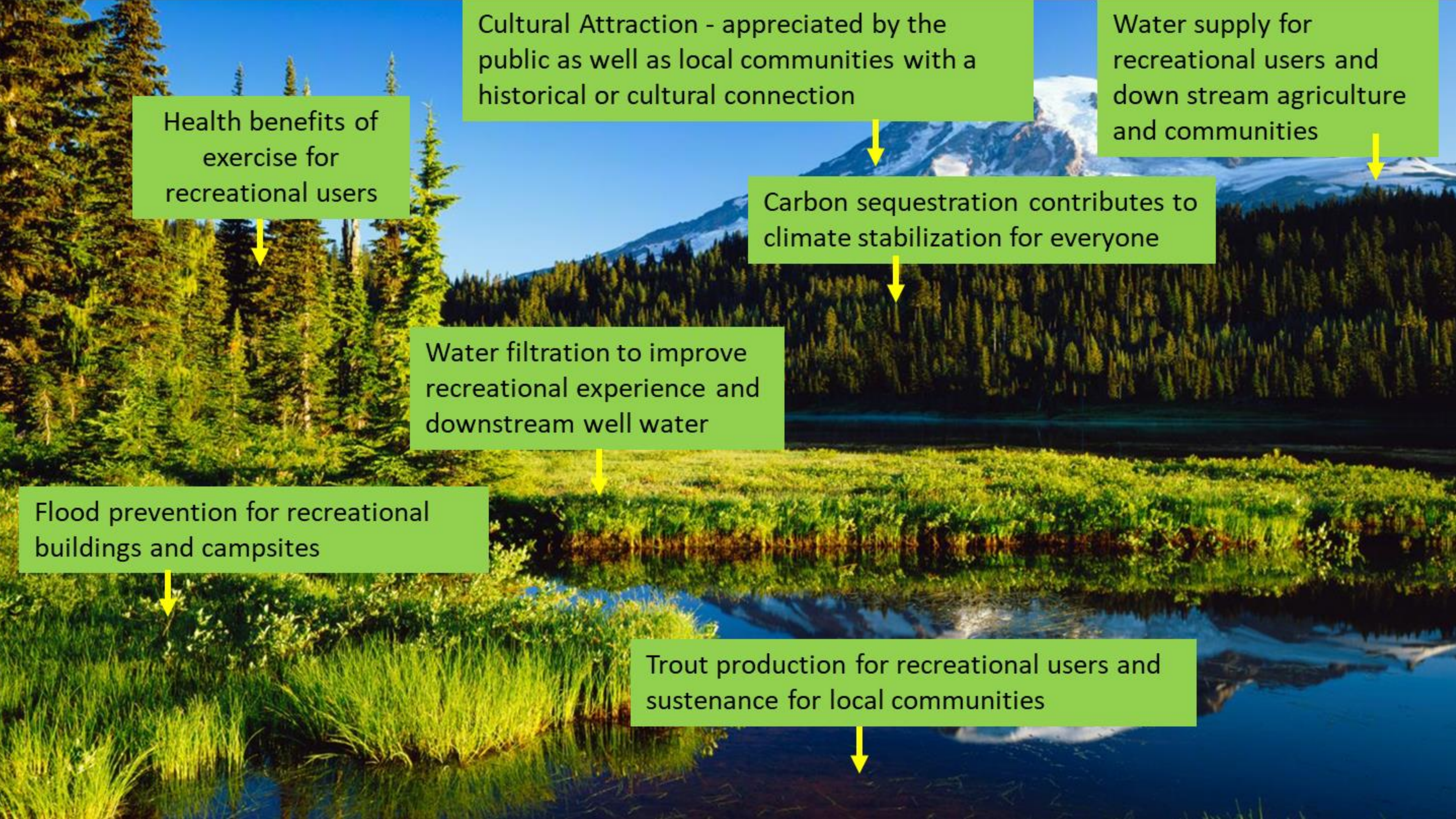
Cultural Attraction - appreciated by the public as well as local communities with a historical or cultural connection
Water supply for recreational users and down stream agriculture and communities
Health benefits of exercise for recreational users
Carbon sequestration contributes to climate stabilization for everyone
Water filtration to improve recreational experience and downstream well water
Flood prevention for recreational buildings and campsites
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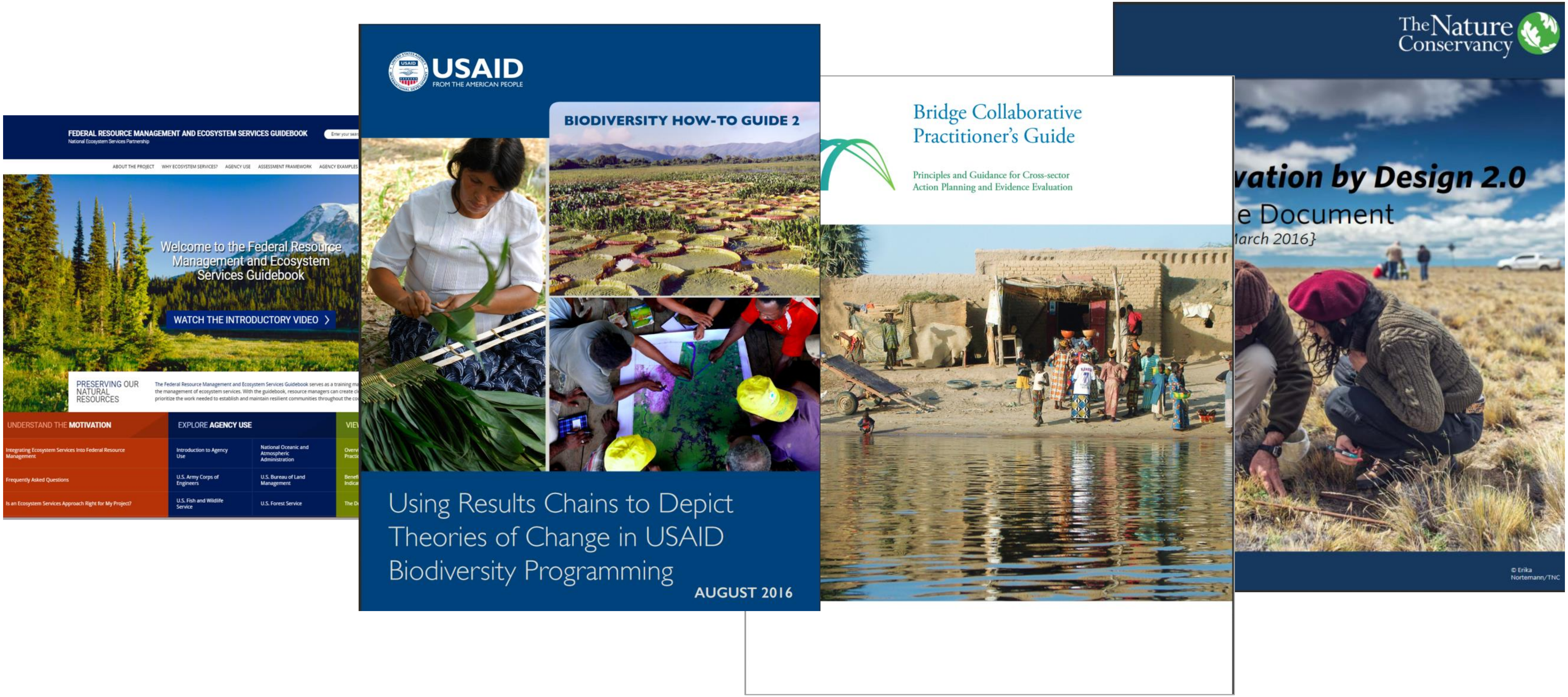
FEDERAL RESOURCE MANAGEMENT AND ECOSYSTEM SERVICES GUIDEBOOK
National Ecosystem Services Partnership
ABOUT THE PROJECT
WHY ECOSYSTEM SERVICES?
AGENCY USE
ASSESSMENT FRAMEWORK
AGENCY EXAMPLES
Welcome to the Federal Resource Management and Ecosystem Services Guidebook
WATCH THE INTRODUCTORY VIDEO
PRESERVING OUR NATURAL RESOURCES
UNDERSTAND THE MOTIVATION
Integrating Ecosystem Services Into Federal Resource Management
Frequently Asked Questions
Is an Ecosystem Services Approach Right for My Project?
EXPLORE AGENCY USE
Introduction to Agency Use
National Oceanic and Atmospheric Administration
U.S. Army Corps of Engineers
U.S. Bureau of Land Management
U.S. Fish and Wildlife Service
U.S. Forest Service
USAID
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BIODIVERSITY HOW-TO GUIDE 2
Using Results Chains to Depict Theories of Change in USAID Biodiversity Programming
AUGUST 2016
Bridge Collaborative Practitioner's Guide
Principles and Guidance for Cross-sector Action Planning and Evidence Evaluation
The Nature Conservancy
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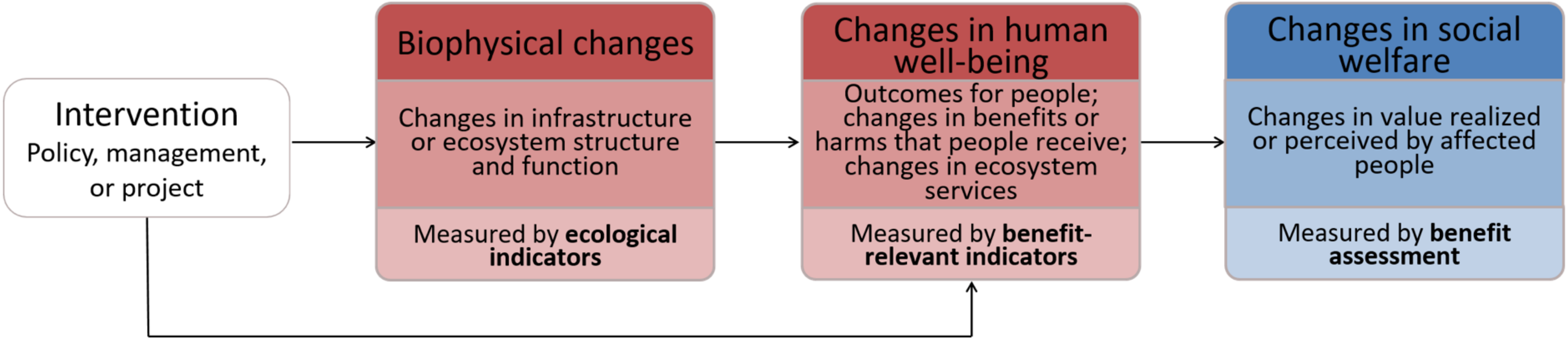
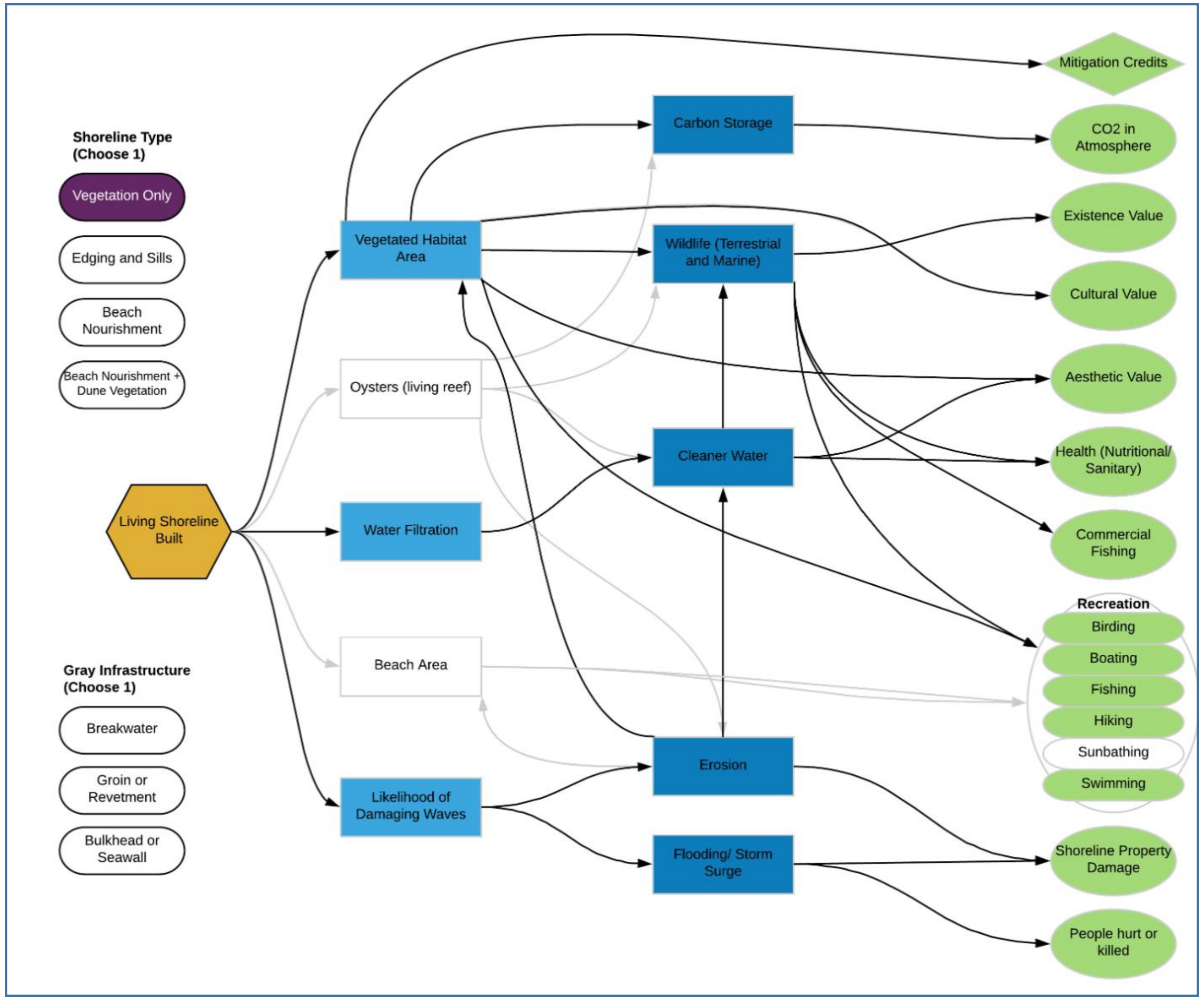
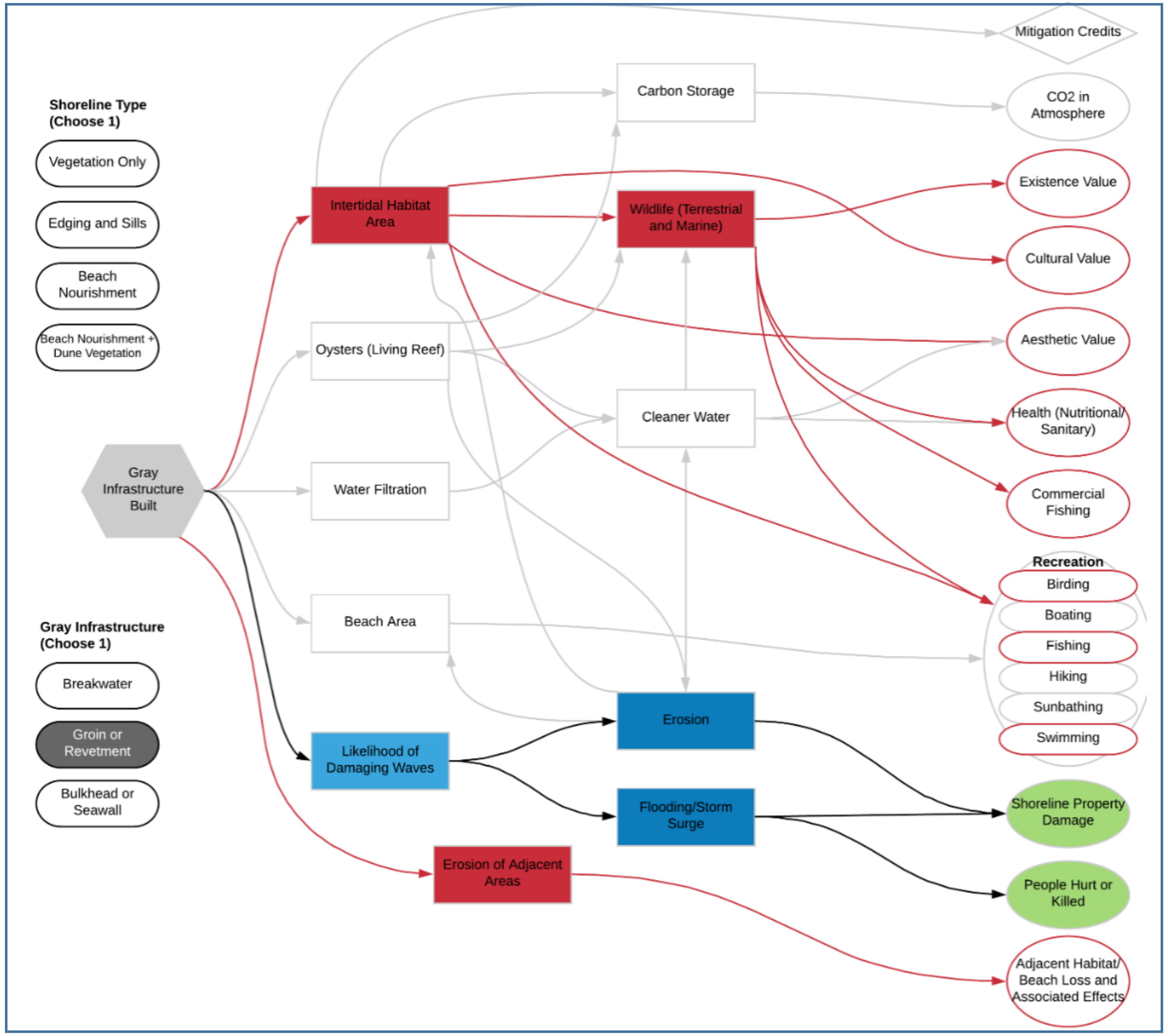
What is an ESCM?



Example: ESCMs for Green vs Gray shorelines





Types of Conceptual Models

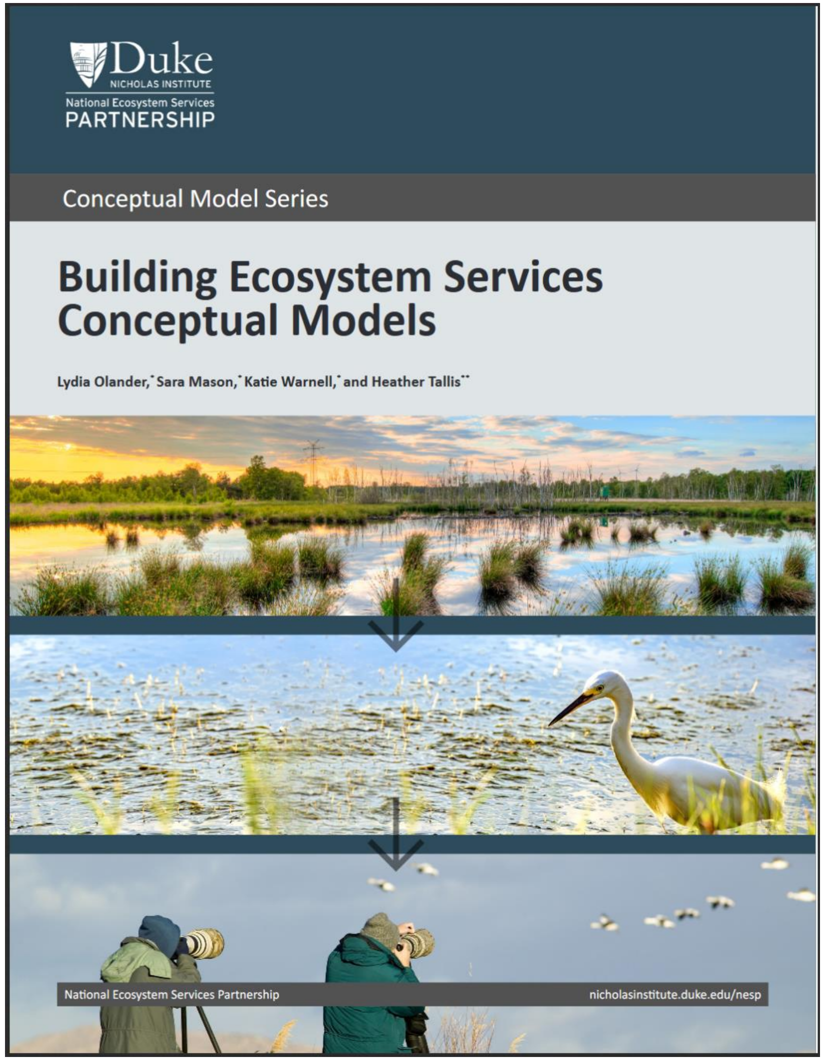
Types of Models	Characteristics	What it takes to make them
Exploratory	Preliminary, incomplete, unspecified	Quick initial sketch. Takes a few hours to a day, ideally with some input from experts, managers, and stakeholders or knowledge of the issues.
General	Complete, vetted, captures changes in generalized categories that represent a habitat or intervention type. (A parent model)	Few weeks to get sufficient expert input
Specified	Complete, vetted, captures specific outcomes (including species, recreational activities, etc…) that are specific to place and decision context (mostly likely to be used in decisions and to have quantifiable indicators associated)	Requires input from (or at a minimum knowledge of the priorities for a) wide range of stakeholders and beneficiaries as well as input from managers and experts.

Building evidence based ESCMs

1) Start with an exploratory or general model
2) Specify the model for your context
3) Clarify model assumptions
4) Build an evidence library
5) Assess the evidence
6) Map the strength of evidence

Add-ons:

- Developing common indicators
- Building a predictive model

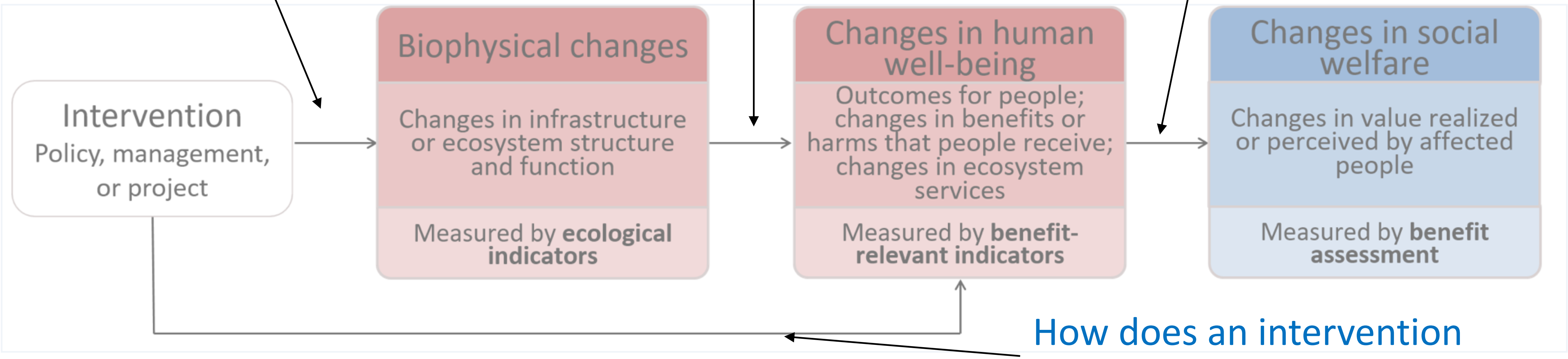


1. Four questions can help start the model building process

1.How does an intervention affect biophysical and ecological conditions?

2.How do changes in these conditions lead to changes in the delivery of ecosystem services to people who are using them, affected by them or appreciating them?

3.How do the changes in delivery of services affect the benefits or costs to individuals or groups?



How does an intervention directly affect people?

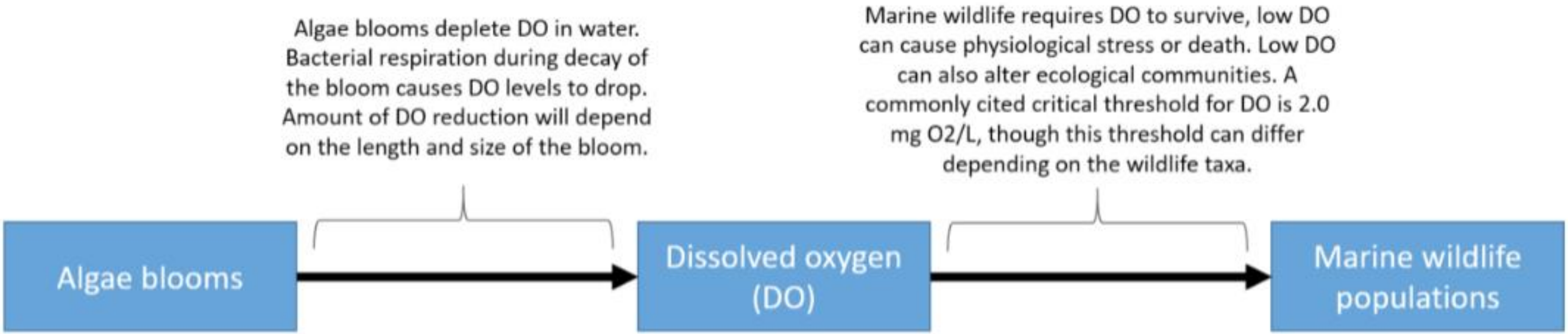
2. Specifying the models

Table 5. Illustrative questions to elicit specified outcomes and endpoints for a conceptual model for salt marsh restoration in San Francisco Bay

Ecosystem service/ social outcome	Details
Health impacts (water quality)	Health impacts could include illness from exposure to contaminated water by swimming or drinking. **Are these impacts important or relevant in San Francisco? Which contaminants introduce the greatest health risks? Are SF populations more vulnerable to certain contaminant risks because of other prevalent health conditions?**
Health impacts (dietary)	Health impacts could include nutritional changes based on changing fish/ shellfish populations and availability. **Which groups of people rely on fish/shellfish from SF Bay? What portion of their protein or micronutrient needs are met by local fish/shellfish? Do SF residents depending on wild local fish/ shellfish have access to dietary alternatives with similar nutritional qualities?**
Existence	Existence value represents the value that people place on the existence of elements of the ecosystem—for example, the marsh itself or specific species that use the marsh as habitat. Often endangered, threatened, or charismatic species have high existence value. **Which population's existence values do people care about capturing (local SF bay residents, U.S. residents, global residents)? Which species are most valued by the focal population? Which marsh characteristics are most valued?**

3.Articulating assumptions

Figure 5. Example of articulating model assumptions



4. Evidence Library

- Description of the relationship
- Summary of the evidence
- Confidence in the assumption given available evidence
- List of other factors that may result in variation (location, timing, external drivers, and so on)
- List of sources

Table 6. Illustrative evidence library entry describing the link between solar energy development and water use for solar energy installation on Bureau of Land Management lands

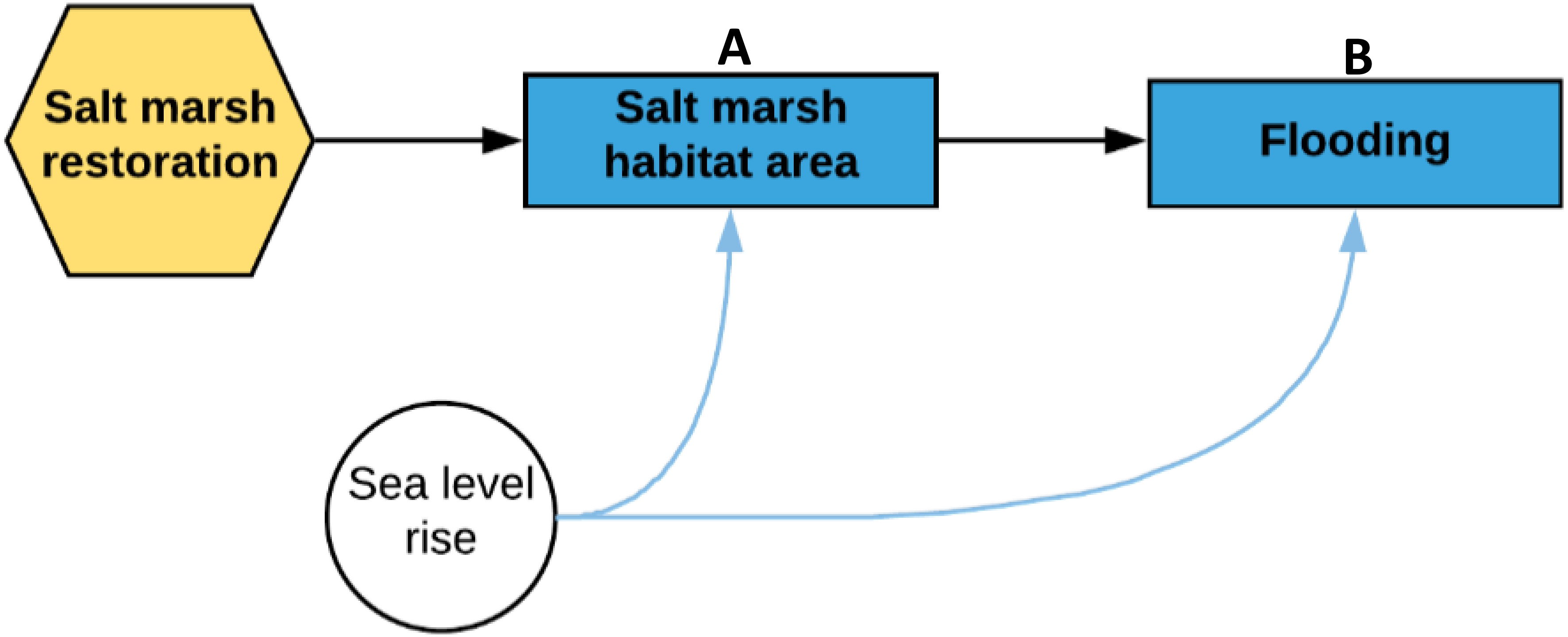
Evidence element	Example from solar energy development conceptual model
Link ID	10a: Solar energy development >> Water use
Description of relationship	Photovoltaic solar plants consume 11–226 gallons of water per MWh of electricity produced. This consumption includes water used to manufacture photovoltaic panels and for dust suppression during construction.
Summary of evidence	One meta-analysis harmonized lifecycle water consumption estimates for photovoltaic power plants and found the water consumption values listed above. It included 23 estimates of upstream (raw materials, manufacturing, construction, and transportation) and downstream (decommissioning) water consumption for crystalline silicon panels and 9 estimates of water consumption during operation.
Strength of evidence	Fair: The meta-analysis of water consumption by solar energy facilities was constrained by the number of studies available, and the included water consumption estimates ranged over an order of magnitude. This analysis did not account for site-specific factors including climate that may influence water consumption.
Other factors	The amount of water required for manufacturing photovoltaic panels varies by specific panel technology; for example, cadmium telluride panels require less water to produce than crystalline silicon panels.
Sources	Meldrum, J., S. Nettles-Anderson, G. Heath, and J. Macknick. 2013. "Life Cycle Water Use for Electricity Generation: A Review and Harmonization of Literature Estimates." *Environmental Research Letters* 8. stacks.iop.org/ERL/8/015031. Sinha, P. 2013. "Life Cycle Materials and Water Management for CdTe Photovoltaics." *Solar Energy Materials and Solar Cells* 119: 271–275. https://doi.org/10.1016/j.solmat.2013.08.022.

5. Evidence Assessment Matrix

	Criteria			
Confidence level	**Types of evidence**	**Consistency of results**	**Methods**	**Applicability**
High	Multiple	Direction and magnitude of effects are consistent across sources, types of evidence, and contexts	Well documented and accepted	High
Moderate	Several	Some consistency	Some documentation, not fully accepted	Some
Fair	A few	Limited consistency	Limited documentation, emerging methods	Limited
Low	Limited, extrapolations	Inconsistent	Poor documentation or untested	Limited to none
None	None	Not applicable	Not applicable	Not applicable

Source: Adapted from Bridge Collaborative strength of evidence template.

External factors



6. Strength of Evidence Map

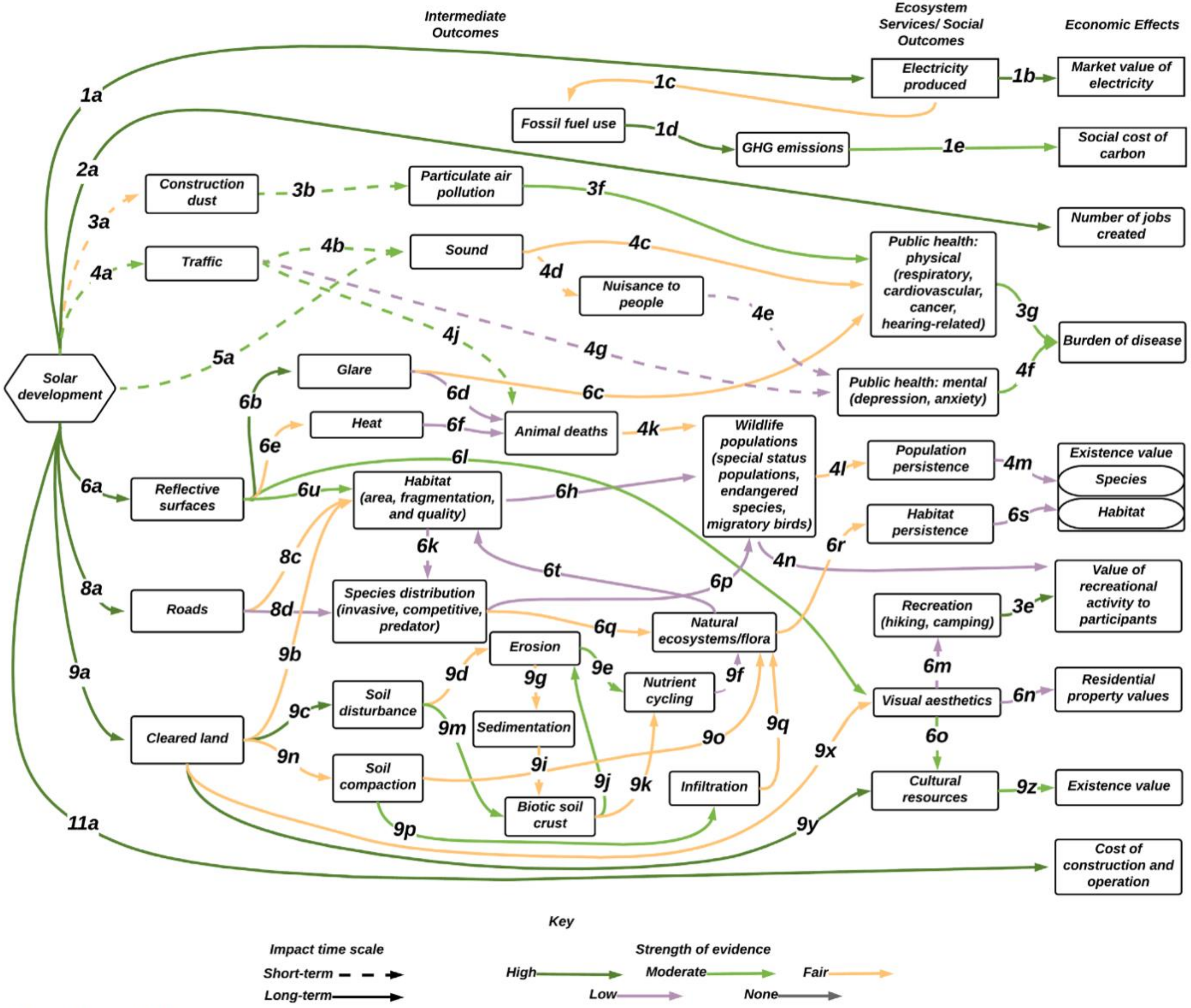
GREEN – high

YELLOW - Fair

PURPLE – Low or None

-----> Short-term

⟶ Long-term



Indicators

Ecosystem services or social benefit	Indicator (benefit-relevant or monetary)
Health impacts	Numbers of households exposed to water-borne disease Number of hospitalizations resulting from forest fire smoke each year
Commercial fishing	Increase in commercial fishing revenues ($) Avoided number of days of shellfish bed closures (acre/day)
Recreation	Numbers of anglers visiting Distance people are willing to travel to recreate ($)
Existence	Willingness to pay for the existence of certain species or habitat ($) Number of books, art, or literature tied to a specific species or place
Flooding	Likelihood of flooding each year (likelihood/number of properties) Days of disruption due the closure of critical services
Education/research	Number of people participating in educational events Use of related science by other people

Time and Expertise Required

Task	Time	Expertise
Exploratory Model	**1 hour to 1 day**	Familiarity with ES and conceptual models
Refined Model (general or specified)	**1 to 2 weeks** for articulation of assumptions and expert review	Same as above
Identifying socio-economic indicators/metrics	Part of **initial 1 hr – 1 day** session	
Assessing indicator/metric feasibility	**0.5-6 months full time**	Familiarity with socio-economic measures and local monitoring
Initial evidence library and evidence assessment	**6 weeks full time** for new one **3 weeks or fewer** for adapting	Experience with literature review and gathering expert input, understanding of ecosystems, and ecosystem services

How ESCMs can help with implementation

- Get stakeholders and experts on the same page.
- Provide an intuitive entry point for those new to considering ecosystem services
- Capture priorities and link them to interventions in a transparent and systematic way.
- Make sure there are no critical outcomes/impacts that are missing from consideration.
- Provide an evidence-based qualitative assessment of ecosystem services implications of interventions.
- Provide a common foundation of best available science to reduce time and expertise needed for use and to reduce duplication of effort.
- Identify critical information gaps that generate significant uncertainty for decision makers, and pinpoint crucial research/monitoring needs.
- Identify a subset of socio-economic metrics that best capture important ecosystem service outcomes.
- Provide consistency in services assessed, evidence considered, and metrics selected.
- Provide a consistent and credible foundation for qualitative assessments, quantitative assessments, or monetary or non-monetary valuation where such methods are desired

Using ESCMs to support implementation: Reference Model and Library

Example: USFS forest management actions

Goal	Actions
Fire risk reduction (frequency, severity)	Thinning, prescribed burns, chemical treatment
Wildlife support	Habitat restoration, road removal, fire management
Timber production	Harvest, thinning, replanting
Drinking water provision	Fire suppression, riparian zone management, thinning to reduce evapotranspiration
Healthy forest system	Invasive species and pest management
Increase recreational opportunities	Improving access (paths, docks), viewsheds, or siting opportunities

Olander, Lydia P., Dean Urban, Robert J. Johnston, George Van Houtven, and James Kagan. 2016.
“Proposal for Increasing Consistency When Incorporating Ecosystem Services into Decision Making.”
National Ecosystem Services Partnership Policy Brief 16-01

Large Scale Solar Installation for BLM

BLM Solar Energy Program

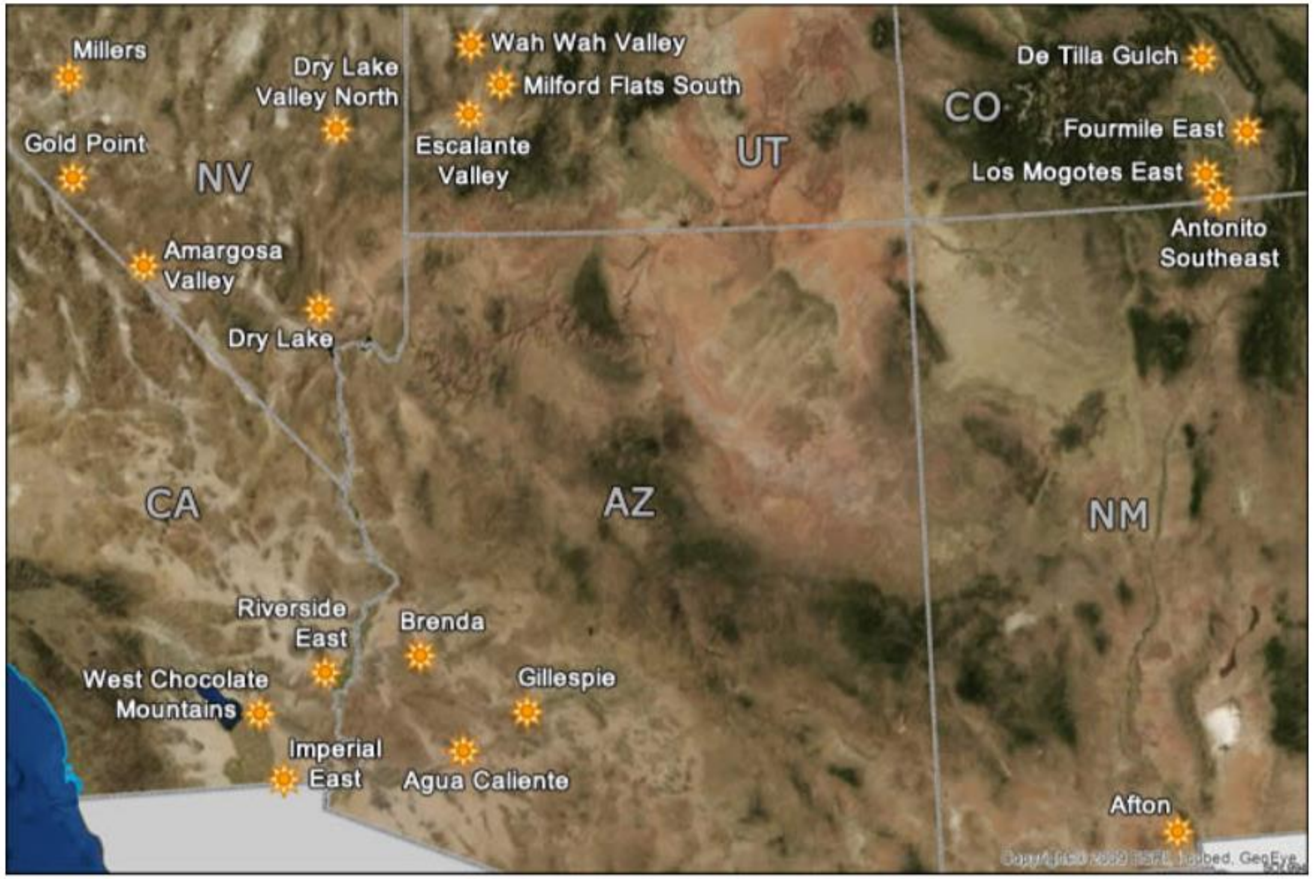
Purpose:

- Facilitate utility-scale solar energy development on suitable BLM lands
- Minimize the ecological and social impacts of solar energy development

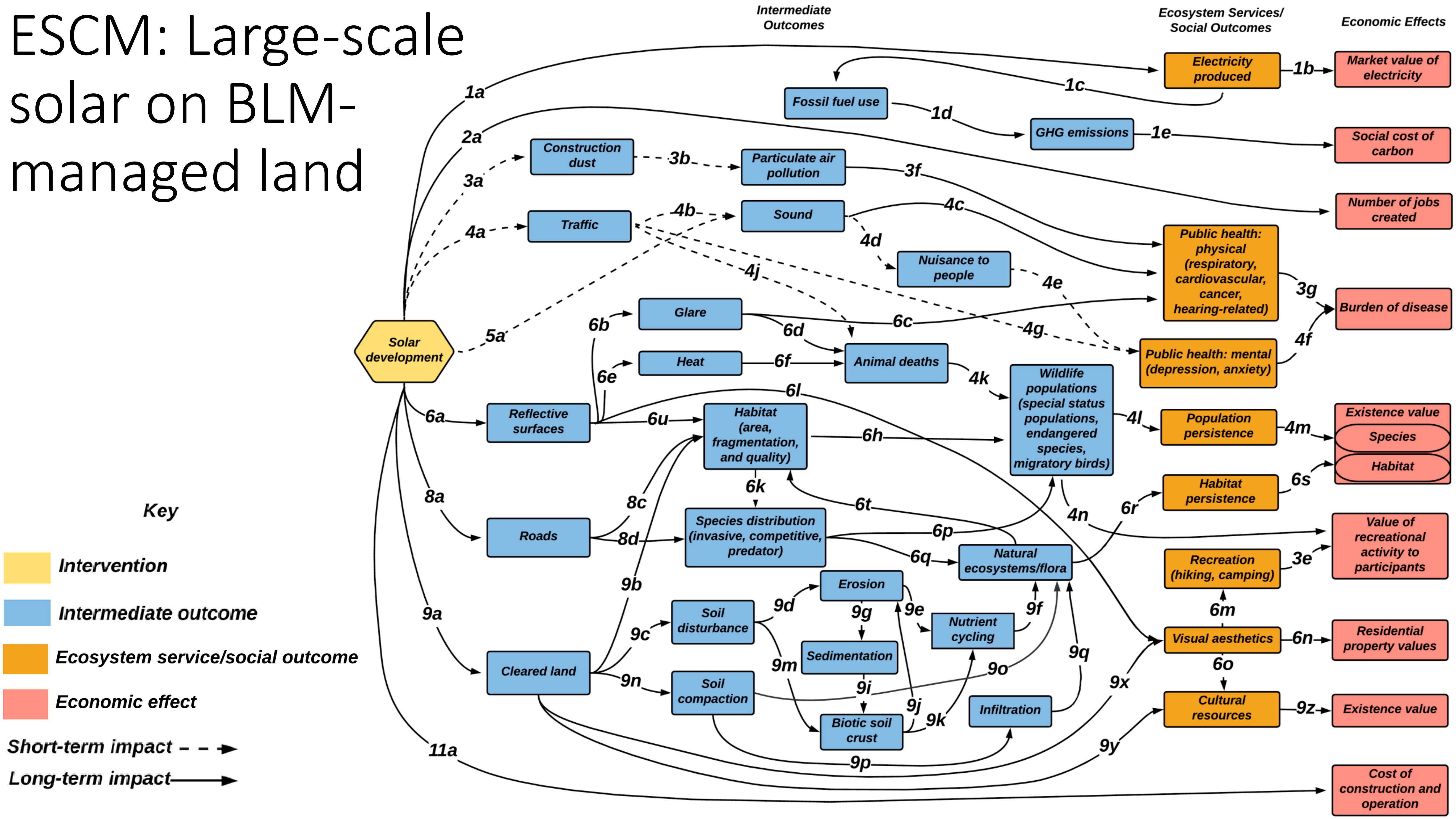
Solar Energy Zones:

- Areas of high solar energy potential where ecological and social impacts will be relatively low
- Project authorization is streamlined, but a site-specific environmental assessment is required

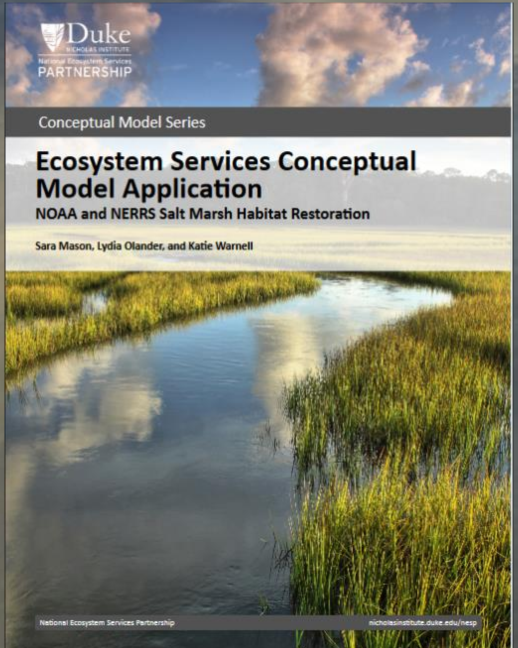
Solar Energy Zones (SEZs)



ESCM: Large-scale solar on BLM-managed land



NOAA and NERRS Salt Marsh Habitat Restoration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Conceptual Model Series

Ecosystem Services Conceptual Model Application

NOAA and NERRS Salt Marsh Habitat Restoration

Sara Mason, Lydia Olander, and Katie Warnell

National Ecosystem Services Partnership

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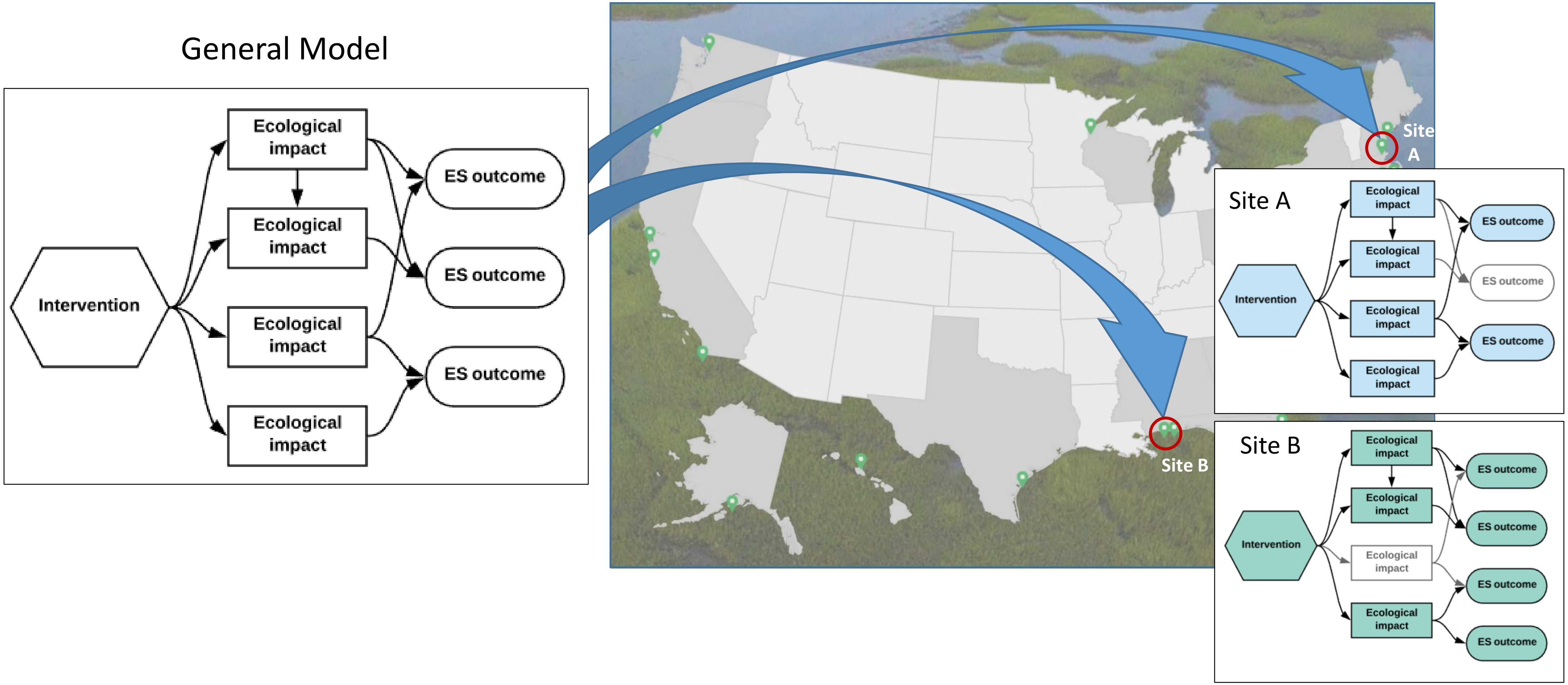
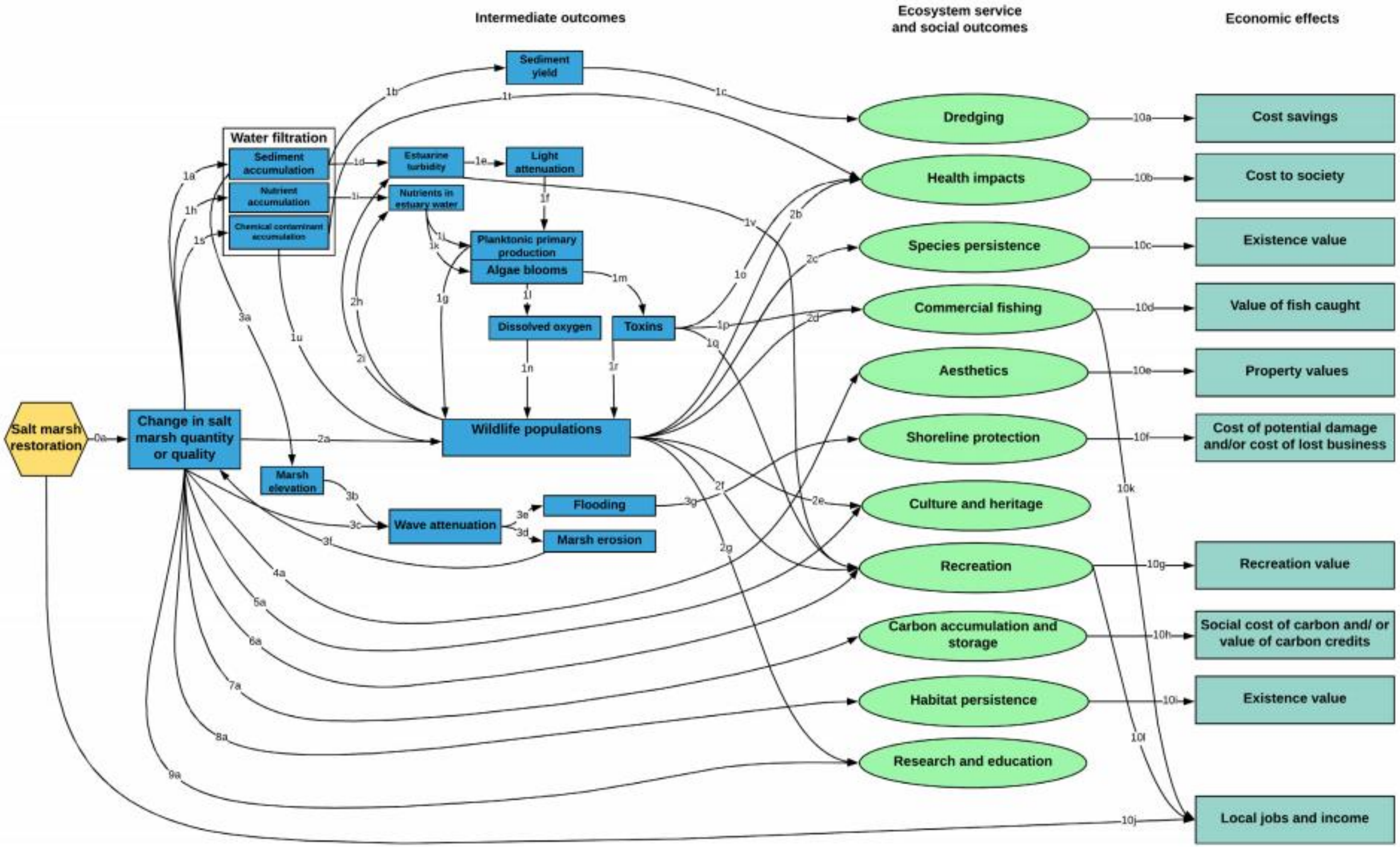
General Model

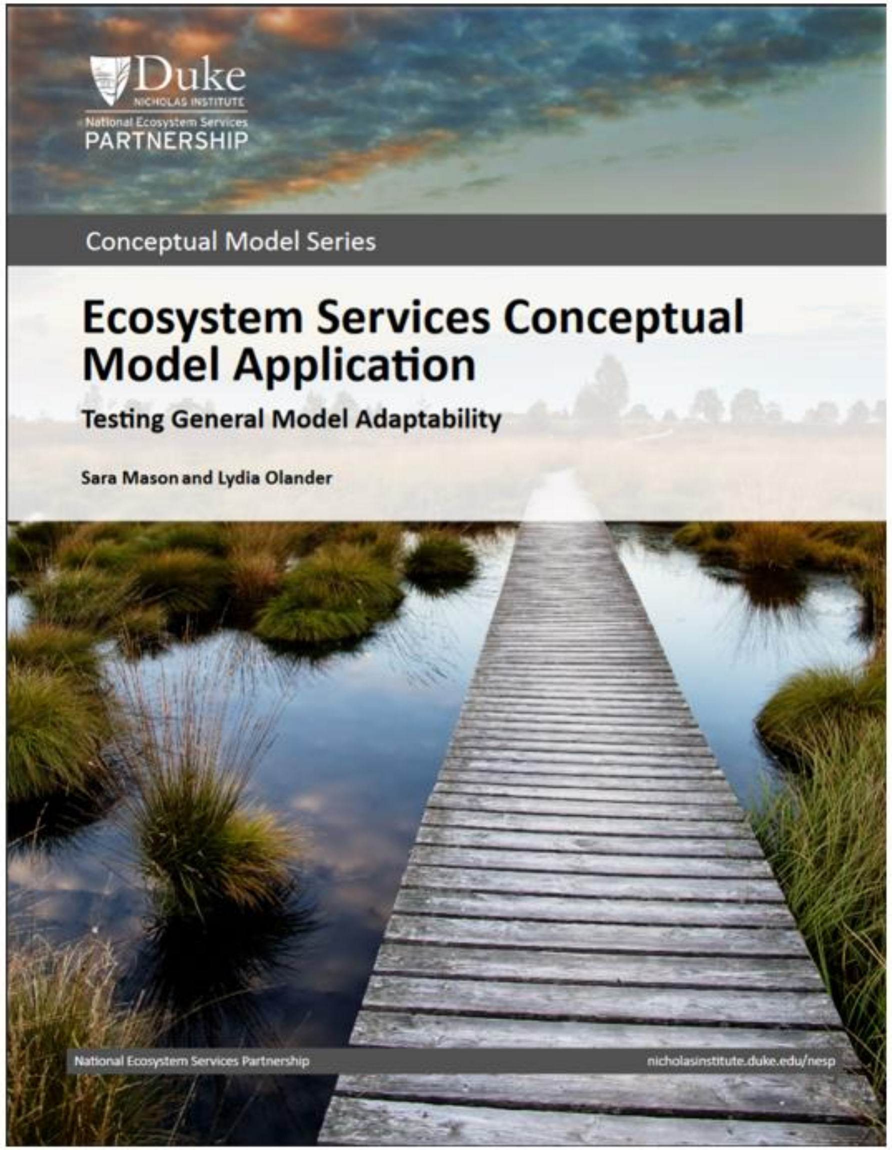


Map source: https://coast.noaa.gov/nerrs/.



Intermediate outcomes
Ecosystem service and social outcomes
Economic effects
Salt marsh restoration
Change in salt marsh quantity or quality
Water filtration
Sediment accumulation
Nutrient accumulation
Chemical contaminant accumulation
Sediment yield
Estuarine turbidity
Light attenuation
Nutrients in estuary water
Planktonic primary production
Algae blooms
Dissolved oxygen
Toxins
Wildlife populations
Marsh elevation
Wave attenuation
Flooding
Marsh erosion
Dredging
Health impacts
Species persistence
Commercial fishing
Aesthetics
Shoreline protection
Culture and heritage
Recreation
Carbon accumulation and storage
Habitat persistence
Research and education
Cost savings
Cost to society
Existence value
Value of fish caught
Property values
Cost of potential damage and/or cost of lost business
Recreation value
Social cost of carbon and/ or value of carbon credits
Existence value
Local jobs and income

General Model Adaptability



New Applications of ESCMs

Gulf of Mexico (RESTORE, NRDA)	Indicators	Oyster reef restoration
NOAA National Estuary Research Reserves	Indicators	Oyster reef restoration Salt marsh restoration Mangrove restoration
Department of Defense	Predictive Model	ES provided by military bases; ES provision of lands surrounding bases
US Forest Service	Predictive Model	How forest management activities affect ES provision

Discussion: How agencies think ESCMs could be helpful for implementation.

Pete Wiley (NOAA), Rebecca Moore (BLM), Frank Casey (USGS)

Questions?

ESCM series https://nicholasinstitute.duke.edu/conceptual-model-series

Contact: Lydia.olander@duke.edu

https://nespguidebook.com/

If you are interested in joining the NESP e-mail list, please e-mail ***nesp@duke.edu****.*

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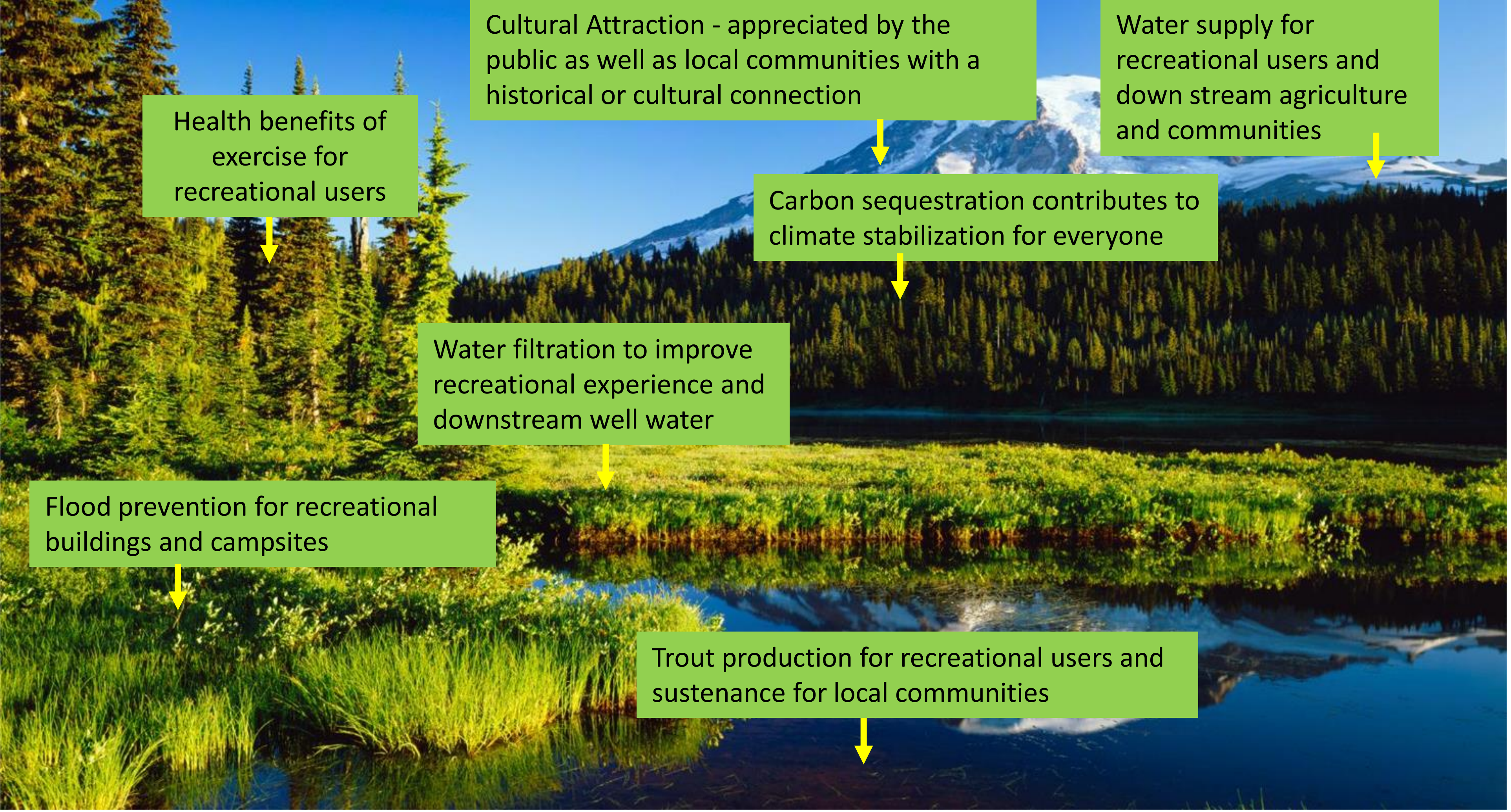
National Ecosystem Services PARTNERSHIP

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.

- NESP Community of Practice (email list)
- Quarterly newsletter
- Webinars
- FRMES Online guidebook
- Best Practice Guidance & Workshops
- Engaged Expert Network

https://nicholasinstitute.duke.edu/focal-areas/national-ecosystem-services-partnership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Box 2. Principles for Collaboration

Use evidence to inform decisions.
By learning from evidence of what has and has not worked in the past, decision makers can make faster progress, cut costs, and avoid failures and backtracking.

Act now and learn by doing.
Acknowledge that progress can be made now even in the absence of complete understanding, evidence, or political or social alignment. Encourage flexibility and intentional learning along the way to improve actions and impact.

Seek and respect other perspectives.
Believe and act as if goals for one type of objective (e.g., economic) may be met more effectively, efficiently, or sustainably by embracing ideas, interventions, approaches, or concepts from other areas (e.g., conservation).

Be intentional about inclusion.
Use established tools for including and empowering under-represented groups.

Strive to do no harm.
Seek out and circumvent potential harmful outcomes, strive for positive outcomes that do not come at the expense of negative outcomes for other sectors (economic, health, environment), other groups, or future generations. When trade-offs occur, make efforts to minimize and mitigate negative outcomes.

Share information.
Share data, frameworks, and concepts quickly, openly, and transparently.

Source: Adapted from the Bridge Collaborative (Tallis et al. 2017).