

Identification & Valuation of Ecosystem Service in Public Sectors' Impact Assessment

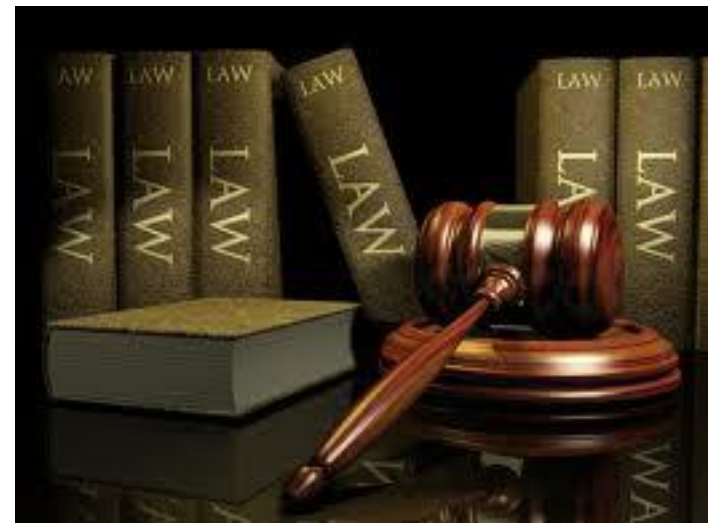
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Impact Assessment in Public Sectors

- Environmental Impact Assessment is practiced by governmental agencies in many countries
 - An anticipatory tool
 - Identify, evaluate and mitigate the environmental/social/economic effects of proposed projects

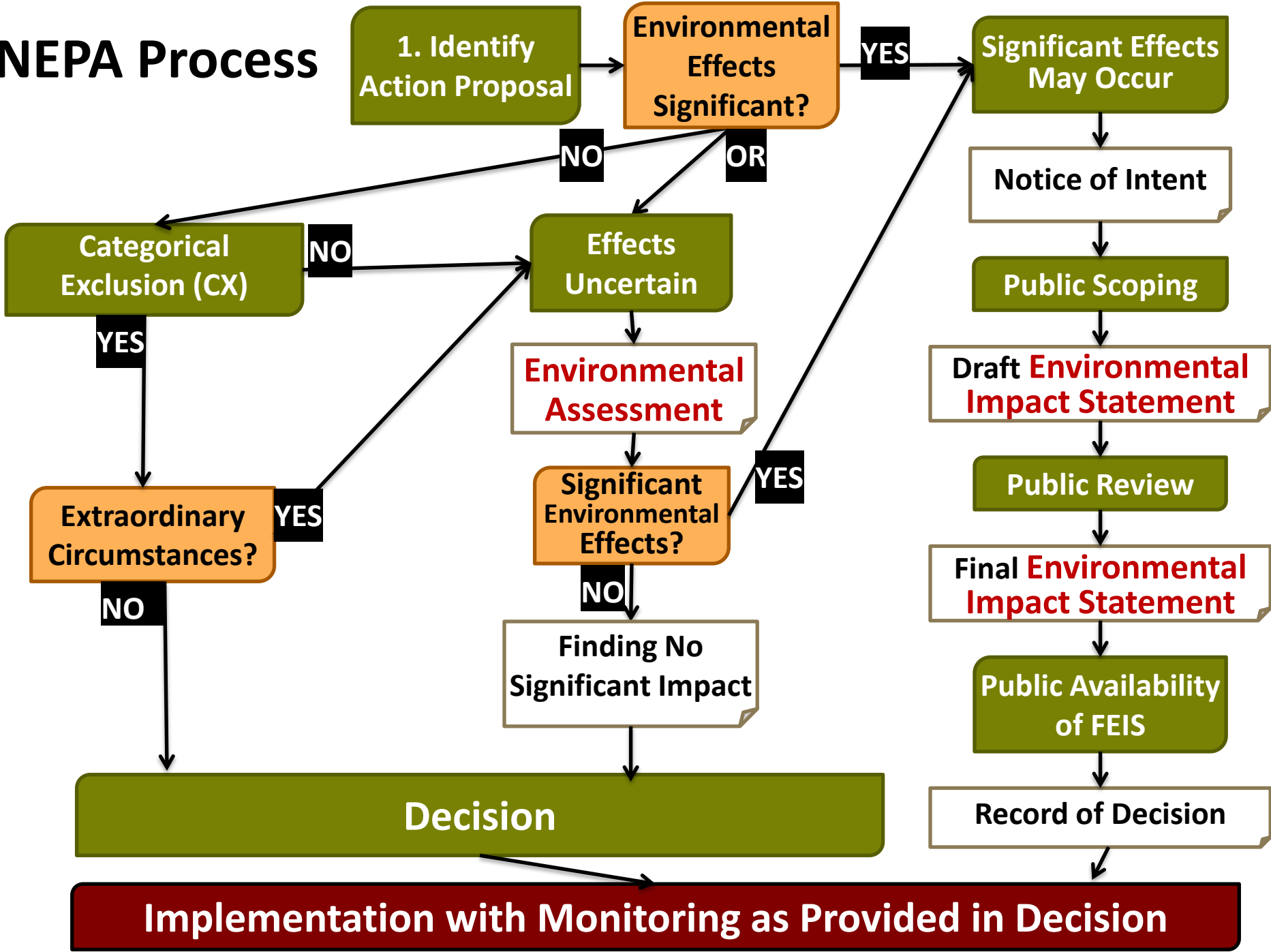
- Public sectors' impact assessment is often mandated and regulated by legislation.



United States' National Environmental Policy Act

- **National Environmental Policy Act (NEPA)** is signed into law by President Nixon in 1970.
- **Objective:** ensure federal agencies to appropriately consider environmental factors along with economic, social and technical factors in their decision making process.
- **President's Council** on Environmental Quality (CEQ) set overarching standard for NEPA compliance.
- **Federal agencies** are required to create their own NEPA implementing procedures.

NEPA Process



“Ecosystem Services” in NEPA

- **President's Council on Environmental Quality:**
 - “Ecosystem services” is not incorporated.
 - Requires descriptions of biophysical resources and their alternation due to proposed action.
 - Recommended (but not required) agencies to incorporate “biodiversity” in impact assessment in 1993.

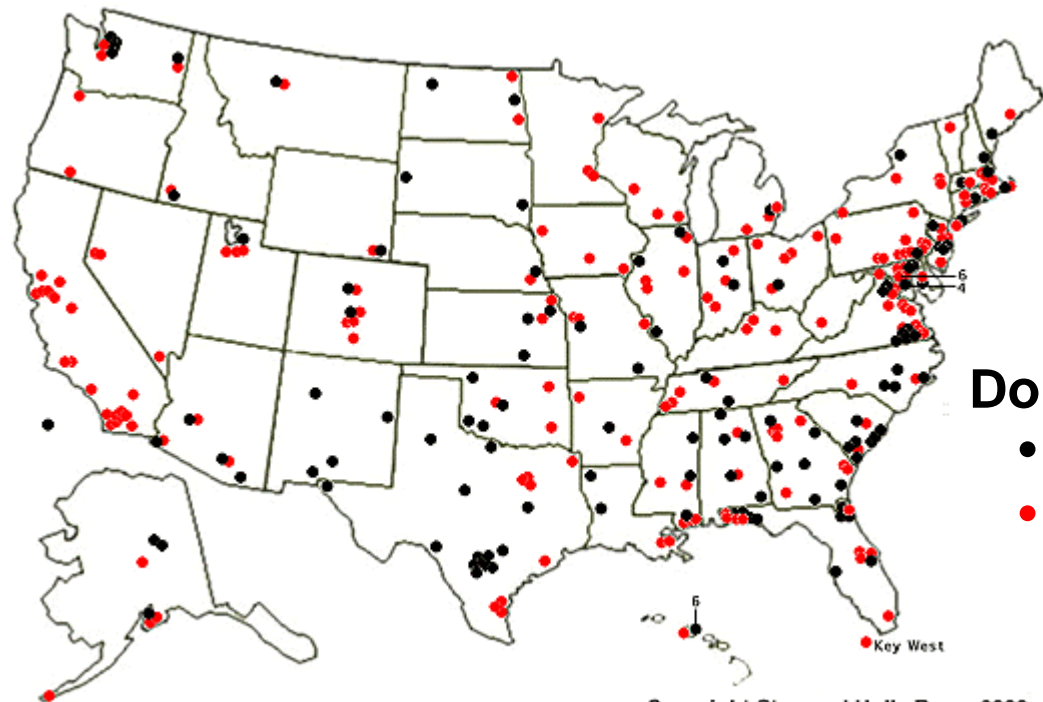
“Ecosystem Services” in NEPA

- **Federal Agencies:**

- Most agencies do not directly incorporate “ecosystem services” evaluation into NEPA guidance.
- Some analyze impact on **ecological functions and process**, such as water filtration or soil retention.
- EPA’s 1999 guidance on ecological processes describes ecological functions and **services**, such as “hydrologic patterns, nutrient cycling, and purification services”.
- **Economic value** of ecosystem services has not been assessed.

U.S. Dept of Defense (DoD) Example

- Third largest federal land managing agency (1% lands)
- Hosts a wide range of well preserved ecosystems
- Disproportionate number of the sensitive species



DoD bases

• Major

• Minor

Ecosystem Service Valuation at DoD sites



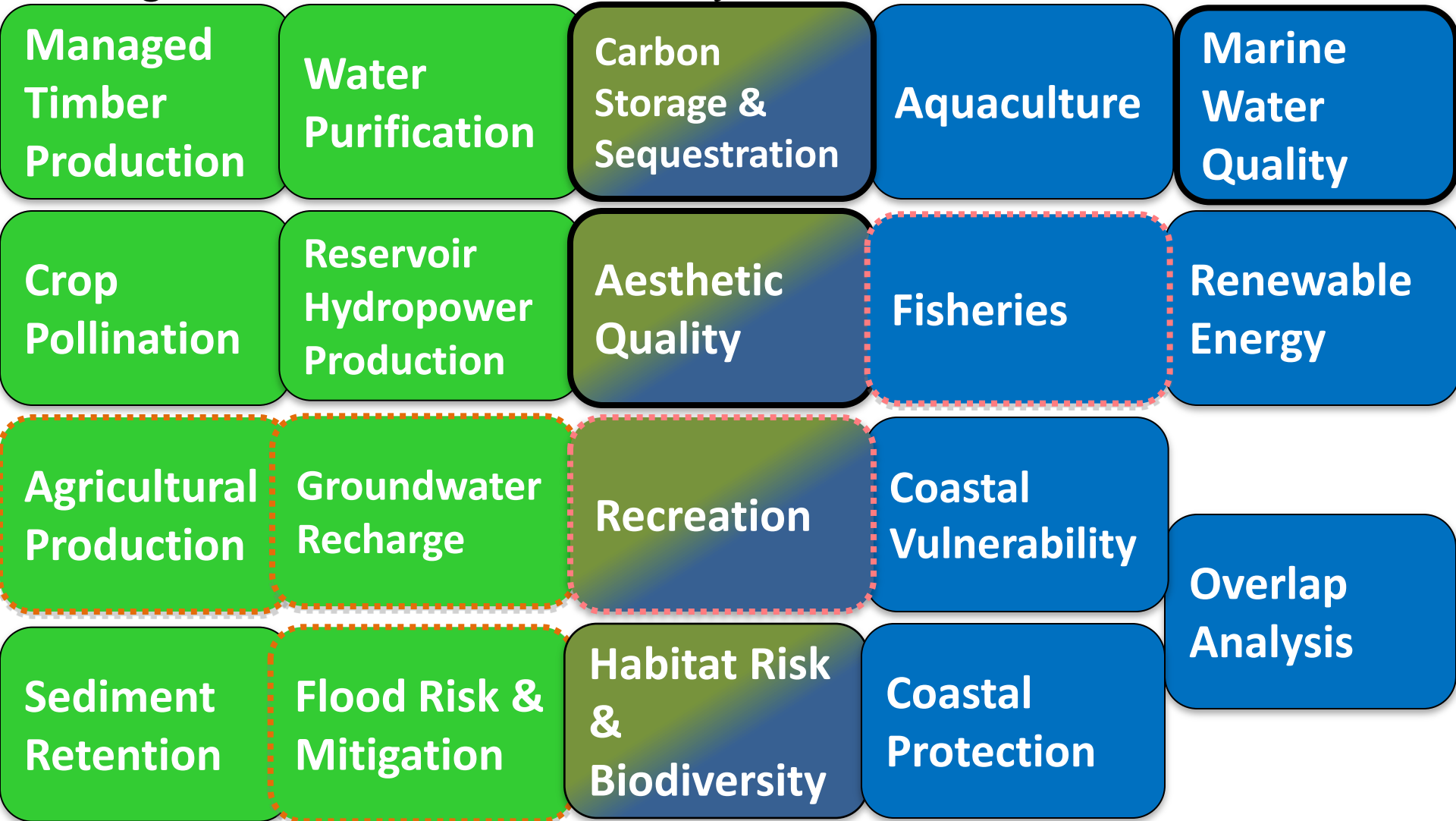
- Apply a GIS-based modeling tool set, **Integrated Valuation of Environmental Services and Tradeoffs (InVEST)** at three army bases.
- Model and map the provision and value of ecosystem services under alternative scenarios.
- Illuminate the tradeoffs and broader policy implications of land-management decisions (including **NEPA process**).

Natural Capital Project



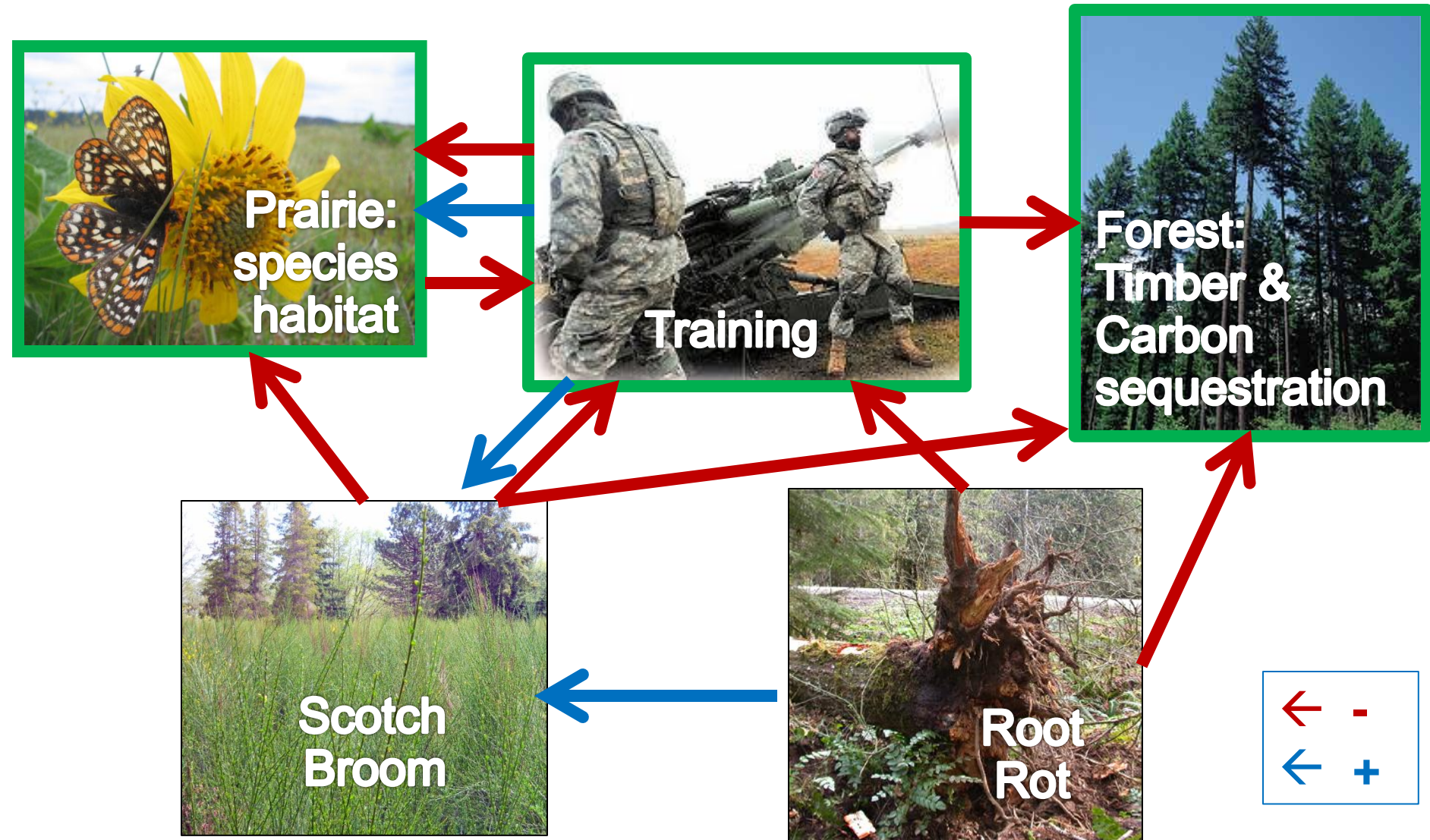
InVEST models:

Integrated Valuation of Ecosystem Services and Tradeoffs



Model coming soon!

Dynamics of ecosystem management at Fort Lewis, WA



Develop scenarios

Looking forward 20 years (2010-2030) – 5 scenarios

Increased

Training

Troop
number

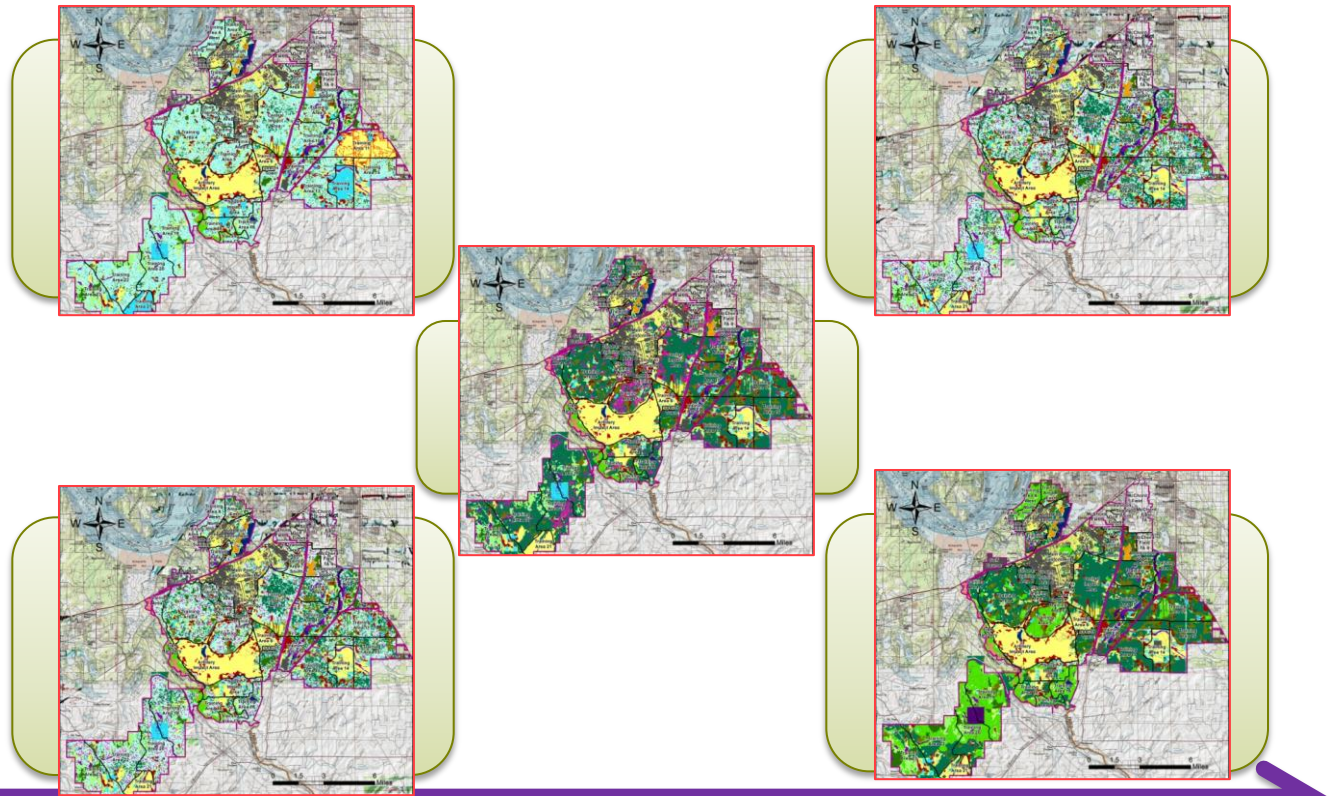
Training
intensity

Decreased

Low

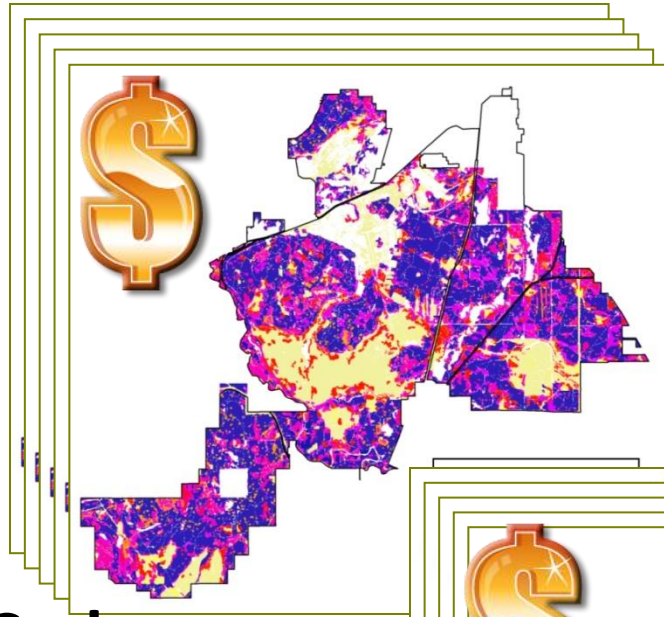
Budget

High

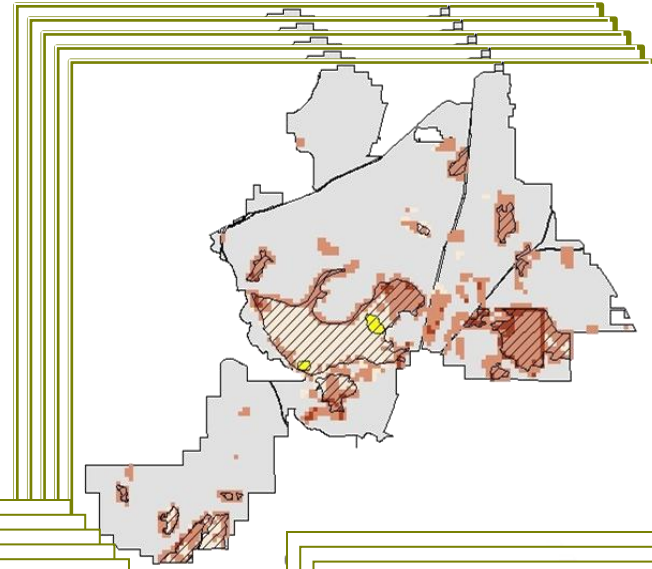


Invasive species expansion
On- and off-base restoration
Areas without training restriction

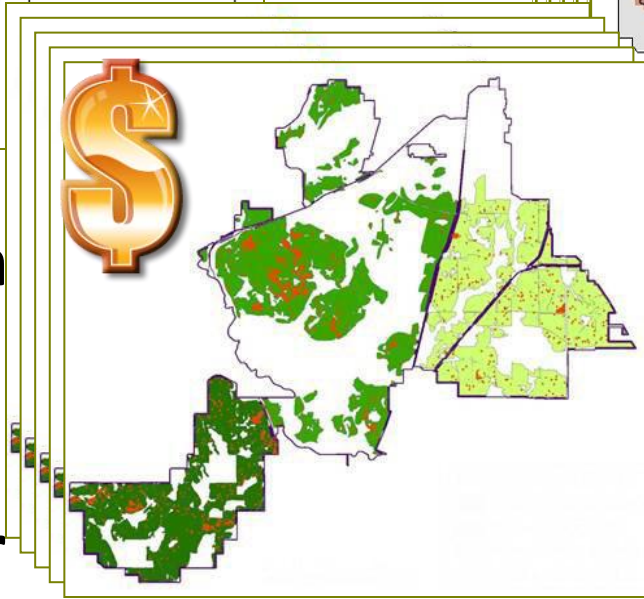
Individual Model Outputs



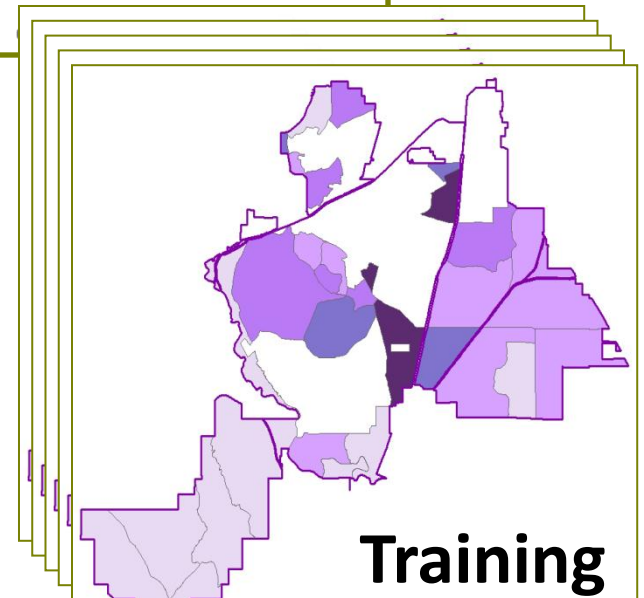
**Carbon
Sequestration**



**Species
Habitat**



**Timber
Production**

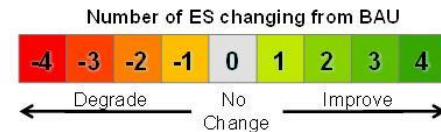
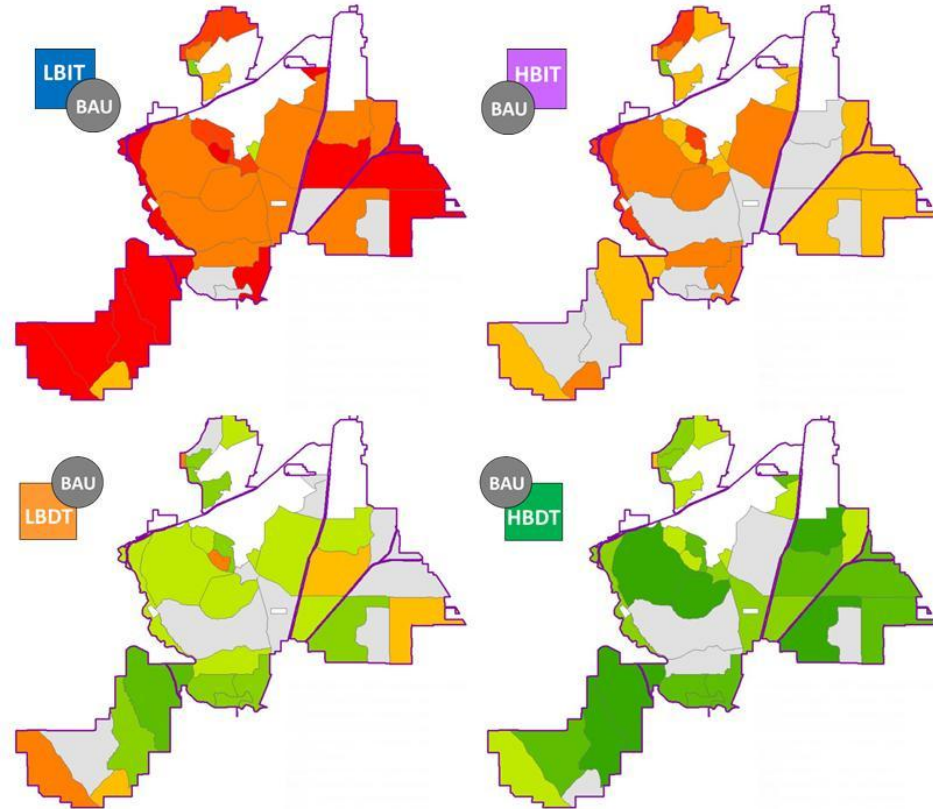
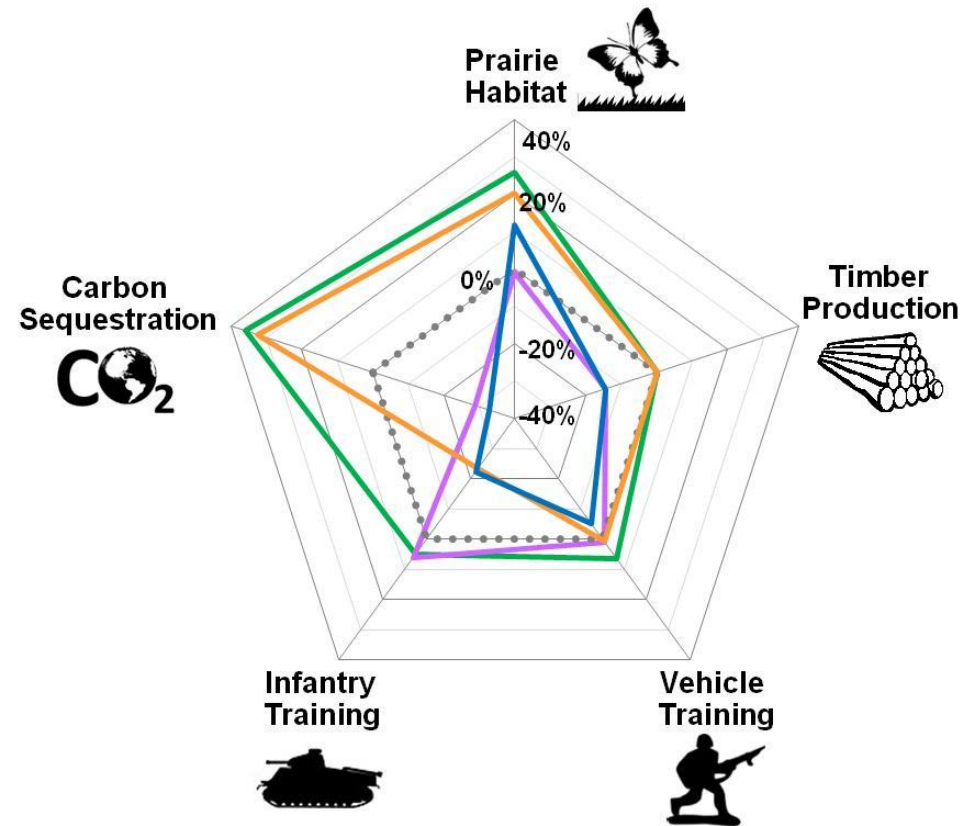


Training

Multi-service Outputs

Aggregate Trade-off

Spatial overlap analysis



DoD NEPA Process

1) Scoping

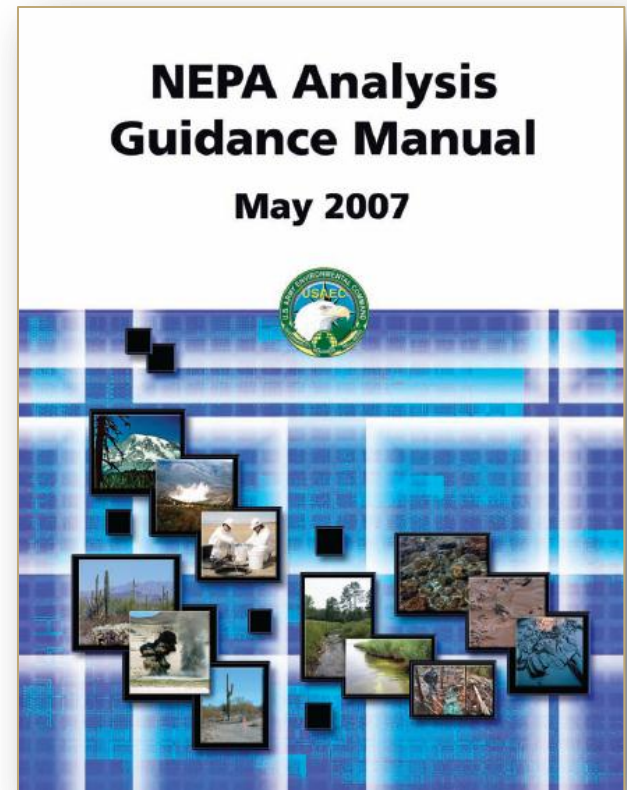
- Define assessment **goals**
- Establish analysis **geographic** scope and **time** frame

2) Describing Affected Environment

- Identify and characterize **Valued Environmental Components (VECs)**, and responses to environmental changes

3) Determining Consequences

- Define **baseline** condition for the VECs.
- Identify important **cause-effect relationships** b/t activities and VECs.
- Determine **cumulative effects.**
- Modify **alternatives to avoid/ minimize/ mitigate** significant cumulative effects.
- **Monitor** cumulative effects



Valued Environmental Components (VECs)

- Definition: Resources important for a specific region
- Focus on **local/regional resources** rather than “action-impact” approach

Regulating Services

Air Quality	Soil Erosion
Airspace Resource	Water Resource
Noise Effect	Wetland Resource

Provisioning Services

Energy Demand

Cultural Services

Cultural Resources

Biodiversity

Threatened/ endangered Species

Informed Decisions

Land Use Conflict/ Compatibilities
Socio-economics
Traffic / Transportation
Facilities
Hazardous materials

Cumulative Effect Analysis (CEA)

- **Cumulative effect:**

“While specific direct or indirect environmental effects may not be significant by themselves, the **minor effects can accumulate over time** and degrade important resources.”

→ Emphasize broadened geographic and temporal consequence

- **An integrated ecosystem service approach with alternative scenarios would contribute by:**
 - Identifying long-term ecosystem benefits/losses
 - Defining boundary of beneficiaries
 - Supporting multi-services overlap assessment

Advantages of ES valuation



- **Evaluate competing land uses in benefit-cost analysis**

Training
Facility

VS.

Forest
(timber production, carbon, habitat)

- **Develop off-site mitigation strategies**

- Off-site replacement/substitution (same service)
- Off-site off-kind service
(different service, equal or greater total benefits)
- In-lieu fees for mitigation taken by others
- ✓ No monetary value is needed if complete mitigation is achieved for original beneficiaries

Servicesheds

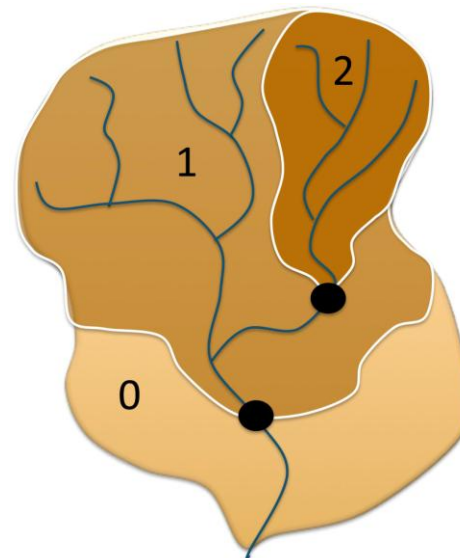
Serviceshed: area with potential to provide a service to a specific beneficiary

- Supply
- Physical access
- Institutional access

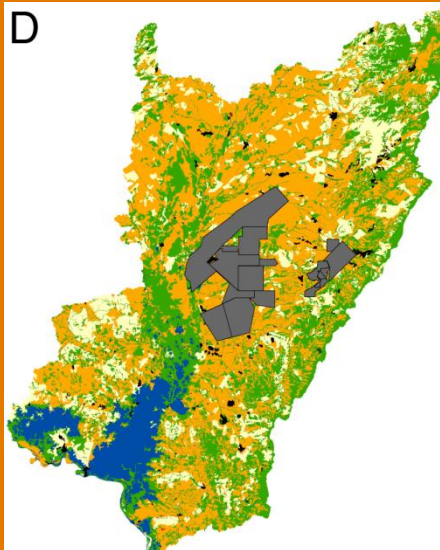
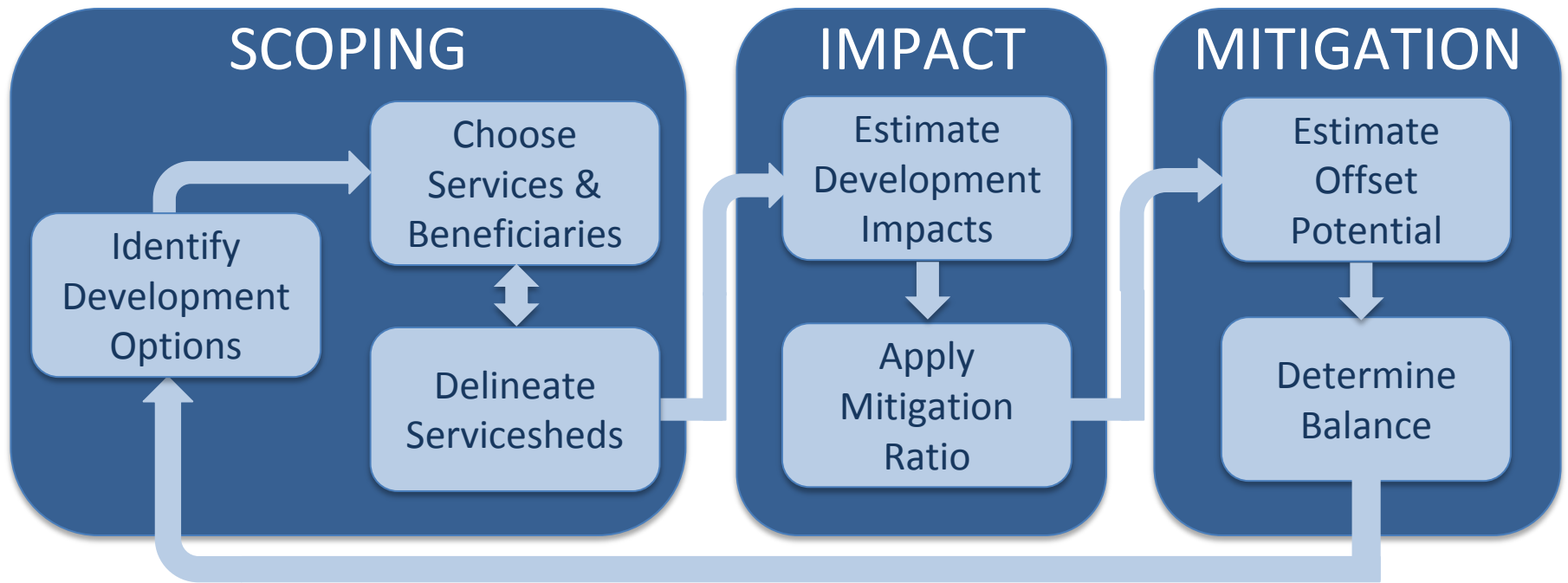
Carbon



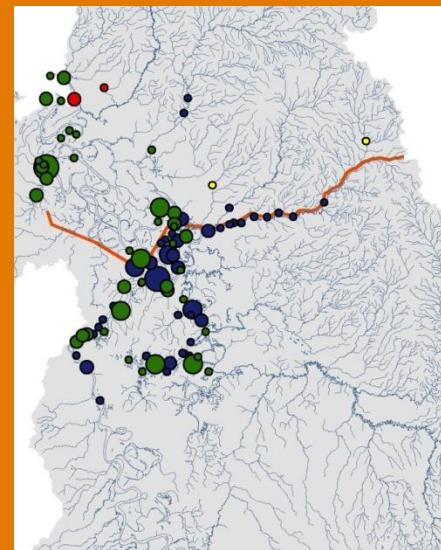
Water



ES Impact Assessment



Case 1:
Mine
Permitting in
Colombia



Case 2:
Road
Permitting in
Peru

Case 1: Colombia Mining permitting

Identify Development Options

Choose Services and Beneficiaries

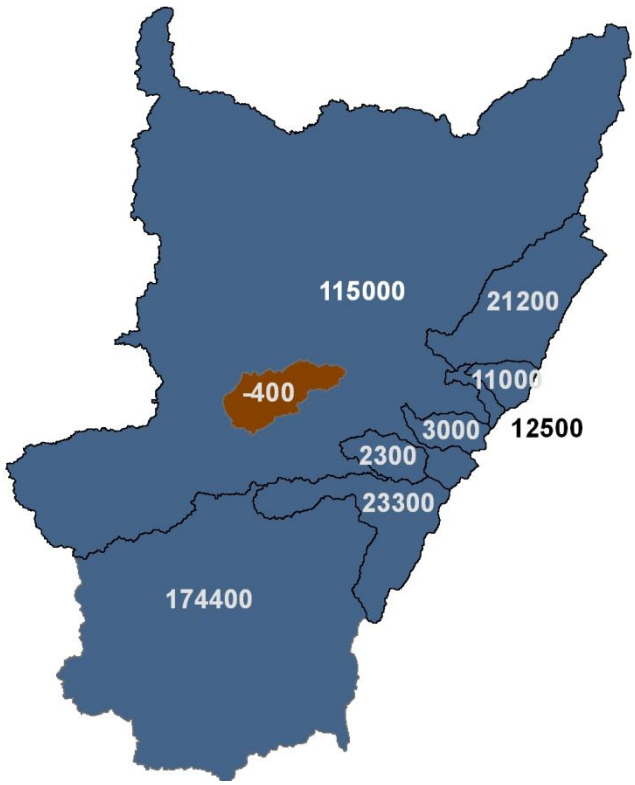
Delineate Servicesheds



Assess Development Impacts

Apply Mitigation Ratio

Assess Offset Potential

Determine Balance (potential for "no net loss")



 Mitigation NOT Achieved
 Mitigation Achieved

**Same benefits to same people

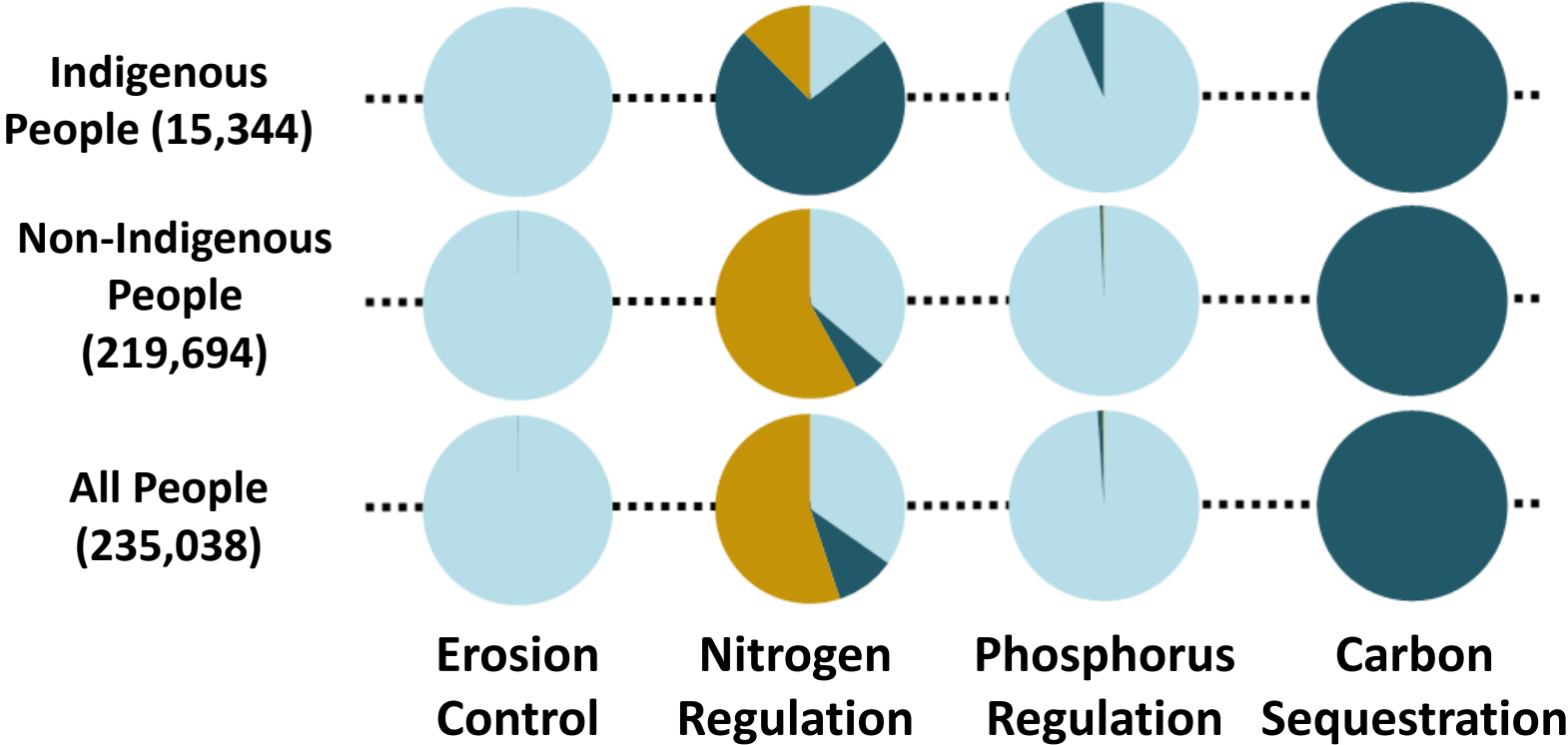
Case 2: Peru road permitting

SCOPING

IMPACT

MITIGATION

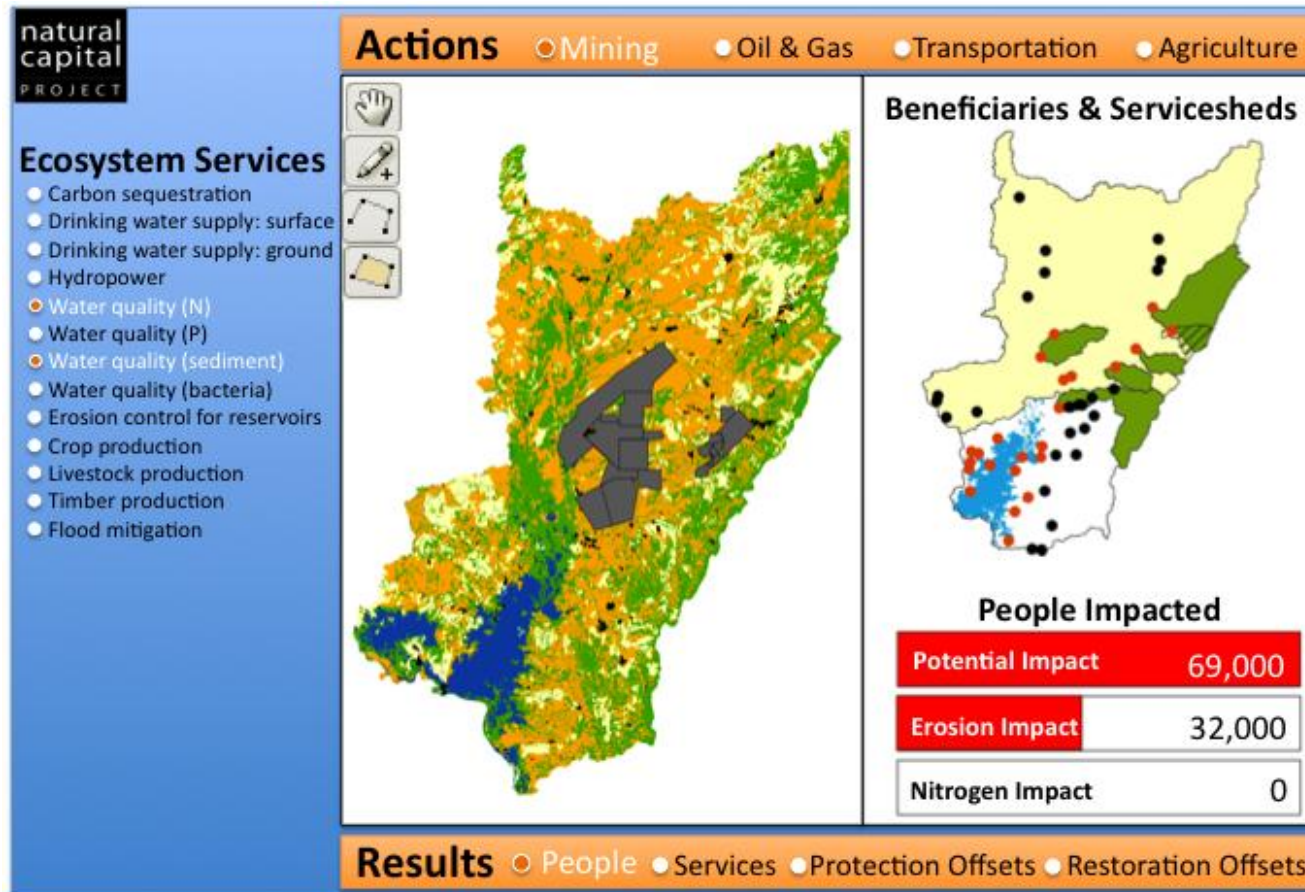
Mitigation effect



Legend:
 Light blue: Not impacted by road
 Dark teal: No net loss
 Gold: Net loss of service

Online permitting tool (under development)

- Serviced approach allows us to account for distributional effects of development
- Complementary to existing biodiversity impact mitigation approaches



Thanks!

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