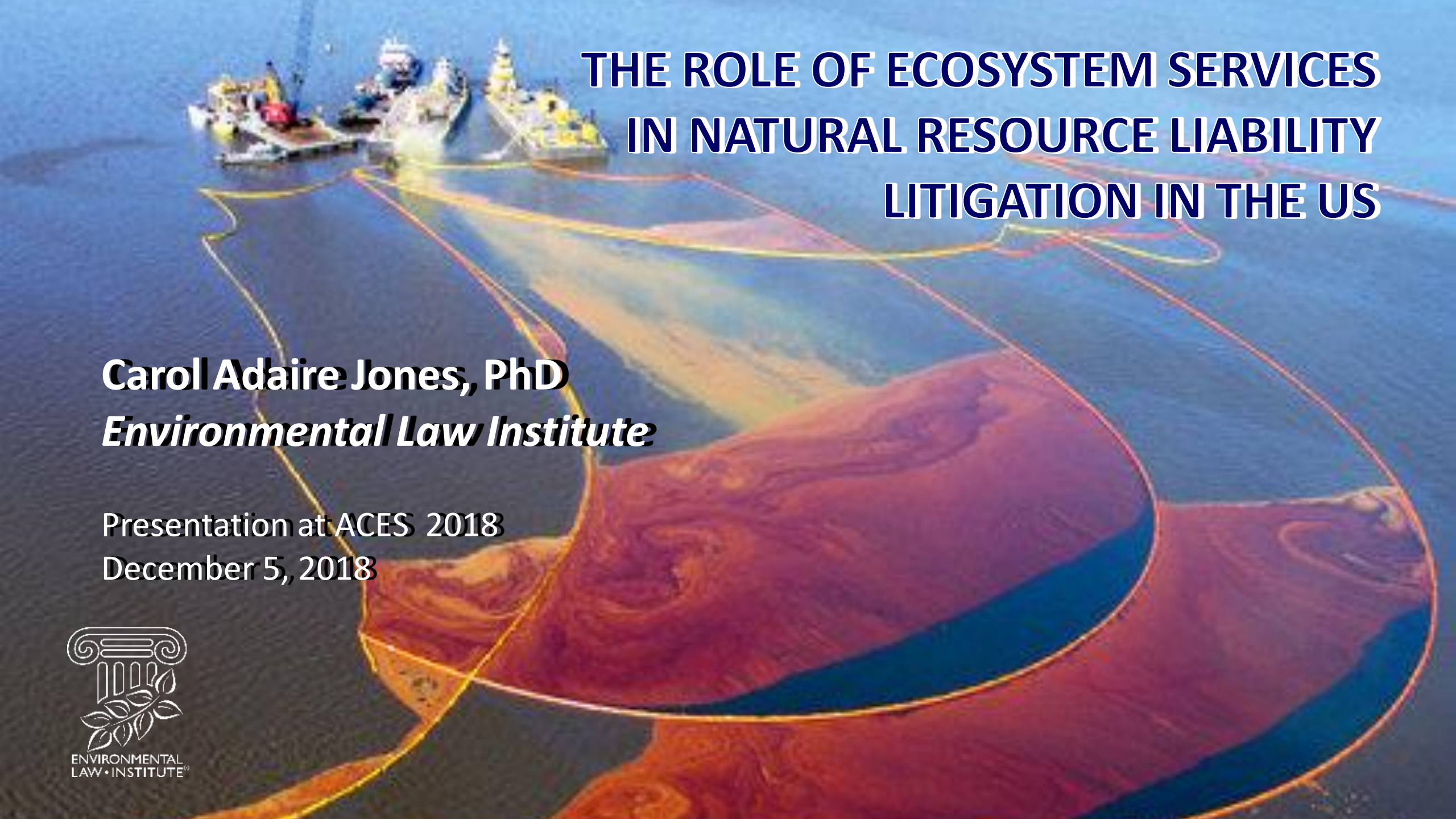

THE ROLE OF ECOSYSTEM SERVICES IN NATURAL RESOURCE LIABILITY LITIGATION IN THE US

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Major US natural resource liability laws

Oil spills
Oil Pollution Act, Clean Water Act

Hazardous waste
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

Protected resources
National Marine Sanctuaries Act, Park System Resource Protection Act, Applicable State Laws

Features of US natural resource liability statutes

- Establish liability for environmental harm to public resources
- Embody the principle that the “polluter pays” damages sufficient to “make the public whole”
- All recoveries are to be spent on restoration or replacement of resources
- Designate Federal, state, and tribal resource agencies as trustees to bring suits on behalf of public (not citizens)
- Citizens can file private claims for financial losses

Claims for public natural resource damages (NRD) are one of many potential types of claims in a case

Deepwater Horizon 2010 oil spill *BP payouts (2015)*:

- NRD: $8.1 billion + up to $0.7 billion for unknown injury and adaptive management
- Response and clean up costs (self-implemented and self-reported): $14 billion
- Civil penalties: $5.5 billion
- Criminal settlement: $4 billion
- Financial losses of private individuals, state and local governments: $19.3B

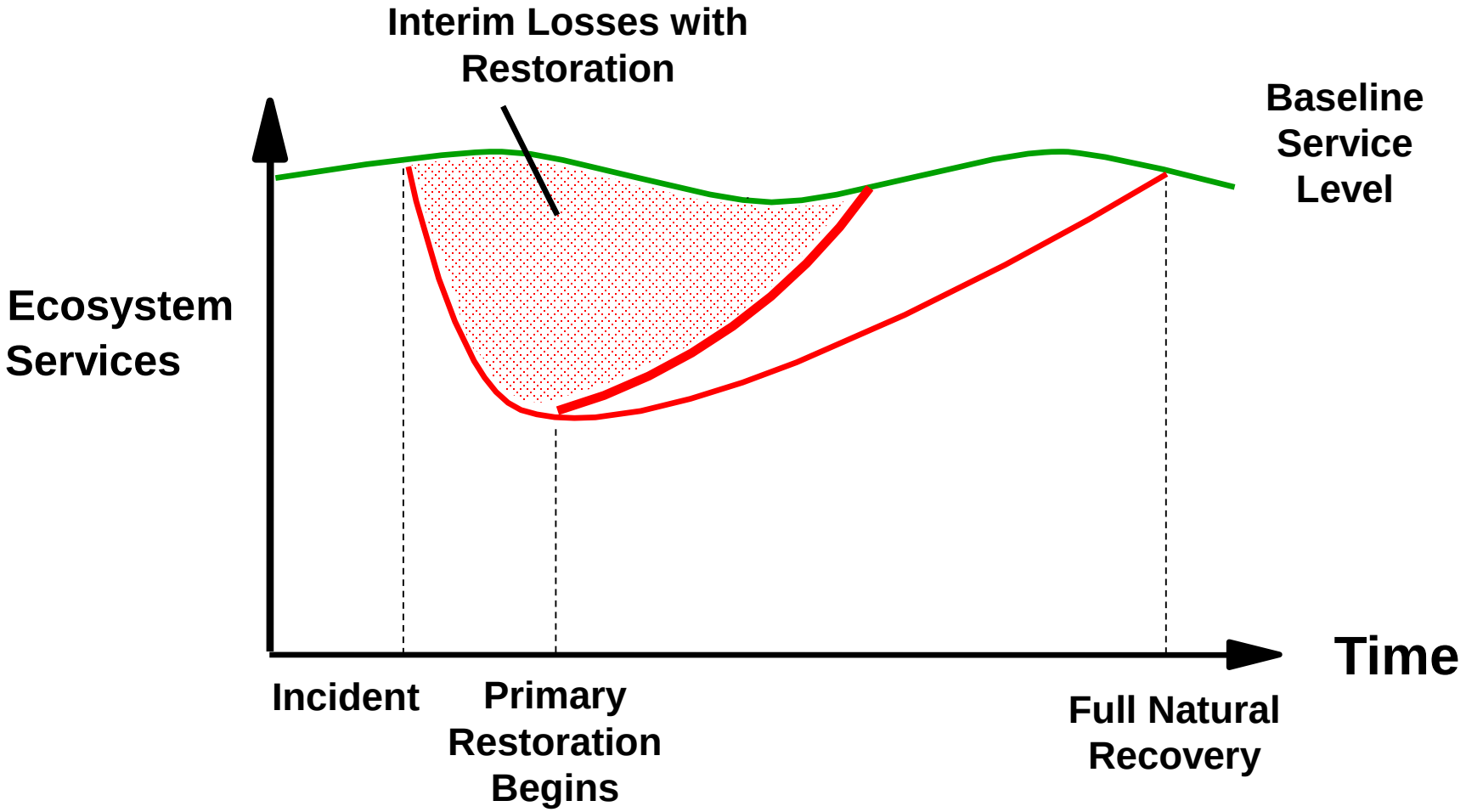
US measure of damages in NRD liability

Goal: Make public whole for resource injuries

1. Cost of restoring (or replacing) injured resources and services to baseline level (*but-for* injury)
2. Compensation for interim losses from time of injury until resources recovery to baseline
3. Reasonable costs of assessment

Statutory Restriction: all recoveries must be spent on restoring or replacing resources

Full compensation: restoring resources to baseline *plus* compensation for interim losses



PD Value = Present discounted value

Metric is ecosystem services

Provisioning Services
(may be sold on market)

Products from ecosystems

- Food
- Water
- Raw materials
- Medicinal resources
- Ornamental resources
- Genetic resources

Regulating Services
(not sold on market)

- Climate regulation
- Natural hazards regulation
- Purification and detoxification of water, air and soil
- Water / water flow
- Erosion and soil fertility
- Pollination
- Pest and disease regulation

Cultural Services
(not sold on market)

- Recreation and tourism
- Aesthetic values
- Information for education and research
- Spiritual and religious experience
- Cultural identify and heritage

Habitat Services (not sold on market)

Maintenance of species lifecycles

Biodiversity maintenance and protection

Ecosystem service losses from typical oil spill

- Spill oils recreational beaches and wetland habitat
- Ecosystem services losses:
  - Cultural: recreation
  - Habitat: nursery services, gene pool protection
  - Provisioning: timber, fishery, agriculture, water, hydro power
  - Regulating: carbon storage, flood and erosion prevention, pest control

Two approaches to damages claims

Initial US version:

1. Costs of **primary restoration** or replacement ***plus***

2. **Value** of interim losses

{New preferred US version:

1. Costs of **primary restoration** or replacement ***plus***

2. Costs of **compensatory restoration** (compensating for interim losses)

=> A Restoration Plan}

Valuation methods for non-market ecosystem services

- Infer value based on choices: observed or stated
- Revealed preference methods: travel cost
  - Opportunity cost of travel functions like a price: willingness to travel long distances signals high value
  - Used to value lost recreation
- Stated preference methods:
  - Individuals offered scenarios of goods or services, and supply context, including payment method
  - Asked if they would be willing to pay specified price
  - Only option to value market goods that are not currently available ***or*** non-market goods/ecosystem services with passive use value

Matching valuation methods to injured ecosystem services

Examples of methods suited to particular uses:

- **Commercial (market goods)**: Market models of supply and demand
- **Recreation**: Travel cost method
- Indirect (off-site) human use impacts for **ecological services**:
  - Production functions (linking the service to the human use), plus values (from a valuation method) for the impact
  - Contingent valuation for values

The second approach to damages claims embodies multiple uses of term "restoration costs"

Initial US version:

1. Costs of **primary restoration** or replacement ***plus***

2. ***Value*** of interim losses

Issues:

- Economic methods for non-market valuation can be controversial
- Not consistent with statutory requirement to spend recoveries on resources

New preferred US version:

1. Costs of **primary restoration** or replacement ***plus***

2. ***Costs*** of **compensatory restoration** (compensating for interim losses)

=> A Restoration Plan

Option remains to calculate interim lost **value** pending recovery as claim, and allocate to restoration

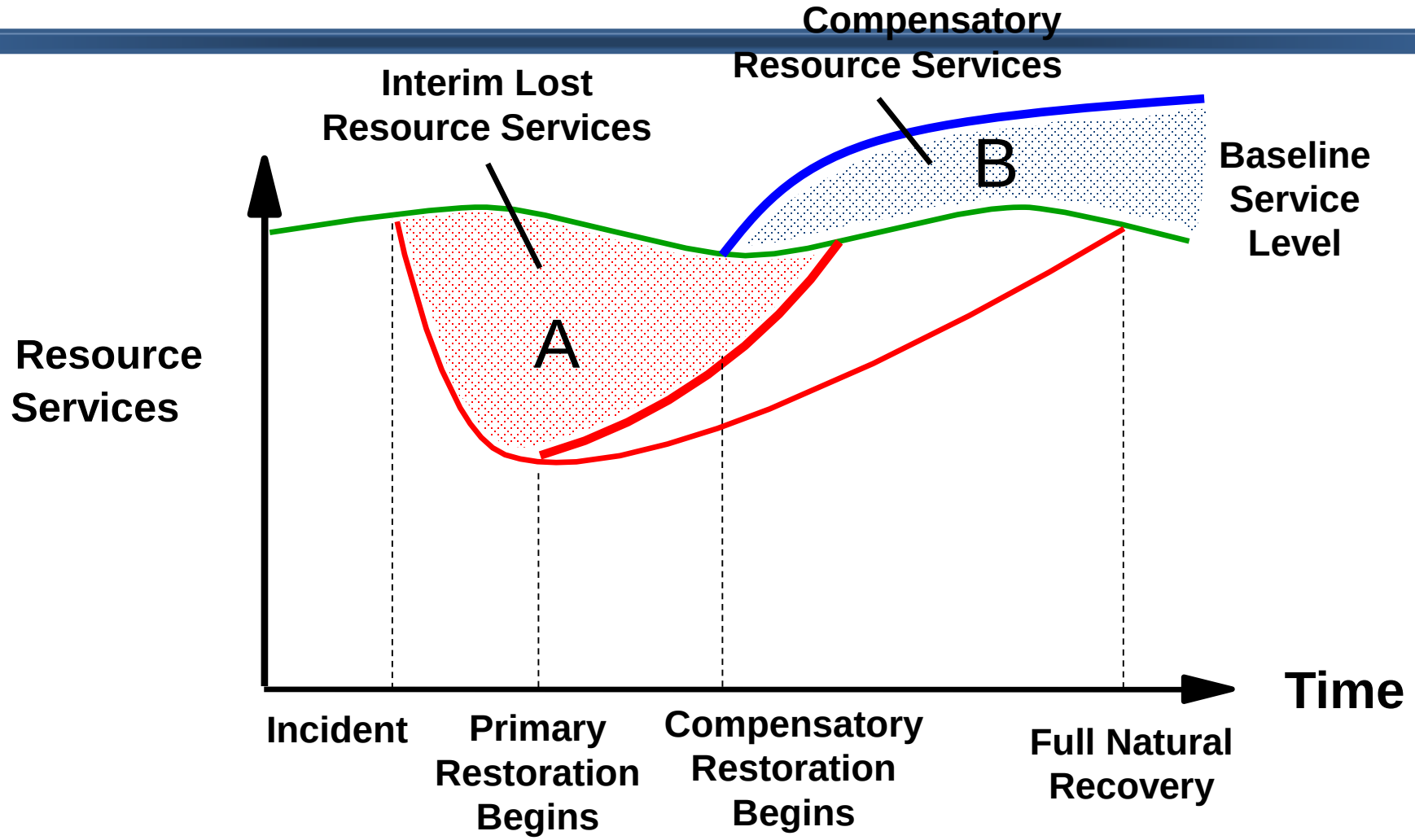
Role of ecosystem services in compensatory restoration

- Inform choice of compensatory restoration projects
  - Priority is for in-kind ES replacement: *not only* of **same type**, *but also* of **same quality** and **comparable value (capacity/opportunity/payoff)**
  - When not feasible, will a different set of resources provide comparable services and comparable value?
- Choice of metric to capture ES quantity and quality, for scaling compensatory restoration projects

Compensatory restoration:
Priority for in-kind projects of same quality/comparable value

- **Injured habitat**: rehabilitate degraded habitat, acquire and protect habitat threatened by development
- **Injured resources**: rehabilitate injured animals; enhance spawning, nesting or foraging habitat; manage predators; reestablish breeding colonies, reduce fishing by-catch
- **Lost recreational use**: improve quality of resource, increase access to resource (boat ramps, boardwalks over wetlands), increase environmental awareness (educational centers)
- **Native American cultural losses:** fund cultural institutions focused on horticulture, medicine, healing, language transmission; apprenticeships

Scaling compensatory restoration so that PD Value(gains =B) =PD Value(losses = A)



PD Value = Present discounted value

Approaches to scale compensatory restoration: *How much is enough?*

- Scaling: value created by compensatory restoration is comparable to lost value from injury

  PD Value (services lost until resource recovers) =

  PD Value (services gained from project lifetime)

  Where PD Value = present discounted value over time

  - Two approaches: ***Service to service*** (a simplified approach, analogous to environmental trading); ***Value to value***
  - Alternative: ***value to cost***

Scaling: Service-to-service approach

- When:
  - *Compensatory* project resources & services are of **same type and quality**, and **comparable value** to *injured* resources
- What:
  - PD (service losses) = PD (service gains) ie, value cancels out of both sides of the equation
  - Claim = cost of implementing restoration
- Method: Habitat or resource equivalency analysis

  Most commonly used approach for US habitat or resource injuries

Habitat Equivalency Analysis: Applications and challenges

- Applications to date include seagrass, marsh, oyster reef, mangrove, coral, soft-bottom benthos, river/riparian habitats
- *Resource Equivalency Analysis* is a variant, where injury involves primarily one or more species, rather than habitat
- Choice of ES metric: (ratio of service levels at *injury* and *project* sites)
  - Typically ecological process or function – rely on choice of projects to ensure service levels occur in same proportion to the metric at injury and compensatory project sites
  - Scientific judgment is required to identify equivalencies when substitutions are made across landscape, time, habitat species
- Upheld in court in 2 early seagrass cases; most cases are settled

Scaling: Value-to-value approach

- When:
  - *Compensatory* project resources and services do not provide same type and quality of services, but provide comparable services (lower ranked option)
- What:
  - PDV (service losses) = PDV (service gains)
  - Claim = cost of implementing restoration
- Methods:
  - Stated preference methods
  - Travel cost models
  - Benefits transfer (apply value estimates from other studies)
  - Avoidance or replacement costs (lower bound)

Value-to-value: Applications and challenges

- Limited applications to date include:
  - Recreational fishing in Lavaca Bay (replacement in-kind ES)
  - Lower Fox River/Green Bay (replace different resource due to enduring, widespread PCD contamination of fishery resources)
- Usage limited due to:
  - More costly and controversial than simplified HEA approach
  - Constrained in number of tradeoff parameters that can be estimated to avoid respondent burden: makes it difficult get enough detail to inform restoration planning

Scaling: Value-to-cost option

- When:
  - Service-to-service not appropriate; and
  - Valuation of lost services is possible, but valuation of replacement services cannot be done at reasonable cost
- What:
  - Claim = PD value of interim losses (spend on restoration projects)
- Methods:
  - Stated preference methods (value total interim losses)
  - Benefits transfer (apply value estimates from other studies) to value individual lost services: create valuation schedules

Value-to-cost: Applications and challenges

- US has used large scale stated preference studies in very large cases:
  - Exxon Valdez oil spill (pre-Oil Pollution Act); Montrose PBC, DDT chronic contamination; *Deepwater Horizon* oil spill
  - Results informed pre-litigation settlements
- US has also used this approach for recreational losses

Typical valuation strategy for typical oil spill

- Spill oils recreational beaches and wetland habitat
- Damage claim is based on the costs of a Restoration Plan

  1) Primary restoration to expedite recovery of wetland habitat

  2) To scale compensatory restoration to compensate for interim loss:

    - For lost habitat, trustees use habitat equivalency analysis to scale
    - For recreational losses, trustees estimate the lost value of recreation

US experience: key points

- Legal innovation of restoration-based damages measure now widely accepted as effective in producing case settlements, timely restoration
  - In part, its success is due to providing a framework for valuing ecological services that is simplified and deflects controversy from stated preference methods
- Courts have admitted Habitat Equivalency Analysis to scale compensatory restoration of ecological services
- Two factors are key to achieving equivalency in value at injury and compensatory project sites: project selection, and choice of ES metric
- Complex ES production function models hold future promise for capturing greater detail in ES relationships than HEA, currently modelling uncertainties remain great at fine scale required for litigation

International experience: key points

- EU's Environmental Liability Directive (2004) adopted the US resource compensation approach (including habitat equivalency analysis)
- Relative to US and EU, we found in a survey of 6 tropical countries (Brazil, Mexico, India, DRC, Indonesia, Philippines), their public liability statutes generally:
  - Cover a broader scope of harms
  - Include broader standing provisions
  - Include measures of damages that often were more narrow
  - Have regulatory language on ES that reflects the state of ES literature at time of adoption, though countries do not consistently cover all ES

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Thank you!

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