ECOSYSTEM SERVICE VALUATION

Natural Capital Symposium

March 23, 2015

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HIGHLIGHTS

What is ecosystem service valuation?

Why value ecosystem services?

How InVEST values ecosystem services?

Expanding beyond InVEST

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VALUE
ECOSYSTEM SERVICES

natural capital PROJECT

Value depends on human well-being

Tradeoffs between scarce resources

Social Relations

Material Needs

Safety

Health

Spiritual Satisfaction

Monetary and non-monetary valuatio

ECOSYSTEM SERVICES
BENEFITS PEOPLE OBTAIN FROM ECOSYSTEMS

Provisioning Services
- Food
- Fresh water
- Wood and fiber
- Fuel
- ...

Regulating Services
- Climate regulation
- Flood regulation
- Disease regulation
- Water regulation
- ...

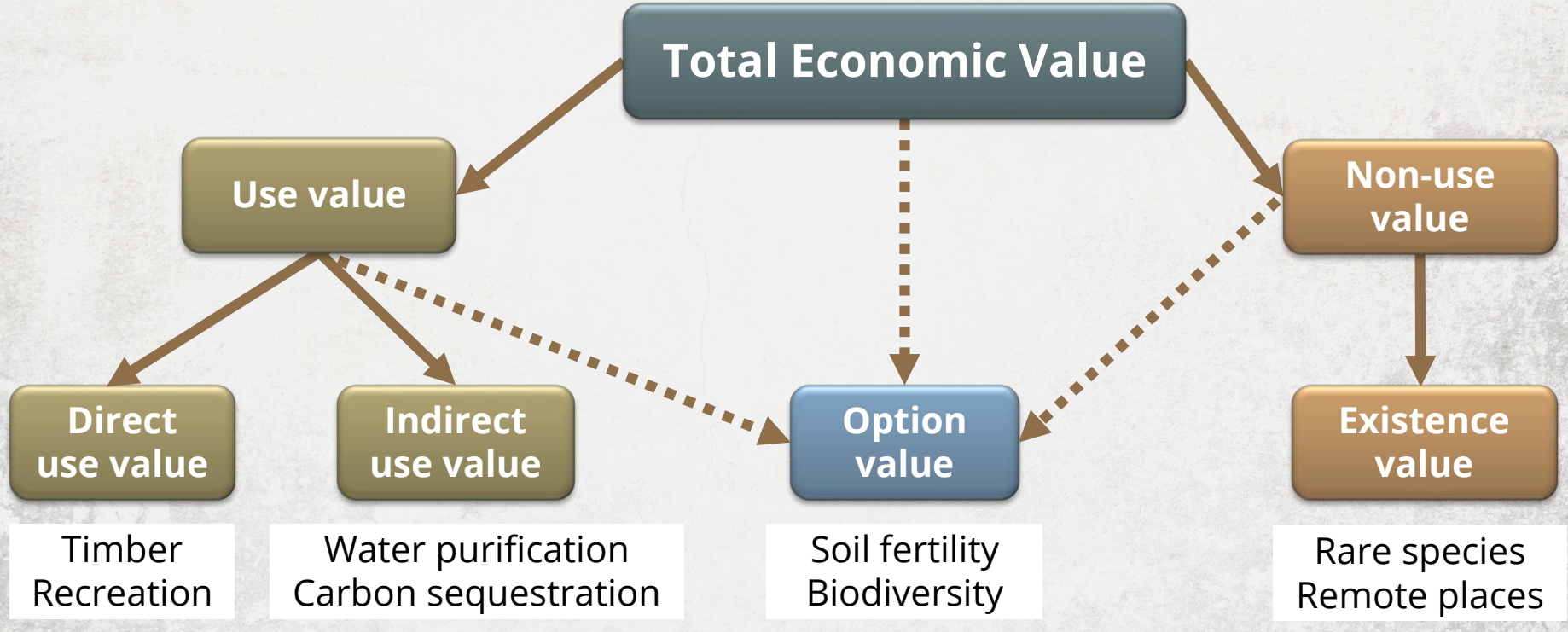
Cultural Services
- Aesthetic
- Spiritual
- Educational
- Recreational
- ...

Supporting Services

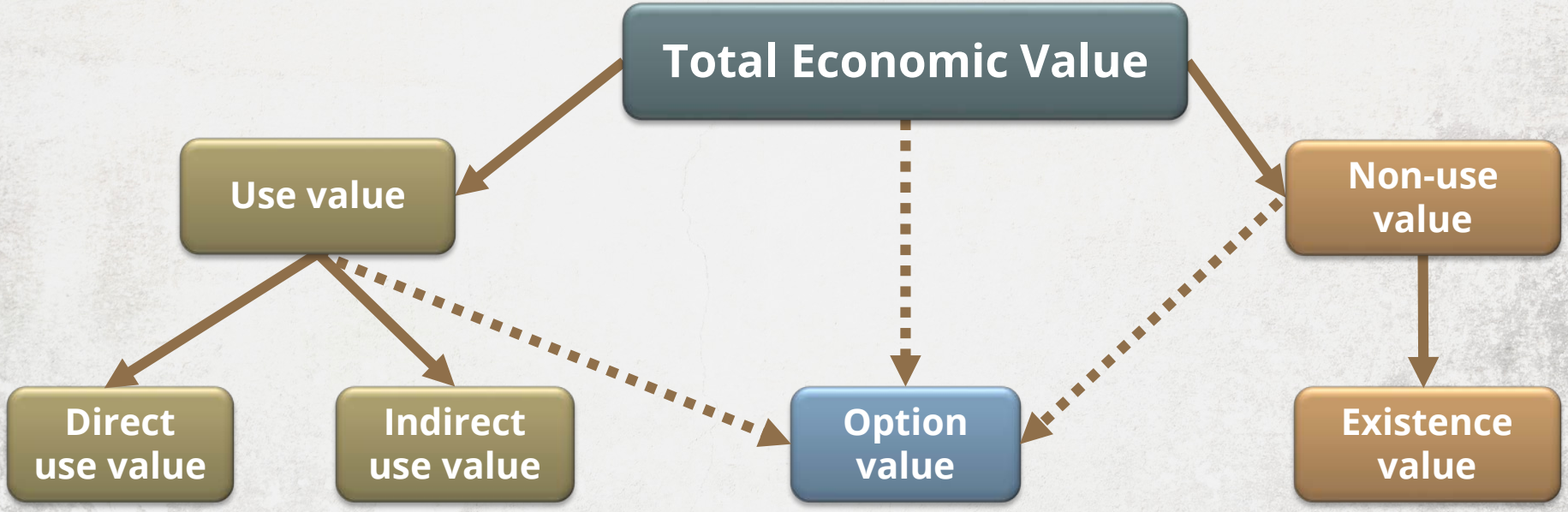
-Nutrient cycling - Soil formation - Primary production
-Water cycling - Provision of habitat

Millennium Ecosystem Assessment

MONETARY VALUATION
ECOSYSTEM SERVICES



MONETARY VALUATION



Market-based valuation and non-market valuation

Non-market valuation

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RESEARCH QUESTION

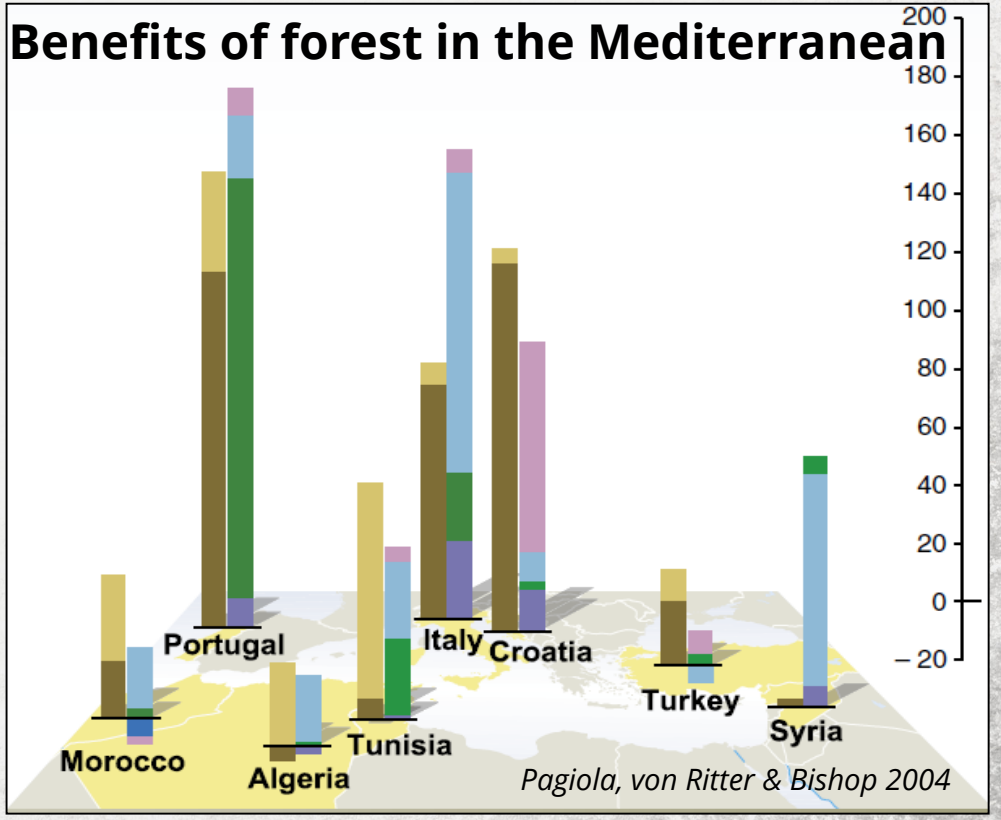
DETERMINE THE TOTAL BENEFITS FROM ECOSYSTEMS

Commonly Measured

- Grazing
- Timber and fuelwood

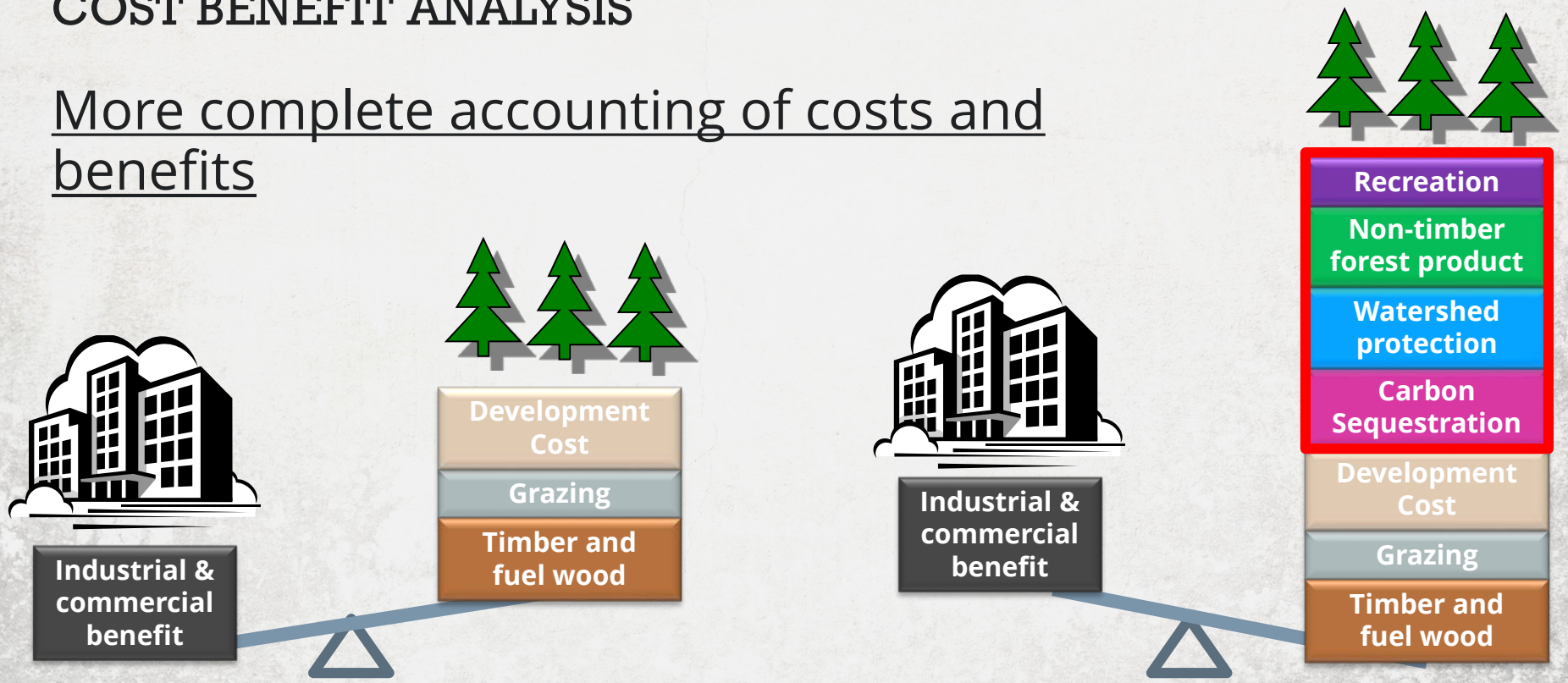
Non-market and other values

- Carbon sequestration
- Watershed protection
- Non-timber forest products
- Recreation and hunting



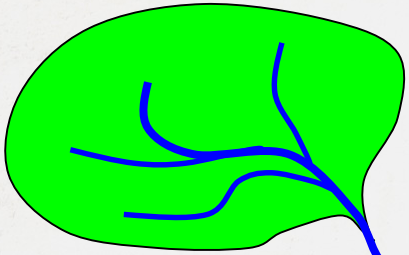
RESEARCH QUESTION
COST BENEFIT ANALYSIS

More complete accounting of costs and benefits



RESEARCH QUESTION

FINANCE ECOSYSTEM CONSERVATION



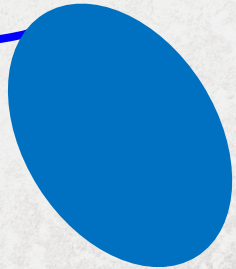
Erosion control
Climate regulation

Upstream Watershed Conservation

Farmers and Foresters

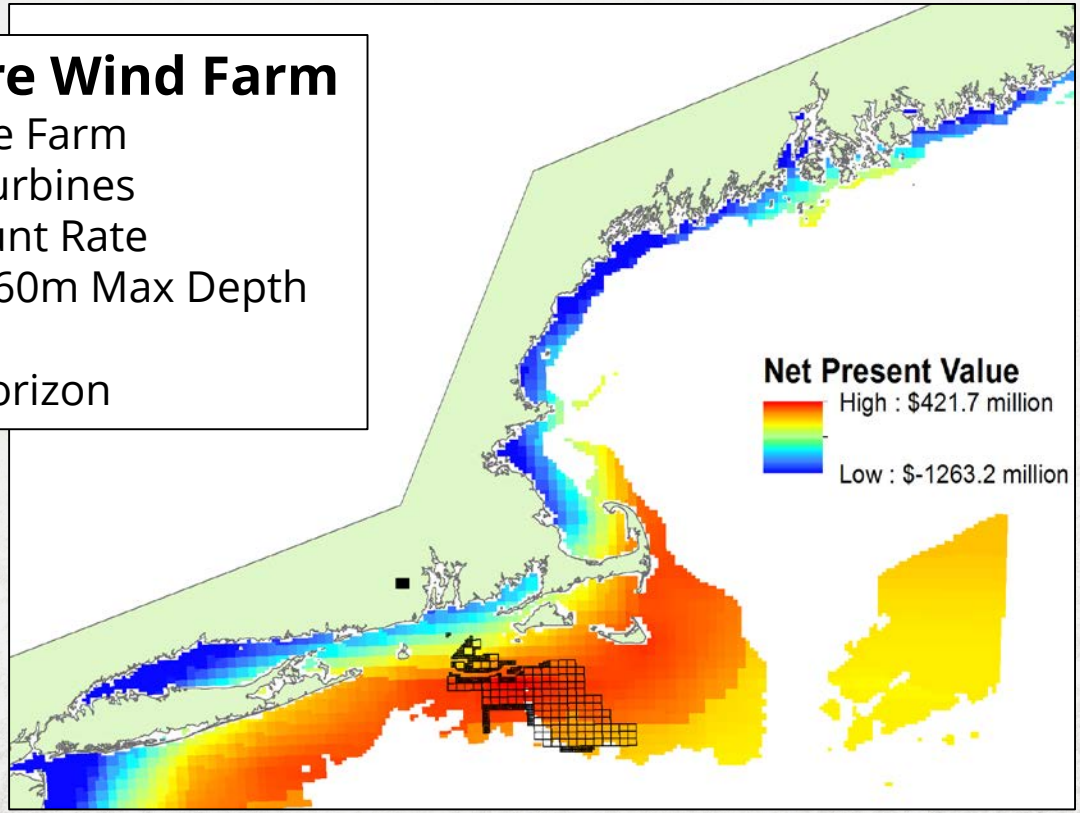
Water purification
Flood control
Sediment mitigation

Water utility
Hydropower industry
Beverage company
Municipalities



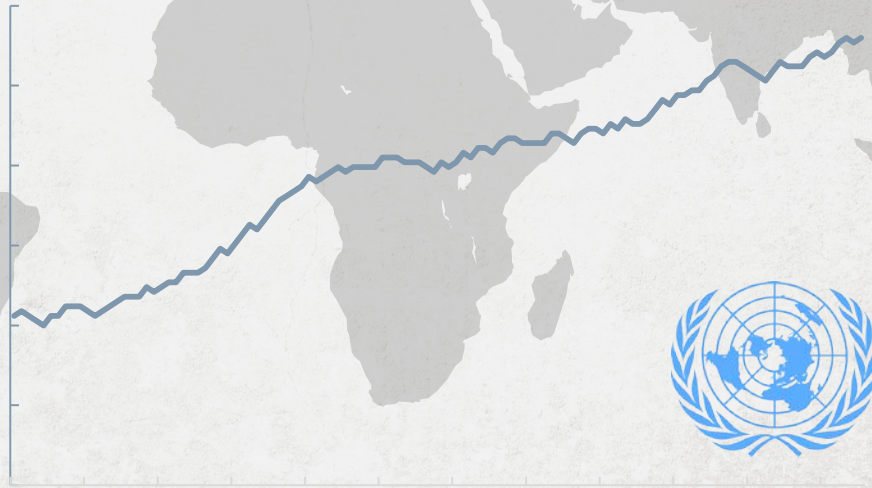
RESEARCH QUESTION
OPTIMAL SITING DECISIONS

Offshore Wind Farm
80 Turbine Farm
3.6 MW Turbines
7% Discount Rate
3m Min / 60m Max Depth
$.18/kWh
20 year horizon



NATIONAL ACCOUNTING

TIME TREND OF NATURAL ASSET BASE



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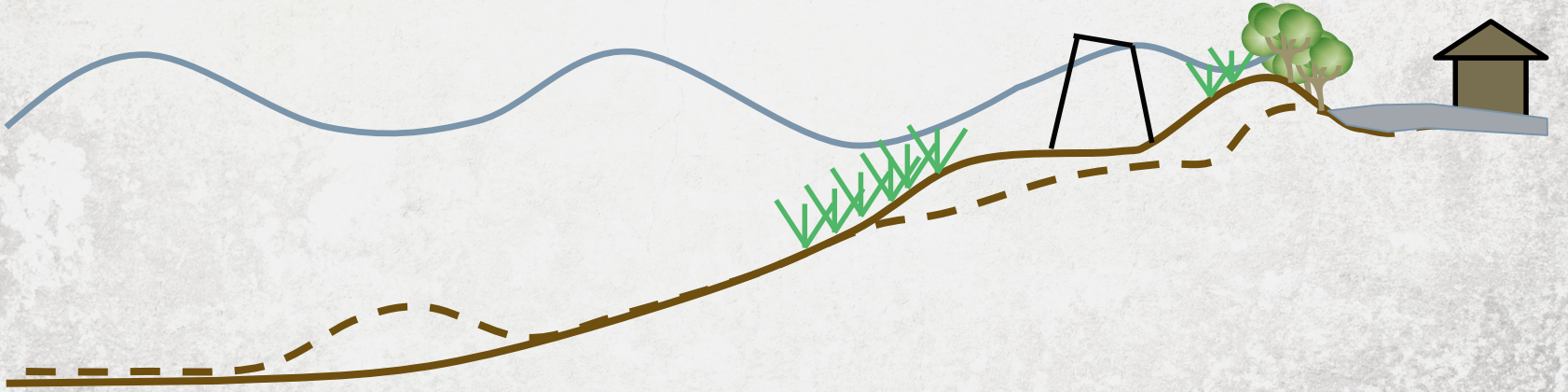
PROCESS BASED MODELS
COASTAL PROTECTION

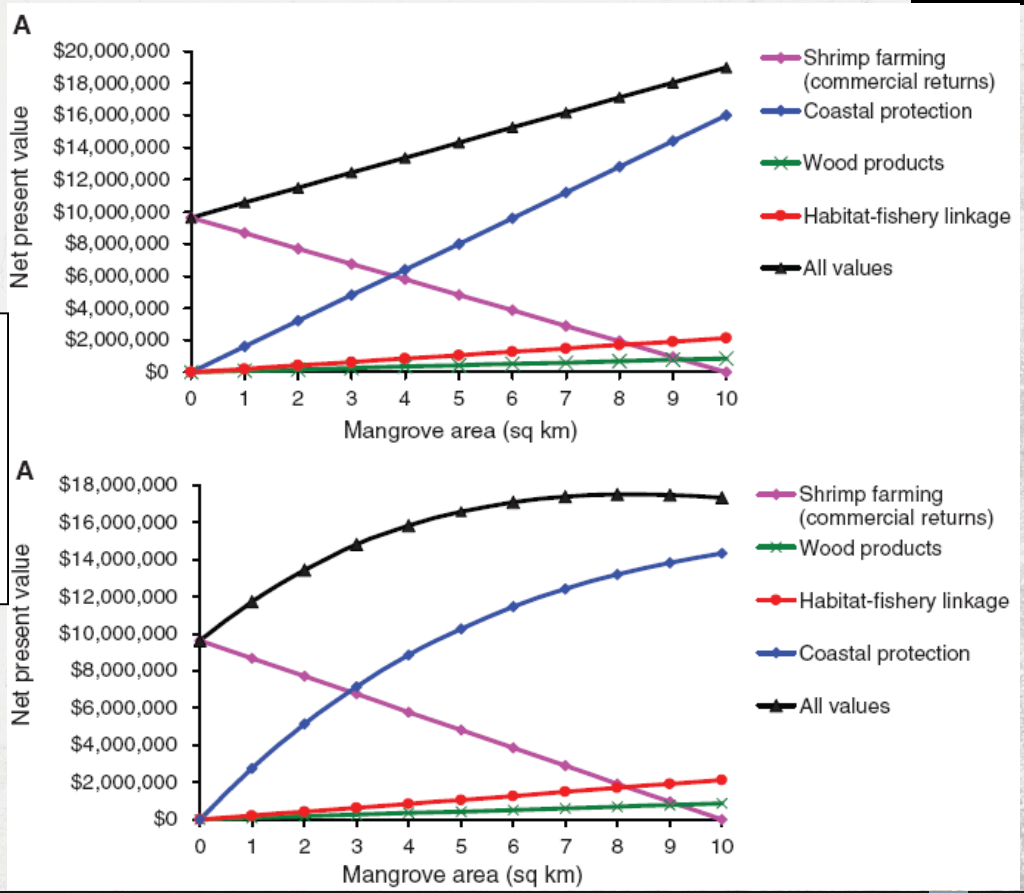
Forcing Conditions	→	**Attenuation**	→	Hydrodynamic Output	→	Erosion Flooding
Waves Baseline tide Long-term sea-level rise Currents Wind		**Biogenic habitat** **Abiotic morphology** **'Hard' structures**		Wave height Mean water level Runup Storm surge		Near property and people



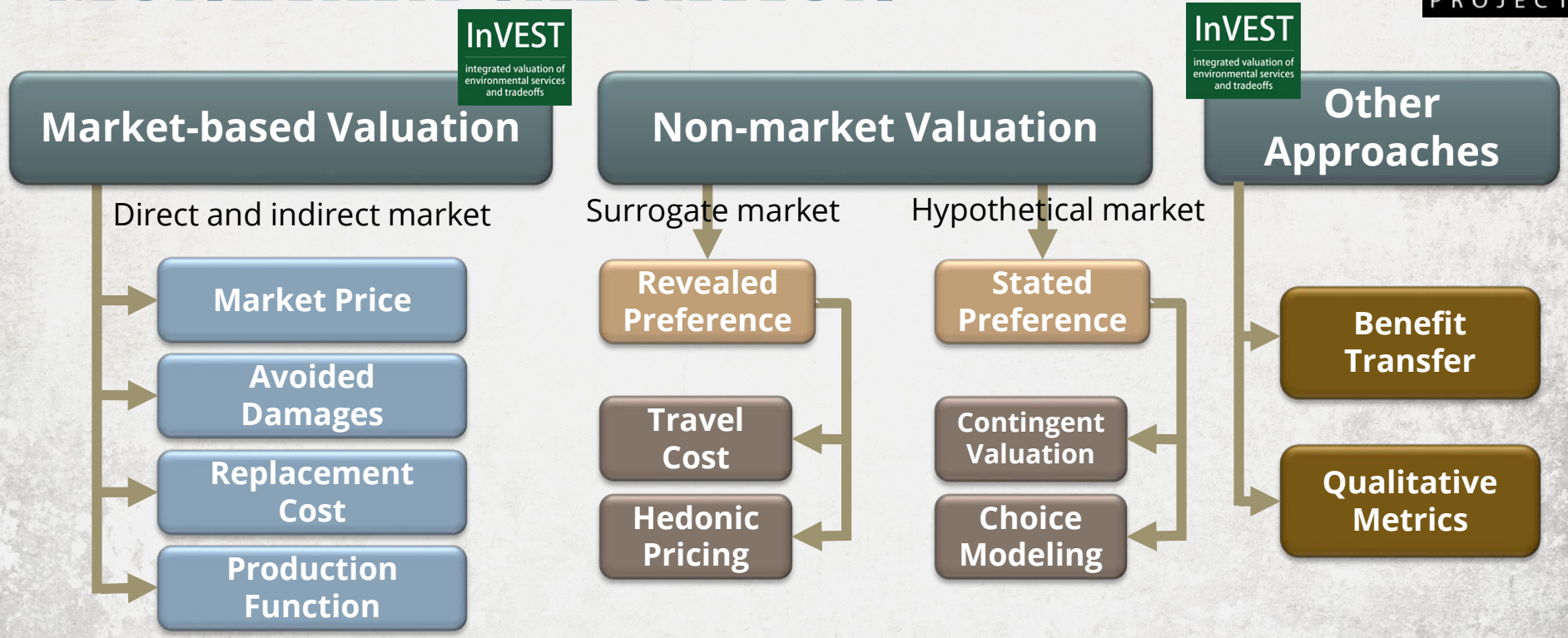
VALUATION THEORY
MARGINAL VALUE

Coastal Ecosystem–Based Management with Nonlinear Ecological Functions and Values

Edward B. Barbier,[1]* Evamaria W. Koch,[2] Brian R. Silliman,[3] Sally D. Hacker,[4] Eric Wolanski,[5] Jurgenne Primavera,[6] Elise F. Granek,[7] Stephen Polasky,[8] Shankar Aswani,[9] Lori A. Cramer,[10] David M. Stoms,[11] Chris J. Kennedy,[1] David Bael,[8] Carrie V. Kappel,[12] Gerardo M. E. Perillo,[13] Denise J. Reed[14]

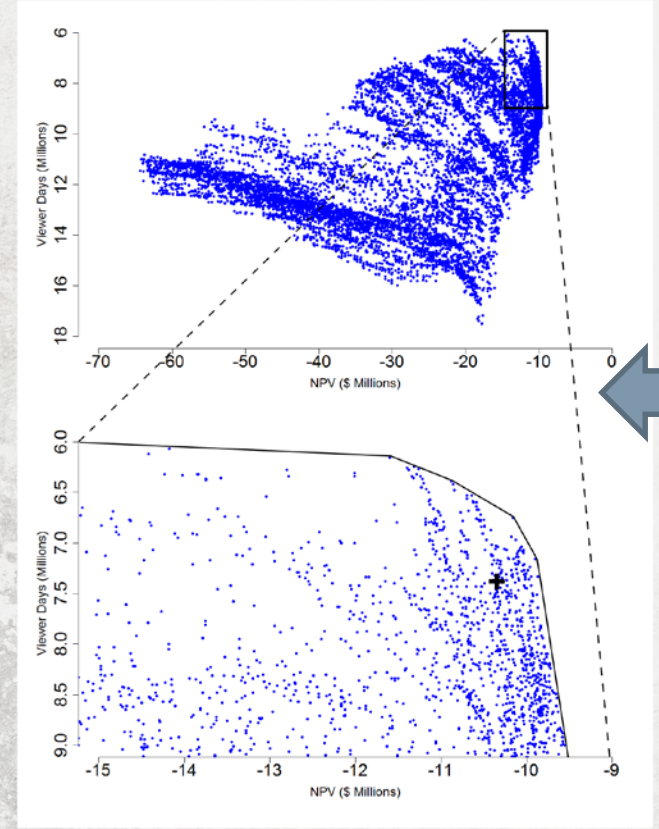


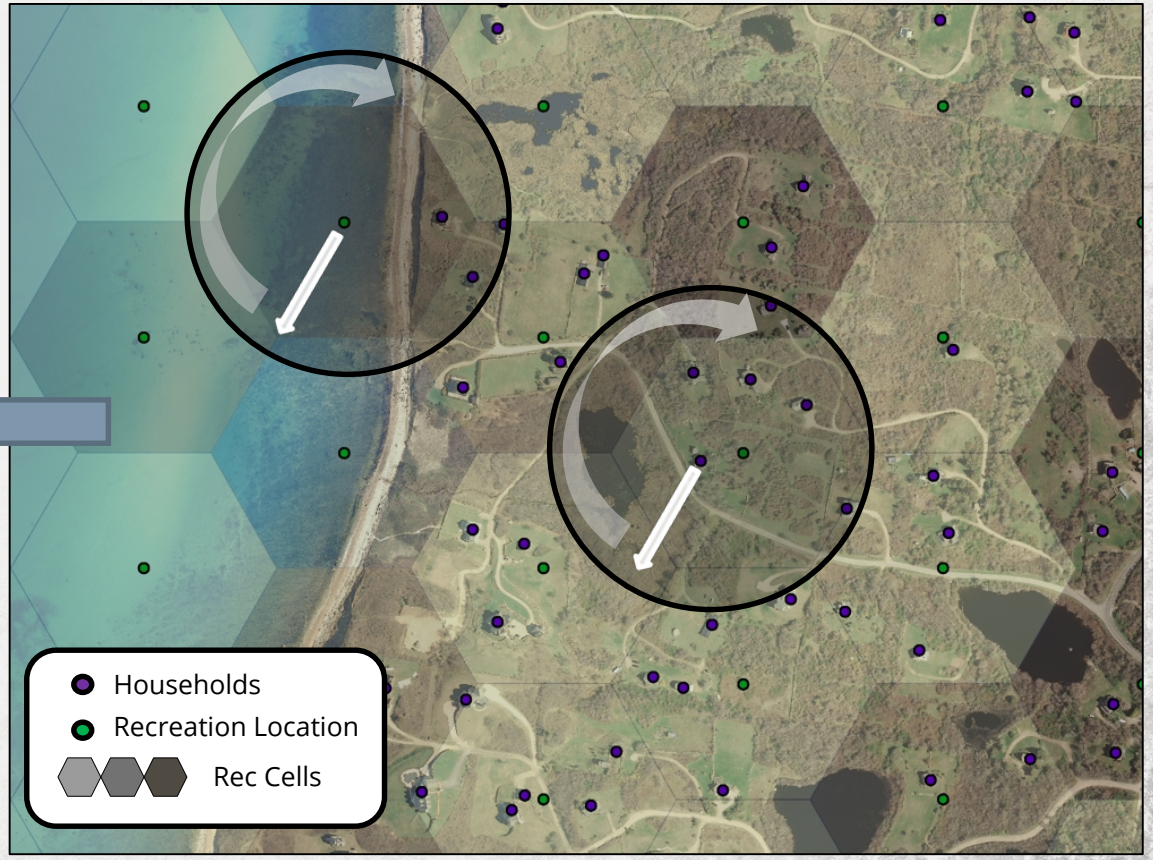
MONETARY VALUATION



NON-MONETARY VALUE

VIEWS AND WIND ENERGY





SCENARIOS AND OPTIMIZATION

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InVEST
integrated valuation of environmental services and tradeoffs

Scenario-based analysis and optimization using Python

Optimal conservation for watershed ecosystem services under a budget

RIOS

OPAL

Landscape-level tool for mitigating environmental losses from development

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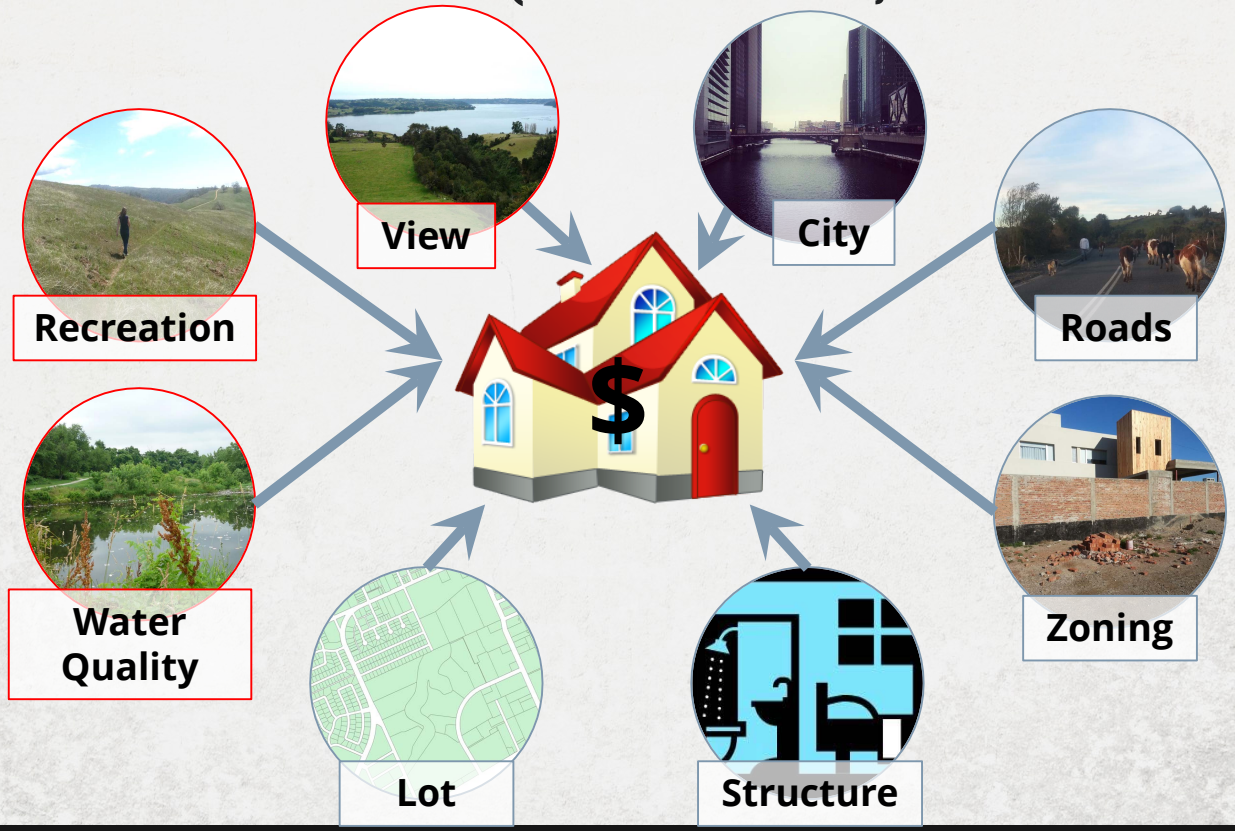
HEDONIC PRICING

LAND/PROPERTY PRICE= *F* (ATTRIBUTE1, ATTRIBUTE2,…)



STATED PREFERENCE
CONTINGENT VALUATION AND CHOICE MODELLING

Contingent valuation

Ask respondents to express their willingness to pay (WTP) or willingness to accept (WTA) for changes in ecosystem services

Choice modeling

Ask respondents to rank/rate/choose alternative choice sets which have different combination of price attribute and ecosystem attributes

THANKS!
MODEL SUMMARY

Method	ES type	InVEST model
Market price	Provisioning Service	**Fish Aquaculture** **Managed Timber Production** **Wave Energy** **Hydropower Production** **Wind energy** **Recreation (expenditures)** **Fisheries** **Agricultural Production** **Non-timber Forest Product Production**
	Regulating Service	**Carbon Sequestration (Marine, Terrestrial)** **Water for Irrigation**
Avoided damages/ replacement cost	Regulating Service	**Nutrient Retention** **Carbon Sequestration (Marine, Terrestrial)** **Sediment Retention** **Coastal Protection** **Storm Peak Mitigation**
Non $ Values	All	**Overlap Analysis** **Scenic Quality** **Coastal Vulnerability** **Pollination**
NA	Cultural/Supporting /Regulating Services	Biodiversity/Habitat quality and rarity Habitat risk assessment