

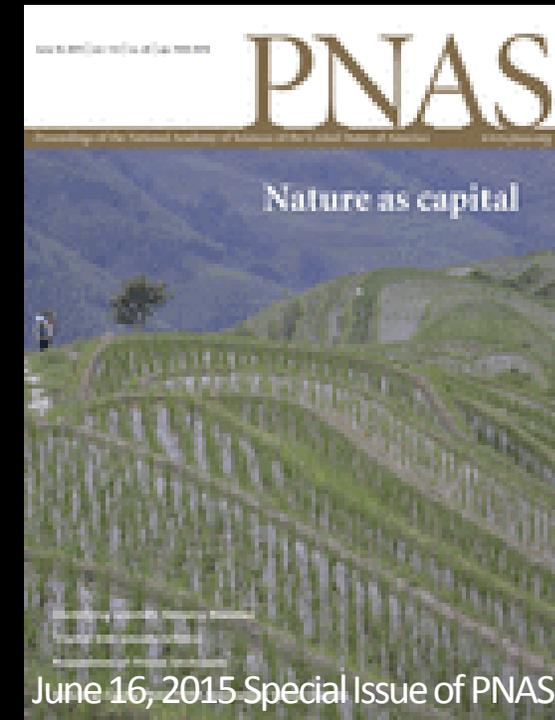
# Policy Implications of Natural Capital Accounting

Stephen Polasky  
University of Minnesota  
Natural Capital Project

This is not an ADB material. The views expressed in this document are the views of the author/s and/or their organizations and do not necessarily reflect the views or policies of the Asian Development Bank, or its Board of Governors, or the governments they represent. ADB does not guarantee the accuracy and/or completeness of the material's contents, and accepts no responsibility for any direct or indirect consequence of their use or reliance, whether wholly or partially. Please feel free to contact the authors directly should you have queries.

# Nature as capital

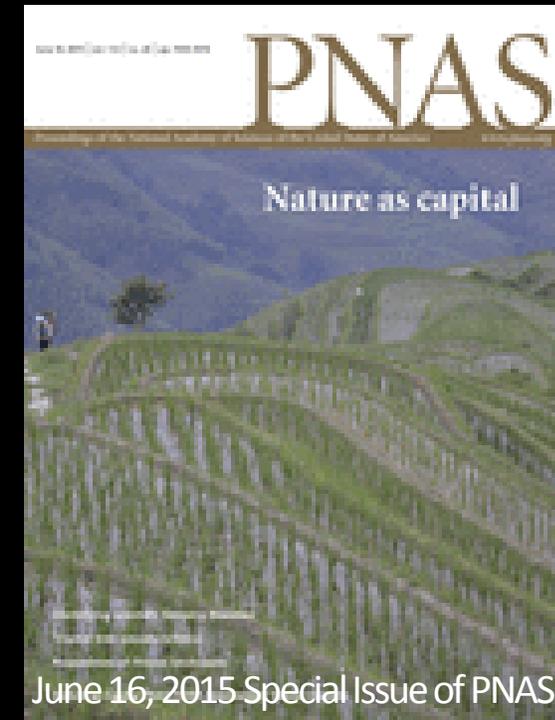
- “The central challenge of the 21st century is to develop economic, social, and governance systems capable of ending poverty and achieving sustainable levels of population and consumption while securing the life-support systems underpinning current and future human well-being”



Guerry, Polasky, Lubchenco, et al. 2015. Natural capital and ecosystem services informing decisions: From promise to practice. *Proceedings of the National Academy of Sciences (PNAS)* 112: 7348-7355.

# Mainstreaming the value of natural capital

- “Essential to meeting this challenge is the incorporation of natural capital and the ecosystem services it provides into decision-making.”
- Government decisions
- Business decisions
- Household decisions



Guerry, Polasky, Lubchenco, et al. 2015. Natural capital and ecosystem services informing decisions: From promise to practice. *PNAS* 112: 7348-7355.

# Capital assets

- **Capital assets:** economic resources that can be used to produce valuable goods and services
  - Tangible assets: land, buildings, equipment...
  - Intangible assets: reputation, patents, knowledge and skill...

# Natural capital

- **Natural capital:**

- Land
- Natural resources (oil, natural gas, minerals...)
- Ecosystems

- **Forest example:**

- Stock of standing timber (inventory)
- Forest ecosystem: regeneration of timber (productive equipment)

# Value of capital assets

- **Market value of a capital asset:** the contribution the asset makes to current and future income of the owner of the asset
- **Societal value of a capital asset:** the contribution the asset makes to current and future human well-being for members of society

# Divergence of market and social value

- **Natural capital** often generates **societal value** that is greater than the **market value** it generates.
  - “Externalities”
- Forest example:
  - Market value: timber
  - Additional social values: water purification, water flow regulation, habitat for valued species, carbon sequestration...

# Measuring the value of capital assets

- **Market value:** present value of the flow of income created by the asset
- Forest example:
  - Revenue from timber sales minus planting and harvesting costs
  - Future revenue and costs are discounted using appropriate interest rate

# Measuring the value of capital assets

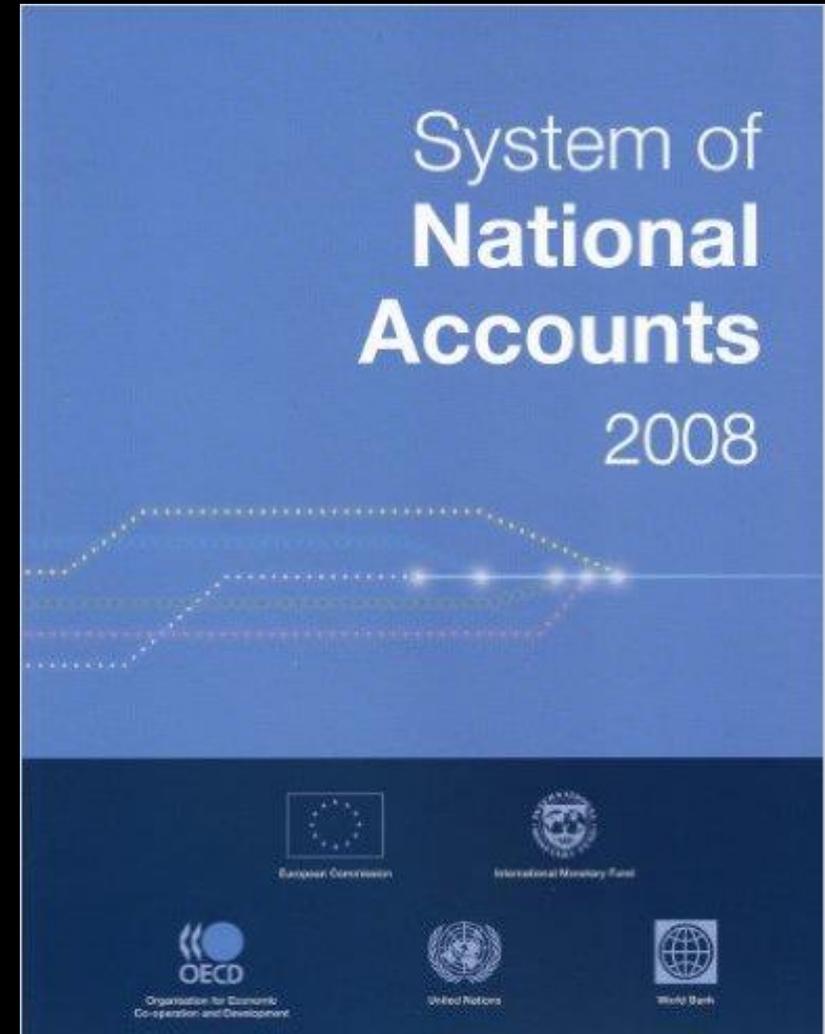
- **Societal value of a capital asset:** present value of the contribution to human well-being measured in a common metric (typically money)
- **Problem:** the value of most contributions do not go through markets and are not measured in a common monetary metric (non-market values)
- Use non-market valuation methods from economics to measure the value of contributions in a common monetary metric

# Measuring the value of capital assets

- Forest example:
  - Water purification: present value of avoided cost of building and operating water filtration facilities
  - Water flow regulation: present value of reduced damages from flooding and drought
  - Habitat for valued species: present value of recreation value (travel cost); existence value (contingent valuation surveys)
  - Carbon sequestration: present value of carbon storage using carbon market price or social cost of carbon

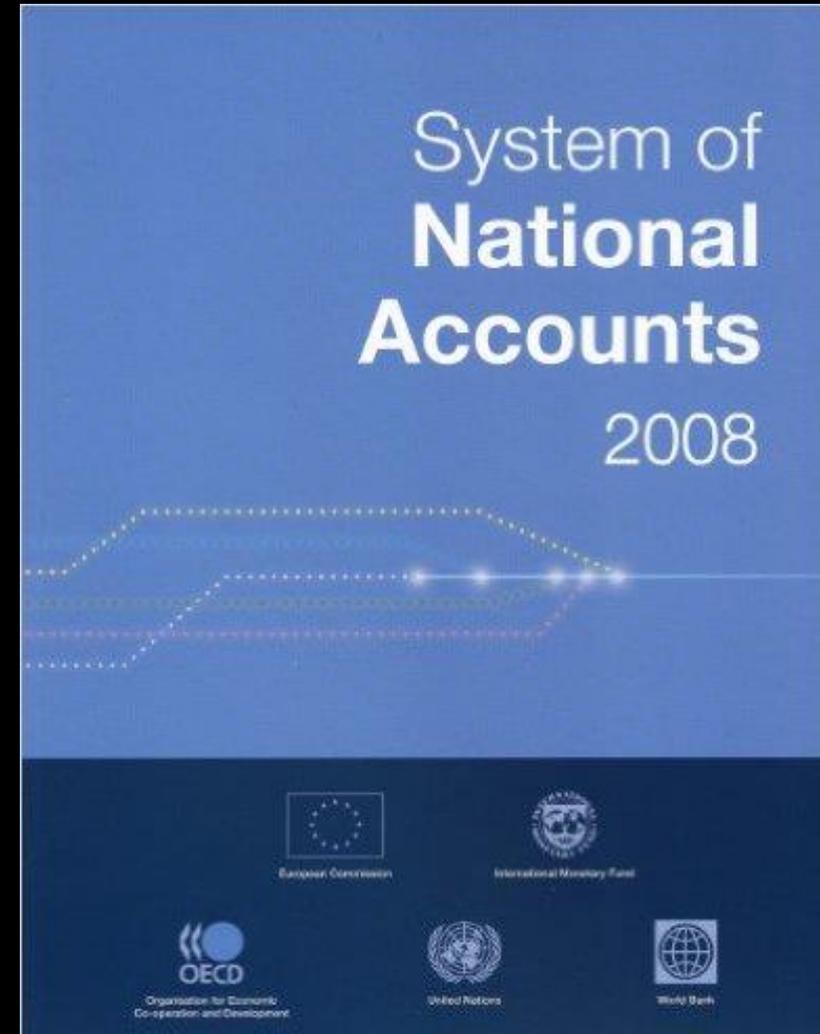
# Brief history of economic accounting

- Prior to 1930s: no systematic accounting of the economy
- 1940s: first systematic measure of Gross Domestic Product (GDP)
- 1947: first national income accounts
- System of National Accounts: clear and consistent accounting of income (GDP) and wealth as measured by market values



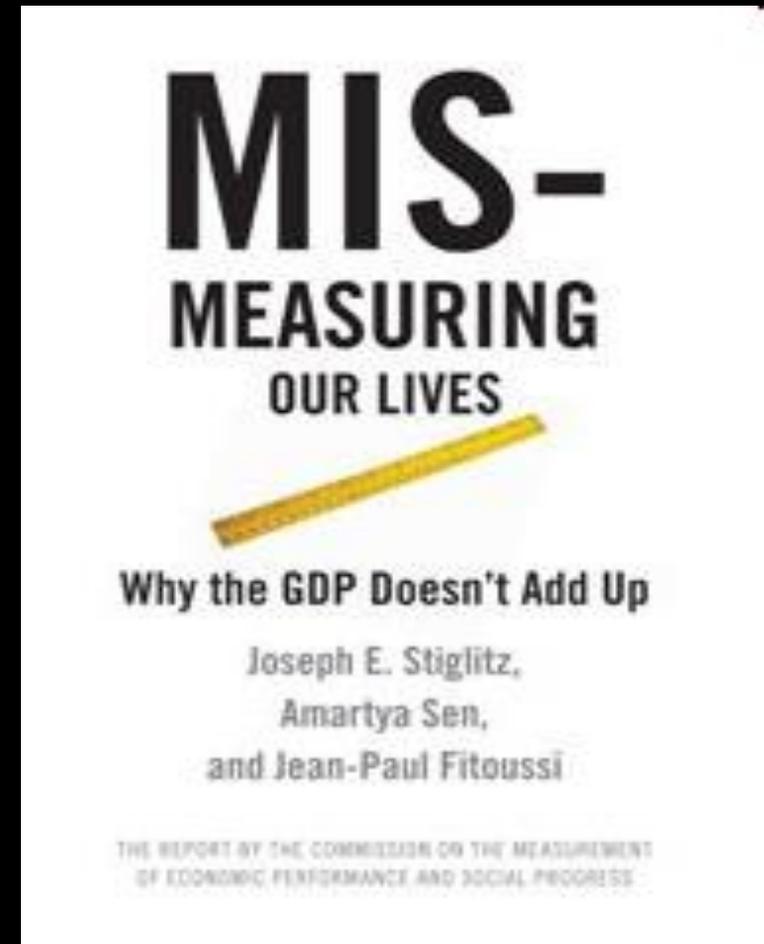
# Brief history of economic accounting

- Economic accounts **ONLY** measure market values.
- Economic accounts do not include non-market values.
- Forest example:
  - Income: net revenue from timber operation in a given year
  - Wealth: value of forest land, capitalized value of timber operations
  - Ignores: water purification, water flow regulation, habitat for species, carbon sequestration



# Need for expanded accounting

- Include the value non-market values generated by natural capital



# Current economic accounting system

	Flow (Income)	Stock (Asset)
Biophysical measure	Amounts of various goods and services provided	Amounts of various capital assets
Monetary measure	GDP: market price times amount produced summed over all goods and services	Measure of wealth: market price times amount of asset summed over all assets

# Expanded accounting system to include natural capital and ecosystem services

	<b>Flow (Income)</b>	<b>Stock (Asset)</b>
<b>Biophysical measure</b>	Ecosystem services: amounts of various goods and services provided by natural capital	Amounts of various forms of natural capital
<b>Monetary measure</b>	Gross ecosystem product: GEP	Measure of inclusive wealth (including natural capital)

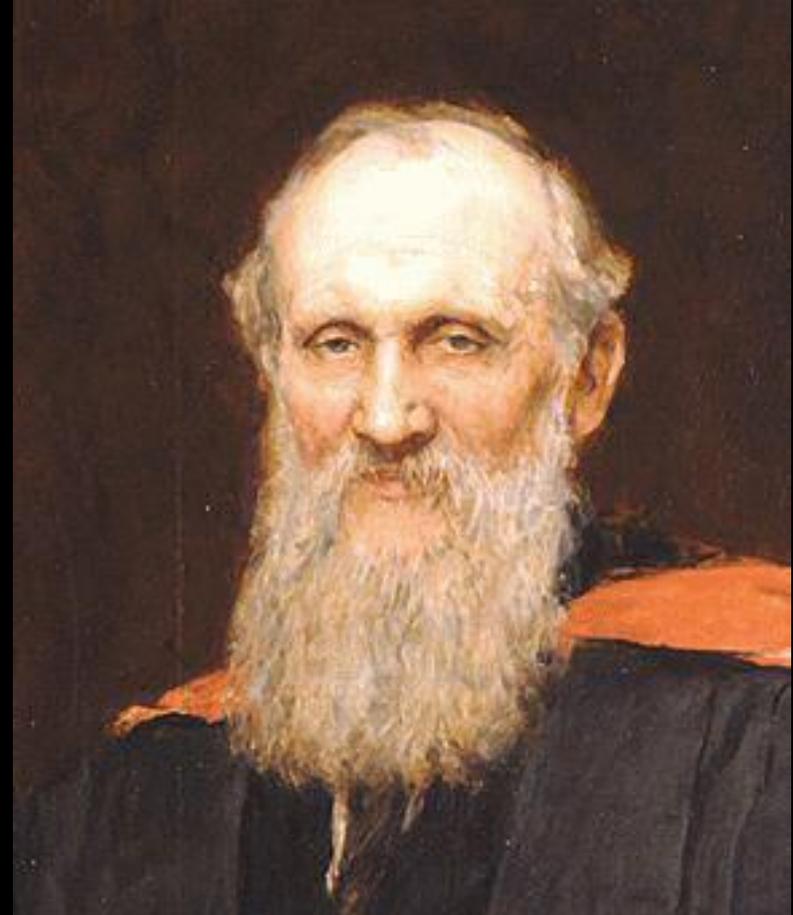
# Two important measurement tasks

1. Measuring the biophysical quantities of ecosystem services and natural capital assets
2. Measuring values using both market and non-market values

# Importance of measurement

- “If you can measure ... you know something of your subject; but if you cannot measure it, your knowledge is meager and unsatisfactory.”

Lord Kelvin



# Importance of measurement

- Modern version I:  
“If you can't measure it, you can't manage it.”
- Modern version II:  
“If you don't value it, you won't sustain it.”

# Trends in ecosystem services: Millennium Ecosystem Assessment

Service	Sub-category	Status	Notes
<b>Provisioning Services</b>			
Food	crops	▲	substantial production increase
	livestock	▲	substantial production increase
	capture fisheries	▼	declining production due to overharvest
	aquaculture	▲	substantial production increase
	wild foods	▼	declining production
Fiber	timber	+/-	forest loss in some regions, growth in others
	cotton, hemp, silk	+/-	declining production of some fibers, growth in others
	wood fuel	▼	declining production
Genetic resources		▼	lost through extinction and crop genetic resource loss
Biochemicals, natural medicines, pharmaceuticals		▼	lost through extinction, overharvest
Fresh water		▼	unsustainable use for drinking, industry, and irrigation; amount of hydro energy unchanged, but dams increase ability to use that energy
<b>Regulating Services</b>			
Air quality regulation		▼	decline in ability of atmosphere to cleanse itself
Climate regulation	global	▲	net source of carbon sequestration since mid-century
	regional and local	▼	preponderance of negative impacts
Water regulation		+/-	varies depending on ecosystem change and location
Erosion regulation		▼	increased soil degradation
Water purification and waste treatment		▼	declining water quality
Disease regulation		+/-	varies depending on ecosystem change
Pest regulation		▼	natural control degraded through pesticide use
Pollination		▼ <sup>a</sup>	apparent global decline in abundance of pollinators
Natural hazard regulation		▼	loss of natural buffers (wetlands, mangroves)
<b>Cultural Services</b>			
Spiritual and religious values		▼	rapid decline in sacred groves and species
Aesthetic values		▼	decline in quantity and quality of natural lands
Recreation and ecotourism		+/-	more areas accessible but many degraded

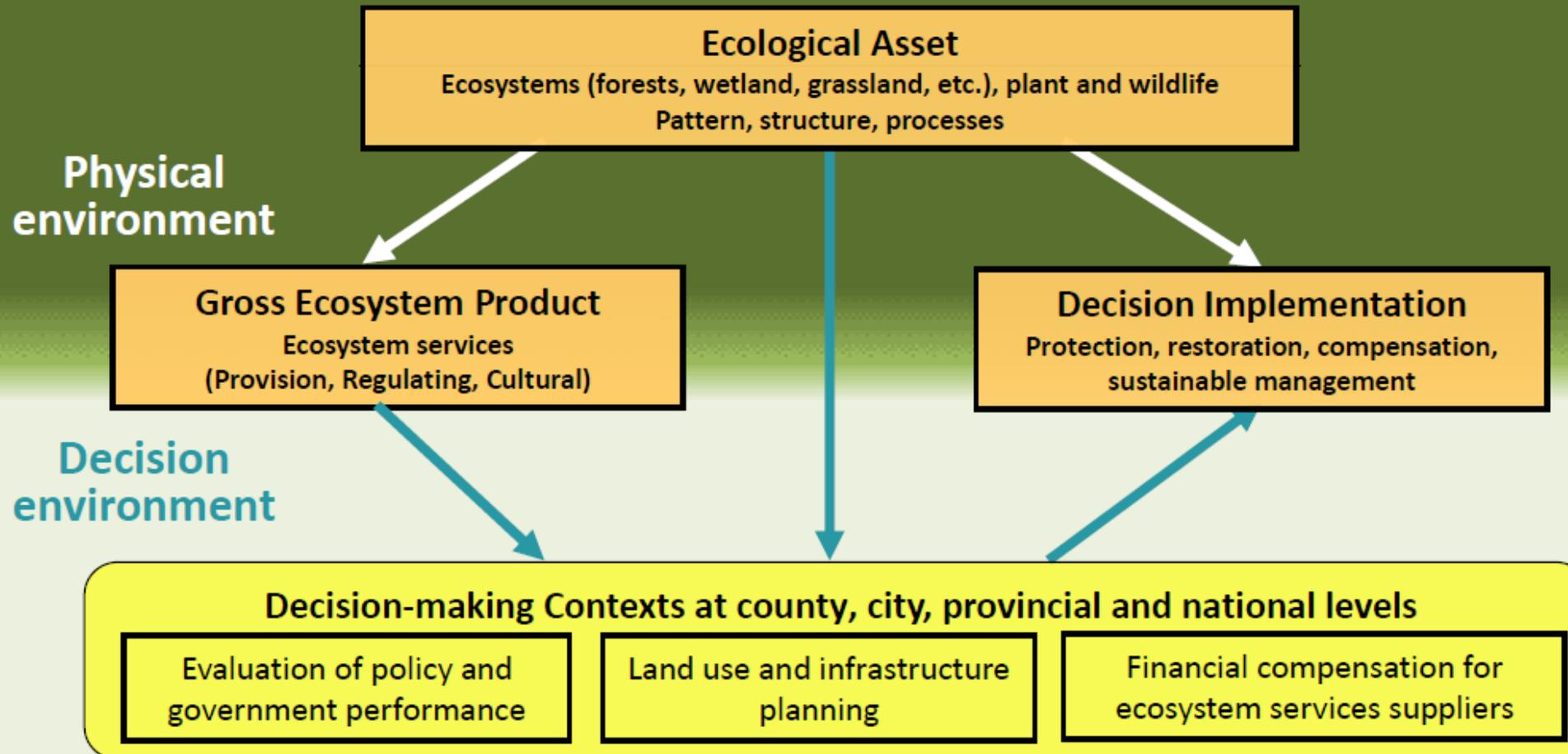
**Trends in ecosystem services:**

**Millennium Ecosystem Assessment**

Service	Sub-category	Status	Notes	Millennium Ecosystem Assessment
<b>Provisioning Services</b>				
Food	crops	▲	substantial production increase	
	livestock	▲	substantial production increase	
	capture fisheries	▼	declining production due to overharvest	
	aquaculture	▲	substantial production increase	
	wild foods	▼	declining production	
Fiber	timber	+/-	forest loss in some regions, growth in others	
	cotton, hemp, silk	+/-	declining production of some fibers, growth in others	
	wood fuel	▼	declining production	
Genetic resources		▼	lost through extinction and crop genetic resource loss	
Biochemicals, natural medicines, pharmaceuticals		▼	lost through extinction, overharvest	
Fresh water		▼	unsustainable use for drinking, industry, and irrigation; amount of hydro energy unchanged, but dams increase ability to use that energy	
<b>Regulating Services</b>				
Air quality regulation		▼	decline in ability of atmosphere to cleanse itself	
Climate regulation	global	▲	net source of carbon sequestration since mid-century	
	regional and local	▼	preponderance of negative impacts	
Water regulation		+/-	varies depending on ecosystem change and location	
Erosion regulation		▼	increased soil degradation	
Water purification and waste treatment		▼	declining water quality	
Disease regulation		+/-	varies depending on ecosystem change	
Pest regulation		▼	natural control degraded through pesticide use	
Pollination		▼ <sup>a</sup>	apparent global decline in abundance of pollinators	
Natural hazard regulation		▼	loss of natural buffers (wetlands, mangroves)	
<b>Cultural Services</b>				
Spiritual and religious values		▼	rapid decline in sacred groves and species	
Aesthetic values		▼	decline in quantity and quality of natural lands	
Recreation and ecotourism		+/-	more areas accessible but many degraded	

High correlation between market value and increasing trend

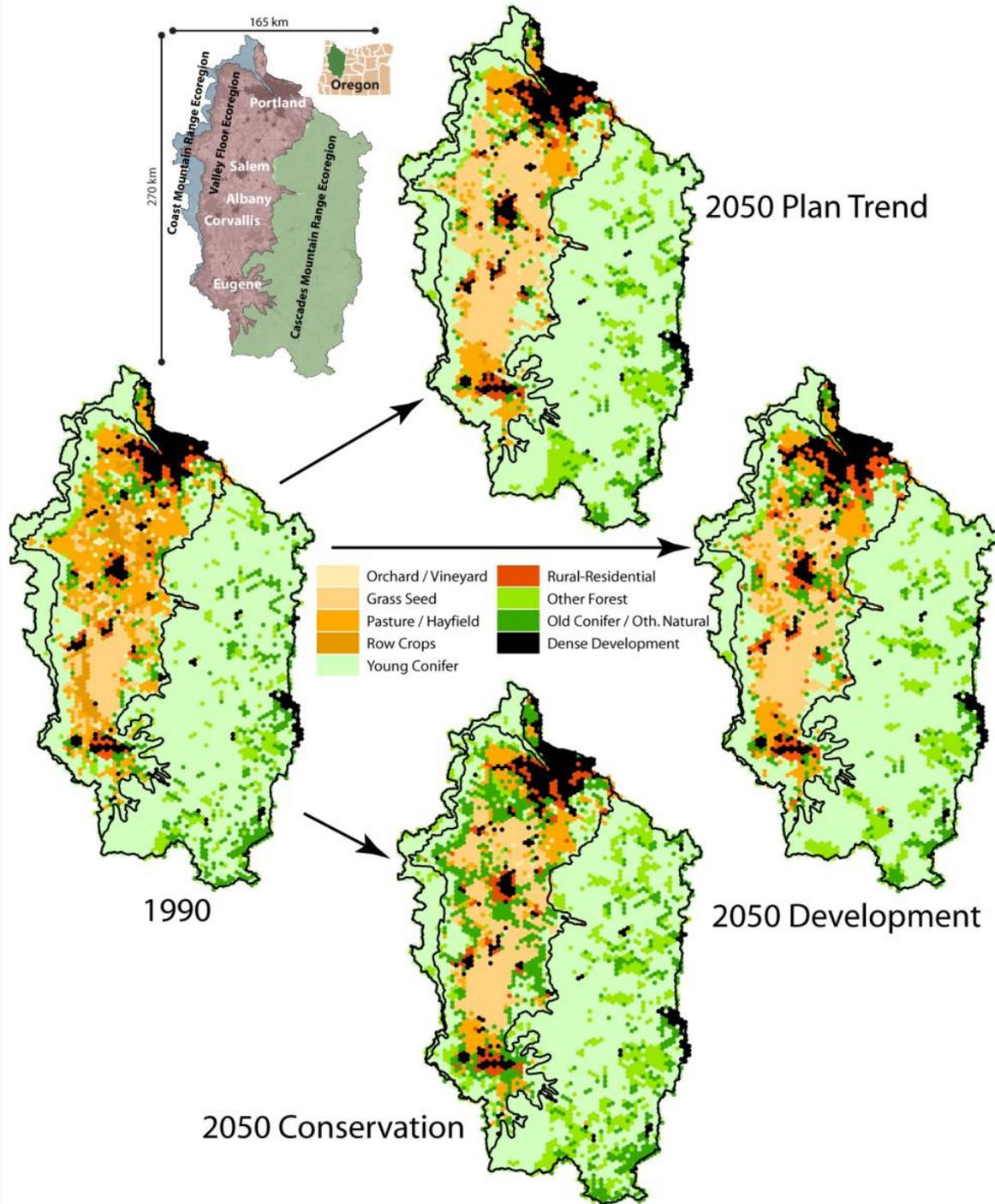
# Using natural capital accounting in decision-making



# Example of natural capital accounting in land-use and infrastructure planning: Modeling multiple ecosystem services and tradeoffs at landscape scales



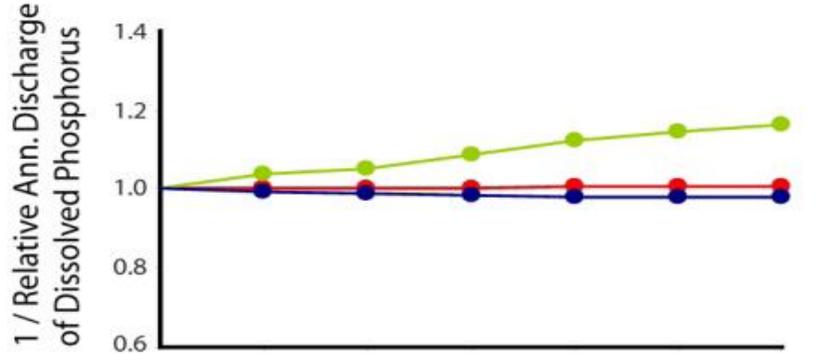
Nelson et al. 2009. *Frontiers in Ecology and Environment* 7(1): 4–11.



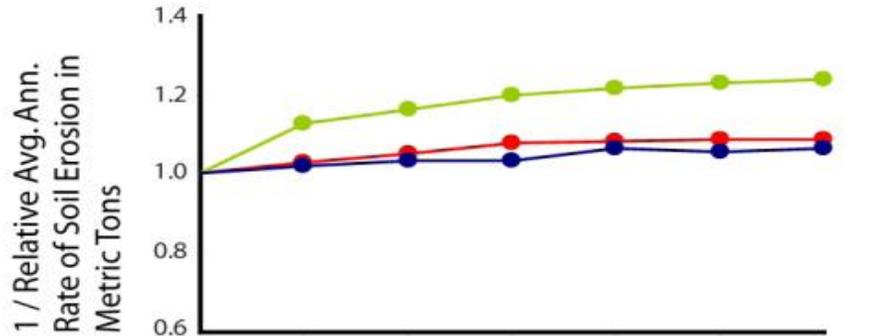
Projected land use change in 2050 under three scenarios

# Ecosystem service outputs through time

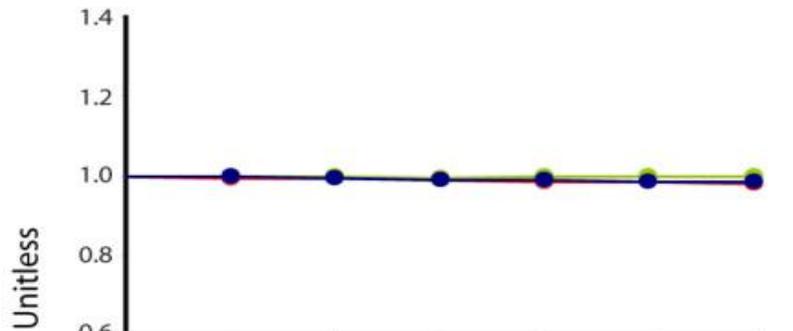
Water Quality



Potential Soil Conservation

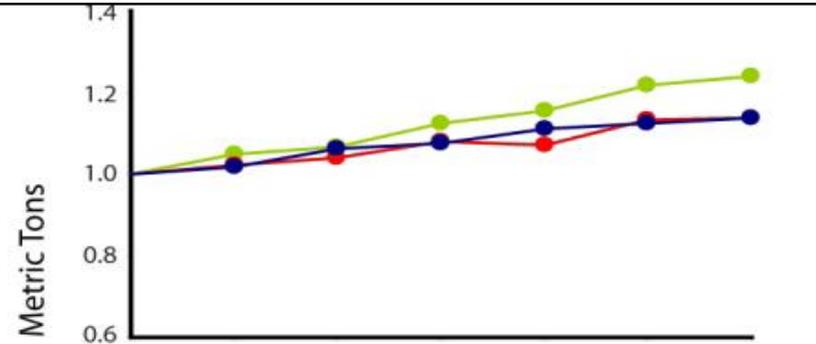


Storm Peak Management

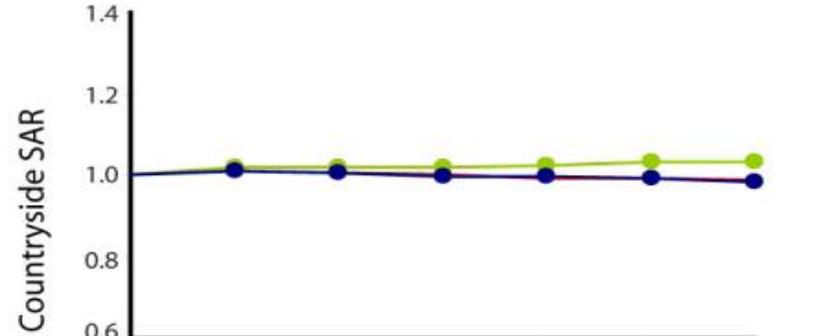


● Plan Trend ● Development ● Conservation

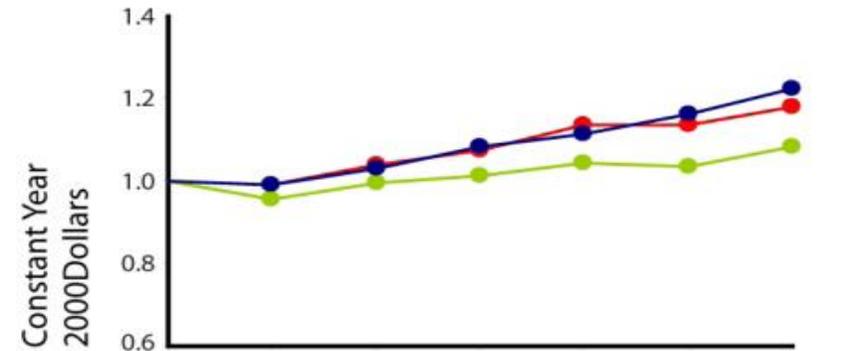
Carbon Sequestration



Biodiversity

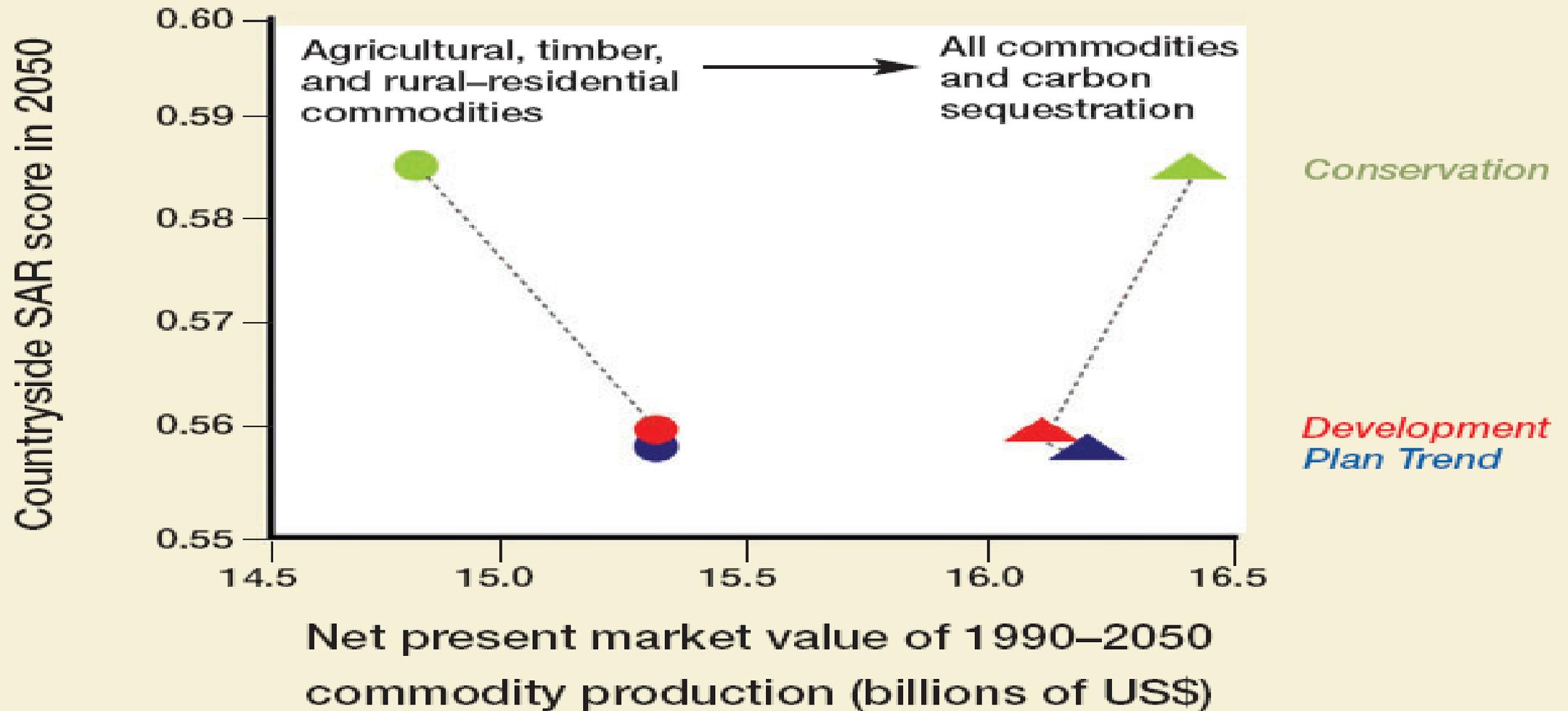


Market Value



● Plan Trend ● Development ● Conservation

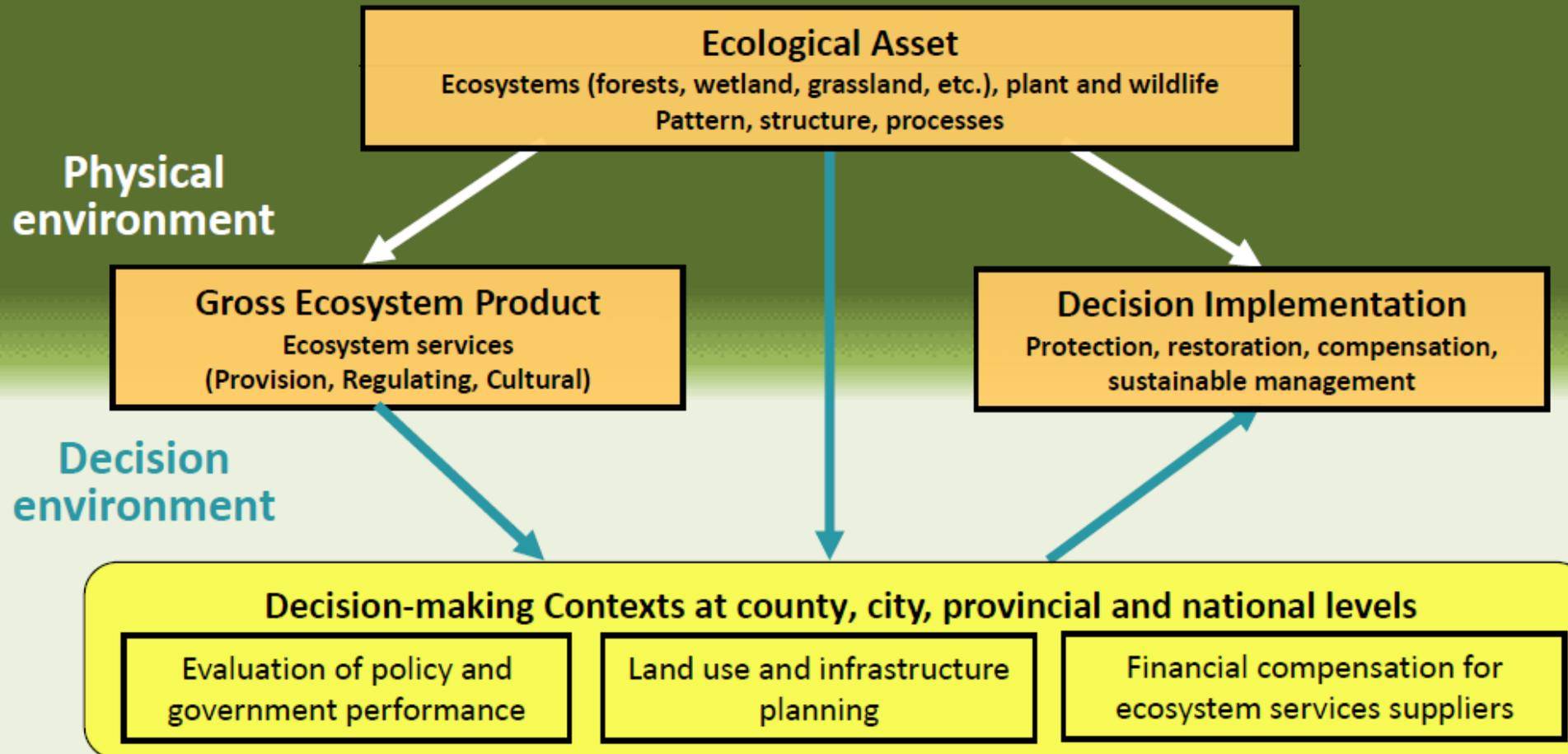
# Net present value and tradeoffs



# **Role for policy: shifting outcome from plan trend to conservation pathway**

- **Mainstream value of natural capital: align market and social values (“internalize the externalities”)**
- **Various policy approaches**
  - **Payments for ecosystem services (PES)**
  - **Regulatory approaches (e.g., land use zoning)**

# Using natural capital accounting in decision-making



# Using natural capital accounting in decision-making

- Evaluation of policy and government performance
  - How do government decisions affect the well-being of citizens?
  - Having job performance of government officials depend on GEP and measures of value of natural capital in addition to GDP
- Land use and infrastructure planning
  - Ecological Function Conservation Areas
  - Ecological Redlining
- Financial compensation for ecosystem service providers
  - Tie incentive payments to positive impact on service provision and maintenance of important natural capital

# Importance of natural capital accounting

- **Current economic accounting measures only market values:**  
Distortions in social decision-making from ignoring non-market contributions to social values
- **Exclusive focus on GDP or GEP:** these are measures of current income and ignore changes in assets and their impact on future values
  - Forestry example: harvest trees faster than they regenerate gives high current income but low future returns

# Importance of natural capital accounting

- Measuring the value of natural capital and ecosystem services (GEP) AND incorporating these values into decision-making is essential for sustainable development.
- The People's Republic of China is leading in both measuring GEP and the value of natural capital and incorporating these values into decision-making.
- This effort promises better outcomes for Chinese citizens and sets an inspiring example for other nations to follow.

A scenic landscape featuring a wide river that perfectly reflects the surrounding environment. The river is flanked by steep, lush green mountains covered in dense forests of various trees. The sky is clear and bright, and the overall scene is peaceful and serene. In the center of the image, the Chinese characters '谢谢' (Thank you) are overlaid in a large, white, calligraphic font.

谢谢